Meliadine Gold Project
NWB Water Licence 2AM-MEL1631
2017 Annual Report

Prepared for:
Nunavut Water Board, Kivalliq Inuit Association

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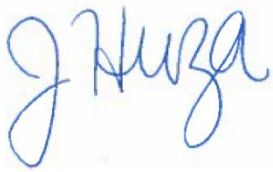

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SECTION 1 • INTRODUCTION

Type A water license 2AM-MEL1631 (the License) was issued to Agnico-Eagle Mines Limited for Meliadine Gold Project (the Project) on April 1, 2016.
As required under Part B Item 2 and Schedule B of the License, this report documents the water management and monitoring activities at Agnico Eagle Meliadine for 2017.
In 2017, the Project was in advanced construction stage. The production at Meliadine is expected to commence in 2019.

SECTION 2 • CONSTRUCTION

For structures constructed to withhold Water or Waste:

a. **An overview of methods and frequency used to monitor deformations, Seepage and geothermal responses**
   and
b. **A comparison of measured versus predicted performance**
   and
c. **A discussion of any unanticipated observations including changes in risk and mitigation measures implemented to reduce risk**

Monitoring of the structures, constructed to withhold Water[1] or Waste[2] consists of periodic visual inspections and review of the instrumentation data.

Visual inspections are undertaken by both Agnico Eagle employees and third party consultants. In 2017 Agnico Eagle's construction department personnel conducted periodic visual inspections of water retaining structures, frequency of those inspections increased before and during freshet.
In addition to the inspections, undertaken by Agnico Eagle staff, at least once a year a third party consultant conducts a comprehensive annual geotechnical inspection at Meliadine. In 2017 the annual geotechnical inspection was completed by Golder Associates; the complete report on the results of this inspection is provided in the Appendix I.

Instrumentation includes thermistors to monitor permafrost, settlement survey monuments to monitor displacements and flow meters to monitor and measure seepage.

[1] Existing in 2017 structures constructed to withhold water include water collection ponds CP-1 and CP-5 and associated dikes DCP-1 and DCP-5, Saline Pond, diversion channel 2, diversion channel 5 and associated berm 3.

[2] Structures, constructed to withhold waste include Type A (operation) and Type B (exploration) landfarms, Type A and Type B landfills

a) Thermistors

Permafrost monitoring is based on the data collected from thermistors. Approximately 20 thermistors are in working condition and are being used to collect the data. Two types of thermistors are present on site:

- Thermistors to monitor the base of permafrost and geothermal gradient - cables, placed in deep (100 m – 600 m) vertical boreholes.
- Thermistors to monitor the active layer of permafrost – cables, placed in shallow vertical (<25 m) or horizontal boreholes.

Frequency of data collection depends on the thermistor priority; Agnico designated three levels of priority, from highest to lowest:

1) thermistors located in close proximity to the mine infrastructure: most frequent readings;
2) thermistors in the vicinity of the future Tiriganiaq open pit: less frequent readings;
3) Other thermistors, used to monitor deep permafrost: least frequent readings since the temperature at high depth is not susceptible to seasonal fluctuations.

Data from the thermistors was used to generate temperature profiles, provided in Appendix C to the 2017 Annual Geotechnical Report.

b) Settlement survey monuments

Settlement survey monument, as the name implies, assist with detection of settlements; a total of 9 survey monuments were installed over the liner crest in the central area of the dikes DCP-1 (6 monuments) and DCP-5 (3 monuments).

The survey monitoring monuments indicated 1 to 2 cm of settlement at DCP-1 from late July to late October 2017. Readings prior to this period were completed with a GPS which was not accurate enough for monitoring settlement.

The survey monitoring monument data indicated approximately 3 cm of settlement at M-3 on DCP-5 from late July to late October 2017. The other two survey monitoring points showed less than 1 cm of settlement. The geotechnical inspection concluded that both dikes appeared stable with no significant geotechnical concerns.

d. As-built drawings of all mitigation works undertaken

In 2017 all structures, constructed to withhold water or waste, performed as expected.

The analysis of the HGTC-1 thermistor data, installed at D-CP1 dike, revealed the temperature anomaly, possibly caused by water infiltration. To intercept any surface water flowing down the north abutment towards the downstream key trench, and direct it away from the dike into the sump, the DCP-1 diversion ditch was excavated and connected to DCP-1 channel. The work on the ditch took place between October 6 and October 20; the as-built drawing of the ditch is provided in the Appendix A.

The April 8, 2017 diesel fuel spill resulted in large volume of contaminated snow; to mitigate the spill and to contain the contaminated snow for subsequent treatment, a so-called “snow cell” was built within P-Area.

The snow cell is a bermed rectangular containment, lined with impermeable liner sandwiched between two layers of geotextile. The snow cell was built entirely within P Area, therefore its construction did not increase the disturbed area. Design drawing of the snow cell is provided in Appendix B. In September 2017, contaminated melted water from the snow cell was treated using AquaSweep™ oil separator; treated water was discharged into CP1. The snow cell is a temporary structure, which is currently not actively being used and is planned to be decommissioned in 2018.

e. Any changes in the design and/or as-built condition and respective consequences of any changes to safety, water balance and water quality

Water from the containment pond CP1 was planned to be released into the environment through a pipeline leading to a diffusor at the deep portion of Meliadine Lake. Pre-discharge sample, taken in early August 2017, indicated TDS in CP1 at 1,600 mg/L, exceeding the license limit of 1,400 mg/L, therefore Agnico decided not to discharge the water in 2017 and is exploring various water treatment/ discharge options for 2018.

f. Data collected from instrumentation used to monitor earthworks and an interpretation of that data

Please refer to sections 2 a, b, & c for more information on instrumentation used and interpretation of the collected data.

g. A summary of maintenance work undertaken as a result of settlement or deformation of dikes, dams and berm

In 2017, only minor settlement of dikes, dams and berms was observed, which did not warrant the maintenance work.

h. The daily, monthly and annual flow volumes of any watercourse diverted during Construction activities

No watercourses were diverted during construction activities in 2017.

i. The daily, monthly and annual quantities of Seepage from dikes, dams and other structures in cubic metres

Four containment pond dikes (DP1-A, DP1-B, DP2-A, and DP3-A) were constructed in the spring of 2016. Daily inspections were conducted and seepage occurrences or indication of seepage were visually observed along the dikes, downstream at DP1-B and DP3-A.

To capture seepage and to provide a more accurate seepage rate, in the fall of 2016 two trenches were excavated downstream of DP1-B and DP3-A.

The quantity of seepage is estimated from the flowmeter data; water, collected from trenches downstream from DP1 and DP3 dikes is metered and pumped back into P-Area ponds, as discussed in the section 2 a). The monthly and annual quantities of seepage are provided in the following Table 2-1:

Table 2-1 Volumes of seepage, pumped from the trenches downstream from DP1 and DP3

	January	February	March	April	May	June	July	August	September	October	November	December	**2017 Total**
Pumped from DP1, m³	-	-	-	-	-	385	5,255	16,490	22,011	10,482	-	-	**54,623**
Pumped from DP3, m³	-	-	-	-	-	521	8,927	32,606	28,800	8,882	-	-	**79,736**
Total DP1 and DP3, m³	-	-	-	-	-	906	14,182	49,096	50,811	19,364	-	-	**134,359**

No seepage from other dams or other structures, constructed to withhold water, was observed in 2017.

SECTION 3 • WATER

2. Monthly and annual volume of fresh Water obtained from Meliadine Lake.

The new fresh water treatment plant was commissioned in March of 2017. The summary of freshwater withdrawals from Meliadine Lake is provided in the following Table 3-1:

Table 3-1: Volume of Fresh Water, withdrawn from Meliadine Lake in 2017

	January	February	March	April	May	June	July	August	September	October	November	December	**2017 Total**
Water withdrawn, m³	-	-	288	676	1,001	1,229	1,781	2,216	2,008	1,975	2,132	1,557	**14,863**

A total of 14,863 m³ of freshwater was withdrawn from Meliadine Lake in 2017, or approximately 24% of the maximum allowed (62,000 m³) under the License.

3. Monthly and annual volume of fresh Water transferred to Meliadine Lake as a result of dewatering activities.

No dewatering activities took place in 2017.

4. Monthly and annual volume of fresh Water obtained from Meliadine River for road dust suppression activities.

In 2017, no water was obtained from the Meliadine River for road dust suppression activities; instead, water was withdrawn from small ponds, proximal to the All-Weather Access Road (AWAR).

5. Summary of reporting results for the Water Balance and Water Quality model as required in Part E Items 11-12.

The Water Balance and Water Quality models can be found in the Water Management Plan, updated in March 2018, and provided in Appendix K to this report.

SECTION 4 • WASTE

6. Geochemical monitoring results including:

a. Geochemical monitoring results including Operational acid/base accounting and paste pH test work used for waste rock designation (PAG and NPAG rock)

Geochemical sampling program at Meliadine is comprised of two parts: surface and underground.

Surface rock geochemical sampling

Surface rock was sourced from surface quarries for construction of roads, pads, dikes and other structures. All rock tested was identified as NPAG (with the exception of one sample – G26) and non-metal leaching; the only sample that indicated some potential for acid generation (G26) had been collected from the existing community stockpile, adjacent to the Itivia Quarry. The sample is PAG, however because of substantial amount of NP in the sample it will take a long time for ARD to develop (likely decades in Nunavut) and possibly not at all as sulphur will also deplete to levels that may not pose a concern. More samples, collected from the same location, showed no potential for acid generation. Material from this stockpile was not used and will not be used in the future by Agnico.

Underground rock (waste rock) geochemical sampling

Starting in 2017, underground geochemical sampling is conducted according to Meliadine ARD-ML testing protocol. A total of 12 representative samples are collected quarterly from different geological units (3 from the sedimentary, 8 from volcanic and 1 from iron rock formations). To date, all underground samples were NPAG.

Results of geochemical analyses and geochemical monitoring can be found in Appendix C. In 2017, samples were collected from the Saline Pond overburden (Appendix C1), Emulsion Esker (Appendix C2), Meliadine Esker – East extension (Appendix C3), Itivia Quarry (before and during exploitation), Site D borrow pit, Rankin Fuel Farm Quarry (Appendix C4), and underground waste rock (Appendix C5).

b. As-built volumes of waste rock used in construction and sent to the Waste Rock Storage Facilities with estimated balance of acid generation to acid neutralization capacity in a given sample as well as metal toxicity

In 2017 a total of approximately 240,000 m³ of waste rock (ROM) was produced from the underground development. Some ROM material was crushed and sorted into 3 fractions: 0-30 mm, 0 – 50 mm and 0 – 200 mm. Approximately 200,000 m³ of ROM and crushed material was used for the construction of site infrastructure (roads, pads, berms, dikes etc.).

Around 10,000 m³ of unused ROM and 30,000 m³ of crushed material were stockpiled on site as of December 31, 2017 for future construction.

No waste rock was placed into the waste rock storage facilities to date.
Based on analysis conducted during the Final Environmental Impact Statement process and samples collected in 2017, 100% of the waste rock is NPAG.

c. All monitoring data with respect to geochemical analyses on site and related to roads and quarries

Please refer to the Chapter 4, section 6.a. for the discussion on surface geochemical sampling.

d. Leaching observations and tests on pit slope and dike exposure

No leaching was observed on pit slope in 2017 as the open pit development did not yet commence. No leaching was observed on dike exposure in 2017.

e. Any geochemical outcomes or observations that could imply or lead to environmental impact

In 2017 Agnico conducted geochemical testing on waste rock material from underground development and surface material from approved quarries and eskers. Representative samples of this material were analyzed for ARD and metal leaching at the certified third-party laboratory (SGS). No observations/ results indicated adverse geochemical impact on the environment.

f. Geochemical data associated with tailings, cyanide leach residue, and bleed from the cyanide destruction process including an interpretation of the data

There were no tailings, cyanide leach residue or bleed from the cyanide destruction process produced on site in 2017.

g. Results related to the Borrow pits/ Quarries and roads, including the All-weather Access Road.

Please refer to the Chapter 4, sections 6 a., b. and c. and Appendix C for more information.

7. An update on the current capacity of the Tailings Storage Facility.

The Tailings Storage Facility has not been built yet.

8. Summary of quantities and analysis of Seepage and runoff monitoring from the Landfill, Landfarm, Waste Rock Storage Facilities, Borrow pits and Quarries.

Landfill and Landfarm were commissioned in November 2017. No seepage was observed from either due to frozen conditions.

The Waste Rock Storage Facility infrastructures approved under water license 2AM-MEL1631 has not been built yet.
No seepage was observed around operating quarries and borrow pits located on site and along the AWAR as per regular inspections completed by the Environment Department.

9. A summary report of all general waste disposal activities including monthly and annual quantities in cubic metres of waste generated and locations of disposal.

All waste, produced at Meliadine, falls into 4 major categories:
1) Hazardous waste;
2) General (dry, non-hazardous) waste;
3) Food waste;
4) Contaminated soil.

Hazardous waste, such as waste coolant, used oil filters, waste grease, used batteries, sewage sludge etc. is segregated according to material type, stored in sea containers, and shipped south during the sealift season. All hazardous waste on site was shipped by Nunavut Sealink and Supply Inc., to Qikiqtaaluq Environmental Services facility in Quebec, via Port of Bécancour.
In 2017 a total of 148.3 tons of hazardous waste was shipped south in 14 sea containers; documentation for the transfer of hazardous waste can be found in Appendix D.

General waste, such as glass, concrete, non-reusable wood and ash was landfilled on-site and off-site. Type A landfill was commissioned in November 2017; volume of the landfilled waste is being estimated through periodic surveys. An estimated 5,767 m^3 of waste was placed into Type A and Type B landfills as of the end of 2017. A total of 435.3 tonnes of inert construction debris was shipped to the Port of Bécancour; after reaching the port, this waste was taken to an approved landfill for disposal.

Food waste, including food packaging, was incinerated to avoid landfilling the material, and attracting the wildlife. Produced ash was landfilled.

Contaminated soil was placed into the landfarm for treatment. Type A landfram was commissioned in November 2017; an estimated 692 m^3 of contaminated soil was placed there in 2017.

In 2017 a total of 305.4 t of material was shipped south for recycling, including 285 t of scrap steel, 12.4 t of electric cable and 8 t of used tires.

10. **Report of Incinerator test results including the materials burned and the efficiency of the Incinerator as they relate to Water and the deposit of Waste into Water.**

    The incinerator approved under Water License 2AM-MEL1631 has been commissioned at the end of November 2017; the incinerator test will be undertaken in 2018.

SECTION 5 • SPILLS

11. A list and description of all unauthorized discharges including volumes, spill report line identification number and summaries of follow-up action taken.

In 2017, a total of 14 reportable spills took place at Meliadine, including 6 spills of petroleum hydrocarbons, and 8 spills of non-compliant effluent, originating from the explo camp sewage treatment plant. The table, summarizing all spills, which took place at Meliadine in 2017, is provided in Appendix E.

Several spills, including: all exploration STP effluent exceedances, April 8, 2017 exploration fuel farm diesel fuel release, July 25, 2017 HYSTER roll-over, and December 3, 2017 exploration camp genset diesel fuel release, are reported in the Water License 2BB-1424 2017 Annual report. The rest of the spills are reported in the following section:

I) On May 15, 2017, while drilling near the Lake A8, a leak from the hose on the fuel pump led to the spill of approximately 50 L of diesel fuel (spill report line ID number 2017169). Once the spill was noticed, the area was cleaned up (snow/ice removal) and reported to the Environment department. Containment booms were placed in the water at the shore of Lake A8 to contain any residual fuel to the localized area by the spill site. Since the spill occurrence, weekly inspections at the spill site were completed by the Environment Department in order to secure the booms and to ensure that the localized impacted area is contained until the affected area was considered remediated through visual observations of surface sheen. Samples of the water outside the containment boom ("A8 Lake") and within the contained area ("A8 Shore") were collected. It should be noted that drilling was undertaken by the third party (Orbit Garant Drilling Inc.), contracted by Agnico Eagle.

II) On September 22, 2017, when off-loading totes of oil from a trailer, the fork lift operator was setting two totes together, had his forks set too high and hit the plastic portion of the tote and the forks punctured the tote. The tote was immediately flipped on its back, stopping the spill of the product; a total of approximately 150 L of engine oil was spilled (spill report line ID number 2017359). Spill pads were deployed to absorb the oil; the absorbent pads were disposed of in the Hazmat waste area at the Meliadine site. The contaminated soil was excavated and taken to the exploration landfarm.

III) On October 17, 2017, an excavator was operating downstream of D-CP1 to complete snow removal. A hydraulic hose on the excavator broke, releasing 180 L of hydraulic oil onto the ground. The operator responded quickly by building a berm to contain the spill. The hydraulic oil was cleaned up by absorbent pads and by excavating approximately 5 m^3 of snow/contaminated material. This was placed in containment

at site. Verification samples were collected to confirm if the clean-up is complete. No water body was impacted by the spill.

SECTION 6 • MODIFICATIONS

12. A summary of modifications and/or major maintenance work carried out on all Water and waste related structures and facilities.

No modifications and/or major maintenance work was carried out on water and waste related structures and facilities related to Water License 2AM-MEL1631 in 2017.

SECTION 7 • MONITORING

13. The results and interpretation of the Monitoring Program in accordance with Part D and Part I and Schedule I.

Part D, item 12

No dewatering activities were undertaken in 2017, therefore no sampling at the sampling stations MEL-D-1 through MEL-D-TBD took place.

Part D, item 18

A total of 9 monitoring stations for surface runoff has been designated (MEL-SR1 to MEL-SR9) and sampled between May 12 and October 7, 2017. The summary of the sampling data is provided in the Appendix F.

The sampling criteria, included in Part D, item 18 of the Licence, refers to the qualitative criterion for oil and grease: "no visible sheen". The environmental technicians were instructed to visually assess the presence of oil and grease; in addition, samples were analyzed for oil and grease to confirm the visual assessment. No exceedances of oil and grease were observed/ detected.

The exceedances of TSS were detected on several occasions, which can be attributed to the fine particles/sediment being stirred up during freshet.

ii. As per Part I Item 9:

a. The volume of fresh Water obtained from Meliadine Lake at Monitoring Program Station MEL-01;

All water from Meliadine Lake under the License A was taken at MEL-01 (MEL-11) monitoring station. The summary of the water withdrawals is provided in the following table 7-3.

Table 7-3. The volume of fresh water obtained from Meliadine Lake at MEL-01

	January	February	March	April	May	June	July	August	September	October	November	December	**2017 Total**
Water withdrawn, m³	-	-	288	676	1,001	1,229	1,781	2,216	2,008	1,975	2,132	1,557	**14,863**

b. The volume of fresh Water transferred to the Meliadine Lake during lakes' dewatering activities;

No dewatering activities took place at Meliadine Project in 2017. No lakes' dewatering is expected in the nearest future.

c. The volume of fresh Water obtained along the road and Meliadine River for dust suppression activities;

In 2017, no water was obtained from the Meliadine River for road dust suppression activities; instead, water was withdrawn from small ponds, proximal to the All-Weather Access Road (AWAR). The summary of water withdrawals is presented in the following

Table 7-.

Table 7-4 Monthly and annual water withdrawals for dust suppression

	January	February	March	April	May	June	July	August	September	October	November	December	**2017 Total**
Water withdrawn, m³	-	-	-	-	-	-	-	17	-	-	-	-	**17**

d. The volume of Effluent discharged from Final Discharge Point at Monitoring Program Station MEL-14;

In 2017 no effluent was discharged from Final Discharge Point at Monitoring Program Station MEL-14 (new monitoring station name as per Board's approval), the discharge from this station was postponed until 2018.

e. The volume of reclaim Water obtained from the CP1;

No reclaim water was obtained from the CP1 in 2017.

f. The volume of Effluent discharged onto tundra at Monitoring Program Station MEL-25 or transferred to CP1 from the Itivia Site Fuel Storage and Containment Facility

No effluent was discharged onto tundra at Monitoring Program Station MEL-25 (new monitoring station name as per Board's approval) or transferred to CP1 from the Itivia Site Fuel Storage and Containment Facility.

g. The volume of Effluent and Fresh Water transferred to the pits during pits' flooding

Not applicable as no pits have been developed yet.

h. The volume of Sewage sludge removed from the Sewage Treatment Plant and the locations or methods of Sewage sludge disposal

The Sewage Treatment Plant under Water License 2AM-MEL1631 has been commissioned in the spring of 2017. Total of 43 m³ of sludge was removed from the STP and placed in approximately 250 drums of 205 L each (not filled to the top), for subsequent shipment south.

i. Quantity of waste placed within the Landfill and Landfarm

Both the landfill and landfarm were commissioned in the fall of 2017. The volume of the waste placed in both structures is assessed through periodic surveys. No survey of the new landfill was undertaken yet because of winter conditions. As of December 31, 2017, approximately 800 m³ of contaminated soil was placed in the Type A Landfarm.

j. Tonnes of ore stockpiled and ore processed through the mill

A total of 48,080 tonnes of ore is currently on site. No ore was processed through the mill, which is expected to be commissioned in 2019.

k. Tonnes of waste rocks placed within the Waste Rock Storage Facilities

No waste rock was placed in the waste rock storage facility in 2017. Rock from underground development was used in construction; as of December 31, 2017 around 10,000 m³ of unused ROM and 30,000 m³ of crushed material were stockpiled on site for future construction, as discussed in the Section 4, item 6 b.

l. The daily tonnes of dry combined tailings placed within the Tailings Storage Facility

The Tailings Storage Facility was not yet built in 2017.

14. The results of monitoring related to the Environmental Management and Protection including:

a. Aquatic Effects Monitoring Program;

Please refer to Appendix J for the 2017 Report of the Aquatics Effects Monitoring Program.

b. Metal Mining Effluent Regulation (MMER) Monitoring;

In August 2017 Agnico Eagle submitted to Environment and Climate Change Canada (ECCC) the Cycle 1 Study Design, related to H17 dewatering, as per MMER-EEM regulations.

c. Mine site Water quality monitoring, including groundwater monitoring; and

In 2017, water quality samples were collected on a regular basis, according to the sampling calendar from the following stations: MEL-SR-1 to MEL-SR9, Channel 5, Culvert 2, Culvert 3, DCP1 Downstream, DCP5 Downstream and MEL-17.

The tabular summary of the sampling results is provided in Appendix F.

d. Visual AWAR Water quality monitoring.

In 2017 the environment department visually inspected the All-Weather Access Road (AWAR) during weekly inspections. Water course crossings were inspected for oil and sediment plumes, signs of contamination and erosion. No issues were identified.

SECTION 8 • CLOSURE

15. **A summary of any progressive closure and reclamation work undertaken including photographic records of site conditions before and after completion of operations, and an outline of any work anticipated for the next year, including any changes to implementation and scheduling.**

    Construction was underway at Meliadine in 2017, no progressive closure or reclamation work was undertaken during the year.

16. **A summary of on-going field trials to determine effective capping thickness for the Tailings Storage Facility and Waste Rock Storage Facilities for the purpose of long term environmental protection.**

    The Tailings Storage Facility and the Waste Rock Storage Facilities have not been built yet, therefore no field trials were conducted in 2017.

17. **An updated estimate of the current restoration liability based on Project development monitoring, results of restoration research and any changes or modifications to the Appurtenant Undertaking.**

    A permanent closure and reclamation financial security cost estimate was prepared in March 2014 using the RECLAIM model, version 7.0. According to that estimate, the closure and reclamation of all Project facilities amounted to 47,449,337$. This estimate was included in the Preliminary Closure and Reclamation Plan (April 2015) prepared as part of the Type A Water License application. In negotiations between INAC, Agnico and KIA the quantum of security was increased to $49,555,000.

    On July 1, 2017, the Production Lease KVPL11D01 between KIA and Agnico Eagle came into effect; the security was confirmed at $49,555,000. Agnico Eagle posted a Reclamation Security Deposit, equal to 50% of this estimate ($24,777,500) with KIA.

SECTION 9 • PLANS/REPORTS/STUDIES

18. A summary of any studies requested by the Board that relate to Water use, Waste disposal or Reclamation, and a brief description of any future studies planned.

No studies, related to Water use, Waste disposal or Reclamation were requested by the Board.

In 2017 Agnico Eagle retained the National Research Council Canada (NRC) to undertake the contaminated soil assessment in the landfarm. NRC performed a feasibility study to determine the potential for biodegradation of the diesel contamination by indigenous microorganisms, present in the soil. The study developed recommendations for bioremediation to address soil contamination with petroleum hydrocarbons. Full text of the study is provided in Appendix G to Type B Water License 2BB-MEL1424 2017 annual report.

Agnico Eagle in partnership with the University of Saskatchewan is planning a tundra revegetation/restoration study, scheduled to commence in the summer of 2018. Both past mineral exploration drilling and proposed operations have and will impact the tundra environment at Meladine; with over 3000 drilling sites in the regional area and further drilling and mine site development expected, there is a strong need for site-specific tundra restoration techniques. Seeding and fertilization is commonly used in many revegetation efforts. However, the ecological and economic feasibility of this approach in northern tundra environments is limited due to the lack of commercial seed stocks for northern native tundra vegetation and isolated site locations. To establish natural successional trajectories and promote key ecosystem processes, the study will develop restoration techniques reliant only on materials available on-site.

19. Where applicable, revisions as Addendums, with an indication of where changes have been made, for Plans, Reports, and Manuals.

The following Type A Management Plans were updated and are included in Appendix K:

1. Borrow Pits and Quarries Management Plan
2. Environmental Management and Protection Plan
3. Explosives Management Plan
4. Freshet Action Plan (included in the Water Management Plan)
5. Groundwater Management Plan

6. Hazardous Materials Management Plan
7. Incineration Management Plan
8. Landfarm Management Plan
9. Landfill Management Plan
10. Mine Waste Management Plan
11. QA/QC Plan
12. Road Management Plan
13. Spill Contingency Plan
14. Water Management Plan

Listed management plans were also submitted to the NIRB as part of the 2017 Annual Report. Changes are indicated in the first section of each management plan.

20. An executive summary in English and Inuktitut of all updated plans, reports, or studies conducted under this Licence.

The executive summaries for all updated Management Plans, listed in the Section 9, Item 19, have been translated to Inuktitut, as requested.

SECTION 10 • GENERAL

21. A summary of actions taken to address concerns or deficiencies listed in the inspection reports and/or compliance reports filed by an Inspector.

A list of inspections/site visits/audits completed by regulators at Meliadine in 2017 is presented in the Table 10-1 below.

Table 10-1. Inspections and site visits by regulators in 2017

Month	Authority	Topic	Feedback/Outcome
March 23	INAC, KIA	Expo STP inspection and sampling – follow up on reported exceedance	Detailed in the item 1)
April 10	INAC, KIA	Follow-up on April 8 fuel spill	Detailed in the item 2)
May 8	INAC	Follow-up on April 8 fuel spill, previous April 10 INAC inspection	No deficiencies
May 18	INAC	Q1 Type A license inspection, Type B License inspection, visit of the diesel fuel spill site, drill sites inspection	No deficiencies
Juy 6	KIA	Water sampling	No deficiencies
July 26	INAC	Type A license inspection of the STP, DCP-1 downstream area	Detailed in the item 4)
August 2-3	ECCC	MMER/EMM discharge points, hazardous material storage, emission standards and reporting, fuel storage at Itivia.	Detailed in the item 3)
August 22	NIRB	Site inspection of the mine site, AWAR, Itivia	No deficiencies
October 19	GN	Excessive presence of foxes on site	Detailed in the item 5)
October 18-20	INAC	STP, DCP-1, DCP-5 performance, snow management, etc.	Detailed in the item 6)
November 17	INAC	Written Warning in response to repeated exceedances of effluent limits at the Explo STP	Detailed in the item 7)

1) INAC March 23, 2017 inspection & Written Warning, dated April 13, 2017

Following the March 23 inspection and sampling, INAC inspector on April 13 issued a Written Warning for the exceedances of effluent quality limits (ammonia). Agnico conducted an internal investigation, contracted the 3rd party water treatment consultant and developed the action plan to improve the effluent quality. The written response was provided to INAC on May 25, 2017.

2) INAC April 10, 2017 Inspection and Water License Inspection Form

Following April 8, 2017 diesel fuel spill, INAC inspector visited the site and inspected the spill location, took pictures and water samples. Following the April 10, 2017 visit, INAC inspector issued the inspection form, requesting additional information regarding, clean-up and mitigation actions. Detailed response was provided on May 5, 2017.

3) ECCC August 2-3, 2017 inspection

The inspector identified a buried portion of the fuel pipe and verbally recommended to excavate/ uncover it and to create a secondary containment. Corrective actions are planned for spring 2018.

4) INAC inspection form issued on October 31, 2017

The Inspector requested Agnico to submit the findings of the investigation into the elevated TDS in CP-1 to the NWB and the Inspector – the memo is being finalized.

5) GN regional manager/ conservation officer site visit on October 19, 2017

GN personnel recommended to raise awareness among the contractors on site towards obligations related to wildlife provided additional training for the environmental department personnel on managing the problem wildlife. Those recommendations have been addressed by Agnico by holding additional toolbox meetings and training for the environment department personnel. Additionally, the GN personnel recommended that all environment technicians be properly trained on use of a firearm. Subsequently, all environment technicians will be following a Firearms course and will complete periodic firing practice in 2018.

6) INAC Inspector visit on October 18-20, 2017

The Inspector communicated the request for more rigorous monitoring program at the exploration STP, decommissioning of the snow cell within P-area, implementation of the Freshet Action Plan for 2018. Agnico put in place additional sampling at the STP, have not been actively using the snow cell with the intention of removing it in 2018 and have updated the Freshet Action Plan for the upcoming freshet.

7) INAC Written Warning, dated November 17, 2017

In response to the repeated exceedances of the effluent limits from the exploration STP, Agnico suspended the discharge of effluent into the environment and treated all the effluent at the main camp STP, and immediately commenced an extensive clean-up, maintenance and upgrade of the plant. As of time of writing of this report (March 2018), quality of the treated effluent has substantially improved and complied with the effluent limits, as confirmed by weekly sampling; treated effluent was discharged into the CP1.

SECTION 11 • OTHER

22. **A summary of public consultation and participation with local organizations and the residents of the nearby communities, including a schedule of upcoming community events and information sessions.**

    The 2017 consultation log is provided in the Appendix G.

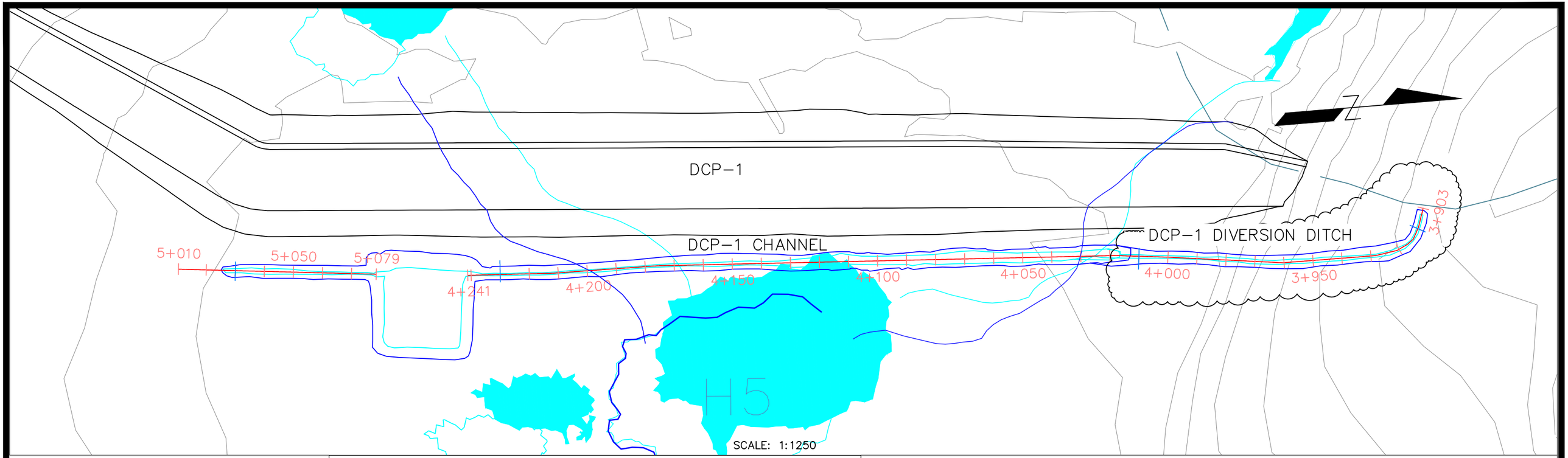
    The schedule of consultations, which took place in 2018, prior to the completion of this report, and upcoming events and information sessions, is provided in the table Appendix H.

23. **Any other details on Water use or Waste disposal requested by the Board by November 1st of the year being reported.**

    No other details were requested by the Board by November 1, 2017.

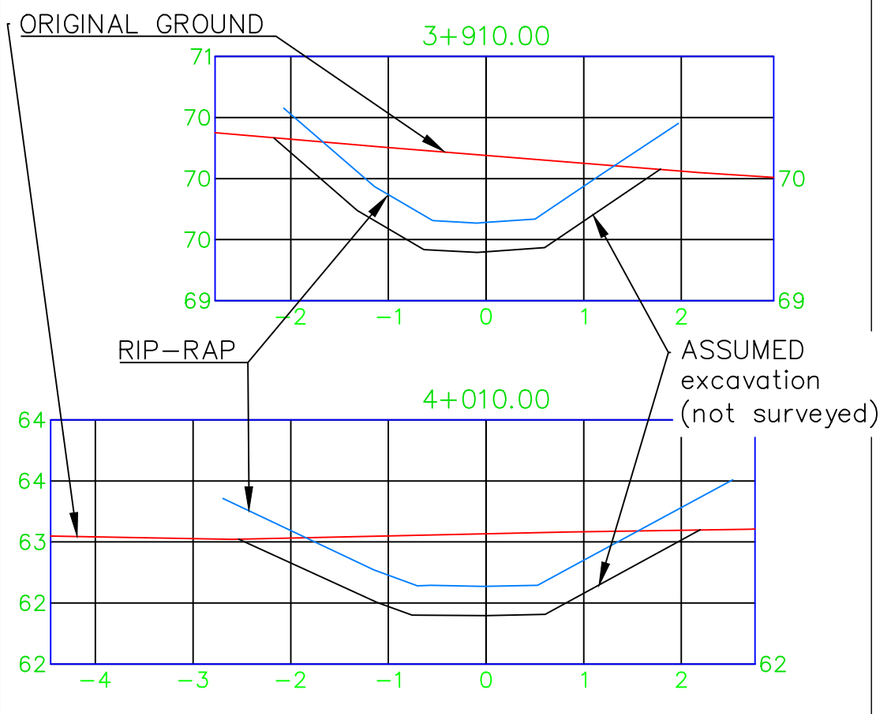
Appendix A

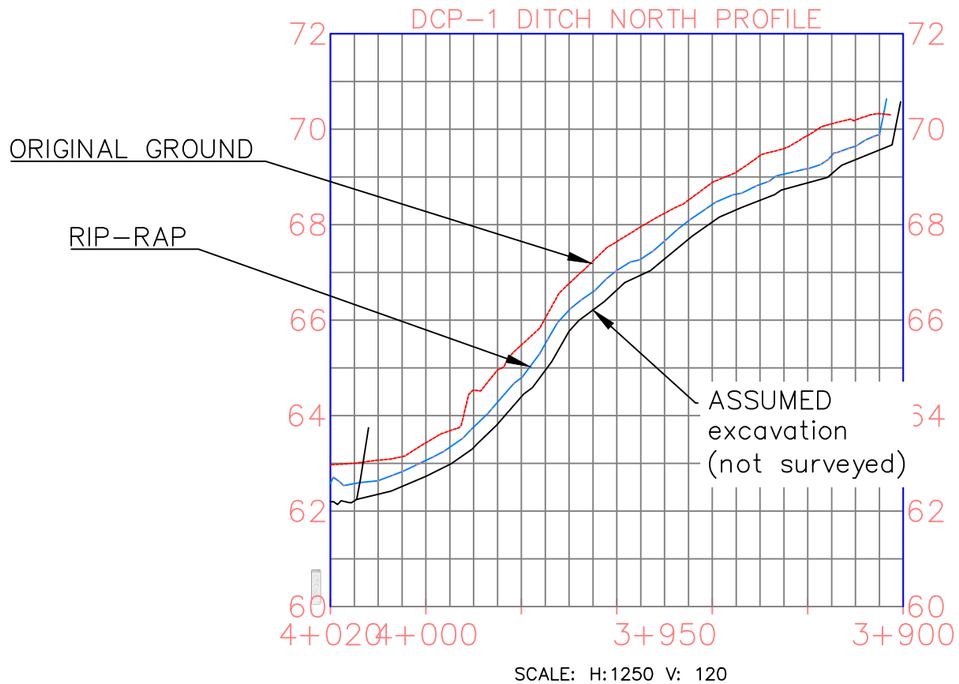
As-built Report for DCP-1 Diversion Ditch



VOLUMES

GEOTEXTILE	626 M^2	(APPROX)
EXCAVATION	344 M^3	(APPROX.)
RIP–RAP	188 M^3	(APPROX.)





SCALE: H:1250 V: 120

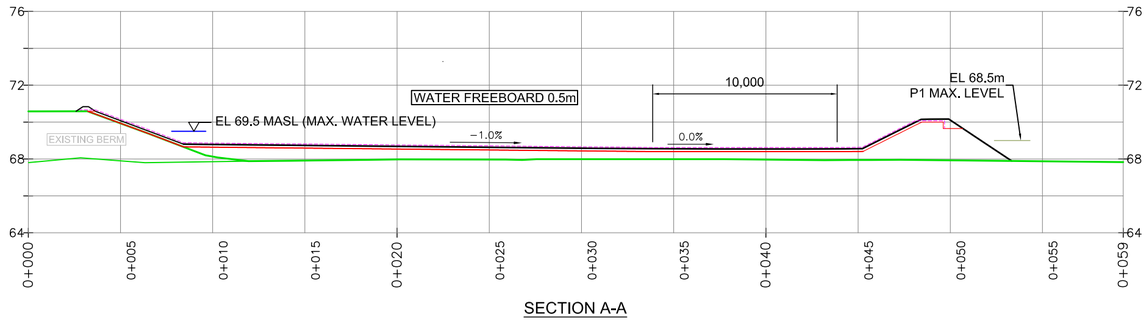
HA MASSELARPENTAGE	Système de Coord.: NAD83–UTM15 Echelle: 1:1250	No plan: 65–685–142–200–R0–ABD	AS BUILT DCP–1 DITCH	AGNICO EAGLE	Date des travaux : 2017–10–22 Date d'envoi : 2017–10–26	Dessine par: R.CLOUATRE Approuve par: C. Hamel

Appendix B

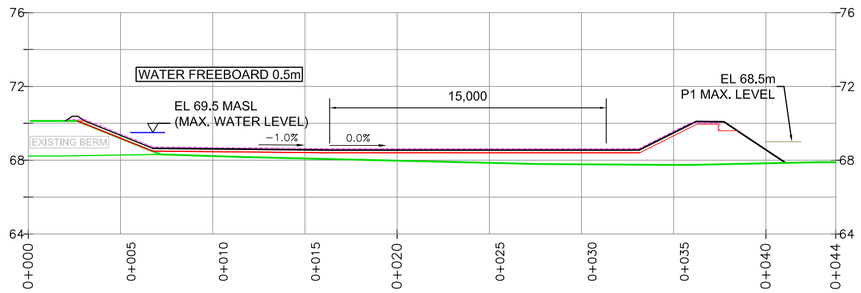
As-built Report for the Snow Cell

NO. DESSIN
DRAWING NO.

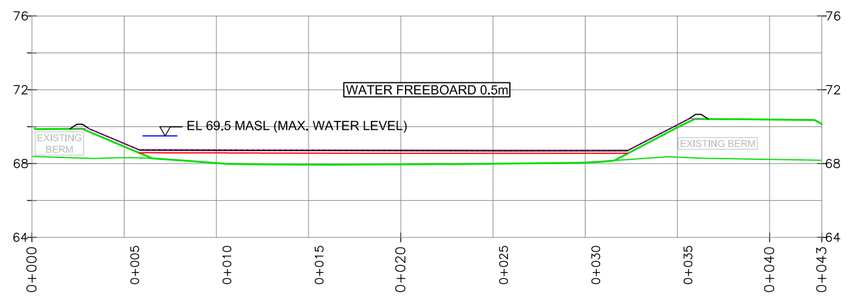
FORMAT ANSI C



SECTION A-A

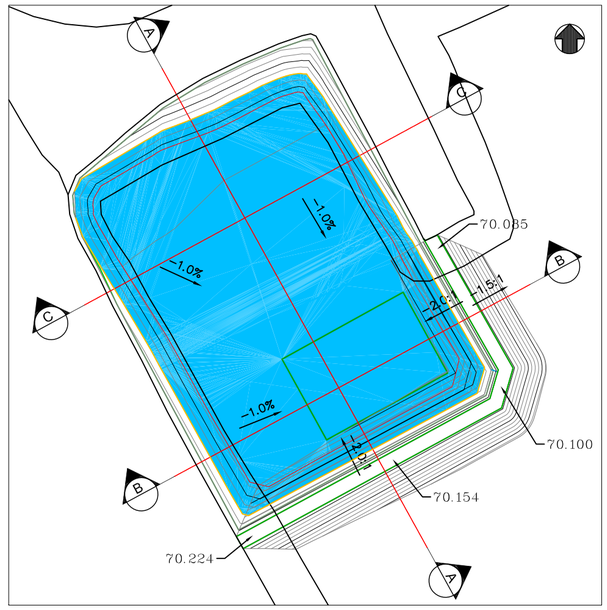


SECTION B-B



SECTION C-C

LEGEND:
- ORIGINAL GROUND
- FINE FILL
- LINERS



TOP VIEW (N.T.S.)

NOTES FOR CONSTRUCTION

1) This cell is for temporary storage of contaminated snow during summer 2017. Depending on its performance and condition, it could be used for other usages beyond summer 2017. If so, the liner need to be weighted to prevent liner lift up.

2) Placement of snow will have to be done carefully to avoid damage to the liner.

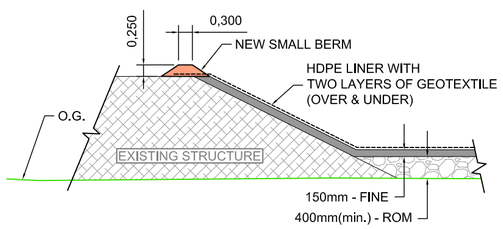
3) Water level in the snow containment cell should be maintained 0.5 m below the minimum liner elevation.

4) The maximum elevation of P1 pond should be ajusted to prevent water inflow in the snow all and should not exceed the elevation 68.5 MASL.

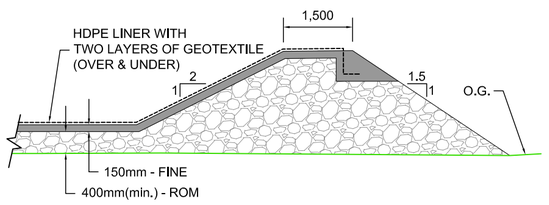
5) Geotextile : TEXEL 160E (or equivalent) placed with an overlap of 0.3m between each width. Needlepunched nonwoven short staple fibers geotextile; polypropylene made

6) Liner : HDPE 1.5mm, TYPE SOLMAX 460 (or equivalent) placed with proper overlap to allow welding to take place. The installer is to provide detailed QC information describing the placement and welding.

REGISTERED PROFESSIONAL ENGINEER
M. JULIEN
LICENSEE
NWT/NU

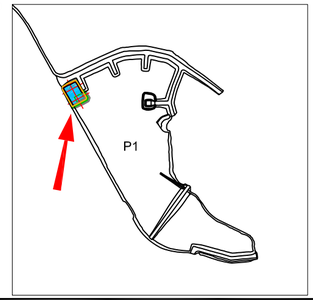


DETAIL #1 - INFRASTRUCTURE WITH EXISTING BERM



DETAIL #2 - NEW BERM & INFRASTRUCTURE DETAILS

PLAN CLÉ
KEY PLAN



NOTES GÉNÉRALES / GENERAL NOTES

POUR APPROBATION
FOR APPROVAL
AGNICO EAGLE
DATE : 2017-05-24

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DESSINS EN RÉFÉRENCE / REFERENCE DRAWINGS

TITRE / TITLE	# DWG
–	–
–	–
–	–
–	–

AGNICO EAGLE
MELIADINE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT
2	2017-05-24	ISSUED FOR APPROBATION	J.C.	T.L.	M.R.J.
1	2017-05-10	ISSUED FOR APPROBATION	J.C.	T.L.	M.R.J.

REVISIONS

TITRE / TITLE
AGNICO-EAGLE – MELIADINE DIVISION
695 – WATER MANAGEMENT
230 – EARTH WORK
PLAN , SECTION & DETAILS
SNOW CONTAINMENT

DESSINÉ PAR / DRAWN BY	JOCELYN CRETE	DATE 2017-05-04
VERIFIÉ PAR / CHECKED BY	THOMAS LEPINE	2017-05-08
APPROUVÉ PAR / APPROVED BY	MICHEL JULIEN	2017-05-08
ÉCHELLE / SCALE	N/A	DATE 2017-05-04

NO. DESSIN / DRAWING NO.
65-695-230-001

NO. PROJET / PROJECT NO.	REVISION	FEUILLE / SHT
65	2	1 / 1

I:\Regional\Groupe\Meliadine\020 Operation support\Snow Containment\65-695-230-001_R2(SnowCont)(C3D).dwg, 24 Mai 2017

AE-CART-ANSI C

I:\Regional\Groupe\Meliadine\020 Operation support\Snow Containment\65-695-230-001_R2(SnowCont)(C3D).dwg-2017-05-24 08:05:38

FILE NO. .DWG

Appendix C1

Geochemical Monitoring Results – Saline Pond overburden

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

ABA - Modified Sobek

Project : PO# 598591

14-September-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 23 August 2017
LR Report: **CA15638-AUG17**
Reference: AEM-Meliadine Gold Project

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: "001"	6: "002"	7: "003"
Sample Date & Time			27-Jul-17	27-Jul-17	27-Jul-17
Paste pH	07-Sep-17	15:12	7.98	8.10	7.94
Fizz Rate [---]	07-Sep-17	15:12	3	3	3
Sample weight [g]	07-Sep-17	15:12	2.00	1.99	2.00
HCl Added [mL]	07-Sep-17	15:12	20.00	22.00	20.00
HCl [Normality]	07-Sep-17	15:12	0.10	0.10	0.10
NaOH [Normality]	07-Sep-17	15:12	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	07-Sep-17	15:12	11.03	9.22	11.92
Final pH	07-Sep-17	15:12	1.43	1.77	1.42
NP [t CaCO3/1000 t]	07-Sep-17	15:12	22	32	20
AP [t CaCO3/1000 t]	---	---	1.56	2.19	2.19
Net NP [t CaCO3/1000 t]	---	---	20.8	29.9	18.0
NP/AP [ratio]	---	---	14.3	14.7	9.23
Sulphur (total) [%]	07-Sep-17	15:19	0.071	0.096	0.093
Acid Leachable SO4-S [%]	---	---	0.02	0.03	0.02
Sulphide [%]	01-Sep-17	16:09	0.05	0.07	0.07
Carbon (total) [%]	07-Sep-17	15:19	0.629	0.660	0.564
Carbonate [%]	01-Sep-17	16:07	0.565	1.18	0.470

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001133878

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SGS Canada Inc.
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Project : PO# 598591

07-September-2017

Agnico Eagle Mines Limited
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, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 23 August 2017
LR Report: **CA15639-AUG17**
Reference: AEM-Meliadine Gold Project

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: "001"	6: "002"	7: "003"
Sample Date & Time			27-Jul-17	27-Jul-17	27-Jul-17
Silver [µg/g]	06-Sep-17	10:38	0.20	0.18	0.18
Aluminum [µg/g]	06-Sep-17	16:13	67000	68000	69000
Arsenic [µg/g]	06-Sep-17	10:38	43	43	45
Barium [µg/g]	06-Sep-17	10:38	640	640	680
Beryllium [µg/g]	06-Sep-17	10:38	1.3	1.3	1.3
Bismuth [µg/g]	06-Sep-17	10:38	0.20	0.17	0.19
Calcium [µg/g]	06-Sep-17	16:13	18000	20000	16000
Cadmium [µg/g]	06-Sep-17	10:38	0.92	0.91	0.94
Cobalt [µg/g]	06-Sep-17	10:38	12	14	14
Chromium [µg/g]	06-Sep-17	10:38	53	66	54
Copper [µg/g]	06-Sep-17	10:38	32	34	30
Iron [µg/g]	06-Sep-17	16:13	28000	29000	29000
Potassium [µg/g]	06-Sep-17	16:13	19000	20000	21000
Lithium [µg/g]	06-Sep-17	10:38	20	22	24
Magnesium [µg/g]	06-Sep-17	16:13	9700	10000	10000
Manganese [µg/g]	06-Sep-17	10:38	330	380	350
Molybdenum [µg/g]	06-Sep-17	10:38	2.7	2.4	2.7
Sodium [µg/g]	06-Sep-17	16:13	24000	22000	23000
Nickel [µg/g]	06-Sep-17	10:38	39	39	39
Phosphorus [µg/g]	06-Sep-17	16:13	570	520	570
Lead [µg/g]	06-Sep-17	10:38	16	16	16
Antimony [µg/g]	06-Sep-17	10:38	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	06-Sep-17	10:38	< 0.7	< 0.7	< 0.7
Tin [µg/g]	06-Sep-17	10:38	< 6	< 6	< 6
Strontium [µg/g]	06-Sep-17	10:38	340	320	310
Titanium [µg/g]	06-Sep-17	10:38	1800	1700	1900
Thallium [µg/g]	06-Sep-17	10:38	0.44	0.43	0.47
Uranium [µg/g]	06-Sep-17	10:38	1.7	1.5	1.7
Vanadium [µg/g]	06-Sep-17	10:38	75	70	75

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0001125191

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO# 598591

LR Report : **CA15639-AUG17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: "001"	6: "002"	7: "003"
Yttrium [µg/g]	06-Sep-17	10:38	9.2	8.6	9.1
Zinc [µg/g]	06-Sep-17	10:38	54	51	56

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001125191

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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO# 598591

30-August-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 23 August 2017
LR Report: **CA15640-AUG17**
Reference: AEM-Meliadine Gold Project

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	5: "001"	6: "002"	7: "003"
Sample Date & Time	27-Jul-17	27-Jul-17	27-Jul-17
SiO2 [%]	68.2	67.7	67.7
Al2O3 [%]	13.7	13.7	14.1
Fe2O3 [%]	4.18	4.28	4.44
MgO [%]	1.72	1.79	1.82
CaO [%]	2.63	2.88	2.39
Na2O [%]	3.36	3.11	3.30
K2O [%]	2.10	2.18	2.25
TiO2 [%]	0.48	0.47	0.50
P2O5 [%]	0.14	0.13	0.14
MnO [%]	0.05	0.06	0.05
Cr2O3 [%]	0.02	0.02	0.02
V2O5 [%]	0.01	0.01	< 0.01
LOI [%]	3.30	3.47	3.21
Sum [%]	99.9	99.8	100.0

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001117233

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Test method information available upon request. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Shake Flask Leach (3:1 Ratio)

Project : PO# 598591

14-September-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 23 August 2017
LR Report: **CA15641-AUG17**
Reference: AEM-Meliadine Gold Project

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: "001"	6: "002"	7: "003"	8: "003"
Sample Date & Time			27-Jul-17	27-Jul-17	27-Jul-17	
Sample weight [g]	31-Aug-17	13:09	250	250	250	250
Volume D.I. Water [mL]	31-Aug-17	13:09	750	750	750	750
Final pH	31-Aug-17	13:09	8.16	8.29	8.12	8.17
pH [no unit]	01-Sep-17	13:53	7.93	7.97	7.90	7.97
Conductivity [uS/cm]	01-Sep-17	13:53	1050	1020	1100	1070
Alkalinity [mg/L as CaCO3]	01-Sep-17	13:53	42	39	42	53
Sulphate [mg/L]	31-Aug-17	16:58	110	110	130	120
Mercury [mg/L]	14-Sep-17	07:44	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	05-Sep-17	13:03	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	05-Sep-17	13:03	0.090	0.086	0.054	0.062
Arsenic [mg/L]	05-Sep-17	13:03	0.0091	0.0122	0.0082	0.0087
Barium [mg/L]	05-Sep-17	13:03	0.0477	0.0425	0.0549	0.0545
Boron [mg/L]	05-Sep-17	13:03	0.037	0.040	0.035	0.036
Beryllium [mg/L]	05-Sep-17	13:03	0.000016	0.000016	0.000013	0.000015
Bismuth [mg/L]	05-Sep-17	13:03	0.000057	0.000032	0.000033	0.000013
Calcium [mg/L]	05-Sep-17	13:03	86.7	72.4	99.1	92.4
Cadmium [mg/L]	05-Sep-17	13:03	0.000011	0.000017	0.000020	0.000015
Cobalt [mg/L]	05-Sep-17	13:03	0.00143	0.00135	0.00168	0.00155
Chromium [mg/L]	05-Sep-17	13:03	0.00010	0.00009	0.00011	0.00009
Copper [mg/L]	05-Sep-17	13:03	0.00359	0.00251	0.00348	0.00404
Iron [mg/L]	05-Sep-17	13:03	0.013	0.010	0.012	0.011
Potassium [mg/L]	05-Sep-17	13:03	19.9	17.1	16.0	16.6
Lithium [mg/L]	05-Sep-17	13:03	0.0112	0.0103	0.0163	0.0163
Manganese [mg/L]	05-Sep-17	13:03	0.0964	0.0707	0.192	0.164
Magnesium [mg/L]	05-Sep-17	13:03	21.3	20.1	22.7	21.8
Molybdenum [mg/L]	05-Sep-17	13:03	0.00947	0.0112	0.0109	0.0108
Sodium [mg/L]	05-Sep-17	13:03	86.3	93.2	81.7	81.4
Nickel [mg/L]	05-Sep-17	13:03	0.0029	0.0027	0.0037	0.0036
Phosphorus [mg/L]	05-Sep-17	13:03	0.019	0.012	0.014	0.012

OnLine LIMS

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0001133875

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Shake Flask Leach (3:1 Ratio)

Project : PO# 598591

LR Report : **CA15641-AUG17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: "001"	6: "002"	7: "003"	8: "003"
Lead [mg/L]	05-Sep-17	13:03	0.00005	0.00008	0.00005	0.00009
Antimony [mg/L]	05-Sep-17	13:03	0.0010	0.0012	0.0008	0.0007
Selenium [mg/L]	05-Sep-17	13:03	0.00017	0.00022	0.00019	0.00018
Silicon [mg/L]	05-Sep-17	13:03	2.65	3.10	3.13	3.29
Tin [mg/L]	05-Sep-17	13:03	0.00022	0.00016	0.00022	0.00027
Strontium [mg/L]	05-Sep-17	13:03	0.516	0.432	0.613	0.578
Titanium [mg/L]	05-Sep-17	13:03	0.00024	0.00025	0.00030	0.00024
Thallium [mg/L]	05-Sep-17	13:03	0.000027	0.000021	0.000022	0.000022
Uranium [mg/L]	05-Sep-17	13:03	0.00198	0.00201	0.00165	0.00185
Vanadium [mg/L]	05-Sep-17	13:03	0.00042	0.00051	0.00034	0.00036
Zinc [mg/L]	05-Sep-17	13:03	< 0.002	< 0.002	< 0.002	0.002
Zirconium [mg/L]	05-Sep-17	13:03	< 0.002	< 0.002	< 0.002	< 0.002

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001133875

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Appendix C2

Geochemical Monitoring Results – Emulsion Esker Quarry

SGS Canada Inc.
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Phone: 705-652-2000 FAX: 705-652-6365

ABA - Modified Sobek

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
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25-October-2017

Date Rec. : 28 September 2017
LR Report: **CA12600-SEP17**

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 490-Explosive Plant-1	6: 490-Explosive Plant-2	7: 490-Explosive Plant-3	8: 490-Explosive Plant-4	9: 490-Explosive Plant-5	10: 490-Explosive Plant-6	11: 490-Explosive Plant-7	12: 490-Explosive Plant-8	13: 490-Explosive Plant-9	14: 490-Explosive Plant-10
Sample Date & Time			20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17
Paste pH	24-Oct-17	16:41	9.20	8.78	8.81	8.82	9.06	8.82	8.57	8.83	8.66	8.39
Fizz Rate [---]	24-Oct-17	16:41	1	1	1	2	2	2	2	2	1	1
Sample weight [g]	24-Oct-17	16:41	2.05	2.03	1.99	2.01	2.02	2.00	2.00	1.97	1.99	2.02
HCl Added [mL]	24-Oct-17	16:41	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
HCl [Normality]	24-Oct-17	16:41	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	24-Oct-17	16:41	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	24-Oct-17	16:41	14.38	14.26	14.77	13.43	13.50	11.78	14.85	14.52	15.23	16.42
Final pH	24-Oct-17	16:41	1.35	1.35	1.37	1.38	1.38	1.48	1.33	1.34	1.36	1.29
NP [t CaCO3/1000 t]	24-Oct-17	16:41	14	14	13	16	16	20	13	14	12	8.9
AP [t CaCO3/1000 t]	---	---	0.62	0.62	0.62	0.62	0.94	0.94	0.62	0.62	0.62	0.62
Net NP [t CaCO3/1000 t]	---	---	13.1	13.5	12.5	15.7	15.2	19.6	12.3	13.3	11.4	8.28
NP/AP [ratio]	---	---	22.1	22.7	21.1	26.3	17.2	21.9	20.8	22.4	19.4	14.4
Sulphur (total) [%]	12-Oct-17	09:35	0.037	0.020	0.034	0.024	0.044	0.056	0.027	0.021	0.019	0.023
Acid Leachable SO4-S [%]	---	---	0.037	0.02	0.034	0.024	< 0.02	0.03	0.027	0.021	< 0.02	0.023
Sulphide [%]	12-Oct-17	09:35	< 0.02	< 0.02	< 0.02	< 0.02	0.03	0.03	< 0.02	< 0.02	< 0.02	< 0.02
Carbon (total) [%]	12-Oct-17	11:35	0.157	0.140	0.124	0.163	0.249	0.344	0.185	0.152	0.130	0.306
Carbonate [%]	12-Oct-17	11:35	0.365	0.350	0.285	0.440	0.545	0.709	0.360	0.350	0.225	0.155

OnLine LIMS

00011777730

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ABA - Modified Sobek

LR Report : **CA12600-SEP17**

Analysis	15: 490-Explosive Plant-11	16: 490-Explosive Plant-12	17: 490-Explosive Plant-13	18: 490-Explosive Plant-14
Sample Date & Time	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17
Paste pH	8.93	8.64	9.77	8.96
Fizz Rate [---]	1	1	2	1
Sample weight [g]	2.02	2.01	1.99	2.02
HCl Added [mL]	20.00	20.00	49.50	20.00
HCl [Normality]	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	13.55	14.94	27.32	15.55
Final pH	1.44	1.24	1.71	1.26
NP [t CaCO3/1000 t]	16	13	56	11
AP [t CaCO3/1000 t]	0.62	0.62	2.19	0.62
Net NP [t CaCO3/1000 t]	15.4	12.0	53.5	10.4
NP/AP [ratio]	25.8	20.3	25.5	17.6
Sulphur (total) [%]	0.032	0.017	0.151	0.024
Acid Leachable SO4-S [%]	0.032	< 0.02	0.08	< 0.02
Sulphide [%]	< 0.02	< 0.02	0.07	0.02
Carbon (total) [%]	0.310	0.104	0.705	0.258
Carbonate [%]	0.520	0.210	2.18	0.295

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OnLine LIMS

0001177730

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13-October-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Date Rec. : 28 September 2017
LR Report: **CA12601-SEP17**

Baker Lake,
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CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: 490-Explosive Plant-1	6: 490-Explosive Plant-2	7: 490-Explosive Plant-3	8: 490-Explosive Plant-4	9: 490-Explosive Plant-5	10: 490-Explosive Plant-6	11: 490-Explosive Plant-7	12: 490-Explosive Plant-8
Sample Date & Time					20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17
Silver [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	0.05	0.06	0.03	0.05	0.04	0.05	0.06	0.03
Aluminum [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	77000	73000	74000	76000	76000	72000	73000	76000
Arsenic [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	9.4	18	23	13	18	18	20	19
Barium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	850	680	680	760	680	670	680	620
Beryllium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	1.2	1.2	1.3	1.4	1.2	1.5	1.3	1.3
Bismuth [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	0.12	0.23	0.16	0.17	0.14	0.20	0.18	0.29
Calcium [µg/g]	12-Oct-17	12:49	12-Oct-17	15:08	23000	24000	20000	21000	20000	22000	19000	20000
Cadmium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	0.08	0.04	0.08	0.04	0.05	0.05	0.05	0.04
Cobalt [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	12	20	18	17	11	13	14	14
Chromium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	76	92	93	85	80	85	97	83
Copper [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	21	50	43	42	22	26	39	34
Iron [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	32000	37000	33000	33000	30000	29000	33000	30000
Potassium [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	23000	22000	18000	21000	18000	19000	19000	18000
Lithium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	19	18	20	24	20	20	19	19
Magnesium [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	11000	16000	12000	13000	11000	11000	12000	11000
Manganese [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	470	750	720	560	420	440	540	600
Molybdenum [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	7.3	3.2	1.9	3.3	1.4	2.1	3.8	2.4
Sodium [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	29000	27000	26000	28000	28000	27000	25000	28000
Nickel [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	25	66	41	39	29	32	35	34
Phosphorus [µg/g]	12-Oct-17	12:49	12-Oct-17	13:40	500	520	590	620	590	730	570	550

OnLine LIMS

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LR Report : **CA12601-SEP17**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: 490-Explosive Plant-1	6: 490-Explosive Plant-2	7: 490-Explosive Plant-3	8: 490-Explosive Plant-4	9: 490-Explosive Plant-5	10: 490-Explosive Plant-6	11: 490-Explosive Plant-7	12: 490-Explosive Plant-8
Lead [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	14	13	13	15	13	19	15	14
Antimony [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	440	410	480	490	510	470	400	450
Titanium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	2500	2500	2700	2600	2300	2300	2300	2300
Thallium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	0.42	0.35	0.33	0.34	0.33	0.35	0.36	0.37
Uranium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	1.2	1.3	1.2	1.3	1.3	1.4	1.9	1.2
Vanadium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	65	79	73	71	72	68	78	68
Yttrium [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	8.8	11	11	10	9.4	10	11	9.5
Zinc [µg/g]	11-Oct-17	17:00	12-Oct-17	15:08	58	63	61	64	61	55	59	55

Analysis	13: 490-Explosive Plant-9	14: 490-Explosive Plant-10	15: 490-Explosive Plant-11	16: 490-Explosive Plant-12	17: 490-Explosive Plant-13	18: 490-Explosive Plant-14
Sample Date & Time	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17
Silver [µg/g]	0.03	0.04	0.05	0.04	0.06	0.04
Aluminum [µg/g]	75000	78000	71000	75000	78000	76000
Arsenic [µg/g]	17	21	22	18	23	23
Barium [µg/g]	660	700	650	690	480	670
Beryllium [µg/g]	1.4	1.3	1.4	1.3	1.1	1.3
Bismuth [µg/g]	0.19	0.17	0.50	0.16	0.15	0.17
Calcium [µg/g]	22000	17000	26000	23000	16000	16000
Cadmium [µg/g]	0.04	0.04	0.09	0.04	0.06	0.07
Cobalt [µg/g]	14	13	17	17	10	12
Chromium [µg/g]	87	92	120	78	140	100
Copper [µg/g]	30	22	23	31	40	22
Iron [µg/g]	34000	32000	37000	31000	34000	32000
Potassium [µg/g]	20000	21000	19000	18000	19000	20000
Lithium [µg/g]	20	25	21	18	22	21
Magnesium [µg/g]	12000	11000	16000	11000	14000	11000
Manganese [µg/g]	540	470	600	620	480	470
Molybdenum [µg/g]	1.7	2.0	2.5	2.8	6.3	1.8
Sodium [µg/g]	29000	29000	25000	28000	29000	27000
Nickel [µg/g]	32	29	41	33	57	34

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LR Report : **CA12601-SEP17**

Analysis	13: 490-Explosive Plant-9	14: 490-Explosive Plant-10	15: 490-Explosive Plant-11	16: 490-Explosive Plant-12	17: 490-Explosive Plant-13	18: 490-Explosive Plant-14
Phosphorus [µg/g]	610	510	700	630	510	520
Lead [µg/g]	15	12	13	14	7.3	14
Antimony [µg/g]	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	420	410	440	460	410	390
Titanium [µg/g]	2600	2500	2800	2500	2200	2300
Thallium [µg/g]	0.41	0.41	0.37	0.29	0.46	0.37
Uranium [µg/g]	1.2	1.4	1.5	1.2	1.3	1.4
Vanadium [µg/g]	71	73	87	72	84	82
Yttrium [µg/g]	11	11	13	10	7.7	10
Zinc [µg/g]	58	62	69	56	68	61

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11-October-2017

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Date Rec. : 28 September 2017
LR Report: **CA12602-SEP17**

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CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
5: 490-Explosive Plant-1	20-Sep-17	66.7	14.7	4.53	1.88	3.29	3.78	2.40	0.50	0.12	0.06	0.02	0.01	1.64	99.6
6: 490-Explosive Plant-2	20-Sep-17	65.6	14.2	5.42	2.76	3.51	3.53	2.26	0.46	0.13	0.11	0.03	0.02	1.76	99.8
7: 490-Explosive Plant-3	20-Sep-17	66.3	14.8	4.96	2.07	3.03	3.83	2.03	0.50	0.16	0.11	0.02	0.02	1.86	99.8
8: 490-Explosive Plant-4	20-Sep-17	65.9	15.1	4.94	2.20	3.03	3.81	2.25	0.48	0.16	0.08	0.02	0.02	1.93	99.8
9: 490-Explosive Plant-5	20-Sep-17	66.7	15.0	4.45	1.91	3.02	3.93	2.02	0.48	0.15	0.06	0.02	0.01	2.04	99.9
10: 490-Explosive Plant-6	20-Sep-17	68.1	14.0	4.35	1.95	3.27	3.74	2.02	0.46	0.18	0.06	0.03	0.01	2.12	100.3
11: 490-Explosive Plant-7	20-Sep-17	67.7	14.3	4.79	2.03	2.78	3.54	2.04	0.48	0.14	0.08	0.03	0.02	1.87	99.8
12: 490-Explosive Plant-8	20-Sep-17	67.3	14.7	4.51	1.85	2.93	3.89	1.99	0.44	0.14	0.09	0.02	0.01	1.76	99.7
13: 490-Explosive Plant-9	20-Sep-17	67.4	14.5	4.93	1.98	3.19	3.81	2.12	0.49	0.15	0.07	0.03	< 0.01	1.50	100.2
14: 490-Explosive Plant-10	20-Sep-17	67.0	14.8	4.55	1.87	2.43	3.86	2.21	0.47	0.12	0.08	0.02	0.02	2.07	99.5
15: 490-Explosive Plant-11	20-Sep-17	65.1	13.9	5.52	2.83	3.74	3.43	2.01	0.54	0.18	0.09	0.03	0.01	2.05	99.4
16: 490-Explosive Plant-12	20-Sep-17	66.8	14.7	4.69	1.94	3.33	3.86	2.01	0.44	0.16	0.08	0.02	0.02	1.47	99.6
17: 490-Explosive Plant-13	20-Sep-17	64.6	15.0	4.88	2.33	2.30	3.87	1.96	0.52	0.12	0.06	0.04	0.02	4.32	100.0
18: 490-Explosive Plant-14	20-Sep-17	67.5	14.7	4.69	1.94	2.24	3.64	2.11	0.50	0.13	0.06	0.02	0.01	2.26	99.8

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0001161846

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LR Report : **CA12602-SEP17**

Brian Graham B.Sc.
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Environmental Services, Analytical

OnLine LIMS

000116184

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16-October-2017

Agnico Eagle Mines Limited
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Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 28 September 2017
LR Report: **CA12603-SEP17**

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: 490-Explosive Plant-1	6: 490-Explosive Plant-2	7: 490-Explosive Plant-3	8: 490-Explosive Plant-4	9: 490-Explosive Plant-5	10: 490-Explosive Plant-6
Sample Date & Time					20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17
Sample weight [g]	05-Oct-17	07:56	10-Oct-17	09:49	250	250	250	250	250	250
Volume D.I. Water [mL]	05-Oct-17	07:56	10-Oct-17	09:49	750	750	750	750	750	750
Final pH	06-Oct-17	08:00	10-Oct-17	09:49	9.10	9.05	8.84	9.41	8.82	8.49
pH [no unit]	10-Oct-17	12:59	16-Oct-17	10:52	7.87	7.90	7.65	8.63	7.85	7.70
Conductivity [uS/cm]	10-Oct-17	12:59	16-Oct-17	10:52	134	187	166	236	156	188
Alkalinity [mg/L as CaCO3]	10-Oct-17	12:59	16-Oct-17	10:52	34	31	32	35	42	46
Sulphate [mg/L]	06-Oct-17	16:18	10-Oct-17	13:07	15	20	19	35	22	28
Mercury [mg/L]	10-Oct-17	17:23	11-Oct-17	09:57	< 0.00001	0.00003	0.00002	0.00002	0.00003	0.00003
Silver [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.874	0.322	0.264	0.303	0.641	0.984
Arsenic [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.0132	0.0279	0.0220	0.0336	0.0286	0.0256
Barium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.0148	0.00459	0.00388	0.00502	0.0104	0.0225
Boron [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.017	0.056	0.053	0.070	0.018	0.022
Beryllium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.000012	< 0.000007	< 0.000007	< 0.000007	< 0.000007	0.000020
Bismuth [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	0.000011	< 0.000007	< 0.000007	< 0.000007	0.000007	0.000023
Calcium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:56	8.00	11.0	10.5	16.3	14.5	17.6

OnLine LIMS

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Shake Flask Leach (3:1 Ratio)

LR Report : **CA12603-SEP17**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: 490-Explosive Plant-1	6: 490-Explosive Plant-2	7: 490-Explosive Plant-3	8: 490-Explosive Plant-4	9: 490-Explosive Plant-5	10: 490-Explosive Plant-6
Cadmium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.000007	0.000025	0.000035	0.000022	0.000014	0.000012
Cobalt [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.000548	0.000160	0.000210	0.000096	0.000560	0.00166
Chromium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00059	0.00027	0.00015	0.00055	0.00042	0.00155
Copper [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00951	0.00541	0.00658	0.00730	0.0121	0.0175
Iron [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.286	0.090	0.098	0.031	0.187	0.907
Potassium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	9.34	9.44	8.71	10.5	8.15	9.61
Lithium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.0026	0.0047	0.0048	0.0022	0.0014	0.0022
Manganese [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00883	0.00539	0.00722	0.00164	0.00811	0.0284
Magnesium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.912	1.78	1.67	1.51	1.34	1.88
Molybdenum [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00360	0.0551	0.0753	0.0435	0.00439	0.00476
Sodium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	10.4	17.0	14.7	18.8	10.3	10.5
Nickel [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.0013	0.0012	0.0016	0.0008	0.0019	0.0041
Phosphorus [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.044	0.058	0.053	0.073	0.037	0.056
Lead [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00058	0.00011	0.00013	0.00007	0.00058	0.00154
Antimony [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.0009	0.0008	0.0011	0.0012	0.0008	0.0006
Selenium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00024	0.00046	0.00049	0.00058	0.00031	0.00042
Silicon [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	3.30	2.97	2.99	3.28	2.43	3.89
Tin [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00013	0.00010	0.00011	0.00018	0.00012	0.00017
Strontium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.0457	0.0591	0.0557	0.0909	0.0687	0.0908
Titanium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.0130	0.00199	0.00152	0.00067	0.00459	0.0300
Thallium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.000006	< 0.000005	< 0.000005	< 0.000005	< 0.000005	0.000010
Uranium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.000680	0.000633	0.000817	0.000716	0.00157	0.00184
Vanadium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	0.00744	0.00208	0.00133	0.00580	0.00339	0.00356
Zinc [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.004
Zirconium [mg/L]	10-Oct-17	15:25	12-Oct-17	16:57	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

OnLine LIMS

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LR Report : **CA12603-SEP17**

Analysis	11: 490-Explosive Plant-7	12: 490-Explosive Plant-8	13: 490-Explosive Plant-9	14: 490-Explosive Plant-10	15: 490-Explosive Plant-11	16: 490-Explosive Plant-12	17: 490-Explosive Plant-13	18: 490-Explosive Plant-14	19: 490-Explosive Plant-14
Sample Date & Time	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	20-Sep-17	
Sample weight [g]	250	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750	750	750	750	750	750
Final pH	8.57	8.83	8.59	8.02	8.40	9.24	8.90	8.24	8.27
pH [no unit]	7.82	7.93	7.76	8.04	7.91	8.23	7.88	7.95	7.97
Conductivity [uS/cm]	316	283	208	148	145	117	289	127	123
Alkalinity [mg/L as CaCO3]	34	34	37	66	45	54	34	60	55
Sulphate [mg/L]	54	38	26	< 2	17	< 2	38	< 2	< 2
Mercury [mg/L]	0.00001	0.00004	0.00004	0.00002	0.00003	< 0.00001	0.00002	< 0.00001	0.00002
Silver [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	0.718	0.221	0.400	0.213	0.485	0.587	0.253	0.421	0.495
Arsenic [mg/L]	0.0193	0.0150	0.0200	0.0081	0.0234	0.0273	0.0185	0.0123	0.0128
Barium [mg/L]	0.0261	0.00685	0.0175	0.0228	0.0133	0.00163	0.00634	0.0166	0.0165
Boron [mg/L]	0.080	0.086	0.069	0.006	0.013	0.007	0.105	0.005	0.005
Beryllium [mg/L]	0.000018	< 0.000007	0.000007	< 0.000007	0.000008	< 0.000007	< 0.000007	0.000009	0.000012
Bismuth [mg/L]	0.000032	< 0.000007	0.000014	0.000010	0.000016	< 0.000007	< 0.000007	0.000013	0.000013
Calcium [mg/L]	24.7	18.0	11.9	19.6	17.5	7.42	14.8	14.7	13.1
Cadmium [mg/L]	0.000039	0.000034	0.000009	0.000014	0.000006	< 0.000003	0.000020	0.000007	0.000011
Cobalt [mg/L]	0.00278	0.000115	0.000780	0.000738	0.000956	0.000034	0.000105	0.000927	0.000973
Chromium [mg/L]	0.00132	0.00018	0.00035	0.00045	0.00058	0.00008	0.00018	0.00052	0.00067
Copper [mg/L]	0.0180	0.00674	0.0135	0.00891	0.0243	0.00124	0.00740	0.00904	0.00823
Iron [mg/L]	1.16	0.018	0.346	0.310	0.363	0.012	0.027	0.404	0.504
Potassium [mg/L]	10.1	10.1	9.98	8.50	8.52	8.30	10.4	8.17	7.79
Lithium [mg/L]	0.0040	0.0049	0.0029	0.0010	0.0014	0.0005	0.0056	0.0010	0.0010
Manganese [mg/L]	0.0834	0.0109	0.0166	0.0467	0.0153	0.00114	0.00435	0.0293	0.0250
Magnesium [mg/L]	3.94	3.46	2.12	2.80	1.79	1.70	3.20	2.04	1.79
Molybdenum [mg/L]	0.0565	0.0765	0.0329	0.00403	0.00347	0.00325	0.0614	0.00333	0.00305
Sodium [mg/L]	25.1	26.3	19.9	5.00	6.21	9.44	28.2	5.22	4.73
Nickel [mg/L]	0.0058	0.0014	0.0023	0.0020	0.0033	0.0002	0.0011	0.0019	0.0019

OnLine LIMS

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA12603-SEP17**

Analysis	11: 490-Explosive Plant-7	12: 490-Explosive Plant-8	13: 490-Explosive Plant-9	14: 490-Explosive Plant-10	15: 490-Explosive Plant-11	16: 490-Explosive Plant-12	17: 490-Explosive Plant-13	18: 490-Explosive Plant-14	19: 490-Explosive Plant-14
Phosphorus [mg/L]	0.061	0.026	0.043	0.030	0.042	< 0.003	0.033	0.017	0.012
Lead [mg/L]	0.00188	0.00004	0.00047	0.00040	0.00099	0.00003	0.00005	0.00059	0.00071
Antimony [mg/L]	0.0008	0.0013	0.0008	0.0004	0.0004	0.0007	0.0009	0.0004	0.0005
Selenium [mg/L]	0.00049	0.00046	0.00048	0.00024	0.00040	0.00009	0.00062	0.00021	0.00015
Silicon [mg/L]	3.66	2.74	2.51	2.58	2.23	2.05	2.77	2.69	2.57
Tin [mg/L]	0.00008	0.00012	0.00014	0.00015	0.00034	0.00010	0.00012	0.00015	0.00031
Strontium [mg/L]	0.152	0.115	0.0807	0.0758	0.0823	0.0347	0.101	0.0620	0.0627
Titanium [mg/L]	0.0245	0.00031	0.00625	0.00795	0.00775	0.00194	0.00077	0.00995	0.0136
Thallium [mg/L]	0.000016	0.000007	0.000008	0.000006	< 0.000005	0.000006	0.000005	0.000011	0.000012
Uranium [mg/L]	0.00118	0.000834	0.000863	0.000928	0.00163	0.000187	0.000672	0.000933	0.00102
Vanadium [mg/L]	0.00217	0.00104	0.00135	0.00090	0.00165	0.00248	0.00110	0.00120	0.00128
Zinc [mg/L]	0.003	< 0.002	< 0.002	< 0.002	0.007	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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Appendix C3

Geochemical Monitoring Results – Meliadine Esker

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05-May-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 17 April 2017
LR Report: **CA15314-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008
Sample Date & Time			09-Apr-17	09-Apr-17	09-Apr-17
Paste pH	03-May-17	10:05	9.65	8.90	9.38
Fizz Rate [---]	03-May-17	10:05	1	3	3
Sample weight [g]	03-May-17	10:05	2.00	1.91	2.08
HCl Added [mL]	03-May-17	10:05	20.00	30.00	26.50
HCl [Normality]	03-May-17	10:05	0.10	0.10	0.10
NaOH [Normality]	03-May-17	10:05	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	03-May-17	10:05	14.50	12.08	15.31
Final pH	03-May-17	10:05	1.40	1.79	1.55
NP [t CaCO3/1000 t]	03-May-17	10:05	14	47	27
AP [t CaCO3/1000 t]	---	---	0.94	0.62	0.62
Net NP [t CaCO3/1000 t]	---	---	12.9	46.3	26.3
NP/AP [ratio]	---	---	14.7	75.6	43.4
Sulphur (total) [%]	05-May-17	08:54	0.048	0.030	0.022
Acid Leachable SO4-S [%]	---	---	< 0.02	0.03	0.02
Sulphide [%]	05-May-17	08:54	0.03	< 0.02	< 0.02
Carbon (total) [%]	03-May-17	16:28	0.100	0.678	0.310
Carbonate [%]	03-May-17	16:28	0.305	2.41	1.04

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Project Specialist
Environmental Services, Analytical

OnLine LIMS

6606860000

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28-April-2017

Agnico Eagle Mines Limited
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, X0C 0A0
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Date Rec. : 17 April 2017
LR Report: **CA15315-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008
Sample Date & Time			09-Apr-17	09-Apr-17	09-Apr-17
Silver [µg/g]	28-Apr-17	13:47	0.05	0.05	0.02
Aluminum [µg/g]	28-Apr-17	13:47	74000	66000	73000
Arsenic [µg/g]	28-Apr-17	13:47	3.0	35	6.4
Barium [µg/g]	28-Apr-17	13:47	590	570	670
Beryllium [µg/g]	28-Apr-17	13:47	0.91	0.80	0.93
Bismuth [µg/g]	28-Apr-17	13:47	0.15	0.11	0.11
Calcium [µg/g]	28-Apr-17	13:47	26000	30000	28000
Cadmium [µg/g]	28-Apr-17	13:47	0.04	0.07	0.06
Cobalt [µg/g]	28-Apr-17	13:47	13	15	10
Chromium [µg/g]	28-Apr-17	13:47	100	150	120
Copper [µg/g]	28-Apr-17	15:52	31	28	20
Iron [µg/g]	28-Apr-17	13:48	34000	36000	32000
Potassium [µg/g]	28-Apr-17	13:48	17000	16000	17000
Lithium [µg/g]	28-Apr-17	13:48	23	21	21
Magnesium [µg/g]	28-Apr-17	13:48	12000	14000	11000
Manganese [µg/g]	28-Apr-17	13:48	470	620	450
Molybdenum [µg/g]	28-Apr-17	13:48	1.3	1.4	1.1
Sodium [µg/g]	28-Apr-17	13:48	30000	24000	31000
Nickel [µg/g]	28-Apr-17	13:48	25	38	23
Phosphorus [µg/g]	28-Apr-17	13:48	500	370	550
Lead [µg/g]	28-Apr-17	13:48	11	11	11
Antimony [µg/g]	28-Apr-17	13:48	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	28-Apr-17	13:48	< 0.7	< 0.7	< 0.7
Tin [µg/g]	28-Apr-17	13:48	< 6	< 6	< 6
Strontium [µg/g]	28-Apr-17	13:48	410	360	400
Titanium [µg/g]	28-Apr-17	13:48	2300	2400	2100
Thallium [µg/g]	28-Apr-17	13:48	0.39	0.34	0.34
Uranium [µg/g]	28-Apr-17	13:48	1.1	1.0	1.1
Vanadium [µg/g]	28-Apr-17	13:48	82	98	70
Yttrium [µg/g]	28-Apr-17	13:48	9.1	10.0	8.7
Zinc [µg/g]	28-Apr-17	13:48	49	55	46

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0000983019

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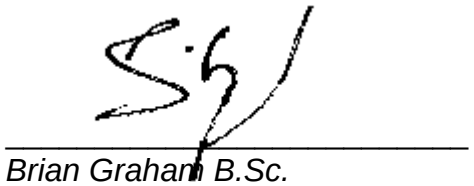
LR Report : **CA15315-APR17**



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OnLine LIMS

0000983019

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28-April-2017

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Date Rec. : 17 April 2017
LR Report: **CA15316-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008
Sample Date & Time			09-Apr-17	09-Apr-17	09-Apr-17
Sample weight [g]	28-Apr-17	15:14	1.52	1.50	1.50
Vol H2O2 [mL]	28-Apr-17	15:14	150	150	150
Final pH	28-Apr-17	15:14	8.02	10.72	10.74
NaOH [Normality]	28-Apr-17	15:14	0.10	0.10	0.10
Vol NaOH to PH 4.5 [mL]	28-Apr-17	15:14	0.00	0.00	0.00
Vol NaOH to PH 7.0 [mL]	28-Apr-17	15:14	0.00	0.00	0.00
NAG (pH 4.5) [kg H2SO4/tonne]	28-Apr-17	15:14	0.0	0.0	0.0
NAG (pH 7.0) [kg H2SO4/tonne]	28-Apr-17	15:14	0.0	0.0	0.0

Brian Graham B.Sc.
Project Specialist
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00009830 28

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Test method information available upon request. "Temperature Upon Receipt" is representative of the whole shipment and may not reflect the temperature of individual samples.

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
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02-May-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 17 April 2017
LR Report: **CA15317-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008	8: ARP-ME-ESK-008
Sample Date & Time			09-Apr-17	09-Apr-17	09-Apr-17	
Sample weight [g]	28-Apr-17	10:49	2.47	2.47	2.46	2.46
Vol H2O2 [mL]	28-Apr-17	10:49	250	250	250	250
pH [no unit]	01-May-17	13:14	8.30	11.1	11.0	10.9
Conductivity [uS/cm]	01-May-17	13:14	149	380	332	291
Acidity [mg/L as CaCO3]	01-May-17	13:14	< 2	< 2	< 2	< 2
Sulphate [mg/L]	02-May-17	13:01	17	6	5	5
Mercury [mg/L]	02-May-17	09:47	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Aluminum [mg/L]	02-May-17	13:25	1.30	2.99	3.29	3.18
Arsenic [mg/L]	02-May-17	13:25	0.0092	0.0034	0.0043	0.0041
Boron [mg/L]	02-May-17	13:25	0.011	0.156	0.042	0.040
Barium [mg/L]	02-May-17	13:25	0.0159	0.0255	0.0319	0.0298
Beryllium [mg/L]	02-May-17	13:25	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	02-May-17	13:25	0.000019	0.000011	0.000007	< 0.000007
Cadmium [mg/L]	02-May-17	13:25	0.000005	0.000005	0.000007	0.000007
Cobalt [mg/L]	02-May-17	13:25	0.000013	0.000008	0.000006	0.000006
Chromium [mg/L]	02-May-17	13:25	0.0279	0.0263	0.0344	0.0307
Copper [mg/L]	02-May-17	13:25	0.00120	0.00137	0.00035	0.00031
Iron [mg/L]	02-May-17	13:25	0.008	< 0.007	< 0.007	< 0.007
Lithium [mg/L]	02-May-17	13:25	0.0127	0.0013	0.0039	0.0037
Manganese [mg/L]	02-May-17	13:25	0.00228	0.00012	0.00013	0.00010
Molybdenum [mg/L]	02-May-17	13:25	0.00303	0.00374	0.00546	0.00369
Nickel [mg/L]	02-May-17	13:25	0.0002	< 0.0001	< 0.0001	< 0.0001
Phosphorus [mg/L]	02-May-17	13:25	0.050	< 0.003	< 0.003	< 0.003
Lead [mg/L]	02-May-17	13:25	0.00004	0.00003	0.00002	0.00002
Antimony [mg/L]	02-May-17	13:25	0.0012	0.0005	0.0004	0.0003
Selenium [mg/L]	02-May-17	13:25	0.00104	0.00079	0.00081	0.00078
Silicon [mg/L]	02-May-17	13:25	7.83	10.3	14.6	15.1
Tin [mg/L]	02-May-17	13:25	0.00040	0.00017	0.00017	0.00013
Strontium [mg/L]	02-May-17	13:25	0.0746	0.199	0.137	0.126
Titanium [mg/L]	02-May-17	13:25	0.00351	0.00017	0.00028	0.00030

OnLine LIMS

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LR Report : **CA15317-APR17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008	8: ARP-ME-ESK-008
Thallium [mg/L]	02-May-17	13:25	0.000097	0.000114	0.000035	0.000028
Uranium [mg/L]	02-May-17	13:25	0.000112	0.000006	0.000012	0.000015
Vanadium [mg/L]	02-May-17	13:25	0.0211	0.0177	0.0272	0.0242
Zinc [mg/L]	02-May-17	13:25	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	02-May-17	13:25	< 0.002	< 0.002	< 0.002	< 0.002

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OnLine LIMS

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03-May-2017

Agnico Eagle Mines Limited
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Date Rec. : 17 April 2017
LR Report: **CA15319-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008
Sample Date & Time			09-Apr-17	09-Apr-17	09-Apr-17
Sample weight [g]	01-May-17	13:56	250	250	250
Volume D.I. Water [mL]	01-May-17	13:56	750	750	750
Final pH	01-May-17	13:56	9.39	8.90	9.27
Alkalinity [mg/L as CaCO3]	02-May-17	15:52	91	42	34
pH [no unit]	02-May-17	15:52	8.16	8.22	8.21
Conductivity [uS/cm]	02-May-17	15:52	642	222	157
Sulphate [mg/L]	02-May-17	13:02	50	49	16
Mercury [mg/L]	03-May-17	10:54	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	03-May-17	10:54	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	03-May-17	10:54	0.543	0.433	0.569
Arsenic [mg/L]	03-May-17	10:54	0.0091	0.0242	0.0268
Barium [mg/L]	03-May-17	10:54	0.0143	0.0119	0.0210
Boron [mg/L]	03-May-17	10:54	0.012	0.029	0.021
Beryllium [mg/L]	03-May-17	10:54	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	03-May-17	10:54	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	03-May-17	10:54	16.5	24.3	12.4
Cadmium [mg/L]	03-May-17	10:54	0.000008	0.000026	0.000005
Cobalt [mg/L]	03-May-17	10:54	0.000186	0.000183	0.000163
Chromium [mg/L]	03-May-17	10:54	0.00019	0.00010	0.00023
Copper [mg/L]	03-May-17	10:54	0.00232	0.00460	0.00397
Iron [mg/L]	03-May-17	10:54	0.047	0.020	0.085
Potassium [mg/L]	03-May-17	10:54	9.69	9.62	8.38
Lithium [mg/L]	03-May-17	10:54	0.0013	0.0012	0.0021
Manganese [mg/L]	03-May-17	10:54	0.00145	0.00186	0.00233
Magnesium [mg/L]	03-May-17	10:54	0.905	2.92	1.32
Molybdenum [mg/L]	03-May-17	10:54	0.00323	0.00896	0.00530
Sodium [mg/L]	03-May-17	10:54	8.55	14.6	11.7
Nickel [mg/L]	03-May-17	10:54	0.0004	0.0006	0.0005
Phosphorus [mg/L]	03-May-17	10:54	0.033	0.013	0.035
Lead [mg/L]	03-May-17	10:54	0.00010	0.00024	0.00020

OnLine LIMS

00009869206

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LR Report : **CA15319-APR17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: ARP-ME-ESK-006	6: ARP-ME-ESK-007	7: ARP-ME-ESK-008
Antimony [mg/L]	03-May-17	10:54	0.0006	0.0005	0.0005
Selenium [mg/L]	03-May-17	10:54	0.00020	0.00041	0.00029
Silicon [mg/L]	03-May-17	10:54	3.38	2.21	3.22
Tin [mg/L]	03-May-17	10:54	0.00012	0.00003	0.00005
Strontium [mg/L]	03-May-17	10:54	0.0575	0.105	0.0677
Titanium [mg/L]	03-May-17	10:54	0.00305	0.00059	0.00326
Thallium [mg/L]	03-May-17	10:54	0.000007	0.000009	0.000005
Uranium [mg/L]	03-May-17	10:54	0.000345	0.000857	0.000837
Vanadium [mg/L]	03-May-17	10:54	0.00995	0.00160	0.00632
Zinc [mg/L]	03-May-17	10:54	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	03-May-17	10:54	< 0.002	< 0.002	< 0.002

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Project Specialist
Environmental Services, Analytical

OnLine LIMS

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25-April-2017

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Date Rec. : 17 April 2017
LR Report: **CA15318-APR17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	**5: ARP-ME-ESK-006**	**6: ARP-ME-ESK-007**	**7: ARP-ME-ESK-008**
Sample Date & Time	09-Apr-17	09-Apr-17	09-Apr-17
SiO2 [%]	66.1	65.0	66.9
Al2O3 [%]	15.0	13.6	14.3
Fe2O3 [%]	5.07	5.42	4.57
MgO [%]	2.15	2.44	1.86
CaO [%]	3.81	4.58	3.92
Na2O [%]	4.07	3.32	4.05
K2O [%]	1.96	1.78	1.83
TiO2 [%]	0.47	0.49	0.44
P2O5 [%]	0.13	0.10	0.14
MnO [%]	0.06	0.06	0.06
Cr2O3 [%]	0.01	0.02	0.03
V2O5 [%]	0.01	0.02	0.01
LOI [%]	1.67	3.76	2.21
Sum [%]	100.5	100.6	100.3

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OnLine LIMS

0000877455

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Appendix C4

Geochemical Monitoring Results – Itivia Quarry and Site D Borrow Pit

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10-February-2017

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Date Rec. : 26 January 2017
LR Report: **CA13653-JAN17**
Reference: PO# 533041

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Itivia Esker Sample 1	6: Itivia Esker Sample 2	7: Itivia Esker Sample 3	8: Itivia Esker Sample 4
Sample Date & Time			19-Jan-17	19-Jan-17	19-Jan-17	19-Jan-17
Paste pH	07-Feb-17	12:53	9.81	9.67	9.84	9.87
Fizz Rate [---]	07-Feb-17	12:53	1	1	2	3
Sample weight [g]	07-Feb-17	12:53	2.02	2.00	2.00	1.99
HCl Added [mL]	07-Feb-17	12:53	20.00	20.00	20.00	29.00
HCl [Normality]	07-Feb-17	12:53	0.10	0.10	0.10	0.10
NaOH [Normality]	07-Feb-17	12:53	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	07-Feb-17	12:53	15.88	13.01	8.33	11.24
Final pH	07-Feb-17	12:53	1.43	1.28	1.80	1.55
NP [t CaCO3/1000 t]	07-Feb-17	12:53	10	18	29	45
AP [t CaCO3/1000 t]	10-Feb-17	13:43	4.38	1.56	2.81	4.06
Net NP [t CaCO3/1000 t]	10-Feb-17	13:43	5.82	15.9	26.4	40.5
NP/AP [ratio]	10-Feb-17	13:43	2.33	11.2	10.4	11.0
Sulphur (total) [%]	10-Feb-17	13:43	0.174	0.073	0.142	0.163
Acid Leachable SO4-S [%]	10-Feb-17	13:43	0.03	0.02	0.05	0.03
Sulphide [%]	10-Feb-17	13:40	0.14	0.05	0.09	0.13
Carbon (total) [%]	10-Feb-17	10:00	0.077	0.160	0.355	0.539
Carbonate [%]	10-Feb-17	10:00	0.270	0.595	1.03	2.25

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0000909635

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ABA - Modified Sobek

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03-August-2017

Date Rec. : 11 July 2017
LR Report: **CA14272-JUL17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	5: Itivia Quarry H48 Blast-2	6: Itivia Quarry K43 Blast-2	7: Q18 ELV20	8: IQ12 001 N19 ELV14	9: G26	10: G31	11: AK38	12: AB44	13: X36	14: I26	15: AG38	16: L1000	17: H27	18: U38
Sample Date & Time	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17
Paste pH	9.46	9.43	9.68	9.65	8.57	8.93	8.90	9.08	9.14	8.85	9.16	9.22	8.97	9.20
Fizz Rate [---]	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Sample weight [g]	2.00	2.01	1.99	1.98	2.02	1.99	2.00	2.05	2.02	2.01	2.05	2.02	2.01	2.04
HCl Added [mL]	20.00	26.00	26.00	32.20	54.00	20.00	30.00	33.00	20.00	31.00	65.40	46.00	20.00	30.00
HCl [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	12.83	13.50	18.81	21.03	20.89	13.90	14.30	11.78	8.08	14.14	26.90	18.76	10.41	12.29
Final pH	1.76	1.73	1.56	1.57	1.69	1.31	1.50	1.65	1.90	1.74	1.55	1.57	1.57	1.60
NP [t CaCO3/1000 t]	18	31	18	28	82	15	39	52	30	42	94	67	24	43
AP [t CaCO3/1000 t]	0.62	1.25	0.62	0.94	34.4	2.81	15.6	10.3	3.44	6.25	6.56	6.25	1.25	3.44
Net NP [t CaCO3/1000 t]	17.3	29.8	17.5	27.3	47.6	12.5	23.7	41.5	26.1	35.6	87.3	61.2	22.6	40.0
NP/AP [ratio]	28.6	24.9	29.2	30.1	2.39	5.44	2.52	5.02	8.58	6.70	14.3	10.8	19.0	12.6
Sulphur (total) [%]	0.031	0.060	0.022	0.060	1.32	0.110	0.542	0.362	0.141	0.244	0.278	0.238	0.076	0.127
Acid Leachable SO4-S [%]	< 0.02	0.02	0.02	0.03	0.22	0.02	0.04	0.03	0.03	0.04	0.07	0.04	0.04	< 0.02
Sulphide [%]	0.02	0.04	< 0.02	0.03	1.10	0.09	0.50	0.33	0.11	0.20	0.21	0.20	0.04	0.11
Carbon (total) [%]	0.067	0.275	0.139	0.236	1.14	0.209	0.496	0.711	0.361	0.525	1.22	0.908	0.300	0.578
Carbonate [%]	0.240	1.10	0.485	0.869	2.37	0.540	1.26	2.72	1.27	1.14	4.72	3.35	0.824	2.10

OnLine LIMS

00010881B4

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ABA - Modified Sobek

LR Report : **CA14272-JUL17**

Analysis	19: M34	20: J39	21: AG44	22: A137
Sample Date & Time	May-17	May-17	May-17	May-17
Paste pH	9.11	9.19	9.12	9.09
Fizz Rate [---]	3	3	3	3
Sample weight [g]	2.05	1.98	2.00	2.04
HCl Added [mL]	201.00	80.00	20.00	28.00
HCl [Normality]	0.10	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	45.14	19.42	8.09	16.17
Final pH	1.76	1.76	1.82	1.53
NP [t CaCO3/1000 t]	380	153	30	29
AP [t CaCO3/1000 t]	2.81	2.50	1.88	3.44
Net NP [t CaCO3/1000 t]	377	150	27.9	25.6
NP/AP [ratio]	135	61.2	15.9	8.44
Sulphur (total) [%]	0.101	0.108	0.067	0.162
Acid Leachable SO4-S [%]	< 0.02	0.03	< 0.02	0.05
Sulphide [%]	0.09	0.08	0.06	0.11
Carbon (total) [%]	4.81	2.04	0.417	0.314
Carbonate [%]	22.0	8.81	1.31	0.734

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Phone: 705-652-2000 FAX: 705-652-6365

03-August-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 11 July 2017
LR Report: **CA14273-JUL17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Itivia Quarry H48 Blast-2	6: Itivia Quarry K43 Blast-2	7: Q18 ELV20	8: IQ12 001 N19 ELV14	9: G26	10: G31	11: AK38	12: AB44	13: X36	14: I26	15: AG38	16: L1000
Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17
Silver [µg/g]	25-Jul-17	15:36	0.05	0.05	0.05	0.12	0.11	0.14	0.07	0.90	0.11	0.06	0.10	0.03
Aluminum [µg/g]	26-Jul-17	11:51	64000	66000	72000	69000	23000	8000	12000	8400	24000	23000	28000	13000
Arsenic [µg/g]	25-Jul-17	15:36	0.9	0.6	< 0.5	< 0.5	13	3.5	16	18	22	5.6	10	7.4
Barium [µg/g]	25-Jul-17	15:36	50	34	200	270	190	120	110	63	190	210	250	110
Beryllium [µg/g]	25-Jul-17	15:36	0.36	0.33	0.33	0.32	0.41	0.21	0.22	0.16	0.45	0.50	0.54	0.30
Bismuth [µg/g]	25-Jul-17	15:36	< 0.09	< 0.09	< 0.09	< 0.09	0.33	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.09	< 0.09
Calcium [µg/g]	26-Jul-17	11:51	63000	68000	59000	67000	25000	5900	9900	14000	12000	15000	26000	18000
Cadmium [µg/g]	25-Jul-17	15:36	0.15	0.10	0.08	0.23	0.09	0.11	0.07	0.09	0.11	0.07	0.13	0.03
Cobalt [µg/g]	25-Jul-17	15:36	55	48	46	45	11	5.3	5.4	12	6.5	8.3	9.6	5.5
Chromium [µg/g]	25-Jul-17	15:36	530	390	360	370	280	170	190	160	39	200	150	160
Copper [µg/g]	25-Jul-17	15:36	86	91	92	110	50	11	15	15	15	21	24	12
Iron [µg/g]	26-Jul-17	11:52	82000	78000	80000	79000	32000	6800	13000	10000	14000	16000	17000	12000
Potassium [µg/g]	26-Jul-17	11:52	2400	1500	5800	7700	6500	2500	4900	2500	7400	7100	8900	3900
Lithium [µg/g]	25-Jul-17	15:36	16	13	18	17	8	4	6	5	8	9	11	5
Magnesium [µg/g]	26-Jul-17	11:52	66000	56000	53000	55000	14000	3000	5700	7000	6900	8400	15000	10000
Manganese [µg/g]	25-Jul-17	15:36	1100	1000	1000	1000	300	110	130	190	210	220	330	250
Molybdenum [µg/g]	25-Jul-17	15:36	0.5	0.6	0.7	1.0	16	1.8	2.3	1.9	2.2	2.3	3.1	2.5
Sodium [µg/g]	26-Jul-17	11:52	17000	20000	17000	15000	6700	2000	1800	1600	5400	6700	7800	3600
Nickel [µg/g]	25-Jul-17	15:36	220	160	110	110	34	13	16	12	17	23	26	16

OnLine LIMS

00010882O9

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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

LR Report : **CA14273-JUL17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Itivia Quarry H48 Blast-2	6: Itivia Quarry K43 Blast-2	7: Q18 ELV20	8: IQ12 001 N19 ELV14	9: G26	10: G31	11: AK38	12: AB44	13: X36	14: I26	15: AG38	16: L1000
Phosphorus [µg/g]	26-Jul-17	11:52	260	260	290	290	210	74	230	170	310	230	230	190
Lead [µg/g]	25-Jul-17	15:36	1.1	1.2	1.0	1.3	6.0	1.9	3.5	5.2	3.7	4.3	6.4	2.8
Antimony [µg/g]	25-Jul-17	15:36	< 0.8	< 0.8	< 0.8	< 0.8	1.6	< 0.8	1.6	2.5	< 0.8	< 0.8	3.2	1.0
Selenium [µg/g]	25-Jul-17	15:36	< 0.7	< 0.7	< 0.7	< 0.7	1.1	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	1.1
Tin [µg/g]	25-Jul-17	15:36	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	25-Jul-17	15:36	130	140	79	73	78	28	34	30	65	71	84	47
Titanium [µg/g]	25-Jul-17	15:36	3700	3800	4200	4000	850	330	320	260	880	850	900	540
Thallium [µg/g]	25-Jul-17	15:36	< 0.02	< 0.02	0.09	0.12	0.12	0.04	0.09	0.04	0.15	0.14	0.15	0.06
Uranium [µg/g]	25-Jul-17	15:36	0.18	0.18	0.19	0.19	1.5	0.51	1.1	0.85	0.74	0.86	1.4	0.90
Vanadium [µg/g]	25-Jul-17	15:36	150	170	180	180	18	7	2	9	27	17	30	17
Yttrium [µg/g]	25-Jul-17	15:36	15	15	16	17	5.5	30	7.7	5.9	4.6	4.9	5.9	3.8
Zinc [µg/g]	25-Jul-17	15:36	87	79	85	87	20	6.0	8.8	11	17	18	24	11

Analysis	17: H27	18: U38	19: M34	20: J39	21: AG44	22: A137
Sample Date & Time	May-17	May-17	May-17	May-17	May-17	May-17
Silver [µg/g]	0.05	0.02	0.04	0.73	0.04	0.15
Aluminum [µg/g]	18000	5900	6700	12000	6200	27000
Arsenic [µg/g]	6.0	20	5.9	5.4	5.6	7.0
Barium [µg/g]	180	61	77	110	56	250
Beryllium [µg/g]	0.33	0.21	0.24	0.31	0.20	0.47
Bismuth [µg/g]	< 0.09	< 0.09	< 0.09	0.19	< 0.09	< 0.09
Calcium [µg/g]	10000	10000	82000	37000	7400	16000
Cadmium [µg/g]	0.05	0.03	0.10	0.08	0.03	0.10
Cobalt [µg/g]	8.6	3.0	2.8	4.6	4.0	11
Chromium [µg/g]	160	180	130	130	160	220
Copper [µg/g]	16	10	9.1	13	13	28
Iron [µg/g]	12000	7100	9000	8900	7400	18000
Potassium [µg/g]	4900	2500	2700	4500	2100	7800
Lithium [µg/g]	7	3	3	5	3	9
Magnesium [µg/g]	6100	5000	41000	18000	4100	9700
Manganese [µg/g]	180	200	650	340	170	270
Molybdenum [µg/g]	1.4	2.7	1.5	3.3	3.8	3.4
Sodium [µg/g]	5200	870	1200	2000	1600	7100

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00010888209

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LR Report : **CA14273-JUL17**

Analysis	17: H27	18: U38	19: M34	20: J39	21: AG44	22: A137
Nickel [µg/g]	21	11	8.4	14	14	34
Phosphorus [µg/g]	180	82	330	360	72	250
Lead [µg/g]	3.4	2.7	5.6	4.2	2.2	4.8
Antimony [µg/g]	< 0.8	1.2	2.5	1.4	1.0	0.8
Selenium [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	59	24	64	54	23	90
Titanium [µg/g]	740	190	190	390	240	1200
Thallium [µg/g]	0.10	0.04	0.04	0.09	0.04	0.16
Uranium [µg/g]	0.71	0.60	4.4	2.6	0.62	0.88
Vanadium [µg/g]	19	< 1	17	18	7	31
Yttrium [µg/g]	5.2	2.6	6.1	5.3	2.8	5.9
Zinc [µg/g]	16	5.1	12	11	5.7	23

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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20-July-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 11 July 2017
LR Report: **CA14274-JUL17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
5: Itivia Quarry H48 Blast-2	21-Jun-17	49.2	11.8	12.0	11.6	9.17	2.21	0.23	0.82	0.06	0.17	0.12	0.04	3.47	100.9
6: Itivia Quarry K43 Blast-2	21-Jun-17	49.1	12.3	11.7	9.78	10.2	2.70	0.16	0.85	0.07	0.17	0.09	0.05	3.54	100.7
7: Q18 ELV20	21-Jun-17	49.5	13.6	12.0	9.37	8.81	2.24	0.59	0.92	0.07	0.17	0.08	0.05	3.25	100.7
8: IQ12 001 N19 ELV14	21-Jun-17	49.3	12.6	11.7	9.42	9.71	1.95	0.80	0.87	0.07	0.18	0.09	0.05	3.16	99.9
9: G26	May-17	78.6	4.10	4.43	2.31	3.56	0.83	0.65	0.20	0.05	0.03	0.08	0.01	5.07	100.0
10: G31	May-17	94.3	1.42	0.99	0.54	0.82	0.25	0.25	0.07	0.02	0.01	0.06	< 0.01	1.25	100.0
11: AK38	May-17	91.2	2.28	1.92	1.01	1.46	0.24	0.50	0.10	0.06	< 0.01	0.07	< 0.01	2.35	101.2
12: AB44	May-17	90.6	1.49	1.51	1.22	1.98	0.21	0.24	0.11	0.04	0.03	0.06	< 0.01	2.66	100.1
13: X36	May-17	87.8	4.33	2.10	1.21	1.82	0.69	0.77	0.20	0.07	< 0.01	0.01	< 0.01	2.03	101.1
14: I26	May-17	84.8	4.18	2.34	1.48	2.18	0.85	0.73	0.19	0.05	0.03	0.06	0.01	3.02	99.9
15: AG38	May-17	78.3	5.16	2.54	2.67	3.81	1.01	0.94	0.20	0.06	0.05	0.04	< 0.01	4.89	99.7
16: L1000	May-17	87.1	2.42	1.82	1.81	2.62	0.47	0.41	0.12	0.05	0.03	0.06	< 0.01	3.57	100.5
17: H27	May-17	89.2	3.36	1.91	1.14	1.55	0.68	0.52	0.16	0.05	0.02	0.06	< 0.01	1.80	100.4
18: U38	May-17	93.4	1.07	1.05	0.90	1.48	0.11	0.26	0.05	0.02	0.02	0.08	< 0.01	2.18	100.6
19: M34	May-17	59.6	1.23	1.36	7.32	12.3	0.17	0.29	0.06	0.09	0.09	0.04	< 0.01	18.0	100.5
20: J39	May-17	78.7	2.38	1.40	3.21	5.75	0.28	0.51	0.11	0.09	0.04	0.04	0.01	7.48	100.0
21: AG44	May-17	94.1	1.22	1.16	0.76	1.14	0.23	0.23	0.06	0.03	0.02	0.07	< 0.01	1.70	100.7
22: A137	May-17	83.5	5.32	2.85	1.76	2.45	0.95	0.85	0.26	0.07	0.03	0.09	0.02	2.28	100.4

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00001017826

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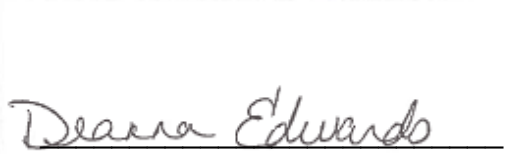
LR Report : **CA14274-JUL17**



Deanna Edwards, B.Sc, C.Chem
Project Specialist
Environmental Services, Analytical

OnLine LIMS

00001071826

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Shake Flask Leach (3:1 Ratio)

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

03-August-2017

Date Rec. : 11 July 2017
LR Report: **CA14275-JUL17**
Reference: OL-617203

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Itivia Quarry H48 Blast-2	6: Itivia Quarry K43 Blast-2	7: Q18 ELV20	8: IQ12 001 N19 ELV14	9: G26	10: G31	11: AK38	12: AB44
Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	May-17	May-17	May-17	May-17
Sample weight [g]	21-Jul-17	14:09	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	21-Jul-17	14:09	750	750	750	750	750	750	750	750
Final pH	21-Jul-17	14:09	9.77	9.41	9.95	9.84	8.17	9.08	8.89	9.07
pH [no unit]	24-Jul-17	15:36	9.30	8.94	9.54	9.51	8.02	8.42	8.22	8.24
Conductivity [uS/cm]	24-Jul-17	15:36	129	116	175	162	890	234	382	179
Alkalinity [mg/L as CaCO3]	24-Jul-17	15:36	55	42	69	60	58	32	33	40
Sulphate [mg/L]	21-Jul-17	15:14	2	10	3	3	160	31	49	28
Mercury [mg/L]	24-Jul-17	10:24	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	25-Jul-17	15:23	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.00009	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	25-Jul-17	15:23	0.585	0.257	0.944	0.612	0.066	0.088	0.058	0.024
Arsenic [mg/L]	25-Jul-17	15:23	0.0019	0.0024	0.0009	0.0028	0.0015	0.0244	0.0201	0.0354
Barium [mg/L]	25-Jul-17	15:23	0.00140	0.00206	0.00325	0.00337	0.0387	0.0203	0.0108	0.00990
Boron [mg/L]	25-Jul-17	15:23	0.050	0.030	0.084	0.077	0.076	0.021	0.050	0.011
Beryllium [mg/L]	25-Jul-17	15:23	< 0.000007	< 0.000007	0.000008	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	25-Jul-17	15:23	< 0.000007	0.000007	< 0.000007	< 0.000007	0.000025	< 0.000007	< 0.000007	< 0.000007

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00001088225

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14275-JUL17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: Itivia Quarry H48 Blast-2	6: Itivia Quarry K43 Blast-2	7: Q18 ELV20	8: IQ12 001 N19 ELV14	9: G26	10: G31	11: AK38	12: AB44
Calcium [mg/L]	25-Jul-17	15:23	1.75	4.65	1.03	1.73	61.7	14.8	17.8	17.3
Cadmium [mg/L]	25-Jul-17	15:23	0.000009	0.000009	0.000006	0.000003	0.000037	0.000017	0.000016	0.000003
Cobalt [mg/L]	25-Jul-17	15:23	0.000432	0.000181	0.000632	0.000498	0.000159	0.000722	0.000047	0.00232
Chromium [mg/L]	25-Jul-17	15:23	0.00601	0.00154	0.00707	0.00484	0.00096	0.00053	0.00027	0.00029
Copper [mg/L]	25-Jul-17	15:23	0.00084	0.00101	0.00120	0.00113	0.00054	0.00233	0.00134	0.0108
Iron [mg/L]	25-Jul-17	15:23	0.549	0.215	0.992	0.697	0.009	0.094	0.011	0.016
Potassium [mg/L]	25-Jul-17	15:23	2.37	2.05	7.14	10.0	18.9	5.69	8.15	4.40
Lithium [mg/L]	25-Jul-17	15:23	0.0003	0.0002	0.0005	0.0003	0.0064	0.0065	0.0079	0.0153
Manganese [mg/L]	25-Jul-17	15:23	0.00829	0.00343	0.0158	0.0110	0.0192	0.00286	0.00166	0.00172
Magnesium [mg/L]	25-Jul-17	15:23	0.816	1.57	0.860	0.746	30.4	5.71	8.67	6.60
Molybdenum [mg/L]	25-Jul-17	15:23	0.00126	0.00204	0.00281	0.00558	0.149	0.0292	0.0206	0.0155
Sodium [mg/L]	25-Jul-17	15:23	26.5	17.7	34.9	29.3	67.2	18.1	38.4	6.01
Nickel [mg/L]	25-Jul-17	15:23	0.0020	0.0007	0.0018	0.0013	0.0013	0.0009	0.0004	0.0010
Phosphorus [mg/L]	25-Jul-17	15:23	0.012	0.008	0.032	0.020	0.006	0.009	0.036	0.018
Lead [mg/L]	25-Jul-17	15:23	0.00005	0.00009	0.00003	0.00004	0.00006	0.00011	0.00002	0.00005
Antimony [mg/L]	25-Jul-17	15:23	0.0007	0.0009	0.0014	0.0019	0.0097	0.0050	0.0142	0.0537
Selenium [mg/L]	25-Jul-17	15:23	0.00023	0.00055	0.00018	0.00048	0.00271	0.00041	0.00257	0.00079
Silicon [mg/L]	25-Jul-17	15:23	6.26	5.58	8.53	8.36	4.17	17.9	7.13	14.1
Tin [mg/L]	25-Jul-17	15:23	0.00009	0.00010	0.00006	0.00010	0.00003	0.00010	0.00010	0.00003
Strontium [mg/L]	25-Jul-17	15:23	0.00401	0.00928	0.00190	0.00311	0.174	0.0504	0.0647	0.0468
Titanium [mg/L]	25-Jul-17	15:23	0.0201	0.00770	0.0218	0.0187	0.00035	0.00243	0.00038	0.00039
Thallium [mg/L]	25-Jul-17	15:23	0.000005	0.000008	0.000007	0.000010	0.000018	0.000008	0.000015	0.000006
Uranium [mg/L]	25-Jul-17	15:23	0.000051	0.000023	0.000017	0.000011	0.002698	0.000380	0.000838	0.001084
Vanadium [mg/L]	25-Jul-17	15:23	0.0430	0.0249	0.0896	0.0730	0.00043	0.00512	0.00268	0.00299
Zinc [mg/L]	25-Jul-17	15:23	< 0.002	< 0.002	0.002	0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	25-Jul-17	15:23	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

OnLine LIMS

00010888225

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14275-JUL17**

Analysis	13: X36	14: I26	15: AG38	16: L1000	17: H27	18: U38	19: M34	20: J39	21: AG44	22: A137
Sample Date & Time	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17	May-17
Sample weight [g]	250	250	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750	750	750	750	750	750	750
Final pH	9.13	8.85	9.07	9.17	9.09	9.33	9.48	9.21	9.24	9.09
pH [no unit]	8.36	7.96	8.56	8.88	7.52	9.04	9.36	8.82	9.10	8.31
Conductivity [uS/cm]	284	581	286	238	346	237	343	348	200	391
Alkalinity [mg/L as CaCO3]	29	30	38	45	33	47	68	48	38	29
Sulphate [mg/L]	52	91	59	46	39	25	32	39	16	55
Mercury [mg/L]	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00002	0.00004	0.00003	0.00003	0.00002
Silver [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	0.097	0.048	0.120	0.017	0.067	0.025	0.043	0.028	0.043	0.110
Arsenic [mg/L]	0.0407	0.0161	0.0274	0.0229	0.0220	0.0524	0.0155	0.0253	0.0357	0.0314
Barium [mg/L]	0.0215	0.0394	0.0228	0.0131	0.0247	0.0107	0.0167	0.0151	0.0129	0.0195
Boron [mg/L]	0.039	0.065	0.033	0.016	0.038	0.028	0.031	0.028	0.027	0.055
Beryllium [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	16.2	29.1	16.3	17.0	15.4	13.9	9.47	15.8	12.0	15.7
Cadmium [mg/L]	< 0.000003	0.000006	0.000006	0.000003	< 0.000003	< 0.000003	0.000005	0.000006	0.000012	0.000018
Cobalt [mg/L]	0.000036	0.000117	0.000031	0.000170	0.000323	0.000046	0.000025	0.000112	0.000191	0.000036
Chromium [mg/L]	0.00016	0.00018	0.00018	0.00031	0.00038	0.00021	0.00012	0.00013	0.00022	0.00046
Copper [mg/L]	0.00048	0.00103	0.00122	0.00516	0.00231	0.00165	0.00089	0.00392	0.00433	0.00039
Iron [mg/L]	0.010	0.008	< 0.007	< 0.007	0.046	< 0.007	< 0.007	< 0.007	0.037	0.010
Potassium [mg/L]	9.43	11.4	11.9	6.69	7.72	5.01	6.60	8.34	4.57	12.0
Lithium [mg/L]	0.0026	0.0061	0.0031	0.0046	0.0022	0.0043	0.0061	0.0303	0.0060	0.0014
Manganese [mg/L]	0.00107	0.00393	0.00132	0.00150	0.00191	0.00131	0.00111	0.00121	0.00200	0.00121
Magnesium [mg/L]	6.32	13.0	8.88	9.84	6.27	6.79	19.9	12.0	5.68	6.64
Molybdenum [mg/L]	0.00906	0.0124	0.0106	0.0180	0.00745	0.00678	0.0117	0.0148	0.0141	0.0574
Sodium [mg/L]	23.3	60.3	19.1	10.2	33.7	18.6	27.4	30.7	16.7	46.8
Nickel [mg/L]	0.0002	0.0006	0.0003	0.0006	0.0009	0.0003	0.0001	0.0006	0.0005	0.0003

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14275-JUL17**

Analysis	13: X36	14: I26	15: AG38	16: L1000	17: H27	18: U38	19: M34	20: J39	21: AG44	22: A137
Phosphorus [mg/L]	0.012	0.010	< 0.003	0.017	0.016	0.013	0.007	0.018	0.031	< 0.003
Lead [mg/L]	0.00001	0.00002	0.00002	0.00001	0.00005	0.00003	< 0.00001	< 0.00001	0.00010	0.00004
Antimony [mg/L]	0.0076	0.0111	0.0443	0.0074	0.0052	0.0212	0.0238	0.0191	0.0353	0.0094
Selenium [mg/L]	0.00044	0.00063	0.00105	0.00102	0.00038	0.00076	0.00133	0.00056	0.00071	0.00055
Silicon [mg/L]	6.77	8.12	5.31	11.5	13.6	13.3	6.90	12.0	16.4	5.86
Tin [mg/L]	0.00004	0.00005	0.00012	0.00003	0.00013	0.00007	0.00004	0.00004	0.00016	0.00004
Strontium [mg/L]	0.0784	0.114	0.0798	0.0474	0.0631	0.0502	0.0481	0.0787	0.0413	0.0745
Titanium [mg/L]	0.00048	0.00049	0.00027	0.00016	0.00196	0.00016	< 0.00005	0.00024	0.00081	0.00058
Thallium [mg/L]	0.000010	0.000017	0.000013	0.000008	0.000013	0.000005	0.000010	0.000005	0.000011	0.000014
Uranium [mg/L]	0.000312	0.000733	0.00105	0.00168	0.000458	0.000831	0.00377	0.00521	0.000757	0.000255
Vanadium [mg/L]	0.00730	0.00430	0.00456	0.00371	0.00531	0.00519	0.00577	0.00601	0.00478	0.00729
Zinc [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

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Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001088225

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28-August-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

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, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

Date Rec. : 02 August 2017
LR Report: **CA15061-AUG17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: J20	6: H19	7: Site D Sand Pit
Sample Date & Time			13-Jul-17	13-Jul-17	15-Jul-17
Paste pH	22-Aug-17	11:40	9.80	9.72	9.39
Fizz Rate [---]	22-Aug-17	11:40	2	2	2
Sample weight [g]	22-Aug-17	11:40	2.01	2.00	1.97
HCl Added [mL]	22-Aug-17	11:40	20.00	20.00	20.00
HCl [Normality]	22-Aug-17	11:40	0.10	0.10	0.10
NaOH [Normality]	22-Aug-17	11:40	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	22-Aug-17	11:40	13.47	16.48	12.58
Final pH	22-Aug-17	11:40	1.51	1.22	1.36
NP [t CaCO3/1000 t]	22-Aug-17	11:40	16	8.8	19
AP [t CaCO3/1000 t]	---	---	0.62	0.94	0.62
Net NP [t CaCO3/1000 t]	---	---	15.6	7.86	18.2
NP/AP [ratio]	---	---	25.9	9.39	30.3
Sulphur (total) [%]	10-Aug-17	14:15	0.035	0.060	0.017
Acid Leachable SO4-S [%]			< 0.02	0.03	< 0.02
Sulphide [%]	10-Aug-17	14:10	0.02	0.03	< 0.02
Carbon (total) [%]	10-Aug-17	14:15	0.127	0.070	0.200
Carbonate [%]	10-Aug-17	14:04	0.520	0.265	0.649

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0001114418

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18-August-2017

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Date Rec. : 02 August 2017
LR Report: **CA15062-AUG17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: J20	6: H19	7: Site D Sand Pit
Sample Date & Time			13-Jul-17	13-Jul-17	15-Jul-17
Silver [µg/g]	15-Aug-17	09:36	0.11	0.07	0.10
Aluminum [µg/g]	14-Aug-17	09:30	71000	75000	65000
Arsenic [µg/g]	15-Aug-17	09:36	0.6	< 0.5	2.0
Barium [µg/g]	15-Aug-17	09:36	90	70	590
Beryllium [µg/g]	15-Aug-17	09:36	0.26	0.29	1.3
Bismuth [µg/g]	15-Aug-17	09:36	0.18	< 0.09	0.24
Calcium [µg/g]	14-Aug-17	09:30	74000	67000	22000
Cadmium [µg/g]	15-Aug-17	09:36	0.13	0.09	0.08
Cobalt [µg/g]	15-Aug-17	09:36	41	44	8.0
Chromium [µg/g]	15-Aug-17	09:36	300	300	60
Copper [µg/g]	15-Aug-17	09:36	59	61	18
Iron [µg/g]	14-Aug-17	09:30	83000	87000	23000
Potassium [µg/g]	14-Aug-17	09:30	2600	1600	20000
Lithium [µg/g]	15-Aug-17	09:37	12	18	16
Magnesium [µg/g]	14-Aug-17	09:30	52000	57000	8000
Manganese [µg/g]	15-Aug-17	09:37	1100	1200	340
Molybdenum [µg/g]	15-Aug-17	09:37	0.8	0.7	0.9
Sodium [µg/g]	14-Aug-17	09:30	16000	17000	25000
Nickel [µg/g]	15-Aug-17	09:37	100	100	21
Phosphorus [µg/g]	14-Aug-17	09:31	280	270	400
Lead [µg/g]	15-Aug-17	09:37	2.0	1.3	14
Antimony [µg/g]	15-Aug-17	09:37	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	15-Aug-17	09:37	< 0.7	< 0.7	< 0.7
Tin [µg/g]	15-Aug-17	09:37	< 6	< 6	< 6
Strontium [µg/g]	15-Aug-17	09:37	120	110	330
Titanium [µg/g]	15-Aug-17	09:37	4000	4200	1700
Thallium [µg/g]	15-Aug-17	09:37	0.09	0.02	0.48
Uranium [µg/g]	15-Aug-17	09:37	0.45	0.23	1.3

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LR Report : **CA15062-AUG17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: J20	6: H19	7: Site D Sand Pit
Vanadium [µg/g]	15-Aug-17	09:37	190	200	55
Yttrium [µg/g]	15-Aug-17	09:37	17	17	7.8
Zinc [µg/g]	15-Aug-17	09:37	69	74	34

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

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13-September-2017

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Date Rec. : 02 August 2017
LR Report: **CA15063-AUG17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	5: J20	6: H19	7: Site D Sand Pit
Sample Date & Time	13-Jul-17	13-Jul-17	15-Jul-17
SiO2 [%]	49.3	48.0	71.4
Al2O3 [%]	13.2	13.7	12.9
Fe2O3 [%]	11.9	12.5	3.38
MgO [%]	9.37	10.2	1.49
CaO [%]	10.7	9.46	3.18
Na2O [%]	2.24	2.39	3.42
K2O [%]	0.27	0.16	2.13
TiO2 [%]	0.88	0.90	0.31
P2O5 [%]	0.07	0.07	0.09
MnO [%]	0.19	0.19	0.04
Cr2O3 [%]	0.07	0.08	0.01
V2O5 [%]	0.05	0.05	< 0.01
LOI [%]	2.92	3.31	1.83
Sum [%]	101.1	101.0	100.3

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0001131870

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28-August-2017

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Date Rec. : 02 August 2017
LR Report: **CA15064-AUG17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: J20	6: H19	7: Site D Sand Pit
Sample Date & Time			13-Jul-17	13-Jul-17	15-Jul-17
Sample weight [g]	22-Aug-17	11:41	250	250	250
Volume D.I. Water [mL]	22-Aug-17	11:41	750	750	750
Final pH	22-Aug-17	11:41	10.01	10.00	9.36
pH [no unit]	23-Aug-17	10:13	9.47	9.48	8.19
Conductivity [uS/cm]	23-Aug-17	10:13	186	160	112
Alkalinity [mg/L as CaCO3]	23-Aug-17	10:13	64	50	36
Sulphate [mg/L]	22-Aug-17	12:28	6	5	11
Mercury [mg/L]	23-Aug-17	08:13	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	24-Aug-17	14:18	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	24-Aug-17	14:18	0.426	0.531	0.754
Arsenic [mg/L]	24-Aug-17	14:18	0.0030	0.0008	0.0076
Barium [mg/L]	24-Aug-17	14:18	0.00299	0.00262	0.0108
Boron [mg/L]	24-Aug-17	14:18	0.060	0.070	0.061
Beryllium [mg/L]	24-Aug-17	14:18	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	24-Aug-17	14:18	< 0.000007	< 0.000007	0.000028
Calcium [mg/L]	24-Aug-17	14:18	1.68	1.35	11.0
Cadmium [mg/L]	24-Aug-17	14:18	0.000006	0.000007	0.000006
Cobalt [mg/L]	24-Aug-17	14:18	0.000335	0.000334	0.000130
Chromium [mg/L]	24-Aug-17	14:18	0.00329	0.00328	0.00057
Copper [mg/L]	24-Aug-17	14:18	0.00131	0.00296	0.00659
Iron [mg/L]	24-Aug-17	14:18	0.466	0.518	0.168
Potassium [mg/L]	24-Aug-17	14:18	8.94	6.37	8.77
Lithium [mg/L]	24-Aug-17	14:18	0.0002	0.0003	0.0034
Manganese [mg/L]	24-Aug-17	14:18	0.00740	0.00859	0.00162
Magnesium [mg/L]	24-Aug-17	14:18	0.534	0.616	1.20
Molybdenum [mg/L]	24-Aug-17	14:18	0.00649	0.00172	0.00197
Sodium [mg/L]	24-Aug-17	14:18	35.2	31.7	6.14
Nickel [mg/L]	24-Aug-17	14:18	0.0010	0.0008	0.0005
Phosphorus [mg/L]	24-Aug-17	14:18	0.020	0.024	0.041
Lead [mg/L]	24-Aug-17	14:18	0.00012	0.00028	0.00030

OnLine LIMS

0001114421

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LR Report : **CA15064-AUG17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: J20	6: H19	7: Site D Sand Pit
Antimony [mg/L]	24-Aug-17	14:18	0.0014	0.0007	0.0004
Selenium [mg/L]	24-Aug-17	14:18	0.00117	0.00026	0.00055
Silicon [mg/L]	24-Aug-17	14:18	9.62	8.24	2.98
Tin [mg/L]	24-Aug-17	14:18	0.00015	0.00247	0.00023
Strontium [mg/L]	24-Aug-17	14:18	0.00338	0.00338	0.0721
Titanium [mg/L]	24-Aug-17	14:18	0.0143	0.0122	0.00498
Thallium [mg/L]	24-Aug-17	14:18	< 0.000005	< 0.000005	< 0.000005
Uranium [mg/L]	24-Aug-17	14:18	0.000036	0.000009	0.00143
Vanadium [mg/L]	24-Aug-17	14:18	0.0700	0.0524	0.0120
Zinc [mg/L]	24-Aug-17	14:18	< 0.002	0.005	< 0.002
Zirconium [mg/L]	24-Aug-17	14:18	< 0.002	< 0.002	< 0.002

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Project Specialist
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OnLine LIMS

0001114421

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Appendix C5

Geochemical Monitoring Results – Underground Waste Rock

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

ABA - Modified Sobek

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake
, Nunavut
X0C 0A0,

Phone: (819) 759-3555 x3928
Fax:(819) 759-3663

11-October-2017

Date Rec. : 04 July 2017
LR Report: **CA14000-JUL17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225W VOL	6: 317002-FW225W VOL	7: 317003-FW250W VOL	8: 317004-FW250W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL
Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17
Paste pH	24-Jul-17	10:35	8.78	9.01	9.23	9.05	8.41	8.53	8.40	8.88	8.42
Fizz Rate [---]	24-Jul-17	10:35	4	4	4	4	4	4	4	4	4
Sample weight [g]	24-Jul-17	10:35	2.01	2.01	2.01	1.98	1.95	2.04	2.00	2.00	1.98
HCl Added [mL]	24-Jul-17	10:35	140.00	160.00	120.00	178.00	90.00	122.00	40.00	40.00	112.00
HCl [Normality]	24-Jul-17	10:35	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	24-Jul-17	10:35	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	24-Jul-17	10:35	47.94	51.06	47.03	79.37	20.38	36.66	21.70	18.28	27.75
Final pH	24-Jul-17	10:35	1.63	1.78	1.64	1.60	1.88	1.68	1.55	1.75	1.84
NP [t CaCO3/1000 t]	24-Jul-17	10:35	229	271	182	249	178	209	46	54	213
AP [t CaCO3/1000 t]	---	---	1.88	7.81	15.0	10.3	2.19	1.88	2.19	2.81	2.19
Net NP [t CaCO3/1000 t]	---	---	227	263	166	239	176	207	43.6	51.5	211
NP/AP [ratio]	---	---	122	34.7	12.1	24.2	81.6	112	20.9	19.3	97.3
Sulphur (total) [%]	28-Jul-17	14:23	0.129	0.367	0.747	0.439	0.117	0.093	0.124	0.145	0.113
Acid Leachable SO4-S [%]	---	---	0.07	0.12	0.27	0.11	0.05	0.03	0.05	0.06	0.04
Sulphide [%]	28-Jul-17	14:23	0.06	0.25	0.48	0.33	0.07	0.06	0.07	0.09	0.07
Carbon (total) [%]	27-Jul-17	10:51	3.02	3.74	2.55	3.83	2.16	2.52	0.624	0.725	2.74
Carbonate [%]	27-Jul-17	10:51	14.2	17.3	10.8	16.6	10.1	11.9	1.71	2.37	12.8

OnLine LIMS

00011161180

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ABA - Modified Sobek

LR Report : **CA14000-JUL17**

Analysis	14: 317010-DRAW pt 350 171 VOL	15: 317011-FW350E VOL	16: 317012-FW350E VOL
Sample Date & Time	21-Jun-17	21-Jun-17	21-Jun-17
Paste pH	8.49	8.56	8.68
Fizz Rate [---]	4	4	4
Sample weight [g]	2.01	2.00	2.06
HCl Added [mL]	160.00	136.00	126.00
HCl [Normality]	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	43.56	50.71	49.24
Final pH	1.63	1.60	1.63
NP [t CaCO3/1000 t]	290	213	186
AP [t CaCO3/1000 t]	8.75	2.19	1.56
Net NP [t CaCO3/1000 t]	281	211	185
NP/AP [ratio]	33.1	97.5	119
Sulphur (total) [%]	0.355	0.107	0.069
Acid Leachable SO4-S [%]	0.08	0.04	< 0.02
Sulphide [%]	0.28	0.07	0.05
Carbon (total) [%]	3.20	2.79	2.30
Carbonate [%]	14.7	13.1	10.8

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001161180

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11-October-2017

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Phone: (819) 759-3555 x3928
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Date Rec. : 04 July 2017
LR Report: **CA14001-JUL17**
Reference: OL-617203

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225 W VOL	6: 317002-FW225 W VOL	7: 317003-FW250 W VOL	8: 317004-FW250 W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL	14: 317010-DRAW pt 350 171 VOL
Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17
Silver [µg/g]	21-Jul-17	16:32	0.25	0.77	0.20	0.16	0.15	0.14	0.22	0.24	0.11	0.18
Aluminum [µg/g]	21-Jul-17	15:46	77000	76000	81000	68000	53000	48000	77000	87000	71000	72000
Arsenic [µg/g]	21-Jul-17	16:32	15	100	87	380	24	13	310	150	30	57
Barium [µg/g]	21-Jul-17	16:32	91	88	67	140	310	210	590	680	50	330
Beryllium [µg/g]	21-Jul-17	16:32	0.44	0.32	0.39	0.37	0.50	0.39	1.1	1.2	0.26	0.56
Bismuth [µg/g]	21-Jul-17	16:32	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.12	0.16	< 0.09	< 0.09
Calcium [µg/g]	21-Jul-17	15:47	94000	110000	72000	82000	84000	95000	12000	14000	86000	94000
Cadmium [µg/g]	21-Jul-17	16:32	0.17	0.22	0.17	0.20	0.15	0.17	0.16	0.18	0.21	0.22
Cobalt [µg/g]	21-Jul-17	16:32	42	50	55	44	49	47	22	18	43	41
Chromium [µg/g]	21-Jul-17	16:32	110	100	97	98	170	200	100	110	100	100
Copper [µg/g]	21-Jul-17	16:32	91	99	140	90	150	160	47	42	94	81
Iron [µg/g]	21-Jul-17	15:47	63000	63000	77000	67000	87000	84000	38000	41000	77000	74000
Potassium [µg/g]	21-Jul-17	15:47	5400	7300	4600	9200	1400	670	21000	25000	3200	14000
Lithium [µg/g]	21-Jul-17	16:32	47	38	45	28	22	18	28	28	39	36
Magnesium [µg/g]	21-Jul-17	15:47	22000	21000	18000	21000	43000	42000	14000	15000	27000	23000
Manganese [µg/g]	21-Jul-17	16:33	1300	1500	1300	1400	1500	1600	320	340	1200	1600
Molybdenum [µg/g]	21-Jul-17	16:33	0.3	0.4	0.3	0.3	0.6	0.5	1.8	2.2	0.7	0.6
Sodium [µg/g]	21-Jul-17	15:47	19000	18000	20000	19000	12000	12000	24000	25000	24000	12000
Nickel [µg/g]	21-Jul-17	16:33	100	100	110	100	110	130	62	62	100	94

OnLine LIMS

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LR Report : **CA14001-JUL17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225 W VOL	6: 317002-FW225 W VOL	7: 317003-FW250 W VOL	8: 317004-FW250 W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL	14: 317010-DRAW pt 350 171 VOL
Phosphorus [µg/g]	21-Jul-17	15:47	310	270	330	300	320	280	420	480	230	330
Lead [µg/g]	21-Jul-17	16:33	5.2	13	20	31	7.5	8.1	15	12	4.9	7.3
Antimony [µg/g]	21-Jul-17	16:33	< 0.8	< 0.8	< 0.8	< 0.8	0.8	< 0.8	< 0.8	< 0.8	1.1	0.8
Selenium [µg/g]	21-Jul-17	16:33	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	21-Jul-17	16:33	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	21-Jul-17	16:33	110	120	120	110	250	190	230	260	130	130
Titanium [µg/g]	21-Jul-17	16:33	2600	2200	3700	2800	4000	3600	2200	2400	3300	3400
Thallium [µg/g]	21-Jul-17	16:33	0.21	0.25	0.14	0.35	0.22	0.09	0.48	0.55	0.11	0.58
Uranium [µg/g]	21-Jul-17	16:33	0.081	0.071	0.098	0.078	0.15	0.15	1.6	1.8	0.15	0.30
Vanadium [µg/g]	21-Jul-17	16:33	170	160	210	180	160	150	88	97	180	190
Yttrium [µg/g]	21-Jul-17	16:33	7.0	7.1	6.2	5.8	14	14	5.9	6.5	9.7	10
Zinc [µg/g]	21-Jul-17	16:33	70	58	71	50	91	80	64	65	85	91

Analysis	15: 317011-FW350 E VOL	16: 317012-FW350 E VOL
Sample Date & Time	21-Jun-17	21-Jun-17
Silver [µg/g]	0.15	0.14
Aluminum [µg/g]	73000	73000
Arsenic [µg/g]	78	77
Barium [µg/g]	230	120
Beryllium [µg/g]	0.49	0.30
Bismuth [µg/g]	< 0.09	< 0.09
Calcium [µg/g]	82000	72000
Cadmium [µg/g]	0.21	0.16
Cobalt [µg/g]	41	45
Chromium [µg/g]	99	96
Copper [µg/g]	66	78
Iron [µg/g]	82000	87000
Potassium [µg/g]	11000	6000
Lithium [µg/g]	48	41
Magnesium [µg/g]	25000	24000
Manganese [µg/g]	1300	1200
Molybdenum [µg/g]	0.5	0.3
Sodium [µg/g]	8000	18000

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LR Report : **CA14001-JUL17**

Analysis	15: 317011-FW350 E VOL	16: 317012-FW350 E VOL
Nickel [µg/g]	91	93
Phosphorus [µg/g]	250	270
Lead [µg/g]	7.6	4.0
Antimony [µg/g]	< 0.8	< 0.8
Selenium [µg/g]	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6
Strontium [µg/g]	110	98
Titanium [µg/g]	3800	3900
Thallium [µg/g]	0.45	0.22
Uranium [µg/g]	0.13	0.072
Vanadium [µg/g]	200	190
Yttrium [µg/g]	8.7	9.1
Zinc [µg/g]	120	100

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OnLine LIMS

000116185

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Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17
Silver [µg/g]	21-Jul-17	16:32	0.25	0.77	0.20	0.16	0.15	0.14	0.22	0.24	0.11	0.18
Aluminum [µg/g]	21-Jul-17	15:46	77000	76000	81000	68000	53000	48000	77000	87000	71000	72000
Arsenic [µg/g]	21-Jul-17	16:32	15	100	87	380	24	13	310	150	30	57
Barium [µg/g]	21-Jul-17	16:32	91	88	67	140	310	210	590	680	50	330
Beryllium [µg/g]	21-Jul-17	16:32	0.44	0.32	0.39	0.37	0.50	0.39	1.1	1.2	0.26	0.56
Bismuth [µg/g]	21-Jul-17	16:32	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	0.12	0.16	< 0.09	< 0.09
Calcium [µg/g]	21-Jul-17	15:47	94000	110000	72000	82000	84000	95000	12000	14000	86000	94000
Cadmium [µg/g]	21-Jul-17	16:32	0.17	0.22	0.17	0.20	0.15	0.17	0.16	0.18	0.21	0.22
Cobalt [µg/g]	21-Jul-17	16:32	42	50	55	44	49	47	22	18	43	41
Chromium [µg/g]	21-Jul-17	16:32	110	100	97	98	170	200	100	110	100	100
Copper [µg/g]	21-Jul-17	16:32	91	99	140	90	150	160	47	42	94	81
Iron [µg/g]	21-Jul-17	15:47	63000	63000	77000	67000	87000	84000	38000	41000	77000	74000
Potassium [µg/g]	21-Jul-17	15:47	5400	7300	4600	9200	1400	670	21000	25000	3200	14000
Lithium [µg/g]	21-Jul-17	16:32	47	38	45	28	22	18	28	28	39	36
Magnesium [µg/g]	21-Jul-17	15:47	22000	21000	18000	21000	43000	42000	14000	15000	27000	23000
Manganese [µg/g]	21-Jul-17	16:33	1300	1500	1300	1400	1500	1600	320	340	1200	1600
Molybdenum [µg/g]	21-Jul-17	16:33	0.3	0.4	0.3	0.3	0.6	0.5	1.8	2.2	0.7	0.6
Sodium [µg/g]	21-Jul-17	15:47	19000	18000	20000	19000	12000	12000	24000	25000	24000	12000
Nickel [µg/g]	21-Jul-17	16:33	100	100	110	100	110	130	62	62	100	94

OnLine LIMS

0001161183

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LR Report : **CA14001-JUL17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225 W VOL	6: 317002-FW225 W VOL	7: 317003-FW250 W VOL	8: 317004-FW250 W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL	14: 317010-DRAW pt 350 171 VOL
Phosphorus [µg/g]	21-Jul-17	15:47	310	270	330	300	320	280	420	480	230	330
Lead [µg/g]	21-Jul-17	16:33	5.2	13	20	31	7.5	8.1	15	12	4.9	7.3
Antimony [µg/g]	21-Jul-17	16:33	< 0.8	< 0.8	< 0.8	< 0.8	0.8	< 0.8	< 0.8	< 0.8	1.1	0.8
Selenium [µg/g]	21-Jul-17	16:33	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	21-Jul-17	16:33	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	21-Jul-17	16:33	110	120	120	110	250	190	230	260	130	130
Titanium [µg/g]	21-Jul-17	16:33	2600	2200	3700	2800	4000	3600	2200	2400	3300	3400
Thallium [µg/g]	21-Jul-17	16:33	0.21	0.25	0.14	0.35	0.22	0.09	0.48	0.55	0.11	0.58
Uranium [µg/g]	21-Jul-17	16:33	0.081	0.071	0.098	0.078	0.15	0.15	1.6	1.8	0.15	0.30
Vanadium [µg/g]	21-Jul-17	16:33	170	160	210	180	160	150	88	97	180	190
Yttrium [µg/g]	21-Jul-17	16:33	7.0	7.1	6.2	5.8	14	14	5.9	6.5	9.7	10
Zinc [µg/g]	21-Jul-17	16:33	70	58	71	50	91	80	64	65	85	91

Analysis	15: 317011-FW350 E VOL	16: 317012-FW350 E VOL
Sample Date & Time	21-Jun-17	21-Jun-17
Silver [µg/g]	0.15	0.14
Aluminum [µg/g]	73000	73000
Arsenic [µg/g]	78	77
Barium [µg/g]	230	120
Beryllium [µg/g]	0.49	0.30
Bismuth [µg/g]	< 0.09	< 0.09
Calcium [µg/g]	82000	72000
Cadmium [µg/g]	0.21	0.16
Cobalt [µg/g]	41	45
Chromium [µg/g]	99	96
Copper [µg/g]	66	78
Iron [µg/g]	82000	87000
Potassium [µg/g]	11000	6000
Lithium [µg/g]	48	41
Magnesium [µg/g]	25000	24000
Manganese [µg/g]	1300	1200
Molybdenum [µg/g]	0.5	0.3
Sodium [µg/g]	8000	18000

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0001161183

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LR Report : **CA14001-JUL17**

Analysis	15: 317011-FW350 E VOL	16: 317012-FW350 E VOL
Nickel [µg/g]	91	93
Phosphorus [µg/g]	250	270
Lead [µg/g]	7.6	4.0
Antimony [µg/g]	< 0.8	< 0.8
Selenium [µg/g]	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6
Strontium [µg/g]	110	98
Titanium [µg/g]	3800	3900
Thallium [µg/g]	0.45	0.22
Uranium [µg/g]	0.13	0.072
Vanadium [µg/g]	200	190
Yttrium [µg/g]	8.7	9.1
Zinc [µg/g]	120	100

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Project Specialist
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P.O. Box 4300 - 185 Concession St.
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Shake Flask Leach (3:1 Ratio)

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake
, Nunavut
X0C 0A0,

Phone: (819) 759-3555 x3928
Fax:(819) 759-3663

11-October-2017

Date Rec. : 04 July 2017
LR Report: **CA14003-JUL17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225W VOL	6: 317002-FW225W VOL	7: 317003-FW250W VOL	8: 317004-FW250W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL
Sample Date & Time			21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17	21-Jun-17
Sample weight [g]	21-Jul-17	14:09	250	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	21-Jul-17	14:09	750	750	750	750	750	750	750	750	750
Final pH	21-Jul-17	14:09	8.62	8.52	8.50	8.45	8.84	8.93	8.60	8.61	8.53
pH [no unit]	24-Jul-17	15:36	8.29	8.28	8.30	8.37	8.26	8.50	8.09	8.23	8.21
Conductivity [uS/cm]	24-Jul-17	15:36	173	230	235	467	747	504	1310	1230	858
Alkalinity [mg/L as CaCO3]	24-Jul-17	15:36	64	78	84	96	31	35	43	49	50
Sulphate [mg/L]	21-Jul-17	15:13	< 2	3	< 2	7	8	3	31	28	9
Mercury [mg/L]	24-Jul-17	10:24	< 0.00001	< 0.00001	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	25-Jul-17	15:22	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	25-Jul-17	15:22	0.592	0.530	0.482	0.399	0.175	0.190	0.317	0.367	0.323
Arsenic [mg/L]	25-Jul-17	15:22	0.0014	0.0201	0.0136	0.0324	0.0027	0.0010	0.0603	0.0375	0.0018
Barium [mg/L]	25-Jul-17	15:22	0.00068	0.00060	0.00041	0.00188	0.395	0.399	0.0189	0.0167	0.00492
Boron [mg/L]	25-Jul-17	15:22	0.011	0.009	0.005	0.011	0.051	0.091	0.039	0.037	0.030
Beryllium [mg/L]	25-Jul-17	15:22	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	25-Jul-17	15:22	< 0.000007	< 0.000007	0.000013	0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	25-Jul-17	15:22	13.5	15.8	17.3	22.1	28.7	20.6	45.5	43.3	37.1
Cadmium [mg/L]	25-Jul-17	15:22	0.000006	< 0.000003	< 0.000003	< 0.000003	0.000003	< 0.000003	0.000003	< 0.000003	0.000005
Cobalt [mg/L]	25-Jul-17	15:22	0.000019	0.000079	0.000069	0.000144	0.000188	0.000206	0.000535	0.000739	0.000100
Chromium [mg/L]	25-Jul-17	15:22	0.00012	0.00016	0.00010	0.00009	0.00012	0.00008	0.00019	0.00009	0.00019

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14003-JUL17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: 317001-FW225W VOL	6: 317002-FW225W VOL	7: 317003-FW250W VOL	8: 317004-FW250W VOL	9: 317005-VT225 SED	10: 317006-VT225 SED	11: 317007-UP RAMP SED	12: 317008-UP RAMP SED	13: 317009-DRAW pt 350 171 VOL
Copper [mg/L]	25-Jul-17	15:22	0.00037	0.00018	0.00033	0.00009	0.00018	0.00023	0.00012	0.00029	0.00021
Iron [mg/L]	25-Jul-17	15:22	< 0.007	< 0.007	0.015	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	25-Jul-17	15:22	3.00	4.48	2.31	9.80	6.23	4.22	27.1	29.6	8.73
Lithium [mg/L]	25-Jul-17	15:22	0.0045	0.0047	0.0056	0.0075	0.0015	0.0009	0.0111	0.0100	0.0044
Manganese [mg/L]	25-Jul-17	15:22	0.00400	0.00592	0.00780	0.0102	0.00300	0.00266	0.00581	0.00514	0.00883
Magnesium [mg/L]	25-Jul-17	15:22	5.16	8.51	7.15	14.1	8.88	5.98	18.4	16.7	13.0
Molybdenum [mg/L]	25-Jul-17	15:22	0.00173	0.00051	0.00030	0.00023	0.00060	0.00037	0.00132	0.00165	0.00095
Sodium [mg/L]	25-Jul-17	15:22	13.7	18.9	20.4	45.8	91.7	52.0	158	139	93.8
Nickel [mg/L]	25-Jul-17	15:22	< 0.0001	0.0004	0.0008	0.0009	< 0.0001	< 0.0001	0.0007	0.0006	< 0.0001
Phosphorus [mg/L]	25-Jul-17	15:22	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	0.004	0.005	< 0.003
Lead [mg/L]	25-Jul-17	15:22	0.00006	0.00005	0.00003	0.00001	0.00001	0.00002	0.00003	0.00003	0.00002
Antimony [mg/L]	25-Jul-17	15:22	0.0025	0.0023	0.0024	0.0020	0.0014	0.0015	0.0030	0.0034	0.0017
Selenium [mg/L]	25-Jul-17	15:22	0.00005	0.00021	0.00012	0.00037	0.00007	0.00007	0.00017	0.00020	0.00018
Silicon [mg/L]	25-Jul-17	15:22	1.20	1.20	1.10	1.41	2.15	2.03	2.06	1.92	1.17
Tin [mg/L]	25-Jul-17	15:22	0.00065	0.00010	0.00010	0.00005	0.00007	0.00006	0.00012	0.00012	0.00011
Strontium [mg/L]	25-Jul-17	15:22	0.0302	0.0337	0.0365	0.0781	0.732	0.395	0.821	0.666	0.461
Titanium [mg/L]	25-Jul-17	15:22	0.00017	< 0.00005	0.00005	< 0.00005	< 0.00005	< 0.00005	0.00008	< 0.00005	< 0.00005
Thallium [mg/L]	25-Jul-17	15:22	< 0.000005	< 0.000005	< 0.000005	< 0.000005	0.000087	0.000069	0.000028	0.000025	0.000051
Uranium [mg/L]	25-Jul-17	15:22	0.000021	0.000006	0.000003	0.000004	0.000003	< 0.000002	0.000066	0.000077	0.000004
Vanadium [mg/L]	25-Jul-17	15:22	0.00060	0.00058	0.00046	0.00058	0.00077	0.00068	0.00091	0.00085	0.00035
Zinc [mg/L]	25-Jul-17	15:22	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	25-Jul-17	15:22	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Analysis	14: 317010-DRAW pt 350 171 VOL	15: 317011-FW350E VOL	16: 317012-FW350E VOL	17: 317012-FW350E VOL
Sample Date & Time	21-Jun-17	21-Jun-17	21-Jun-17	
Sample weight [g]	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750
Final pH	8.57	8.56	8.61	8.58
pH [no unit]	8.10	8.12	8.16	8.18
Conductivity [uS/cm]	518	445	396	413
Alkalinity [mg/L as CaCO3]	57	57	53	53
Sulphate [mg/L]	4	4	4	4
Mercury [mg/L]	< 0.00001	< 0.00001	< 0.00001	< 0.00001

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14003-JUL17**

Analysis	14: 317010-DRAW pt 350 171 VOL	15: 317011-FW350E VOL	16: 317012-FW350E VOL	17: 317012-FW350E VOL
Silver [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	0.385	0.410	0.457	0.447
Arsenic [mg/L]	0.0139	0.0137	0.0110	0.0106
Barium [mg/L]	0.00345	0.00258	0.00335	0.00210
Boron [mg/L]	0.020	0.019	0.015	0.014
Beryllium [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	23.7	22.1	21.6	21.3
Cadmium [mg/L]	< 0.000003	< 0.000003	< 0.000003	< 0.000003
Cobalt [mg/L]	0.000190	0.000117	0.000078	0.000083
Chromium [mg/L]	0.00011	0.00006	0.00006	0.00016
Copper [mg/L]	0.00019	0.00012	0.00008	0.00019
Iron [mg/L]	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	14.0	11.7	8.34	8.39
Lithium [mg/L]	0.0026	0.0029	0.0019	0.0019
Manganese [mg/L]	0.00640	0.00597	0.00461	0.00462
Magnesium [mg/L]	8.21	7.24	6.07	6.12
Molybdenum [mg/L]	0.00050	0.00027	0.00040	0.00034
Sodium [mg/L]	52.8	42.5	42.3	42.5
Nickel [mg/L]	0.0002	0.0002	0.0001	0.0001
Phosphorus [mg/L]	< 0.003	< 0.003	< 0.003	< 0.003
Lead [mg/L]	0.00001	0.00002	0.00001	0.00002
Antimony [mg/L]	0.0020	0.0023	0.0016	0.0016
Selenium [mg/L]	0.00012	0.00013	0.00016	0.00012
Silicon [mg/L]	1.14	1.03	1.06	1.10
Tin [mg/L]	0.00007	0.00007	0.00004	0.00009
Strontium [mg/L]	0.164	0.122	0.129	0.129
Titanium [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Thallium [mg/L]	0.000032	0.000023	0.000025	0.000020
Uranium [mg/L]	0.000002	0.000003	< 0.000002	< 0.000002
Vanadium [mg/L]	0.00041	0.00034	0.00041	0.00043
Zinc [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA14003-JUL17**

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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ABA - Modified Sobek

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10-October-2017

Date Rec. : 18 September 2017
LR Report: **CA13713-SEP17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD200	8: CAEXD317016-DD2200	9: CAEXD317017-FW2-300W	10: CAEXD317018-DP-350-151	11: CAEXD317019-FW350W	12: CAEXD317020-FW350W	13: CAEXD251474-PR425-400
Sample Date & Time			13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17
Paste pH	28-Sep-17	15:42	8.34	8.76	8.62	8.86	8.75	8.03	8.38	8.30	9.50
Fizz Rate [---]	28-Sep-17	15:42	3	3	3	3	3	3	3	3	3
Sample weight [g]	28-Sep-17	15:42	2.03	2.04	2.00	2.04	2.00	1.98	2.03	1.98	1.98
HCl Added [mL]	28-Sep-17	15:42	31.00	32.00	125.00	112.00	55.00	71.00	161.00	132.00	44.00
HCl [Normality]	28-Sep-17	15:42	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	28-Sep-17	15:42	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	28-Sep-17	15:42	16.50	16.73	51.50	32.58	26.36	30.46	72.66	52.29	26.34
Final pH	28-Sep-17	15:42	1.72	1.84	1.62	1.90	1.68	1.67	1.55	1.57	1.65
NP [t CaCO3/1000 t]	28-Sep-17	15:42	36	37	184	195	72	102	218	201	45
AP [t CaCO3/1000 t]	---	---	5.00	5.94	2.19	6.56	2.81	4.06	2.50	1.56	2.50
Net NP [t CaCO3/1000 t]	---	---	30.7	31.5	182	188	68.8	98.3	215	200	42.1
NP/AP [ratio]	---	---	7.14	6.30	84.0	29.7	25.5	25.2	87.0	129	17.8
Sulphur (total) [%]	28-Sep-17	12:16	0.193	0.234	0.100	0.240	0.106	0.179	0.096	0.053	0.130
Acid Leachable SO4-S [%]	---	---	---	0.04	0.03	0.03	< 0.02	0.05	< 0.02	< 0.02	0.05
Sulphide [%]	28-Sep-17	12:16	0.16	0.19	0.07	0.21	0.09	0.13	0.08	0.05	0.08
Carbon (total) [%]	28-Sep-17	12:16	0.435	0.478	2.42	2.66	1.02	1.39	2.98	2.63	0.393
Carbonate [%]	28-Sep-17	12:16	0.465	1.40	11.2	12.4	3.83	4.44	13.9	12.3	1.44

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ABA - Modified Sobek

LR Report : **CA13713-SEP17**

Analysis	14: CAEXD251475-R P425-400	15: CAMLD160902-FW400E	16: CAMLD160903-FW400E
Sample Date & Time	13-Sep-17	13-Sep-17	13-Sep-17
Paste pH	9.16	8.55	9.14
Fizz Rate [---]	3	3	3
Sample weight [g]	2.00	1.99	1.97
HCl Added [mL]	28.00	131.00	125.00
HCl [Normality]	0.10	0.10	0.10
NaOH [Normality]	0.10	0.10	0.10
NaOH to pH=8.3 [mL]	19.98	39.21	50.81
Final pH	1.66	1.79	1.58
NP [t CaCO3/1000 t]	20	231	188
AP [t CaCO3/1000 t]	2.19	7.19	3.44
Net NP [t CaCO3/1000 t]	17.9	223	185
NP/AP [ratio]	9.19	32.1	54.8
Sulphur (total) [%]	0.106	0.390	0.128
Acid Leachable SO4-S [%]	0.04	0.16	< 0.02
Sulphide [%]	0.07	0.23	0.11
Carbon (total) [%]	0.086	2.92	2.49
Carbonate [%]	0.090	13.8	11.9

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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10-October-2017

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Date Rec. : 18 September 2017
LR Report: **CA13714-SEP17**
Reference: OL-617203

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD200	8: CAEXD317016-DD2200	9: CAEXD317017-FW2-300W	10: CAEXD317018-DP-350-151	11: CAEXD317019-FW350W	12: CAEXD317020-FW350W	13: CAEXD251474-PR425-400
Sample Date & Time			13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17
Silver [µg/g]	03-Oct-17	09:21	0.03	0.03	0.01	0.02	< 0.01	0.02	0.02	0.01	0.02
Aluminum [µg/g]	03-Oct-17	15:24	85000	85000	70000	68000	49000	67000	68000	69000	68000
Arsenic [µg/g]	03-Oct-17	09:21	27	9.7	1.1	1.3	4.1	14	6.9	5.7	9.0
Barium [µg/g]	03-Oct-17	09:21	120	130	5.3	4.8	72	66	21	26	140
Beryllium [µg/g]	03-Oct-17	09:21	0.24	0.25	0.06	0.06	0.17	0.14	0.08	0.09	0.18
Bismuth [µg/g]	03-Oct-17	09:21	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	03-Oct-17	15:23	9500	9600	71000	73000	24000	40000	89000	74000	54000
Cadmium [µg/g]	03-Oct-17	09:21	0.04	0.04	0.04	0.04	< 0.02	0.03	0.03	0.02	0.05
Cobalt [µg/g]	03-Oct-17	09:21	5.2	4.9	9.1	8.4	1.6	4.1	8.4	7.7	10
Chromium [µg/g]	03-Oct-17	09:21	20	19	23	23	5.3	12	23	25	11
Copper [µg/g]	03-Oct-17	09:21	13	10	18	21	5.3	13	19	14	28
Iron [µg/g]	03-Oct-17	15:23	47000	44000	87000	80000	130000	81000	67000	67000	100000
Potassium [µg/g]	03-Oct-17	15:23	24000	25000	2000	2100	11000	10000	9000	10000	16000
Lithium [µg/g]	03-Oct-17	09:21	10	10	12	10	4	7	11	11	8
Magnesium [µg/g]	03-Oct-17	15:23	18000	16000	26000	19000	8800	16000	24000	27000	24000
Manganese [µg/g]	03-Oct-17	09:21	110	82	360	380	70	150	330	280	270
Molybdenum [µg/g]	03-Oct-17	09:21	0.4	0.3	< 0.1	< 0.1	0.2	0.4	< 0.1	< 0.1	0.3
Sodium [µg/g]	03-Oct-17	15:23	18000	18000	16000	21000	14000	19000	9700	8400	14000
Nickel [µg/g]	03-Oct-17	09:21	19	17	20	20	4.3	11	22	21	18

OnLine LIMS

00011160187

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LR Report : **CA13714-SEP17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD200	8: CAEXD317016-DD2200	9: CAEXD317017-FW2-300W	10: CAEXD317018-DP-350-151	11: CAEXD317019-FW350W	12: CAEXD317020-FW350W	13: CAEXD251474-PR425-400
Phosphorus [µg/g]	03-Oct-17	15:24	480	520	270	240	520	410	250	280	850
Lead [µg/g]	03-Oct-17	09:21	3.8	2.7	0.91	1.0	0.94	2.1	0.41	0.37	3.2
Antimony [µg/g]	03-Oct-17	09:21	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	03-Oct-17	09:21	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	03-Oct-17	09:21	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	03-Oct-17	09:21	51	54	25	21	46	68	31	30	45
Titanium [µg/g]	03-Oct-17	09:21	150	150	940	990	290	410	780	580	1700
Thallium [µg/g]	03-Oct-17	09:21	0.10	0.11	< 0.02	< 0.02	0.04	0.04	0.05	0.06	0.11
Uranium [µg/g]	03-Oct-17	09:21	0.33	0.34	0.014	0.013	0.16	0.16	0.017	0.019	0.27
Vanadium [µg/g]	03-Oct-17	09:21	25	24	52	53	8	20	48	44	36
Yttrium [µg/g]	03-Oct-17	09:21	1.1	1.1	2.5	2.2	1.1	1.4	2.4	1.5	4.7
Zinc [µg/g]	03-Oct-17	09:21	20	18	28	28	9.8	14	17	16	28

Analysis	14: CAEXD251475-RP425-400	15: CAMLD160902-FW400E	16: CAMLD160903-FW400E
Sample Date & Time	13-Sep-17	13-Sep-17	13-Sep-17
Silver [µg/g]	0.03	0.01	0.02
Aluminum [µg/g]	68000	66000	73000
Arsenic [µg/g]	10	2.8	3.4
Barium [µg/g]	100	39	9.8
Beryllium [µg/g]	0.20	0.09	0.07
Bismuth [µg/g]	< 0.09	< 0.09	< 0.09
Calcium [µg/g]	50000	87000	69000
Cadmium [µg/g]	0.05	0.04	0.03
Cobalt [µg/g]	11	9.2	9.3
Chromium [µg/g]	11	21	24
Copper [µg/g]	32	16	26
Iron [µg/g]	100000	63000	64000
Potassium [µg/g]	11000	7800	5000
Lithium [µg/g]	6	9	10
Magnesium [µg/g]	24000	20000	25000
Manganese [µg/g]	270	330	300
Molybdenum [µg/g]	0.2	0.2	0.2
Sodium [µg/g]	15000	14000	22000

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LR Report : **CA13714-SEP17**

Analysis	14: CAEXD251475-R P425-400	15: CAMLD160902-FW400E	16: CAMLD160903-FW400E
Nickel [µg/g]	18	21	23
Phosphorus [µg/g]	870	210	220
Lead [µg/g]	1.9	0.54	0.46
Antimony [µg/g]	< 0.8	< 0.8	< 0.8
Selenium [µg/g]	< 0.7	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6	< 6
Strontium [µg/g]	45	336	33
Titanium [µg/g]	1900	730	750
Thallium [µg/g]	0.07	0.04	0.03
Uranium [µg/g]	0.25	0.028	0.014
Vanadium [µg/g]	38	44	49
Yttrium [µg/g]	4.9	2.2	2.2
Zinc [µg/g]	28	18	16

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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10-October-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake
, Nunavut
X0C 0A0,

Phone: (819) 759-3555 x3928
Fax:(819) 759-3663

Date Rec. : 18 September 2017
LR Report: **CA13715-SEP17**
Reference: OL-617203

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD200	8: CAEXD317016-DD2200	9: CAEXD317017-FW2-300W	10: CAEXD317018-DP-350-151	11: CAEXD317019-FW350W	12: CAEXD317020-FW350W	13: CAEXD251474-PR425-400	14: CAEXD251475-RP425-400
Sample Date & Time	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17
SiO2 [%]	58.2	59.6	43.5	43.4	57.0	54.2	42.5	45.0	50.2	51.1
Al2O3 [%]	18.6	18.1	13.5	13.8	9.87	13.2	13.3	13.4	13.4	13.8
Fe2O3 [%]	7.23	6.68	12.9	12.1	19.7	11.9	9.93	10.0	15.8	16.3
MgO [%]	3.22	2.94	4.37	3.39	1.59	2.79	4.08	4.69	4.29	4.34
CaO [%]	1.47	1.45	10.5	11.2	3.44	5.78	13.4	11.2	8.31	7.65
Na2O [%]	2.52	2.50	2.27	3.04	2.04	2.64	1.34	1.14	2.04	2.25
K2O [%]	2.78	2.84	0.22	0.23	1.27	1.14	1.00	1.15	1.80	1.32
TiO2 [%]	0.72	0.69	0.93	0.91	0.28	0.52	0.84	0.81	1.55	1.67
P2O5 [%]	0.13	0.13	0.07	0.07	0.14	0.11	0.06	0.07	0.21	0.22
MnO [%]	0.07	0.05	0.24	0.25	0.04	0.10	0.22	0.18	0.18	0.18
Cr2O3 [%]	0.03	0.02	0.02	0.02	< 0.01	< 0.01	0.03	0.04	0.01	< 0.01
V2O5 [%]	0.03	0.02	0.04	0.05	< 0.01	0.02	0.04	0.05	0.05	0.04
LOI [%]	4.89	4.73	11.7	11.7	4.91	7.61	13.6	12.6	2.58	1.73
Sum [%]	99.8	99.7	100.4	100.1	100.3	100.0	100.4	100.4	100.4	100.6

OnLine LIMS

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LR Report : **CA13715-SEP17**

Analysis	15: CAMLD160902-FW400E	16: CAMLD160903-FW400E
Sample Date & Time	13-Sep-17	13-Sep-17
SiO2 [%]	43.5	45.4
Al2O3 [%]	12.9	14.6
Fe2O3 [%]	9.34	9.49
MgO [%]	3.58	4.37
CaO [%]	13.2	10.5
Na2O [%]	1.99	3.13
K2O [%]	0.88	0.57
TiO2 [%]	0.81	0.88
P2O5 [%]	0.07	0.07
MnO [%]	0.22	0.19
Cr2O3 [%]	0.03	0.03
V2O5 [%]	0.04	0.05
LOI [%]	12.8	11.2
Sum [%]	99.4	100.5

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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10-October-2017

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

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, Nunavut
X0C 0A0,

Phone: (819) 759-3555 x3928
Fax:(819) 759-3663

Date Rec. : 18 September 2017
LR Report: **CA13716-SEP17**
Reference: OL-617203

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD 200	8: CAEXD317016-DD 2200	9: CAEXD317017-FW 2-300W	10: CAEXD317018-DP- 350-151	11: CAEXD317019-FW 350W	12: CAEXD317020-FW 350W
Sample Date & Time			13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17
Sample weight [g]	26-Sep-17	14:37	250	250	250	250	250	250	250	250
Volume D.I. Water [mL]	26-Sep-17	14:37	750	750	750	750	750	750	750	750
Final pH	26-Sep-17	14:37	8.82	8.92	8.76	8.61	8.73	8.20	8.74	8.77
pH [no unit]	26-Sep-17	14:40	8.38	8.14	8.14	8.19	8.13	7.58	8.13	8.19
Conductivity [uS/cm]	26-Sep-17	14:40	736	443	208	214	435	3160	465	474
Alkalinity [mg/L as CaCO3]	26-Sep-17	14:40	49	45	55	69	55	36	43	43
Sulphate [mg/L]	27-Sep-17	12:48	13	8	< 2	2	8	160	7	6
Mercury [mg/L]	28-Sep-17	08:25	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	29-Sep-17	13:22	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	29-Sep-17	13:22	0.473	0.624	0.464	0.453	0.405	0.146	0.437	0.445
Arsenic [mg/L]	29-Sep-17	13:22	0.0181	0.0146	0.0004	0.0004	0.0047	0.0072	0.0042	0.0026
Barium [mg/L]	29-Sep-17	13:22	0.00592	0.00412	0.00042	0.00031	0.00801	0.0714	0.00145	0.00193
Boron [mg/L]	29-Sep-17	13:22	0.029	0.024	0.007	0.008	0.017	0.304	0.020	0.024
Beryllium [mg/L]	29-Sep-17	13:22	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	29-Sep-17	13:22	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	29-Sep-17	13:22	23.3	16.1	14.5	17.1	19.8	170	23.0	22.3
Cadmium [mg/L]	29-Sep-17	13:22	0.000007	0.000003	0.000010	0.000006	0.000003	0.000016	0.000009	0.000007
Cobalt [mg/L]	29-Sep-17	13:22	0.000301	0.000204	0.000034	0.000017	0.000049	0.000293	0.000063	0.000064
Chromium [mg/L]	29-Sep-17	13:22	0.00014	0.00016	0.00015	0.00008	0.00013	0.00013	0.00013	0.00022

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA13716-SEP17**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CAEXD317013-UP Ramp 225	6: CAEXD317014-UP Ramp 225	7: CAEXD317015-DD 200	8: CAEXD317016-DD 2200	9: CAEXD317017-FW 2-300W	10: CAEXD317018-DP- 350-151	11: CAEXD317019-FW 350W	12: CAEXD317020-FW 350W
Copper [mg/L]	29-Sep-17	13:22	0.00020	0.00019	0.00015	0.00014	0.00030	0.00037	0.00011	0.00027
Iron [mg/L]	29-Sep-17	13:22	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	29-Sep-17	13:22	22.5	20.4	2.06	1.96	13.3	30.1	10.1	10.4
Lithium [mg/L]	29-Sep-17	13:22	0.0023	0.0015	0.0029	0.0040	0.0020	0.112	0.0025	0.0028
Manganese [mg/L]	29-Sep-17	13:22	0.00132	0.00113	0.00366	0.00565	0.00154	0.0321	0.00404	0.00311
Magnesium [mg/L]	29-Sep-17	13:22	7.89	4.84	4.55	6.32	5.99	49.8	5.29	5.75
Molybdenum [mg/L]	29-Sep-17	13:22	0.00124	0.00088	0.00022	0.00027	0.00086	0.00540	0.00080	0.00069
Sodium [mg/L]	29-Sep-17	13:22	68.3	42.7	16.4	16.5	47.9	327	44.0	45.7
Nickel [mg/L]	29-Sep-17	13:22	0.0002	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0007	< 0.0001	< 0.0001
Phosphorus [mg/L]	29-Sep-17	13:22	< 0.003	0.004	< 0.003	< 0.003	< 0.003	0.007	< 0.003	< 0.003
Lead [mg/L]	29-Sep-17	13:22	0.00002	0.00006	< 0.00001	< 0.00001	0.00002	0.00003	< 0.00001	0.00004
Antimony [mg/L]	29-Sep-17	13:22	0.0030	0.0028	0.0015	0.0017	0.0010	0.0016	0.0007	0.0006
Selenium [mg/L]	29-Sep-17	13:22	0.00006	0.00007	0.00004	0.00008	0.00008	0.00019	0.00004	0.00004
Silicon [mg/L]	29-Sep-17	13:22	1.51	1.55	1.08	0.98	1.66	2.00	1.09	1.16
Tin [mg/L]	29-Sep-17	13:22	0.00010	0.00009	0.00010	0.00012	0.00018	0.00026	0.00004	0.00011
Strontium [mg/L]	29-Sep-17	13:22	0.195	0.106	0.0478	0.0407	0.179	4.11	0.119	0.164
Titanium [mg/L]	29-Sep-17	13:22	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	0.00006	< 0.00005	< 0.00005
Thallium [mg/L]	29-Sep-17	13:22	0.000029	0.000014	0.000005	< 0.000005	0.000008	0.000065	0.000037	0.000035
Uranium [mg/L]	29-Sep-17	13:22	0.000012	0.000014	< 0.000002	< 0.000002	0.000010	0.000187	< 0.000002	0.000002
Vanadium [mg/L]	29-Sep-17	13:22	0.00073	0.00129	0.00031	0.00030	0.00020	0.00019	0.00043	0.00043
Zinc [mg/L]	29-Sep-17	13:22	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	29-Sep-17	13:22	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Analysis	13: CAEXD251474-PR 425-400	14: CAEXD251475-RP 425-400	15: CAMLD160902-FW 400E	16: CAMLD160903-FW 400E	17: CAMLD160903-FW 400E	18:BLK: $D.I. Leachate Blank
Sample Date & Time	13-Sep-17	13-Sep-17	13-Sep-17	13-Sep-17		
Sample weight [g]	250	250	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750	750	750
Final pH	9.66	9.46	9.02	9.05	8.96	5.67
pH [no unit]	8.52	8.42	8.23	8.08	8.01	5.37
Conductivity [uS/cm]	324	450	160	121	133	3
Alkalinity [mg/L as CaCO3]	28	23	45	49	51	< 2
Sulphate [mg/L]	7	11	3	< 2	< 2	< 2
Mercury [mg/L]	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

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0001160202

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA13716-SEP17**

Analysis	13: CAEXD251474-PR 425-400	14: CAEXD251475-RP 425-400	15: CAMLD160902-FW 400E	16: CAMLD160903-FW 400E	17: CAMLD160903-FW 400E	18:BLK: $D.I. Leachate Blank
Silver [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	0.641	0.411	0.789	0.617	0.589	0.001
Arsenic [mg/L]	0.0123	0.0091	0.0006	0.0010	0.0010	< 0.0002
Barium [mg/L]	0.0329	0.0516	0.00180	0.00032	0.00042	0.00013
Boron [mg/L]	0.025	0.031	0.012	0.006	0.006	< 0.002
Beryllium [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	5.73	11.2	13.2	9.43	10.6	0.08
Cadmium [mg/L]	0.000012	< 0.000003	0.000012	0.000009	0.000011	0.000010
Cobalt [mg/L]	0.000044	0.000066	0.000175	0.000074	0.000089	< 0.000004
Chromium [mg/L]	0.00025	0.00021	0.00022	0.00016	0.00012	0.00017
Copper [mg/L]	0.00032	0.00015	0.00054	0.00022	0.00019	0.00042
Iron [mg/L]	0.008	0.008	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	24.6	21.5	6.90	2.80	2.91	0.119
Lithium [mg/L]	0.0134	0.0074	0.0021	0.0019	0.0021	0.0001
Manganese [mg/L]	0.00029	0.00024	0.00267	0.00150	0.00190	0.00112
Magnesium [mg/L]	0.636	1.72	2.38	3.12	3.63	0.006
Molybdenum [mg/L]	0.00112	0.00138	0.00032	0.00014	0.00014	0.00005
Sodium [mg/L]	35.3	54.2	8.69	8.63	9.89	0.12
Nickel [mg/L]	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Phosphorus [mg/L]	< 0.003	0.010	< 0.003	< 0.003	< 0.003	< 0.003
Lead [mg/L]	0.00005	0.00004	0.00008	0.00004	0.00003	0.00006
Antimony [mg/L]	0.0099	0.0083	0.0012	0.0010	0.0011	0.0004
Selenium [mg/L]	0.00021	0.00011	< 0.00004	< 0.00004	< 0.00004	< 0.00004
Silicon [mg/L]	3.04	2.89	0.92	1.20	1.31	< 0.02
Tin [mg/L]	0.00019	0.00015	0.00025	0.00017	0.00008	0.00010
Strontium [mg/L]	0.0501	0.111	0.364	0.0249	0.0296	0.00011
Titanium [mg/L]	0.00021	0.00035	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Thallium [mg/L]	< 0.000005	0.000007	0.000014	< 0.000005	0.000005	< 0.000005
Uranium [mg/L]	0.000010	0.000012	< 0.000002	< 0.000002	< 0.000002	< 0.000002
Vanadium [mg/L]	0.0105	0.00694	0.00074	0.00106	0.00087	< 0.00001
Zinc [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

OnLine LIMS

00011602O2

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA13716-SEP17**

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

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0001160202

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Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake
, Nunavut
X0C 0A0,

Phone: (819) 759-3555 x3928
Fax:(819) 759-3663

ABA - Modified Sobek

Project : PO#617203

17-January-2018

Date Rec. : 04 January 2018
LR Report: **CA12147-JAN18**

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CERTIFICATE OF ANALYSIS

Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: CALM006901-F W325W	6: CALM106904-F W400E	7: CALM106905-F W325W	8: CALM106906-F W350W	9: CALM106907-RP-375-350	10: CALM106908-F W350E	11: CALM106909-C C300-152	12: CALM1069010-D P325-156	13: CALM1069011-F W400E	14: CALM1069012-VA425
Sample Date & Time			30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17
Paste pH	16-Jan-18	12:35	8.49	8.25	8.17	8.54	8.96	8.61	8.51	8.99	8.47	8.42
Fizz Rate [---]	16-Jan-18	12:35	4	4	4	4	4	4	4	4	4	4
Sample weight [g]	16-Jan-18	12:35	2.01	2.02	2.02	2.02	2.02	2.02	2.03	2.04	2.03	1.99
HCl_add [mL]	16-Jan-18	12:35	114.50	131.30	42.60	115.20	40.00	151.70	59.40	50.00	105.50	65.00
HCl [Normality]	16-Jan-18	12:35	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH [Normality]	16-Jan-18	12:35	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vol NaOH to pH=8.3 [mL]	16-Jan-18	12:35	20.17	40.23	20.40	26.91	26.92	64.22	19.79	24.98	32.60	17.90
Final pH	16-Jan-18	12:35	1.63	1.64	1.65	1.90	1.58	1.56	1.81	1.64	1.72	1.85
NP [t CaCO3/1000 t]	16-Jan-18	12:35	235	225	55	218	32	216	98	61	180	118
AP [t CaCO3/1000 t]	---	---	5.31	0.94	7.81	4.38	4.06	5.31	6.88	2.50	4.06	0.62
Net NP [t CaCO3/1000 t]	---	---	229	224	47.1	214	28.3	211	90.7	58.8	175	118
NP/AP [ratio]	---	---	44.2	240	7.03	49.9	7.98	40.8	14.2	24.5	44.2	191
S [%]	11-Jan-18	11:55	0.248	0.047	0.294	0.201	0.185	0.258	0.243	0.121	0.169	0.074
Acid Leachable SO4-S [%]	---	---	0.08	< 0.02	0.04	0.06	0.06	0.09	0.02	0.04	0.04	0.07
Sulphide [%]	11-Jan-18	11:55	0.17	0.03	0.25	0.14	0.13	0.17	0.22	0.08	0.13	< 0.02
C [%]	11-Jan-18	13:11	2.60	2.88	0.848	3.06	0.221	3.09	1.66	0.864	2.29	1.48
CO3 [%]	11-Jan-18	13:11	12.0	13.5	1.56	12.8	0.500	13.9	6.65	3.25	10.4	6.66

OnLine LIMS

0001258871

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ABA - Modified Sobek

Project : PO#617203

LR Report : **CA12147-JAN18**

Analysis	15: CALM1069013-LA425	16: CALM1069014-RP000-225
Sample Date & Time	30-Dec-17	30-Dec-17
Paste pH	8.56	8.61
Fizz Rate [---]	4	3
Sample weight [g]	2.01	2.00
HCl_add [mL]	136.70	30.00
HCl [Normality]	0.10	0.10
NaOH [Normality]	0.10	0.10
Vol NaOH to pH=8.3 [mL]	41.90	15.92
Final pH	1.73	1.60
NP [t CaCO3/1000 t]	236	35
AP [t CaCO3/1000 t]	1.56	3.12
Net NP [t CaCO3/1000 t]	234	32.1
NP/AP [ratio]	151	11.3
S [%]	0.090	0.143
Acid Leachable SO4-S [%]	0.04	0.04
Sulphide [%]	0.05	0.10
C [%]	2.82	0.455
CO3 [%]	14.0	1.08

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001258871

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Project : PO#617203

07-March-2018

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Date Rec. : 04 January 2018
LR Report: **CA12148-JAN18**

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, Nunavut
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CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: CALM006901-FW 325W	6: CALM106904-FW 400E	7: CALM106905-FW 325W	8: CALM106906-FW 350W	9: CALM106907-RP-375-350	10: CALM106908-FW 350E	11: CALM106909-CC 300-152
Sample Date & Time					30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17
Silver [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.061	0.15	0.022	0.064	0.033	0.14	< 0.01
Aluminum [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	74000	72000	79000	69000	66000	77000	33000
Arsenic [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	16	6.7	300	97	80	39	28
Barium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	150	78	710	86	280	100	320
Beryllium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.52	0.43	1.5	0.55	1.5	0.71	0.63
Bismuth [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	< 0.09	< 0.09	0.12	< 0.09	0.098	< 0.09	0.13
Calcium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	79000	86000	16000	73000	46000	62000	38000
Cadmium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.13	0.12	0.070	0.14	0.14	0.12	0.090
Cobalt [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	49	40	11	47	56	42	3.6
Chromium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	140	460	53	110	74	120	31
Copper [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	94	110	32	77	92	130	15
Iron [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	67000	67000	46000	73000	100000	72000	190000
Potassium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	4700	3100	18000	6600	8300	11000	7800
Lithium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	83	81	22	72	36	66	7.3
Magnesium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	22000	20000	9100	25000	26000	32000	7900
Manganese [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	1600	2000	340	1800	1400	1200	610
Molybdenum [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.47	5.5	0.85	0.57	0.93	0.24	0.54
Sodium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	14000	20000	23000	14000	18000	14000	510
Nickel [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	110	120	32	100	99	100	9.1
Phosphorus [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	240	210	340	200	780	230	500

OnLine LIMS

00013034G7

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO#617203
LR Report : **CA12148-JAN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: CALM006901-FW 325W	6: CALM106904-FW 400E	7: CALM106905-FW 325W	8: CALM106906-FW 350W	9: CALM106907-RP-375-350	10: CALM106908-FW 350E	11: CALM106909-CC 300-152
Lead [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	4.4	4.0	5.9	4.3	9.5	10	5.5
Antimony [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.80	< 0.8	< 0.8	< 0.8	1.1	< 0.8	< 0.8
Selenium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	< 6	< 6	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	200	110	180	140	200	190	420
Titanium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	4500	4200	2400	3900	10000	2400	860
Thallium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.19	0.11	0.44	0.20	0.30	0.29	0.14
Uranium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	0.098	0.092	1.2	0.069	1.3	0.052	0.58
Vanadium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	250	240	64	250	190	210	19
Yttrium [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	14	15	6.6	8.5	24	5.8	4.5
Zinc [µg/g]	19-Jan-18	10:25	22-Jan-18	13:02	90	93	62	120	140	87	35

Analysis	12: CALM1069010-DP325-156	13: CALM1069011-FW400E	14: CALM1069012-VA425	15: CALM1069013-LA425	16: CALM1069014-RP000-225
Sample Date & Time	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17
Silver [µg/g]	0.022	0.057	0.051	0.085	0.037
Aluminum [µg/g]	74000	73000	74000	68000	89000
Arsenic [µg/g]	8.4	9.0	11	56	180
Barium [µg/g]	630	47	12	110	670
Beryllium [µg/g]	1.3	0.32	0.27	0.37	1.3
Bismuth [µg/g]	0.098	< 0.09	< 0.09	< 0.09	0.12
Calcium [µg/g]	22000	71000	77000	85000	11000
Cadmium [µg/g]	0.044	0.11	0.12	0.098	0.067
Cobalt [µg/g]	13	45	44	50	25
Chromium [µg/g]	37	120	170	130	88
Copper [µg/g]	21	110	83	110	42
Iron [µg/g]	78000	70000	79000	63000	47000
Potassium [µg/g]	17000	2600	370	4900	21000
Lithium [µg/g]	29	67	54	47	58
Magnesium [µg/g]	8800	21000	34000	26000	18000
Manganese [µg/g]	350	1700	1400	1800	390
Molybdenum [µg/g]	0.69	0.18	0.22	0.14	1.5
Sodium [µg/g]	29000	18000	7200	19000	17000
Nickel [µg/g]	23	110	110	120	85

OnLine LIMS

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00013034 67

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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : PO#617203
LR Report : **CA12148-JAN18**

Analysis	12: CALM1069010-D P325-156	13: CALM1069011-F W400E	14: CALM1069012-V A425	15: CALM1069013-L A425	16: CALM1069014-R P000-225
Phosphorus [µg/g]	420	220	190	140	460
Lead [µg/g]	7.5	2.7	8.3	1.9	12
Antimony [µg/g]	< 0.8	< 0.8	1.2	< 0.8	< 0.8
Selenium [µg/g]	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7
Tin [µg/g]	< 6	< 6	< 6	< 6	< 6
Strontium [µg/g]	300	100	210	74	290
Titanium [µg/g]	2800	4800	4900	4000	1200
Thallium [µg/g]	0.33	0.080	< 0.02	0.14	0.46
Uranium [µg/g]	1.1	0.052	0.063	0.062	1.6
Vanadium [µg/g]	53	250	240	220	120
Yttrium [µg/g]	5.7	12	15	12	8.1
Zinc [µg/g]	55	100	81	74	99

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

00013034 67

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10-January-2018

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Date Rec. : 04 January 2018
LR Report: **CA12149-JAN18**

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, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

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CERTIFICATE OF ANALYSIS

Final Report

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %
5: CALM006901-FW325W	30-Dec-18	44.8	14.0	9.88	3.84	12.6	2.02	0.56	0.90	0.07	0.20	0.04	0.04	11.4	100.4
6: CALM106904-FW400E	30-Dec-18	42.2	14.0	9.46	3.64	13.8	2.81	0.38	0.87	0.06	0.27	0.04	0.05	12.9	100.5
7: CALM106905-FW325W	30-Dec-18	62.1	15.3	6.91	1.68	2.42	3.35	2.47	0.46	0.10	0.06	0.01	0.01	4.52	99.4
8: CALM106906-FW350W	30-Dec-18	42.8	13.3	11.0	4.39	11.7	2.06	0.83	0.84	0.06	0.24	0.02	0.05	12.7	100.1
9: CALM106907-RP-375-350	30-Dec-18	50.1	13.5	16.4	4.70	7.54	2.66	1.05	1.63	0.22	0.20	0.01	0.04	1.95	100.0
10: CALM106908-FW350E	30-Dec-18	42.3	14.5	10.4	5.68	9.33	1.98	1.32	0.78	0.06	0.16	0.03	0.04	13.1	99.7
11: CALM106909-CC300-152	30-Dec-18	51.8	6.32	28.1	1.40	5.47	0.07	0.96	0.12	0.14	0.09	< 0.01	0.01	5.34	99.9
12: CALM1069010-DP325-156	30-Dec-18	60.0	13.8	11.1	1.47	3.01	3.84	1.95	0.40	0.12	0.04	< 0.01	< 0.01	4.15	99.8
13: CALM1069011-FW400E	30-Dec-18	46.5	13.8	10.2	3.73	11.2	2.49	0.33	0.86	0.06	0.24	0.03	0.05	10.3	99.8
14: CALM1069012-VA425	30-Dec-18	45.5	14.0	11.7	6.15	12.1	1.07	0.05	0.77	0.05	0.19	0.04	0.04	8.76	100.5
15: CALM1069013-LA425	30-Dec-18	41.6	13.2	9.65	4.51	13.4	2.64	0.60	0.63	0.04	0.25	0.03	0.04	13.2	99.8
16: CALM1069014-RP000-225	30-Dec-18	58.1	18.3	7.03	3.22	1.36	2.43	2.85	0.71	0.14	0.05	0.03	0.01	4.46	98.7

OnLine LIMS

0001252165

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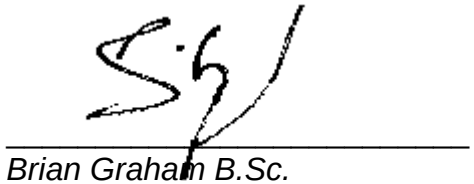
LR Report : **CA12149-JAN18**



Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

0001252165

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Shake Flask Leach (3:1 Ratio)

Agnico Eagle Mines Limited
Attn : Jeffrey Pratt

Baker Lake,
, X0C 0A0
Phone: (819) 759-3555 x3928, Fax:(819) 759-3663

12-January-2018

Date Rec. : 04 January 2018
LR Report: **CA12150-JAN18**

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: CALM006901-FW 325W	6: CALM106904-FW 400E	7: CALM106905-FW 325W	8: CALM106906-FW 350W	9: CALM106907-RP- 375-350	10: CALM106908-FW 350E	11: CALM106909-CC 300-152
Sample Date & Time					30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17
Sample weight [g]	08-Jan-18	08:12	09-Jan-18	09:31	250	250	250	250	250	250	250
Volume D.I. Water [mL]	08-Jan-18	08:12	09-Jan-18	09:31	750	750	750	750	750	750	750
Final pH	09-Jan-18	08:51	09-Jan-18	09:31	8.57	8.43	8.39	8.56	9.11	8.58	8.44
pH [no unit]	09-Jan-18	08:20	10-Jan-18	12:01	7.96	8.10	7.94	8.11	8.42	8.24	8.00
Conductivity [uS/cm]	09-Jan-18	08:20	10-Jan-18	12:01	491	1140	1640	390	706	382	411
Alkalinity [mg/L as CaCO3]	09-Jan-18	08:20	10-Jan-18	12:01	31	33	37	51	17	66	55
Sulphate [mg/L]	10-Jan-18	08:23	10-Jan-18	15:52	15	23	19	3	25	2	21
Mercury [mg/L]	10-Jan-18	12:14	10-Jan-18	13:36	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Aluminum [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.476	0.280	0.267	0.345	0.223	0.320	0.209
Arsenic [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.0011	0.0007	0.0122	0.0280	0.0134	0.0039	0.0016
Barium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00380	0.0185	0.0420	0.00138	0.0475	0.00145	0.00916
Boron [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.055	0.083	0.151	0.033	0.054	0.045	0.021
Beryllium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	31.3	67.4	87.6	22.3	34.8	21.9	28.5
Cadmium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.000003	< 0.000003	0.000006	< 0.000003	< 0.000003	< 0.000003	< 0.000003
Cobalt [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.000038	0.000073	0.000133	0.000072	0.000057	0.000022	0.000006
Chromium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.00003	0.00004	0.00005	< 0.00003	< 0.00003	< 0.00003	< 0.00003
Copper [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.00002	< 0.00002	0.00038	< 0.00002	< 0.00002	< 0.00002	< 0.00002

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SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Shake Flask Leach (3:1 Ratio)

LR Report : **CA12150-JAN18**

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: CALM006901-FW 325W	6: CALM106904-FW 400E	7: CALM106905-FW 325W	8: CALM106906-FW 350W	9: CALM106907-RP- 375-350	10: CALM106908-FW 350E	11: CALM106909-CC 300-152
Iron [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	6.75	7.78	29.2	8.09	18.6	10.4	9.44
Lithium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.0090	0.0272	0.0835	0.0048	0.0135	0.0075	0.0008
Manganese [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00699	0.0183	0.0100	0.00520	0.00091	0.00227	0.00297
Magnesium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	4.70	12.6	18.8	6.61	5.15	10.1	4.35
Molybdenum [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00033	0.00060	0.00128	0.00014	0.00107	< 0.00001	0.00091
Sodium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	40.0	107	149	28.7	62.1	22.8	31.2
Nickel [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.0001	0.0002	0.0003	0.0003	0.0002	0.0001	< 0.0001
Phosphorus [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Lead [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.00001	0.00001	0.00003	< 0.00001	0.00003	< 0.00001	0.00002
Antimony [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.0005	0.0003	0.0010	< 0.0002	0.0057	0.0005	0.0004
Selenium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00006	< 0.00004	0.00006	< 0.00004	0.00006	0.00004	0.00005
Silicon [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.91	1.04	1.17	0.87	2.44	0.99	1.06
Tin [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00001	0.00004	0.00002	< 0.00001	0.00003	< 0.00001	0.00001
Strontium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.304	1.27	1.90	0.205	0.591	0.255	0.560
Titanium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00013	0.00006	0.00008	< 0.00005	0.00009	< 0.00005	< 0.00005
Thallium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.000026	0.000058	0.000015	0.000009	0.000007	0.000013	< 0.000005
Uranium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.000006	0.000003	0.000074	0.000002	0.000008	< 0.000002	0.000027
Vanadium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	0.00058	0.00039	0.00029	0.00042	0.00289	0.00030	0.00003
Zinc [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	09-Jan-18	15:13	10-Jan-18	16:07	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Analysis	12: CALM1069010-D P325-156	13: CALM1069011-F W400E	14: CALM1069012-V A425	15: CALM1069013-L A425	16: CALM1069014-R P000-225
Sample Date & Time	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17	30-Dec-17
Sample weight [g]	250	250	250	250	250
Volume D.I. Water [mL]	750	750	750	750	750
Final pH	8.61	9.02	8.75	8.73	8.73
pH [no unit]	8.10	8.29	7.69	8.32	8.54
Conductivity [uS/cm]	472	200	1150	692	714
Alkalinity [mg/L as CaCO3]	37	53	11	37	38
Sulphate [mg/L]	4	3	380	11	5
Mercury [mg/L]	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Silver [mg/L]	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA12150-JAN18**

Analysis	12: CALM1069010-DP325-156	13: CALM1069011-FW400E	14: CALM1069012-VA425	15: CALM1069013-LA425	16: CALM1069014-RP000-225
Aluminum [mg/L]	0.416	0.503	0.286	0.384	0.345
Arsenic [mg/L]	0.0006	0.0006	0.0022	0.0234	0.0032
Barium [mg/L]	0.00168	0.00540	0.0326	0.00721	0.00429
Boron [mg/L]	0.028	0.009	0.032	0.075	0.025
Beryllium [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Bismuth [mg/L]	< 0.000007	< 0.000007	< 0.000007	< 0.000007	< 0.000007
Calcium [mg/L]	30.0	8.63	173	32.7	31.1
Cadmium [mg/L]	0.000005	< 0.000003	0.000003	< 0.000003	< 0.000003
Cobalt [mg/L]	0.000018	0.000004	0.000041	0.000120	0.000047
Chromium [mg/L]	< 0.00003	< 0.00003	< 0.00003	< 0.00003	< 0.00003
Copper [mg/L]	< 0.00002	< 0.00002	0.00006	0.00016	0.00010
Iron [mg/L]	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
Potassium [mg/L]	4.16	10.2	2.53	22.5	8.72
Lithium [mg/L]	0.0061	0.0014	0.0069	0.0083	0.0021
Manganese [mg/L]	0.00770	0.00096	0.0152	0.00153	0.00423
Magnesium [mg/L]	5.31	1.97	8.16	6.92	6.43
Molybdenum [mg/L]	0.00626	0.00053	0.00609	0.00546	0.00057
Sodium [mg/L]	42.1	21.3	41.1	58.7	68.9
Nickel [mg/L]	< 0.0001	< 0.0001	0.0002	0.0003	0.0001
Phosphorus [mg/L]	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003
Lead [mg/L]	< 0.00001	< 0.00001	0.00003	0.00002	0.00004
Antimony [mg/L]	0.0005	0.0008	0.0016	0.0035	0.0012
Selenium [mg/L]	< 0.00004	0.00006	< 0.00004	< 0.00004	< 0.00004
Silicon [mg/L]	0.83	1.46	1.14	1.18	0.91
Tin [mg/L]	0.00002	0.00002	0.00005	0.00004	0.00002
Strontium [mg/L]	0.271	0.0750	3.04	0.431	0.241
Titanium [mg/L]	< 0.00005	0.00012	< 0.00005	< 0.00005	< 0.00005
Thallium [mg/L]	0.000012	0.000006	0.000038	0.000012	0.000095
Uranium [mg/L]	0.000002	0.000043	0.000002	0.000018	< 0.000002
Vanadium [mg/L]	0.00039	0.00047	0.00065	0.00070	0.00036
Zinc [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002
Zirconium [mg/L]	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

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Shake Flask Leach (3:1 Ratio)

LR Report : **CA12150-JAN18**

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

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Appendix D

Hazardous Materials Shipment Documentation

MOVEMENT DOCUMENT / MANIFEST
DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial transport and environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement et le transport.

PC55999-9

Movement Document / Manifest Reference No. / N° de référence du document de mouvement/manifeste

1 of 16

A Generator / consignor / Producteur / expéditeur

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial 1: NUG 10006B

Company name / Nom de l'entreprise: AGNICO-EAGLE MINES LTD

Mailing address / Adresse postale: 145 KING ST E, SUITE 400, TORONTO, ON, M5C 2Y7

City / Ville:

Province:

Postal code / Code postal:

E-mail / Courrier électronique:

Tel. No. / N° de tél.: 416 9471512

Shipping site address / Adresse du lieu de l'expédition: MEADOWBANK SITE

City / Ville: RANKIN INLET

Province: NU

Postal code / Code postal: X0C0G0

Intended Receiver / consignee / Réceptionnaire / destinataire prévu 2: QIKIQTAALUK ENVIRONMENTAL

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial: 1162026159

Mailing address / Adresse postale: 9935 CHATEAUNEUF AV. SUITE 200, BROSSARD, QC, J4Z3V4

City / Ville:

Province:

Postal code / Code postal:

E-mail / Courrier électronique:

Tel. No. / N° de tél.: 514940 3332

Receiving site address / Adresse du lieu de destination: PORT OF BECANCOUR

City / Ville: BECANCOUR

Province: QC

Postal code / Code postal: G9Y2Y7

B Carrier / Transporteur

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial 23: NUG 20002

Company name / Nom de l'entreprise: NUNAVUT SEALIFT & SUPPLY INC.

Mailing address / Adresse postale: 6565 HEBERT BLVD, STE-CATHERINE, QC, J5C1B5

City / Ville:

Province:

Postal code / Code postal:

E-mail / Courrier électronique:

Tel. No. / N° de tél.: 450 6350833

Vehicle / Véhicule	Registration No. / N° d'immatriculation	Prov. 24
Trailer - Rail car No. 1 / 1re remorque - wagon		
Trailer - Rail car No. 2 / 2e remorque - wagon		

Port of entry / Point d'entrée: International use only

Port of exit / Point de sortie: International use only 25

Carrier Certification: I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct. / **Attestation du transporteur:** J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets. 26

Name of authorized person (print): / Nom de l'agent autorisé (caractères d'imprimerie):

Tel. No. / N° de tél.: 450 6350833

Year / Année | Month / Mois | Day / Jour | Signature

C Receiver / consignee / Réceptionnaire / destinataire

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés 27: QE17-143-2

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial 28

Receiver / consignee information same as in Part A / Les renseignements du réceptionnaire / destinataire sont les mêmes qu'à la Partie A

☐ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous

Company name / Nom de l'entreprise

Mailing address / Adresse postale

City / Ville | Province | Postal code / Code postal

E-mail / Courrier électronique | Tel. No. / N° de tél. ( )

Receiving site address / Adresse du lieu de destination

Date received / Date de réception: Year / Année | Month / Mois | Day / Jour

Time / Heure 29: ☐ A.M. ☐ P.M.

If waste or recyclable material to be transferred, specify intended company name/ Si les déchets ou matières recyclables doivent être transférés, préciser le nom du destinataire 30

Registration No./Provincial ID No. / N° d'immatriculation/d'id provincial

(i) Prov. code / Code prov. 3	Shipping name / Appellation réglementaire 4	Class / Classe Sub. class(es) / Classe(s) sub. 5	UN No. / N° NU 6	Packing / risk gr. / Gr. d'emballage/ de risque 7	Quantity shipped / Quantité expédiée	Units / L or / ou Kg / Unités 8	Packaging / Contenant No. / N° 9	Codes Int. – ext.	Phys. state / État phys. 10
(i)	SEE ANNEX ATTACHED								
(ii)									
(iii)									
(iv)									

Quantity received / Quantité reçue	Units / L or / ou Kg / Unités 31	Comments / Commentaires 32	Handling Code / Code de manutention 33	Shipment / Envoi Accepted / Accepté 34	Refused / Refusé	Decont. 35 Pack. Cont.	Veh.

Notice No. / N° de notification 11	Notice Line No / N° de ligne de la notification	Shipment / Envoi 12	Of / De	D or R code / Code D ou R 13	C code / Code C 14	Basel Annex VIII or OECD Code / Annexe VIII de Bâle ou Code OCDE 15	H code / Code H 16	Y code / Code Y 17	National code in country of / Code du pays: Export / Exportation 18	Import / Importation	Customs code(s) / Code(s) de douanes 19
(i)											
(ii)											
(iii)											
(iv)											

International use only

If handling code "Other" (specify) / Si code de manutention « autre » (spécifier) 36

Receiver / consignee certification: I certify that the information contained in Part C is correct and complete. / **Attestation du réceptionnaire / destinataire:** J'atteste que tous les renseignements à la partie C sont exacts et complets.

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie) 37

Signature

Tel. No. / N° de tél. ( )

Special handling / Manutention spéciale 22: 1-613-996-6666

☐ Attached /Ci-joint: ☒ As follows/ Ci-contre: INCASE OF EMERGENCY 24 HRS CALL CANUTEC

Generator / consignor certification: I certify that the information contained in Part A is correct and complete. / **Attestation du producteur / expéditeur:** J'atteste que tous les renseignements à la partie A sont exacts et complets. 20

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie): YVON BEAUDOIN

Signature

Tel. No. / N° de tél.: 514 444 9512

21 Date shipped / Date d'expédition: Year / Année | Month / Mois | Day / Jour

Time / Heure: ☐ A.M. ☐ P.M.

Scheduled arrival date / Date d'arrivée prévue: Year / Année | Month / Mois | Day / Jour

MOE 04-1917 (12/13)

Instructions for completion and distribution on reverse / Instructions pour compléter et distribuer au verso

Copy / Copie 1 (white / blanche)

IMDG DECLARATION

Shipper/consignor
AGNICO-EAGLE MINE LTD - MELIADINE PROJECT
RANKIN INLET, NUNAVUT, X0C 0G0
TEL: 1-819-759-3555

Reference number(s) MANIFEST #C55999-G
PROJECT: QE17-143-2
Page 1 of 6 Pages

Consignee
QIKIQTAALUQ ENVIRONMENTAL
355, BOUL ALPHONSE-DESHAIES
BECANCOUR, QC, G9H 2Y7
TEL: 514-940-3332

Carrier NUNAVUT SEALIFT AND SUPPLY INC,
6565 HEBERT BLVD
STE-CATHERINE, QC, J5C 1B5
TEL: 1-450-635 0833

CONTAINER/VEHICLE PACKING CERTIFICATE

DECLARATION

It is declared that the packing of the goods into the container/vehicle has been carried out in accordance with the applicable provisions.

TO BE COMPLETED FOR SHIPMENTS IN CONTAINERS OR VEHICLES

Container/Vehicle #:

Name/status, company/organization of signatory
YVON BEAUDOIN / PROJECT MANAGER / Q.E.

Place and date
MELIDOINE SITE, RANKIN INLET, NU SEPT 7, 2017

Signature on behalf of packer

Vessel No. and Date

Port of loading
RANKIN INLET

Port of discharge
BECANCOUR

(Reserved for text, instructions or other matter)

No. & Kind of Packages	DESCRIPTION OF GOODS (UN Number, PSN, Hazard Class, Packing Group, Flash Point, Marine Pollutant)	QUANTITY Gross mass (kg)	Net mass (kg)	Cube (m^3)
	SEE ANNEX ATTACHED			

Additional Information / Seal Number(s):

Emergency Telephone No. / 24-Hour Number: CALL CANUTEC 1-613 996 6666

SHIPPER'S DECLARATION

I hereby declare that the contents of this consignment are fully and accurately described above by the Proper Shipping Name, and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national government regulations.

Name/status of declarant
YVON BEAUDOIN / PROJECT MANAGER

Place and date
MELIADINE SITE / RANKIN INLET SEPT 7, 2017

Signature on behalf of shipper

2017 09 07 - MELIADINE PROJECT - HAZMAT CONTAINERS		
#	CONTAINER NO.	PLACARDS
1	GATU 052603-6	NO
2	GATU 069679-4	NO
3	MSCU 105804-5	class 8
4	MIGU 154819-7	NO
5	ITAU 216984-1	class 2.1
6	GLDU 223244-9	NO
7	TEXU 244404-5	NO
8	TBCU 306123-1	NO
9	MSCU 310277-0	NO
10	IPXU 331483-3	class 8
11	TRIU 382868-7	NO
12	CBHU 386438-5	NO
13	FSCU 395369-0	NO
14	TDRU 723349-6	NO

AGNICO EAGLE

A.E.M. MELIADINE 2017
Shipper's Declaration of Dangerous Goods
Form for each container containing dangerous goods as per TDGA or IMDG Code

AGNICO EAGLE

Shipper's Declaration For Dangerous Goods

Shipper :	**Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063**
Transporter :	**Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002**
Consignor	**Qikiqtaaluk Environmental - Port Of Becancour - Prov ID n°. : 1162926159**
CONTAINER #	**MSCU 105804-5**
Size and Type :	**20 FT marine container** **Reference : manifest PC55999-9**

line	No. & Kind of packages		DESCRIPTION OF GOODS UN Number, Shipping Name, Hazard Class (Sub), Packing Group, F.P. (deg. C), Marine Pollutant, Add technical name (s.p. 274 for primary and sub. classes and M.P.)	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	1	Drum 205 L	UN 3028 BATTERIES, DRY, CONTAINING POTASSIUM HYDROXIDE, SOLID, CLASS 8	205	250
b.	2	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	410	250
c.	3	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTERS	615	300
d.	4	Drum 205 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	820	400
e.	17	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	3485	3400
f.	1	Drum 205 L	Not Regulated under T.D.G.A. - HYDROCARBONS CONTAMINATED SOIL	205	2050
g.	10	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	7650	2000
h.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1000	800
i.	2	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	2000	600
j.					
k.					

placards required : Class 8

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition

for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations. It is declared that the packing of the goods into the unit has been carried out in accordance the provisions of 5.4.2.1

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M., Rankin Inlet, Nunavut Place & Date : AEM - Meliadine site, September 7, 2017

Port of Discharge : Port de Becancour Signature:

AGNICO EAGLE

Shipper's Declaration For Dangerous Goods

Shipper :	**Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063**
Transporter :	**Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002**
Consignor	**Qikiqtaaluk Environmental - Port Of Becancour - Prov ID n°. : 1162926159**
CONTAINER #	**ITAU 216984-1**
Size and Type :	**20 FT marine container** **Reference : manifest PC55999-9**

line	No. & Kind of packages		DESCRIPTION OF GOODS UN Number, Shipping Name, Hazard Class (Sub), Packing Group, F.P. (deg. C), Marine Pollutant, Add technical name (s.p. 274 for primary and sub. classes and M.P.)	QUANTITY Net Qty (L)	QUANTITY Gross mass(kg)
a.	7	Drum 205 L	UN 1950, AEROSOLS, FLAMMABLE Class 2.1 - *EMPTY SPRAY CANS*	1435	385
b.	3	Quatrex Bags 765 L	UN 1950, AEROSOLS, FLAMMABLE Class 2.1 - *EMPTY SPRAY CANS*	2295	750
c.	5	Drum 205 L	Not Regulated under T.D.G.A. - HYDROCARBON CONTAMINATED SOIL	1025	1250
d.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	1025	1025
e.	4	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTERS	820	400
f.	1	Drum 205 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	205	100
g.	9	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	1845	900
h.	4	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	3060	800
i.	2	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	2000	600
j.					
k.					

placards required : CLASS 2.1

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition

for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations. It is declared that the packing of the goods into the unit has been carried out in accordance the provisions of 5.4.2.1

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M., Rankin Inlet, Nunavut Place & Date : AEM - Meliadine site, September 7, 2017

Port of Discharge : Port de Becancour Signature :

AGNICO EAGLE

Shipper's Declaration For Dangerous Goods

Shipper :	**Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063**
Transporter :	**Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002**
Consignor	**Qikiqtaaluk Environmental - Port Of Becancour - Prov ID n°. : 1162926159**
CONTAINER #	**IPXU331483-3**
Size and Type :	**20 FT marine container** **Reference : manifest PC55999-9**

line	No. & Kind of packages		DESCRIPTION OF GOODS UN Number, Shipping Name, Hazard Class (Sub), Packing Group, F.P. (deg. C), Marine Pollutant, Add technical name (s.p. 274 for primary and sub. classes and M.P.)	QUANTITY Net Qty (L)	QUANTITY Gross mass(kg)
a.	10	Quatrex Bags 380 L	UN 2794 BATTERIES, WET, FILLED WITH ACID, CLASS 8 - *LEAD BATTERIES*	3800	3000
b.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	1025	625
c.	2	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTERS	410	200
d.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	1025	500
e.	12	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	9180	2400
f.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - SOLID RESIN	765	600
g.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1000	800
h.					
i.					
j.					
k.					

placards required : Class 8

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

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for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations. It is declared that the packing of the goods into the unit has been carried out in accordance the provisions of 5.4.2.1

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M., Rankin Inlet, Nunavut Place & Date : AEM - Meliadine site, September 7, 2017

Port of Discharge : Port de Becancour Signature :

AGNICO EAGLE

A.E.M. - MELIADINE PROJECT
MARINE BILL OF LADING
FOR HAZMAT C-CANS
WITHOUT
DANGEROUS GOODS

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG10006**3**
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	GATU 052603-6
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	56	Drum 205 L	Not Regulated under T.D.G.A. - SEWER WATER	11480	11200
b.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	600	500
c.	1	Pallet	Not Regulated under T.D.G.A. - SOLID RESIN	765	200
d.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1000	800
e.	1	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	1000	300
f.					
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport

Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	GATU 069679-4
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	56	Drum 205 L	Not Regulated under T.D.G.A. - SEWER WATER	11480	11200
b.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	600	500
c.	1	Pallet	Not Regulated under T.D.G.A. - SOLID RESIN	765	200
d.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1000	800
e.	1	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	1000	300
f.					
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	MIGU 154819-7
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	8	Drum 205 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1640	1600
b.	4	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTER	820	500
c.	4	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	820	800
d.	14	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	8400	7000
e.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - USED ELECTRONIC PARTS	765	200
f.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - EMPTY PAILS	765	125
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	GLDU 223244-9
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	7	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	1435	1400
b.	1	Drum 205 L	Not Regulated under T.D.G.A. - FIRE EXTINGUISHER MEDIA	205	180
c.	16	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	9600	8000
d.	2	Pallet	Not Regulated under T.D.G.A. - SOLID RESIN	1200	1000
e.	1	Tote 1000 L	Not Regulated under T.D.G.A. - USED OIL FILTER	765	400
f.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	765	300
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature :

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	TEXU 244404-5
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	4	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	820	800
b.	13	Drum 205 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	2665	3250
c.	1	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTER	205	125
d.	2	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	410	400
e.	11	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	6600	5500
f.	2	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	1530	600
g.	2	Tote 1000 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	1530	2000
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature :

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	TBCU 306123-1
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	17	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	10200	8500
b.	2	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - SOLID RESIN	1200	1000
c.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - CONTAMINATED EMPTY PAILS	765	100
d.	1	Tote 1000 L	Not Regulated under T.D.G.A. - OILY WATER	1000	800
e.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	765	800
f.					
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport

Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	MSCU 310277-0
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	39	Drum 205 L	Not Regulated under T.D.G.A. - SEWER WATER	7995	7800
b.	1	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	205	200
c.	3	Drum 205 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	615	540
d.	1	Drum 205 L	Not Regulated under T.D.G.A. - USED GREASE	205	100
e.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	600	500
f.	1	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	765	300
g.	4	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	4000	3200
h.	3	Tote 1000 L	Not Regulated under T.D.G.A. - OILY WATER	3000	2400
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : **Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental**

Port of Loading : **A.E.M. Rankin Inlet, Nunavut** Place & Date : **Agnico Eagle Mines - Meliadine, NU. September 7, 2017**

Port of Discharge : **Port de Bécancour** Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	TRIU 382868-7
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	4	Drum 205 L	Not Regulated under T.D.G.A. - HYDROCARBON CONTAMINATED SOIL	820	1000
b.	15	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	11475	7500
c.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - MIX LABPACK WASTE	765	300
d.	2	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	2000	600
e.	1	Tote 1000 L	Not Regulated under T.D.G.A. - OILY WATER	1000	800
f.					
g.					
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport

Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	CBHU 386438-5
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	61	Drum 205 L	Not Regulated under T.D.G.A. - SEWER WATER	12505	12200
b.	1	Drum 205 L	Not Regulated under T.D.G.A. - USED GREASE	205	100
c.	2	Drum 205 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	410	360
d.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	600	500
e.	1	Pallet	Not Regulated under T.D.G.A. - SOLID RESIN	600	500
f.	1	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	765	300
g.	1	Tote 1000 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1000	800
h.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	FSCU 395369-0
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	1	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	205	100
b.	1	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	205	180
c.	1	Drum 205 L	Not Regulated under T.D.G.A. - USED GREASE	205	100
d.	14	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTERS	2870	1750
e.	1	Drum 205 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	205	180
f.	1	Drum 205 L	Not Regulated under T.D.G.A. - BROKEN GLASS	205	150
g.	2	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - KITCHEN GREASE	1530	800
h.	10	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	7650	2000
i.	2	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - WASTE POLY-INSULATION	1530	400
j.	1	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - MIX LABPACK WASTE	1000	400

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

AGNICO EAGLE

Agnico Eagle Mines - Meliadine Project - Bill of Lading - Marine Transport	
Reference no. :	Manifest : PC55999-9
Shipper :	Agnico Eagle Mines ltd - Rankin Inlet, Nunavut - Prov ID n°. : NUG100063
Transporter :	Nunavut Sealink And Supply Inc. - Prov ID n°. : NUG200002
Consignor	Qikiqtaaluk Environmental - Port of Becancour - Prov ID n°.: 1162926159
Container n°.	TDRU 723349-6
Size and Type :	20 FT marine container Reference : manifest PC55999-9

line	No. & Kind of packages		DESCRIPTION OF GOODS	QUANTITY	
				Net Qty (L)	Gross mass(kg)
a.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	1025	500
b.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY WATER	1025	900
c.	5	Drum 205 L	Not Regulated under T.D.G.A. - OILY SLUDGE AND DEBRIS	1025	1250
d.	5	Drum 205 L	Not Regulated under T.D.G.A. - USED OIL FILTERS	1025	625
e.	13	Quatrex Bags 765 L	Not Regulated under T.D.G.A. - OILY CONTAMINATED SOLID	9945	2600
f.	2	Tote 1000 L	Not Regulated under T.D.G.A. - USED HYDRAULIC HOSES	1530	600
g.					
h.					
l.					
i.					

placards required : NONE

In case of emergency (24 hours) call : CANUTEC 1-613-996-6666

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, are properly classified and packaged, have dangerous goods safety marks properly affixed or displayed on them, and are in all respects in proper condition for transport according to the IMDG Code and the Transportation of Dangerous Goods Regulations

Ship's Name : Name, Title, Firm of signatory : Yvon Beaudoin, Project Manager, Qikiqtaaluk Environmental

Port of Loading : A.E.M. Rankin Inlet, Nunavut Place & Date : Agnico Eagle Mines - Meliadine, NU. September 7, 2017

Port of Discharge : Port de Bécancour Signature:

Appendix E

List of Spills That Have Occurred in 2017

Date and time	Contaminant	Est. Qty, L	Location of the spill	Description of incident	Probable cause	Clean-up actions
1/3/2017 1:00	Anti-freeze	1	539200 / 6989870	During the holiday shutdown, spill trays and pads had been placed under the 740 haul trucks. Antifreeze hadbeen leaking from 5360 truck, and while the majority of the antifreeze/contaminated snow was contained, there was some antifreeze found outside the spill tray.	Other	
1/6/2017 1:00	Anti-freeze	1	539200 / 6989870	During the holiday shutdown, spill trays and pads had been placed under the 740 haul trucks. Antifreeze had been leaking from 5360 truck, and while the majority of the antifreeze/contaminated snow was contained, there was some antifreeze found outside the spill tray.	Other	Contaminated snow was collected and placed in plastic bags to be disposed of in the Hazmat sea can. Saturated pads were also collected, and new pads were placed. Trays will be monitored frequently
1/6/2017 1:00	Anti-freeze	1	539200 / 6989870	During the holiday shutdown, spill trays and pads had been placed under the 740 haul trucks. Antifreeze had been leaking from 5362 truck, and while the majority of the antifreeze/contaminated snow was contained, there was some antifreeze found outside the spill tray.	Other	Contaminated snow was collected and placed in plastic bags to be disposed of in the Hazmat sea can. Saturated pads were also collected, and new pads were placed. Trays will be monitored frequently.
1/6/2017 1:00	Anti-freeze	1	539200 / 6989870	During the holiday shutdown, spill trays and pads had been placed under the 740 haul trucks. Antifreeze had been leaking from 5361 truck, and while the majority of the antifreeze/contaminated snow was contained, there was some antifreeze found outside the spill tray.	Other	Contaminated snow was collected and placed in plastic bags to be disposed of in the Hazmat sea can. Saturated pads were also collected, and new pads were placed. Trays will be monitored frequently.
1/7/2017 1:00	Anti-freeze	1	539200 / 6989870	During the holiday shutdown, spill trays and pads had been placed under the 740 haul trucks. Antifreeze had been leaking from 5397 truck, and while the majority of the antifreeze/contaminated snow was contained, there was some antifreeze found outside the spill tray.	Other	
1/7/2017 19:00	Other	5	Camp	Power steering fluid leak due to hose line rupture (cold weather related)	Equipment failure	Contaminated snow picked up and disposed of appropriately
1/8/2017 19:00	Antifreeze	1	Portal	Because of cold weather and long term inactivity, W045 welder has a slow leak of antifreeze results in some antifreeze to come into contact with the snow outside the MTKSL shop	Equipment malfunction	Contaminated soil picked up and disposed of appropriately
1/8/2017 19:00	Antifreeze	1	Portal	5362 Haul has had a known slow antifreeze leak due to cold weather and inactivity. Trays and pads were placed to contain this leak. It was found on Jan 9th that an additional hose on the truck had also started leaking antifreeze for similar reasons.	Equipment failure	Contaminated snow picked up and disposed of appropriately
1/10/2017 1:00	Hydraulic Oil	40	Industrial Pad	When starting the man lift at the batch plant, the operator went o get tools and when he returned the hydraulic pump was leaking	Equipment failure	Contaminated snow picked up and disposed of adequately
1/10/2017 1:00	Other	0.15	Portal	After Holiday break, the fuel truck had snow and ice inside the control box. A heater was put on this area to thaw the control box, and knowing that this may cause some dirty water to hit the ground, maintenance crews placed spill containment under the box. While the majority of the dirty water was contained, a few drops did hit the ground.	Other	Contaminated snow picked up and disposed of appropriately
1/10/2017 1:00	Hydraulic Fluid	1	Batch Plant	Usual check up on loader and hydraulic hose was loose and leaked	Other	Report
1/10/2017 1:00	hydraulic fluid	40	Batch Plant	When the man lift was started, operator when to get tools, and the equipment was leaking	Equipment malfunction	stopped equipment
1/12/2017 1:00	Hydraulic Oil	88	Portal	The rock truck was dumping is load at the transfer pad, but the box wouldn't lift after two attempts, he found oil leaking from the cylinder	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
1/12/2017 1:00	Other	1	Industrial Pad	Portland cement bag fell off of zoom boom during transport and broke open on the road way	Other	Contaminated snow picked up and disposed of adequately
1/13/2017 1:00	Hydraulic Oil	1	Industrial Pad	When starting the loader the quick attach hose leaked.	Equipment malfunction	Contaminated snow picked up and disposed of adequately, The machine was stopped and fitting replace
1/14/2017 1:00	Hydraulic Oil	2	Industrial Pad	Differential leaking by the bleeder	Equipment failure	Contaminated snow picked up and disposed of adequately
1/20/2017 1:00		15	Tank no.3	WHILE PREPARING TO FIL LUP TANK 3 FROM THE M&T FUEL TRUCK, KENNY SECURED THE NOZZEL TO THE TANK COVER. HOWEVER WHEN TURNING ON THE FUEL PUMP, THE NOZZLE JERKED OUT OF THE TANK AND SPILLED FUEL ON THE SIDE OF THE TANK. THE FUEL ACCUMULATED UNDER THE TANK.	Human error	SPILL PADS WERE PLACED ON THE CONTAMINATED AREA AND HELD IN PLACE WITH ROCKS. BECAUSE OF THE HARD TO REACH AREA AND THE FROZEN GROUND, I DON'T THINK IT WILL BE POSSIBLE TO CLEAN UP THAT AREA UNTIL SPRING
1/29/2017 1:00	Diesel	2	Portal	On January,29 2017 at 1:00pm MTKSL worker was walking past Nuna Winch tractor Unit#0039 at the construction-MTKSL shop when he noticed a small leak under the passenger side fuel tank. The worker contacted the mechanic in the shop immediately to look at the unit. Upon observation the mechanic believes the source of the leak is due to moisture freezing in the fuel line/fitting causing a small crack this allowing diesel fuel to contact the ground. (snow-ice)	Equipment malfunction	Contaminated snow picked up and disposed of adequately
1/30/2017 11:30	Antifreeze	1	Industrial Pad	Antifreeze leaking from the engine compartment on the haul truck	Equipment malfunction	Contaminated snow picked up and disposed of adequately
2/5/2017 1:00	Waste oil	15	Portal	A valve was removed from a used oil tote in the Gen Set corridor, as it was needed for another purpose. The tote was placed on its side to prevent leakage, but the message was not relayed to the other staff working in the area, and the tote was tipped back to its standard orientation, causing the contents to spill on to the floor and under the corridor on t the ground beneath.	Human error	Contaminated snow picked up and disposed of adequately
2/6/2017 1:00	Diesel	0.5	Industrial Pad	Fuel overflowed during refueling because the new nozzle doesn't have an automatic shut off	Human error	Contaminated snow picked up and disposed of adequately
2/7/2017 1:00	Diesel	0.5	Camp	On February MTKSL fuel/Lube truck operator was fueling MTKSL fuel/lube truck unit #1273 by means of transferring fuel from AEM fuel truck into MTKSL unit. As the operator pressurized the AEM fuel system and began the transfer process another employee possibly for AEM or Fountain Tire was walking past and noticed a drip coming from the back of the AEM unit. MTKSL operator immediately stopped fueling and placed an absorbent pad where drip was. MTKSL supervisor and Safety were called scene to assess. AEM unit seems to drip diesel fuel from the fitting on the drivers side hose reel- Red hose.	Equipment malfunction	Contaminated snow picked up and disposed of adequately
2/18/2017 1:00	Engine Oil	3	Industrial Pad	Mechanical part broke under the pick up	Equipment failure	Contaminated snow picked up and disposed of adequately
2/18/2017 10:00	engine oil	1	Maintenance Shop	The pick up was parked outside in the parking we used for equipement and he had leak motor we bring the pick up in the shop and we clean the little leak outside put the contaminated snow in the oily waste solid quatrex bag	Equipment failure	Contaminated snow picked up and disposed of adequately

2/24/2017 19:00	Antifreeze	1.5	Portal	Equipment being turned off in order to conserve fuel in cold weather, Seals gaskets and hoses shrink in the cold climate resulting in small leaks as engine temperatures drop. MTKSL vehicle laydown	Equipment malfunction	Contaminated snow picked up and disposed of adequately
2/24/2017 19:00	Antifreeze	1.5	Portal	Equipment being turned off in order to conserve fuel in cold weather, Seals gaskets and hoses shrink in the cold climate resulting in small leaks as engine temperatures drop. Location - DCP1 vehicle laydown	Equipment malfunction	Contaminated snow picked up and disposed of adequately
2/27/2017 1:00	Hydraulic Oil	1	Industrial Pad	After a repair job on the loader, hydraulic fluid on the interior pan leaked onto the ground due to the loader being parked on a slope	Other	Contaminated snow picked up and disposed of adequately
2/28/2017 19:00	Antifreeze	1.5	Site Roads	The fan belt broke and the equipment overheated resulting with an anti-freeze spill (leak) on the ground. ***Road to Tiriganiaq esker	Equipment malfunction	Contaminated snow picked up and disposed of adequately
3/1/2017 1:00	Engine Oil	0.3	Camp	Small oil leak was noticed underneath the truck, originating from the oil pan.	Equipment failure	Contaminated snow picked up and disposed of adequately
3/2/2017 19:00	Hydraulic Oil	0.5	Portal	Pressure test bank under rear window on D8T cat had small hydraulic leak on input hose-Wear and Tear. At KSL/Nuna yard	Equipment malfunction	Contaminated snow picked up and disposed of adequately
3/2/2017 19:00	Diesel	0.3	Portal	Geology and Orbit were preparing to go underground. After the tractor inspection Evens parked the tractor in front of the fuel station entrance located at the mine portal. As I attempted to fuel the tractor Evens noticed that there was a small incision on the fuel hose, fuel was leaking on my coveralls, boots, and on the ground. We stopped fueling and turned the fuel pump off. Evens cleaned up the spill using the spill kit materials in the fuel station. Pierre Luc gathered his tools and proceeded to replace the hose immediately inside the fuel station. As soon as the hose was repaired, we tested the hose for any further leaks, when it was confirmed that the hose was fixed, we continued fueling the tractor.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately. Hose replaced
3/12/2017 14:30		3	DCP01	Worker was operating unit no.2315 998 Loader at the DCP01 dike when he noticed a stream of fluid spreading out from under his unit. He immediately stopped his unit and deployed containment and absorbent material. Approximately 6 L of radiator coolant was release of which 4 L made contact with the ground. 2L was absorbed into the spill absorbent material within the containment. Both the contaminated snow and the absorbent material was properly disposed of.	Equipment failure	Deployed mean of containments/properly collected and disposed.
3/13/2017 7:30	Fecal Coliform		MEL-7	On March 13th 2017 a sample from MEL-07 (STP effluent) was collected and sent for analysis. The results were received on March 21st 2017 and the fecal coliforms were measured at 7000 CFU/100 mL, which exceeds the permitted discharge limit of 1000 CFU/100 mL set forth in the Water License 2BB-MEL1424.	Equipment malfunction	An investigation is underway to determine the cause of the incident. Upon completion, a follow up report will be issued.
3/13/2017 11:00		4	Nuna Shop Yard	While conducting a formal environmental inspection of the Nuna Shop and yard, a 3x3 area of discolored contaminated snow was discovered. It was assume to be a 3-4 L of engine coolant.	Equipment malfunction	contaminated snow recovered and properly disposed of.
3/22/2017 1:00	Hydraulic Oil	30	Industrial Pad	Busted Hose	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
3/22/2017 1:00	Compressor Oil	1	Industrial Pad	Busted Hoses	Equipment failure	Contaminated soil picked up and disposed of appropriately
3/23/2017 1:00	Hydraulic Oil	10	Portal	Busted Hose	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
3/24/2017 1:00	Antifreeze	1	Portal	While staged at the Nuna construction shop the Hertz Air compressor began to leak coolant (Antifreeze)	Equipment failure	Contaminated snow picked up and disposed of adequately
3/26/2017 1:00	Engine Oil	0.5	Portal	While attempting to transfer a small quantity of used oil in a plastic pail to the proper storage location a small amount spilled onto the snow covered ground.	Human error	Contaminated snow picked up and disposed of adequately
3/27/2017 1:00	Diesel	25	Portal	Overflow on tank; some fuel in snow on top and side of the tank	Human error	Contaminated snow picked up and disposed of adequately
3/27/2017 1:00	Diesel	5	Portal	Overflow on tank; some fuel in snow on top and side of the tank	Human error	Contaminated snow picked up and disposed of adequately
3/27/2017 1:00	Diesel	5	Fuel farm	Overflow on tank; some fuel in snow on top and side of the tank	Human error	Contaminated snow picked up and disposed of adequately
3/27/2017 1:00	Diesel	3	Camp	Overflow on tank; some fuel in snow on top and side of the tank	Human error	Contaminated snow picked up and disposed of adequately
3/28/2017 1:00	Antifreeze	2	Industrial Pad	At the end of the shift a spill was noticed on the ground underneath the welding machine. The machine had to be moved in order to observe the spill.	Equipment failure	Contaminated snow picked up and disposed of adequately
3/30/2017 1:00	Hydraulic Oil	10	Portal	While working at DCP5, hydraulic hose between the boom and the stick fitting broke and caused an oil leak	Equipment failure	Contaminated snow picked up and disposed of adequately
3/31/2017 1:00	Hydraulic Oil	3	Industrial Pad	Traction hydraulic hose broke and caused a spill	Equipment failure	Contaminated snow picked up and disposed of adequately
3/31/2017 1:00	Transmission Fluid	1.5	Industrial Pad	Employee added more oil than was necessary to the chain case of the crane - caused overflow	Human error	Contaminated snow picked up and disposed of adequately
4/1/2017 15:30		0.25	Back of Wing 2	Cedrick unload the pick-up when he come back at the pickup he saw red drops sundk under the pick-up.	Equipment failure	Put spill mat immediately and call the garage and scrape and remove the snow and put in bucket
4/3/2017 1:00	Gear Oil	8	Industrial Pad	While inspecting a leak under a crane, a plate was removed and caused gear oil to spill on the ground.	Equipment failure	Contaminated snow picked up and disposed of adequately
4/3/2017 1:00	Hydraulic Oil	1	Industrial Pad	When changing the bucket to the hammer, the connecting hose leaked	Human error	Contaminated snow picked up and disposed of adequately
4/7/2017 17:00		50	LTP PAD Surface	Haul Truck slide off of road and got stuck by the LTP pad on surface causing brake line to break.	Human error	Shut off the engine, put down spill pads, called mechanics
4/8/2017 16:30		30000	63,1'24" - 92,11'07"	Agnico Eagle reports that a Diesel spill of approximately 30,000 liters has occurred at the fuel tank storage facility at the Meliadine project on Saturday, April 8, 2017. The spill was caused by a leak from a hose on one of the 100,000-litre tanks and occurred between two fuel truck refills.	Equipment failure	At this time, cleaning is still under progress and there is no indication that the spill exceeded the storage tanks' area. No fuel has entered any fresh water system. Investigations remain underway to determine the root cause of the spill.
4/10/2017 15:00		25	Portal Fuel tank	Scoop was fueling up at the start of the shift, Hook up the wiggins nozzle started to fuel up, then went into dome 1 to get washer fluid, then the fuel started to overfill coming out of fuel tank.	Human error	Workers in area immediately shut off the fuel pump, removed the scoop and put down spill pads.
4/17/2017 1:00		40	Waste pad portal	the haul truck has been unloaded, and there was no power hydraulic. He stop the equipment and as call mechanic to verify the leakage and clean the oil with spill pad and shovel	Equipment failure	they put spill pad and clean all of rest with shovel
4/18/2017 1:00	Diesel	20	Other, Wolf Area	Frédérick was refueling units as usual, at the end of the refill, piston in the nozzle did'nt close. Tank was almost full, by the time Federick go to the pump on the tanker outside to shut it down, the tank overfill in the heating unit. Most of the fuel stay in the container and has been clean right away with the spill kit inside this unit. 4 to 5 liters Maximum may have leak by the doors behind and on the side we try to clean the most as possible on the lake this night and the day after. Most of the fuel has been recovered, final clean up will be done today april 20 th after we move all units.	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately

4/21/2017 1:00	Hydraulic Oil	20	Industrial Pad	Hose on unit broke, resulting in spill	Equipment failure	Contaminated snow picked up and disposed of adequately
4/22/2017 1:00		10	Industrial Pad	hose broken on the excavator	Equipment failure	Contaminated soil picked up and disposed of in the landfarm
4/22/2017 1:00	Hydraulic Oil	20	Industrial Pad	Broken Hose on the equipment (excavator)	Equipment failure	Contaminated soil picked up and disposed of in the landfarm
4/22/2017 1:00		1	Industrial Pad	Overfilling a gaz tank on a truck	Human error	Contaminated soil picked up and disposed of appropriately
4/23/2017 1:00	Diesel	3	Fuel farm	M&T fuel truck wasn't able to unload their truck in our fuel truck. Electrical problem as been solve by Site services electrician, but when power when back, 3 liters of fuel went out ogf the fuel gun	Equipment failure	Contaminated soil picked up and disposed of in the landfarm
4/25/2017 1:00	Hydraulic Oil	1	Itivia Area	Fitting came loose on a hose	Equipment failure	Contaminated soil picked up and disposed of appropriately
4/27/2017 1:00	Antifreeze	2	Industrial Pad	With the vibrations caused by drilling, the hose of a compressor at the process plant location became unplugged resulting in a leak of antifreeze.	Equipment failure	Contaminated snow picked up and disposed of adequately
4/28/2017 1:00	Hydraulic Oil	20	Industrial Pad	a worker was driving a D300 haul truck from the DCP01 dyke to the crusher lay down. When he was half way to his destination, he was alerted on the radio that the truck was leaking fluid. The operator immediately stopped his truck, deployed his spill kit and radioed his supervisor who then contacted the mechanics. Approximately 19 L of hydraulic fluid released to ground. Approximately 10 c.m. of contaminated snow recovered.	Equipment failure	Contaminated snow picked up and disposed of adequately
4/29/2017 1:00	Gasoline	1	Camp	Jerry can fell on its side in the sled and caused a spill inside of the sled - Entire spill was inside sled which also contained snow	Improper storage	Contaminated snow picked up and disposed of adequately
5/1/2017 1:00	Grease		Camp	Samples collected at the MEL-7 sampling point on May 1, 2017 - Lab results showed an exceedance for "Total Oil and Grease" (license limit = 5 mg/L, result = 6.1 mg/L). The exceedance was reported as a spill to the NWB on May 27th. The STP treated 30m3 over a 24 hour period at this time.	Other	***
5/1/2017 1:00	Hydraulic Oil	2	Industrial Pad	Loos hydraulic hose	Equipment failure	Contaminated soil picked up and disposed of appropriately
5/3/2017 12:00		10	Power plant pad	After filling up the air compressor, fuel tank there was a leek noticed up the middle of the tank. On top of the tank.	Human error	The leek was immediately stop. Berm were installed and absorbent pad were used. Fuel was removed from the ground and stored in the HAZMAT seacan.
5/7/2017 1:00		5	546049.116/6963641.392 (ITIVIA)	At approximately 21:15 hrs on May 7th 2017 a hydraulic hose failed on the CAT 325 Excavator resulting in a hydraulic oil spill.	Equipment failure	Shut machine down, placed absorbent pad and drip tray.
5/7/2017 1:00		1	Crusher pad	Fuel man fueled up the 988G and forgot to put the gas cap back on. The operator noticed the fuel kind of spilled out of the fuel tank intake, he stop , notice fuel on the ground and called his supervisor.	Human error	Loader was stopped immediately and fuel (Spill) was cleaned by the operator and the fuel-man using spill bags and shovel. the bags were taken to the containment berm by the fuel farm.
5/8/2017 1:00		20	Process pad	The lincoln electric welding machine was found with a spill surrounding it in the early morning. A break down of the fuel hose tank is the cause.	Equipment failure	- Fournier team put some absorbent pad when they saw the spill. - Forstfighter were installed with tarp in order to unfreeze the spill. - The Lincoln was brought in the dome for repairing with a yellow berm under. - contaminated soil and ice was removed and stored in HAZMAT.
5/11/2017 15:30	SEWAGE	20	NEW STP H20	Foam from the STP get out by over flow piping	Equipment malfunction	cleaning with the sucker truck
5/14/2017 1:00	Hydraulic Oil	20	Portal	THE OPERATOR CALL THE MECHANIC SHOP BECAUSE IS NOT ABLE TO TURN THE STEERING AT THE MUCK PILE AT THE SURFACE. HE STOP THE EQUIPEMENT AND WAIT FOR MECHANIC . ALEXANDRE TREMBLAY BRING ALL TOOL HE NEED AND CHANGE THE STEERING HOSE . AFTER JOB IS DONE HE CLEAN EVERYTHING WITH THE SPILL PAD AND HE PUT ALLS THE SPILL PAD IN THE QUADREX BAG INT THE SHOP MECHANIC	Equipment failure	INSTALL SPILL PAD AND RETENTION TOTE UNDER THE TRUCK
5/15/2017 8:00	Diesel	50	Other	Francis Hachey did not respect proper work procedures with the fuel pump; there was a leak in the hose which caused the spill	Human error	Other- barrier was placed on lake to prevent spill from entering; spill rags and booms put down on spill- contaminated material brought to hazmat
5/21/2017 1:00	Antifreeze	5	Site Roads	The grader reversed in to the truck 13 and broke the radiator; the operator of the truck was not suppose to be there	Human error	Contaminated soil picked up and disposed of in the landfarm
5/23/2017 1:00	Hydraulic Oil	1	Itivia Area	Busted hose on excavator	Equipment failure	Contaminated soil picked up and disposed of appropriately
5/23/2017 1:00	Hydraulic Oil	0.5	Itivia Area	While loading a haul truck a hydraulic hose and a small amount of hydraulic oil went on the ground from the 4574 Excavator; equipment was shut down immediately.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
5/24/2017 1:00	Hydraulic Oil	1		Hydraulic leak at the winch of equipment- equipment was shut down and reported to environment right away	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
5/24/2017 15:00	Hydraulic Oil	1	Other	ON MAY 23RD, THE DOZER WE RENT FROM INNUKSHUK CONSTRUCTION FOR A MONTH HAS BEEN PICKED UP AT OG GARAGE. DOZER WAS LEAKING HYDRAULIC OIL FROM THE WINCH. ICE FINISH TO MELT AFTER WE MOVE IT, OIL MIX WITH WATER AND A SHEEN APPEAR IN WATER AROUND.	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
5/26/2017 1:00	Hydraulic Oil	1	Industrial Pad	Grader on operation on the site road hydraulic hose start to leak, stop operation to fix the leak	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
5/26/2017 1:00	Engine Oil	1	Industrial Pad	The truck was down for maintenance - the turbo was removed and an "out of order" sign was in place, but the driver didn't see the sign and started the truck and in turn caused a spill/leak.	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
5/26/2017 1:00	Hydraulic Oil	1	Industrial Pad	Pump was parked in the yard and a small leak from the hydraulic pump occurred because the nuts were not tight (new pump)	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
5/27/2017 1:00	Hydraulic Oil	25	Other	Hyster was stuck in the exit of the Landfill so the operator tried to use the load to move and blew hydraulic hose; the pressure blew oil all over equipment and drip on the ground	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
5/29/2017 1:00	Hydraulic Oil	2	Industrial Pad	Broken O-Ring on hydraulic hose at the body valve	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
5/29/2017 1:00	Antifreeze	10	Industrial Pad	When starting to pour concrete at Dome B, the Prestone hose started to leak and then the hose broke.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately

5/31/2017 11:30	Grey Water, kitchen grease	25	Industrial Pad	After complaints about odors by the kitchen staff, a verification have been done under the kitchen and a pipe's break have been found. When they opened the trap to find where was the break, some of the used water and grease spilled on the field. Most part of the spill have been capted by the insulating wool and the Styrofoam. The cause of break seen to be freezing and unfreezing of the pipe. Because the insolation material have containing the spill, it is difficult to know when it happened.	Equipment failure	Contaminated soil picked up and disposed of appropriately
6/10/2017 9:00	Other	0.5	Camp	The tar were behind a toolbox was left by Tangmaarvik (3 buckets total- only 1 was knocked over)	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
6/17/2017 1:00	Hydraulic Oil	1	Camp	Presently the dozer is immobilized in the Orbit yard for repair - Hydraulic tank, track, etc. Leak is originating from Hydraulic line	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
6/18/2017 1:00	Engine Oil	1	Portal	Spill was found in front or portal office in the parking area - no equipment in the area to identify the source	Equipment failure	Contaminated soil picked up and disposed of appropriately
6/19/2017 1:00	Engine Oil	5	Camp	During storage of drums, the drums were stored on top of tote. This action resulted in pressure being applied to the container portion of the tote which in turn directed the waste oil to escape from the screwed on cap.	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
6/21/2017 1:00	Engine Oil	0.25	Other	During the refueling of tank 21; Sebastien noticed engine oil leaking on the ground.	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
6/21/2017 1:00	Transmission Fluid	0.1	Other	During the refueling of tank 21; Sebastien noticed Transmssion oil leaking	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
6/21/2017 1:00	Hydraulic Oil,Diesel and Transmission Fluid	1	Other	During the refueling of tank 30; Sebastian noticed fuel, hydraulic and transmission fluids leaking on the ground.	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
6/23/2017 1:00	Hydraulic Oil	2	Industrial Pad	Small hydraulic hose for joystick functions broke	Equipment failure	Contaminated soil picked up and disposed of appropriately
6/23/2017 1:00	Hydraulic Oil	90	Waste Rock Storage	As the 988 loader operator was attempting to dump the second bucket of material into a 773 CAT haul truck they felt a bump on the floor of the loader unit. As the operator attempted to curl the bucket of the loader upwards it would not curl and the operator noticed what appeared to be a leak on the ground. At this point the 988 loader operator advised the 773 haul truck operator to move forward so it would be possible to lower the loader bucket. The 988 bucket was lowered to the ground safely and the loader was turned off. Approximately 70-90 liters of Hydraulic fluid leaked out of the 988 due to the hose crimp failing on the main 2.1/2 inch main supply hose	Equipment failure	Spill was contained and contaminated soil picked up and disposed of in the landfarm
6/24/2017 1:00	Hydraulic Oil	1	Industrial Pad	While driving on the industrial pad with the bob cat, the rear left wheel came off and caused a leak	Equipment failure	Contaminated soil picked up and disposed of appropriately
6/26/2017 7:00	Grey water	0	Camp	On June 26th 2017, a sample from Mel-07 (STP effluent) was collected and sent for analysis. The results were received on July 6th 2017, and a pH in the effluent of 5.67 occurred. This is lower than the permitted discharge limit of 6-9.5 set forth in the Water License 2BB-MEL1424. A pH reading was taken at 10:00 am on June 26th and a reading of 6.5 was measured (daily flow rate ~1500 m3/h).	Equipment failure	Other
6/29/2017 15:30	Diesel	30	Fuel farm	The procedure for the fuel transfer has been followed. But when they start the PTO on the M&T fuel truck for fuel transfer in tank # 22, the spring valve wasn't close the right way on the truck. When Brenda was done her inspection after pumping the fuel, she saw the fuel leaking on the ground. So she immediately stops the PTO. A Maximum of 30 liters as leak on the ground.	Equipment malfunction	Contaminated soil picked up and disposed of in the landfarm
7/7/2017 1:00	Diesel	1	Industrial Pad	The frost fighter was filled up with fuel; the fuel line was broken and caused a spill on the ground	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
7/15/2017 1:00	Hydraulic Oil	50	Portal	Worker was operating excavator at the portal # 2 site loading blast rock into a haul truck when he noticed fluid on his right track. He immediately lowered his bucket to the ground, shut down his equipment, deployed his spill kit and contacted his supervisor and the maintenance foreman.	Equipment failure	Contaminated soil picked up and disposed of appropriately
7/16/2017 1:00	Hydraulic Oil	4.5	Camp	When doing a check up on rig before moving to parker; Orbit then noticed that a O-ring blown up on the strainer of the hydraulic tank. Strainer has been put upside down during last maintenance and caused a pressure break on the o ring.	Human error	Hydraulic Oil
7/16/2017 1:00	Diesel	0.5	Industrial Pad	During a loading training, one drain fuel valve leaked	Equipment failure	Contaminated soil picked up and disposed of appropriately
7/24/2017 7:00	Fecal Colifroms	2600	Camp	On July 24th 2017, a sample from MEL-07 (STP effluent) was collected and sent for analysis. The results were received on August 1st 2017 and the fecal coliforms were measured at 2600 CFU/100 mL, which exceeds the permitted discharge limit of 1000 CFU/100 mL set forth in the Water License 2BB-MEL1424.	Other	Other- Site service advised- reported to GN
7/26/2017 1:00	Hydraullic OIl	5	Itivia Pad #1	When machine arrived at the storage placed at the beach spill occurred. Hydraulic hose leaked on to Plafolift Unit #01030-001	Equipment failure	They waited by equipment to inform the driver.
7/26/2017 1:00		5	Dome 1	Fuel gun stopped working, fuel starting pouring	Equipment failure	Richard Roy
8/1/2017 1:00	OIl	20	Watering Pad	During drilling, a blue off valve on the compressor broke causing an oil leak.	Equipment failure	Switched off the compressor and checked leak. Contained with spill kit and clean site. Cleaned the compressor with spill matting.
8/4/2017 1:00	Hydraulic Oil	2	Process Plant	Hydraulic hose broke	Equipment failure	Contaminated soil picked up and disposed of appropriately
8/5/2017 11:00	Hydraulic Oil	5	Portal	Rock truck moved to close to a stationary gravel truck - rock truck scraped hydraulic gauge causing tank to leak	Human error	Contaminated soil picked up and disposed of appropriately
8/12/2017 18:00		15	Fuel farm	PTO Pump failure/ Fuel transfer pump leaking failure	Equipment failure	Spill was contained and contaminated soil picked up and disposed of in the landfarm
8/14/2017 1:00	Oil	1	Fuel Farm	A hose broke on compressor spraying oil on the ground.	Equipment failure	Shut engine down and put absorbent pad down to clean. Rocks and soil material were cleared and put in waste drum. Piece of equipment was removed from field and shipped out for repair.
8/14/2017 1:00	Diesel	1	Industrial Pad	A hose broke on the compressor- sprayed oil on the ground	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
8/17/2017 1:00	Transmission Fluid	1	Itivia Area	Equipment was park and dripped over night absorbent pads were install but with the high wind flew near by	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
8/17/2017 1:00	Hydraulic Fluid	5	AWAR KM12 Gravel Pit	During the process of regular crushing operations, a small leak originating from the jaw assembly hydraulic line on the Mitsu Crusher.	Equipment failure	The Faulty hydraulic line was removed from service and replaced. Absorbent pads were applied to the spill and removed from site.

8/22/2017 1:00	Hydraulic Oil	0.5	South	Hydraulic hose on the end of boom started to leak (spray).	Equipment failure	Equipment was shut down. Contaminated soil removed to secondary containment (to be dumped at landfarm).
8/23/2017 1:00	Oil	1	on Mill Crane Pad	O Ring or valve required replacement	Equipment failure	Put down an absorbent pad and a garbage bag a a container to stop more from spilling on ground.
8/25/2017 1:00	Fuel	12	Process Plant	Pump operator was fueling pump with the auxiliary fuel tank operator was asked to go check his boom on the pour and the fuel over flowed willing filling.	Human error	Put diapers down to absorb most of the spill
8/29/2017 12:00	grease	1	MTKSL Shop /Yard	Mechanics were taking the boom off of the excavator and a grease made contact with the ground from extracting the pins and brushing during the boom removal. the mechanics did have a secondary containment however a small amount of grease missed the secondary containment/	Human error	Clean grease/ gravel contaminants and place in steel secondary containment in Hazmat located in the MTKSL Shop.
9/1/2017 12:00	Jet-A	50	JET-A Pump Shack	There is a broken seal on the Jet A fuel pump. Jet A was contained by the berm under the pump until it overflows. Jet A fuel then drop on gravel under the pump Shack The pump leaking connector and pipe was fixed	Equipment malfunction	Jet A fuel has been recovered partially, matting as been put in place, in the pump Shack Gravel dug out and put in 1 Harzard drums. Coreshack technician changes the matting, 2 times per day. Proper planning will be took by Geology and Site Service to complete the clean-up heavy equipment will be involved and pump shack moved.
9/3/2017 1:00	Diesel	12	Fuel farm	Fuel valve malfunction	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of in the landfarm
9/9/2017 1:00	Hydraulic Oil	3	Quarry	worked in this area a long period of time (approx. 2 weeks) and over that period of time hydraulic oil dripped from the hydraulic container	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
9/11/2017 1:00	Hydraulic Oil	2	Other	A small leak occurred on Fournier rock breaker at Itivia quarry. With the vibration a hydraulic fitting came lose and fluid got out of one of the hose on the rock breaker. The operator stop immediately place some absorbent on the and dippers on the contaminated area.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
9/12/2017 19:30	Fuel	0.5	End of artic corndor	Tank overflow after filling	Human error	Use pad and clean fuel and gravel
9/14/2017 1:00	Hydraulic Oil	4	Rankin Inlet Quarry	An hydraulic spool valve that the cover or casing is breaking on the main body valve for hammer function.	Equipment failure	Put down peat moss and diapers
9/22/2017 1:00	Oil 5W30	150	Warehouse Laydown	During he offload a c-can of tote, he squize 2 tote together but the fork was to high and he hit the one at the back.	Human error	Spill was contained and contaminated soil picked up and disposed of in the landfarm
9/25/2017 15:00	Grey Water	0	Camp	On September 25th 2017, a sample from MEL-07 (STP effluent) was collected and sent for analysis. The results were received on September 29th 2017 and the fecal coliforms were measured at 4200 CFU/100 mL, which exceeds the permitted discharge limit of 1000 CFU/100 mL set forth in the Water License 2BB-MEL1424.	Equipment failure	Other
9/29/2017 1:00	Antifreeze	3	AWAR	Rock flew under front tire damaging a fitting causing the cooling system to leak	Equipment failure	Contaminated soil picked up and disposed of appropriately
9/30/2017 1:00	Hydraulic Oil	4	MSB pad	We start the engine and an hose has broked.	Equipment failure	Absorbent boom used on water spot to retrieve oil spilled.
10/1/2017 1:00	Hydraulic Oil	0.25	Industrial Pad	Eric was testing the rotork and noticed the cap was leaking - cap was replaced	Improper storage	Contaminated soil picked up and disposed of appropriately
10/3/2017 7:30	Diesel	60	Fuel farm	at 630 AM Tuesday Morning Fuel/Lube truck out fueling equipment came to the 740 rock truck started to fuel and for what ever reason he left the nozzle unattended he was check oils on the truck then he realized the fuel was hitting the ground by the time he react he had lost 60 L of fuel and our safety policy is never to leave hose nozzle unattended	Human error	Contaminated soil picked up and disposed of in the landfarm
10/6/2017 1:00	Diesel	1	fuel farm	The worker fill the welding machine with a 5 gallons of diesel and the welding machine was full and splash on the ground	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
10/16/2017 1:00	Diesel	0.01	Itivia Area	Ships coupling connected to the vessel's hose was not fastened tightly enough for a secure connection. Possible snow/ice/dirt in threads.	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
10/17/2017 1:00	Engine oil	0.25	Intake Raise Plenum	An equipment malfunction occurred on the Lincoln Welder. The unit is brand new and was assembled as per manufacturers instructions however after approximately 5hrs of run time, the oil resevoir malfunctioned and a leak occurred. Spill was contained to the plenum building and no leaks/drips were made on the ground/earth.	Equipment malfunction	Spill was contained and contaminated soil picked up and disposed of appropriately
10/17/2017 1:00	Hydraulic Oil	180	DCP1	When the operator start his job of snow removal at DCP1 an hydraulic hose of tracks motor in undercariage have busted.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of in the landfarm Contaminated snow picked up and disposed of adequately
10/23/2017 6:30		1	Process Plant	On Oct 23rd, around 5h30 AM, the operator was doing the fueilling of the frossfighters . He was moving a fuel reservoir with his skytrack . The reservoir was strapped with a binder. While moving, the binder suddenly broke and the fuel reservoir fell on his side. The operator retained and collected the fuel immediatly.	Work procedure not followed	Spill was contained and contaminated soil picked up and disposed of appropriately
10/28/2017 1:00	Hydraulic Oil	10	Other	While drilling was in operation, a hydraulic hose broke inside the console	Equipment failure	Spill was contained and contaminated soil picked up and disposed of appropriately
10/30/2017 1:00	Coolant	4	AWAR	Malfunction of the bearing on the cooling fan- tandem truck motor resulting in a spill of coolant	Equipment malfunction	Contaminated soil picked up and disposed of appropriately
10/30/2017 8:00	Fecal Coliforms		Camp	MEL-07 weekly samples were collected on Oct 30th @ 7h00 for laboratory submission. The results for bacteriology were received on Nov 7th, and showed an exceedance for fecal coliforms. Water license limit = 1000 CFU/100mL, result = 1100 CFU/100mL. The operator did not record the testing or inspections of the unit for several days prior to the sampling event, so the volume of effluent discharged over the previous 24 hour period is not known.	Other	Site Services supervisor and STP operators notified immediately upon reception of the laboratory results; Investigation ongoing. The exceedance was reported to the Nunavut spill hotline and all appropriate governing bodies.
11/7/2017 8:00	Fecal Coliform		Sewage Treatment Plant	On November 7th 2017, a sample from MEL-07 (STP effluent) was collected and sent for analysis. The results were received on November 14th 2017 and the fecal coliforms were measured at 14000 CFU/100 mL, which exceeds the permitted discharge limit of 1000 CFU/100 mL set forth in the Water License 2BB-MEL1424.	Other	An investigation is underway to determine the cause of the incident. Upon completion, a follow up report will be issued. System have been put in recirculation
11/13/2017 7:00	Grey Water	0	Main Camp	On November 13th 2017, a sample from MEL-07 (STP effluent) was collected and sent for analysis. The results showed that fecal coliforms were measured at 2300 CFU/100 mL, which exceeds the permitted discharge limit of 1000 CFU/100 mL set forth in the Water License 2BB-MEL1424. As of the 15th of November effluent discharge was stopped. An investigation was conducted and upgrades to the STP are planned and effluent will not be discharged until upgrades are completed.	Equipment failure	Other

11/15/2017 1:00	FUEL	20	Process Plant	Upon starting the crane and doing his inspection a fuel leak was noticed at rear of crane by fuel tank. vramne was shu off and leaking hose repaired.	Equipment failure	Spill was contained and contaminated soil picked up and disposed of in the landfarm
11/22/2017 1:00	STP Sludge	40	New Camp STP	During an unexpected electric shutdown (blizzard), a sludge decant was in progress. It is invilving a manual valve opening and the overflow is going to the sump tank. Operator was away, helping on the shoveling and other emergency in the blizzard. When operator came back, the sump tank was overfolwing dur to the sump pump shutdown.	Equipment failure	Contaminated snow picked up and disposed of adequately
11/27/2017 12:30	Hydraulic Oil	30	Portal	Haul truck was on the waste-rock storage pad when he went to empty his bucket he noticed hydraulic oil on the ground and stopped the equipment. Fred contacted his supervisor Tony who called the environment dept for support. (Broken hydraulic line)	Equipment failure	Spill was contained and contaminated soil picked up and disposed of in the landfarm
11/28/2017 1:00	Hydraulic Oil	2	Process Plant	A faulty hydraulic gauge was leaking	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
12/3/2017 21:30	Diesel Fuel	7500	Genset Explo Camp	The float switch was broken and a manual start was used as the automatic mode was not in function. It was then forgotten. While going to shut off the fuel supply switch the fuel operator was distracted through conversation with another co-worker.	Human error	The source of spill was controlled and investigation and remediation efforts commenced.
12/6/2017 16:30		1	Other	While moving the Almiq AWP the mechanic and the superintendent have noticed a spill of hydraulic oil.	Human error	Spill was contained and contaminated soil picked up and disposed of appropriately
12/12/2017 1:00	Diesel Fuel	5	Itivia Fuel Farm Fill station	The employee was doing some testing by loading the new tanker. While relieving the air pressure on top of the tanker some fuel spilled out.	Human error	The contractor reacted quickly and installed some absorbent pads on the ground and underneath the tanker to catch the fuel.
12/12/2017 1:00	Diesel	10	New Incinerator	Approximately the half of the 10 L of fuel was contained in the small container on the tip of the tank. A small quantity of fuel was dripping on the side of the tank.	Equipment failure	Sebastian wiped tank with absorbent pads. He also shoveled the contaminated snow into two bucket and dropped them into a secondary containment.
12/29/2017 17:00	Hydraulic Oil	5	Itivia Area	At approximately 4 pm on Dec 29, 2017 the employee started the engine of the reach stacker and let it warm up (due to being cold for a couple of weeks) for 45 min (temperature outside was -36*C at this time). Upon return to the machine, the operator began to complete their warm up checks with the hydraulics prior to use. The main boom was extended and then retracted. Upon retraction, a shuddering was experienced and the operator ceased operation. The operator then noticed the oil leaking outside the underbelly of the machine (on operators right hand side). The machine was turned off to prevent further pressure and stop the leak. It was reported to the supervisor at approximately 5pm that day and containment was started.	Equipment failure	Contaminated soil picked up and disposed of appropriately

Appendix F

Tabular Summary of Monitoring Data

Sampling Station MEL-SR1

Maxxam ID		EKF924	EKY350	ELQ334	EMU905			EQF369	ERJ568
Sampling Date		2017/05/12 14:30	2017/05/16 13:30	2017/05/23 14:50	2017/05/30 15:08	2017/06/06 09:35	2017/06/13 12:58	2017/06/20 06:00	2017/06/27 14:00
	UNITS	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**
Inorganics									
Total Ammonia-N	mg/L	0.28	4.6	[redacted]	[redacted]	0.1	0.1	0.1	<0.01
Total Dissolved Solids (TDS)	mg/L	242	206	[redacted]	[redacted]	570	924.0	1220	3280
pH	pH	7.53	7.88	7.61	7.90	7.99	8.1	7.94	6.90
Total Suspended Solids (TSS)	mg/L	100	25	1	1	9	4.0	1	3
Dissolved Sulphate (SO4)	mg/L	39	30	[redacted]	[redacted]	120	200.0	200	230
Turbidity	NTU	93	20	[redacted]	[redacted]	1.5	0.9	0.9	0.2
Alkalinity (Total as CaCO3)	mg/L	60	100	[redacted]	[redacted]	130	160.0	200	11
Nitrite (N)	mg/L	0.020	0.016	[redacted]	[redacted]	0.028	<0.010	0.013	<0.010
Nitrate (N)	mg/L	0.26	0.11	[redacted]	[redacted]	0.28	<0.10	<0.10	<0.10
Nitrate + Nitrite (N)	mg/L	0.28	0.13	[redacted]	[redacted]	0.31	<0.10	<0.10	<0.10
Mercury (Hg)	mg/L	<0.00001	<0.00001	[redacted]	[redacted]	<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L	113	139	[redacted]	[redacted]	304	474.0	536.0	517.0
Total Calcium (Ca)	ug/L	32200	42800	[redacted]	[redacted]	93600	143000.0	163000.0	38100.0
Total Magnesium (Mg)	ug/L	7860	7830	[redacted]	[redacted]	17000	28300.0	31300.0	103000.0
Total Potassium (K)	ug/L	6020	6210	[redacted]	[redacted]	8100	11500.0	12900.0	35900.0
Total Sodium (Na)	ug/L	17500	16700	[redacted]	[redacted]	61400	100000.0	128000.0	870000.0
Total Oil & Grease	mg/L	-	-	<0.50	0.80	-	-	-	<0.50
Bicarb. Alkalinity (as CaCO3)	mg/L	-	-	-	-	130	160.0	200	11
Carb. Alkalinity (CaCO3)	mg/L	-	-	-	-	1.2	1.9	1.6	<1.0
Dissolved Chloride	mg/L	-	-	-	-	140	210.0	290	1600
Conductivity	umho/cm	-	-	-	-	930	1400.0	1700	5700

Maxxam ID		ESI492		ETZ831	EVC165	EWP509	EXJ712	EYN527	EZR521
Sampling Date		2017/07/04 13:30	7/11/2017	7/16/2017	2017/07/23 16:00	2017/07/29 12:38	2017/08/06 11:10	2017/08/13 09:00	2017/08/20 15:15
	UNITS	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**
Inorganics									
Total Ammonia-N	mg/L	0.24	0.07	0.04	0.03	0.65	0.06	0.03	0.04
Total Dissolved Solids (TDS)	mg/L	1190	968	1280	1150	1320	1450	1440	1490
pH	pH	7.95	8.07	7.97	7.84	8.03	8.04	7.84	8.05
Total Suspended Solids (TSS)	mg/L	8	11	6	3	5	20	2	<2
Dissolved Sulphate (SO4)	mg/L	180	200	160	170	260	260	280	170
Turbidity	NTU	2.6	1.5	1.0	1.2	1.2	0.4	0.5	0.3
Alkalinity (Total as CaCO3)	mg/L	230	210	270	260	140	210	230	230
Nitrite (N)	mg/L	<0.010	<0.010	0.012	<0.010	0.090	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	0.21	0.27	0.15	0.16	4.15	0.58	0.25	0.35
Nitrate + Nitrite (N)	mg/L	0.21	0.27	0.16	0.16	4.24	0.58	0.25	0.35
Mercury (Hg)	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L	525.0	484.0	489.0	512.0	606.0	583.0	647.0	609.0
Total Calcium (Ca)	ug/L	152000.0	143000.0	144000.0	149000.0	179000.0	177000.0	-	-
Total Magnesium (Mg)	ug/L	35400.0	30800.0	31300.0	33700.0	38600.0	34500.0	-	-
Total Potassium (K)	ug/L	13700.0	12300.0	14100.0	13500.0	15700.0	14000.0	-	-
Total Sodium (Na)	ug/L	170000.0	133000.0	156000.0	165000.0	152000.0	146000.0	-	-
Total Oil & Grease	mg/L	<0.50	1.30	<0.50	0.60	<0.50	<0.50	2.10	2.20
Bicarb. Alkalinity (as CaCO3)	mg/L	230	210	270	260	140	210	230	230
Carb. Alkalinity (CaCO3)	mg/L	1.9	2.3	2.4	1.7	1.4	2.2	1.5	2.4
Dissolved Chloride	mg/L	320	280	330	360	350	290	370	270
Conductivity	umho/cm	1900	1700	1900	1900	2000	1800	2000	2100

Maxxam ID		FBL315	FCR581	FCR581	FDN344	FDZ998	FFW543	FHQ753
Sampling Date		2017/08/29 10:25	2017/09/07 12:00	2017/09/10 12:00	2017/09/12 10:30	9/16/2017 15:50	9/27/2017 15:40	10/7/2017 14:30
	UNITS	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**	**MEL-SR1**
Inorganics								
Total Ammonia-N	mg/L	-	-	-	-	-	-	-
Total Dissolved Solids (TDS)	mg/L	-	-	-	-	-	-	-
pH	pH	7.76	7.96	7.99	8.02	7.99	7.98	8
Total Suspended Solids (TSS)	mg/L	12	2	3	<10	1	3	<1
Dissolved Sulphate (SO4)	mg/L	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-
Alkalinity (Total as CaCO3)	mg/L	-	-	-	-	-	-	-
Nitrite (N)	mg/L	-	-	-	-	-	-	-
Nitrate (N)	mg/L	-	-	-	-	-	-	-
Nitrate + Nitrite (N)	mg/L	-	-	-	-	-	-	-
Mercury (Hg)	mg/L	-	-	-	-	-	-	-
Total Hardness (CaCO3)	mg/L	-	-	-	-	-	-	-
Total Calcium (Ca)	ug/L	-	-	-	-	-	-	-
Total Magnesium (Mg)	ug/L	-	-	-	-	-	-	-
Total Potassium (K)	ug/L	-	-	-	-	-	-	-
Total Sodium (Na)	ug/L	-	-	-	-	-	-	-
Total Oil & Grease	mg/L	0.50	<0.50	1.80	<0.50	1	1.6	0.7
Bicarb. Alkalinity (as CaCO3)	mg/L	-	-	-	-	-	-	-
Carb. Alkalinity (CaCO3)	mg/L	-	-	-	-	-	-	-
Dissolved Chloride	mg/L	-	-	-	-	-	-	-
Conductivity	umho/cm	-	-	-	-	-	-	-

Sampling Station MEL-SR2

Maxxam ID		EKF925	ELQ335	EMU906	FEA001
Sampling Date		2017/05/12 14:35	2017/05/23 15:05	2017/05/30 15:33	9/16/2017 15:47
	UNITS	**MEL-SR2**	**MEL-SR2**	**MEL-SR2**	**MEL-SR-2**
Inorganics					
Total Ammonia-N	mg/L	0.27	-	-	-
Total Dissolved Solids	mg/L	250	-	-	-
pH	pH	7.65	7.40	7.69	7.94
Total Suspended Solids	mg/L	470	<1	1	2
Dissolved Sulphate (SO4)	mg/L	40	-	-	-
Turbidity	NTU	170	-	-	-
Alkalinity (Total as CaCO3)	mg/L	73	-	-	-
Nitrite (N)	mg/L	0.025	-	-	-
Nitrate (N)	mg/L	0.33	-	-	-
Nitrate + Nitrite (N)	mg/L	0.36	-	-	-
Mercury (Hg)	mg/L	0.00002	-	-	-
Total Hardness (CaCO3)	mg/L	183	-	-	-
Total Calcium (Ca)	ug/L	47400	-	-	-
Total Magnesium (Mg)	ug/L	15700	-	-	-
Total Potassium (K)	ug/L	7800	-	-	-
Total Sodium (Na)	ug/L	19300	-	-	-
Total Oil & Grease	mg/L	-	<0.50	0.60	1.2

Sampling Station MEL-SR3

Maxxam ID		EKF926	EKY351		EPA803	EQF370	ERJ569	ESI493
Sampling Date		2017/05/12 14:40	2017/05/16 13:30	2017/06/06 09:35	2017/06/13 12:50	2017/06/20 13:45	2017/06/27 14:15	2017/07/04 13:40
	UNITS	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**
Inorganics								
Total Ammonia-N	mg/L	0.27	4.1	0.09	0.03	0.03	0.05	0.14
Total Dissolved Solids	mg/L	266	232	476	5270	3410	1290	31600
pH	pH	7.61	7.82	8.00	7.68	7.65	7.94	7.76
Total Suspended Solids	mg/L	330	110	9	14	78	3	130
Dissolved Sulphate (SO4)	mg/L	39	39	120	350	240	200	2100
Turbidity	NTU	140	96	3.8	4.2	6.8	1.1	0.2
Alkalinity (Total as CaCO3)	mg/L	67	100	130	43	36	220	100
Nitrite (N)	mg/L	0.023	0.022	0.024	<0.010	<0.010	0.011	<0.10
Nitrate (N)	mg/L	0.31	0.13	0.27	<0.10	<0.10	<0.10	<1.0
Nitrate + Nitrite (N)	mg/L	0.33	0.16	0.29	<0.10	<0.10	<0.10	<1.0
Mercury (Hg)	mg/L	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L	146	138	295	936	535	641	4810
Total Calcium (Ca)	ug/L	35500	41000	91100	76700	67800.0	201000.0	317000.0
Total Magnesium (Mg)	ug/L	13800	8600	16400	181000	88800.0	33700.0	977000.0
Total Potassium (K)	ug/L	7110	6250	8180	61500	32700.0	13700.0	326000.0
Total Sodium (Na)	ug/L	26800	22000	59800	1570000	747000	133000	8050000
Bicarb. Alkalinity (as CaCO3)	mg/L	-	-	130	43	36	220	100
Carb. Alkalinity (CaCO3)	mg/L	-	-	1.2	<1.0	<1.0	1.8	<1.0
Dissolved Chloride	mg/L	-	-	130	2600	1800	300	15000
Conductivity	umho/cm	-	-	930	8900	5800	1800	45000
Total Oil & Grease	mg/L	-	-	-	-	-	0.6	<0.5

Maxxam ID			ETZ832	EVC167	EWP510	EXJ713	EYN528	EZR523
Sampling Date		7/11/2017	7/16/2017	2017/07/23 14:15	2017/07/29 13:10	2017/08/06 11:10	2017/08/13 09:00	2017/08/20 15:15
	UNITS	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**
Inorganics								
Total Ammonia-N	mg/L	0.13	0.13	0.11	0.22	0.13	0.10	0.12
Total Dissolved Solids	mg/L	30400	29700	29700	29300	29700	31500	29700
pH	pH	7.92	7.87	7.83	7.93	7.90	7.84	7.90
Total Suspended Solids	mg/L	53	53	20	73	26	28	33
Dissolved Sulphate (SO4)	mg/L	2200	2100	2100	2000	750	2300	2200
Turbidity	NTU	1.3	0.2	0.5	0.2	0.5	1.1	0.6
Alkalinity (Total as CaCO3)	mg/L	110	110	110	110	110	110	110
Nitrite (N)	mg/L	<0.10	<0.10	<0.10	0.014	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<1.0	<1.0	<1.0	0.31	<0.10	<0.10	<0.10
Nitrate + Nitrite (N)	mg/L	<1.0	<1.0	<1.0	0.33	<0.10	<0.10	<0.10
Mercury (Hg)	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L	5410	4850	5180	4710	4890	5180	5090
Total Calcium (Ca)	ug/L	357000.0	335000.0	329000.0	324000.0	341000.0	-	-
Total Magnesium (Mg)	ug/L	1100000.0	976000.0	1060000.0	947000.0	981000.0	-	-
Total Potassium (K)	ug/L	348000.0	329000.0	310000.0	310000.0	317000.0	-	-
Total Sodium (Na)	ug/L	9350000	8400000	8610000	7780000	8340000	-	-
Bicarb. Alkalinity (as CaCO3)	mg/L	110	100	110	110	110	110	110
Carb. Alkalinity (CaCO3)	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Dissolved Chloride	mg/L	16000	15000	16000	14000	8000	16000	16000
Conductivity	umho/cm	45000	44000	44000	42000	42000	42000	44000
Total Oil & Grease	mg/L	-	<0.50	0.9	<0.50	<0.50	0.8	1.3

Maxxam ID		FBL317	FCR582	FCR582	FDN345	FDZ999	FFW544	FHQ754
Sampling Date		2017/08/29 10:25	2017/09/07 12:20	2017/09/10 12:20	2017/09/12 10:30	2017/09/16 15:53	2017/09/27 15:40	2017/10/07 14:30
	UNITS	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**	**MEL-SR3**
Inorganics								
Total Ammonia-N	mg/L	-	-	-	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-	-	-	-
pH	pH	7.97	7.96	7.98	7.93	8.00	7.92	7.84
Total Suspended Solids	mg/L	49	230	31	<10	11	36	47
Dissolved Sulphate (SO4)	mg/L	-	-	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	-	-
Alkalinity (Total as CaCO3)	mg/L	-	-	-	-	-	-	-
Nitrite (N)	mg/L	-	-	-	-	-	-	-
Nitrate (N)	mg/L	-	-	-	-	-	-	-
Nitrate + Nitrite (N)	mg/L	-	-	-	-	-	-	-
Mercury (Hg)	mg/L	-	-	-	-	-	-	-
Total Hardness (CaCO3)	mg/L	-	-	-	-	-	-	-
Total Calcium (Ca)	ug/L	-	-	-	-	-	-	-
Total Magnesium (Mg)	ug/L	-	-	-	-	-	-	-
Total Potassium (K)	ug/L	-	-	-	-	-	-	-
Total Sodium (Na)	ug/L	-	-	-	-	-	-	-
Bicarb. Alkalinity (as CaCO3)	mg/L	-	-	-	-	-	-	-
Carb. Alkalinity (CaCO3)	mg/L	-	-	-	-	-	-	-
Dissolved Chloride	mg/L	-	-	-	-	-	-	-
Conductivity	umho/cm	-	-	-	-	-	-	-
Total Oil & Grease	mg/L	0.8	<0.50	0.9	<0.50	1.3	1.8	<0.50

Sampling Station MEL-SR4

Maxxam ID		B7B5823
Sampling Date		2017/05/29 14:50
	UNITS	**MEL-SR4**
Inorganics		
pH	pH	7.70
Total Suspended Solids	mg/L	870
Total Oil & Grease	mg/L	<0.50

Sampling Station MEL-SR5

Maxxam ID		B7B5823
Sampling Date		2017/05/31 12:00
	UNITS	**MEL-SR5**
Inorganics		
pH	pH	7.15
Phenols-4AAP	mg/L	0.00
Total Suspended Solids	mg/L	290
Total Oil & Grease	mg/L	2.3
Benzene	ug/L	<0.20
Toluene	ug/L	<0.20
Ethylbenzene	ug/L	<0.20
o-Xylene	ug/L	0.27
p+m-Xylene	ug/L	<0.40
Total Xylenes	ug/L	<0.40
1,4-Difluorobenzene	%	100
4-Bromofluorobenzene	%	101
D10-Ethylbenzene	%	103
D4-1,2-Dichloroethane	%	95
Total Lead (Pb)	mg/L	0.00191

Sampling Station MEL-SR6

Maxxam ID		B7B5823
Sampling Date		2017/05/31 12:00
	UNITS	**MEL-SR6**
Inorganics		
pH	pH	6.87
Phenols-4AAP	mg/L	<0.020
Total Suspended Solids	mg/L	40
Total Oil & Grease	mg/L	<0.50
Benzene	ug/L	<0.20
Toluene	ug/L	0.24
Ethylbenzene	ug/L	<0.20
o-Xylene	ug/L	0.32
p+m-Xylene	ug/L	<0.40
Total Xylenes	ug/L	<0.40
1,4-Difluorobenzene	%	100
4-Bromofluorobenzene	%	102
D10-Ethylbenzene	%	104
D4-1,2-Dichloroethane	%	96
Total Lead (Pb)	mg/L	0.00069

Sampling Station MEL-SR7

Maxxam ID		EVC166	EWP511	EXJ714	EYN529	EZR524
Sampling Date		2017/07/23 16:00	2017/07/29 12:50	2017/08/06 11:20	2017/08/13 09:15	2017/08/20 14:40
	UNITS	**MEL-SR7**	**MEL-SR7**	**MEL-SR7**	**MEL-SR7**	**MEL-SR7**
Inorganics						
Total Ammonia-N	mg/L	0.03	0.95	0.05	0.05	0.04
Total Dissolved Solids	mg/L	1360	986	1610	1400	1190
pH	pH	8.10	8.05	8.04	7.83	8.07
Total Suspended Solids	mg/L	2	5	2	<1	3
Dissolved Sulphate (SO4)	mg/L	290	190	42	250	120
Turbidity	NTU	0.8	0.4	1	0.4	0.3
Alkalinity (Total as CaCO3)	mg/L	110	91	220	220	190
Nitrite (N)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010
Nitrate (N)	mg/L	<0.10	0.19	0.27	0.41	<0.10
Nitrate + Nitrite (N)	mg/L	<0.10	0.19	0.27	0.41	<0.10
Mercury (Hg)	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L	633	470	781	631	607
Total Calcium (Ca)	ug/L	189000	148000	243000	-	-
Total Magnesium (Mg)	ug/L	39400.0	24700.0	42500	-	-
Total Potassium (K)	ug/L	11800.0	8080.0	16200	-	-
Total Sodium (Na)	ug/L	129000	80000	153000	-	-
Bicarb. Alkalinity (as CaCO3)	mg/L	110	90	220	220	190
Carb. Alkalinity (CaCO3)	mg/L	1.3	<1.0	2.3	1.4	2
Dissolved Chloride	mg/L	390	230	96	340	150
Conductivity	umho/cm	2000	1400	1900	1900	1700
Total Oil & Grease	mg/L	<0.50	<0.50	<0.50	1.1	1.2

Maxxam ID		FBL318	FBL318	FEA000	FFW545
Sampling Date		2017/08/29 10:40	2017/09/10 10:40	2017/09/16 15:44	2017/09/27 15:53
	UNITS	**MEL-SR7**	**MEL-SR7**	**MEL-SR7**	**MEL-SR7**
Inorganics					
Total Ammonia-N	mg/L	-	-	-	-
Total Dissolved Solids	mg/L	-	-	-	-
pH	pH	8.14	8.00	7.72	8.00
Total Suspended Solids	mg/L	<10	1	2	<1
Dissolved Sulphate (SO4)	mg/L	-	-	-	-
Turbidity	NTU	-	-	-	-
Alkalinity (Total as CaCO3)	mg/L	-	-	-	-
Nitrite (N)	mg/L	-	-	-	-
Nitrate (N)	mg/L	-	-	-	-
Nitrate + Nitrite (N)	mg/L	-	-	-	-
Mercury (Hg)	mg/L	-	-	-	-
Total Hardness (CaCO3)	mg/L	-	-	-	-
Total Calcium (Ca)	ug/L	-	-	-	-
Total Magnesium (Mg)	ug/L	-	-	-	-
Total Potassium (K)	ug/L	-	-	-	-
Total Sodium (Na)	ug/L	-	-	-	-
Bicarb. Alkalinity (as CaCO3)	mg/L	-	-	-	-
Carb. Alkalinity (CaCO3)	mg/L	-	-	-	-
Dissolved Chloride	mg/L	-	-	-	-
Conductivity	umho/cm	-	-	-	-
Total Oil & Grease	mg/L	<0.50	1.7	0.7	2.2

Sampling Station MEL-SR8

Maxxam ID		RQ7664	EWP512	EZR522	FBL318	FBL318	FFW546
Sampling Date		2017/07/25 15:15	2017/07/29 12:18	2017/08/20 15:30	2017/08/29 10:15	2017/09/10 10:15	2017/09/27 15:30
	UNITS	**MEL-SR8**	**MEL-SR8**	**MEL-SR8**	**MEL-SR8**	**MEL-SR8**	**MEL-SR8**
Inorganics							
Total Ammonia-N	mg/L	0.09	2.9	0.06	-	-	-
Total Dissolved Solids	mg/L	10700	520	1300	-	-	-
pH	pH	7.96	7.90	8.35	8.03	7.72	7.50
Total Suspended Solids	mg/L	7	5	6	<10	15	210
Dissolved Sulphate (SO4)	mg/L	700	-	99	-	-	-
Turbidity	NTU	3.9	-	1.2	-	-	-
Alkalinity (Total as CaCO3)	mg/L	220	140	220	-	-	-
Nitrite (N)	mg/L	<0.010	0.209	<0.010	-	-	-
Nitrate (N)	mg/L	<0.10	18.40	0.33	-	-	-
Nitrate + Nitrite (N)	mg/L	<0.10	18.60	0.33	-	-	-
Total Kjeldahl Nitrogen	mg/L	0.41	2.70	-	-	-	-
Mercury (Hg)	mg/L	<0.00001	<0.00001	<0.00001	-	-	-
Dissolved Mercury (Hg)	mg/L	<0.00001	<0.00001	-	-	-	-
Total Hardness (CaCO3)	mg/L	1350	230	411	-	-	-
Total Calcium (Ca)	ug/L	213000	66400	-	-	-	-
Total Magnesium (Mg)	ug/L	199000	15600	-	-	-	-
Total Potassium (K)	ug/L	72700	9430	-	-	-	-
Total Sodium (Na)	ug/L	1670000	91700	-	-	-	-
Dissolved Hardness (CaCO3)	mg/L	3500	216	-	-	-	-
Dissolved Calcium (Ca)	ug/L	282000	60600	-	-	-	-
Dissolved Magnesium (Mg)	ug/L	679000	15800	-	-	-	-
Dissolved Potassium (K)	ug/L	195000	9320	-	-	-	-
Dissolved Sodium (Na)	ug/L	5430000	93200	-	-	-	-
Bicarb. Alkalinity (as CaCO3)	mg/L	220	140	220	-	-	-
Carb. Alkalinity (CaCO3)	mg/L	1.9	1	4.6	-	-	-
Dissolved Chloride	mg/L	5700	120	380	-	-	-
Conductivity	umho/cm	17000	-	2100	-	-	-
Total Oil & Grease	mg/L	-	-	<0.50	<0.50	1.4	1.9
Reactive Silica	mg/L	7	4.9	-	-	-	-
Dissolved Organic Carbon (DOC)	mg/L	5	4.6	-	-	-	-
Total Organic Carbon (TOC)	mg/L	6.3	4.8	-	-	-	-
Orthophosphate	mg/L	0.02	0.011	-	-	-	-
Total Cyanide	mg/L	<0.0050	0.0094	-	-	-	-
Free Cyanide (WAD)	mg/L	<0.0010	0.0058	-	-	-	-
Total Phosphorus	mg/L	0.066	0.025	-	-	-	-

Sampling Station MEL-SR9

Maxxam ID		FDN346
Sampling Date		2017/09/12 11:00
COC Number		na
	UNITS	**MEL-SR9**
Inorganics		
Total Ammonia-N	mg/L	-
Total Dissolved Solids	mg/L	-
pH	pH	8.22
Total Suspended Solids	mg/L	30
Dissolved Sulphate (SO4)	mg/L	-
Turbidity	NTU	-
Alkalinity (Total as CaCO3)	mg/L	-
Nitrite (N)	mg/L	-
Nitrate (N)	mg/L	-
Nitrate + Nitrite (N)	mg/L	-
Total Kjeldahl Nitrogen	mg/L	-
Mercury (Hg)	mg/L	-
Dissolved Mercury (Hg)	mg/L	-
Total Hardness (CaCO3)	mg/L	-
Total Calcium (Ca)	ug/L	-
Total Magnesium (Mg)	ug/L	-
Total Potassium (K)	ug/L	-
Total Sodium (Na)	ug/L	-
Dissolved Hardness (CaCO3)	mg/L	-
Dissolved Calcium (Ca)	ug/L	-
Dissolved Magnesium (Mg)	ug/L	-
Dissolved Potassium (K)	ug/L	-
Dissolved Sodium (Na)	ug/L	-
Bicarb. Alkalinity (as CaCO3)	mg/L	-
Carb. Alkalinity (CaCO3)	mg/L	-
Dissolved Chloride	mg/L	-
Conductivity	umho/cm	-
Total Oil & Grease	mg/L	<0.50
Reactive Silica	mg/L	-
Dissolved Organic Carbon (DOC)	mg/L	-
Total Organic Carbon (TOC)	mg/L	-
Orthophosphate	mg/L	-
Total Cyanide	mg/L	-
Free Cyanide (WAD)	mg/L	-
Total Phosphorus	mg/L	-

Waterbody : Channel 5-Upstream		Site Specific Criteria	MMER Criteria	CCME	2017	
Year						
Date Sampled					2017/09/17 13:40	2017/09/27 11:32
Lab Reference					B7K6408	B7L6861
LAB					Maxxam	Maxxam
Parameters	**Units**					
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				75	80
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	<1.0
Total Ammonia-N	mg/L	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	8.2	6.7
Conductivity	µmhos/cm				4600	4400
Total Dissolved Solids (TDS)	mg/L	1400			3670	2510
Free Cyanide (Cn)	mg/L		0.010		0.0011	0.0012
Total Kjeldahl Nitrogen (TKN)	mg/L				8.7	6.7
Dissolved Organic Carbon (DOC)	mg/L				15	15
Total Organic Carbon (TOC)	mg/L				16	16
Orthophosphate (P)	mg/L				<0.010	<0.010
pH		6.0 to 9.5		6.5-9.0 (long term)	7.70	7.71
Total Phosphorus (P)	mg/L	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	0.017	0.017
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	7	6
Dissolved Sulphate (SO4)	mg/L				-	280
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		<0.0050	<0.0050
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	8.2	13
Alkalinity (Total as CaCO3)	mg/L				75	81
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	-	1200
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.199	0.154
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L (long term)	13.5	8.48
Nitrite-Nitrate (as N)	mg/L				13.7	8.63
Radium-226	Bq/L				-	-
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	0.00004
Dissolved Mercury (Hg)	mg/L				<0.00001	0.00003
Total Hardness (CaCO3)	mg/L				1330	1390
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	0.037	0.023
Total Antimony (Sb)	mg/L				<0.0025	<0.0025
Total Arsenic (As)	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	0.00377	0.00335
Total Barium (Ba)	mg/L				0.217	0.197
Total Beryllium (Be)	mg/L				<0.00050	<0.00050
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	<0.25	<0.25
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	0.000116	0.000107
Total Chromium (Cr)	mg/L				<0.0050	<0.0050
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	0.0028	0.0027
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	1.44	1.92

Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	<0.0010	<0.0010
Total Lithium (Li)	mg/L				0.326	0.308
Total Manganese (Mn)	mg/L				0.562	0.604
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	<0.0050	<0.0050
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	0.0126	0.0126
Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	<0.00050	<0.00050
Total Silver (Ag)	mg/L				<0.00010	<0.00010
Total Strontium (Sr)	mg/L				6.91	6.62
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	0.000091	0.000072
Total Tin (Sn)	mg/L				<0.025	<0.025
Total Titanium (Ti)	mg/L				<0.025	<0.025
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	0.00198	0.00176
Total Vanadium	mg/L				<0.025	<0.025
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	<0.025	<0.025
Total Calcium	mg/L				423	448
Total Magnesium	mg/L				67.2	66
Total Potassium	mg/L				22.8	21.1
Total Sodium	mg/L				250	241
BTEX & F1 Hydrocarbons						
Benzene	ug/L				<0.20	-
Toluene	ug/L				<0.20	-
Ethylbenzene	ug/L				<0.20	-
o-Xylene	ug/L				<0.20	-
p+m-Xylene	ug/L				<0.40	-
Total Xylenes	ug/L				<0.40	-
F1 (C6-C10)	ug/L				<25	-
F1 (C6-C10) - BTEX	ug/L				<25	-
Hydrocarbons (L) (Fraction F2 - F4))						
F2 (C10-C16 Hydrocarbons)	ug/L				-	-
F3 (C16-34 Hydrocarbons)	ug/L				-	-
F4 (C34-50 Hydrocarbons)	ug/L				-	-
Reached Baseline at C50	ug/L				-	-
F4G-sg (Grav. Heavy Hydrocarbons)	ug/L				-	-
1,4-Difluorobenzene	%				106	-
4-Bromofluorobenzene	%				96	-
D10-Ethylbenzene	%				102	-
D4-1,2-Dichloroethane	%				94	-
o-Terphenyl	%				-	-
Dissolved Hardness	mg/L				1440	1390
Dissolved Aluminium (Al)	mg/L				<0.015	<0.015
Dissolved Antimony (Sb)	mg/L				<0.0025	<0.0025
Dissolved Arsenic (As	mg/L		0.010		0.00276	0.00217
Dissolved Barium (Ba)	mg/L				0.23	0.206
Dissolved Beryllium (Be)	mg/L				<0.00050	<0.00050
Dissolved Boron (B)	mg/L				<0.25	<0.25
Dissolved Cadmium (Cd)	mg/L				0.000124	0.000101
Dissolved Chromium (Cr)	mg/L				<0.0050	<0.0050
Dissolved Copper (Cu)	mg/L		0.010		0.0025	0.0025
Dissolved Iron (Fe)	mg/L				0.549	0.546
Dissolved Lead (Pb)	mg/L		0.010		<0.0010	<0.0010
Dissolved Lithium (Li)	mg/L				0.34	0.293
Dissolved Manganese (Mn)	mg/L				0.605	0.641
Dissolved Molybdenum (Mo)	mg/L				<0.0050	<0.0050
Dissolved Nickel (Ni)	mg/L		0.020		0.0132	0.0138
Dissolved Selenium (Se)	mg/L				<0.00050	<0.00050
Dissolved Silver (Ag)	mg/L				<0.00010	<0.00010
Dissolved Strontium (Sr)	mg/L				7.8	6.47
Dissolved thallium (Tl)	mg/L				0.000095	0.000071
Dissolved Tin (Sn)	mg/L				<0.025	<0.025
Dissolved Titanium (Ti)	mg/L				<0.025	<0.025
Dissolved Uranium	mg/L				0.00203	0.00176
Dissolved Vanadium	mg/L				<0.025	<0.025
Dissolved Zinc	mg/L		0.010		<0.025	<0.025
Dissolved Calcium	mg/L				452	445
Dissolved Magnesium	mg/L				74.4	67.9
Dissolved Potassium	mg/L				25.3	22.6
Dissolved Sodium	mg/L				275	235
Reactive Silica (Si)	mg/L				7.3	7.6

Waterbody : CULVERT 2 - UPSTREAM		Site Specific Criteria	MMER Criteria	CCME	2017								
Year													
Date Sampled					2017/06/06 - 14:45	6/13/2017 13:40:00 PM	2017/06/20 10:30	2017/07/04 15:40	7/11/2017	2017/07/18 13:30	2017/07/26 11:25	2017/08/01 07:55	2017/08/22 11:35
Lab Reference					B7C1605	B7C7727	B7D4025	B7E5120	B7F3007	B7F7257	B7G3476	B7G9742	B7I6985
LAB					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Parameters	**Units**												
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				61	61	73	80	84	85	82	160	130
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Ammonia-N	mg/L	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	3	3.3	3.2	3	2.7	2.2	1.9	4.1	-
Conductivity	µmhos/cm				760	880	970	1100	1200	1200	1300	1300	4600
Total Dissolved Solids (TDS)	mg/L	1400			552	734	892	1050	1050	912	942	1090	3370
Free Cyanide (Cn)	mg/L		0.010		-	-	-	-	-	-	-	-	0.0014
Total Kjeldahl Nitrogen (TKN)	mg/L				-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon (DOC)	mg/L				-	-	-	-	-	-	-	-	37
Total Organic Carbon (TOC)	mg/L				-	-	-	-	-	-	-	-	-
Orthophosphate (P)	mg/L				-	-	-	-	-	-	-	-	-
pH		6.0 to 9.5		6.5-9.0 (long term)	7.74	7.87	7.85	7.98	8.05	7.85	7.97	7.54	7.86
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	30	5	2	2	4	5	5	11	36
Dissolved Sulphate (SO4)	mg/L				35	38	36	37	39	42	35	36	200
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	-	-	-	-	<0.0050
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	14	1.7	1.2	1.1	0.5	1	1	15	21
Alkalinity (Total as CaCO3)	mg/L				61	61	74	81	85	85	82	160	130
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	150	170	200	240	250	270	250	250	1300
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.077	0.102	0.082	0.078	0.086	0.079	0.118	<0.010	-
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L (long term)	2.3	3.4	2.46	2.18	2	1.6	2.31	<0.10	-
Nitrite-Nitrate (as N)	mg/L				2.38	3.5	2.54	2.26	2.09	1.68	2.43	<0.10	-
Total Oil & Grease	mg/L				-	-	-	-	-	-	-	-	<0.50
Radium-226	Bq/L				-	-	-	-	-	-	-	-	-
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)	mg/L												<0.00001
Total Hardness (CaCO3)	mg/L				263	276	294	343	369	380	397	457	1350
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	-	-	-	-	-	0.485	0.0306	0.0145	0.573
Total Antimony (Sb)	mg/L				-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.0025
Total Arsenic (As	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	-	-	-	-	-	0.00445	0.00254	0.00917	0.0134
Total Barium (Ba)	mg/L				-	-	-	-	-	0.128	0.122	0.209	0.477
Total Beryllium (Be)	mg/L				-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00050
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	-	-	-	-	-	0.057	0.052	<0.050	0.26
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	-	-	-	-	-	0.000013	<0.000010	<0.000010	<0.000050
Total Chromium (Cr)	mg/L				-	-	-	-	-	0.0019	<0.0010	<0.0010	<0.0050
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	-	-	-	-	-	0.003	0.00183	<0.00050	0.0066
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	-	-	-	-	-	1.12	0.172	3.52	1.52
Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	-	-	-	-	-	0.00054	<0.00020	<0.00020	0.0014
Total Lithium (Li)	mg/L				-	-	-	-	-	0.054	0.051	0.0238	0.228
Total Manganese (Mn)	mg/L				-	-	-	-	-	0.0748	0.0286	1.47	0.901
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	-	-	-	-	-	<0.0010	<0.0010	<0.0010	0.0063
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	-	-	-	-	-	0.0042	0.0027	0.0024	0.0165
Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00050
Total Silver (Ag)	mg/L				-	-	-	-	-	<0.000020	<0.000020	<0.000020	<0.00010
Total Strontium (Sr)	mg/L				-	-	-	-	-	1.64	1.62	1.12	6.74
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	-	-	-	-	-	0.000029	0.000029	<0.000010	0.000056
Total Tin (Sn)	mg/L				-	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.025
Total Titanium (Ti)	mg/L				-	-	-	-	-	0.0109	<0.0050	<0.0050	0.028
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	-	-	-	-	-	0.00063	0.00044	0.00012	0.00484
Total Vanadium	mg/L				-	-	-	-	-	<0.0050	<0.0050	<0.0050	<0.025
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	-	-	-	-	-	0.0052	<0.0050	<0.0050	<0.025
Total Calcium	mg/L				83.6	87.6	96.5	110	115	120	127	150	418
Total Magnesium	mg/L				13.1	13.8	13	16.8	20	19.4	19.4	20.2	73.4
Total Potassium	mg/L				6.74	7.37	7.3	8.74	9.69	9.64	10.4	7.66	34.7
Total Sodium	mg/L				37.5	45.5	43.8	59.7	63.9	61.8	63.4	48.7	332
BTEX & F1 Hydrocarbons					-	-	-	-	-	-	-	-	

Benzene	ug/L				-	-	-	-	-	-	-	-	<0.20
Toluene	ug/L				-	-	-	-	-	-	-	-	<0.20
Ethylbenzene	ug/L				-	-	-	-	-	-	-	-	<0.20
o-Xylene	ug/L				-	-	-	-	-	-	-	-	<0.20
p+m-Xylene	ug/L				-	-	-	-	-	-	-	-	<0.40
Total Xylenes	ug/L				-	-	-	-	-	-	-	-	<0.40
F1 (C6-C10)	ug/L				-	-	-	-	-	-	-	-	<25
F1 (C6-C10) - BTEX	ug/L				-	-	-	-	-	-	-	-	<25
1,4-Difluorobenzene	%				-	-	-	-	-	-	-	-	104
4-Bromofluorobenzene	%				-	-	-	-	-	-	-	-	88
D10-Ethylbenzene	%				-	-	-	-	-	-	-	-	101
D4-1,2-Dichloroethane	%				-	-	-	-	-	-	-	-	108
o-Terphenyl	%				-	-	-	-	-	-	-	-	-
Dissolved Hardness	mg/L				-	-	-	-	-	-	-	-	1460
Dissolved Aluminium (Al)	mg/L				-	-	-	-	-	-	-	-	0.022
Dissolved Antimony (Sb)	mg/L				-	-	-	-	-	-	-	-	<0.0025
Dissolved Arsenic (As	mg/L		0.010		-	-	-	-	-	-	-	-	0.00544
Dissolved Barium (Ba)	mg/L				-	-	-	-	-	-	-	-	0.445
Dissolved Beryllium (Be)	mg/L				-	-	-	-	-	-	-	-	<0.00050
Dissolved Boron (B)	mg/L				-	-	-	-	-	-	-	-	0.25
Dissolved Cadmium (Cd)	mg/L				-	-	-	-	-	-	-	-	<0.000050
Dissolved Chromium (Cr)	mg/L				-	-	-	-	-	-	-	-	<0.0050
Dissolved Copper (Cu)	mg/L		0.010		-	-	-	-	-	-	-	-	0.0036
Dissolved Iron (Fe)	mg/L				-	-	-	-	-	-	-	-	0.086
Dissolved Lead (Pb)	mg/L		0.010		-	-	-	-	-	-	-	-	<0.0010
Dissolved Lithium (Li)	mg/L				-	-	-	-	-	-	-	-	0.229
Dissolved Manganese (Mn)	mg/L				-	-	-	-	-	-	-	-	0.752
Dissolved Molybdenum (Mo)	mg/L				-	-	-	-	-	-	-	-	0.0065
Dissolved Nickel (Ni)	mg/L		0.020		-	-	-	-	-	-	-	-	0.0117
Dissolved Selenium (Se)	mg/L				-	-	-	-	-	-	-	-	<0.00050
Dissolved Silver (Ag)	mg/L				-	-	-	-	-	-	-	-	<0.00010
Dissolved Strontium (Sr)	mg/L				-	-	-	-	-	-	-	-	6.75
Dissolved thallium (Tl)	mg/L				-	-	-	-	-	-	-	-	<0.000050
Dissolved Tin (Sn)	mg/L				-	-	-	-	-	-	-	-	<0.025
Dissolved Titanium (Ti)	mg/L				-	-	-	-	-	-	-	-	<0.025
Dissolved Uranium	mg/L				-	-	-	-	-	-	-	-	0.00485
Dissolved Vanadium	mg/L				-	-	-	-	-	-	-	-	<0.025
Dissolved Zinc	mg/L		0.010		-	-	-	-	-	-	-	-	<0.025
Dissolved Calcium	mg/L				-	-	-	-	-	-	-	-	460
Dissolved Magnesium	mg/L				-	-	-	-	-	-	-	-	75.8
Dissolved Potassium	mg/L				-	-	-	-	-	-	-	-	32.2
Dissolved Sodium	mg/L				-	-	-	-	-	-	-	-	331
Reactive Silica (Si)	mg/L												8.7

Note:
- not analyzed
BOLD - exceeds oneor more guidelines

Waterbody : CULVERT 3 - UPSTREAM		Site Specific Criteria	MMER Criteria	CCME	2017										
Year															
Date Sampled					07/18/17	07/26/17	08/01/17	08/06/17	08/13/17	08/22/17	08/29/17	09/13/17	09/17/17	09/27/17	10/03/17
Lab Reference					B7F7257	B7G3476	B7G9742	B7H1202	B7H7102	B7I6985	B7J2724	B7K4227	B7K6408	B7L6861	B7L9990
LAB					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Parameters	**Units**														
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				77	80	77	77	74	78	76	7.78	120	73	-
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	7	1.1	<1.0	-
Total Ammonia-N	mg/L	14 Effluent 18 Grab sample		Table (field pH/ field Temp)			29	61	7.1	-	-	-	7	2.5	-
Conductivity	µmhos/cm				1700	1900	6200	21000	3200	3800	4500	-	4000	2900	-
Total Dissolved Solids (TDS)	mg/L	1400			1250	1530	7270	15100	2530	2860	2930	-	3310	1720	-
Free Cyanide (Cn)	mg/L		0.010		-	-	-	-	-	<0.0010	<0.0010	-	0.0012	0.001	-
Total Kjeldahl Nitrogen (TKN)	mg/L				-	-	-	-	-	-	-	-	7.7	3.1	-
Dissolved Organic Carbon (DOC)	mg/L				-	-	-	-	-	13	14	-	18	13	-
Total Organic Carbon (TOC)	mg/L				-	-	-	-	-	-	-	-	19	15	-
Orthophosphate (P)	mg/L				-	-	-	-	-	-	-	-	<0.010	<0.010	-
pH		6.0 to 9.5		6.5-9.0 (long term)	7.72	7.6	7.63	7.38	7.65	7.72	7.75	-	7.99	7.85	7.8
Total Phosphorus (P)	mg/L	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	-	-	-	-	-	-	-	-	0.016	0.043	-
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	5	7	8	16	5	10	<10	-	7	6	32
Dissolved Sulphate (SO4)	mg/L				52	43	160	440	88	110	120	-		86	-
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	1.8	12	3	3.9	3.1	3	2.8	-	8.6	5.5	-
Alkalinity (Total as CaCO3)	mg/L				77	80	77	77	75	78	77	-	120	74	-
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	400	460	1800	7000	940	1100	1300	-	-	780	-
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.108	0.153	0.586	1.97	0.157	-	-	-	0.179	0.149	-
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L (long term)	3.86	4.42	22.8	75.6	8.9	-	-	-	6.06	5.75	-
Nitrite-Nitrate (as N)	mg/L				3.97	4.58	23.4	77.6	9.06	-	-	-	6.23	5.9	-
Total Oil & Grease	mg/L				-	-	-	-	-	<0.50	0.7	<0.50	<0.50	<0.50	2.1
Radium-226	Bq/L				-	-	-	-	-	-	-	-	-	-	-
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	<0.00001	0.00001	-
Dissolved Mercury (Hg)	mg/L				-	-	-	-	-	<0.00001	<0.00001	-	<0.00001	0.00001	-
Total Hardness (CaCO3)	mg/L				512	610	2290	5520	953	1140	1270	-	1150	829	-
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	0.023	0.036	0.047	<0.060	0.023	0.015	0.352	-	0.041	0.015	-
Total Antimony (Sb)	mg/L				<0.00050	<0.0025	<0.0025	<0.010	<0.0025	<0.0025	<0.0025	-	<0.0025	<0.0025	-
Total Arsenic (As)	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	0.00303	0.00302	0.0032	0.0034	0.00258	0.0026	0.00217	-	0.00286	0.002	-
Total Barium (Ba)	mg/L				0.135	0.178	0.41	0.697	0.236	0.237	0.296	-	0.261	0.19	-
Total Beryllium (Be)	mg/L				<0.00010	<0.00050	<0.00050	<0.0020	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	0.119	<0.25	0.41	1.1	<0.25	<0.25	<0.25	-	<0.25	<0.25	-
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	0.000022	<0.000050	0.000455	0.00094	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Total Chromium (Cr)	mg/L				<0.0010	<0.0050	<0.0050	<0.020	<0.0050	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	0.00216	<0.0025	<0.0025	<0.010	<0.0025	<0.0025	<0.0025	-	0.0026	<0.0025	-
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	0.232	2.25	0.649	<0.20	0.603	0.873	0.748	-	1.22	0.42	-
Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	<0.00020	<0.0010	<0.0010	<0.0040	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Total Lithium (Li)	mg/L				0.142	0.139	0.757	2.06	0.274	0.276	0.3	-	0.179	0.233	-
Total Manganese (Mn)	mg/L				0.107	0.628	0.357	0.631	0.197	0.276	0.203	-	0.843	0.224	-
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	0.0014	<0.0050	<0.0050	<0.020	<0.0050	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	0.0029	0.0054	0.0056	<0.020	<0.0050	<0.0050	<0.0050	-	0.0058	<0.0050	-
Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	<0.00010	<0.00050	<0.00050	<0.0020	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Total Silver (Ag)	mg/L				<0.000020	<0.00010	<0.00010	<0.00040	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Total Strontium (Sr)	mg/L				2.97	2.79	17	47.6	5.41	5.72	7.26	-	5.35	4.57	-
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	0.000042	<0.000050	0.000199	0.00055	0.000051	0.000051	0.000054	-	<0.000050	<0.000050	-
Total Tin (Sn)	mg/L				<0.0050	<0.025	<0.025	<0.10	<0.025	<0.025	<0.025	-	<0.025	<0.025	-
Total Titanium (Ti)	mg/L				<0.0050	<0.025	<0.025	<0.10	<0.025	<0.025	0.026	-	<0.025	<0.025	-
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	0.00073	0.0007	0.00107	0.0022	0.00076	0.00084	0.00118	-	0.00344	0.00105	-
Total Vanadium	mg/L				<0.0050	<0.025	<0.025	<0.10	<0.025	<0.025	<0.025	-	<0.025	<0.025	-
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	0.463	0.347	<0.025	<0.10	0.079	0.076	0.083	-	<0.025	0.062	-

Total Calcium	mg/L				165	201	692	1640	304	365	397	-	361	262	-
Total Magnesium	mg/L				23.9	26.5	136	345	47.1	56.4	67.1	-	61.1	42.9	-
Total Potassium	mg/L				11.8	13.2	62	159	23.1	26.2	29.9	-	22.3	18.4	-
Total Sodium	mg/L				92.1	94	885	2380	232	276	319	-	226	195	-
BTEX & F1 Hydrocarbons															
Benzene	ug/L				-	-	-	-	-	<0.20	<0.20	-	<0.20	-	-
Toluene	ug/L				-	-	-	-	-	<0.20	<0.20	-	<0.20	-	-
Ethylbenzene	ug/L				-	-	-	-	-	<0.20	<0.20	-	<0.20	-	-
o-Xylene	ug/L				-	-	-	-	-	<0.20	<0.20	-	<0.20	-	-
p+m-Xylene	ug/L				-	-	-	-	-	<0.40	<0.40	-	<0.40	-	-
Total Xylenes	ug/L				-	-	-	-	-	<0.40	<0.40	-	<0.40	-	-
F1 (C6-C10)	ug/L				-	-	-	-	-	<25	<25	-	<25	-	-
F1 (C6-C10) - BTEX	ug/L				-	-	-	-	-	<25	<25	-	<25	-	-
Hydrocarbons (L) (Fraction F2 - F4))															
F2 (C10-C16 Hydrocarbons)	ug/L				-	-	-	-	-	-	-	-	-	-	-
F3 (C16-34 Hydrocarbons)	ug/L				-	-	-	-	-	-	-	-	-	-	-
F4 (C34-50 Hydrocarbons)	ug/L				-	-	-	-	-	-	-	-	-	-	-
Reached Baseline at C50	ug/L				-	-	-	-	-	-	-	-	-	-	-
F4G-sg (Grav. Heavy Hydrocarbons)	ug/L				-	-	-	-	-	-	-	-	-	-	-
1,4-Difluorobenzene	%				-	-	-	-	-	105	101	-	104	-	-
4-Bromofluorobenzene	%				-	-	-	-	-	91	103	-	100	-	-
D10-Ethylbenzene	%				-	-	-	-	-	101	94	-	106	-	-
D4-1,2-Dichloroethane	%				-	-	-	-	-	107	104	-	92	-	-
o-Terphenyl	%				-	-	-	-	-	-	-	-	-	-	-
Dissolved Hardness	mg/L				-	-	-	-	-	1170	1260	-	1200	791	-
Dissolved Aluminium (Al)	mg/L				-	-	-	-	-	<0.015	<0.015	-	<0.015	<0.015	-
Dissolved Antimony (Sb)	mg/L				-	-	-	-	-	<0.0025	<0.0025	-	<0.0025	<0.0025	-
Dissolved Arsenic (As	mg/L		0.010		-	-	-	-	-	0.00247	0.00185	-	0.00215	0.00161	-
Dissolved Barium (Ba)	mg/L				-	-	-	-	-	0.254	0.291	-	0.268	0.189	-
Dissolved Beryllium (Be)	mg/L				-	-	-	-	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Dissolved Boron (B)	mg/L				-	-	-	-	-	<0.25	<0.25	-	<0.25	<0.25	-
Dissolved Cadmium (Cd)	mg/L				-	-	-	-	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Dissolved Chromium (Cr)	mg/L				-	-	-	-	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Dissolved Copper (Cu)	mg/L		0.010		-	-	-	-	-	0.0014	0.0015	-	0.0021	0.0018	-
Dissolved Iron (Fe)	mg/L				-	-	-	-	-	0.548	0.211	-	0.236	0.166	-
Dissolved Lead (Pb)	mg/L		0.010		-	-	-	-	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Dissolved Lithium (Li)	mg/L				-	-	-	-	-	0.274	0.3	-	0.183	0.214	-
Dissolved Manganese (Mn)	mg/L				-	-	-	-	-	0.236	0.183	-	0.821	0.201	-
Dissolved Molybdenum (Mo)	mg/L				-	-	-	-	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Dissolved Nickel (Ni)	mg/L		0.020		-	-	-	-	-	<0.0050	<0.0050	-	0.0055	<0.0050	-
Dissolved Selenium (Se)	mg/L				-	-	-	-	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Dissolved Silver (Ag)	mg/L				-	-	-	-	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Dissolved Strontium (Sr)	mg/L				-	-	-	-	-	6.06	6.92	-	5.82	4.25	-
Dissolved thallium (Tl)	mg/L				-	-	-	-	-	0.000055	0.000050	-	<0.000050	<0.000050	-
Dissolved Tin (Sn)	mg/L				-	-	-	-	-	<0.025	<0.025	-	<0.025	<0.025	-
Dissolved Titanium (Ti)	mg/L				-	-	-	-	-	<0.025	<0.025	-	<0.025	<0.025	-
Dissolved Uranium	mg/L				-	-	-	-	-	0.00103	0.00116	-	0.00344	0.00096	-
Dissolved Vanadium	mg/L				-	-	-	-	-	<0.025	<0.025	-	<0.025	<0.025	-
Dissolved Zinc	mg/L		0.010		-	-	-	-	-	0.064	0.072	-	<0.025	0.059	-
Dissolved Calcium	mg/L				-	-	-	-	-	370	393	-	380	250	-
Dissolved Magnesium	mg/L				-	-	-	-	-	59.2	67.7	-	59.9	40.6	-
Dissolved Potassium	mg/L				-	-	-	-	-	26.6	30.1	-	22.5	18.8	-
Dissolved Sodium	mg/L				-	-	-	-	-	291	312	-	226	183	-
Reactive Silica (Si)	mg/L				-	-	-	-	-	5.7	1.8	-	8.1	1.3	-

Waterbody : DCP1-Downstream	Site Specific Criteria	MMER Criteria	CCME	2017					
Year									
Date Sampled				5/14/17	5/24/17	6/6/17	6/13/17	6/20/17	7/4/17
Lab Reference				B7A3182	B7A9722	B7C1605	B7C7727	B7D4025	B7E5120
LAB				Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Parameters									
Bicarb. Alkalinity (calc. as CaCO3)				-	-	81	100	150	180
Carb. Alkalinity (calc. as CaCO3)				-	-	<1.0	<1.0	<1.0	<1.0
Total Ammonia-N	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	2.1	5.6	5.9	3.3	29	55
Conductivity				-	-	1400	2100	6200	5100
Total Dissolved Solids (TDS)	1400			478	808	1050	1730	5270	3860
Fluoride (F-)									
Free Cyanide (Cn)		0.010		-	-	-	-	-	-
Total Kjeldahl Nitrogen (TKN)				-	-	-	-	-	-
Dissolved Organic Carbon (DOC)				-	-	-	-	-	-
Total Organic Carbon (TOC)				-	-	-	-	-	-
Orthophosphate (P)				-	-	-	-	-	-
pH	6.0 to 9.5		6.5-9.0 (long term)	7.49	7.69	7.68	7.82	7.59	7.75
Total Phosphorus (P)	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	-	-	-	-	-	-
Total Suspended Solids (TSS)	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	310	17	120	28	170	19
Dissolved Sulphate (SO4)				26	48	52	140	540	580
Total Cyanide (Cn)	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	-	-
Turbidity			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	390	6.3	94	30	140	7.4
Alkalinity (Total as CaCO3)				55	110	82	100	150	180
Dissolved chloride (Cl)			640 mg/L (short term); 120 mg/L (long term)	-	-	300	480	1600	1100
Nitrite (as N)			60 mg/L NO2-N (long term)	0.083	0.252	0.308	0.089	2.32	2.15
Nitrate (as N)			550 mg/L (short term); 13 mg/L (long term)	2.47	5.26	6.09	2.32	47.3	78.8
Nitrite-Nitrate (as N)				2.56	5.52	6.4	2.4	49.6	81
Radium-226									
Mercury (Hg)			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)									
Total Hardness (CaCO3)				176	336	381	807	1990	1640
Total Aluminium (Al)	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	-	0.339	-	-	-	-
Total Antimony (Sb)				-	0.00064	-	-	-	-
Total Arsenic (As)	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	-	0.00436	-	-	-	-
Total Barium (Ba)				-	0.0925	-	-	-	-
Total Beryllium (Be)				-	<0.00010	-	-	-	-
Total Boron (B)			29 mg/L (short term); 1.5 mg/L (long term)	-	0.081	-	-	-	-
Total Cadmium (Cd)			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	-	0.000026	-	-	-	-

Total Chromium (Cr)				-	<0.0010	-	-	-	-
Total Copper (Cu)	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	-	0.00528	-	-	-	-
Total Iron (Fe)			300 ug/L (long term) (or 0.3mg/L)	-	0.348	-	-	-	-
Total Lead (Pb)	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	-	0.0007	-	-	-	-
Total Lithium (Li)				-	0.159	-	-	-	-
Total Manganese (Mn)				-	0.11	-	-	-	-
Total Molybdenum (Mo)			73 ug/L (long term) (or 0.073 mg/L)	-	0.0038	-	-	-	-
Total Nickel (Ni)	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	-	0.0034	-	-	-	-
Total Selenium (Se)			1 ug/L (long term) (or 0.001 mg/L)	-	0.00035	-	-	-	-
Total Silver (Ag)				-	<0.000020	-	-	-	-
Total Strontium (Sr)				-	1.94	-	-	-	-
Total thallium (Tl)			0.8 ug/L (long term) (or 0.0008 mg/L)	-	0.000052	-	-	-	-
Total Tin (Sn)				-	<0.0050	-	-	-	-
Total Titanium (Ti)				-	0.0072	-	-	-	-
Total Uranium			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	-	0.00148	-	-	-	-
Total Vanadium				-	<0.0050	-	-	-	-
Total Zinc	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	-	0.0075	-	-	-	-
Total Calcium				53.2	108	123	265	642	492
Total Magnesium				10.6	16.4	17.8	35.4	94.7	100
Total Potassium				7.55	8.7	9.43	15.3	49.2	40.2
Total Sodium				23	132	86.7	76.6	390	273

Waterbody : DCP1-Downstream Year	Site Specific Criteria	MMER Criteria	**CCME**						
Date Sampled				7/11/17	7/18/17	7/26/17	8/1/17	9/10/17	10/2/17
Lab Reference				B7F3007	B7F7257	B7G3476	B7G9742	B7K0900	B7M1107
LAB				Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Field Measurments									
Water Temperature									
pH									
Conductivity									
Laboratory-Measured									
Parameters									
Bicarb. Alkalinity (calc. as CaCO3)				170	170	170	140	-	-
Carb. Alkalinity (calc. as CaCO3)				1.3	1.1	1.1	<1.0	-	-
Total Ammonia-N	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	58	61	59	53	30	7.4
Conductivity				5000	5000	5000	6600	-	-
Total Dissolved Solids (TDS)	1400			3900	3330	4050	5540	3600	1980
Fluoride (F-)									<0.10
Free Cyanide (Cn)		0.010		-	-	-	-	0.0091	0.0015
Total Kjeldahl Nitrogen (TKN)				-	-	-	-	-	-
Dissolved Organic Carbon (DOC)				-	-	-	-	-	-
Total Organic Carbon (TOC)				-	-	-	-	-	-
Orthophosphate (P)				-	-	-	-	<0.010	<0.010
pH	6.0 to 9.5		6.5-9.0 (long term)	7.9	7.83	7.87	7.76	7.98	8.04
Total Phosphorus (P)	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	-	-	-	-	-	0.012

Total Suspended Solids (TSS)	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	12	8	10	39	3	4
Dissolved Sulphate (SO4)				590	590	440	580	450	310
Total Cyanide (Cn)	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	0.013	<0.0050
Turbidity			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	4	3.5	1.9	1.1	1.3	1.3
Alkalinity (Total as CaCO3)				170	170	170	140	220	170
Dissolved chloride (Cl)			640 mg/L (short term); 120 mg/L (long term)	1000	1000	840	1600	1000	730
Nitrite (as N)			60 mg/L NO2-N (long term)	1.89	1.67	1.53	1.27	0.324	0.023
Nitrate (as N)			550 mg/L (short term); 13 mg/L (long term)	85.9	89	82	76.6	34.7	0.93
Nitrite-Nitrate (as N)				87.8	90.7	83.6	77.9	35	0.96
Radium-226									
Mercury (Hg)			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)									
Total Hardness (CaCO3)				1580	1600	1850	1930	1470	1060
Total Aluminium (Al)	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	-	0.239	0.244	1.23	0.095	0.133
Total Antimony (Sb)				-	<0.0025	<0.0025	<0.0025	<0.0025	<0.0025
Total Arsenic (As)	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	-	0.00986	0.0112	0.0113	0.00787	0.00717
Total Barium (Ba)				-	0.0904	0.0867	0.141	0.0869	0.109
Total Beryllium (Be)				-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Total Boron (B)			29 mg/L (short term); 1.5 mg/L (long term)	-	0.57	0.54	0.71	0.36	<0.25
Total Cadmium (Cd)			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	-	<0.000050	<0.000050	0.000128	0.000091	0.000053
Total Chromium (Cr)				-	<0.0050	<0.0050	0.0053	<0.0050	<0.0050
Total Copper (Cu)	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	-	0.0189	0.0189	0.0163	0.0133	0.0065
Total Iron (Fe)			300 ug/L (long term) (or 0.3mg/L)	-	0.45	0.496	2.69	0.262	0.294
Total Lead (Pb)	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	-	0.001	<0.0010	0.0034	<0.0010	<0.0010
Total Lithium (Li)				-	0.453	0.445	0.541	0.31	0.186
Total Manganese (Mn)				-	0.495	0.481	0.655	0.632	0.423
Total Molybdenum (Mo)			73 ug/L (long term) (or 0.073 mg/L)	-	0.0279	0.0266	0.021	0.0146	<0.0050

Total Nickel (Ni)	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	-	0.0578	0.0598	0.0674	0.0609	0.0301
Total Selenium (Se)			1 ug/L (long term) (or 0.001 mg/L)	-	0.00089	0.00102	0.00095	0.00092	<0.00050
Total Silver (Ag)				-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Total Strontium (Sr)				-	9.79	9.28	14	7.85	5.05
Total thallium (Tl)			0.8 ug/L (long term) (or 0.0008 mg/L)	-	0.000189	0.000185	0.000296	0.000145	0.000079
Total Tin (Sn)				-	<0.025	<0.025	<0.025	<0.025	<0.025
Total Titanium (Ti)				-	<0.025	<0.025	<0.025	<0.025	<0.025
Total Uranium			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	-	0.0317	0.0305	0.0254	0.0277	0.00976
Total Vanadium				-	<0.025	<0.025	<0.025	<0.025	<0.025
Total Zinc	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	-	0.027	<0.025	<0.025	<0.025	<0.025
Total Calcium				459	471	549	565	432	335
Total Magnesium				106	104	115	127	95.7	54
Total Potassium				39.5	39.6	43.5	50.7	32.9	18.3
Total Sodium				281	265	282	466	268	156

Waterbody : DCP5-Downstream		Site Specific Criteria	MMER Criteria	CCME	2017					
Year										
Date Sampled					5/14/17	5/18/17	5/24/17	6/13/17	6/20/17	7/4/17
Lab Reference					B7A3182	B7A5875	B7A9722	B7C7727	B7D4025	B7E5120
LAB					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Parameters	**Units**									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				-	-	-	96	110	130
Carb. Alkalinity (calc. as CaCO3)	mg/L				-	-	-	<1.0	<1.0	<1.0
Total Ammonia-N	mg/L	14 Effluent		Table (field pH/ field Temp)	5.4	3.1	2.9	4	3.6	26
Conductivity	µmhos/cm				-	-	-	1100	2700	7800
Total Dissolved Solids (TDS)	mg/L	1400			860	718	634	950	2580	6750
Fluoride (F-)	mg/L				-	-	-	-	-	-
Free Cyanide (Cn)	mg/L		0.010		-	-	-	-	-	-
Total Kjeldahl Nitrogen (TKN)	mg/L				-	-	-	-	-	-
Dissolved Organic Carbon (DOC)	mg/L				-	-	-	-	-	-
Total Organic Carbon (TOC)	mg/L				-	-	-	-	-	-
Orthophosphate (P)	mg/L				-	-	-	-	-	-
pH		6.0 to 9.5		6.5-9.0 (long term)	7.48	7.66	7.72	7.89	7.91	7.59
Total Phosphorus (P)	mg/L	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	-	-	-	-	-	-
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	61	19	570	1100	5	12
Dissolved Sulphate (SO4)	mg/L				46	40	43	56	170	430
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	-	-
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	11	5.4	210	350	4.1	4.8
Alkalinity (Total as CaCO3)	mg/L				47	58	75	97	110	140
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	-	-	-	220	660	2300
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.436	0.257	0.146	0.194	0.073	0.878
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L	6	4.13	3.7	3.76	1.96	19.3
Nitrite-Nitrate (as N)	mg/L				6.44	4.38	3.85	3.95	2.03	20.2
Radium-226	Bq/L									
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)	mg/L									
Total Hardness (CaCO3)	mg/L				283	138	464	383	1050	2700
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	-	-	1.64	9.49	-	-
Total Antimony (Sb)	mg/L				-	-	<0.00050	<0.00050	-	-
Total Arsenic (As	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	-	-	0.00968	0.00246	-	-
Total Barium (Ba)	mg/L				-	-	0.108	0.0549	-	-
Total Beryllium (Be)	mg/L				-	-	<0.00010	<0.00010	-	-
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	-	-	<0.050	0.095	-	-
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	-	-	0.00006	0.000012	-	-
Total Chromium (Cr)	mg/L				-	-	0.0061	<0.0010	-	-
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	-	-	0.0124	0.0038	-	-
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	-	-	3.99	0.323	-	-
Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	-	-	0.00363	<0.00020	-	-
Total Lithium (Li)	mg/L				-	-	0.0508	0.59	-	-
Total Manganese (Mn)	mg/L				-	-	0.184	0.0546	-	-
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	-	-	0.004	0.001	-	-
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	-	-	0.0186	0.0147	-	-
Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	-	-	0.00016	<0.00010	-	-
Total Silver (Ag)	mg/L				-	-	0.000031	<0.000020	-	-
Total Strontium (Sr)	mg/L				-	-	1.49	0.526	-	-
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	-	-	0.000037	0.00001	-	-
Total Tin (Sn)	mg/L				-	-	<0.0050	<0.0050	-	-
Total Titanium (Ti)	mg/L				-	-	0.0891	<0.0050	-	-
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	-	-	0.00295	0.00254	-	-
Total Vanadium	mg/L				-	-	0.007	<0.0050	-	-
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	-	-	0.0111	0.0179	-	-

Total Calcium	mg/L				88	44.6	160	119	353	877
Total Magnesium	mg/L				15.3	6.47	15.8	20.7	41.2	124
Total Potassium	mg/L				8.57	4.23	6.89	11.5	17.9	61.2
Total Sodium	mg/L				64.3	44.9	43.7	66.9	79.9	387

Waterbody : DCP5-Downstream		Site Specific Criteria	MMER Criteria	**CCME**						
Year										
Date Sampled					7/11/17	7/18/17	7/26/17	8/1/17	9/10/17	10/2/17
Lab Reference					B7F3007	B7F7257	B7G3476	B7G9742	B7K0900	B7M1107
LAB					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam	Maxxam
Field Measurments										
Water Temperature										
pH										
Conductivity										
Laboratory-Measured										
Parameters	**Units**									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				150	130	130	98	-	-
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	<1.0	<1.0	<1.0	-	-
Total Ammonia-N	mg/L	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	50	58	55	7.4	11	11
Conductivity	µmhos/cm				13000	15000	15000	4800	-	-
Total Dissolved Solids (TDS)	mg/L	1400			9200	9990	9780	4550	5120	3330
Fluoride (F-)	mg/L				-	-	-	-	-	0.14
Free Cyanide (Cn)	mg/L		0.010		-	-	-	-	0.0023	0.0018
Total Kjeldahl Nitrogen (TKN)	mg/L				-	-	-	-	-	-
Dissolved Organic Carbon (DOC)	mg/L				-	-	-	-	-	-
Total Organic Carbon (TOC)	mg/L				-	-	-	-	-	-
Orthophosphate (P)	mg/L				-	-	-	-	<0.010	<0.010
pH		6.0 to 9.5		6.5-9.0 (long term)	7.77	7.62	7.62	7.76	7.93	7.86
Total Phosphorus (P)	mg/L	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	-	-	-	-	-	0.04
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	10	12	10	7	8	48
Dissolved Sulphate (SO4)	mg/L				540	640	710	640	750	650
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		-	-	-	-	0.0064	0.0055
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	2.8	3	4	2.6	9	13
Alkalinity (Total as CaCO3)	mg/L				150	140	130	98	350	240
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	3800	4500	4600	1200	1600	1200
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.861	0.684	0.584	0.109	0.204	0.115
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L (long term)	51	69.1	68.9	5.88	6.8	10.4
Nitrite-Nitrate (as N)	mg/L				51.8	69.8	69.5	5.99	7	10.5
Radium-226	Bq/L							-	-	-
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)	mg/L									
Total Hardness (CaCO3)	mg/L				4650	5060	5830	2000	2530	1930
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	-	0.04	0.07	0.105	<0.030	0.517
Total Antimony (Sb)	mg/L				-	<0.0050	<0.010	<0.0025	<0.0050	<0.0025
Total Arsenic (As	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	-	0.0077	0.0077	0.00686	0.0138	0.0113
Total Barium (Ba)	mg/L				-	0.282	0.261	0.168	0.12	0.0879
Total Beryllium (Be)	mg/L				-	<0.0010	<0.0020	<0.00050	<0.0010	<0.00050
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	-	1.43	1.6	<0.25	<0.50	<0.25
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	-	0.0003	0.00029	0.000114	0.0001	0.000127
Total Chromium (Cr)	mg/L				-	<0.010	<0.020	<0.0050	<0.010	<0.0050
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	-	0.0075	<0.010	0.0082	0.0087	0.0073
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	-	0.25	0.44	0.528	1.37	1.66
Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	-	<0.0020	<0.0040	<0.0010	<0.0020	0.0014
Total Lithium (Li)	mg/L				-	1.8	1.92	0.245	0.288	0.246
Total Manganese (Mn)	mg/L				-	1.83	1.61	1.36	1.55	1.37
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	-	0.021	0.021	0.0075	<0.010	0.0053
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	-	0.299	0.362	0.0923	0.097	0.096

Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	-	<0.0010	<0.0020	0.00051	<0.0010	0.00052
Total Silver (Ag)	mg/L				-	<0.00020	<0.00040	<0.00010	<0.00020	<0.00010
Total Strontium (Sr)	mg/L				-	40.3	39.6	8.46	9.14	8.28
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	-	<0.00010	<0.00020	<0.000050	<0.00010	0.000059
Total Tin (Sn)	mg/L				-	<0.050	<0.10	<0.025	<0.050	<0.025
Total Titanium (Ti)	mg/L				-	<0.050	<0.10	<0.025	<0.050	<0.025
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	-	0.038	0.0418	0.0064	0.0103	0.0111
Total Vanadium	mg/L				-	<0.050	<0.10	<0.025	<0.050	<0.025
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	-	0.47	0.46	0.048	<0.050	<0.025
Total Calcium	mg/L				1480	1620	1910	649	607	523
Total Magnesium	mg/L				232	245	259	92.6	245	152
Total Potassium	mg/L				113	120	132	36.5	56	39.2
Total Sodium	mg/L				852	908	970	191	299	233

Waterbody : Mel-17		Site Specific Criteria	MMER Criteria	CCME	2017			
Year								
Date Sampled					6/24/2017	7/24/2017	8/23/2017	9/13/2017
Lab Reference					B7D6320	B7G3631	B7I6940	B7K4224
LAB					MAXXAM	MAXXAM	MAXXAM	MAXXAM
Field Measurments								
GPS Coordinates					540685-6989588	540685-6989588	540685-6989588	540685-6989588
Water Temperature	oC				-	-	15.5	8.9
pH	pH units				-	-	8.51	8.36
Conductivity	(mS/cm)				-	-	0.677	0.802
Parameters	**Units**							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L				34	40	46	56
Carb. Alkalinity (calc. as CaCO3)	mg/L				<1.0	<1.0	<1.0	<1.0
Total Ammonia-N	mg/L	14 Effluent 18 Grab sample		Table (field pH/ field Temp)	0.23	0.04	0.02	0.04
Conductivity	µmhos/cm				510	800	700	620
Total Dissolved Solids (TDS)	mg/L	1400			406	736	600	620
Free Cyanide (Cn)	mg/L		0.010		-		<0.0010	0.0016
Total Kjeldahl Nitrogen (TKN)	mg/L				0.62	0.45	0.56	0.4
Dissolved Organic Carbon (DOC)	mg/L				7.7	11	10	-
Total Organic Carbon (TOC)	mg/L				7.9	11	11	9.9
Orthophosphate (P)	mg/L				<0.010	<0.010	0.026	0.011
pH		6.0 to 9.5		6.5-9.0 (long term)	7.53	7.71	7.82	7.87
Total Phosphorus (P)	mg/L	2.0 Effluent 4.0 Grab sample		ultra-oligotrophic <4 ug/L (or 0.004 mg/L) or oligotrophic 4-10 (0.004 to 0.01 mg/L)	0.007	0.006	0.007	0.005
Total Suspended Solids (TSS)	mg/L	15 Effluent 30 Grab sample	15 Effluent 30 Grab sample	Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d).	1	2	<10	2
Dissolved Sulphate (SO4)	mg/L				13	18	13	18
Total Cyanide (Cn)	mg/L	0.5 Effluent 1 Grab sample	0.010		-	<0.0050	<0.0050	<0.0050
Turbidity	NTU			Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).	0.5	0.4	0.8	0.6
Alkalinity (Total as CaCO3)	mg/L				34	40	47	56
Dissolved chloride (Cl)	mg/L			640 mg/L (short term); 120 mg/L (long term)	120	190	160	140
Nitrite (as N)	mg/L			60 mg/L NO2-N (long term)	0.017	<0.010	<0.010	<0.010
Nitrate (as N)	mg/L			550 mg/L (short term); 13 mg/L (long term)	0.31	<0.10	<0.10	<0.10
Nitrite-Nitrate (as N)	mg/L				0.33	<0.10	<0.10	<0.10
Radium-226	Bq/L							
Mercury (Hg)	mg/L			0.026 ug/L (long term) (or 0.00026 mg/L)	<0.00001	<0.00001	<0.00001	<0.00001
Dissolved Mercury (Hg)	mg/L				<0.00001	<0.00001	<0.00001	<0.00001
Total Hardness (CaCO3)	mg/L				168	253	43	-
Total Aluminium (Al)	mg/L	2 Effluent 3 Grab sample		5 µg/L (0.005 mg/L)if pH < 6.5 ; 100 µg/L (0.1 mg/L) if pH ≥ 6.5	0.006	<0.0030	0.0031	0.0083
Total Antimony (Sb)	mg/L				<0.00050	<0.00050	<0.00050	<0.00050
Total Arsenic (As	mg/L	0.3 Effluent 0.6 Grab sample		5 ug/L (long term) (or 0.005 mg/L)	0.00064	0.00079	0.0008	0.00069
Total Barium (Ba)	mg/L				0.0516	0.0632	0.0558	0.0552
Total Beryllium (Be)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010
Total Boron (B)	mg/L			29 mg/L (short term); 1.5 mg/L (long term)	<0.050	<0.050	<0.050	<0.050
Total Cadmium (Cd)	mg/L			1 ug/L or 0.001 mg/L (short term) ; 0.09 ug/L or 0.00009 mg/L (long term)	<0.000010	<0.000010	<0.000010	<0.000010
Total Chromium (Cr)	mg/L				<0.0010	<0.0010	<0.0010	<0.0010
Total Copper (Cu)	mg/L	0.2 Effluent 0.4 Grab sample		if hardness 0 to < 82 mg/L, the CWQG is 2 µg/L (or 0.002 mg/L) ; if hardness >180 mg/L, the CWQG is 4 µg/L (or 0.004 mg/L)	0.00093	0.00092	0.00095	0.00102
Total Iron (Fe)	mg/L			300 ug/L (long term) (or 0.3mg/L)	0.149	0.12	0.217	0.208
Total Lead (Pb)	mg/L	0.2 Effluent 0.4 Grab sample	0.2 Effluent 0.4 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 1 µg/L (or 0.001 mg/L) At hardness >180 mg/L, the CWQG is 7 µg/L (or 0.007mg/L)	<0.00020	<0.00020	<0.00020	<0.00020
Total Lithium (Li)	mg/L				0.0376	0.0604	0.0498	0.0394
Total Manganese (Mn)	mg/L				0.0406	0.0111	0.0186	0.0294
Total Molybdenum (Mo)	mg/L			73 ug/L (long term) (or 0.073 mg/L)	<0.0010	<0.0010	<0.0010	<0.0010
Total Nickel (Ni)	mg/L	0.5 Effluent 1.0 Grab sample	0.5 Effluent 1.0 Grab sample	hardness is 0 to ≤ 60 mg/L, the CWQG is 25 µg/L (or 0.025 mg/L) hardness >180 mg/L, the CWQG is 150 µg/L (or 0.15 mg/L)	0.0014	0.0013	0.0012	0.0017
Total Selenium (Se)	mg/L			1 ug/L (long term) (or 0.001 mg/L)	<0.00010	<0.00010	<0.00010	<0.00010
Total Silver (Ag)	mg/L				<0.000020	<0.000020	<0.000020	<0.000020
Total Strontium (Sr)	mg/L				0.719	1.11	0.953	0.811
Total thallium (Tl)	mg/L			0.8 ug/L (long term) (or 0.0008 mg/L)	<0.000010	0.000011	<0.000010	<0.000010
Total Tin (Sn)	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Total Titanium (Ti)	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Total Uranium	mg/L			33 ug/L (short term) (or 0.033 mg/L); 15 ug/L (long term) (or 0.015 mg/L)	<0.00010	0.00012	0.0001	0.00018
Total Vanadium	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Total Zinc	mg/L	0.4 Effluent 0.8 Grab sample		30 ug/L (long term) (or 0.03 mg/L)	<0.0050	<0.0050	<0.0050	<0.0050

Total Calcium	mg/L				56.5	84	90.8	72.3
Total Magnesium	mg/L				6.53	10.6	9.55	8.31
Total Potassium	mg/L				3.53	5.45	5.23	4.12
Total Sodium	mg/L				19.8	32	28	21.5
Dissolved Metals								
Dissolved Hardness	mg/L				162	241	41.4	-
Dissolved Aluminium (Al)	mg/L				0.0038	<0.0030	<0.0030	0.0079
Dissolved Antimony (Sb)	mg/L				<0.00050	<0.00050	<0.00050	<0.00050
Dissolved Arsenic (As	mg/L		0.010		0.00061	0.00076	0.0008	0.00063
Dissolved Barium (Ba)	mg/L				0.0493	0.0607	0.0561	0.0511
Dissolved Beryllium (Be)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Boron (B)	mg/L				<0.050	<0.050	<0.050	<0.050
Dissolved Cadmium (Cd)	mg/L				<0.000010	<0.000010	<0.000010	<0.000010
Dissolved Chromium (Cr)	mg/L				<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Copper (Cu)	mg/L		0.010		0.00083	0.00079	0.00088	0.00085
Dissolved Iron (Fe)	mg/L				0.077	0.0726	0.119	0.116
Dissolved Lead (Pb)	mg/L		0.010		<0.00020	<0.00020	<0.00020	<0.00020
Dissolved Lithium (Li)	mg/L				0.0399	0.0583	0.0496	0.0356
Dissolved Manganese (Mn)	mg/L				0.0251	0.0095	0.0141	0.0257
Dissolved Molybdenum (Mo)	mg/L				<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Nickel (Ni)	mg/L		0.020		0.0013	0.0012	0.0012	0.0015
Dissolved Selenium (Se)	mg/L				<0.00010	<0.00010	<0.00010	<0.00010
Dissolved Silver (Ag)	mg/L				<0.000020	<0.000020	<0.000020	<0.000020
Dissolved Strontium (Sr)	mg/L				0.71	1.16	0.94	0.767
Dissolved thallium (Tl)	mg/L				0.00001	0.00001	<0.000010	<0.000010
Dissolved Tin (Sn)	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Titanium (Ti)	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Uranium	mg/L				<0.00010	0.00011	0.0001	0.00017
Dissolved Vanadium	mg/L				<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Zinc	mg/L		0.010		<0.0050	<0.0050	<0.0050	<0.0050
Dissolved Calcium	mg/L				54.3	80.3	84.6	64.4
Dissolved Magnesium	mg/L				6.32	9.91	9.77	7.97
Dissolved Potassium	mg/L				3.39	5.35	5.11	4.23
Dissolved Sodium	mg/L				19.7	29.9	27.8	21.8
Reactive Silica (Si)	mg/L				0.52	1.3	1.5	2.9

Note:
- not analyzed
BOLD - exceeds oneor more guidelines

Appendix G

Summary of Public Consultations and Participation

Public Consultation 2017 Meliadine

Date	Title	Location	Type	Subject categories
2017-12-11	Meeting with Peter Tapatai		In person	
2017-12-09	One-on-one assistance with M&T		Meeting	IIBA - Contractor Training
2017-11-24	By Pass road site visit with Elder/HTO representative	Rankin Inlet, NU	In person	Community - Community Development / Infrastructure / Investment Community - Hunting / Harvesting / Fishing Community - Hunters and Trappers' Organization (HTO) Community - Impacts Environment - Visual Impacts
2017-11-24	Training discussion with Albert Netser (Arctic College director for Trades program)		In person	Training / Education
2017-11-17	Rankin Inlet Community Information Session	Rankin Inlet, NU	Open House	Community - Business opportunities / Business development Community - Community Development / Infrastructure / Investment Community - Community Visits Community - Scholarships Community - Consultation Community Community Agreements - Community Investment Fund (CIF) Community Agreements Human Resources - Recruitment Human Resources - Labour Pool Process
2017-11-09	Hamlet Agnico Gala		Meeting	Community - Assistance, Donation or Sponsorship
2017-10-23	FW: Partnership Agreement-Whale Cove		Meeting	Community Agreements - Community Coordinator Agreement Community Agreements - Community Partnership Agreement
2017-10-20	Rankin HTO Meeting - October 20-2017.docx		Meeting	Community - Hunters and Trappers' Organization (HTO)
2017-10-12	Community Liaison Committee Meeting-Oct 11		Meeting	Community - Business opportunities / Business development Community - Community Development / Infrastructure / Investment Community - Hunting / Harvesting / Fishing Community - Hunters and Trappers' Organization (HTO) Community - TASK Week Community - Community Liaison Committee (CLC) Community - Wellness Planning Environment - Hazardous Waste / Waste Environment - Dust Environment - Wildlife Community Agreements - Family Days Human Resources - Recruitment Human Resources - Labour Pool Process
2017-10-03	FW: Information Meeting - TODAY 5:30		Meeting	Community - Community Development / Infrastructure / Investment Community
2017-09-22	Aluki Kotierk, NTI President		In person	Community - Impacts Community - Gender Equity Community - Employment/Jobs IIBA - Implementation IIBA Socio-Economic Training / Education
2017-09-22	Presented to Exucutive Development Leadership Program in Iqaluit	Iqaluit, NU	In person	Community Socio-Economic Training / Education Human Resources
2017-09-20	Kivalliq Mayors meeting	Rankin Inlet, NU	Meeting	Community IIBA Socio-Economic

Date	Title	Location	Type	Subject categories
2017-08-02	13 December 2016 Hamlet Council Meeting - Itivia	Rankin Inlet, NU	Meeting	Community - Community Development / Infrastructure / Investment Government - Permitting Project - Construction Activities
2017-07-27	Rankin Inlet Public Meeting - Itivia	Rankin Inlet, NU	Public Meeting	Community - Community Development / Infrastructure / Investment Environment - Vibration Environment - Dust Environment - Caribou Project - Construction Activities Issues or Concerns - Complaint
2017-07-26	Rankin HTO Meeting	Rankin Inlet, NU	Meeting	Community - Hunters and Trappers' Organization (HTO)
2017-07-18	Rankin Inlet - Community Open House		Meeting	Community Environment - Dust Project - Construction Activities
2017-07-18	Rankin Inlet - Open House Itivia	Rankin Inlet, NU	Open House	Environment - Dust Project - Construction Activities Issues or Concerns - Complaint
2017-07-17	Rankin SAO: Dust control	Rankin Inlet, NU	Meeting	Community - Impacts Environment - Dust Environment - Water
2017-07-12	MEL OSWG #2017-01	Rankin Inlet, NU	Meeting	IIBA - Meliadine Working Group
2017-07-11	Phone call with Nunavut Airports - Itivia project		Meeting	
2017-07-10	Meeting with Chesterfield Hamlet Council	Chesterfield Inlet, NU	In person	
2017-07-05	Meeting with Coral Harbour HTO	Chesterfield Inlet, NU	In person	Project - Whale Tail
2017-06-19	High school awards	Rankin Inlet, NU	In person	Community
2017-06-19	Phone call with Nunavut Airports - Itivia Permitting project		Meeting	Government - Permitting
2017-06-08	Meeting with Panniuq		Meeting	IIBA - KIA Information Transmission IIBA - Meadowbank Working Group
2017-06-05	Q2 Employment session Rankin Inlet	Rankin Inlet, NU	Open House	IIBA Human Resources - Labour Pool Process
2017-05-23	Implementation Committee Meeting #2017-01	Rankin Inlet, NU	Meeting	IIBA - Implementation Committee (IC)
2017-05-18	CPA Financial Statements Training Review	Rankin Inlet, NU	Meeting	Community - Business opportunities / Business development Training / Education
2017-05-17	Rankin Shooting Range		Meeting	Community - Community Development / Infrastructure / Investment Health & Safety
2017-05-17	Meliadine On-Site IIBA Awareness	Rankin Inlet, NU	Meeting	IIBA - Implementation
2017-05-17	Meliadine On-Site IIBA Awareness	Rankin Inlet, NU	Meeting	IIBA - Implementation
2017-05-16	High School Awards	Rankin Inlet, NU	Meeting	Training / Education
2017-05-16	IIBA awareness and BOC visit presentation notes	Rankin Inlet, NU	Meeting	IIBA - Business Opportunities Committee (BOC)
2017-05-16	Phone call with Nunavut Airports - Itivia Permitting project		Meeting	Government - Permitting
2017-05-15	Rankin Hamlet Agnico Working group	Rankin Inlet, NU	Meeting	Community - Hamlet Working Committee Community - Impacts Community Community Agreements - Community Investment Fund (CIF) Community Agreements - Green Community Agreement Health & Safety
2017-05-12	2017 Business Opportunities Information Session - Rankin Inlet		Open House	Procurement - Pre-qualification Process Procurement - Tendering Process
2017-05-10	Meliadine On-Site IIBA Awareness	Rankin Inlet, NU	Meeting	IIBA - Implementation

Date	Title	Location	Type	Subject categories
2017-05-04	Site Tour		Site Tour	Community - Impacts Environment - Visual Impacts
2017-04-28	Phone call with Hamlet - Itivia Permitting project		Meeting	Government - Permitting
2017-04-24	Hamlet Council meeting - Itivia Permitting project	Rankin Inlet, NU	Meeting	Government - Permitting
2017-04-20	Introduced and set up future meeting re: Itivia Emergency Services		Meeting	Community - Impacts Community
2017-04-20	2017 Q1: Open Door Baker Lake	Baker Lake, NU	Public Meeting	IIBA - Business Opportunities Committee (BOC) IIBA - Employment and Culture Committee (ECC) Project - Whale Tail Procurement - Pre-qualification Process Human Resources - Labour Pool Process
2017-04-19	2017 Q1: Rankin Inlet - Itivia Open House and Q1 Employment Information Session April 2017	Rankin Inlet, NU	Open House	IIBA - Employment Information Session (EIS) Project - Construction Activities Human Resources - Labour Pool Process
2017-04-13	Meeting with Nunavut Airports - Itivia Permitting project		Meeting	Government - Permitting
2017-04-03	Phone call with Hamlet - Itivia Permitting project		Meeting	Government - Permitting
2017-03-31	Baker Lake Interim Mayor		Meeting	Community - Community Development / Infrastructure / Investment Community - Assistance, Donation or Sponsorship Community Government Socio-Economic Community Agreements Training / Education
2017-03-31	Rankin Inlet - Itivia Open House March 2017		Open House	Project - Construction Activities Human Resources - Labour Pool Process
2017-03-30	Robert Janes Hudson Bay Roundtable		Meeting	Community Government
2017-03-30	Mayor Bob Leonard		Meeting	Community Government
2017-03-30	Naujaat Mayor		Meeting	Community Government
2017-03-24	Phone call with Nunavut Airports - Itivia Permitting project		Meeting	Government - Permitting
2017-03-16	Hamlet meeting re: boat launch and Itivia Project		In person	
2017-03-16	informal meeting with councillor	Rankin Inlet, NU	In person	Community - Hamlet Working Committee Project
2017-03-15	Meeting with National Defense - Itivia Permitting project		Meeting	Government - Permitting
2017-03-13	Hamlet Council meeting - Itivia Permitting project	Rankin Inlet, NU	Meeting	Government - Permitting
2017-02-27	Meeting with Nunavut Airports - Itivia Permitting project	Rankin Inlet, NU	Meeting	Government - Permitting
2017-02-27	Hamlet Council Meeting - Itivia Permitting project	Rankin Inlet, NU	Meeting	Government - Permitting
2017-02-17	Hamlet AEM Working group meeting	Rankin Inlet, NU	Meeting	Community
2017-02-10	Itivia and NU Airports		In person	Community
2017-01-25	Meeting with Nunavut Airports - Itivia Permitting project	Rankin Inlet, NU	Meeting	Government - Permitting
2017-01-24	Meeting with National Defense - Itivia Permitting project		Meeting	Government - Permitting
2017-01-19	Boat laung idea meeting with Hamlet		Meeting	Community
2017-01-17	Boat launch idea		Meeting	Community

Appendix H

Upcoming Events and Information Sessions

Q1 - 2018 Employment Information Sessions

Date	Community	Time (4 hours)	Location
26-Mar	Arviat	1 p.m. 5 p.m.	Community Hall
TBD	Whale Cove	TBD	Hamlet Chambers
23-Mar	Chesterfield Inlet	1 p.m. 5 p.m.	Agnico Office
TBD	Rankin Inlet	TBD	Inns North
9-Mar	Coral Harbour	1 p.m. 5 p.m.	Hamlet Chambers
26-Mar	Naujaat	1 p.m. 5 p.m.	Hamlet Chambers
22-Mar	Baker Lake	2 p.m. 6 p.m.	Agnico Office

Q1 Meetings

Date	Community	Type of Meeting	Topic
18-Jan	Rankin Inlet	ECC Meeting	
5-Feb	Rankin Inlet	BOC Meeting	
8-Feb	Baker Lake	Community Meeting	Inpit disposal
12-Feb	Rankin Inlet	IC Meeting	
13-Feb	Whale Cove	Community Meeting	Huckleberry
14-Feb	Arviat	Hamlet Meeting	
15-Feb	Rankin Inlet	Hamlet Meeting	
19-Feb	Rankin Inlet	Working Committee	Diffuser + Huckleberry
21-Feb	Whale Cove	Community Meeting	Huckleberry
26-Feb	Rankin Inlet	Community Meeting	Diffuser
6-Mar	Rankin Inlet	Hamlet Meeting	Diffuser
6-Mar	Rankin Inlet	Community Meeting	Diffuser
12-Mar	Rankin Inlet	ECC Meeting	
14-Mar	Meliadine	CEDO visit at Meliadine	
15-Mar	Rankin Inlet	Community Meeting	Diffuser

Q2 Meetings

3-Apr	Rankin Inlet	BOC Meeting	
9-Apr	Rankin Inlet	ECC Meeting	
8-May	Rankin Inlet	IC Meeting	
15-May	Rankin Inlet	ECC Meeting	
13-Jun	Rankin Inlet	BOC Meeting	

Q3 Meetings

10-Jul	Rankin Inlet	ECC Meeting	
8-Aug	Rankin Inlet	IC Meeting	
21-Aug	Rankin Inlet	BOC Meeting	

Q4 Meetings

4-Sep	Rankin Inlet	ECC Meeting	
16-Oct	Rankin Inlet	BOC Meeting	
20-Nov	Rankin Inlet	IC Meeting	
27-Nov	Rankin Inlet	ECC Meeting	
4-Dec	Rankin Inlet	BOC Meeting	

Appendix I

2017 Annual Geotechnical Inspection

21 March 2018

MELIADINE GOLD PROJECT, RANKIN INLET, NUNAVUT

2017 Annual Geotechnical Inspection

Submitted to:
Agnico Eagle Mines Limited
PO Box 879
Rankin Inlet, Nunavut
X0C 0G0

Attention: Ms. Jennifer Brown

REPORT

Reference Number: 1660296-024-R-Rev0-3000

Distribution:

1 Hard Copy - Agnico Eagle Minest Limited
Electronic Copy - Agnico Eagle Mines Limited
Electronic Copy - Golder Associates Ltd.

Golder Associates

Executive Summary

Agnico Eagle Mines Limited (AEM) retained Golder Associates Ltd. (Golder) to conduct the 2017 annual geotechnical inspection of the Meliadine Gold Project (Project) to comply with the requirements of AEM's Water Licence No. 2AM-MEL1631 (Water Licence). The inspection was conducted between 19 September and 22 September 2017 and covered the geotechnical aspects and review of the available instrumentation data for water management infrastructure, roads, waste facilities, and infrastructure pads in the following areas:

- main site
- exploration camp site
- all-weather access road (AWAR)
- Itivia site and by-pass road

Infrastructure for the mine is progressively being built, including some of the water management collection ponds, associated dikes, the tailings storage facility, open pits, waste rock storage facilities, diversion berms and channels. The inspection was carried out in accordance with the requirements of the Water Licence, for the facilities in existence at the time of the inspection.

The inspection occurred when there was no snow or ice on the lakes or land, following the freshet, and when surface water flows were generally low. Peak surface water flows typically occur during the freshet (mid-June to mid-July). During the inspection the weather was generally clear with some periods of rain. Daily temperatures varied between 0°C and 10°C. Water levels were considered to be normal for this period of the year, and the flow observed at water crossings was low.

AEM's environmental department monitors the water levels and quality in the collection ponds and collects instrumentation data; however, no geotechnical inspections are conducted and the instrumentation data is not reviewed.

The results of the 2017 annual geotechnical inspection carried out at the Project site, along the All Weather Access Road (AWAR), and at the Itivia site, indicate that the infrastructure was generally in good condition and performing as designed.

The following presents a summary of the key findings and recommendations from the 2017 geotechnical inspection for the infrastructure in each of the areas inspected:

Main site:

- It is recommended that an operation, maintenance, and surveillance (OMS) manual be developed for the water management infrastructure on site, including requirements for regular geotechnical inspections and monitoring of the structures, including collection, plotting, and review of instrumentation data.
- An Emergency Response Plan should also be developed to address the consequences of failure of the water management structures.

- Geotechnical inspections should be carried out and documented for all facilities following the schedule specified in the OMS manual. In addition, instrumentation should be monitored and the data reviewed, following the schedule specified in the OMS manual.
- The containment pond dikes, have been designed to have a frozen core, which is to function as a low permeability barrier, to reduce seepage through the structures. Therefore, to reduce the potential for infiltration, cracks and areas of minor settlement in the containment pond dikes should be monitored and filled and/or re-contoured.
- Where access is feasible, removal of snow from the water collection pond dikes (temporary and permanent) is recommended to reduce the insulating effects of the snow, thereby allowing the temperature of the core material in the dikes and the foundations to drop as low as possible. Snow removal is more important if thermistor data indicates that temperatures within the dikes and/or foundation are warmer than expected.
- Water volumes within containment ponds should be managed (pumped down in the fall), to maximize capacity for storage during the freshet.
- A cover layer of coarser rockfill should be placed where esker sand has been used for construction of infrastructure to reduce erosion potential.
- The Wesmeg Borrow Area should be re-contoured and either capped with a coarser material or revegetated to reduce erosion.
- The openings in the berm around the perimeter of Portal No. 2 should be filled in to provide a complete perimeter berm and loose materials on the benches around the portal excavation should be pulled back to reduce the potential for material to roll into the excavation.
- If the exploration landfill is kept in operation, it is recommended that its berms be compacted to fill in the cracks to reduce further slumping and erosion. A coarser rockfill should also be placed on the berm slopes and crests to reduce erosion.
- Remediate the disturbance adjacent to the new emulsion plant road through backfill, grading, placement of coarse material or revegetation to reduce the potential for ponding adjacent to the road and erosion.
- If ponding occurs adjacent to site roads, consideration should be given to installing culverts to facilitate drainage and reduce the potential for permafrost degradation.
- Roadway embankment slope angles and material types should be selected such that they do not negatively affect wildlife movement and erosion. Embankment materials should be compacted to reduce the potential of the material being eroded, and if necessary a coarser, well graded, material could be placed and compacted to further reduce erosion potential.
- When culverts are installed, ensure bedding material surrounding culverts is of a suitable gradation (e.g., sandy) and compacted. Larger sized particles (e.g., cobbles) should not be placed in direct contact with the culverts.
- Implement a road and culvert monitoring program for site roads, as is done for the AWAR, which is tied to a maintenance program.

Exploration Camp Site:

- Repair surface erosion along south slope of exploration camp pad. Grade surface to reduce channelization of surface water flows and therefore reduce the potential for the erosion to reoccur. In this area, a coarser surfacing layer could be placed on top to help reduce the potential for future erosion.
- AEM should try to minimize the amount of water contained within the exploration landfarm until it is decommissioned and remediated.

AWAR:

- Continue to monitor culverts and hydraulic effectiveness to assess if current culverts provide adequate capacity or if additional culverts are required. Evaluate if any culverts need to be installed at a lower elevation to reduce ponding, and downstream erosion.
- The kilometre markings on the AWAR culverts should be checked and replaced with accurate numbers.
- Continue regular road inspections and documentation, snow removal, and maintenance of the AWAR.

Itivia Site and By-pass Road:

- Once construction is complete, develop and implement a visual geotechnical monitoring program for the slopes and berms at the Itivia site.
- Once the road is in use, develop and implement a road and culvert monitoring program for the Itivia by-pass road, as is done for the AWAR, which is tied to a maintenance program.

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APPENDICES

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Meliadine Site Photographs

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P-Area: DP1-A, DP1-B, DP2-A, DP3-A

APPENDIX A 2
Permanent Water Management Facilities: D-CP1, D-CP5, Channel 5, Berm 3, Saline Pond, and Channel 2

APPENDIX A 3
Site Roads and Culverts, Wesmeg Borrow Area, Tiriganiaq Esker Area, Emulsion Plant Pad and Access Road, Main Site Water Intake Access Road

APPENDIX A 4
Waste Rock and Ore Storage Piles

APPENDIX A 5
Industrial Pad and Other Site Facilities: Landfarm, Effluent Water Treatment Plant Pad and Intake, Underground Portal No. 1 and Underground Portal No. 2, Fuel Storage, Ventilation Intake Pad, Exploration Landfill, and Operation Landfill

APPENDIX A 6
Exploration Camp Pad and Access Road, Fresh Water Intake, Diffuser Access, Fuel Storage, and Landfarm

APPENDIX B
Meliadine All-Weather Access Road (AWAR) Inspection Photographs

APPENDIX C
Thermistor Locations and Data

APPENDIX C 1
Background Permafrost Thermistor Locations and Data

APPENDIX C 2
P-Area, D-CP1, and D-CP5 Thermistor Locations and Data

APPENDIX D
Itivia Site and By-pass Road Inspection Photographs

APPENDIX D 1
Itivia Site

APPENDIX D 2
Itivia By-pass Road Inspection Photographs

1.0 INTRODUCTION

Agnico Eagle Mines Limited (AEM) is developing the Meliadine Gold Project (the Project). It is located approximately 25 km north of Rankin Inlet, in the Kivalliq Region of Nunavut. A series of open pits as well as underground development will be used to extract gold.

AEM retained Golder Associates Ltd. (Golder) to conduct the 2017 annual geotechnical inspection for the Project, pursuant to the requirements of the Type A Water Licence Permit No.2AM-MEL1631 (Nunavut Water Board 2016).

Under Part I, Item 14 (page 21) and Schedule I, Item 1 (page 39) of the Water Licence, AEM is required to undertake an annual geotechnical inspection of its facilities between the months of July and September. The inspection is to be carried out by a geotechnical engineer, and to be in accordance with the Canadian Dam Association (CDA) *Dam Safety Guidelines* (CDA 2013), where applicable. The inspection occurred between 19 and 22 September 2017, and was conducted by Allison Isidoro, a geotechnical engineer, holding professional registration in Nunavut, and employed by Golder.

Construction of the infrastructure for the Project has commenced and will continue in stages as development and mining progresses. The following structures were inspected:

- main site including
  - P-Area temporary collection ponds (P1, P2, and P3) and associated dikes (DP1-A, DP1-B, DP2-A, DP3-A)
  - permanent water collection ponds CP1 and CP5 and their associated dikes (D-CP1 and D-CP5)
  - diversion Berm 3
  - diversion Channel 2 and Channel 5
  - saline pond
  - site roads
    - industrial pad area, including Culvert 3 and Culvert 4
    - road to Tiriganiaq Esker, including Culvert 6
    - road to Wesmeg Borrow Area
    - main site water intake access road
    - new emulsion plant pad and road
  - current explosives (ANFO plant) pad and magazine storage
  - Wesmeg borrow and vent raise
  - ore and waste rock storage areas
  - industrial site pad
  - landfarm

  - exploration and operations landfills
  - effluent water treatment plant and intake causeway
  - underground Portals No. 1 and No. 2
  - new fuel storage
  - ventilation intake pad
- exploration camp site including
  - site pad and diffuser access
  - fresh water intake
  - access road
  - landfarm
  - fuel storage
- all-weather access road (AWAR)
- Itivia site
  - fuel storage
  - bypass road

The facilities at the main mine site and exploration camp areas that had been constructed at the time of the 2017 inspection are shown in Figure 1. At the time of the inspection, the P-Area had been completed in addition to permanent water management pond dikes D-CP1 and D-CP5. Some site service roads were in place with the associated culverts and ditches constructed to manage water around infrastructure and roads. Construction of the industrial pad was ongoing. Most of the rockfill pad had been constructed and active construction was largely of the facilities. Underground Portal No. 1 was operational. Underground development was occurring, with associated waste rock and ore being hauled to the surface and placed in stockpiles. The entrance to underground Portal No. 2 was complete and the drift was being advanced. The ventilation intake pad had been constructed and the ventilation intake building was under construction. The operations landfill and landfarm facilities had been constructed but were not yet in use. The effluent water treatment plant and associated intake had been constructed; however, not commissioned. The fresh water intake pump and associated pipeline were in place and an access road had been constructed to within a few metres of the lake; however, a causeway and permanent pump house had not been built. The pipeline was running along the toe of the road. The fuel storage facility was partially constructed. Liner had been placed over the base of the facility and the tanks were in place, but liner had not been extended up the slopes of the containment berms. The saline water pond had been constructed and was storing water. The emulsion plant was under construction and the access road had recently been constructed.

The exploration camp site was the first area of the Project to be developed and at the time of the site visit the exploration camp and office facilities were being used, but AEM was in the process of transitioning staff to the new camp facilities at the main site. Once the multi-purpose building is complete offices will also be transitioned to the main site. It is expected that the exploration camp will be used until approximately December 2018. The exploration site was inspected, including the site pad, fresh water intake, diffuser access, landfarm, fuel storage, and access road.

Many other aspects of the future development for the Project had not been constructed at the time of the visit including: the water management collection ponds (CP3, CP4, and CP6) and associated dikes (D-CP3, D-CP4, and D-CP6), tailings storage facility, open pits, waste rock storage facilities, ore storage facilities, diversion berms 1 and 2, several diversion channels (1, 3, 4, 6, 7, and 8). The final layout of the main site, including water management structures, is shown on Figure 2.

The AWAR connecting Rankin Inlet to the Project provides one-way traffic access (with pull-outs to allow vehicles to pass) and was in use.

The Itivia shipping and fuel storage site in Rankin Inlet was under construction. The site pads were in place and the fuel storage facility was under construction with active liner placement at the time of the site visit. The Itivia bypass road was under construction.

Where applicable, the inspection was performed consistent with the principles set out by the CDA (2013). The inspection consisted of visually observing each of the facilities listed above; taking photographs to document the conditions at the time of the inspection (Appendix A, Appendix B, and Appendix D); reviewing instrumentation data (Appendix C), inspection reports, and other relevant files and reports (listed in the reference section of this report); communication with AEM on-site staff (Mr. Jeffrey Pratt and Ms. Jennifer Brown); and preparation of this report to document the inspection.

The inspection occurred when there was no snow or ice on the lakes or land, following the freshet, and when surface water flows were generally low. Peak surface water flows typically occur during the freshet (mid-June to mid-July). During the inspection, the weather was generally clear with some periods of rain. Daily temperatures varied between 0°C and 10°C. Water levels were considered to be normal for this period of the year, and the flow observed at water crossings was low.

The site water management plan (AEM 2017) provides a summary of the water management infrastructure and the overall water management approach.

This report describes the geotechnical aspects of the areas inspected and presents general observations and recommendations. In addition, a description of the geophysical and permafrost conditions for the site is provided.

1.1 Scope Limitations

The scope of the inspection is limited to observation of the geotechnical aspects of each of the facilities listed above and review of the associated instrumentation data. The inspection did not include other assessments such as structural, mechanical, or environmental.

For additional information related to the limitations of this scope, reference should be made to the Study Limitations following the main text of this report.

EMULSION PLANT PAD
FRESH WATER PUMPING STATION
CHANNEL 2
INDUSTRIAL PAD
MELIADINE ESKER QUARRY
LANDFARM
EFFLUENT WATER TREATMENT PLANT AND INTAKE CAUSEWAY
CP1
MELIADINE LAKE
OPERATIONS LANDFILL
CULVERT 2
CULVERT 3
CULVERT 4
PORTAL #2
EXPLORATION LANDFILL
D-CP1
ORE AND WASTE STOCKPILES
FUEL STORAGE
P1
P-AREA
P2
P3
SALINE WATER STORAGE / TRANSFER POND / BERM
CULVERT 6
PORTAL No. 1
CP5
CP5 JETTY
CHANNEL 5
ANFO PLANT
BERM 3
VENTILATION INTAKE
D-CP5
MAGAZINE STORAGE
WESMEG ESKER QUARRY
EXPLORATION CAMP WATER INTAKE
DIFFUSER
EXPLORATION CAMP
MELIADINE LAKE
EXPLORATION LAND FARM
EXPLORATION FUEL STORAGE AREA
GATE HOUSE
AWAR
538 000 E
538 500 E
539 000 E
539 500 E
540 000 E
540 500 E
541 000 E
541 500 E
542 000 E
542 500 E
543 000 E
543 500 E
6 990 500 N
6 990 000 N
6 989 500 N
6 989 000 N
6 988 500 N
6 988 000 N
0 250 500
1:7,500 METRES

LEGEND

- WATER BODY
- EXISTING GROUND CONTOURS

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE IS NOTED.
2. COORDINATE SYSTEM UTM15 NAD83.
3. CONTOUR INTERVAL EVERY 2m.

REFERENCE

1. GENERAL ARRANGEMENT PROVIDED BY HAMEL ARPENTAGE, AUGUST 22 2016. FILE NAME: SK - MELIADINE GENERAL.DWG
2. SITE INFRASTRUCTURE PROVIDED BY AGNICO EAGLE MINES , 20 FEBRUARY, 2018. FILE NAME: 65-000-210-200-2_R2.dwg

CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
MELIADINE GOLD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-19
DESIGNED	AI
PREPARED	MSH/JY
REVIEWED	FE
APPROVED	AI

TITLE
GENERAL SITE PLAN LAYOUT SEPTEMBER 2017

PROJECT NO.	PHASE/DOC#	REV.	FIGURE
1660296	3000/024	0	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

25 mm

Path: \\golder.gds\gal\burnaby\CAD-GIS\Client\agnico_eagle_mines_ltd\meliadine_gold_project\69_projects\1660296_engineering services\02_PRODUCTION\Phase_3000\Task_3000\DWG\Doc 024\ | File Name: 1660296-3000-024-001.dwg

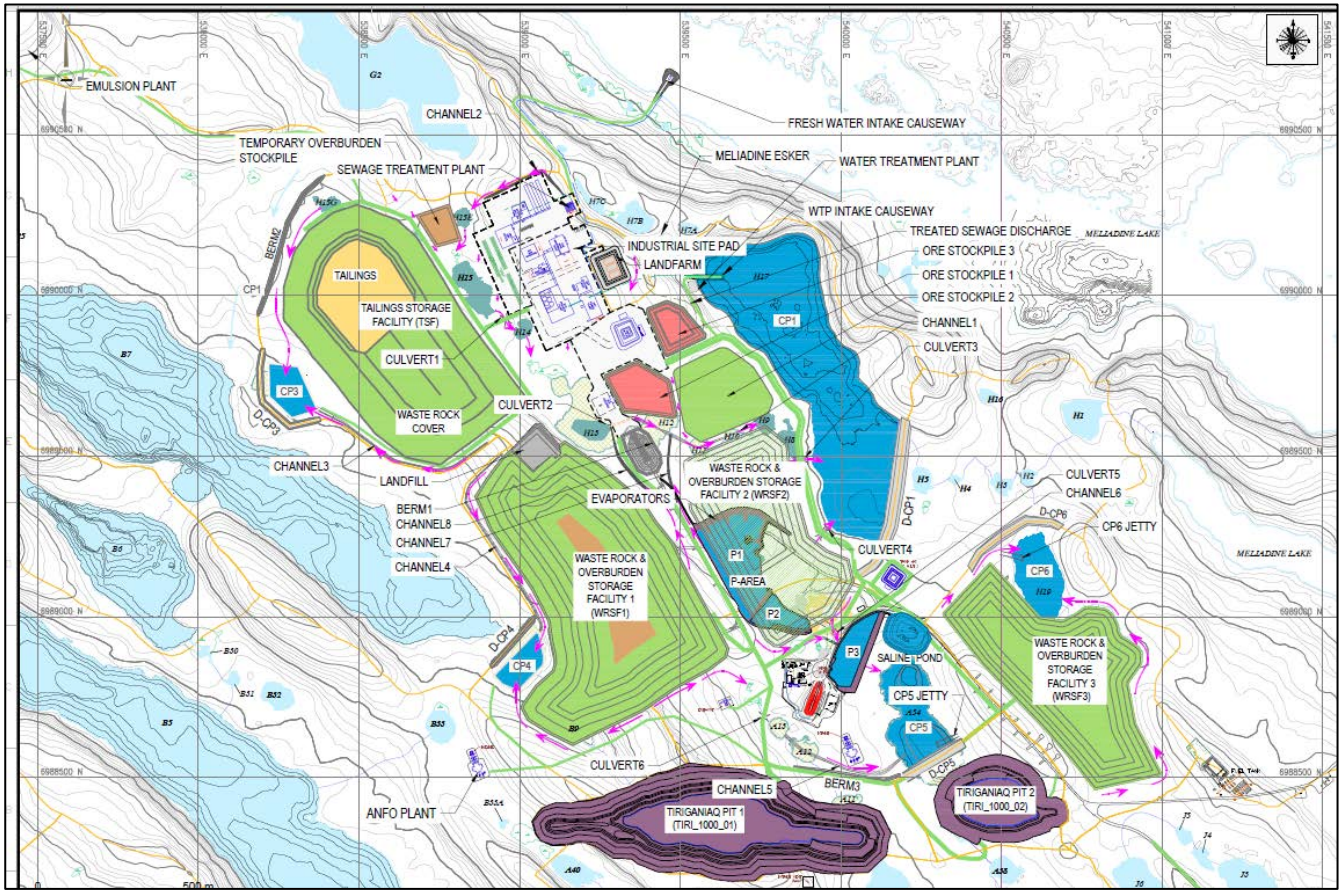


Figure 2: Main Site General Layout and Water Management Infrastructure

Source: AEM 2017.

2.0 GEOPHYSICAL AND PERMAFROST CONDITIONS

The Project is located in the Kivalliq Region, near the northern border of the southern Arctic terrestrial eco-zone, and within the Arctic tundra climate region. It is located within the Churchill geological province, which forms part of the northern Canadian Shield.

The landscape is dominated by features characteristic of glaciated terrain and exposed bedrock. Primarily underlain by Precambrian granitic bedrock, the terrain consists of broadly rolling uplands and lowlands. The Project is located at an approximate elevation of 60 metres above sea level (masl) with a maximum topographic relief of 20 m. There are numerous small lakes, wetlands, and creeks, indicating poorly drained conditions. The upland areas are generally well drained. A series of low relief ridges composed of glacial deposits oriented northwest–southeast control the regional surface drainage pattern. Periodic ice blockages at outlets of small lakes and wetlands occur during the freshet, these can temporarily increase the downstream flood peak discharges and affect the flood characteristics. High flows are observed during the freshet, while low flows and dry stream channels are typical in late summer.

Soils are typically Cryosols. Glacial moraine deposits are predominant, ranging in thickness from veneers (less than 2 m) to blankets (2 to 5 m) to hummocky deposits (5 to 15 m). Glaciofluvial deposits are also present, with the most prominent being a network of sinuous eskers. Lacustrine deposits occur in association with the numerous lakes. Near the coast of Hudson Bay, finer textured marine sediments cover the ground surface.

The Project is located in a zone of continuous permafrost and has an annual average air temperature of -10.4°C, based on climate data from Rankin Inlet. Within the permafrost there are intervening taliks (areas of unfrozen ground) and thaw bulbs induced by lakes. The permafrost in the region is considered to be “cold” (i.e., has an average annual surface temperature and zero amplitude temperature of less than -4°C). The depth of permafrost and of the active layer varies based on the proximity to lakes, soil thickness, vegetation, climate conditions, and slope direction. Based on thermal studies and measurements of ground temperatures, the depth of permafrost is generally between 360 to 495 metres below ground surface (mbgs). The depth of the active layer ranges from about 1 mbgs in areas with shallow surficial soils, up to about 3 mbgs adjacent to the lakes (AEM 2014b). The typical permafrost ground temperatures at the depths of zero annual amplitude are in the range of -5.0°C to -7.5°C in the areas away from lakes and streams, and generally are reached at a depth of 15 to 35 mbgs. The geothermal gradient ranges from 0.012°C/m to 0.02°C/m (Golder 2014). The ground ice content in the region is expected to be between 0% and 10% (dry permafrost) based on the regional scale compilation data and the Canada Permafrost Map published by Natural Resources Canada (NRC 1993). However, areas of local higher ground ice content occur and are generally associated with low lying areas of poor drainage.

Taliks may occur where lake depths are greater than about 1 to 2.3 m. The presence and extent of each talik is influenced by the geometry (size and shape) of the lake. As the depth and size of lakes increase, the extent of the talik increases. Formation of an open-talik, which penetrates through the permafrost, would be expected for lakes that exceed a critical depth and size. It is anticipated that open-taliks exists below Meliadine Lake, Lake B7, and Lake D7 based on their depth and geometry (Golder 2013).

The salinity of groundwater also influences the temperature at which the groundwater freezes. Testing has indicated that the salinity of the groundwater in the Project area generally increases with depth. Test results on two deep groundwater samples collected below the base of the permafrost as part of the baseline study indicated salinity level leads to a freezing point depression of about 3.2°C (AEM 2014a, Volume 7, Appendix 7.2-A).

Thermistor cables have been installed to monitor natural ground temperatures in the vicinity of the Project. Data are presented in Appendix C along with plan views of thermistor installation locations (Figure C1 and C2). Priorities and frequencies for reading these thermistors are summarized in AEM (2015c) and are based on the development sequence for the mine. Thermistors located in close proximity to the process plant and other mine infrastructure have the highest priority and are read more often. Thermistors located in the Tiriganiaq open pit area are given the next priority. The thermistors installed to monitor the deep permafrost are given the lowest priority as the conditions within the deep permafrost do not fluctuate seasonally, so fewer readings are required.

3.0 P-AREA TEMPORARY DIKES AND COLLECTION PONDS

During the winter of 2016, it was recognized by AEM personnel, as an interim measure to manage an emergency situation, that temporary water collection ponds were required to collect and manage surface runoff water near underground Portal No. 1 and the waste rock storage area (AEM 2016a). The concern related to the potential that surface runoff water from the ore and waste rock stockpiles could contain elevated chloride and ammonia concentrations, above the permitted discharge criteria standards per the Metal Mining Effluent Regulations under the *Fisheries Act* and/or Canadian Council of Ministers of the Environment guidelines for the protection of aquatic life.

Therefore, prior to the 2016 freshet, four temporary containment dikes (referred to as DP1-A, DP1-B, DP2-A, and DP3-A) were constructed between 25 March and 10 May 2016 to create three temporary ponds (P1, P2, and P3) to manage the runoff near Portal No.1 and from the waste rock storage area (Figure 3). Representatives from Tetra Tech EBA were on site during the majority of dike construction to provide geotechnical assistance, monitor the construction, and prepare the construction record report (Tetra Tech EBA 2016c).

The collection ponds are referred to collectively as the P-Area. The dikes do not completely enclose the ponds. Portions of the pond boundaries are associated with natural areas of higher ground, the ore and waste stockpile area, and/or existing roads. These roads were not built as water containment structures. Similarly, the stockpiles of ore and waste are granular in nature and do not function as water containment structures on a year-round basis.

In general, the P-Area receives direct precipitation, runoff from the site roads immediately surrounding the area and runoff and pore water from the ore and waste rock stockpiles near Portal No. 1. Water from underground is also pumped to the P-Area, typically via the Saline Pond. Pipelines and associated pumping systems exist to allow water to be transferred from P2 and P3 to P1. Three evaporator units have been installed within P1. A pumping station within P1 connects to the evaporators.

In accordance with the CDA (2013), dam classification is assigned based on an assessment of the consequence of failure, evaluated on the basis of potential incremental losses of life, environmental and cultural values, and third party infrastructure and economics. The class is determined by the highest potential consequence ranking. Although these dikes are less than 2.5 m in height, and therefore do not meet the definition of a dam (CDA 2013), due to the potential negative environmental consequences associated with release of the water contained by the dikes, a consequence classification of significant has been assigned. Failure of the dikes would not be anticipated to cause any loss of life, loss to cultural values, nor loss to third party infrastructure and economics. The environmental consequence, if any, to downstream fish-bearing lakes, which is Lake A8 for this particular situation, would be expected to be short term, with restoration or compensation in kind highly possible.

The four containment dikes were designed and generally constructed to be frozen core dike structures. The central zone of each dike was intended to be constructed of saturated crushed (30 mm minus) material that was to freeze and become the frozen core, thereby forming the water-retaining element of each dike. Transition material (200 mm minus) was to be placed on the upstream and downstream sides of the frozen core, with additional coarser grained rockfill placed further upstream and downstream and above the core. The upstream and downstream slopes are approximately 2 horizontal to 1 vertical. The maximum height of the frozen core of any of the dikes is approximately 2.5 m, and the maximum height of the entire dike (frozen core and thermal cover) is 4 m. Single bead thermistor cables were installed at selected locations at the crest of the frozen core to monitor the thermal conditions at the crest of the core; however, these instruments stopped working within a few months after installation. Six new vertical thermistors were installed in 2017. Their locations are shown in Figure C3 (Appendix C).

Appendix A1 contains a summary of photographs of the temporary dikes and collection ponds from the 2017 inspection.

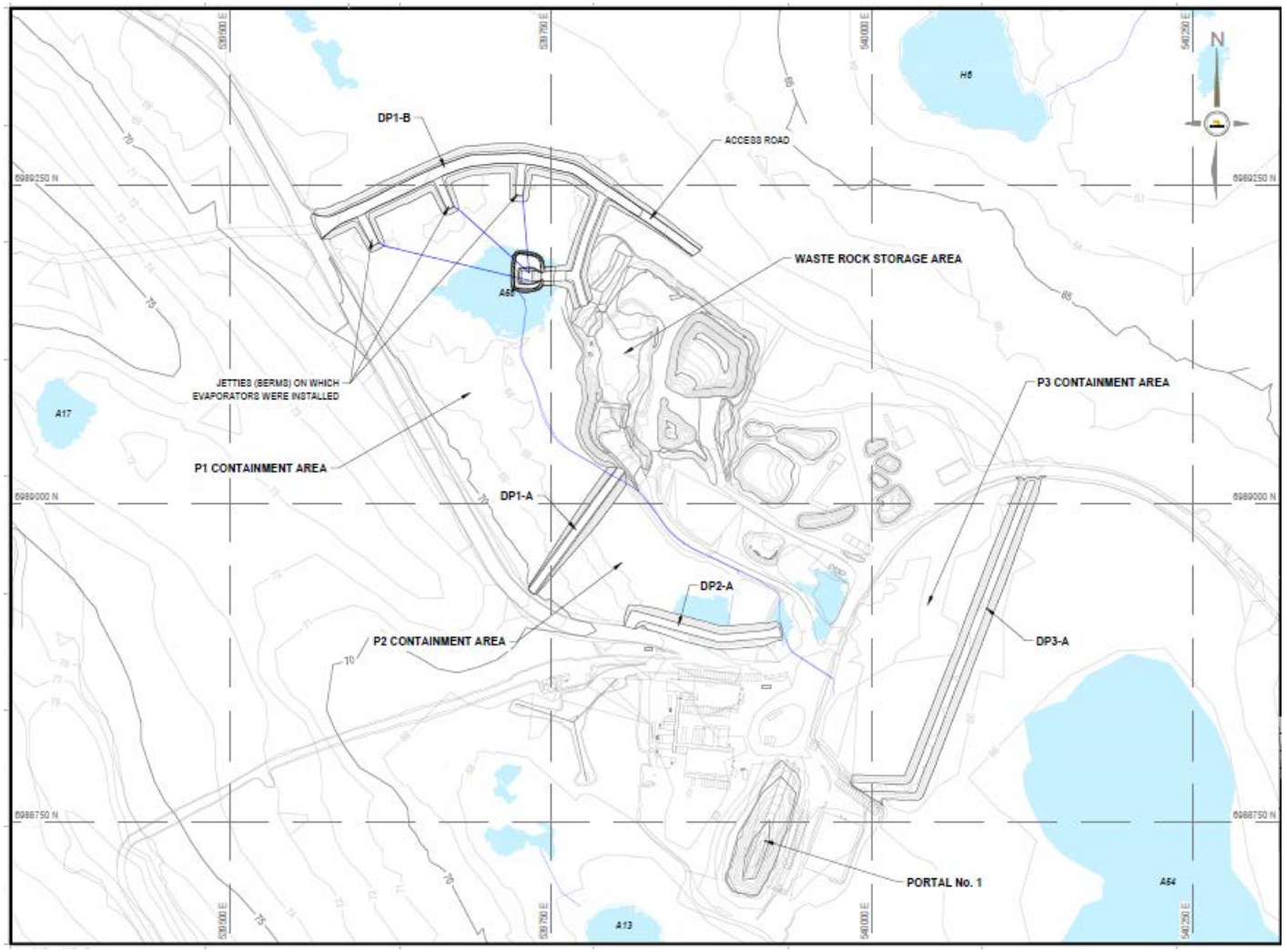


Figure 3: P-Area and Dikes DP1-A, DP1-B, DP2-A, DP3-A

Source: Tetra Tech EBA 2016c

Additional information regarding the thermal conditions and monitoring of the dikes is provided in Section 3.2. Figure 4 shows a typical section through one of the dikes (DP3-A).

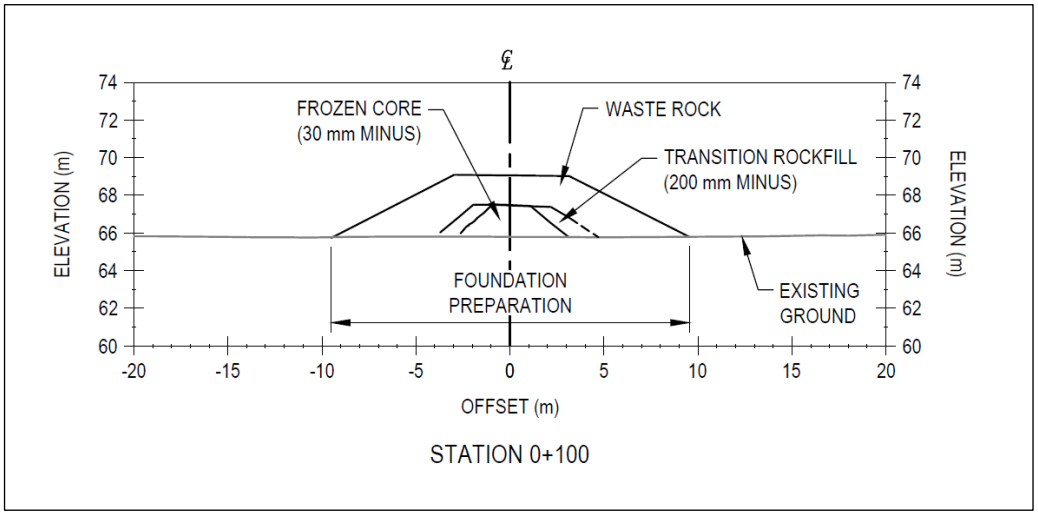


Figure 4: Typical Section through Temporary P-Area Dike DP3-A

Source: Tetra Tech EBA 2016c

There are no spillways in the dikes. Water levels within each pond are controlled through pumping and the use of the evaporators installed within P1.

Due to warmer weather conditions at the time of construction of portions of the dikes, some of the crushed material was not placed in a saturated condition in the central zones:

- DP1-A minimum saturated and frozen core elevation was 67.9 masl at the time of construction
- DP1-B entire core unsaturated
- DP2-A entire core unsaturated
- DP3-A saturated core elevation varied along the length of the dike, with a minimum elevation of 65.7 masl at the time of construction

P1 was subdivided into two areas by an internal berm. Details regarding the internal divider berm are not included within the P-Area construction record report, nor is its location shown on the drawings.

A lined pond was constructed in the northwest corner of P1 in May 2017 to contain contaminated snow from a fuel spill at the exploration camp fuel farm. The snow melt water was treated with an oil water separator in September 2017 and the clean water was pumped to CP1. The snow and rain that collects in the snow melt pond over the winter and 2018 spring freshet may require treatment, after which time the water will be pumped to CP1 and the snow melt pond will be decommissioned.

The P-Area area temporary dikes and collection ponds are intended to be an interim measure during development of the site to manage the runoff water until permanent water management dikes and collection ponds are constructed and operating to the design. As the project advances, the P-Area will become covered by waste rock and soil as Waste Rock Storage Facility 2 is developed.

3.1 Visual Observations

The inspection involved walking along the crest and toes of the dikes (DP1-A, DP1-B, DP2-A, and DP3-A), examining the condition of the upstream and downstream slopes of the dikes for visual signs of deformation and instability, cracking, and uneven surfaces. Each pond contained water at the time of the site visit, so it was not possible to walk the upstream toe of the dikes. Seepage occurrences and/or indications of seepage were noted along the downstream toes. A photographic record of the inspection, with annotations added, where appropriate, is included in Appendix A1.

At the time of the inspection, the following general observations were made:

- Overall, the dikes appear stable, with no significant geotechnical concerns identified.
- The dikes do not completely enclose the ponds. The ore and waste stockpile area and existing roads form a portion of the pond boundaries. Neither the stockpiles nor the roads function as water containment structures, on a year-round basis. Collectively, the ponds and the associated dikes appear to capture the majority of the surface water runoff from the area of concern.
- The P1 divider berm appears to have been constructed of till with some rockfill on the downstream slope, as shown in Photographs 26 through 28 (Appendix A1).
- Seepage zones were evident downstream of DP1-B and DP3-A (e.g., Photographs 12 through 15 and Photographs 39 through 43, Appendix A1). The flow was clear.
- Ditches and sumps had been constructed downstream of DP1-B and DP3-A and water was being actively pumped back into the ponds from the downstream collection systems at the time of the site visit.
- As noted in the 2016 annual inspection report (Golder 2017), the rockfill used as thermal cover above the core and on the upstream and downstream slopes of the dikes was of variable grain size, particularly for DCP2-A and DCP3-A (e.g., Photograph 33 and Photograph 48 Appendix A1). Finer rockfill was observed on the crest of DCP3-A (e.g., Photographs 44 and 45, Appendix A1). The crest of DCP1-B was also observed to have a cap of finer material which may have been placed or may be due to traffic on the dike crest.
- Cracks and periodic small depressions were observed in selected areas of DCP1-A (Photograph 4, Appendix A1), DCP1-B evaporator jetties (Photograph 24 and 25, Appendix A1), DCP2-A (Photograph 33, Appendix A1), and DCP3-A (Photographs 46, 47, and 50, Appendix A1). The cracks observed in the DCP1-B jetties and the east end of DCP2-A were the most substantial and should be the priority areas for remediation and ongoing monitoring.

- Circular cracks with settlement (vertical displacement or slump) and small circular voids were observed during the 2016 inspection along the upstream slope of DP2-A, approximately between Stn 0+50 and Stn 0+65. The observed settlement and cracking may have been associated with 1) thawing of the foundation soils, in particular, if the soils were ice-rich, and/or 2) melting of snow or ice that may have been entrapped within the transition and rockfill material at the time of construction. At the time of the 2017 inspection, fine rockfill was observed to have been used to remediate the slope in the area of the settlement (Photographs 30, 31, and 36, Appendix A1). Some cracking and vertical displacement was still evident on either side of the fine rockfill (Photographs 32 and 36, Appendix A1). This settlement is not a concern for the stability or integrity of the dike; however, it should be monitored, and placement of additional fine rockfill, regrading, and re-compacting the slope may be warranted to reduce the potential for infiltration into the dike, if the dike continues to be used.
- The single point thermistor cables that were installed during the construction of the P-Area dikes stopped working a few months after they were installed in August 2016.
- White staining observed on the upstream slopes of the rockfill of the P-Area dikes is attributed to the salinity levels within the water, indicates the high water mark within the ponds (e.g., Photographs 19 and 35, Appendix A1). The staining was less obvious on DCP3-A, which may be a result of a higher pond elevation at the time of the site visit.
- Water levels within each pond are measured daily during the open water season, and the pond levels were maintained below the maximum design water elevation except for P1, which rose above the design maximum pond elevation for four days at the end of July and the beginning of August 2017.

3.2 Geotechnical Instrumentation and Monitoring Data

Single bead thermistors were installed by Tetra Tech EBA at the crest of the core (30 mm minus) material, at selected stations along each dike during construction. These thermistors stopped working in August 2016 (a few months after installation).

Six new vertical thermistors were installed in the P-Area dikes on 30 September and 2 November 2017. Two were installed in DP1-B, one was installed in DP2-A, and three were installed in DP3-A (Figure C3, Appendix C2). The thermistors were read by AEM staff after installation. The instruments installed on 30 September 2017 were read three times and the instruments installed on 2 November were read once. Plots of the thermistor data are provided in Appendix C2. The data indicate that the dikes, and the foundation materials directly below the dikes, were at or below 0°C by late October to early November 2017. Due to the limited data available in 2017 it is not possible to evaluate the seasonal variation of the thermal conditions within the dikes. The data from these instruments will have to be reviewed through 2018 to provide a better understanding of the thermal conditions of the dikes and foundations and whether frozen conditions are maintained throughout the year.

Table 1 shows key information regarding the construction of each dike and thermistor installation locations.

Table 1: Summary of Key Dike Information and Thermistor Locations

Dike Structure	Minimum Elevation of Core	Minimum Saturated Elevation of Core [(a)]	Minimum Dike Rockfill Crest Elevation	Maximum Pond Operating Elevation [(b)]	Thermistor Location
DP1-A	68.9 m	67.9 m	70.3 m	68.5 m	no instrumentation
DP1-B	68.9 m	none	70.5 m	68.5 m	DCP1B-1: Stn 0+150 DCP1B-2: Stn 0+220
DP2-A	67.9 m	none	69.5 m	67.25 m	DCP2A-1: Stn 0+090
DP3-A	67.4 m	65.7 m	69.0 m	66.35 m	DCP3A-1: Stn 0+050 DCP3A-2: Stn 0+150 DCP3A-3: Stn 0+250

(a) At the time of construction.

(b) Water level associated with a 24-hour duration extreme rainfall event with a return period of 1:100 years, which would bring the elevation to within 300 mm of the top of the core. (File: 20160530 P1_P2_P3 Water Balance for 2016.xlsm, P1-Area Water Balance, Tetra Tech 2016c).

Stn = Station (distance) along centreline of each dike from the starting reference point; SB# = thermistor instrument identification number.

In 2017, AEM staff performed the following monitoring activities:

- recorded the daily volumes of water pumped from underground to the P-Area
- recorded the daily volumes of water transferred between the ponds
- measured and recorded water elevations within each pond during the open water season on a graph with the maximum allowable pond elevation
- performed daily inspections of water condition (e.g., frozen or thawed, clear or cloudy) and flow at water management facilities during the freshet (17 May to 12 June 2016)
- collected samples from the P-Area approximately weekly for water quality analysis from 22 May to 25 September 2017

The information collected is contained within various spreadsheets, which were provided to Golder for review.

Geotechnical inspections were not carried out in 2017; however, environmental staff conducting water flow and quality inspections were at the dikes on a regular basis. AEM has indicated that it will have an engineering team on site in 2018 and will conduct regular geotechnical inspections.

An operation, maintenance, and surveillance (OMS) manual has not been prepared for the P-Area and associated dike structures. An overall Project *Risk Management and Emergency Response Plan* (AEM 2015a), dated April 2015, has been prepared and includes identification of the potential failure scenarios associated with the dikes and future tailings facility. However, an Emergency Response Plan to address the consequences of failure of any of the temporary dikes currently on site and the procedures to be followed in the event of a failure has not yet been developed.

3.3 Recommendations

The following recommendations are provided regarding the temporary dikes and ponds, for the period of their operation:

- AEM personnel should conduct regular geotechnical inspections and document visual observations such as, cracking, slumping, and/or seepage. Thermistor data should be collected, plotted and reviewed, and pond water levels should continue to be measured and tracked. Inspection reports should be prepared for documentation.
- Continue to collect and pump back seepage water, as deemed necessary, in areas where seepage could impact downstream areas.
- The limited thermistor data available indicate that the dikes were not frozen at the time of the initial readings in the fall of 2017 and therefore may not have been functioning as frozen core dams. The thermistors should be read regularly throughout the year, especially from freshet to freeze up to determine if the dikes remain frozen. To maintain the thermal integrity of the frozen core, the following should be implemented:
  - The open cracks and depressions observed on the dike crests should be filled to reduce the potential for infiltration into the core and associated thermal warming. As some of the cracks are relatively narrow, sand could be used. These areas should continue to be monitored following repair works to determine if these cracks and depressions reappear.
  - Where access is feasible, removal of snow from the water collection pond dikes is recommended to reduce the insulating effects of the snow, thereby allowing the temperature of the core material in the dikes and the foundations to drop as low as possible such that the frozen core can be established, with the potential that it could reach a cold enough temperature that the core could be maintained in a frozen condition throughout the following summer. Snow removal is more important if thermistor data indicates that temperatures within the dikes and/or foundation are warmer than expected.
  - The water levels in the ponds should be reduced as much as possible in the winter to promote freezing of the dam cores. This would also increase the capacity within the ponds to manage water during the 2018 freshet, if necessary.
- Circular cracks with settlement (vertical displacement or slump) and small circular voids evident along the upstream slope of DP2-A, near Stn 0+40 and Stn 0+75 should continue to be monitored and consideration for filling in the cracks, with additional fine rockfill, regrading, and re-compacting the slope may be warranted to reduce the potential for infiltration into the dike, if the dike continues to be used.
- Make sure each thermistor cable is well marked so they can be located and maintained during the winter, and are not damaged during snow removal operations. Consider adding data loggers to record the temperatures.
- Consider adding rockfill material to cover the till berm in P1, to protect the till and maintain its integrity if this berm is required for water management.
- If the temporary ponds and associated dikes continue to be used by AEM, then an OMS manual should be prepared and implemented. An Emergency Response Plan to address the consequences of failure of any of the dikes on site should also be prepared. Once prepared, it is a good practice to review these documents on an annual basis, along with the overall site Emergency Response Plan, and update them as necessary (e.g., the names and contact numbers for key personnel).

4.0 PERMANENT WATER COLLECTION PONDS, DIKES, BERMS, AND CHANNELS

The permanent water management facilities for the Meliadine Gold Project will be constructed as the Project develops. This section presents a summary of the permanent water collection ponds and associated dikes, berms, and channels that had been constructed prior to the 2017 inspection, including Collection Pond 1 (CP1) and its associated dike (D-CP1), Collection Pond 5 (CP5) and its associated dike (D-CP5), Berm 3, Channel 2, Channel 5, and the saline pond.

4.1 Water Collection Ponds and Associated Dikes

At the time of the site visit in September 2017, two of the permanent water collection pond dikes had been constructed, D-CP1 and D-CP5. These dikes were constructed between October 2016 and July 2017. Both dikes are composed of rockfill and transition shells with a geomembrane liner anchored into a key trench within the permafrost foundation (soil or bedrock).

D-CP1 is approximately 600 m long with a maximum height of 6.6 m (Tetra Tech 2017e) and is located northeast of the P-Area, as shown in Figure 5. It is oriented approximately south–north with a slight inflection 200 m from the south abutment. D-CP1 was constructed across the outlets of lakes H6 and H17, which combine to form CP1. The CDA (2013) dam consequence classification for D-CP1 is *Significant* (Tetra Tech 2016a). A downstream collection sump and two channels were constructed approximately 5 m downstream of the D-CP1 toe to collect surface run-off and any possible dike seepage for pump back to CP1. CP1 is the final water management facility on site, and water from various parts of the site will be pumped to CP1 for treatment and discharge to Meliadine Lake.

D-CP5 is approximately 300 m long with a maximum height of 3.3 m (Tetra Tech 2017d) and is located southeast of the P-Area, as shown in Figure 5. It is oriented approximately southwest–northeast and was constructed across the south portion of Lake A54 such that the northern portion of the lake now forms CP5. The CDA (2013) dam consequence classification for D-CP5 is *Significant* (Tetra Tech 2016b). A small collection sump is located in a natural depression downstream of D-CP5 to collect surface run-off and any possible seepage through the dike for pump back to CP5. CP5 will be used seasonally for temporary water storage with active pumping to CP1.

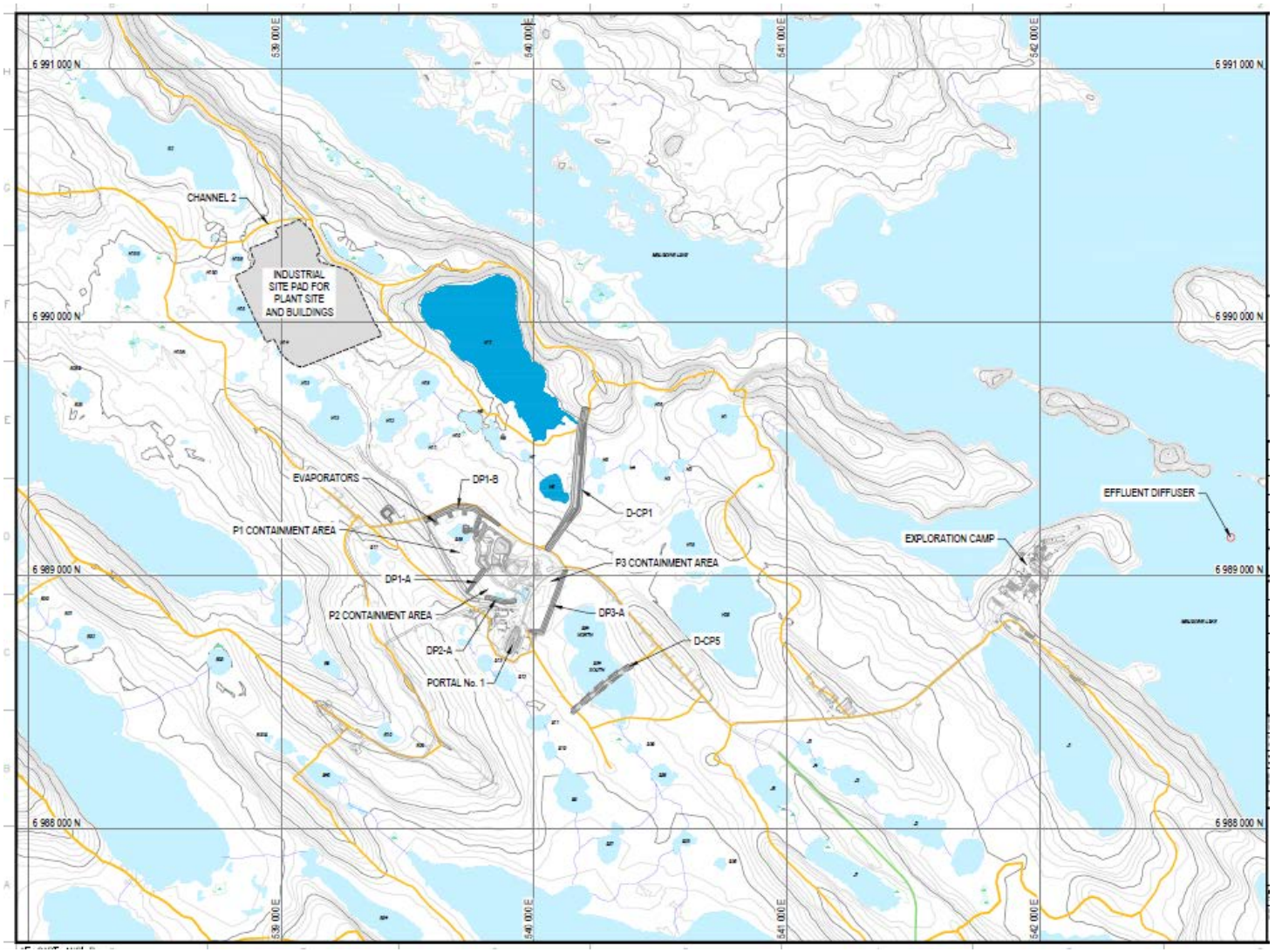


Figure 5: General Location of Dikes D-CP1 and D-CP5

Source: Tetra Tech 2017e

4.1.1 Visual Observations

The inspection involved walking along the crests and toes of the dikes and examining the condition of the slopes of the dikes for visual signs of deformation and instability, cracking, and uneven surfaces. There was water in CP1 and CP5 at the time of the site visit, so it was not possible to walk along the upstream toes of the dikes. Visible observations of seepage occurrences and/or indications of seepage were noted. A photographic record of the inspection, with annotations added where appropriate, is included in Appendix A2.

Construction of the dikes was completed in July 2017, and AEM indicated that it was in the process of transferring the dikes from its construction team to its operations and engineering team on site. Due to the transition, there were no geotechnical inspections completed for the dikes in 2017 after construction was complete.

AEM provided Golder with plots that are used to document the pond levels in CP1 and CP5 one or two times per day during the freshet (17 May to 7 June 2017) and then every one to nine days until the end of October 2017. The plots included the maximum allowable pond levels for pre-freshet, open water, pre-winter, and during a flood. AEM also provided documentation of the volumes of water pumped from the ponds during the open water season.

Dike D-CP1

At the time of the inspection of D-CP1, the following general observations were made:

- Overall, the dike appeared stable, with no significant geotechnical concerns identified.
- Minor cracking and small settlement was observed along significant portions of the upstream slope and crest (Photographs 4 through 6 and Photographs 8 through 10, Appendix A2). The largest cracks were up to 2 to 3 cm wide (Photograph 9, Appendix A2).
- There was some indication of possible minor sloughing of the downstream slope (e.g., Photographs 18 and 19, Appendix A2).
- There were cracks observed downstream of the downstream collection channel (e.g., Photograph 22, Appendix A2). This cracking was observed within the muck from construction of the channel that was placed along the sides; however, it may be due to thaw settlement and extend into the original ground.
- Settlement and cracking are likely due to thaw settlement in the foundation and/or dike fills prior to it freezing.
- The downstream collection channel appeared to be consistently graded to the downstream collection sump. A small amount of water was ponded in the channel from approximately Stn 1+330 to the pond (Photographs 22 and 23, Appendix A2).
- Minor cracking was observed in the crests of the downstream collection sump berms (e.g., Photograph 24, Appendix A2).
- Water was observed to be flowing back towards the collection sump from downstream (southwest) of the collection sump (Photograph 26, Appendix A2).

Dike D-CP5

At the time of the inspection of D-CP5, the following general observations were made:

- Overall, the dike appeared stable, with no significant geotechnical concerns identified.
- Minor cracking was observed in a few locations on the upstream and downstream sides of the dike crest (Photographs 31 and 44, Appendix A2).
- A small hole was observed upstream of ground temperature cable VGTC-2 (Photograph 35, Appendix A2) and there was space around the instrument itself. When sand was kicked into the hole, it was possible to hear it hit water below.
- A small sump area had been excavated downstream of the dike, and there was active intermittent pump back of water at the time of the site visit (Photographs 39 and 40, Appendix A2). The pump back was being discharged on to the upstream slope of the dike. Mr. Jeff Pratt, who was accompanying Mrs. Isidoro during the inspection, put a piece of plywood in front of the discharge (Photograph 36, Appendix A2); however, the water was still flowing into the rockfill shell. Mr. Pratt was able to pull the pipeline straighter to extend it past the rockfill toe (Photograph 37, Appendix A2).
- Water appeared to be ponding within the upstream toe of the rockfill shell near where the pump back water was being discharged (Photograph 38, Appendix A2). It appeared that the access road upstream of the rockfill toe may have been blocking the water within the rockfill shell.
- Jetty 5 is the causeway for the pump back station for CP5. Jetty 5 appeared stable with no significant geotechnical concerns identified (Photographs 45 and 46, Appendix A2). However, there was some minor slumping and cracking observed at the southwest toe (Photograph 47, Appendix A2).

4.1.2 Geotechnical Instrumentation and Monitoring

Horizontal and vertical thermistors were installed in D-CP1 and D-CP5, as shown in Figures C4 to C7 in Appendix C. Plots of the thermistor data are provided in Appendix C.

Dike DCP-1

There were five horizontal thermistors installed in D-CP1 above the liner parallel to the key trench and five vertical thermistors installed upstream and downstream of the key trench. The locations of these instruments are summarized in Table 2. There were also six settlement survey monuments installed over the liner crest in the central area of the dike as shown in Figures C4 and C5 in Appendix C2.

Table 2: Summary of D-CP1 Thermistor Locations

Instrument	Horizontal or Vertical (H or V)	Location	Additional Details
HGTC-1	H	Stn. 1+513 to 1+562	
HGTC-2	H	Stn. 1+254 to 1+304	
HGTC-3	H	Stn. 1+343 to 1+394	
HGTC-4	H	Stn. 1+432 to 1+482	
HGTC-5	H	Stn. 1+117 to 1+158	
VGTC-1	V	1+278	upstream of the liner and key trench
VGTC-2	V	1+280	downstream of the liner and key trench
VGTC-3	V	1+461	upstream of the liner and key trench
VGTC-4	V	1+460	downstream of the liner and key trench
VGTC-5	V	1+300	along slope upstream of the Phase 2 liner

Stn = Station (distance) along centreline of each dike from the starting reference point.

The following observations were made regarding the instrumentation readings collected for D-CP1:

- The horizontal ground temperature cable plots (Appendix C2) indicate a warming trend in the base of the key trench from the time the instruments were installed in March 2017 until December 2017. This is not unexpected as the horizontal ground temperature cables would have been exposed to colder ambient temperatures when they were initially installed in the base of the key trench in March 2017, followed by warming ambient temperatures and placement of fills over the instruments. The plots indicate the temperatures were stabilizing at values in the range of -2°C to -6°C in November and December 2017. Data from the thermistors should be evaluated through 2018 to get a better understanding of the thermal conditions in the key trench.
- Vertical ground temperature cable plots (Appendix C2) indicate that the dike and foundation were below 0°C by October or November 2017, with the exception of VGTC-4, located downstream of the key trench and liner, which was still showing temperatures above 0°C to a depth of approximately 5 m below the original ground surface up until the end of December 2017. VGTC-3 is located directly upstream of VGTC-4. The temperature plot for VGTC-3 indicates the foundation below the dike has been frozen since June 2017 and the dike fills have been below 0°C since the end of October 2017, so it appears that the warmer temperatures measured in VGTC-4 are localized. Thermistor VGTC-4 should be monitored closely to determine if the foundation and dike continue to freeze. Data from all the thermistors should be evaluated through 2018 to get a better understanding of the thermal conditions and potential variability throughout the year.
- The survey monitoring points indicated 1 to 2 cm of settlement from late July to late October 2017. Readings prior to this period were completed with a GPS which was not accurate enough for monitoring settlement.

Dike D-CP5

Two horizontal thermistors were installed in the key trench approximately 250 mm above the liner along most of the length of the trench. Three vertical thermistors were installed upstream and downstream of the key trench and liner. The locations of these instruments are summarized in Table 3. There were also three settlement survey monuments installed over the liner crest in the central area of the dike as shown in Figures C6 and C7 in Appendix C2.

Table 3: Summary of D-CP5 Thermistor Locations

Instrument	Horizontal or Vertical (H or V)	Location	Additional Details
HGTC-1	H	Stn. 0+052 to 0+202	
HGTC-2	H	Stn. 0+164 to 0+304	
VGTC-1	V	Stn. 0+181	upstream of the liner and key trench
VGTC-2	V	Stn. 0+185	upstream of the liner and key trench
VGTC-3	V	Stn. 0+185	downstream of the liner and key trench

Stn = Station (distance) along centreline of each dike from the starting reference point.

The following observations were made regarding the instrumentation readings collected for D-CP5:

- The horizontal ground temperature cable plots (Appendix C2) indicate a warming trend in the base of the key trench from the time the instruments were installed in April 2017 until December 2017. This is not unexpected as the horizontal ground temperature cables would have been exposed to colder ambient temperatures when they were initially installed in the base of the key trench in April 2017, followed by warming ambient temperatures and placement of fills over the instruments. The plots indicate the temperatures were stabilizing at about -2°C in November and December 2017. Data from these thermistors should be evaluated through 2018 to get a better understanding of the thermal conditions in the key trench.
- Vertical ground temperature cable plots (Appendix C2) indicate that the dike and foundation were below 0°C by October or November 2017. Data from all the thermistors should be evaluated through 2018 to get a better understanding of the thermal conditions and potential variability throughout the year.
- The survey monitoring point data indicate approximately 3 cm of settlement at M-3 from late July to late October 2017. Readings prior to this period were completed with a GPS which was not accurate enough for monitoring settlement. The other two survey monitoring points showed less than 1 cm of settlement.

4.1.3 Recommendations

The following recommendations are provided regarding D-CP1 and D-CP5:

- The open cracks and depressions observed in the dike crests should be filled with fine rockfill or sand to reduce the potential for infiltration into the dike and associated thermal warming. These areas should be monitored following repair works to determine if these cracks and depressions reappear.
- The pipe ramp constructed out of sand upstream of D-CP1 near Stn. 1+140 will be susceptible to erosion. It is recommended that the pipe ramp be covered with a coarser rockfill to protect it from erosion.

- Monitor the cracking observed in the D-CP1 downstream sump berms and adjacent to the downstream collection channel. Recontouring and/or compacting the areas of cracking to close the cracks will reduce the potential for water to infiltrate into the cracks that could lead to warming of the permafrost and additional thaw settlement and cracking.
- The D-CP1 sump and downstream collection channel should be emptied in the fall/early winter to refreeze the ground around these facilities. During the open water season, keeping the water level in the downstream channel and sump low will reduce the potential for thaw of the ground around and associated settlement.
- It is recommended that AEM develop an OMS manual for the water management structures on site that includes such information as responsible personnel, monitoring frequencies for visual inspections and instrumentation monitoring, and pond/channel storage design criteria. AEM has indicated that preparation of the OMS manual has been started. An Emergency Response Plan should also be developed to address the consequences of failure of any of the water management structures. Once prepared, it is a good practice to review these documents on an annual basis, along with the overall site Emergency Response Plan, and update them as necessary (e.g., the names and contact numbers for key personnel).
- The water levels in the ponds should be reduced, as much as possible, in the fall/winter to manage water during the spring freshet.
- Geotechnical inspections of the dikes should be conducted and documented following the schedule developed in the OMS manual. Inspections should include observations such as cracking or settlement in the crests and/or slopes, seepage or indications of seepage, and pond level.
- The ground temperature cables and survey monitoring points should be monitored following the schedule developed in the OMS manual. The design engineer recommends the ground temperature cables be read twice per month in June and July and monthly for the rest of the year (Tetra Tech 2017d, e). They also recommend the survey monitoring points be surveyed monthly for the first two years and then quarterly for the remainder of the operation of the dike. The data should be plotted and reviewed following the process laid out in the OMS manual.
- Vertical ground temperature cable VGTC-4 in D-CP1 should be monitored closely as it was showing readings above 0°C up until the end of 2017. Horizontal ground temperature cable HGTC-1 in D-CP1 should also be monitored closely as it was indicating temperatures around -2°C for the base of the key trench, which is warmer than other sections of the trench.
- The ground temperature should be monitored to determine if the foundation remains frozen. Fluctuation of the temperature within the active layer in the dike are expected; however, the foundation is designed to be maintained frozen.
- The pump back line for D-CP5 should be permanently extended to ensure that pump back water is discharged upstream of the dam toe and does not flow into the rockfill shell.
- Where access is feasible, snow should be removed from the dike crests and slopes in the winter as this can help to reduce the insulating effects of the snow, thereby allowing the temperatures of the dike and foundation to drop as low as possible. Snow removal is more important if thermistor readings indicate warmer temperatures than expected.

4.2 Channel 5 and Berm 3

Channel 5 and Berm 3 are located west of CP5 and are designed to divert water from the A12 catchment area into CP5 so that this water does not flow into Tiriganiaq Pit 1. Channel 5 is the main water diversion structure; Berm 3 is only required to temporarily retain water under an extreme rainfall event when the water level in CP5 is temporarily high (Tetra Tech 2016d).

Channel 5 was constructed from 17 to 26 November 2016 and is approximately 335 m long with a base width of approximately 3 m and a maximum depth of 1.6 m. The channel was designed with a geotextile lining covered with riprap.

Berm 3 was built between 3 August and 9 September 2017. Berm 3 is approximately 315 m long with a maximum height of about 2.8 m. Berm 3 consists of a till core, a foundation key trench backfilled with till, and a cover layer constructed out of 600 mm minus esker material. The design specified run-of-mine rockfill for the cover; however, this material was not available at the time of construction.

4.2.1 Visual Observations

The inspection involved walking along the crest and slopes of Berm 3, examining the condition of the berm for visual signs of deformation and instability, cracking, or uneven surfaces. There was water ponded along sections of the upstream and downstream toes of Berm 3 at the time of the inspection. Seepage occurrences and/or indications of seepage were noted.

Channel 5 was inspected by walking the southern crest from near the outlet to CP5 to approximately Stn. 1+040. Water had overflowed the shallow section of Channel 5 between approximately Stn 0+085 and 1+045 at the time of the site visit, which limited access to portions of the channel.

A photographic record of the inspection, with annotations added where appropriate, is included in Appendix A2. At the time of the inspection of Channel 5 and Berm 3, the following general observations were made:

- Overall, Berm 3 and Channel 5 appeared stable, with no significant geotechnical concerns identified.
- There was some cracking observed adjacent to Channel 5 (Photograph 49, Appendix A2). This cracking may be within waste materials removed during construction of Channel 5 or may be due to thaw settlement and extend into original ground.
- Water was ponded in Channel 5 along its entire length and had overflowed the shallow section of Channel 5 between approximately Stn. 0+085 and 1+045 (Photographs 48 through 51, Appendix A2). Water was ponding against the upstream side of Berm 3 from approximately Stn. 0+100 to 0+200 (Photographs 51 through 52, and Photographs 54 through 55, Appendix A2).
- The esker material used for the Berm 3 cover layer (e.g., Photographs 53 through 58, Appendix A2) may be susceptible to erosion.
- There was a small pond against the downstream toe of Berm 3 near the northwest end of the berm (Photograph 56, Appendix A2). There was also shallow water ponded within the vegetation adjacent to the downstream toe of Berm 3 near the mid-point of the berm (Photograph 57, Appendix A2). There were no visible signs of seepage. The water observed on the downstream side of the berm may be due to seepage from the water ponded on the upstream side of the berm, but could also be due to run-off collecting where there is low topography of the original ground in this area.

4.2.2 Recommendations

The following recommendations are provided regarding Channel 5 and Berm 3:

- Monitor the cracking adjacent to Channel 5. Recontouring and/or compacting the areas of cracking to close the cracks will reduce the potential for water to infiltrate into the cracks leading to warming of the permafrost and additional thaw settlement and cracking.
- According to the design for Channel 5 and Berm 3 (Tetra Tech EBA 2016d), Channel 5 is supposed to be able to handle run-off flows except for an extreme rain event and Berm 3 is only intended to temporarily retain water when the water level in CP5 is high due to an extreme rain event. However, at the time of the site visit, water had overflowed Channel 5 and was ponded against Berm 3. The ponding appeared to be relatively shallow. Ponding upstream of Berm 3 should be monitored to determine how much and how often ponding occurs and if Berm 3 can perform as required with the ponding.
- The Berm 3 cover materials may be susceptible to erosion. This should be monitored, and if there is erosion, consideration should be given to placing coarser material on Berm 3 to reduce the potential for erosion.

4.3 Saline Pond

The saline pond is located east of DP3-A and was constructed during the third quarter of 2016. The saline pond was constructed to manage excess underground saline water starting in the third quarter of 2016, before a long-term saline water disposal/treatment plan was finalized. During 2017, water was transferred from the saline pond to the P-Area for evaporation. AEM is planning to have a permanent saline water treatment plant by January 2019.

The saline pond was largely constructed by excavation within permafrost overburden and bedrock. A small berm approximately 1 to 2 m high was constructed around the excavation with a till core and rockfill cover to promote permafrost development in the original ground below the berm and keep surface water from the surrounding area from draining into the pond. The pond is designed to maintain the maximum pond elevation under the inflow design flood (1-in-100-year precipitation event) below original ground and below the level of CP5 to minimize the potential for seepage out of the saline pond.

4.3.1 Visual Observations

The inspection involved walking along the crest of the saline pond perimeter berm, examining the condition of the berm for visual signs of deformation and instability, cracking, or uneven surfaces. Seepage occurrences and/or indications of seepage were noted. A selection of photos from the inspection are included in Appendix A2.

At the time of the inspection of the saline pond, the following general observations were made:

- Overall, the pond and perimeter berm appeared stable, with no significant geotechnical concerns identified.
- There was water in the pond at the time of the site visit that was well below the top of the bedrock excavation (Photographs 59 and 60, Appendix A2).

- Cracking and settlement were observed in the perimeter berm in a few locations. Most of the cracking and settlement was minor (e.g., Photograph 63, Appendix A2) with the exception of the northwest section of the perimeter berm which had some larger cracks (Photograph 61, Appendix A2). There was also an area near the upstream toe of the perimeter berm that appeared to have undergone more substantial settlement (Photograph 62, Appendix A2). AEM has indicated that there is a fault in this area and surface water sometimes seeps into the pond through the northwest section of the perimeter berm (downstream of DP3-A), which are likely causing the settlement and cracking within the berm.
- A small pond of water was observed adjacent to the northwest perimeter berm, downstream of DCP3-A (Photograph 66, Appendix A2).

4.3.2 Recommendations

The following recommendations are provided regarding the saline pond for the time it is in operation:

- Recontouring and/or compacting the areas of cracking in the perimeter berm is recommended, particularly the northwest section of the berm, to close the cracks. This area should also be monitored to assess if cracking and settlement continues.
- Monitor the downstream side of the perimeter berm for ponding water and consider diverting it or pumping it so it does not seep into the saline pond.

4.4 Channel 2

Channel 2 has been constructed along the northern end of the main mine site industrial pad. To construct the channel, a trench was excavated, woven geotextile was placed to line the excavation, and then the channel was lined with riprap (coarser rocks). A selection of photos from the inspection are included in Appendix A2 (Photographs 67 through 73).

During construction and operation, contact water from the plant site area will naturally flow or be diverted into Channel 2, which in turn will flow into ponds H15E, H15, H14, H13, H12, H9, H8, and eventually into CP1.

The slope of the channel base is not consistent and some pooling of water and deposition of sediment in lower areas was observed. Ponded water may infiltrate into the channel base, but is not expected to be substantial. No geotechnical concerns associated with Channel 2 were identified.

5.0 SITE ROADS, CULVERTS, AND TIRIGANIAQ ESKER AND WESMEG BORROW AREA

This section summarizes the observations made during the 2017 geotechnical inspection regarding the main site roads and associated culverts, and the Tiriganiaq Esker and Wesmeg Borrow Area roads and facilities. Appendix A3 contains selected photographs taken during the inspection.

5.1 Site Roads and Culverts

At the time of the site visit, the site roads were generally in good condition and constructed for two-way traffic with pull outs. As the site is in active construction, roads were in various stages of construction and operation and had been constructed with materials with variable sizes and gradations.

The roads appeared to generally be of adequate width, and pull outs to allow vehicles to safely pass had been constructed. The heights of the road fills were such that berms were not required. The roads appeared to have been constructed using a combination of sand and gravel obtained from esker borrow areas, rockfill, and crushed aggregate. No geotechnical concerns were identified during the inspection. Normal maintenance of the roads should be anticipated.

There were three permanent water management culverts in place at the time of the site visit: Culverts 3, 4, and 6. Culvert 2 had been removed for repair and replacement. AEM has indicated that Culvert 2 was put back in place shortly after the 2017 site visit. A summary of the culverts inspected, general observations, and any recommendations is provided in Table 4, and Appendix A3 contains selected photographs of the culverts (Photographs 2 through 6 and Photographs 10 through 12).

At the time of the 2016 inspection, the access road to the Wesmeg Borrow Area had recently been established. The road had been built by creating trenches on either side of the road and then using this borrow material to create the roadway. Water was ponding in some portions of the trenches along the road. The road looked to have been constructed from till materials with higher fines contents. The condition of the road and areas adjacent to the road that were observed during the 2017 inspection were much improved. The trench areas adjacent to the road had been regraded, and some rockfill material had been placed on the road (Photographs 13 and 14, Appendix A3). Water was ponded against the road where it crosses low topography north of Lake B33A (Photographs 7 and 13, Appendix A3). The design report for the Wesmeg Road (Tetra Tech EBA 2016e) indicates that a culvert was planned for this location and should be installed.

The main site water intake access road appeared to have been recently constructed using a combination of sand and gravel obtained from esker borrow areas and rockfill (Photographs 42 through 45, Appendix A3). No geotechnical concerns were identified during the inspection. Normal maintenance should be anticipated.

Table 4: Summary of Site Culverts Inspected

Access Road	Culvert No.	Culvert Description	Comments/Recommendations
Access road on west side of CP1	3	3×600 mm CSP	Culverts were in good condition (Photographs 2 and 3, Appendix A3). Water was flowing through the culverts at the time of the site visit from H8 to CP1. The downstream ends of the culverts were mostly submerged within CP1. Culverts appeared to have appropriately sized cover material.
	4	1×600 mm CSP	Small amount of damage to upstream end of the culvert (Photograph 5, Appendix A3). No flow through the culvert. Downstream end of culvert was partially submerged by CP1 (Photograph 6, Appendix A3). Culvert appeared to have appropriately sized cover material.
Road to Tiriganiaq Esker	conduit	CSP conduit for pipeline crossing	CSP placed as a conduit for a pipeline crossing. CSP was badly damaged (Photographs 8 and 9, Appendix A3). If pipeline crossing will stay in place, CSP should be replaced and additional road fill cover should be placed.
	6	1×600 mm CSP	Culvert was in good condition (Photographs 10 through 12, Appendix 3). Small flow observed.

Note: 1×600 mm = the number of culverts × the diameter of the culvert

CSP = corrugated steel pipe.

5.2 Tiriganiaq Esker and Wesmeg Borrow Area Facilities

The ANFO plant, the magazine storage, and the Wesmeg Borrow and vent raise areas were inspected, (Photographs 7 through 26, Appendix A3). The following are some of the general observations and recommendations:

- Cracking and erosion were observed at the Wesmeg Borrow Area (Photograph 15 through 18). This material should be recontoured and either capped with a coarser material or some other form of reclamation to protect against erosion.
- A small rockfill pad had been constructed at the Wesmeg vent raise with a low area and a berm on the west side (Photograph 19, Appendix A3). Water was ponded in the low area. A steel pipe was installed through the access point of the pad for water management (Photographs 19 and 20, Appendix A3). There was no flow at the time of the site visit.
- The magazine storage area and blast guard berms were inspected and there were no signs of erosion or cracking. No geotechnical concerns associated with the magazine storage area were identified.
- The ANFO plant pad was inspected and appeared to have been constructed mostly out of rockfill and possibly also some esker sand and gravel. The slopes are approximately 2 horizontal to 1 vertical, and appeared stable. There were two areas on the southwest slope that had some signs of erosion and settlement (Photographs 24 and 25, Appendix A3), but otherwise the slopes of the pad were generally in good condition. The alignments of the slopes were somewhat irregular and the sea-containers (stacked 2 to 3 high) were observed to be relatively close to the crests of the slopes (Photographs 27 and 28). Consideration should be given to using a larger set-back from the slopes for placement of sea-containers.

5.3 New Emulsion Plant and Access Road

The new emulsion plant pad north of the main mine site (industrial pad) was under construction at the time of the 2017 site inspection and the access road had recently been constructed (Photographs 29 to 41, Appendix A3). The following are some of the general observations and recommendations:

- The road appeared to generally be of adequate width, and pull outs to allow vehicles to safely pass had been constructed. The height of the road fill was such that berms were not required.
- The road appeared to have been constructed using esker sand and gravel material, which may be susceptible to erosion.
- Lake H15E was ponding on the northeast side of the road at the south end of the road near the main camp and no culvert had been installed at the time of the site visit; however, AEM indicated that Culvert 1 was installed through the road at this location after the site visit.
- A culvert was installed through the road near the borrow area and a small flow was observed (Photographs 35 through 37, Appendix A3). Straw logs had been placed to control erosion and suspended solids in the flow and appeared to be functioning well (Photograph 38, Appendix A3).
- Areas adjacent to the road had been stripped of organics and there was variable amounts of ponded water in these areas. In some areas water filled most of the excavation (e.g., Photograph 33 and 39). Ponding of water may result in greater thaw of the permafrost that could lead to greater settlement of the road fill.
- The emulsion plant pad appeared to be constructed with dirty rockfill and a sand and gravel layer was being placed over the rockfill base at the time of the inspection (Photographs 40 and 41, Appendix A3). A rockfill berm and drainage channel had been constructed along the northwest side of the pad (Photograph 40, Appendix A3). No geotechnical concerns were identified during the inspection.

5.4 Recommendations

The following are recommendations for the site roads and culverts and the Tiriganiaq and Wesmeg borrow areas:

- The culvert planned for where the Wesmeg borrow access road crosses low topography north of Lake B33A should be installed.
- If the CSP for the pipeline crossing under the Tiriganiaq Esker access road will stay in place, the CSP should be replaced and additional road fill cover should be placed.
- The Wesmeg borrow area should be recontoured and either capped with a coarser material or some other form of reclamation to protect against erosion.
- Consideration should be given to using a larger set-back from the ANFO plant pad slopes for placement of sea-containers.
- Areas of erosion on ANFO plant pad should be monitored.
- If erosion occurs in the esker sand material used to construct the emulsion plant road, rockfill should be placed to cap the road and reduce erosion.

- It is recommended that the disturbed areas adjacent to the emulsion plant road are regraded so that water does not pond.
- Regular monitoring and maintenance of the roads should be conducted.

6.0 ORE AND WASTE STOCKPILES

The ore and waste rock storage area is located east of the P-Area. At this time in the development of the site, there were only relatively small piles of waste rock and ore (high grade and low grade). A selection of photographs from the inspection are provided in Appendix A4 (Photographs 1 through 9).

Ore and waste materials removed from the underground development are transported to surface and placed in stockpiles. The majority of waste rock is crushed into various sizes for use in construction. There were various piles of waste materials that have been crushed in this area. One of the high grade ore piles and one of the waste rock piles had access ramps and a top crest area. Berms were in place around the crests of both piles.

No geotechnical concerns related to the stability of the stockpiles were identified.

7.0 OTHER MELIADINE FACILITIES

This section contains the observations and recommendations from the 2017 geotechnical inspection of other Meliadine facilities: industrial pad, landfarm, effluent water treatment plant pad, underground Portal No. 1, underground Portal No. 2, fuel storage area, ventilation intake pad, exploration landfill, and operations landfill.

7.1 Industrial Pad

At the time of the 2017 inspection, the industrial pad appeared to have been mostly completed; however, various facilities were under construction, such as the process plant building, the multi-services building, the incinerator, and the fuel storage area. The camp facility trailers had been set up and AEM was in the process of moving people from the exploration camp to the main camp. Some temporary trailers had also been set up for office space. Appendix A5 contains a selection of the photographs taken during the inspection (Photographs 1 through 17).

The industrial pad is constructed using a combination of rockfill and esker sand and gravel obtained from borrow areas. A surface layer of crushed aggregate was observed in some areas (e.g., Photographs 14 and 15, Appendix A5). The height of the pad varies, based on topography. The slopes of the edges of the pad ranged from approximately 2.5 to 3 horizontal to 1 vertical, and appeared stable. No cracking or settlement was observed on the top surface of the pad. There was erosion observed in several locations along the north slopes where esker sand and gravel had been used for construction (e.g., Photographs 4 and 5, Appendix A5).

Culverts were generally not observed through access ramps and roads within and around the industrial pad, with the exception of one culvert located through an access ramp off of the road at the south end of the industrial pad (Photograph 12, Appendix A5).

Normal maintenance of the surface of the pad, and in particular areas with heavier traffic (e.g., roads), should be anticipated. No geotechnical concerns were identified.

7.2 Landfarm

The new landfarm is located at the southeast corner of the industrial pad area and west of the water treatment plant (Photograph 1, Appendix A5) and will replace the exploration landfarm (Section 8.3) which will be decommissioned. At the time of the 2017 site visit, the perimeter berms of the new landfarm had been constructed and the liner bedding material had been placed; however, the geotextile and geomembrane liner had not been placed. The berms looked to have been constructed with a combination of rockfill and esker materials and the slopes appeared to be approximately 2.5 horizontal to 1 vertical as per the design (Tetra Tech 2017b). There were no signs of erosion, cracking, or settlement, which is expected as the landfarm was newly constructed. No geotechnical concerns were identified. A selection of photos from the inspection are included in Appendix A5 (Photographs 18 through 23).

7.3 Effluent Water Treatment Plant Pad and Intake Causeway

The effluent water treatment plant is located on the northwest shore of CP1 (Photograph 24). A rockfill pad was constructed for the effluent water treatment plant and a rockfill causeway was constructed into CP1 for the intake line and pump house. A selection of photos from the inspection are included in Appendix A5 (Photographs 24 through 32).

The slopes of the pad appeared to be approximately 2 horizontal to 1 vertical, and the slopes of the causeway appeared to be approximately 2.5 horizontal to 1 vertical. There were no signs of erosion, cracking, or settlement, which is expected as the pad was newly constructed. No geotechnical concerns were identified with the pad or causeway. A pipe berm on the south side of the effluent water treatment plant pad had been constructed out of sand that is susceptible to erosion (Photograph 25, Appendix A5).

7.4 Underground Portal No. 1

Underground Portal No. 1 is located southwest of P3 (Photograph 33, Appendix A5). At the time of the inspection, Portal No. 1 had been constructed and was in use. A selection of photos from the inspection are included in Appendix A5 (Photographs 33 through 39).

A small excavation and corrugated culvert is used to connect the underground ramp to surface. Portal No. 1 was observed from the surface only, with observation of the small bedrock cut face above the culvert. A rockfill berm was also in place around the perimeter of the portal excavation. The toe of the rockfill perimeter berm was close to the crest of the rock face in some locations and there was evidence of ravelling of rockfill into the cut; however, the corrugated culvert protects the access to the portal, so there is no safety concern. No other geotechnical concerns were identified at the time of the inspection.

7.5 Underground Portal No. 2

Underground Portal No. 2 is located northwest of the P-Area, on the west side of the access road from Portal No. 1 to the main camp site (industrial pad) (Photograph 33, Appendix A5). At the time of the inspection, Portal No. 2 was being constructed. A selection of photos from the inspection are included in Appendix A5 (Photographs 40 through 47).

Portal No. 2 was observed from the surface only, with observation of the small bedrock cut face and perimeter berm. The toe of the rockfill perimeter berm was close to the crest of the rock face in some locations and there was evidence of ravelling of rockfill onto one of the rock cut benches (Photograph 44, Appendix A5). Ravelling of loose rockfill is a safety concern during entry and exit to the portal. Water was observed ponding in some areas around the perimeter of the portal (outside the perimeter berm) and there was no water management in place (Photographs 46 and 47, Appendix A5). There was an opening in the perimeter berm above the south end of the portal (Photograph 47).

7.6 Fuel Storage Containment Area

The new fuel storage containment area is located south of the west end of D-CP1 and north of the saline pond (Photograph 48, Appendix A5). At the time of the site visit, the fuel storage area was partially constructed. The containment area base and dikes had been constructed and the tanks (3 million litres and 250,000 litres) had been erected. Liner and liner cover had been placed below the tanks; however, the dikes were not yet lined. The dike slopes appeared to be approximately 2 horizontal to 1 vertical, as per the design (Tetra Tech and WSP Canada Inc. 2017) and there were no signs of cracking or settlement. No geotechnical concerns were identified at the time of the site visit. A selection of photos from the inspection are included in Appendix A5 (Photographs 48 through 54).

7.7 Ventilation Intake Pad

The ventilation intake pad is located southeast of Portal No. 1 and north of Channel 5 and Berm 3 (Photograph 55, Appendix A5). At the time of the inspection, the pad had been recently completed and the ventilation intake facility was under construction. A selection of photos from the inspection are included in Appendix A5 (Photographs 56 through 58).

The pad looked to have been constructed out of variable esker materials and the slopes appeared to be approximately 2.5 horizontal to 1 vertical. The finer sand and gravel material may be susceptible to erosion. There was no cracking or settlement observed.

7.8 Exploration Landfill

The exploration landfill is located southwest of Portal No. 2 and northwest of the P-Area (Figure 6). At the time of the site visit, the operation landfill (Section 7.9) was almost completed. It is understood that the exploration landfill will be decommissioned once the new landfill becomes operational.

The exploration landfill is located on gently sloping ground and is contained on three sides by berms and by high ground on the fourth (south) side. The berms appeared to be constructed with esker materials that contained substantial amounts of sand and gravel. The slopes appeared to be approximately 2.5 horizontal to 1 vertical. A selection of photos from the inspection are included in Appendix A5 (Photographs 60 through 68).

A lot of cracking was observed on the downstream slopes of the containment berms. The cracking appeared to be largely due to translational slumping of the berm materials on the slope (e.g., Photographs 61, 62, and 64, Appendix A5). There was also some areas where materials had been eroded and deposited at the toe of the slope (Photograph 66, Appendix A5). There was no ponded water or seepage observed.

7.9 Operation Landfill

The operation landfill (Figure 6 and Photograph 59, Appendix A5) is located northwest of Portal No. 2 and within the northeast corner of the future Waste Rock Storage Facility 1 footprint. At the time of the site visit, construction of the operation landfill appeared to be almost completed.

The operation landfill is located on sloping ground and is contained by perimeter berms. The berms appeared to be constructed with a combination of rockfill and esker materials that contained substantial amounts of sand and gravel. The slopes appeared to match the design of approximately 2.5 horizontal to 1 vertical for the exterior slopes and 2 horizontal to 1 vertical for interior slopes. A sand and gravel layer had been placed over the base of the landfill, but not over the interior slopes of the berms, as shown in the design (Tetra Tech 2017c). There were no cracks or settlement observed. A selection of photos from the inspection are included in Appendix A5 (Photographs 69 through 75).

The sand and gravel material may be susceptible to erosion. If erosion is observed, a coarser rockfill layer should be placed over the exterior slopes and berm crests to protect against erosion. A small amount of water was observed ponding behind the southwest perimeter berm, adjacent to the access ramp to the landfill (Photograph 75, Appendix A5). It is recommended that the area to the southwest of the landfill be graded to reduce the potential for ponding once the landfill is in operation. A few very small puddles of water were observed on the base of the landfill; however, the base appeared to be generally well graded, so substantial ponding is not expected (Photograph 69, Appendix A5).

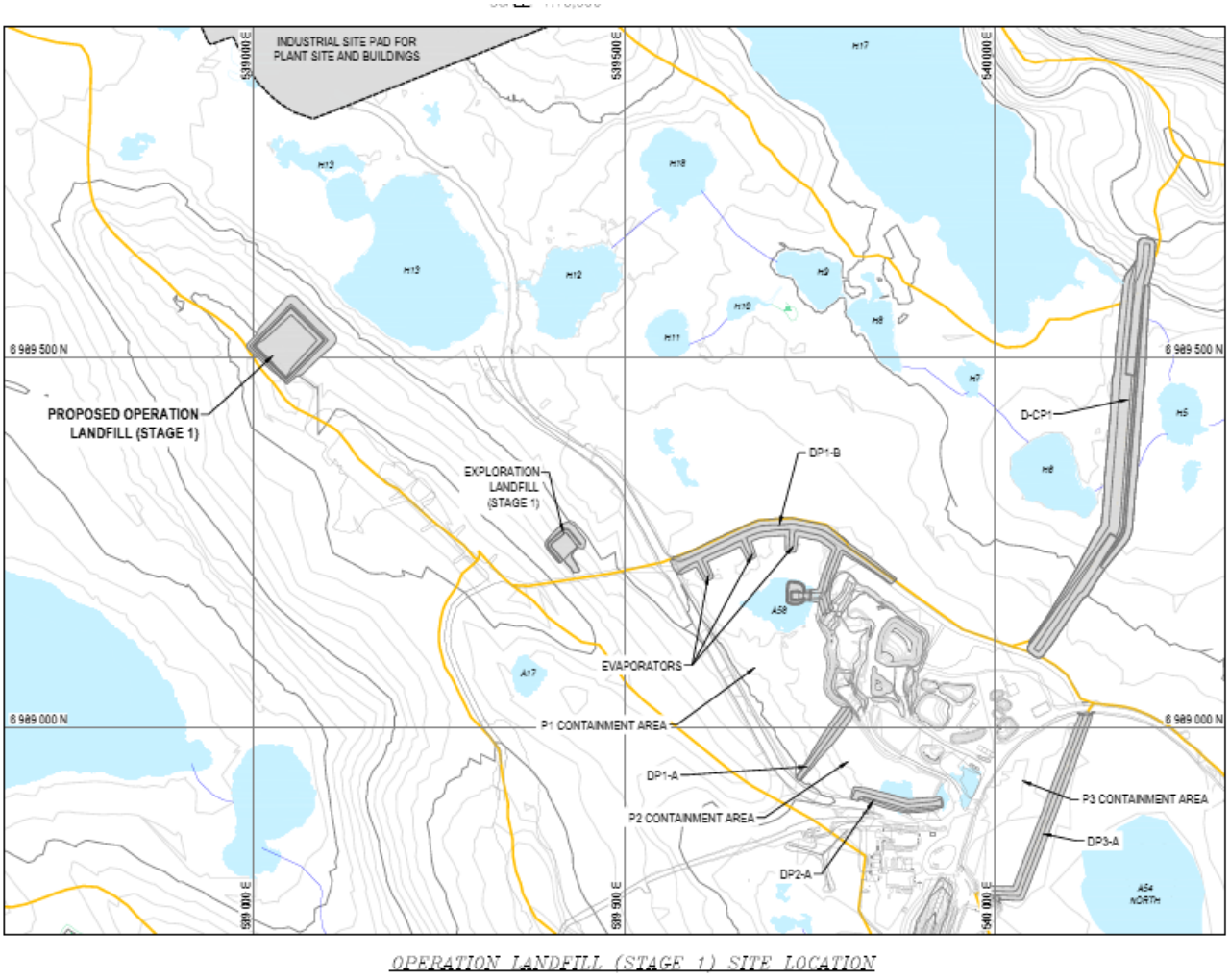


Figure 6: Exploration and Operation Landfill Location Plan

Source: Tetra Tech 2017c.

7.10 Recommendations

The following are recommendations for the Meliadine Mine site facilities summarized in Section 7.0:

- It is recommended that the north slopes of the industrial pad are recontoured and that a coarser surfacing layer is placed on the slope where erosion is substantial.
- It is recommended that the pipe berm constructed out of sand on the south side of the effluent water treatment plant pad be covered with a coarser rockfill to protect against erosion.
- It is recommended that loose rockfill material on the slopes above Portal # 2 is pulled back in areas where it is close to the edge of the cut face and people should not work on the ramp area outside of the portal entrance.
- The opening in the perimeter berm above the south end of Portal No. 2 should be filled in to restrict access and run-off into the excavation.
- Snow management around and above Portal No. 1 and 2 may be advisable, especially prior to freshet, to reduce the potential for larger surface water inflows entering the underground.
- If erosion occurs on the slopes of the ventilation intake facility pad, coarser rockfill should be placed over the slopes and crests to reduce the potential for erosion.
- Some sea-containers were observed to be very close to the edge of the ventilation intake facility pad crest. It is recommended that sea-containers or other structures be placed with a set-back from the slope.
- If the exploration landfill is kept in operation, it is recommended that the berms be compacted to fill in the cracks to avoid further infiltration of water leading to more slumping and erosion. A coarser rockfill should also be placed on the berm slopes and crests to reduce erosion.

8.0 EXPLORATION CAMP AND ACCESS ROAD

The exploration camp site was the first area of the project that was developed and at the time of the site visit it had camp and office facilities; however, AEM was in the process of transitioning staff to the new camp facilities at the main site. The exploration site was inspected including the site pad, fresh water intake, diffuser access, landfarm, fuel storage, and access road. The following sections provide a summary of the observations and recommendations relating to the exploration camp and access road.

8.1 Exploration Camp Pad, Water Intake, and Diffuser Access

The exploration camp site is located on a peninsula on the west shore of Meliadine Lake. The exploration pad has primarily been constructed with esker sand and gravel material; however, small localized portions of the slopes contain coarser grained particles. The thickness of the pad varies based on topography; however, it is generally relatively thin. The slopes appeared to be approximately 2 to 2.5 horizontal to 1 vertical. The slopes generally appeared stable. A selection of photos from the inspection are included in Appendix A6 (Photographs 1 through 9).

There was evidence of surface erosion occurring along the south side of the exploration camp pad (Photographs 4 and 5, Appendix A6).

A short access road extends to the north from the exploration camp pad to the edge of Meliadine Lake, to provide vehicle access to the fresh water intake pump house and pipeline. Photographs 10 through 13 (Appendix A6) show the access road and water intake structures. No geotechnical concerns were identified.

The diffuser access road starts at the water intake access road and runs east to Meliadine Lake. Photographs 14 through 20 (Appendix A6) show the diffuser access road. There was some minor cracking at the eastern end of the road close to Meliadine Lake (Photographs 16 and 18, Appendix A6).

8.2 Exploration Camp Access Road

At the time of the site visit, the exploration road was generally in good condition and appeared to have been constructed with esker materials. There were three culverts installed through the road, and observations from the inspection are summarized in Table 5.

There was an area near the intersection with the main road where water was ponding on either side of the road and the AEM representative mentioned that this section of road is often wet (Photograph 27, Appendix A6).

Table 5: Exploration Camp Access Road Culvert Summary

Culvert Location	Culvert Description	Comments/Recommendations
North side of camp	1×450 mm HDPE corrugated	Upstream end of culvert appears to have been buried within the exploration camp pad (Photographs 21 and 22, Appendix A6).
North side of camp	1×600 mm CSP	Culvert in good condition, no obstructions, no flow. Silt curtain downstream of outlet. Core racks are located upstream, and would trap snow. Evidence of flow during freshet and storms. Esker sand surrounding culvert. Upstream and downstream slopes are not armoured. Consider adding armouring. (Photographs 21, 23, and 24, Appendix A6).
West of camp near Lake J1	1×600 mm HDPE corrugated	Culvert in good condition. Upstream inlet to culvert armoured with rockfill that extends into culvert. Downstream end of culvert partially blocked with sand that should be cleared out. Some large boulders around downstream end of culvert that should be removed to prevent damage to the culvert. (Photographs 25 and 26, Appendix A6).

Note: 1×__ mm = the number of culverts × the diameter of the culvert

CSP = corrugated steel pipe.

8.3 Fuel Storage Area and Landfarm

The fuel storage area, landfarm, and core storage pad are located along the north side of the exploration camp access road, approximately 0.9 km west of the camp. A selection of photos from the inspection are included in Appendix A6 (Photographs 28 through 40).

The exploration bulk fuel storage tanks contain jet fuel and diesel. At the exploration camp, there is a small tank with gasoline (Photograph 8, Appendix A6). All tanks are double lined and self-contained. The tanks are located on a raised pad, constructed with esker sand and gravel. There is no liner or berm surrounding the tanks. The pad was generally in good condition; however, some minor cracking was observed along the east crest due to settlement (e.g., Photographs 30 and 31, Appendix A6).

The exploration landfarm consists of an above-ground bermed containment area, which appears to have been constructed of esker sand and gravel, with a 60 millimetre HDPE textured geomembrane liner and nonwoven geotextile beneath the liner. The liner surface has been covered with a layer of sand and gravel. Contaminated soils have been placed within the bermed area. Water, from precipitation events, has also accumulated within the landfarm (e.g., Photographs 35, 36, and 38, Appendix A6). It is understood that water samples are periodically collected and, if necessary, the water is treated prior to discharge. A small pond was observed near the northeast toe of the landfarm, which is likely due to seepage (Photograph 34, Appendix A6). Evidence of seepage was also observed along the base and lower portion of the berms in some areas, particularly the north slope (Photograph 35, Appendix A6).

It is understood that AEM intends to decommission the exploration landfarm once the new landfarm at the main site is operational (Section 7.2). When the exploration landfarm is decommissioned, it is anticipated that some cleanup of the foundation soil, and containment berms material will be necessary. Until such time that the operation landfarm is commissioned, AEM should try to minimize the amount of water contained within the exploration landfarm.

The core storage pad is located north of the landfarm. The pad slopes generally looked stable; however, there were some fairly large cracks along the east crest (e.g., Photograph 40, Appendix A6) that should be monitored and consideration given to filling them in to reduce infiltration leading to further erosion and cracking.

8.4 Recommendations

The following are recommendations for the exploration camp and access road:

- The south side of the exploration camp pad should be graded to manage surface water to reduce channelization of the flow that leads to erosion. The slope should also be regraded. A coarser surfacing layer could also be placed on top to help reduce the potential for future erosion.
- The diffuser access road could be regraded to close up the cracks and reduce the potential for future cracking.
- Armouring could be added around the 600 mm CSP through the exploration camp access road to reduce erosion.
- The downstream end of the 600 mm corrugated HDPE culvert through the exploration camp access road should be cleared of material. The large boulders around the downstream end of the culvert should also be removed to prevent damage to the culvert.
- If water continues to pond adjacent to the exploration camp access road near the intersection with the main road, consideration should be given to installing a culvert.
- The cracks in fuel storage pad should be monitored; however, they are not considered to be a geotechnical concern.

  Seepage from the landfarm should be monitored and managed, if deemed necessary due to water quality.

9.0 ALL-WEATHER ACCESS ROAD (AWAR) AND ASSOCIATED WATER MANAGEMENT STRUCTURES

The All Weather Access Road (AWAR) construction activities began during the winter of 2012, and construction was completed by the end of October 2013 to connect the hamlet of Rankin Inlet to the Project. Appendix B contains photographs taken during the inspection. The road is approximately 23.8 km long, with three bridge crossings and culverts installed at a total of 19 locations. The road has two-way traffic, and is approximately 6.5 m wide with pull offs approximately every 400 m ±50 m to facilitate vehicles passing.

The AWAR is used by AEM and also provides unrestricted all-terrain vehicle (ATV) access for the public, if it is safe to do so. The AWAR is used to transport building materials, construction/mining equipment, fuel, reagents, supplies, workers, and contractors to the Project.

The road design is based on a general sub-base composed of rockfill or sand and gravel from esker sources and crushed granular surfacing with a combined minimum thickness of 500 mm. The road design varied based on the relative susceptibility to freeze and thaw induced settlement of the foundation soils. The thickness of the road fill material was generally increased, to a minimum of 1.3 m, in areas where potentially thaw-sensitive soils were identified. Along portions of the road where thaw-sensitive soils were identified, a geotextile material was incorporated into the road design to limit damage to the road should the foundation material thaw.

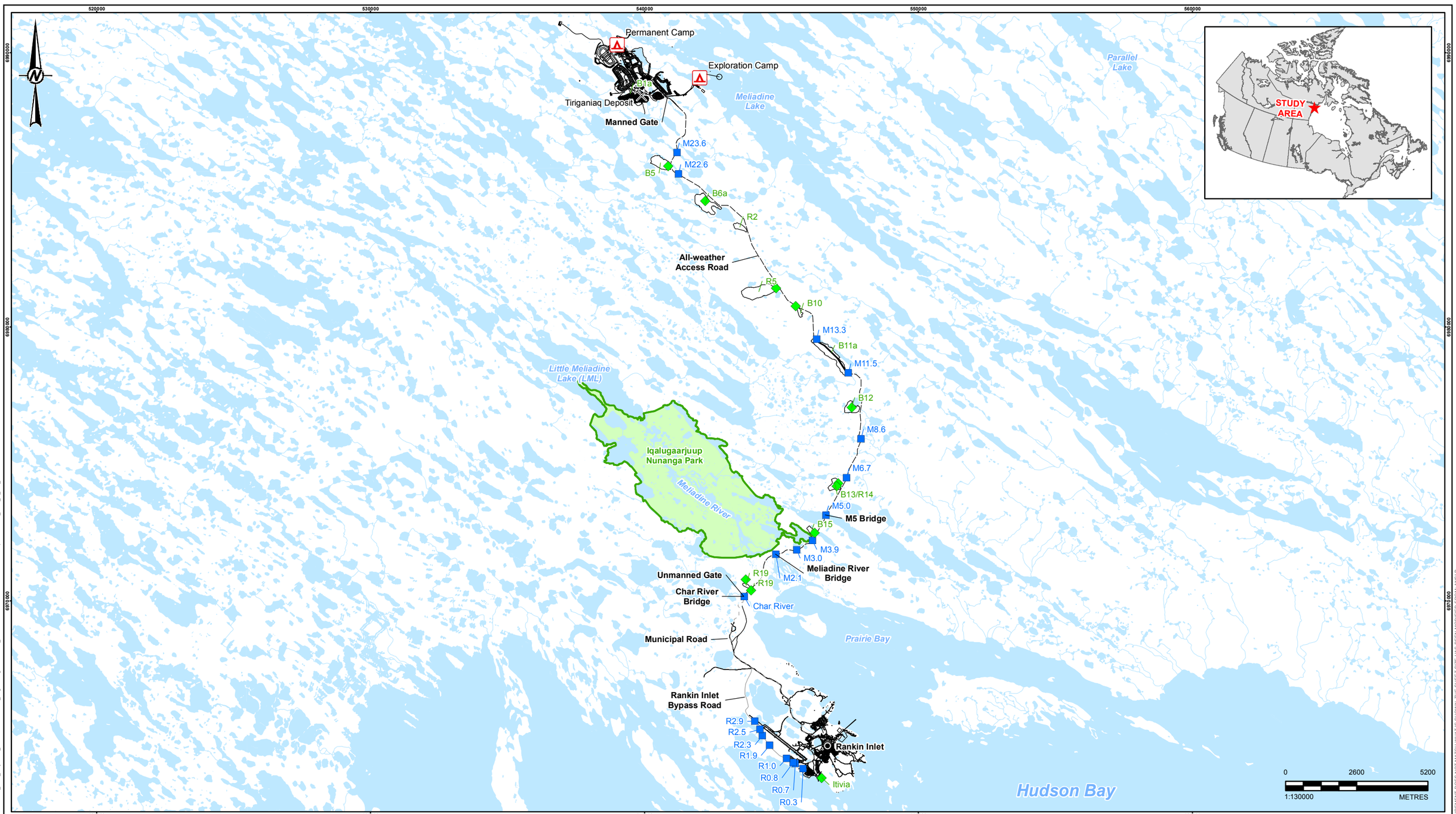
No evidence of thermal degradation of the permafrost was observed on the road during the inspection. It should be noted that visual evidence may not necessarily be observed due to the regular road maintenance performed by AEM. During the inspection, water levels were considered to be normal to low and flow velocities at the crossings were considered to be low.

9.1 Observations and Recommendations

The culverts were generally observed to be in good condition, at the time of the inspection. Most culverts were unobstructed with no signs of damage to the culverts. All bridges and their embankments were in good geotechnical condition at the time of the inspection. A structural and/or mechanical assessment of the bridges was not conducted and is beyond the scope of this geotechnical inspection.

A photographic record of the inspected culverts and bridges is provided in Appendix B. Figure 7 shows the location of the primary water management structures along the road (e.g., M3.9). However, additional culverts have been added that are not shown in Figure 7.

Table 6 lists the locations of water management structures: culverts and bridges that have been installed along the AWAR. The location of the culverts and bridges are listed, based on distance from the Friendship Centre in Rankin Inlet, with the gate house at Meliadine being 29 km. Size and number of culverts is provided in Table 6, along with specific observations and photos at the time of the inspection, and any recommendations. It was observed during the 2017 inspection that flags with kilometre markings had been installed at the culvert locations; however, the distance markings on the culverts did not match with the location along the AWAR.



LEGEND

- CAMP
- PROPOSED MINE SITE
- QUARRY/BORROW PIT LOCATION
- WATERCOURSE CROSSING
- ALL-WEATHER ACCESS ROAD (AWAR)
- ROAD - NEW
- ROAD - EXISTING
- WATERCOURSE
- WATERBODY
- TERRITORIAL PARK

REFERENCE(S)

1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
MELIADINE GOLD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-11-17
DESIGNED	FE
PREPARED	CDB
REVIEWED	
APPROVED	

TITLE
MELIADINE ACCESS ROAD NETWORK WITH QUARRIES AND DRAINAGE

PROJECT NO.	CONTROL	REV.	FIGURE
1660296	3000/R-024	0	**7**

PATH: Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1661\0296_Engineering Services\02_PRODUCTION\2000\DOC R-006\MXD\Report\1660296_2000_R_006_004.mxd PRINTED ON: 2016-11-21 AT: 4:04:31 PM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25mm

Table 6: 2017 Inspection Record of Water Management Structures along the All-Weather Access Road

Station (distance from Friendship Centre)	Water Management Structure Description	Conditions, Observations, and Recommendations (at time of inspection)
KM 6.0	Char River Bridge	Good condition, stable embankments and abutments. Left abutment downstream, sand and gravel, with potential for erosion, Recommendation: Monitor left abutment to determine if armouring should be added.
KM 6.2	3 CSP culverts: 2×1,300 mm 1×700 mm	The culverts are vertically offset with the 700 mm culvert elevated above the 1,300 mm culverts. All clear and in good condition. Small flow in the lower 1,300 mm culvert.
KM 7.0	3 CSP culverts: 2×1,000 mm 1×700 mm	The culverts are vertically offset with the 700 mm culvert elevated above the 1,000 mm culverts. The 700 mm culvert had a dent in side. One of the 1,000 mm culverts had no flow, but contained ponded water. Other 1,000 mm culvert had small flow. Sandy soil around culverts, potential for erosion causing turbidity. Recommendation: Consider adding armouring around culverts to reduce potential for erosion.
KM 7.1	3 CSP culverts: 2×1,000 mm 1×700 mm	Vertically offset. 700 mm culvert is elevated, minor deformation of culverts under the road, no substantial reduction of cross-sectional area. Minor flow in lower 1,000 mm culvert.
KM 7.4	3 CSP culverts: 1×900 mm 1×700 mm 1×1,000 mm	Vertically offset. 700 mm culvert is elevated. Damaged, partially crushed inlet of the 900 mm culvert. Erosion potential due to sandy soils around 700 mm culvert and the inlet was not well armoured. 1,000 mm clear, low flow/ponding water. Recommendation: Consider extending 700 mm culvert and armour around it to reduce erosion.
KM 8.0	Meliadine River Bridge	Right abutment, downstream slope has exposed esker sand and gravel. Recommendation: Monitor right abutment to determine if armouring should be added.
KM 9.1	2×1,000 mm CSP culverts	Minor deformation of both culverts under the road. No flow, water ponded below the inlets. Design was for 5 culverts.
KM 9.5	1×1,300 mm CSP culvert.	Water ponded on upstream side of culvert/road with very low flow due to elevated inlet of CSP. CSP in good condition. Design was for 4 culverts.
KM 10.5	M-5 Bridge	Good condition, stable embankment and abutments of the bridge. Potential small erosion/settlement of rock embankment on the bridge's right abutment identified during 2016 inspection shows no signs of change. Exposed geotextile exposed at base of downstream end of left abutment that could be due to erosion. Recommendation: Continue to monitor for erosion and/or settlement.
KM 12.1	4 CSP culverts: 2×1,300 mm 1×900 mm 1×700 mm	Vertically offset. 700 mm and 900 mm culverts are elevated. Some small dents and bending of haunches in 700 mm and one of the 1,300 mm culverts. Minor flow through the lowest of the 1,300 mm culverts.
KM 12.6	no culverts	Area of poor drainage. Flow along road edge, suspect seepage under the road. Some erosion along toe of road.
KM 13.5	5 CSP culverts: 3×1,300 mm 2×900 mm	Vertically offset, 900 mm culverts are elevated above 1,300 mm culverts. Good condition, no flow, minor dents and deflection in haunch.
KM 14.7	Access road to B12 quarry, 500 mm HDPE corrugated culvert	No flow, small amount of water ponded against AWAR and quarry access road, below inlet of culvert. Minor dents observed in culvert. Small erosion at outlet.
KM 16.3	3 CSP culverts: 1×1,300 mm 1×700 mm 1×1,000 mm	Vertically offset, 1,300 mm culvert is the lowest, then the 1,000 mm culvert and the 700 mm culvert is the highest. No flow in the 700 mm and 1,000 mm culverts, good condition. Small clear flow in 1,300 mm culvert, good condition, small erosion visible at outlet. Outlets are all elevated increasing erosion potential. Drainage appears to be connected to M13.3 area (KM18.1 and 18.15), survey required to confirm. Recommendation: Monitor to assess if hydraulic capacity is adequate and if erosion is an issue. Consider installing culverts at lower elevations to improve water management.
KM 18.1	2 CSP culverts: 1×900 mm, 1×1,000 mm	Vertically offset culverts. The 900 mm culvert is elevated above 1,000 mm culvert. Lower culvert has some flow, minor dent on upstream end. Upper culvert is in good condition. Cover over upper culvert appears thin on upstream side. Note for flow to occur in upper culvert, the road near KM18.15 would be nearly flooded. Culvert outlet is high, therefore potential for erosion during high flow periods exists. Trench exists along upstream toe of road connecting the culverts at KM 18.1 to KM18.15. Recommendation: Monitor cover over upper culvert. If cover thickness is reduced, additional material should be placed to protect the culvert. Consider lowering culverts to allow flow with less ponding adjacent to road and less potential for erosion.
KM 18.15	1×600 mm CSP culvert.	Invert and outlet are both elevated, increasing erosion potential. Ponding adjacent to road required before reaching the culvert inlet. Some erosion of road slope and toe visible. Flow may initially occur through the road fill beneath the culvert. Trench exists along upstream toe of road connecting the culverts at KM 18.1 to KM18.15. Recommendation: Assess if hydraulic capacity is adequate. If water management challenges observed, consider installing an additional culvert at this location, at a lower elevation.
KM 21.7	2×160 mm steel pipes, used as culverts	Vertically offset steel pipes, clear, no flow. High water level evident. AEM inspection reports note water ponding at or over road in this area. Capacity of pipes may be inadequate, or pipes could have been frozen (blocked) causing water to backup. Recommendation: Consider marking pipe location and cleaning out, prior to freshet. Assess if additional capacity is required. Monitor for signs of erosion.
KM 22.3	2×160 mm steel pipes, used as culverts	Vertically offset, clear, no flow. Recommendations: Culverts could be lowered to reduce ponding upstream.
KM 22.7	No culverts	Water ponded on the east side of the road, signs of wet ground observed on west side of road indicating possible seepage under the road. Recommendation: Consider installing a culvert to manage water in this area.
KM 25.8	1×600 mm HDPE corrugated culvert	No flow, minor amount of gravel in base of culvert, some dents on upstream inlet to culvert. Sandy soil around inlet and outlet. Some sediment erosion and deposition evident on downstream side of culvert. Some erosion of slope of road visible in this area. AEM inspection reports noted ponding of water at or over the road in this area during the freshet. Recommendation: Consider adding armouring around culverts. Consider adding additional culverts if water management continues to be an issue during freshet.

Station (distance from Friendship Centre)	Water Management Structure Description	Conditions, Observations, and Recommendations (at time of inspection)
KM 26.2	2×160 mm steel pipes, used as culverts	Vertically offset, lower pipe bent upwards, unable to see through, upper pipe is clear. Some sediment deposition downstream is evident. Water ponded along road below upstream inverts of pipes. AEM inspection reports noted ponding of water at or over the road in this area during the freshet. Recommendation: Lower pipe should be replaced. Consider adding additional culverts if water management continues to be an issue during freshet.
KM 26.5	3×700 mm CSP culverts.	Equal elevation, clear, no flow, small dents, no blockages.
KM 26.8	2×160 mm steel pipes, used as culverts	Vertically offset, clear, no flow.
KM 27.1	3 CSP culverts: 1×900 mm 1×700 mm 1×1,000 mm (southernmost)	Vertically offset, middle culvert (700 mm) elevated above adjacent culverts. Clear, minor flow in lowest culvert, some small dents in 900 mm and 1,000 mm culverts.
KM 28.7	Seepage	Ponded water on east side of road. AEM notes that water ponds against road for most of open water season and road surface often is moist, indicating signs of seepage through road. Recommendation: Consider installation of a culvert.
KM 29.6	1×500 mm HDPE corrugated culvert	Clear, no flow, some small dents, small erosion evident upstream, water ponded on downstream.

1×__ mm = the number of culverts × the diameter of the culvert.

CSP = corrugated steel pipe; AWAR = all-weather access road.

AEM has implemented a watercourse crossing inspection and maintenance program (AEM 2015b), which includes:

- a regular inspection program to identify issues relating to watercourse crossings, such as structural integrity and hydraulic function
- an event-based inspection program to track the impacts of larger storm events on watercourse crossings
- a culvert location inspection program to ensure that culverts have been installed in the correct location with respect to watercourses and that the culvert capacity is adequate, for hydraulic conditions

A total of 26 inspections were conducted by AEM's environment department in 2017. During May and June (during freshet), the inspections were conducted one to two times per week. In April, July, August, and October, inspections were conducted two to three times per month, and for the rest of the year inspections were completed once per month.

Prior to spring freshet, the culverts and bridges were inspected to assess their condition and ability to accommodate rapid spring thaws. The visual inspections are intended to identify any structural issues, blockages, ponding against or over the road, required maintenance, damage, bed erosion, or scour. The inspections include photos of key observations and are documented and filed for future reference.

Road maintenance and snow management are carried out, as deemed necessary. Steaming of culverts, is included as a maintenance activity.

Records of the inspections carried out by the environmental team were provided to Golder for review. The following are some of the key observations documented in the inspection reports during the open water season:

- M5 and Char River under bridge snow accumulation would need to be cleaned up before freshet.
- There was no snow buildup observed on the side of the road.
- Culvert 8.6 needs monitoring; it looks like there is not enough capacity for the water flow required in the area.
- Snow removal around bridges and culverts was successful.
- Water pooling can be observed in the Meliadine River area.
- The situation [water backing up leading to a concern that there may not be sufficient capacity for the flows] at Culvert 8.6 seems to be back to normal (water flushed through culvert).
- The Meliadine River area is back to normal water levels.
- Water pooling can be observed at KM 28 to 30 (to monitor).
- Water is ponding in a number of areas. No GPS coordinates were taken. Straw logs were deployed along areas where water was seen flowing across the road toward a water body.
- All bridge crossings are flowing—no water is backing up.

- There are three areas between KM 25 and KM 29 where water is flowing over the road towards a water body. Straw logs were placed in these areas on 24 May to help manage sediment (more will be placed).
- Water was observed to be encroaching on the road at KM 22 and 26.
- Water pooling should be monitored at KM 22 and 29.
- Recent warm weather reduced size of pooling at KM 22 and 29 drastically.
- Meliadine River Bridge has a rock cage that requires repair to prevent further damage.

By mid-June, observations noted in the inspection reports that the culverts were no longer flowing and there was no more ponding against the road.

10.0 ITIVIA FUEL STORAGE SITE AND BYPASS ROAD

The Itivia site is located south of Rankin Inlet on the north shore of Melvin Bay (Photograph 1, Appendix D1). To minimize impacts on Rankin Inlet, AEM is constructing a bypass road to divert traffic travelling to and from the Itivia site and the Project site around Rankin Inlet. The following sections provide a summary of the observations and recommendations relating to the fuel storage site bypass road.

10.1 Fuel Storage

The Itivia site will be used for bulk fuel storage and will provide a laydown area for transfer of materials to the Project site. At the time of the 2017 site visit, the laydown pad areas appeared to be generally complete and the fuel storage area was under construction. A selection of the photos taken during the site visit are provided in Appendix D1 (Photographs 2 through 16).

The laydown pad areas had been constructed with rockfill and crushed aggregate materials and the slopes appeared to range from about 2 to 3 horizontal to 1 vertical (Photographs 8 through 11, Appendix D1). There was a rock cut face between the fuel storage facility and the upper laydown area above (Photograph 7, Appendix D1). There were no geotechnical concerns identified.

The fuel storage area has two tanks (20 million and 13.5 million litres) within a bermed secondary containment facility. The tanks had been erected, and the raised base and perimeter berms had been constructed out of rockfill. HDPE liner, liner bedding and transition, and liner cover placement were in progress. Selected photographs from the site visit are provided in Appendix D1 (Photographs 2 through 7). There were no geotechnical concerns identified.

Two 450 mm corrugated steel culverts had been installed across the access road into the Itivia site (Photographs 13 through 16, Appendix A6). There was a small pond of water on both the upstream and downstream sides of the culverts, but no visible flow. There was a small bermed pool area constructed out of sand on the downstream side of the culverts in addition to straw logs for sediment control. There were no geotechnical concerns identified.

10.2 Bypass Road

The Itivia bypass road is a 6.3 km gravel road that will divert traffic from the Itivia laydown area to the Project site around Rankin Inlet (Figure 8). The road is designed to be 6.5 m wide for most of its length with pull outs to allow two-way traffic. Two sections are designed to be 8 m to allow two-way traffic without pullouts.

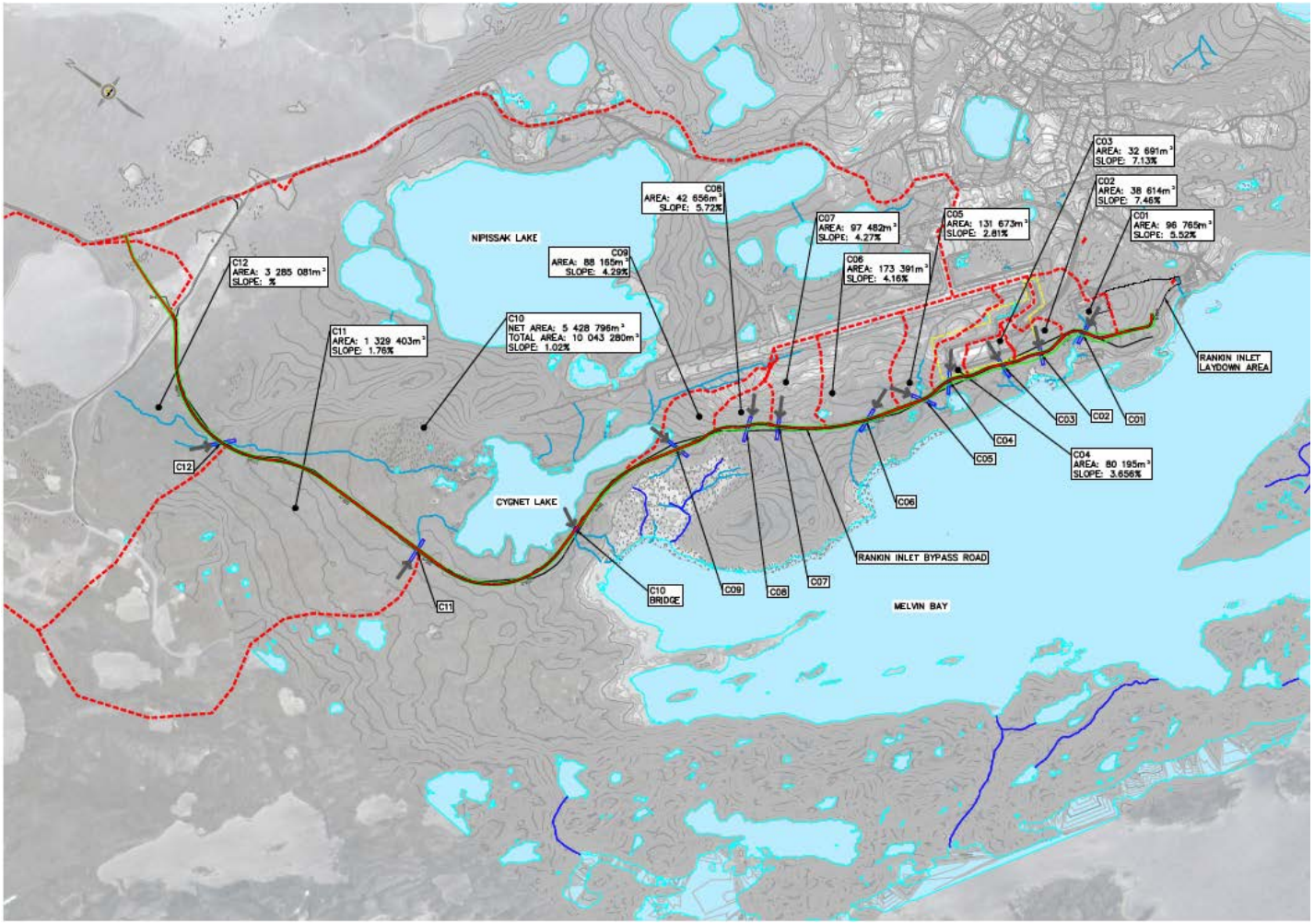


Figure 8: Itivia Bypass Road Alignment

Source: Tetra Tech 2017a.

At the time of the site visit, the road was under construction. Approximately 1.5 km of the northwest end of the road was inspected starting at its intersection with the main AWAR road. Six culvert locations had been constructed and were inspected. All the culverts were corrugated steel culverts and ranged in size from 0.7 to 1.2 m diameter. The locations of the culverts inspected do not appear to match well with the design drawings (Tetra Tech 2017a), which may be a result of modifications to the culvert locations during construction based on site observations and conditions. A selection of the photos taken during the site visit are provided in Appendix D2 (Photographs 17 through 34).

Table 7 provides a summary of the culverts inspected and the observations. There was one location approximately 1.2 km from the intersection with the AWAR where water was ponded on both sides of the road but there was no culvert (Photographs 21 and 22, Appendix D2). A natural drainage course could be seen on the west side of the road, but it also appeared that there had been some excavation in the area, creating a hole for water to pond in. When the inspection is completed in 2018, this area should be checked to see if there is further ponding. No other geotechnical concerns were identified.

Table 7: Itivia Bypass Road Culvert Inspection Summary

Distance from Intersection with AWAR	Number of Culverts (diameter)	Observations	Photographs (Appendix D2)
0.1	3 (1.2 m)	Water ponding on both sides below the inverts of the culverts. No flow through culverts.	17 and 18
0.3	2 (0.7 m)	Water ponding on both sides at or below the inverts of the culverts. No flow through culverts. Some larger rocks within the road fills above the culverts that could cause damage, so should be removed.	19 and 20
1.3	2 (1.2 m)	Shallow water ponding within the vegetation on both sides of the road. No flow through culverts. Some larger rocks within the road fills above the culverts that could cause damage, so should be removed.	23 through 26
1.4	2 (1.2 m)	Shallow water ponding within the vegetation on both sides of the road. No flow through culverts. Silt fencing in place on east side of the road.	27 through 29
1.45	2 (1.2 m)	Water course visible just past the ends of the culverts on both the east and west side of the road. Water was below the inverts of the culverts. No flow through culverts. Some larger rocks within the road fills above the culverts that could cause damage, so should be removed.	30 through 32
1.5	1 (1.0 m)	Water course visible just past the ends of the culverts on both the east and west side of the road. Water was below the inverts of the culvert. No flow through culvert.	33 and 34

AWAR = all-weather access road.

10.3 Recommendations

The following are recommendations for the Itivia fuel storage area and by-pass road:

- The locations of the culverts through the Itivia by-pass road do not appear to match well with the design drawings (Tetra Tech 2017a). The discrepancy in the locations of the culverts may be due to modifications to the locations during construction based on site observations and conditions. The culvert locations should be referenced to the as-built report and drawings during the 2018 annual geotechnical inspection.
- When the Itivia by-pass road inspection is completed in 2018, the area approximately 1.2 km from the intersection with the AWAR should be checked to see if there is still ponding.
- There were some larger rocks within the road fills above the culverts located at 1.3 km and 1.45 km from the intersection with the AWAR that could cause damage, so should be removed. Once the road construction is complete, all culverts should be checked and large rocks removed as necessary.
- Once construction is complete, develop and implement a visual geotechnical monitoring program for the slopes and berms at the Itivia site.
- Once the road is in use, develop and implement a road and culvert monitoring program for the Itivia by-pass road, as is done for the AWAR, which is tied to a maintenance program.

11.0 SUMMARY AND RECOMMENDATIONS

The results of the 2017 annual geotechnical inspection carried out at the Project site, along the AWAR, and at the Itivia site, indicate that the infrastructure was generally in good condition and performing as designed.

The following presents a summary of the findings and recommendations from the 2017 geotechnical inspection for the infrastructure in each of the areas inspected:

Main Site:

- It is recommended that AEM develop an OMS manual for the water management structures on site that includes such information as responsible personnel, monitoring frequencies for visual inspections and instrumentation monitoring, and pond/channel storage design criteria. AEM has indicated that preparation of an OMS manual has started.
- An Emergency Response Plan should be developed to address the consequences of failure of any of the water management structures. Once prepared, it is a good practice to review these documents on an annual basis, along with the overall site Emergency Response Plan, and update them as necessary (e.g., the names and contact numbers for key personnel).
- Geotechnical inspections should be carried out and documented for all facilities following the schedule developed in the OMS manual. In addition, instrumentation should be monitored, and the data should be plotted and reviewed, following the schedule developed in the OMS manual.
- Cracks and areas of minor settlement in the containment pond dikes should be monitored and filled and/or recontoured to close the cracks and reduce the potential for infiltration.
- Where access is feasible, removal of snow from the water collection pond dikes (temporary and permanent) is recommended to reduce the insulating effects of the snow, thereby allowing the temperature of the core material in the dikes and the foundations to drop as low as possible. Snow removal is more important if thermistor data is indicating that the dike and/or foundation temperatures are warmer than expected.
- Water volumes within containment ponds should be managed (pumping down), to maximize capacity for the freshet.
- Make sure thermistors in the water management dikes are well marked so they can be located and maintained during the winter, and are not damaged during snow removal operations. Consider adding data loggers to record the temperatures.
- Consider adding rockfill material to cover the till berm in P1, to protect the till and maintain its integrity if this berm is required for water management.
- Monitor the cracking observed in the D-CP1 downstream sump berms and adjacent to the downstream collection channel. Recontouring and/or compacting the areas of cracking to close the cracks will reduce the potential for water to infiltrate into the cracks leading to warming of the permafrost and additional thaw settlement and cracking.
- The D-CP1 sump and downstream collection channel should be emptied in the fall/early winter to refreeze the ground around these facilities. During the open water season, keeping the water level in the downstream channel and sump low will reduce the potential for thaw of the ground around and associated settlement.

- Vertical ground temperature cable VGTC-4 in D-CP1 should be monitored closely as it was showing readings above 0°C up until the end of 2017. Horizontal ground temperature cable HGTC-1 in D-CP1 should also be monitored closely as it was indicating temperatures around -2°C for the base of the key trench, which is warmer than other sections of the trench.
- The ground temperatures below the water management dikes should be monitored to determine if the foundation remains frozen. Fluctuation of the temperature within the active layer in the dike are expected; however, the foundation is designed to be maintained frozen.
- The pump back line for D-CP5 should be permanently extended to ensure that pump back water is discharged upstream of the dam toe and does not flow into the rockfill shell.
- Soil stabilization should be conducted to reduce erosion potential where esker sand has been used for construction of infrastructure.
- If ponding of water is observed in areas, grading should be conducted to reduce ponding, and if ponding occurs adjacent to roads, consideration should be given to installing culverts.
- Consider using a minimum set-back distance from slope crests for sea-containers or other structures placed on pads.
- The Wesmeg Borrow Area should be recontoured and either capped with a coarser material or revegetated to reduce erosion.
- Monitor the cracking adjacent to Channel 5. Recontouring and/or compacting the areas of cracking to close the cracks will reduce the potential for water to infiltrate into the cracks leading to warming of the permafrost and additional thaw settlement and cracking.
- Ponding upstream of Berm 3 should be monitored to determine how much and how often ponding occurs and if Berm 3 can perform as required with the ponding.
- The Berm 3 cover materials may be susceptible to erosion. This should be monitored, and if there is erosion, consideration should be given to placing coarser material on Berm 3 to reduce the potential for erosion.
- Fill in openings in the berm around the perimeter of Portal No. 2 and pull back loose materials on the benches around the excavation to reduce the potential for material to roll into the excavation.
- Snow management around and above Portal No. 1 and 2 may be advisable, especially prior to freshet, to reduce the potential for larger surface water inflows entering the underground.
- If the exploration landfill is kept in operation, it is recommended that its berms be compacted to fill in the cracks to reduce further slumping and erosion. A coarser rockfill should also be placed on the berm slopes and crests to reduce erosion.

- Remediate the disturbance adjacent to the new emulsion plant road through backfill, grading, placement of coarse material or revegetation to reduce the potential for ponding adjacent to the road and erosion.
- Roadway embankment slope angles and material types should be selected such that they do not negatively affect wildlife movement. Embankment materials should be compacted to reduce the potential of the material being eroded, and if necessary a coarser, well graded, material could be placed and compacted to further reduce erosion potential.
- When culverts are installed, ensure bedding material surrounding culverts is of a suitable gradation (e.g., sandy) and compacted. Larger sized particles (e.g., cobbles) should not be placed in direct contact with the culverts within the road fills; however, the slopes of the road around the outlets of the culverts should be armoured to reduce erosion.
- If the CSP for the pipeline crossing under the road to the Tiriganiaq Esker will stay in place, the CSP should be replaced and additional road fill cover should be placed.
- Implement a road and culvert monitoring program for site roads, as is done for the AWAR, which is tied to a maintenance program.

Exploration Camp Site:

- Repair surface erosion along south slope of exploration camp pad. Grade surface to reduce channelization of surface water flows and therefore reduce the potential for the erosion to reoccur. In this area, a coarser surfacing layer could be placed on top to help reduce the potential for future erosion.
- AEM should try to minimize the amount of water contained within the exploration landfarm until it is decommissioned and remediated.
- The diffuser access road could be regraded to close up the cracks and reduce the potential for future cracking.
- Armouring could be added around the 600 mm CSP through the exploration camp access road to reduce erosion.
- The downstream end of the 600 mm corrugated HDPE culvert through the exploration camp access road should be cleared of material. The large boulders around the downstream end of the culvert should also be removed to prevent damage to the culvert.
- If water continues to pond adjacent to the exploration camp access road near the intersection with the main road, consideration should be given to installing a culvert.
- The cracks in fuel storage pad should be monitored; however, they are not considered to be a geotechnical concern.

All-weather Access Road:

- Continue to monitor culverts and hydraulic effectiveness to assess if current culverts provide adequate capacity and if any changes are required. Evaluate if any culverts need to be installed at a lower elevation to reduce ponding, and downstream erosion.
- Monitor areas that have ponding, but no culverts and consider installing culverts to manage water.
- The kilometre markings on the AWAR culverts should be checked and replaced with accurate numbers.
- Continue regular road inspections and documentation, snow removal, and maintenance for AWAR.

Specific recommendations for the AWAR culverts and bridges are summarized in Table 8.

Itivia Site and By-pass Road:

- The locations of the culverts through the Itivia by-pass road do not appear to match well with the design drawings (Tetra Tech 2017a). The culvert locations should be referenced to the as-built report and drawings during the 2018 annual geotechnical inspection.
- When the Itivia by-pass road inspection is completed in 2018, the area approximately 1.2 km from the intersection with the AWAR should be checked to see if there is still ponding.
- There were some larger rocks within the Itivia by-pass road fills around the culverts inspected in 2017 that should be removed. Once the road construction is complete, all culverts should be checked and large rocks removed as necessary.
- Once construction is complete, develop and implement a visual geotechnical monitoring program for the slopes and berms at the Itivia site.
- Once the road is in use, develop and implement a road and culvert monitoring program for the Itivia by-pass road, as is done for the AWAR, which is tied to a maintenance program.

Table 8: Recommendations for All-Weather Access Road

Station (distance from Friendship Centre in Rankin Inlet)	Water Management Structure Description	Recommendations
KM 6.0	Char River Bridge	Potential for erosion of sand and gravel on left abutment downstream. Monitor to determine if armouring should be added.
KM 7.0	3 CSP culverts: 2×1000 mm 1×700 mm	Potential for erosion of sandy soil around culverts. Monitor to determine if armouring should be added.
KM 7.4	3 CSP culverts: 1×900 mm 1×700 mm 1×1000 mm	Erosion potential due to sandy soils around 700 mm culvert and the inlet was not well armoured. Consider extending and adding armouring.
KM 8.0	Meliadine River Bridge	Right abutment, downstream slope has exposed esker sand and gravel. Monitor to determine if armouring should be added.
KM 10.5	M-5 Bridge	Potential small erosion/settlement of rock embankment on the bridge's right abutment identified during 2016 inspection shows no signs of change. Continue to monitor. Exposed geotextile exposed at base of downstream end of left abutment that could be due to erosion, so should be monitored.
KM 12.6	no culverts	Area of poor drainage. Flow along road edge, suspect seepage under the road. Some erosion along toe of road. Monitor and consider installing a culvert to manage water and/or rockfill to protect road for further erosion.
KM 16.3	3 CSP culverts: 1×1,300 mm 1×700 mm 1×1,000 mm	Outlets are all elevated increasing erosion potential. Monitor to assess if hydraulic capacity is adequate and if erosion is an issue. Consider installing culverts at lower elevations to improve water management.
KM 18.1	2 CSP culverts: 1×900 mm, 1×1,000 mm	Consider adding cover over upper culvert on upstream side. Upper culvert outlet is high, therefore water has to pond close to road surface for culvert to pass flows. Elevation of culvert leads to potential for erosion during high flow periods. Assess if hydraulic capacity is adequate.
KM 18.15	1×600 mm CSP culvert.	Invert and outlet are both elevated, increasing erosion potential. Some erosion of road slope and toe visible. Assess if hydraulic capacity is adequate. If water management challenges observed, consider installing an additional culvert at this location, at a lower elevation.
KM 21.7	2×160 mm steel pipes, used as culverts	High water level evident near road surface. AEM inspection reports note water ponding at or over road in this area. Consider marking pipe location and cleaning out, prior to freshet. Monitor for signs of erosion and adequacy of hydraulic capacity. Add additional culvert in this area if required.
KM 22.7	No culverts	Water ponded on the east side of the road, signs of wet ground observed on west side of road indicating possible seepage under the road. Consider installing a culvert.
KM 25.8	1×600 mm HDPE corrugated culvert	Sandy soil around inlet and outlet and some sediment erosion and deposition evident on downstream side of culvert. Consider adding armouring. Some erosion of slope of road visible in this area. AEM inspection reports noted ponding of water at or over the road in this area during the freshet. Consider adding additional culverts if water management continues to be an issue during freshet. Also consider adding armour around culvert and on road slopes.
KM 26.2	2×160 mm steel pipes, used as culverts	Lower pipe bent upwards and should be replaced. Some sediment deposition downstream is evident. Water ponded along road below upstream inverts of pipes. AEM inspection reports noted ponding of water at or over the road in this area during the freshet. Consider adding additional culverts if water management continues to be an issue during freshet.
KM 28.7	Seepage	Ponded water on east side of road. AEM notes that water ponds against road for most of open water season and road surface often is moist, indicating signs of seepage through road. Consider installation of a culvert.
KM 29.6	1×500 mm HDPE corrugated culvert	Clear, no flow, some small dents, small erosion evident upstream, water ponded on downstream. Monitor and consider lowering the culvert or adding a culvert at a lower elevation.

1×__ mm = the number of culverts × the diameter of the culvert.

CSP = corrugated steel pipe.

12.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this report.

This report was prepared to summarize the findings of the 2017 geotechnical inspection conducted between 19 and 22 September, 2017, to comply with the requirements of AEM's Type A Water Licence No. 2AM-MEL1631, Part I, Item 14 (page 21) and Schedule I, Item 1 (page 39).

We trust the information provided within is sufficient for your current needs. Should you require additional information or further clarification, please contact us.

GOLDER ASSOCIATES LTD.

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GOLDER ASSOCIATES LTD.
Signature ORIGINAL SIGNED
Date 21 March 2018
PERMIT NUMBER: P 049
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REFERENCES

AEM (Agnico Eagle Mines Limited). 2014a. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

AEM. 2014b. Volume 6, Supporting Document 6-1 – Permafrost Thermal Regime Baseline Studies. Final Environmental Impact Statement (FEIS) – Meliadine Gold Project, Nunavut. Submitted to Nunavut Impact Review Board. April 2014.

AEM. 2015a. Risk Management and Emergency Response Plan. Version 4. April 2015. Document No. 6513-RMMM-01.

AEM. 2015b. Roads Management Plan. Version 4. April 2015. Document No. 6513-MPS-03.

AEM 2015c. Follow-up of Ground Thermistor Cables and Permafrost at Meliadine – Compilation of the Data from 2007 to 2015. Revision C. October 2015. Report No. 6515-REP-032.

AEM. 2016a. Letter regarding: Meliadine – 2BB-MEL1424, Meliadine Portal Area – Water Quality Monitoring in Lake A54, Adverse Trends Noted – Mitigation Measures being implemented. Submitted to Nunavut Water Board and Kivalliq Inuit Association. 17 March 2016.

AEM. 2017. Water Management Plan. Version 3. March 2017. Document No. 6513-MPS-11.

CDA (Canadian Dam Association) 2013. Dam safety guidelines. Original 2007, revised 2013.

Golder (Golder Associates Ltd.). 2013. SD 2-3 Tailings Storage Facility preliminary design – Meliadine Gold Project, Nunavut. Final Report submitted to Agnico Eagle Mines Limited. Golder Doc. No. 255-1114280011/3000. 7 January 2013.

Golder. 2014. SD 6-1 Permafrost thermal Regime Baseline Studies – Meliadine Gold Project, Nunavut. Report submitted to Agnico Eagle Mines Limited. Golder Doc. No. 255-1314280007 Ver. 0. April 2014.

Golder. 2017. Meliadine Gold Project, Rankin Inlet, Nunavut. 2016 Annual Geotechnical Inspection. Report submitted to Agnico Eagle Mines Limited. Golder Doc. No. 1660296-006-R-Rev0-2000. February 2017.

NRC (National Research Council Canada). 1993. The Atlas of Canada Permafrost. http://atlas.nrcan.gc.ca/auth/english/maps/environment/land/permafrost.

Nunavut Water Board. 2016. Water Licence No. 2AM-MEL1631. Issued 1 April 2016.

Tetra Tech EBA (Tetra Tech EBA Inc.). 2016a. Design Report for D-CP1 Meliadine Gold Project, NU. Prepared for Agnico Eagle Mines Limited. 15 August 2016. Document No. 6515-E-132-007-132-REP-003.

Tetra Tech EBA (Tetra Tech EBA Inc.). 2016b. Design Report for D-CP5 Meliadine Gold Project, NU. Prepared for Agnico Eagle Mines Limited. 15 August 2016. Document No. 6515-E-132-007-132-REP-004.

Tetra Tech. EBA 2016c (Tetra Tech EBA Inc.). Meliadine – P-Area Containment Construction Record Report. Prepared for Agnico Eagle Mines Limited. September 2016. Document No. 6515-C-230-002.

Tetra Tech (Tetra Tech EBA Inc.). 2016d. Design Report for Berm 3 and Channel 5, Meliadine Gold Project, NU. Prepared for Agnico Eagle Mines Limited. September 2016. Document No. 6515-E-132-007-132-REP-005.

Tetra Tech EBA. 2016e. Design Report for Wesmeg Road Culverts Meliadine Project, Nunavut. Prepared for Agnico Eagle Mines Limited. October 2016. Document No. 6515-E-132-005-132-REP-003.

Tetra Tech. 2017a. Design Report and Drawings For Rankin Inlet Bypass Road, Culverts and Bridge, Meliadine Gold Project. Prepared for Agnico Eagle Mines Limited. March 2017. Document No. 6515-E-132-005-132-REP-006.

Tetra Tech. 2017b. Design Report for Landfarm, Meliadine Gold Project. Prepared for Agnico Eagle Mines Limited. 23 June 2017. Document No. 6515-E-132-007-132-REP-009.

Tetra Tech. 2017c. Design Report for Operation Landfill (Stage 1), Meliadine Gold Project. Prepared for Agnico Eagle Mines Limited. 13 July 2017. Document No. 6515-E-132-007-132-REP-010.

Tetra Tech. 2017d. Construction Summary (As-Built) Report For Dike D-CP5, Meliadine Gold Project Nunavut. Prepared for Agnico Eagle Mines Limited. 6 October 2017. Document No. 6515-E-132-007-132-REP-013.

Tetra Tech. 2017e. Construction Summary (As-Built) Report For Dike D-CP1, Meliadine Gold Project Nunavut. Prepared for Agnico Eagle Mines Limited. 19 October 2017. Document No. 6515-E-132-007-132-REP-012.

Tetra Tech and WSP Canada Inc. 2017. Meliadine Project Design Report and Drawings For the Fuel Storage and Containment Facilities. Prepared for Agnico Eagle Mines Limited. April 2017. Document No. 6515-E-132-004-132-REP-006.

STUDY LIMITATIONS

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APPENDIX A

Meliadine Site Photographs

Appendix A1: P- Area

Appendix A2: Permanent Water Management Structures

Appendix A3: Site Roads, Borrow Areas, and Culverts

Appendix A4: Ore and Waste Stockpiles

Appendix A5: Industrial Pad, Other Site Facilities

Appendix A6: Exploration Camp and Water Intake Causeway

APPENDIX A 1

P-Area: DP1-A, DP1-B, DP2-A, DP3-A

Photograph 1: Overview of P-Area, Google Earth Image, 20 August 2017

Photograph 2: DP1-A, Looking East from the Road (20 September 2017)

Photograph 3: DP1-A, South Slope Looking East (20 September 2017)

Photograph 4: DP1-A, Cracking Observed On Crest (20 September 2017)

Photograph 5: DP1-A, North Slope, Looking West (20 September 2017)

Photograph 6: DP1-B, Looking Northeast (20 September 2017)

Photograph 7: Snow Melt Management Pond, Looking North (20 September 2017)

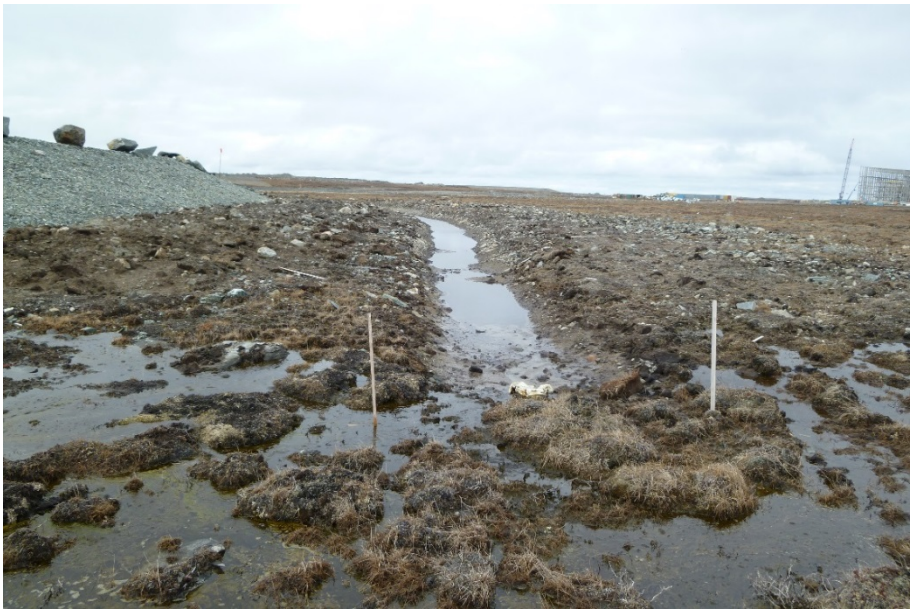
Photograph 8: Snow Melt Management Pond, South Berm Downstream Slope, Looking East (20 September 2017)

Photograph 9: Snow Melt Management Pond, East Berm Downstream Slope, Looking North (20 September 2017)

Photograph 10: DP1-B, Downstream Slope near Station 0+150, Looking East. Orange Delineator on Crest Marks Thermistor Location (20 September 2017)

Photograph 11: DP1-B, Downstream Slope near Station 0+240, Looking West. Orange Delineator on Crest Marks Thermistor Location (20 September 2017)

Photograph 12: DP1-B, Downstream Slope near Station 0+300, Looking West from Access Ramp. Some Seepage from Downstream Toe. Run-off and Seepage Collection Channel to Right of Photograph (20 September 2017)



Photograph 13: DP1-B, Run-off and Seepage Collection Channel Downstream of Dike near Station 0+300, Looking West (20 September 2017)

Photograph 14: DP1-B, Run-off and Seepage Collection Channel Downstream of Dike near Station 0+200, Looking East. Visible Flow towards Sump (20 September 2017)

Photograph 15: DP1-B, Seepage Visible from Dike Toe near Station 0+190 (20 September 2017)

Photograph 16: DP1-B, Downstream Channel and Sump near Station 0+120, Looking East. Active Pumping at Time of Site Visit (20 September2017)

Photograph 17: DP1-B, Seepage Water being Pumped back into P1 from Downstream Sump, East of Snow Melt Pond (20 September 2017)

Photograph 18: DP1-B Causeway for Pump Barge and Evaporator #3 near Station 0+410, Looking Northwest (20 September 2017)

Photograph 19: DP1-B, Upstream Slope near Station 0+390, Looking Northeast from Pump Barge Causeway (20 September 2017)

Photograph 20: DP1-B, Upstream Slope near Station 0+320, Looking North towards Jetty for Evaporator #2 (20 September 2017)

Photograph 21: DP1-B, Upstream Slope near Station 0+250, Looking West towards Jetty for Evaporator #1 (20 September 2017)

Photograph 22: DP1-B, Upstream Slope near Station 0+180, Looking West towards Snow Melt Pond (20 September 2017)

Photograph 23: DP1-B, Upstream Slope of Access Road along West Side of P1, Looking North towards Snow Melt Pond (20 September 2017)

Photograph 24: DP1-B Cracking Observed in Crest of Jetty for Evaporator #2

Photograph 25: DP1-B, Cracking Observed (3 to 10 cm wide) in Jetty for Evaporator #1

Photograph 26: P1 Till Dividing Berm, Looking East (20 September 2017)

Photograph 27: P1 Till Dividing Berm, Erosion and Cracking Observed, Looking East near Intersection with DP1-B (Station 0+420)

Photograph 28: P1 Till Dividing Berm, Looking West (20 September 2017)

Photograph 29: DP2-A, Upstream Slope of West End of Dike, Looking East (20 September 2017)

Photograph 30: DP2-A, Upstream Slope near Station 0+025, Looking East. Finer Grained Material on Slope Where Historic Slump was Remediated (20 September 2017)

Photograph 31: DP2-A, Upstream Slope near Station 0+065, Looking West. Finer Grained Material on Slope Where Historic Slump was Remediated (20 September 2017)

Photograph 32: DP2-A, Cracking on Upstream Slope near Station 0+075 (20 September 2017)

Photograph 33: DP2-A, Cracking on Crest of Dike near Station 0+090, Looking East (20 September 2017)

Photograph 34: DP2-A, Crest of Dike near Station 0+070, Looking West (20 September 2017)

Photograph 35: DP2-A, Upstream Face of East End of Dike, Looking South, some Cracking Visible (20 September 2017)

Photograph 36: DP2-A, Upstream Face of West End of Dike, Looking South. Repair of Previous Sloughing of the Slope Visible, near Station 0+065 (20 September 2017)

Photograph 37: DP2-A, Downstream Slope Adjacent to Access Road, Looking West (20 September 2017)

Photograph 38: DP2-A, Downstream Slope Adjacent to Access Road, Looking East (20 September 2017)

Photograph 39: DP3-A, Downstream Slope and Run-off and Seepage Collection Channel, Looking West from Saline Pond (19 September 2017)

Photograph 40: DP3-A, Downstream Slope near Station 0+300, Looking Southwest. Saline Pond Berm to Left (19 September 2017)

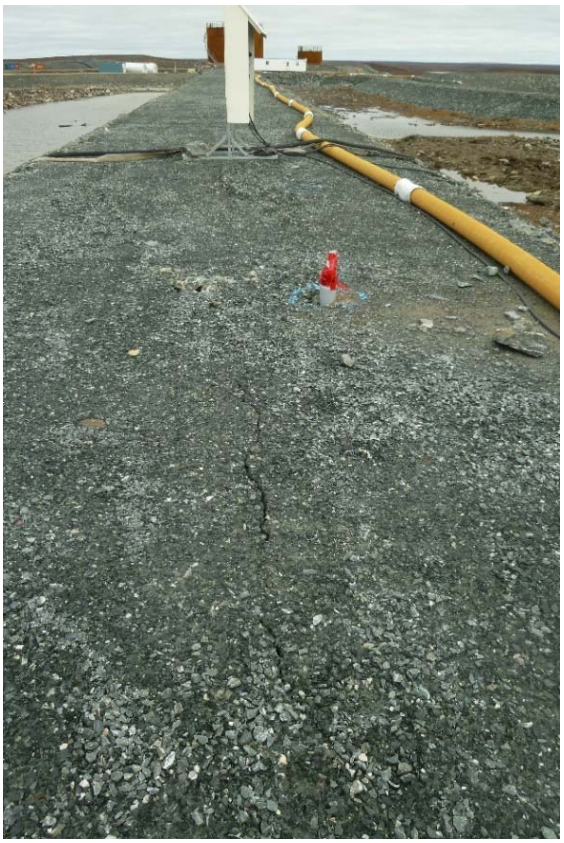
Photograph 41: DP3-A, Downstream Face of Dike near Station 0+050, Looking North (19 September 2017)

Photograph 42: DP3-A, Visible Seepage from Toe of Dike near Station 0+050 (19 September 2017)

Photograph 43: DP3-A, Downstream Face near Station 0+220, Looking Northeast (19 September 2017)

Photograph 44: DP3-A Crest near Station 0+260, Looking West (19 September 2017)

Photograph 45: DP3-A, Upstream Slope near 0+170, Looking West (19 September 2017)



Photograph 46: DP3-A, Cracking Observed on Crest near Station 0+150, Looking Southwest (19 September 2017)

Photograph 47: DP3-A, Cracking Observed on Crest near Station 0+140 (19 September 2017)

Photograph 48: DP3-A, Upstream Slope, Looking Northeast near Station 0+050 (19 September 2017)

Photograph 49: DP3-A, Upstream Slope near Station 0+040, Looking West. (19 September 2017)

Photograph 50: DP3-A, Cracking Observed on Crest from Station 0+000 to 0+050, Looking West (19 September 2017)

APPENDIX A 2

Permanent Water Management Facilities: D-CP1, D-CP5, Channel 5, Berm 3, Saline Pond, and Channel 2

Photograph 1: Overview of D-CP1, Google Earth Image (20 August 2017)

Photograph 2: D-CP1, Water Pipeline Ramp Upstream of the Dike near Station 1+140, Looking West. Sand is Susceptible to Erosion (19 September 2017)

Photograph 3: D-CP1 - Upstream Slope near Station 1+140, Looking Northeast (19 September 2017)

Photograph 4: D-CP1, Cracking on Upstream Bench Crest near Station 1+150, Looking Northeast (19 September 2017)

Photograph 5: D-CP1, Cracking along Upstream Bench Crest near Station 1+225, Looking North (19 September 2017)

Photograph 6: D-CP1, Cracking on Upstream Slope near Station 1+270, Looking North (19 September 2017)

Photograph 7: D-CP1, Upstream Bench Crest and Upstream Slope near Station 1+285, Looking South (19 September 2017)

Photograph 8: D-CP1, Cracking along Upstream Bench Crest near Station 1+450, Looking South (19 September 2017)

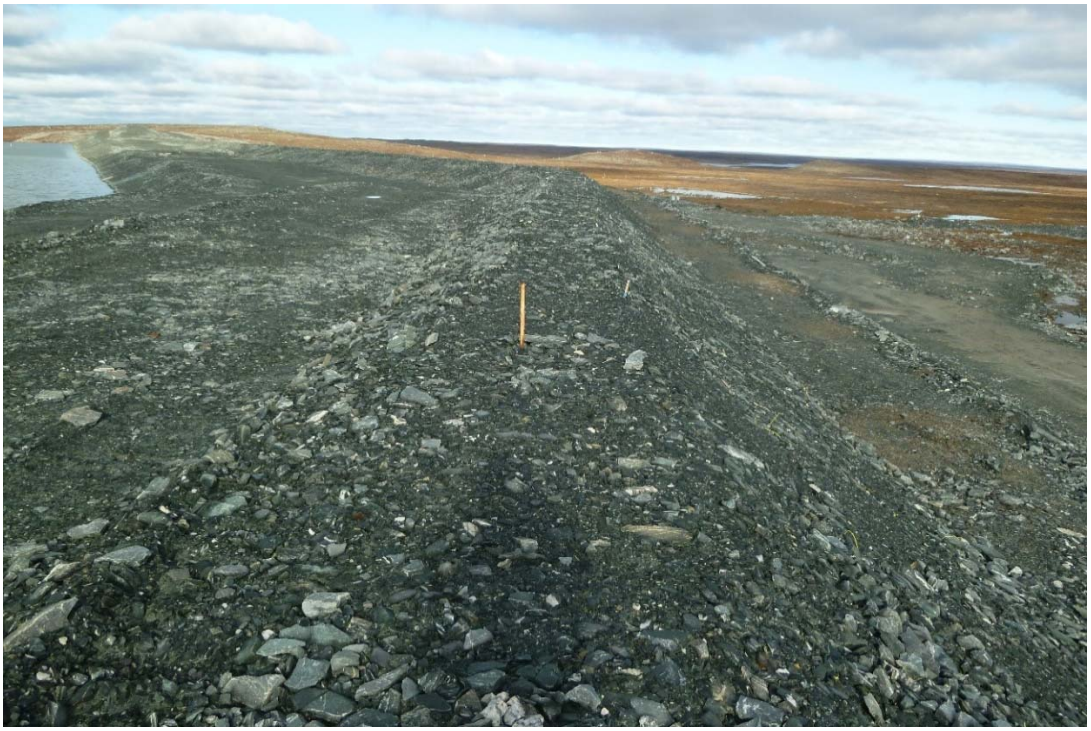
Photograph 9: D-CP1, Crack (approximately 2 to 3 cm wide) on Upstream Bench near Station 1+435 (19 September 2017)

Photograph 10: D-CP1, Small Settlement/depression near Upstream Toe near Station 1+500, Looking South (19 September 2017)

Photograph 11: D-CP1, Upstream Slope Near Station 1+525, Looking South (19 September 2017)

Photograph 12: D-CP1, Crest Looking South near Station 1+450 (19 September 2017)

Photograph 13: D-CP1, Crest and View of Downstream Sump Looking Northeast near Station 1+230 (19 September 2017)



Photograph 14: D-CP1, Overview of Crest near Station 1+150, and Looking Northeast (19 September 2017)

Photograph 15: D-CP1, Overview of Crest near Station 1+000, and Looking Northeast (19 September 2017)

Photograph 16: D-CP1, Downstream Slope and North Abutment near Station 1+525, Looking North (19 September 2017)

Photograph 17: D-CP1, Downstream Slope near Station 1+450, and Looking South (19 September 2017)

Photograph 18: D-CP1, Downstream Slope near Station 1+220, and Looking Northwest (19 September 2017)

Photograph 19: D-CP1, Downstream Slope at Corner of Dike near Station 1+210, and Looking Northwest (19 September 2017)

Photograph 20: D-CP1, Downstream Slope of Dike from Corner of Dike near Station 1+210 to South Abutment, Looking South (19 September 2017)

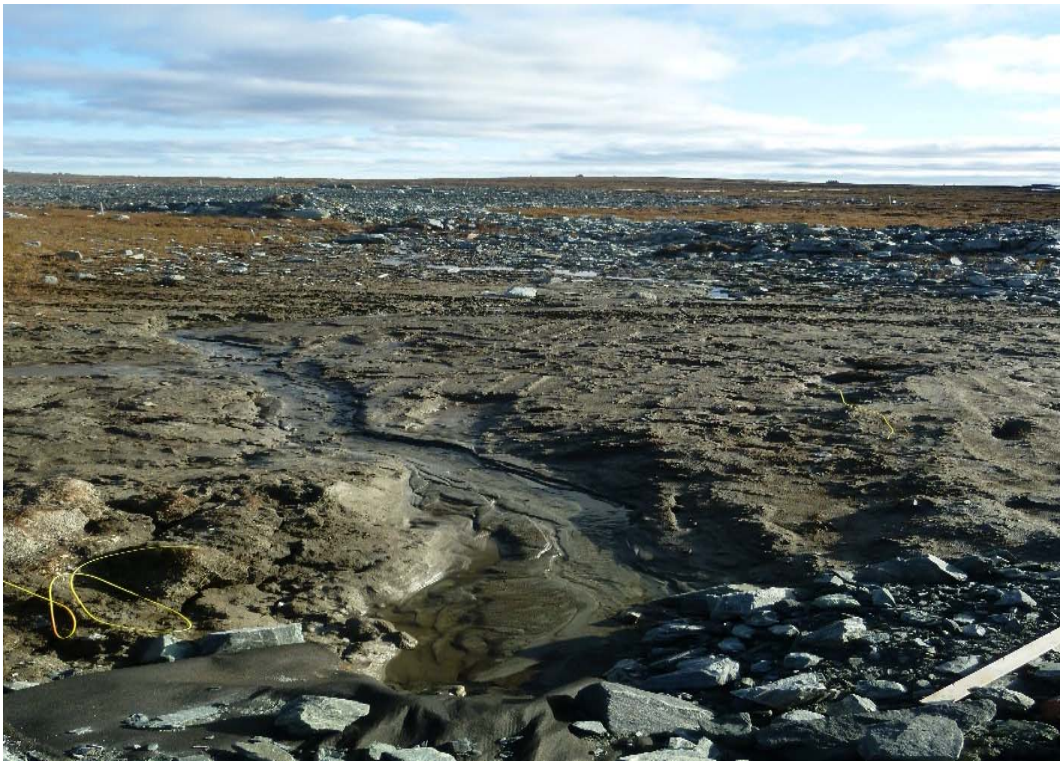
Photograph 21: D-CP1, Downstream Seepage Collection Channel from North End near Station 1+510, Looking South (19 September 2017)

Photograph 22: D-CP1, Cracking Downstream of the Seepage Collection Channel near Station 1+330, Looking South (19 September 2017)

Photograph 23: D-CP1, Downstream Seepage Collection Channel near Station 1+285, and Looking North (19 September 2017)

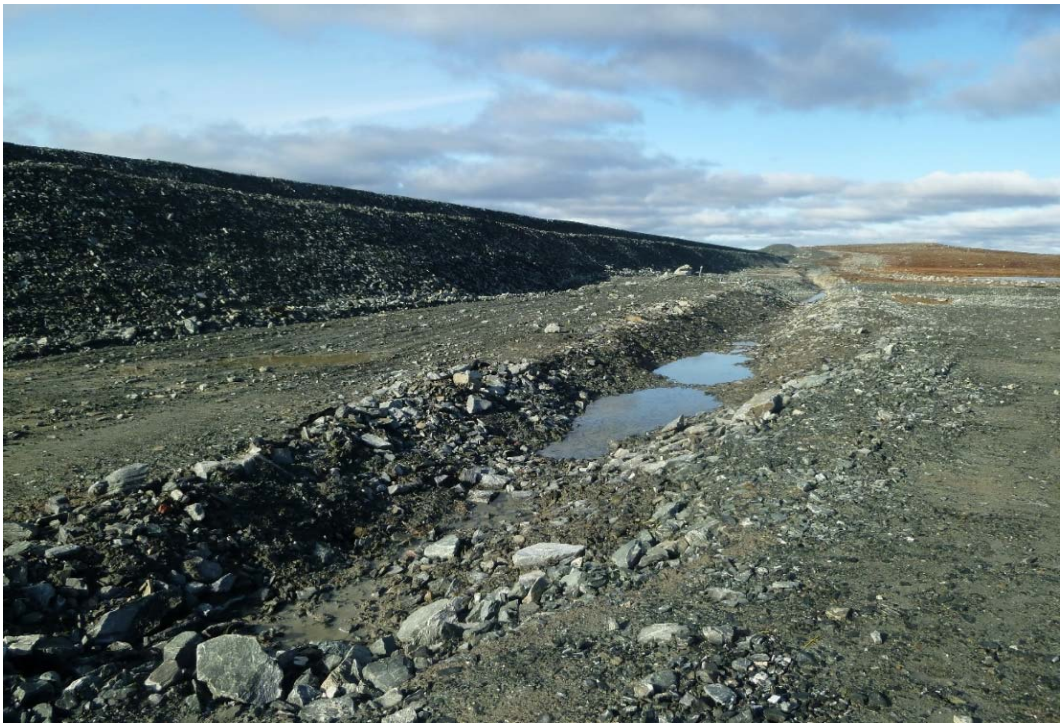
Photograph 24: D-CP1, North Side of Downstream Pond, and Some Cracking/slumping, Looking East (19 September 2017)

Photograph 25: D-CP1, Downstream Sump, Looking East (19 September 2017)



Photograph 26: D-CP1, Water Flowing Towards Southeast Corner of Pond, Looking Southeast (19 September 2017)

Photograph 27: D-CP1, Downstream Channel, Looking South from Sump (19 September 2017)



Photograph 28: D-CP1, Overview of Channel and Downstream Slope of Dike near Station 1+210, Looking North (19 September 2017)

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Photograph 29: General overview of D-CP5, Berm 3, Channel 5, and the Saline Pond, Google Earth Image (August 2017)

Photograph 30: D-CP5, Overview of Northeast End of Upstream Dike Toe near Station 1+300, and Looking Southwest (19 September 2017)

Photograph 31: D-CP5, Minor Settlement and Cracking on Upstream Crest and Slope, near Station 1+210 (19 September 2017)

Photograph 32: DPC-5, Upstream Crest near Station 1+150, and Looking Southwest (19 September 2017)

Photograph 33: DPC-5, Upstream Crest near Station 1+150, and Looking Northeast (19 September 2017)

Photograph 34: D-CP5, Crest at Southwest Abutment near Station 1+025, and Looking Northeast (19 September 2017)

Photograph 35: D-CP5, Small Hole in Upstream Crest near Station 1+185. Vertical Temperature Cable (VGTC-2) in Background (19 September 2017)

Photograph 36: D-CP5, Pump Back Discharge on Upstream Slope (prior to being extended) near Station 1+170 (19 September 2017)

Photograph 37: D-CP5, Pump Back Discharge on Upstream Slope (after being extended) near Station 1+170 (19 September 2017)

Photograph 38: D-CP5, Ponded Water at Upstream Toe of Dike near Station 1+185. Vertical Temperature Cables (VGTC-1 and 2) in Background (19 September 2017)

Photograph 39: D-CP5 Downstream Sump and Pump Back Line near Station 1+170, Looking Southwest (19 September 2017)

Photograph 40: D-CP5, Dam Crest, Downstream Sump, and Pump Back Line near Station 1+170, Looking Northeast (19 September 2017)

Photograph 41: D-CP5, Dike Crest and Downstream Slope near Station 1+030, Downstream Face and Crest (19 September 2017)

Photograph 42: D-CP5, Downstream Slope near Station 1+050, and Looking Southwest (19 September 2017)

Photograph 43: D-CP5, Overview of Downstream Slope from Northeast Abutment, Looking Southwest (19 September 2017)

Photograph 44: D-CP5, Cracking on Downstream Berm Crest near 1+ 175, Looking Northeast (19 September 2017)

Photograph 45: D-CP5, Jetty 5 and Pumping Station, Looking Northeast (19 September 2017)

Photograph 46: D-CP5, Jetty 5 and Pumping Station. South Slope of Jetty, Looking West (19 September 2017)

Photograph 47: D-CP5, Jetty 5, Cracking and Settlement of the Southwest Toe of the Jetty (19 September 2017)

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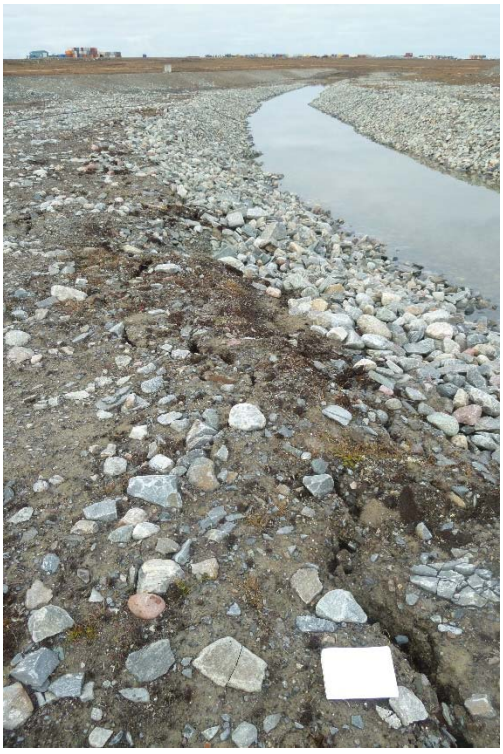
Photograph 48: Channel 5, Looking Northeast from near Station 0+250 (19 September 2017)



Photograph 49: Channel 5, Looking West from near Station 0+250. Some Cracking Adjacent to Channel (19 September 2017)

Photograph 50: Channel 5, Looking West near Station 0+210 (19 September 2017)

Photograph 51: Channel 5, Looking West near Station 0+145. Water has Overflowed Channel 5 and is Ponding against Berm 3 (19 September 2017)

Photograph 52: View of Upstream Slope of Berm 3 and Channel 5, Looking Northwest (19 September 2017)

Photograph 53: Berm 3, Upstream Slope and Crest near Station 0+230, Looking Southeast. D-CP5 in Background and Channel 5 at Far Left (19 September 2017)

Photograph 54: Berm 3, Upstream Slope and Crest with Water Ponded on Upstream near Station 0+140, Looking Southeast (19 September 2017)

Photograph 55: Berm 3, Upstream Slope and Crest with Water Ponded on Upstream near Station 0+180, Looking Northwest (19 September 2017)

Photograph 56: Berm 3, Downstream Slope and Crest, Small Pond of Water against Downstream Toe near Northwest Abutment, Looking Southeast (19 September 2017)

Photograph 57: Berm 3, Downstream Slope near Mid-point of Dike, Water Ponded within Vegetation, Looking Southeast (19 September 2017)

Photograph 58: Berm 3, Downstream Slope near Mid-point of Dike, Looking Northwest (19 September 2017)

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Photograph 59: Saline Pond, Looking Northwest at Pond and Perimeter Berm (19 September 2017)

Photograph 60: Saline Pond, Looking East (19 September 2017)

Photograph 61: Saline Pond, Cracking in Perimeter Berm on Northwest Side of Pond (19 September 2017)

Photograph 62: Saline Pond, Possible Settlement near Toe of Northwest Perimeter Berm (19 September 2017)

Photograph 63: Saline Pond, Southwest Perimeter Berm Minor Cracking in Berm Crest (19 September 2017)

Photograph 64: Saline Pond, Southwest Perimeter Berm Looking Southeast. Collection Pond CP5 to Right of Photo (19 September 2017)

Photograph 65: Saline Pond, Southwest Perimeter Berm Looking Southwest. Collection Pond CP5 to Left of Photo (19 September 2017)

Photograph 66: Saline Pond, Downstream Slope of the Northwest Perimeter Berm and Area between Saline Pond and DCP3-A. Small Amount of Water Ponded Adjacent to the Saline Pond Perimeter Berm (19 September 2017)

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Photograph 67: Unlined Extension of East End of Channel 2, Looking Southeast at Start of Channel (20 September 2017)

Photograph 68: Unlined Extension of East End of Channel 2, Looking Northwest (20 September 2017)

Photograph 69: Channel 2, Start of Lined Channel at East End, Looking Southwest. Industrial Pad in Background (20 September 2017)

Photograph 70: Channel 2, Eastern Section, Looking West (20 September 2017)

Photograph 71: Channel 2, Western Section, Looking East (20 September 2017)

Photograph 72: Channel 2, West End near Outlet, Looking West. Some Water Ponded in Base of Channel (20 September 2017)

Photograph 73: Channel 2, Outlet of Channel at West End (20 September 2017)

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APPENDIX A 3

Site Roads and Culverts, Wesmeg Borrow Area, Tiriganiaq Esker Area, Emulsion Plant Pad and Access Road, Main Site Water Intake Access Road

Photograph 1: Overview Showing Locations of Culverts 3 and 4, Google Earth Image (August 2017)

Photograph 2: Culvert #3, Upstream End of Culverts, Looking North. Access Road on Right (21 September 2017)

Photograph 3: Culvert #3, Downstream End of Culverts, Looking Northeast (21 September 2017)

Photograph 4: Culvert #4, Upstream End of Culvert, Looking South (21 September 2017)

Photograph 5: Culvert #4, Looking Through Upstream End of Culvert. Some Damage Visible (21 September 2017)

Photograph 6: Culvert #4, Downstream End of Culvert, Looking South. Access Road Visible on Right (21 September 2017)

Photograph 7: Overview of Tiriganiaq and Wesmeg areas. Google Earth Image (August 2017)

Photograph 8: Road to Tiriganiaq Esker, South Side of Road, Looking West. Culvert for Pipeline Crossing (21 September 2017)

Photograph 9: Road to Tiriganiaq Esker, Culvert for Pipeline Crossing North Side of Road (21 September 2017)

Photograph 10: Culvert #6, Upstream End of Culvert through Road to Tiriganiaq Esker, Looking West (21 September 2017)

Photograph 11: Culvert #6, Downstream End of Culvert through Road to Tiriganiaq Esker, Looking Southeast (21 September 2017)

Photograph 12: Culvert #6, Looking Through Culvert from Upstream End (21 September 2017)

Photograph 13: Road to Wesmeg Borrow, Stripping along Edge of Road has been Recontoured, Water Ponded against Road in Low Area in Background, Looking West (21 September 2017)

Photograph 14: Road to Wesmeg Borrow, Stripping Along Edge of Road has been Recontoured, Coarser Rockfill Placed on Road Surface, Looking East, Magazine Storage in Background (21 September 2017)

Photograph 15: Wesmeg Borrow, Erosion Downslope, Looking Northwest (21 September 2017)

Photograph 16: Wesmeg Borrow, Erosion Downslope, Looking Southeast (21 September 2017)

Photograph 17: Wesmeg Borrow Cracking Along Crest of Slope (21 September 2017)

Photograph 18: Wesmeg Borrow Overview Looking Northeast (21 September 2017)

Photograph 19: Wesmeg Ventilation Raise, Upstream End of Pipe Culvert at Left, Looking Southeast (21 September 2017)

Photograph 20: Wesmeg Ventilation Raise, Looking Southeast at Southwest Edge of Development Area. Downstream End of Pipe Culvert at Right (21 September 2017)

Photograph 21: Magazine Storage Area Overview (21 September 2017)

Photograph 22: ANFO Plant Pad, Overview of Northwest and Southwest Slopes, Looking East (21 September 2017)

Photograph 23: ANFO Plant Pad, Southwest Slope, Looking Southeast (21 September 2017)

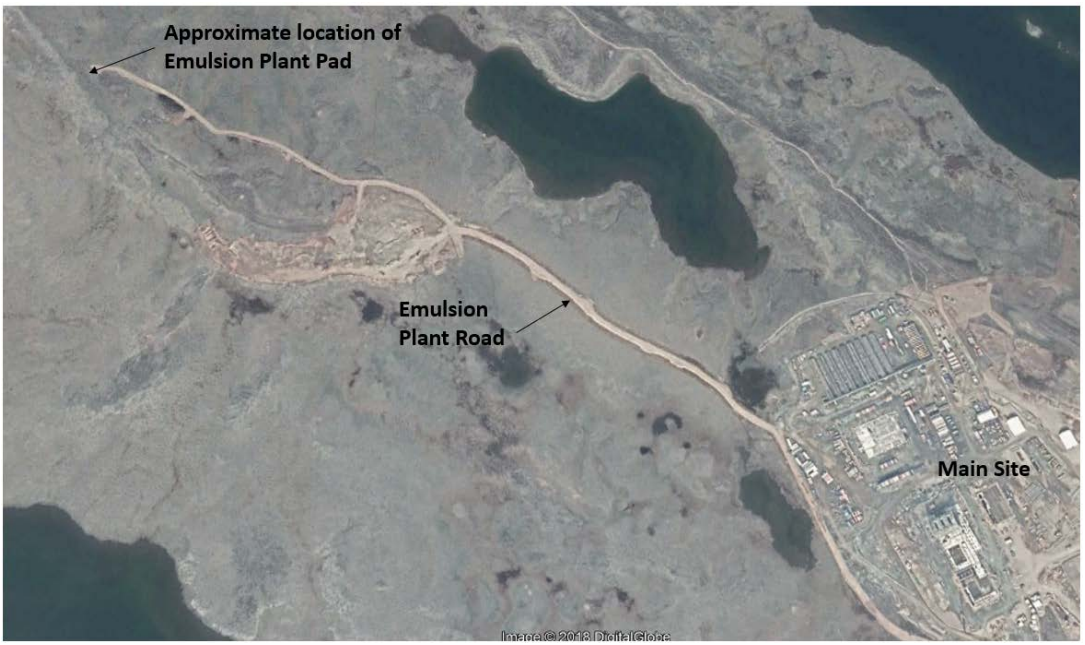
Photograph 24: ANFO Plant Pad, Some Erosion and Settlement on Southwest Slope, Looking Northwest (21 September 2017)

Photograph 25: ANFO Plant Pad, Some Erosion on Southwest Slope, Looking Northwest (21 September 2017)

Photograph 26: ANFO Plant Pad, North Slope, Looking West (21 September 2017)

Photograph 27: ANFO Plant Pad, East Slope, Looking North. Sea-containers are Located Very Close to Crest (21 September 2017)

Photograph 28: ANFO Plant Pad, Overview of East Slope (21 September 2017)



Photograph 29: Overview of Emulsion Plant Access Road. Emulsion Plant Pad Not Constructed at Time of this Photo. Google Earth Image (August 2017)

Photograph 30: Emulsion Plant Access Road, Lake H15E Ponding on Northeast Side of the Road near South End of Road. No Culvert Installed (21 September 2017)

Photograph 31: Emulsion Plant Access Road, Lake H15E in top Right of Photo (Photograph 30), and Minimal Water on Southwest Side of Access Road. No Culvert in Place (21 September 2017)

Photograph 32: Emulsion Plant Access Road, Area Stripped Adjacent to the Road with Small Amount of Ponding, Looking Southeast (21 September 2017)

Photograph 33: Emulsion Plant Access Road, Water Ponded on Southwest Side of Road where Stripping was Completed, Looking Northwest (21 September 2017)

Photograph 34: Emulsion Plant Access Road, No Water Ponded on Northeast Side of Road Opposite to Photograph 33 Above (21 September 2017)

Photograph 35: Emulsion Plant Access Road, Upstream End of Culvert through Road near Borrow Area (21 September 2017)

Photograph 36: Emulsion Plant Access Road, Water Management Upstream of Culvert through Road near Borrow Area (Photograph 35) (21 September 2017)

Photograph 38: Emulsion Plant Access Road, Water Management Downstream of Culvert through Road near Borrow (Photograph 35) (21 September 2017)

Photograph 39: Emulsion Plant Access Road, Looking South from Emulsion Plant Pad. Water Ponded on Southwest Side of Road where Foundation was Stripped (21 September 2017)

Photograph 40: Emulsion Plant Pad, Eastern Perimeter Berm and Ditching, Looking Northwest from Southeast Corner (21 September 2017)

Photograph 41: Emulsion Plant Pad, North Slope, Looking Northeast (21 September 2017)

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Photograph 42: Overview of Main Site Water Intake and Access Road, Google Earth Image (August 2017)

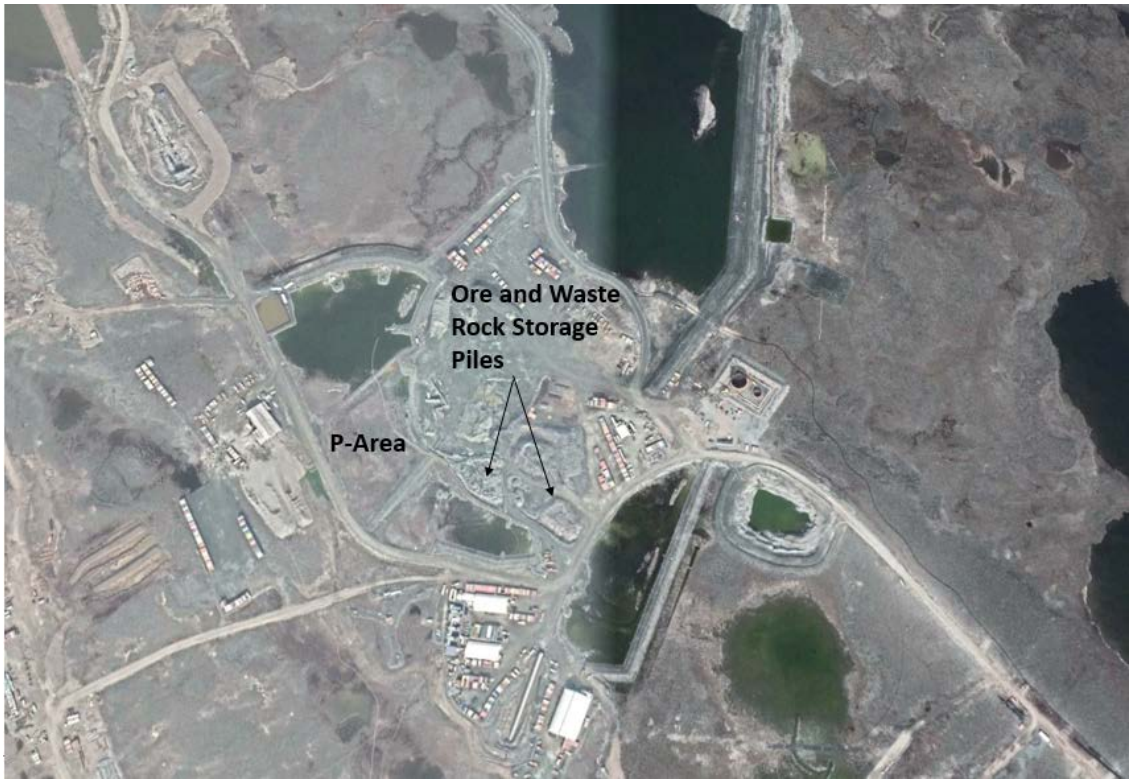
Photograph 43: Main Site Water Intake, Overview of Pipeline and Access Road, Looking South (21 September 2017)

Photograph 44: Main Site Water Intake, East End of Access Road Ends back from Meliadine Lake (21 September 2017)

Photograph 45: Main Site Water Intake, Overview of Pipeline and Access Road, Looking West from East End, near Meliadine Lake (21 September 2017)

APPENDIX A 4

Waste Rock and Ore Storage Piles



Photograph 1: Overview of Ore and Waste Rock Storage Area, Google Earth Image (August 2017)

Photograph 2: Overview of Low Grade Ore Stockpile (21 September 2017)

Photograph 3: Low Grade Ore Stockpile (21 September 2017)

Photograph 4: High Grade Ore Stockpile (21 September 2017)

Photograph 5: High grade ore stockpile (21 September 2017)

Photograph 6: Overview of Top of High Grade Ore Stockpile, Safety Berms in Place (21 September 2017)

Photograph 7: Waste Rock Storage Pile Slope (21 September 2017)

Photograph 8: Waste Rock Storage Pile Slope (21 September 2017)

Photograph 9: Waste Rock Storage pile, Top of Pile, Safety Berms in Place (21 September 2017)

APPENDIX A 5

Industrial Pad and Other Site Facilities: Landfarm, Effluent Water Treatment Plant Pad and Intake, Underground Portal No. 1 and Underground Portal No. 2, Fuel Storage, Ventilation Intake Pad, Exploration Landfill, and Operation Landfill

Photograph 1: Google Earth Image

Photograph 2: Industrial Pad, North End of West Slope, Looking North (20 September 2017)

Photograph 3: Industrial Pad, North End of West Slope with Access Ramp in back Right of Photograph, Looking South (20 September 2017)

Photograph 4: Industrial Pad, Erosion of North Slope, Looking East (20 September 2017)

Photograph 5: Industrial Pad, Erosion of North Slope (20 September 2017)

Photograph 6: Industrial Pad, East End of North Slope, Coarser Material, Less Erosion (20 September 2017)

Photograph 7: Industrial Pad, North End of East Slope, Looking South (20 September 2017)

Photograph 8: Industrial Pad, Area at Northeast Corner of Site near Start of Water Intake Access Road, Looking South. (21 September 2017)

Photograph 9: Industrial Pad, Quarry Area East of the Industrial Pad, Looking South (21 September 2017)

Photograph 10: Industrial Pad, Quarry Area East of Industrial Pad, Water Ponding and Ditching for Water Management, Looking South (21 September 2017)

Photograph 11: Industrial Pad, Slopes of Pad Located West of Future Fuel Storage Area, Looking North (21 September 2017)

Photograph 12: Industrial Pad, Access Road at South End of Site, Culvert through Access is Exposed (21 September 2017)

Photograph 13: Industrial Pad, Interior Slope north of Multi-services Building, Looking West (21 September 2017)

Photograph 14: Incinerator Pad, West Slope, Looking South. Variable Material Used for Pad Construction (21 September 2017)

Photograph 15: Incinerator Pad, East Slope Looking South. Variable Material Used for Pad Construction. No Culvert Installed Through Access Road to Incinerator (21 September 2017)

Photograph 16: Future Fuel Storage for Powerhouse, Downstream Face of East Slope, Looking Northwest (21 September 2017)

Photograph 17: Future Fuel Storage for Powerhouse, South and West Slopes, Looking Northeast (21 September 2017)

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Photograph 18: Landfarm, East Slope, Looking South (20 September 2017)

Photograph 19: Landfarm, South Slope Facing West (20 September 2017)

Photograph 20: Landfarm, South Corner Slope Facing North (20 September 2017)

Photograph 21: Landfarm, West Slope Facing North (20 September 2017)

Photograph 22: Landfarm, North Slope Facing East from West Corner (20 September 2017)

Photograph 23: Landfarm, Overview of Interior from West Corner (20 September 2017)

Photograph 24: Overview of Effluent Water Treatment Plant Location. Google Earth Image (August 2017)

Photograph 25: Effluent Water Treatment Plant, South Slope of Pad, Looking North. Pipe Ramp Constructed with Sand that is Susceptible to Erosion (21 September 2017)

Photograph 26: Effluent Water Treatment Plant, East Slope of Pad, and Looking Southwest from Intake Causeway (21 September 2017)

Photograph 27: Effluent Water Treatment Plant, East Slope of Pad, Looking Southeast (21 September 2017)

Photograph 28: Effluent Water Treatment Plant, Crest of Pad above East Slope, Looking South (21 September 2017)

Photograph 29: Effluent Water Treatment Plant, Overview of Effluent Water Treatment Plant Intake Causeway, Looking North (21 September 2017)

Photograph 30: Effluent Water Treatment Plant, Crest and South Slope of Intake Causeway, Looking East (21 September 2017)

Photograph 31: Effluent Water Treatment Plant, North Slope of Intake Causeway, Looking West (21 September 2017)

Photograph 32: Effluent Water Treatment Plant, End of Intake Causeway, Looking Northeast (21 September 2017)

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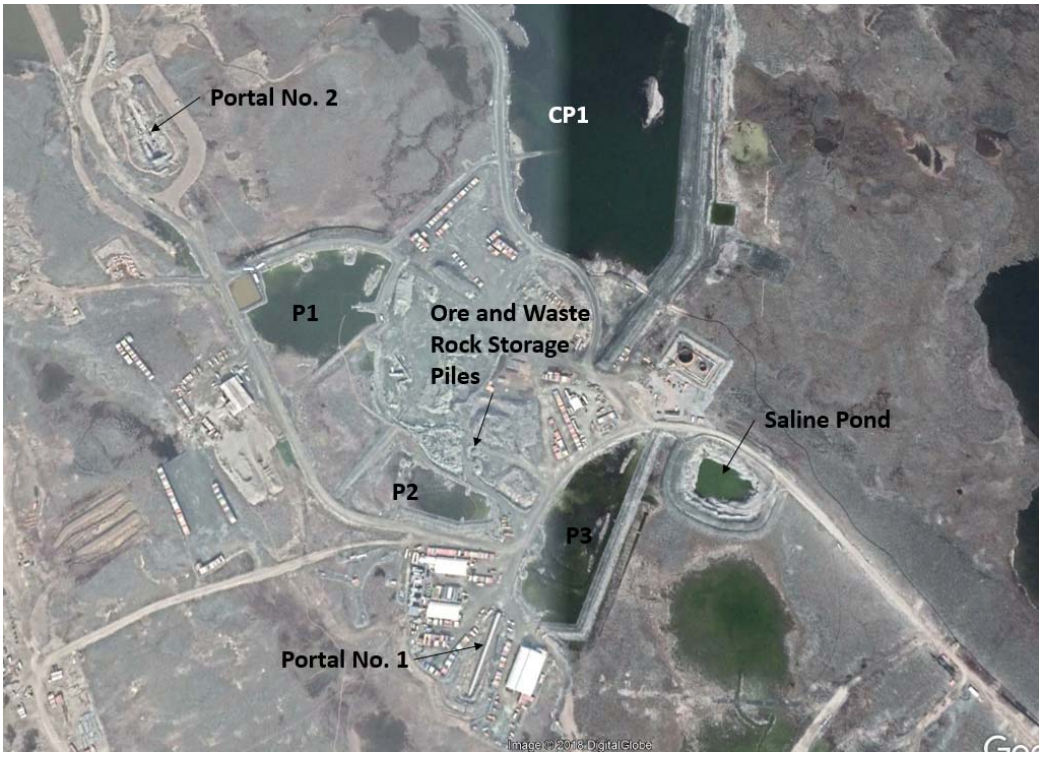

Photograph 34: Overview of Portal No. 1 and Portal No. 2 Locations. Google Earth Image (August 2017)

Photograph 35: Portal No. 1, Looking Northeast (21 September 2017)

Photograph 36: Portal No. 1, Looking North at Perimeter Berm (21 September 2017)

Photograph 37: Portal No. 1, looking Southwest at South Perimeter Berm and Rock Cut from Adjacent to Portal Entrance (21 September 2017)

Photograph 38: Portal No. 1, Looking Southwest at North Perimeter Berm and Rock Cut from Adjacent to Portal Entrance (21 September 2017)

Photograph 39: Portal No. 1, Looking Southwest at Rock Slopes (21 September 2017)

Photograph 40: Portal No. 2, Looking South (21 September 2017)

Photograph 41: Portal No. 2, Closeup of Portal Entrance, Looking South (21 September 2017)

Photograph 42: Portal No. 2, East Perimeter Berm, Looking South (21 September 2017)

Photograph 43: Portal No. 2, East Perimeter Berm, Looking North (21 September 2017)

Photograph 44: Portal No. 2, East Rock Cut Face, Looking Southeast, and Some Evidence of Ravelling of Loose Rock onto the Rockfill Bench (21 September 2017)

Photograph 45: Portal No. 2, West Perimeter Rock Cut Face and Perimeter Berm, Looking West (21 September 2017)

Photograph 46: Portal No. 2, Opening in Perimeter Berm above South End of Portal Cut, Looking Northwest. No Water Management (21 September 2017)

Photograph 47: Portal No. 2, Water Ponded Adjacent to the West Side of the Portal Cut, Looking North. No Water Management (21 September 2017)

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Photograph 48: Overview of New Fuel Storage Area Location. Google Earth Image (August 2017)

Photograph 49: New Fuel Tank Storage Area, Outer Slope of Northwest Berm, Looking Southwest (19 September 2017)

Photograph 50: New Fuel Tank Storage Area, Outer Slope of Northeast Berm, Looking Southeast (19 September 2017)

Photograph 51: New Fuel Tank Storage Area, Outer Slope of Southeast Berm, Looking Northeast (19 September 2017)

Photograph 52: New Fuel Tank Storage Area, Crest and Inside Slope of Northwest Berm, Looking Southwest (19 September 2017)

Photograph 53: New Fuel Tank Storage Area, Crest and Inside Slope of Northeast Berm, Looking Northwest. (19 September 2017)

Photograph 54: New Fuel Tank Storage Area, Southwest Berm, Looking Southeast (19 September 2017)

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Photograph 55: Overview of Ventilation Intake Pad location. Google Earth Image (August 2017)

Photograph 56: Ventilation Intake Pad, West Slope, Looking East. Some Fine Grained Material used for Pad which may be Susceptible to Erosion (21 September 2017)

Photograph 57: Ventilation Intake Pad, East Slope, Facing Southwest (21 September 2017)

Photograph 58: Ventilation Intake Pad, Southwest Crest and Slope, Looking Southeast. Sea-containers are Located Very Close to Crest (21 September 2017)

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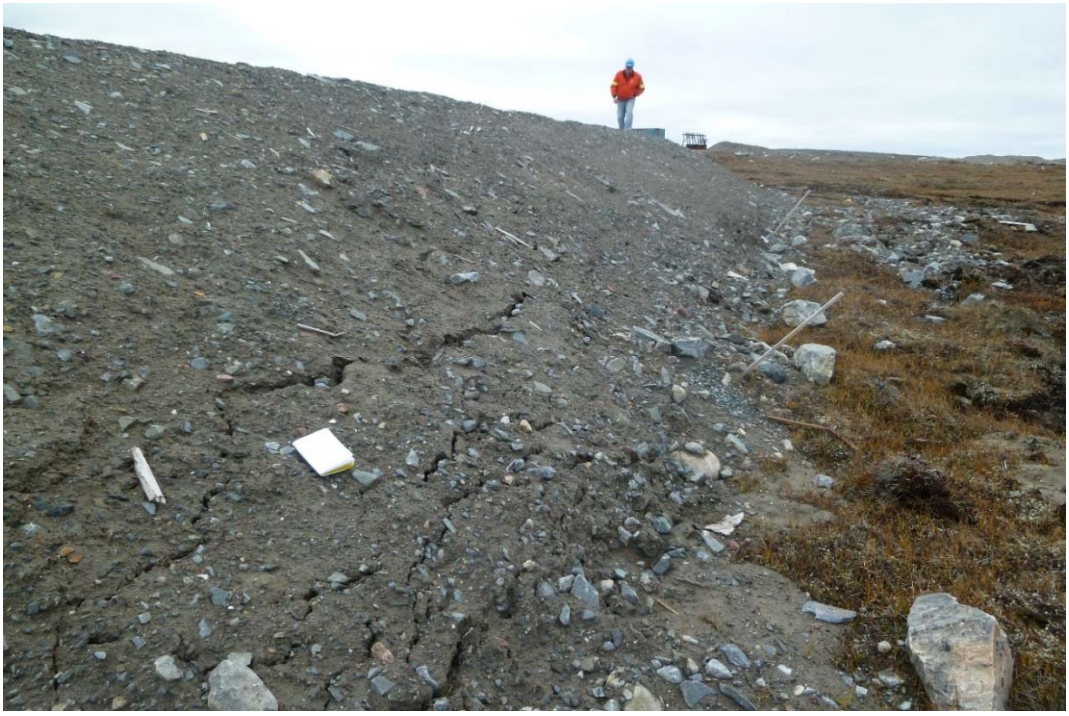
Photograph 59: Overview of the Location of the Exploration and Operation Landfills. Google Earth Image (August 2017)

Photograph 60: Overview of the Exploration Landfill Looking Northeast (19 September 2017)

Photograph 61: Exploration Landfill, Downstream Slope of West Berm, Looking North, Cracking Visible (19 September 2017)

Photograph 62: Exploration Landfill, Downstream Slope of North End of West Berm, Cracking Visible (19 September 2017)

Photograph 63: Exploration Landfill, Downstream Slope of North Berm, and Looking East from West Corner (19 September 2017)



Photograph 64: Exploration Landfill, Cracking on Downstream Slope of North Berm, Looking West (19 September 2017)

Photograph 65: Exploration Landfill, Cracking Mid Slope of East Berm, Looking North (19 September 2017)

Photograph 66: Exploration Landfill, Downstream Slope of East Berm, Looking North (19 September 2017)

Photograph 67: Exploration Landfill, Crest of East Berm, Looking North. Cracking and some Erosion Visible (19 September 2017)

Photograph 68: Exploration Landfill, Interior and Upstream Slopes of North Berm, Looking North (19 September 2017)

Photograph 69: Operation Landfill, Overview of Interior of Facility from East Corner (20 September 2017)

Photograph 70: Operation Landfill, Crest and Interior Slope of Northeast Berm, Looking Southeast (20 September 2017)

Photograph 71: Operation Landfill, Exterior Slope of Northwest Berm Looking East from West Corner (20 September 2017)

Photograph 72: Operation Landfill, Exterior Slope of Northwest Berm, and Looking West from East Corner (20 September 2017)

Photograph 73: Operation Landfill, Exterior Slope of Northeast Berm, and Looking Southeast from North Corner (20 September 2017)

Photograph 74: Operation Landfill, Exterior Slope of Northeast Berm, and Looking Northwest from East Corner (20 September 2017)

Photograph 75: Operation Landfill, Exterior Slope of Southeast Berm Looking Northeast from South Corner (20 September 2017)

Photograph 76: Operation Landfill, Exterior Slope of Southwest Berm, Looking Northwest from South Corner. Some Water Ponded Outside the Landfill Adjacent to the Access Ramp (20 September 2017)

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APPENDIX A 6

Exploration Camp Pad and Access Road, Fresh Water Intake, Diffuser Access, Fuel Storage, and Landfarm

Photograph 1: Overview of Exploration Camp Pad and Access Road. Google Earth Image (August 2017)

Photograph 2: Exploration Camp Pad, North Slope, and Looking West, near Fresh Water Intake Access Road (21 September 2017)

Photograph 3: Exploration Camp Pad, South Slope, Looking West from East End (21 September 2017)

Photograph 4: Exploration Camp Pad, Erosion on South Slope (21 September 2017)

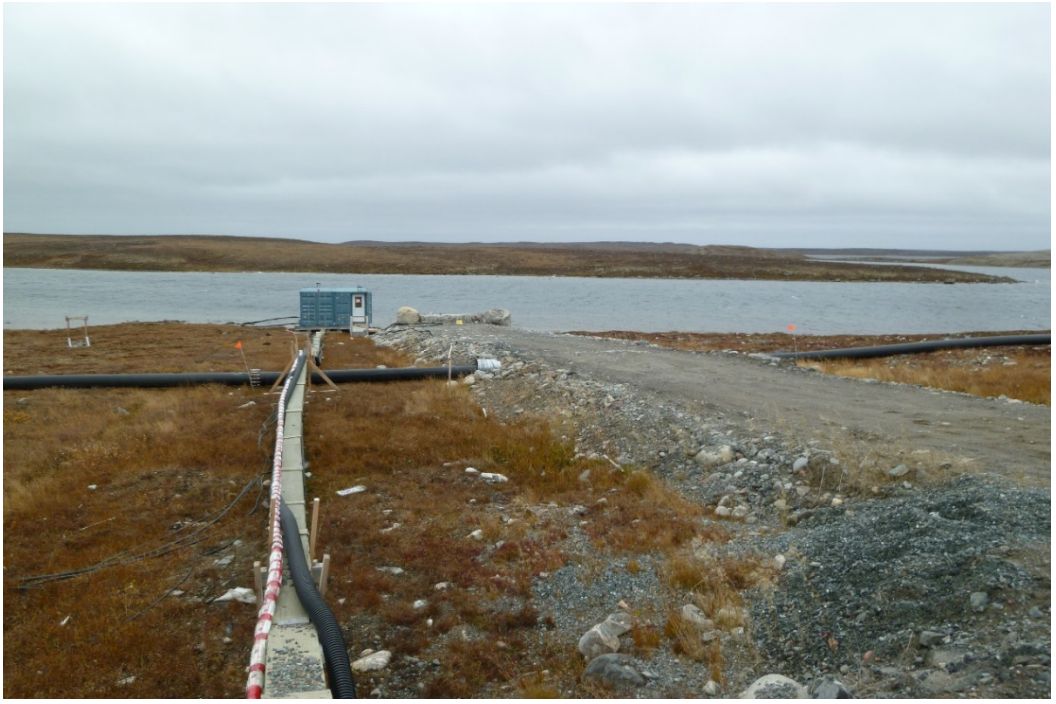
Photograph 5: Exploration Camp Pad, Localized Ponding and Erosion on South Slope (21 September 2017)

Photograph 6: Exploration Camp Pad, South Slope Looking North. Water Treatment Discharge on Left (21 September 2017)

Photograph 7: Exploration Camp Pad, Slope South of Camp Trailers, Looking Southwest (21 September 2017)

Photograph 8: Exploration Camp Pad, Fuel Storage Tanks near Helicopter Pad (21 September 2017)

Photograph 9: Exploration Camp Pad, Interior Slope Looking South (21 September 2017)



Photograph 10: Exploration Camp Fresh Water Intake Access, Looking Northeast (21 September 2017)

Photograph 11: Exploration Camp Fresh Water Intake Access, Looking Northwest (21 September 2017)

Photograph 12: Exploration Camp Fresh Water Intake Access, Culvert for Pipe Crossing (21 September 2017)

Photograph 13: Exploration Camp Fresh Water Intake Pump House (21 September 2017)

Photograph 14: Exploration Camp Pad. Diffuser Access Road Adjacent to Camp Trailers, Looking Northeast (21 September 2017)

Photograph 15: Exploration Camp Diffuser Access Road, near Camp, Looking Northwest (21 September 2017)

Photograph 16: Exploration Camp Diffuser Access Road, Some Cracking along Slope, Looking Northwest (21 September 2017)

Photograph 17: Exploration Camp Diffuser Access Road, Looking Northwest (21 September 2017)

Photograph 18: Exploration Camp Diffuser Access Road, cracking near Southeast end near Meliadine Lake (21 September 2017)

Photograph 19: Exploration Camp Diffuser Access Road, Adjacent to Meliadine Lake, Looking South (21 September 2017)

Photograph 20: Exploration Camp Diffuser Access Road, Adjacent to Meliadine Lake, Looking North (21 September 2017)

Photograph 21: Exploration Camp Access Road, Downstream ends of Culverts near Camp (black corrugated plastic and corrugated steel) (22 September 2017)

Photograph 22: Exploration Camp Access Road, Downstream end of Culvert near Camp (22 September 2017)

Photograph 23: Exploration Camp Access Road, Downstream end of Culvert near Camp (21 September 2017)

Photograph 24: Exploration Camp Access Road, Upstream end of Culvert near Camp (21 September 2017)

Photograph 25: Exploration Camp Access Road, Upstream end of Culvert near Fuel Storage (22 September 2017)

Photograph 26: Exploration Camp Access Road, Downstream end of Culver near Fuel Storage, Partially Blocked (21 September 2017)

Photograph 27: Exploration Camp Access Road, Water Ponded Along East Edge of Road between Fuel Storage and Intersection with Main Road (21 September 2017)

Photograph 28: Exploration Fuel Storage Pad, North Slope, Looking South (19 September 2017)

Photograph 29: Exploration Fuel Storage Pad, East Slope, Looking North (19 September 2017)

Photograph 30: Exploration Fuel Storage Pad, Cracking along Crest of East Slope, Looking South (19 September 2017)

Photograph 31: Exploration Fuel Storage Pad, Minor Cracking near Crest of East Slope, Looking North (19 September 2017)

Photograph 32: Exploration Fuel Storage Pad, Looking Northwest (19 September 2017)

Photograph 33: Exploration Camp Landfarm, Downstream Face of West Slope, Looking Northwest (19 September 2017)

Photograph 34: Exploration Camp Landfarm, Small Pond of Water at Toe of Northeast Corner, Possible Seepage (19 September 2017)

Photograph 35: Exploration Camp Landfarm, North Slope and Crest, Looking Northeast (19 September 2017)

Photograph 36: Exploration Camp Landfarm, West Slope Crest, Looking Southeast. Water Ponded within Landfarm (19 September 2017)

Photograph 37: Exploration Camp Landfarm, East Slope, Looking Southeast (19 September 2017)

Photograph 38: Exploration Camp Landfarm, South Slope and Crest, Looking Southwest (19 September 2017)

Photograph 39: Core Storage Pad, West Slope Looking North (19 September 2017)

Photograph 40: Core Storage Pad, Cracking on Crest of East Slope, Looking South (19 September 2017)

APPENDIX B

Meliadine All-Weather Access Road (AWAR) Inspection Photographs

Photographs 1 to 4 were taken at KM14.7 at access road to B12 Quarry

Photograph 1: At KM14.7, Access Road to B12 Quarry. Upstream End of 500 mm Ø Corrugated HDPE Culvert. Some Ponding Against Quarry Access Road and AWAR below Inlet of Culvert (20 September 2017)

Photograph 2: View through Culvert Under Access Road to B12 Quarry at KM14.7, Some Dents, No Flow, Small Amount of Ponded Water Within Culvert (20 September 2017)

Photograph 3: Downstream End of Culvert through Access Road to B12 Quarry at KM14.7 (20 September 2017)

Photograph 4: Water Ponded Adjacent to AWAR and Access Road to B12 Quarry at KM14.7. Looking at AWAR from Quarry Access Road. (20 September 2017)

Photographs 5 to 10 were taken at KM16.3.

Photograph 5: KM16.3, Upstream Ends of 3 CSP Culverts from Front to Back of Photo: 1000 mm, 700 mm, and 1300 mm Ø Looking South (20 September 2017)

Photograph 6, 1 and 8: 3 CSP culverts at KM 16.3 from Upstream Looking Downstream. Good Condition, some Clear Flow in 1300 mm Ø Culvert. Good condition and no Flow for the 700 mm Ø (middle) and 1000 mm Ø (right) Culverts. (20 September 2017)

Photograph 9: Downstream Ends of Three CSP Culverts at KM16.3. Small Flow in 1300 Ø Culvert, Minor Deformation of End of Culvert. Small Erosion Visible at Outlet (20 September 2017)

Photograph 10: Road Over 3 CSP Culverts, at KM16.3 Looking North (20 September 2017)

Photograph 11: View of Upstream Ends of Two CSP Culverts at KM18.1, Upper is 900 mm Ø and the Lower is 1000 mm Ø, Looking North to Single 600 mm Ø CSP at KM18.15 in Background of Photo. Cover Over Upper (900 mm Ø) Culvert is Thin on Upstream Side (20 September 2017)

Photographs 11 to 14 were taken at KM18.1. There are 2 vertically offset, CSP culverts the upper culvert is 900 mm Ø and the lower culvert is 1000 mm Ø. Note that the road near KM18.1 would need to almost be flooded to reach inlet of 900 mm Ø culvert. If water management in this area is a problem, suggest installing second culvert at a lower elevation. A ditch on the upstream side hydraulically connects the culverts at KM18.1 to culvert at KM18.15.

Photograph 12: View Through 1000 mm Ø CSP Culvert at KM18.1 From Upstream Side. Some Damage to Inlet of Culvert (20 September 2017)

Photograph 13: Downstream View of Two CSP Culverts at KM 18.1 (20 September 2017)

Photograph 14: Downstream Ends of the Two CSP Culverts at KM 18.1 (20 September 2017)

Photographs 15 to 19 taken at KM18.15 where there is a single 600 mm Ø CSP culvert.

Photograph 15: Upstream End of 600 mm Ø CSP Culvert at KM18.15 (20 September 2017)

Photograph 16: View through 600 mm Ø CSP Culvert at KM18.15 from Upstream end (20 September 2017)

Photograph 17: View of The Road Embankment North of Upstream End Of 600 Mm Ø CSP Culvert at KM18.15. Some Erosion Observed on Embankment (20 September 2017)

Photograph 18: Downstream End of 600 mm Ø CSP Culvert at KM18.15 (20 September 2017)

Photograph 19: Road Surface Looking North from 600 mm Ø CSP Culvert at KM18.15 (20 September 2017).

Photographs 20 to 23 were taken at KM21.7. There are two 170 mm outside Ø pipes, vertically offset. AEM inspections note water ponding at or over road in this area during freshet. There is evidence of high water surrounding the area, the capacity of the pipes may be inadequate, or pipes could have been frozen/blocked causing water to backup.

Photograph 20: KM21.7, View of the Upstream Ends of Pipes (20 September 2017)

Photograph 21: Looking through Upper Pipe at KM21.7 (20 September 2017)

Photograph 22: Looking through Lower Pipe at KM21.7 (20 September 2017)

Photograph 23: Downstream View of the Pipes at KM21.7 (20 September 2017)

Photographs 24 26 through 98 were taken at KM22.3. There are two steel pipes vertically offset, 160 mm Ø. Both pipes were clear with no flow. AEM inspection reports note water ponding at or over road in this area during freshet. The capacity of the pipes may be inadequate, or pipes could have been frozen/blocked causing water to backup.

Photograph 24: KM22.3, There are Two Steel Pipes Vertically Offset, 160 Mm Ø. Looking at Upstream Ends. Inlets are Elevated, Could Be Installed at a Lower Elevation to Reduce Ponded Water Along Road (20 September 2017)

Photograph 25: Downstream End of Pipes at KM22.3 (20 September 2017)

Photograph 26: Road Surface North of The Steel Pipes at KM22.3 Looking North (20 September 2017)

Photographs 27 to 29 were taken at KM22.7. Ponded water, no culvert.

Photograph 27: Ponded Water on East Side of the Road Near KM22.7 (22 September 2017)

Photograph 28: Wet Ground on West side of Road Indicating Possible Seepage through Road Near KM22.7 (22 September 2017)

Photographs 29 through 32 were taken at KM25.8. HDPE corrugated 600 mm Ø culvert. Minor flow, some gravel in the base of the culvert and minor dents. Erosion observed on road embankment.

Photograph 29: Upstream end of HDPE Corrugated 600 mm Ø Culvert at KM25.8 (22 September 2017)

Photograph 30: Looking at the Inlet of the Culvert from Upstream to Downstream, 600 mm Ø HDPE, at KM25.8 (22 September 2017)

Photograph 31: Downstream end of 600 mm Ø HDPE Culvert at KM25.8. Some Sediment Erosion and Deposition Evident (22 September 2017)

Photograph 32: Erosion of Road Embankment Near 600mm Ø HDPE culvert at KM25.8 (22 September 2017)

Photographs 33 through 35 were taken at KM26.2. 2 vertically offset, 160 mm Ø steel pipes. The lower pipe is bent upwards. Unable to see through the lower culvert.

Photograph 33: Upstream Ends of Two Vertically Offset, 160 Mm Ø Steel Pipes at KM26.2. The Lower Pipe is Bent Upwards and Should Be Replaced (20 September 2017)

Photograph 34: Two Vertically Offset, 160 mm Ø steel pipes. Downstream Ends of the Pipes, at KM26.2 (20 September 2017)

Photograph 35: Road North of Two Vertically Offset, 160 mm Ø Steel Pipes, at KM26.2 (20 September 2017)

Photographs 36 through 39 are at KM26.5, 3×700mm Ø CSP, installed at equal elevation. Small dents in culverts, no blockages, no flow.

Photograph 36: 3×700mm Ø CSP at KM26.5. Inverts from Upstream Side (20 September 2017)

Photograph 37: 3×700mm Ø CSP at KM26.5. Upstream Ends of the Culverts (20 September 2017)

Photograph 38: 3×700mm Ø CSP at KM26.5. Downstream Ends of the Culverts (20 September 2017)

Photograph 39: 3×700mm Ø CSP at KM26.5. This Photo Showing the Inside of the North Culvert from Downstream Looking Upstream (20 September 2017)

Photographs 40 through 42 are at KM26.8, 2×160mm Ø steel pipes, installed vertically offset. No flow.

Photograph 40: 2 Vertically Offset 160mm Ø Steel Pipes, Clear, no Flow, Upstream View – at KM26.8 (20 September 2017)

Photograph 41: 2 Vertically Offset 160 mm Ø Steel Pipes, Looking from Upstream to Downstream at Inlet of The Steel Pipes, At KM26.8. Pipes Showing More Oxidation Since 2016 Inspection (20 September 2017)

Photograph 42: 2 vertically Offset 160 mm Ø Steel Pipes, Looking Downstream at Outlet of the Steel Pipes, At KM26.8 (20 September 2017)

Photographs 43 through 47 are at KM27.1, 3 CSP – 900 mm, 700 mm, and 1000 mm Ø CSP, installed vertically offset. Small flow in lowest CSP.

Photograph 43: View Upstream from Three Culverts at KM27.1 (20 September 2017)

Photograph 44: Upstream Ends of Three Culverts at KM27.1. From left to right, 1000 mm, 700 mm, and 900 mm ø CSP (20 September 2017)

Photograph 45: Photo through the 900mm Ø culvert from Downstream to Upstream, Small Flow – KM27.1 (20 September 2017)

Photograph 46: Downstream Ends Of 3 CSP Culverts, Left to Right: 1000 mm, 700 mm, 900 mm Ø at KM27.1 (20 September 2017)

Photograph 47: Looking Downstream At 3 CSP, Left to Right: 900 mm, 700 mm, 1000 mm Ø at KM27.1 (20 September 2017)

Photograph 48: KM28.7, Water Ponded on East Side of Road. AEM Reports that the Road is Wet for Most of the Open Water Season in this Area, Indicating Seepage through the Road. (22 September 2017)

Photographs 48 and 49 are at KM28.7, ponding water on east side of road. Consider installing culvert.

Photograph 49: KM28.7, Surface and West Side of Road Opposite Ponded Water on East (22 September 2017)

Photographs 50 and 53 are at KM29.6, 1x500 mm ø corrugated HDPE culvert, ponding water on west side of road. Consider lowering culvert invert.

Photograph 50: Water Ponded on West Side of Road Upstream Of 500 mm Ø Corrugated HDPE Culvert at KM29.6, Looking North (22 September 2017)

Photograph 51: 500mm Ø HDPE Corrugated Culvert Upstream Inlet (Between Rocks), At KM29.6, Looking South (22 September 2017)

Photograph 52: 500 mm ø HDPE Corrugated Culvert, View Through Culvert from Downstream to Upstream, Clear, No Flow, Some Dents of Side Wall at KM29.6 (22 September 2017)

Photograph 53: 500 mm Ø HDPE Corrugated Culvert, Downstream Inlet of Culvert at KM29.6. Small Erosion Evident Upstream (22 September 2017)

Photographs 54 to 58 taken at KM6.0 of the Char River Bridge.

Photograph 54: Char River Bridge at KM6.0 Looking South (20 September 2017)

Photograph 55: Char River Bridge, Left (north) Abutment Armouring from the Upstream Side (20 September 2017)

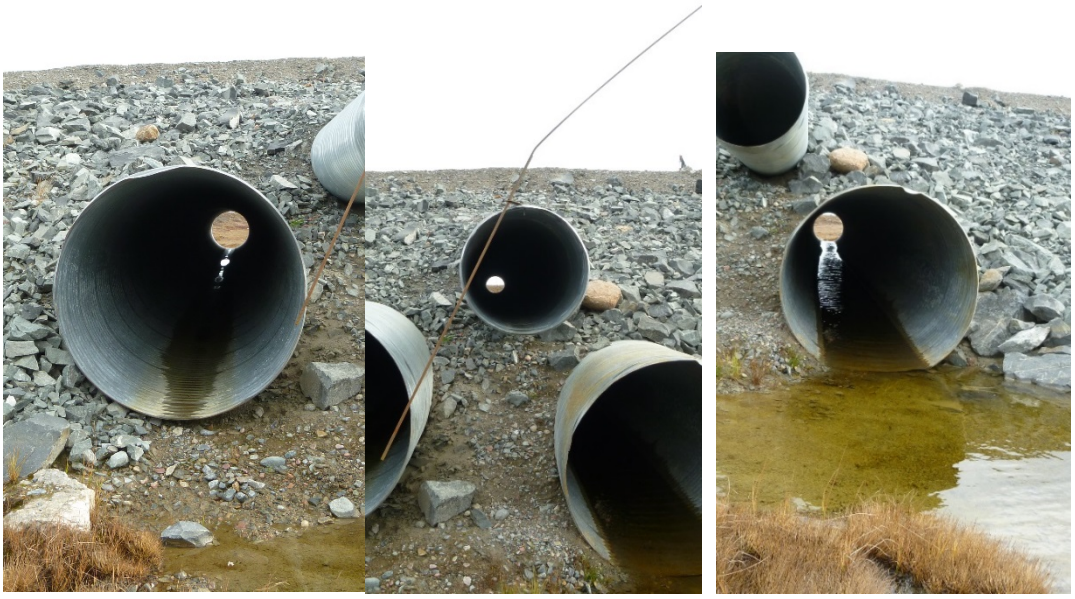
Photograph 56: Char River Bridge, Right (south) Abutment, Upstream (20 September 2017)

Photograph 57: Char River Bridge, left (north) Abutment, Downstream Side Taken from the Downstream Side of the Right (south) Abutment (20 September 2017)

Photograph 58: Char River Bridge, Downstream Side of Right (South) Abutment, Taken from the Downstream Side of the Left (North) Abutment (20 September 2017)

Photographs 59 to 63 taken at KM6.2 where there are 3 CSP culverts.

Photograph 59: At KM6.2, Upstream Ends Of 3 CSP Culverts. Lower Two Culverts Are 1300 mm in Diameter, Upper Culvert Is 700 mm in Diameter. All are in Good Condition (20 September 2017)



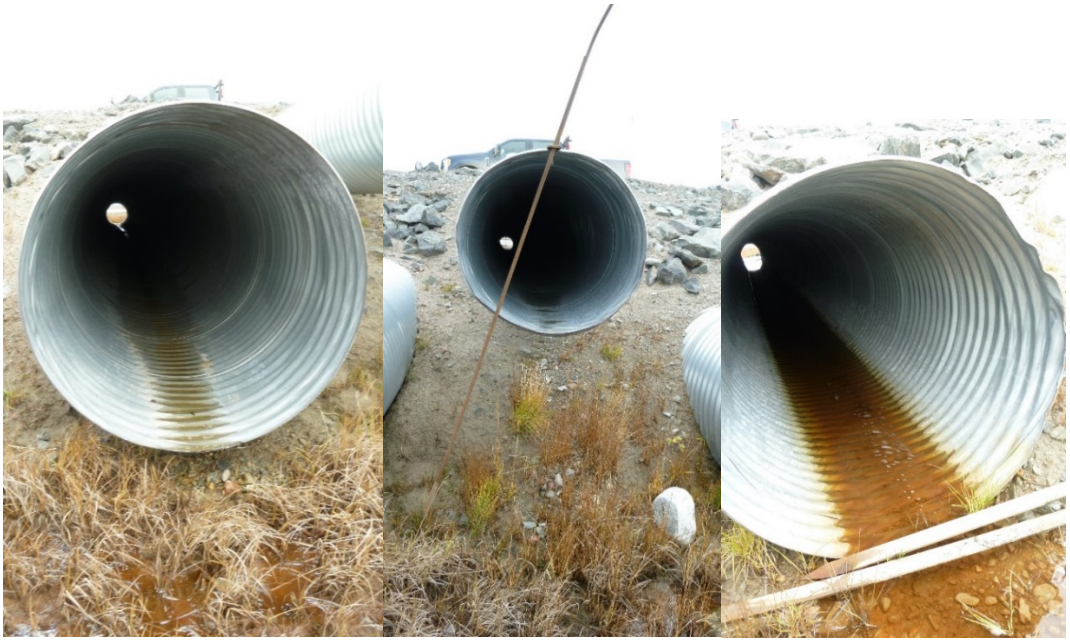
Photographs 60, 61 And 62: Upstream to Downstream View Through 3 CSP Culverts at KM6.2. Photographs are Ordered Left to Right Corresponding to the Order Shown in Photograph 56. Small Erosion Between Culverts, Consider Adding Armouring (20 September 2017)

Photograph 63: Downstream Ends of 3 CSP Culverts at KM6.2 (20 September 2017)

Photographs 64 to 69 were taken at KM7.0 where there are 3 CSP culverts.

Photograph 64: Road Over 3 CSP Culverts at KM7.0 (20 September 2017)

Photograph 65: At KM7.0, Upstream Ends of 3 CSP Culverts. Vertically Offset. Lower Two Culverts are 1000 mm in Diameter and Upper Culvert is 700 mm in Diameter. Some Exposed Esker Sand, Additional Armouring should be Considered (20 September 2017)



Photographs 66, 67, 68: Upstream to Downstream View Through 3 CSP Culverts at KM7.0. Photographs are Ordered Left to Right Corresponding to the Order Shown in Photograph 62 (20 September 2017)

Photograph 69: Downstream Ends of 3 CSP Culverts at KM7.0 (20 September 2017)

Photographs 70 to 73 were taken at KM7.1 where there are 3 CSP culverts.

Photograph 70: At KM7.1, Upstream Ends of 3 CSP Culverts. Lower Two Culverts are 1000 mm in Diameter and Upper Culvert Is 700 mm in Diameter. Small Flow Through Culvert on the Right Hand Side, at Time of Inspection, Some Dents in 700 mm (20 September 2017)

Photograph 71: Upstream to Downstream View Through 700 mm Diameter CSP Culvert at KM7.1 (20 September 2017)

Photograph 72: Upstream to Downstream View Through Right 1000 mm Diameter CSP Culvert at KM7.1 (20 September 2017)

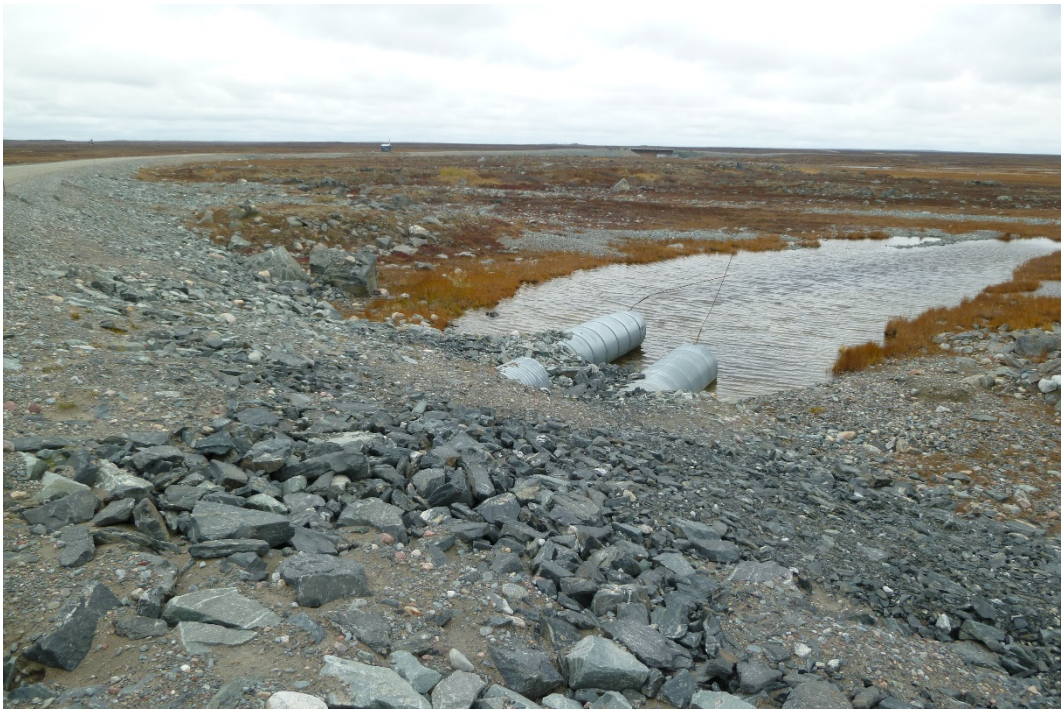
Photograph 73: Downstream Ends of 3 CSP Culverts at KM7.1 (20 September 2017)

Photographs 74 to 80 were taken at KM7.4 where there are 3 CSP culverts.

Photograph 74: At KM7.4, Upstream Ends of 3 CSP Culverts. Culvert Diameters are from Right to Left, 1000 mm, 700 mm, and 900 mm. Inlet of the 900 mm has been Partially Crushed (20 September 2017)

Photograph 75 And 76: At KM7.4, Upstream to Downstream View Through Damaged 900 mm Diameter Culvert Inlet, Likely Crushed by Rocks (On Left). Upstream to Downstream View Through 700 mm Diameter Culvert (on right) (20 September 2017)

Photograph 77: At KM7.4, Upstream to Downstream View Through 1000 mm Diameter Culvert (20 September 2017)



Photograph 78: At KM7.4, Looking at Downstream Ends of 3 CSP Culverts (20 September 2017)

Photograph 79: Downstream Ends of 3 CSP Culverts at KM7.4. Middle, (700 mm Diameter) Culvert Should be Extended and Additional Armouring Added to Reduce Erosion Potential (20 September 2017)

Photograph 80: Road Surface Over 3 CSP Culverts at KM 7.4 (20 September 2017)

Photographs 81 to 89 of the Meliadine River Bridge were taken at KM8.0.

Photograph 81: Meliadine River Bridge at KM8.0, Looking South (20 September 2017)

Photograph 82: Meliadine River Bridge at KM8.0. Left (North) Abutment Looking North. Upstream to the Left (20 September 2017)

Photograph 83: Meliadine River Bridge at KM8.0. Left (North) Abutment Looking Downstream from Upstream (20 September 2017)

Photograph 84: Meliadine River Bridge at KM8.0. Left (North) Abutment Looking Upstream from Downstream (20 September 2017)

Photograph 85: Meliadine River Bridge at KM8.0. Right (South) Abutment, Looking South. Downstream to Left (20 September 2017)

Photograph 86: Meliadine River Bridge at KM8.0. Right (South) Abutment Looking Downstream from Upstream (20 September 2017).

Photograph 87: Meliadine River Bridge at KM8.0. Right (South) Abutment Looking Upstream from Downstream (20 September 2017)

Photograph 88: Meliadine River Bridge at KM8.0. Slope of Right (South) Abutment, Esker Sand Exposed. Consider Adding Armouring with Coarser Grained Material to Reduce Erosion Potential (20 September 2017)

Photograph 89: Meliadine River Bridge View from Upstream to Downstream Beneath Bridge Deck. Low Flow at Time of Inspection Gravel and Cobble Bedding (20 September 2017)

Photographs 90 to 94 were taken at KM9.1. There are 2 CSP culverts, each 1000 mm in diameter. There is some minor deformation in the culverts under the road, no flow, water ponded below inverts.

Photograph 90: Upstream Ends of Two 1000 mm Diameter CSP Culverts at KM9.1 Looking North (20 September 2017)

Photograph 91: View through North CSP Culvert at KM9.1 from Upstream to Downstream. Some Deformation of Culvert below Road (20 September 2017)

Photograph 921: View Through South CSP Culvert at KM9.1 from Upstream to Downstream (20 September 2017)

Photograph 93: Downstream Ends of Two CSP Culverts at KM9.1 (20 September 2017)

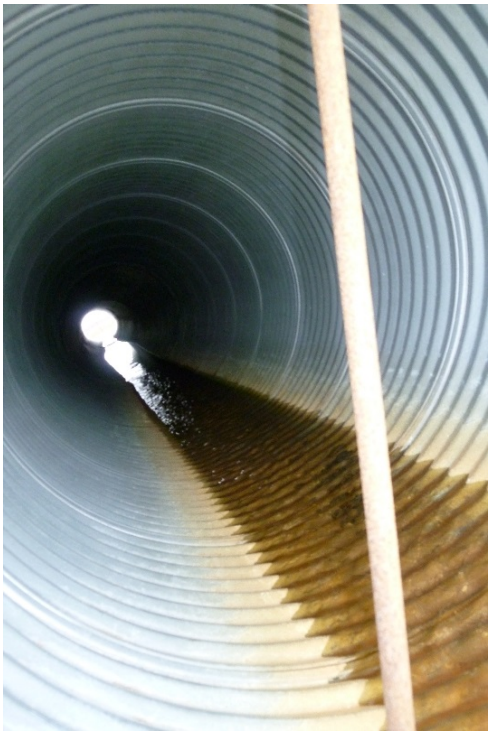
Photograph 94: Road Surface Over Two CSP Culverts at KM9.1 (20 September 2017)

Photograph 95: Road Surface Over a Single 1300 mm Diameter CSP Culvert at KM9.5 (20 September 2017)

Photographs 95 to 98 were taken at KM9.5. There is a single CSP culvert, it is in good condition, clear and had virtually no flow, even though there is water ponded upstream, due to inlet elevation being elevated.

Photograph 96: Upstream End of a Single 1300 mm Diameter CSP Culvert at KM9.5. Good Condition, no Obstructions. Water Ponded on Upstream with very Low Flow Due to Elevated Inlet of CSP (20 September 2017)

Photograph 97: Downstream End of a Single 1300 mm Diameter CSP Culvert at KM9.5 (20 September 2017)



Photograph 98: KM9.5, Looking from Downstream to Upstream Through the 1300 mm Diameter Culvert (20 September 2017)

Photographs 99 to 106 taken of M-5 Bridge, at KM10.5. Abutments all look good.

Photograph 99: M-5 Bridge at KM10.5 Left (North) Abutment, Upstream Side (20 September 2017)

Photograph 100: M-5 Bridge at KM10.5 Left (North) Abutment, Downstream Side (20 September 2017)

Photograph 101: M-5 Bridge at KM10.5 Left (North) Abutment Looking Upstream from the Downstream Side of the Bridge (20 September 2017)

Photograph 1022: M-5 Bridge at KM10.5, Exposed Fabric on Downstream End of Left (North) Abutment Indicating Possible Erosion (20 September 2017)

Photograph 103: M-5 Bridge at KM10.5 Right (South) Abutment, Upstream Side. Area of Possible Erosion or Settlement Identified During 2016 Inspection Shows no Signs of Change (20 September 2017)

Photograph 104: M-5 Bridge at KM10.5 Right (South) Abutment, Downstream Side (20 September 2017)

Photograph 105: M-5 Bridge Deck at KM10.5, Looking South (20 September 2017)

Photograph 106: Road Leading North From M-5 Bridge at KM10.5 (20 September 2017)

Photos 107 to 114 were taken along AWAR at KM12.1. Four CSP culverts installed at this location. These culverts appear bent in the middle under the road.

Photograph 107: Downstream Ends of Four CSP Culverts at KM12.1 (20 September 2017)

Photograph 108: Downstream Ends of Four CSP Culverts at KM12.1. From Left to Right Diameters are 1300 mm, 700 mm, 1300 mm, 900 mm (20 September 2017)

Photograph 109: Upstream Ends of Four CSP Culverts at KM12.1 (20 September 2017)

Photograph 110: Upstream Ends of Four CSP Culverts at KM12.1 (20 September 2017)

Photographs 111 and 112: Upstream to Downstream View Through Two Northern CSP Culverts at Km12.1. 900 mm Ø on Left and 1300 mm Ø On Right (20 September 2017)

Photographs 113 and 114: Upstream to Downstream View Through Two Southern CSP Culverts at Km12.1. 700 mm Ø On Left and 1300 mm Ø On Right (20 September 2017)

Photos 115 to 117 were taken along AWAR at KM12.6. Flow visible along the road, the road embankment shows signs of erosion/slumping.

Photograph 115: AWAR KM12.6, Some Water, No Defined Channel. Low Lying Area, Poor Drainage (22 September 2017)

Photograph 116: KM 12.6, Ponded Water and Erosion of Toe Road Embankment Evident (22 September 2017)

Photograph 117: KM 12.6, Ponded Water and Erosion of Road Embankment Evident (22 September 2017)

Photograph 118: At KM13.5, There are 5 CSP Culverts (3×1300 mm Ø; 2×900mm Ø). View of Upstream Ends of the Culverts. 900 mm Culverts are Vertically Elevated (20 September 2017)

Photos 118 to 125 were taken along AWAR at KM13.5. Five CSP culverts are installed at this location, three of 1300 mm ø and two of 900 mm ø. The inverts of the 900 mm culverts are elevated higher than the inverts of the 1300 mm culverts.

Photograph 119: Downstream View of 5 CSP Culverts at KM13.5 (20 September 2017)

Photographs 120 and 121: Upstream to Downstream Views Through Northern-Most 1300 mm Ø CSP Culvert (Left Photograph) and North 900 mm Ø CSP Culvert (Right Photograph) Located at KM13.5 (20 September 2017)

Photographs 122, 123 And 124: Upstream to Downstream Views Through Middle and South 1300 mm Ø CSP Culverts (Left and Middle Photographs Respectively) and South 900 mm Ø CSP Culvert (Right Photograph) Located at KM13.5 (20 September 2017)

Photograph 125: Road Surface Over Five CSP Culverts Located at KM13.5, Looking North (20 September 2017)

APPENDIX C

Thermistor Locations and Data

Appendix C1: Background Permafrost Thermistor Locations and Data

Appendix C2: P-Area, D-CP1, and D-CP5 Thermistor Locations and Data

APPENDIX C 1

Background Permafrost Thermistor Locations and Data

No.	DRILLED	EASTING	NORTHING	TYPE
1	M98-195	539968.00	6988660.00	Historic Geotechnical Borehole with Thermister
2	GT07-06	539814.63	6988750.01	Historic Geotechnical Borehole with Thermister
3	GT07-07	540020.00	6988749.98	Historic Geotechnical Borehole with Thermister
4	GT07-09	537952.43	6989323.52	Historic Geotechnical Borehole with Thermister
5	GT07-10	538506.89	6988805.51	Historic Geotechnical Borehole with Thermister
6	GT07-11	538507.00	6989910.00	Historic Geotechnical Borehole with Thermister
7	GT09-01	542011.99	6986289.01	Historic Geotechnical Borehole with Thermister
8	GT09-02	542078.00	6986235.99	Historic Geotechnical Borehole with Thermister
9	GT09-04	542861.00	6986230.00	Historic Geotechnical Borehole with Thermister
10	GT09-07	542429.00	6986260.00	F-Zone Geotechnical Borehole with Thermister (2009)
11	GT09-08	542494.01	6986317.00	F-Zone Geotechnical Borehole with Thermister (2009)
12	GT09-10	542740.00	6986059.00	F-Zone Geotechnical Borehole with Thermister (2009)
13	GT09-12	542546.01	6986651.00	F-Zone Geotechnical Borehole with Thermister (2009)
14	GT09-13	538775.00	6988730.99	Geotechnical Borehole with Thermister (2009)
15	GT09-14	539572.01	6988198.00	Geotechnical Borehole with Thermister (2009)
16	GT09-16	538034.00	6990252.00	Geotechnical Borehole with Thermister (2009)
17	GT09-17	537283.00	6990428.99	Geotechnical Borehole with Thermister (2009)
18	GT09-18	537875.00	6989363.00	Geotechnical Borehole with Thermister (2009)
19	GT09-19	537899.00	6989458.00	Hydrogeological Testing Borehole with Termistor (2009)
20	GT09-20	539492.00	6989279.99	Geotechnical Borehole with Thermister (2009)
21	GT09-21	540058.73	6988926.90	Geotechnical Borehole with Thermister (2009)
22	GT09-22	539898.01	6989273.00	Geotechnical Borehole with Thermister (2009)
23	GT09-25	539867.99	6989118.00	Geotechnical Borehole with Thermister (2009)
24	GT11-01	537031.00	6990207.00	Geotechnical Borehole with Thermister (2011)
25	GT11-02	537737.00	6990558.00	Geotechnical Borehole with Thermister (2011)
26	GT11-05	539243.00	6990003.00	Geotechnical Borehole with Thermister (2011)
27	GT11-07	539106.00	6988978.00	Geotechnical Borehole with Thermister (2011)
28	GT11-08	538223.00	6989155.00	Geotechnical Borehole with Thermister (2011)
29	GT11-12	537152.00	6989258.00	Geotechnical Borehole with Thermister (2011)
30	GT11-14	537984.00	6987633.00	Geotechnical Borehole with Thermister (2011)
31	GT11-17	540134.00	6986035.00	Geotechnical Borehole with Thermister (2011)
32	GT13-01	539193.00	6988639.83	Geotechnical Borehole with Thermister (2013)
33	GT13-04	537906.98	6989339.02	Geotechnical Borehole with Thermister (2013)
34	GT13-05	537000.99	6990176.99	Geotechnical Borehole with Thermister (2013)
35	GT13-07	538686.00	6989948.01	Geotechnical Borehole with Thermister (2013)
36	GT14-03	540729.42	6989050.54	Geotechnical Borehole with Thermister (2014)
37	GT14-05	540110.14	6989177.38	Geotechnical Borehole with Thermister (2014)
38	GT14-07	540151.49	6989531.96	Geotechnical Borehole with Thermister (2014)
39	GT14-16	539150.41	6989960.29	Geotechnical Borehole with Thermister (2014)
40	GT14-17	539087.96	6989983.94	Geotechnical Borehole with Thermister (2014)
41	GT14-18	539096.00	6990169.00	Geotechnical Borehole with Thermister (2014)
42	GT14-19	539137.00	6990147.00	Geotechnical Borehole with Thermister (2014)
43	GT14-22	539038.00	6990135.00	Geotechnical Borehole with Thermister (2014)
44	GT14-27	539333.23	6989884.13	Geotechnical Borehole with Thermister (2014)

LEGEND

- WATER BODY
- EXISTING GROUND CONTOURS
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2014)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2013)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2011)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2009)
- HYDROGEOLOGICAL TESTING BOREHOLE WITH THERMISTOR (2009)
- HISTORIC GEOTECHNICAL BOREHOLE WITH THERMISTOR
- F-ZONE GEOTECHNICAL BOREHOLE WITH THERMISTOR (2009)

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE IS NOTED.
2. COORDINATE SYSTEM UTM15 NAD83.
3. CONTOUR INTERVAL EVERY 2m.

REFERENCE

1. GENERAL ARRANGEMENT PROVIDED BY HAMEL ARPENTAGE, AUGUST 22 2016. FILE NAME: SK - MELIADINE GENERAL.DWG
2. SITE INFRASTRUCTURE PROVIDED BY AGNICO EAGLE MINES , 20 FEBRUARY, 2018. FILE NAME: 65-000-210-200-2_R2.dwg

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1:12,500 METRES

CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
MELIADINE GOLD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-19
DESIGNED	AI
PREPARED	MSH
REVIEWED	FE
APPROVED	A1

TITLE
LOCATION OF BOREHOLES WITH THERMISTORS

PROJECT NO.	PHASE/DOC#	REV.	FIGURE
1660296	3000/024	0	C-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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1	M98-195	539968.00	6988660.00	Historic Geotechnical Borehole with Thermister
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10	GT09-07	542429.00	6986260.00	F-Zone Geotechnical Borehole with Thermister (2009)
11	GT09-08	542494.01	6986317.00	F-Zone Geotechnical Borehole with Thermister (2009)
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15	GT09-14	539572.01	6988198.00	Geotechnical Borehole with Thermister (2009)
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17	GT09-17	537283.00	6990428.99	Geotechnical Borehole with Thermister (2009)
18	GT09-18	537875.00	6989363.00	Geotechnical Borehole with Thermister (2009)
19	GT09-19	537899.00	6989458.00	Hydrogeological Testing Borehole with Termistor (2009)
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LEGEND

- WATER BODY
- EXISTING GROUND CONTOURS
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2014)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2013)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2011)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2009)
- HYDROGEOLOGICAL TESTING BOREHOLE WITH THERMISTOR (2009)
- HISTORIC GEOTECHNICAL BOREHOLE WITH THERMISTOR
- F-ZONE GEOTECHNICAL BOREHOLE WITH THERMISTOR (2009)

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE IS NOTED.
2. COORDINATE SYSTEM UTM15 NAD83.
3. CONTOUR INTERVAL EVERY 2m.

REFERENCE

1. GENERAL ARRANGEMENT PROVIDED BY HAMEL ARPENTAGE, AUGUST 22 2016. FILE NAME: SK - MELIADINE GENERAL.DWG
2. SITE INFRASTRUCTURE PROVIDED BY AGNICO EAGLE MINES , 20 FEBRUARY, 2018. FILE NAME: 65-000-210-200-2_R2.dwg

0 500 1,000
1:12,500 METRES

CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
MELIADINE GOLD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-19
DESIGNED	AI
PREPARED	MSH
REVIEWED	FE
APPROVED	A1

TITLE
LOCATION OF BOREHOLES WITH THERMISTORS

PROJECT NO.	PHASE/DOC#	REV.	FIGURE
1660296	3000/024	0	C-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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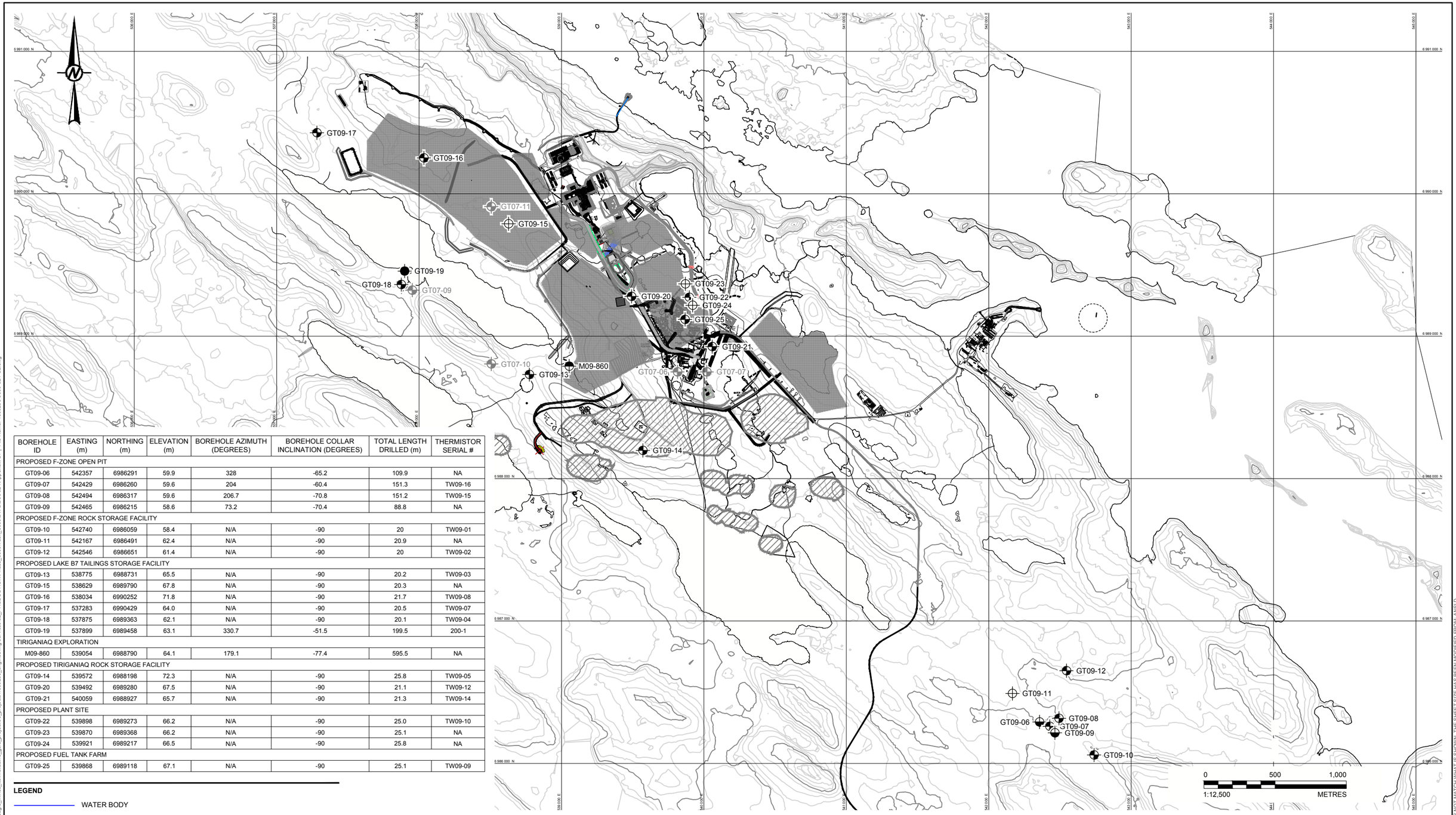

BOREHOLE ID	EASTING (m)	NORTHING (m)	ELEVATION (m)	BOREHOLE AZIMUTH (DEGREES)	BOREHOLE COLLAR INCLINATION (DEGREES)	TOTAL LENGTH DRILLED (m)	THERMISTOR SERIAL #
PROPOSED F-ZONE OPEN PIT							
GT09-06	542357	6986291	59.9	328	-65.2	109.9	NA
GT09-07	542429	6986260	59.6	204	-60.4	151.3	TW09-16
GT09-08	542494	6986317	59.6	206.7	-70.8	151.2	TW09-15
GT09-09	542465	6986215	58.6	73.2	-70.4	88.8	NA
PROPOSED F-ZONE ROCK STORAGE FACILITY							
GT09-10	542740	6986059	58.4	N/A	-90	20	TW09-01
GT09-11	542167	6986491	62.4	N/A	-90	20.9	NA
GT09-12	542546	6986651	61.4	N/A	-90	20	TW09-02
PROPOSED LAKE B7 TAILINGS STORAGE FACILITY							
GT09-13	538775	6988731	65.5	N/A	-90	20.2	TW09-03
GT09-15	538629	6989790	67.8	N/A	-90	20.3	NA
GT09-16	538034	6990252	71.8	N/A	-90	21.7	TW09-08
GT09-17	537283	6990429	64.0	N/A	-90	20.5	TW09-07
GT09-18	537875	6989363	62.1	N/A	-90	20.1	TW09-04
GT09-19	537899	6989458	63.1	330.7	-51.5	199.5	200-1
TIRIGANIAQ EXPLORATION							
M09-860	539054	6988790	64.1	179.1	-77.4	595.5	NA
PROPOSED TIRIGANIAQ ROCK STORAGE FACILITY							
GT09-14	539572	6988198	72.3	N/A	-90	25.8	TW09-05
GT09-20	539492	6989280	67.5	N/A	-90	21.1	TW09-12
GT09-21	540059	6988927	65.7	N/A	-90	21.3	TW09-14
PROPOSED PLANT SITE							
GT09-22	539898	6989273	66.2	N/A	-90	25.0	TW09-10
GT09-23	539870	6989368	66.2	N/A	-90	25.1	NA
GT09-24	539921	6989217	66.5	N/A	-90	25.8	NA
PROPOSED FUEL TANK FARM							
GT09-25	539868	6989118	67.1	N/A	-90	25.1	TW09-09

LEGEND

- WATER BODY
- EXISTING GROUND CONTOURS
- GEOTECHNICAL BOREHOLE (2009)
- GEOTECHNICAL BOREHOLE WITH THERMISTOR (2009)
- F-ZONE OPEN PIT GEOTECHNICAL BOREHOLE
- F-ZONE OPEN PIT GEOTECHNICAL BOREHOLE WITH THERMISTOR
- HISTORICAL GEOTECHNICAL BOREHOLE
- HYDROGEOLOGICAL TESTING BOREHOLE
- HYDROGEOLOGICAL TESTING BOREHOLE WITH THERMISTOR

NOTE(S)

1. ALL UNITS ARE IN METRES UNLESS OTHERWISE IS NOTED.
2. COORDINATE SYSTEM UTM15 NAD83.
3. CONTOUR INTERVAL EVERY 2m.

REFERENCE

1. GENERAL ARRANGEMENT PROVIDED BY HAMEL ARPENTAGE, AUGUST 22 2016. FILE NAME: SK - MELIADINE GENERAL.DWG
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CLIENT
AGNICO EAGLE MINES LTD.

PROJECT
MELIADINE GOLD PROJECT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-19
DESIGNED	AI
PREPARED	MSH
REVIEWED	FE
APPROVED	AI

TITLE
2009 SUMMER GEOTECHNICAL FIELD PROGRAM BOREHOLE LOCATIONS

PROJECT NO.	PHASE/DOC#	REV.	FIGURE
1660296	3000/024	0	C-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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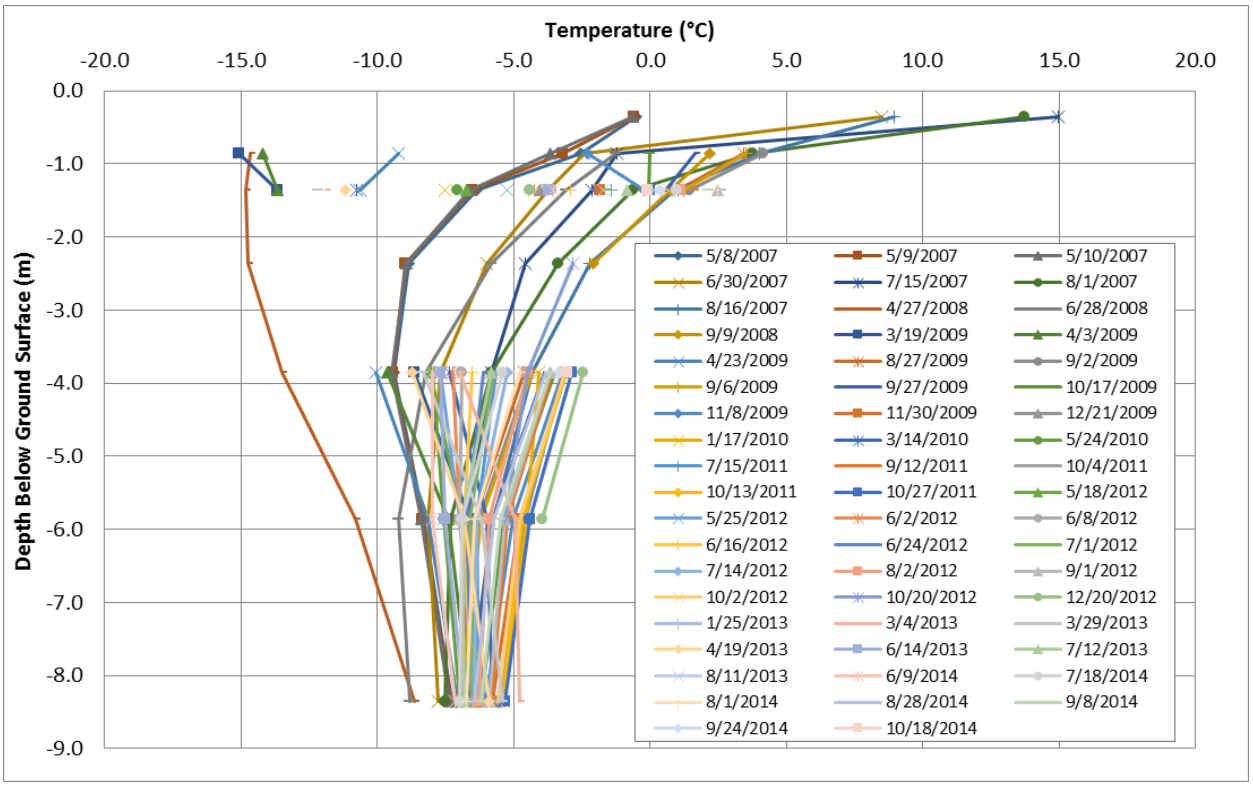
GT07-06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-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
Depth Below Ground Surface (m)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
5/8/2007
5/9/2007
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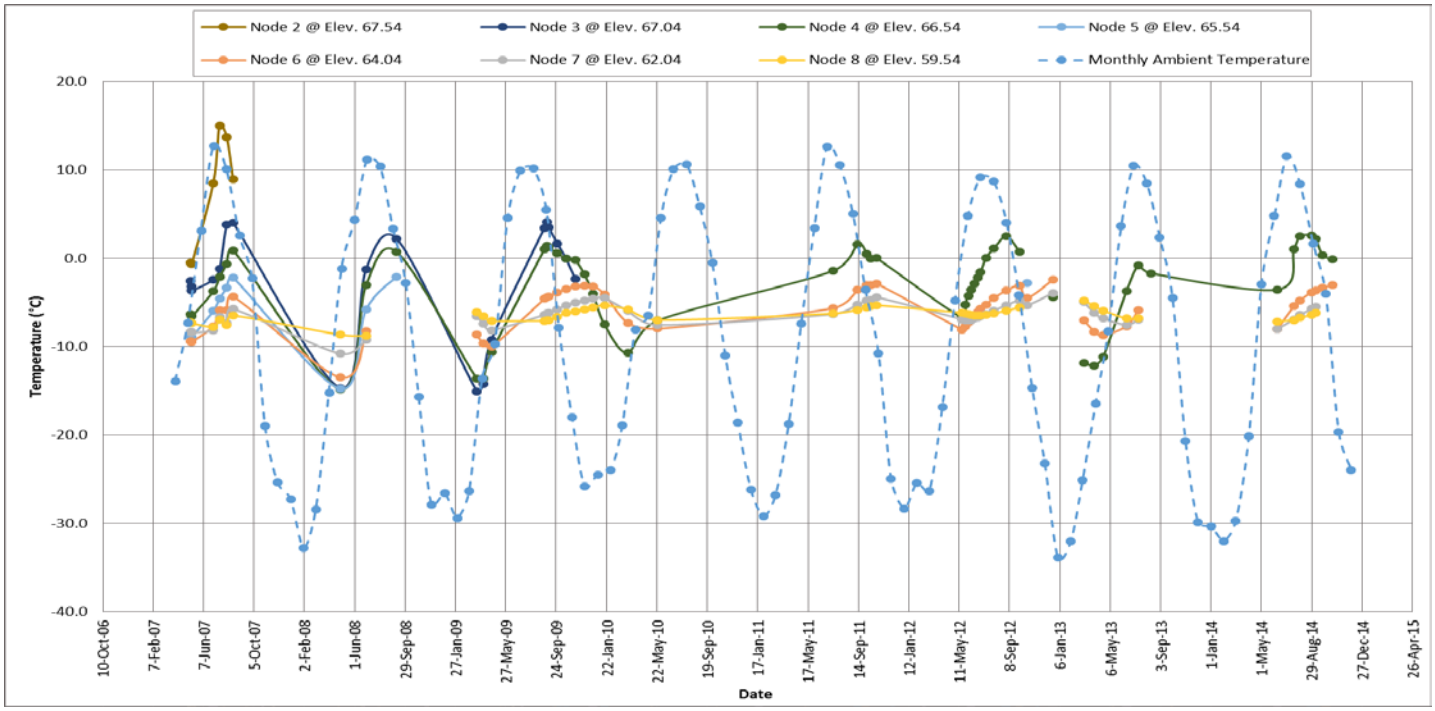
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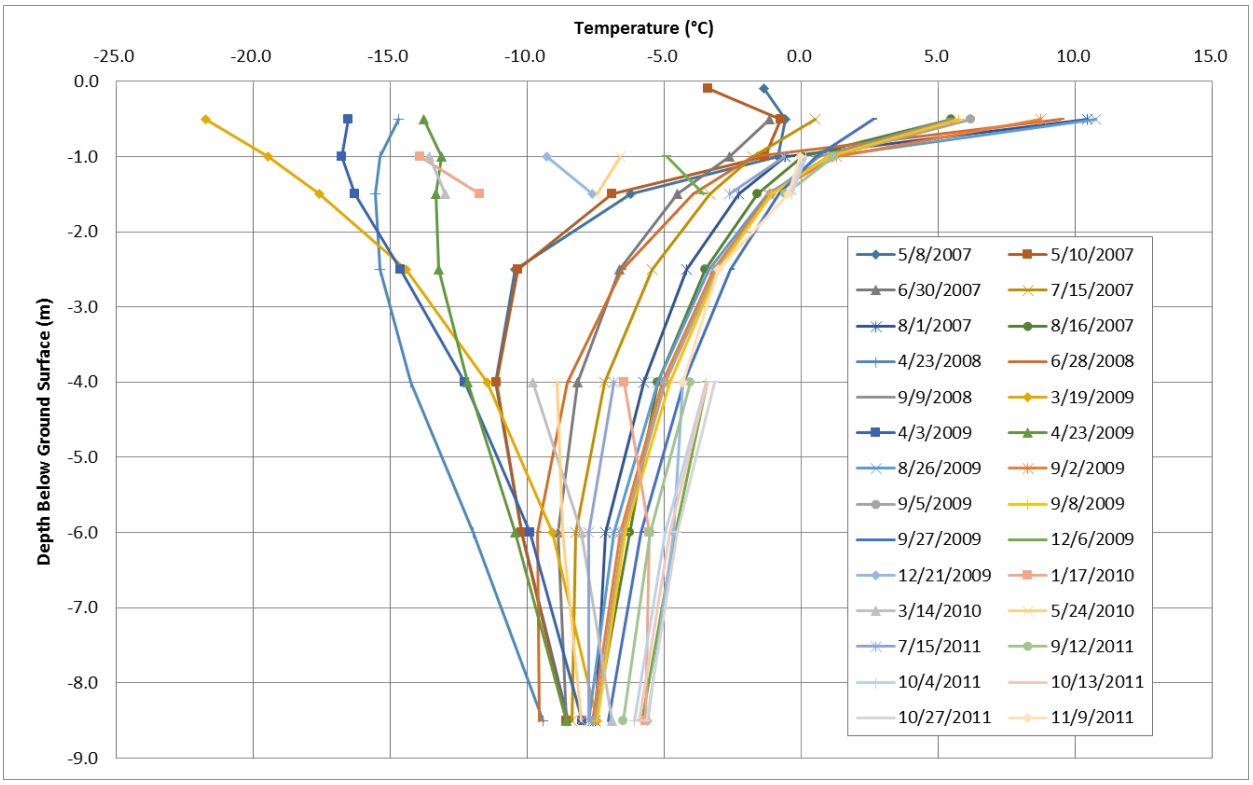
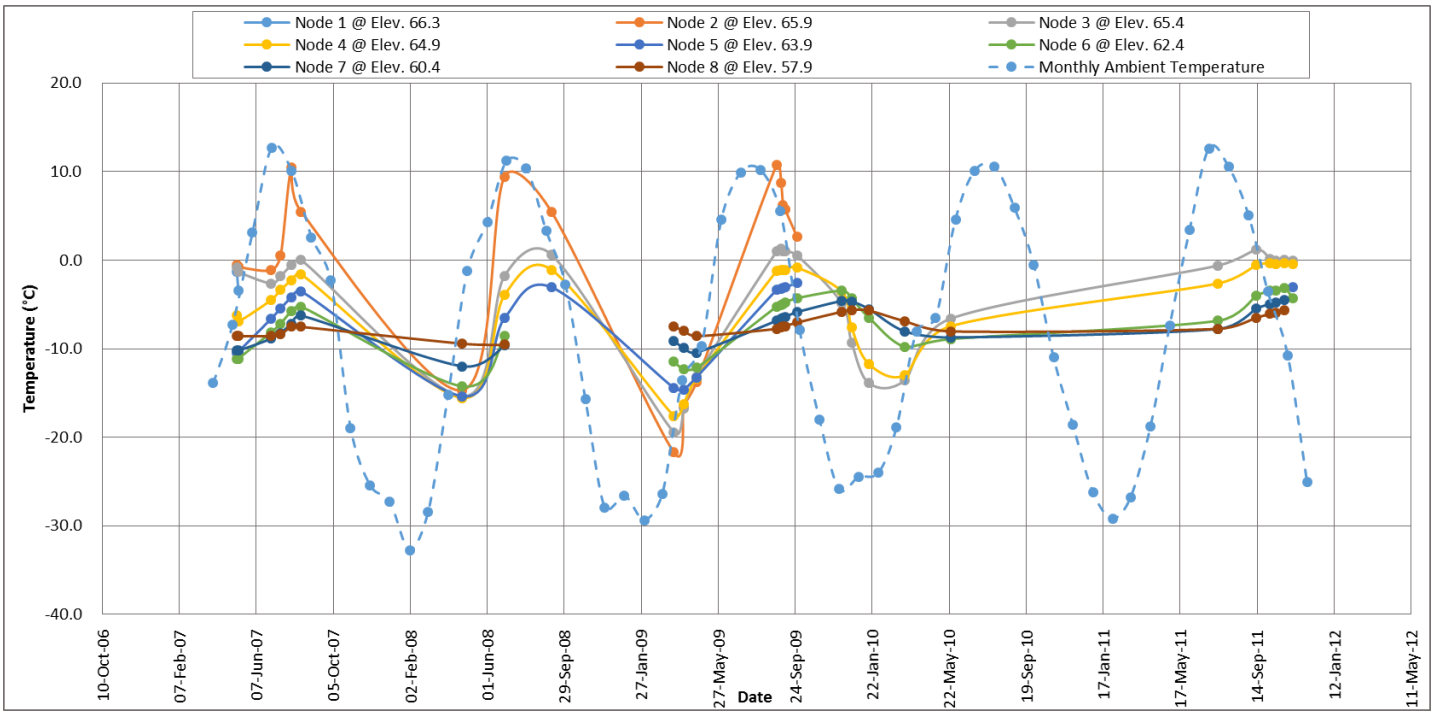
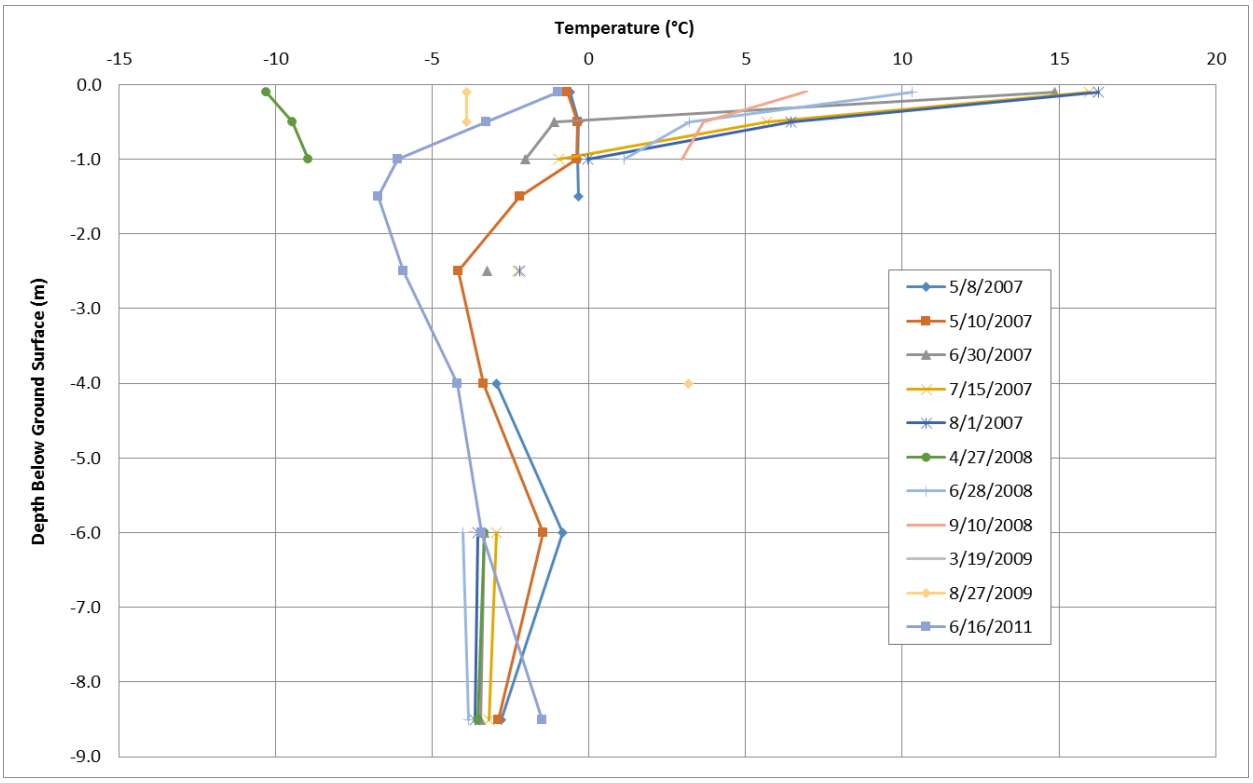
Node 3 @ Elev. 67.04
Node 4 @ Elev. 66.54
Node 5 @ Elev. 65.54
Node 6 @ Elev. 64.04
Node 7 @ Elev. 62.04
Node 8 @ Elev. 59.54
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
10-Oct-06
7-Feb-07
7-Jun-07
5-Oct-07
2-Feb-08
1-Jun-08
29-Sep-08
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
Date

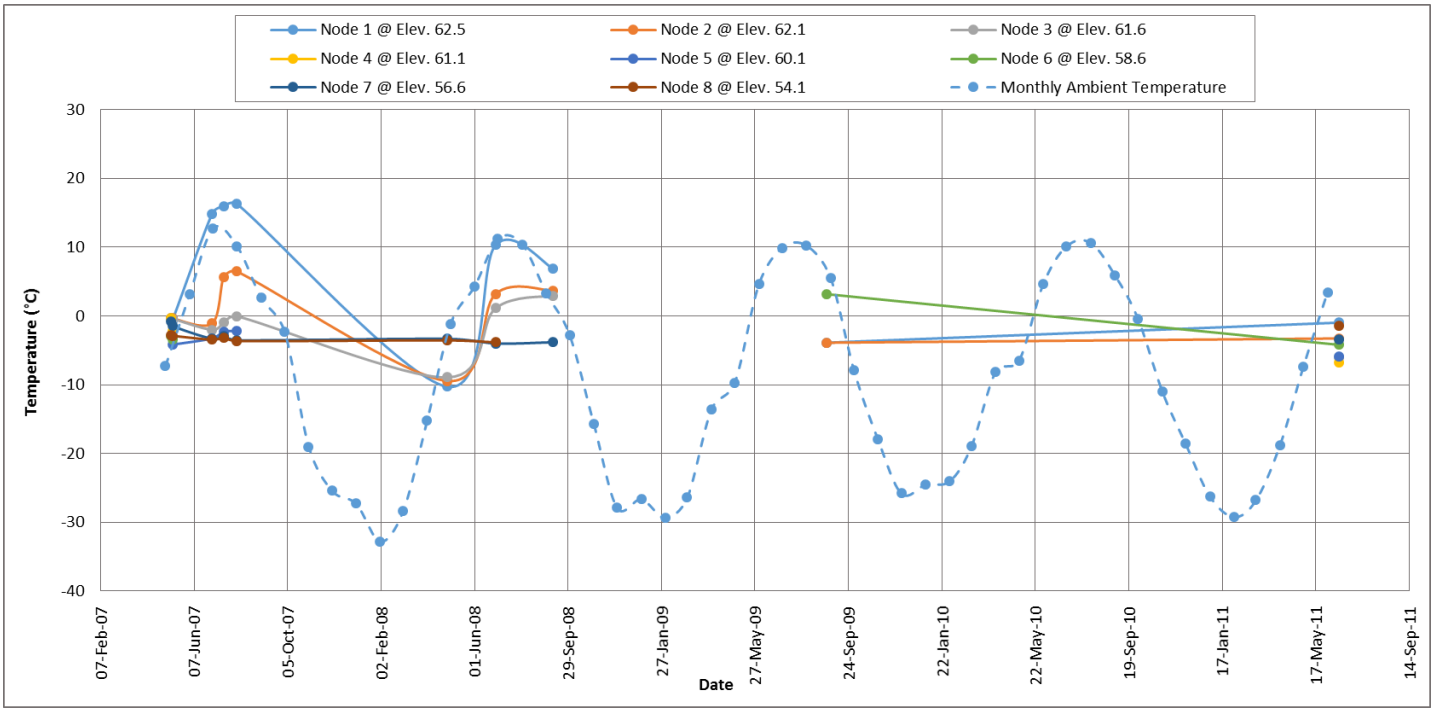
GT07-07


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
Depth Below Ground Surface (m)
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
5/8/2007
5/10/2007
6/30/2007
7/15/2007
8/1/2007
8/16/2007
4/23/2008
6/28/2008
9/9/2008
3/19/2009
4/3/2009
4/23/2009
8/26/2009
9/2/2009
9/5/2009
9/8/2009
9/27/2009
12/6/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
7/15/2011
9/12/2011
10/4/2011
10/13/2011
10/27/2011
11/9/2011

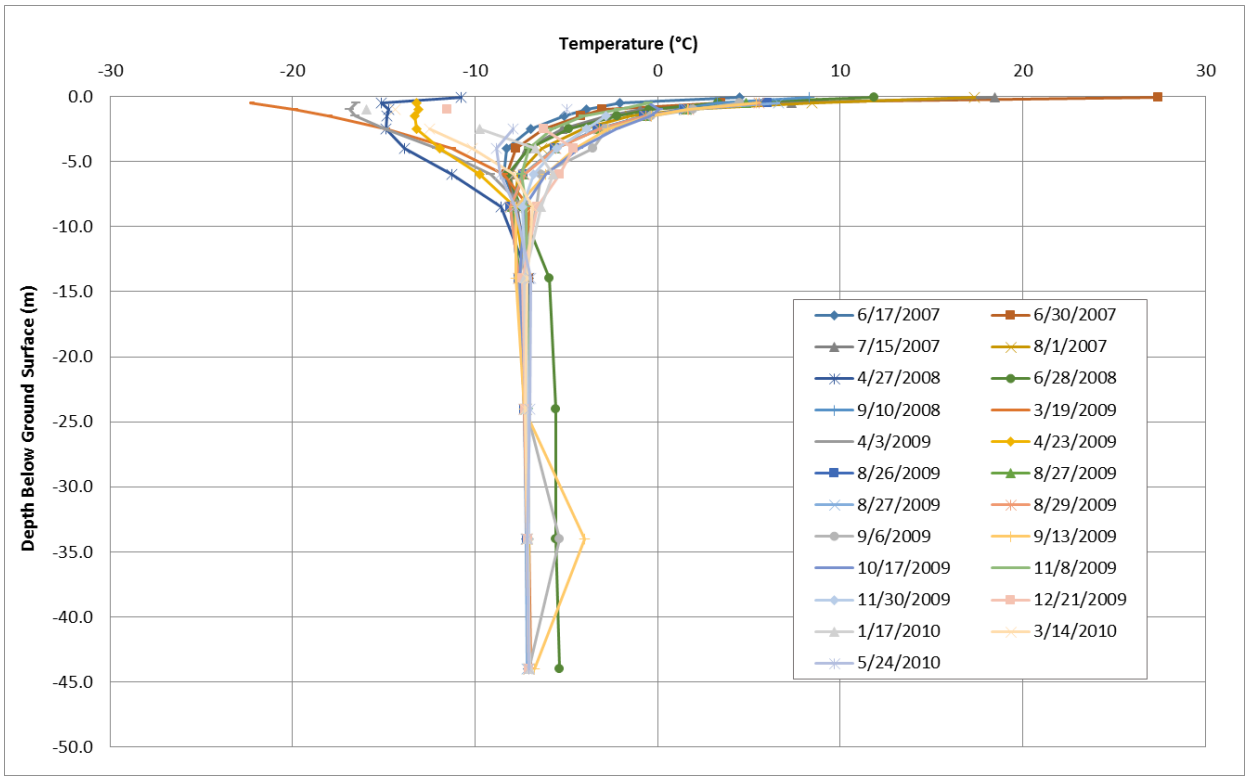

Node 1 @ Elev. 66.3
Node 2 @ Elev. 65.9
Node 3 @ Elev. 65.4
Node 4 @ Elev. 64.9
Node 5 @ Elev. 63.9
Node 6 @ Elev. 62.4
Node 7 @ Elev. 60.4
Node 8 @ Elev. 57.9
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
10-Oct-06
07-Feb-07
07-Jun-07
05-Oct-07
02-Feb-08
01-Jun-08
29-Sep-08
27-Jan-09
27-May-09
Date
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12

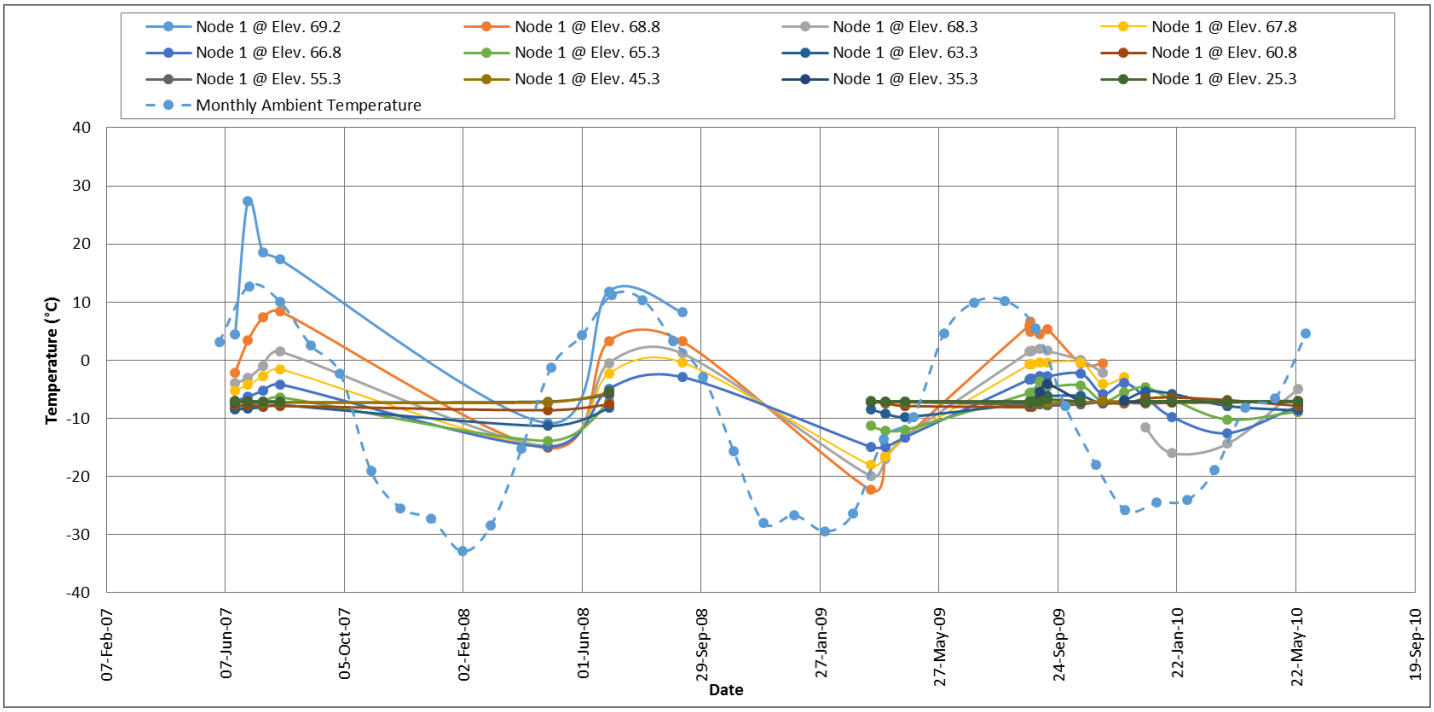
GT07-09


Temperature (°C)
-15
-10
-5
0
5
10
15
20
0.0
-1.0
-2.0
-3.0
-4.0
-5.0
-6.0
-7.0
-8.0
-9.0
Depth Below Ground Surface (m)
5/8/2007
5/10/2007
6/30/2007
7/15/2007
8/1/2007
4/27/2008
6/28/2008
9/10/2008
3/19/2009
8/27/2009
6/16/2011

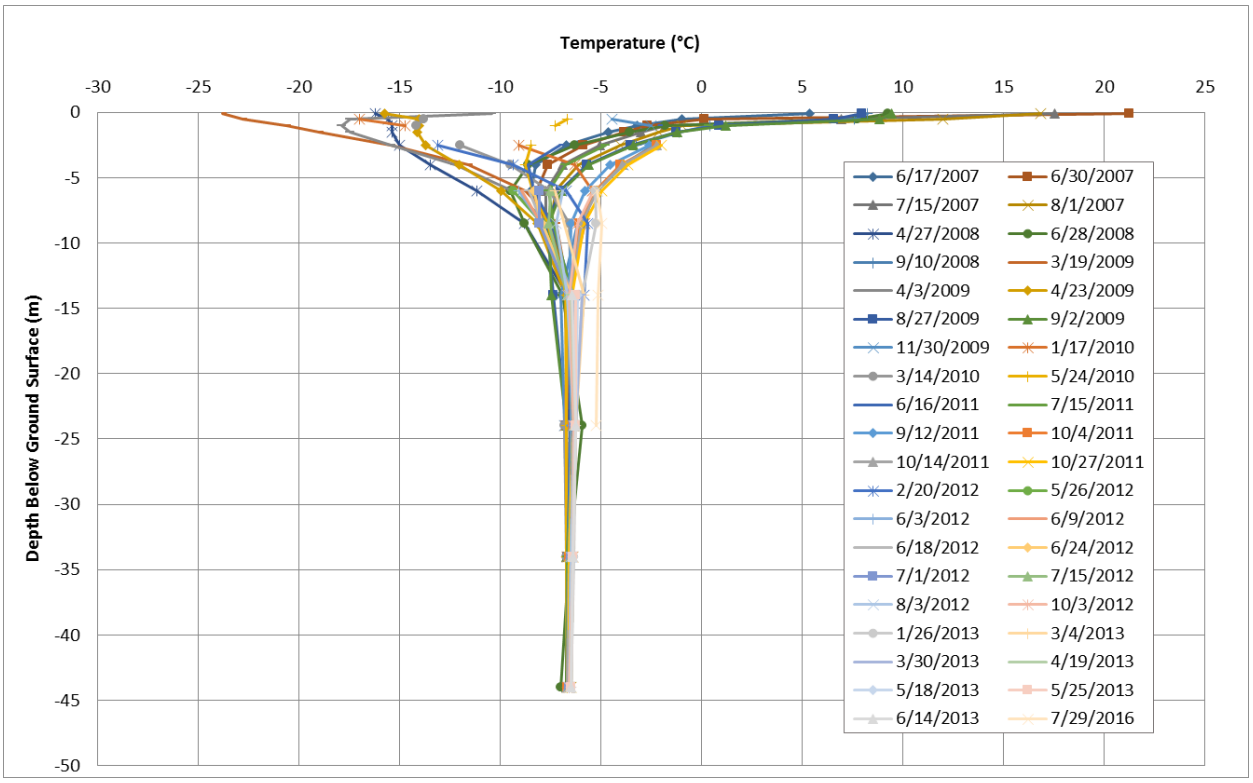

Node 1 @ Elev. 62.5
Node 2 @ Elev. 62.1
Node 3 @ Elev. 61.6
Node 4 @ Elev. 61.1
Node 5 @ Elev. 60.1
Node 6 @ Elev. 58.6
Node 7 @ Elev. 56.6
Node 8 @ Elev. 54.1
Monthly Ambient Temperature
30
20
10
0
-10
-20
-30
-40
Temperature (°C)
07-Feb-07
07-Jun-07
05-Oct-07
02-Feb-08
01-Jun-08
29-Sep-08
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
Date

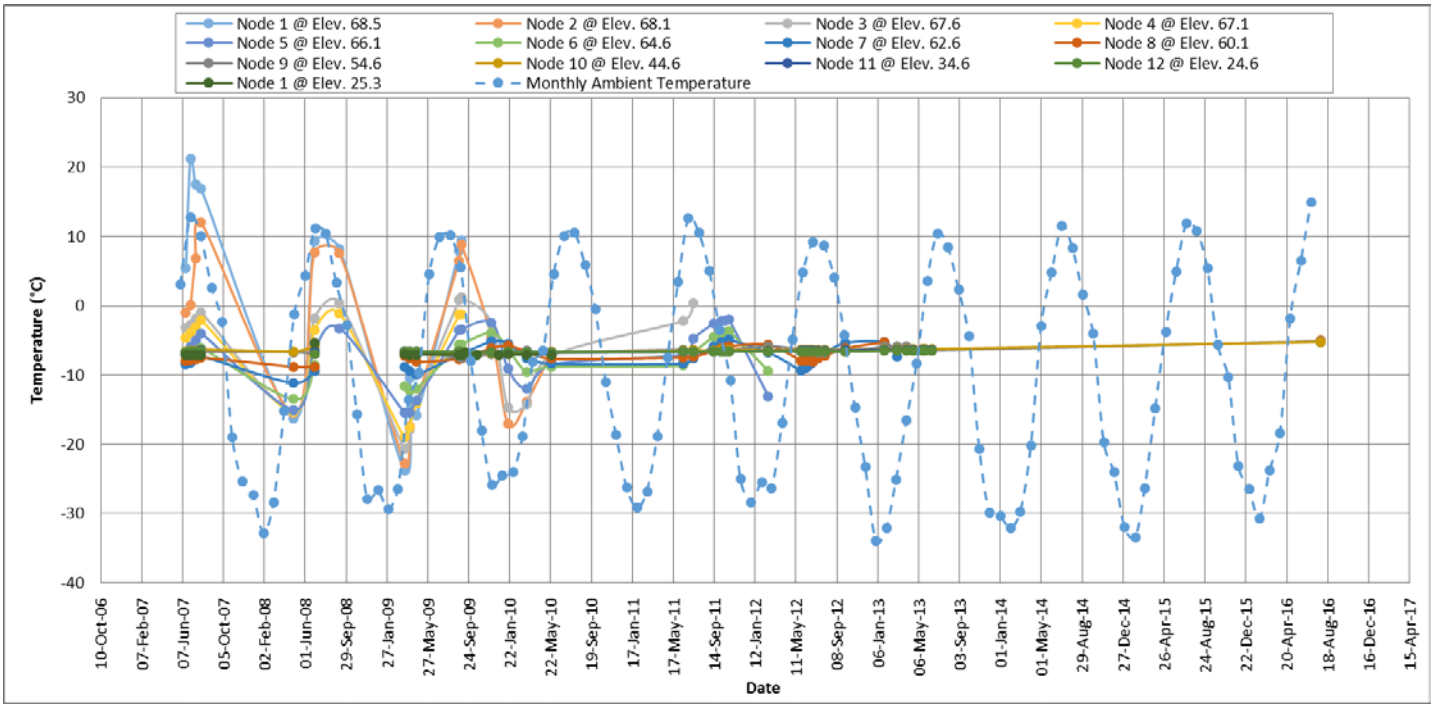
GT07-10


Temperature (°C)
-30
-20
-10
0
10
20
30
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
-45.0
-50.0
Depth Below Ground Surface (m)
6/17/2007
6/30/2007
7/15/2007
8/1/2007
4/27/2008
6/28/2008
9/10/2008
3/19/2009
4/3/2009
4/23/2009
8/26/2009
8/27/2009
8/27/2009
8/29/2009
9/6/2009
9/13/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010

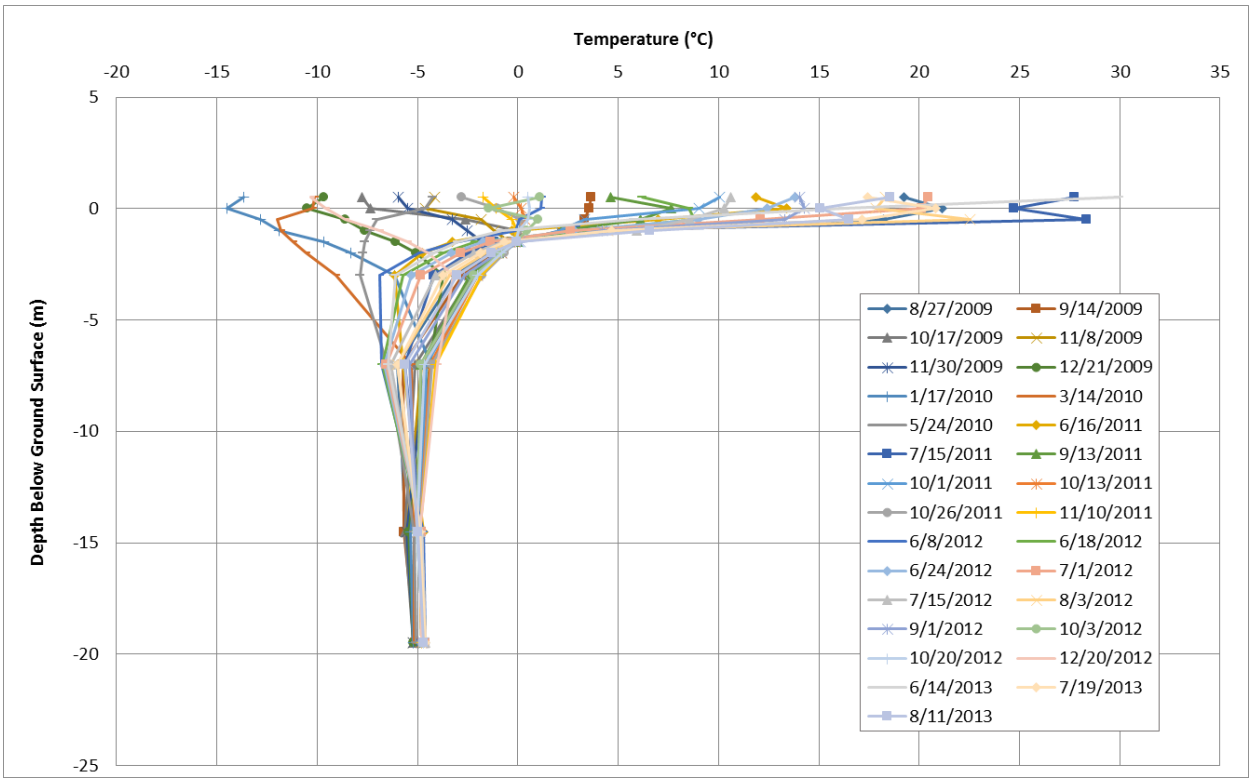

Node 1 @ Elev. 69.2
Node 1 @ Elev. 68.8
Node 1 @ Elev. 68.3
Node 1 @ Elev. 67.8
Node 1 @ Elev. 66.8
Node 1 @ Elev. 65.3
Node 1 @ Elev. 63.3
Node 1 @ Elev. 60.8
Node 1 @ Elev. 55.3
Node 1 @ Elev. 45.3
Node 1 @ Elev. 35.3
Node 1 @ Elev. 25.3
Monthly Ambient Temperature
40
30
20
10
0
-10
-20
-30
-40
Temperature (°C)
07-Feb-07
07-Jun-07
05-Oct-07
02-Feb-08
01-Jun-08
29-Sep-08
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
Date

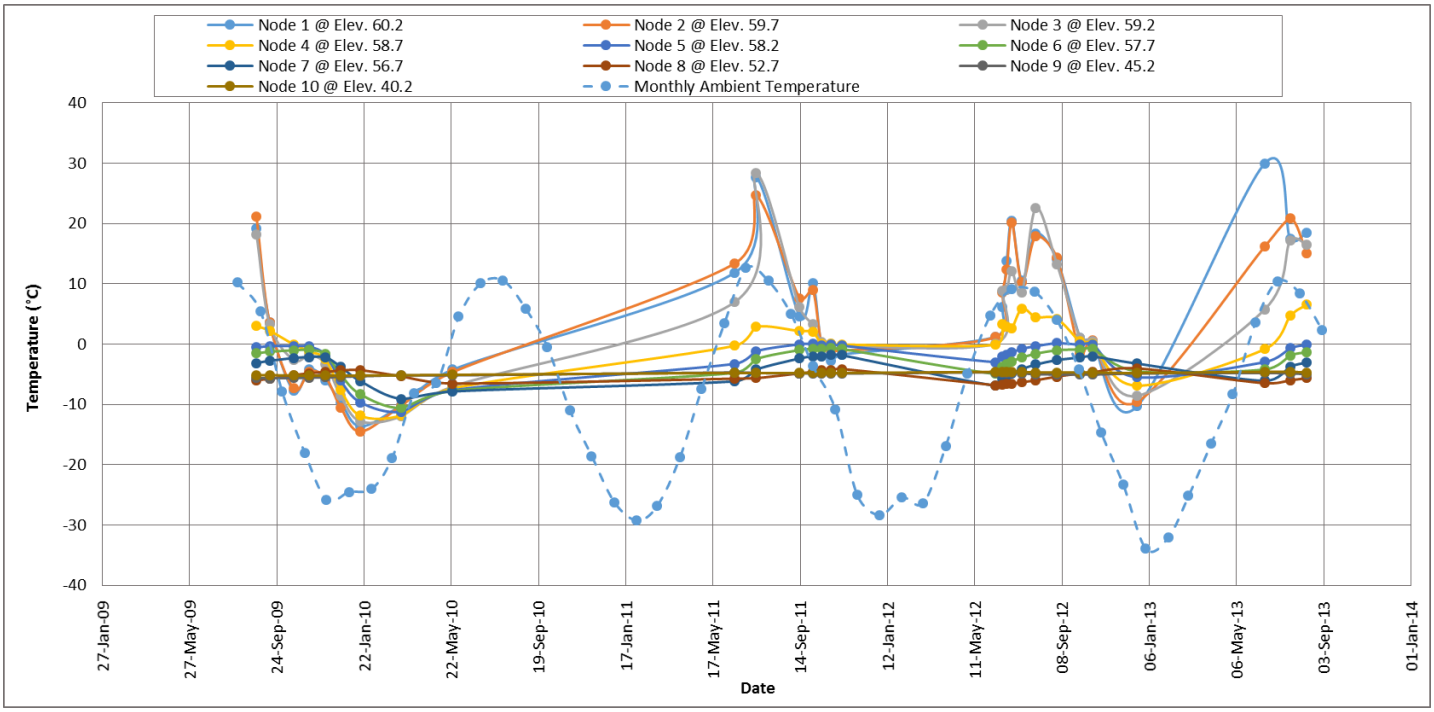
GT07-11


Temperature (°C)
Depth Below Ground Surface (m)
6/17/2007
6/30/2007
7/15/2007
8/1/2007
4/27/2008
6/28/2008
9/10/2008
3/19/2009
4/3/2009
4/23/2009
8/27/2009
9/2/2009
11/30/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/15/2011
9/12/2011
10/4/2011
10/14/2011
10/27/2011
2/20/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
10/3/2012
1/26/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/29/2016

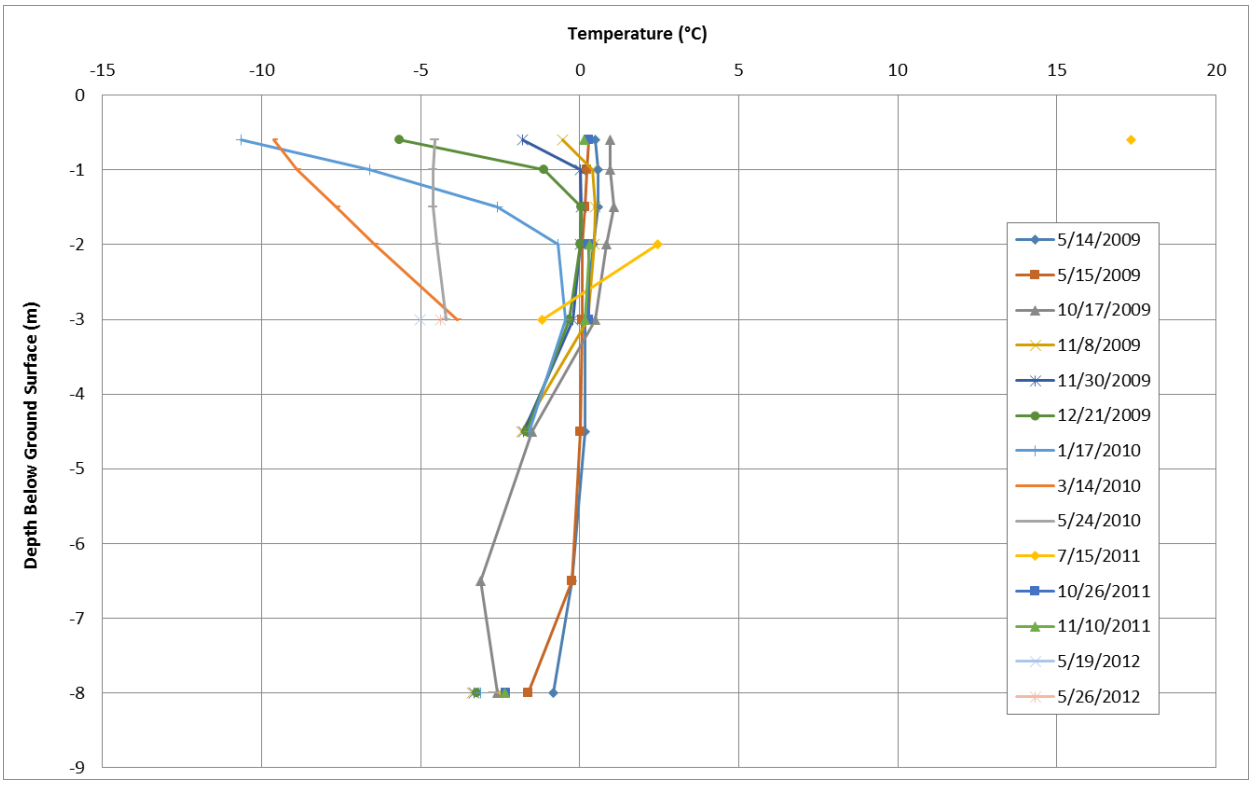

Node 1 @ Elev. 68.5
Node 2 @ Elev. 68.1
Node 3 @ Elev. 67.6
Node 4 @ Elev. 67.1
Node 5 @ Elev. 66.1
Node 6 @ Elev. 64.6
Node 7 @ Elev. 62.6
Node 8 @ Elev. 60.1
Node 9 @ Elev. 54.6
Node 10 @ Elev. 44.6
Node 11 @ Elev. 34.6
Node 12 @ Elev. 24.6
Node 1 @ Elev. 25.3
Monthly Ambient Temperature
Temperature (°C)
Date

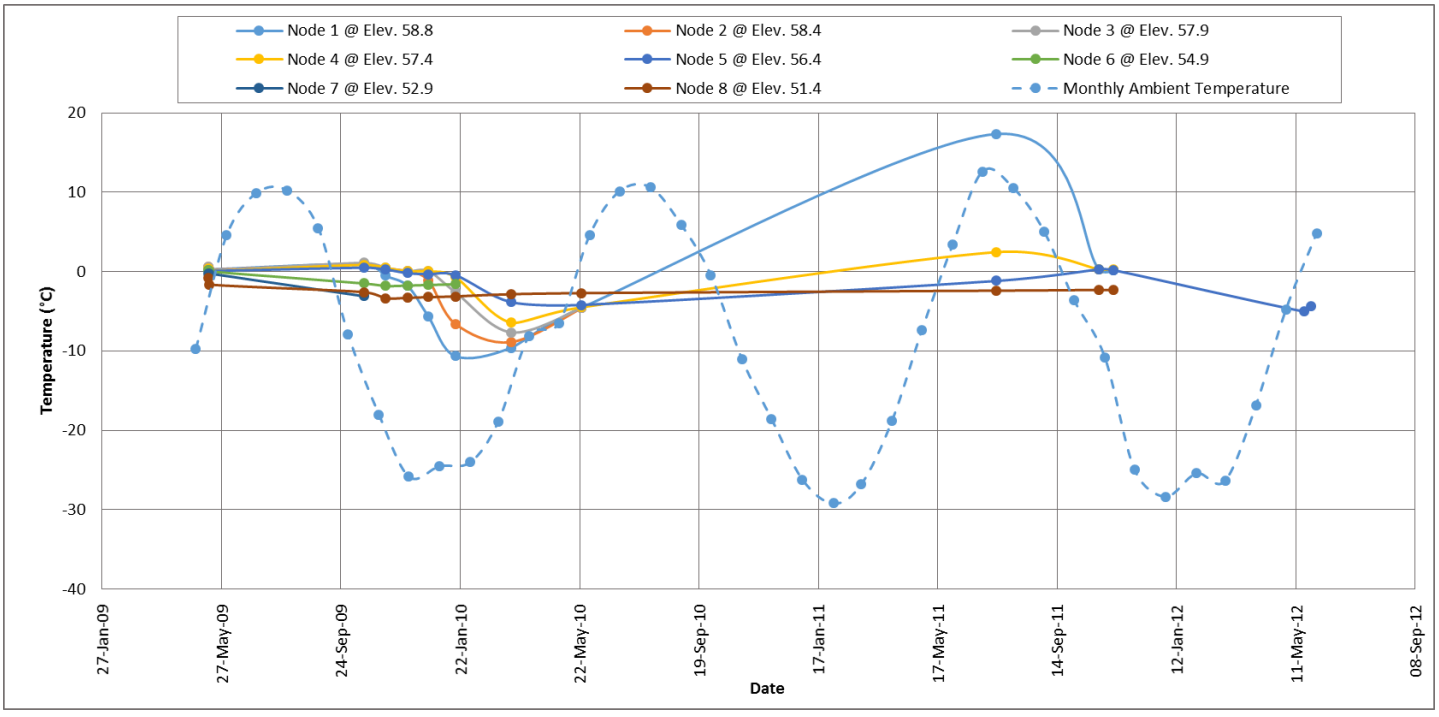
GT09-01


Temperature (°C)
-20
-15
-10
-5
0
5
10
15
20
25
30
35
Depth Below Ground Surface (m)
5
0
-5
-10
-15
-20
-25
8/27/2009
9/14/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/15/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
11/10/2011
6/8/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
6/14/2013
7/19/2013
8/11/2013

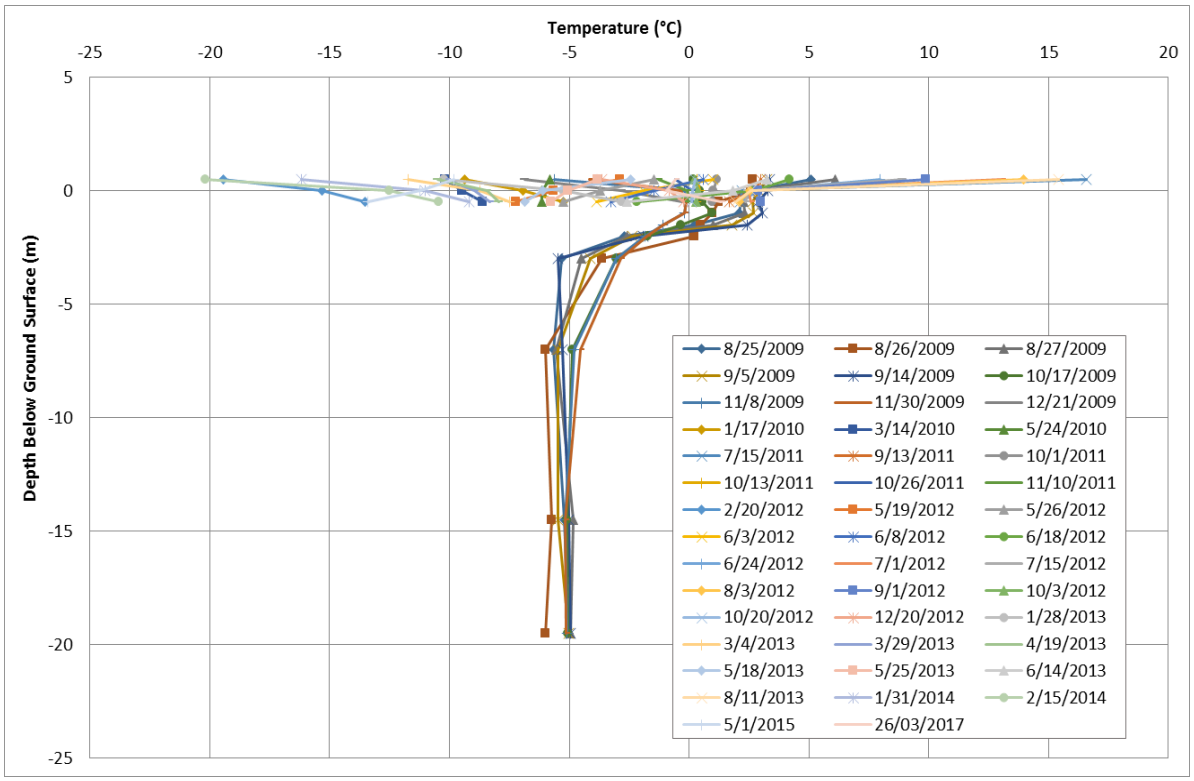

Node 1 @ Elev. 60.2
Node 2 @ Elev. 59.7
Node 3 @ Elev. 59.2
Node 4 @ Elev. 58.7
Node 5 @ Elev. 58.2
Node 6 @ Elev. 57.7
Node 7 @ Elev. 56.7
Node 8 @ Elev. 52.7
Node 9 @ Elev. 45.2
Node 10 @ Elev. 40.2
Monthly Ambient Temperature
Temperature (°C)
40
30
20
10
0
-10
-20
-30
-40
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
Date

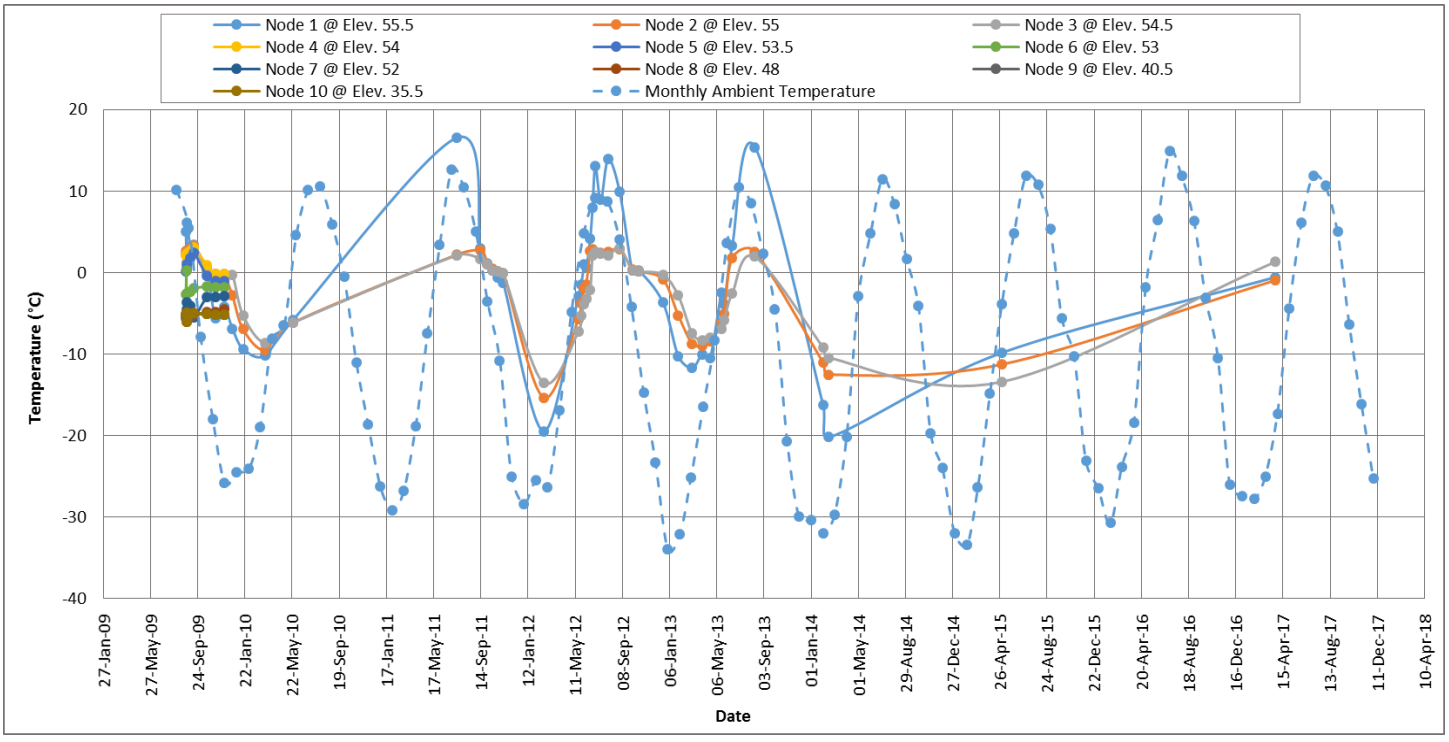
GT09-02


Temperature (°C)
-15
-10
-5
0
5
10
15
20
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
Depth Below Ground Surface (m)
5/14/2009
5/15/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
7/15/2011
10/26/2011
11/10/2011
5/19/2012
5/26/2012

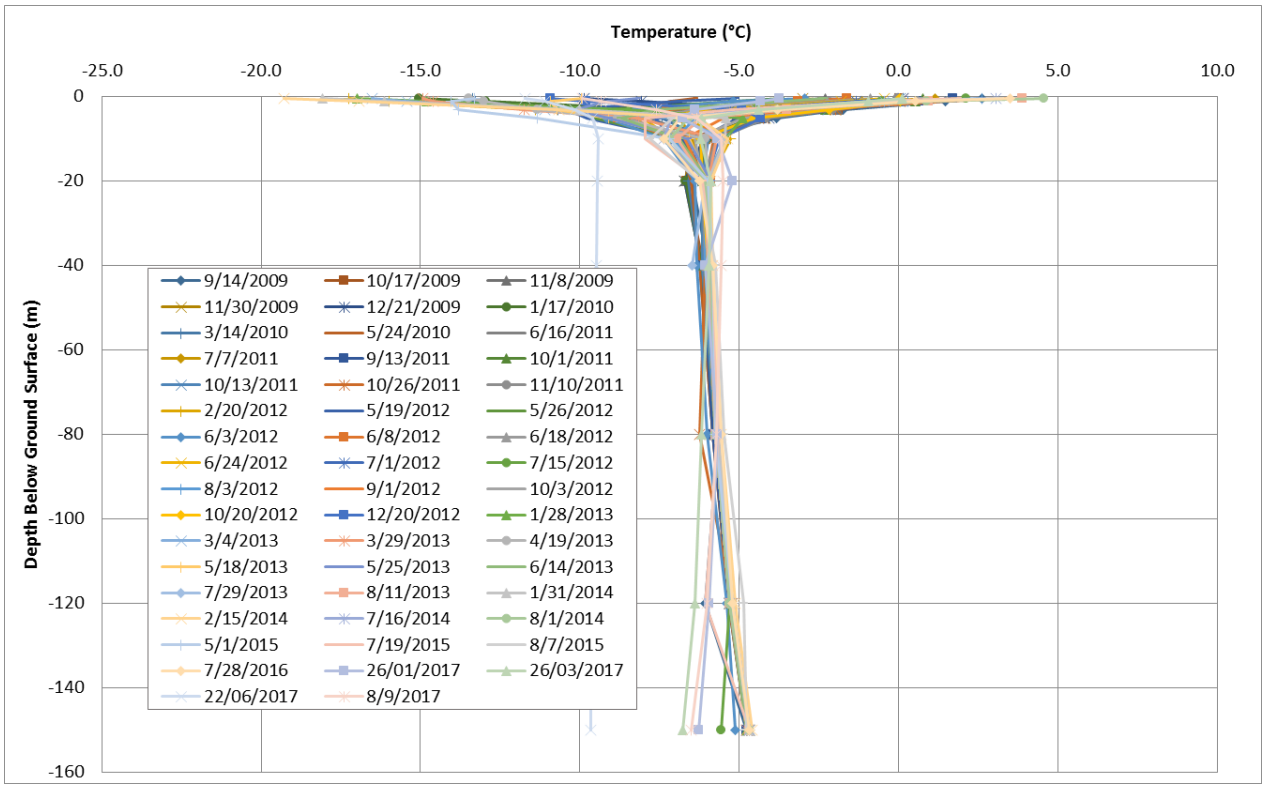

Node 1 @ Elev. 58.8
Node 2 @ Elev. 58.4
Node 3 @ Elev. 57.9
Node 4 @ Elev. 57.4
Node 5 @ Elev. 56.4
Node 6 @ Elev. 54.9
Node 7 @ Elev. 52.9
Node 8 @ Elev. 51.4
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
Date

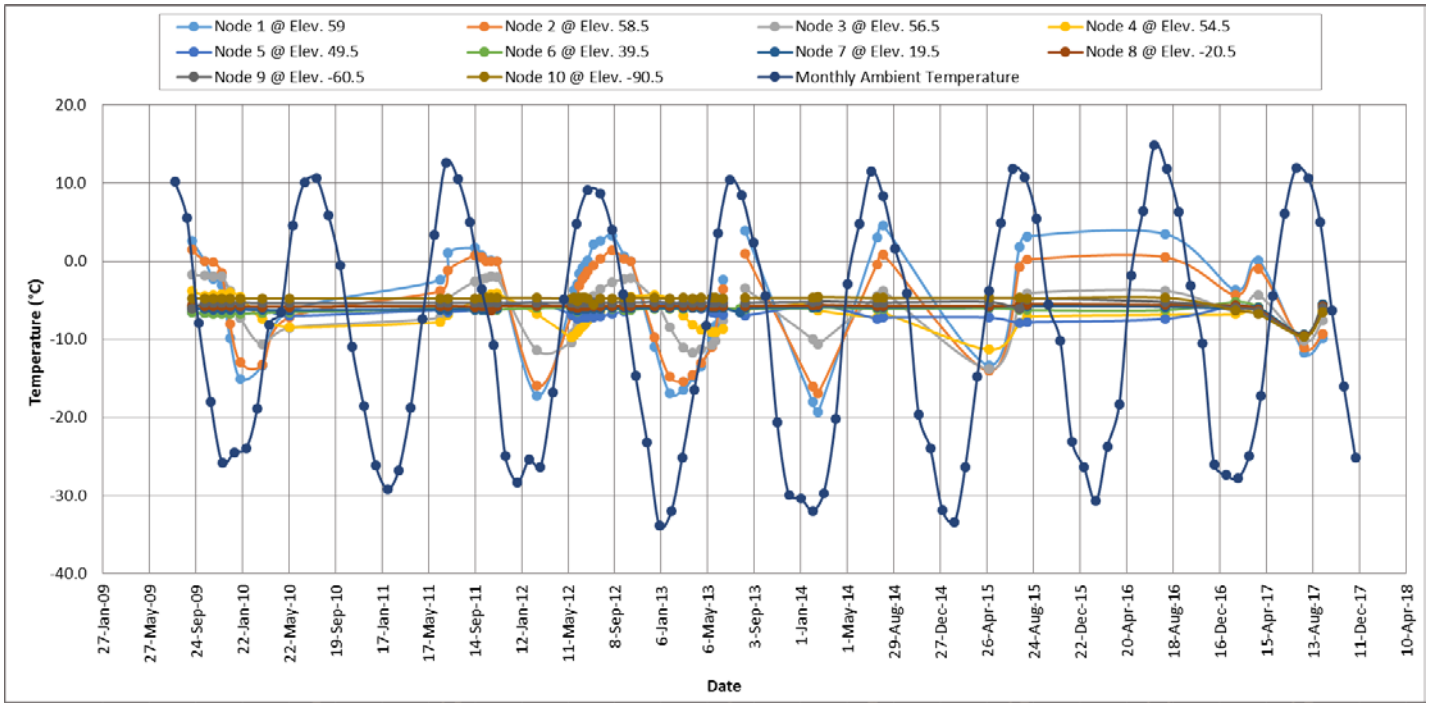
GT09-04


Temperature (°C)
Depth Below Ground Surface (m)
8/25/2009
8/26/2009
8/27/2009
9/5/2009
9/14/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
7/15/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
11/10/2011
2/20/2012
5/19/2012
5/26/2012
6/3/2012
6/8/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/28/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
8/11/2013
1/31/2014
2/15/2014
5/1/2015
26/03/2017

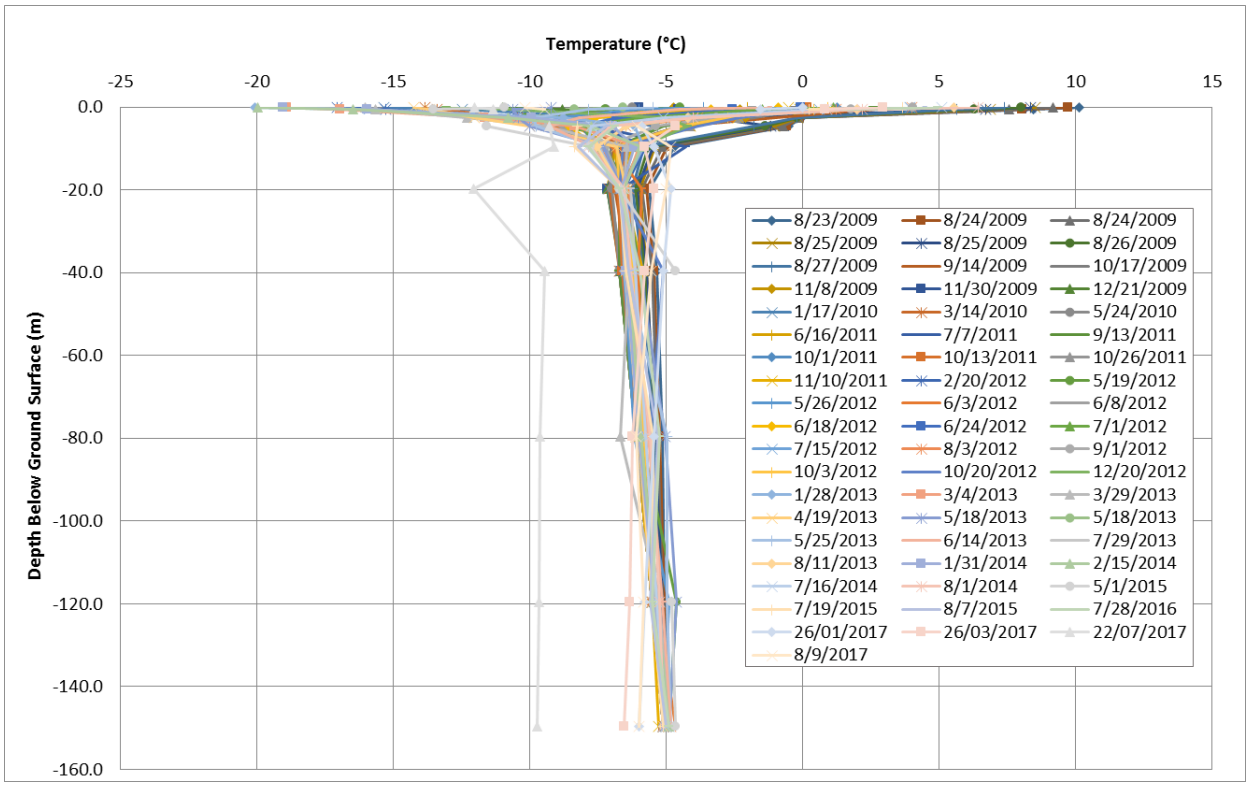

Node 1 @ Elev. 55.5
Node 2 @ Elev. 55
Node 3 @ Elev. 54.5
Node 4 @ Elev. 54
Node 5 @ Elev. 53.5
Node 6 @ Elev. 53
Node 7 @ Elev. 52
Node 8 @ Elev. 48
Node 9 @ Elev. 40.5
Node 10 @ Elev. 35.5
Monthly Ambient Temperature
Temperature (°C)
Date

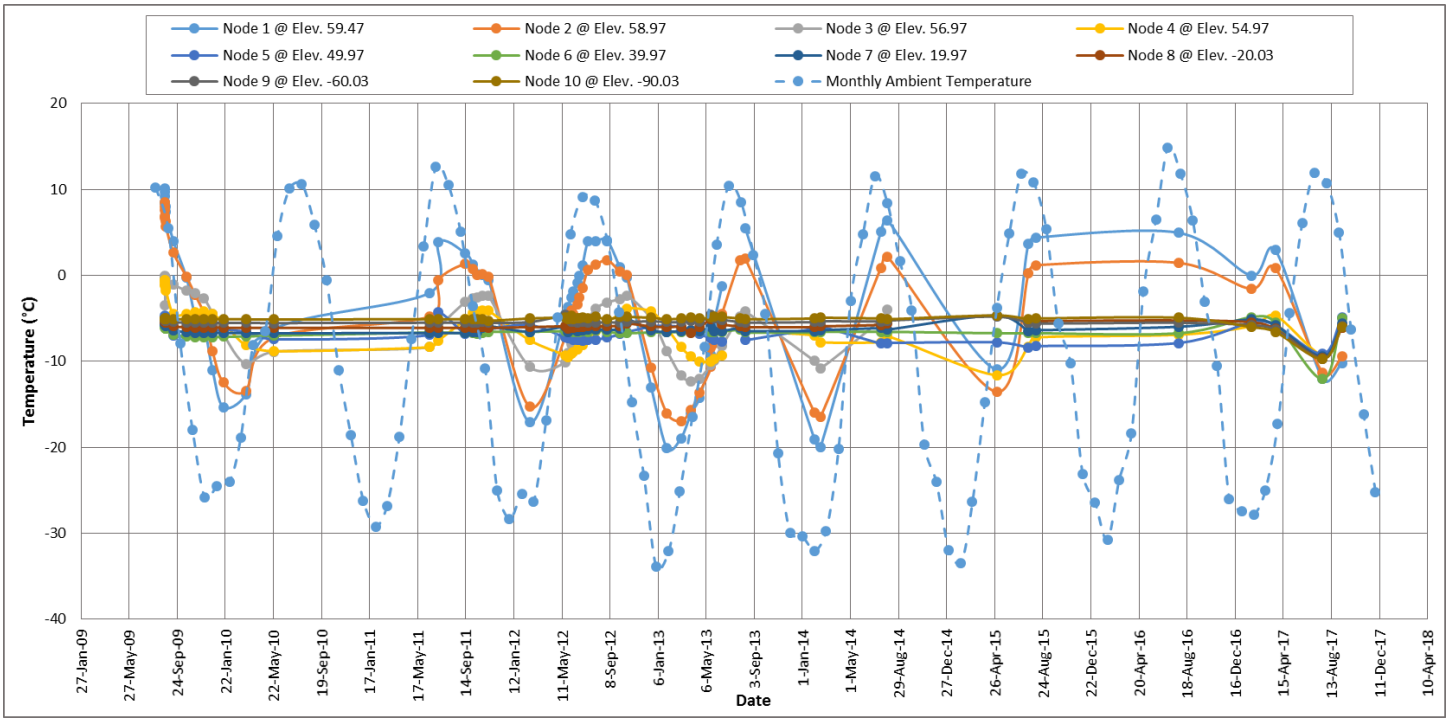
GT09-07


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
0
-20
-40
-60
-80
-100
-120
-140
-160
Depth Below Ground Surface (m)
9/14/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
11/10/2011
2/20/2012
5/19/2012
5/26/2012
6/3/2012
6/8/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/28/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/29/2013
8/11/2013
1/31/2014
2/15/2014
7/16/2014
8/1/2014
5/1/2015
7/19/2015
8/7/2015
7/28/2016
26/01/2017
26/03/2017
22/06/2017
8/9/2017

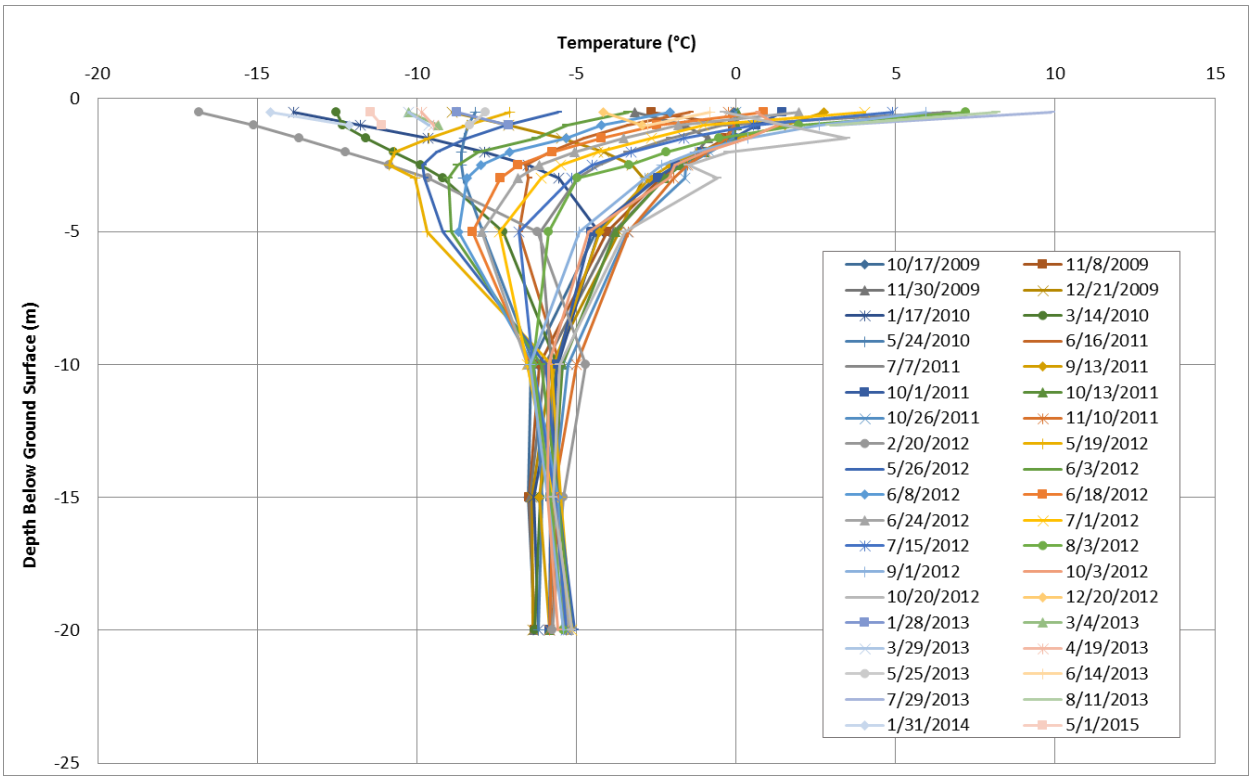

Node 1 @ Elev. 59
Node 2 @ Elev. 58.5
Node 3 @ Elev. 56.5
Node 4 @ Elev. 54.5
Node 5 @ Elev. 49.5
Node 6 @ Elev. 39.5
Node 7 @ Elev. 19.5
Node 8 @ Elev. -20.5
Node 9 @ Elev. -60.5
Node 10 @ Elev. -90.5
Monthly Ambient Temperature
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Temperature (°C)
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

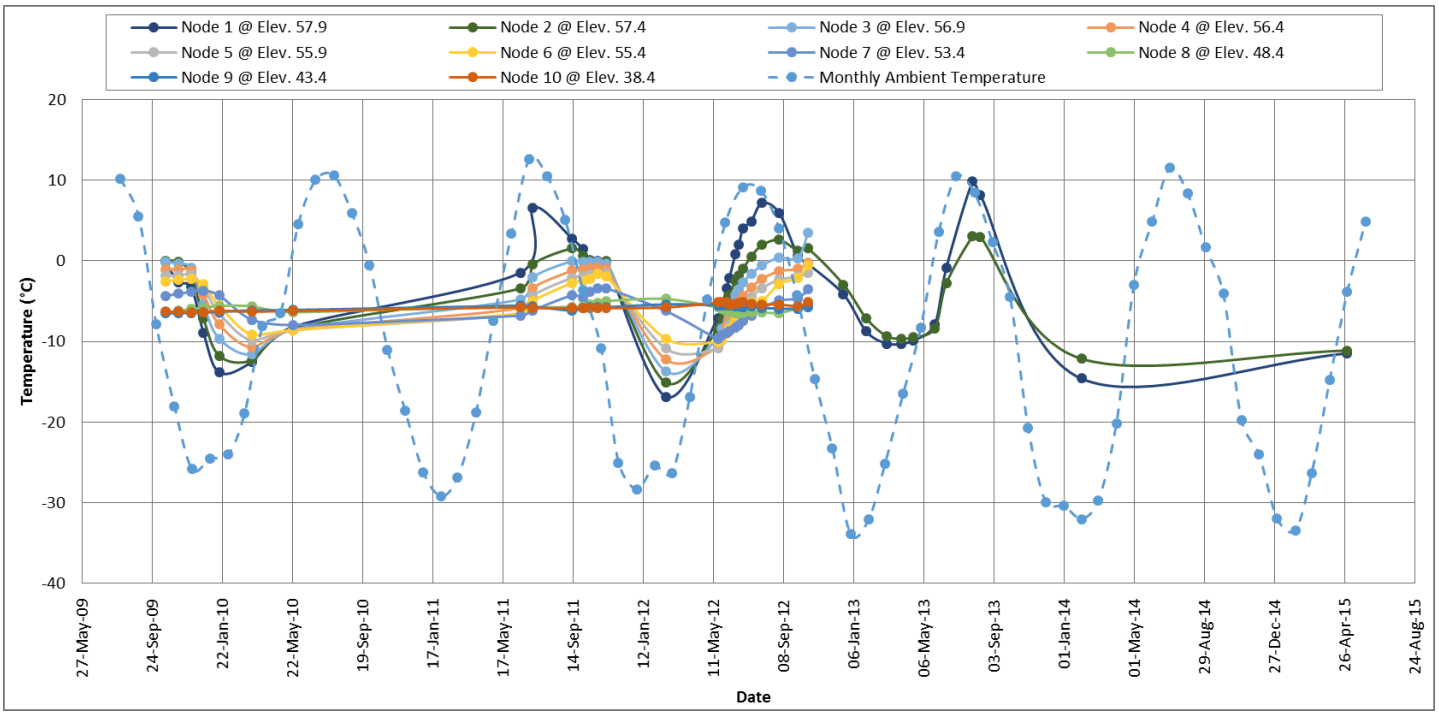
GT09-08


Temperature (°C)
-25
-20
-15
-10
-5
0
5
10
15
0.0
-20.0
-40.0
-60.0
-80.0
-100.0
-120.0
-140.0
-160.0
Depth Below Ground Surface (m)
8/23/2009
8/24/2009
8/24/2009
8/25/2009
8/25/2009
8/26/2009
8/27/2009
9/14/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
11/10/2011
2/20/2012
5/19/2012
5/26/2012
6/3/2012
6/8/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/28/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/18/2013
5/25/2013
6/14/2013
7/29/2013
8/11/2013
1/31/2014
2/15/2014
7/16/2014
8/1/2014
5/1/2015
7/19/2015
8/7/2015
7/28/2016
26/01/2017
26/03/2017
22/07/2017
8/9/2017

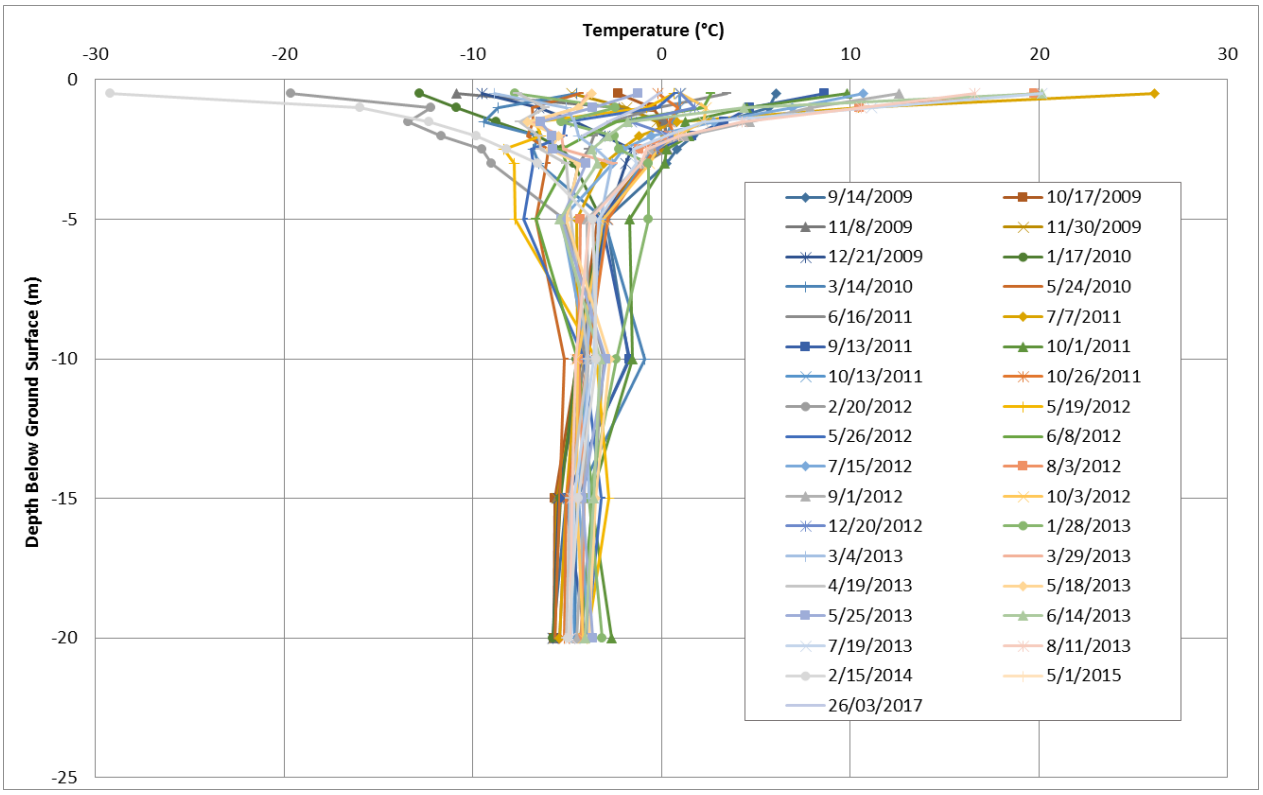

Node 1 @ Elev. 59.47
Node 2 @ Elev. 58.97
Node 3 @ Elev. 56.97
Node 4 @ Elev. 54.97
Node 5 @ Elev. 49.97
Node 6 @ Elev. 39.97
Node 7 @ Elev. 19.97
Node 8 @ Elev. -20.03
Node 9 @ Elev. -60.03
Node 10 @ Elev. -90.03
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

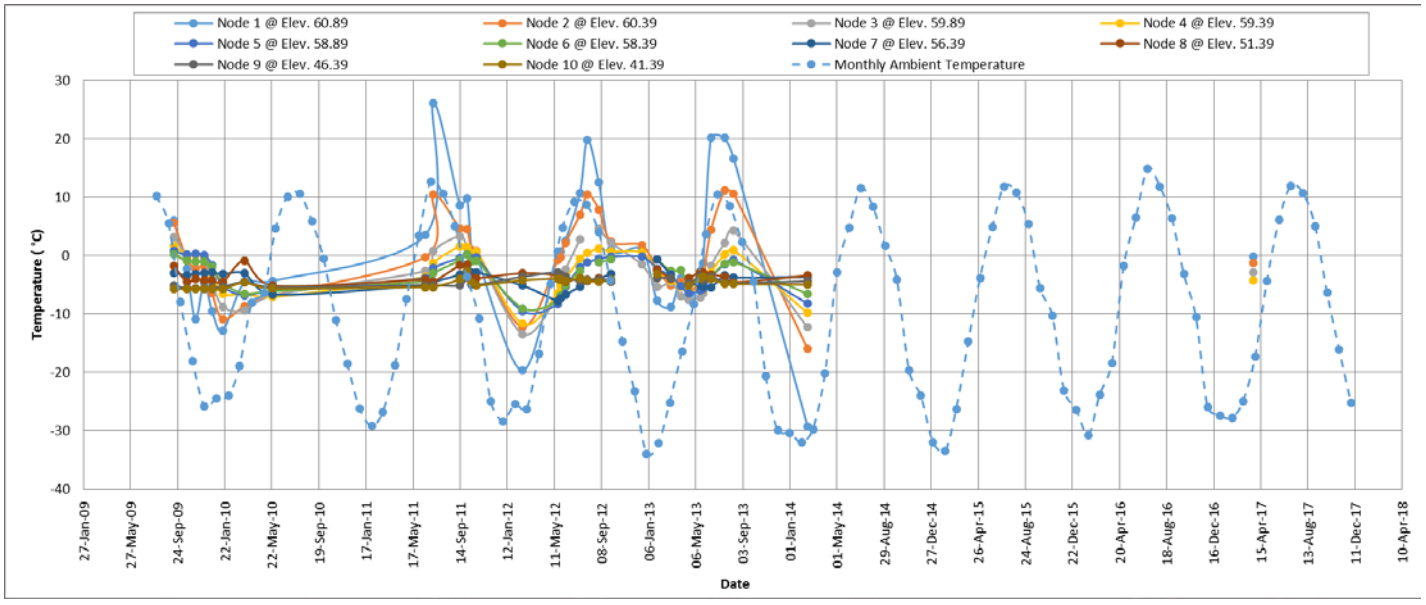
GT09-10


Temperature (°C)
-20
-15
-10
-5
0
5
10
15
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
11/10/2011
2/20/2012
5/19/2012
5/26/2012
6/3/2012
6/8/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/28/2013
3/4/2013
3/29/2013
4/19/2013
5/25/2013
6/14/2013
7/29/2013
8/11/2013
1/31/2014
5/1/2015

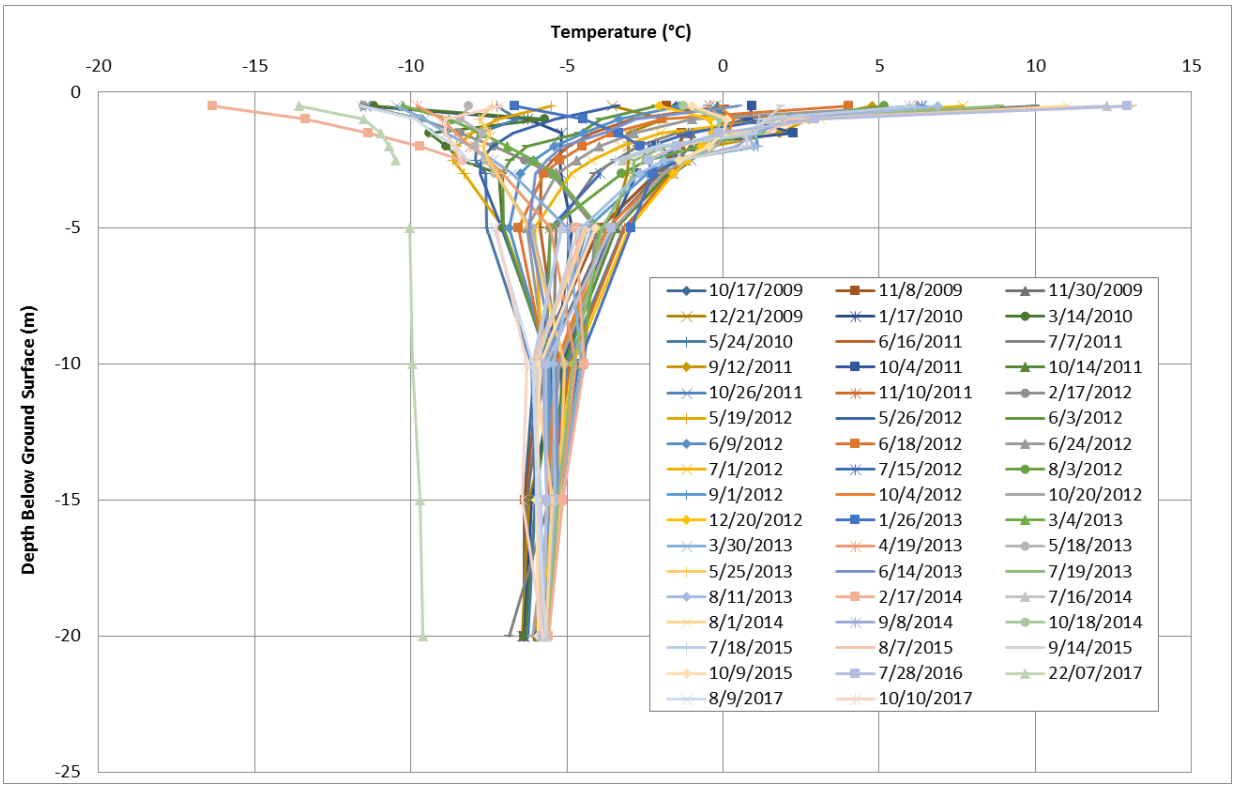

Node 1 @ Elev. 57.9
Node 2 @ Elev. 57.4
Node 3 @ Elev. 56.9
Node 4 @ Elev. 56.4
Node 5 @ Elev. 55.9
Node 6 @ Elev. 55.4
Node 7 @ Elev. 53.4
Node 8 @ Elev. 48.4
Node 9 @ Elev. 43.4
Node 10 @ Elev. 38.4
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
Date

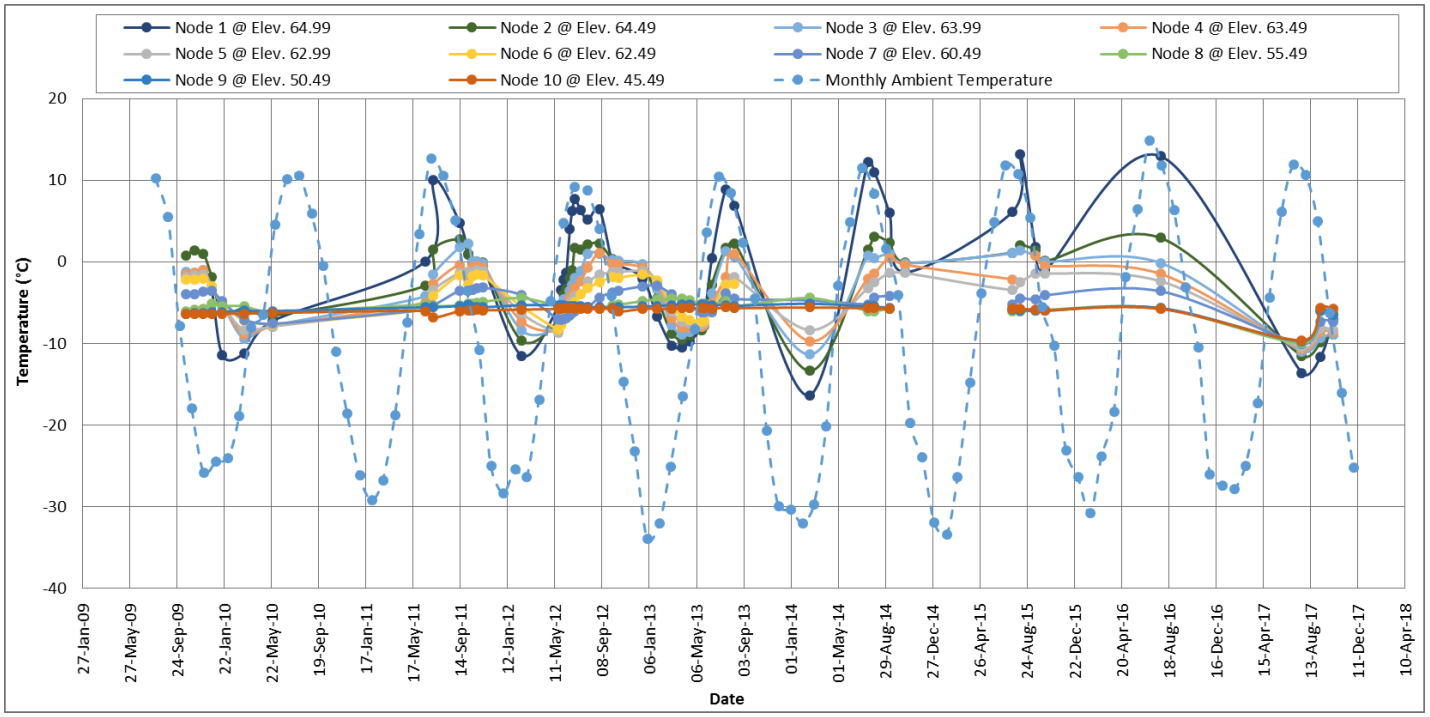
GT09-12


Temperature (°C)
-30
-20
-10
0
10
20
30
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
9/14/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/13/2011
10/1/2011
10/13/2011
10/26/2011
2/20/2012
5/19/2012
5/26/2012
6/8/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
12/20/2012
1/28/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/15/2014
5/1/2015
26/03/2017

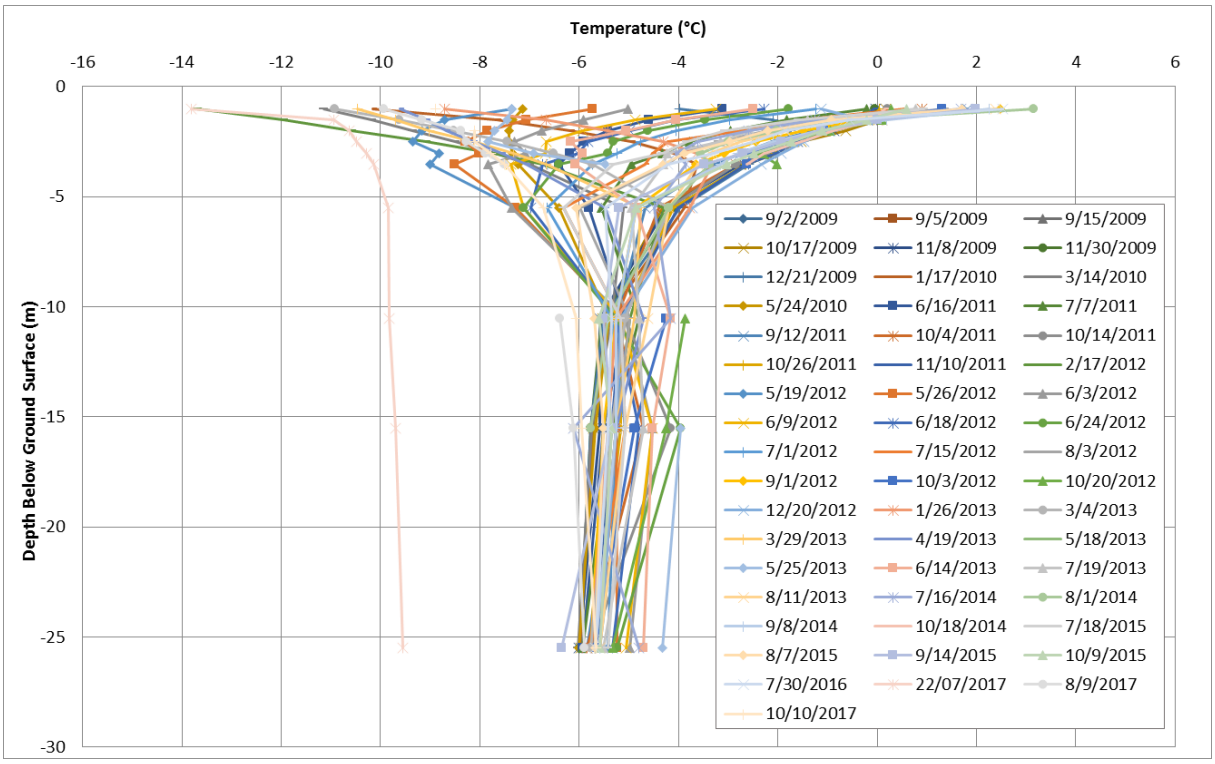

Node 1 @ Elev. 60.89
Node 2 @ Elev. 60.39
Node 3 @ Elev. 59.89
Node 4 @ Elev. 59.39
Node 5 @ Elev. 58.89
Node 6 @ Elev. 58.39
Node 7 @ Elev. 56.39
Node 8 @ Elev. 51.39
Node 9 @ Elev. 46.39
Node 10 @ Elev. 41.39
Monthly Ambient Temperature
Temperature (°C)
30
20
10
0
-10
-20
-30
-40
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

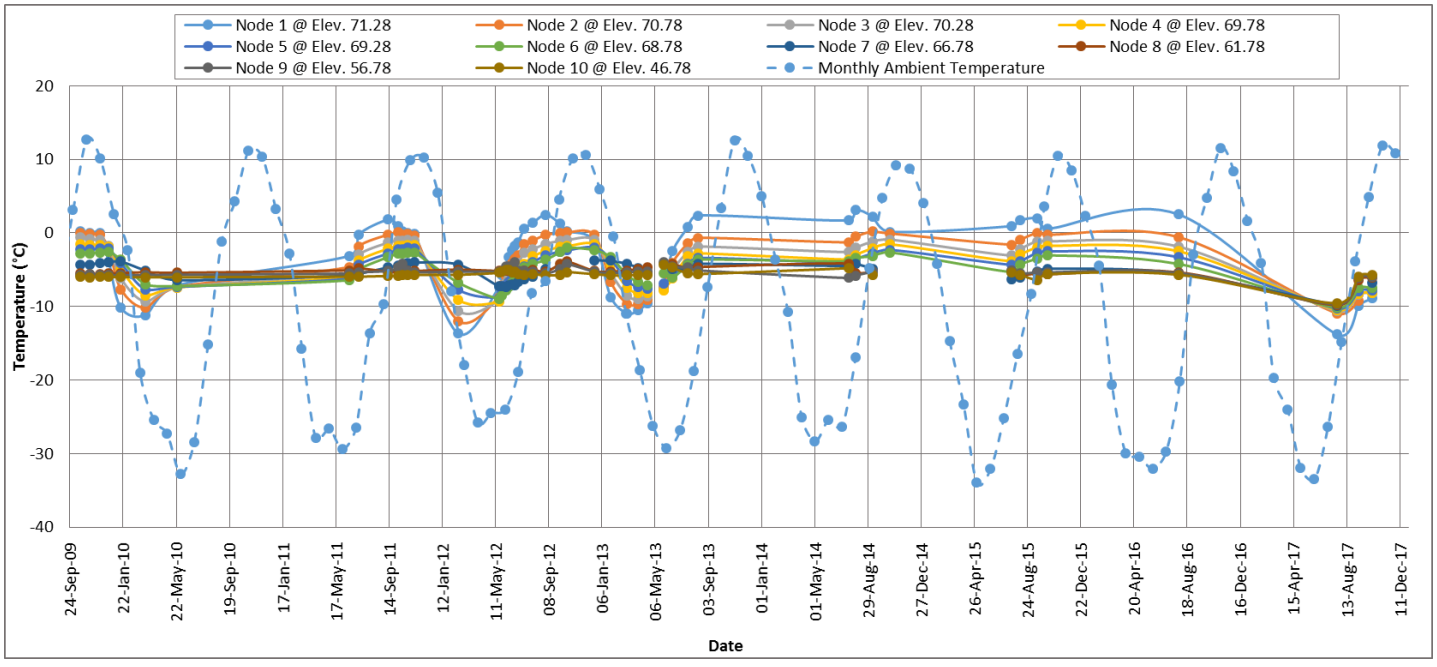
GT09-13


Temperature (°C)
-20
-15
-10
-5
0
5
10
15
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/14/2011
10/26/2011
11/10/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/4/2012
10/20/2012
12/20/2012
1/26/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014
7/16/2014
8/1/2014
9/8/2014
10/18/2014
7/18/2015
8/7/2015
9/14/2015
10/9/2015
7/28/2016
22/07/2017
8/9/2017
10/10/2017

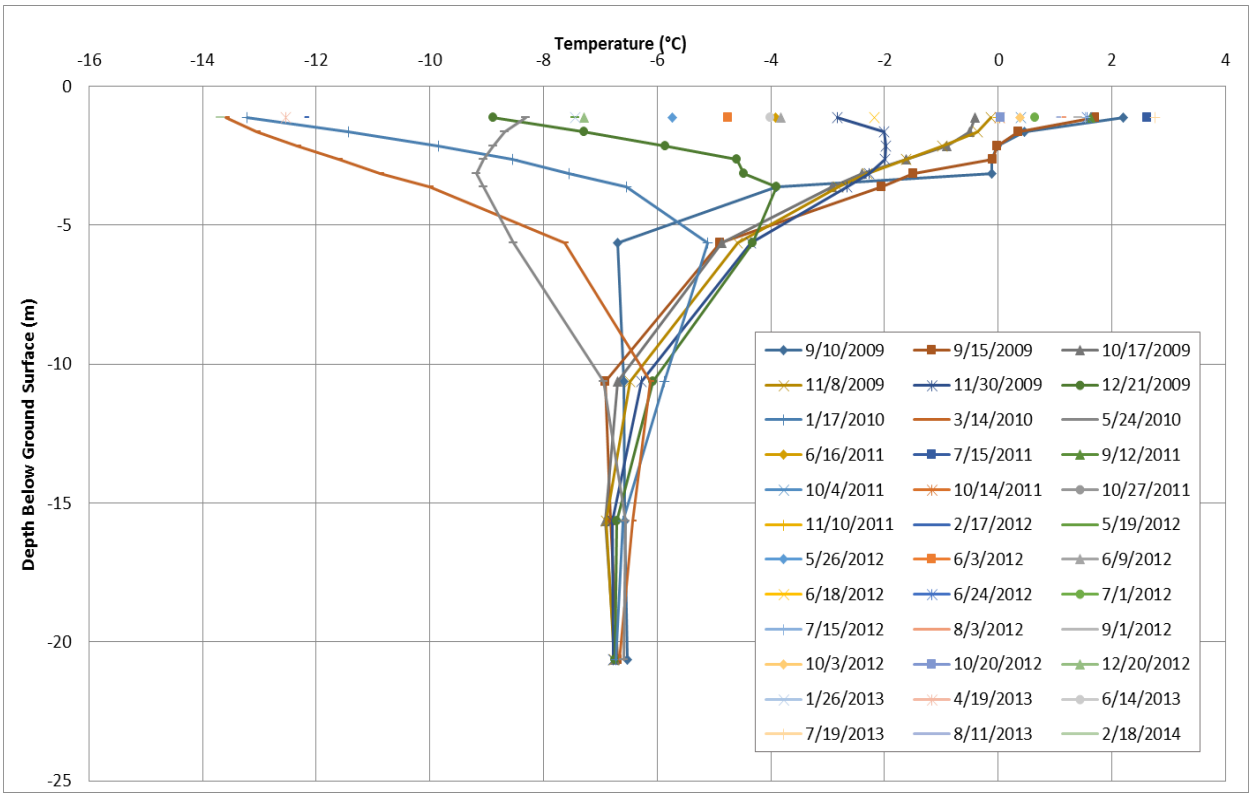

Node 1 @ Elev. 64.99
Node 2 @ Elev. 64.49
Node 3 @ Elev. 63.99
Node 4 @ Elev. 63.49
Node 5 @ Elev. 62.99
Node 6 @ Elev. 62.49
Node 7 @ Elev. 60.49
Node 8 @ Elev. 55.49
Node 9 @ Elev. 50.49
Node 10 @ Elev. 45.49
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

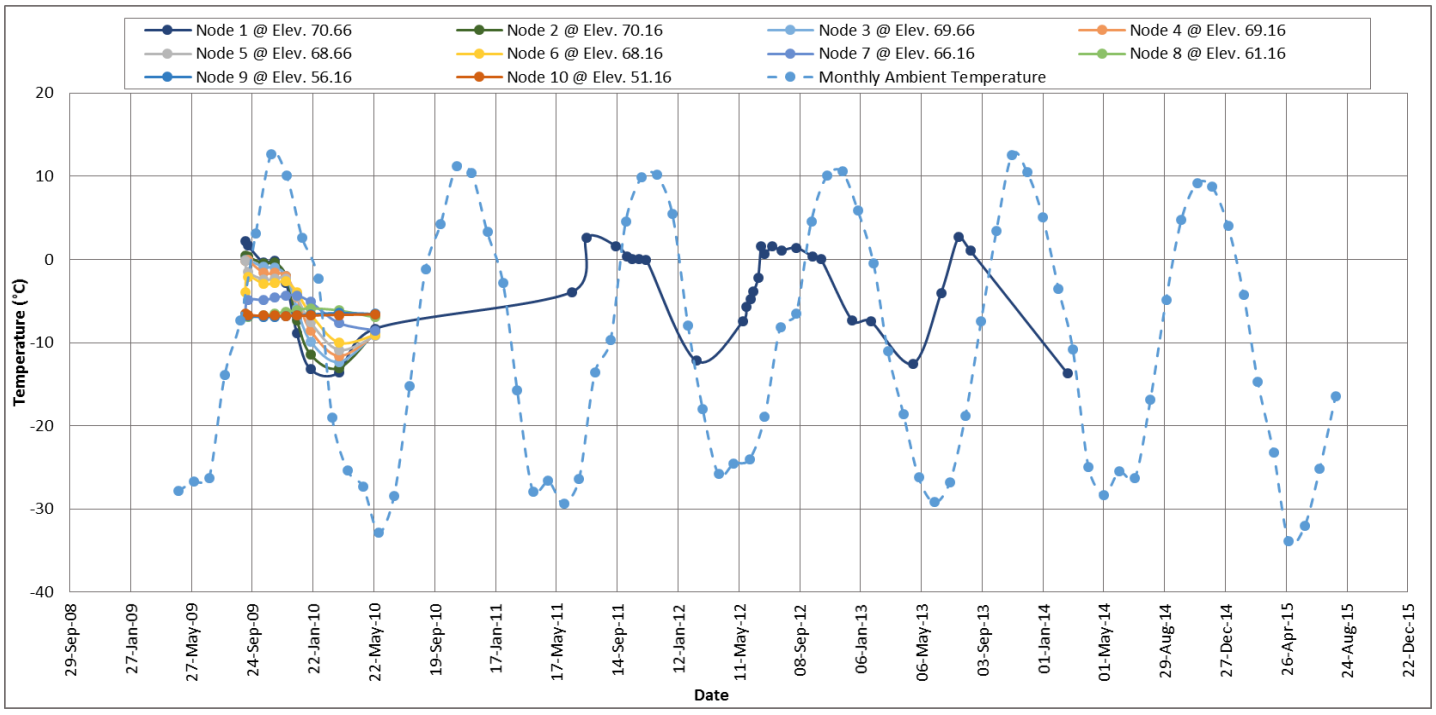
GT9-14


Temperature (°C)
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
0
-5
-10
-15
-20
-25
-30
Depth Below Ground Surface (m)
9/2/2009
9/5/2009
9/15/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/14/2011
10/26/2011
11/10/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/26/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
7/16/2014
8/1/2014
9/8/2014
10/18/2014
7/18/2015
8/7/2015
9/14/2015
10/9/2015
7/30/2016
22/07/2017
8/9/2017
10/10/2017

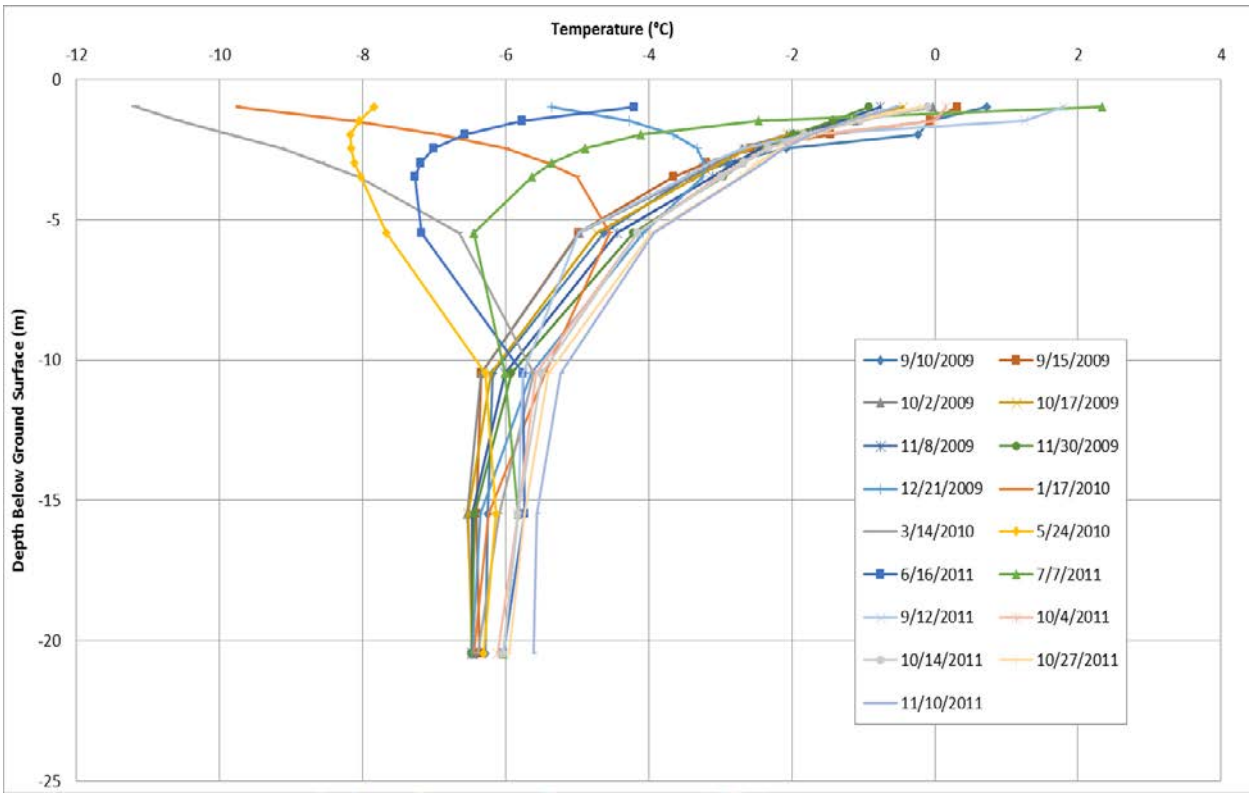

Node 1 @ Elev. 71.28
Node 2 @ Elev. 70.78
Node 3 @ Elev. 70.28
Node 4 @ Elev. 69.78
Node 5 @ Elev. 69.28
Node 6 @ Elev. 68.78
Node 7 @ Elev. 66.78
Node 8 @ Elev. 61.78
Node 9 @ Elev. 56.78
Node 10 @ Elev. 46.78
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
Date

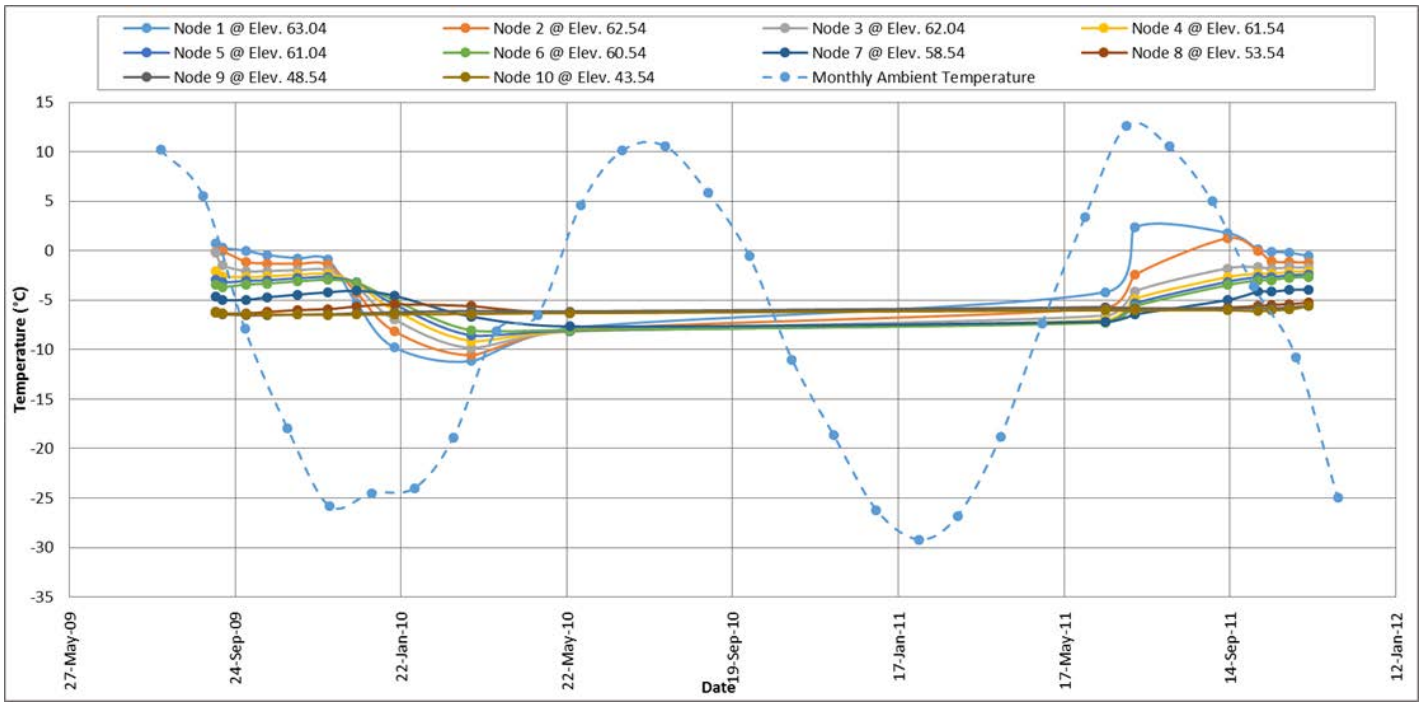
GT09-16


Temperature (°C)
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
9/10/2009
9/15/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/15/2011
9/12/2011
10/4/2011
10/14/2011
10/27/2011
11/10/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/26/2013
4/19/2013
6/14/2013
7/19/2013
8/11/2013
2/18/2014

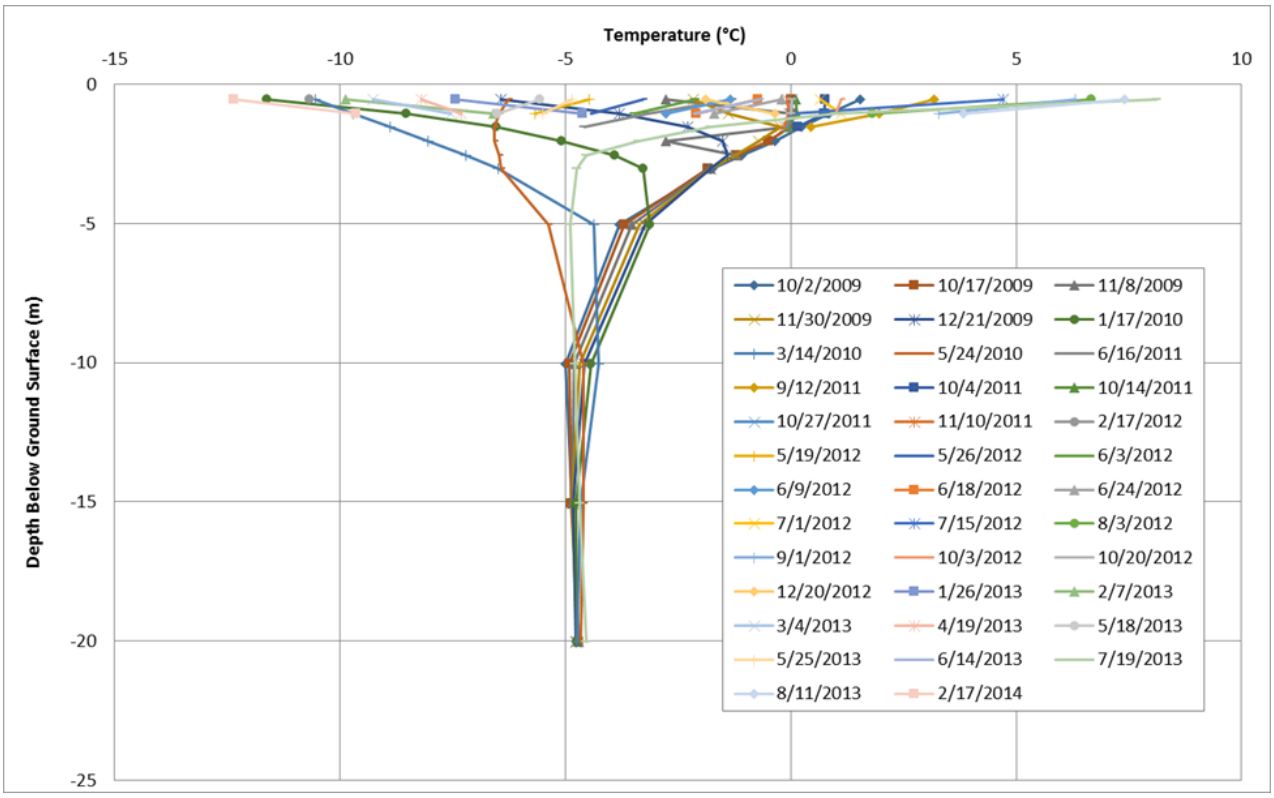

Node 1 @ Elev. 70.66
Node 2 @ Elev. 70.16
Node 3 @ Elev. 69.66
Node 4 @ Elev. 69.16
Node 5 @ Elev. 68.66
Node 6 @ Elev. 68.16
Node 7 @ Elev. 66.16
Node 8 @ Elev. 61.16
Node 9 @ Elev. 56.16
Node 10 @ Elev. 51.16
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
29-Sep-08
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
Date

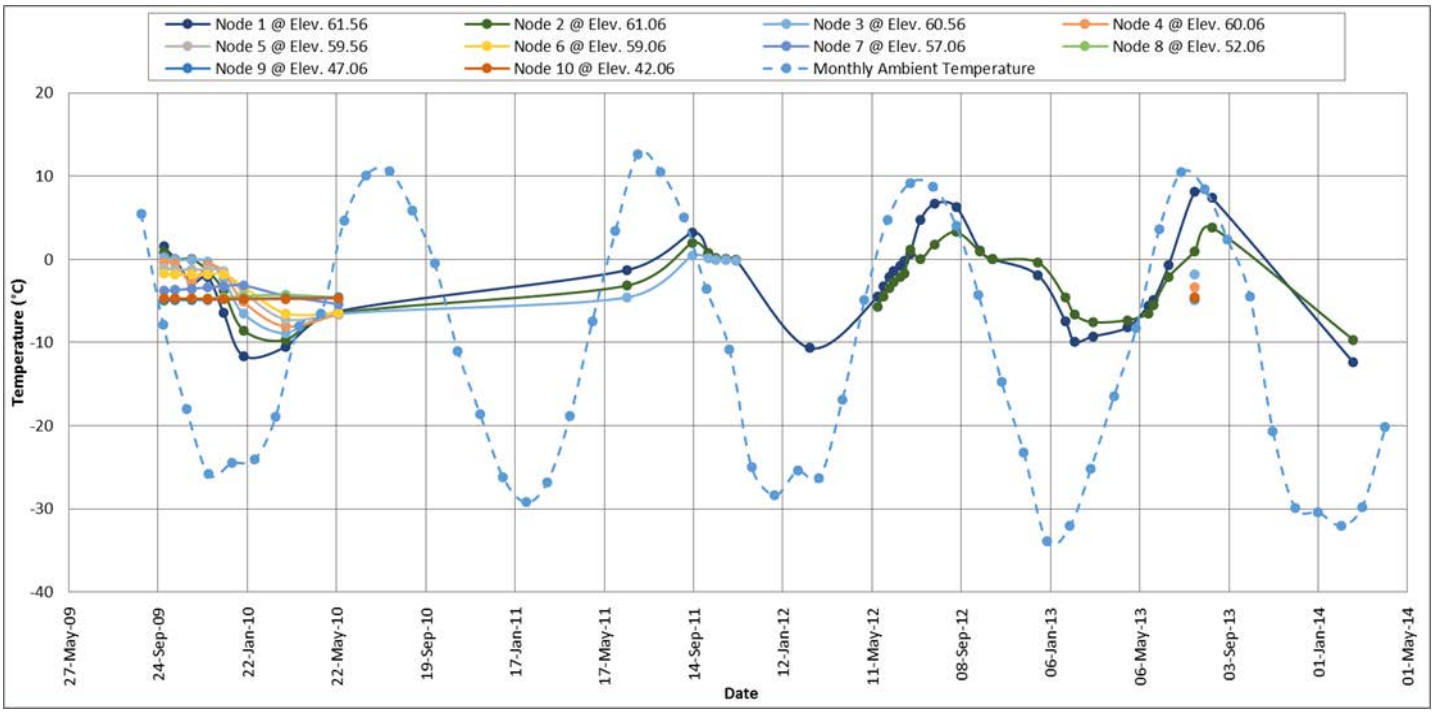
GT09-17


Temperature (°C)
-12
-10
-8
-6
-4
-2
0
2
4
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
9/10/2009
9/15/2009
10/2/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/14/2011
10/27/2011
11/10/2011

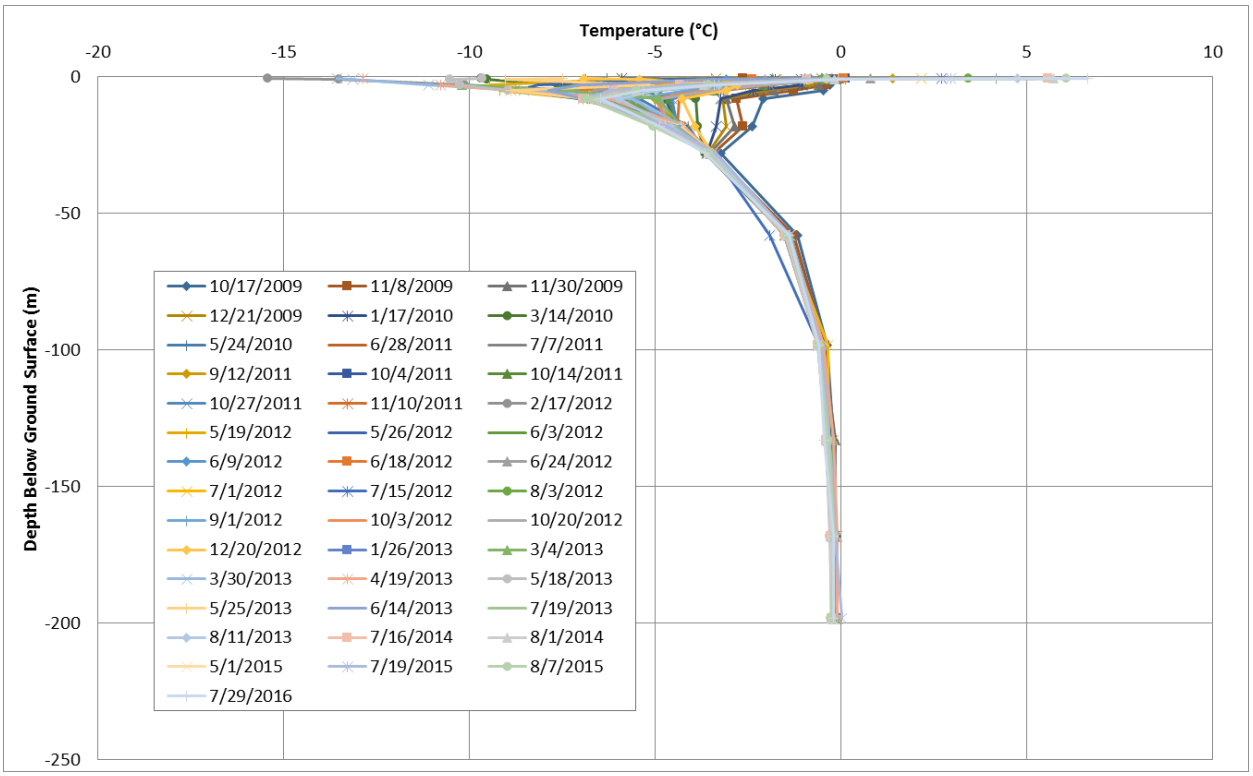

Node 1 @ Elev. 63.04
Node 2 @ Elev. 62.54
Node 3 @ Elev. 62.04
Node 4 @ Elev. 61.54
Node 5 @ Elev. 61.04
Node 6 @ Elev. 60.54
Node 7 @ Elev. 58.54
Node 8 @ Elev. 53.54
Node 9 @ Elev. 48.54
Node 10 @ Elev. 43.54
Monthly Ambient Temperature
15
10
5
0
-5
-10
-15
-20
-25
-30
-35
Temperature (°C)
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
Date

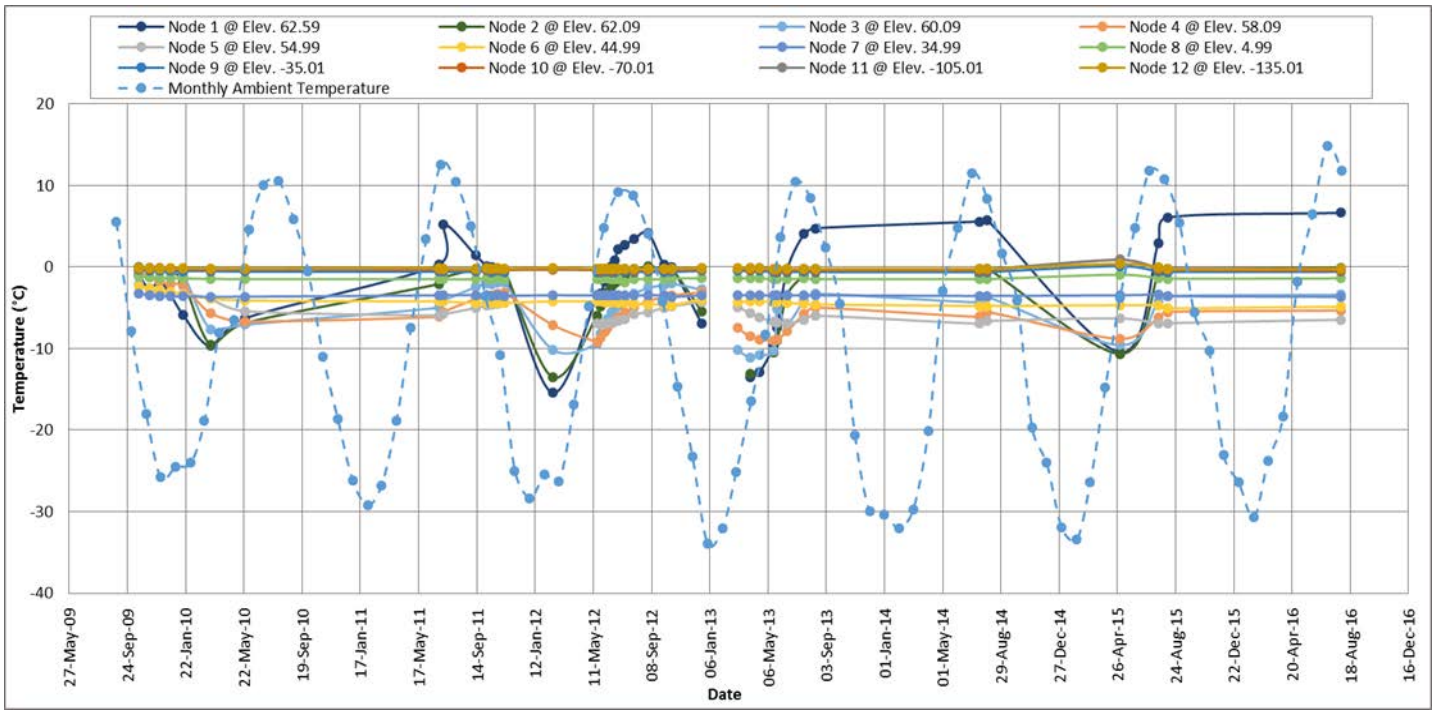
GT09-18


Temperature (°C)
-15
-10
-5
0
5
10
Depth Below Ground Surface (m)
0
-5
-10
-15
-20
-25
10/2/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
9/12/2011
10/4/2011
10/14/2011
10/27/2011
11/10/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/26/2013
2/7/2013
3/4/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014

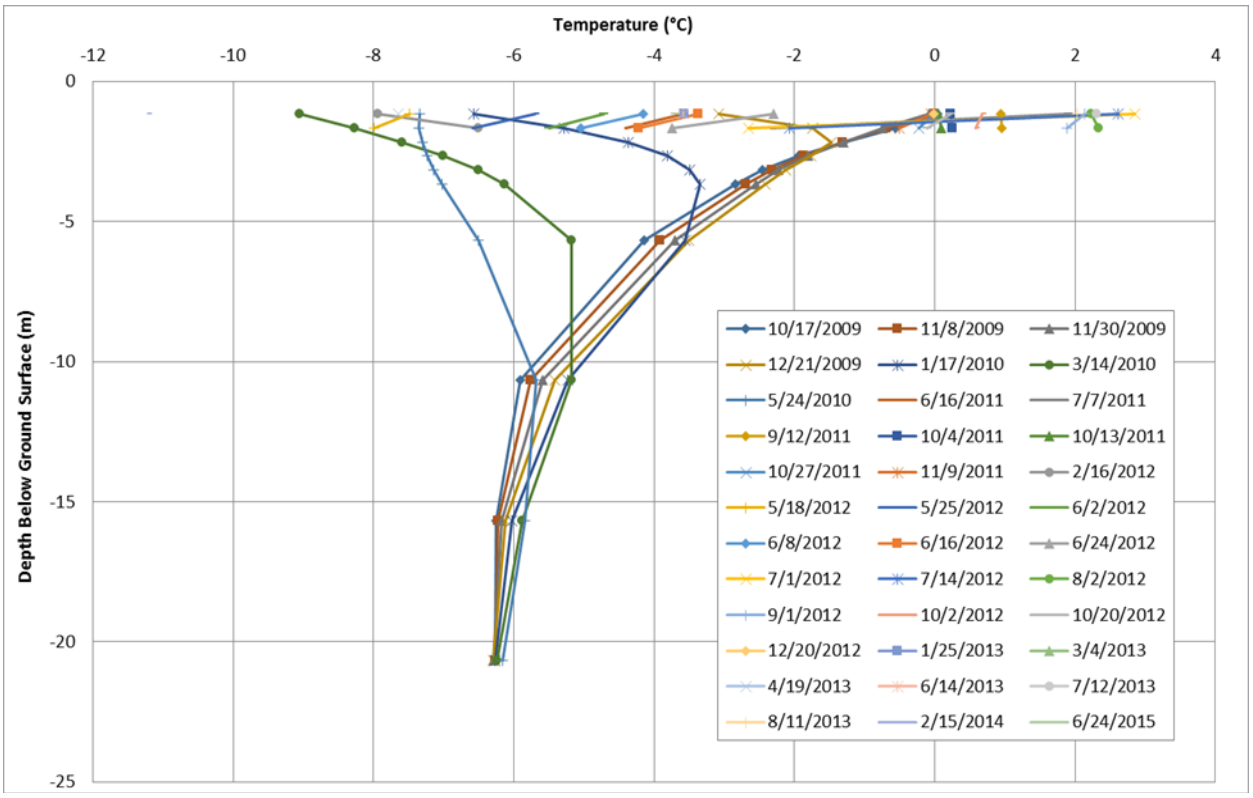

Node 1 @ Elev. 61.56
Node 2 @ Elev. 61.06
Node 3 @ Elev. 60.56
Node 4 @ Elev. 60.06
Node 5 @ Elev. 59.56
Node 6 @ Elev. 59.06
Node 7 @ Elev. 57.06
Node 8 @ Elev. 52.06
Node 9 @ Elev. 47.06
Node 10 @ Elev. 42.06
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
Date

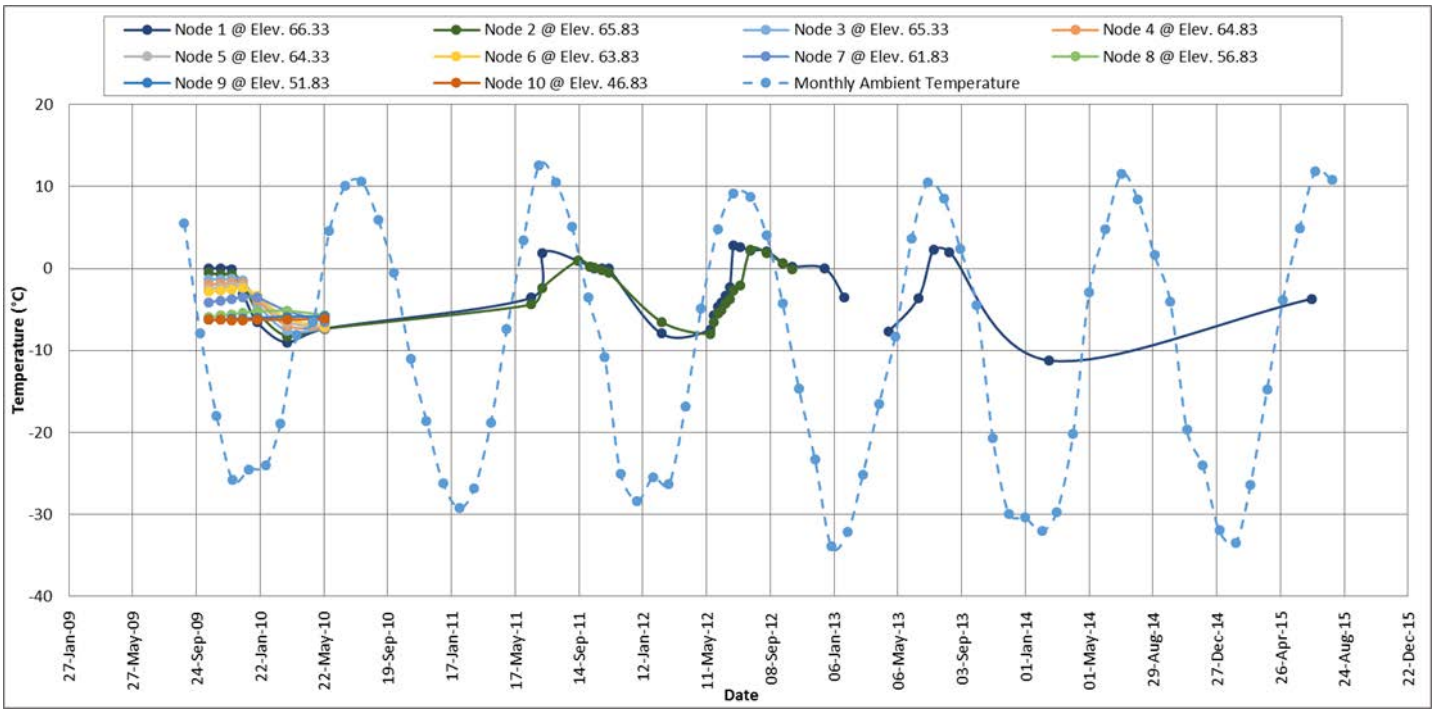
GT09-19


Temperature (°C)
-20
-15
-10
-5
0
5
10
0
-50
-100
-150
-200
-250
Depth Below Ground Surface (m)
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/28/2011
7/7/2011
9/12/2011
10/4/2011
10/14/2011
10/27/2011
11/10/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/26/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
7/16/2014
8/1/2014
5/1/2015
7/19/2015
8/7/2015
7/29/2016

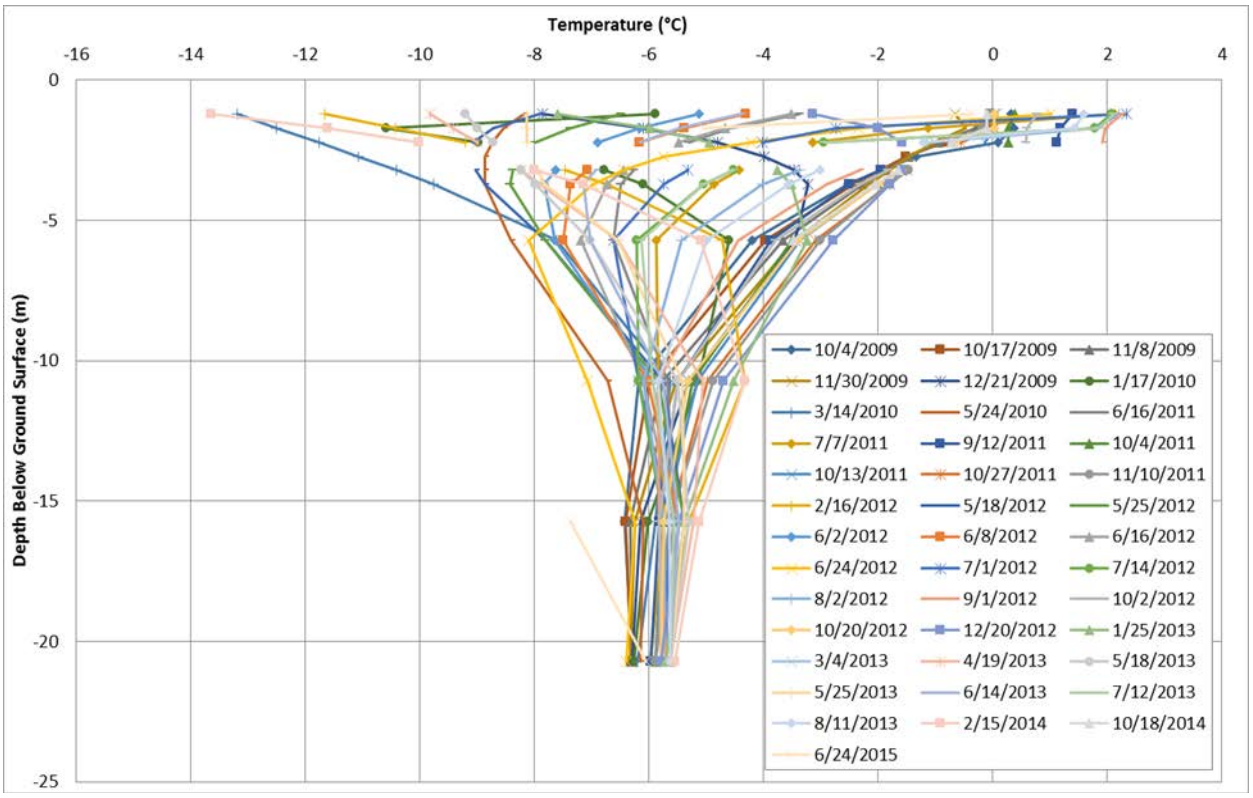

Node 1 @ Elev. 62.59
Node 2 @ Elev. 62.09
Node 3 @ Elev. 60.09
Node 4 @ Elev. 58.09
Node 5 @ Elev. 54.99
Node 6 @ Elev. 44.99
Node 7 @ Elev. 34.99
Node 8 @ Elev. 4.99
Node 9 @ Elev. -35.01
Node 10 @ Elev. -70.01
Node 11 @ Elev. -105.01
Node 12 @ Elev. -135.01
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

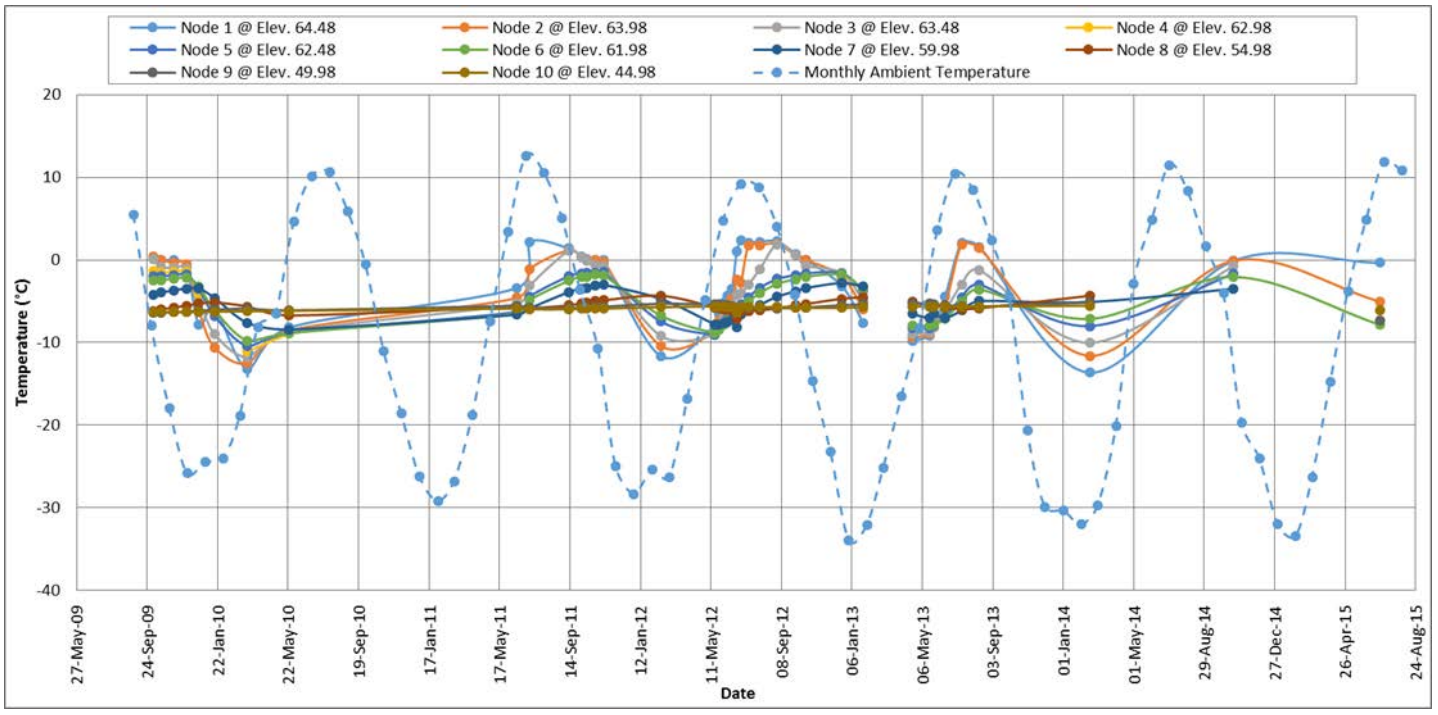
GT09-20


Temperature (°C)
-12
-10
-8
-6
-4
-2
0
2
4
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/13/2011
10/27/2011
11/9/2011
2/16/2012
5/18/2012
5/25/2012
6/2/2012
6/8/2012
6/16/2012
6/24/2012
7/1/2012
7/14/2012
8/2/2012
9/1/2012
10/2/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
4/19/2013
6/14/2013
7/12/2013
8/11/2013
2/15/2014
6/24/2015

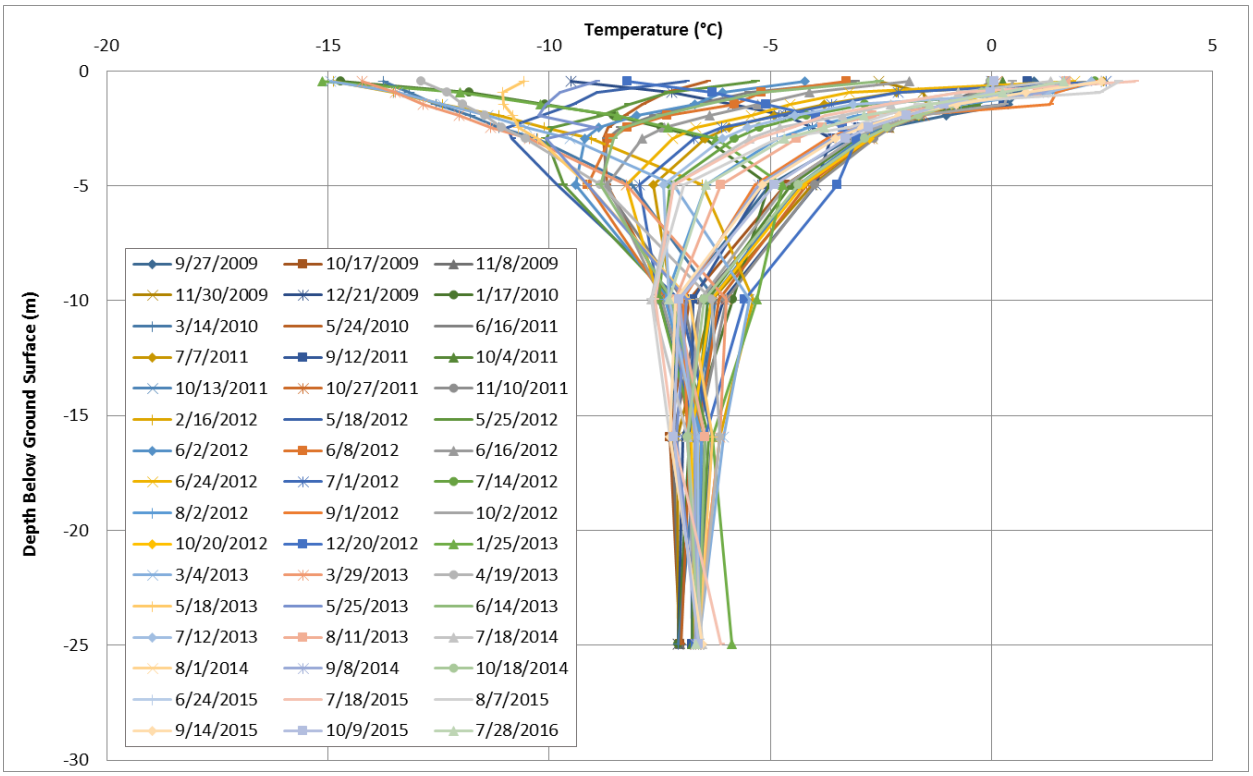

Node 1 @ Elev. 66.33
Node 2 @ Elev. 65.83
Node 3 @ Elev. 65.33
Node 4 @ Elev. 64.83
Node 5 @ Elev. 64.33
Node 6 @ Elev. 63.83
Node 7 @ Elev. 61.83
Node 8 @ Elev. 56.83
Node 9 @ Elev. 51.83
Node 10 @ Elev. 46.83
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-Jan-09
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
Date

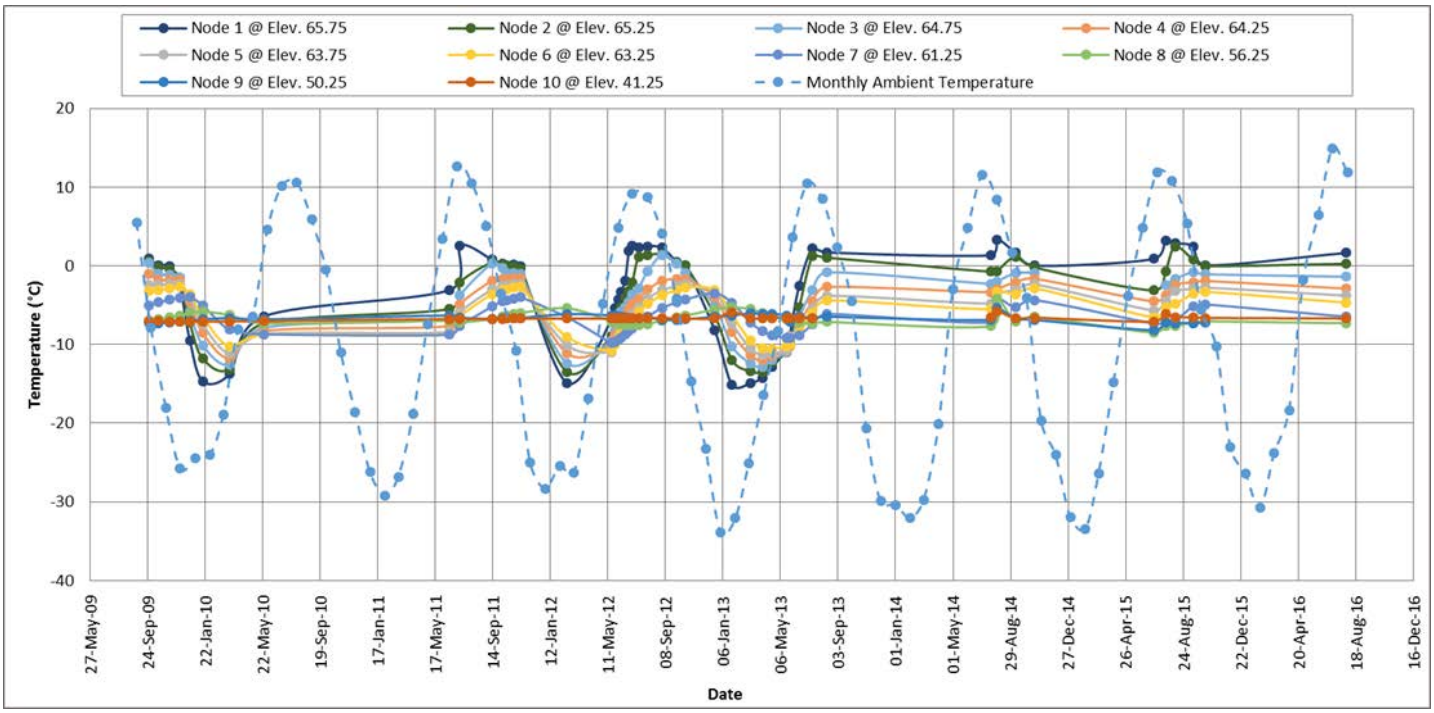
GT09-21


Temperature (°C)
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/4/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/13/2011
10/27/2011
11/10/2011
2/16/2012
5/18/2012
5/25/2012
6/2/2012
6/8/2012
6/16/2012
6/24/2012
7/1/2012
7/14/2012
8/2/2012
9/1/2012
10/2/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/12/2013
8/11/2013
2/15/2014
10/18/2014
6/24/2015

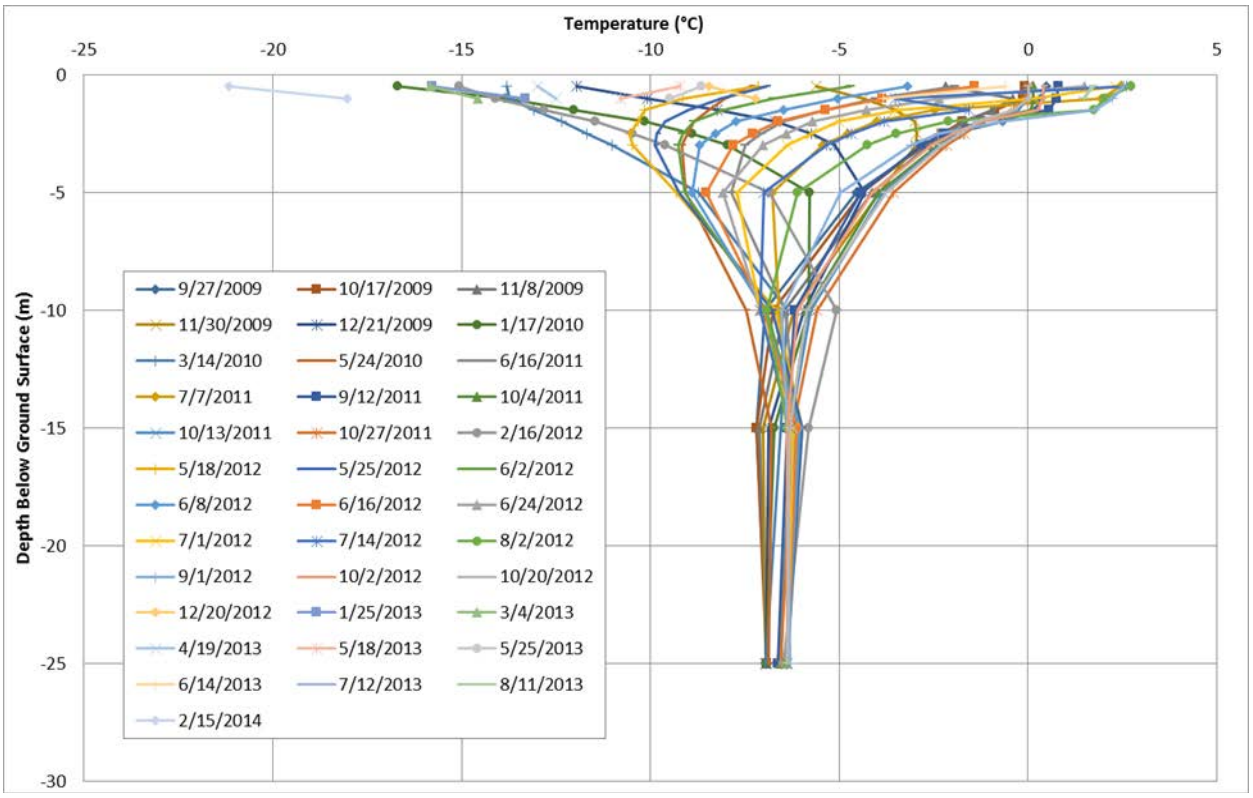

Node 1 @ Elev. 64.48
Node 2 @ Elev. 63.98
Node 3 @ Elev. 63.48
Node 4 @ Elev. 62.98
Node 5 @ Elev. 62.48
Node 6 @ Elev. 61.98
Node 7 @ Elev. 59.98
Node 8 @ Elev. 54.98
Node 9 @ Elev. 49.98
Node 10 @ Elev. 44.98
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
Date

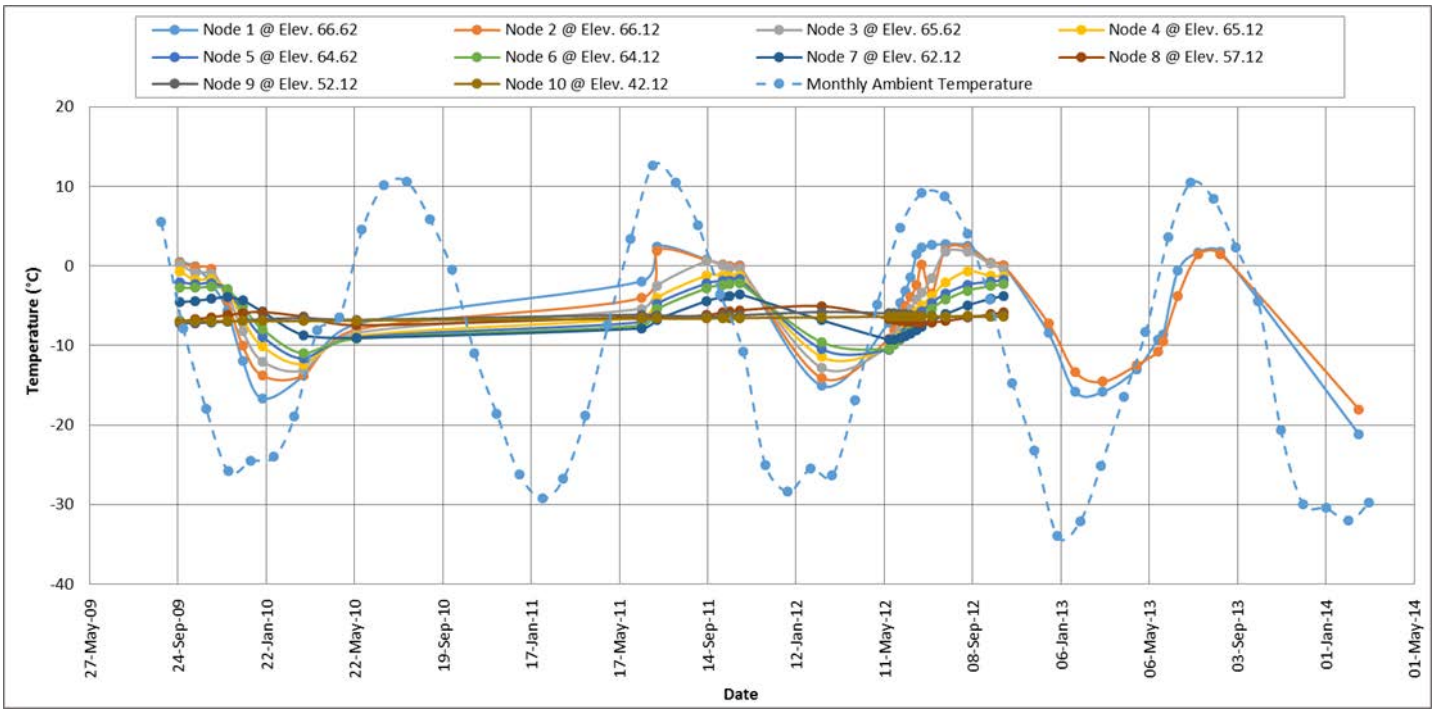
GT09-22


Temperature (°C)
-20
-15
-10
-5
0
5
Depth Below Ground Surface (m)
0
-5
-10
-15
-20
-25
-30
9/27/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/13/2011
10/27/2011
11/10/2011
2/16/2012
5/18/2012
5/25/2012
6/2/2012
6/8/2012
6/16/2012
6/24/2012
7/1/2012
7/14/2012
8/2/2012
9/1/2012
10/2/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
3/29/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/12/2013
8/11/2013
7/18/2014
8/1/2014
9/8/2014
10/18/2014
6/24/2015
7/18/2015
8/7/2015
9/14/2015
10/9/2015
7/28/2016

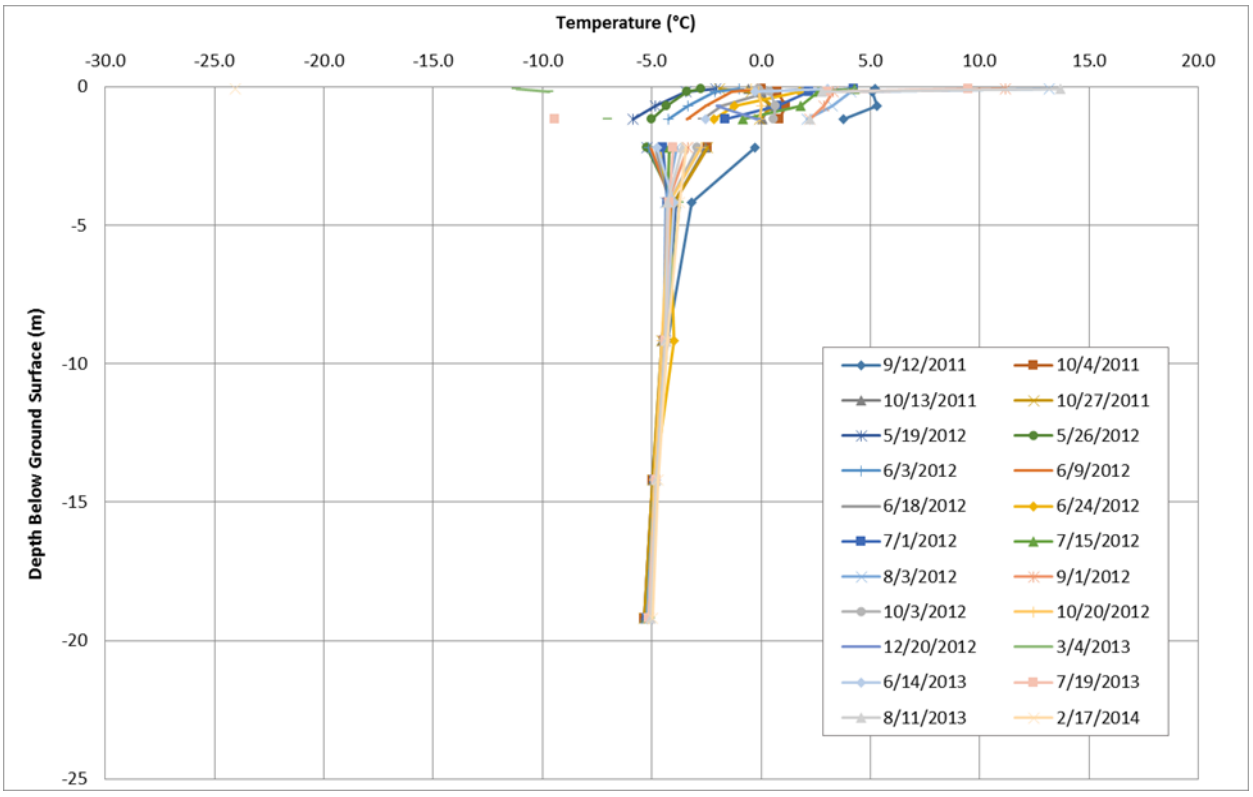

Node 1 @ Elev. 65.75
Node 2 @ Elev. 65.25
Node 3 @ Elev. 64.75
Node 4 @ Elev. 64.25
Node 5 @ Elev. 63.75
Node 6 @ Elev. 63.25
Node 7 @ Elev. 61.25
Node 8 @ Elev. 56.25
Node 9 @ Elev. 50.25
Node 10 @ Elev. 41.25
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

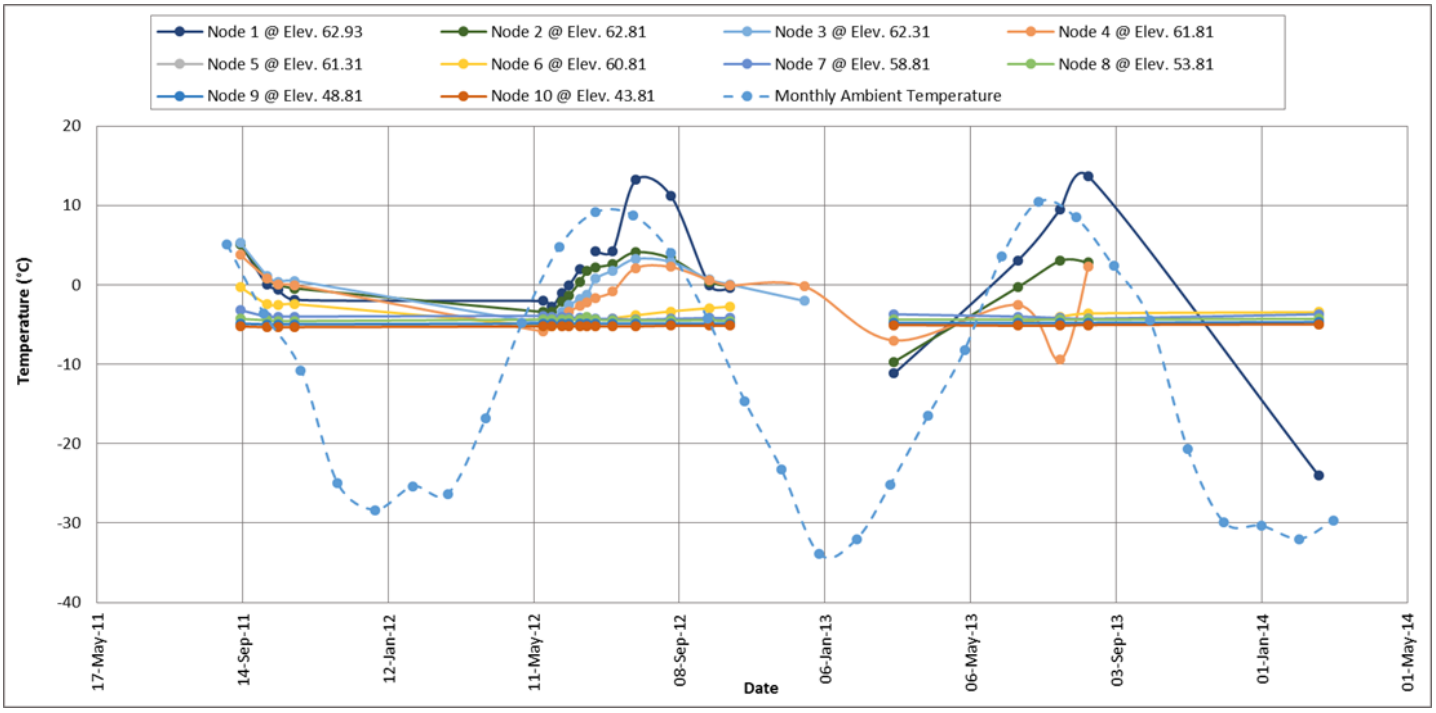
GT09-25


Temperature (°C)
-25
-20
-15
-10
-5
0
5
Depth Below Ground Surface (m)
0
-5
-10
-15
-20
-25
-30
9/27/2009
10/17/2009
11/8/2009
11/30/2009
12/21/2009
1/17/2010
3/14/2010
5/24/2010
6/16/2011
7/7/2011
9/12/2011
10/4/2011
10/13/2011
10/27/2011
2/16/2012
5/18/2012
5/25/2012
6/2/2012
6/8/2012
6/16/2012
6/24/2012
7/1/2012
7/14/2012
8/2/2012
9/1/2012
10/2/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/12/2013
8/11/2013
2/15/2014

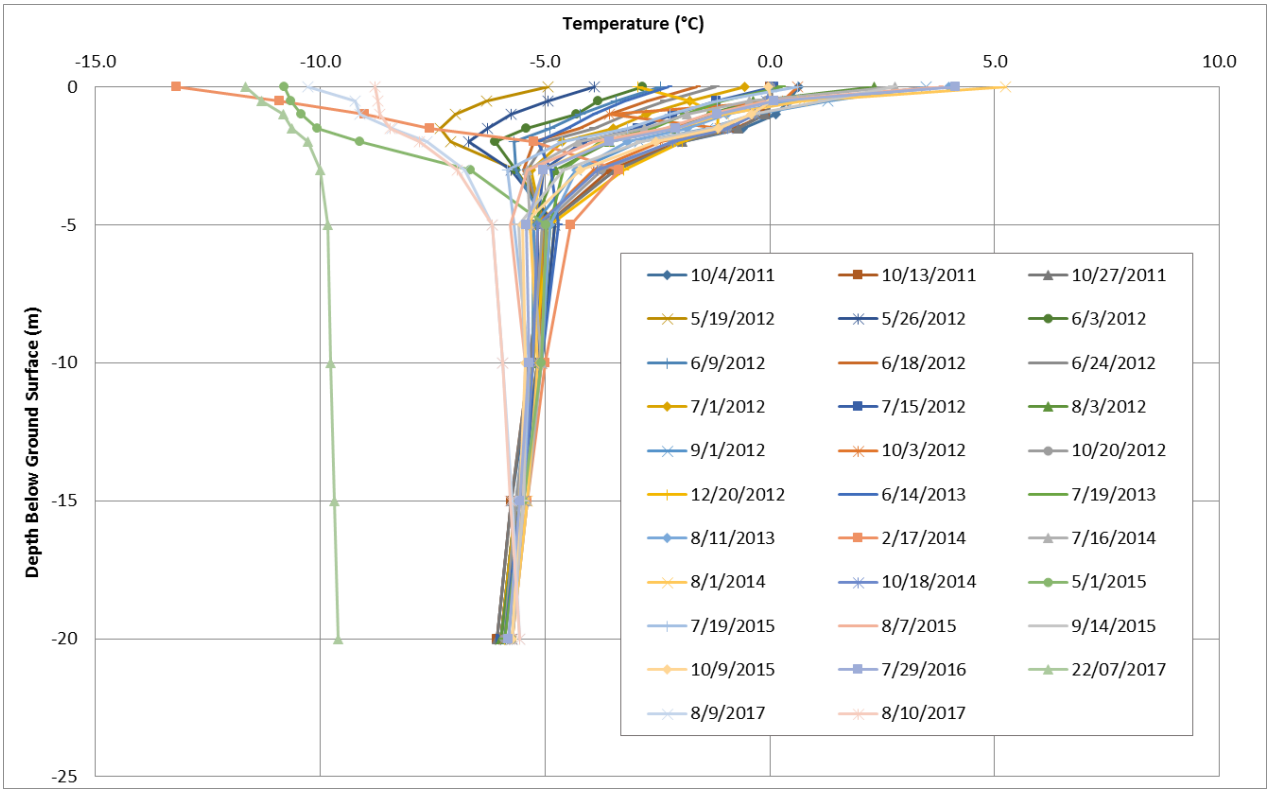

Node 1 @ Elev. 66.62
Node 2 @ Elev. 66.12
Node 3 @ Elev. 65.62
Node 4 @ Elev. 65.12
Node 5 @ Elev. 64.62
Node 6 @ Elev. 64.12
Node 7 @ Elev. 62.12
Node 8 @ Elev. 57.12
Node 9 @ Elev. 52.12
Node 10 @ Elev. 42.12
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
27-May-09
24-Sep-09
22-Jan-10
22-May-10
19-Sep-10
17-Jan-11
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
Date

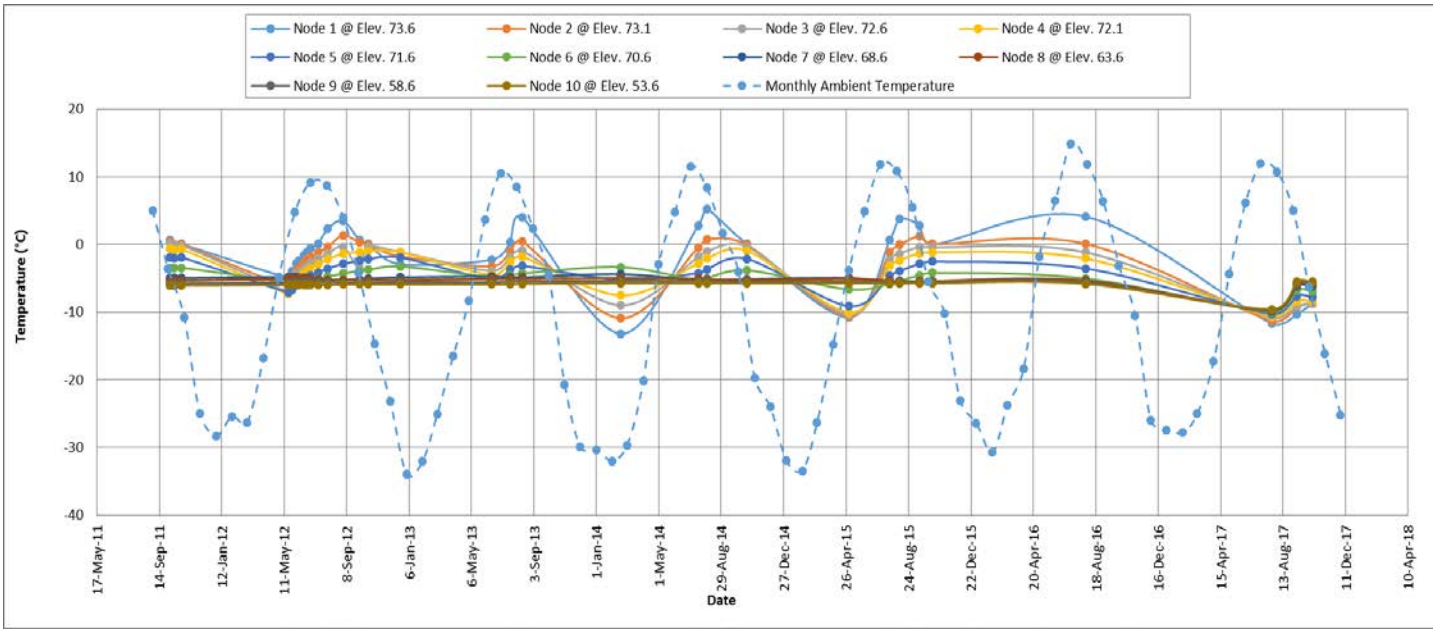
GT11-01


Temperature (°C)
-30.0
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
9/12/2011
10/4/2011
10/13/2011
10/27/2011
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
3/4/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014

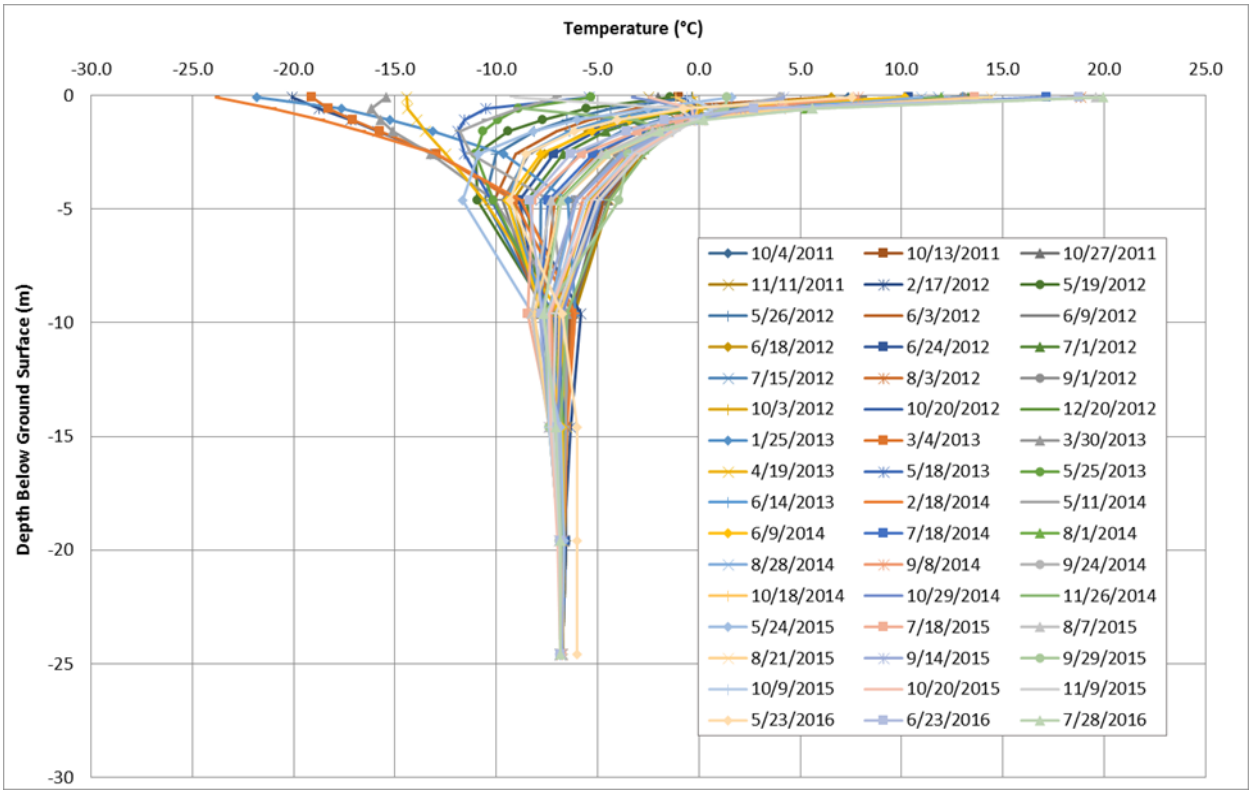

Node 1 @ Elev. 62.93
Node 2 @ Elev. 62.81
Node 3 @ Elev. 62.31
Node 4 @ Elev. 61.81
Node 5 @ Elev. 61.31
Node 6 @ Elev. 60.81
Node 7 @ Elev. 58.81
Node 8 @ Elev. 53.81
Node 9 @ Elev. 48.81
Node 10 @ Elev. 43.81
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
Date

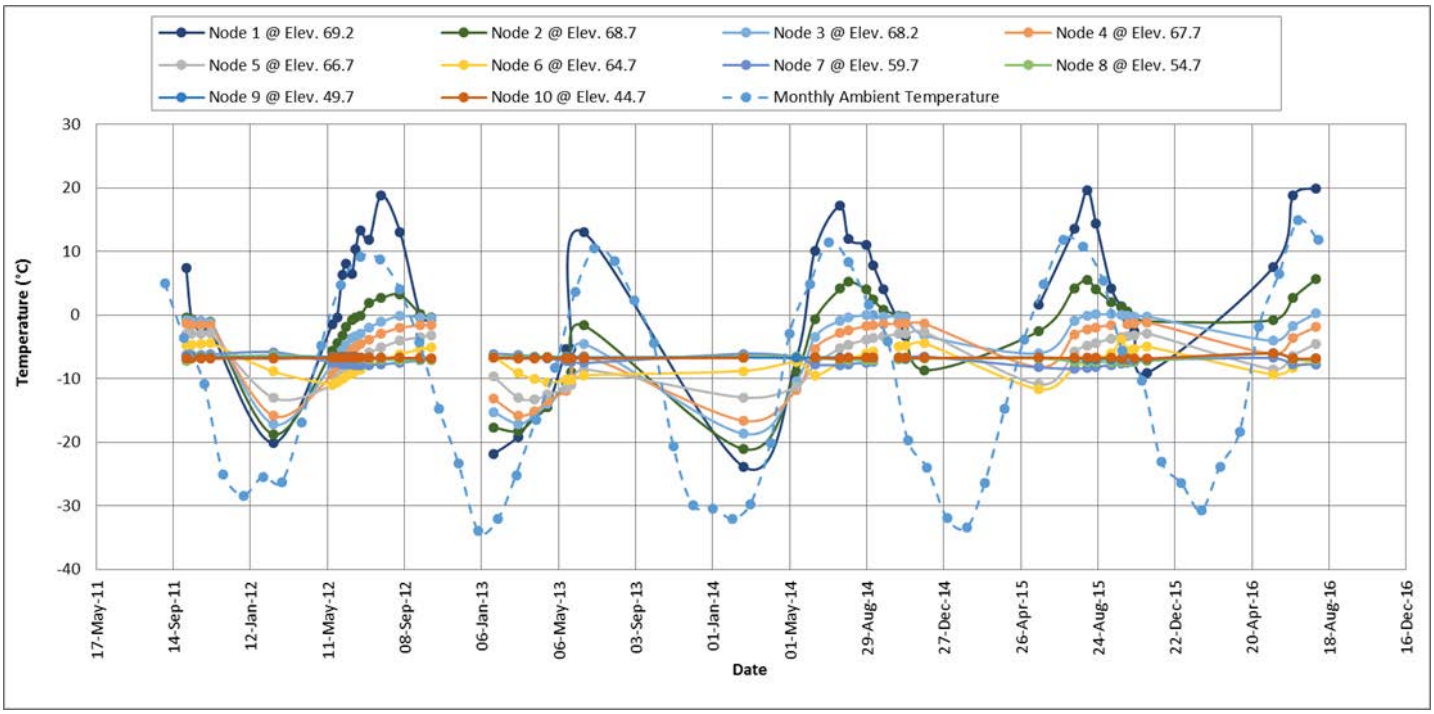
GT11-02


Temperature (°C)
-15.0
-10.0
-5.0
0.0
5.0
10.0
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/4/2011
10/13/2011
10/27/2011
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
6/14/2013
7/19/2013
8/11/2013
2/17/2014
7/16/2014
8/1/2014
10/18/2014
5/1/2015
7/19/2015
8/7/2015
9/14/2015
10/9/2015
7/29/2016
22/07/2017
8/9/2017
8/10/2017

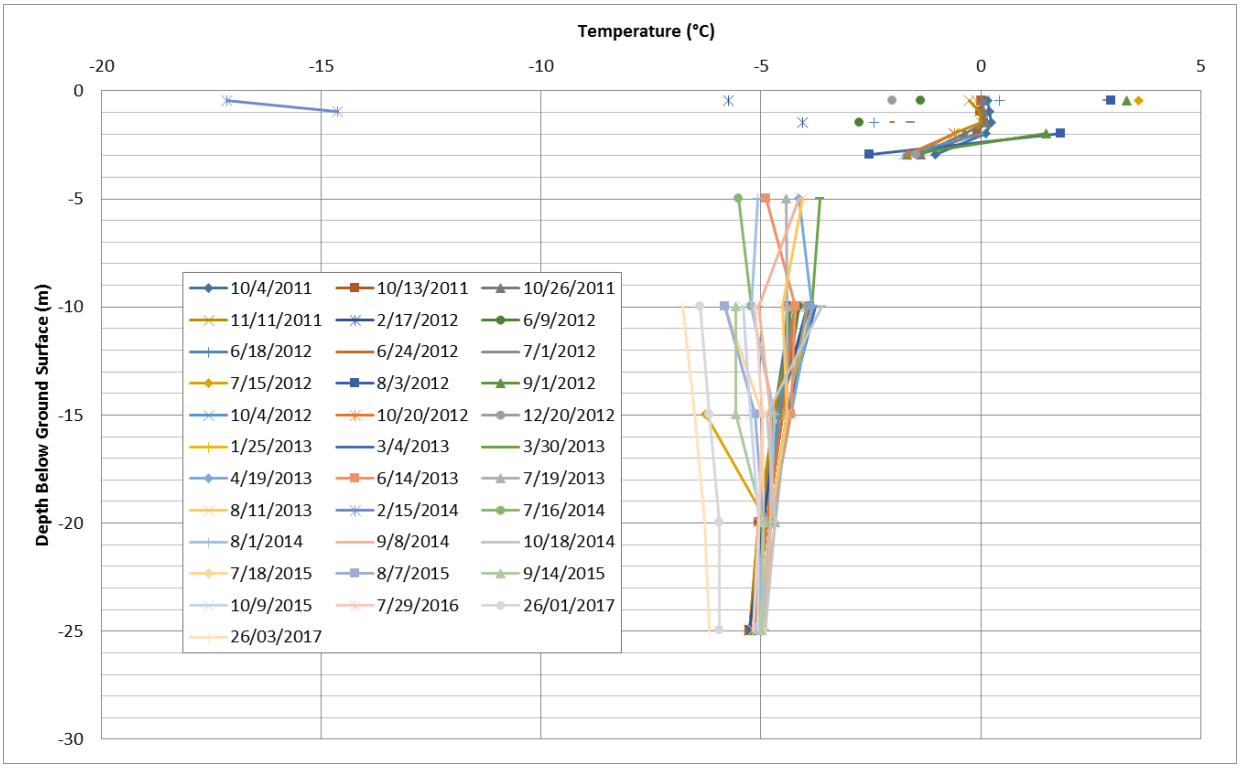

Node 1 @ Elev. 73.6
Node 2 @ Elev. 73.1
Node 3 @ Elev. 72.6
Node 4 @ Elev. 72.1
Node 5 @ Elev. 71.6
Node 6 @ Elev. 70.6
Node 7 @ Elev. 68.6
Node 8 @ Elev. 63.6
Node 9 @ Elev. 58.6
Node 10 @ Elev. 53.6
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

GT11-05


Temperature (°C)
-30.0
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
25.0
0
-5
-10
-15
-20
-25
-30
Depth Below Ground Surface (m)
10/4/2011
10/13/2011
10/27/2011
11/11/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
2/18/2014
5/11/2014
6/9/2014
7/18/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/24/2015
7/18/2015
8/7/2015
8/21/2015
9/14/2015
9/29/2015
10/9/2015
10/20/2015
11/9/2015
5/23/2016
6/23/2016
7/28/2016


Node 1 @ Elev. 69.2
Node 2 @ Elev. 68.7
Node 3 @ Elev. 68.2
Node 4 @ Elev. 67.7
Node 5 @ Elev. 66.7
Node 6 @ Elev. 64.7
Node 7 @ Elev. 59.7
Node 8 @ Elev. 54.7
Node 9 @ Elev. 49.7
Node 10 @ Elev. 44.7
Monthly Ambient Temperature
30
20
10
0
-10
-20
-30
-40
Temperature (°C)
17-May-11
14-Sep-11
12-Jan-12
11-May-12
08-Sep-12
06-Jan-13
06-May-13
03-Sep-13
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

GT11-07


Temperature (°C)
-20
-15
-10
-5
0
5
0
-5
-10
-15
-20
-25
-30
Depth Below Ground Surface (m)
10/4/2011
10/13/2011
10/26/2011
11/11/2011
2/17/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/4/2012
10/20/2012
12/20/2012
1/25/2013
3/4/2013
3/30/2013
4/19/2013
6/14/2013
7/19/2013
8/11/2013
2/15/2014
7/16/2014
8/1/2014
9/8/2014
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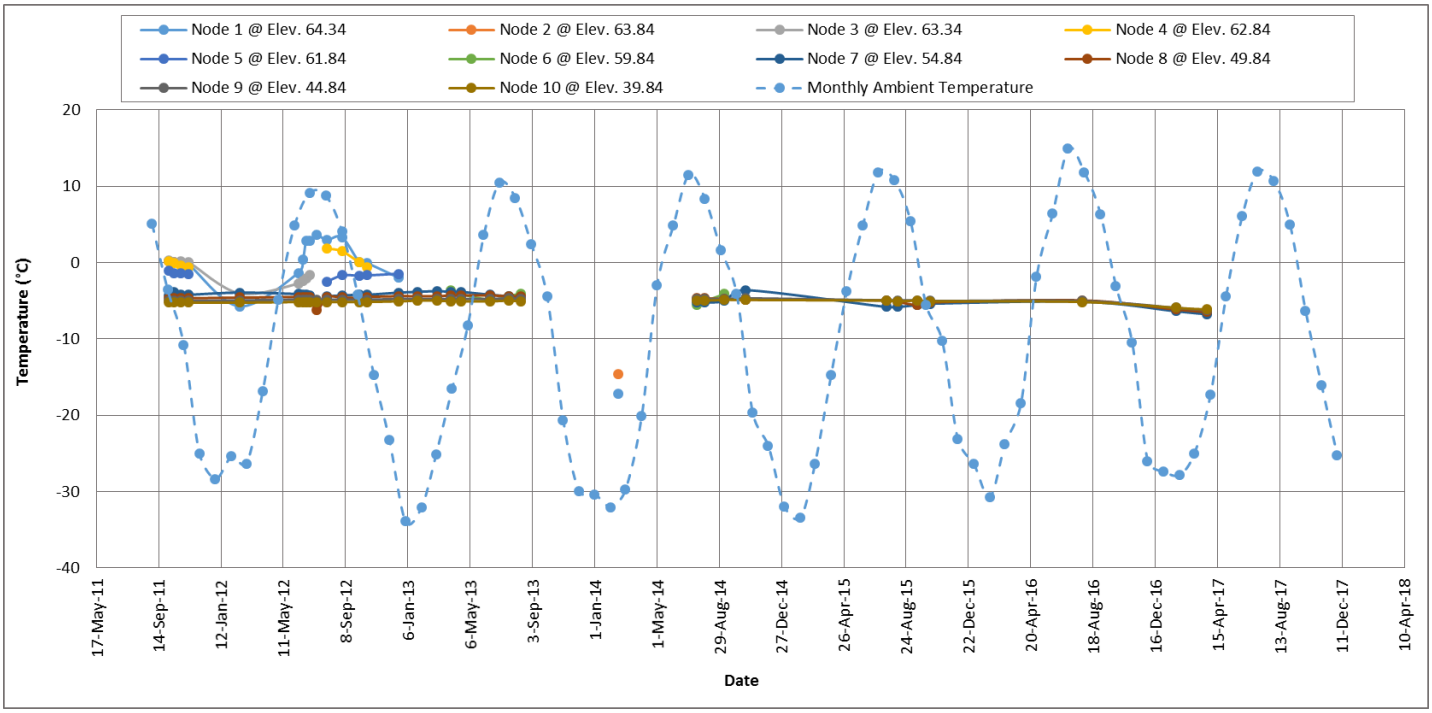
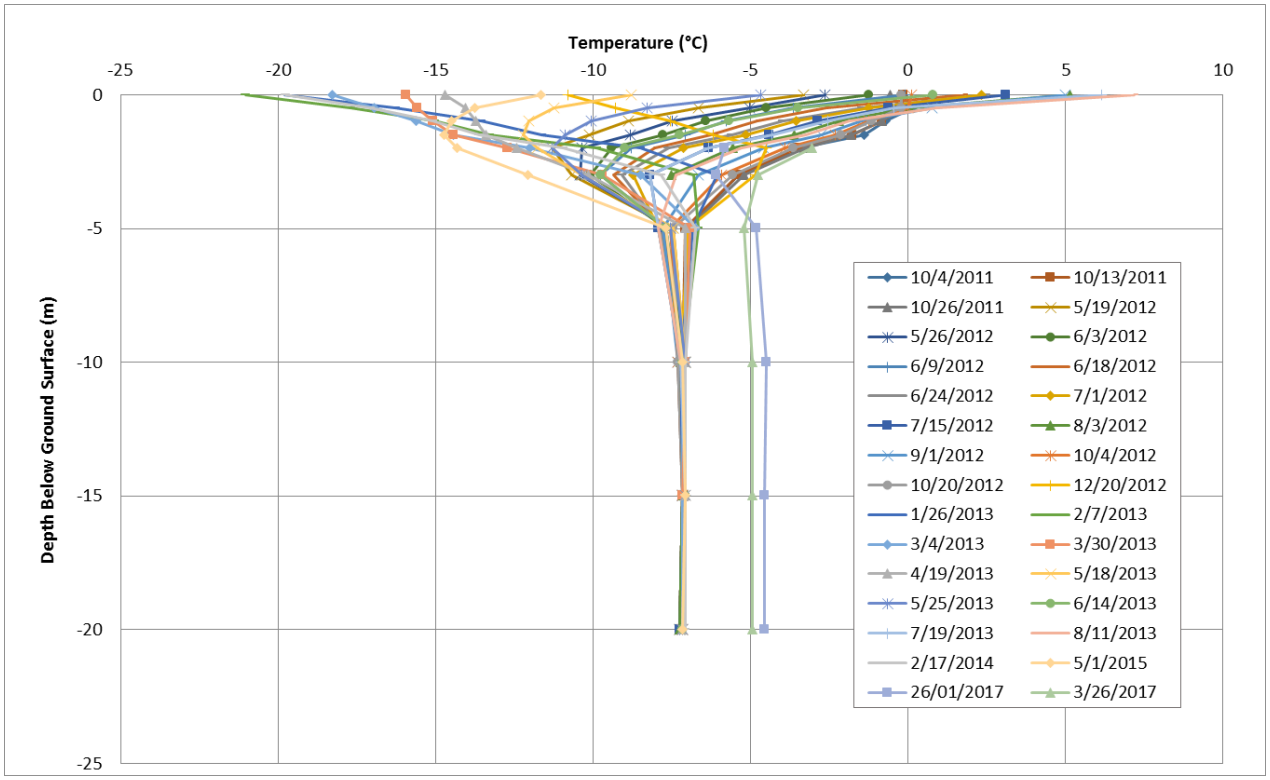
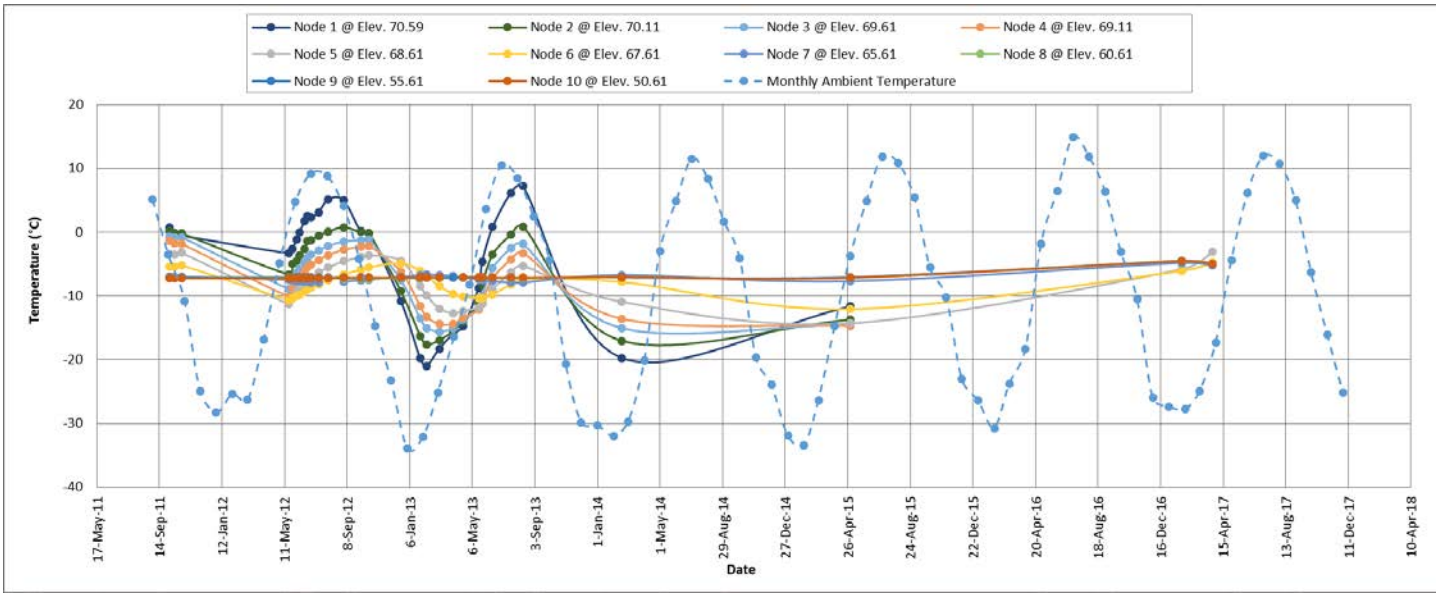
26/01/2017
26/03/2017

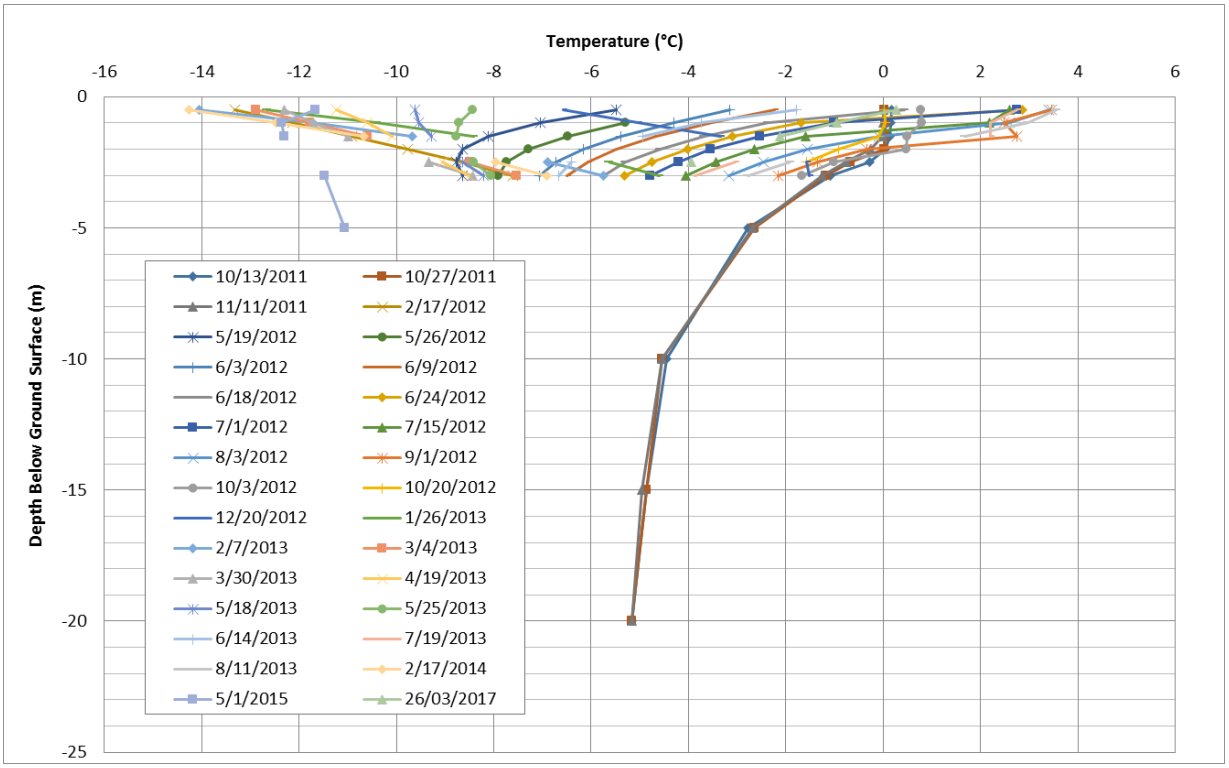

Node 1 @ Elev. 64.34
Node 2 @ Elev. 63.84
Node 3 @ Elev. 63.34
Node 4 @ Elev. 62.84
Node 5 @ Elev. 61.84
Node 6 @ Elev. 59.84
Node 7 @ Elev. 54.84
Node 8 @ Elev. 49.84
Node 9 @ Elev. 44.84
Node 10 @ Elev. 39.84
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

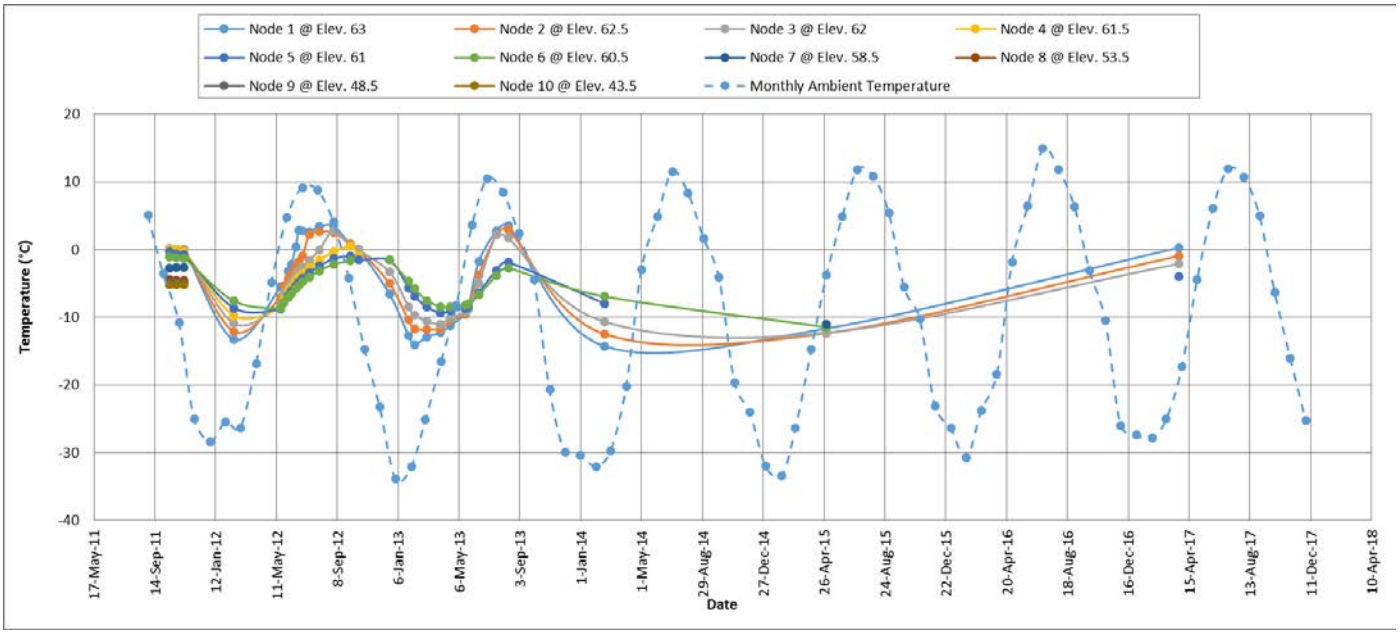
GT11-08


Temperature (°C)
-25
-20
-15
-10
-5
0
5
10
Depth Below Ground Surface (m)
0
-5
-10
-15
-20
-25
10/4/2011
10/13/2011
10/26/2011
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/4/2012
10/20/2012
12/20/2012
1/26/2013
2/7/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014
5/1/2015
26/01/2017
3/26/2017

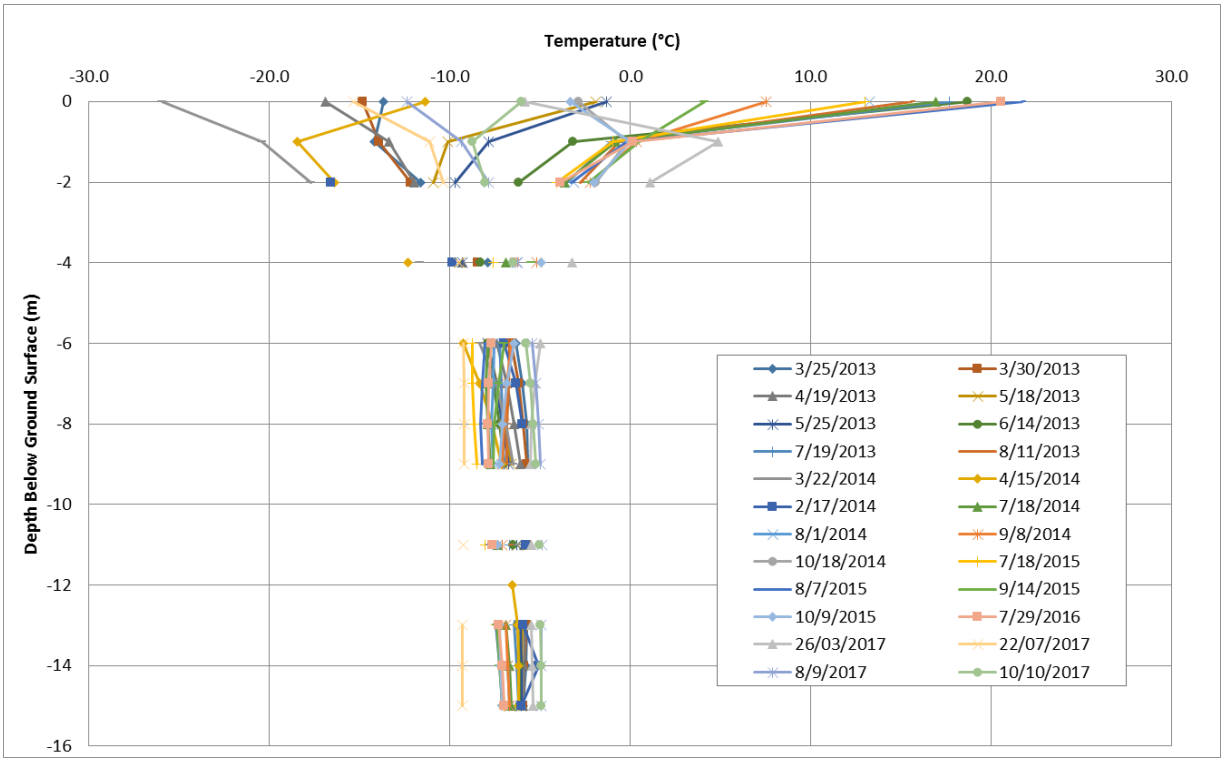

Node 1 @ Elev. 70.59
Node 2 @ Elev. 70.11
Node 3 @ Elev. 69.61
Node 4 @ Elev. 69.11
Node 5 @ Elev. 68.61
Node 6 @ Elev. 67.61
Node 7 @ Elev. 65.61
Node 8 @ Elev. 60.61
Node 9 @ Elev. 55.61
Node 10 @ Elev. 50.61
Monthly Ambient Temperature
Temperature (°C)
20
10
0
-10
-20
-30
-40
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

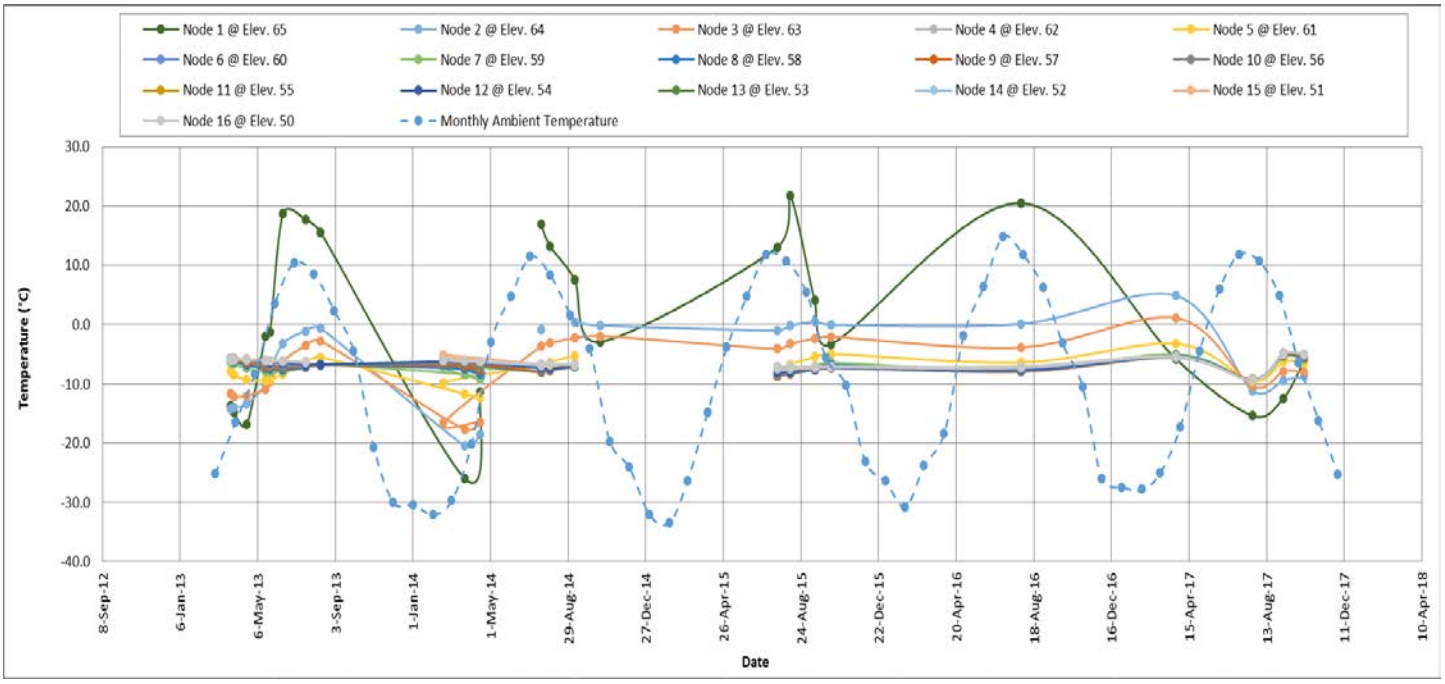
GT11-12


Temperature (°C)
-16
-14
-12
-10
-8
-6
-4
-2
0
2
4
6
0
-5
-10
-15
-20
-25
Depth Below Ground Surface (m)
10/13/2011
10/27/2011
11/11/2011
2/17/2012
5/19/2012
5/26/2012
6/3/2012
6/9/2012
6/18/2012
6/24/2012
7/1/2012
7/15/2012
8/3/2012
9/1/2012
10/3/2012
10/20/2012
12/20/2012
1/26/2013
2/7/2013
3/4/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014
5/1/2015
26/03/2017

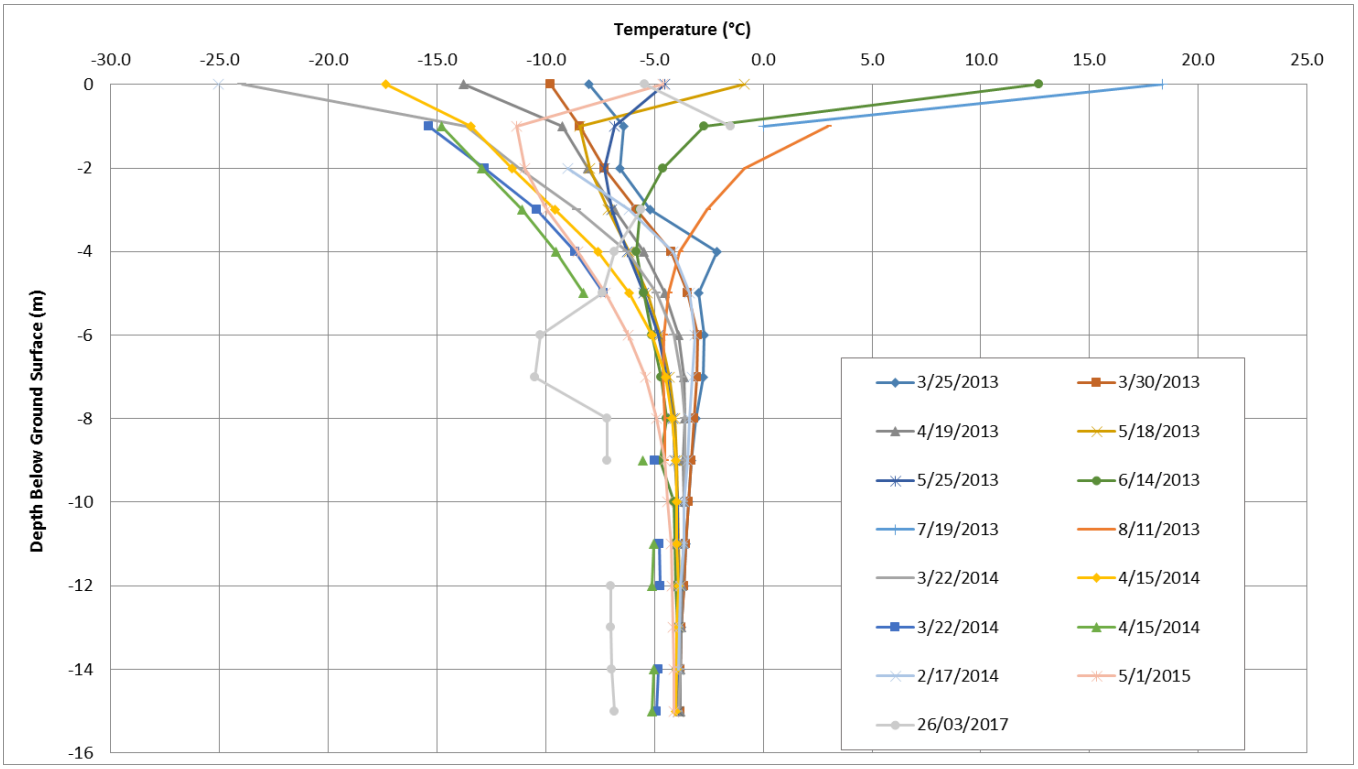

Node 1 @ Elev. 63
Node 2 @ Elev. 62.5
Node 3 @ Elev. 62
Node 4 @ Elev. 61.5
Node 5 @ Elev. 61
Node 6 @ Elev. 60.5
Node 7 @ Elev. 58.5
Node 8 @ Elev. 53.5
Node 9 @ Elev. 48.5
Node 10 @ Elev. 43.5
Monthly Ambient Temperature
20
10
0
-10
-20
-30
-40
Temperature (°C)
17-May-11
14-Sep-11
12-Jan-12
11-May-12
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

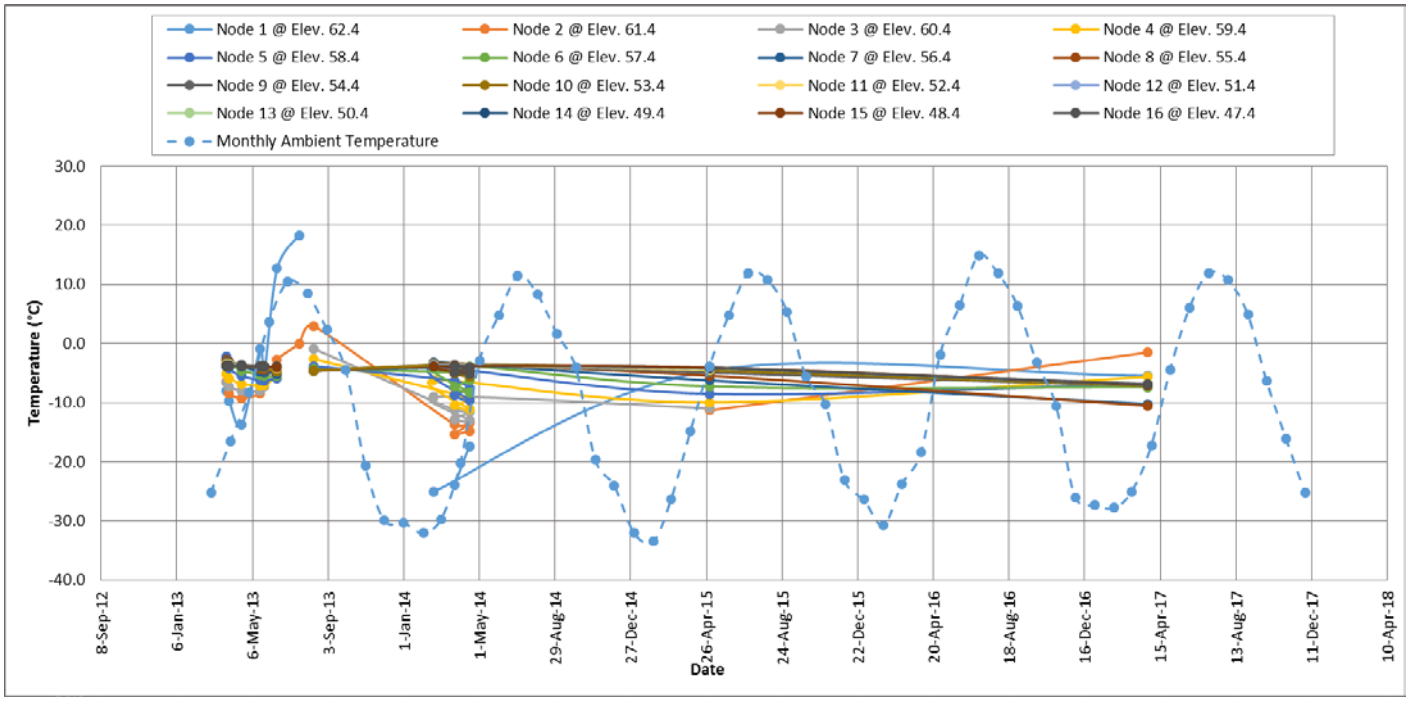
GT13-01


Temperature (°C)
-30.0
-20.0
-10.0
0.0
10.0
20.0
30.0
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth Below Ground Surface (m)
3/25/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
3/22/2014
4/15/2014
2/17/2014
7/18/2014
8/1/2014
9/8/2014
10/18/2014
7/18/2015
8/7/2015
9/14/2015
10/9/2015
7/29/2016
26/03/2017
22/07/2017
8/9/2017
10/10/2017

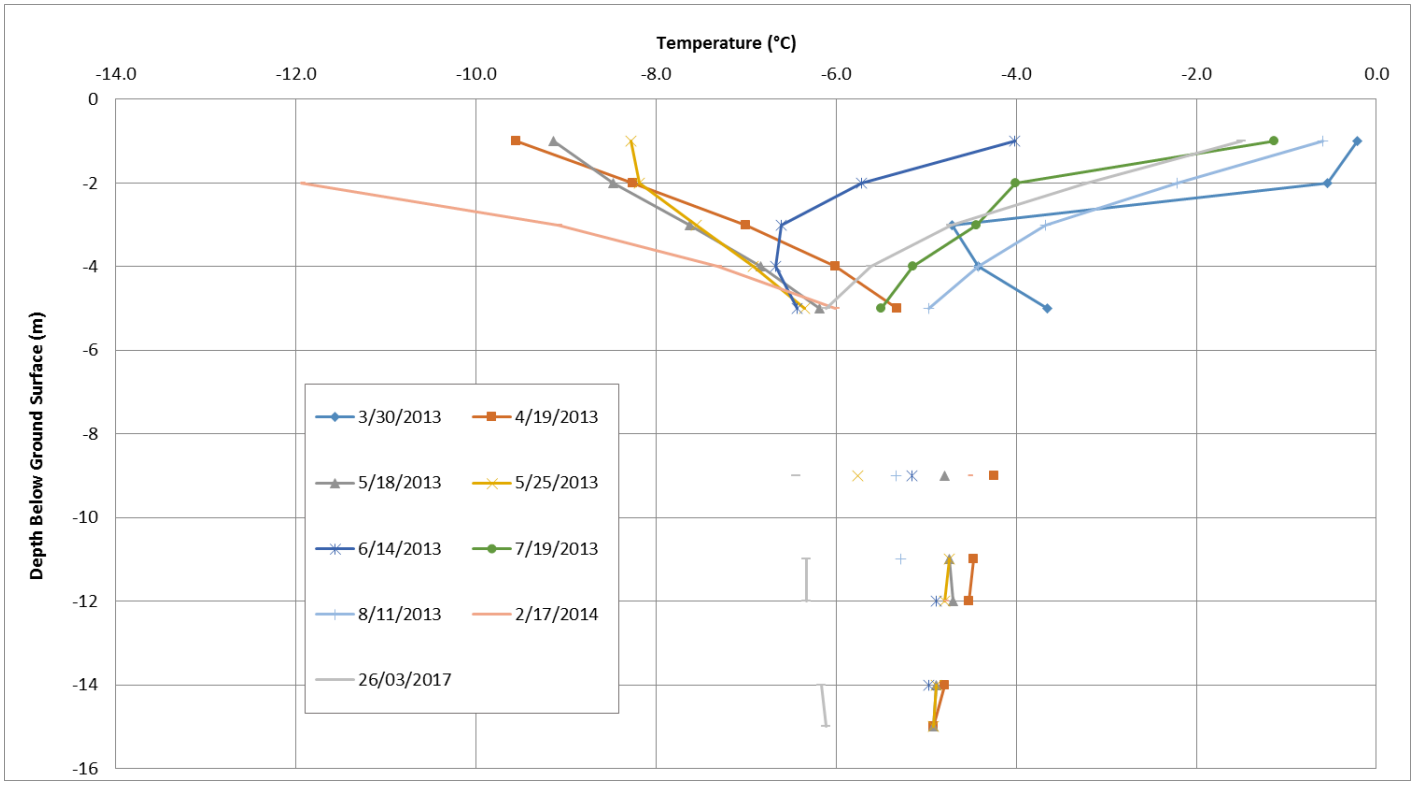

Node 1 @ Elev. 65
Node 2 @ Elev. 64
Node 3 @ Elev. 63
Node 4 @ Elev. 62
Node 5 @ Elev. 61
Node 6 @ Elev. 60
Node 7 @ Elev. 59
Node 8 @ Elev. 58
Node 9 @ Elev. 57
Node 10 @ Elev. 56
Node 11 @ Elev. 55
Node 12 @ Elev. 54
Node 13 @ Elev. 53
Node 14 @ Elev. 52
Node 15 @ Elev. 51
Node 16 @ Elev. 50
Monthly Ambient Temperature
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Temperature (°C)
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

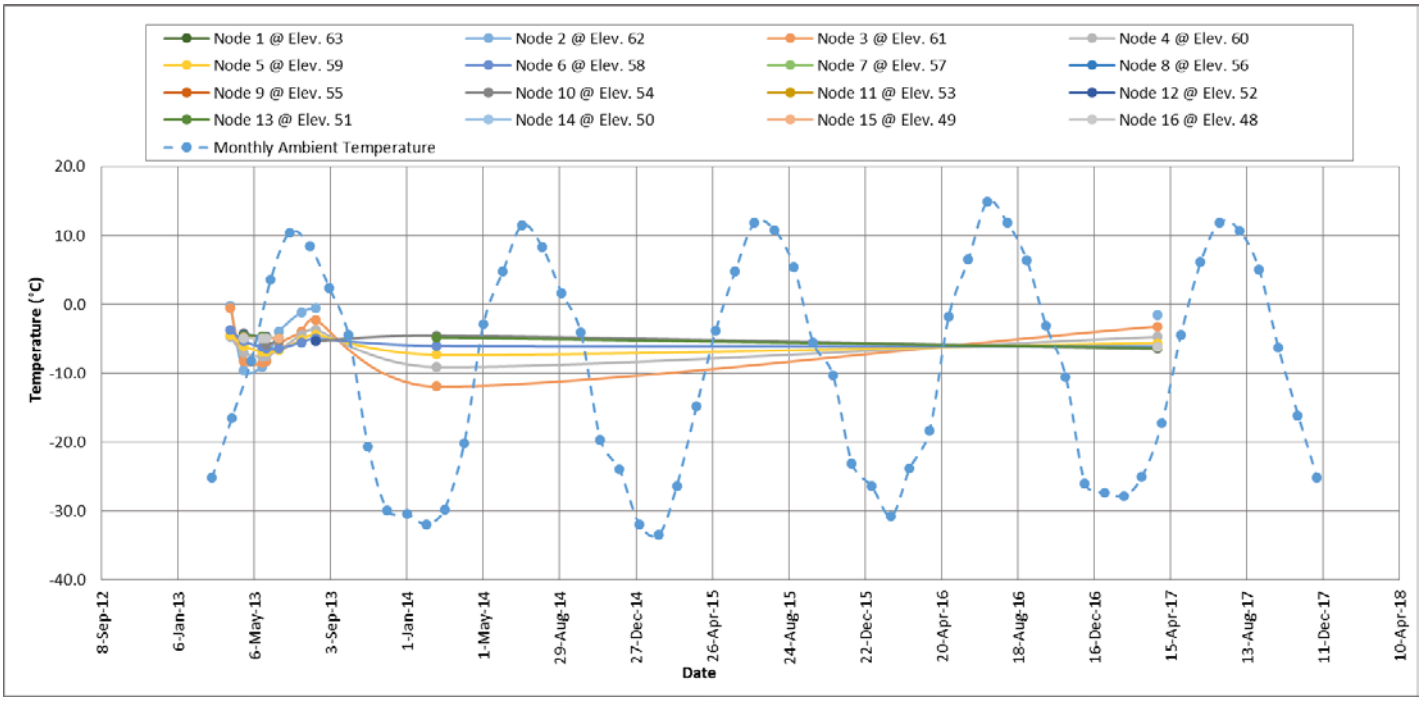
GT13-04


Temperature (°C)
-30.0
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
25.0
Depth Below Ground Surface (m)
0
-2
-4
-6
-8
-10
-12
-14
-16
3/25/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
3/22/2014
4/15/2014
3/22/2014
4/15/2014
2/17/2014
5/1/2015
26/03/2017

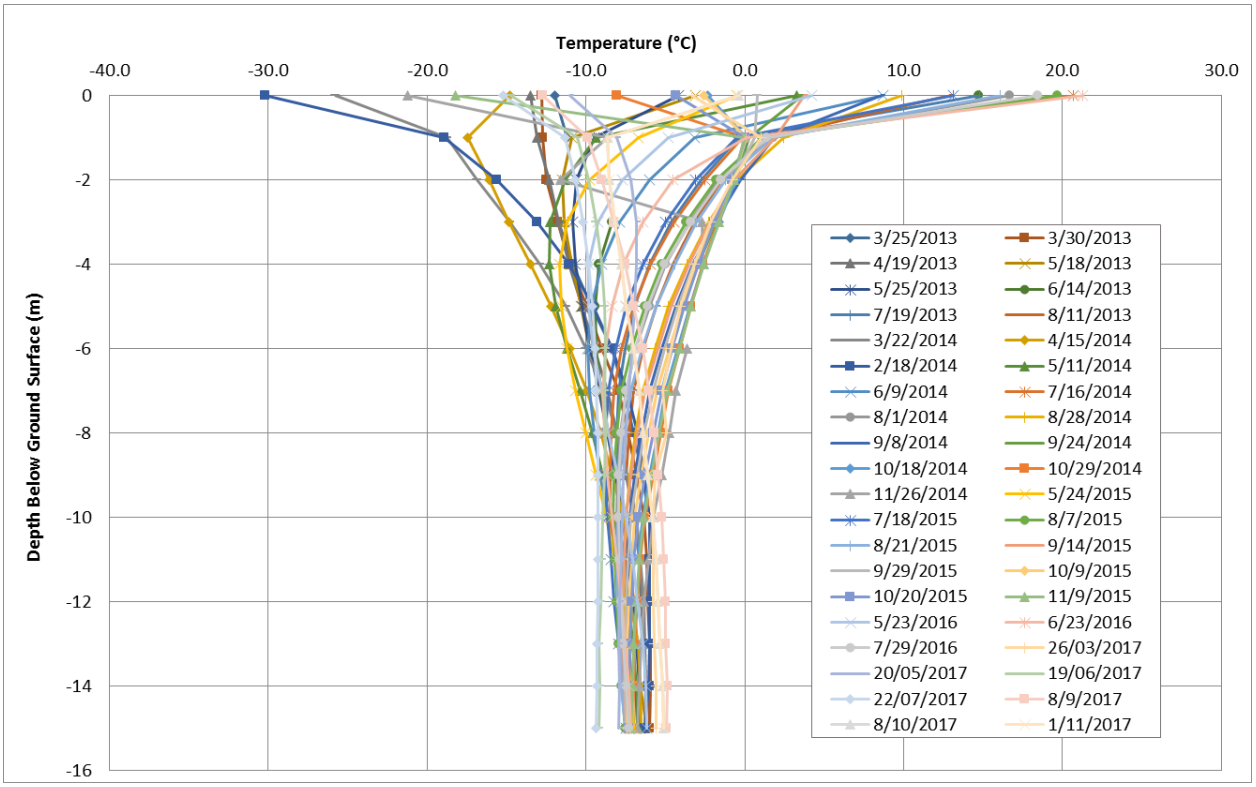

Node 1 @ Elev. 62.4
Node 2 @ Elev. 61.4
Node 3 @ Elev. 60.4
Node 4 @ Elev. 59.4
Node 5 @ Elev. 58.4
Node 6 @ Elev. 57.4
Node 7 @ Elev. 56.4
Node 8 @ Elev. 55.4
Node 9 @ Elev. 54.4
Node 10 @ Elev. 53.4
Node 11 @ Elev. 52.4
Node 12 @ Elev. 51.4
Node 13 @ Elev. 50.4
Node 14 @ Elev. 49.4
Node 15 @ Elev. 48.4
Node 16 @ Elev. 47.4
Monthly Ambient Temperature
Temperature (°C)
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

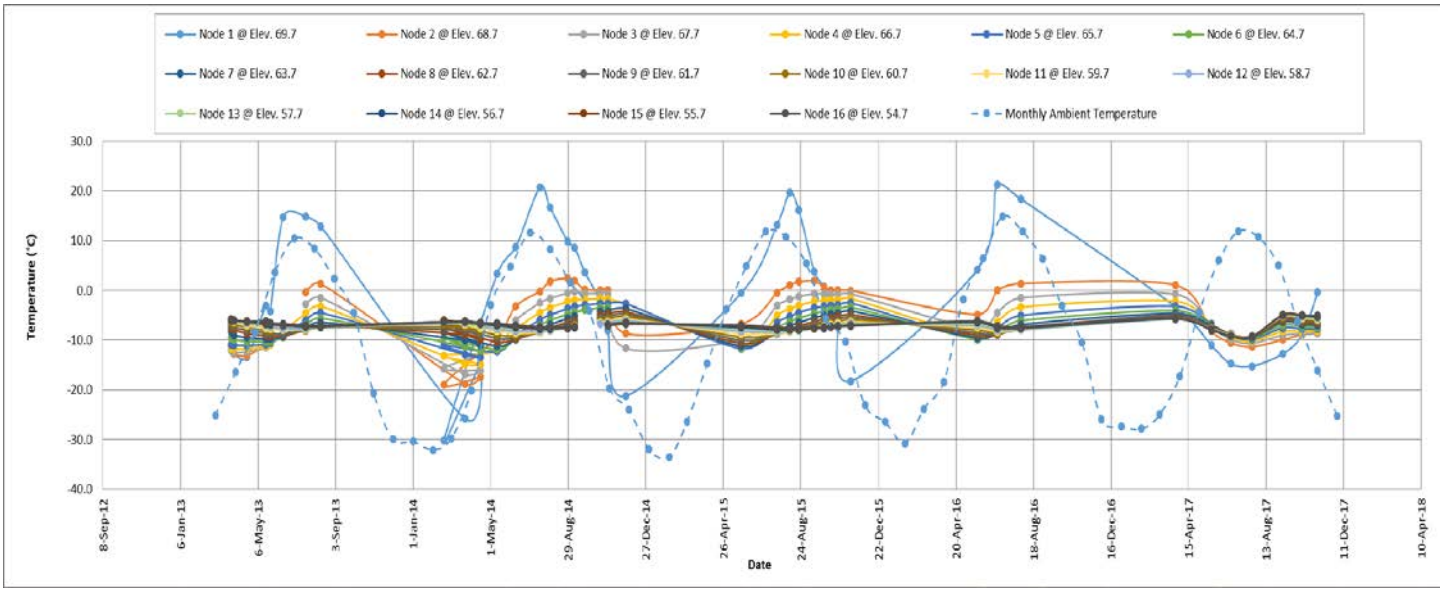
GT13-05


Temperature (°C)
-14.0
-12.0
-10.0
-8.0
-6.0
-4.0
-2.0
0.0
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth Below Ground Surface (m)
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
2/17/2014
26/03/2017

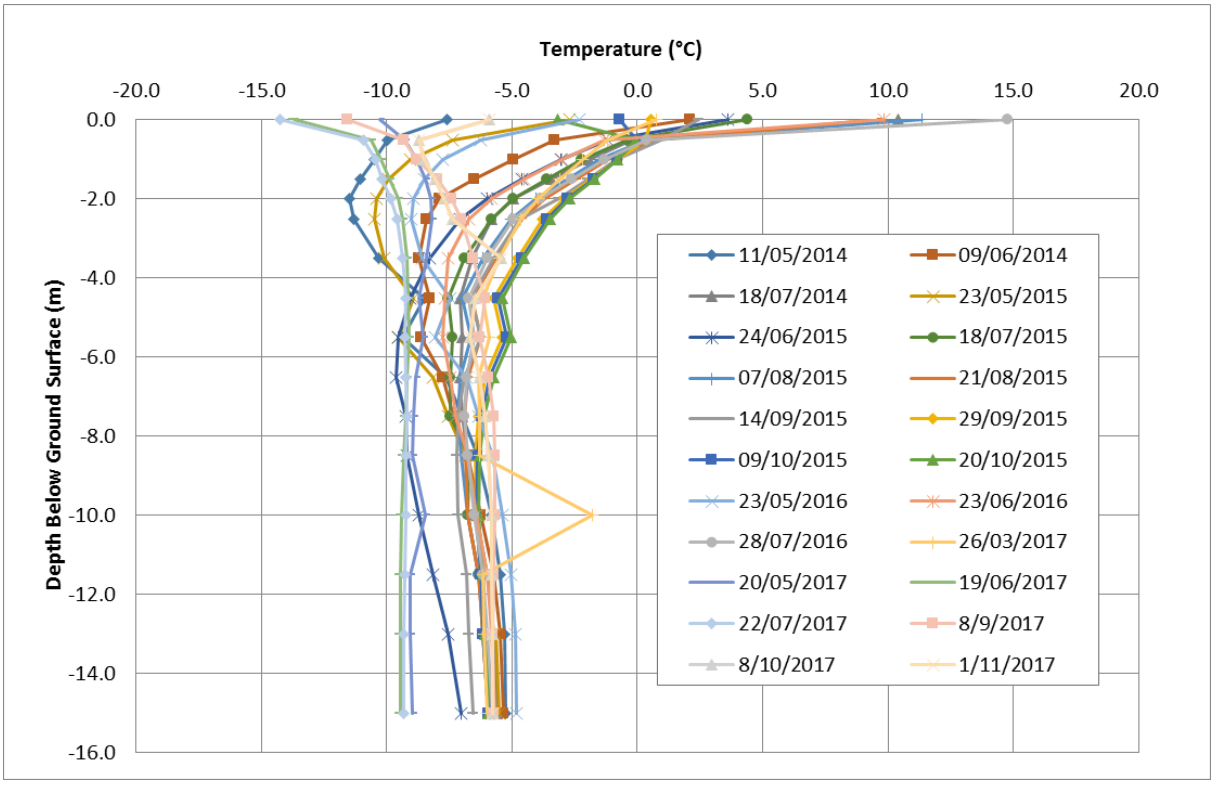

Node 1 @ Elev. 63
Node 2 @ Elev. 62
Node 3 @ Elev. 61
Node 4 @ Elev. 60
Node 5 @ Elev. 59
Node 6 @ Elev. 58
Node 7 @ Elev. 57
Node 8 @ Elev. 56
Node 9 @ Elev. 55
Node 10 @ Elev. 54
Node 11 @ Elev. 53
Node 12 @ Elev. 52
Node 13 @ Elev. 51
Node 14 @ Elev. 50
Node 15 @ Elev. 49
Node 16 @ Elev. 48
Monthly Ambient Temperature
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Temperature (°C)
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

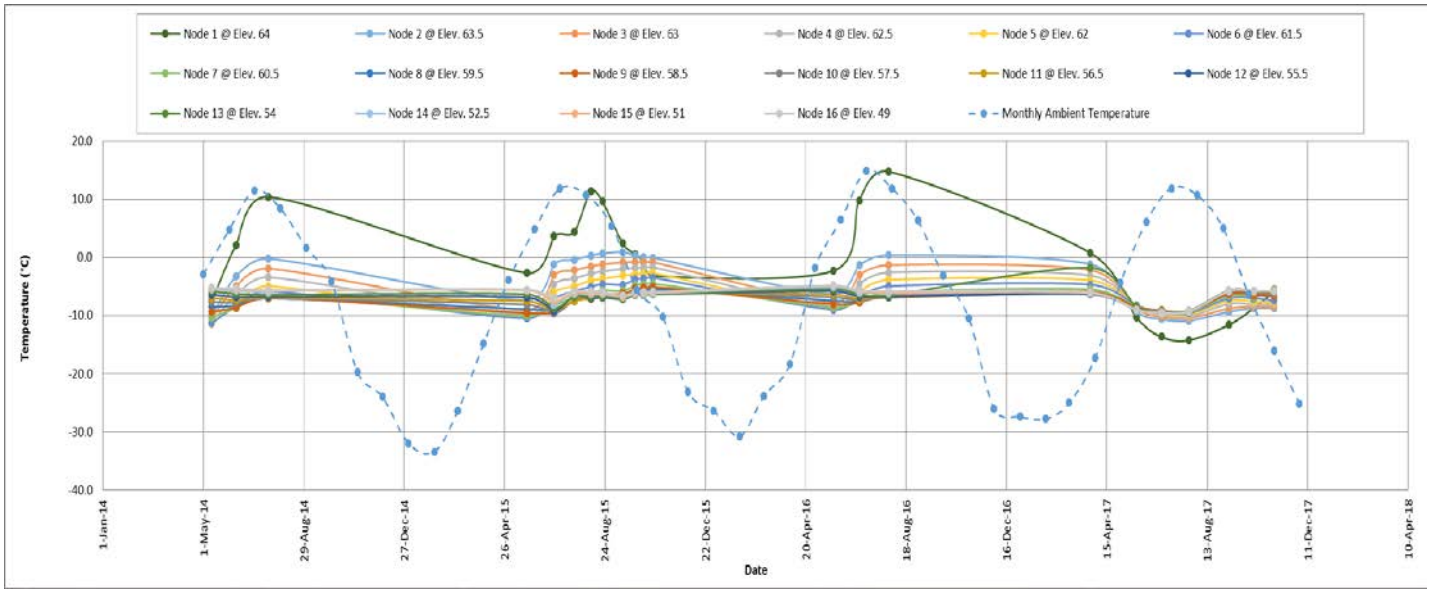
GT13-07


Temperature (°C)
-40.0
-30.0
-20.0
-10.0
0.0
10.0
20.0
30.0
0
-2
-4
-6
-8
-10
-12
-14
-16
Depth Below Ground Surface (m)
3/25/2013
3/30/2013
4/19/2013
5/18/2013
5/25/2013
6/14/2013
7/19/2013
8/11/2013
3/22/2014
4/15/2014
2/18/2014
5/11/2014
6/9/2014
7/16/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/24/2015
7/18/2015
8/7/2015
8/21/2015
9/14/2015
9/29/2015
10/9/2015
10/20/2015
11/9/2015
5/23/2016
6/23/2016
7/29/2016
26/03/2017
20/05/2017
19/06/2017
22/07/2017
8/9/2017
8/10/2017
1/11/2017

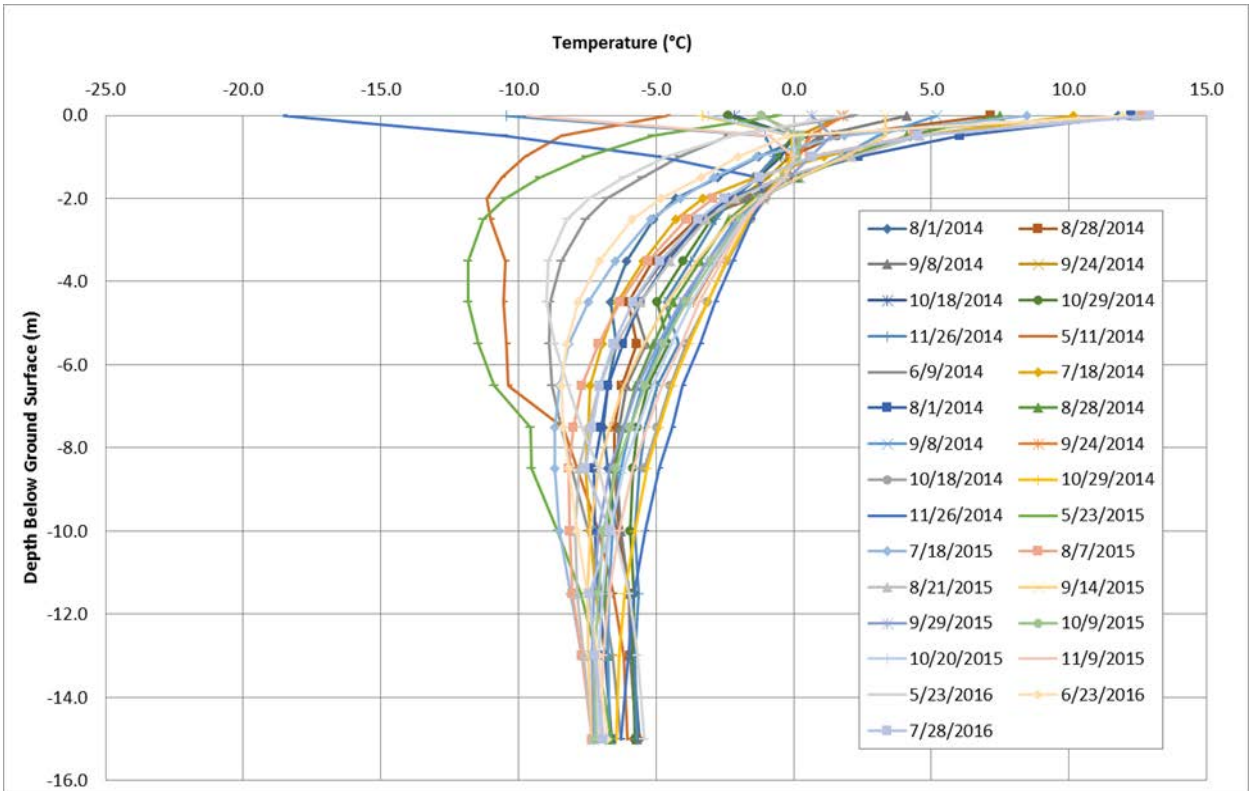

Node 1 @ Elev. 69.7
Node 2 @ Elev. 68.7
Node 3 @ Elev. 67.7
Node 4 @ Elev. 66.7
Node 5 @ Elev. 65.7
Node 6 @ Elev. 64.7
Node 7 @ Elev. 63.7
Node 8 @ Elev. 62.7
Node 9 @ Elev. 61.7
Node 10 @ Elev. 60.7
Node 11 @ Elev. 59.7
Node 12 @ Elev. 58.7
Node 13 @ Elev. 57.7
Node 14 @ Elev. 56.7
Node 15 @ Elev. 55.7
Node 16 @ Elev. 54.7
Monthly Ambient Temperature
Temperature (°C)
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
8-Sep-12
6-Jan-13
6-May-13
3-Sep-13
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

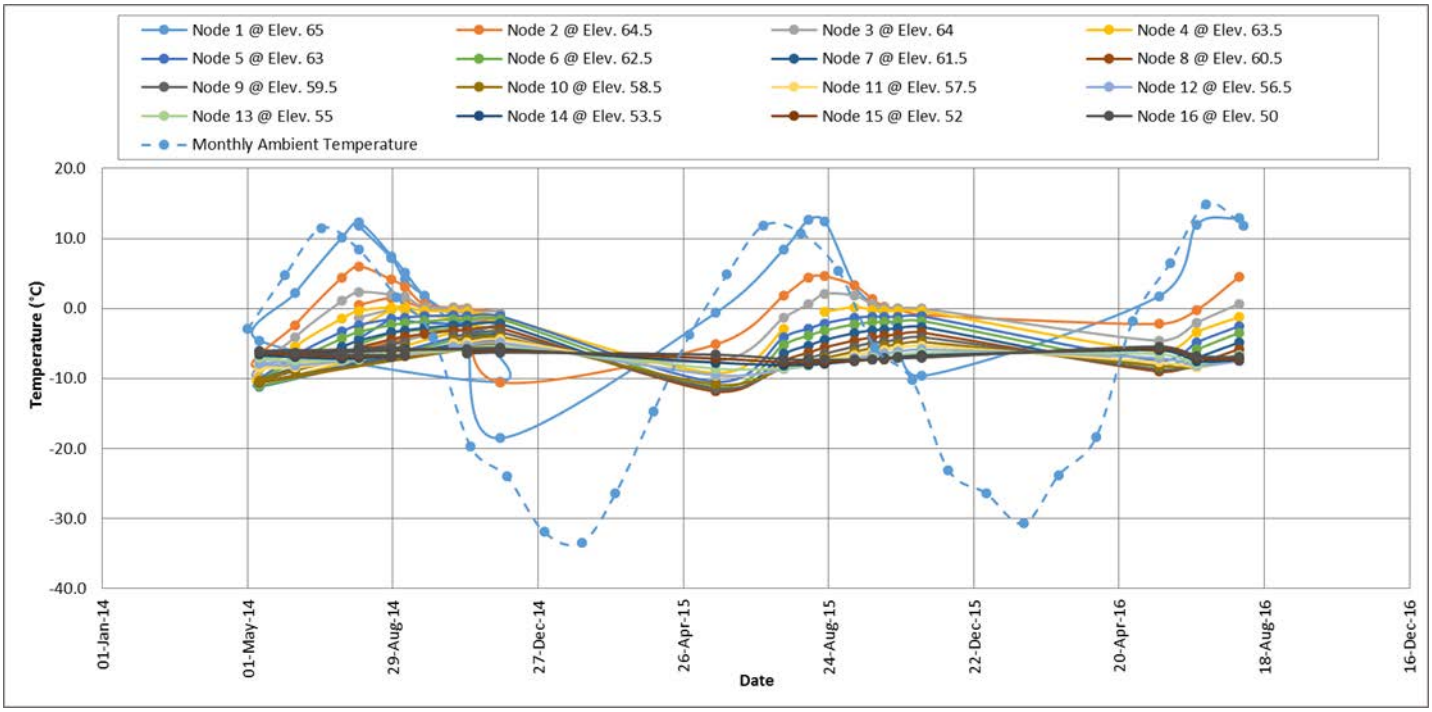
GT14-03


Temperature (°C)
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
11/05/2014
09/06/2014
18/07/2014
23/05/2015
24/06/2015
18/07/2015
07/08/2015
21/08/2015
14/09/2015
29/09/2015
09/10/2015
20/10/2015
23/05/2016
23/06/2016
28/07/2016
26/03/2017
20/05/2017
19/06/2017
22/07/2017
8/9/2017
8/10/2017
1/11/2017

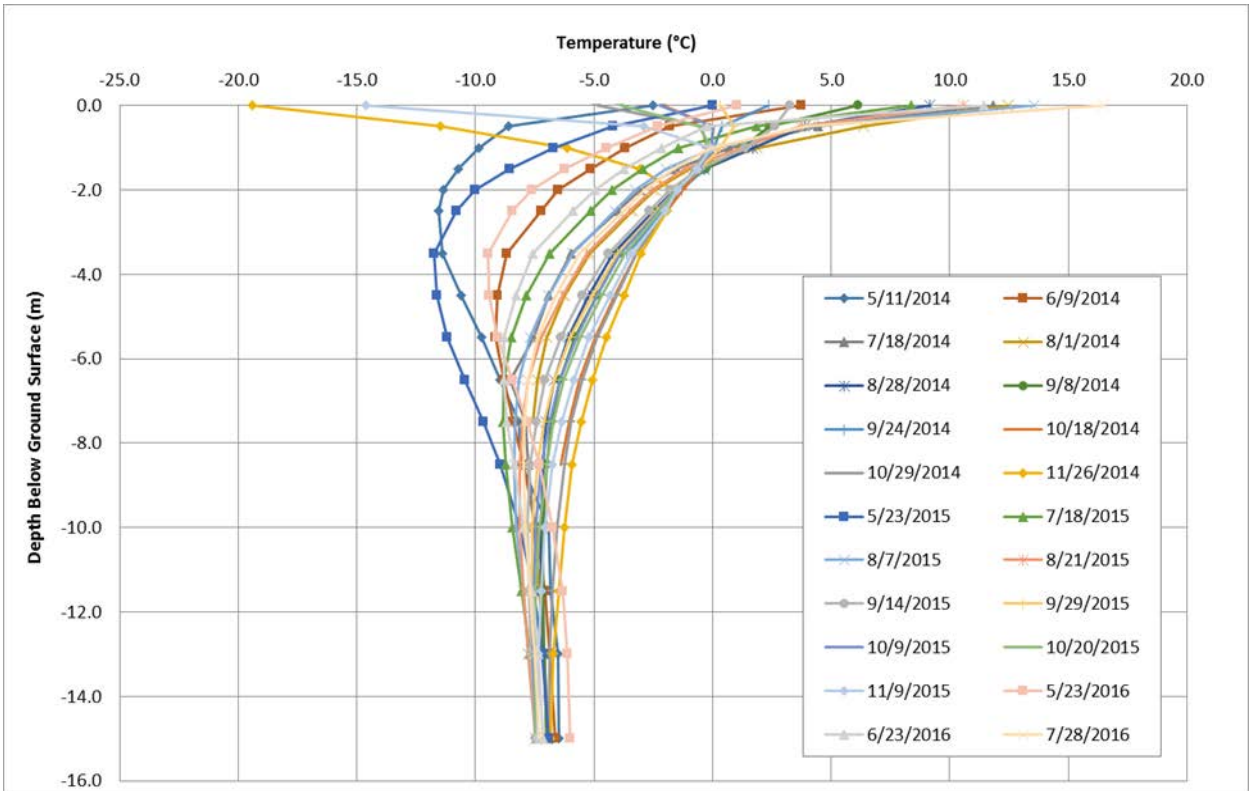

Node 1 @ Elev. 64
Node 2 @ Elev. 63.5
Node 3 @ Elev. 63
Node 4 @ Elev. 62.5
Node 5 @ Elev. 62
Node 6 @ Elev. 61.5
Node 7 @ Elev. 60.5
Node 8 @ Elev. 59.5
Node 9 @ Elev. 58.5
Node 10 @ Elev. 57.5
Node 11 @ Elev. 56.5
Node 12 @ Elev. 55.5
Node 13 @ Elev. 54
Node 14 @ Elev. 52.5
Node 15 @ Elev. 51
Node 16 @ Elev. 49
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

GT14-05


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/11/2014
6/9/2014
7/18/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/23/2015
7/18/2015
8/7/2015
8/21/2015
9/14/2015
9/29/2015
10/9/2015
10/20/2015
11/9/2015
5/23/2016
6/23/2016
7/28/2016


Node 1 @ Elev. 65
Node 2 @ Elev. 64.5
Node 3 @ Elev. 64
Node 4 @ Elev. 63.5
Node 5 @ Elev. 63
Node 6 @ Elev. 62.5
Node 7 @ Elev. 61.5
Node 8 @ Elev. 60.5
Node 9 @ Elev. 59.5
Node 10 @ Elev. 58.5
Node 11 @ Elev. 57.5
Node 12 @ Elev. 56.5
Node 13 @ Elev. 55
Node 14 @ Elev. 53.5
Node 15 @ Elev. 52
Node 16 @ Elev. 50
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

GT14-07


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
5/11/2014
6/9/2014
7/18/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/23/2015
7/18/2015
8/7/2015
8/21/2015
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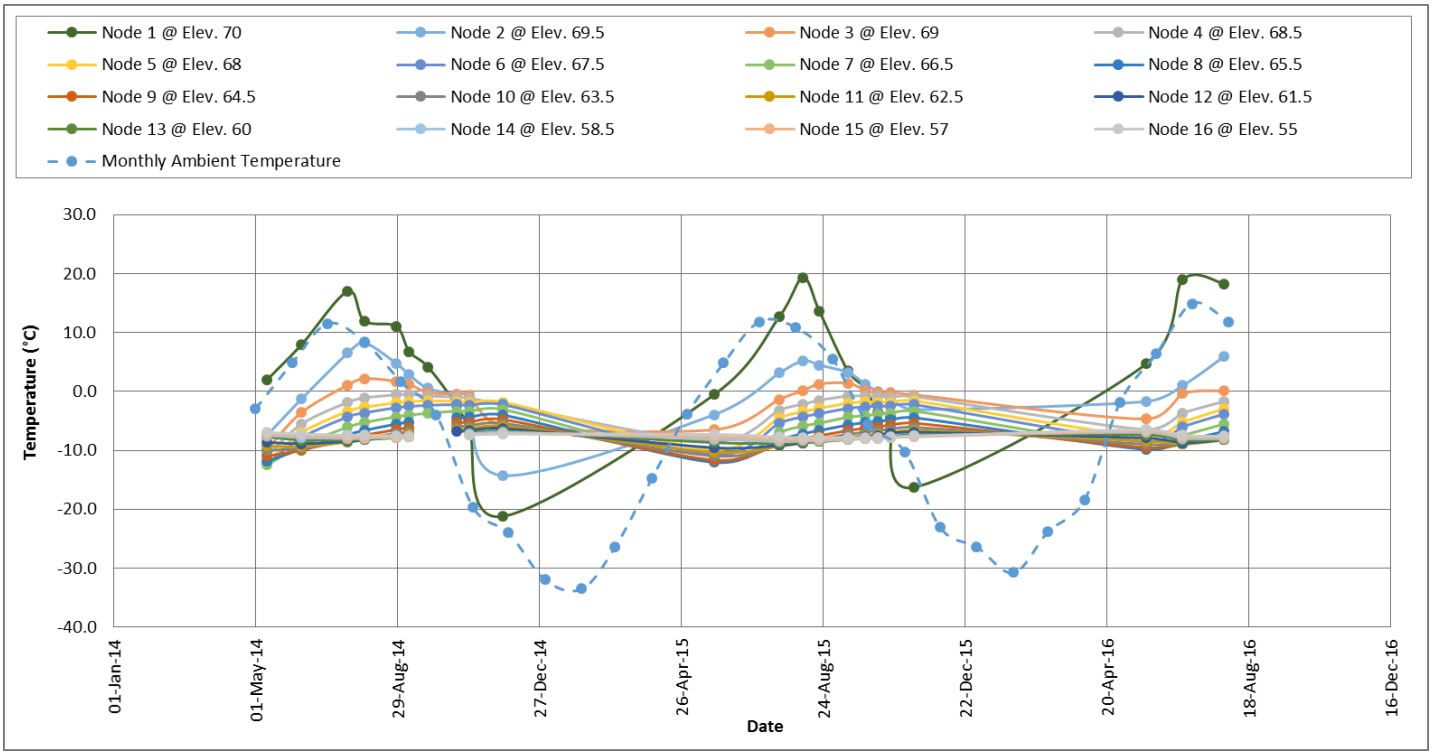
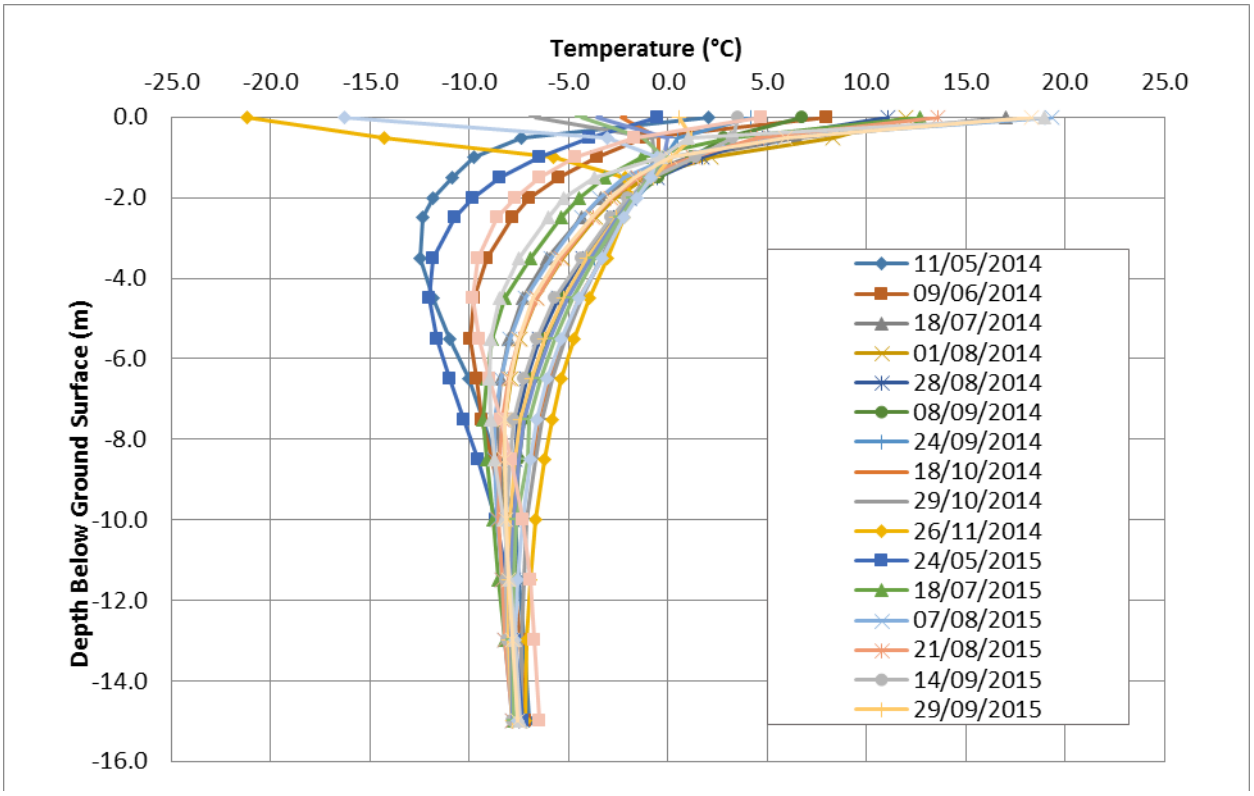
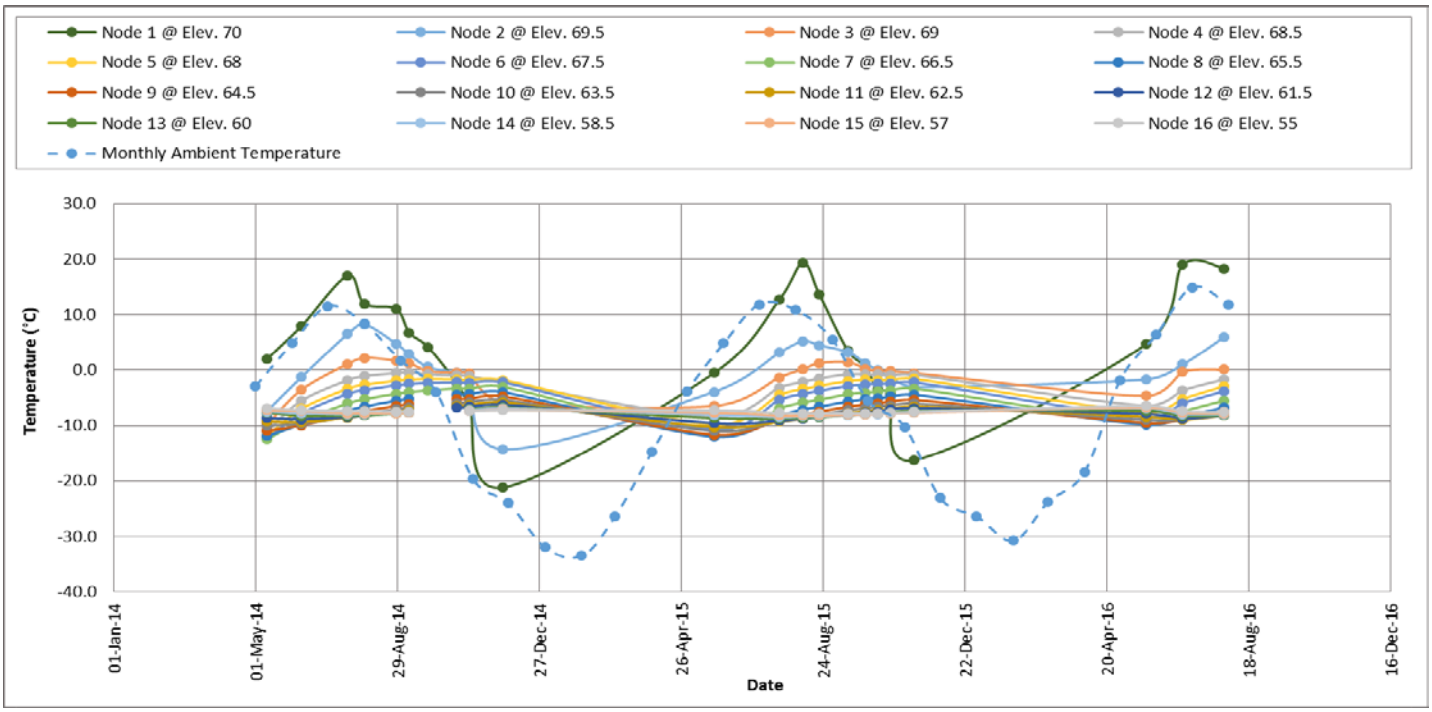
10/9/2015
10/20/2015
11/9/2015
5/23/2016
6/23/2016
7/28/2016

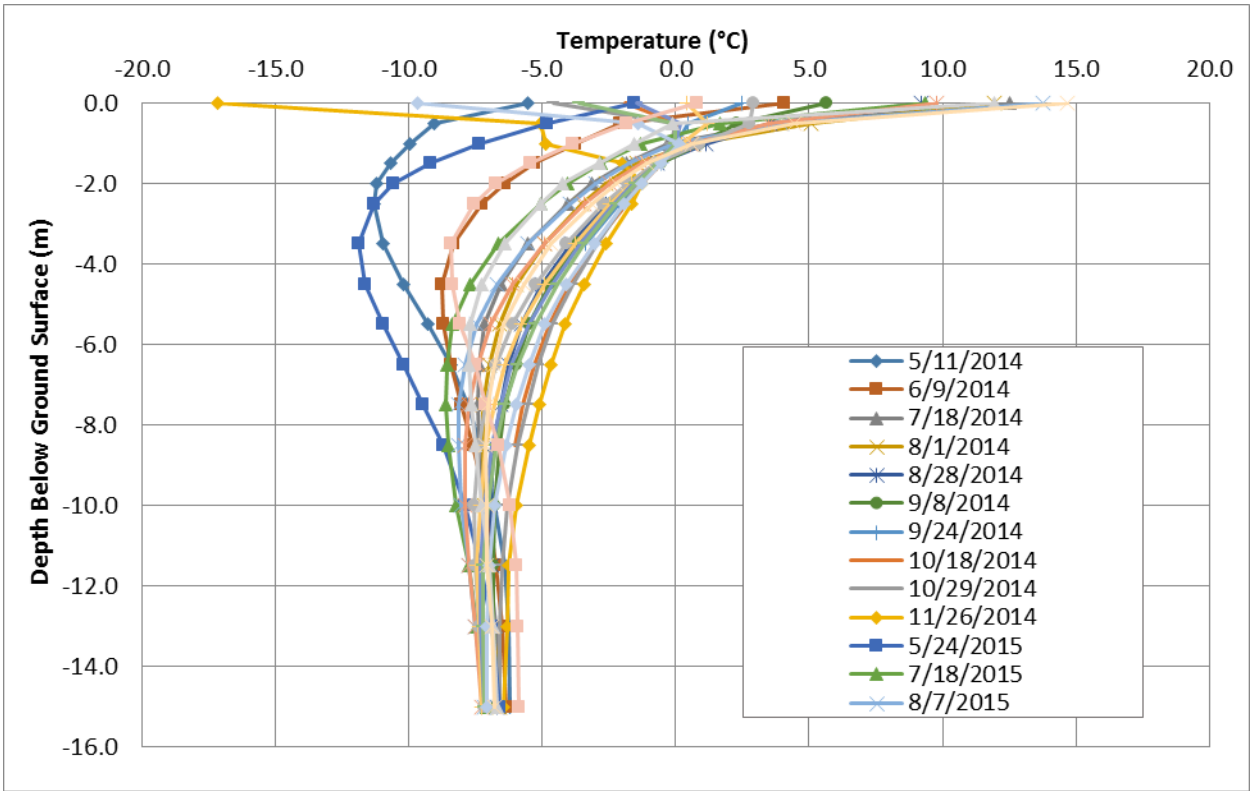

Node 1 @ Elev. 70
Node 2 @ Elev. 69.5
Node 3 @ Elev. 69
Node 4 @ Elev. 68.5
Node 5 @ Elev. 68
Node 6 @ Elev. 67.5
Node 7 @ Elev. 66.5
Node 8 @ Elev. 65.5
Node 9 @ Elev. 64.5
Node 10 @ Elev. 63.5
Node 11 @ Elev. 62.5
Node 12 @ Elev. 61.5
Node 13 @ Elev. 60
Node 14 @ Elev. 58.5
Node 15 @ Elev. 57
Node 16 @ Elev. 55
Monthly Ambient Temperature
Temperature (°C)
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

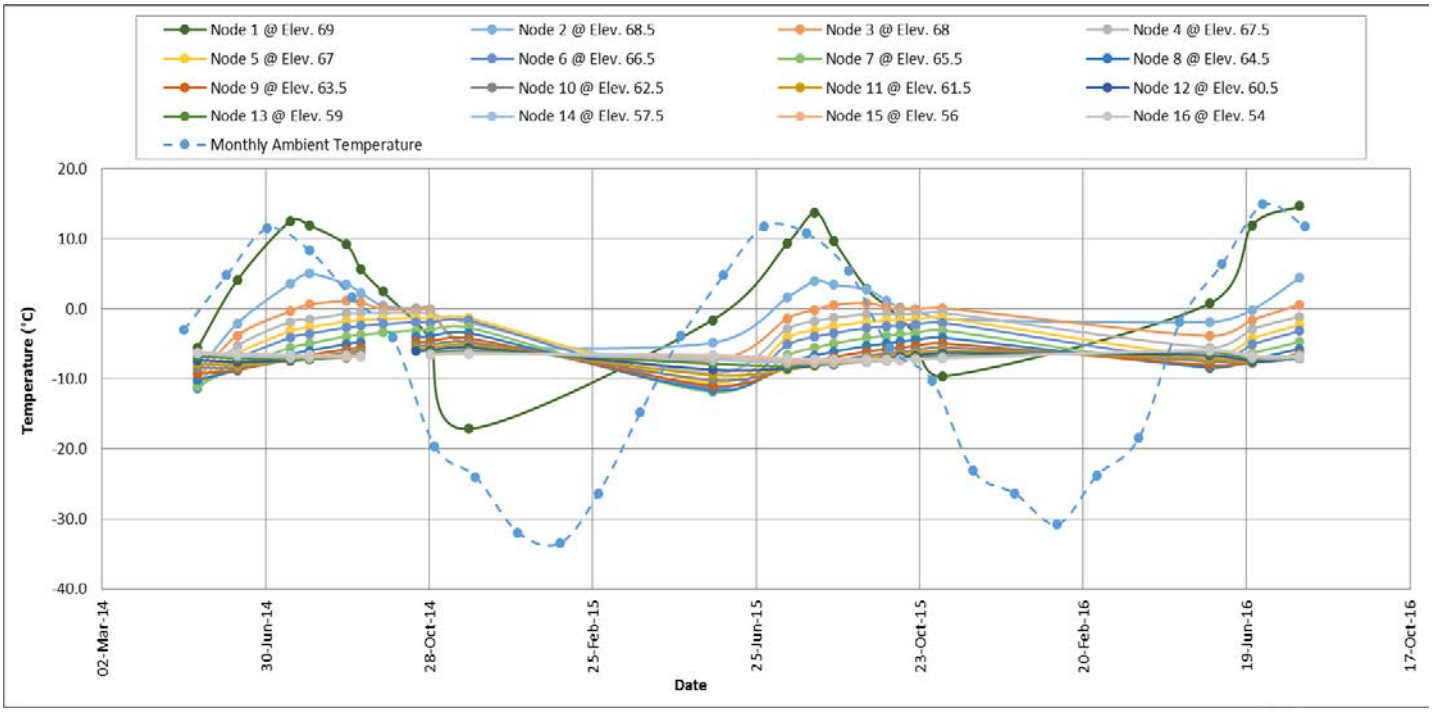
GT14-16


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
25.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
11/05/2014
09/06/2014
18/07/2014
01/08/2014
28/08/2014
08/09/2014
24/09/2014
18/10/2014
29/10/2014
26/11/2014
24/05/2015
18/07/2015
07/08/2015
21/08/2015
14/09/2015
29/09/2015

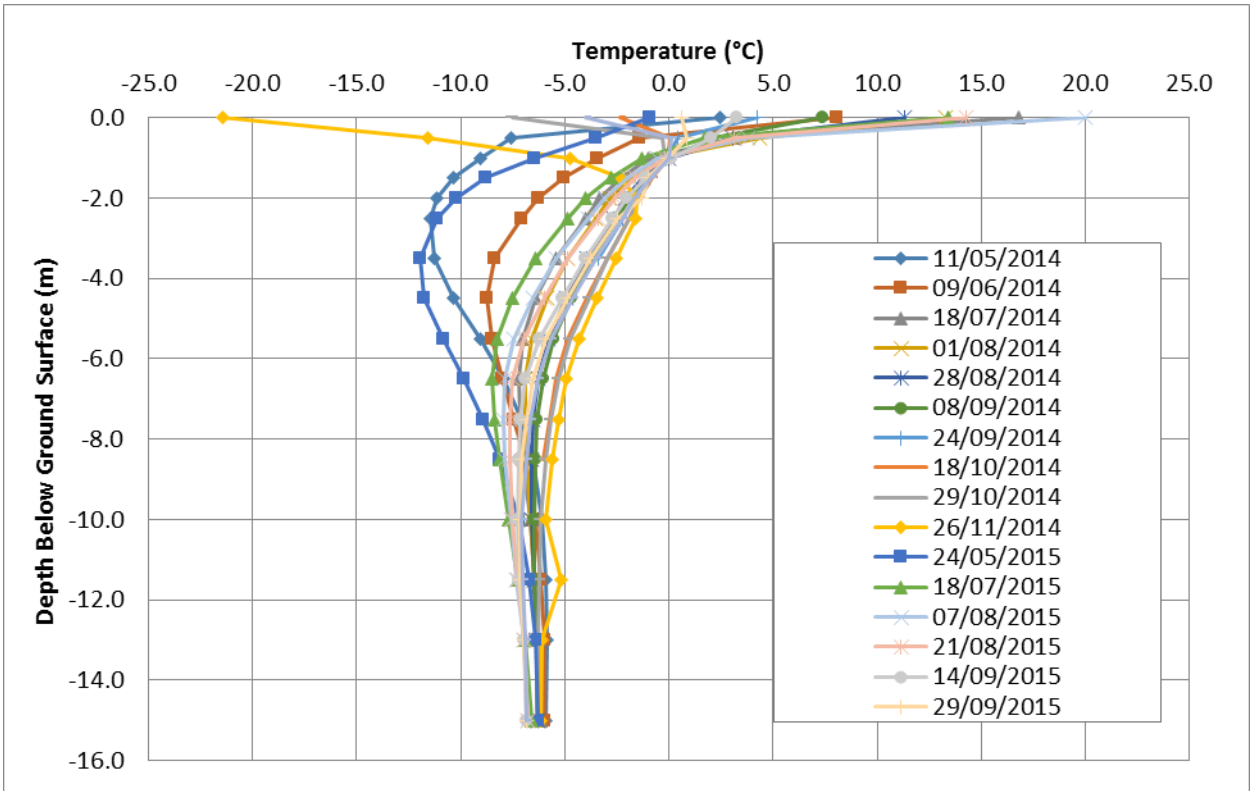

Node 1 @ Elev. 70
Node 2 @ Elev. 69.5
Node 3 @ Elev. 69
Node 4 @ Elev. 68.5
Node 5 @ Elev. 68
Node 6 @ Elev. 67.5
Node 7 @ Elev. 66.5
Node 8 @ Elev. 65.5
Node 9 @ Elev. 64.5
Node 10 @ Elev. 63.5
Node 11 @ Elev. 62.5
Node 12 @ Elev. 61.5
Node 13 @ Elev. 60
Node 14 @ Elev. 58.5
Node 15 @ Elev. 57
Node 16 @ Elev. 55
Monthly Ambient Temperature
Temperature (°C)
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
01-Jan-14
01-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
Date

GT14-17


Temperature (°C)
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
5/11/2014
6/9/2014
7/18/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
5/24/2015
7/18/2015
8/7/2015


Node 1 @ Elev. 69
Node 2 @ Elev. 68.5
Node 3 @ Elev. 68
Node 4 @ Elev. 67.5
Node 5 @ Elev. 67
Node 6 @ Elev. 66.5
Node 7 @ Elev. 65.5
Node 8 @ Elev. 64.5
Node 9 @ Elev. 63.5
Node 10 @ Elev. 62.5
Node 11 @ Elev. 61.5
Node 12 @ Elev. 60.5
Node 13 @ Elev. 59
Node 14 @ Elev. 57.5
Node 15 @ Elev. 56
Node 16 @ Elev. 54
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
02-Mar-14
30-Jun-14
28-Oct-14
25-Feb-15
25-Jun-15
23-Oct-15
20-Feb-16
19-Jun-16
17-Oct-16
Date

GT14-18


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
25.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
11/05/2014
09/06/2014
18/07/2014
01/08/2014
28/08/2014
08/09/2014
24/09/2014
18/10/2014
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07/08/2015
21/08/2015
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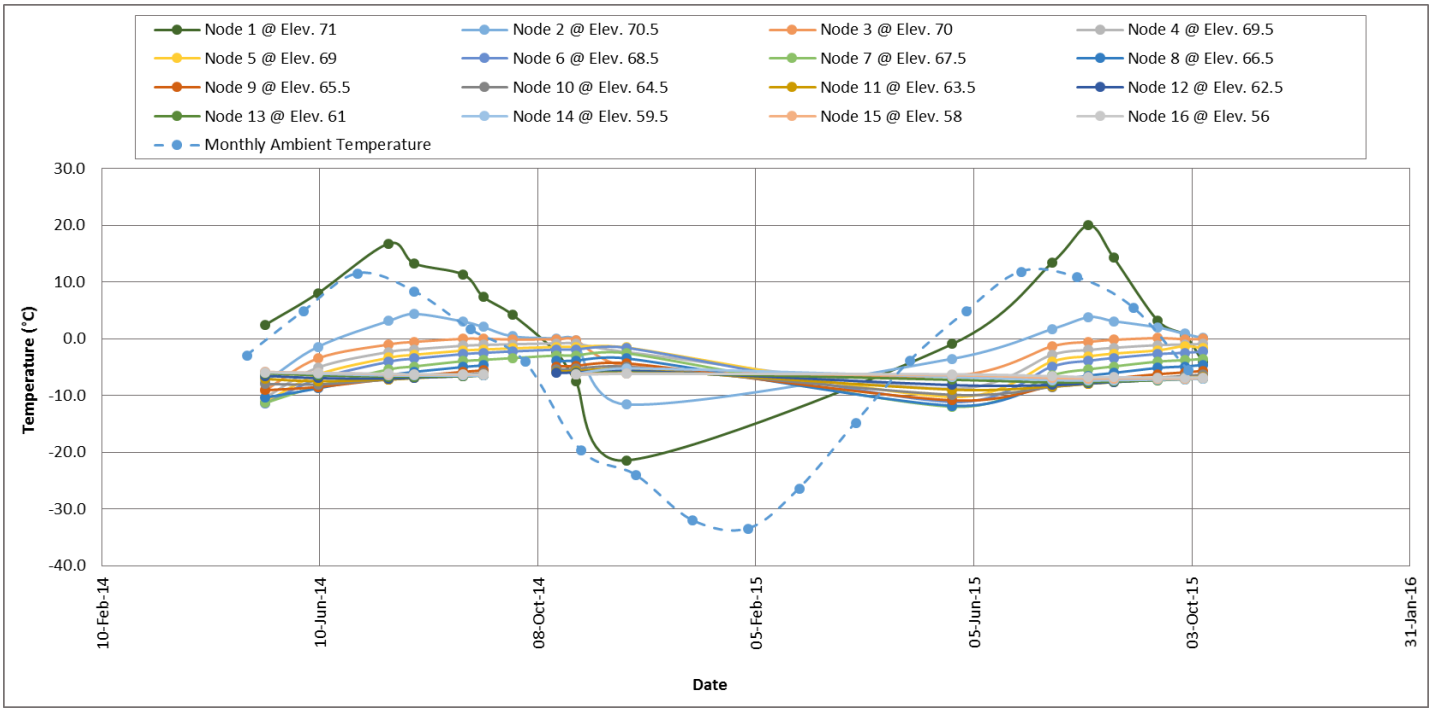
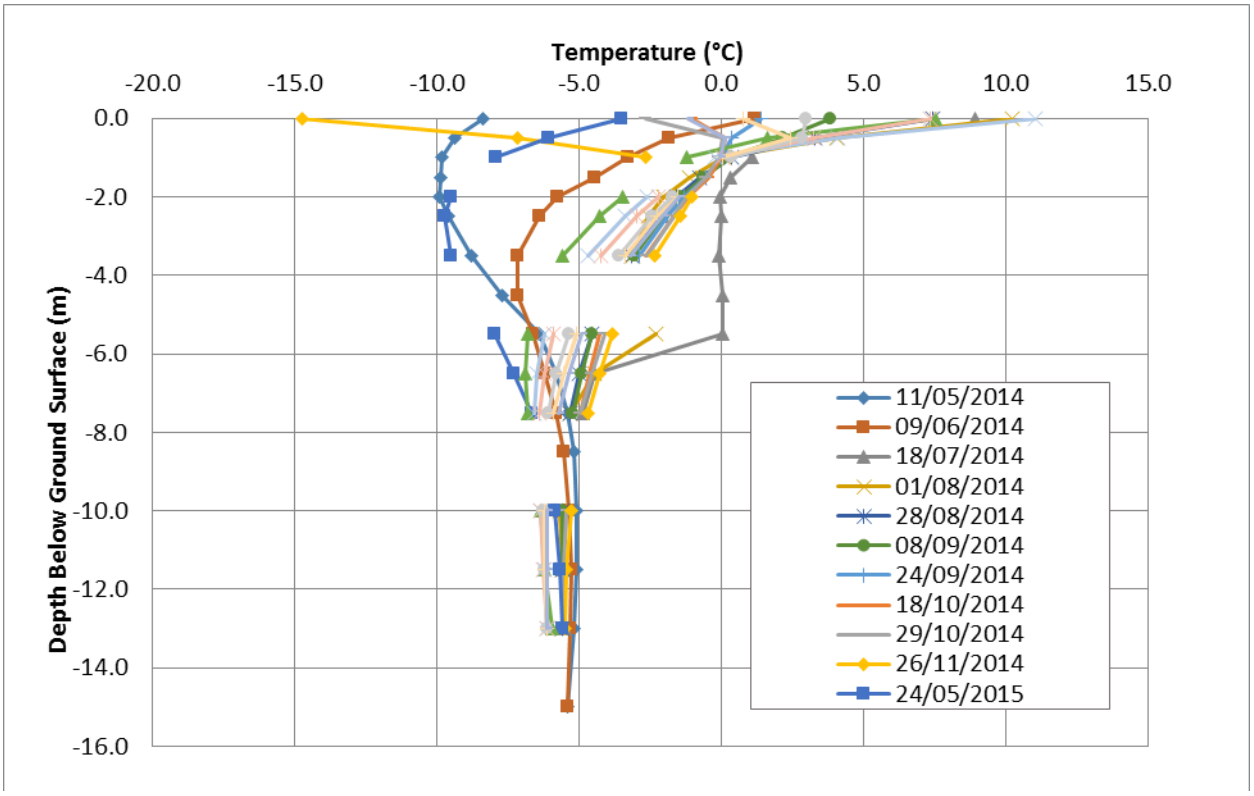
29/09/2015


Node 1 @ Elev. 71
Node 2 @ Elev. 70.5
Node 3 @ Elev. 70
Node 4 @ Elev. 69.5
Node 5 @ Elev. 69
Node 6 @ Elev. 68.5
Node 7 @ Elev. 67.5
Node 8 @ Elev. 66.5
Node 9 @ Elev. 65.5
Node 10 @ Elev. 64.5
Node 11 @ Elev. 63.5
Node 12 @ Elev. 62.5
Node 13 @ Elev. 61
Node 14 @ Elev. 59.5
Node 15 @ Elev. 58
Node 16 @ Elev. 56
Monthly Ambient Temperature
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Temperature (°C)
10-Feb-14
10-Jun-14
08-Oct-14
05-Feb-15
05-Jun-15
03-Oct-15
31-Jan-16
Date

GT14-19


Temperature (°C)
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-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
11/05/2014
09/06/2014
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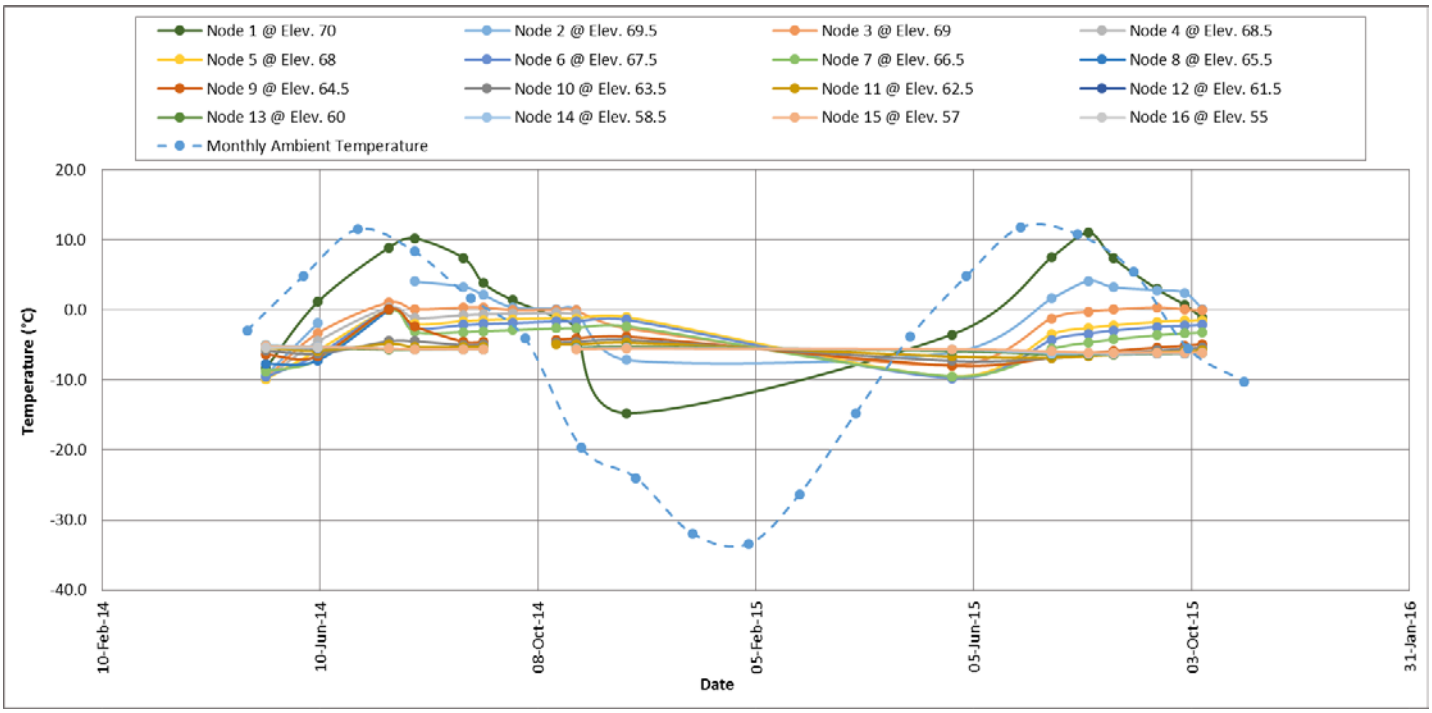
26/11/2014
24/05/2015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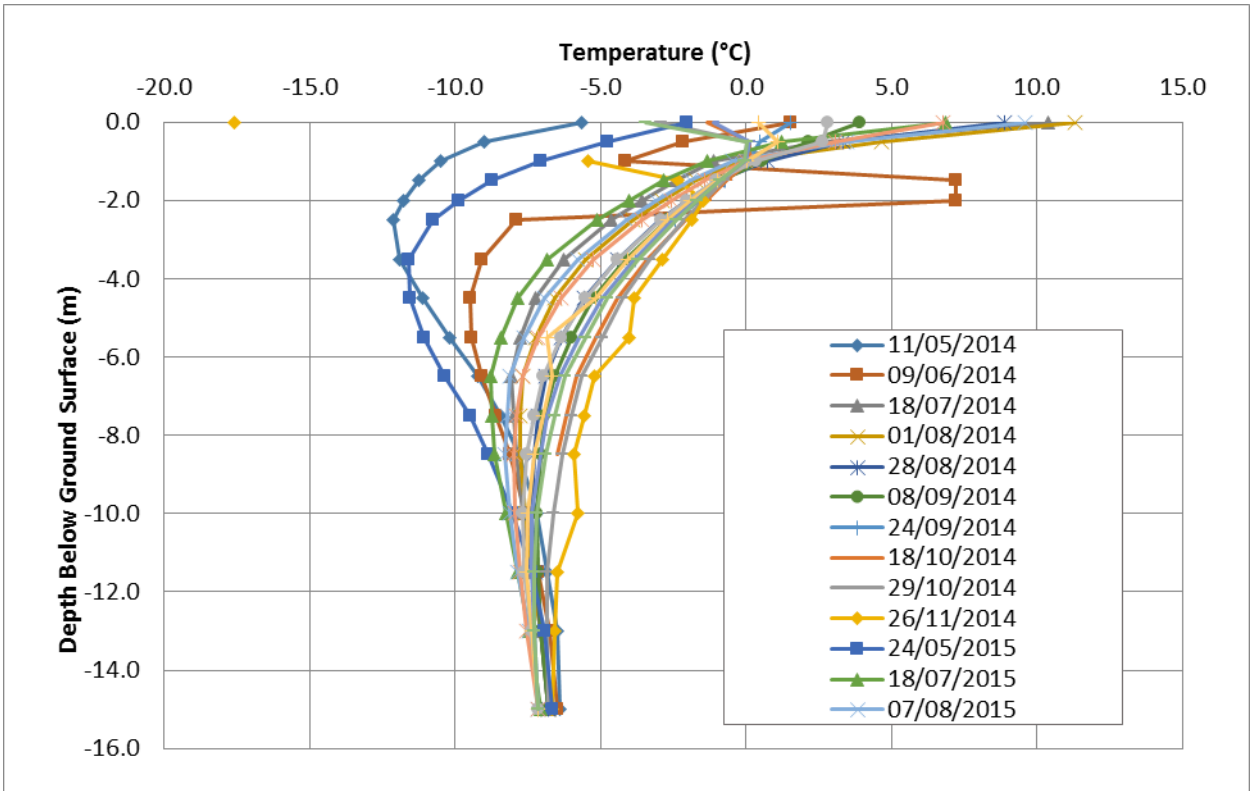
Node 2 @ Elev. 69.5
Node 3 @ Elev. 69
Node 4 @ Elev. 68.5
Node 5 @ Elev. 68
Node 6 @ Elev. 67.5
Node 7 @ Elev. 66.5
Node 8 @ Elev. 65.5
Node 9 @ Elev. 64.5
Node 10 @ Elev. 63.5
Node 11 @ Elev. 62.5
Node 12 @ Elev. 61.5
Node 13 @ Elev. 60
Node 14 @ Elev. 58.5
Node 15 @ Elev. 57
Node 16 @ Elev. 55
Monthly Ambient Temperature
Temperature (°C)
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
10-Feb-14
10-Jun-14
08-Oct-14
05-Feb-15
05-Jun-15
03-Oct-15
31-Jan-16
Date

GT14-22


Temperature (°C)
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-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
Depth Below Ground Surface (m)
11/05/2014
09/06/2014
18/07/2014
01/08/2014
28/08/2014
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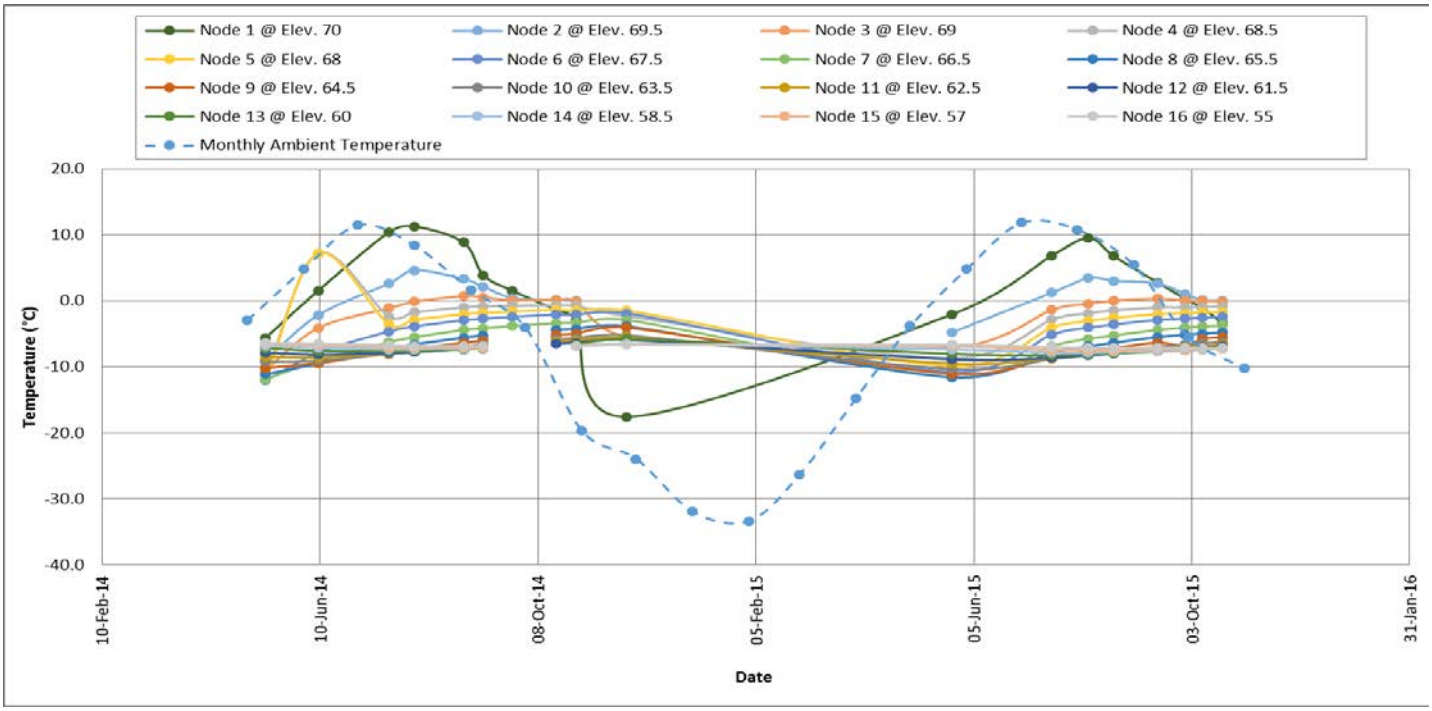
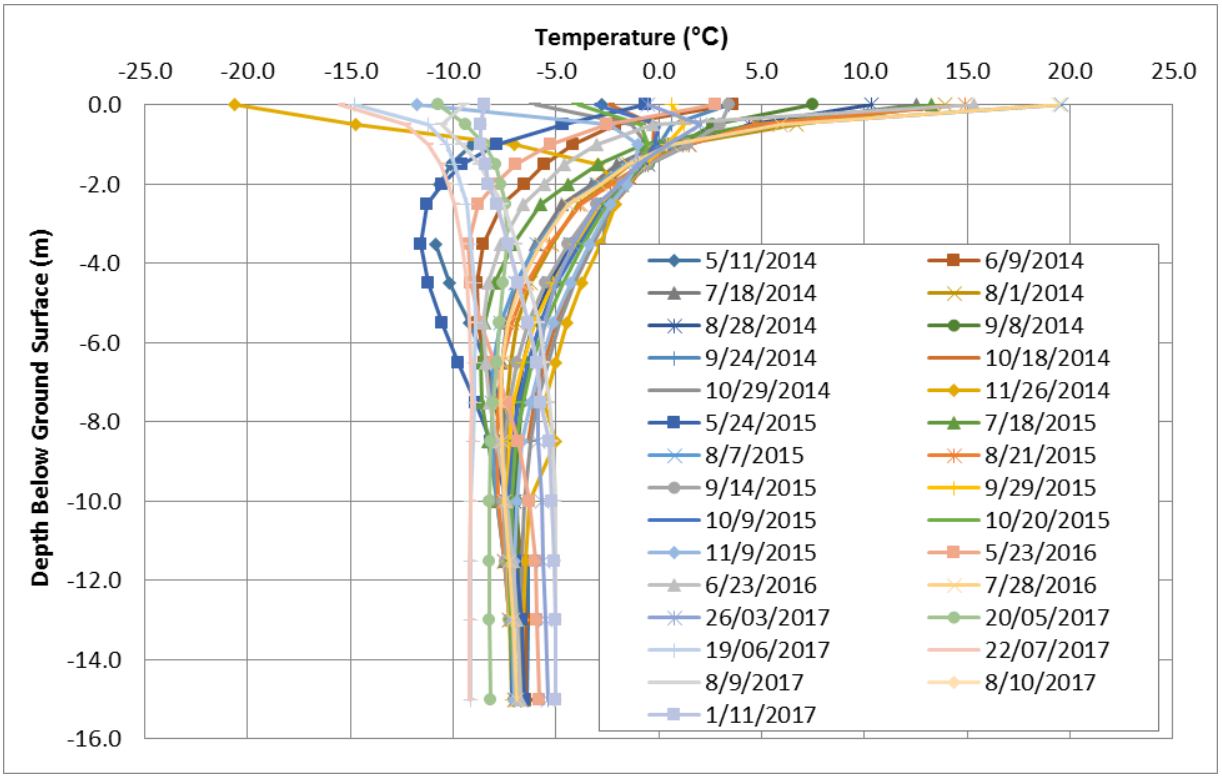
18/07/2015
07/08/2015


Node 1 @ Elev. 70
Node 2 @ Elev. 69.5
Node 3 @ Elev. 69
Node 4 @ Elev. 68.5
Node 5 @ Elev. 68
Node 6 @ Elev. 67.5
Node 7 @ Elev. 66.5
Node 8 @ Elev. 65.5
Node 9 @ Elev. 64.5
Node 10 @ Elev. 63.5
Node 11 @ Elev. 62.5
Node 12 @ Elev. 61.5
Node 13 @ Elev. 60
Node 14 @ Elev. 58.5
Node 15 @ Elev. 57
Node 16 @ Elev. 55
Monthly Ambient Temperature
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
Temperature (°C)
10-Feb-14
10-Jun-14
08-Oct-14
05-Feb-15
05-Jun-15
03-Oct-15
31-Jan-16
Date

GT14-27


Temperature (°C)
-25.0
-20.0
-15.0
-10.0
-5.0
0.0
5.0
10.0
15.0
20.0
25.0
Depth Below Ground Surface (m)
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
-14.0
-16.0
5/11/2014
6/9/2014
7/18/2014
8/1/2014
8/28/2014
9/8/2014
9/24/2014
10/18/2014
10/29/2014
11/26/2014
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8/9/2017
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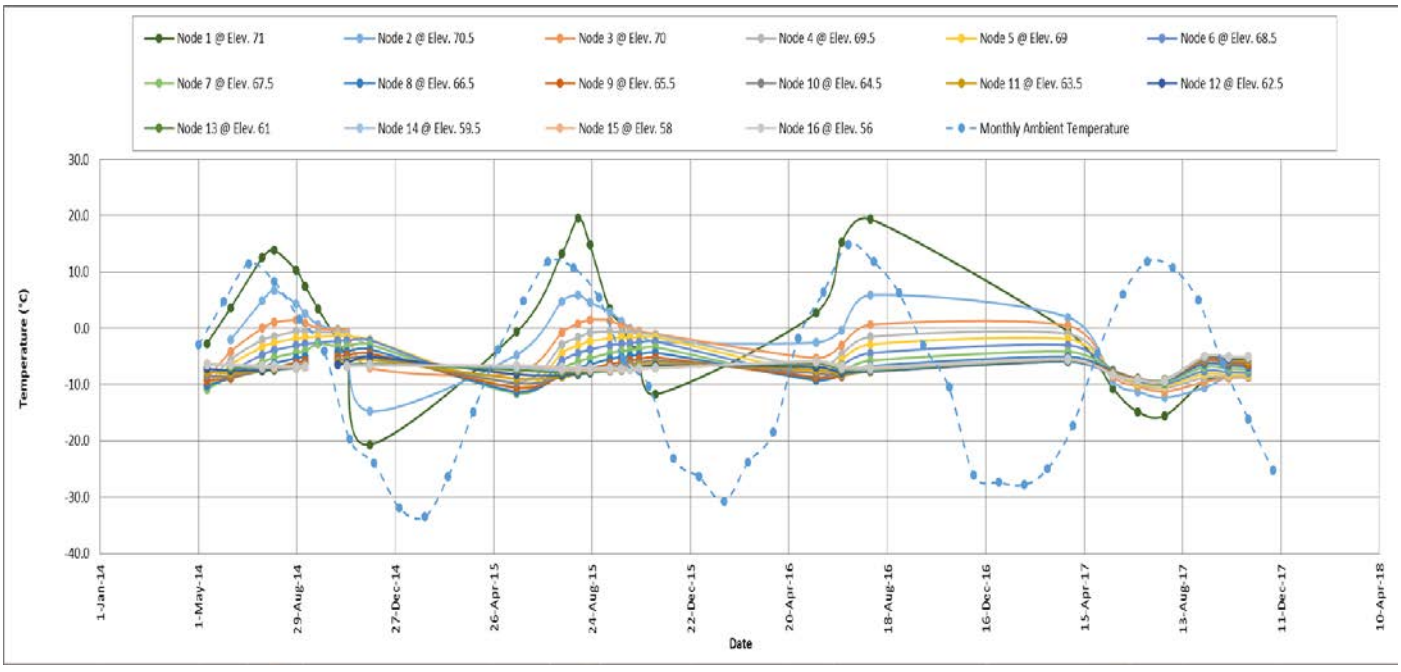
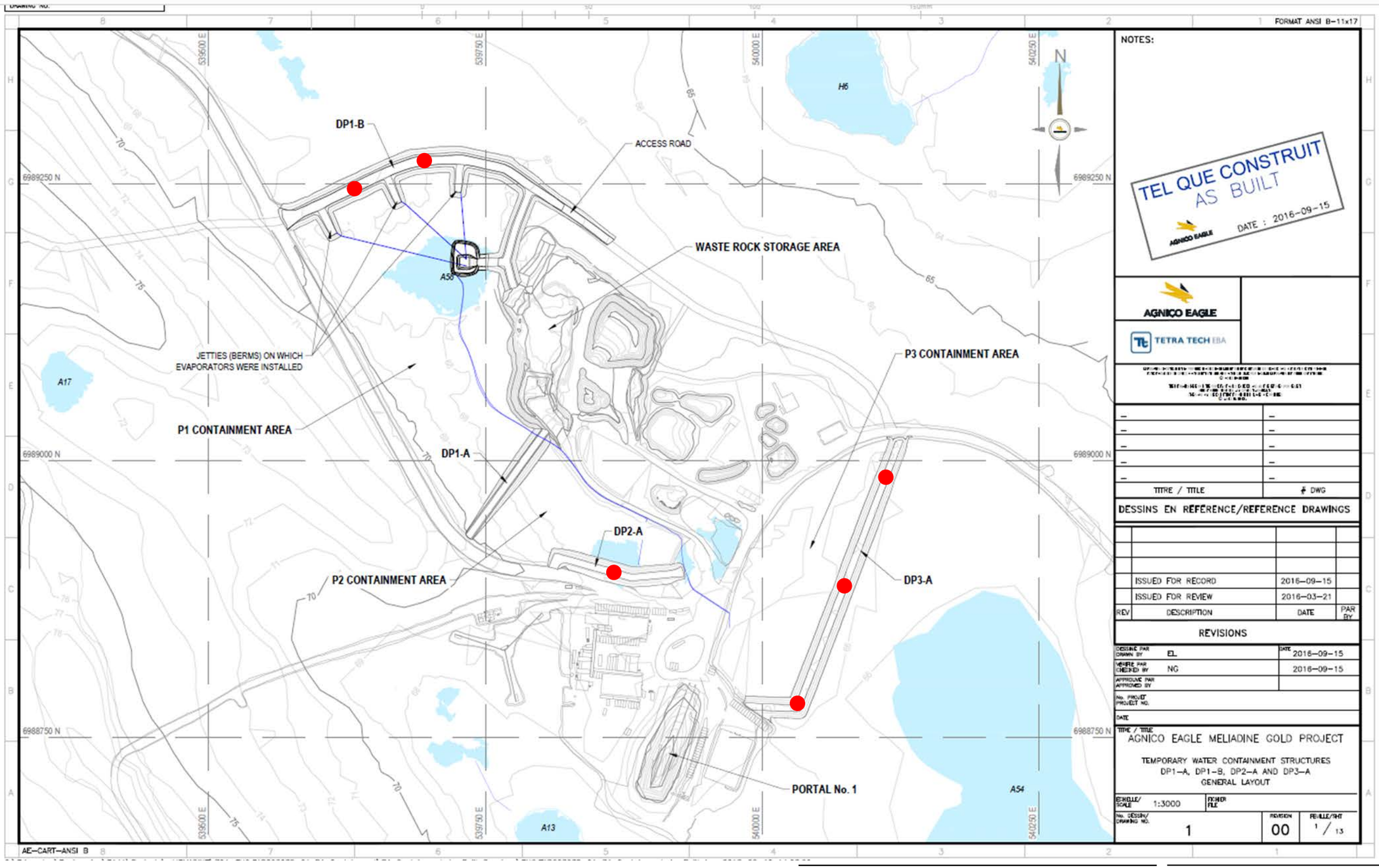
1/11/2017


Node 1 @ Elev. 71
Node 2 @ Elev. 70.5
Node 3 @ Elev. 70
Node 4 @ Elev. 69.5
Node 5 @ Elev. 69
Node 6 @ Elev. 68.5
Node 7 @ Elev. 67.5
Node 8 @ Elev. 66.5
Node 9 @ Elev. 65.5
Node 10 @ Elev. 64.5
Node 11 @ Elev. 63.5
Node 12 @ Elev. 62.5
Node 13 @ Elev. 61
Node 14 @ Elev. 59.5
Node 15 @ Elev. 58
Node 16 @ Elev. 56
Monthly Ambient Temperature
Temperature (°C)
30.0
20.0
10.0
0.0
-10.0
-20.0
-30.0
-40.0
1-Jan-14
1-May-14
29-Aug-14
27-Dec-14
26-Apr-15
24-Aug-15
22-Dec-15
20-Apr-16
18-Aug-16
16-Dec-16
15-Apr-17
13-Aug-17
11-Dec-17
10-Apr-18
Date

APPENDIX C 2

P-Area, D-CP1, and D-CP5 Thermistor Locations and Data



NOTES:

TEL QUE CONSTRUIT
AS BUILT
AGNICO EAGLE
DATE : 2016-09-15

AGNICO EAGLE

TETRA TECH EBA

–	–
–	–
–	–
–	–
–	–
TITRE / TITLE	# DWG

DESSINS EN RÉFÉRENCE/REFERENCE DRAWINGS

REV	DESCRIPTION	DATE	PAR BY
	ISSUED FOR RECORD	2016-09-15	
	ISSUED FOR REVIEW	2016-03-21	

REVISIONS

DESSINÉ PAR / DRAWN BY	EL	2016-09-15
VÉRIFIÉ PAR / CHECKED BY	NG	2016-09-15
APPROUVÉ PAR / APPROVED BY		
No. PROJET / PROJECT NO.		
DATE		

TITRE / TITLE
AGNICO EAGLE MELIADINE GOLD PROJECT

TEMPORARY WATER CONTAINMENT STRUCTURES
DP1-A, DP1-B, DP2-A AND DP3-A
GENERAL LAYOUT

ÉCHELLE/SCALE	FICHIER/FILE
1:3000	

No. DESSIN/DRAWING NO.	REVISION	FEUILLE/SHT
1	00	1 / 13

FORMAT ANSI B–11x17

AE–CART–ANSI B

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

Base Drawing from:
Tetra Tech. 2016. Meliadine P-Area Containment Construction Record Report. Prepared for Agnico Eagle Mines Limited. September 2016. Document No. 6515-C-230-002.

CLIENT
AGNICO-EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-21
PREPARED	CP
DESIGN	-
REVIEW	FE
APPROVED	ACI

PROJECT
Meliadine Gold Project
Rankin Inlet, Nunavut

TITLE
APPROXIMATE P-AREA VERTICAL THERMISTOR LOCATIONS

PROJECT No.	PHASE	Rev.	FIGURE
1660296	**3000**	**0**	C3

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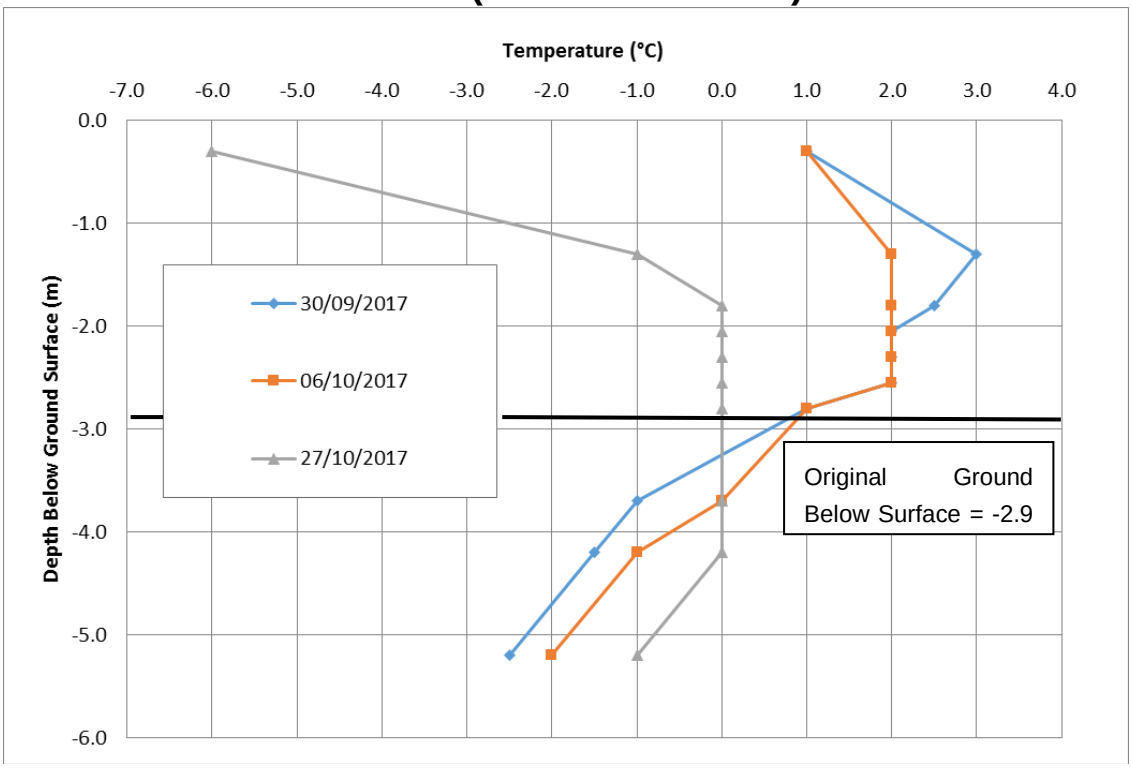

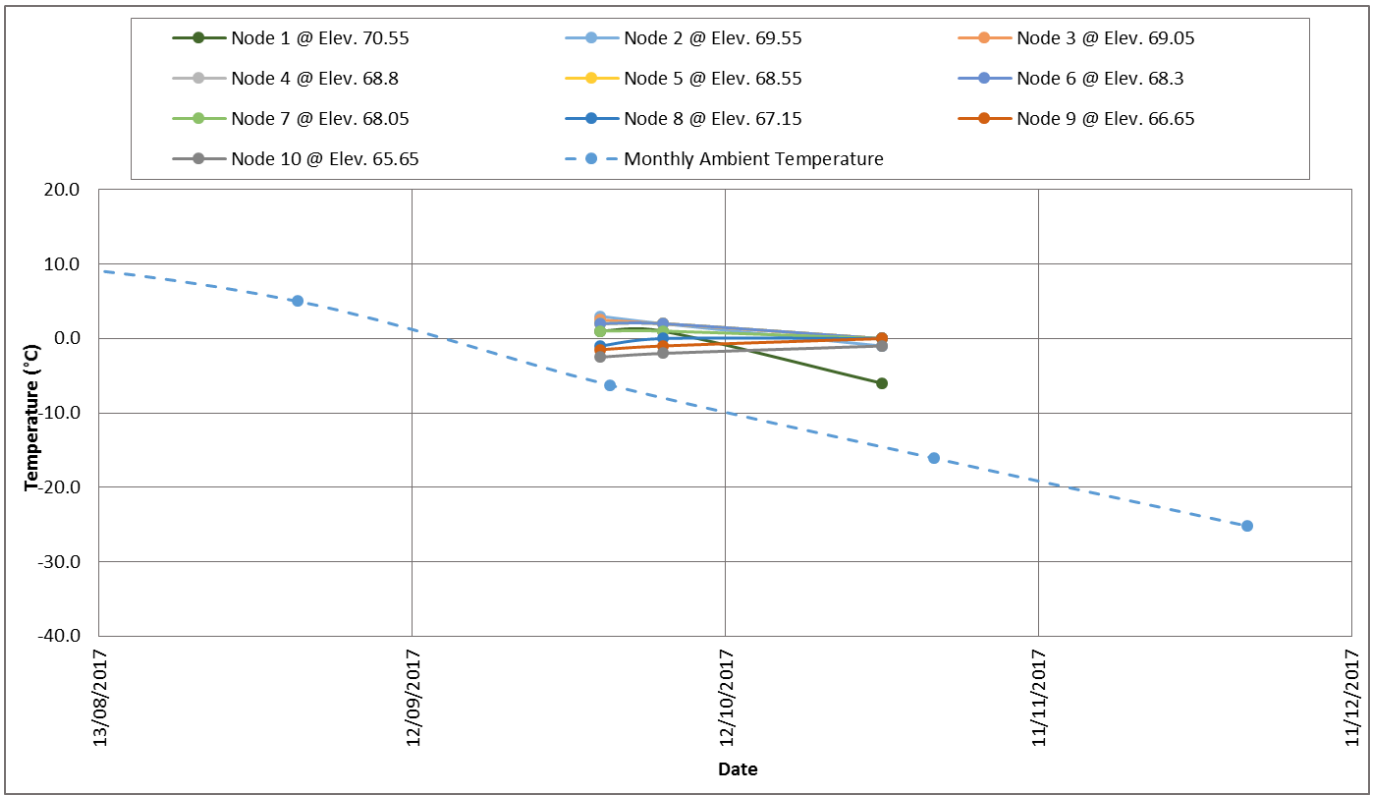

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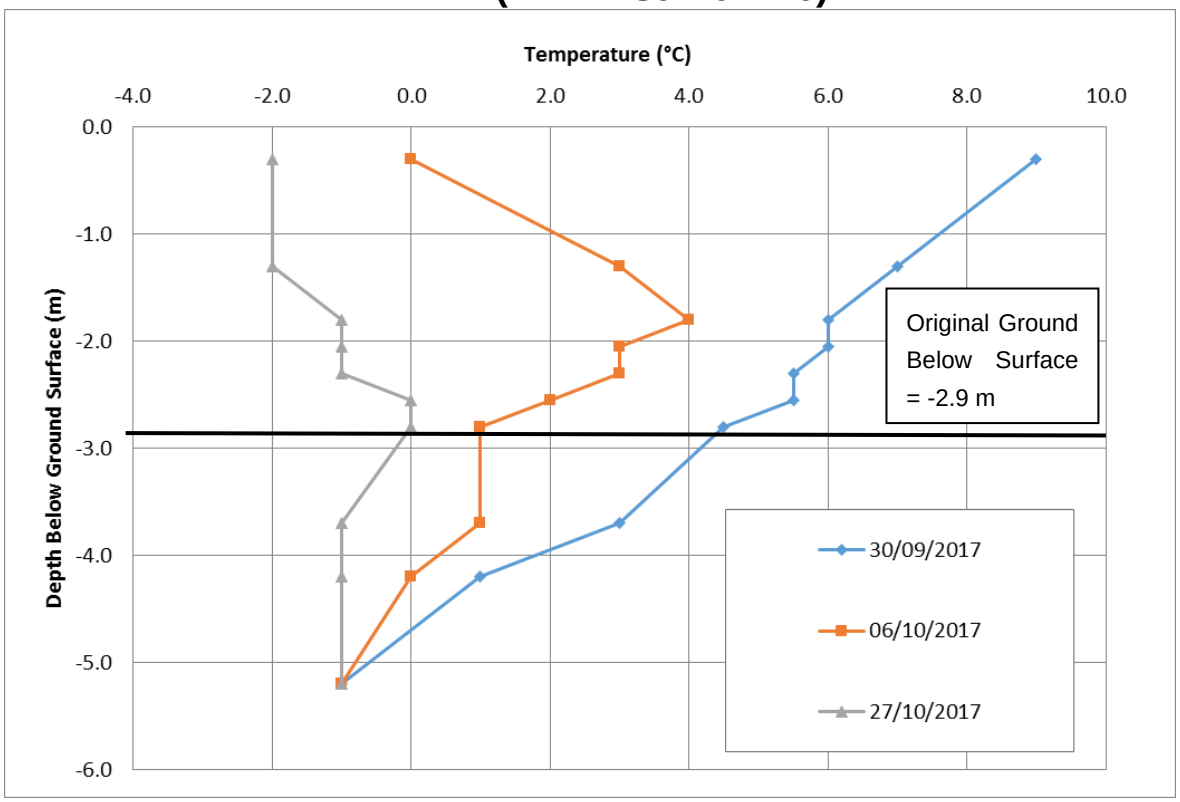

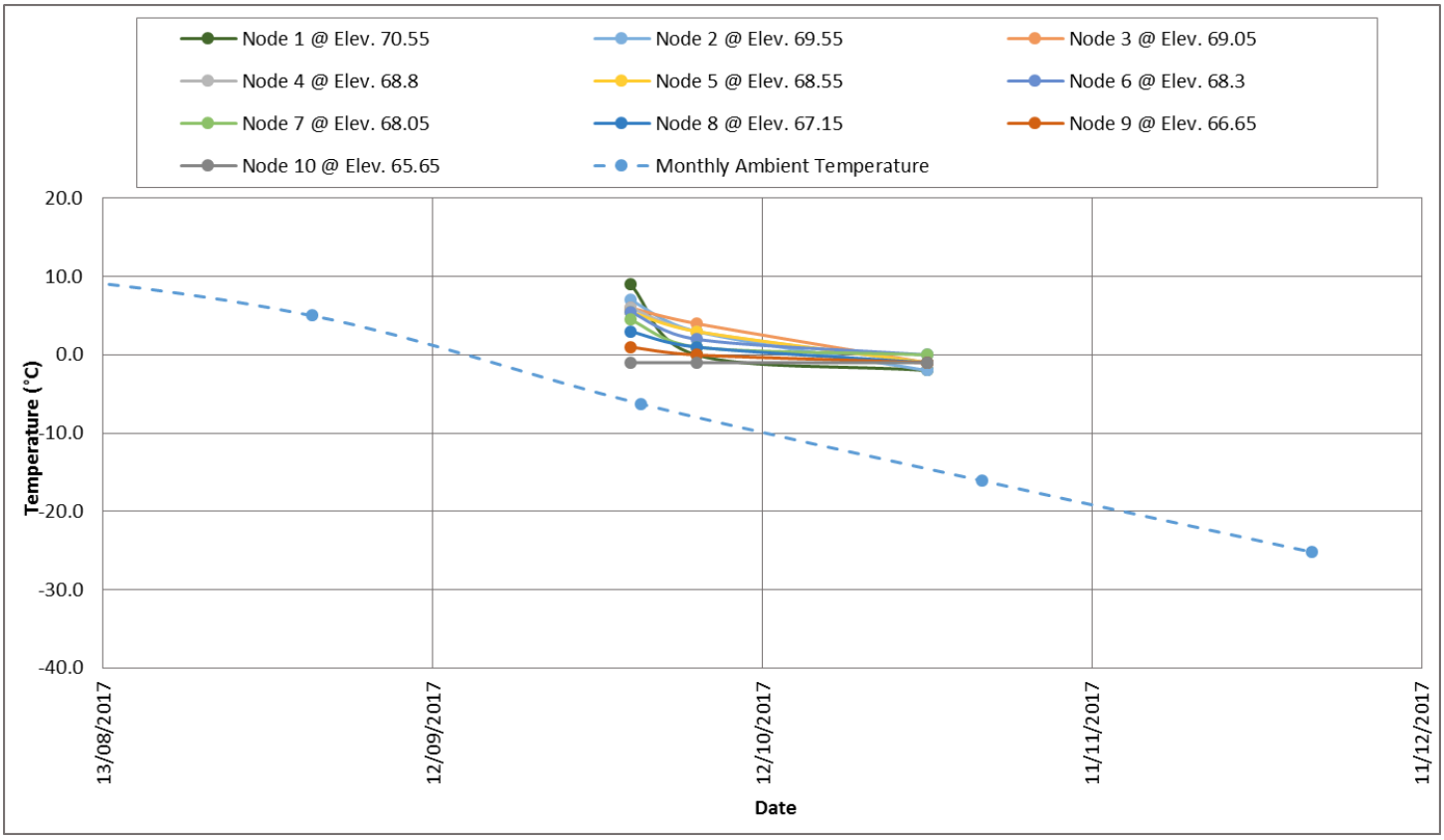

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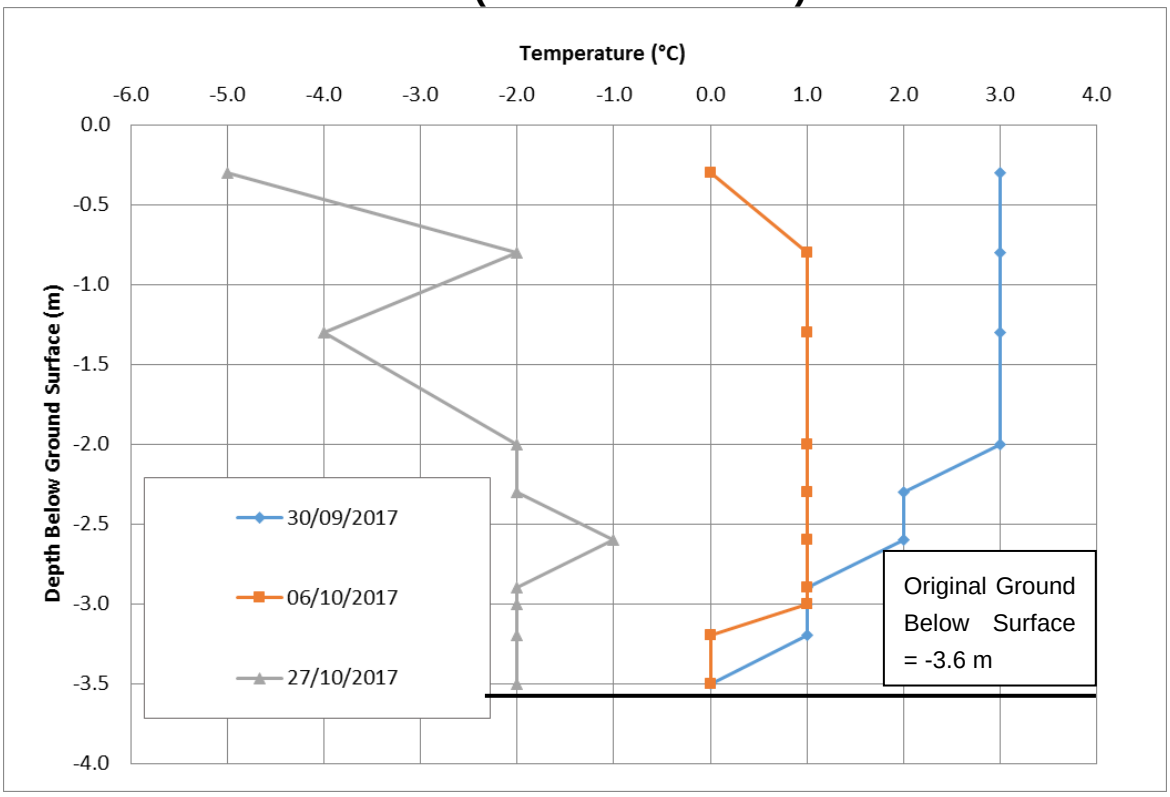

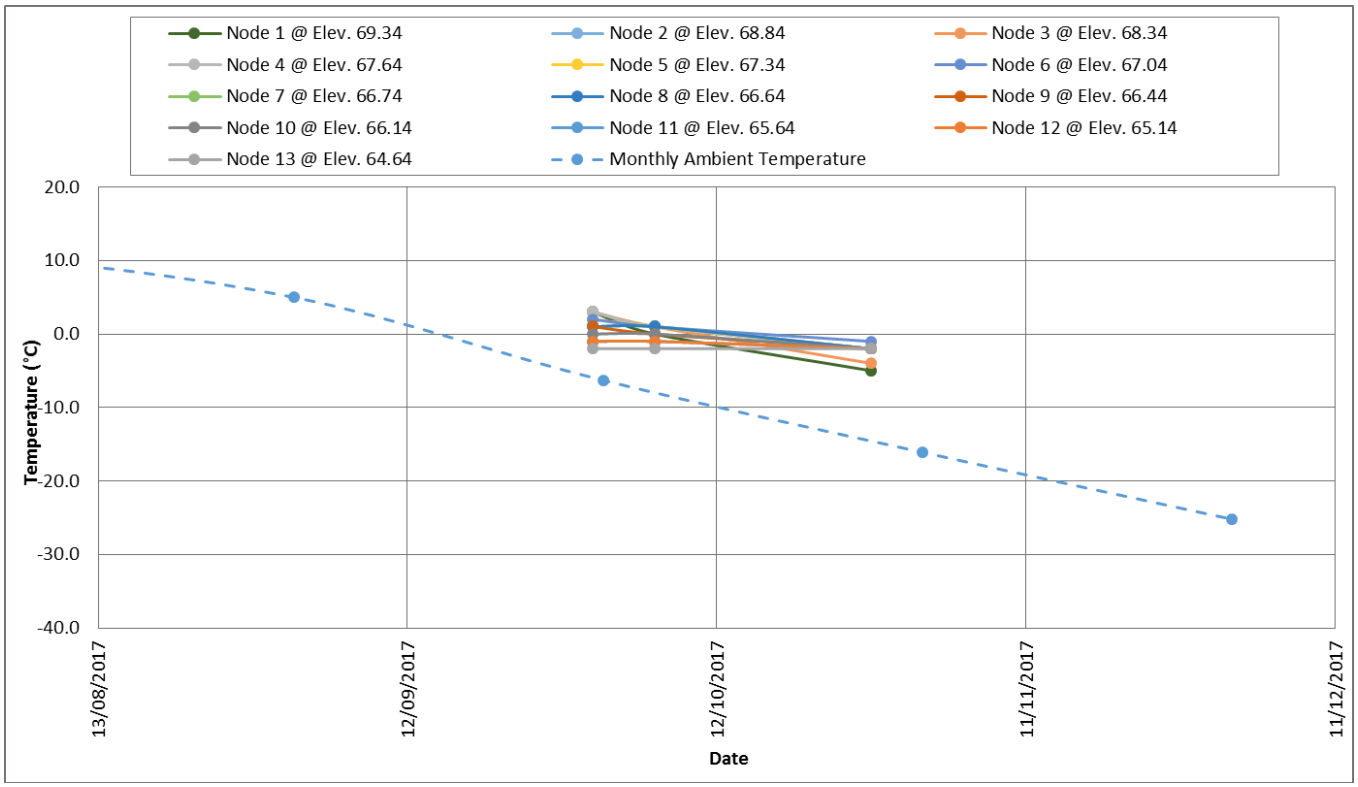

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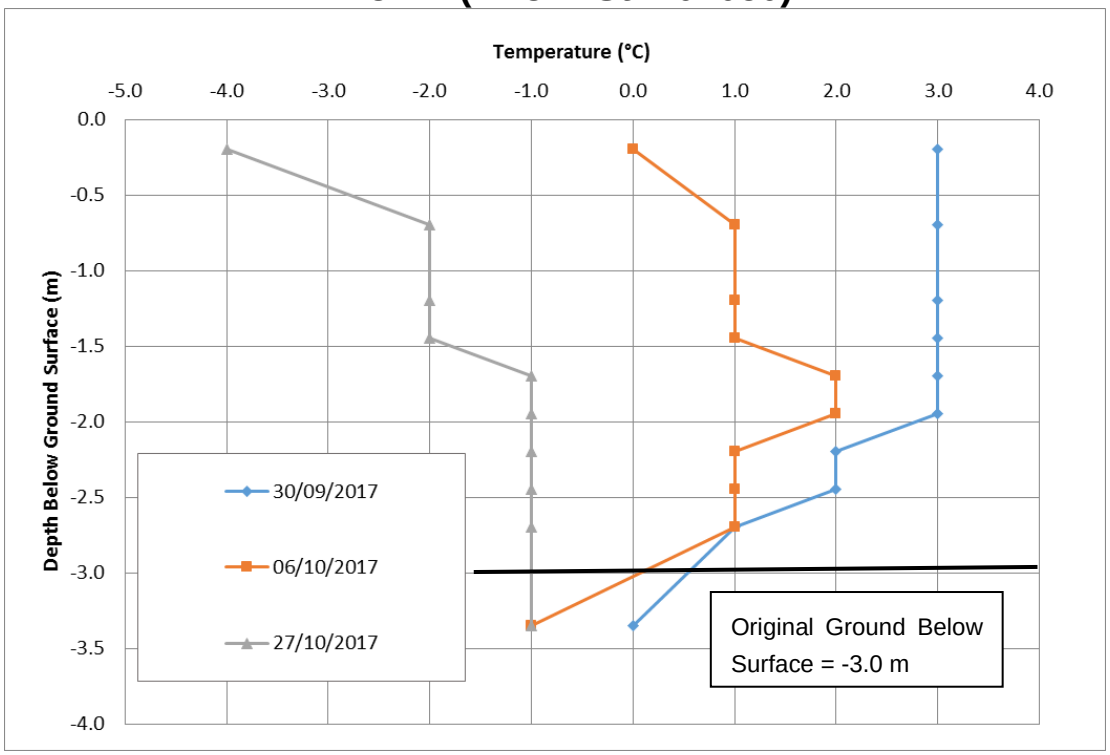

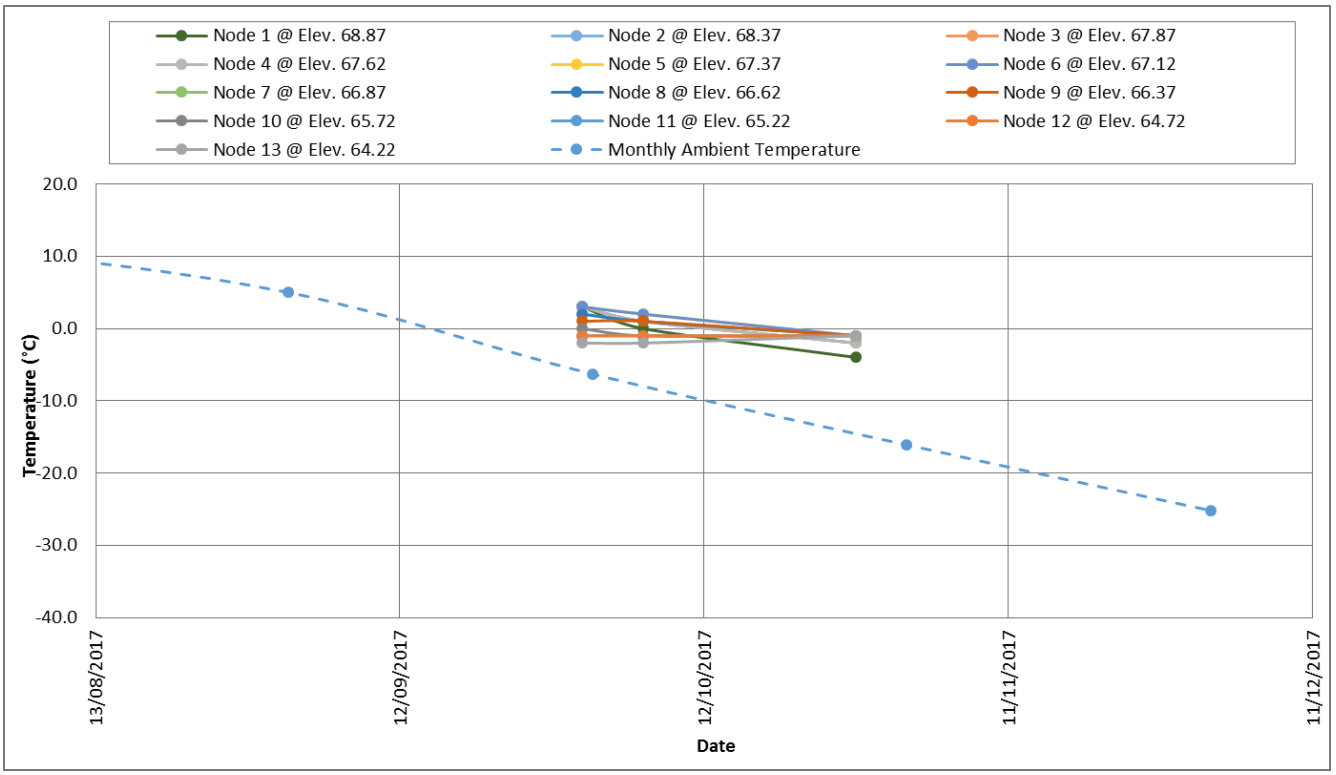

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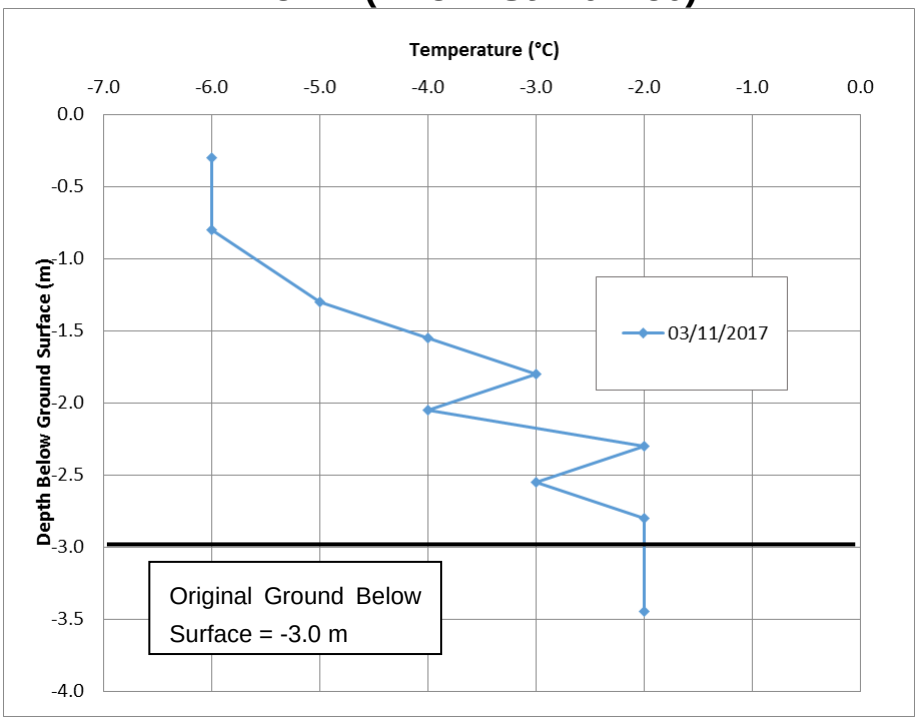

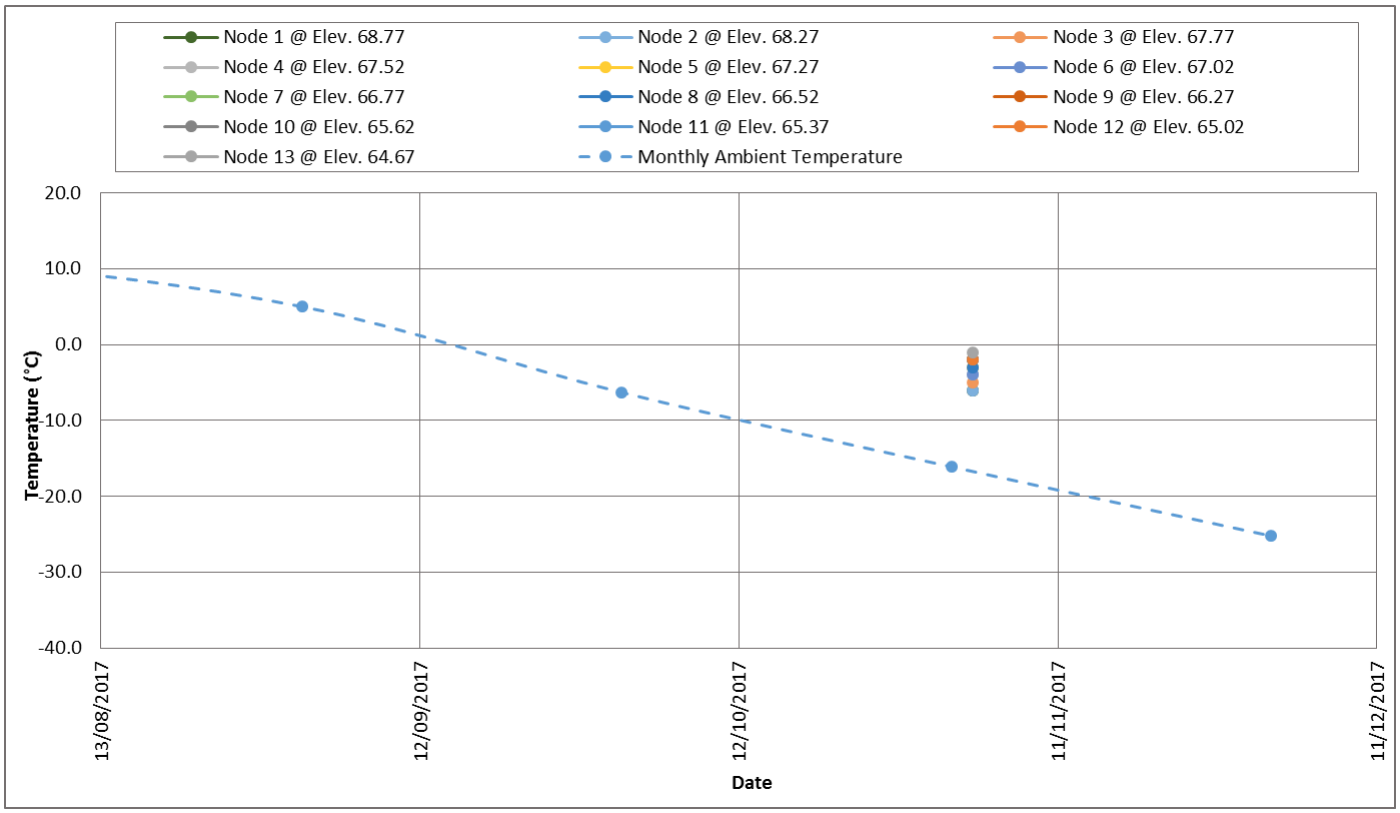

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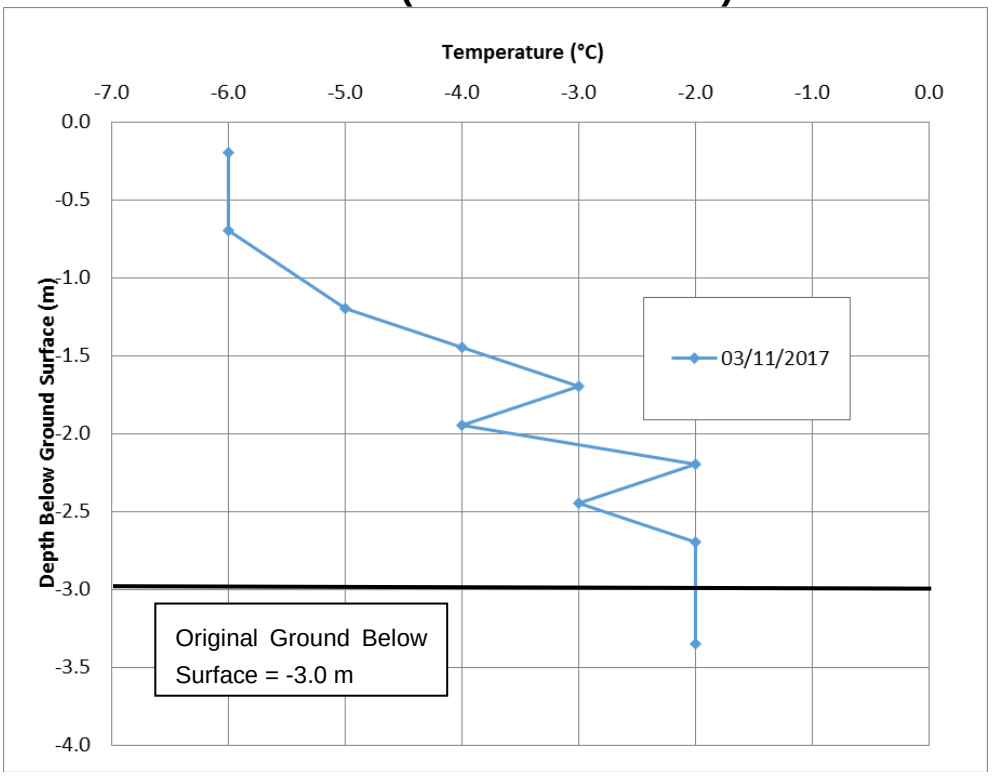
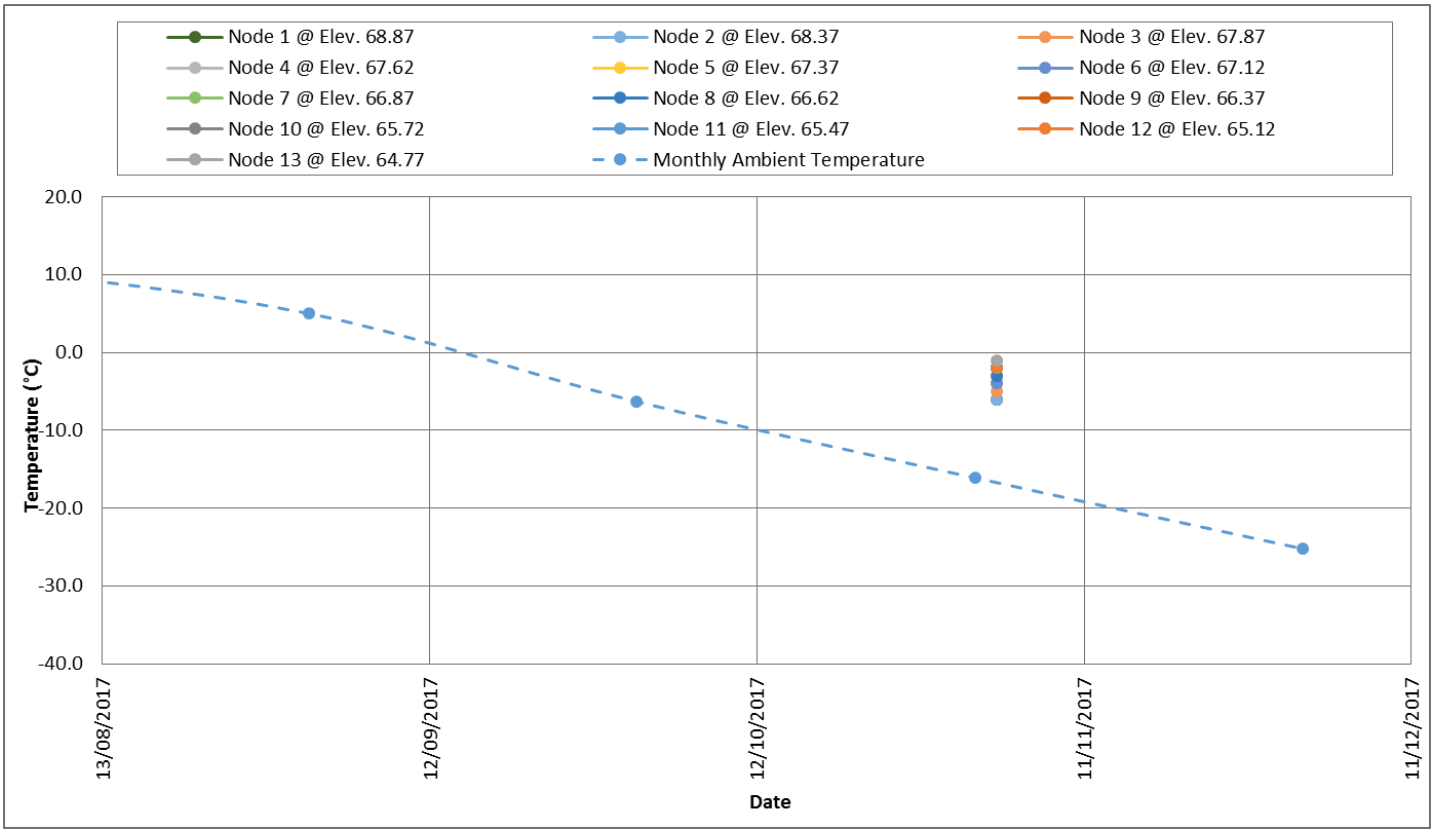
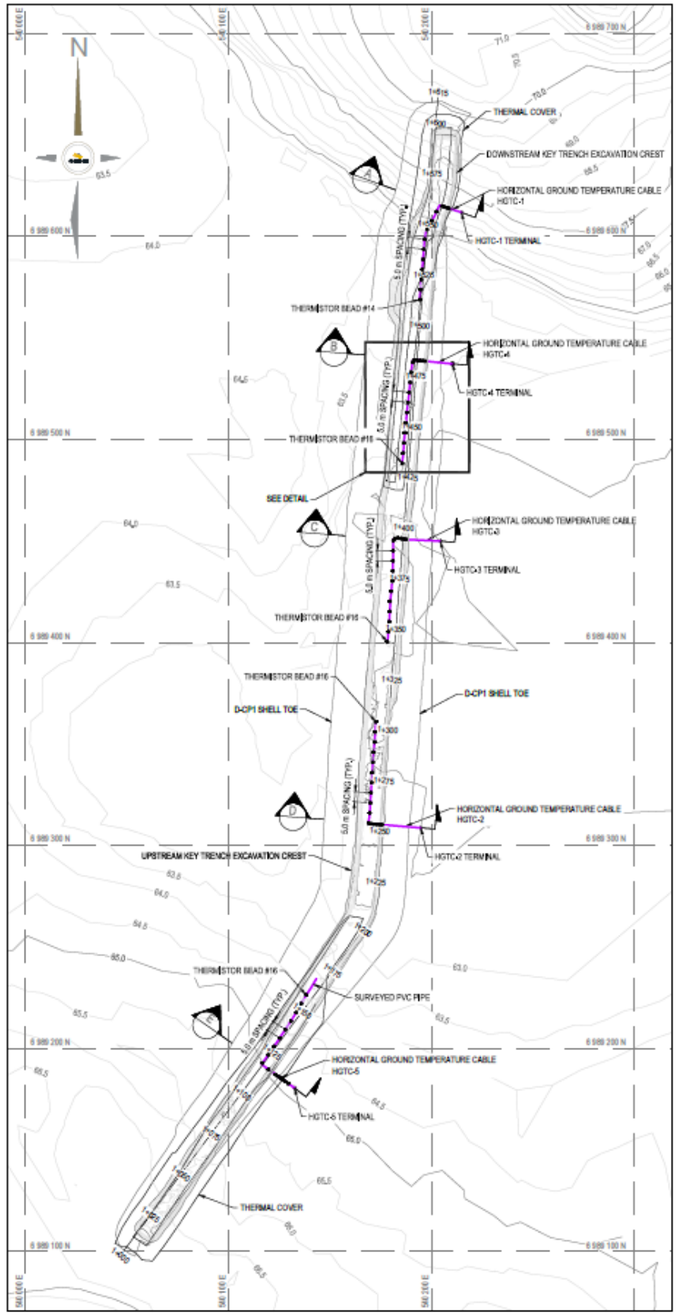
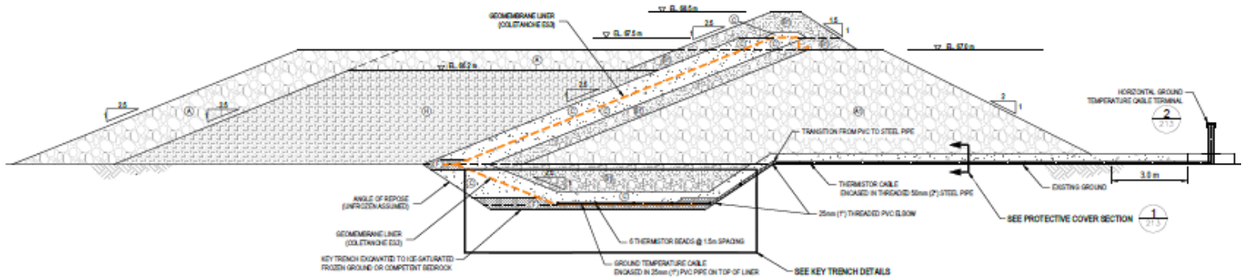


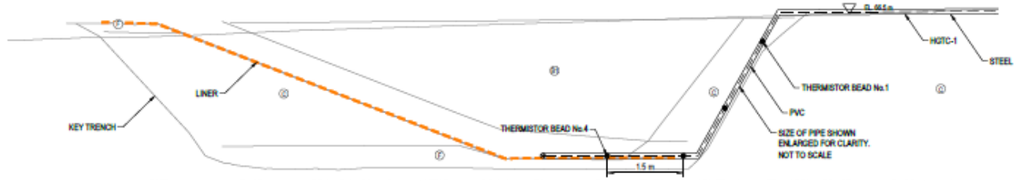




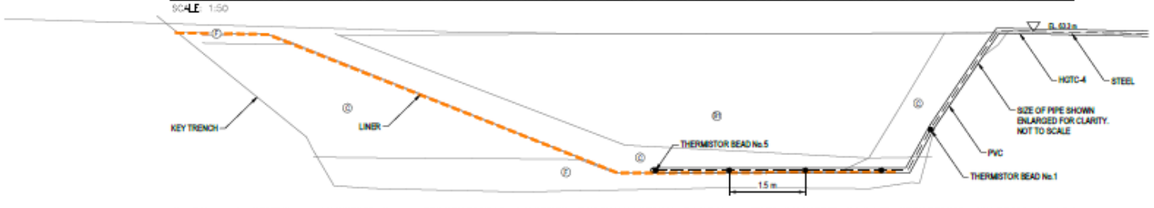
D-CP1 AS-BUILT HORIZONTAL GROUND TEMPERATURE CABLE LAYOUT
SCALE 1:1250



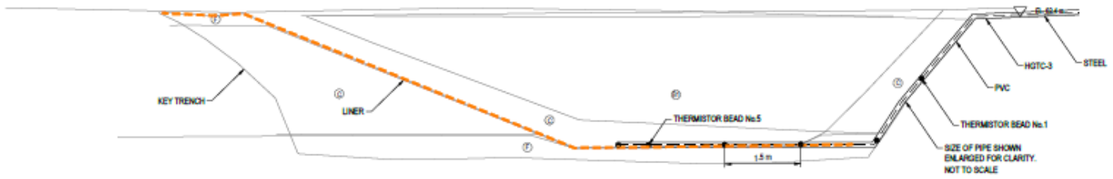
D-CP1 HORIZONTAL GROUND TEMPERATURE CABLE - DESIGN TYPICAL SECTION
SCALE 1:100



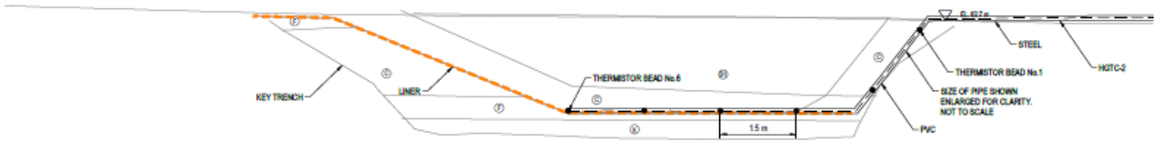
D-CP1 AS-BUILT - SECTION A - HORIZONTAL GROUND TEMPERATURE CABLE - KEY TRENCH DETAIL THROUGH STATION 1+562
SCALE 1:50



D-CP1 AS-BUILT - SECTION B - HORIZONTAL GROUND TEMPERATURE CABLE - KEY TRENCH DETAIL THROUGH STATION 1+482
SCALE 1:50



D-CP1 AS-BUILT - SECTION C - HORIZONTAL GROUND TEMPERATURE CABLE - KEY TRENCH DETAIL THROUGH STATION 1+394
SCALE 1:50



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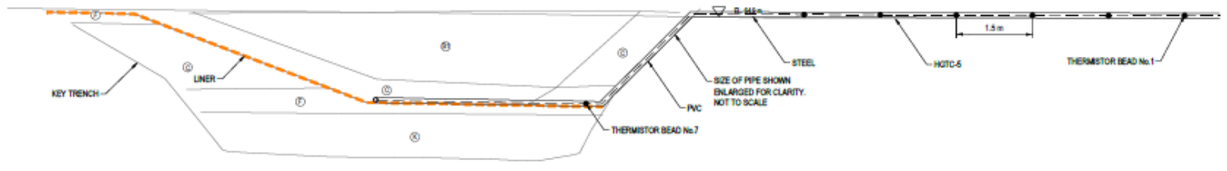
SCALE 1:50



D-CP1 AS-BUILT - SECTION E - HORIZONTAL GROUND TEMPERATURE CABLE - KEY TRENCH DETAIL THROUGH STATION 1+117
SCALE 1:50

Reference:

Tetra Tech. 2017. Construction Summary (as-built) Report Dike D-CP1, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Limited. October 2017. Document No. 6515-E-132-007-132-REP-012.

CLIENT
AGNICO-EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-21
PREPARED	CP
DESIGN	-
REVIEW	FE
APPROVED	ACI

PROJECT
Meliadine Gold Project
Rankin Inlet, Nunavut

TITLE
D-CP1 AS-BUILT INSTRUMENTATION PLAN AND DETAILS FOR HORIZONTAL GROUND TEMPERATURE CABLES

PROJECT No.	PHASE	Rev.	FIGURE
1660296	**3000**	**0**	C4

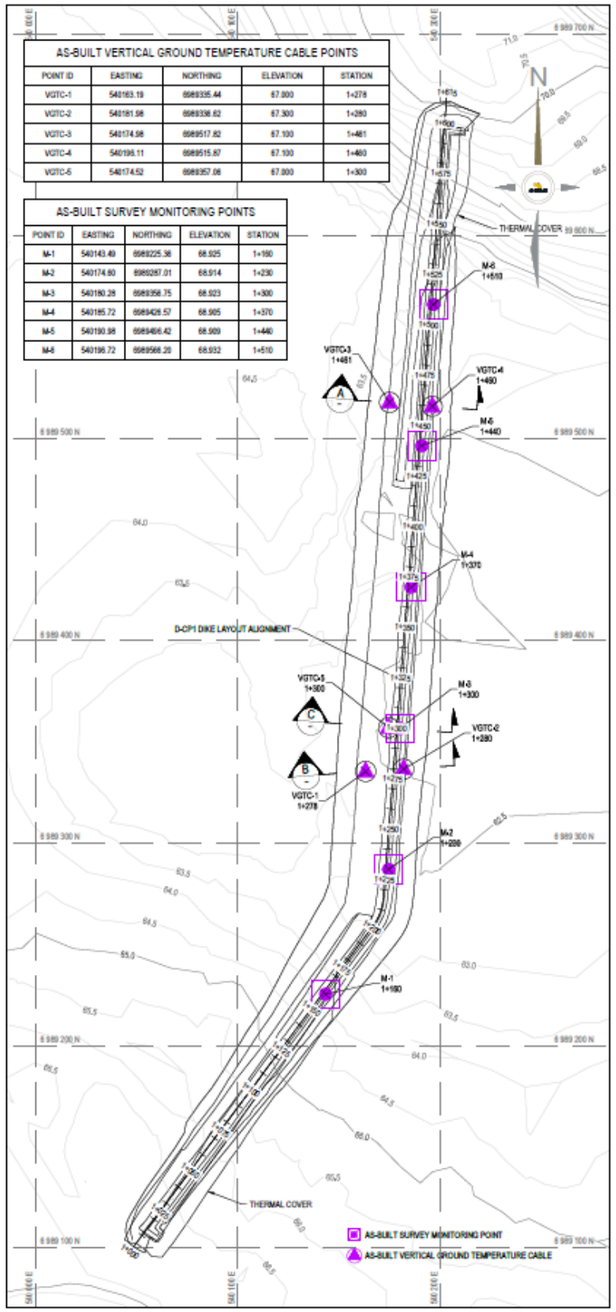
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

AS-BUILT VERTICAL GROUND TEMPERATURE CABLE POINTS

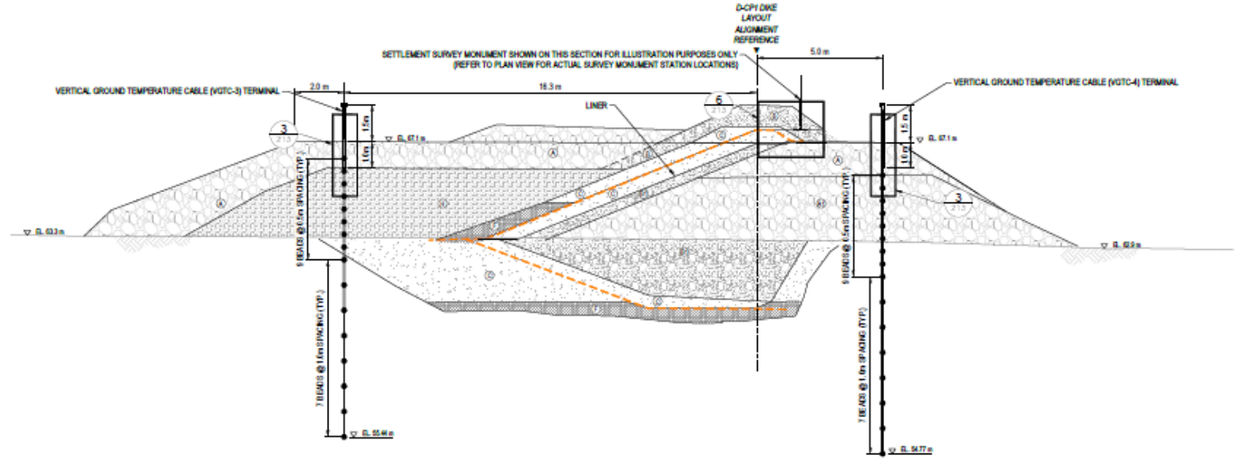
POINT ID	EASTING	NORTHING	ELEVATION	STATION
VGTC-1	540163.19	6989335.44	67.800	1+278
VGTC-2	540161.98	6989336.82	67.300	1+280
VGTC-3	540174.98	6989517.82	67.100	1+481
VGTC-4	540196.11	6989515.87	67.100	1+480
VGTC-5	540174.52	6989357.06	67.800	1+300

AS-BUILT SURVEY MONITORING POINTS

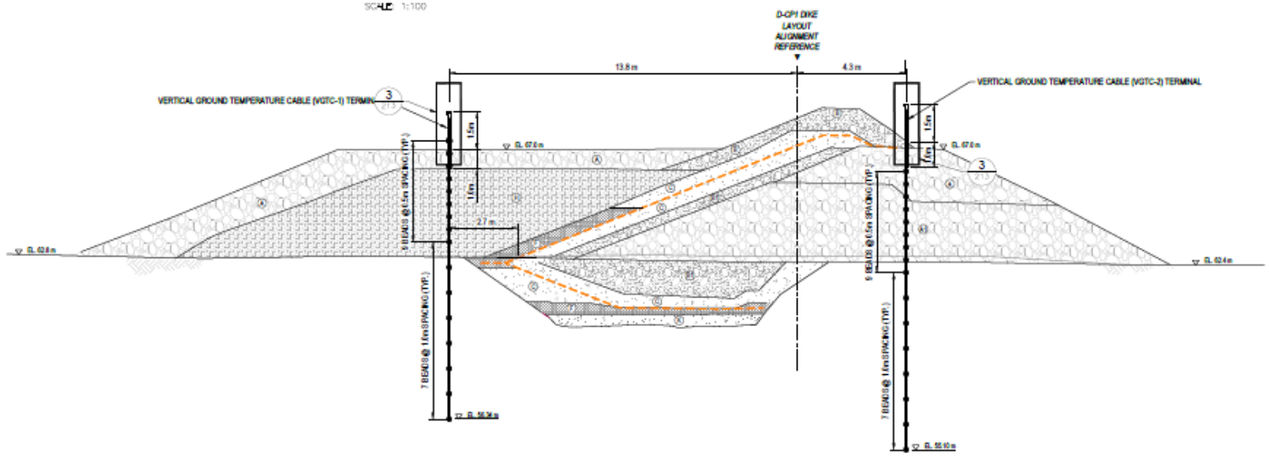
POINT ID	EASTING	NORTHING	ELEVATION	STATION
M-1	540143.49	6989225.36	68.925	1+190
M-2	540174.80	6989287.01	68.914	1+230
M-3	540180.28	6989356.75	68.923	1+300
M-4	540185.72	6989426.57	68.905	1+370
M-5	540190.98	6989496.42	68.909	1+440
M-6	540196.72	6989566.20	68.932	1+510



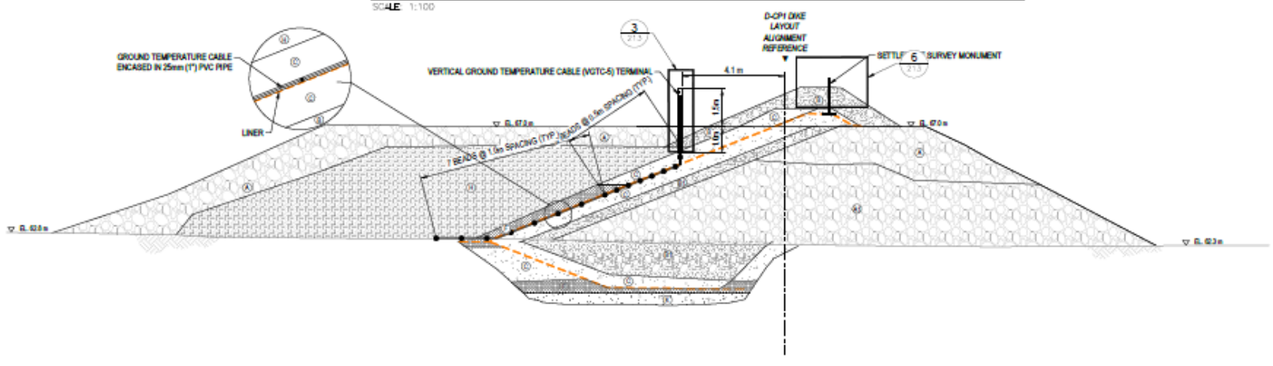
D–CP1 AS–BUILT SURVEY MONUMENT AND VERTICAL GROUND TEMPERATURE CABLE LAYOUT
SCALE 1:1250



D–CP1 – AS–BUILT – SECTION A – VERTICAL GROUND TEMPERATURE CABLE – STATION 1+460
SCALE 1:100



D–CP1 AS–BUILT – SECTION B – VERTICAL GROUND TEMPERATURE CABLE – STATION 1+279
SCALE 1:100



D–CP1 – AS–BUILT – SECTION C – VERTICAL GROUND TEMPERATURE CABLE – STATION 1+300
SCALE 1:100

Reference:

Tetra Tech. 2017. Construction Summary (as-built) Report Dike D-CP1, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Limited. October 2017. Document No. 6515-E-132-007-132-REP-012.

CLIENT
AGNICO-EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-21
PREPARED	CP
DESIGN	-
REVIEW	FE
APPROVED	ACI

PROJECT
Meliadine Gold Project
Rankin Inlet, Nunavut

TITLE
D-CP1 AS-BUILT INSTRUMENTATION PLAN AND DETAILS FOR VERTICAL GROUND TEMPERATURE CABLES AND SETTLEMENT SURVEY MONUMENT POINTS

PROJECT No.	PHASE	Rev.	FIGURE
1660296	3000	0	C5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

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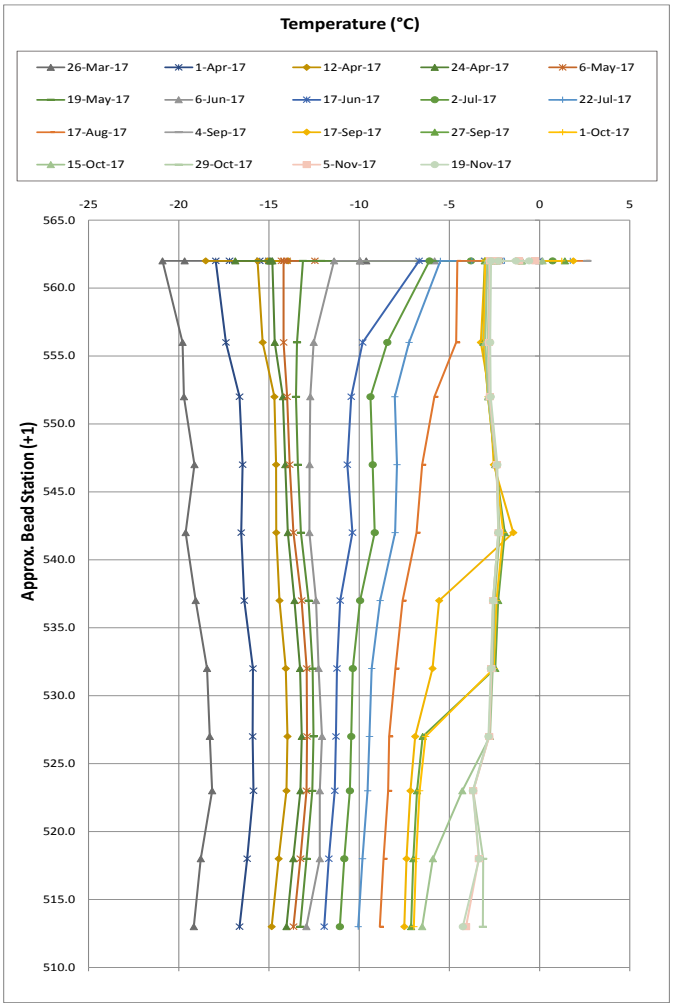

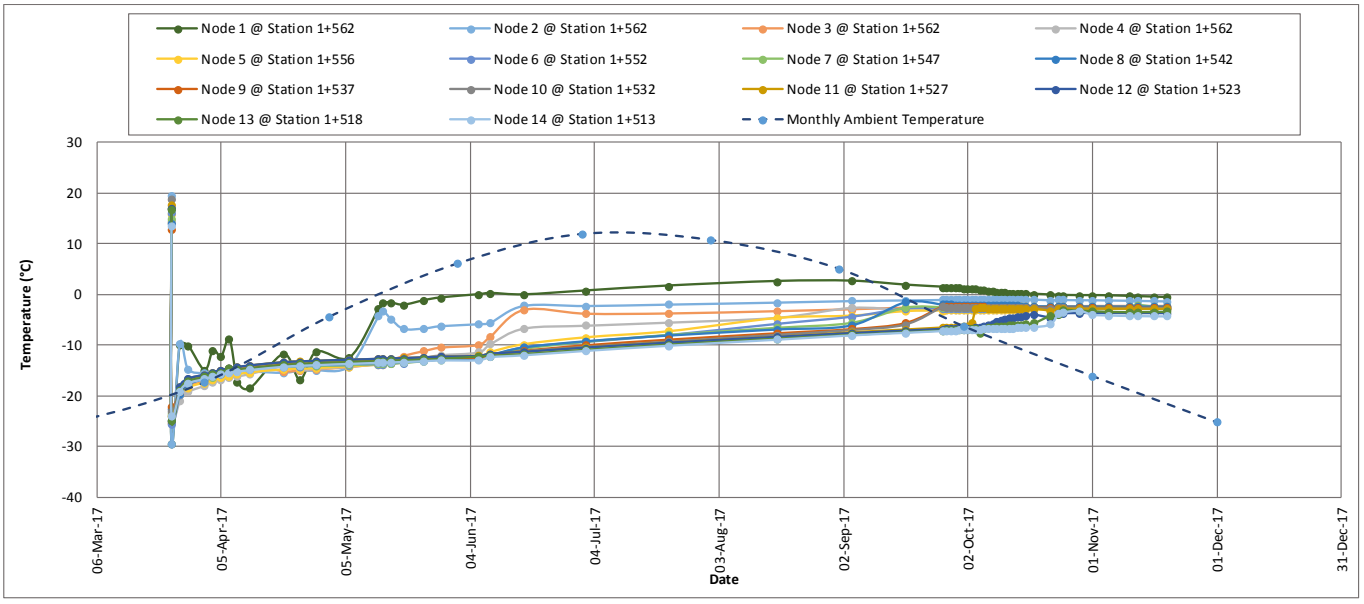

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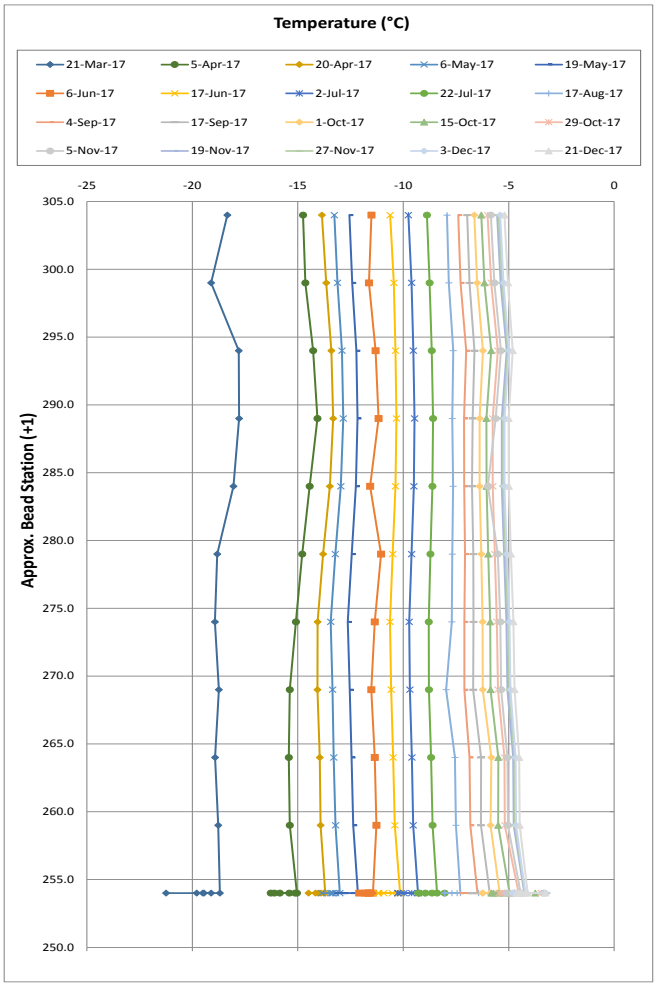

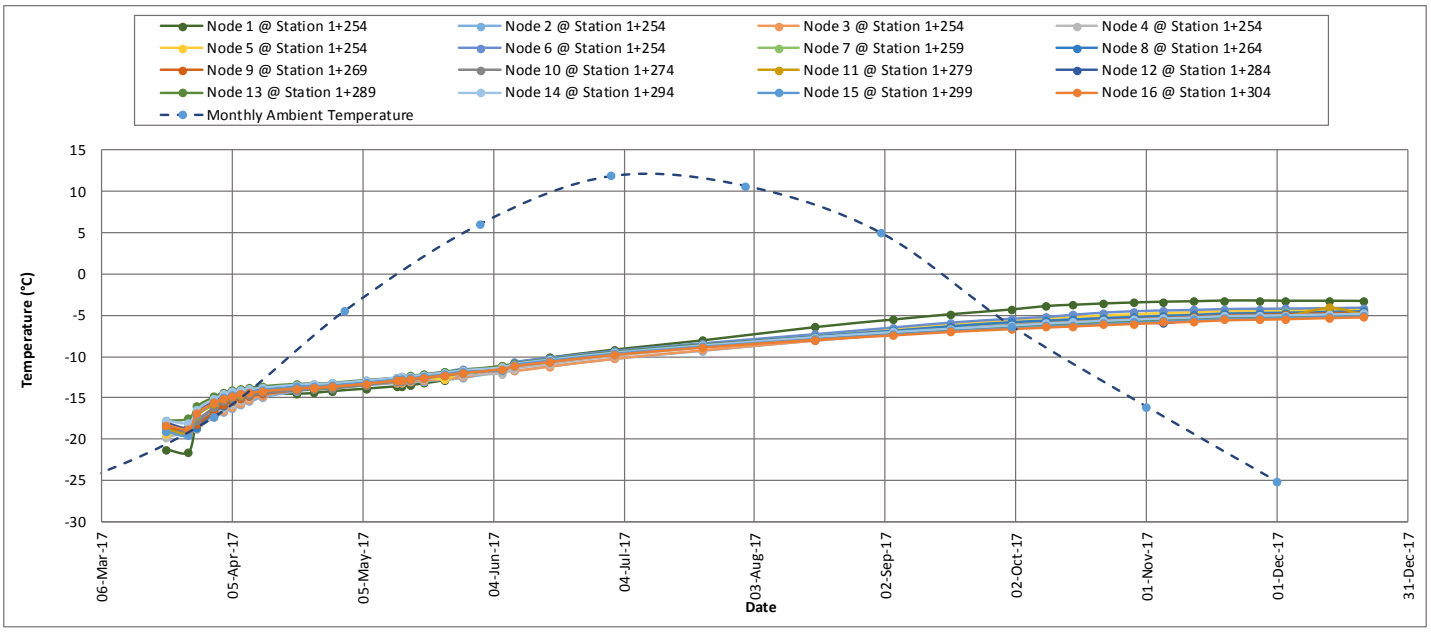

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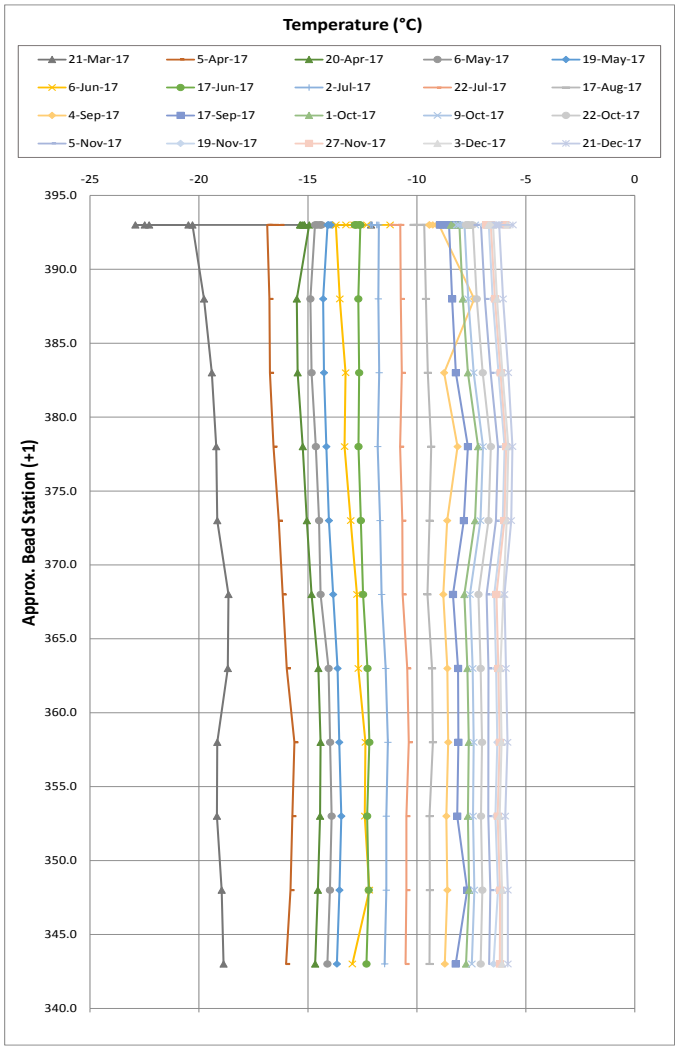

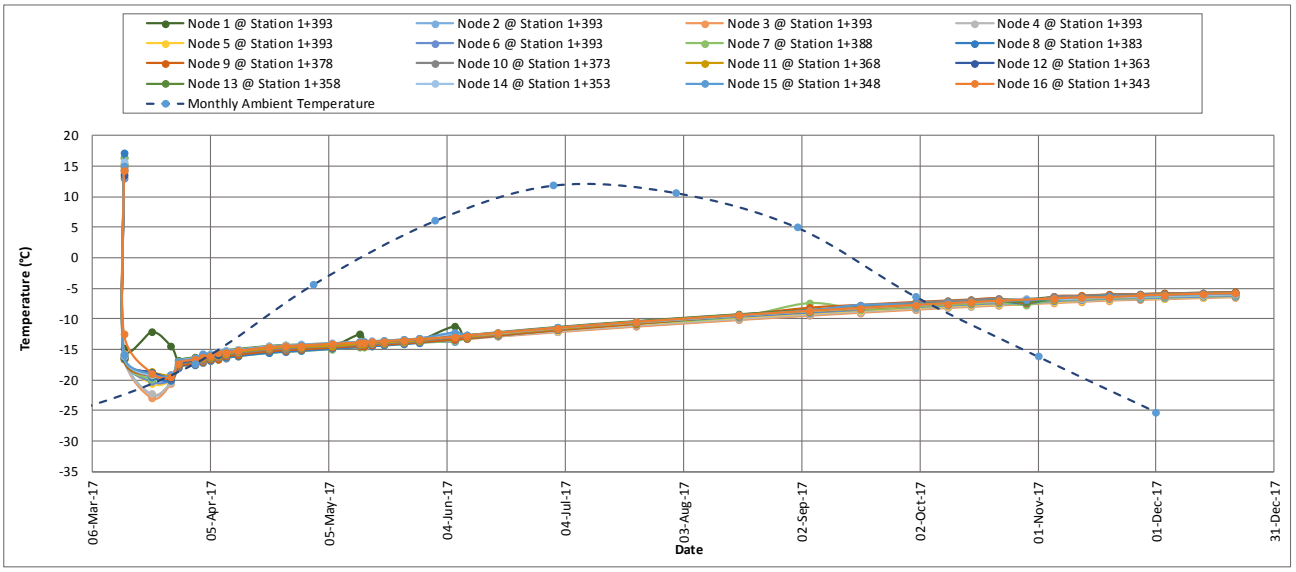

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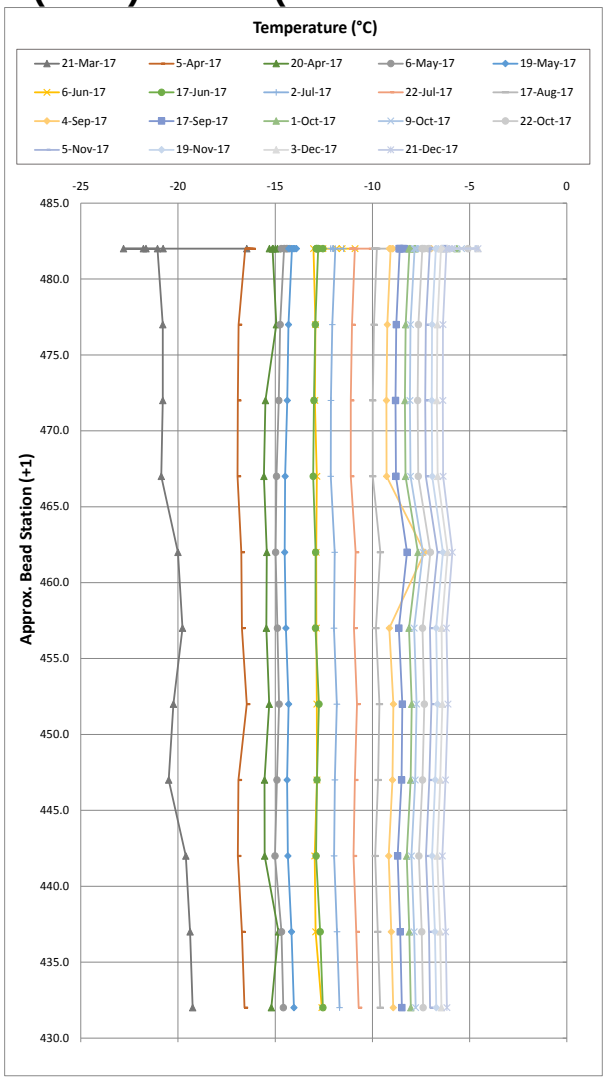

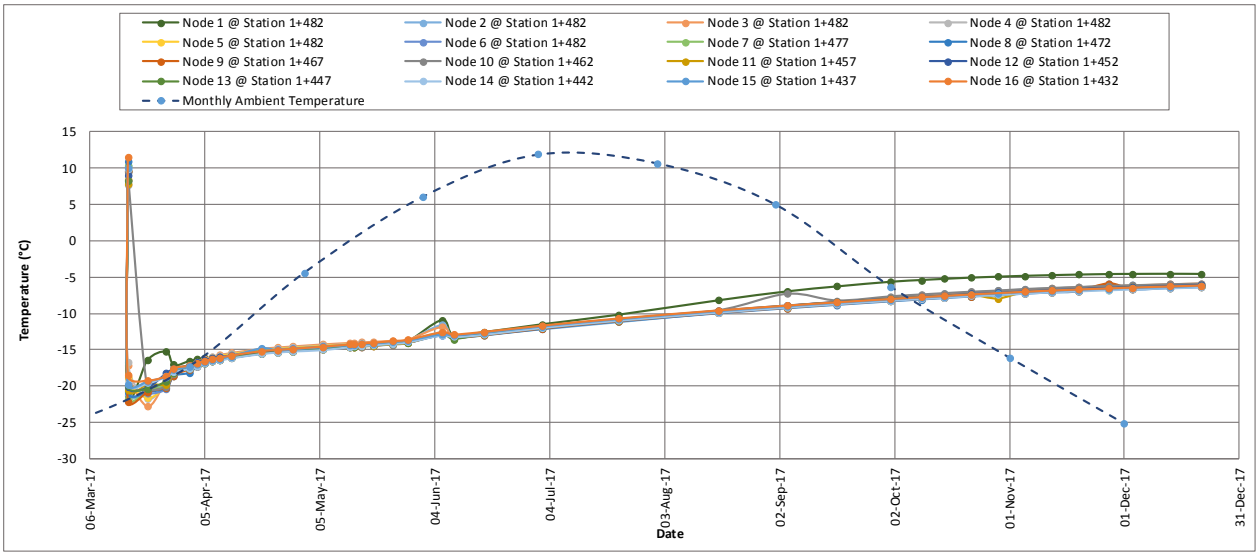

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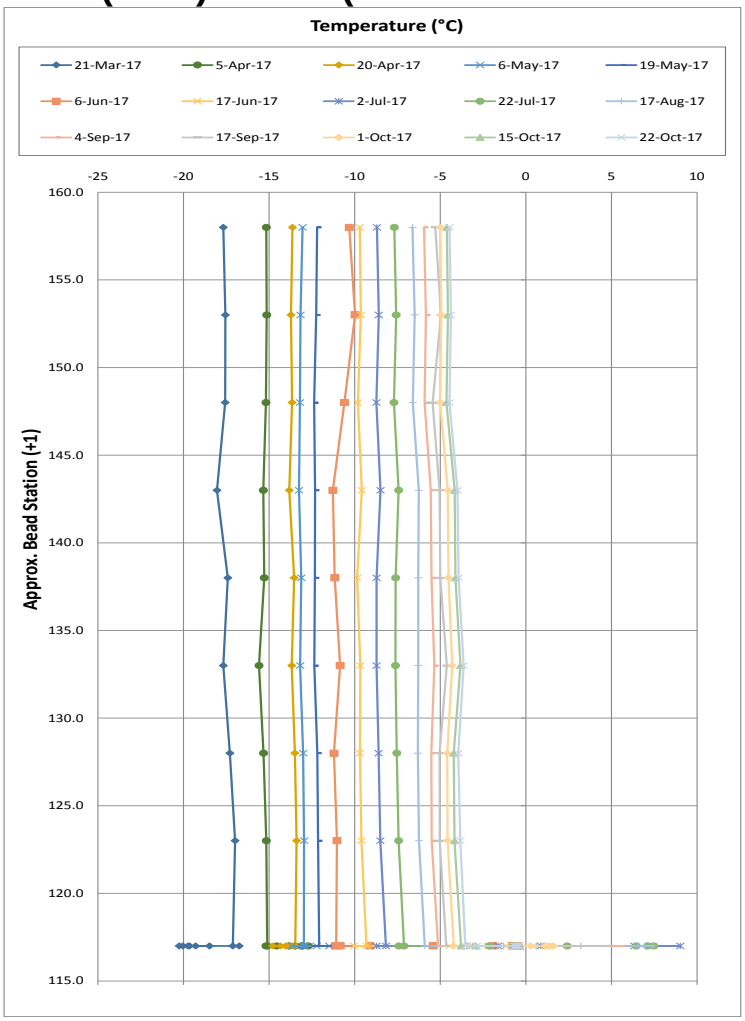
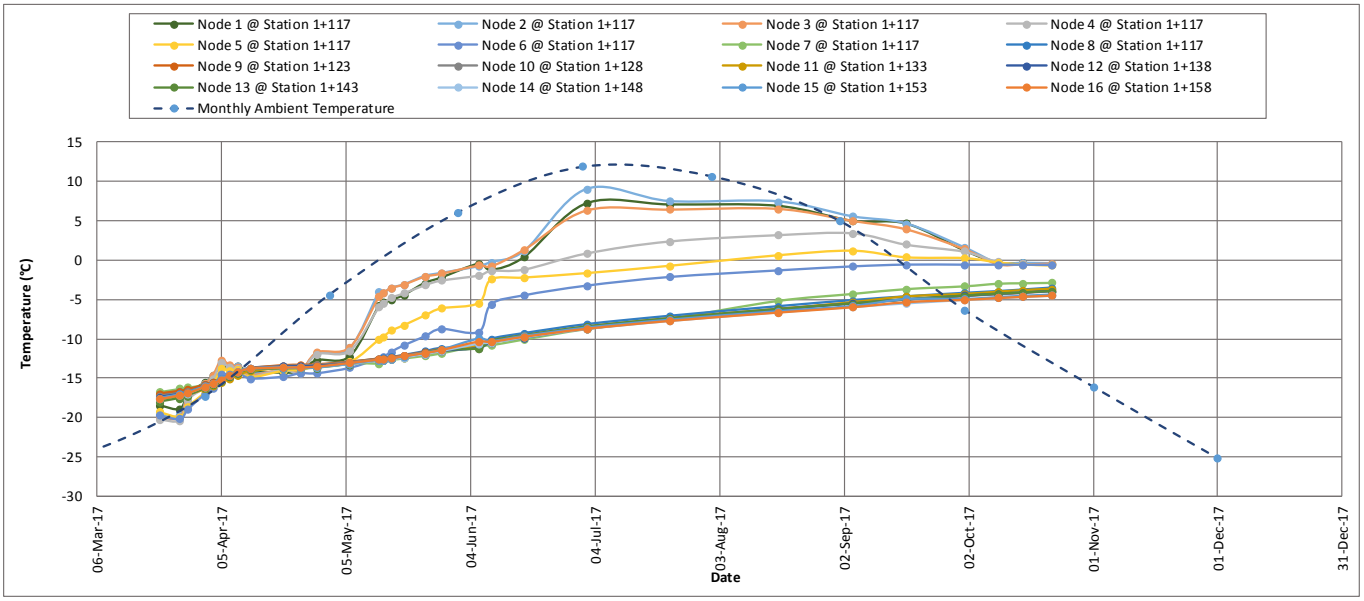
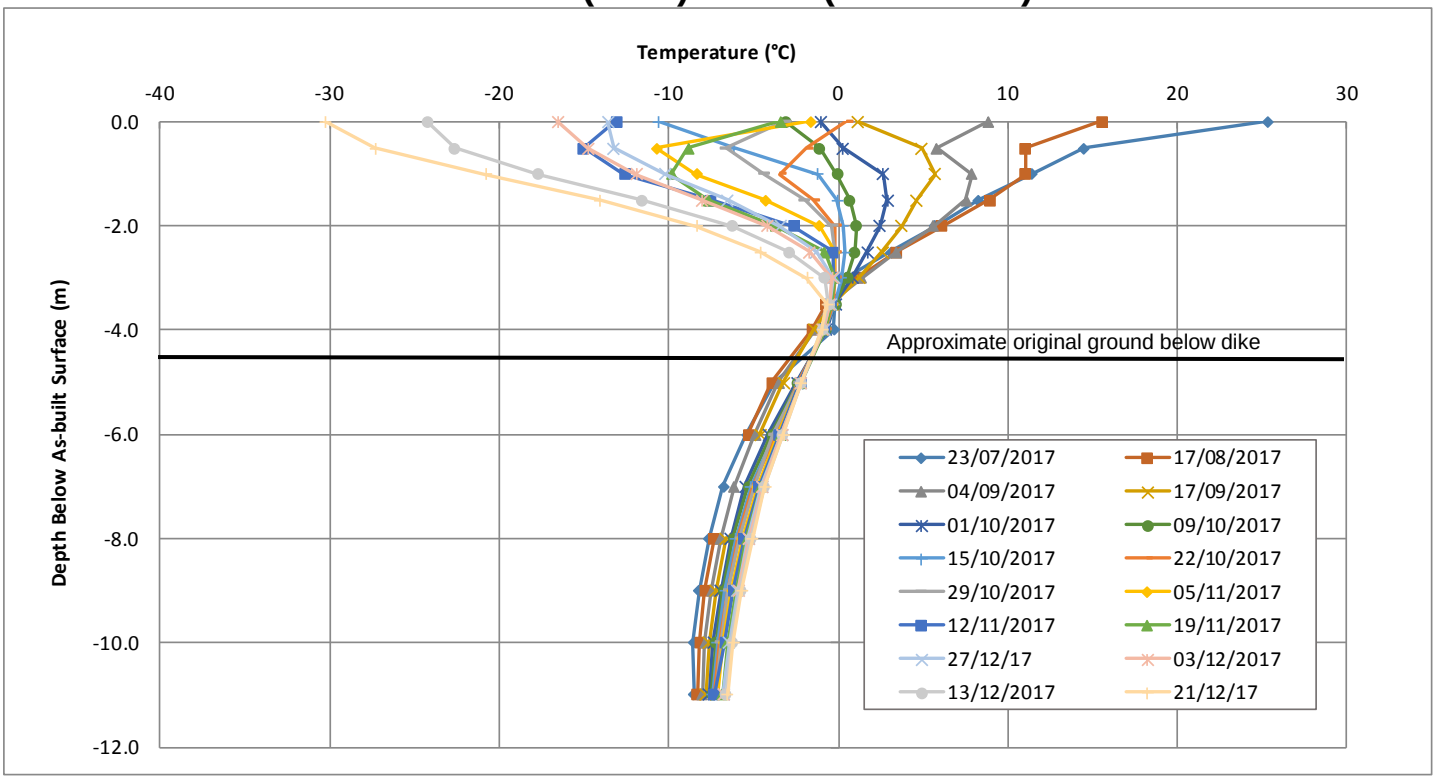
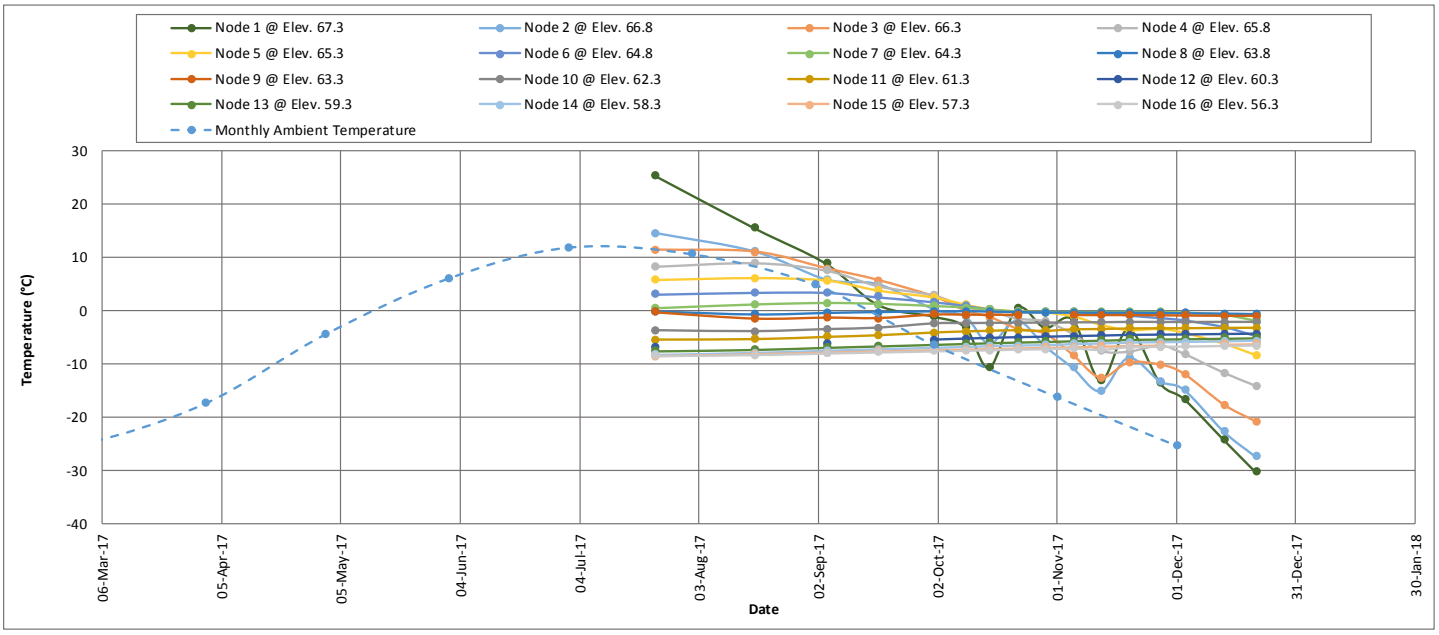




VGTC-01 (2626) D-CP1 (Stn. 1+278)





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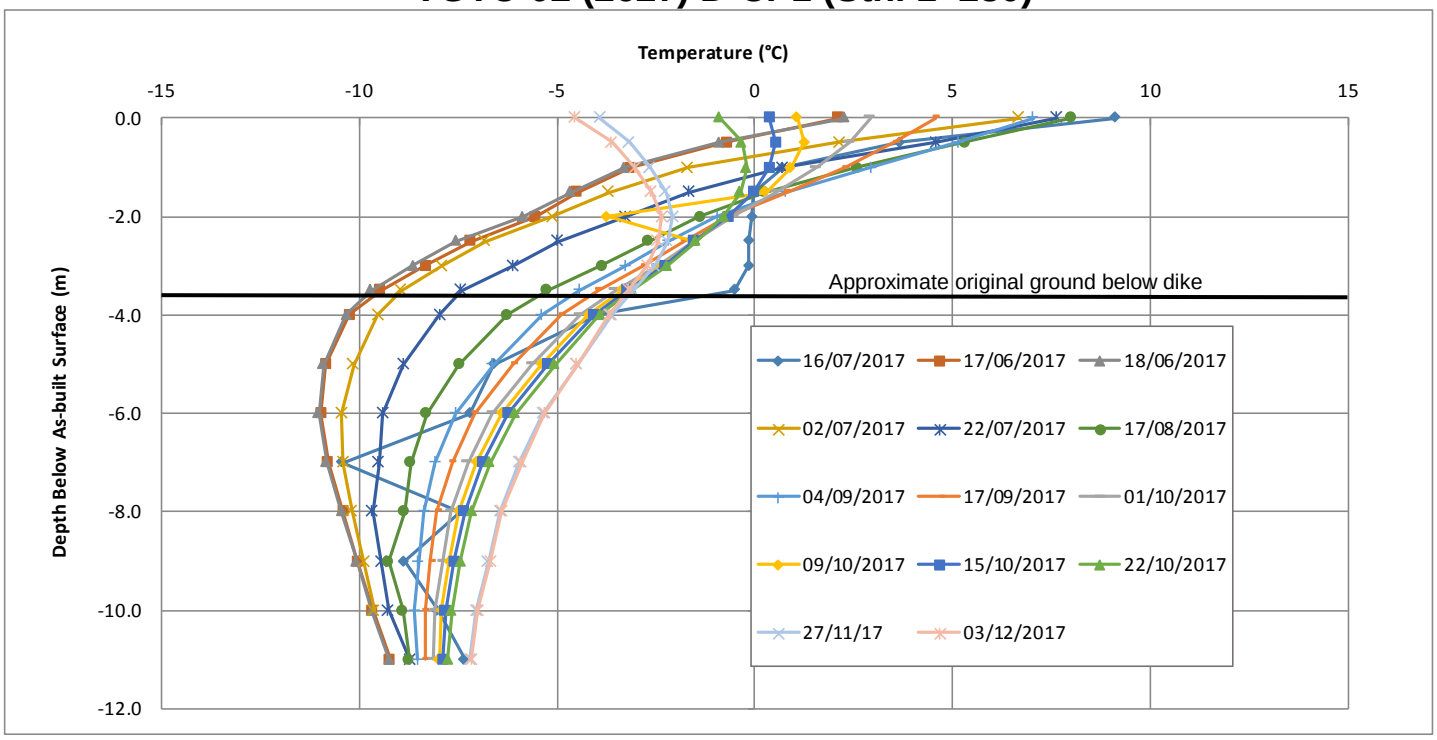

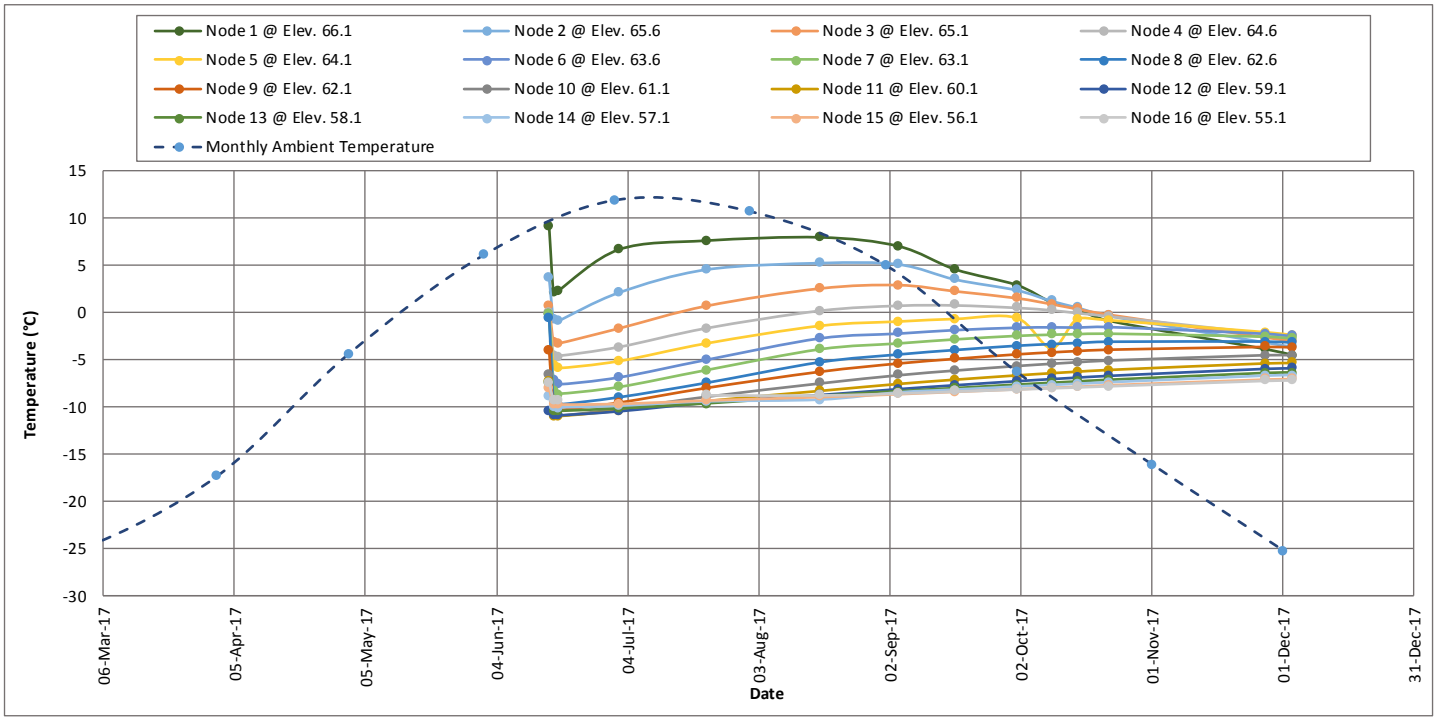

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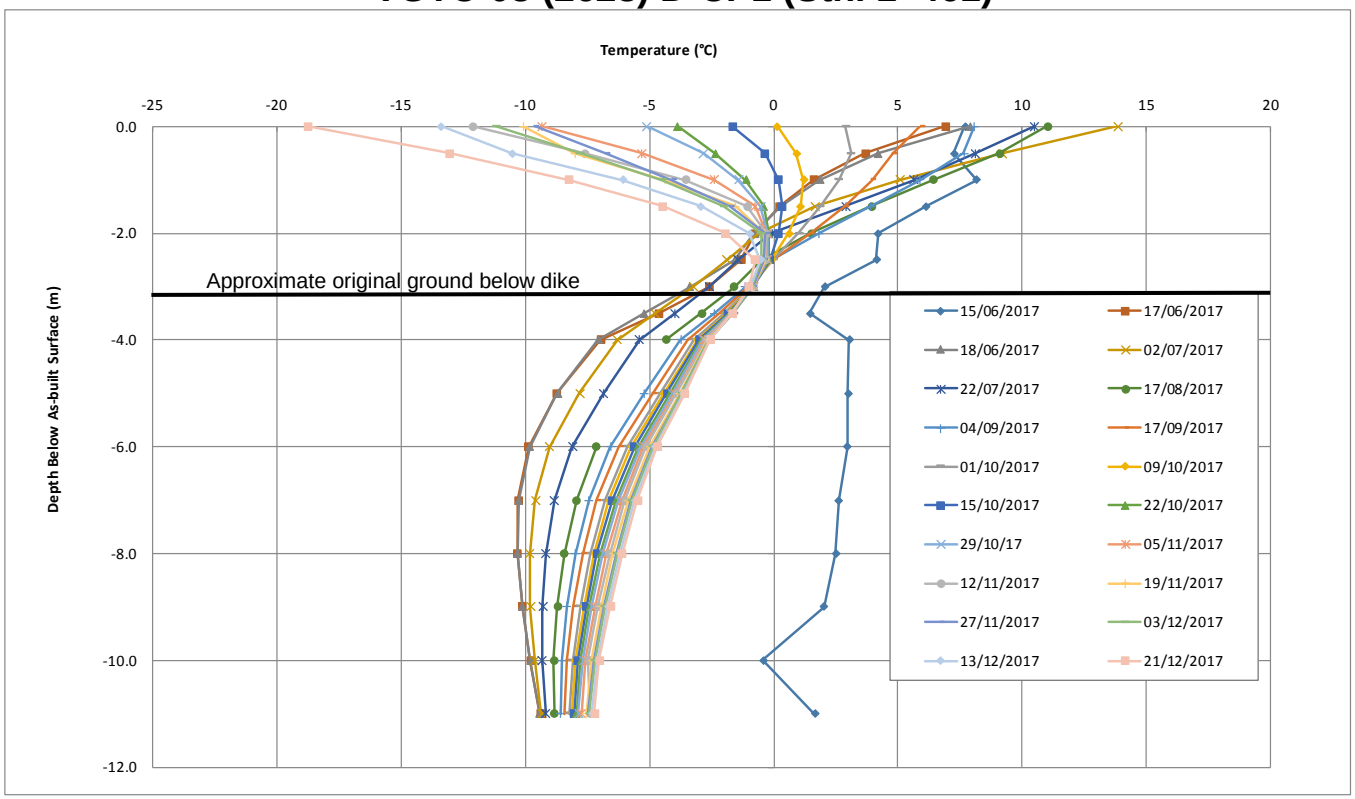

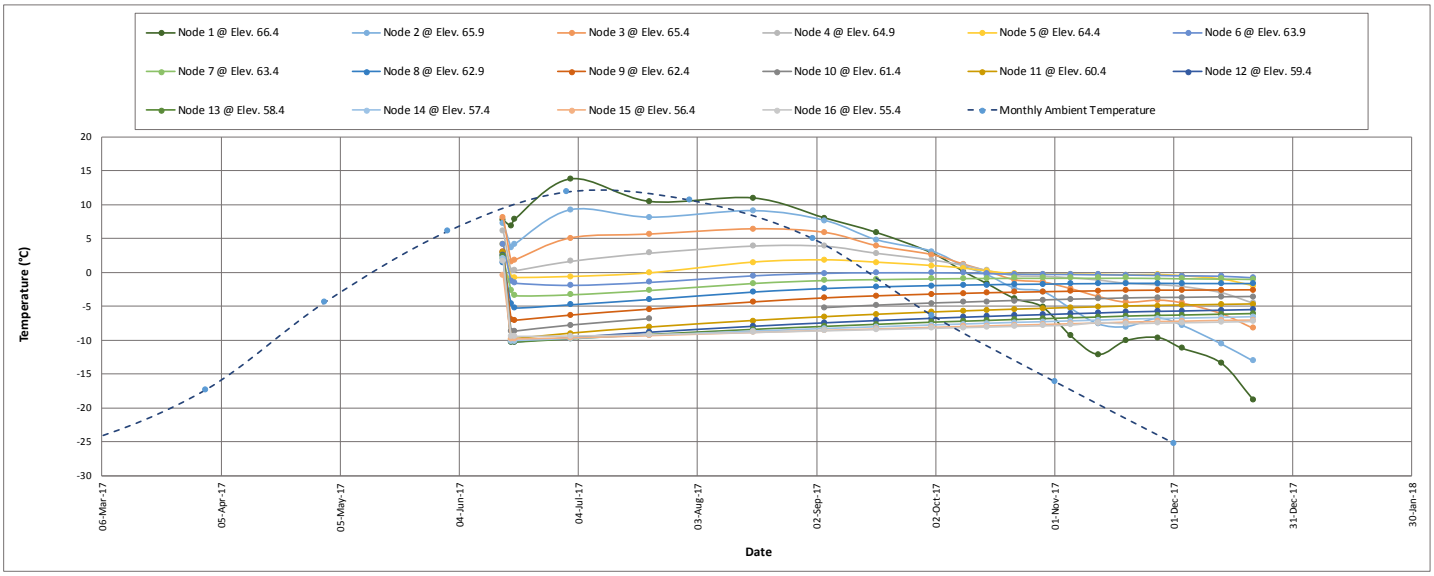

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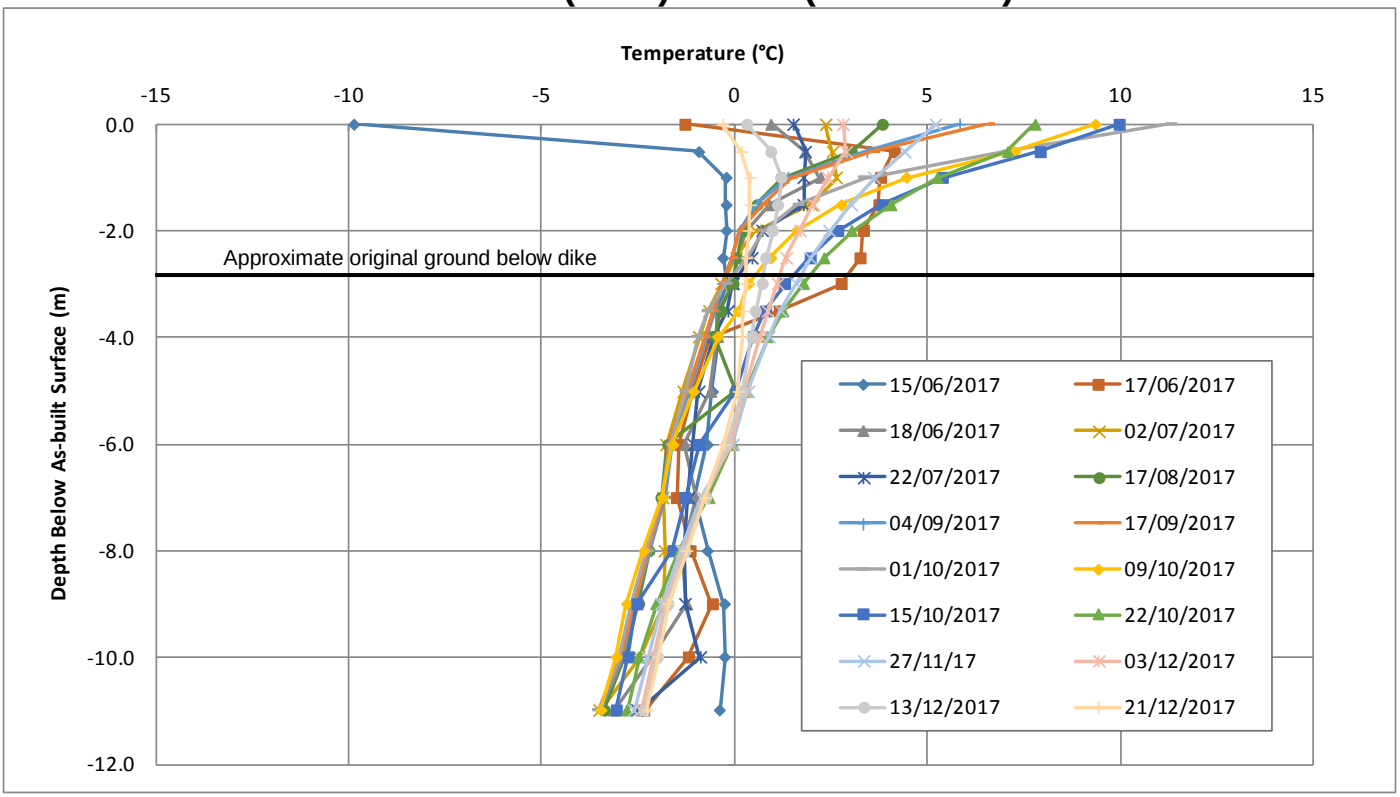

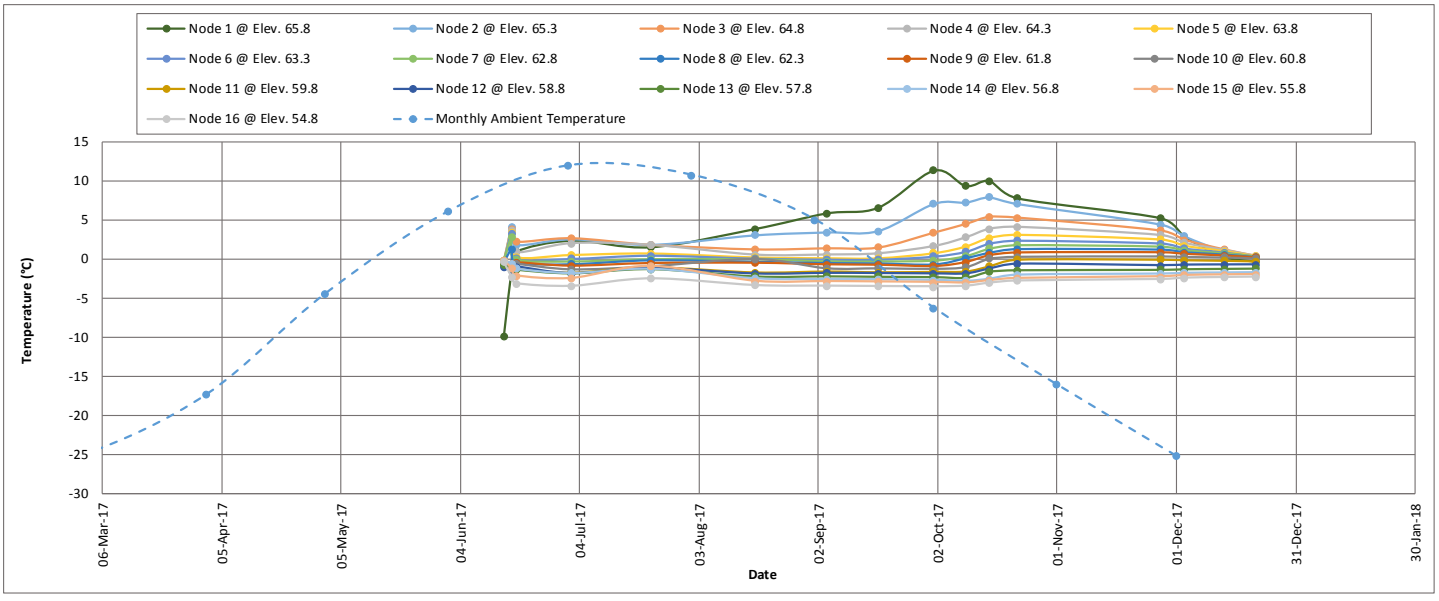

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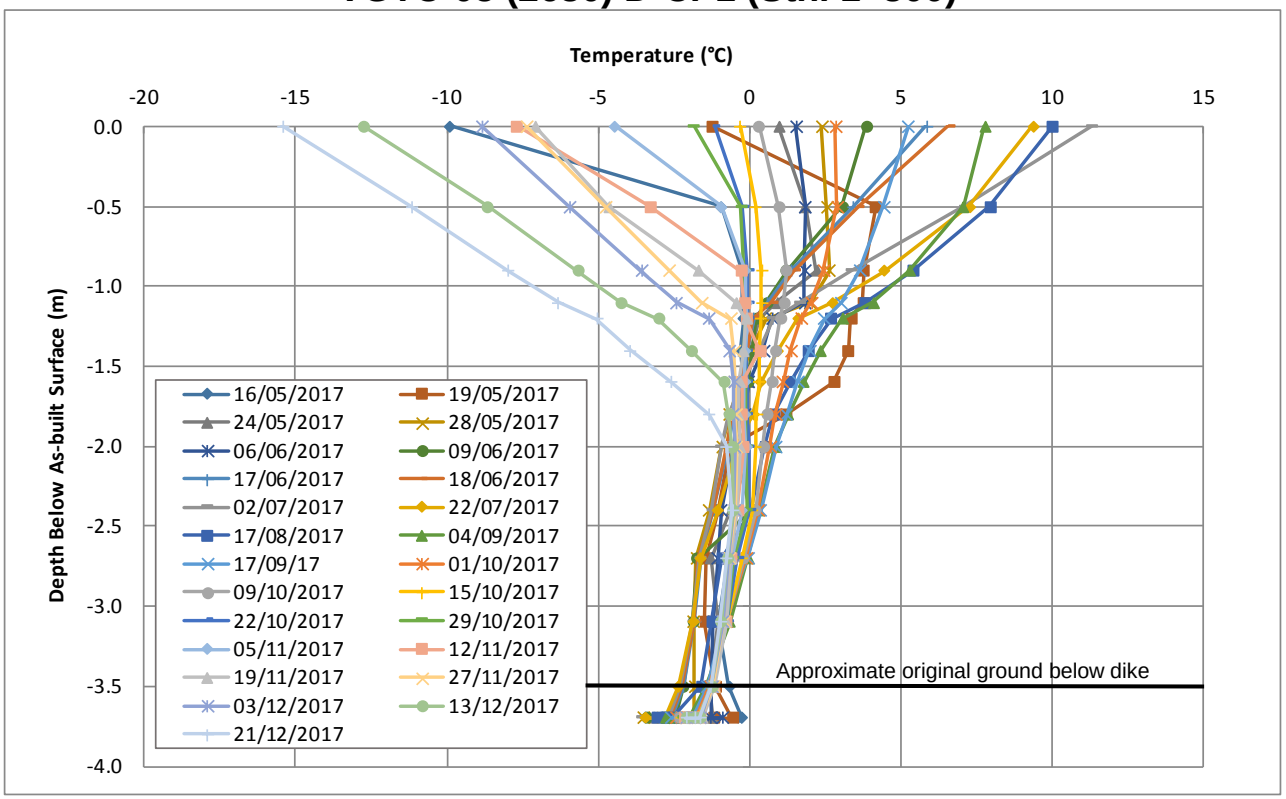
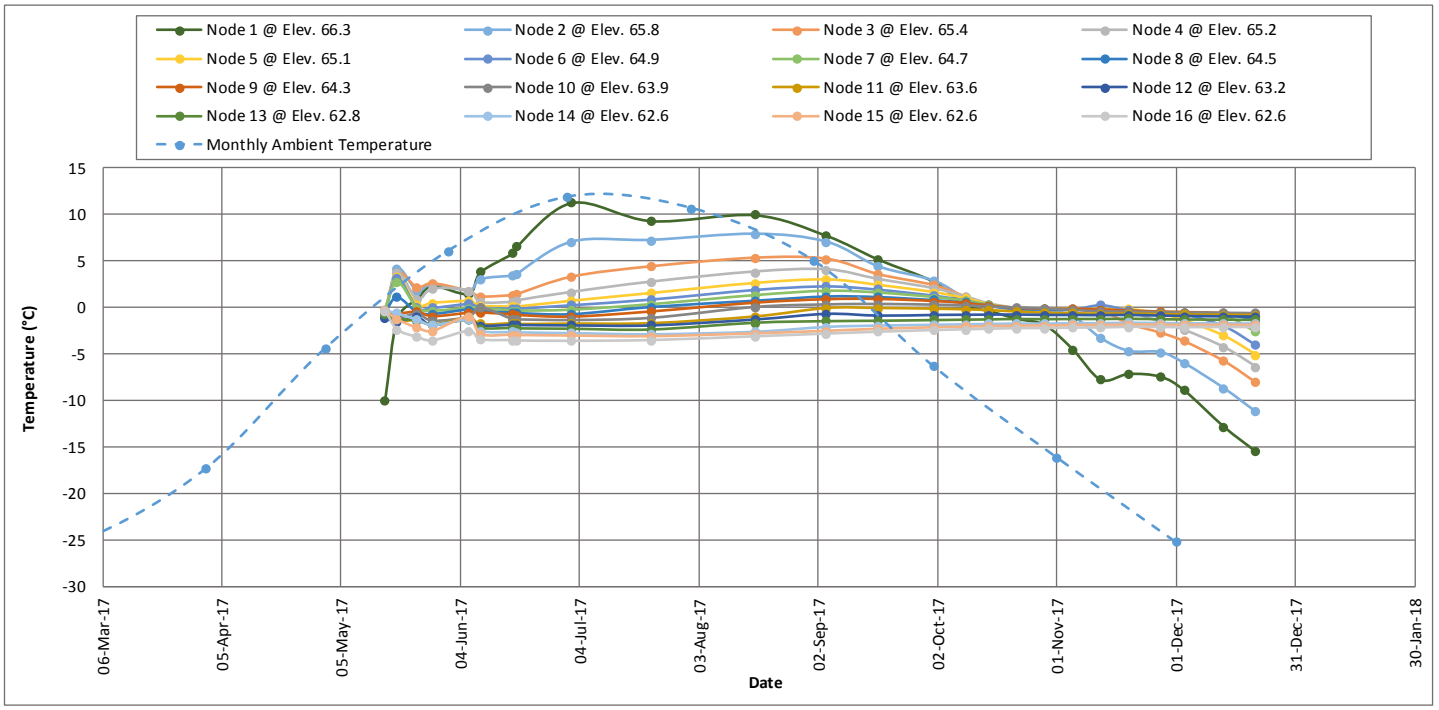
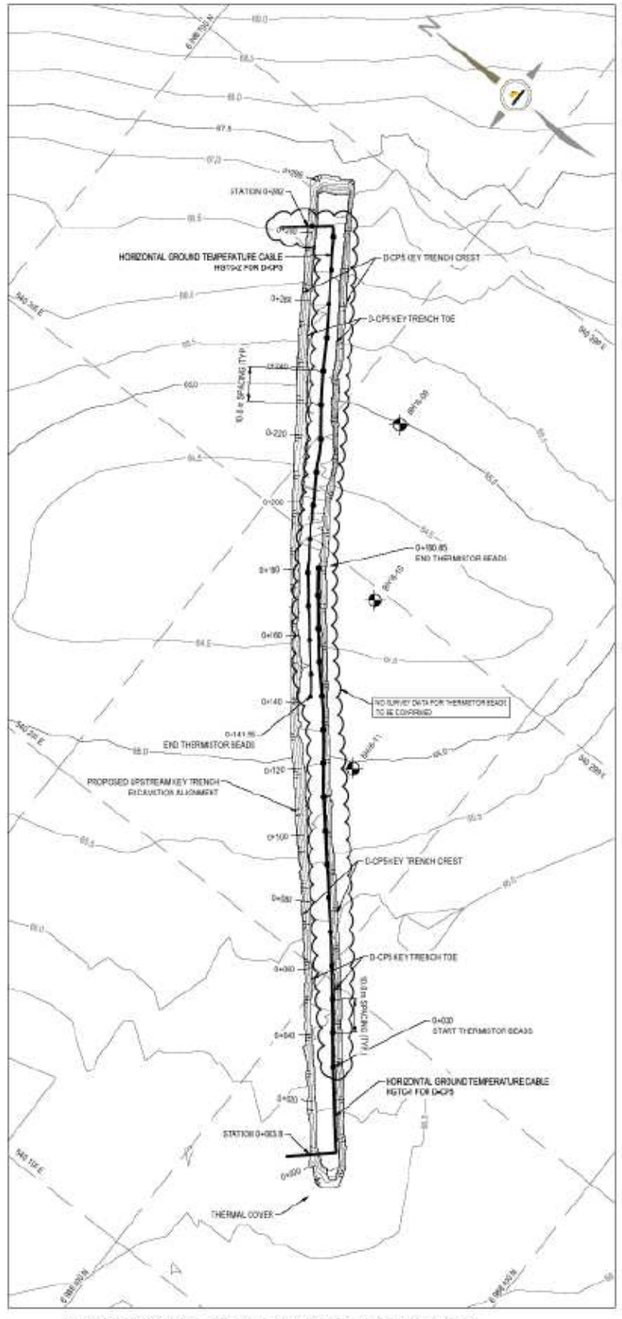
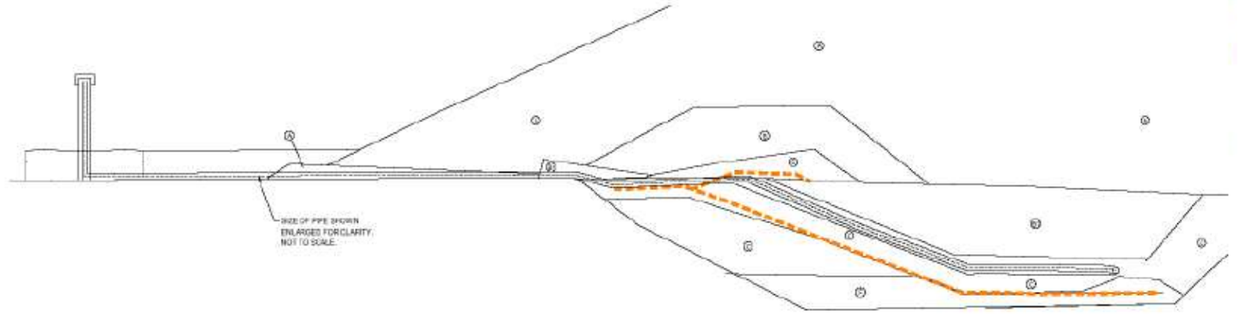


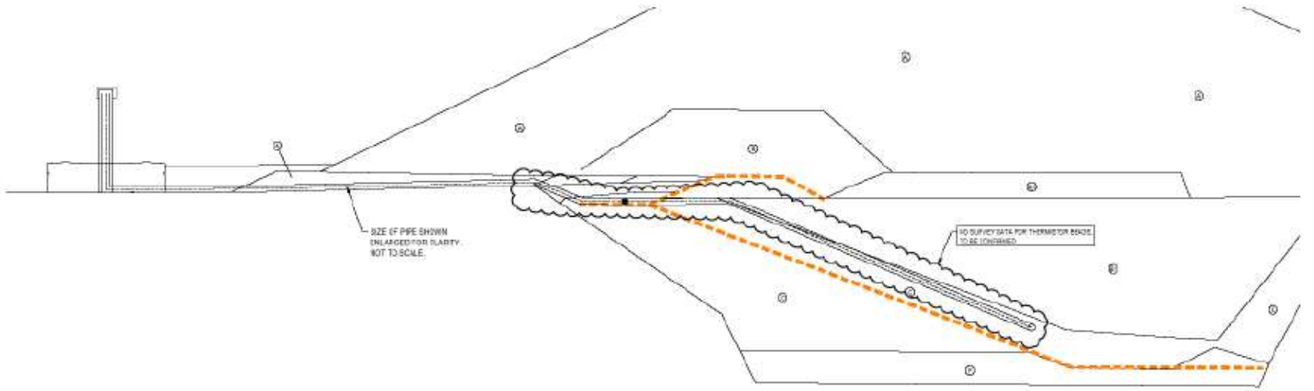




D-CP5 HORIZONTAL GROUND TEMPERATURE CABLE LAYOUT
SCALE: 1:750



D-CP5 HORIZONTAL GROUND TEMPERATURE CABLE – SOUTH TERMINAL SECTION THROUGH STATION 0+003.8
SCALE: 1:100



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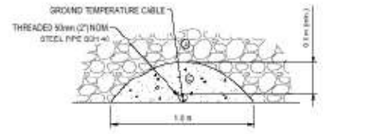
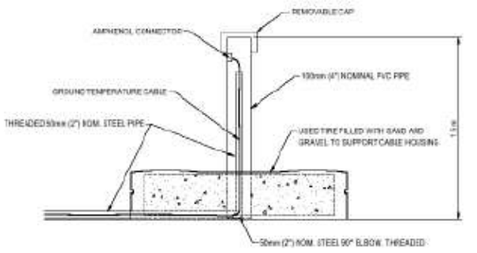
SCALE: 1:100



TEMPERATURE CABLE – PROTECTIVE COVER SECTION
SCALE: NTS



TEMPERATURE CABLE – TERMINAL SUPPORT DETAIL
SCALE: NTS

Reference:

Tetra Tech. 2017. Construction Summary (as-built) Report Dike D-CP5, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Limited. October 2017. Document No. 6515-E-132-007-132-REP-013.

CLIENT
AGNICO-EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-21
PREPARED	CP
DESIGN	-
REVIEW	FE
APPROVED	ACI

PROJECT
Meliadine Gold Project
Rankin Inlet, Nunavut

TITLE
D-CP5 AS-BUILT INSTRUMENTATION PLAN AND DETAILS FOR HORIZONTAL GROUND TEMPERATURE CABLES

PROJECT No.	PHASE	Rev.	FIGURE
1660296	**3000**	**0**	C6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
1 in
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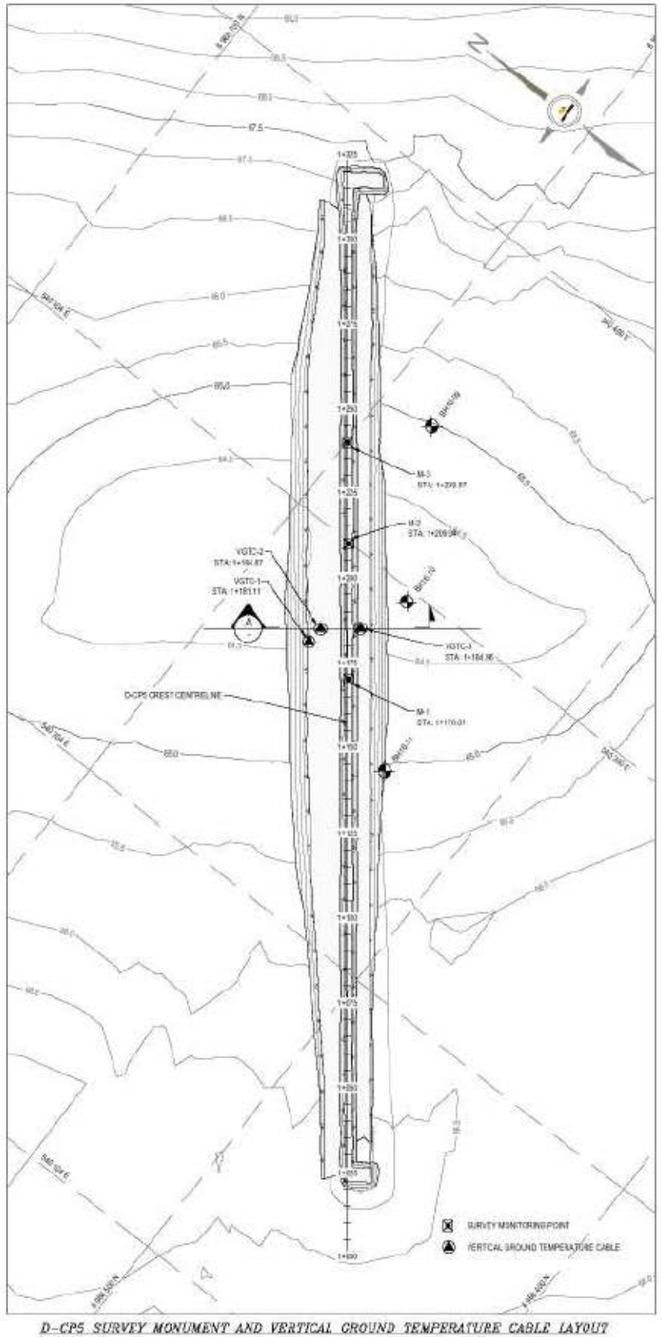
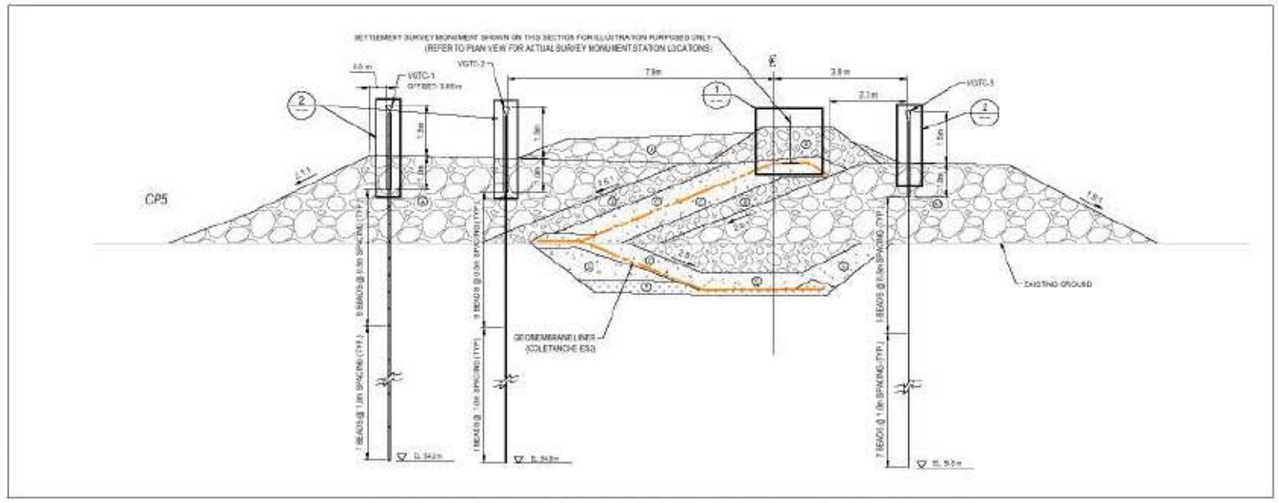
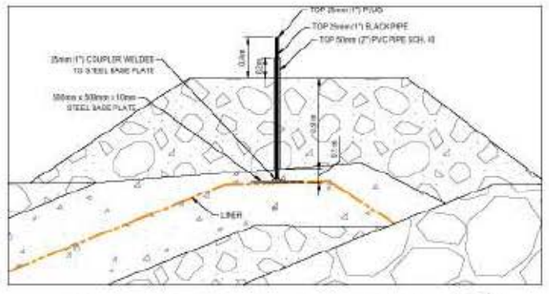


D-CP5 SURVEY MONUMENT AND VERTICAL GROUND TEMPERATURE CABLE LAYOUT
SCALE: 1:750



D-CP5 - SECTION A - VERTICAL GROUND TEMPERATURE CABLE - STATION 1+185
SCALE: 1:75



D-CP1 TYPICAL SETTLEMENT SURVEY MONUMENT DETAIL (1)
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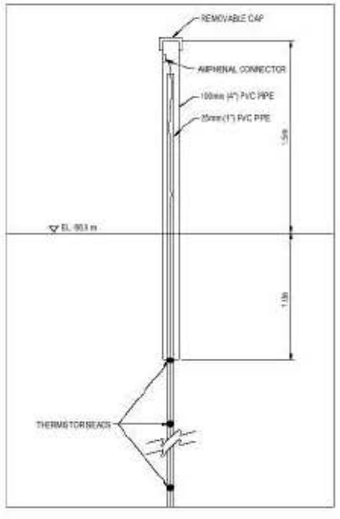

D-CP1 TYPICAL VERTICAL GROUND TEMPERATURE CABLE TERMINAL DETAIL (2)
SCALE: 1:20

Reference:
Tetra Tech. 2017. Construction Summary (as-built) Report Dike D-CP5, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Limited. October 2017. Document No. 6515-E-132-007-132-REP-013.

CLIENT
AGNICO-EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

CONSULTANT
Golder Associates

YYYY-MM-DD	2018-03-21
PREPARED	CP
DESIGN	-
REVIEW	FE
APPROVED	ACI

PROJECT
Meliadine Gold Project
Rankin Inlet, Nunavut

TITLE
D-CP5 AS-BUILT – INSTRUMENTATION PLAN AND DETAILS FOR VERTICAL GROUND TEMPERATURE CABLES AND SETTLEMENT SURVEY MONUMENTS

PROJECT No.	PHASE	Rev.	FIGURE
1660296	**3000**	**0**	C7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
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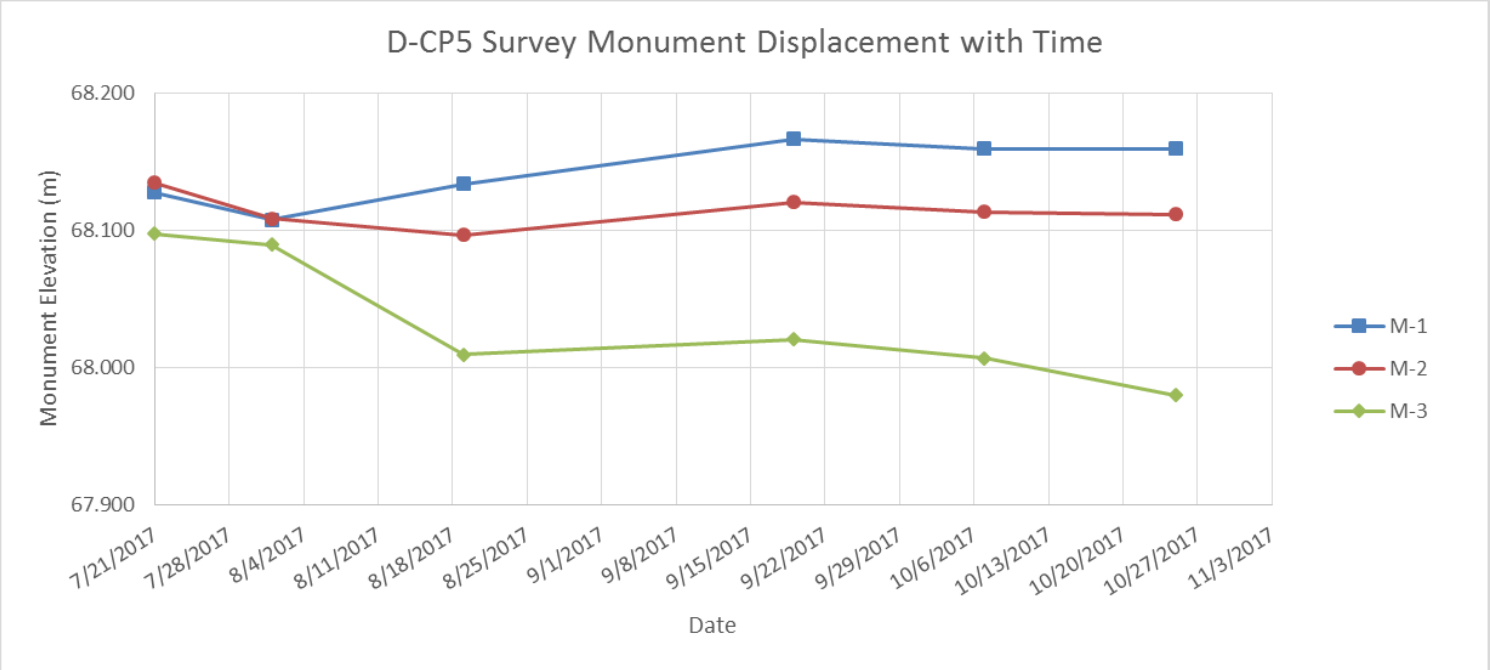
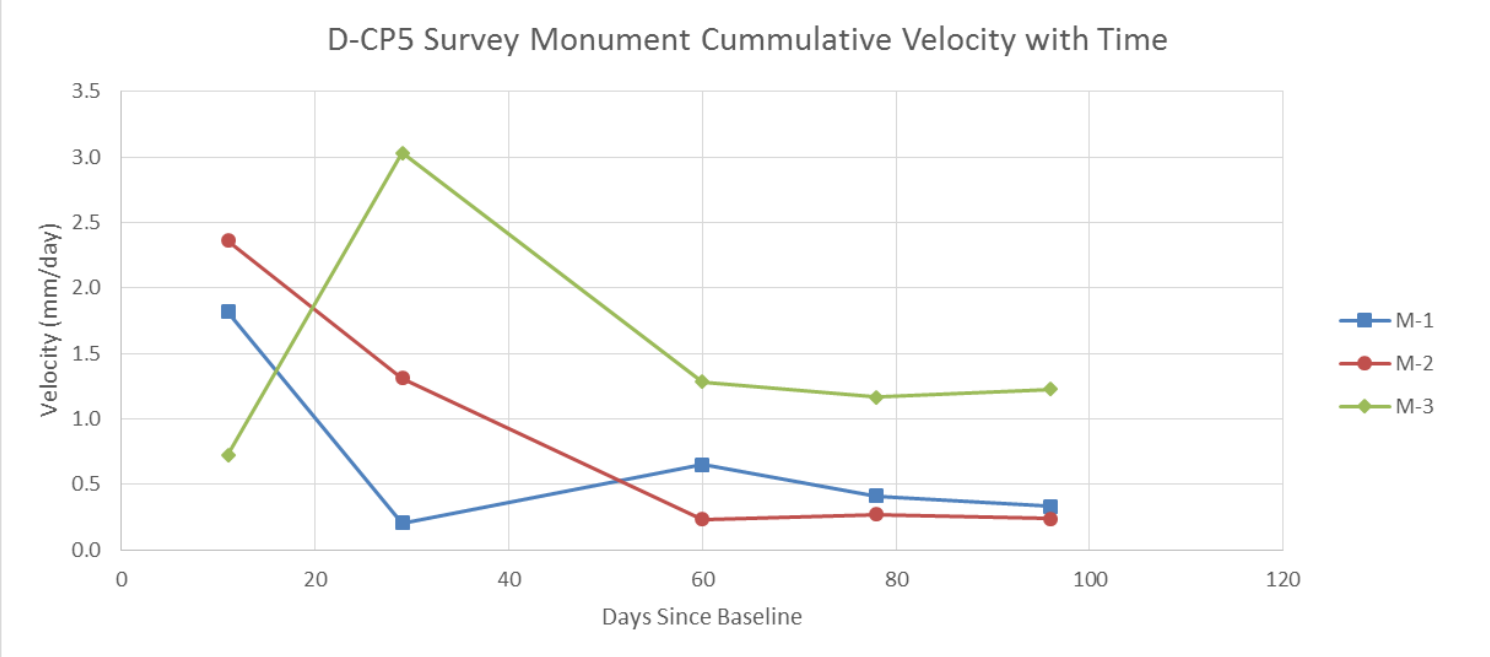
D-CP5 Survey Monuments





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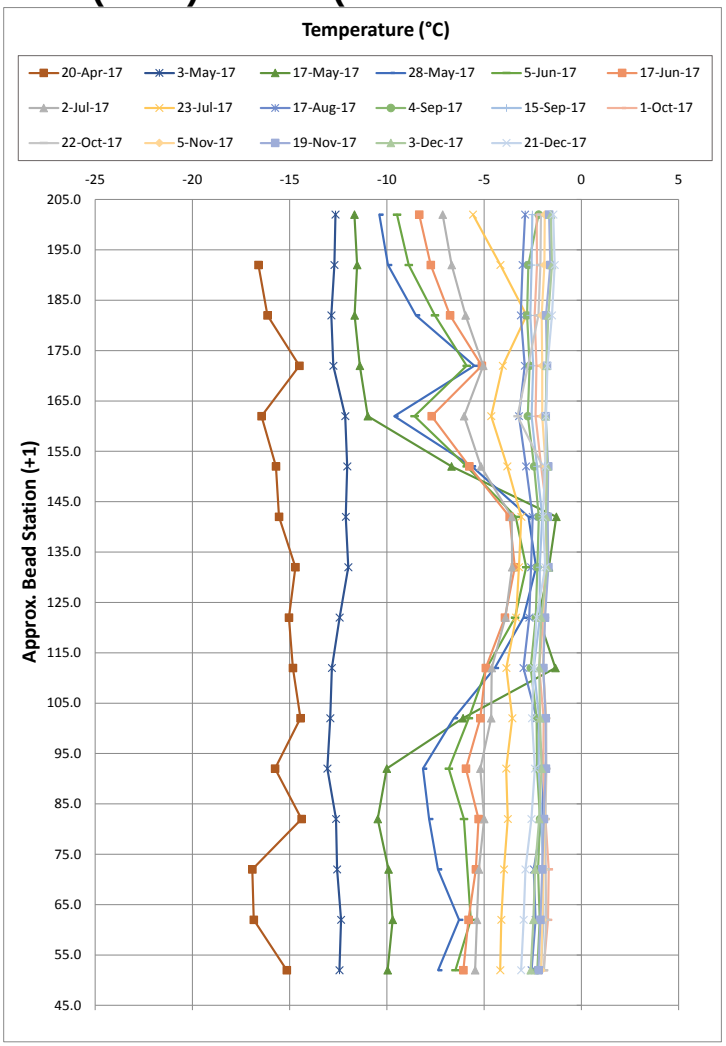

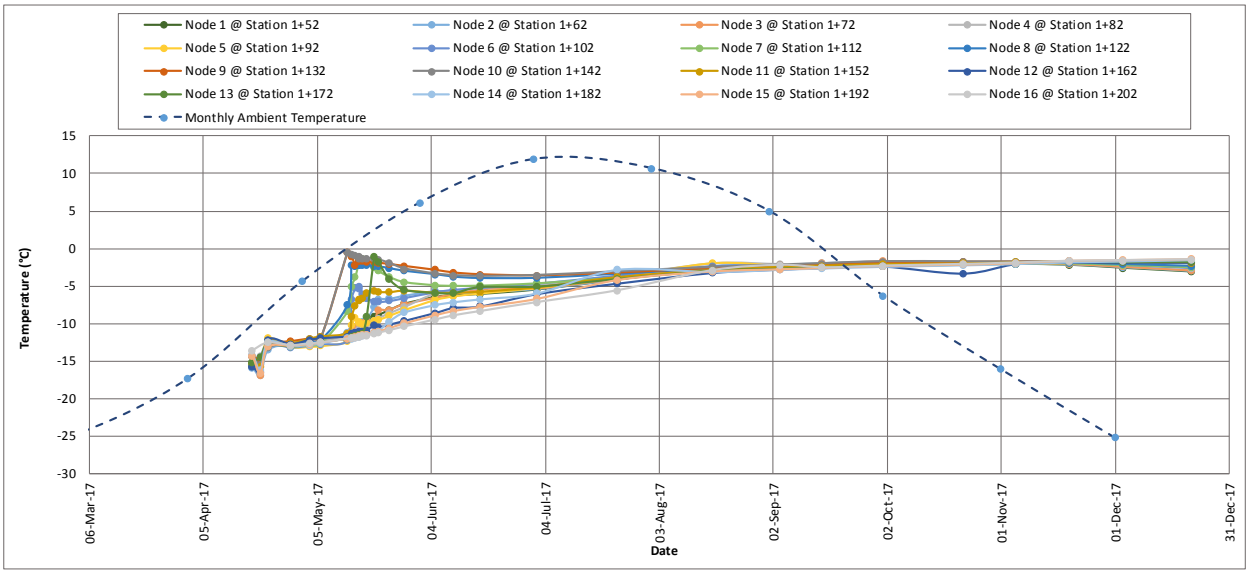

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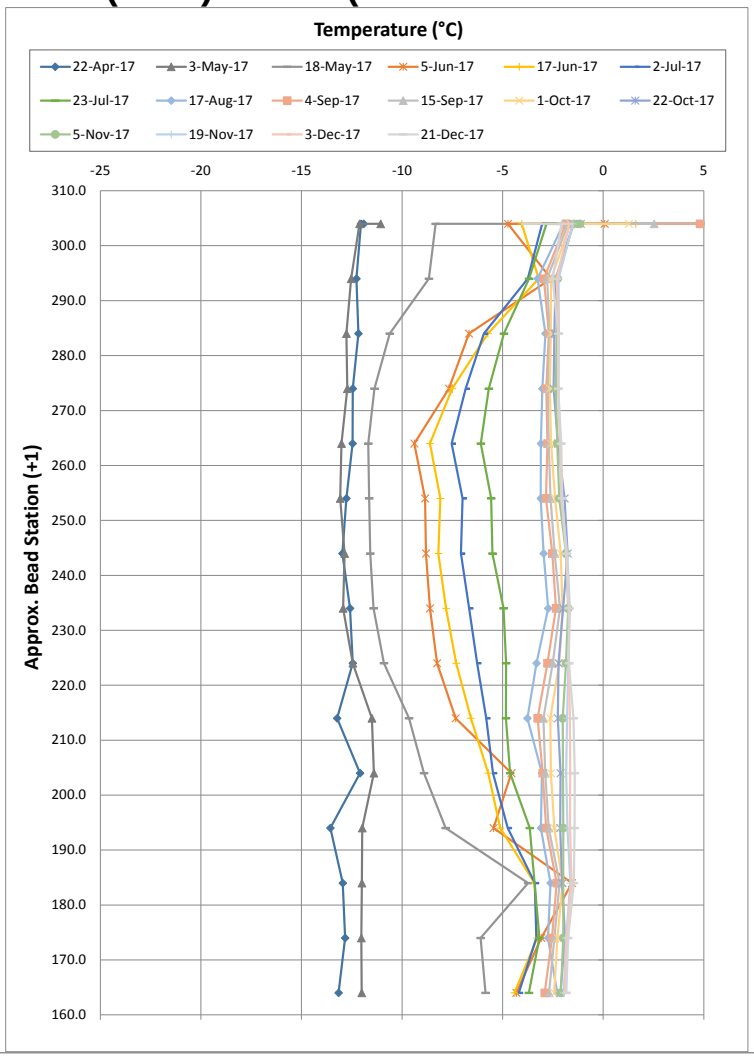

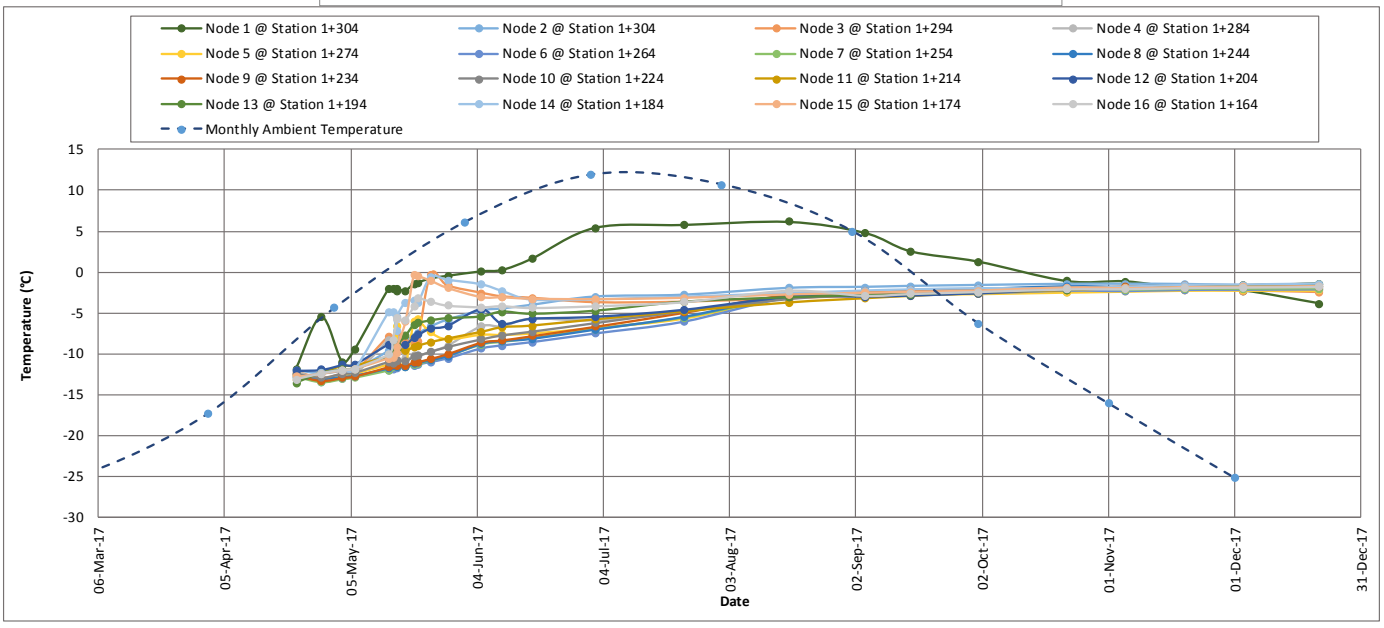

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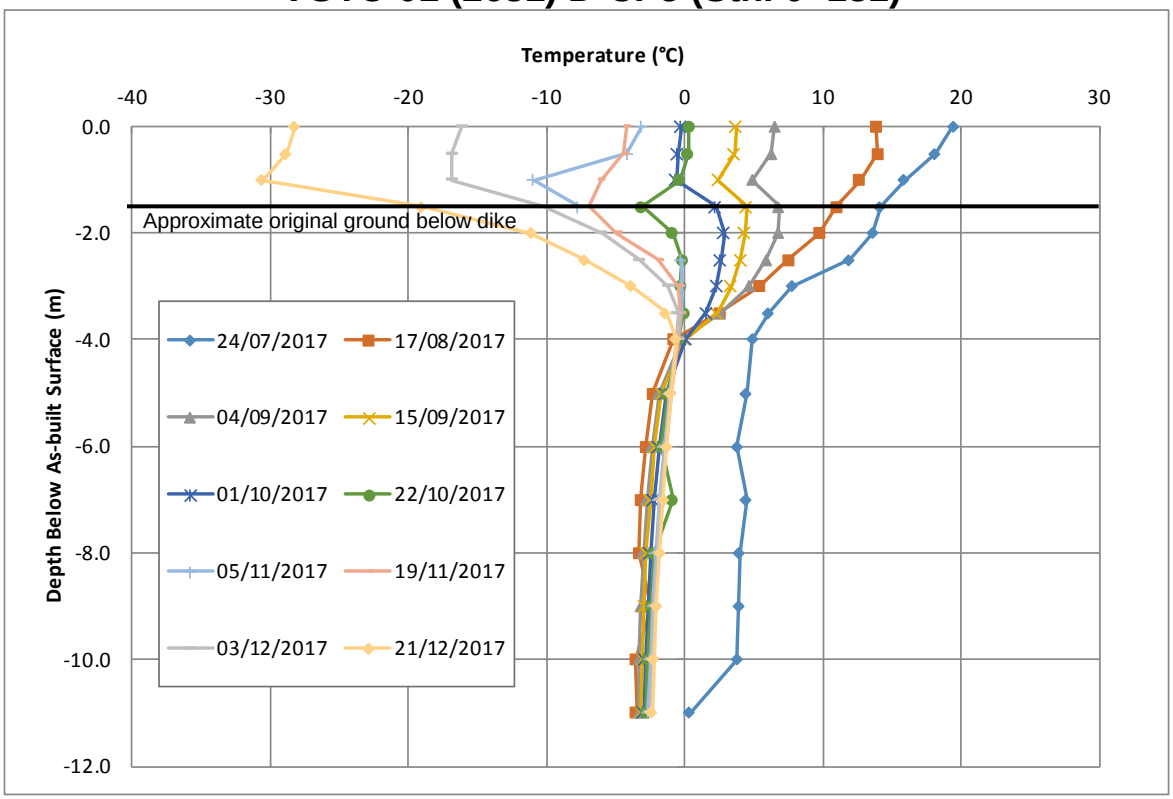

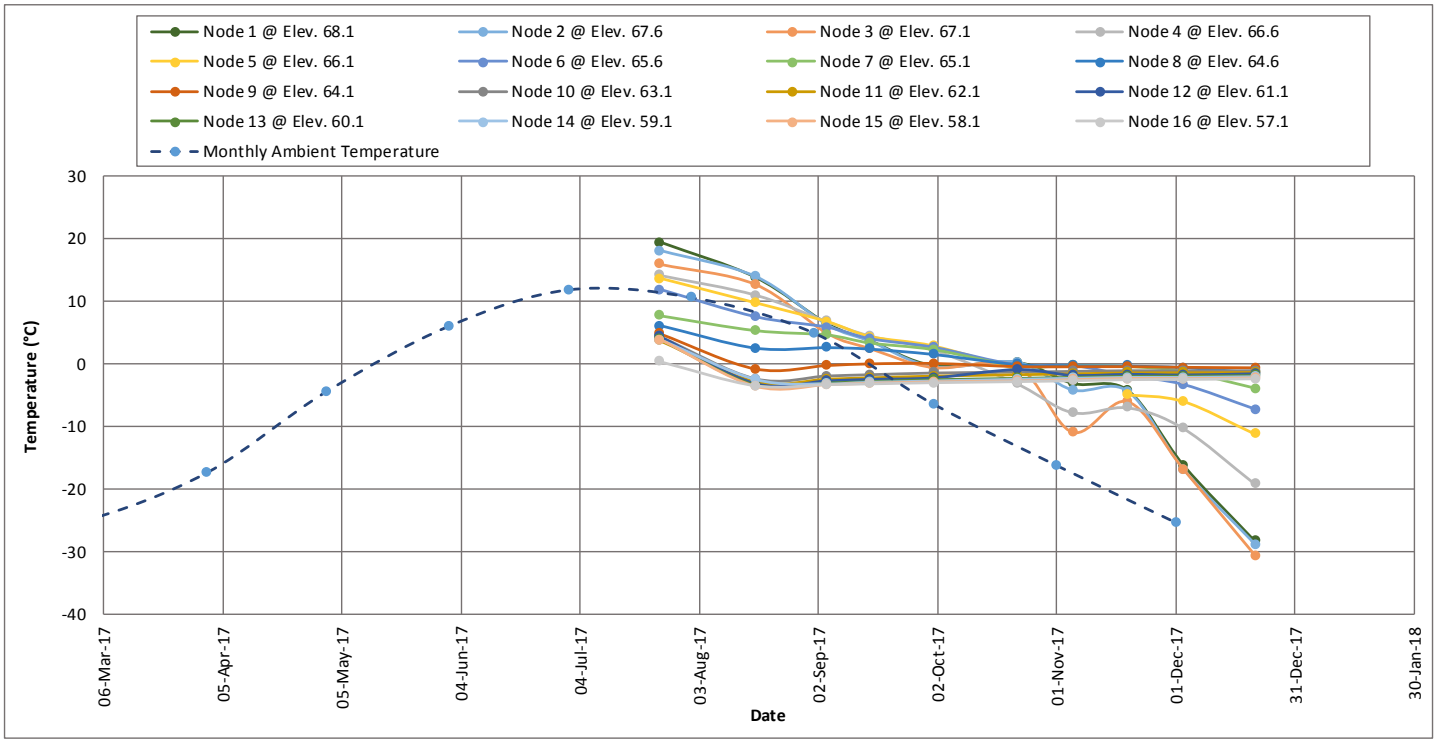

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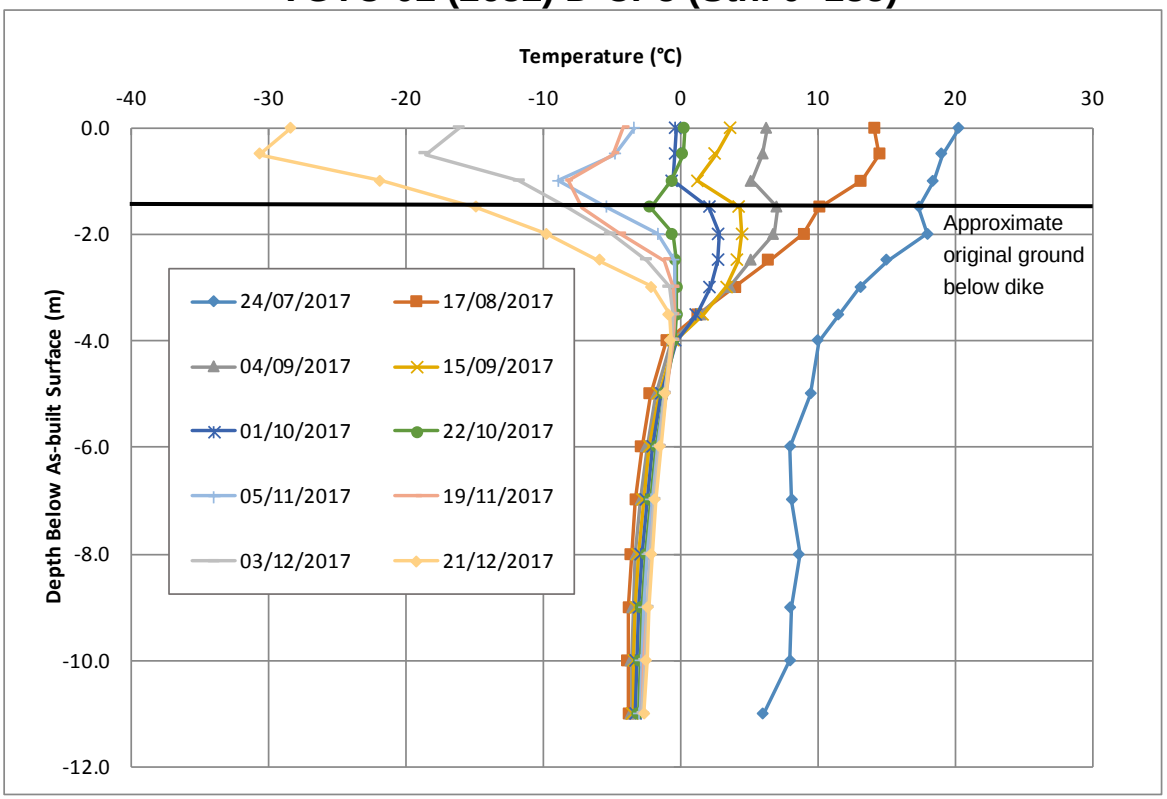

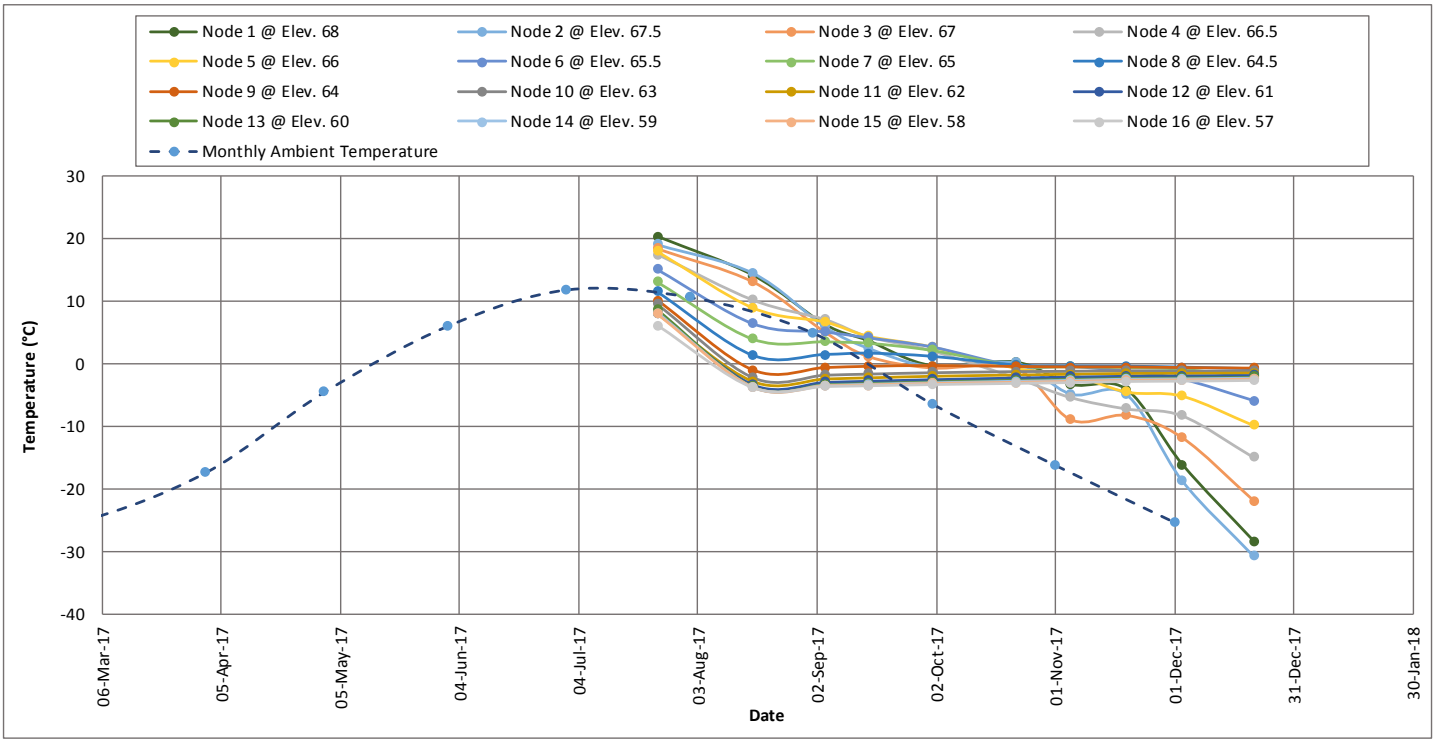

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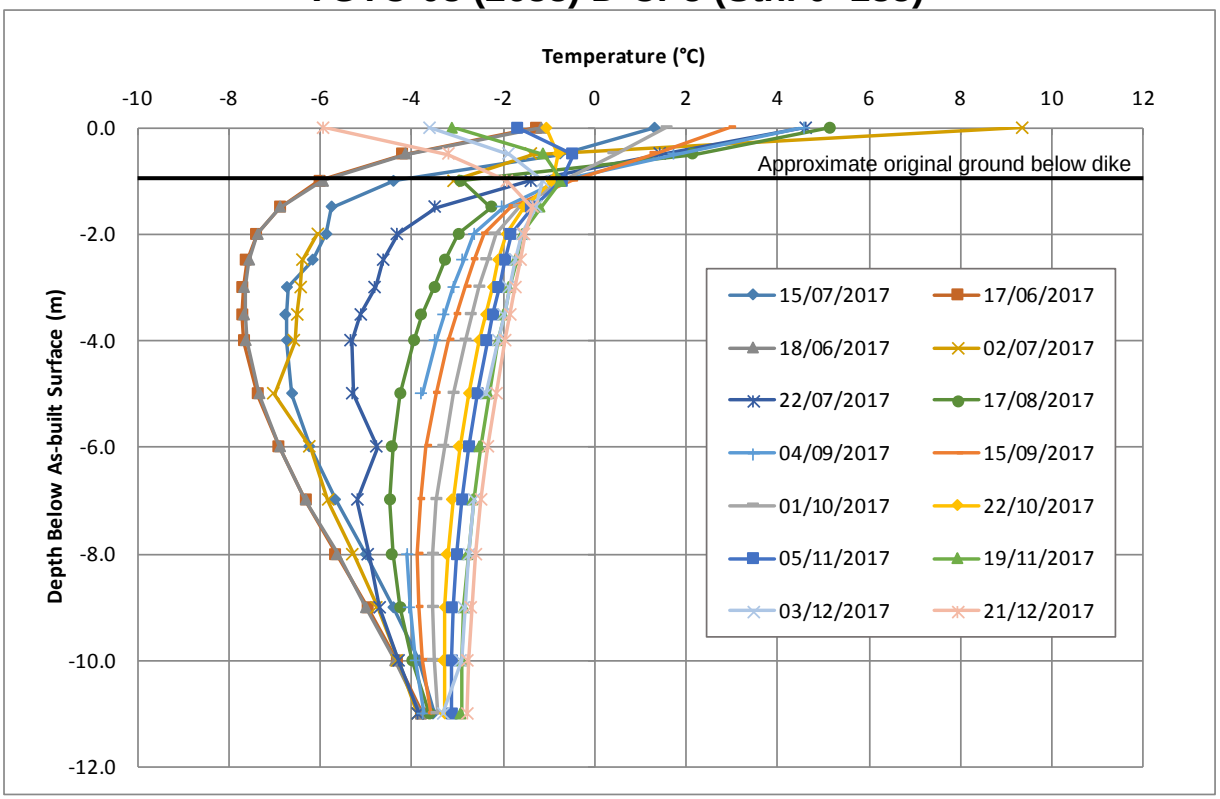

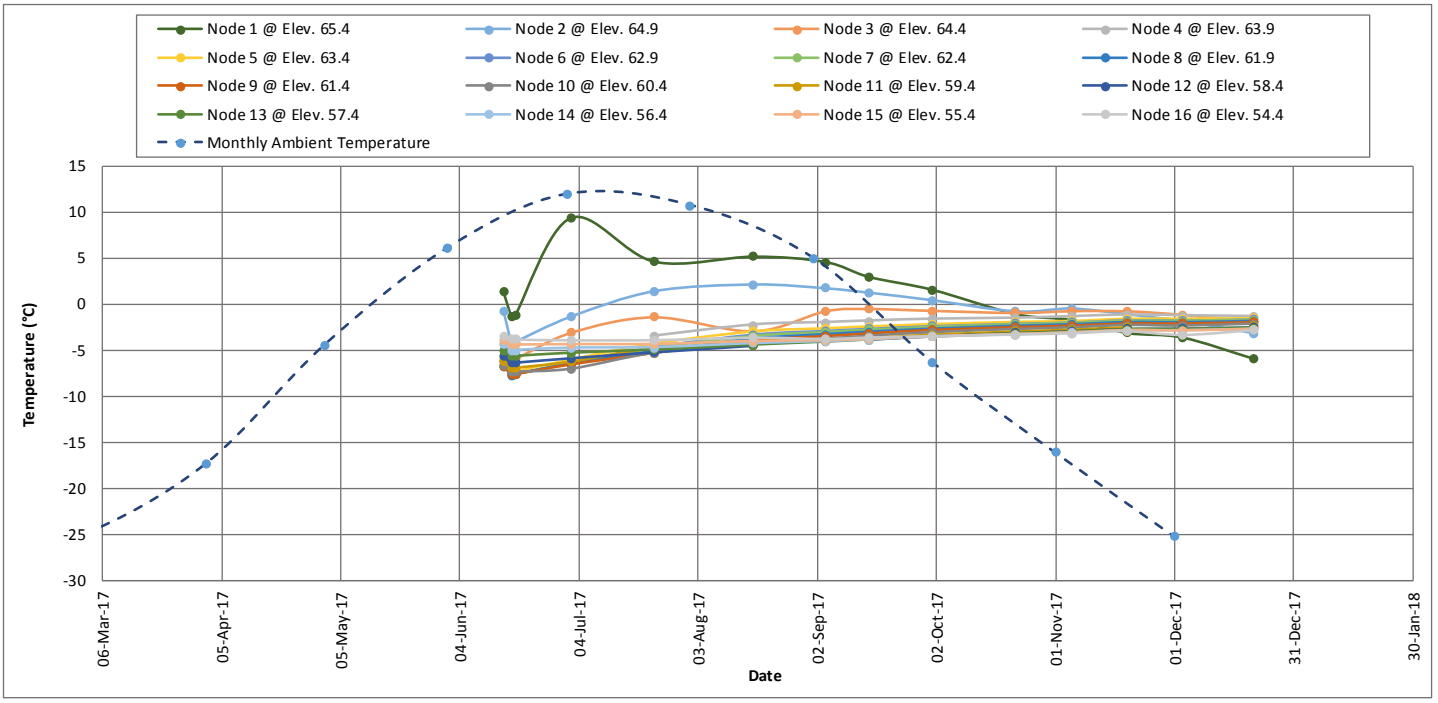

APPENDIX D

Itivia Site and By-pass Road Inspection Photographs

Appendix D1: Itivia Site

Appendix D2: Itivia By-pass Road Inspection Photographs

APPENDIX D 1

Itivia Site

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Appendix J

Aquatic Effects Monitoring Program – 2017 Annual Report

REPORT

Aquatic Effects Monitoring Program - 2017 Annual Report

Agnico Eagle Mines Limited - Meliadine Gold Project

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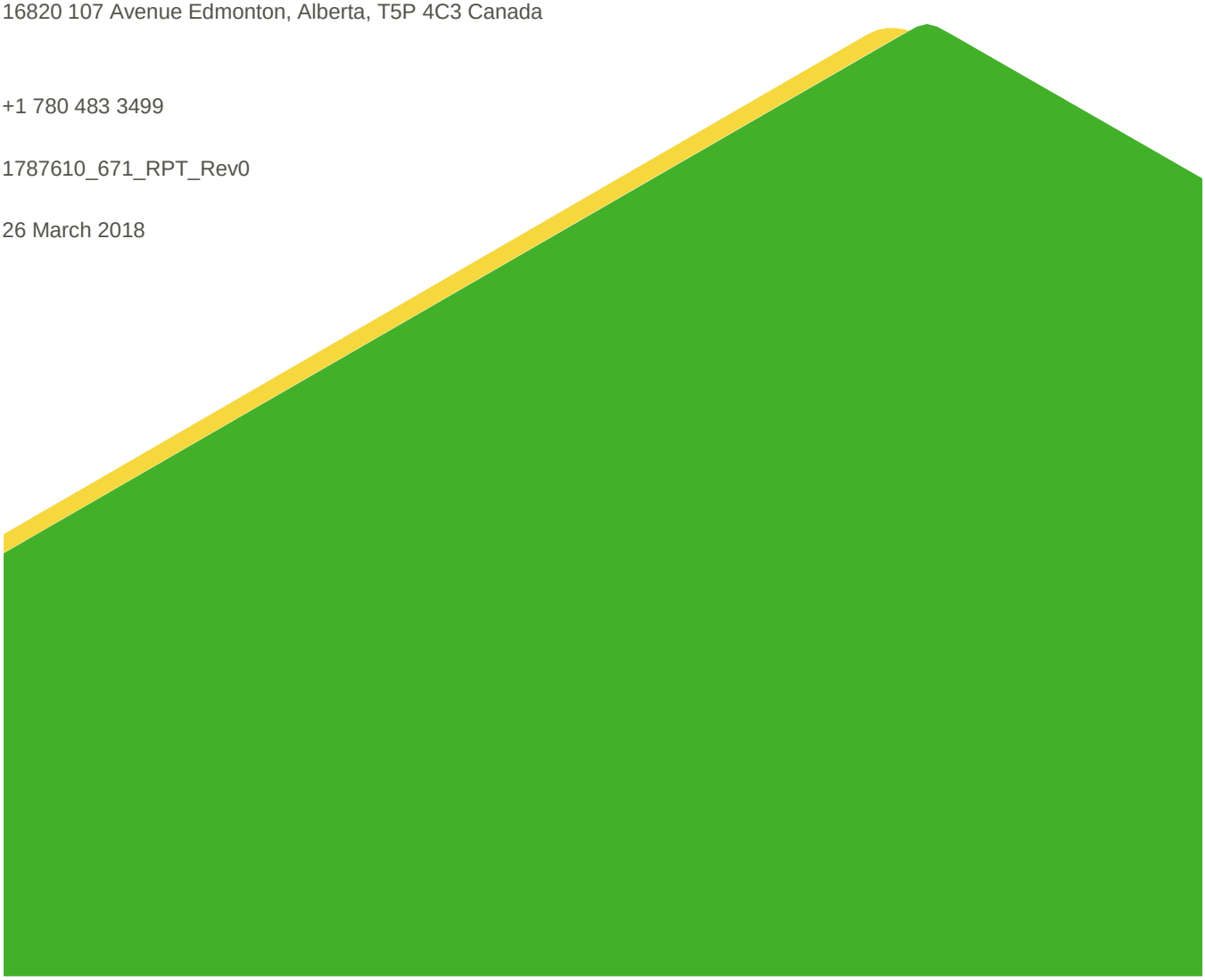

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Executive Summary

Overview

The Meliadine Gold Mine (Mine) is located in the Kivalliq District of Nunavut near the western shore of Hudson Bay, in Northern Canada, approximately 25 km north of Rankin Inlet. Pre-development works started in 2015 and construction started in fall of 2016.

The Aquatic Effects Monitoring Program (AEMP) is a requirement of the Type A Water Licence (2AM-MEL-1631, Part I, Item 3). The AEMP is structured as a comprehensive monitoring program that incorporates various aquatic components and provides integration between components. The study areas include Meliadine Lake and three peninsula lakes. The core components of the AEMP are water quality, sediment quality, benthic invertebrate community, and fish (fish health and fish tissue chemistry), with a targeted, plankton study. The AEMP was intended to function as an integrated monitoring program, which considers pathways to potential effects of the Mine on the aquatic environment including changes in surface water quality, sediment quality, lower trophic communities, fish habitat, and fish health due to release of mine water, physical alteration of watersheds, and air emissions during construction, operations, and closure are considered in the AEMP.

The overall objective of the AEMP is to assess potential mine related effects on the aquatic ecosystem, meet regulatory requirements outlined in the Type A Water Licence (2AM-MEL-1631), and meet commitments made during the environmental permitting process. There are two distinct programs in the AEMP for the Meliadine Mine: the Meliadine Lake study and the Peninsula Lakes study. The Meliadine Lake study was designed around the key aspects of environmental effects monitoring requirements under the Metal Mining Effluent Regulations. The core components of the Meliadine Lake study are water quality, sediment quality, benthic invertebrate communities, and fish health and fish tissue chemistry. A targeted plankton study was also included to investigate the potential of plankton as a useful monitoring tool to support interpretations of potential mine effects on the aquatic environment. The Peninsula Lakes study was designed to detect potential indirect effects from deposition of aerial emissions or alteration of watersheds. Water quality is the core component of the Peninsula Lakes study, with the intent to add biological studies if the water quality results suggest mine-related changes have occurred.

Data and results presented in this report were collected as per the approved AEMP study design for the Meliadine Mine. This report documents data collected in 2017 (documentation of 2015 and 2016 data were included in the 2016 annual report) with detailed evaluation of all data collected from 2015 to 2017. This is the first interpretative AEMP baseline report for the Meliadine Mine. For water quality, sediment quality, and fish (health and tissue), provisional normal ranges were calculated for ecologically relevant parameters and biological endpoints (e.g., fish weight, fish length). A normal range is the range of data that includes 95% of reference or background data. The normal ranges presented in this report are considered provisional due to limited sample size for some components. The normal ranges, in addition to guidelines and trends in data will be used to evaluate future monitoring data and the potential effect of the Mine on the aquatic community once the Mine enters operations.

Mine Development Updates

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

Pre-construction activities were completed at the Mine in 2015 and 2016, and construction activities were initiated in October 2016. The sewage treatment plant associated with Water Licence 2BB MEL 1424 was operational in 2015, 2016, and 2017. The sewage treatment plant and effluent discharge associated with the Type A Water Licence (2AM MEL 1631) became operational as of 2017. Water management related activities that occurred in 2017 included completion of dikes around CP1 (the final water management pond on site) and CP5, construction of berms to direct water to CP1, construction and installation of the effluent pipeline and diffuser to Meliadine Lake, and evaporation of water from the P-area. Discharge of water from CP1 through the diffuser was planned for September to October 2017, but did not occur.

Water Quality

Water quality sampling was conducted in 2015, 2016, and 2017 from Meliadine Lake and from three peninsula lakes. For 2017, water quality sampling was conducted in Meliadine Lake during open water conditions (July, August, and September) and during ice covered conditions (January and February) from up to 25 stations across five sampling areas. The three peninsula lakes were sampled during open water conditions (July and August) from three stations per lake. Similar data collection occurred in 2015 and 2016.

Overall, water quality in Meliadine Lake in 2017 was similar to water quality in 2015 and 2016 (baseline conditions prior to construction). Water quality in Meliadine Lake is characterized as consistent in temperature through the water column, well oxygenated, neutral to alkaline, clear water, low specific conductivity, soft water, oligotrophic (very low in nutrients), and very low in metals.

Water quality data were analyzed to determine if there are differences between the Near-field exposure area, the Mid-field exposure area, and the pooled reference areas of Meliadine Lake. Many water quality parameters were different in the Near-field as compared to the Mid-field and the reference areas for open-water conditions, and in the Near-field as compared to the Mid-field area for ice-covered conditions. Concentrations of major ions (e.g., chloride), nutrients (e.g., phosphorus), and metals (e.g., arsenic and nickel) were higher in the Near-field as compared to other areas. It is noted that the differences were small and statistically significant, but not ecologically relevant as concentrations were orders of magnitude lower than water quality guidelines.

Overall, water quality in the peninsula lakes in 2017 was similar to water quality in 2015 and 2016 (baseline conditions prior to construction). Water quality in the peninsula lakes is characterized as consistent water temperature through the water column, well oxygenated (with some exceptions in late spring), neutral to alkaline, oligotrophic to mesotrophic (low to moderate nutrients), generally higher concentrations of water quality constituents as compared to Meliadine Lake, but, generally at concentrations less than the water quality guidelines.

The peninsula lakes were sampled for chlorophyll *a* during open-water conditions (July and August; 2015 to 2017); these lakes were not sampled for phytoplankton and zooplankton biomass and diversity. In general, chlorophyll *a* varied among lakes, months, and years, but typically concentrations were higher in August as compared to July.

Provisional normal ranges for ecologically relevant water quality parameters (i.e., parameters that have the potential for chronic or acute toxicity effects when elevated above a certain concentration) were calculated for Meliadine Lake (separately for ice-covered and open-water conditions) and for peninsula lakes (open-water conditions).

Sediment Quality

Sediment quality sampling was conducted in Meliadine Lake in August of 2015 and 2016; there was no new sediment sample collection in 2017. In 2015, sediments were collected from the Near-field and Mid-field areas in Meliadine Lake; in 2016, sediments were collected from the Near-field and Mid-field, and three reference areas in Meliadine Lake. Sediments were analyzed for particle size, organic carbon, and metals. Concentrations of arsenic, chromium, and copper exceeds the Canadian sediment quality guidelines for more than half of the samples. Specifically, arsenic concentrations exceeded the ISQG and PEL in 77% and 40%, respectively, of the samples, and exceeded the ISQG for chromium and copper in 51% and 71%, respectively, of the samples.

Data analysis revealed that the reference areas had significantly more sand and the Near-field area had significantly more silt. As proportion of fine sediment in a sample can influence the total concentration of metals, the sediment chemistry data were normalized to the percent of fines before evaluation of statistical comparisons of areas of Meliadine Lake, and calculation of normal ranges for Meliadine Lake.

Arsenic, iron and mercury concentrations were higher in the Near-field area compared to the reference area, whereas total organic carbon, calcium, strontium and sulphur were higher in the reference area compared to Near-field area.

Normal ranges for Meliadine Lake were calculated for sediment quality parameters after normalization to percent fines. The complete dataset was used to calculate the normal ranges, because discharge of treated mine effluent to Meliadine Lake has not occurred.

Benthic Invertebrate Community

Benthic invertebrates (i.e., small animals with no backbones) live within sediments, or on the sediment surface, for all or part of their life cycles, and are an integral part of Arctic ecosystem food webs. Benthic invertebrate community (BIC) sampling was conducted in Meliadine Lake in August of 2015 (Near-field and Mid-field areas) and 2016 (Near-field, Mid-field, and three Reference Areas); BIC samples were not collected in 2017. This report provides an interpretation of benthic invertebrate community data collected during baseline conditions before the effluent discharge associated with the Type A Water Licence to the Near-field area of Meliadine Lake.

Low total density and richness characterized the exposure and reference area invertebrate communities. Invertebrate communities were dominated by midges and fingernail clams and were diverse. Spatial and temporal differences in community structure among areas were attributed to a combination of (1) habitat (i.e., substrate type) variation among sampling areas, (2) potential differences in water quality, and (3) among-year biological variability.

Based on 2016 data, the benthic invertebrate community in the Near-field area was significantly different from reference area communities in terms of total density and Bray-Curtis distance calculated using the environmental effects monitoring (EEM) method. Further evidence of differences among sampling areas was evident in multivariate analysis results, which showed that the Near-field area community was dissimilar from the reference area and Mid-field area communities. In addition, there were differences among the reference areas. Invertebrate density and diversity were higher in Reference Area 1 compared to Reference Areas 2 and 3. Reference area 1 appears to be closest to the Near-field area in terms of benthic invertebrate community structure.

Based on the variability in the dataset (i.e., year-to-year variability in the Near-field and Mid-field areas, and variability among reference areas) and possible confounding influences, normal ranges for BIC endpoints were not calculated. Additional sampling may be required to refine reference area locations and evaluate existing differences in water quality among sampling areas.

Fish Health and Fish Tissue

A fish health and tissue chemistry program was conducted in Meliadine Lake in 2015 (Near-field exposure area) and 2017 (two reference areas); a fish program was not conducted in the peninsula lakes. This report describes data collection in 2017 and provides a comparison of the 2015 and 2017 datasets. Threespine Stickleback were collected from the Near-field area and reference areas of Meliadine Lake, and Lake Trout was collected from the Near-field area.

Threespine Stickleback from the Near-field area were larger than those collected from the two reference areas. Provisional normal ranges were calculated using baseline data from each of the sampling areas. Fish health parameters for male Threespine Stickleback sampled from the Near-field area exceeded provisional normal ranges for length, body weight, carcass weight, and condition factor in fish from the Near-field area.

Threespine Stickleback from the Near-field and reference areas were analyzed for tissue chemistry. Concentrations of arsenic and tin in fish from the Near-field area were higher than the provisional normal range, but concentrations of chromium, iron, molybdenum, nickel, rubidium, and selenium in fish from the Near-field area were lower than the provisional normal range.

The Near-field sampling program was conducted in 2015 and the reference area sampling program was conducted in 2017. As the Near-field and reference areas were sampled in separate years, it could not be determined from the baseline data whether differences in fish health and fish tissue endpoints between the Near-field and reference areas resulted from geographic or interannual variation. During future AEMP sampling, the Near-field and reference areas will be sampled in the same year and at the same time, thus controlling the temporal factor.

The majority of Threespine Stickleback captured were infected by a tapeworm that competes with the host for available resources and decreases the energy allocated to storage and spawning. This represents a confounding factor that needs to be considered in the design and interpretation of future fish health and fish tissue monitoring programs.

Based on these data, Threespine Stickleback were confirmed to be a suitable sentinel species for the Meliadine Gold Project AEMP.

Plankton

Plankton monitoring was conducted as a targeted study to characterize baseline conditions for the plankton community in Meliadine Lake and to evaluate the usefulness of plankton as a potential long-term monitoring tool.

Plankton sampling (including phytoplankton, zooplankton, chlorophyll *a*, and depth integrated nutrients) was conducted in Meliadine Lake during open water conditions (July, August, and September) in 2015, 2016, and 2017. Results from the targeted study show that there is spatial and seasonal variability observed in the majority of plankton endpoints (e.g., density, species diversity). However, the use of phytoplankton communities and chlorophyll *a* are expected to be the most useful monitoring tools to be carried forward to provide an integrated measure of biological effects.

In Meliadine Lake, variability among years in the phytoplankton community was generally high in July and September, but low in August. In August, abundance and biomass were higher in the Near-field area compared to the Mid-field and reference areas. The current dataset shows a reasonable correlation between phytoplankton biomass and chlorophyll *a* with a moderate amount of variability between the two measurements suggesting that chlorophyll *a* may be a potentially useful indicator of phytoplankton biomass in Meliadine Lake. Concurrent sampling of chlorophyll *a* and phytoplankton biomass will further refine the relationship.

Among-year variability in the zooplankton community sampled in each area was high. Consistent spatial trends in zooplankton abundance or biomass could not be discerned due to the high temporal and seasonal variability. Inherent variability in the zooplankton community may limit the usefulness of zooplankton community endpoints for long-term monitoring.

The targeted study provided useful information to characterize plankton communities in Meliadine Lake and to inform selection of monitoring tools that could be incorporated into the AEMP.

Conclusions

The report provides interpretation and summary of the core components of the Meliadine Lake study and the Peninsula Lakes study for data collected from 2015 to 2017, and interpretation and summary of the targeted plankton study. Results from this study will be used to update the benchmarks and response framework in the AEMP design plan.

As per the AEMP design plan, water quality monitoring in Meliadine Lake and the peninsula lakes is an annual program, while monitoring for sediment quality, BIC, and fish health and fish tissue moves to the EEM schedule after baseline data have been collected and once the mine triggers under Metal Mining Effluent Regulations (MMER). Meliadine Mine triggered under the MMER in 2016 after dewatering of Lake H17. The Cycle 1 study design was submitted in August 2017 and will be completed in 2018.

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1.0 INTRODUCTION

1.1 Background

The Meliadine Gold Mine (Mine) is located in the Kivalliq District of Nunavut near the western shore of Hudson Bay, in Northern Canada (Figure 1.1 1). The nearest community is Rankin Inlet (coordinates: 62°48’35’’N; 092°05’58’’W), approximately 25 km south of the Tiriganiaq deposit (coordinates: 63°01’03’’N, 92°12’03’’W). The Mine is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The Aquatic Effects Monitoring Program (AEMP) design plan is a requirement of the Type A Water Licence (2AM MEL 1631, Part I, Item 3). The design plan (v1 submitted June 2016; Golder 2016b) was intended to function as an integrated monitoring program, which considers pathways to potential effects of the Mine on the aquatic environment: changes in surface water quality, sediment quality, lower trophic communities, fish habitat, and fish health due to release of mine water, physical alteration of watersheds, and air emissions during construction, operations, and closure are considered in the AEMP.

The AEMP is structured as a comprehensive monitoring plan that incorporates various aquatic components and provides integration, where possible, in terms of stations sampled, sample matrix, and sample analysis. The AEMP for the Mine has been designed around the key aspects of the Metal Mining Effluent Regulations (MMER) Environmental Effects Monitoring (EEM) requirements, with supplemental components included to fulfill the additional conditions and requirements of the Water Licence, and to monitor for potential mine related effects to the aquatic environment. The core components of the AEMP are as follows:

- water quality
- sediment quality
- benthic invertebrate community
- fish (i.e., fish health and fish tissue chemistry)

Two distinct programs are proposed within the AEMP, the Meliadine Lake study and the peninsula lakes study (Figure 1.1-2). In addition, there is a targeted plankton study (e.g., plankton studies) of short duration with focussed objectives.

480000 500000 520000 540000 560000 580000

7040000 7020000 7000000 6980000 6960000

Diana River
Peter Lake
Meliadine Lake
Meliadine Lake
Parallel Lake
Mine Location
Meliadine River
Little Meliadine Lake (LML)
Char River
Thompson
Dry Cove
Atulik
Rankin Inlet
Rankin Inlet
Rankin Inlet
Hudson Bay

LEGEND

- DIRECTION OF FLOW AT WATERSHED OUTLET
- ALL-WEATHER ACCESS ROAD (AWAR)
- ROAD - NEW
- ROAD - EXISTING
- MINE FOOTPRINT
- WATERSHED BOUNDARY
- TERRITORIAL PARK
- WATERCOURSE
- WATERBODY

0 8 16
1:400,000 KILOMETRES

REFERENCE(S)
1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT
AGNICO EAGLE MINES LIMITED
AGNICO EAGLE

PROJECT
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
LOCATION OF THE MELIADINE MINE

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-26
DESIGNED	JN
PREPARED	MH
REVIEWED	RS
APPROVED	RS

PROJECT NO.	CONTROL	REV.	FIGURE
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525000
530000
535000
540000
545000
7000000
6995000
6990000

REFERENCE AREA 2 (Mel-04)
Mel-04-05
Mel-04-03
Mel-04-02
Mel-04-04
Mel-04-01

Meliadine Lake

REFERENCE AREA 1 (Mel-03)
Mel-03-03
Mel-03-04
Mel-03-02
Mel-03-01
Mel-03-05

Meliadine Lake

MID-FIELD EXPOSURE AREA (Mel-02)
Mel-02-01
Mel-02-05
Mel-02-02
Mel-02-03
Mel-02-04

REFERENCE AREA 3 (Mel-05)
Mel-05-03
Mel-05-04
Mel-05-05
Mel-05-01
Mel-05-02

B7-03
B7-02
B7-01
B7
D7-01
D7-02
D7-03
D7

CP1 DIFFUSER
Mel-01-05
STP EFFLUENT DISCHARGE

NEAR-FIELD EXPOSURE AREA (Mel-01)
Mel-01-02
Mel-01-04
Mel-01-01
Mel-01-03

A8-04
A8-03
A8-01
A8
A8-05
A8-02

LEGEND

- WATER QUALITY STATION
- DE-WATERING EFFLUENT DISCHARGE LOCATION
- INACTIVE CP1 DIFFUSER
- DIRECTION OF FLOW AT WATERSHED OUTLET
- MINE FOOTPRINT
- WATERSHED BOUNDARY
- WATERCOURSE
- WATERBODY

0 1.5 3
1:75,000 KILOMETRES

REFERENCE(S)
1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
STUDY AREA FOR THE MELIADINE AQUATIC EFFECTS MONITORING PROGRAM

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-26
DESIGNED	JN
PREPARED	MH
REVIEWED	RS
APPROVED	RS

PROJECT NO.	CONTROL	REV.	FIGURE
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1.2 Objectives

The overall objective of the AEMP is to assess potential mine related effects on the aquatic ecosystem, meet regulatory requirements outlined in the Type A Water Licence (2AM MEL 1631), and meet commitments made during the environmental permitting process (see Table 1-1 in the AEMP design plan [Golder 2016b]). Additionally, the AEMP is designed to provide an early warning system where the results of aquatic monitoring are used to reduce or prevent adverse environmental effects through a response framework and regular evaluation of the monitoring program. The Meliadine Mine is currently under construction and is not milling ore, as such, operational discharge has not been initiated.

The specific objectives of this report are to document 2017 data collection, and detailed analyses of data collected from 2015 to 2017 of the core studies on water quality, sediment quality, benthic invertebrate community, and fish health and fish tissue, and the targeted study on plankton. Sections are dedicated to each of these study components with methods, quality assurance and quality control (QA/QC), results and discussion, with supporting appendices.

A commitment was made during the water licence hearings to develop AEMP benchmarks (i.e., to support the Action Levels) as part of the Response Framework for use during operational monitoring (Golder 2016b). Development of the benchmarks was deferred until sufficient baseline data were collected. Baseline data collected from 2015 to 2017, and included in this report, will be used to develop the benchmarks and update the draft Response Framework as presented in the AEMP design plan (Golder 2016b).

1.3 Report Structure

This report addresses Part B, Item 2 and Schedule B, Item 13 of the Water Licence for submission of an annual AEMP report with accompanying results and interpretation. This report includes data collected in 2017, with a summary of data collected in 2015 to 2017. The document is organized as follows:

- Executive Summary
- Project Overview (Section 2)
- Water Quality (Section 3)
- Sediment Quality (Section 4)
- Benthic Invertebrate Community (Section 5)
- Fish Health and Tissue (Section 6)
- Plankton Targeted Study (Section 7)
- Conclusions (Section 8)
- Closure (Section 9)

2.0 PROJECT OVERVIEW

2.1 Environmental Setting

The Mine is located in the Kivalliq Region of Nunavut, near the coast of Hudson Bay. Here, continuous permafrost underlies the ground's surface and the terrain is gently rolling with a mean elevation of 65 m above sea level. Drumlins (glacial till) and eskers (gravel and sand) are also among the dominant land forms within the region. The climate is characterized by long, cold winters and short, cool summers. Total annual precipitation is less than (<) 30 cm and strong winds are prevalent due to the openness of the landscape.

Because low lying areas are poorly drained, the landscape is a series of interconnected shallow ponds and lakes. Local watersheds include Meliadine Lake and the Chickenhead and Control sub watersheds that drain to Meliadine Lake, Meliadine River, and a number of smaller watersheds. Aquatic habitats support a variety of fish species, including Threespine stickleback (*Gasterosteus aculeatus*), Arctic char (*Salvelinus alpinus*), Ninespine stickleback (*Pungitius pungitius*), Cisco (*Coregonus clupeaformis*), Arctic grayling (*Thymallus arcticus*), Lake trout (*Salvelinus namaycush*), and Round whitefish (*Prosopium cylindraceum*).

The region supports some of Canada's largest caribou (*Rangifer tarandus groenlandicus*) herds during the calving season and summer, including the Qamanirjuaq Caribou Herd, which is an important food source for the Inuit. Carnivores such as gray wolf (*Canis lupis*) and polar bear (*Ursus maritimus*) are also found in the region, as are nesting and breeding migratory birds. Protected areas of the Kivalliq region include Arvia'juaq and Qikiqtaarjuk National Historic Site of Canada, East Bay Migratory Bird Sanctuary, Fall Caribou Crossing National Historic Site of Canada, Harry Gibbons Migratory Bird Sanctuary, Iqalugaarjuup Nunanga Territorial Park, Inuujarvik Territorial Park, McConnell River Migratory Bird Sanctuary, and part of the Thelon Wildlife Sanctuary.

Over 80% of the human population in the Kivalliq Region is Inuit. The area is sparsely populated, and the local economy is dependent on subsistence hunting, trapping, and fishing. Other activities in the area include mineral exploration, mining, construction, tourism, and government services.

2.2 Mine Description and Summary of Activities from 2015 - 2017

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards) (Agnico Eagle 2015). The AEMP has been designed to encompass all phases of mine development.

Pre-construction activities were completed at the Mine in 2015 and 2016. Pre development activities underway in 2015 included development of an industrial pad, including an access road, pad, and pilings, as well as work on the exploration ramp. Construction activities were initiated at the Mine in October 2016. Construction activities and civil work were also completed at the temporary landfill, industrial pad, exploration ramp, and saline pond in 2016. Construction of the temporary landfill was completed in October; no water monitoring was completed at the site due to frozen conditions. Construction of the saline pond occurred from July to October, and work at the exploration ramp, including construction of the ventilation raise, was completed throughout the year. Water management activities carried out in 2016 in support of mine development were summarized in the 2016 AEMP report (Golder 2017a). The sewage treatment plant and landfarm associated with 2BB MEL 1424 were operational in 2015, 2016, and 2017. The sewage treatment plant effluent was discharged to a rock-bed channel that emptied into Meliadine Lake (shown on Figure 1.1-2) near the exploration camp; water from the landfarm was discharged to land. The sewage treatment plant, landfarm, freshwater intake, and effluent discharge associated with the Type A Water Licence (2AM MEL 1631) were not in use until 2017.

The following water management activities were carried out in support of mine development in 2017 (Tetra Tech 2017a; Tetra Tech 2017b):

- Completion of dikes D-CP1 and D-CP5 (Appendix 2A, Figure 1.2): These dikes were constructed between October 2016 and July 2017. Both dikes are composed of rockfill and transition shells with a geomembrane liner anchored into a key trench within the permafrost foundation (soil or bedrock). A downstream collection sump and two channels were constructed approximately 5 m downstream of the D-CP1 toe to collect surface runoff from the dike and any possible dike seepage for pumping back to CP1. CP1 is the final water management facility on site, and water from various parts of the site will be pumped to CP1 for treatment and discharge to Meliadine Lake. A small collection sump located in a natural depression downstream of CP5 is used to collect surface runoff from the dike and any possible seepage through the dike for pump back to CP5. CP5 will be used seasonally for temporary water storage with active pumping to CP1.
- Construction of the water treatment plant at CP1 (Appendix 2A, Figure 1.2): This also included the construction of the 4 km effluent pipeline and diffuser in Meliadine Lake and was completed in September 2017.
- Construction of Berm 3 and Channel 5 (Appendix 2A, Figure 1.2): Channel 5 and Berm 3 are located west of CP5 and are designed to divert water into CP5 so that this water does not flow into Tiriganiaq Pit 1. Channel 5 is the main water diversion structure; Berm 3 is required to temporarily retain water under an extreme rainfall event when the water level cannot be contained within Channel 5. Channel 5 was constructed in November 2016 and Berm 3 was built in August and September 2017.
- Active evaporation from the P-area (Appendix 2A, Figure 1.2): Active evaporation from the P-area occurred from June to September 2017.

Discharge from CP1 was planned during September to October 2017 but did not occur because concentrations of total dissolved solids (TDS) in CP1 were above the Type A Water Licence discharge criteria of 1,400 mg/L. Concentrations of TDS above the discharge criteria limit started in early August reaching a maximum of 1,800 mg/L; concentrations decreased to 1,500 mg/L by late September. A TDS management plan, that includes a mobile reverse osmosis treatment unit to treat the high TDS water is planned to support management of water before and during freshet 2018.

2.3 Interactions with the Aquatic Environment

The Project will interact with the aquatic environment throughout all phases of mine development through the following pathways:

- the release of treated effluent
- the release of air emissions (acidifying emissions, dust, and associated metals)
- the alteration of natural watersheds
- potential accidental seepage and spills
- Influence from underground workings

Additionally, for peninsula lakes in particular, Project components that may affect the aquatic environment include the alteration of watersheds through dewatering operations, diverting natural drainage paths, constructing new drainage channels, and changing the water balance.

3.0 WATER QUALITY

In support of the AEMP and Water Licence requirements for the Mine, water quality monitoring was completed in 2015, 2016 and 2017 at Meliadine Lake areas and peninsula lakes (Figure 1.1-2). The specific objective of monitoring activities was to characterize water quality conditions in Meliadine Lake so that water quality trends and adaptive management strategies can be identified, as required, during the life of mine.

This report section provides a summary of the water quality monitoring programs completed in 2017 at Meliadine Lake and the peninsula lakes, analysis of data collected between 2015 and 2017, and an interpretation of the results. Data analysis presented in this report are based on the AEMP study design (Golder 2016b), and response to comments from Environment and Climate Change Canada (ECCC) and Indigenous and Northern Affairs Canada (INAC) during review of the 2016 AEMP annual report (Golder 2017a).

3.1 Methods

3.1.1 Field Measurements

Design of the water quality program in 2017 was based on the Meliadine AEMP design plan (Golder 2016b) and consisted of two sampling events during ice-covered conditions and three sampling programs during open-water conditions (Table 3.1-1). This is consistent with the sampling frequency of water quality data collected in 2016; in 2015 samples were collected only during open-water conditions (Golder 2017a). The 2016 and 2017 programs targeted the exposure and reference areas of Meliadine Lake, while the 2015 program targeted the exposure areas of Meliadine Lake. The study design includes five stations in each of the proposed Near-field and Mid-field exposure areas, and Reference Areas 1, 2, and 3 of Meliadine Lake, at a target water depth of 8 to 10 m, and three stations in each of the peninsula lakes at a target water depth of 1.5 to 2.5 m (Figure 1.1-2). The location and timing of sample collection in 2017 is summarized in Table 3.1-1. Sampling events conducted in 2015 and 2016 are summarized in Golder 2017a.

Table 3.1-1: Water Quality Sampling Stations and Sampling Effort Summary in 2017

Waterbody	Area	Station ID	UTM Coordinates (NAD 83, Zone 15V)		Average Total Depth[a] (m)	Average Secchi Depth[b] (m)	2017				
							Ice-Covered		Open-Water		
			Easting	Northing			19 to 20 January	18 to 19 February	16 to 23 July	8 to 15 August	1 to 5 September
							Winter-1	Winter-2[c]	Late Spring[c]	Summer[c]	Fall[c]
Meliadine Lake	Near-field Exposure	Mel-01-01	542693	6989136	9.4	6.3	Yes	Yes	Yes	Yes	Yes
		Mel-01-02	542666	6989280	8.1	6.5	Yes	Yes	Yes	Yes	Yes
		Mel-01-03	542634	6988989	9.0	6.0	Yes	Yes	Yes	Yes	Yes
		Mel-01-04	543145	6989088	8.6	5.8	Yes	Yes	Yes	Yes	Yes
		Mel-01-05	542136	6989358	8.0	5.7	Yes	Yes (QC-dup)	Yes (QC-dup)	Yes	Yes
	Mid-field Exposure	Mel-02-01	537491	6992999	7.8	7.0	Yes	Yes	Yes	Yes (QC-dup)	Yes
		Mel-02-02	537102	6992624	9.1	7.5	Yes	Yes	Yes	Yes	Yes
		Mel-02-03	537499	6992327	9.2	7.0	Yes	Yes	Yes	Yes	Yes
		Mel-02-04	537963	6992341	8.2	7.4	Yes	Yes (QC-dup)	Yes	Yes	Yes
		Mel-02-05	537834	6992688	8.8	6.7	Yes	Yes	Yes	Yes	Yes (QC-dup)
	Reference Area 1	Mel-03-01	533317	6998541	6.9	6.7	-	-	Yes	Yes (QC-dup)	Yes
		Mel-03-02	533256	6998671	8.4	7.7	-	-	Yes	Yes	Yes
		Mel-03-03	532962	6998844	10.0	8.5	-	-	Yes	Yes	Yes
		Mel-03-04	533628	6998672	8.1	7.3	-	-	Yes	Yes	Yes
		Mel-03-05	534001	6998272	7.5	7.5	-	-	Yes	Yes	Yes
	Reference Area 2	Mel-04-01	525647	7000878	7.5	7.5	-	-	-	Yes	-
		Mel-04-02	526149	7001519	9.5	9.5	-	-	-	Yes	-
		Mel-04-03	525351	7001359	9.5	9.5	-	-	-	Yes	-
		Mel-04-04	525401	7001085	8.1	8.1	-	-	-	Yes	-
		Mel-04-05	525735	7001129	8.4	8.4	-	-	-	Yes (QC-dup)	-
	Reference Area 3	Mel-05-01	530926	6990858	10.0	9.0	-	-	-	Yes (QC-dup)	-

Waterbody	Area	Station ID	UTM Coordinates (NAD 83, Zone 15V)		Average Total Depth[a] (m)	Average Secchi Depth[b] (m)	2017				
			Easting	Northing			Ice-Covered		Open-Water		
							19 to 20 January	18 to 19 February	16 to 23 July	8 to 15 August	1 to 5 September
							Winter-1	Winter-2[c]	Late Spring[c]	Summer[c]	Fall[c]
		Mel-05-02	530669	6990884	8.7	8.7	-	-	-	Yes	-
		Mel-05-03	530735	6991374	8.0	8.0	-	-	-	Yes	-
		Mel-05-04	530570	6991223	10.0	10.0	-	-	-	Yes	-
		Mel-05-05	530240	6991162	7.8	7.8	-	-	-	Yes	-
Peninsula Lakes	Lake A8	A8-01	540009	6987658	2.5	2.5	-	-	Yes (QC-dup)	Yes	-
		A8-02	540211	6987203	2.1	2.1	-	-	Yes	Yes	-
		A8-03	540922	6987423	1.9	1.9	-	-	Yes	Yes	-
	Lake B7	B7-01	538628	6989096	1.5	1.5	-	-	Yes	Yes	-
		B7-02	538198	6989437	2.0	2.0	-	-	Yes	Yes	-
		B7-03	537713	6989800	2.0	2.0	-	-	Yes (QC-dup)	Yes	-
	Lake D7	D7-01	536391	6989339	1.7	1.7	-	-	Yes	Yes	-
		D7-02	536563	6988874	1.9	1.9	-	-	Yes	Yes	-
		D7-03	536859	6988692	1.9	1.9	-	-	Yes	Yes	-

(a) The total depths recorded during each sampling program were averaged for individual stations.

(b) The average Secchi depth (a measure of the clarity of surface waters) was calculated based on Secchi depths recorded during each of the open-water (i.e., late spring, summer, and fall) sampling programs.

(c) Blank samples (i.e., travel, field, equipment) were collected.

“yes” = field measurements recorded and water sample collected for laboratory analysis; QC-dup = duplicate quality control samples were collected; - = the site was not included in the sampling plan for a particular field program.

ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; QC = quality control; dup = duplicate.

Field Measurements

At each sampling station, water depth and physico-chemical measurements were collected. Total depth of the water column was measured either by using a sounding line or a boat-mounted sonar unit. In situ physico-chemical measurements of water temperature, dissolved oxygen (DO), pH, and specific conductivity collected at each lake station using a submersible multi-sensor probe system (Manta II multiprobe). In situ physico-chemical measurements were taken just below the surface (or below the ice during ice-covered conditions) and every 1 m (Meliadine Lake areas) or 0.5 m (peninsula lake areas) thereafter throughout the water column ending at approximately 1 m above the lake bed. During open-water conditions, Secchi depth was measured using a Secchi disk at each station. A Secchi disk is a black and white disk that is lowered into the water and the depth is recorded at which it is no longer visible; this information was used to provide a coarse estimate of the euphotic zone depth for the purposes of the depth-integrated nutrient sample collection to support the plankton special study (Section 7.0). During ice-covered conditions, ice thickness was measured.

Water Sample Collection

Discrete water samples were collected at each sampling station from mid-depth within the water column using a Kemmerer sampler. At each station, the Kemmerer was triple-rinsed with surface water representative of the station, and then lowered to the required depth (i.e., mid-depth in the water column), triggered by the messenger to collect a sample, returned to the surface, and used to fill the lab-supplied sample bottles. This procedure was repeated until all sample bottles for the station were filled.

Sample bottles were provided by ALS Environmental (ALS; Edmonton location), an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation Inc (CALA). Water samples were processed (i.e., filtered and/or preserved as required, and refrigerated) at site according to the instructions provided by ALS. Water samples requiring filtration were filtered through a 0.45 micrometre (µm) Millipore filter in a Nalgene filter tower using a vacuum pump before being preserved with laboratory-provided preservative based on the required analysis. Water samples were kept refrigerated before shipping; ice-packs were added to the coolers to keep the samples as cool as possible during transport. Samples were shipped to ALS as soon as possible after sample collection and processing.

Water quality samples were analyzed for a suite of parameters, including:

- conventional parameters (i.e., pH, specific conductivity, total alkalinity, hardness, total dissolved solids [TDS], total suspended solids [TSS], and turbidity)
- major ions (i.e., bicarbonate, carbonate, hydroxide, chloride, fluoride, sulphate, calcium, magnesium, potassium, sodium, and silica)
- nutrients (i.e., nitrate, nitrite, total ammonia, total Kjeldahl nitrogen [TKN], total nitrogen [TN], total phosphorus [TP], total dissolved phosphorus [TDP], orthophosphate, total organic carbon [TOC], and dissolved organic carbon [DOC])
- total and dissolved metals, metalloids, and non-metals[1] (i.e., aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, and zinc)
- cyanide (i.e., weak acid dissociable, total, free)

[1] Henceforth, metals, metalloids (e.g., arsenic), and non-metals (e.g., selenium) will be referred to as “metals.

The samples were analyzed using laboratory test methods with analytical detection limits (DLs) less than the *Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQGs) for the protection of aquatic life* (CCME 1999) and *Health Canada Drinking Water Quality Guidelines (DWQGs;* Health Canada 2014*).*

Samples for chlorophyll a analysis were collected from the peninsula lakes according to the methods described in the plankton section (Section 7.1.1.1).

3.1.2 Guideline Analysis

Water quality aquatic life guidelines are numerical limits or narrative statements based on the most current, scientifically defensible toxicological data available for the parameter of interest, and are designed to be protective of all forms of aquatic life including the most sensitive life stage of the most sensitive species. An exceedance of a guideline does not necessarily imply the likelihood of an adverse environmental effect. Exceedances of guidelines under baseline conditions indicate naturally elevated concentrations relative to other sites, and suggest that resident aquatic biota have adapted to these concentrations. Similarly, water quality results can be compared to drinking water guidelines to evaluate if water is of sufficient quality for consumption by humans or if there is potential risk to human and wildlife health.

Water quality results for Meliadine Lake stations and peninsula lakes were compared to acute and chronic Canadian water quality guidelines (CWQGs) for the protection of aquatic life (CCME 1999) and aesthetic and drinking water quality guidelines (DWQGs, Health Canada 2014). Water quality results from Meliadine Lake stations were also compared to the site-specific water quality objectives developed for the Mine (Golder 2013). These guidelines and objectives are summarized in Table 3.1-2; these guidelines, in addition to baseline data, form a starting point for the future monitoring benchmarks.

Table 3.1-2:Water Quality Guidelines

Parameter	Unit	Aquatic Life [a]		Drinking Water [b]	Aesthetic [b]	SSWQO [c]
		Acute	Chronic			
Field Parameters						
Dissolved Oxygen	mg/L	-	6.5[d]	-	-	-
pH	NA	-	6.5 to 9.0	7.0 to 10.5	-	-
Temperature	ºC	-	-	-	15	-
Conventional Parameters						
Total dissolved solids	mg/L	-	-	-	500	-
pH	NA		6.5 to 9.0	-	7.0 to 10.5	-
Major Ions						
Chloride	mg/L	640	120	-	250	-
Fluoride	mg/L	-	0.12	1.5	-	2.8
Sodium	mg/L	-	-	-	200	-
Sulphate	mg/L	-	-	-	500	-
Cyanide Species						
Cyanide	mg/L	-	0.005	0.2	-	-
Nutrients						
Nitrate	mg-N/L	124	2.9	10	-	-
Nitrite	mg-N/L	-	0.06	1	-	-
Total ammonia	mg-N/L	-	2.68[e]	-	-	-
Total Metals						
Aluminum	µg/L	-	5 to 100[g]	-	200	-
Antimony	µg/L	-	-	6	-	-
Arsenic	µg/L	-	5	10	-	25
Barium	µg/L	-	-	1,000	-	-
Boron	µg/L	29,000	1,500	5,000	-	-

Parameter	Unit	Aquatic Life [a]		Drinking Water [b]	Aesthetic [b]	SSWQO [c]
		Acute	Chronic			
Cadmium	µg/L	0.45[f]	0.04[f]	5	-	-
Chromium	µg/L	-	1	50	-	-
Copper	µg/L	-	2[f]	-	1,000	-
Iron	µg/L	-	300	-	300	1,060
Lead	µg/L	-	1[f]	10	-	-
Manganese	µg/L	-	-	-	50	-
Mercury	µg/L	-	0.026	1	-	-
Molybdenum	µg/L	-	73	-	-	-
Nickel	µg/L	-	25[f]	-	-	-
Selenium	µg/L	-	1	50	-	-
Silver	µg/L	-	0.25	-	-	-
Thallium	µg/L	-	0.8	-	-	-
Uranium	µg/L	33	15	20	-	-
Zinc	µg/L	-	30	-	5,000	-

(a) CCME 1999.

(b) Health Canada 2014.

(c) SSWQO developed for the Meliadine Gold Mine (Golder 2013). SSWQOs supersede generic guidelines for review of monitoring and determination of effects.

(d) Lowest acceptable for cold water biota CCME 1999.

(e) The guideline shown corresponds to a temperature of 10°C and pH of 7.5. For individual samples, the guidelines were calculated based on the specific temperature and pH measured from the sample (CCME 2010).

(f) The guideline is hardness dependent (value shown corresponds to a median hardness of 22.7 mg/L as $CaCO_3$). For individual samples, the guideline was calculated based on the specific hardness measurement taken from the sample.

(g) The guideline is pH dependent. The 5 µg/L guideline correspond to a pH<6.5 and 100 µg/L corresponds to a pH≥6.5. Guidelines were applied to individual sample based on specific pH measurement taken from the sample.

Note: Only parameters that have guidelines are presented.

SSWQO = site-specific water quality objective; NA = not applicable; mg/L = milligrams per litre; - = no guideline; mg-N/L = milligrams nitrogen per litre; µg/L = micrograms per litre.

Water quality data collected in 2017 represents third year of data collected at Meliadine Lake and peninsula lakes following the AEMP design plan. Water quality data collected between 2015 and 2017 at Meliadine Lake were separated by season: ice-covered (January and February) and open-water (July to September). Water quality data for peninsula lakes represents only the open-water conditions (July and August).

Field data (physico-chemical) profiles were compared graphically within each lake area (by showing results for each station) and by season (ice-covered and open-water). Water temperature, dissolved oxygen concentration and percent saturation, pH, and specific conductivity, were plotted against measured depth.

Water chemistry results were plotted in time series scatter-plot for each parameter at each station and guidelines to aid in visual assessment of data trends relative to sampling event and guidelines.

3.1.3 Statistical Analyses

Descriptive statistics (i.e., minimum, median, mean, maximum, standard deviation, number of values below DL, and percentage of values above the water quality guidelines and objectives) were calculated to compare and evaluate the spatial and temporal data collected within Meliadine Lake; descriptive statistics were also used to compare water quality among the three peninsula lakes. A summary of statistics analysis calculated for each sampling area representing the conditions for 2015 to 2017 period are presented in this report.

Prior to completing statistical analyses, values below DL were substituted with one-half of the DL. Subsequently, statistical outliers were removed from the dataset. Statistical outliers were identified using standardized residual, which provide a measure of the difference between observed and expected values (i.e., residuals), normalized to the variance of the dataset, and were calculated as follows:

Standardized Residual: $x_z = \frac{X_i}{\sigma}$

Where: x_z is the standardized residual

x_i is the residual of a data point

σ is the sample standard deviation

Data points with standardized residuals greater than |3.5| (i.e., more than 3.5 standard deviations from the sample mean), were omitted from the analysis.

To compare the water quality parameters between the exposure areas (i.e., Near-field, and Mid-field areas), and the reference areas at Meliadine Lake, a series of Analysis of Variance (ANOVA) tests were completed (Systat 2009). The comparisons of Near-field or Mid-field areas and reference areas were completed for open-water conditions. In addition, comparisons between Near-field and Mid-field areas were completed for open-water and ice-covered conditions. Prior to data analyses, the water quality data were checked for statistical assumptions (e.g., normality, and homoscedasticity; Zar 1996). If data did not meet the statistical assumptions, the equivalent non-parametric tests (e.g., Mann-Whitney U; Zar 1996) were completed. Significant differences were determined using $\alpha = 0.05$. One half the DL was substituted for non-detect values in the dataset prior to data analyses.

3.1.4 Normal Range Calculations

Normal range concentrations were calculated for Meliadine Lake for open-water conditions based on 2016 and 2017 data collected at the reference areas (MEL-03, MEL-04, and MEL-05) and for ice-covered conditions based on data collected at the Mid-field area (MEL-02). Normal ranges for peninsula lakes were calculated separately for each lake.

The calculation methods used to estimate normal ranges followed the methods outlined in Barrett et. al. 2015.

When the baseline data were normally distributed, the normal range was estimated for the average of five observations as the 95% prediction interval (PI) of the dataset selected to represent natural variability (Barrett et al. 2015). Normality was assessed using the Shapiro Wilk test, using $p < 0.05$ to detect a significant departure from normality. When the baseline data were not normally distributed, but normality could be achieved after $\log_{10}$ transformation, the normal range was calculated on the log-transformed data and the upper and lower bound of the normal ranges were back-transformed. If both the untransformed data and log-transformed datasets were non-normal, the normal range boundaries were defined as the 2.5^{th} and 97.5^{th} percentile of the baseline data. In cases where the percentile method was used, 1,000 random samples of size five were generated from the normal range dataset and the 2.5^{th} and 97.5^{th} percentile were calculated from this distribution of 1,000 mean values to estimate the normal range of mean values. Finally, in cases where the untransformed data were normally distributed but the lower bound of the normal range calculated using the PI method was less than zero, the normal range was calculated using either the log-PI method or the percentile method, depending on whether normality could be achieved after $\log_{10}$ transformation. This approach resulted in the lower bound of the normal range always being greater than zero.

The normal ranges provided in this report are considered provisional during initial monitoring under the AEMP due to the limited sample sizes used in the calculations. The normal range is intended to estimate the range of natural spatial and temporal variability, and the more reference data incorporated into the calculation, the more accurate the estimate becomes. These normal ranges may be re-defined in future reports to allow for the inclusion of additional monitoring data after Mine construction has begun. Normal ranges were not calculated for water quality constituents that were represented by other constituents (e.g., turbidity was not included because it is represented by TSS), for constituents that have no ecological relevance (e.g., bicarbonate), or for constituents that were detectable in less than 50% of the samples.

Each calculated normal range was evaluated for representativeness. For example, some parameters had variable DLs, or parameters with low detection frequency could have calculated upper bound normal ranges that were less than the DL, whereas actual concentrations could be anywhere between zero and the DL. Therefore, the calculated normal ranges for parameters with non-detect concentrations in the dataset were revised according to the following criteria:

- If all values were less than the DL, then the lower bound of the normal range was set to zero and the upper bound was set to the DL value.
- If the lower bound of the normal range was less than the DL, then it was set to zero.
- If the upper bound of the normal range was less than the DL, then it was set to the DL value.
- If the dataset included a mix of DLs and all the values were non-detect, then the normal range was set to zero (lower bound) and the most common used DL (upper bound).

- If the dataset included a mix of DLs, and the upper bound of the normal range was between the lowest and highest DL, then the upper bound of the normal range was set to the highest DL.
- If the dataset included a mix of DLs, and the DLs varied by more than an order of magnitude, then the data with the higher DL was removed analysis and the normal range was re-calculated.

3.2 Quality Assurance and Quality Control

The quality assurance/quality control (QA/QC) practices applied during this study and detailed results of the quality control (QC) analyses for discrete water quality samples collected at Meliadine Lake and peninsula lakes are provided in Appendix 3A. Quality assurance (QA) components of the program included the use of trained personnel and an accredited analytical laboratory; QC components included assessments of duplicates and field, equipment, and travel blank samples. Dissolved and total parameter concentrations were also compared.

3.2.1 Results

A total of 22 QC samples consisting of field duplicates, field blanks, travel blanks and equipment blanks were collected during the 2017 programs.

Key QC findings for the water quality monitoring programs include the following:

- Field physico-chemical data for most parameters were reliable and within expected ranges, with the exception of dissolved oxygen measurements during ice-covered conditions (January and February). During winter programs dissolved oxygen readings were higher than the acceptable ranges and were excluded for data analysis. The cold environment where these measurements were taken can affect the functionality of the probes. To minimize the potential for data gaps and improve the QC/QA practices for dissolved oxygen measurements, Winkler tests were performed on 12% of the samples in the subsequent field programs.
- The water quality QC sample evaluation indicated that for the equipment, field, and travel blanks, 3.1%, 1.3%, and 1.2% of parameters, respectively, were detected at concentrations more than five times the DL. Results of blank samples indicated a potential phosphorus contamination during the February sampling program and total and dissolved phosphorus results measured in February were excluded from data analysis.
- Approximately 7.5% of paired concentrations in duplicate discrete water quality samples differed by more than 20%.
- Concentrations of dissolved parameters were generally lower than corresponding total concentrations for the discrete and QC samples. For the discrete dataset, including duplicates, only 2.7% of dissolved concentrations were higher than total concentrations. In blank samples, dissolved concentrations were higher than total concentrations for 1.7% of metals pairs.

The overall quality of the water quality dataset is considered high and the results of the 2017 monitoring program is expected to be adequate to support the AEMP program for the Mine.

3.3 Results and Discussion

In situ physico-chemical measurements and discrete laboratory-measured water quality data collected at Meliadine Lake and the Peninsula lakes in 2017 are summarized in Section 3.3.1 and 3.3.2, respectively. Detailed 2017 data are presented in Appendices 3B and 3C; detailed data collected in 2015 and 2016 are summarized in Golder 2017a.

3.3.1 Meliadine Lake

Meliadine Lake areas were sampled during ice-covered conditions (January, February) and open-water conditions (July, August, September). A total of 20 discrete samples were collected during ice-covered conditions and 55 discrete samples during open-water conditions in 2017.

3.3.1.1 Field Measured Physico-chemical Parameters

Water column profiles of in situ measurements for water temperature, dissolved oxygen, pH, and specific conductivity at Meliadine Lake areas in 2017 are presented in Appendix 3B; in situ profiles for 2015 and 2016 programs are presented in Golder 2017a.

There was no evidence of thermal stratification at Meliadine Lake in 2017 (Appendix 3B, Figures 3B1-1 to 3B1-5) and temperatures ranged from 0 to 2°C during ice-covered conditions and from 9 to 14°C during open-water conditions. Similar temperatures were measured in 2015 and 2016.

Some oxic stratification was observed during the ice-covered conditions in 2017; however, most of the DO measurements during ice-covered conditions were higher than the acceptable range and deemed unreliable and excluded from analysis (Appendix 3B, Tables 3B1 to 3B5). Some stratification of DO measurements were also observed in the past during ice-covered conditions. In 2016, DO concentrations measured at the bottom were lower than those measured at the surface and some concentrations (21% of measurements) in the Near-field area were lower than the minimum chronic guideline requirement for the protection of aquatic life (CCME 1999).

There was no evidence of oxic stratification during open-water conditions (Appendix 3B, Figures 3B.2-1 to 3B.2-3). Water was well-oxygenated, ranging from 10.3 to 11.6 mg/L (100 to 110% saturation) and was within the CWQG for the protection of aquatic life (CCME 1999). Similar DO concentrations were observed in 2015 and 2016 (Appendix 3E, Figure 3E.1-1*a*).

Water in Meliadine Lake was circumneutral to basic, ranging from 6.6 to 8.3 during ice-covered conditions and from 7.0 to 8.1 during open-water conditions (Appendix 3B, Figures 3B.3-1 to 3B.3-5). Similar pH values were observed in 2015 and 2016 (Appendix 3E, Figure 3E.1-1*b*). Most pH values were within the CWQGs and DWQG ranges (i.e., pH=6.5 to 9 and pH = 7.0 to 10.5, respectively), with some exceptions at the exposure areas. The minimum CWQG for the protection of aquatic life was exceeded in 8% of samples collected during ice-covered conditions (2016), and the DWQG was exceeded in 40% of total samples collected during ice-covered conditions (2016 and 2017) and 2% of total samples collected during open-water conditions (2015 to 2017) (Appendix 3D, Tables 3D.1 to 3D.5).

Water column profile measurements of specific conductivity were generally similar among stations and sampling programs. During ice-covered conditions in 2017 specific conductivity ranged from 30 to 117 µS/cm and during open-water conditions ranged from 68 to 82 µS/cm (Appendix 3B, Figures 3B.4-1 to 3B.4-5). Similar conductivity values were observed in 2015 and 2016 (Appendix 3E, Figure 3E.1-2*a*). Specific conductivity values were slightly higher at the Near-field area (MEL-01) and generally more variable during ice-covered conditions.

Median pH was similar between ice-covered and open-water conditions, but conductivity was generally higher during under-ice conditions (as compared to open-water conditions), and dissolved oxygen (and temperature) were lower during under-ice conditions (as compared to open-water conditions) (Table 3.3-1). Statistical tests indicate that both, Near-field and Mid-field areas, had statistically different pH and conductivity values, lower and higher respectively, than the reference areas; conductivity was also statistically different between Near-field and Mid-field areas under open-water conditions (Table 3.3-2). Dissolved oxygen was similar between all areas.

Table 3.3-1: Median Concentrations (2015 to 2017) of Selected Field-Measured Parameters, Meliadine Lake

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
pH	NA	7.3	7.1	7.5	7.6	7.6	7.6	7.7
Specific conductivity	µS/cm	75	87	72	69	67	67	70
Temperature	°C	1.1	1.1	12.6	12.5	12.6	13.6	13.3
Dissolved oxygen	mg/L	8.9	11.5	10.5	11.8	10.8	10.2	10.6
Dissolved oxygen	%	64	84	101	102	104	99	102

NA = not applicable; µS/cm = microsiemens per centimetre; mg/L = milligrams per litre; % = percentage saturation.

Table 3.3-2: Statistical Test Summary for Selected Field-Measured Parameters, Meliadine Lake

Parameter	Ice-Covered		Open-Water					
	MEL-01 versus MEL-02		MEL-01 versus MEL-02		MEL-01 versus Reference		MEL-02 versus Reference	
	P-value	Test	*P*-value	Test	*P*-value	Test	*P*-value	Test
Dissolved oxygen	0.035	ANOVA	0.330	ANOVA	0.737	ANOVA	0.172	M-W U test
pH	0.334	ANOVA	0.744	ANOVA	**0.009**	ANOVA	**0.035**	ANOVA
Specific conductivity	0.271	ANOVA	**0.001**	ANOVA	**<0.001**	ANOVA	**0.045**	ANOVA

Note: **Bolded** cells represent statistically different values (i.e., p <0.05).

ANOVA = analysis of variance; M-W U tests = Mann-Whitney U statistical test.

3.3.1.2 Water Chemistry

Water chemistry results for discrete samples collected from Meliadine Lake areas in 2017 are provided in Appendix 3C, Tables 3C.1 to 3C.5. Summaries of the 2015 and 2016 dataset were provided in Golder 2017a and a summary of statistical analysis for each Meliadine Lake area on the 2015 to 2017 dataset is provided in Appendix 3D, Tables 3D.1 to 3D.5. Time series plots for selected parameters of interest are presented in Appendix 3E to illustrate general trends in parameter concentrations in Meliadine Lake.

Conventional Parameters

Consistent with field measurements, laboratory-measured conductivity in 2017 was slightly higher at the Near-field area as compared to the rest of the areas during each sampling program (Appendix 3C). Also, slightly higher conductivities were observed during ice-covered conditions as compared to open-water conditions (Table 3.3-3). Similar trends were observed in 2015 and 2016 (Appendix 3E, Figure 3E.1-2*a*). Statistical tests indicated that both Near-field and Mid-field areas had statistically different conductivity values than the reference areas; conductivity was also statistically different between Near-field and Mid-field areas (Table 3.3-4).

Water hardness was generally higher at the Near-field area than all areas during open-water conditions and higher than the Mid-field area during ice-covered conditions. In 2017, hardness ranged from 25 to 32 mg/L (ice-covered conditions) and from 19 to 25 mg/L (open-water conditions) and classified as *very soft* water (McNeely et al 1979). Similar hardness values were measured in 2015 to 2016 (Appendix 3E, Figure 3E.1-2b). Statistical tests indicate that hardness at the Near-field area was statistically different than the Mid-field and reference areas (Table 3.3-4).

Alkalinity in 2017 was consistent among stations and seasons and ranged from 13 to 21 mg/L, which classifies Meliadine Lake as *moderately sensitive* to acid deposition (Saffran and Trew 1996). Similar hardness values were measured in 2015 to 2016 (Appendix 3E, Figure 3E.1-2*c*)

Concentrations of total dissolved solids (TDS) in 2017 ranged from less than the DL to 67 mg/L (Appendix 3C, Tables 3C.1 to 3C.5). Concentrations of TDS were consistent among years and stations (Appendix 3E, Figure 3E.1-2*d*) and all TDS concentrations were well below the Health Canada Aesthetic guideline (Health Canada 2014).

Concentrations of total suspended solids (TSS) ranged from less than DL to 7.6 mg/L (Appendix 3C). Concentrations were consistent among years and stations, but TSS was more frequently detected in samples collected during open-water conditions in 2017 (Appendix 3E.1-2*e*).

Statistical tests indicate that both, Near-field and Mid-field areas, had statistically higher TDS concentrations than the reference areas. The Near-field area also had statistically higher TDS concentrations than the Mid-field area during ice-covered conditions, but TDS concentrations between the Near-field and Mid-field were not statistically different during open-water conditions (Table 3.3-4).

Table 3.3-3: Median Concentrations (2015 to 2017) of Selected Conventional Parameters, Meliadine Lake

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Specific conductivity	µS/cm	91	83	74	70	67	67	71
Total hardness	mg/L	27	26	23	21	21	21	22
Total alkalinity	mg/L	17	17	15	16	16	16	17
Total dissolved solids	mg/L	54	45	47	45	43	41	44
Total suspended solids	mg/L	<1.0	<1.0	1.2	1.1	<1.0	<1.0	<1.0
Turbidity	NTU	0.18	0.15	0.41	0.31	0.27	0.25	0.25

µS/cm = microsiemens per centimetre; mg/L = milligrams per litre; NTU = Nephelometric turbidity unit; < = less than.

Table 3.3-4: Statistical Test Summary for Selected Conventional Parameters, Meliadine Lake

Parameter	Ice-Covered		Open-Water					
	MEL-01 versus MEL-02		MEL-01 versus MEL-02		MEL-01 versus Reference		MEL-02 versus Reference	
	P-value	Test	*P*-value	Test	*P*-value	Test	*P*-value	Test
Specific conductivity	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA
Total hardness	**0.010**	ANOVA	**0.001**	ANOVA	**<0.001**	ANOVA	0.774	M-W U test
Total alkalinity	0.937	ANOVA	0.869	ANOVA	0.229	ANOVA	0.231	M-W U test
Total dissolved solids	**0.022**	ANOVA	0.449	ANOVA	**<0.001**	ANOVA	**0.067**	M-W U test

Note: **Bolded** cells represent statistically different values (i.e., p <0.05).

ANOVA = analysis of variance; M-W U tests = Mann-Whitney U statistical test; < = less than.

Major Ions

Concentrations of major ions measured in 2017 were within similar ranges as those measured in previous two years (Appendix 3C). Bicarbonate, chloride, and fluoride were the dominant anions during both ice-covered and open-water conditions (Table 3.3-5); carbonate and hydroxide were non-detectable in all samples.

Major ions concentrations measured between 2015 and 2017 were generally consistent throughout the sampling period and among stations, with the exception of some ions concentrations being higher at the Near-field area and some being higher during ice-covered conditions (Appendix 3D, Tables 3D.1 to 3D.5; Appendix 3E, Figures 3E.1-3).

In 2017, chloride concentrations ranged from 8 to 13 mg/L and were slightly higher in the Near-field area as compared to all areas during open-water and as compared to the Mid-field during ice-covered conditions (Table 3.3-5). Fluoride concentrations ranged <0.02 to 0.04 mg/L and were consistent among areas and seasons (Appendix 3C). Both, chloride and fluoride, were in concentrations lower than the applicable CWQGs for the protection of aquatic life, DWQGs, and SSWQOs (Table 3.1-2). Similar trends and concentrations were observed in 2015 and 2016 (Appendix 3E, Figures 3E.1-3*c* and 3E.1-3*d*).

Sulphate concentrations ranged from 3.1 to 5.5 mg/L and silica concentrations ranged from 0.21 to 0.62 mg/L and both were generally higher at the Near-field area (Appendix 3C, Tables 3C.1 to 3C.5). Similar sulphate and silica concentrations were observed in 2015 and 2016 (Appendix 3E, Figures 3E.1-3*h* and 3E.1-3*i*).

Major cations were overall slightly higher at the Near-field area as compared to the Mid-field and reference areas; major cations were also higher during ice-covered conditions as compared to the open-water conditions (Table 3.3-5). Calcium concentrations ranged from 6.2 to 10.2 mg/L, magnesium concentrations ranged from 1.0 to 1.6 mg/L; potassium concentrations ranged from 0.8 to 1.1 mg/L; and sodium concentrations ranged from 3.9 to 6.3 mg/L. Similar trends and ranges were observed in 2015 and 2016 (Appendix 3E, Figures 3E.1-3*b, e, f, g*).

Statistical tests indicate than most ions concentrations were statistically higher in the Near-field as compared to the Mid-field during under-ice conditions, and in the Near-field and Mid-field as compared to the reference areas during open-water conditions (Table 3.3-6). It is noted that the concentrations are not ecologically relevant (i.e., at concentrations that could cause ecological or toxicological effects) as they are orders of magnitude below the generic and conservative guidelines.

Table 3.3-5: Median Concentrations (2015 to 2017) of Major Ions, Meliadine Lake

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Bicarbonate	mg/L	21	21	19	19	19	19	21
Calcium	mg/L	8.9	8.2	7.1	6.7	6.5	6.4	6.9
Chloride	mg/L	12	10	9.4	8.6	8.0	8.1	8.2
Fluoride	mg/L	0.027	0.026	0.024	0.030	0.026	0.028	0.026
Magnesium	mg/L	1.5	1.4	1.2	1.1	1.1	1.1	1.1
Potassium	mg/L	1.1	1.0	0.9	0.9	0.9	0.8	0.9
Sodium	mg/L	5.9	5.3	4.9	4.4	4.2	4.1	4.3
Sulphate	mg/L	5.2	4.4	4.1	3.7	3.4	3.5	3.5
Silica (reactive)	mg/L	0.57	0.41	0.47	0.29	0.22	0.22	0.24

mg/L = milligrams per litre.

Table 3.3-6: Statistical Test Summary for Selected Major Ions, Meliadine Lake

Parameter	Ice-Covered		Open-Water					
	MEL-01 versus MEL-02		MEL-01 versus MEL-02		MEL-01 versus Reference		MEL-02 versus Reference	
	***P*-value**	**Test**	***P*-value**	**Test**	***P*-value**	**Test**	***P*-value**	**Test**
Chloride	**<0.001**	M-W U test	**<0.001**	M-W U test	**<0.001**	M-W U test	**<0.001**	M-W U test
Fluoride	0.447	M-W U test	0.223	M-W U test	0.025	M-W U test	0.118	M-W U test
Calcium	**0.027**	ANOVA	**0.005**	ANOVA	<0.001	ANOVA	0.657	ANOVA
Magnesium	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA	**0.002**	ANOVA
Potassium	0.057	ANOVA	0.230	ANOVA	**0.006**	ANOVA	0.082	ANOVA
Sodium	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA
Sulphate	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA
Silica (reactive)	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	ANOVA

Note: **Bolded** cells represent statistically different values (i.e., p <0.05).

M-W U tests = Mann-Whitney U statistical test; ANOVA = analysis of variance; < = less than.

Nutrients

Nutrients concentrations in 2017 were low and generally consistent among stations and sampling events (Appendix 3C, Tables 3C.1 to 3C.5). Nitrate concentrations ranged from <0.005 to 0.17 mg-N/L and were slightly higher in September at Mid-field area, and some stations within the Near-field area and Reference Area 1 (MEL-03). Nitrite concentrations ranged from <0.001 to 0.004 mg-N/L and were all lower than the CWQG for the protection of aquatic life. Concentrations were low in all areas (Table 3.3-7); however, nitrate concentrations were statistically different between the two exposure areas during ice-covered conditions but not open-water conditions and concentrations were not statistically different during open-water conditions (Table 3.3-8).

Total ammonia concentrations were also low in 2017, ranging from <0.005 to 0.030 mg-N/L, with slightly higher values during ice-covered conditions (Table 3.3-7). Similar concentrations and trends were observed in 2015 and 2016 and concentrations were statistically different between the two exposure areas during ice-covered conditions; concentrations were similar between all areas during open-water conditions (Table 3.3-8). All detected ammonia concentrations were below the CWQGs for the protection of aquatic life.

Concentrations of TKN ranged from 0.10 to 0.39 mg-N/L (Appendix 3C) and were slightly higher at the exposure areas (Table 3.3-7). Similar TKN concentrations and trends were observed in 2015 and 2016 (Appendix 3E, Figures 3E.1-4*c* and 3E.1-4*d*) and, during open-water conditions, concentrations were statistically higher in the Near-field and Mid-field as compared to the reference areas (Table 3.3-8).

Total phosphorus (TP) and dissolved phosphorus (TDP) were detected in most samples in 2017 and concentrations ranged from <0.001 to 0.013 mg-P/L and 0.006 mg-P/L, respectively (Appendix 3C). Similar concentrations were observed in 2015 and 2016 (Appendix 3E, Figures 3E.1-4*e* and 3E.1-4*f*). Statistical tests indicate that TP concentrations at the Near-field area were statistically different than Mid-field and reference areas during open-water conditions (Table 3.3-8).

Based on the range of TP concentrations reported for Meliadine Lake in 2017 (median of 0.004 mg-P/L), and TP trigger ranges for Canadian lakes (CCME 2004), Meliadine Lake can be classified as *oligotrophic* (i.e., concentrations are generally within the 0.0004 to 0.01 mg-P/L range). Trophic status, as based on nutrient and chlorophyll *a* concentrations, and Secchi depth, is classified as *oligotrophic* (Section 7.3.2).

Organic carbon occurred primarily in dissolved form as opposed to particulate organic carbon. Total organic carbon (TOC) concentrations ranged from 2.0 to 4.3 mg/L; dissolved organic carbon (DOC) concentrations ranged from 2.0 to 4.1 mg/L.

Table 3.3-7: Median Concentrations (2015 to 2017) of Nutrient Parameters, Meliadine Lake

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Nitrate	mg-N/L	0.010	0.006	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Ammonia	mg-N/L	0.024	0.016	<0.005	<0.005	<0.005	<0.005	<0.005
TKN	mg-N/L	0.20	0.18	0.17	0.17	0.14	0.14	0.11
Total phosphorus	mg-P/L	0.003	0.003	0.006	0.004	0.004	0.004	0.004
Dissolved phosphorus	mg-P/L	0.001	0.002	0.002	0.002	0.002	0.002	0.003
Orthophosphate	mg-P/L	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total organic carbon	mg/L	3.2	2.9	2.9	2.6	2.3	2.3	2.4
Dissolved organic carbon	mg/L	3.2	2.9	2.9	2.6	2.2	2.2	2.2

TKN= total Kjeldahl nitrogen; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; mg/L = milligrams per litre; < = less than.

Table 3.3-8: Statistical Test Summary for Selected Nutrient Parameters, Meliadine Lake

Parameter	Ice-Covered		Open-Water					
	MEL-01 versus MEL-02		MEL-01 versus MEL-02		MEL-01 versus Reference		MEL-02 versus Reference	
	P-value	Test	*P*-value	Test	*P*-value	Test	*P*-value	Test
Nitrate	**0.006**	ANOVA	0.402	ANOVA	0.087	ANOVA	0.559	M-W U test
Ammonia	**<0.001**	ANOVA	0.456	ANOVA	0.357	ANOVA	0.834	M-W U test
TKN	0.052	ANOVA	0.394	ANOVA	**<0.001**	ANOVA	**0.006**	ANOVA
Total phosphorus	0.051	ANOVA	**0.005**	ANOVA	**<0.001**	ANOVA	0.163	M-W U test

Note: **Bolded** cells represent statistically different values (i.e., p <0.05).

ANOVA = analysis of variance; M-W U test = Mann-Whitney U statistical test; < = less than.

Metals

Total and dissolved metals analyzed in 2017 were detected in most samples but concentrations were low and within similar ranges as those measured in the past two years, with some exceptions. During the September program, concentrations of some total metals (i.e., aluminum, molybdenum, nickel, tin, and zinc) and dissolved metals (cadmium and molybdenum) were slightly higher than in past programs, primarily at some stations in the Near-field area. Metals were analyzed using DLs lower than applicable guidelines and site-specific objectives and all detected metals concentrations in 2017 were lower than the guidelines or objectives (Appendix 3C, Tables 3C.1 to 3C.5).

Between 2015 and 2017, total beryllium was not detected in any sample, and total bismuth, cadmium, chromium, silver, thallium, tin, titanium, and vanadium were not detected in any sample collected during ice-covered conditions, but were detected during open-water conditions (Appendix 3D, Tables 3D.1 to 3D.5; Appendix 3E, Figures 3E.1-5).

Total metals concentrations were generally consistent among sampling programs and seasons. Among sampling stations, detected concentration of some total metals (e.g., arsenic, cobalt, manganese, nickel, strontium) and dissolved metals (e.g., arsenic, iron, lead, nickel, zinc) were generally slightly higher at the Near-field area as compared to the Mid-field or reference areas (Table 3.3-9; Appendix 3E, Figures 3E.1-5). Statistical tests indicate that total arsenic, barium, cobalt, copper, iron, lithium, manganese, mercury, nickel, strontium, and uranium were statistically different between the exposure and reference areas (Table 3.3-10; Appendix 3F, Table 3F.1). Concentrations of arsenic, cobalt, iron, manganese, and nickel were statistically higher in the Near-field as compared to Mid-field during ice-covered and open-water conditions and reference areas during open-water conditions. Concentrations of barium were higher in the reference areas as compared to the Near-field and Mid-field areas, and concentrations of mercury, strontium and uranium were higher in the Near-field and Mid-field as compared to the reference areas during open-water conditions. It is noted that the concentrations are not ecologically relevant as they are orders of magnitude below the guidelines.

Table 3.3-9: Median Concentrations (2015 to 2017) of Total Metals Parameters, Meliadine Lake

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Aluminum	µg/L	1.1	1.0	2.9	2.4	2.7	2.2	1.9
Antimony	µg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	0.38	0.28	0.39	0.26	0.20	0.18	0.25
Barium	µg/L	8.8	8.8	7.3	7.5	7.5	7.6	7.7
Beryllium	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Boron	µg/L	5.4	5.1	<5.0	<5.0	<5.0	<5.0	5.0
Cadmium	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium	µg/L	<0.06	<0.06	<0.06	<0.06	<0.1	<0.1	<0.1
Cobalt	µg/L	0.013	<0.010	0.021	0.015	0.010	0.011	0.011
Copper	µg/L	0.89	0.82	0.74	0.74	0.71	0.69	0.70
Iron	µg/L	8.6	4.1	21	13	11	7.2	7.6
Lead	µg/L	<0.01	0.012	<0.01	<0.01	<0.01	<0.01	<0.01
Lithium	µg/L	0.85	0.84	0.69	0.62	<0.5	0.67	0.60
Manganese	µg/L	2.3	1.4	5.5	4.2	2.3	2.6	2.8
Mercury	µg/L	0.0005	<0.0005	0.0006	0.0006	0.0006	0.0006	<0.0005
Molybdenum	µg/L	0.080	0.074	0.066	0.063	0.062	0.065	0.073
Nickel	µg/L	0.67	0.53	0.59	0.51	0.37	0.37	0.37
Selenium	µg/L	0.040	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silver	µg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	42	39	33	31	31	31	32
Thallium	µg/L	<0.005	<0.005	<0.005	<0.005	0.0021	<0.005	<0.005
Tin	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Titanium	µg/L	<0.1	<0.1	0.13	<0.1	0.34	<0.5	<0.5

Parameter	Unit	Ice-Covered		Open-Water				
		MEL-01	MEL-02	MEL-01	MEL-02	MEL-03	MEL-04	MEL-05
Uranium	µg/L	0.015	0.013	0.015	0.014	0.014	0.014	0.014
Vanadium	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	1.3

µg/L = microgram per litre; < = less than.

Table 3.3-10: Statistical Test Summary for Selected Total Metals, Meliadine Lake

Parameter	Ice-Covered		Open-Water					
	MEL-01 versus MEL-02		MEL-01 versus MEL-02		MEL-01 versus Reference		MEL-02 versus Reference	
	P-value	Test	*P*-value	Test	*P*-value	Test	*P*-value	Test
Aluminum	0.101	ANOVA	0.200	ANOVA	0.168	M-W U test	0.168	M-W U test
Arsenic	**<0.001**	ANOVA	<0.001	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Barium	0.464	ANOVA	0.044	ANOVA	**0.018**	M-W U test	**0.018**	M-W U test
Boron	0.306	ANOVA	0.751	ANOVA	0.432	M-W U test	0.432	M-W U test
Cadmium	-	-	-	-	0.284	M-W U test	0.284	M-W U test
Cobalt	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Copper	**<0.001**	ANOVA	0.288	ANOVA	**0.001**	M-W U test	**0.001**	M-W U test
Iron	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Lead	-	-	-	-	0.282	M-W U test	0.282	M-W U test
Manganese	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Mercury	-	-	0.263	ANOVA	**0.023**	M-W U test	**0.023**	M-W U test
Molybdenum	**0.015**	ANOVA	0.453	ANOVA	0.690	M-W U test	0.690	M-W U test
Nickel	**<0.001**	ANOVA	**<0.001**	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Strontium	0.093	ANOVA	0.115	ANOVA	**<0.001**	M-W U test	**<0.001**	M-W U test
Uranium	-	-	0.119	ANOVA	**0.008**	M-W U test	**0.008**	M-W U test
Zinc	-	-	-	-	0.844	M-W U test	0.844	M-W U test

Note: **Bolded** cells represent statistically different values (i.e., p <0.05).

ANOVA = analysis of variance; M-W U test = Mann-Whitney U statistical test; < = less than; - = statistical test not completed as more than 50% of the results were non-detect.

Cyanide

Free and weak acid dissociable cyanide species measured between 2015 and 2017 were below the analytical DL for all stations and sampling events (Appendix 3D, Tables 3D.1 through 3D.5). Detection limits for cyanide species were at, or lower than, applicable guidelines (i.e., 0.005 mg/L CCME 1999).

3.3.2 Peninsula Lakes

Three peninsula lakes were sampled in July and August 2017 during open-water conditions. Water quality samples were also collected at the peninsula lakes in 2015 (August) and 2016 (July and August) and a summary of the 2015 and 2016 data were provided in Golder 2017a. Detailed water quality data collected at peninsula lakes in 2017 is summarized in Appendix 3C and a general characterization is presented in this section.

3.3.2.1 Field Measured Physico-chemical Parameters

In situ measurements of physico-chemical parameters at the peninsula lakes during the 2017 sampling programs did not indicate stratification within the water column at the time of sampling and results were generally similar to those measured in the previous two years (Appendix 3B, Figures 3B.6 to 3B.8; Golder 2017a).

Water temperatures at the peninsula lakes in 2017 ranged from 9.4°C to 14.7°C and were overall consistent among lakes. Dissolved oxygen concentrations ranged from 10.0 to 11.6 mg/L (100 to 108% saturation) and were also similar among lakes. Dissolved oxygen concentrations in 2017 were all above the minimum CWQG requirements for the protection of aquatic life (i.e., 6.5 mg/L). Similar temperatures and oxygen concentrations were measured in 2015 and 2016 (Appendix 3E, Figure 3E.2-1).

Peninsula lakes had slightly basic conditions (Cowardin et al. 1979), with pH values ranging from 7.9 to 8.4; similar pH conditions were observed in 2015 and 2016. All pH measurements in 2017 were within CWQG for the protection of aquatic life and Health Canada guidelines ranges (i.e., pH = 6.5 to 9 and 7.0 to 10.5, respectively).

Specific conductivity profiles were consistent throughout the water column at each lake. Conductivities ranged from 151 to 306 µS/cm and were slightly higher at Lake A8 as compared to lakes B7 and D7 (Table 3.3-11). Similar conductivity trend was observed in the past (Appendix 3D, Tables 3D.6 to 3D.8).

Field-measured parameters at the peninsula lakes were similar to those measured in Meliadine Lake, with exception of specific conductivities, which were lower in Meliadine Lake (median = 69 µS/cm; Section 3.2.1.1).

Table 3.3-11: Median Concentrations (2015 to 2017) of Selected Field-Measured Parameters, Peninsula Lakes

Parameter	Unit	Lake A8	Lake B7	Lake D7
pH	NA	8.2	7.9	8.3
Specific conductivity	µS/cm	289	159	147
Temperature	°C	14.1	12.1	12.9
Dissolved oxygen	mg/L	9.8	9.8	10.7
Dissolved oxygen	%	96	96	103

NA = not applicable; µS/cm = microsiemens per centimetre; mg/L = milligrams per litre; % = percentage saturation.

3.3.2.2 Water Chemistry

Water chemistry results for discrete samples collected at the peninsula lakes in 2017 are presented in Appendix 3C (Tables 3C.6 to 3C.8). A descriptive statistic summary for 2015 to 2017 dataset is presented in Appendix 3D (Tables 3D.6 to 3D.8) and detailed results of the 2015 and 2016 sampling programs are presented in Golder 2017a. Summary plots for selected parameters of interest to illustrate general trends in parameter concentrations in the peninsula lakes are presented in Appendix 3E.

Conventional Parameters

Water hardness in peninsula lakes in 2017 ranged from 52 to 115 mg $CaCO_3$/L and was consistently higher at Lake A8 (Table 3.3-12). Lakes A8 and B7 had *moderately soft* water (McNeeley et al. 1979), while Lake D7 had *soft* water.

Based on alkalinity, peninsula lakes are classified as having *minimal* or *low sensitivity* to acid deposition (Saffran and Trew 1996). Alkalinities ranged from 37 to 55 mg $CaCO_3$/L, and were slightly higher at Lake D7 (Appendix 3C).

Peninsula lakes had low to moderate ionic strength; TDS concentrations ranged from 89 to 229 mg/L and were higher at Lake A8. Concentrations of TSS and turbidity indicate that water in the peninsula lakes was clear (i.e., TSS concentrations were less than 3.4 mg/L and turbidity less than 1.0 NTU; Appendix 3C, Tables 3C.6 to 3C.8).

Similar trends and concentrations of conventional parameters were observed in 2015 and 2016. Hardness, specific conductivity, and TDS concentrations were higher at Lake A8, and alkalinity was slightly higher at D7 (Table 3.3-12; Appendix 3E, Figures 3E.2-2).

Higher conductivity, hardness, alkalinity, and TDS concentrations were observed in the peninsula lakes than those measured in Meliadine Lake (Section 3.2.1.1).

Table 3.3-12: Median Concentrations (2015 to 2017) of Selected Conventional Parameters, Peninsula Lakes

Parameter	Unit	Lake A8	Lake B7	Lake D7
Specific conductivity	µS/cm	285	163	146
Total hardness	mg/L	108	63	52
Total alkalinity	mg/L	45	37	52
Total dissolved solids	mg/L	197	108	90
Total suspended solids	mg/L	<1.0	1.1	<1.0
Turbidity	NTU	0.50	0.43	0.82

µS/cm = microsiemens per centimetre; mg/L = milligrams per litre; NTU = Nephelometric turbidity unit; < = less than.

Major Ions

Concentrations of major ions in 2017 differed among peninsula lakes, but were similar among stations and sampling events within each lake. Lake D7 had higher bicarbonate and fluoride concentrations, and Lake A8 had higher chloride, sulphate, and major cations than the other two lakes (Table 3.3-13). Carbonate and hydroxide were non-detectable in all samples (Appendix 3C, Tables 3C.6 to 3C.8). Similar concentrations and trends were observed in 2015 and 2016 (Appendix 3E, Figures 3E.2-3).

None of the measured concentrations of major ions (i.e., chloride, fluoride, and sulphate) exceeded associated guidelines and/or objectives (Appendix 3C, Tables 3C.6 to 3C.8). With exception of the non-detectable ions (i.e., carbonate and hydroxide), all other major ions had higher concentrations in the peninsula lakes than in Meliadine Lake (Section 3.2.1.1).

Table 3.3-13: Median Concentrations (2015 to 2017) of Selected Major Ions, Peninsula Lakes

Parameter	Unit	Lake A8	Lake B7	Lake D7
Bicarbonate	mg/L	54	45	63
Calcium	mg/L	36	21	16
Chloride	mg/L	57	24	12
Fluoride	mg/L	0.03	0.03	0.04
Magnesium	mg/L	4.5	2.4	2.9
Potassium	mg/L	2.0	1.3	1.3
Sodium	mg/L	7.8	3.9	8.0
Sulphate	mg/L	6.6	4.6	4.3
Silica (reactive)	mg/L	0.58	0.83	0.21

mg/L = milligrams per litre.

Nutrients

Concentrations of nutrients measured in 2017 at the peninsula lakes were generally consistent among lakes, with exception of some phosphorus-based nutrients (Appendix 3C, Tables 3C.6 to 3C.8).

Nitrate and nitrite were non-detected in the peninsula lakes in 2017. Total ammonia concentrations were also low, ranging from <0.005 to 0.042 mg-N/L, and were all below the applicable CWQG for the protection of aquatic life.

Total and dissolved phosphorus concentrations were detected in all samples and ranged from 0.005 to 0.017 mg-P/L and from 0.0015 to 0.0064 mg-P/L, respectively. Orthophosphate concentrations were typically below the DL and ranged from <0.001 to 0.004 mg-P/L (Appendix 3C, Tables 3C.6 to 3C.8). Phosphorus-based nutrients were generally higher at Lake D7 (Table 3.3-14). Based on the range of TP concentrations and trigger ranges for Canadian Lakes (CCME 2004) the peninsula lakes can be classified as *oligotrophic* (Lakes A8 and B7) to *mesotrophic* (Lake D7).

Similar nutrients concentrations and trends were observed in 2015 and 2016 (Appendix 3E, Figures 3E.2-4). Nutrient concentrations measured at the peninsula lakes were similar to those measured at Meliadine Lake (Section 3.2.1.1).

Table 3.3-14: Median Concentrations (2015 to 2017) of Selected Nutrients Parameters, Peninsula Lakes

Parameter	Unit	Lake A8	Lake B7	Lake D7
Nitrate	mg-N/L	<0.005	<0.005	<0.005
Nitrite	mg-N/L	<0.001	<0.001	<0.001
Ammonia	mg-N/L	0.005	0.006	0.006
TKN	mg-N/L	0.31	0.33	0.35
Total phosphorus	mg-P/L	0.006	0.007	0.013
Dissolved phosphorus	mg-P/L	0.002	0.002	0.004
Orthophosphate	mg-P/L	<0.001	<0.001	0.001
Total organic carbon	mg/L	4.0	5.3	4.8
Dissolved organic carbon	mg/L	4.0	5.2	4.5

TKN= total Kjeldahl nitrogen; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; mg/L = milligrams per litre; < = less than.

Metals

Total and dissolved metals analyzed in 2017 at the peninsula lakes were detected in most samples, but concentrations were generally low (Appendix 3C; Tables 3C.6 to 3C.8). Total beryllium, bismuth, chromium, silver, and titanium were non-detected in the peninsula lakes, and total antimony, boron, selenium, tin, and vanadium were only detected in one or two lakes. Dissolved beryllium and silver were non-detected in any sample; the remaining dissolved metals were detected at least once in one or all lakes.

Total metals concentrations were generally consistent among years, but some metals (i.e., total arsenic, barium, molybdenum, nickel, and selenium) were slightly higher in 2016 and 2017 as compared to 2015. Also, most metals concentrations were similar among lakes, with some exceptions. Lake D7 had slightly higher total boron, lithium, molybdenum, selenium, uranium, and vanadium, and Lake A8 had higher total arsenic, barium, and strontium than other lakes (Table 3.3-15; Appendix 3E, Figures 3E.2-5).

Metals were analyzed using DLs lower than applicable guidelines and all detected metals concentrations in 2017 were lower than these guidelines or objectives (Appendix 3C, Tables 3C.6 to 3C.8).

Metals concentrations in the peninsula lakes were similar to those measured in Meliadine Lake, with exception of total and dissolved arsenic, barium, lithium, and strontium, which had higher concentrations at the peninsula lakes (Appendix 3E, Figures 3E.1-5 and 3E.2-5).

Table 3.3-15: Median Concentrations (2015 to 2017) of Selected Total Metals, Peninsula Lakes

Parameter	Unit	Lake A8	Lake B7	Lake D7
Aluminum	µg/L	1.7	1.8	5.1
Arsenic	µg/L	2.1	1.4	1.0
Barium	µg/L	29	19	16
Boron	µg/L	<5	<5	13
Cadmium	µg/L	<0.005	<0.005	<0.005
Chromium	µg/L	<0.06	<0.06	<0.06
Cobalt	µg/L	0.033	0.039	0.044
Copper	µg/L	0.66	0.71	0.75
Iron	µg/L	46	74	52
Lead	µg/L	<0.01	0.011	<0.01
Manganese	µg/L	8.8	6.4	10
Mercury	µg/L	0.0008	0.0007	0.0007
Molybdenum	µg/L	0.21	0.17	0.43
Nickel	µg/L	0.81	0.92	0.65
Strontium	µg/L	257	147	78
Uranium	µg/L	0.043	0.026	0.081
Zinc	µg/L	<0.8	<0.8	<0.8

µg/L – micrograms per litre; < = less than.

Cyanide

Free and weak acid dissociable cyanide species measured between 2015 and 2017 in the peninsula lakes were below the analytical DL for all stations and sampling events (Appendix 3D, Tables 3D.6 to 3D.8). Detection limits for cyanide species were at, or lower than, applicable guidelines (i.e., 0.005 mg/L CCME 1999).

3.3.2.3 Chlorophyll a

Chlorophyll *a* concentrations in the peninsula lakes varied among years and among lakes with generally lower concentrations of chlorophyll *a* in 2017 than in previous years (Figure 7.3-28). In July, mean concentrations of chlorophyll *a* were lower in all lakes than in 2016 with a mean of 1.2 ± 0.03 µg/L in Lake A8, 0.6 ± 0.3 µg/L in Lake B7, and 1.8 ± 0.08 µg/L in Lake D7. By comparison, mean chlorophyll *a* concentrations in 2016 were 2.5 ± 0.1 µg/L in Lake A8, 1.8 ± 0.08 µg/L in Lake B7, and 3.5 ± 0.09 µg/L in Lake D7. In August, chlorophyll *a* was slightly higher in each lake than in July but lower in 2017 than in previous years with high variability observed in Lake A8. Mean chlorophyll in August 2017 was 1.2 ± 2.4 µg/L in Lake A8, 1.3 ± 0.06 µg/L in Lake B7, and 2.3 ± 0.05 µg/L in Lake D7.

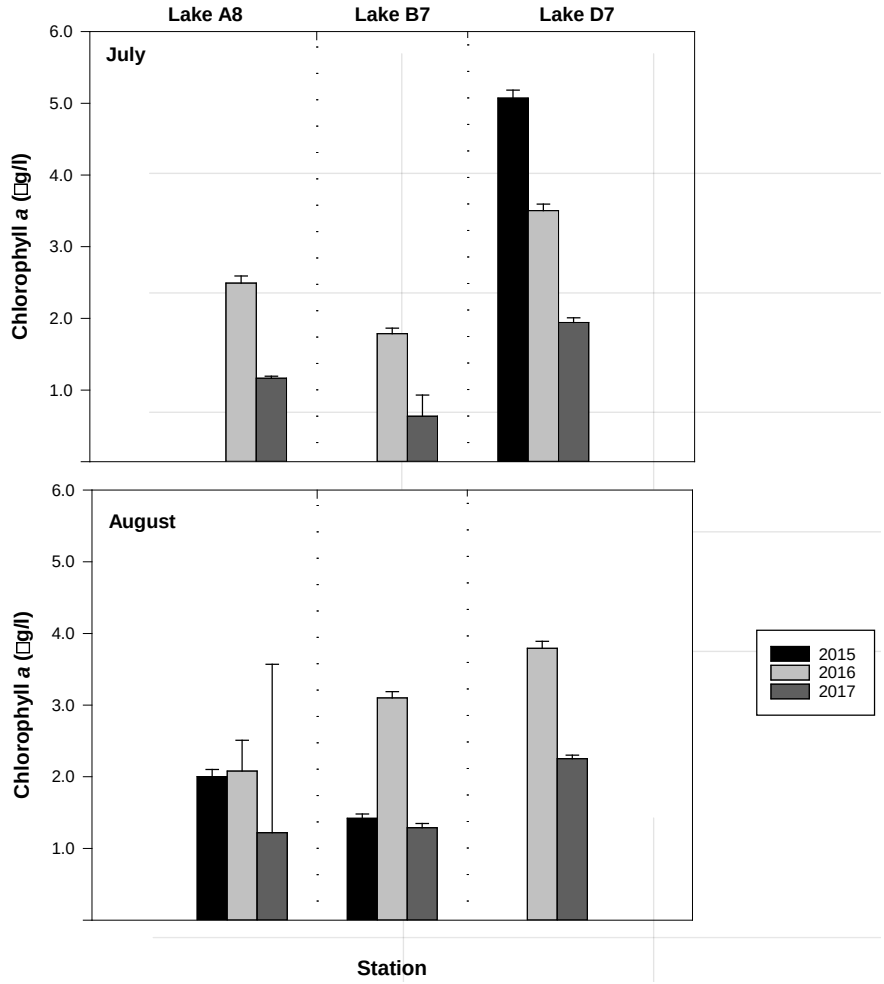


Figure 3.3-1: Mean Chlorophyll a Concentrations in the Peninsula Lakes, 2015 – 2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE).

µg/l = micrograms per litre.

3.4 Normal Ranges

Provisional normal ranges were calculated for ecologically relevant water quality parameters (i.e., parameters with known toxicological benchmarks as defined by generic chronic or acute aquatic life guidelines). Normal ranges are provided for Meliadine Lake and the Peninsula Lakes.

3.4.1 Meliadine Lake

The provisional ice-covered normal range for Meliadine Lake was calculated using ice-covered data collected at the Mid-field area and the provisional open-water normal range for Meliadine Lake was calculated using open-water data from the reference areas (Table 3.4-1). This was done as it was noted that concentrations for some constituents were higher at the Near-field as compared to the Mid-field area during ice-covered conditions and higher at the Near-field and Mid-field as compared to the reference areas during open-water conditions. This may be a reflection of natural within lake variability and will attempt to be resolved by examining baseline data reported in the environmental impact statement report (Agnico Eagle 2014).

Median TDS concentrations at all stations were within the normal ranges, with the exception of the Near-field area during open-water (i.e., 47 mg/L, Table 3.3-3) which had slightly higher median TDS concentration than the normal range upper bound (i.e., 46 mg/L; Table 3.4-1). Median concentrations of major ions at the Near-field area during ice-covered conditions were all slightly higher than the upper bound of normal ranges calculated for ice-covered conditions. During open-water conditions, the Near-field area had slightly higher median calcium, sodium, magnesium, chloride, and sulphate concentrations than the normal ranges and the Mid-field area had slightly higher median chloride, fluoride, and sulphate concentrations than the normal ranges (Table 3.4-1). Median nitrate concentrations were within the provisional normal ranges. Under ice-covered conditions, the Near-field area had higher median ammonia concentration conditions than the normal range. Median TP concentrations were within the normal ranges. Under ice-covered condition, median concentrations of total arsenic, copper, iron, manganese, molybdenum, nickel, and uranium at the Near-field area were slightly higher than the upper bound of the normal range. Under open-water conditions, median concentrations of arsenic, iron, manganese, and nickel at the exposure areas were slightly higher than the normal range.

Table 3.4-1: Normal Ranges (2015 to 2017) for Selected Parameters, Meliadine Lake

Parameter	Unit	Detection Limit	Ice-Covered (Mid-field Area)			Open-Water (Reference Areas)		
			Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound
Major Ions								
Chloride	mg/L	0.5	PI	9.3	11.0	PI	7.8	8.3
Fluoride	mg/L	0.02	%tile	0.024	0.029	%tile	0[(a)]	0.028
Potassium	mg/L	0.02	PI	0.96	1.07	%tile	0.81	0.91
Sulphate	mg/L	0.3	PI	4.08	4.74	PI	3.26	3.59
Nutrients								
Nitrate	mg-N/L	0.005	%tile	0[(a)]	0.010	%tile	0[(a)]	0.006

Parameter	Unit	Detection Limit	Ice-Covered (Mid-field Area)			Open-Water (Reference Areas)		
			Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound
Total ammonia	mg-N/L	0.005	PI	0.011	0.021	%tile	0[a]	0.006
Total phosphorus	mg-P/L	0.001	PI	0.002	0.004	%tile	0.004	0.006
Total Metals								
Aluminum	µg/L	0.3	PI	0.82	1.22	%tile	2.07	4.84
Arsenic	µg/L	0.02	PI	0.256	0.297	PI	0.177	0.231
Barium	µg/L	0.05	PI	8.42	9.31	PI	7.33	7.74
Boron	µg/L	5	PI	0[a]	6.3	%tile	0[a]	6.2
Cadmium	µg/L	0.005	-	0[c]	0.005[c]	-	0[a]	0.005[b]
Cobalt	µg/L	0.005/0.01	%tile	0[a]	0.01[b]	%tile	0[a]	0.016
Copper	µg/L	0.1	PI	0.784	0.868	%tile	0.676	0.822
Iron	µg/L	1	log-PI	2.92	5.92	%tile	7.2	15.3
Lead	µg/L	0.01	%tile	0[a]	0.025	%tile	0[a]	0.059
Manganese	µg/L	0.05	log-PI	1.11	1.76	%tile	2.06	3.04
Mercury	µg/L	0.0005	%tile	0[a]	0.0005[b]	%tile	0[a]	0.00072
Molybdenum	µg/L	0.05	PI	0.064	0.079	%tile	0[a]	0.077
Nickel	µg/L	0.06	PI	0.502	0.564	%tile	0.334	0.400
Strontium	µg/L	0.2	PI	35.5	42.2	PI	29.8	32.1
Uranium	µg/L	0.01	%tile	0.012	0.014	PI	0.013	0.016
Zinc	µg/L	0.5/0.8	%tile	0[a]	0.85	%tile	0[a]	2.61

(a) the lower bound of the normal range was less than the detection limit; therefore, the lower bound of the normal range was set to zero.
(b) the upper bound of the normal range was less than the detection limit; therefore, the upper bound of the normal range was set to the detection limit.
(c) all values in the dataset were non-detect; therefore, the normal range was set from zero to the detection limit.
%tile = 2.5th and 97.5th percentiles; PI = 95% prediction intervals; log-PI = 95% prediction interval on log-transformed data.
mg/L = milligrams per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; µg/L = micrograms per litre.

3.4.2 Peninsula Lakes

The provisional open-water normal range for the Peninsula Lakes was calculated using open-water data collected from lakes A8, B7, and D7 (Table 3.4-2).

Table 3.4-2: Normal Ranges (2015 to 2017) for Peninsula Lakes

Parameter	Unit	Detection Limit	Lake A8			Lake B7			Lake D7		
			Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound
Major Ions											
Chloride	mg/L	0.5	%tile	45	59	%tile	22	25	%tile	10	12
Fluoride	mg/L	0.02	PI	0.028	0.037	%tile	0.021	0.034	%tile	0.036	0.046
Potassium	mg/L	0.02	%tile	1.79	2.13	PI	1.27	1.38	PI	1.10	1.44
Sulphate	mg/L	0.05	%tile	6.14	7.77	%tile	4.25	5.32	%tile	3.58	4.85
Nutrients											
Nitrate	mg-N/L	0.005	%tile	0[(a)]	0.0083	%tile	0[(a)]	0.005[(b)]	-	0[(c)]	0.005[(c)]
Total ammonia	mg-N/L	0.005	%tile	0[(a)]	0.009	%tile	0[(a)]	0.020	PI	0[(a)]	0.009
Total phosphorus	mg-P/L	0.001	PI	0.005	0.008	%tile	0.006	0.008	%tile	0.012	0.021
Total Metals											
Aluminum	µg/L	0.7	log-PI	1.15	2.57	%tile	1.61	5.73	PI	4.06	6.37
Arsenic	µg/L	0.02	PI	1.79	2.35	log-PI	1.29	1.73	PI	0.94	1.13
Barium	µg/L	0.02	%tile	25	30	PI	18	20	PI	15	17
Boron	µg/L	5	%tile	0[(a)]	5.2	%tile	0[(a)]	6.8	PI	10.1	16
Cadmium	µg/L	0.005	-	0[(a)]	0.005[(b)]	%tile	0[(a)]	0.005[(b)]	-	0[(a)]	0.005[(b)]

Parameter	Unit	Detection Limit	Lake A8			Lake B7			Lake D7		
			Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound	Method	Lower Bound	Upper Bound
Chromium	µg/L	0.06	%tile	0[(a)]	0.06[(b)]	-	0[(c)]	0.06[(c)]	%tile	0[(a)]	0.06[(b)]
Cobalt	µg/L	0.005	PI	0.021	0.045	PI	0.034	0.046	%tile	0.039	0.046
Copper	µg/L	0.1	PI	0.56	0.83	log-PI	0.60	0.89	PI	0.60	0.98
Iron	µg/L	1	PI	25	64	PI	57	98	%tile	47	97
Lead	µg/L	0.01	%tile	0[(a)]	0.018	%tile	0[(a)]	0.042	%tile	0[(a)]	0.015
Manganese	µg/L	0.05	PI	4.5	12.4	%tile	4.9	8.2	PI	9	12.1
Mercury	µg/L	0.0005	PI	0[(a)]	0.0011	log-PI	0[(a)]	0.0013	PI	0[(a)]	0.0009
Molybdenum	µg/L	0.05	%tile	0.18	0.22	PI	0.14	0.19	%tile	0.31	0.45
Nickel	µg/L	0.05	%tile	0.788	0.878	%tile	0.872	1.190	PI	0.571	0.725
Strontium	µg/L	0.05	%tile	213	264	PI	138	153	%tile	65	81
Uranium	µg/L	0.003	%tile	0.033	0.049	PI	0.023	0.029	PI	0.066	0.097
Zinc	µg/L	0.5	%tile	0[(a)]	1.53	%tile	0[(a)]	4.27	%tile	0[(a)]	1.69

(a) the lower bound of the normal range was less than the detection limit; therefore, the lower bound of the normal range was set to zero.

(b) the upper bound of the normal range was less than the detection limit; therefore, the upper bound of the normal range was set to the detection limit.

(c) all values in the dataset were non-detect; therefore, the normal range was set from zero to the detection limit.

%tile = 2.5th and 97.5th percentiles; PI = 95% prediction intervals; log-PI = 95% prediction interval on log-transformed data.

DL= detection limit; mg/L = milligram per litre; mg-N/L = milligrams nitrogen per litre; mg-P/L = milligrams phosphorus per litre; µg/L = micrograms per litre.

4.0 SEDIMENT QUALITY

Sediment quality monitoring was completed at Meliadine Lake in 2015 and 2016 to support the AEMP and Water Licence requirements for the Mine; sampling was completed in August of each year. The objective of the sediment monitoring activities was to characterize baseline conditions so that sediment quality trends and adaptive management strategies can be identified, as required, during the life of mine. A summary of the 2015 and 2016 data was provided in the 2016 annual report (Golder 2017a). The 2017 report included some initial data analysis (e.g., comparison to guidelines, calculation of descriptive statistics). This report uses those same data but includes more detailed evaluation of the data with statistical comparison between sampling areas, evaluation of differences in particle size, and discussion of potential confounding factors that could influence future monitoring.

This section of the report provides a detailed analysis of sediment quality based on the 2015 and 2016 dataset. The specific objectives are as follows:

- present detailed descriptive statistics (mean, median, standard deviation and standard error) for each sampling area
- evaluate differences between the exposure and reference areas of Meliadine Lake
- evaluate the effect of particle size on sediment chemistry (including differences in arsenic concentrations)
- discuss confounding factors that may influence future monitoring programs once full effluent discharge starts

4.1 Methods

4.1.1 Sediment Sample Collection

The sediment quality baseline program consisted of one sampling event during open-water conditions in each of 2015 and 2016, and was based on the Meliadine AEMP design plan (Golder 2016b). Sediment samples were collected from the exposure area only of Meliadine Lake in August 2015 and from all five sampling areas in August 2016 (Table 4.1-1). The sediment quality samples were collected as grab samples from the surficial sediments at the water quality stations. Sediment samples were collected either on the same day or within a couple days before or after collection of water quality samples. When water and sediment samples were collected on the same day, sediment samples were collected after all in situ measurements and water quality samples had been collected.

Composite sediment samples were collected using a stainless steel 15 cm Ekman grab. Each composite sample was comprised of up to five separate sample grabs collected within close proximity around the sampling station. Lake sediment was removed from the Ekman grab with a plastic trowel; sediments were removed from the centre of the grab to avoid the metal sides of the Ekman, and from the upper 5 cm of the grab. The process was repeated up to five times, until sufficient sediment was collected (approximately 450 g dry weight or 1.5 kg wet weight) for analysis of the required parameters. Sediment samples were composited by placing each of the five sub-samples into a clean, shallow, plastic pan and mixing with a plastic spoon. Sediment samples were placed in laboratory-provided plastic bags and kept refrigerated until they could be transported to ALS.

Sediment samples were analyzed by ALS for the following:

- physical parameters (i.e., particle size distribution [sand: 0.05 to 2 millimetres {mm}; silt: 0.002 to 0.05 mm; and clay: <0.002 mm])
- nutrients (i.e., total organic carbon)
- metals (i.e., aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, sulfur, thallium, tin, titanium, uranium, vanadium, and zinc)

Laboratory test methods with analytical detection limits less than the CCME sediment quality guidelines for the protection of aquatic life (CCME 2001) were used to analyze the samples.

Table 4.1-1:Sediment Quality Sampling Stations and Sampling Effort Summary, 2015 and 2016

Waterbody	Area	Station ID	UTM Coordinates (NAD 83, Zone 15V)		Total Depth (m)	Sampling Dates	
			Easting	Northing		14 to 19 August 2015	11 to 16 August 2016
Meliadine Lake	Near field Exposure	Mel-01-01	542693	6989136	9.3	SQ	SQ
		Mel-01-02	542666	6989280	8.0	SQ	SQ
		Mel-01-03	542634	6988989	8.9	SQ	SQ
		Mel-01-04	543145	6989088	8.8	SQ	SQ
		Mel-01-05	542136	6989358	7.9	SQ, QC[a]	SQ, QC[b]
	Mid-field Exposure	Mel-02-01	537491	6992999	7.2	SQ	SQ
		Mel-02-02	537102	6992624	9.6	SQ	SQ
		Mel-02-03	537499	6992327	8.8	SQ	SQ
		Mel-02-04	537963	6992341	8.3	SQ	SQ
		Mel-02-05	537834	6992688	8.2	SQ	SQ
	Reference Area 1	Mel-03-01	533317	6998541	7.0	-	SQ, QC[b]
		Mel-03-02	533256	6998671	8.3	-	SQ
		Mel-03-03	532962	6998844	10.0	-	SQ
		Mel-03-04	533628	6998672	8.0	-	SQ
		Mel-03-05	534001	6998272	7.7	-	SQ
	Reference Area 2	Mel-04-01	525647	7000878	8.2	-	SQ
		Mel-04-02	526149	7001519	10.5	-	SQ
		Mel-04-03	525351	7001359	9.7	-	SQ
		Mel-04-04	525401	7001085	9.1	-	SQ
		Mel-04-05	525735	7001129	7.4	-	SQ
	Reference Area 3	Mel-05-01	530926	6990858	9.3	-	SQ
		Mel-05-02	530669	6990884	9.4	-	SQ
		Mel-05-03	530735	6991374	8.5	-	SQ
		Mel-05-04	530570	6991223	10.2	-	SQ
		Mel-05-05	530240	6991162	8.6	-	SQ

(a) Multiple QC samples (i.e., replicates) were collected.

(b) Duplicates were collected.

ID = identifier; UTM = Universal Transverse Mercator; NAD = North American Datum; SQ = sediment quality samples; QC = quality control samples; - = the site was not included in the sampling plan for a particular field program, or was not sampled due to weather, environment, or schedule limitations.

4.1.2 Guidelines and Analysis

Sediment chemistry results were compared to the Interim Sediment Quality Guidelines (ISQG) and Probable Effects Level (PEL) guidelines for the protection of aquatic life (CCME 2001; Table 4.1-2). At concentrations below the ISQG, adverse biological effects are not expected to occur. At concentrations above the ISQG, adverse biological effects may occur. At concentrations above the PEL, adverse biological effects are likely, but not certain, to occur.

Table 4.1-2:Sediment Quality Guidelines

Parameter	Unit	Canadian Council of Ministers of the Environment Sediment Quality Guidelines [a]	
		Interim Sediment Quality Guidelines (ISQG)	Probable Effect Level (PEL)
Total Metals			
Arsenic	µg/g dw	5.9	17
Cadmium	µg/g dw	0.6	3.5
Chromium	µg/g dw	37.3	90
Copper	µg/g dw	35.7	197
Lead	µg/g dw	35	91.3
Mercury	µg/g dw	0.17	0.486
Zinc	µg/g dw	123	315

(a) CCME 2001.

µg/g dw = micrograms per gram dry weight.

Sediment quality can vary spatially within a lake or between lakes due to lake morphology, composition of the bedrock, interaction of surface and groundwater, streams, and other factors. Descriptive statistics were calculated to evaluate differences within Meliadine Lake.

4.1.3 Statistical Analyses

Prior to completing statistical analyses (univariate hypothesis tests [i.e group comparison] and normal range calculations, one half the detection limit was substituted for non-detect values in the dataset. Sediment quality data were then normalized to the fraction of fine sediments ([silt + clay]/100) due to the relation of most parameters with percent-fines. If a linear regression with a single parameter to percent-fines was significant at $p<0.05$, normalization was achieved by dividing each individual metal concentration to the respective fine sediments proportion of the same sample.

Statistical outliers were identified using standardized residuals, which provide a measure of the difference between observed and expected values (i.e., residuals), normalized to the variance of the dataset, and were calculated as follows:

Standardized Residual $x_z = \frac{X_i}{\sigma}$

where x_z is the standardized residual, x^i is the residual of a data point, μ is the sample mean, and σ is the sample standard deviation. Data points with standardized residuals greater than |3.5| (i.e., more than 3.5 standard deviations from the sample mean), were omitted from the analysis.

To assess differences among sampling areas (Near-field vs Mid-field vs. Reference), univariate hypothesis testing was performed. Prior to data analysis, data were screened to remove outliers. Data were checked for normality and/or other assumptions prior to data analyses. An analysis of variance (ANOVA) (for data that met normality and homogeneity of variances) was performed at a significance level of α = 0.05 (Zar 1996; Systat 2009). If data did not meet the statistical assumptions (i.e., normality, homoscedasticity [Zar 1996]), then the equivalent
non-parametric test (i.e., Kruskall-Wallis [KW]) was completed. If more than 50% of data (or of any group) consisted of values below detection limits (DL), data analyses were not performed.

When significant results were identified, a *post-hoc* test was performed to determine which groups differed. A Tukey's Honest Significant Difference test (Tukey's HSD) was performed after ANOVA, while a Pairwise Wilcox Rank Sum test with P-values adjusted was performed after KW.

4.1.4 Normal Range Calculations

Normal ranges for concentrations of sediment quality parameters in Meliadine Lake were estimated using baseline data collected from the Near-field, Mid-field, and reference areas in 2015 and 2016. The calculation methods used to estimate normal ranges followed the methods outlined in Barrett et al (2015).

When the baseline data were normally distributed, the normal range was estimated for the mean of the observations as the 95% prediction interval (PI) of the data selected to represent the natural variability of the system (Barrett et al. 2015). Normality was assessed by using the Shapiro-Wilk test and the data were considered normally distributed if the probability statistic *P* was greater than 0.05. When the baseline data were not normally distributed, but normality could be achieved after $\log_{10}$ transformation, the normal range was defined using $\log_{10}$ transformed data and the upper and lower bounds of the normal range were back-transformed to the original scale.

When both the untransformed and transformed data sets were non-normal, the normal range boundaries were estimated as the 2.5th and 97.5th percentiles of the baseline data. In cases where the percentile method was used, 1000 random samples were generated from the normal range dataset and the 2.5th and 97.5th percentiles were calculated from the distribution of 1000 mean values to estimate the normal range of mean values. Finally, in cases where the untransformed data were normally distributed but the lower bound of the normal range calculated using the PI method was less than zero the normal range was calculated using either the log-PI method or the percentiles method, depending on whether normality could be achieved after $\log_{10}$ transformation. This approach resulted in the lower bound of the normal range always being greater than zero, which was important when evaluating the potential effects related to toxicological impairment.

The normal ranges provided in this report are considered provisional during initial monitoring under the AEMP due to the limited sample sizes used in the calculations. The normal range is intended to estimate the range of natural spatial and temporal variability, and the more reference data incorporated into the calculation, the more accurate the estimate becomes. These normal ranges may be re-defined in future reports to allow for the inclusion of additional monitoring data after Mine construction has begun.

Each calculated normal range was evaluated for representativeness. For example, parameters with low detection frequency could have calculated upper bound normal ranges that were less than the detection limit. Therefore, the calculated normal ranges for parameters with non-detect concentrations in the dataset were revised according to the following criteria:

- If all values were less than the detection limit, then the lower bound of the normal range was set to zero and the upper bound was set to the lowest detection limit.
- If the lower bound of the normal range was less than detection limit, then it was set to zero.
- If the upper bound of the normal range was less than the detection limit, then it was set to the detection limit.
- If the baseline dataset included a mix of detection limits, and the lower bound of the normal range was less than the lowest detection limit, then the lower bound of the normal range was set to zero.
- If the baseline dataset included a mix of detection limits, and the upper bound of the normal range was less than the lowest detection limit, then the lower bound of the normal range was set to the lowest detection limit.
- If the baseline dataset included a mix of detection limits, and the detection limits varied by more than an order of magnitude, then the data with the higher detection limit was removed from the dataset, and the normal range was re-calculated.

If the baseline dataset included a mix of detection limits, and all values with the lowest detection limit were non-detect, then the normal range was set to zero (lower bound) and the lowest detection limit (upper bound).

4.2 Quality Assurance and Quality Control

As new sediment data were not collected in 2017, QA/QC results are not provided in this report. As reported in Golder (2017), the overall quality of the sediment quality dataset is considered moderate, and the results for the 2015 and 2016 monitoring programs are expected to be adequate to support the AEMP program for the Mine.

4.3 Results and Discussion

4.3.1 Comparison to Guidelines and Descriptive Statistics

Descriptive statistics (minimum, median, mean, maximum, standard deviation, standard error, and count) were calculated for the Near-field, Mid-field, and reference areas (combined) and results were compared to the PEL and ISQG (Tables 4.3.1 to 4.3.3).

Median and mean values for total metals and total organic carbon followed the general pattern of higher concentrations in the Near-field (MEL 01) and Mid-field (MEL 02) as compared to the reference areas (MEL-03, MEL-04, and MEL-05). Particle size composition varies among Meliadine Lake areas (Figure 4.3-1). Sediments in the Near-field are mainly composed of loamy sediments (i.e. median silt concentration of 68%), whereas sediments in the Mid-field (median of 51%) and reference areas (median of 62%) are mainly composed of sand.

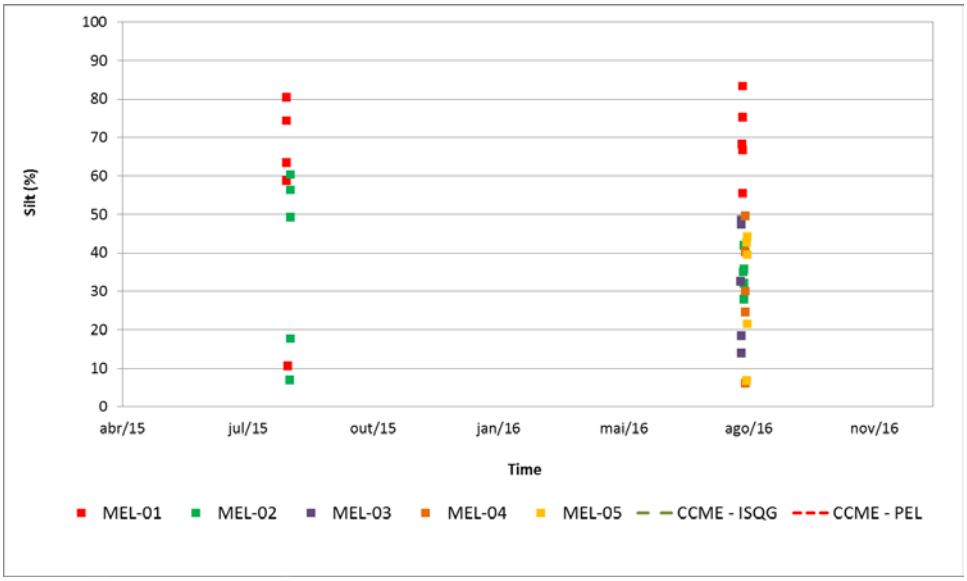


Figure 4.3-1: Silt content in Sediment Samples from Meliadine Lake

Median concentrations of total metals in the Near-field area were up to ten times higher than median concentrations in the reference areas. Median concentrations of total metals in the Mid-field were up to 2.4 times higher than median concentrations in the reference areas.

Arsenic, chromium, and copper concentrations exceeded the guidelines in most samples from all areas in Meliadine Lake (Tables 4.3.1 to 4.3.3). Arsenic was the only parameter with concentrations that exceeded the PEL in Meliadine Lake.

Within the Near-field area, arsenic concentration in 90% of the samples were above both the ISQG and the PEL , with a maximum of 151 µg/g dw in the silt dominated sample from MEL 01-04 from 2016 (Figure 4.3-2). Within the Mid-field area, arsenic concentration in 90% of the samples were above the ISQG whereas only 50% of samples were above than PEL. The highest arsenic concentration in the Mid-field area was 52 µg/g dw (MEL 02-01, August 2016). In contrast, arsenic concentration in 60% of the samples from the reference areas exceeded the ISGQ with no concentrations above the PEL. Arsenic in the reference areas ranged from 1.4 to 12 µg/g dw, with the maximum at MEL 05-02 in 2016.

Chromium concentrations in the Near-field ranged from 13 to 56 µg/g dw with a maximum reported for MEL 01-04 in 2015 (Figure 4.3-3); Chromium concentration in 90% of samples were above ISQG but none were above the PEL. In addition, as based on the low standard deviation, variability in chromium concentration in the Near-field was low (Figure 4.3-3). Chromium concentrations in the Mid-field varied from 10 to 58 µg/g dw (maximum recorded at MEL 02-02 in 2015) and concentrations exceeded the ISQG in 70% of samples. Within the reference areas, chromium concentrations ranged from 9 to 40 µg/g dw, and concentrations in two samples exceeded the ISQG (13% of total).

Copper concentrations in the Near-field ranged from 8.5 to 98 µg/g dw (standard deviation of 24 µg/g dw; Table 4.3-1), with the maximum value reported in 2015. In this area, 80% of samples exceeded the ISQG (Figure 4.3-4). Copper concentrations in the Mid-field were more variable and ranged from 7 to 111 µg/g dw (standard deviation of 36 µg/g dw; Table 4.3-2) with the maximum value reported in 2016 (Figure 4.3-4). Copper concentrations in 70% of samples from the Mid-field exceeded ISQG. Finally, copper concentrations in the reference areas ranged from 9 to 83 µg/g dw and concentrations in 67% of the samples exceeded the ISQG.

Table 4.3-1:Meliadine Lake Near-field (MEL-01) – Sediment Quality Summary, 2015 to 2016

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2015 - 2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Carbon Content												
Total organic carbon	%	-	-	4.7	4.4	0.44	6.8	1.8	0.57	10	-	-
Total Metals												
Aluminum	µg/g	-	-	11,550	10,914	3,430	14,600	2,924	925	10	-	-
Antimony	µg/g	-	-	0.19	0.17	<0.1	0.25	0.050	0.016	10	-	-
Arsenic	µg/g	5.9	17	**64**[I, P]	**74**[I, P]	5.5	**151**[I, P]	48	15	10	90	90
Barium	µg/g	-	-	114	106	19	149	35	11	10	-	-
Beryllium	µg/g	-	-	0.28	0.26	<0.1	0.34	0.078	0.025	10	-	-
Boron	µg/g	-	-	6.5	6.0	<5.0	8.5	1.2	0.38	10	-	-
Cadmium	µg/g	0.6	3.5	0.45	0.4	0.033	0.52	0.14	0.045	10	-	-
Calcium	µg/g	-	-	4,065	3,875	1,390	4,720	914	289	10	-	-
Chromium	µg/g	37	90	**45**[I]	**43**[I]	13	**56**[I]	11	**3.5**	10	90	-
Cobalt	µg/g	-	-	19	16	2.3	23	6.5	2.1	10	-	-
Copper	µg/g	36	197	**68**[I]	**64**[I]	8.5	**98**[I]	**24**	**7.7**	10	80	-
Iron	µg/g	-	-	43,800	42,768	7,380	83,400	21,245	6,718	10	-	-
Lead	µg/g	35	91	13	11	2.0	15	3.9	1.2	10	-	-
Lithium	µg/g	-	-	14	14	4.4	17	3.3	1.0	10	-	-
Magnesium	µg/g	-	-	6,340	6,120	2,010	7,610	1,485	470	10	-	-
Manganese	µg/g	-	-	531	517	129	871	216	68	10	-	-
Mercury	µg/g	0.17	0.49	0.053	0.051	0.0055	0.093	0.024	0.0077	10	-	-
Molybdenum	µg/g	-	-	6.0	6.0	0.71	14	3.5	1.1	10	-	-
Nickel	µg/g	-	-	64	61	11	84	21	6.7	10	-	-

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2015 - 2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Potassium	µg/g	-	-	2,100	2,020	499	2,650	579	183	10	-	-
Selenium	µg/g	-	-	1.0	1.0	<0.2	1.4	0.32	0.10	10	-	-
Silver	µg/g	-	-	0.16	0.16	<0.1	0.24	0.040	0.013	10	-	-
Sodium	µg/g	-	-	295	277	<100	360	67	21	10	-	-
Strontium	µg/g	-	-	23	21	8.0	26	5.2	1.6	10	-	-
Thallium	µg/g	-	-	0.28	0.27	<0.05	0.39	0.086	0.027	10	-	-
Tin	µg/g	-	-	<2.0	-	<2.0	<2.0	-	-	10	-	-
Titanium	µg/g	-	-	637	615	229	815	151	48	10	-	-
Uranium	µg/g	-	-	3.3	3.1	0.53	4.4	1.0	0.31	10	-	-
Vanadium	µg/g	-	-	53	49	12	64	13	4	10	-	-
Zinc	µg/g	123	315	80	76	18	101	24	8	10	-	-
Sulfur	µg/g	-	-	2,125	3,512	160	17,600	4,801	1,518	10	-	-
Bismuth	µg/g	-	-	0.3	0.27	<0.2	0.38	0.059	0.019	10	-	-
Particle Size And Moisture												
Grain size, 0.002-0.05 mm	%	-	-	68	64	11	83	20	6	10	-	-
Grain size, less than 0.002 mm	%	-	-	9.2	8.9	0.55	15	4.1	1.3	10	-	-
Grain size, 2-5 mm	%	-	-	23	27	3.4	89	23	7	10	-	-

Bolded values are higher than sediment quality guidelines.

(I) = value higher than the Interim Sediment Quality Guideline.

(P) = value higher than the Probable Effects Level.

Sediment quality data shown in this table were rounded to reflect laboratory precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or data.

* Means were calculated by replacing non-detect values with the detection limit. Means of parameters with > 50% non-detect values were not calculated.

Table 4.3-2:Meliadine Lake Mid-field (MEL-02) – Sediment Quality Summary, 2015 to 2016

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2015 - 2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Carbon Content												
Total organic carbon	%	-	-	5.2	4.7	0.14	11	3.4	1.1	10	-	-
Total Metals												
Aluminum	µg/g	-	-	10,350	10,092	3,300	13,700	2,760	873	10	-	-
Antimony	µg/g	-	-	0.15	0.14	<0.1	0.31	0.067	0.021	10	-	-
Arsenic	µg/g	5.9	17	**16**[(I)]	**19**[(I, P)]	5.1	**52**[(I, P)]	12	3.8	10	90	50
Barium	µg/g	-	-	105	91	17	134	38	12	10	-	-
Beryllium	µg/g	-	-	0.25	0.23	<0.1	0.33	0.086	0.027	10	-	-
Boron	µg/g	-	-	5.7	5.6	<5.0	10	1.6	0.52	10	-	-
Cadmium	µg/g	0.6	3.5	0.33	0.29	0.034	0.53	0.18	0.057	10	-	-
Calcium	µg/g	-	-	4,475	4,151	1,690	5,710	1,364	431	10	-	-
Chromium	µg/g	37	90	**42**[(I)]	**40**[(I)]	10	**58**[(I)]	13	4.1	10	70	-
Cobalt	µg/g	-	-	11	13	2.5	38	9.0	2.8	10	-	-
Copper	µg/g	36	197	**73**[(I)]	**64**[(I)]	7.0	**111**[(I)]	36	11	10	70	-
Iron	µg/g	-	-	21,800	22,866	8,460	42,400	8,430	2,666	10	-	-
Lead	µg/g	35	91	8.8	8.8	2.6	15	3.9	1.2	10	-	-
Lithium	µg/g	-	-	14	13	4.9	16	3.0	0.93	10	-	-
Magnesium	µg/g	-	-	6,225	5,777	2,010	7,020	1,406	445	10	-	-
Manganese	µg/g	-	-	301	311	114	518	100	32	10	-	-
Mercury	µg/g	0.17	0.49	0.027	0.028	0.007	0.051	0.015	0.0048	10	-	-
Molybdenum	µg/g	-	-	4.7	5.1	0.83	12	2.7	0.85	10	-	-
Nickel	µg/g	-	-	48	44	8.7	69	18	5.8	10	-	-

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2015 - 2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Potassium	µg/g	-	-	1,910	1,824	548	2,670	562	178	10	-	-
Selenium	µg/g	-	-	0.92	0.78	<0.2	1.3	0.042	0.013	10	-	-
Silver	µg/g	-	-	0.15	0.13	<0.1	0.23	0.061	0.019	10	-	-
Sodium	µg/g	-	-	270	239	<100	400	99	31	10	-	-
Strontium	µg/g	-	-	24	22	9.9	31	7.2	2.3	10	-	-
Thallium	µg/g	-	-	0.22	0.21	<0.05	0.4	0.12	0.037	10	-	-
Tin	µg/g	-	-	<2.0	-	<2.0	<2.0	-	-	10	-	-
Titanium	µg/g	-	-	554	571	252	746	135	43	10	-	-
Uranium	µg/g	-	-	3.0	3.0	0.5	4.9	1.3	0.42	10	-	-
Vanadium	µg/g	-	-	51	48	12	67	15	4.6	10	-	-
Zinc	µg/g	123	315	87	75	19	106	28	8.8	10	-	-
Sulfur	µg/g	-	-	1,980	1,954	<100	5,090	1,471	465	10	-	-
Bismuth	µg/g	-	-	0.22	0.21	<0.2	0.33	0.044	0.014	10	-	-
Particle Size And Moisture												
Grain size, 0.002-0.05 mm	%	-	-	36	36	7.2	60	16	5.0	10	-	-
Grain size, less than 0.002 mm	%	-	-	9.6	8.9	0.44	15	5.2	1.7	10	-	-
Grain size, 2-5 mm	%	-	-	51	55	25	92	19	6.1	10	-	-

Bolded values are higher than sediment quality guidelines.

(I) = value higher than the Interim Sediment Quality Guideline.

(P) = value higher than the Probable Effects Level.

Sediment quality data shown in this table were rounded to reflect laboratory precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or data.

* Means were calculated by replacing non-detect values with the detection limit. Means of parameters with > 50% non-detect values were not calculated.

Table 4.3-3:Meliadine Lake Reference Areas (MEL-03, MEL-04. MEL-05) – Sediment Quality, 2016

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Carbon Content												
Total organic carbon	%	-	-	4	3.7	0.53	7.9	2.4	0.53	15	-	-
Total Metals												
Aluminum	µg/g	-	-	7,070	6,618	2,730	9,630	1,886	422	15	-	-
Antimony	µg/g	-	-	<0.1	-	<0.1	0.15	-	-	15	-	-
Arsenic	µg/g	5.9	17	6.7(I)	6.6(I)	1.4	12(I)	3.3	0.74	15	60	-
Barium	µg/g	-	-	67	64	18	102	24	5.5	15	-	-
Beryllium	µg/g	-	-	0.17	0.15	<0.1	0.2	0.035	0.0078	15	-	-
Boron	µg/g	-	-	5.5	-	<5.0	7.9	-	-	15	-	-
Cadmium	µg/g	0.6	3.5	0.19	0.17	<0.02	0.29	0.079	0.018	15	-	-
Calcium	µg/g	-	-	3,760	3,447	1,410	4,980	1,011	226	15	-	-
Chromium	µg/g	37	90	27	25	9	40(I)	8.4	1.9	15	13	-
Cobalt	µg/g	-	-	6.3	5.9	2	9.2	2.0	0.45	15	-	-
Copper	µg/g	36	197	54(I)	44(I)	9	83(I)	23	5.1	15	67	-
Iron	µg/g	-	-	12,300	11,671	4,610	16,900	3,375	755	15	-	-
Lead	µg/g	35	91	4.8	4.8	1.6	9.3	2.0	0.45	15	-	-
Lithium	µg/g	-	-	9.8	9.4	5.3	12	2.1	0.47	15	-	-
Magnesium	µg/g	-	-	4,110	4,011	1,600	6,230	1,238	277	15	-	-
Manganese	µg/g	-	-	157	152	60	232	45	10	15	-	-
Mercury	µg/g	0.17	0.49	0.017	0.016	<0.005	0.036	0.0083	0.0019	15	-	-
Molybdenum	µg/g	-	-	2	2.2	0.47	4.5	1.2	0.27	15	-	-
Nickel	µg/g	-	-	29	27	6.9	43	9.9	2.2	15	-	-

Parameter	Unit (Dry Weight)	Guidelines		Annual Summary								
				2016								
		ISQG	PEL	Median	Mean*	Minimum	Maximum	Standard Deviation	Standard Error	Count	% Above Guideline	
											I	P
Potassium	µg/g	-	-	1,250	1,243	466	2,120	435	97	15	-	-
Selenium	µg/g	-	-	0.57	0.5	<0.2	0.94	0.23	0.052	15	-	-
Silver	µg/g	-	-	<0.1	-	<0.1	0.1	-	-	15	-	-
Sodium	µg/g	-	-	210	181	<100	260	54	12	15	-	-
Strontium	µg/g	-	-	18	16	7.7	23	4.8	1.1	15	-	-
Thallium	µg/g	-	-	0.13	0.12	<0.05	0.2	0.043	0.010	15	-	-
Tin	µg/g	-	-	<2.0	-	<2.0	<2.0	-	-	15	-	-
Titanium	µg/g	-	-	442	426	233	631	104	23	15	-	-
Uranium	µg/g	-	-	1.6	1.5	0.51	2.4	0.6	0.13	15	-	-
Vanadium	µg/g	-	-	31	29	11	47	10	2.3	15	-	-
Zinc	µg/g	123	315	45	39	13	55	13	2.8	15	-	-
Sulfur	µg/g	-	-	1,460	2,053	120	5,350	1,515	339	15	-	-
Bismuth	µg/g	-	-	<0.2	-	<0.2	<0.2	-	-	15	-	-
Particle Size And Moisture												
Grain size, 0.002-0.05 mm	%	-	-	33	31	6.3	50	15	3.3	15	-	-
Grain size, less than 0.002 mm	%	-	-	7	6	0.1	12	3.9	0.87	15	-	-
Grain size, 2-5 mm	%	-	-	62	63	41	93	18	4.1	15	-	-

Bolded values are higher than sediment quality guidelines.

(I) = value higher than the Interim Sediment Quality Guideline.

Sediment quality data shown in this table were rounded to reflect laboratory precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.

- = no guideline or data.

* Means were calculated by replacing non-detect values with the detection limit. Means of parameters with > 50% non-detect values were not calculated.

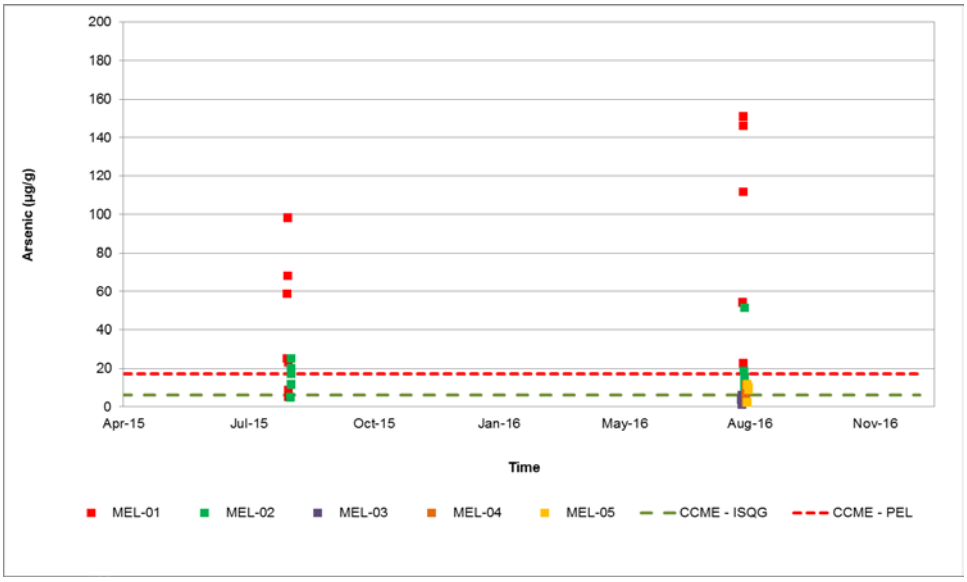


Figure 4.3-2:Arsenic in Sediment Samples from Meliadine Lake

µg/g = micrograms per gram (dry weight); ISQG = Interim Sediment Quality Guidelines; PEL = Probable Effects Level.

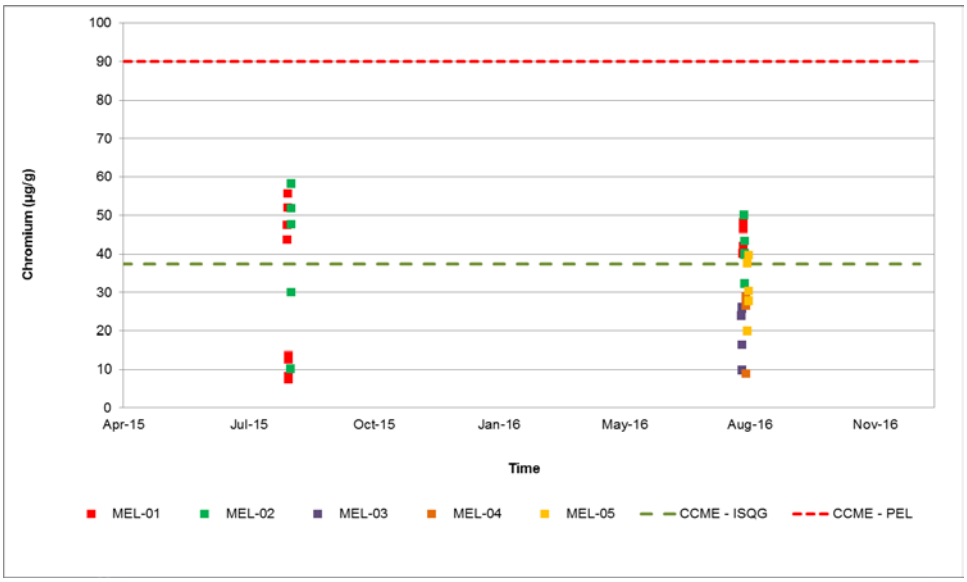


Figure 4.3-3:Chromium in Sediment Samples from Meliadine Lake

µg/g = micrograms per gram (dry weight); ISQG = Interim Sediment Quality Guidelines; PEL = Probable Effects Level.

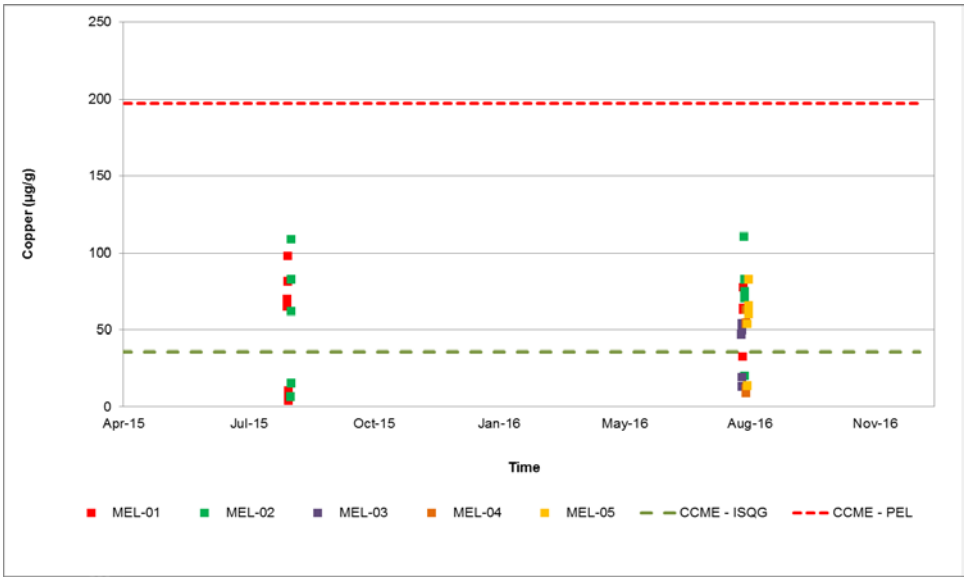


Figure 4.3-4:Copper in Sediment Samples from Meliadine Lake

µg/g = micrograms per gram (dry weight); ISQG = Interim Sediment Quality Guidelines; PEL = Probable Effects Level.

4.3.2 Between Area Comparison

In the Meliadine Lake sediment quality dataset, it was identified that there is a significant relationship between sediment grain size and concentration of total organic carbon and metals (Table 4.3-4). To reduce confounding factors of fine sediments or TOC on sediment chemistry results, sediment datasets are often normalized for a physical grain size category (Furness 1990; Bianchi et al. 1999). All subsequent statistical analyses were completed on the grain-size normalized dataset.

Table 4.3-4:Linear regression of Sediment Quality parameters to fine grained sediments in Meliadine Lake

Parameter	R-squared	*P*-value
Total organic carbon	0.424	**<0.001**
Aluminum	0.669	**<0.001**
Antimony	-	**-**
Arsenic	0.475	**<0.001**
Barium	0.669	**<0.001**
Beryllium	0.720	**<0.001**
Bismuth	-	**-**
Boron	0.316	**<0.001**
Cadmium	0.680	**<0.001**

Parameter	R-squared	*P*-value
Calcium	0.000	**<0.001**
Chromium	0.673	**<0.001**
Cobalt	0.759	**<0.001**
Copper	0.475	**<0.001**
Iron	0.536	**<0.001**
Lead	0.771	**<0.001**
Lithium	0.653	**<0.001**
Magnesium	0.640	**<0.001**
Manganese	0.548	**<0.001**
Mercury	0.651	**<0.001**
Molybdenum	0.619	**<0.001**
Nickel	0.804	**<0.001**
Potassium	0.748	**<0.001**
Selenium	0.759	**<0.001**
Silver	-	**-**
Sodium	0.818	**<0.001**
Strontium	0.549	**<0.001**
Sulfur	0.358	**<0.001**
Thallium	0.695	**<0.001**
Tin	-	**-**
Titanium	0.640	**<0.001**
Uranium	0.741	**<0.001**
Vanadium	0.630	**<0.001**
Zinc	0.614	**<0.001**

P-value = probability value; < = less than; - = more than 50% of data was below detection limits and data analyses were not performed.

Analyses were completed to determine if there were statistical differences between sediment chemistry (before normalization to grain size) in the Near-field versus Mid-field, Near-field versus pooled reference areas, and Mid-field versus pooled reference areas; results of these comparisons are provided in (Table 4-3.5). When data were normally distributed an ANOVA was performed; when data could not fit a normal distribution, a Kruskal-Wallis was performed. Antimony, bismuth, boron, silver and tin could not be tested due to large number of results below DLs.

Results for most parameters were significant at $p<0.05$ (Table 4.3-5), meaning that there were significant differences between groups. Reference areas had significantly greater concentrations of sand than Near-field area, the Near-field area is significantly enriched in silt, whereas clay did not differ between the groups. Comparisons between Mid-field and reference areas for particle size parameters were not significant.

Even after normalization of sediment chemistry to fraction of fine sediments, only cadmium, copper, selenium and thalium not significantly different between areas. For arsenic, iron and mercury, concentrations were higher in the Near-field area as compared to reference area, whereas total organic carbon, calcium, strontium and sulfur were higher in the reference area as compared to Near-field after normalization. For the Mid-field area, which had mean particle-size distribution similar to the reference areas, concentrations of eight metals were still higher in the Mid-field as compared to the reference areas.

The Near-field area is enriched in some sediment chemistry parameters as compared to reference areas. Only treated sewage effluent has been indirectly discharged to Meliadine Lake (i.e., sewage is discharge to a ditch approximately 60 m upstream of Meliadine Lake; Section 2.2, Figure 1.1-2) and so these results reflect pre-existing natural differences in these areas. The use of normalized results has been able to reduce the influence of fine sediments as a confounding factor, allowing for a more robust comparison.

Table 4.3-5:Pairwise Comparisons for Statistical Analyses of Sediment Quality parameters comparing areas within Meliadine Lake

Parameter	Test Performed	Overall Test P-value	NF vs MF	NF vs REF	MF vs REF	Number of Outlier Samples
Particle Size and Moisture						
Clay (< 0.002 mm)	ANOVA / Tukey	0.211	-	-	-	-
Silt (0.002-0.05 mm)	ANOVA / Tukey	**<0.001**	**0.003**	**<0.001**	**0.736**	-
Sand (2-5 mm)	ANOVA / Tukey	**0.001**	**0.016**	**0.001**	**0.609**	-
Carbon Content[(a)]						
Total organic carbon	ANOVA / Tukey	**0.029**	0.131	**0.025**	0.832	-
Total Metals[(a)]						
Aluminum	KW / WRS	**0.014**	**0.009**	0.213	0.147	1
Antimony	-	-	-	-	-	-
Arsenic	KW / WRS	**<0.001**	**0.015**	**<0.001**	**0.004**	-
Barium	ANOVA / Tukey	**0.033**	**0.027**	0.162	0.54	1
Beryllium	KW / WRS	**0.014**	**0.001**	0.32	0.32	-
Bismuth	-	-	-	-	-	-
Boron	-	-	-	-	-	-
Cadmium	ANOVA / Tukey	0.588	-	-	-	-
Chromium	KW / WRS	**0.007**	0.003	0.437	**0.044**	1
Cobalt	KW / WRS	**0.019**	0.55	0.12	**0.020**	1
Copper	ANOVA / Tukey	0.060	-	-	-	-
Iron	KW / WRS	**0.027**	0.579	**0.041**	0.109	-
Lead	ANOVA / Tukey	**0.045**	0.149	0.900	**0.041**	-
Lithium	KW / WRS	**0.01**	0.003	0.112	0.285	1
Manganese	KW / WRS	**0.018**	0.912	0.062	**0.029**	-
Mercury	ANOVA / Tukey	**0.018**	0.927	**0.029**	0.071	-
Molybdenum	KW / WRS	**0.027**	0.189	0.338	0.025	1
Nickel	ANOVA / Tukey	**0.021**	0.23	0.495	0.016	1
Selenium	ANOVA / Tukey	0.409	-	-	-	-
Silver	-	-	-	-	-	-
Strontium	KW / WRS	**0.003**	**0.003**	**0.009**	0.567	-
Sulfur	ANOVA / Tukey	**0.022**	0.467	**0.019**	0.247	1
Thallium	KW / WRS	0.342	-	-	-	1
Tin	-	-	-	-	-	-
Titanium	KW / WRS	**0.028**	**0.016**	0.147	0.472	1
Uranium	ANOVA / Tukey	**0.002**	**0.003**	0.777	**0.008**	-
Vanadium	KW / WRS	**0.005**	**0.002**	0.052	0.371	1
Zinc	ANOVA / Tukey	**<0.001**	**<0.001**	0.925	**0.001**	1

(a) Results conducted on sediment quality normalized to fraction of fine sediments ([silt + clay]/100).

Note: **Bolded** values are significant at p <0.05.

NF = Near-field Mel-01; MF = Mid-field Mel-02; REF = Reference Areas; Tukey = Tukey's HSD test; KW = Kruskal- Wallis test; WRS = Pairwise Wilcox Rank Sum test; < = less than; - = more than 50% of data was below detection limits and data analyses were not performed.

The presence of loamy (or fine-grained) sediments is a key factor for metal accumulation in sediments, therefore, particle size analyses and the use of normalized results to analyze differences among areas and the normal ranges of sediment quality variables are necessary for sediment chemistry assessments. The presence of a high proportion of fine sediments was likely one of the reasons why metal concentrations were higher in MEL 01-04 in 2015 and 2016. Metals also tend to bond to organic carbon present in sediment particles, nevertheless, the small variation of TOC within sediment from Meliadine Lake suggests that organic carbon will not strongly influence the concentrations of metal in the Near-field or Mid-field areas as compared to the reference areas. Based on the data collected so far, particle size appears to have a large influence on accumulation of metals in sediments in Meliadine Lake.

Arsenic is the only parameter in Meliadine Lake with concentrations above the PEL (Tables 4.3-1, 4.3-2, and 4.3-3), and is a parameter of concern within Meliadine Lake. High concentrations of arsenic in the Near-field area are elevated and significantly higher than in reference areas even after normalization. As there has been no mine effluent discharged to the lake, these represent pre-existing conditions of high spatial variability. It is common to find naturally high concentrations of arsenic associated with gold deposits (Straskraba and Moran 1990).

The presence of pre-existing elevated concentrations of parameters in the Near-field area is likely to pose some difficulty for future monitoring. The elevated results will be confounding factors that will need careful review since the Near-field area is naturally enriched in certain parameters. Hence, the use of normal ranges will be an important tool to diminish the possibility of detecting false positive effects. Assessing effects within the Mid-field area will also be key for an appropriate interpretation of mine effluent discharge.

4.3.3 Normal Range

Normal ranges were calculated following the procedure describe in Section 4.1.4 and are summarized in Table 4.3-6. To remove the confounding factor of fine grained sediments, data were normalized to the proportion of fine sediments, and data from the whole lake were included in the analyses. The widest range was for arsenic, where the upper bound was over five times greater than the lower bound. For the majority of the remaining parameters, the variation was confined to 150% to 250% between upper and lower bound.

Table 4.3-6: Normal ranges for Sediment Quality Parameters in Meliadine Lake

Parameter	Unit	Method	Lower Bound	Upper Bound	Number of Outlier Samples
Total Metals					
Aluminum	mg / kg dw Fines	logPI	13,556	27,326	1
Arsenic	mg / kg dw Fines	logPI	15.2	80.1	0
Barium	mg / kg dw Fines	PI	132	227	1
Boron	mg / kg dw Fines	logPI	6.74	18.5	1
Cadmium	mg / kg dw Fines	PI	0.32	0.74	0
Chromium	mg / kg dw Fines	logPI	53.8	102	1
Cobalt	mg / kg dw Fines	logPI	14.4	29.5	1
Copper	mg / kg dw Fines	PI	70.1	166	0
Iron	mg / kg dw Fines	logPI	27,514	76,653	0
Lead	mg / kg dw Fines	PI	11.2	22.6	0
Manganese	mg / kg dw Fines	logPI	369	986	0
Mercury	mg / kg dw Fines	PI	0.0342	0.0796	0
Molybdenum	mg / kg dw Fines	logPI	4.50	11.3	1
Nickel	mg / kg dw Fines	PI	65.9	106	1
Selenium	mg / kg dw Fines	PI	0.978	1.9	0
Strontium	mg / kg dw Fines	logPI	29.3	68.9	0
Uranium	mg / kg dw Fines	PI	3.63	6.68	0
Zinc	mg / kg dw Fines	PI	87.7	175	1

mg/kg dw = milligram per kilogram dry weight; PI = Prediction interval; logPI = log-transformed prediction interval.

5.0 BENTHIC INVERTEBRATE COMMUNITY

Benthic invertebrates (i.e., small animals with no backbones) are an integral part of Arctic ecosystem food webs, as a primary food source for fish and as secondary producers (Minshall et al 2014). They live within sediments, or on the sediment surface, for all or part of their life cycles. Benthic communities often consist of hundreds to thousands of invertebrates within a sample, and display a wide range of tolerance to contaminants, exposure conditions, and habitat types (Hauer and Lamberti 2007). The presence and abundances of specific invertebrates in the benthic invertebrate community present at a location serve as indicators of aquatic health, and can be used to evaluate effects from anthropogenic disturbances (Minshall et al 2014).

Dominant benthic invertebrates previously documented in Meliadine Lake include insects (mostly midges [Chironomidae]), mollusks (fingernail clams [Pisidiidae]), aquatic worms (Oligochaeta), and amphipods (shrimp-like crustaceans); a number of other invertebrates were also present during previous years, although less abundant (Golder 2013).

This report section provides a summary of benthic invertebrate community data collected during the 2015 and 2016 sampling programs in Meliadine Lake. Consistent with the AEMP study design for the Type A Water Licence (2AM MEL 1631, Part I, Item 3), data were collected over two years to characterize baseline (pre-discharge) conditions in exposure areas in the vicinity of the Mine and in reference areas in Meliadine Lake. The main objective of the benthic sampling programs was to collect benthic invertebrate samples to characterize pre-discharge conditions in the Near-field, Mid-field, and three reference areas in Meliadine Lake.

Specific objectives of this section are outlined below:

- assess spatial variability in 2016, by comparing benthic invertebrate communities in the Near-field and Mid-field exposure areas to the reference areas within Meliadine Lake
- evaluate temporal variability in benthic invertebrate communities sampled in the same areas in 2015 and 2016
- assess the potential influence of habitat variation within and among sampling areas, to identify potential confounding factors during future monitoring; where appropriate, consider water and sediment quality results from Sections 3 and 4 in this document
- evaluate whether it is possible to calculate representative normal ranges of variability for benthic invertebrate effect endpoints
- assess within-station variability and evaluate whether the current approach of collecting five subsamples at each station is appropriate for future monitoring
- provide recommendations for the AEMP benthic invertebrate component

5.1 Methods

5.1.1 Study Design Overview

As described by Golder (2014), the study design for monitoring benthic invertebrates in Meliadine Lake considered the requirements of MMER/EEM and alignment with other components, when possible.

The study design described by Golder (2014) included collection of composite samples at 25 stations, located in the Near-field (5 stations) and Mid-field (5 stations) exposure areas in Meliadine Lake, and in three reference areas in Meliadine Lake (Reference Areas 1, 2 and 3; 5 stations in each area) (Figure 1.1 2). The 2015 and 2016 benthic invertebrate sampling programs were harmonized with the August water and sediment sampling in Meliadine Lake. The 2015 program specifically targeted the exposure areas of Meliadine Lake, while the 2016 program was expanded to include both the exposure and reference areas of Meliadine Lake. A list of stations sampled in 2015 and 2016, and a summary of the data collected at each station are provided in Table 5.1 1.

Table 5.1-1: AEMP Baseline Benthic Invertebrate Sampling Program Summary, 2015 and 2016

Waterbody	Area	Station ID	UTM Coordinates (NAD 83, 15V)		Data Collected in 2015	Data Collected in 2016	In situ Profiles [(a)]
			Easting (m)	Northing (m)			
Meliadine Lake	Near-field Area (MEL-01)	MEL-01-01	542690	6989132	yes	yes	yes
		MEL-01-02	542665	6989282	yes	yes	yes
		MEL-01-03	542638	6988979	yes	yes	yes
		MEL-01-04	543145	6989086	yes	yes	yes
		MEL-01-05	542140	6989358	yes	yes	yes
	Mid-field Area (MEL-02)	MEL-02-01	537511	6992932	yes	yes	yes
		MEL-02-02	537093	6992642	yes	yes	yes
		MEL-02-03	537497	6992332	yes	yes	yes
		MEL-02-04	537961	6992341	yes	yes	yes
		MEL-02-05	537831	6992692	yes	yes	yes
	Reference Area 1 (MEL-03)	MEL-03-01	533317	6998541	no	yes	yes
		MEL-03-02	533256	6998671	no	yes	yes
		MEL-03-03	532962	6998844	no	yes	yes
		MEL-03-04	533628	6998672	no	yes	yes
		MEL-03-05	534001	6998272	no	yes	yes

Waterbody	Area	Station ID	UTM Coordinates (NAD 83, 15V)		Data Collected in 2015	Data Collected in 2016	In situ Profiles [a]
			Easting (m)	Northing (m)			
	Reference Area 2 (MEL-04)	MEL-04-01	525647	7000878	no	yes	yes
		MEL-04-02	526149	7001519	no	yes	yes
		MEL-04-03	525351	7001359	no	yes	yes
		MEL-04-04	525401	7001085	no	yes	yes
		MEL-04-05	525735	7001129	no	yes	yes
	Reference Area 3 (MEL-05)	MEL-05-01	530926	6990858	no	yes	yes
		MEL-05-02	530669	6990884	no	yes	yes
		MEL-05-03	530735	6991374	no	yes	yes
		MEL-05-04	530570	6991223	no	yes	yes
		MEL-05-05	530240	6991162	no	yes	yes

Note: No samples were collected in 2017.

a) Maximum depth, and physico chemical measurements of temperature, pH, dissolved oxygen, and specific conductivity.

b) At all of the benthic invertebrate stations in 2015 and 2016, sediment was collected for additional sediment chemistry analysis (particle size, TOC, nutrients, and metals).

UTM = Universal Transverse Mercator; NAD 83 = North American Datum 83; TOC = total organic carbon.

In both 2015 and 2016, benthic invertebrate communities were also sampled in the Peninsula Lakes to collect baseline data in these lakes; Peninsula Lake results are reported in the 2016 AEMP report (Golder 2017a) and are not summarized in this report.

5.1.2 Field Methods

Stations were selected based on similar habitat characteristics and were standardized to the extent possible by water depth (i.e., generally between 8 m and 10 m) and similar substrate characteristics (i.e., high proportion of fines) to reduce the habitat-related variability in the benthic invertebrate community data.

Benthic invertebrate samples were collected using a petite Ponar grab (15.24 × 15.24 cm; bottom sampling area of 0.0232 m^2). At all stations, five subsamples were collected and sieved through a 500 µm mesh screen in the field. At the majority of the stations sampled, the five sub-samples were combined to form a composite sample from the material retained in the mesh and placed in a separate 500 mL sample bottle and preserved with 10% neutral buffered formalin. Exceptions were MEL-03-05 and MEL-05-01, in which the five individual subsamples (i.e., discrete samples) were placed in a separate 500 mL sample bottle and preserved as above. Preserved benthic invertebrate samples were shipped to Cordillera Consulting, Summerland, British Columbia, for taxonomic identification and enumeration of invertebrates.

Bottom sediment samples were taken concurrently with benthic invertebrate samples to characterize substrate composition. Environmental data and observations, such as habitat characteristics and field water quality data, were also recorded in conjunction with benthic sampling to provide supporting information. Specifically, the following information, in-situ surface water quality measurements, and habitat characteristics were recorded at each sampling station:

- sampling date
- global positioning system (GPS) coordinates, recorded as Universal Transverse Mercator (UTM)
- water depth
- presence of aquatic vegetation and algae
- field water quality measurements of water temperature, dissolved oxygen (DO), pH and specific conductivity
- photographs
- observations of the sediments for colour, consistency, and odour

At each station, three to five additional petite Ponar grab samples were collected and combined into a composite sample for sediment chemistry analysis; these samples were shipped to ALS in Edmonton, Alberta (Section 3).

5.1.3 Laboratory Methods

5.1.3.1 Benthic Invertebrate Sample Sorting, Enumeration, and Identification

Benthic invertebrate samples were initially processed to remove the preservative and remaining fine sediment. Samples with high inorganic content were elutriated to separate the organic material from the inorganic material prior to sorting. Inorganic material was checked for shelled or cased invertebrates that may have been too heavy to elutriate; this heavier material was included in the remaining sample to be sorted.

Due to the relatively low number of individuals collected during both 2015 and 2016 sampling events, subsampling was only conducted on a few samples, and the majority of samples were sorted as whole samples. Subsampling was undertaken using a Marchant box (Marchant 1989). Benthic invertebrates were identified to the genus/species level where possible. If organisms could not be identified to the species level, they were identified to the next higher taxonomic level of identification (i.e., genus, family, order, class or phylum). Further details regarding taxonomy methods are provided in the 2016 AEMP Report.

5.1.4 Data Analysis

Both field and taxonomic datasets were screened prior to analysis and adjustments were made to each dataset as described below.

- Field data were screened based on adherence to acceptability criteria for the collection of grab samples with respect to percent fullness. At three locations in 2015 (i.e., stations MEL 01 05, MEL 02 04 and MEL 02 05) there was an absence of sufficient soft, fine grained (silt and sand) depositional sediments, resulting in samples with less than 10% fullness of the petite Ponar grab. As a result, these samples were eliminated from the dataset, because they did not meet the “>60% fullness” criterion.

- Data for Nematoda and Ostracoda were removed from the data set before analysis; these are meiofauna, and are not reliably enumerated using 500 µm mesh sampling gear (Environment Canada 2012).
- Copepoda and Cladocera were excluded from the dataset before analysis because they are non benthic organisms.

5.1.4.1 Selection of Benthic Invertebrate Summary Variables

The following benthic invertebrate summary variables were calculated from the screened 2015 and 2016 datasets:

- total invertebrate density (number of organisms per square metre [org/m²])
- total taxonomic richness at the lowest taxonomic level (LTL) of identification and family level (number of taxa per station [taxa/station])
- Simpson's diversity index at the LTL and family level (SDI)
- Simpson's evenness index at the LTL and family level (SEI)
- Bray-Curtis Index (BCI), using the EEM method (i.e., comparisons to reference median) and the pairwise method
- community composition as percentages of major taxonomic groups
- densities of dominant invertebrates:
  - midges (Chironomidae)
  - bivalves (Pisidiidae)
  - aquatic worms (Oligochaeta)
  - gastropods (Gastropoda)
  - amphipods (Amphipoda)

Density was calculated as organisms per square metre (org/m2) for each station. This calculation was based on the bottom area of the grab sampler (0.0232 m2) multiplied by 5 (i.e., 0.116 m2) to represent the total area sampled by five grabs. Richness is the total number of taxa/station at the family level or the LTL. Richness provides an indication of the diversity of benthic invertebrates in an area; a higher richness value typically indicates a more healthy and balanced community.

For interpretation purposes, ranges in benthic invertebrate densities and LTL richness values were operationally defined as low/moderate/high based on experience with northern lakes, as documented by benthic invertebrate components of other ongoing AEMPs (i.e., 2016 Diavik AEMP Annual Report [Golder 2017b] and the 2016 DeBeers Gahcho Kue AEMP Annual Report [DeBeers 2017]. Observed density and richness values were categorized as follows:

- **low:** density less than 5,000 org/m² and LTL richness less than 10 taxa/station

- **moderate:** density ranging from 5,000 to 50,000 org/m², and LTL richness ranging from 10 to 40 taxa/station
- **high:** density greater than 50,000 org/m² and LTL richness greater than 40 taxa/station

When compared to other lake environments the range of densities described above are relatively low considering some lake environments have densities greater than 100,000 individuals per square metre (Hynes 1970; Resh and Rosenberg 1984; Rosenberg and Resh 1993).

The SDI measures the proportional distribution of organisms in the community, taking into account taxonomic richness and how evenly the total density is distributed among these taxa. Certain conditions may favour one organism over another, resulting in the community being dominated by a few taxa, which is reflected in decreased diversity (Simpson 1949). The SDI values range between zero and one, where lower values indicate a less diverse community and higher values indicate a more diverse community. The SDI was calculated using the formula provided by Krebs (Krebs 1999):

$$D = 1 - \sum_{i=1}^{S} (p_i)^2$$

Where:

- SDI = Simpson's diversity index
- S = the total number of taxa
- pi = the proportion of the ith taxon

The SEI is a measure of how evenly the total invertebrate density is distributed among the taxa present at the station. The SEI is included along with the SDI to provide context as to whether taxonomic richness or the distribution of total density among taxa is driving the SDI values. The SEI is also expressed as a value between one and zero, with one representing high evenness (i.e., equal numbers of all taxa present in a sample) and zero representing low evenness (i.e., a high degree of dominance by one or a few organisms). The SEI values were calculated using the following formula (Smith and Wilson 1996):

$$SEI = 1/\sum_{i=1}^{S} (p_i)^2 \ /S$$

Where:

- SEI = Simpson's evenness index
- pi = the proportion of the ith taxon
- S = the total number of taxa

The above indices are measures of total invertebrate density and taxa richness, but they do not take into account any quantitative information of the types of organism's present. Therefore, the Bray-Curtis Index (a dissimilarity index) was calculated to compare entire communities between reference and exposure areas. The Bray-Curtis Index summarizes the overall difference in community structure between reference and exposure replicate stations (EC 2012). Bray-Curtis Index values range between 0 and 1, whereby lower values indicate that the community in the exposure area is more similar to the reference community.

As recommended by EC 2012, the Bray-Curtis Index was calculated following the method by Legendre and Legendre (1983), where the distance statistic is calculated as:

$$B\text{-}C = \frac{\sum_{i=1}^{n} |y_{i1} - y_{i2}|}{\sum_{i=1}^{n} (y_{i1} + y_{i2})}$$

Where:

- B-C = Bray-Curtis distance between sites 1 and 2
- Yi1 = count for taxon i at site 1
- Yi2 = count for taxon i at site 2
- n = total number of taxa present at the two sites

Bray Curtis index values have historically been calculated by comparing the benthic community of each station to the median reference area community (using pooled reference area data). This method (abbreviated to BCI-EEM in this document) is recommended by the technical guidance document for metal mining EEM (Environment Canada 2012). Huebert et al. (2011) pointed out that using the reference median value as the basis for calculating Bray Curtis distance values would result in frequently finding effects where none exist, referred to as a Type I error. To correctly calculate Bray Curtis distance, Huebert et al. (2011) recommended that pairwise, among area comparisons of individual reference and exposure stations be conducted to generate Bray Curtis distance values for statistical comparisons.

During the 2015 and 2016 AEMP baseline studies, Bray Curtis distance values were also calculated using the "pairwise comparisons" method (abbreviated to BCI-PW in this document), which for replicated reference areas includes comparing the each reference area station to all stations in the other two reference areas and calculating the mean BCI (to estimate background among-area variation), and comparing each exposure station to all reference stations and calculating the mean BCI. To allow results of the baseline AEMPs to be compared to future AEMP results, Bray Curtis distances for 2015 and 2016 were calculated using both the pairwise and the EEM methods.

5.1.4.2 Evaluation of the Effects of Habitat Variation

A spearman rank correlation analysis was used to test the strength of relationships between selected habitat variables and benthic invertebrate community variables. Spearman rank correlation coefficients were calculated using SYSTAT Version 13.0 (Systat Software Inc., Chicago, IL). Thresholds for statistical significance of $P < 0.05$, $P < 0.01$, and $P < 0.001$ were applied to identify significance of correlations. Results of the correlation analysis were used to evaluate whether habitat variation may have been a confounding factor, potentially influencing statistical comparisons of sampling areas.

5.1.4.3 Characterization of Within Station Variability in Benthic Community Variables

To characterize within-station variability, discrete samples were collected from station MEL-01-05 in the Near-field area and station MEL-03-01 in Reference area 1. At each of these stations, five subsamples were collected and sorted separately from one another. The percent standard error (%SE), which is the SE expressed as the percentage of the mean of the five samples was calculated for each station, for total invertebrate abundance and richness. Station data with %SE values of <20% were considered to be typical of within-station variability in benthic invertebrate communities based on Elliott (1971).

5.1.4.4 Statistical Analysis

5.1.4.4.1 Approach

Using the 2016 data, the benthic invertebrate community variables were compared among sampling areas using statistical tests. The following is an overview of the three comparisons completed:

1) Near-field and Mid-field areas compared to the mean of the three reference areas (AEMP “effect” comparisons)

2) Pairwise comparisons of reference areas (exploratory comparisons to evaluate similarity of the three reference areas)

3) Comparisons of Near-field and Mid-field areas to individual reference areas (exploratory comparisons to evaluate suitability of individual reference areas)

The 2015 data for the exposure areas are presented in this report, but were not included in the statistical analysis, which focussed on spatial comparisons between exposure and reference areas, which were both sampled in 2016.

Data were analyzed using Analysis of Variance (ANOVA) or the equivalent non-parametric Kruskal-Wallis test, depending on whether the assumptions of normality and equal variances were met for parametric testing. Calculations and statistical summaries were performed using Excel 2013 for Windows. Statistical tests were performed using SYSTAT 13.1 for Windows (Systat Software 2009).

5.1.4.4.2 Testing Assumptions of Analysis of Variance

The assumptions for parametric tests were verified using the Shapiro-Wilk test for normality and Levene's test for homogeneity of variances on untransformed and log-transformed data for density variables, at P<0.05. Data were transformed where significant normality or equality of variance violations were found and the effectiveness of the transformations was verified.

For most community variables, parametric test assumptions were met by untransformed data; therefore, analysis proceeded using ANOVA. Exceptions are described below.

- Lowest taxonomic level evenness, chironomid, oligochaete, and gastropod density, and lowest taxonomic level BCI were log transformed to meet the assumption of normality. For some samples, the original data had zero values, so the data were log(x+1) transformed.
- Even after transformation of the data, family level richness and amphipod density did not meet the assumptions of parametric test; therefore these variables were analyzed using the Kruskal-Wallis test.

5.1.4.4.3 Analysis of Variance (ANOVA) and Multiple Comparisons

To complete comparison 1, means of all sampling areas were initially compared to one another in an overall ANOVA. If a significant difference was found, the Near-field and Mid-field areas were compared to the reference areas within the overall ANOVA, as a priori comparisons (i.e., planned contrasts). Multiple comparison techniques that were not planned prior to undertaking the analysis (i.e., a posteriori) are frequently used with environmental assessment data; however, these techniques are not always appropriate for testing hypotheses (Hoke et al. 1990). The preferred approach is to analyze the data using planned, linear contrasts by formulating meaningful comparisons among sampling areas prior to conducting the study and outlining these in a study design. This approach was used here to test for differences between the Near-field and Mid-field areas and the mean of the three reference areas as two separate contrasts. To control the probably of Type I error during these contrasts, the Dunn-Šidák correction was applied to account for the two contrasts. Results of these comparisons were considered significant at $P < 0.1$ for the overall ANOVA, and at $P < 0.051$ for the planned contrasts.

A similar approach was used for comparison 2, intended to assess natural variability in benthic community variables among reference areas. The three reference areas sampled in 2016 were compared to one another in a pairwise manner after an overall ANOVA, using three separate contrasts. The Dunn-Šidák correction was applied to account for the three contrasts. Results of these comparisons were considered significant at $P < 0.1$ for the overall ANOVA, and at $P < 0.035$ for the planned contrasts.

The Near-field and Mid-field areas were compared to individual reference areas (comparison 3) using a pairwise comparisons approach. These comparisons were considered unplanned (i.e., a posteriori), and were exploratory in nature. The procedure used for these comparisons was an overall ANOVA with significance evaluated at $P < 0.1$, followed by Tukey's honestly significant difference (HSD) method for pairwise combinations of sampling areas. This test adopts a conservative approach by employing experiment-wise error rates for the Type I error (Day and Quinn 1989). Therefore, a P-value of 0.1 was used for these tests to evaluate significance.

5.1.4.4.4 Kruskal-Wallis Test and Multiple Comparisons

The Kruskal-Wallis test was used to test for differences among sampling areas for variables that did not meet parametric test assumptions. A similar approach was taken to that described for ANOVA. Upon finding a significant overall difference, additional Kruskal-Wallis tests were conducted to test for differences between the Near-field or Mid-field area and the pooled reference areas. Kruskal-Wallis tests were considered significant at $P < 0.1$. Where pairwise comparisons were required a posteriori, the Dwass-Steel-Critchlow-Fligner test was used. This test uses pairwise rankings and is a non-parametric alternative to Tukey's HSD test, and employs the experiment-wise error rate for the Type I error. Therefore, a P-value of 0.1 was used for these tests to evaluate significance.

5.1.4.4.5 Multivariate Analysis

Benthic invertebrate community structure was summarized using non-metric multidimensional scaling (nMDS) (Clarke 1993). An overall one-way analysis of similarities (ANOSIM) test was carried out on the Bray-Curtis resemblance matrix to confirm interpretation of the separation of the points on the MDS ordination plot and to confirm differences in community composition observed in the nMDS ordination plots were significant. In addition, an area-level ANOSIM was carried out on the Bray-Curtis resemblance matrix to test differences between areas contrasted with differences among replicates within each area (Clarke et al. 2014). An R-statistic ranging from 0 to 1 is produced by the analysis; a strong difference in community composition is indicated by $R = 1$ and no difference between communities is indicated by $R = 0$. Significance of the R statistic was achieved when a P-value of <0.05 was observed, based on the five replicates per area. The analysis was run in PRIMER 7.0.11 (Clarke and Gorley 2016).

Lower stress values (i.e., <0.15) indicate less deviation and a greater goodness-of-fit (Clarke 1993). Points that fall close together on the nMDS ordination plot represent stations with similar community composition; points that are far apart from each other represent stations with dissimilar community composition.

5.2 Quality Assurance and Quality Control

The QA/QC practices applied during this study and detailed results of the QC analyses are provided in the 2016 AEMP Report (Golder 2017a, Appendix 4A). Quality assurance (QA) components of the program included the use of trained personnel and a recognized taxonomist; QC components included assessments of assessments of replicate samples. A summary of key QC results is provided below. QA/QC

- Key QC findings for the 2015 and 2016 benthic invertebrate monitoring programs are as follows:
- Grab fullness was evaluated and only data from the analysis of samples where grabs were at least 60% full were included in the data analysis as per Golder's internal Technical Procedures (unpublished file information).
- Sorting efficiency was considered acceptable for the three samples tested (ranged between 91% and 100%) (EC 2012).
- Subsampling efficiency for the 2016 samples was considered acceptable, because the total abundance based on the subsample was within 20% of the total organism count (EC 2012).

- Within-station variability of benthic invertebrate community variables evaluated in 2015 and 2016 for Meliadine Lake and the peninsula lakes was considered acceptable based on the results of the QC assessment (Golder 2017a). In summary, the range in %SE values for total abundance (15% to 40%) was higher than the range for richness (9% to 28%) indicating that within-station variability was greater for abundance compared to richness. However, the %SE ranges were within the range considered to be typical for benthic studies by Elliott (1971) and were indicative of reasonable precision for lakes characterized by low benthic invertebrate density and richness. Variability among benthic invertebrate subsamples and stations were explored further in Section 5.1.13.

Based on this assessment, the benthic invertebrate monitoring data are considered adequate to meet the needs of the AEMP for the Project.

5.3 Results and Discussion

5.3.1 Supporting Habitat Variables

Habitat data for all sampling stations sampled in 2015 and 2016 are summarized in Table 5.3-1 and Figure 5.3-1. Detailed habitat data and summary statistics are presented in Appendix 5A, Table 5A-1. Additional water and sediment quality data collected at these stations are provided in the Sections 2.3 and 3.3, respectively.

The following observations were made from a review of the habitat data collected in 2015 and 2016.

- Conductivity and temperature values at the time of benthic invertebrate sampling were similar among stations and between years. Slightly higher water temperatures were recorded in 2016 at stations in Reference areas 2 and 3 compared to those in Reference area 1.
- Total organic carbon (TOC) and sediment particle size distribution data collected at stations sampled for benthic invertebrates were spatially variable within and among areas, with some variability between years:
  - TOC at the Near-field stations averaged 5.2% in 2015 and 4.5 % in 2016. TOC at the Mid-field stations averaged 7.8% in 2015, and 4.6% in 2016. Mean TOC for the Reference Areas in 2016 ranged from 2.5% to 5.0% (Table 5.3-1). These ranges indicate generally low variability in TOC among areas and between years.
  - Substrates sampled in the Near-field area had a higher proportion of fine sediments (i.e., silt and clay) and less sand compared to samples taken from the 2016 Mid-field and Reference areas that were either predominantly sand or a combination of sand and silt (Figure 5.3-1). These results suggest that differences between Near-field area communities relative to other sampling areas are likely based on habitat variation alone, which may act as a confounding factor during future AEMP comparisons intended to evaluate the effects of the mine discharge.

Table 5.3-1: Summary of Mean Habitat Variables for Meliadine Lake, August 2015 and 2016

Area	Year	Station Depth	Field Water Quality[b]		Sediment Composition			
			Conductivity	Temperature	TOC	Sand	Silt	Clay
		(m)	(µS/cm)	(°C)	(%)	(%)	(%)	(%)
Near-field Area (MEL-01)	2015[a]	8.8	67.5	12.6	5.2	23.8	69.3	7.0
	2016	8.4	72.8	12.5	4.5	18.0	69.9	12.0
Mid-field Area (MEL-02)	2015[a]	9.3	66.0	12.8	7.8	34.9	55.4	9.7
	2016	9.1	68.8	12.6	4.6	54.0	34.7	11.3
Reference Area 1 (MEL-03)	2016	8.4	65.6	12.6	3.7	62.3	32.3	5.4
Reference Area 2 (MEL-04)	2016	9.0	66.2	13.5	2.5	63.5	30.2	6.3
Reference Area 3 (MEL-05)	2016	9.0	68.0	13.5	5.0	62.6	31.1	6.4

a) Some 2015 sites were removed from the analysis due to insufficient grab volumes (<60% fullness) as described in Section 4.2.4.1.

b) Field water quality measurements represent the bottom conditions.

m = metre; µS/cm = microSiemens per centimetre; °C = degree Celsius; % = percent; TOC = total organic carbon; = no data available.

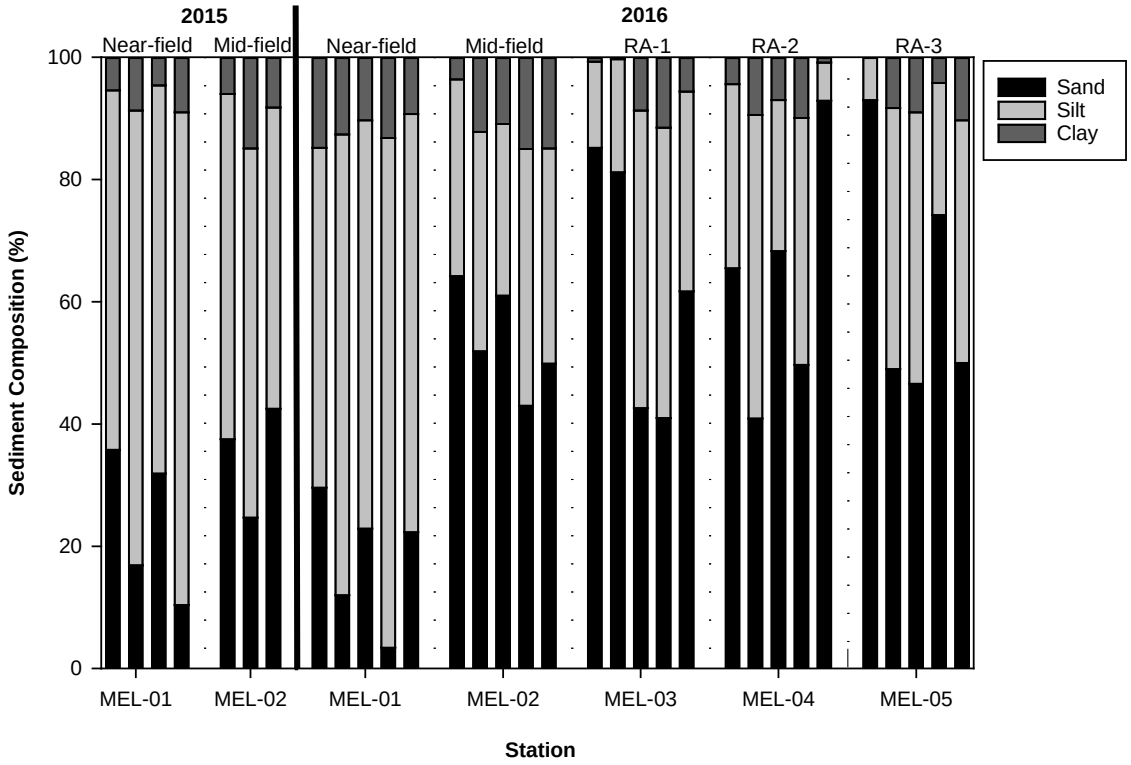


Figure 5.3-1: Sediment Particle Size Comparison for Meliadine Lake, August 2015 and 2016

5.3.2 Benthic Invertebrate Community

Raw benthic invertebrate abundance data, presence/absence data, and a summary of the benthic invertebrate community variables calculated from the raw data are presented in Appendix 5A, Tables 5A-2 to 5A-5. Summaries of statistical comparisons for the benthic community variables between the 2016 exposure and reference areas are presented in Table 5.3 2 to Table 5.3 4 and are discussed further below.

Table 5.3-2: Results of Analysis of Variance for Benthic Invertebrate Community Variables Comparing Near-field and Mid-field Areas to Reference Areas in Meliadine Lake, August 2016

Variable	Trans-formation	Statistical Test	Overall Comparison	Near-field Area (MEL-01) vs. Reference Areas[(a)]	Mid-field Area (MEL-02) vs. Reference Areas
			P	*P*	*P*
Total Density	None	ANOVA	**0.002**	**0.001**	0.300
Richness - Family Level	None	Kruskal-Wallis	**0.095**	0.312	0.388
Richness - LTL	None	ANOVA	**0.041**	0.056	0.201
SDI - Family Level	None	ANOVA	**0.038**	0.377	0.644

Variable	Trans-formation	Statistical Test	Overall Comparison	Near-field Area (MEL-01) vs. Reference Areas[a]	Mid-field Area (MEL-02) vs. Reference Areas
			P	*P*	*P*
SDI - LTL	None	ANOVA	0.947	-	-
SEI - Family Level	None	ANOVA	**<0.001**	0.544	0.107
SEI - LTL	log(x)	ANOVA	0.102	-	-
BCI-EEM - Family Level	None	ANOVA	0.565	-	-
BCI-EEM - LTL	log(x)	ANOVA	**0.026**	**0.008**	0.333
BCI-PW - Family Level	None	ANOVA	0.843	-	-
BCI-PW - LTL	None	ANOVA	0.624	-	-
Chironomid Density	log(x)	ANOVA	**0.001**	0.052	0.212
Bivalve Density	None	ANOVA	0.211	-	-
Oligochaete Density	log(x+1)	ANOVA	0.131 / **0.013**	- / 0.061	- / **0.006**
Gastropod Density	log(x+1)	ANOVA	0.404	-	-
Amphipod Density	None	Kruskal-Wallis	0.971	-	-

LTL = lowest taxonomic level; SDI = Simpson's diversity index; SEI = Simpson's evenness index; BCI = Bray-Curtis index; BCI-EEM = BCI calculated according to EEM methods; BCI-PW= BCI calculated according to the pairwise method.

(a) Reference Areas refers to an average of MEL-03, MEL-04 and MEL-05.

Note: P-values representing significant differences are bolded (overall ANOVA comparisons: P<0.1, contrasts: P<0.051; overall Kruskal-Wallis comparisons and contrasts: P<0.1). Multiple P-values indicate ANOVA results with / without outliers.

Table 5.3-3: Results of Analysis of Variance for Benthic Invertebrate Community Variables Comparing Reference Areas in Meliadine Lake, August 2016

Variable	Trans-formation	Statistical Test	Overall Comparison	Reference Area 1 (MEL-03) vs. Reference Area 2 (MEL-04)	Reference Area 1 (MEL-03) vs. Reference Area 3 (MEL-05)	Reference Area 2 (MEL-04) vs. Reference Area 3 (MEL-05)
			P	*P*	*P*	*P*
Total Density	None	ANOVA	**0.039** / 0.102	**0.017** / -	**0.047** / -	0.587 / -
Richness - Family Level	None	ANOVA	**0.029**	**0.009**	0.147	0.147
Richness - LTL	None	ANOVA	0.159	-	-	-
SDI - Family Level	None	ANOVA	**0.031**	**0.011**	0.056	0.400
SDI - LTL	None	ANOVA	0.792	-	-	-
SEI - Family Level	None	ANOVA	**0.001**	**<0.001**	**0.029**	**0.018**
SEI - LTL	None	ANOVA	0.185	-	-	-
BCI-EEM - Family Level	None	ANOVA	0.525	-	-	-
BCI-EEM - LTL	log(x)	ANOVA	0.134	-	-	-
BCI-PW - Family Level	None	ANOVA	0.615	-	-	-
BCI-PW - LTL	None	ANOVA	0.723	-	-	-
Chironomid Density	None	ANOVA	**0.022** / **0.039**	**0.010** / **0.014**	**0.031** / 0.062	0.539 /0.387
Bivalve Density	None	ANOVA	0.343 / 0.145	-	-	-
Oligochaete Density	log(x+1)	ANOVA	0.487 / 0.124	-	-	-
Gastropod Density	log(x+1)	ANOVA	0.433 / **0.089**	- / 0.450	- / 0.119	- / 0.037
Amphipod Density	None	Kruskal- Wallis	0.909	-	-	-

LTL = lowest taxonomic level; SDI = Simpson's diversity index; SEI = Simpson's evenness index; BCI = Bray-Curtis index; BCI-EEM = BCI calculated according to EEM methods; BCI-PW= BCI calculated according to the pairwise method.

Note: P-values representing significant differences are bolded (overall ANOVA comparisons: P<0.1, contrasts: P<0.035; overall Kruskal-Wallis comparisons and contrasts: P<0.1). Multiple P-values indicate ANOVA results with / without outliers.

Table 5.3-4: Results of Analysis of Variance and Pairwise Comparison with Tukey's HSD of Benthic Invertebrate Community Variables in Meliadine Lake, August 2016

Variable	Trans-formation	Statistical Test	Overall Comparison	Near-field Area (MEL-01) vs Reference Area 1 (MEL-03)	Near-field Area (MEL-01) vs. Reference Area 2 (MEL-04)	Near-field Area (MEL-01) vs. Reference Area 3 (MEL-05)	Mid-field Area (MEL-02) vs. Reference Area 1 (MEL-03)	Mid-field Area (MEL-02) vs. Reference Area 2 (MEL-04)	Mid-field Area (MEL-02) vs. Reference Area 3 (MEL-05)
			P	*P*	*P*	*P*	*P*	*P*	*P*
Total Density	None	ANOVA /Tukey's	**0.002**	0.536	**0.006**	**0.017**	0.177	1	0.995
Richness - Family Level	None	KW / DSCF	**0.095**	0.963	0.137	0.928	0.612	1	0.942
Richness - LTL	None	ANOVA /Tukey's	**0.041**	0.972	**0.084**	0.503	0.248	1	0.798
SDI - Family Level	None	ANOVA /Tukey's	**0.038**	0.104	0.956	0.999	0.196	0.832	1
SDI - LTL	None	ANOVA /Tukey's	0.947	-	-	-	-	-	-
SEI - Family Level	None	ANOVA /Tukey's	**<0.001**	0.248	**0.031**	0.993	**0.006**	0.672	0.598
SEI - LTL	log(x)	ANOVA /Tukey's	0.102	-	-	-	-	-	-
BCI-EEM - Family Level	None	ANOVA /Tukey's	0.565	-	-	-	-	-	-
BCI-EEM - LTL	log(x)	ANOVA /Tukey's	**0.026**	0.666	0.255	**0.013**	1	0.959	0.220
BCI-PW - Family Level	None	ANOVA /Tukey's	0.843	-	-	-	-	-	-
BCI-PW - LTL	None	ANOVA /Tukey's	0.624	-	-	-	-	-	-
Chironomid Density	log(x)	ANOVA /Tukey's	**0.001**	1	**0.009**	0.113	**0.021**	0.999	0.858
Bivalve Density	None	ANOVA /Tukey's	0.211	-	-	-	-	-	-
Oligochaete Density	log(x+1)	ANOVA /Tukey's	0.131 / **0.013**	- / 0.995	- / **0.056**	- / 0.632	- / 0.697	- / **0.009**	- / 0.184
Gastropod Density	log(x+1)	ANOVA /Tukey's	0.404	-	-	-	-	-	-
Amphipod Density	None	KW / DSCF	0.971	-	-	-	-	-	-

LTL = lowest taxonomic level; SDI = Simpson's diversity index; SEI = Simpson's evenness index; BCI = Bray-Curtis index; BCI-EEM = BCI calculated according to EEM methods; BCI-PW = BCI calculated according to the pairwise method; KW = Kruskal-Wallis test; DSCF= Dwass-Steel-Critchlow-Fligner test.

Note: P-values representing significant differences are bolded (P<0.1). Multiple P-values indicate ANOVA results with / without outliers.

5.3.2.1 Total Density and Total Richness

In 2015, total density was considered to be in the low density category described in Section 5.1.3.1, with Near-field (474 to 828 org/m²) and Mid-field values (60 to 224 org/m²) towards the lower end of that category (Figure 5.3 2). Densities in the Near-field and Mid-field areas were higher in 2016 compared to 2015; however, 2016 densities remained low (ranging from 1,172 to 3,491 org/m² in the Near-field area and from 224 to 1,672 org/m² in the Mid-field area). Lower densities were reported in the Mid-Field area compared to the Near-field area in both years (Figure 5.3 2). Low densities were also observed in all three reference areas (i.e., <3,000 org/m²).

The overall statistical comparison of the 2016 densities among the five areas found total density to be significantly different among areas (Table 5.3-2). The mean Near-field area density was significantly higher than the reference area mean density, whereas the Mid-field area density showed no significant difference from the reference area mean density (Table 5.3 2).

Although low densities were observed in the three reference areas relative to the exposure areas, there was moderate spatial variability among reference areas, with significantly higher densities reported in Reference area 1 (1,112 to 2,767 org/m²) compared to the two other areas (Reference area 2: 276 to 1,207 org/m²; Reference area 3: 500 to 1,388 org/m²) (Figure 5.3-2; Table 5.3-3). No significant difference was observed between Reference areas 2 and 3. In general, the spatial variability observed within and among the three reference areas was broadly similar to that observed for the combined 2015 and 2016 dataset for the Near-field and Mid-field exposure areas.

Tukey's pairwise comparisons for total density between the Near-field and Reference areas indicated significant differences from Reference areas 2 and 3 (Table 5.3-4). No significant differences were observed between the Mid-field area and any of the reference areas.

At the family level, total richness values reported for the two exposure areas and the three reference areas were similar (Figure 5.3 2). Apart from the 12 families present at Near-field exposure station MEL-01-03 in 2015, mean family richness was below 10 families at all stations sampled in 2015 and 2016. Family level richness was significantly different among areas overall, but no significant differences were found between the exposure areas and the mean of the reference areas (Table 5.3-2). Richness in Reference area 1 was significantly higher than in Reference area 2 (Table 5.3 3). No significant differences were observed in pairwise comparisons of reference and exposure areas (Table 5.3-4).

In both 2015 and 2016, LTL richness in the Near-field and Mid-field areas was low to moderate (Figure 5.3 2) with proportionally more Mid-field stations with low richness values (i.e., <10 taxa/station) compared to Near-field stations. In 2016, LTL richness was moderate (i.e., 10 to 40 taxa/station) at all stations, except for MEL 04 02 in Reference Area 2 (9 taxa/station). In 2016, LTL Richness was not significantly different between the Near-field area and the reference areas (Table 5.3-2), and the reference areas were also not significantly different from one another (Table 5.3-3). Pairwise comparisons detected a significant difference between the Near-field area and Reference area 2 (Table 5.3-4).

These results indicate moderate to large variation in both total invertebrate density and richness between years and among sampling areas, with the exception of family level richness. They also highlight existing significant differences between the Near-field area and the reference areas in total invertebrate density, as well as among the three reference areas.

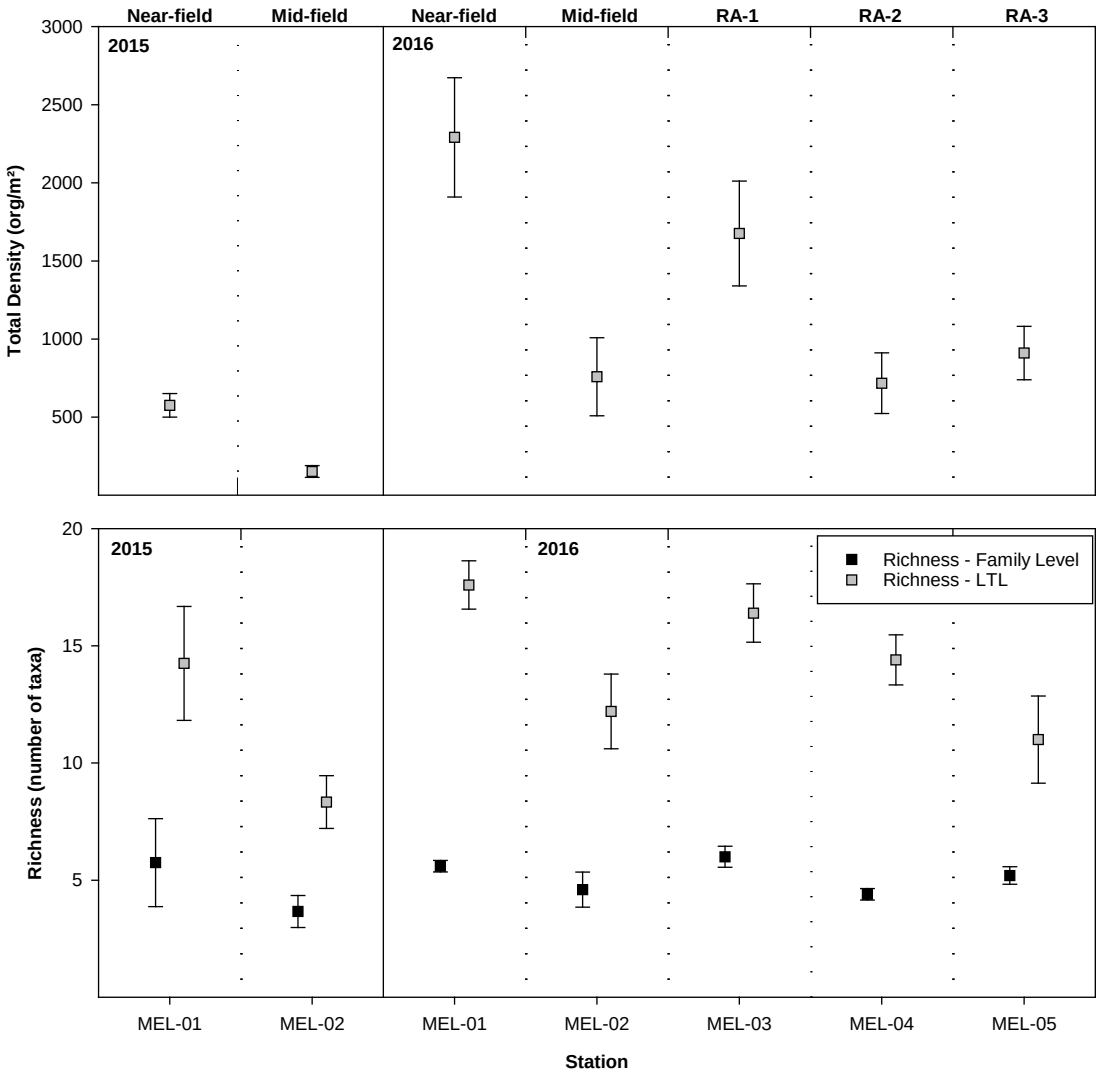


Figure 5.3-2: Mean (± SE) Total Benthic Invertebrate Density and Richness in Meliadine Lake, August 2015 and 2016

5.3.2.2 Simpson's Diversity and Evenness Indices

Overall, family level and LTL SDI values suggested that exposure and reference areas had generally diverse benthic communities. The SEI calculated at the family level and LTL indicated that for the most part, few taxa in these communities accounted for the majority of the invertebrate density at each station.

Diversity and evenness in Meliadine Lake exhibited some differences among areas, but to a lesser extent than density and richness. The following specific differences were noted from the results presented in Tables 5.3-2 to 5.3-4 and Figure 5.3-3.

- At the family level, both SDI and SEI were significantly different among areas in the overall ANOVA, but not when comparing Near-field and Mid-field stations to the reference area mean (Table 5.3-2). Family level SDI and SEI were significantly different among reference areas, with SDI being significantly lower in Reference area 1 compared to Reference areas 2 and 3 (Table 5.3-3). At the family level, each reference area had a significantly different SEI than the other two (i.e., Reference Area 2 > Reference Area 3 > Reference Area 1) (Table 5.3-3).
- Relatively high SDI values were calculated for exposure areas sampled in 2015 and 2016, and reference areas sampled in 2016 (Figure 5.3-3). LTL SDI in 2016 ranged from 0.74 to 0.88 at Near-field stations, 0.79 to 0.85 at Mid-field stations, and 0.74 to 0.91 for stations in the three reference areas. These SDI values were closer to 1 than 0, indicating that communities present in both the exposure and reference areas were diverse.
- SEI was variable among the exposure area stations sampled in 2015 and 2016, but overall SEI values were low to moderate (Figure 5.3-3). As SEI is a measure of the relative densities of the different taxa at each replicate station, a lower SEI value indicates a higher degree of dominance by one or a few organisms. In the Near-field area, LTL SEI values ranged from 0.19 to 0.59 in 2016. A similar range of 0.40 to 0.58 was calculated for the Mid-field area when values observed at MEL 02 01 (0.75) in 2016 and MEL 02 02 (0.91) in 2015 were excluded. Communities at these two stations had low density and richness values and were evenly dominated by bivalves and chironomids.
- The three reference areas sampled in 2016 also had low to moderate LTL SEI values that ranged between 0.26 and 0.78, indicating that few taxa also accounted for the majority of the density at each station. The one exception was station MEL 04 05 in Reference Area 2 that had a substantially higher SEI value of 0.78. Both density and richness were low at this station and no species clearly dominated the community.
- Although SDI values were notably lower when calculated for the family level, evenness values were in similar ranges regardless of taxonomic level in the dataset used for the calculations.

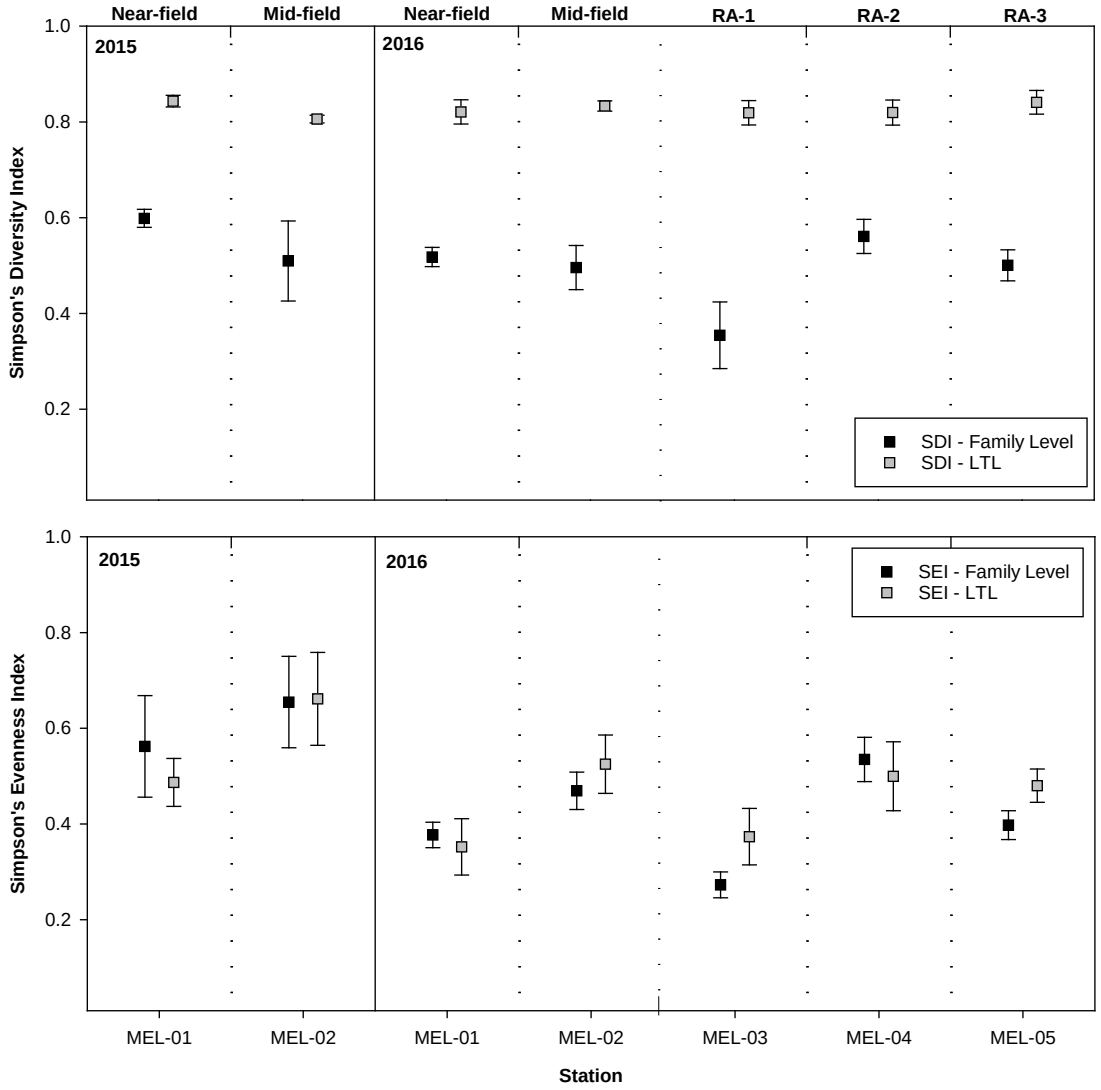


Figure 5.3-3: Mean (± SE) Simpson's Diversity and Evenness Indices for the Benthic Invertebrate Community Collected for Meliadine Lake, August 2015 and 2016

5.3.2.3 Bray-Curtis Index

Bray-Curtis Index values were calculated for the 2016 data, using both family-level taxa and lowest taxonomic level data, as well as following both EEM and pairwise methods. BCI were not calculated for the 2015 data, as there were no reference area data. Meliadine Lake showed few notable differences in similarity between the sampling areas, with the Near-field area being the least similar to the Reference areas in 2016. The following specific observations were made based on the results presented in Tables 5.3-2 to 5.3-4 and Figure 5.3-4.

- Low to moderate BCI (EEM) values were observed in the family level calculations; values for individual stations were highly variable and ranged from 0.07 to 0.67. The LTL BCI (EEM) calculations had a greater variety of index values, ranging from 0.23 to 0.80, although most were moderate in value. Reference area 3 had the lowest average BCI (EEM) among areas (0.23 for family level, and 0.33 for LTL), and the Near-field area had the highest (0.40 for family level and 0.64 for LTL; Figure 5.3-4). BCI (EEM-LTL) was significantly different among areas, with the Near-field area significantly higher than the reference area mean (Table 5.3-2) and the Reference Area 3 value (Table 5.3-4). No significant differences were found in BCI (all 4 variables) among the reference areas (Table 5.3-3).
- BCI (EEM) exhibited a spatial trend among the areas sampled, whereby a slight decreasing trend was observed across the lake with increasing distance from the Near-field area.
- BCI (PW) had a narrower range of values than BCI (EEM), ranging from 0.31 to 0.65 for family-level, and 0.47 to 0.78 for LTL. As with BCI (EEM), average BCI (PW) was lowest at Reference Area 3 and highest at the Near-field area, ranging from 0.39 to 0.46 for family-level, and from 0.54 to 0.64 for LTL (Figure 5.3-4). BCI (PW) did not differ significantly among areas at either taxonomic level (Table 5.3-2).

Using both methods of calculating the BCI allows an evaluation of the suitability of this index for future monitoring data analyses. As expected, the BCI (EEM) method suggests greater existing differences in community composition between the reference areas and exposure areas, which confirms the evaluation of Huebert et al. (2011) regarding the bias in the EEM method of calculating the BCI. For future monitoring, it is recommended that greater emphasis be placed on the results obtained from analyses of BCI values calculated using the pairwise method.

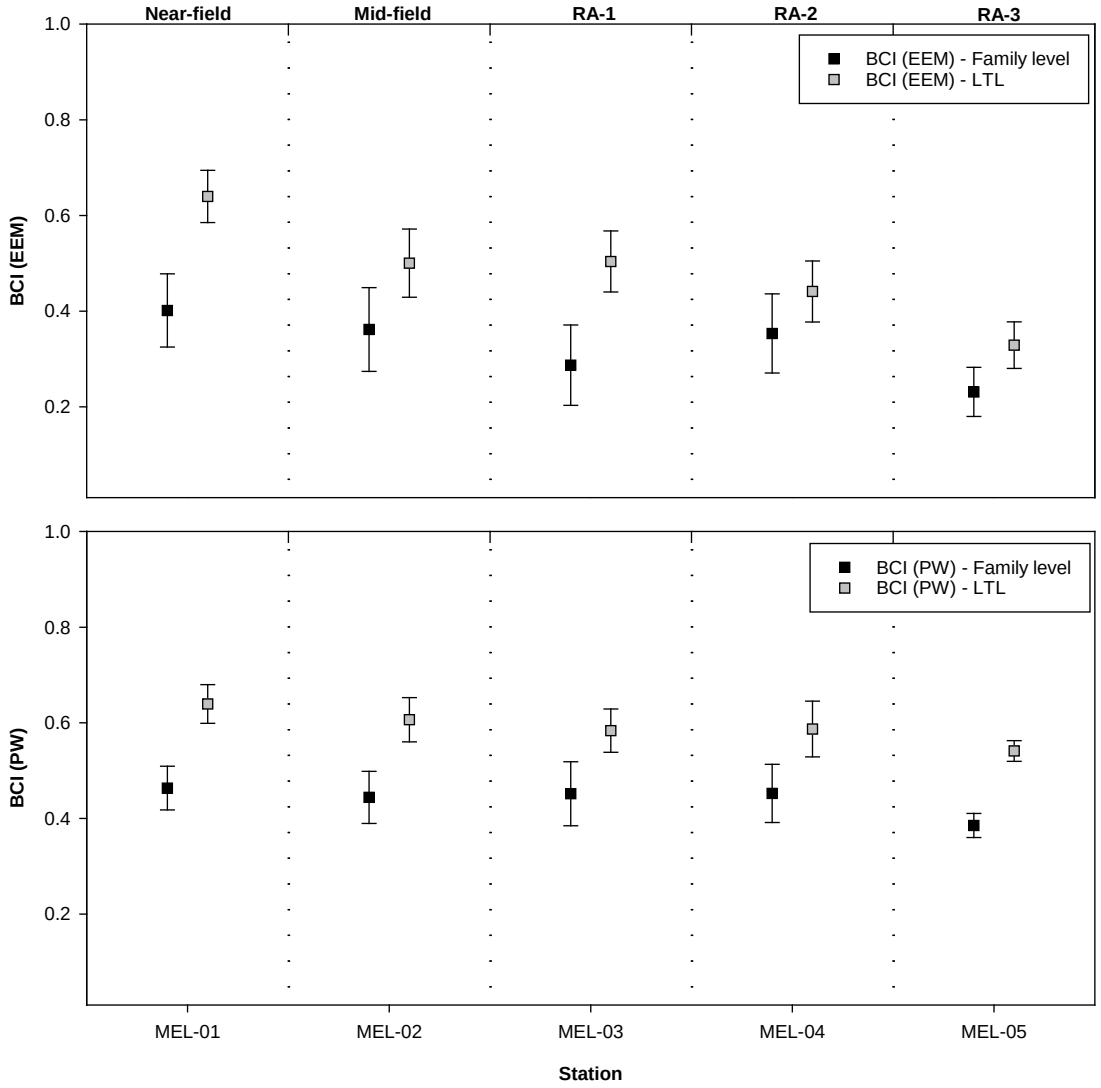


Figure 5.3-4: Mean (± SE) Bray-Curtis Index Values for the Benthic Invertebrate Community in Meliadine Lake, August 2015 and 2016

5.3.2.4 Community Composition

Overall, the composition of the benthic invertebrate community in Meliadine Lake was similar to those of other Arctic Lakes and the taxa present in 2015 and 2016 were similar to those observed during previous sampling years. As shown on Figures 5.3-5 and 5.3-6, differences in relative densities and dominant taxa were noted between areas in 2015 and 2016. These differences and the significant differences between dominant taxa shown in Tables 5.3-2 to 5.3-4 are discussed.

- Insects of the family Chironomidae (non biting midges) and bivalves of the family Pisidiidae (formerly Sphaeriidae: fingernail clams or pea clams) dominated benthic invertebrate communities in the exposure areas in 2015 and 2016. In 2015, various chironomid subfamilies and tribes collectively accounted for 44% to 80% of the total density, and bivalves accounted for 18% to 41% of the total density. A broadly similar community composition was observed in communities sampled in 2016, with chironomids accounting for 41% to 71% of the total density and bivalves accounting for between 8% and 50%. In Arctic lake ecosystems, chironomids constitute a high proportion of the benthic invertebrate communities, often accounting for more than a third of the total relative density (Namayandeh and Quinlan 2011)
- In the Near-field and Mid-field areas, the subfamily Chironominae was the dominant midge group at the majority of stations in 2015 and 2016, with a large portion of the remaining chironomid density represented by the subfamilies Orthocladiinae and Tanypodinae. Although chironomid density varied significantly among sampling areas, the Near-field area mean was not significantly different from the reference area mean (Table 5.3-2). However, pairwise comparisons showed differences between the Near-field area and Reference area 2, and between the Mid-field area and Reference area 1 (Table 5.3-4).
- Similar to the exposure areas, the reference areas were dominated by the family Chironomidae. The various chironomid subfamilies and tribes collectively accounted for 36% to 91% of the total density. Chironomidae density differed among reference area stations, and a significant difference was detected between Reference area 1, and each of Reference areas 2 and 3 (Table 5.3-3).
- Bivalves in the near-field community accounted for 11% to 57% of the total density. The density of bivalves did not differ significantly among sampling areas (Table 5.3-2).
- Oligochaetes were a minor taxon in each area. The density of this group was significantly different between the Mid-field area and the mean of the reference areas (Table 5.3-2), and in the Near-field and Mid-field areas relative to Reference areas 2 and 1 (Table 5.3-4), respectively, but did not vary significantly among the reference areas (Tale 5.3-3).
- Gastropods and amphipods were also minor taxa, and their densities did not vary significantly among areas (Tables 5.3-2 to 5.3-4).
- Some differences in community composition were apparent among the three reference areas in 2016. A significantly higher density of Chironomidae was observed in Reference area 1 compared to Reference areas 2 and 3 (Table 5.3-3). Based on visual assessment (Figure 5.3-6, bottom graph), the relative density of Chironomidae was also higher in Reference area 1 compared to the other two reference areas.
- In terms of community composition as relative densities (Figure 5.3-6), none of the reference areas appeared more similar to the Near-field area than the others; however, statistical test results indicated no significant differences densities of dominant invertebrates between the Near-field area and Reference Area 1.

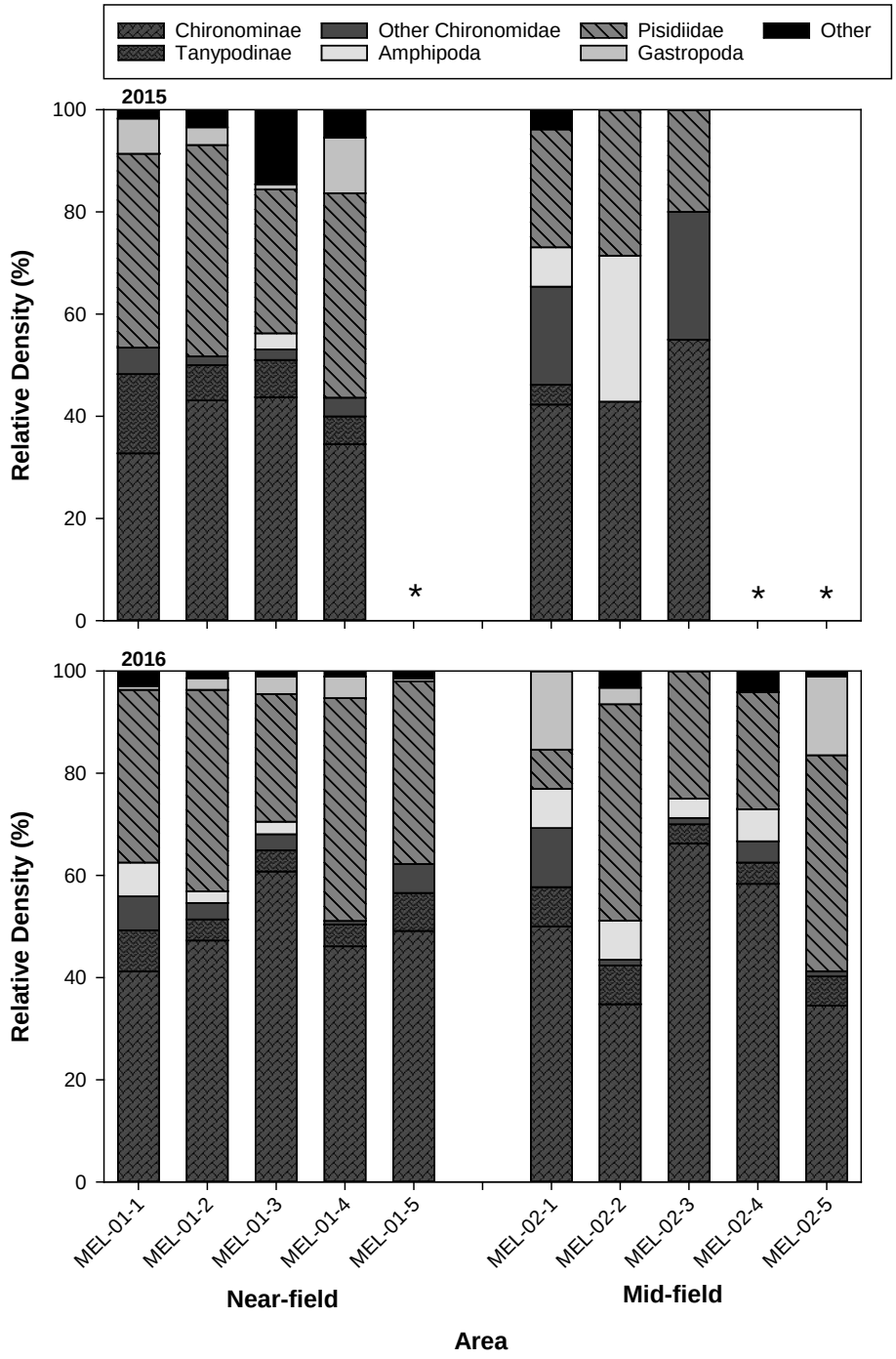


Figure 5.3-5: Relative Densities of Major Benthic Invertebrate Groups in Meliadine Lake (Exposure Areas), August 2015 and 2016

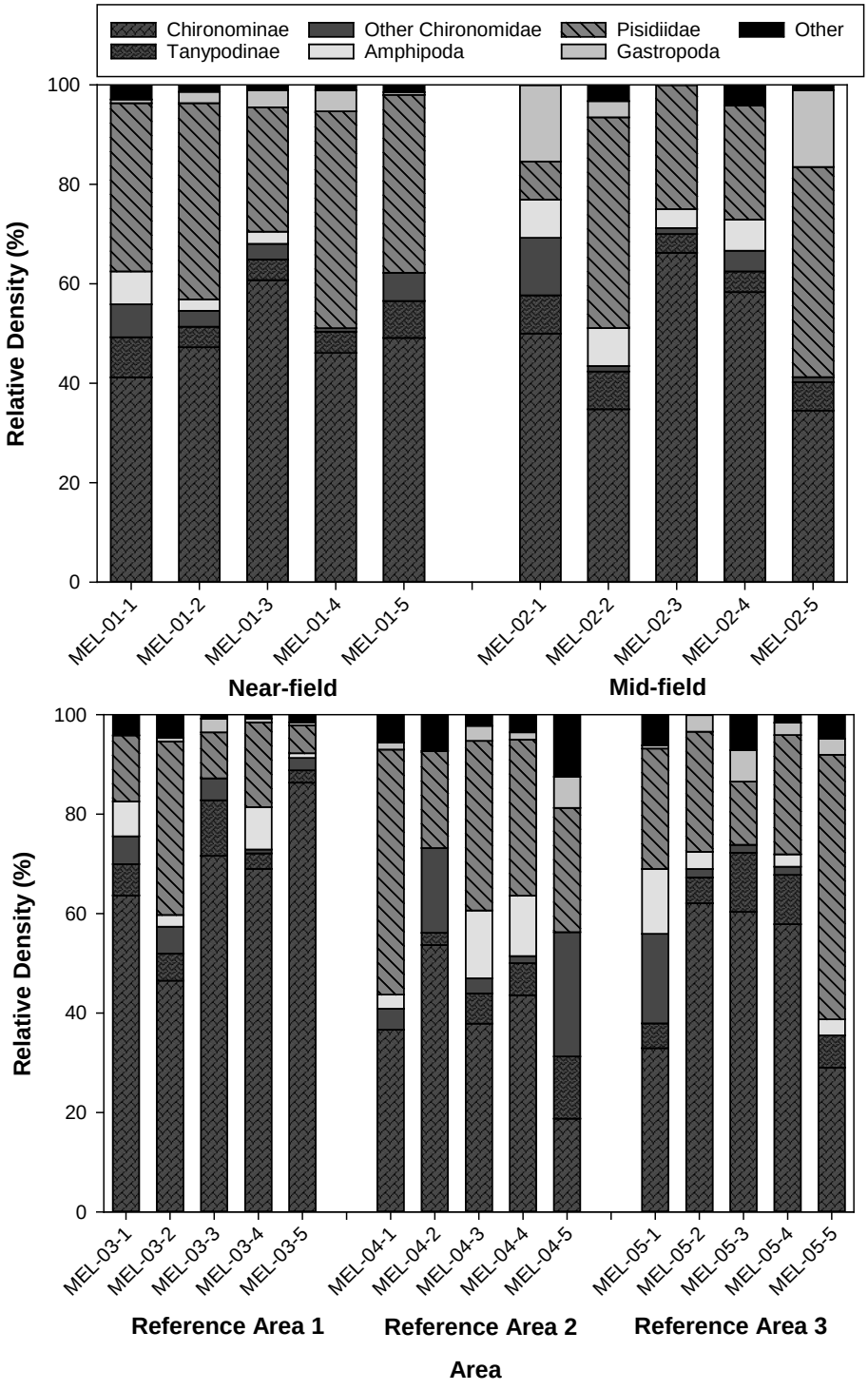


Figure 5.3-6: Relative Densities of Major Benthic Invertebrate Groups in Meliadine Lake, August 2016

5.3.2.5 Multivariate Analysis

The nMDS run on the 2016 benthic invertebrate community dataset produced a two-dimensional configuration with a stress value of 0.11, indicating a successful ordination. All areas compared were fairly similar in community structure, with a moderate to high similarity (i.e., all within the 60% similarity ellipse) as shown in Figure 5.3-7. Some separation among areas was present, consistent with the univariate analysis results. The Mid-field area and all three Reference areas were within the 70% similarity ellipse, while the Near-field area was outside this zone, indicating a greater difference between the Near-field area and other sampling areas, compared to the differences among the other sampling areas. The pairwise ANOSIM comparing all areas for 2016 indicated significant differences between the Near-field area and Reference areas 2 and 3. No other differences were observed (Table 5.3-5).

The results of this analysis suggests that in 2016, the Near-field area benthic invertebrate community was already different from Reference area communities. This is a confounding factor that will need to be addressed in subsequent studies. This finding is discussed further in Section 5.3.5.

Table 5.3-5: Benthic Invertebrate Community ANOSIM Results, 2016

Area	Near-field Area (MEL-01)	Mid-field Area (MEL-02)	Reference Area 1 (MEL-03)	Reference Area 2 (MEL-04)	Reference Area 3 (MEL-05)
Mid-field Area (MEL-02)	0.3	-	-	-	-
Reference Area 1 (MEL-03)	0.2	0.19	-	-	
Reference Area 2 (MEL-04)	**0.4**	<0.1	0.13	-	-
Reference Area 3 (MEL-05)	**0.4**	0.2	0	<0.1	-

Significant differences are **bolded**; significance at *P*<0.05.

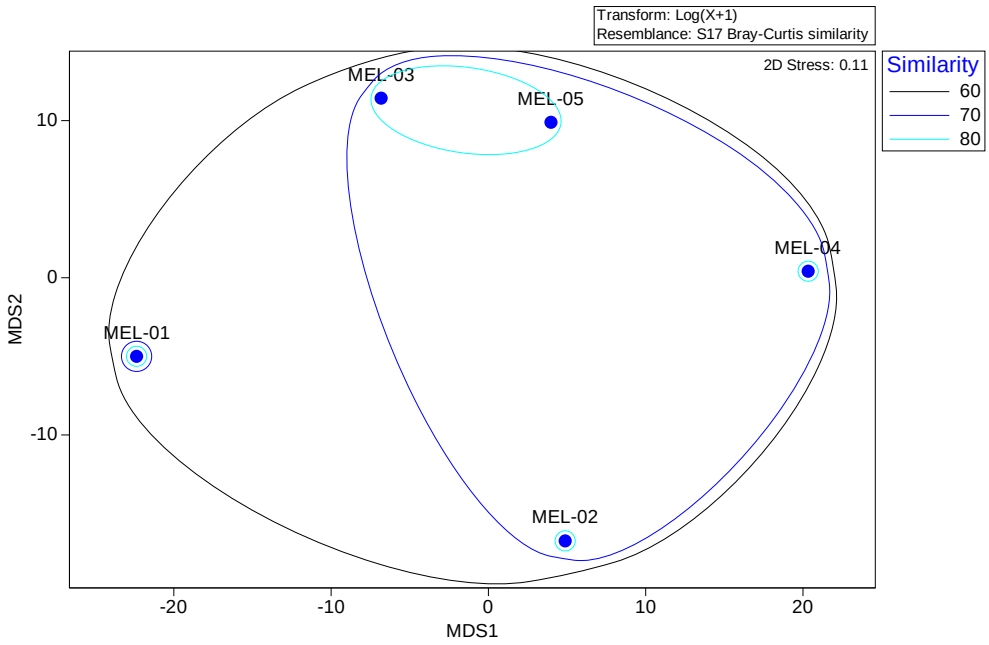


Figure 5.3-7: Ordination Plot of the Benthic Invertebrate Community for Meliadine Lake, August 2016

5.3.3 Effects of Habitat Variation on the Benthic Invertebrate Community

The potential for variation in TOC, grain size and selected sediment chemistry parameters to contribute to the spatial and temporal variability observed in community structure among stations in Meliadine Lake was evaluated Spearman rank correlation analyses for both 2015 and 2016 (Table 5.3-7). Correlation analysis included concentrations of metals present in the Meliadine Lake sediments above CCME sediment quality guidelines (i.e., arsenic, chromium, copper), and water column concentrations of the nutrients total phosphorus and total nitrogen.

Critical values of the correlation coefficient representing significant relationships are summarized in Table 5.3-6, and the results of the Spearman correlations are provided in Table 5.3-7. TOC and grain size variables were not significantly correlated with the benthic community variables in 2015, except for oligochaete density and percent silt, where a significant positive correlation was identified. This weak correlation indicated that in 2015 the number of oligochaetes tended to increase with finer and high percentage of silt, a finding consistent with the substrate preference for oligochaetes (Thorp and Covich 2001). Positive correlations were also found between sediment arsenic concentration, and total density and bivalve density. This could be reflective of higher total invertebrate densities and specifically bivalves in finer sediments, where arsenic is preferentially partitioned, leading to higher arsenic concentrations relative to coarser sediments. With respect to nutrients in water, amphipod density was found to be significantly negatively correlated with total phosphorus in 2015. Due to the small sample sizes and large number of correlations run, it is also likely that at least some of the significant correlations are not biologically meaningful.

When the larger 2016 dataset was considered, the following significant correlations were identified (Table 5.3-7):

- Total density was significantly negatively correlated with percent sand and was significantly positively correlated with percent silt. SDI (LTL) was significantly negatively correlated with percent silt and was significantly positively correlated with percent sand. Thus, finer sediments supported more dense, but less diverse benthic invertebrate communities; a finding consistent with observed patterns in northern oligotrophic lakes such as Meliadine Lake.
- SEI (LTL) was significantly negatively correlated with TOC and percent silt, but significantly positively correlated with percent sand. This finding suggests that communities with lower densities found in sandier sediments tended to be more even with respect to the community composition.
- Bivalve density (Pisidiidae) was significantly negatively correlated with percent sand and significantly positively correlated with TOC and percent silt. Bivalves tend to inhabit sandy substrates in lakes because they are typically limited by substrate sizes above 0.18 mm (fine sand/coarse sand) (Thorp and Covich 2001). In particular, Pisidium, which was the dominant bivalve in Meliadine Lake, is considered to be characteristic of areas with fine sediments (Dillon 2000).
- SDI (LTL), Oligochaete density and Amphipoda density were significantly negatively correlated with sediment arsenic, indicating a decrease in density and diversity where arsenic concentrations were higher. Given that arsenic concentrations above the Predicted Effects Level (PEL) have been documented at some stations prior to the Mine discharge (likely indicative of natural metal deposits in the area; Straskraba and Moran 1990), these correlations are consistent with expectations, but are very weak, based on visual evaluation of scatter-plots.
- Gastropoda density increased with sediment arsenic concentration, which may reflect the affiliation of gastropods and arsenic with fine sediments.

- SDI was significantly positively, but weakly correlated with nitrogen; there is no clear interpretation for this relationship.
- Significant, but very weak positive correlations were observed between each of TN and TP in water and one biological variable. Given the lack of similar correlations between nutrients and other variables, these correlations are unlikely to be meaningful.
- As in the case of the correlation analysis of the 2015 dataset, due to the small sample sizes and large number of correlations run, it is also likely that at least some of the significant correlations detected are not meaningful.

Scatter-plots of habitat and community variables found to be moderately to highly significantly correlated ($P < 0.01$) are provided in Figure 5.3-8, to support interpretation of the significant correlations identified for 2015 and 2016. Examination of the scatterplots values for these correlations indicate that although significant relationships were identified between some habitat and community variables, many of these relationships were weak and unlikely to be meaningful (i.e., all for 2015), with the possible exception of those with sediment silt or sand content in 2016. The directions of relationships with sediment silt and sand content in 2016 are consistent with habitat associations and expected community changes along the gradient of increasing fine sediments, and generally support the interpretation that variation in sediment grain size accounted for at least some of the among-area variability in the benthic invertebrate community in 2016. This suggests that spatial variability observed in biological variables between the Near-field area and reference areas in 2016 was at least partly the result of habitat variation.

Treated effluent from the exploration camp sewage treatment plant was discharged into a small ditch, approximately 60 m from Meliadine Lake during 2015 and 2016 (Section 2.2). The treated effluent flowed into Meliadine Lake close to the Near-field exposure area (MEL-01) (Figure 1.1-2). The water quality of Meliadine Lake was assessed to evaluate whether differences in water quality were observed between the exposure and reference areas. The results of the analyses are provided in Section 3.3 for the 2015 and 2016 datasets and indicate typically low nutrient concentrations throughout the lake (mostly within the oligotrophic range), with instances of slightly higher concentrations of TP, dissolved phosphorus and orthophosphate in the Near-field area compared to other sampling areas during sampling events from 2015 to 2017 (time series plots are shown in Appendix 3E, Figures 3E.1-4e to 3E.1-4g). The median TP concentration in 2016 was slightly higher in the Near-field area compared to other sampling areas, and these differences were found to be statistically significant (Section 3.3.1.2). The plankton component also reported higher chlorophyll *a* concentration and phytoplankton biomass in the Near-field area compared other areas (Section 7.3). These results suggest a potential slight nutrient enrichment effect in the Near-field area compared to other sampling areas.

Evaluation of relationships between habitat variables and benthic community variables, combined with water quality and plankton component results, suggests that the Near-field area benthic invertebrate community may be different from communities in other sampling areas in Meliadine Lake as a result of habitat variation and potentially slight nutrient enrichment. The relative importance of these influences on the benthic invertebrate community cannot be evaluated based on available data, and should be investigated further, to allow adjustment of the AEMP sampling design to remove confounding factors from the analysis of mine-related effects during future monitoring cycles.

Table 5.3-6: Critical Values for Spearman Correlations on Benthic Invertebrate Community Variables

Year	Habitat Variables	n	Critical Value		
			P = 0.05	*P* = 0.01	*P* = 0.001
2015	TOC, % sand, % silt, % clay, sediment As, Cr, Cu	8	0.738	0.881	0.976
	Total phosphorus and total nitrogen in water	7	0.786	0.929	1
2016	TOC, % sand, % silt, % clay, sediment As, Cr, Cu	33	0.345	0.446	0.544
	Total phosphorus in water	25	0.460	0.584	0.712
	Total nitrogen in water	19	0.398	0.511	0.630

n = sample size; P = probability.

Note: Critical values are based on 2-tailed tests.

Table 5.3-7: Spearman Rank Correlations between Benthic Invertebrate Community Variables and Selected Habitat Variables for Meliadine Lake, August 2015 and 2016

Benthic Community Variable	Spearman Correlation Coefficient (r_s)								
	TOC	Sand	Silt	Clay	As in Sediment	Cr in Sediment	Cu in Sediment	TP in Water	TN in Water
2015 Data									
Total density	-0.371	0.180	-0.036	-0.575	**0.766***	-0.108	-0.563	0.180	0.198
Richness family level	-0.228	-0.203	0.292	-0.292	0.292	-0.203	-0.545	-0.408	0.296
Richness lowest level	-0.586	-0.122	0.293	-0.586	0.439	-0.415	-0.537	0.162	0.234
SDI LTL level	-0.571	-0.619	0.690	-0.190	0.024	-0.500	-0.024	0.036	0.250
SEI LTL level	0.143	-0.333	0.190	0.476	-0.571	0.024	**0.738***	-0.071	-0.286
Chironomidae density	-0.405	0.214	-0.071	-0.619	0.714	-0.143	-0.571	0.143	0.107
Bivalvia density	-0.287	0.096	0.048	-0.467	**0.838***	-0.024	-0.515	0.270	0.396
Oligochaeta density	-0.617	-0.617	**0.746***	-0.257	0.591	-0.463	-0.103	0.630	0.408
Gastropoda density	-0.307	-0.393	0.442	-0.025	0.700	0.086	0.098	0.283	0.510
Amphipod density	-0.151	-0.069	0.110	-0.289	-0.316	-0.385	-0.344	**-0.837***	-0.060
2016 Data									
Total density	0.323	**-0.449****	**0.461****	0.158	0.144	0.134	0.057	0.209	0.108
Richness family level	0.057	0.084	-0.070	0.003	-0.267	-0.159	0.013	-0.064	0.353
Richness lowest level	0.036	0.026	-0.047	0.123	-0.239	-0.027	0.125	0.208	0.268

Benthic Community Variable	Spearman Correlation Coefficient (r_s)								
	TOC	Sand	Silt	Clay	As in Sediment	Cr in Sediment	Cu in Sediment	TP in Water	TN in Water
SDI LTL level	-0.276	**0.404***	**-0.474****	0.099	**-0.399***	-0.128	0.100	0.059	**0.511****
SEI LTL level	**-0.393***	**0.476****	**-0.506****	-0.116	-0.165	-0.143	-0.060	-0.112	0.303
Chironomidae density	0.155	-0.218	0.209	0.209	-0.105	0	0.135	0.139	0.099
Bivalvia density	**0.360***	**-0.477****	**0.492****	0.199	0.304	0.313	0.153	**0.513***	-0.061
Oligochaeta density	-0.047	0.123	-0.135	-0.074	**-0.398***	-0.284	-0.017	-0.112	0.128
Gastropoda density	0.309	-0.288	0.325	0.091	**0.511****	0.225	0.166	0.311	0.069
Amphipod density	-0.128	0.219	-0.275	0.137	**-0.367***	-0.037	0.202	0.003	0.072

TP = total phosphorus; TN = total nitrogen.

Note: Significant correlation coefficients are **bolded**; * = $P<0.05$, ** = $P<0.01$.

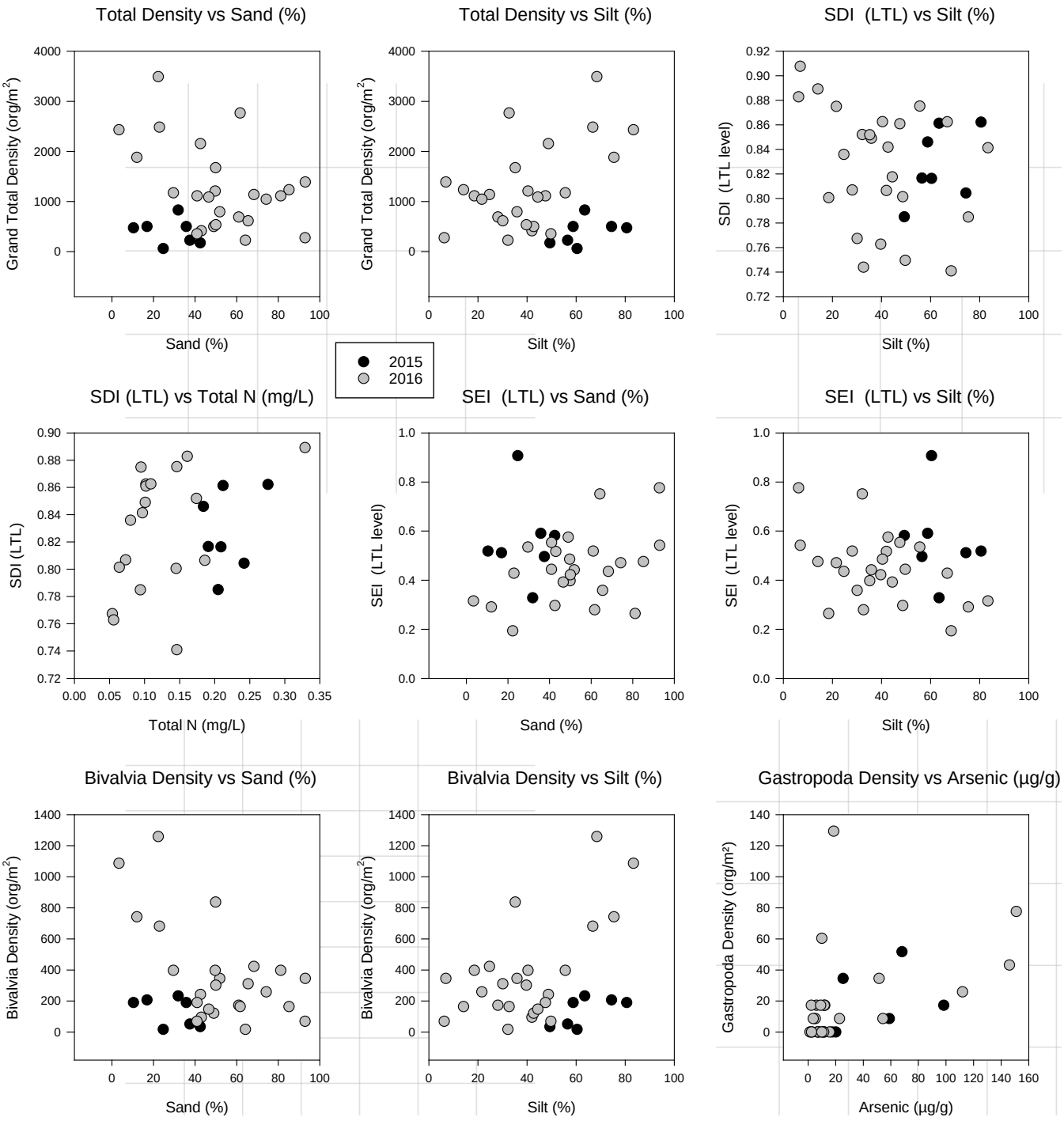


Figure 5.3-8: Scatter-Plots of Benthic Habitat Variables, Sediment Arsenic, and Total Nitrogen in water, versus Benthic Invertebrate Community Variables, August 2015 and 2016

Note: Plots representing moderately to highly significant ($P < 0.01$) Spearman rank correlations are shown.

5.3.4 Characterization of Within-Station Variability

Within-station variability was examined based on the 2016 benthic invertebrate community results. The benthic invertebrate subsamples collected at MEL-01-05 and MEL-03-01 were analyzed separately, which provided information on likely level of representativeness of composite samples taken at other stations.

Within-station estimates of variability for total invertebrate density and richness were summarized as the mean, summary statistics, and the %SE (Table 5.3-8) and the data for individual subsamples were plotted (Figure 5.3-9). The range of %SE values were 16% (MEL-01-05) to 40% (MEL-03-01) for total abundance, and 14% (MEL-01-05) to 28% (MEL-03-01) for richness. Visual evaluation of the data for individual subsamples indicate a moderate degree of within-station variation (Figure 5.3-9).

Values of the %SE greater than 20% indicate a moderate level of variation at the subsample level, and are higher than the typical range observed in benthic invertebrate data (Elliott 1971); however, these results are similar to those observed in other Arctic lakes with low invertebrate densities (e.g., Lac de Gras; Golder 2014), where similar composite sampling methods are used for the AEMP.

Table 5.3-8: Within-Station Variation in Benthic Community Variables in Meliadine Lake, 2016

Station-Replicate	Total Abundance (organisms/subsample)	Richness (no. of taxa/subsample)
MEL-01-05		
MEL-01-05-D1	102	11
MEL-01-05-D2	29	5
MEL-01-05-D3	94	13
MEL-01-05-D4	93	10
MEL-01-05-D5	87	12
Mean	81	10.2
Median	93	11
Maximum	102	13
Minimum	29	5
Standard deviation	29.6	3.1
Standard error	13.2	1.4
% Standard error	16	14

Station-Replicate	Total Abundance (organisms/subsample)	Richness (no. of taxa/subsample)
MEL-03-01		
MEL-03-01-D1	32	13
MEL-03-01-D2	26	11
MEL-03-01-D3	8	2
MEL-03-01-D4	7	4
MEL-03-01-D5	70	15
Mean	29	9
Median	26	11
Maximum	70	15
Minimum	7	2
Standard deviation	26	6
Standard error	11.5	2.5
% Standard error	40	28

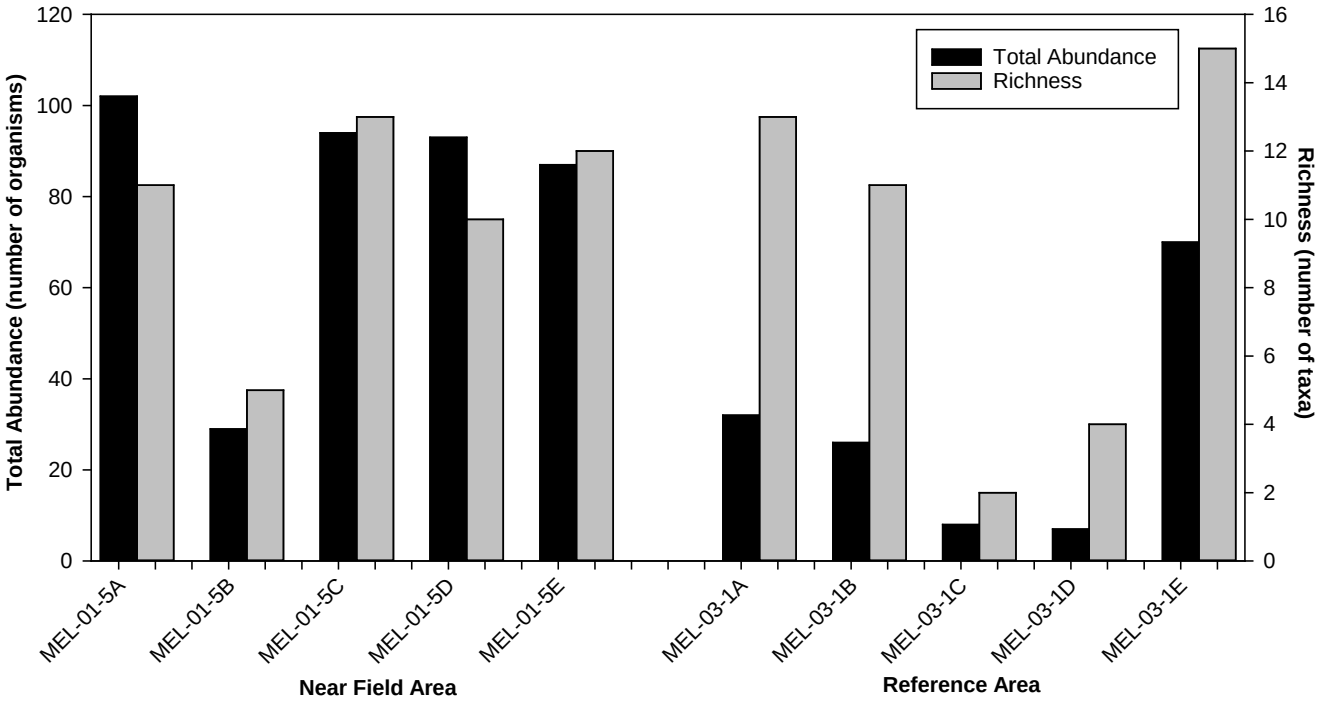


Figure 5.3-9: Within-station Variability for Abundance and Richness in Meliadine Lake, August 2016

5.3.5 Overview

Benthic invertebrate communities in Meliadine Lake were characterized by low total density and low to moderate richness, typical of subarctic lakes. In all sampling areas, invertebrate communities were dominated by chironomid midges, with fingernail clams (Pisidiidae) being the sub-dominant group. Dominance of the benthic invertebrate community by Chironomidae is common in subarctic lakes (Beaty et al. 2006; Northington et al. 2010). SDI values were moderate to high, which indicated the invertebrate communities were diverse. Evenness was more variable and ranged from low to moderate. Collectively, these two indices suggest that baseline benthic communities sampled at most stations in the reference and exposure areas had moderate to high diversity with few taxa that were overly dominant.

The benthic invertebrate community in the Near-field area was significantly different from reference area communities in terms of total density and BCI calculated using the EEM method. Further evidence of differences among sampling areas was evident in nMDS ordination plots, where the Near-field area community was shown to be dissimilar from the reference area communities and the Mid-field area community. A number of other benthic community variables were significantly different among sampling areas, but without a significant difference between the Near-field area mean and the mean of the reference areas. Pairwise comparisons of benthic community variables between the Near-field area and individual reference areas detected two or more significant differences between the Near-field area and Reference areas 2 and 3, but no significant differences between the Near-field area and Reference area 1.

Significant differences in benthic community variables were also observed among the three reference areas in Meliadine Lake, whereby Reference area 1 had greater invertebrate density and richness, lower diversity and evenness, as well as a higher proportion of Chironomidae compared to Reference areas 2 and 3. Based on visual evaluation of spatial patterns in community variables and statistical analysis results, Reference area 1 appears to be closest to the Near-field area in terms of benthic invertebrate community structure.

Habitat variation was found to act as a likely confounding factor for future AEMP monitoring. Sediments within the Near-field area differed from those in other sampling areas. A higher proportion of silt was present in Near-field area sediments, compared to sand-dominated composition observed in the Mid-field area and the reference areas. Fine sediments (silt and clay) are the preferred habitat type for the majority of invertebrates present in Meliadine Lake; therefore, a higher proportion of fine sediments is expected to contribute to higher densities in the Near-field area. The 2016 baseline results for Meliadine Lake indicate that sediment particle size differences are likely resulting in differences between Near-field and reference area benthic communities, even before mine start-up. This is a confounding factor that strongly influences the comparison of EEM BIC endpoints (e.g., density and diversity) and for the current dataset leads to a conclusion of statistically significant differences. It may be necessary to identify reference areas with similar habitat and thus remove this confounding factor from future EEM and AEMP studies.

Treated STP effluent released over land, approximately 60 m from shore, close to the Near-field area in both 2015 and 2016 had the potential to result in nutrient enrichment in part of Meliadine Lake, which may have affected the Near-field area benthic invertebrate community. An increase in nutrient loads to an oligotrophic lake such as Meliadine Lake can result in increased densities of benthic invertebrates within the area closest to the release, and associated community changes (Holopainen and Jonasson 1989; Quigley 1982). Increased nutrient concentrations can affect dominance within the community, often reducing evenness (Hillebrand 2003). However, some studies have also shown that nutrient inputs may result in no response or minimal responses during the first year of inputs, implying that low dosages may not result in sustained effects (Minshall et al 2014; Northington et al. 2010; Hershey et al 1992). At this time, the influence of indirect effluent discharge on the Near-field benthic invertebrate community is inconclusive because observed community changes are also consistent with differences in substrate composition between the Near-field area and other sampling areas.

Within-station variation in total invertebrate density and richness, based on five subsamples collected per station, was found to be generally within acceptable ranges for benthic invertebrate communities characterized by low density in oligotrophic lakes. As per the AEMP design plan (Golder 2016b), samples for BIC analysis will continue to be collected as a combination of composite samples (five grabs per station), along with individual subsamples at a subset of stations (one station per sampling area), for a reassessment of within-station variation based on a larger dataset.

Meaningful normal ranges for the benthic community, as an input to the Response Framework, could not be estimated at this time, due to variability in the available data related to substrate differences between reference and exposure areas, and a potential nutrient enrichment.

6.0 FISH HEALTH AND FISH TISSUE

The fish health and tissue chemistry components of the Aquatic Effects Monitoring Program (AEMP) evaluate potential changes in indicators of fish health (e.g., energy storage, energy usage, and survival) and tissue chemistry (e.g., metals[2] concentrations) in the Near-field area of Meliadine Lake, resulting from the development and operations of the Meliadine Mine Gold Project (Mine).

The objectives of the fish health component are to:

- determine whether Project effluent has an effect on the growth, reproduction, survival, condition or metals concentrations of fish in Meliadine Lake
- verify predictions made in the FEIS pertaining to fish health and fish tissue metal concentrations
- meet the requirements of Part 2, Schedule 9 (b) of the MMER regulations (Government of Canada 2012)
- recommend appropriate changes to the fish health and fish tissue chemistry program for future years
- provide data to inform adaptive management intended to reduce or eliminate Mine-related effects to fish health and fish tissue chemistry in Meliadine Lake

In 2015, baseline fish health and tissue chemistry data were collected for Threespine Stickleback and Lake Trout from the Near-field area of Meliadine Lake (Golder 2016a). Threespine Stickleback were subsequently sampled from the reference areas (i.e., Reference Area 1 and Reference Area 2) in 2017, to complete the fish health and tissue chemistry baseline dataset, and evaluate the compatibility of the Near-field and reference areas to support future sampling during the AEMP.

6.1 Methods

A fish health survey was conducted at Reference Area 1 and Reference Area 2 in August 2017 to confirm the presence and suitability of Threespine Stickleback (*Gasterosteus aculeatus*) as a sentinel species for the AEMP and complete baseline data collections initiated at the Near-field area in 2015 (Golder 2016a). Both a population (i.e., lethal and non-lethal) and a lethal survey were completed. A brief description of fish sampling methods are provided in Sections 6.1.1 to 6.1.3. A more detailed description of fish sampling methods are provided in the AEMP Design Plan, Section 5.4 (Golder 2016b). Baseline sampling for Lake Trout was completed for the Near-field area in 2015 and presented in Golder 2016a, and are not repeated herein.

[2] The term “metals” includes metalloids (e.g., arsenic) and non-metals (e.g., selenium).

6.1.1 Field Methods

Fish sampling was completed at Meliadine Lake from Reference Area 1 and Reference Area 2 between 9 and 18 August 2017 (Table 6.1-1). The timing of the 2017 sampling corresponded to 2015 sampling dates to minimize the impact of seasonal variability on measured endpoints. Fishing methods suitable for nearshore habitats were used to collect Threespine Stickleback during the 2015 and 2017 surveys. Fish were captured using a combination of minnow traps, seines, hoop nets, and backpack electrofishing. Sampling effort for 2015 from the Near-field area is indicated in Figure 6.1-1, sampling effort for 2017 from Reference Area 1 is indicated in Figure 6.1-2 and sampling effort for 2017 from Reference Area 2 is indicated in Figure 6.1-3. Water quality variables (i.e., water temperature, dissolved oxygen, conductivity, and pH) were measured once daily during sampling.

The target sample sizes for the lethal survey included 30 male, 30 female, and 30 juvenile Threespine Stickleback from each of the reference areas. Non-lethal data were collected from at least 100 additional Threespine Stickleback to supplement the population survey. Non-target species captured during sampling were enumerated, measured, weighed, and assessed for external abnormalities prior to release.

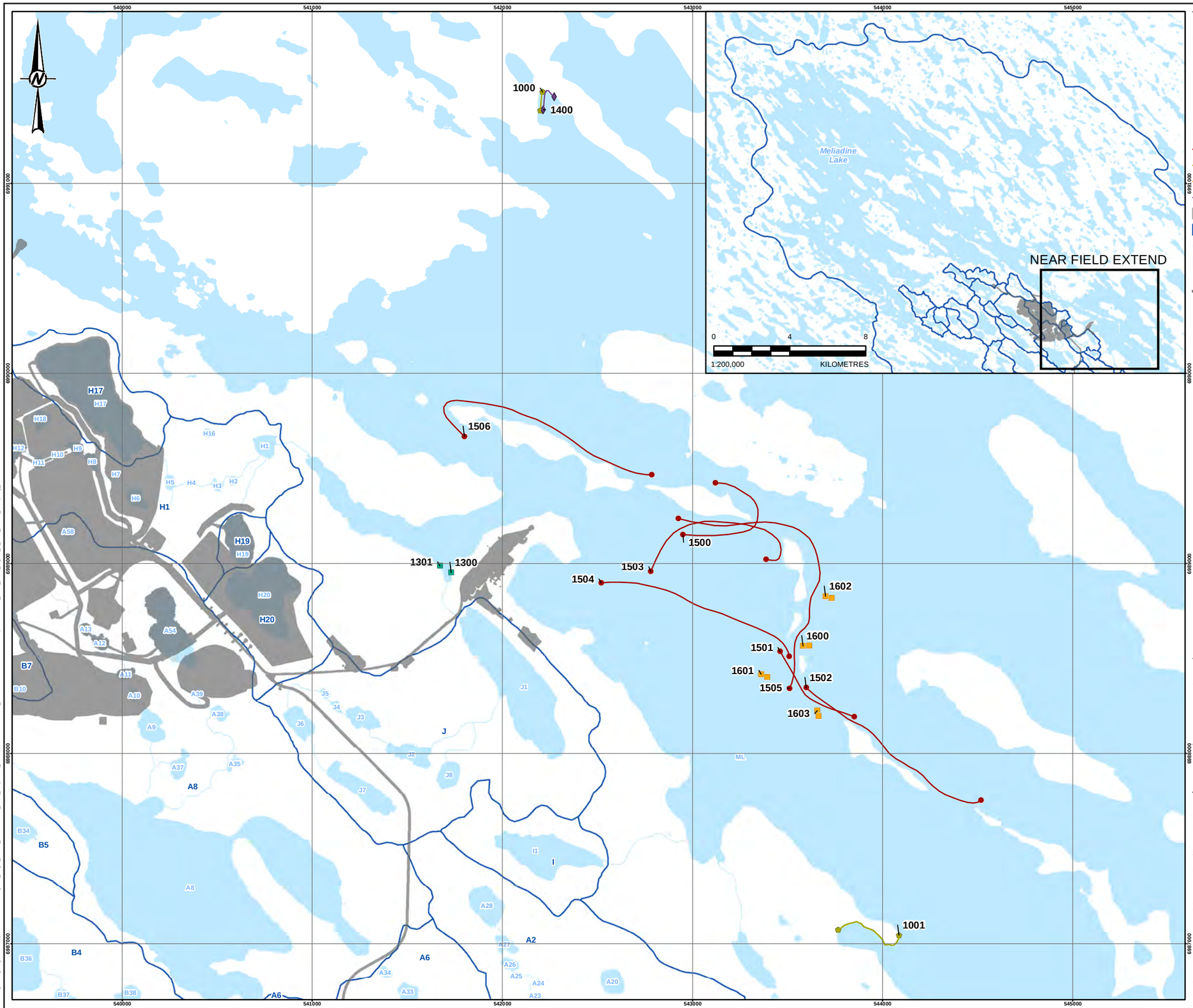
The following information was recorded for each sampling effort:

- effort number (i.e., a unique identification number assigned to each fishing effort)
- gear type (i.e., minnow traps, hoop nets, seines, or electrofishing)
- sampling effort (e.g., set duration for minnow traps, area covered for seine nets)
- sampling coordinates (UTM)
- water depth (m)
- substrate type (e.g., silt, sand, cobble)
- number and species of fish captured

Table 6.1-1: Sampling Dates for Threespine Stickleback Baseline Collections from Meliadine Lake, 2015 and 2017

Meliadine Lake Sampling Area	2015		2017	
	Start Date	Finish Date	Start Date	Finish Date
Near-field Area	14 August 2015	17 August 2015	-	-
Reference Area 1	-	-	9 August 2017	13 August 2017
Reference Area 2	-	-	14 August 2017	18 August 2017

- = not applicable.



LEGEND

FISH HEALTH SAMPLING STATION*
- ANGLING
- BACKPACK ELECTROFISHING
- GILL NETTING
- MINNOW TRAPS
- SEINE NETTING

PATH OF TRAVEL
- ANGLING
- BACKPACK ELECTROFISHING
- GILL NETTING
- SEINE NETTING
- MINE FOOTPRINT
- SUB-WATERSHED BOUNDARY
- WATERCOURSE
- WATERBODY

*FISHING EFFORT NUMBER INDICATES START LOCATION

0 400 800
1:20,000 METRES

REFERENCE(S)
1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT
AGNICO EAGLE MINES LIMITED
AGNICO EAGLE

PROJECT
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
MELIADINE LAKE FISH HEALTH SAMPLING STATIONS - NEAR FIELD

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-23
DESIGNED	CA
PREPARED	MH
REVIEWED	RS
APPROVED	RS

PROJECT NO.	CONTROL	REV.	FIGURE
1787610	2000/2060	0	6.1-1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25mm

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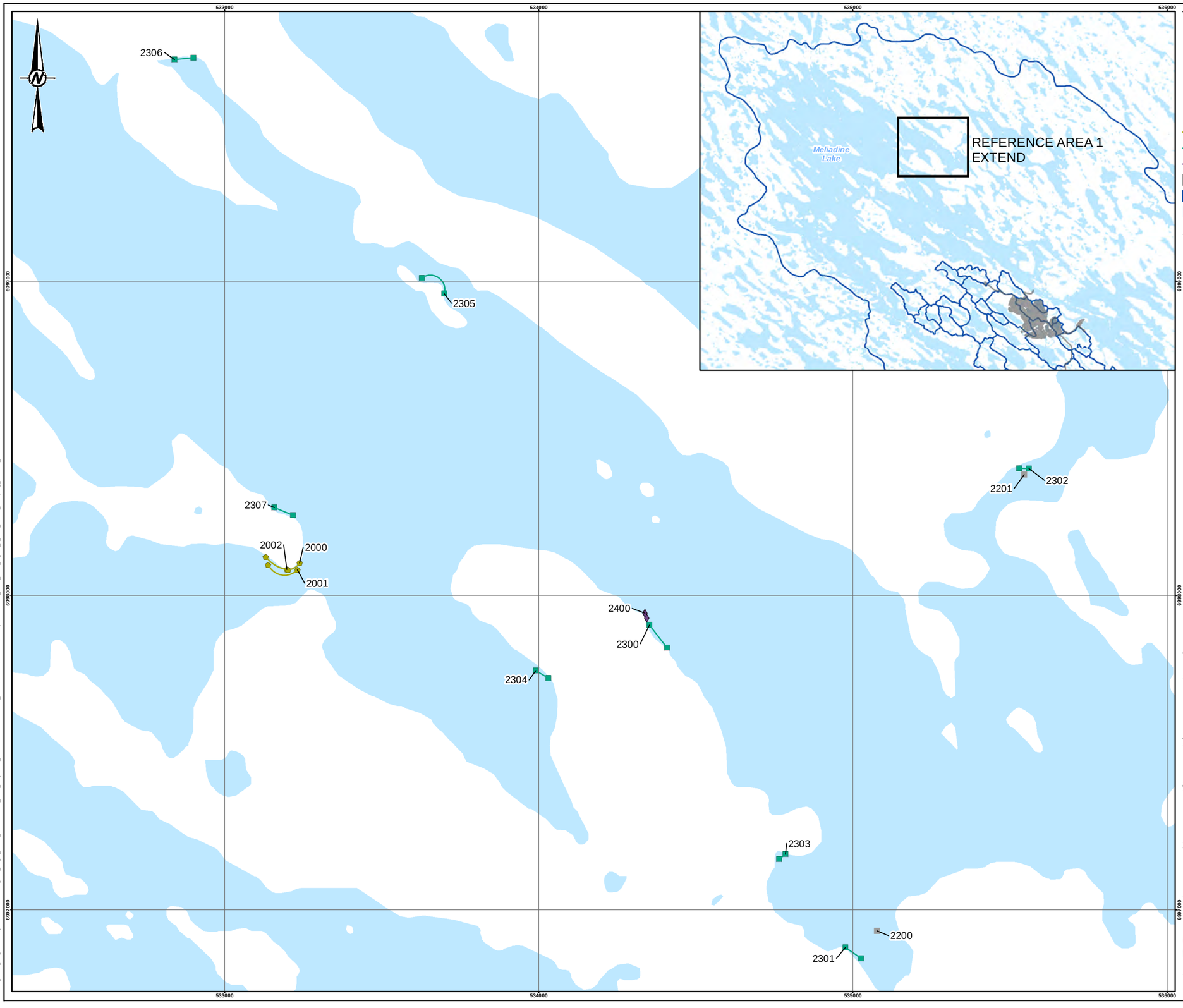
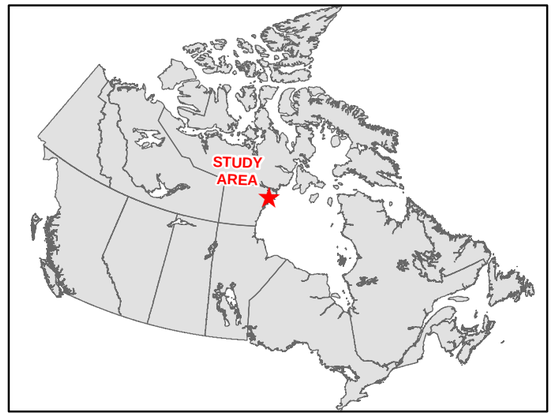


LEGEND

FISH HEALTH SAMPLING STATION*
- BACKPACK ELECTROFISHING
- HOOP NET
- MINNOW TRAP
- SEINE NETTING

PATH OF TRAVEL
- BACKPACK ELETROFISHING
- MINNOW TRAP
- SEINE NETTING
- MINE FOOTPRINT
- SUB-WATERSHED BOUNDARY
- WATERBODY

*FISHING EFFORT NUMBER INDICATES START LOCATION



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2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT

AGNICO EAGLE MINES LIMITED

AGNICO EAGLE

PROJECT

MELIADINE GOLD PROJECT
NUNAVUT

TITLE

MELIADINE LAKE FISH HEALTH SAMPLING STATIONS - REFERENCE AREA 1

CONSULTANT

GOLDER

YYYY-MM-DD	2018-03-23
DESIGNED	CA
PREPARED	MH
REVIEWED	RS
APPROVED	RS

PROJECT NO.	CONTROL	REV.	FIGURE
1787610	2000/2060	0	6.1-2

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525000
526000
527000
7003000
7002000
7001000

REFERENCE AREA 2
EXTEND

Meliadine Lake

0 4 8
1:200,000 KILOMETRES

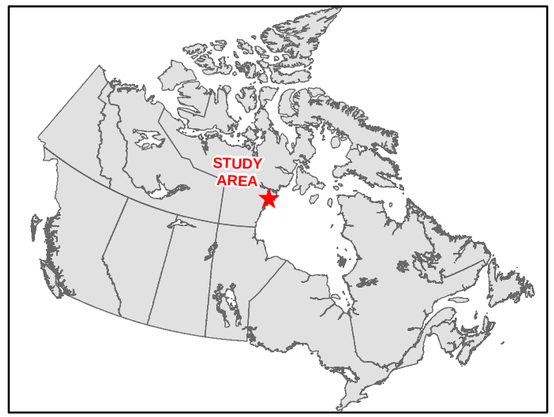
3303
3302
3304
3305
3301
3000
3300

LEGEND

FISH HEALTH SAMPLING STATION*
- BACKPACK ELECTROFISHING
- MINNOW TRAP

PATH OF TRAVEL
- BACKPACK ELETROFISHING
- MINNOW TRAP
- MINE FOOTPRINT
- SUB-WATERSHED BOUNDARY
- WATERBODY

*FISHING EFFORT NUMBER INDICATES START LOCATION



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2. DATUM: NAD83 PROJECTION UTM ZONE 15

CLIENT
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
MELIADINE LAKE FISH HEALTH SAMPLING STATIONS - REFERENCE AREA 2

CONSULTANT
GOLDER

YYYY-MM-DD	2018-03-23
DESIGNED	CA
PREPARED	MH
REVIEWED	RS
APPROVED	RS

PROJECT NO.	CONTROL	REV.	FIGURE
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6.1.2 Population Survey

Threespine Stickleback included in the population survey were sampled using a combination of lethal and non-lethal methods. All fish included in the population survey underwent an external examination and total length (±1 mm) and total body weight (±0.001 g) were recorded. Any features that did not appear normal (i.e., deformities, erosions, lesions, tumours, or external parasites) were documented. Fish that were sampled using non-lethal methods were released near the capture location after processing.

6.1.3 Lethal Surveys

Fish processed during the lethal survey underwent an external examination as described in the Environmental Effects Monitoring (EEM) technical guidance document (2012). Features of the fish that did not appear normal were documented (e.g., occurrence of deformities, erosion, lesions, tumours, or external parasites). Total length (±0.1 mm) and total body weight (±0.001 g) were recorded. Following the external examination, fish were sacrificed by a concussive blow to the head followed by cervical dislocation (i.e., cutting the spinal cord immediately behind the head). The condition of the internal organs were immediately assessed and any abnormalities in size, shape or colouration were documented. The liver and gonads were removed and weighed (±0.001 g). Sex and reproductive stage were assigned for each fish based on a visual examination of the gonads at the time of sampling using macroscopic features described in Table 6.1-2. Tissue samples, including gonads and carcasses (i.e., the body of the fish with internal organs [viscera] removed), were labelled with an identification number and preserved for laboratory analysis. Histology and fecundity samples were preserved using 10% neutral buffered formalin and carcass samples were frozen at -20°C.

6.1.3.1 Histology

Gonad samples from Threespine Stickleback were submitted to Dr. Dave Groman at the University of Prince Edward Island, Atlantic Veterinary College (AVC) to confirm sex and maturity of lethally sampled fish. Sex and maturity were determined based on a histological assessment of gonad tissues with the aid of a light microscope, as per histological features listed in Table 6.1-2. Prior to interpretation, samples were prepared for histology by fixation, dehydration, clearing, embedding, sectioning, and staining. To verify that data quality objectives were met, histology results were cross-referenced with field designated sex and maturity stages, external and internal photographs, as well as biological data. Any discrepancies were reviewed by a second qualified biologist.

6.1.3.2 Fecundity

Threespine Stickleback fecundity samples were processed by qualified biologists at the Golder Saskatoon office. Fecundity (i.e., the number of ripening eggs contained within the ovaries) was estimated by counting the number of ripening eggs present in a subsample of Threespine Stickleback ovarian tissue. Fecundity was then calculated using the following formula:

$$Fecundity = Subsample\ Egg\ Count * \frac{Ovary\ Weight\ (g)}{Subsample\ Weight\ (g)}$$

Mean egg size was determined by measuring the diameter of 30 eggs. To verify that data quality objectives were met, 10% of samples were independently verified by a second qualified biologist.

Table 6.1-2: Gonad Maturity Stages Used During the Meliadine Lake Fish Health Assessment, August 2017

Sex	Stage	Code	Macroscopic Features	Histological Features
Female	Unknown stage	10	Unable to determine stage.	Unable to determine stage.
	Immature	11	Small ovaries, often clear, blood vessels indistinct.	Only oogonia and PG oocytes present. No atresia or muscle bundles. Thin ovarian wall and little space between oocytes.
	Early Stage Development	12	Enlarging ovaries, blood vessels more distinct. Granular in appearance.	PG, CA, Vtg1, and Vtg2 oocytes present. No evidence of POFs or Vtg3 oocytes. Some atresia can be present.
	Late Stage Development	13	Large ovaries filling the body cavity, prominent blood vessels. Individual oocytes visible.	Vtg3 oocytes present or POFs in batch spawners. Atresia of vitellogenic and/or hydrated oocytes may be present. Early stages of OM can be present.
	Ripe	14	Eggs released with gentle pressure on abdomen.	Oocytes undergoing late OM including GVM, GVBD and hydration, or ovulation.
	Spent	15	Deflated ovaries, blood vessels prominent.	Presence of oocyte atresia and, in some species, POFs. Few if any Vtg2 or Vtg3 oocytes.
	Reabsorbing	16	Small atretic oocytes throughout the ovaries, which are hard and white.	Advanced stage oocytes are atretic and no POFs are present.
	Resting	17	Small ovaries, blood vessels reduced but present.	Only oogonia and PG oocytes present. Muscle bundles, enlarged blood vessels, thick ovarian wall, atresia and degenerating POFs may be present.
Male	Unknown stage	20	Unable to determine stage.	Unable to determine stage.
	Immature	21	Small testes, often clear and threadlike.	Sg1 only; no lumen in lobules.
	Early Stage Development	22	Small testes, semi-translucent, but easily identified.	Spermatocysts evident along lobules. Sg2, Sc1, Sc2, St and Sz can be present in spermatocysts. Sz not present in lumen of lobules or in sperm ducts. GE continuous throughout.
	Late Stage Development	23	Testes large, firm and lobate. White to purplish in colour. Granular appearance.	Sz in lumen of lobules and/or sperm ducts. All stages of spermatogenesis (Sg2, Sc, St, Sz) can be present. Spermatocysts throughout the testis, active spermatogenesis. GE may be continuous or discontinuous.
	Ripe	24	Milt released with gentle pressure on abdomen.	Based on macroscopic observation only.
	Spent	25	Small and deflated testes. Blood vessels obvious. Violet-pink in colour.	Residual Sz present in lumen of lobules and in sperm ducts. Widely scattered spermatocysts near periphery containing Sc2, St, Sz. Little to no active spermatogenesis. Spermatogonial proliferation and regeneration of GE common in periphery of testes.
	Reabsorbing	26	Not typically observed in males.	Not typically observed in males.
	Resting	27	Small testes, often threadlike.	No spermatocysts. Lumen of lobule often nonexistent. Proliferation of spermatogonia throughout testes. GE continuous throughout. Small amount of residual Sz occasionally present in lumen of lobules and in sperm duct.

Note: Table modified from Brown-Peterson et al. (2011).

CA = cortical alveolar; GVBD = germinal vesicle breakdown, GVM = germinal vesicle migration, OM = oocyte maturation, PG = primary growth, POF = postovulatory follicle complex, Vtg1 = primary vitellogenic, Vtg2 = secondary vitellogenic, Vtg3 = tertiary vitellogenic, GE = germinal epithelium, Sc1 = primary spermatocyte, Sc2 = secondary spermatocyte, Sg1 = primary spermatogonia, Sg2 = secondary spermatogonia, St = spermatid, Sz = spermatozoa.

6.1.3.3 Tissue Chemistry

Tissue chemistry samples were analyzed by ALS Canada Ltd. (ALS; Burnaby, British Columbia) for metals listed in the AEMP Design Plan, Section 5.5.3 (Golder 2016b). Tissue samples were homogenized and sub-sampled prior to HotBlock® digestion with nitric and hydrochloric acids, in combination with hydrogen peroxide. Instrumental analysis was completed using collision cell inductively coupled plasma - mass spectrometry. A list of metals analyzed and their respective detection limits (DL) for fish tissue are provided in Table 6.1-3. For some metals, the achieved DL differed from those defined in the AEMP Design Plan (Golder 2016b) due to low sample volumes preventing routine analyses; these samples were instead analyzed by high resolution inductively coupled plasma mass spectrometry. Data are reported in milligrams per kilogram wet weight (mg/kg ww).

Table 6.1-3: Analytical Detection Limits for Tissue Samples Processed Using Low Volume Analysis

Parameter	AEMP Design Plan DL[(a)] (mg/kg ww)	Low Volume Analysis DL (mg/kg ww)	Achieved DL (mg/kg ww)	
			2015	2017
Aluminum	0.4	1	0.4 to 1	1 to 2
Antimony	0.002	0.002	0.002	0.002 to 0.004
Arsenic	0.004	0.006	0.004 to 0.006	0.006 to 0.012
Barium	0.01	0.01	0.01	0.01 to 0.02
Beryllium	0.002	0.002	0.002	0.002 to 0.004
Bismuth	0.002	0.002	0.002	0.002 to 0.004
Boron	0.2	0.2	0.2	0.2 to 0.4
Cadmium	0.001	0.002	0.001 to 0.002	0.002 to 0.004
Calcium	4	4	4	4 to 8
Cesium	0.001	0.001	0.001	0.001 to 0.002
Chromium	0.01	0.04	0.01 to 0.04	0.04 to 0.08
Cobalt	0.004	0.004	0.004	0.004 to 0.008
Copper	0.02	0.04	0.02 to 0.04	0.04 to 0.08
Iron	0.6	1	0.6 to 1	1 to 2
Lead	0.04	0.01	0.004 to 0.01	0.01 to 0.02
Lithium	0.1	0.1	0.1	0.1 to 0.2
Magnesium	0.4	0.4	0.4	0.4 to 0.8

Parameter	AEMP Design Plan DL[(a)] (mg/kg ww)	Low Volume Analysis DL (mg/kg ww)	Achieved DL (mg/kg ww)	
			2015	2017
Manganese	0.01	0.01	0.01	0.01 to 0.02
Mercury	0.001	0.001	0.001 to 0.076	0.001 to 0.03
Molybdenum	0.004	0.008	0.004 to 0.008	0.008 to 0.016
Nickel	0.04	0.04	0.04 to 0.13	0.04 to 0.08
Phosphorus	2	2	2	2 to 4
Potassium	4	4	4	4 to 8
Rubidium	0.01	0.01	0.01	0.01 to 0.02
Selenium	0.01	0.02	0.01 to 0.02	0.02 to 0.04
Silver	0.001	0.001	0.001 to 0.002	0.001 to 0.002
Sodium	4	4	4	4 to 8
Strontium	0.01	0.02	0.01 to 0.02	0.02 to 0.04
Tellurium	0.004	0.004	0.004	0.004 to 0.008
Thallium	0.0004	0.0004	0.0004	0.0004 to 0.0008
Tin	0.02	0.02	0.02	0.02 to 0.04
Titanium	NA	0.1	0.02 to 0.1	0.1 to 0.2
Uranium	0.0004	0.0004	0.0004	0.0004 to 0.0008
Vanadium	0.02	0.02	0.02	0.02 to 0.04
Zinc	0.1	0.2	0.1 to 0.2	0.2 to 0.4
Zirconium	0.04	0.04	0.04	0.04 to 0.08
Lipid Content	NA	NA	0.5 to 1.25	0.4 to 2.1

(a) Provided in Golder (2016b).

mg/kg ww = milligrams per kilogram wet weight, DL = detection limit; NA = not applicable.

6.1.4 Data Analysis

Data collected during the fish health program were compared among sampling areas to identify and quantify potential differences in endpoints between the Near-field and reference areas. Endpoints were considered as either “effect” or “supporting” endpoints. Effect endpoints included specific parameters measured to determine whether there were any effects on indicators of survival, energy use, and energy storage among fish populations (Environment Canada 2012). Supporting endpoints included parameters measured to support the interpretation of potential effects. A list of measured effect and supporting endpoints for the population survey and the lethal survey are provided in Table 6.1-4 and Table 6.1-5, respectively. The magnitude of differences in effect endpoints were compared to critical effect sizes (CES), defined by Environment Canada in the EEM program (Environment Canada 2012), which establish effects thresholds indicative of potential risk to the environment (e.g., greater than 10% for relative body weight and greater than 25% for relative liver and gonad size).

Table 6.1-4: Statistical Procedures Used in the Population Survey

Indicator	Parameter	Endpoint	CES	Response Variable (Y)	Covariate (X)	Statistical Procedure
Survival	Length-frequency	Effect[a]	-	-	-	K-S test
Growth (energy use)	Length	Supporting	-	Length	-	ANOVA
	Body weight	Supporting	-	Total weight	-	ANOVA
Condition (energy storage)	Relative body weight	Effect	10%	Total weight	Length	ANCOVA

(a) Length-frequency is an effect endpoint for non-lethal sampling in the EEM program; however, because effect sizes are not expressed as a magnitude, but rather a maximum percent difference, there are no defined CES. Effects were based on the interpretation of the length-frequency distribution.

CES = critical effect size; K-S = Kolmogorov-Smirnov test; ANOVA = analysis of variance; ANCOVA = analysis of covariance; - = not applicable.

Table 6.1-5: Statistical Procedures Used in the Lethal Survey

Indicator	Parameter	Endpoint	CES	Response Variable (Y)	Covariate (X)	Statistical Procedure
Survival	Length-frequency	Supporting	-	-	-	K-S test
Growth (energy use)	Fork length	Effect[a]	25%	Fork length	-	ANOVA
	Body weight	Supporting	-	Total weight	-	ANOVA
	Size-at-age	Effect	25%	Total Weight	Age[b]	ANOVA
Reproduction (energy use)	Relative gonad size	Effect	25%	Gonad weight	Total weight	ANCOVA
	Relative fecundity	Supporting	-	# eggs	Total weight	ANCOVA
Condition (energy storage)	Relative body weight	Effect	10%	Total weight	Fork length	ANCOVA
	Relative liver size	Effect	25%	Liver weight	Total weight	ANCOVA
	Relative egg size	Supporting	-	Mean egg weight	Total weight	ANCOVA
Tissue Chemistry	Metals	Supporting	-	Metals	-	ANOVA

(a) Threespine Stickleback are short-lived in freshwater so length was used as a surrogate for age (Environment Canada 2012).

(b) Due to the short life span of Threespine Stickleback, size-at-age was examined for individuals age classes (i.e., 1+ and 2+) using an ANOVA model based on EEM technical guidance (Environment Canada 2012).

CES = critical effect size; K-S test = Kolmogorov-Smirnov test; ANOVA = analysis of variance; ANCOVA = analysis of covariance; - = not applicable.

6.1.5 Descriptive Statistics

Catch-per-unit effort (CPUE) was calculated to provide an estimate of abundance by standardizing catch data to fishing effort. The CPUE was calculated for each species captured and was summarized by sampling area and gear type. For minnow traps and hoop nets, CPUE was expressed as the number of fish captured per trap per hour. For seine nets, CPUE was expressed as the number of fish captured per m^2 of sampling area. For electrofishing, CPUE was expressed as the number of fish captured per 100 seconds.

Descriptive statistics were calculated for individual fish health and tissue chemistry parameters, separated by sampling area. Descriptive statistics included sample size, median, arithmetic mean, standard deviation (SD), standard error (SE), and minimum and maximum values. Fish health indices were calculated as follows:

$$Condition\ Factor\ = \left(\frac{body\ weight}{length^3}\right) \times\ 100{,}000$$

$$Gonadosomatic\ index\ = \left(\frac{gonad\ weight}{body\ weight}\right) \times 100$$

$$Liver\ somatic\ index = \left(\frac{liver\ weight}{body\ weight}\right) \times 100$$

Weight and length measurements were reported in units of grams (g) and millimetres (mm), respectively.

Fish health and tissue chemistry data were plotted by area using censored box plots as outlined in Barrett et al. (2014). Box plots were used to plot data when eight or more observations were above the DL, otherwise, individual concentrations were plotted. The censored boxplots were defined using the minimum values, the quartiles, and the maximum values. Values that were 1.5 times the interquartile range beyond the quartiles were considered extreme and plotted individually. When extreme values were present, the whiskers were truncated to the next value in the dataset that was within 1.5 times the interquartile range beyond the quartiles (i.e., the whiskers may not always extend to the full 1.5 times the interquartile range if the next value in the dataset is closer to the quartile than the full 1.5 times the interquartile range). The boxplots were censored (by a horizontal line) at the DL and the distribution of values below the DL were not shown. The concentrations below the DL are plotted at half of the DL as open circles.

6.1.6 Inferential Statistics

Statistical comparisons were conducted among sampling areas for fish health endpoints presented in Table 6.1-4 and Table 6.1-5, and fish tissue parameters presented in Table 6.1-3. Differences in the mean length, body weight, size-at-age, and individual metals were compared among sampling areas using analysis of variance (ANOVA). Differences in relative body weight, relative gonad weight, relative liver weight, relative fecundity, and relative egg size were compared among sampling areas using analysis of covariance (ANCOVA). Significant differences between sampling areas were determined using an α (alpha) of 0.1. As tapeworms were frequently observed in Threespine Stickleback captured from all areas of Meliadine Lake, inferential statistics were completed both with and without parasitized fish included (Golder 2016b).

The assumptions of ANOVA and ANCOVA are that the residuals of the data, after being fit to the model, are normally distributed and have equal variance between groups. The assumption of normality was assessed using the Shapiro-Wilk test, while Levene's test was used to assess equality of variances. Significant differences in assumptions were evaluated using an α of 0.05. If the assumptions of normality and equality of variance were not met, the data were $\log_{10}$-transformed and the assumptions were re-tested. When the assumptions of ANOVA could not be met using a $\log_{10}$ transformation, the non-parametric Kruskal-Wallis (K-W) test was used. In addition to the assumptions of normality and equality of variance, ANCOVA has the additional assumption that the parameter regression slopes are parallel among sampling areas. To test this assumption, the ANCOVA was conducted by first fitting separate regression models for each sampling area using a general linear model that included an interaction term between the sampling area and covariate:

Full ANCOVA model: $y = \beta_0 + \beta_1(x) + \beta_2(Area) + \beta_3(x) \times (Area) + \varepsilon$

where y is the response variable, x is the covariate, $Area$ is the sampling area indicator variable, and ε is the error term. If the coefficient β_3 of the $(x) \times (Area)$ interaction term was not significant (i.e., p>0.05), then the slopes were considered parallel and the ANCOVA proceeded by testing the significance of the coefficient β_2 of the $(Area)$ term in the reduced ANCOVA model that fits separate regressions for each area, but with a common regression slope:

Reduced ANCOVA model: $y = \beta_0 + \beta_1(x) + \beta_2(Area) + \varepsilon$.

When a significant interaction was observed, the regression slopes were considered significantly different. When the covariate was a strong predictor of the response variable and the ANCOVA had a high coefficient of determination ($r^2 > 0.8$), the test for parallel slopes had high power to detect a difference that may not be practically significant. In this case, when the interaction term in the full ANCOVA model was significant, the slopes were fixed as parallel by fitting the reduced ANCOVA model because the reduced model explained almost as much (within 2%) of the variability in the response variable as the full model. In this case, the ANCOVA proceeded under the assumption that the regression slopes between groups were practically similar (Barrett et al. 2010).

Statistical outliers were evaluated using studentized residuals (SR) from the ANOVA and ANCOVA models. A magnitude of 3.0 for the SR was used to identify observations that were unusual. When an outlier was detected, the validity of the data point was examined. If the outlier was determined to be the result of a data entry error, it was corrected; if the outlier was not the result of data entry error and could not be resolved otherwise, the analysis was completed with and without outliers included.

When significant differences in fish health and tissue chemistry parameters were observed between sampling areas, the magnitude of difference between the Near-field area and individual reference areas were calculated by expressing the difference as a percentage of the mean as follows:

Magnitude: $$Magnitude = \frac{\bar{x}_{NF} - \bar{x}_{Reference\ Area}}{\bar{x}_{Reference\ Area}} * 100$$

where $\bar{x}$ is the mean of the effect endpoint, and Reference Area refers to either Reference Area 1 or Reference Area 2.

If the statistical comparison was conducted on $\log_{10}$-transformed data, then the magnitude was calculated using geometric means. If the statistical comparison between sampling areas was conducted using the K-W test, the data were not considered to be normally distributed and the magnitude was calculated using medians. As the K-W test is a non-parametric method for testing whether samples originate from the same distribution (i.e., it is not a comparison of sample medians), there were instances where the K-W test was significant, but no differences in medians were observed. For effect endpoints analyzed using ANCOVA, magnitudes were calculated from least squares means. When significant differences were observed among reference areas, the relative percent difference (RPD) was calculated instead, using the formula:

Relative Percent Difference: $$RPD = \frac{\bar{x}_{RA1} - \bar{x}_{RA2}}{\bar{x}_{Reference}} * 100$$

where $\bar{x}_{RA1}$ and $\bar{x}_{RA2}$ are the means of the individual reference areas, and $\bar{x}_{Reference}$ is the mean of the pooled reference areas.

Length-frequency distributions were compared among sampling areas using the non-parametric, two-sample Kolmogorov-Smirnov (K-S) test. The K-S test compares the cumulative relative distributions of total length between sampling areas by comparing the maximum difference between the two cumulative relative frequency distributions to a critical value, which is determined based on sample size, to assess whether the difference is large enough to indicate that the two distributions came from different populations. Ages for individual fish were assigned based on length-frequency analyses of each sampling area using the Petersen Method (Petersen 1892, Mackay et al. 1990), with ages assigned to individual modes. Differences in the length of Threespine Stickleback were compared among gear types using the K-W test. The prevalence of abnormalities, including deformities, erosions, lesions and tumours (DELT), were compared among sampling areas using the chi-square test.

6.1.7 Power Analysis

Power analyses were performed to determine the power and sample size requirements to detect a magnitude of change that was equivalent to the CES defined in the metal mining technical guidance for Environmental Effects Monitoring (Environment Canada 2012). The CES defined for relative body weight was a 10% change in the mean relative to reference; for size-at-age, relative liver size, relative gonad size, the CES defined was a 25% change in the mean relative to reference. Type I (α) and Type II (β) error rates were set to 0.1 (Environment Canada 2012). Power analyses were conducted using the power and sample size function in G*Power 3.1 (Faul et al. 2007). Power analyses were not completed for endpoints without defined CES (Environment Canada 2012).

6.1.8 Normal Range Calculations

Normal ranges for effect endpoints at Meliadine Lake were estimated using baseline data collected from the Near-field area and reference areas between 2015 and 2017. The calculation methods used to estimate normal ranges followed the methods outlined in Barrett et al 2015.

Prior to calculating normal ranges, values below analytical detection limits were substituted with values half of the detection limit. Subsequently, statistical outliers were removed from the dataset. Statistical outliers were identified using standardized residuals, which provide a measure of the difference between observed and expected values (i.e., residuals), normalized to the variance of the dataset, and were calculated as follows:

Standardized Residual: $x_z = \frac{X_i}{\sigma}$

where x_z is the standardized residual, $x_i$is the residual of a data point, and σ is the sample standard deviation. Data points with standardized residuals greater than |3.5| (i.e., more than 3.5 standard deviations from the sample mean), were omitted from the analysis.

When the baseline data were normally distributed, the normal range was estimated for the mean of the observations as the 95% prediction interval (PI) of the data selected to represent the natural variability of the system (Barrett et al. 2015). Normality was assessed by using the Shapiro-Wilk test and the data were considered normally distributed if the probability statistic *P* was greater than 0.05. When the baseline data were not normally distributed, but normality could be achieved after $\log_{10}$ transformation, the normal range was defined using $\log_{10}$ transformed data and the upper and lower bounds of the normal range were back-transformed to the original scale.

When both the untransformed and transformed data sets were non-normal, the normal range boundaries were estimated as the 2.5th and 97.5th percentiles of the baseline data. In cases where the percentile method was used, 1,000 random samples were generated from the normal range dataset and the 2.5th and 97.5th percentiles were calculated from the distribution of 1,000 mean values to estimate the normal range of mean values. Finally, in cases where the untransformed data were normally distributed but the lower bound of the normal range calculated using the PI method was less than zero, the normal range was calculated using either the log-PI method or the percentiles method, depending on whether normality could be achieved after $\log_{10}$ transformation. This approach resulted in the lower bound of the normal range always being greater than zero, which was important when evaluating the potential effects related to toxicological impairment.

The normal ranges provided in this report are considered provisional during initial monitoring under the AEMP due to the limited sample sizes used in the calculations. The normal range is intended to estimate the range of natural spatial and temporal variability, and the more reference data incorporated into the calculation, the more accurate the estimate becomes. These normal ranges may be re-defined in future reports to allow for the inclusion of additional monitoring data (i.e., from reference areas only) after Mine construction has begun.

6.2 Quality Assurance and Quality Control

Quality assurance (QA) and quality control (QC) procedures were applied to field sampling, laboratory analyses, data entry, data analyses, and report preparation. Field equipment were calibrated throughout the field program following manufacturer specifications and all samples were collected by experienced personnel. Samples were labelled, preserved, and shipped according to standard protocols. Specific work instructions outlining each field task in detail were provided to the field personnel by the task manager. Detailed field notes were recorded in waterproof field books and on preprinted waterproof field data sheets in either pencil or indelible ink. Data sheets and sample labels were checked at the end of each field day for completeness and accuracy, and were scanned into electronic copies at the completion of the field program. Chain-of-custody forms were used to track shipment and receipt of samples.

Data screening was performed prior to statistical analyses. Data checks for outliers and confirmation of sex and reproductive staging were performed as follows:

- Fish health data were plotted as box plots and scatterplots to visually examine data for potential data entry errors or unusual data. Plots included total length versus carcass weight, carcass weight versus gonad weight, standard length versus total length, total length versus total body weight, carcass weight versus liver weight, total body weight versus carcass weight, age versus total length, age versus total body weight, age versus carcass weight, and age versus gonad weight.
- Outliers, as detected by the qualitative screening, were removed from the dataset only if they were determined to be the result of human error (i.e., sampling or measurement error). All outliers were checked with field data sheets and field photos as part of the screening process prior to removal from the dataset.
- Histology samples submitted to the AVC for sex and reproductive staging were visually screened for outliers by plotting total length versus total body weight, total length versus gonadosomatic index, and total length versus gonad weight. Outliers and fish identified near the size-at-maturity were selected for reassessment by the lab to confirm the accuracy of their sex and/or reproductive staging assignments.
- The separation of adults and juveniles was determined after consideration of field assessments, gonad weight and histology results. If there were inconsistencies between field assessments and histology results, gonad histology results were weighed more heavily, with consideration of all available data to assign the final gonad maturity categories and sex determination.

6.3 Results and Discussion

6.3.1 Catch Data Summaries

A total of 1,672 fish from 7 species were captured during the August 2015 and August 2017 small-bodied fish health survey at Meliadine Lake (Table 6.3-1). Fish were captured using a combination of minnow traps, seine nets, hoop nets and backpack electrofishing. The spatial extent of sampling is indicated for the Near-field area in Figure 6.1-1, Reference Area 1 in Figure 6.1-2, and Reference Area 2 in Figure 6.1-3. Species richness varied among sampling areas, with 7 species captured from the Near-field area, 6 species from Reference Area 1, and 3 species from Reference Area 2. Catch varied among sampling areas, with 285 fish captured at the Near-field area, 893 fish captured at Reference Area 1, and 494 fish captured at Reference Area 2. Catches at each sampling area were dominated by Threespine Stickleback, accounting for 86% of the total catch at the Near-field area, 96% of the catch at Reference Area 1, and 90% of the catch at Reference Area 2. Differences in catch were driven by variation in sampling effort (Table 6.3-2). Threespine Stickleback were captured primarily using minnow traps at each of the sampling areas. A gear selectivity bias was observed among sampling areas, with significantly larger Threespine Stickleback captured using minnow traps when compared to hoop nets (13%) or backpack electrofishing (11%; $P<0.001$); suggesting minnow traps selected for larger fish when compared to other sampling methods (Figure 6.3-1).

Table 6.3-1: Species Richness and Abundance of Fish Captured at Meliadine Lake, 2015 and 2017

Species	Near-field Area	Reference Area 1	Reference Area 2	Total
Threespine Stickleback (*Gasterosteus aculeatus*)	246	860	447	1,553
Lake Trout (*Salvelinus namaycush*)	6	8	-	14
Ninespine Stickleback (*Pungitius pungitius*)	22	17	42	81
Round Whitefish (*Prosopium cylindraceum*)	1	6	-	7
Slimy Sculpin (*Cottus cognatus*)	8	1	-	9
Burbot (*Lota lota*)	1	1	5	7
Cisco (*Coregonus artedi*)	1	-	-	1
Species Richness	7	6	3	7
Abundance	285	893	494	1,672

- = not applicable.

Table 6.3-2: Catch-Per-Unit Effort for Fish Captured from Meliadine Lake, 2015 and 2017

Area	Sampling Method	Sampling Effort		THST	RNWH	LKTR	SLSC	BURB	NNST	CISC	Total
NF	Minnow Trap	584 h	Abundance	164	0	0	0	1	19	1	185
			CPUE #/h	0.28	0.00	0.00	0.00	<0.01	0.03	<0.01	0.32
	Seine Net	150 m^2	Abundance	2	0	0	0	0	0	0	2
			CPUE #/m^2	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	Backpack Electrofishing	5170 s	Abundance	80	1	6	8	0	3	0	98
			CPUE #/100 s	1.55	0.02	0.12	0.15	0.00	0.06	0.00	1.90
RA1	Minnow Trap	1861 h	Abundance	586	0	1	0	1	16	0	604
			CPUE #/h	0.31	0.00	<0.01	0.00	<0.01	0.01	0.00	0.32
	Seine Net	340 m^2	Abundance	2	4	7	1	0	0	0	14
			CPUE #/m^2	0.01	0.01	0.02	<0.01	0.00	0.00	0.00	0.04
	Hoop Net	43 h	Abundance	118	0	0	0	0	1	0	119
			CPUE #/h	2.76	0.00	0.00	0.00	0.00	0.02	0.00	2.78
	Backpack Electrofishing	1241 s	Abundance	154	2	0	0	0	0	0	156
			CPUE #/100 s	12.41	0.16	0.00	0.00	0.00	0.00	0.00	12.57
RA2	Minnow Trap	1925 h	Abundance	423	0	0	0	3	33	0	459
			CPUE #/h	0.22	0.00	0.00	0.00	<0.01	0.02	0.00	0.24
	Backpack Electrofishing	339 s	Abundance	24	0	0	0	2	9	0	35
			CPUE #/100 s	7.08	0.00	0.00	0.00	0.59	2.65	0.00	10.32

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; THST = Threespine Stickleback; RNWH = Round Whitefish; LKTR = Lake Trout; SLSC = Slimy Sculpin; BURB = Burbot; NNST = Ninespine Stickleback; CISC = Cisco; CPUE = catch-per-unit-effort; # = number of fish.

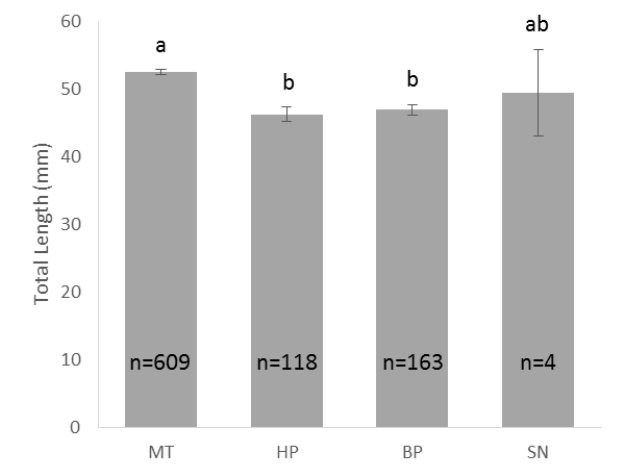

Figure 6.3-1: Total Length of Threespine Stickleback Captured From Meliadine Lake, 2015 and 2017

Note: Groups sharing the same letter are not significantly different from each other.

MT = minnow trap; HP = hoop net; BP = backpack electrofishing; SN = seine; n = sample size.

Water quality measurements were comparable among the Near-field and reference areas. Water temperatures ranged from 8.3 to 9.6°C at the Near-field area in 2015, and 11.0 to 13.7°C at Reference Area 1, and 13.6 to 13.7°C at Reference Area 2 in 2017. pH ranged from 6.2 to 6.6 at the Near-field area, 7.5 to 8.8 at Reference Area 1, and 7.7 to 7.8 at Reference Area 2. Dissolved oxygen concentrations ranged from 11.1 to 12.0 mg/L at the Near-field area, 8.7 to 10.8 at Reference Area 1, and 10.7 at Reference Area 2. Specific conductivity ranged from 49 to 52 µS/cm at the Near-field area, 55 to 88 µS/cm at Reference Area 1, and 68 µS/cm at Reference Area 2. Fish sampling effort and supporting environmental data are provided for each sampling area in Appendix 6A.

6.3.2 Population Survey

A total of 1,553 Threespine Stickleback were captured during the Meliadine Lake fish health program (Table 6.3-1). Of these, 289 were sampled during the lethal survey and an additional 605 Threespine Stickleback were processed using non-lethal methods (Appendix 6B). A combined total of 894 Threespine Stickleback were included in the population survey, while 659 individuals were released without processing (due to high catch volumes and efforts to minimize mortality associated with sampling by unnecessarily extending hold times). Threespine Stickleback sample size targets for the population survey were met at each of the sampling areas (Table 6.3-3). No young-of-the-year fish were captured during the assessment.

Table 6.3-3: Sample Sizes for the Meliadine Lake Population Survey, 2015 and 2017

Target Sample Size[(a)]	Achieved Sample Size			
	Near-field Area	Reference Area 1	Reference Area 2	Total
190	246	332	316	894

(a) Target sample size includes 90 lethal and 100 non-lethal samples.

Threespine Stickleback CPUE varied among gear types and sampling areas, with the majority of Threespine Stickleback captured using minnow traps in Meliadine Lake (Table 6.3-2). The CPUE of Threespine Stickleback captured using minnow traps was 0.28 fish per hour at the Near-field area, 0.31 fish per hour at Reference Area 1, and 0.22 fish per hour at Reference Area 2. The CPUE of Threespine Stickleback captured backpack electrofishing was 1.55 fish per 100 s at the Near-field area, 12.41 fish per 100 s at Reference Area 1, and 7.08 fish per 100 s at Reference Area 2. The CPUE of Threespine Stickleback captured using hoop nets was 2.76 fish per hour at Reference Area 1. Hoop nets were not deployed at the Near-field area or Reference Area 2. The CPUE of Threespine Stickleback captured using seines was 0.01 fish per m^2 at both the Near-field and Reference Area 1. Seine nets were not used at Reference Area 2. Descriptive statistics for the Threespine Stickleback population survey are provided in Table 6.3-4, with the results of statistical comparisons presented in Table 6.3-5. Data are provided in Appendix 6B, and boxplots are presented in Appendix 6C.

6.3.2.1 Length-Frequency

Length-frequency distributions of Threespine Stickleback were significantly different among sampling areas (Table 6.3-5, Figure 6.3-2, and Figure 6.3-3). Significant differences in cumulative relative frequency were observed between the Near-field area and Reference Area 1 (19%), as well as the Near-field area and Reference Area 2 (40%); however, significant differences were also observed between reference areas (27%). Differences in length frequency distributions were driven by the relative proportion of small (i.e., age 1+) and large (i.e., age 2+) Threespine Stickleback captured at each of the sampling areas (Figure 6.3-2 and Figure 6.3-3). The Near-field area and Reference Area 1 were dominated by smaller age 1+ fish, while Reference Area 2 had a greater abundance of larger age 2+ individuals. Differences in length-frequency distributions may reflect natural variation in Threespine Stickleback population structure within Meliadine Lake; however, interpretation of these results were confounded by spatiotemporal differences in size-at-age, sampling effort, and gear. Differences in size-at-age were observed among sampling areas (Table 6.3-5), with 60% and 68% larger age 1+ Threespine Stickleback collected from the Near-field area in 2015 when compared to Reference Area 1 and Reference Area 2 in 2017, respectively. This resulted in comparatively fewer fish under 40 mm at the Near-field area (Figure 6.3-3). As the Near-field and reference areas were sampled in different years, it could not be determined whether differences reflected spatial or interannual variation in size-at-age (i.e., it could not be determined whether growth rates were higher at the Near-field area when compared to the reference areas, or whether growth rates were higher in 2015 when compared to 2017). Sampling effort also varied among sampling areas. A greater proportion of Threespine Stickleback were captured using minnow traps at Reference Area 2 (95%), when compared to the Near-field area (67%), and Reference Area 1 (68%, Appendix 6A). Minnow traps selected for larger individuals when compared to Threespine Stickleback captured using hoop nets and electrofishing (Section 6.3.1), which may have increased the relative abundance of age 2+ fish captured at Reference Area 2.

Table 6.3-4: Descriptive Statistics for Threespine Stickleback Collected from Meliadine Lake, 2015 and 2017

Stage	Parameter	Near-field Area							Reference Area 1							Reference Area 2						
		n	Mean	Median	Min	Max	SD	SE	n	Mean	Median	Min	Max	SD	SE	n	Mean	Median	Min	Max	SD	SE
Adult	Age (yr)	82	1.7	2.0	1.0	2.0	0.4	<0.1	165	2.0	2.0	1.0	2.0	0.2	<0.1	235	2.0	2.0	1.0	2.0	0.2	<0.1
	Total length (mm)	82	58.7	58.1	47.6	72.1	6.3	0.7	165	59.6	60.0	37.6	76.5	7.0	0.5	235	59.2	59.0	38.5	74.0	6.0	0.4
	Total weight (g)	82	1.856	1.779	0.929	3.162	0.610	0.067	165	1.887	1.858	0.395	4.425	0.647	0.050	235	1.792	1.714	0.417	3.237	0.550	0.036
	Condition (TW)	82	0.89	0.87	0.65	1.26	0.10	0.01	165	0.86	0.85	0.59	1.23	0.11	0.01	235	0.84	0.84	0.50	1.18	0.10	0.01
Juvenile	Age (yr)	164	1.0	1.0	1.0	1.0	<0.1	<0.1	167	1.0	1.0	1.0	2.0	0.1	<0.1	81	1.0	1.0	1.0	2.0	0.2	<0.1
	Total length (mm)	164	42.4	44.0	26.7	49.7	5.0	0.4	167	38.8	38.0	31.0	53.6	3.9	0.3	81	40.7	40.2	30.0	51.9	4.1	0.5
	Total weight (g)	163	0.708	0.735	0.177	1.255	0.246	0.019	167	0.498	0.472	0.215	1.144	0.162	0.013	81	0.534	0.492	0.175	1.150	0.197	0.022
	Condition (TW)	163	0.88	0.88	0.57	1.23	0.11	0.01	167	0.83	0.81	0.59	1.37	0.12	0.01	81	0.77	0.75	0.55	1.26	0.14	0.02

n = sample size; SD = standard deviation; SE = standard error; < = less than; TW = calculated using total weight.

Table 6.3-5: Statistical Comparison of Fish Population Survey Parameters among Meliadine Lake Sampling Areas, 2015 and 2017

Parameter	Dependent Variable	Covariate	Endpoint	Statistical Test	n			Interaction *P*-value	Model *P*-value	MSE	Least Squares Mean[(a)]			Power Analysis (↑ / ↓)			Post-hoc P-value			Magnitude (%)		
					NF	RA1	RA2				NF	RA1	RA2	CES	Power[(b)]	n	NF*RA1	NF*RA2	RA1*RA2	NF*RA1	NF*RA2	RA1*RA2
Length-frequency	-	-	Effect	K-S test	246	332	316	-	-	-	-	-	-	-	-	-	**<0.001**	**<0.001**	**<0.001**	19%	40%	27%
Size-at-age	Total weight	Age 1+	Supporting	K-W test	184	172	85	-	**<0.001**	-	0.785	0.468	0.492	25%	1.00	38	**<0.001**	**<0.001**	**<0.001**	68%	60%	-5%
		Age 2+	Supporting	$ANOVA_{log}$	61	160	231	-	**0.001**	0.016	0.306	0.267	0.240		1.00 / 1.00	44 / 31	0.106	**0.001**	**0.099**	-	16%	6%
	Length	Age 1+	Supporting	K-W test	185	172	85	-	**<0.001**	-	44.6	38.1	40.2	-	-	-	**<0.001**	**<0.001**	**<0.001**	17%	11%	-5%
		Age 2+	Supporting	K-W test	61	160	231	-	**0.053**	-	60.8	60.0	59.0	-	-	-	**<0.001**	**<0.001**	**<0.001**	1%	3%	2%
Body weight	Total weight	-	Supporting	K-W test	245	332	316	-	**<0.001**	-	0.881	0.812	1.516	-	-	-	**<0.001**	**<0.001**	**0.010**	8%	-42%	-60%
Length	Length	-	Supporting	K-W test	246	332	316	-	**<0.001**	-	46.5	45.0	46.0	25%	1.00	11	**<0.001**	**<0.001**	**0.001**	3%	1%	-2%
Relative body weight	Total weight	Length	Effect	$ANCOVA_{rank}$	245	332	316	0.279	**<0.001**	2393	460	450	434	10%	1.00	32	**0.027**	**<0.001**	**<0.001**	2%	6%	4%

(a) Medians provided when data compared using the K-W test.

(b) For non-parametric tests power was estimated using ANOVA.

Note: Statistically significant differences indicated in **bold**.

n = sample size; NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; *P*-value = probability value; MSE = mean squared error; CES = critical effect size; < = less than; K-S = Kolmogorov–Smirnov; K-W = Kruskal-Wallis; ANOVA = analysis of variance; log = log_{10} transformed data; ANCOVA = analysis of covariance; rank = rank transformed data; - = not applicable.

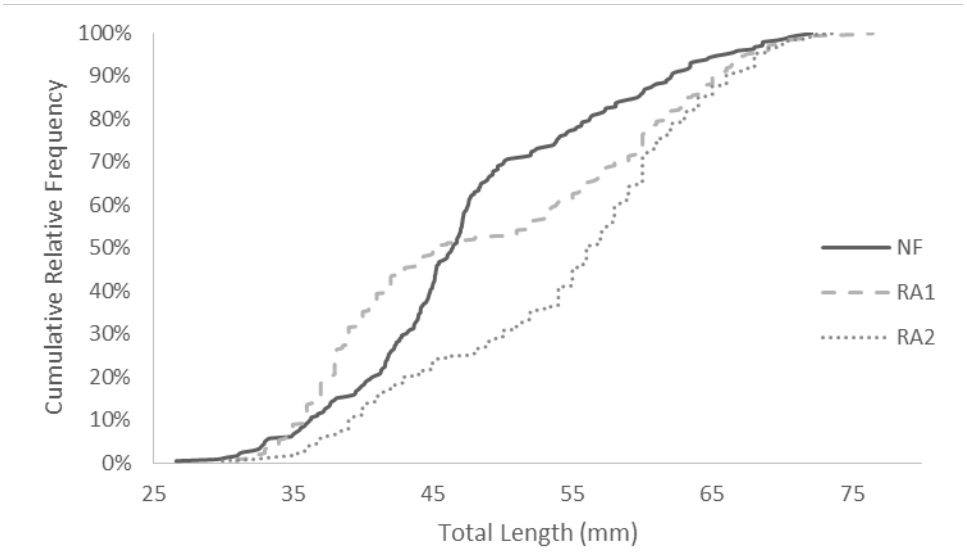

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Figure 6.3-2: Cumulative Length-Frequency Distribution of Threespine Stickleback Collected from Meliadine Lake, 2015 and 2017

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2.

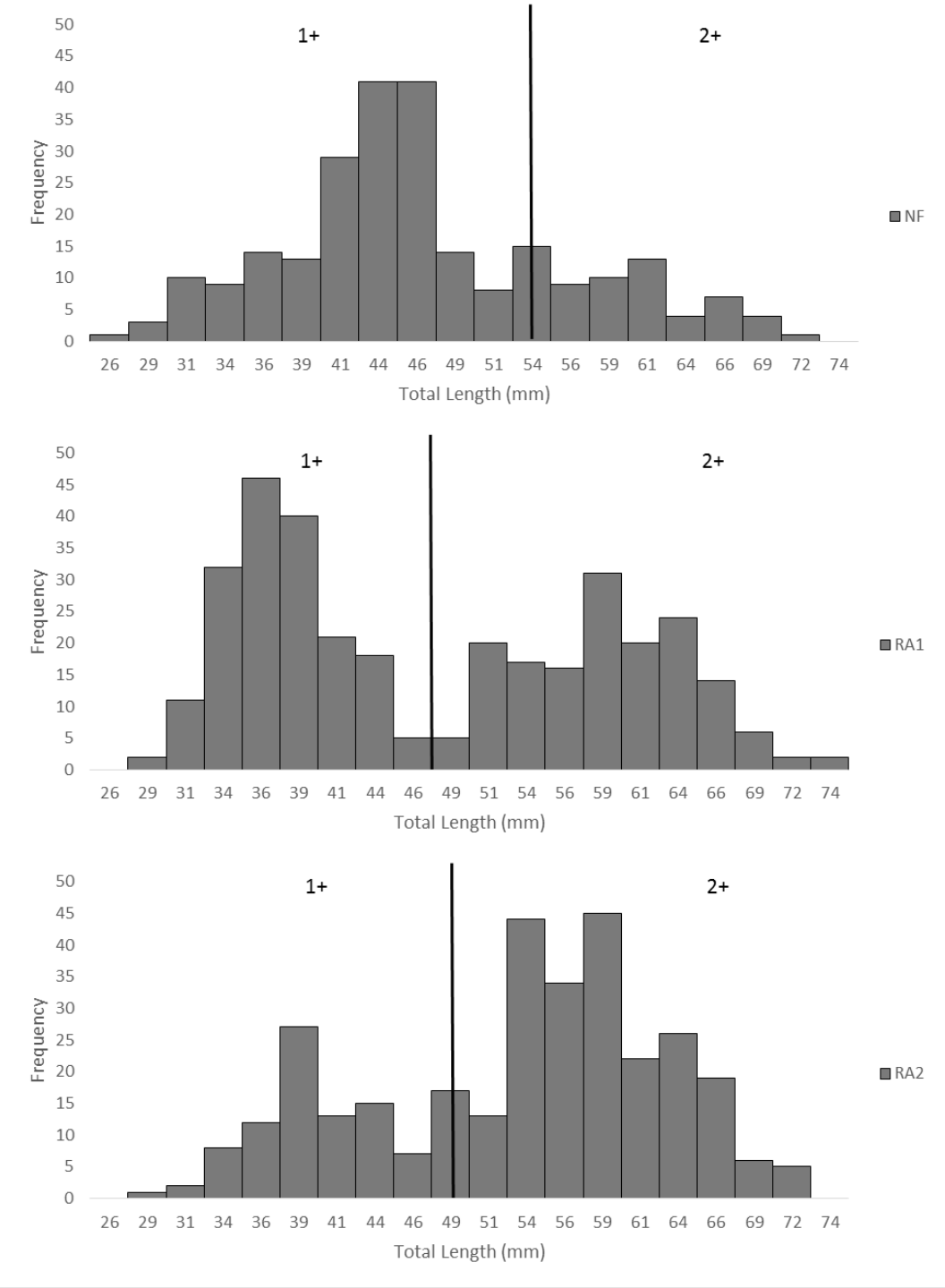

Figure 6.3-3: Length-Frequency Distributions for Threespine Stickleback Collected from Meliadine Lake, 2015 and 2017

Note: Age classes (1+ and 2+ years) delineated by a vertical line.

NF= Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2.

6.3.2.2 Size

Threespine Stickleback ranged in size from 26.7 to 76.5 mm, and 0.175 to 4.425 g (Table 6.3-4, Figure 6.3-4). Significant differences were observed for total length and body weight of Threespine Stickleback captured at each of the sampling areas (Table 6.3-5). Threespine Stickleback collected from the Near-field area were relatively larger than fish collected from Reference Area 1 (i.e., 3% longer, weighing 8% more), and longer but weighed less than Threespine Stickleback collected from Reference Area 2 (i.e., 1% longer, weighing 42% less). Significant differences were also observed between reference areas, with smaller fish collected from Reference Area 1 when compared to Reference Area 2 (i.e., 2% shorter, weighing 60% less). As with length frequency distributions (Section 6.3.2.1), these differences were primarily driven by the relative abundance and size-at-age of age 1+ and age 2+ fish at each of the sampling areas (Figure 6.3-2).

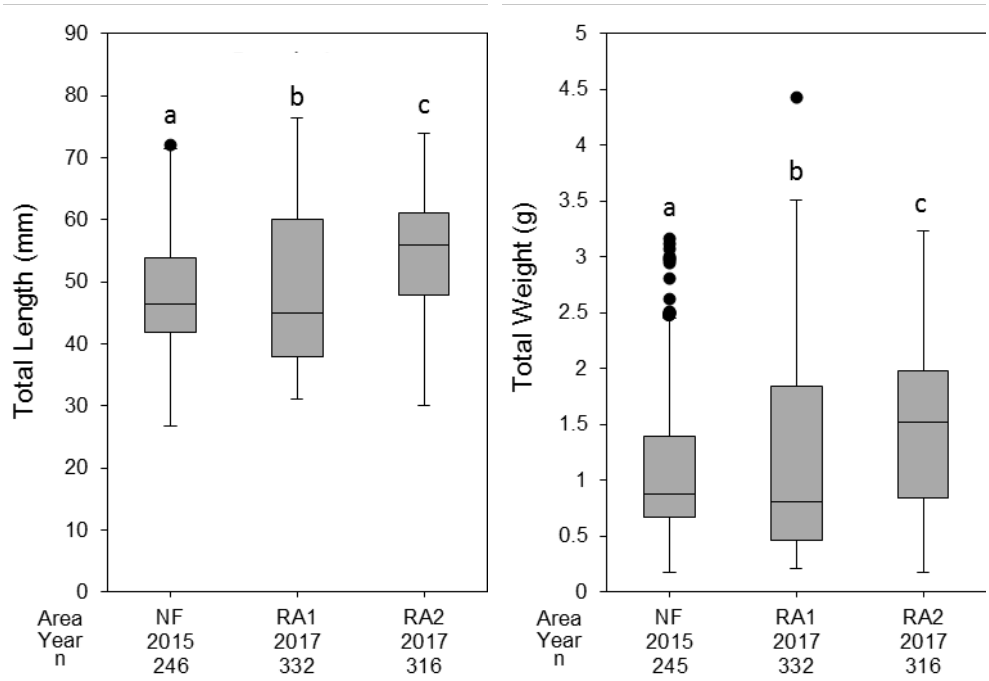

Figure 6.3-4: Length and Weight Threespine Stickleback Measured from Meliadine Lake during the Population Survey, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.2.3 Condition

Condition factor for Threespine Stickleback collected from Meliadine Lake ranged from 0.50 to 1.37 (Table 6.3-4). Relative body weights were significantly different among sampling areas (Table 6.3-5). Relative body weight was significantly greater at the Near-field area when compared to Reference Area 1 (2%), and Reference Area 2 (6%), and was significantly different between reference areas (4%; Figure 6.3-5). The magnitude of differences between the Near-field area and the reference areas were below CES of 10% (Environment Canada 2012).

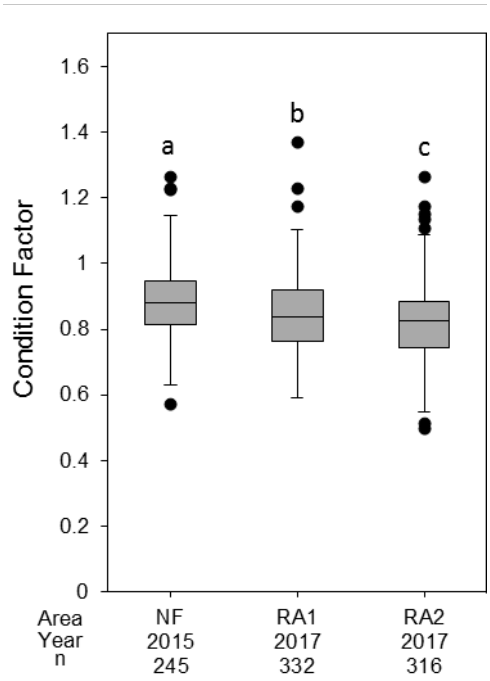

Figure 6.3-5: Condition Factor of Threespine Stickleback Collected During the Population Survey from Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3 Lethal Survey

A total of 289 Threespine Stickleback were lethally sampled from Meliadine Lake during the fish health assessment. Target sample sizes were achieved at each sampling area, with the exception of male Threespine Stickleback from the Near-field area (Table 6.3-6). Descriptive statistics for lethally sampled Threespine Stickleback are provided in Table 6.3-7, with the results of statistical comparisons among sampling areas presented in Table 6.3-8, and statistical comparisons excluding fish parasitized by tapeworms in Table 6.3-9. As sample sizes for unparasitized fish were small (i.e., sample sizes ranged from 0 to 14), results of the lethal survey focused on all Threespine Stickleback sampled. Fish health data and statistical outliers removed from the analyses are provided in Appendix 6B, and boxplots are presented in Appendix 6C.

Table 6.3-6: Sample Sizes for the Meliadine Lake Lethal Survey, 2015 and 2017

Life Stage	Sex	Target Sample Size	Achieved Sample Size			
			Near-field	Reference Area 1	Reference Area 2	Total
Adult	Female	20	38	36	30	104
	Male	20	19	30	33	82
Juvenile		20	38	31	34	103

Table 6.3-7: Descriptive Statistics for Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Sex	Parameter	Near-field							Reference Area 1							Reference Area 2						
		n	Mean	Median	Min	Max	SD	SE	n	Mean	Median	Min	Max	SD	SE	n	Mean	Median	Min	Max	SD	SE
Female	Age (yr)	38	1.9	2.0	1.0	2.0	0.3	0.1	36	1.9	2.0	1.0	2.0	0.2	<0.1	30	2.0	2.0	2.0	2.0	<0.1	<0.1
	Total length (mm)	38	61.4	60.9	52.0	72.1	6.0	1.0	36	62.7	63.9	40.4	76.5	7.2	1.2	30	62.6	61.9	51.2	72.1	6.2	1.1
	Total weight (g)	38	2.081	1.974	1.091	3.162	0.61	0.1	36	2.187	2.163	0.587	4.425	0.74	0.1	30	2.09	2.17	1.16	3.22	0.57	0.1
	Carcass weight (g)	38	1.477	1.369	0.872	2.503	0.47	0.1	36	1.531	1.531	0.482	2.748	0.50	0.1	30	1.50	1.48	0.79	2.21	0.41	0.1
	Condition (TW)	38	0.88	0.88	0.65	1.08	0.08	0.01	36	0.85	0.84	0.67	1.07	0.09	0.01	30	0.84	0.83	0.67	1.18	0.11	0.02
	Condition (CW)	38	0.62	0.62	0.52	0.71	0.05	0.01	36	0.60	0.60	0.48	0.76	0.06	0.01	30	0.60	0.60	0.46	0.77	0.05	0.01
	Liver weight (g)	38	0.059	0.051	0.013	0.148	0.03	<0.1	36	0.051	0.049	0.015	0.139	0.03	<0.1	30	0.05	0.05	0.03	0.10	0.02	<0.1
	Liver somatic index (TW)	38	2.73	2.54	0.77	4.71	0.85	0.14	36	2.36	2.14	0.80	6.07	0.99	0.17	30	2.53	2.34	1.78	4.20	0.63	0.12
	Liver somatic index (CW)	38	3.84	3.80	1.08	6.62	1.08	0.18	36	3.29	3.04	1.25	7.84	1.18	0.20	30	3.49	3.45	2.35	4.97	0.65	0.12
	Gonad weight (g)	38	0.081	0.047	0.013	0.582	0.11	<0.1	36	0.071	0.044	0.006	0.461	0.09	<0.1	30	0.07	0.05	0.01	0.30	0.07	<0.1
	Gonadosomatic index (TW)	38	3.44	2.36	0.80	19.75	3.88	0.63	36	2.75	2.21	0.89	12.12	2.38	0.40	30	2.87	2.20	0.81	10.38	2.22	0.41
	Gonadosomatic index (CW)	38	4.88	3.44	1.23	30.20	5.80	0.94	36	3.96	2.90	1.14	17.40	3.60	0.60	30	4.09	3.32	1.25	17.00	3.56	0.65
	Fecundity	21	982	919	143	1790	357	78	23	725	705	276	1161	248	52	24	923	944	319	1648	413	84
	Mean egg weight (mg)	21	0.291	0.084	0.053	4.076	0.869	0.190	23	0.139	0.104	0.048	0.557	0.121	0.025	24	0.103	0.060	0.021	0.530	0.123	0.025
Male	Age (yr)	19	1.9	2.0	1.0	2.0	0.2	0.1	30	1.8	2.0	1.0	2.0	0.4	0.1	33	1.9	2.0	1.0	2.0	0.3	0.1
	Total length (mm)	19	60.6	61.7	47.6	66.5	4.5	1.0	30	54.4	55.9	37.6	70.0	8.9	1.6	33	56.9	58.2	38.5	64.8	6.0	1.0
	Total weight (g)	19	2.069	2.074	1.173	2.999	0.478	0.110	30	1.528	1.563	0.395	2.756	0.678	0.124	33	1.557	1.582	0.417	2.715	0.489	0.085
	Carcass weight (g)	19	1.566	1.624	0.682	2.230	0.393	0.090	30	1.075	1.096	0.318	1.968	0.470	0.086	33	1.209	1.270	0.342	1.856	0.354	0.062
	Condition (TW)	19	0.92	0.92	0.77	1.09	0.10	0.02	30	0.87	0.88	0.67	1.04	0.09	0.02	33	0.81	0.82	0.63	1.08	0.10	0.02
	Condition (CW)	19	0.69	0.67	0.56	0.87	0.07	0.02	30	0.62	0.63	0.52	0.71	0.05	0.01	33	0.63	0.63	0.51	0.74	0.05	0.01
	Liver weight (g)	19	0.058	0.064	0.025	0.087	0.020	0.004	30	0.027	0.026	0.007	0.067	0.017	0.003	33	0.035	0.033	0.010	0.067	0.014	0.002
	Liver somatic index (TW)	19	2.80	2.72	1.57	4.34	0.70	0.16	30	1.77	1.74	0.87	3.30	0.60	0.11	33	2.32	2.35	1.36	3.68	0.62	0.11
	Liver somatic index (CW)	19	3.69	3.64	2.44	5.20	0.73	0.17	30	2.46	2.38	0.97	4.18	0.75	0.14	33	2.96	2.99	1.78	4.56	0.75	0.13
	Gonad weight (g)	19	0.015	0.016	0.005	0.030	0.006	0.001	29	0.012	0.012	0.001	0.025	0.007	0.001	33	0.016	0.016	0.002	0.036	0.009	0.001
	Gonadosomatic index (TW)	19	0.73	0.65	0.29	1.84	0.39	0.09	29	0.77	0.77	0.16	1.32	0.33	0.06	33	1.04	0.86	0.19	2.58	0.57	0.10
	Gonadosomatic index (CW)	19	0.98	0.87	0.45	2.76	0.56	0.13	29	1.07	1.08	0.18	1.91	0.45	0.08	33	1.33	1.27	0.22	2.98	0.69	0.12
Juvenile	Age (yr)	38	1.0	1.0	1.0	1.0	<0.1	<0.1	31	1.1	1.0	1.0	2.0	0.2	<0.1	34	1.1	1.0	1.0	2.0	0.2	<0.1
	Total length (mm)	38	45.7	46.3	39.5	49.7	2.7	0.4	31	38.3	37.3	31.1	53.6	4.7	0.8	34	40.9	40.1	33.9	51.9	4.4	0.8
	Total weight (g)	38	0.875	0.883	0.556	1.255	0.158	0.026	31	0.461	0.420	0.215	1.144	0.211	0.038	34	0.545	0.459	0.298	1.108	0.211	0.036
	Carcass weight (g)	38	0.573	0.562	0.353	0.948	0.117	0.019	31	0.337	0.313	0.166	0.848	0.146	0.026	34	0.398	0.360	0.240	0.779	0.133	0.023
	Condition (TW)	38	0.91	0.91	0.72	1.22	0.09	0.01	31	0.78	0.77	0.65	1.10	0.10	0.02	34	0.77	0.77	0.64	0.95	0.08	0.01
	Condition (CW)	38	0.59	0.58	0.52	0.84	0.06	0.01	31	0.57	0.56	0.49	0.69	0.05	0.01	34	0.57	0.56	0.46	0.68	0.05	0.01
	Liver weight (g)	38	0.018	0.018	0.010	0.039	0.006	0.001	31	0.010	0.010	0.005	0.023	0.004	0.001	34	0.014	0.014	0.004	0.031	0.005	0.001
	Liver somatic index (TW)	38	2.11	2.06	1.28	3.34	0.50	0.08	31	2.35	2.22	1.01	5.18	0.86	0.15	34	2.69	2.90	0.76	5.22	0.92	0.16
	Liver somatic index (CW)	38	3.23	3.21	1.47	5.29	0.74	0.12	31	3.15	3.13	1.88	7.21	1.09	0.20	34	3.58	3.65	1.14	7.53	1.13	0.19

n = sample size; SD = standard deviation; SE = standard error; < = less than; TW = calculated using total weight; CW = calculated using carcass weight.

Table 6.3-8: Statistical Comparison of Lethal Survey Parameters Measured in Threespine Stickleback Sampled from Meliadine Lake, 2015 and 2017

Sex	Parameter	Dependent Variable	Covariate	Statistical Test	n			Interaction P-value	Model P-value	MSE	Least Squares Mean			Outliers	Power Analysis (↑ / ↓)			Post-hoc P-value			Magnitude (%)		
					NF	RA1	RA2				NF	RA1	RA2		CES	Power	n	NF*RA1	NF*RA2	RA1*RA2	NF*RA1	NF*RA2	RA1*RA2
Female	Age	Age	-	K-W test	38	36	30	-	**0.095**	-	2	2	2	-	25%	1.00	5	0.876	**<0.001**	**<0.001**	-	0%	0%
	Size at age	Total weight	Age 1+	ANOVA	5	2	0	-	**0.005**	0.030	1.314	0.604	-	Included	25%	0.23	29	**0.005**	-	-	118%	-	-
				ANOVA	4	2	0	-	**0.002**	0.011	1.241	0.604	-	Removed		0.41	10	**0.002**	-	-	105%	-	-
			Age 2+	$ANOVA_{log}$	33	34	30	-	0.464	0.014	0.328	0.341	0.304	-		0.97 / 1.00	23 / 15	-	-	-	-	-	-
		Length	Age 1+	K-W test	5	2	0	-	**0.053**	-	53.1	42.6	-	-	-	-	-	**0.053**	-	-	24%	-	-
			Age 2+	ANOVA	33	34	30	-	0.603	32.4	62.6	63.8	62.6	-		-	-	-	-	-	-	-	-
	Length-frequency	Length	-	K-S test	38	36	30	-	-	-	-	-	-	-	-	-	-	0.214	0.850	0.846	-	-	-
	Body weight	Total weight	-	ANOVA	38	36	30	-	0.745	0.419	2.081	2.187	2.090	Included	-	-	-	-	-	-	-	-	-
				ANOVA	38	35	30	-	0.954	0.371	2.081	2.123	2.090	Removed		-	-	-	-	-	-	-	-
	Length	Length	-	ANOVA	38	36	30	-	0.620	42.7	61.4	62.7	62.6	Included	25%[a]	1.00	4	-	-	-	-	-	-
				ANOVA	38	35	30	-	0.391	38.0	61.4	63.3	62.6	Removed		1.00	4	-	-	-	-	-	-
	Relative gonad size	Gonad weight	Total weight	$ANCOVA_{rank}$	35	34	28	0.903	0.260	163	49.6	46.2	51.4	Included	25%	1.00	12	-	-	-	-	-	-
				$ANCOVA_{log}$	34	33	28	0.103	0.562	0.023	-1.388	-1.406	-1.364	Removed		0.94 / 0.99	27 / 18	-	-	-	-	-	-
			Carcass weight	$ANCOVA_{log}$	35	34	28	0.127	0.930	0.025	-1.383	-1.396	-1.397	-	-	-	-	-	-	-	-	-	-
			Length	$ANCOVA_{rank}$	35	34	28	0.536	0.152	179	52.3	46.1	48.1	Included	-	-	-	-	-	-	-	-	-
				$ANCOVA_{log}$	35	33	28	0.546	0.161	0.024	-1.347	-1.418	-1.399	Removed		-	-	-	-	-	-	-	-
	Relative fecundity	Number of eggs	Total weight	$ANCOVA_{rank}$	20	23	24	0.680	**0.005**	295	41.0	24.2	37.6	-	-	-	-	**0.006**	0.795	**0.029**	70%	-	-44%
			Carcass weight	$ANCOVA_{rank}$	20	23	24	0.945	**0.017**	348	41.1	26.1	39.3	-	-	-	-	**0.025**	0.944	**0.049**	57%	-	-40%
			Length	$ANCOVA_{rank}$	20	23	24	0.276	**0.005**	302	41.9	24.4	36.6	-	-	-	-	**0.005**	0.578	**0.052**	72%	-	-40%
	Relative body weight	Total weight	Length	$ANCOVA_{log}$	38	36	30	0.073	0.151	0.002	0.315	0.302	0.294	Included	10%	1.00 / 1.00	16 / 13	-	-	-	-	-	-
				ANCOVA	38	35	30	0.192	0.148	0.047	2.142	2.102	2.037	Removed		1.00	14	-	-	-	-	-	-
		Carcass weight	Length	$ANCOVA_{log}$	38	36	30	0.388	0.161	0.002	0.164	0.149	0.149	Included	-	-	-	-	-	-	-	-	-
				ANCOVA	38	35	30	0.141	0.135	0.021	1.550	1.496	1.484	Removed		-	-	-	-	-	-	-	-
	Relative liver size	Liver weight	Total weight	$ANCOVA_{rank}$	38	36	30	0.350	**0.075**	361	56.4	46.6	54.4	Included	25%	0.98	22	**0.075**	0.908	0.224	21%	-	-
				$ANCOVA_{log}$	37	36	30	0.180	**0.023**	0.025	-1.267	-1.355	-1.303	Removed		0.96 / 0.99	26 / 19	**0.017**	0.515	0.276	22%	-	-
			Carcass weight	$ANCOVA_{rank}$	38	36	30	0.576	**0.019**	249	57.4	46.9	52.8	Included	-	-	-	**0.014**	0.454	0.286	23%	-	-
				$ANCOVA_{log}$	37	36	30	0.297	**0.007**	0.013	-1.265	-1.352	-1.309	Removed		-	-	**0.004**	0.261	0.290	22%	-	-
			Length	$ANCOVA_{rank}$	38	36	30	0.291	**0.016**	348	58.8	46.1	52.0	Included	-	-	-	**0.012**	0.295	0.407	28%	-	-
				$ANCOVA_{log}$	37	35	30	0.069	**0.009**	0.016	-1.254	-1.345	-1.316	Removed		-	-	**0.007**	0.115	0.619	23%	-	-
	Relative egg size	Mean egg weight	Total weight	$ANCOVA_{rank}$	20	23	24	0.157	0.114	248	36.0	38.0	28.5	-	-	-	-	-	**-**	**-**	-	-	-
			Carcass weight	$ANCOVA_{rank}$	20	23	24	0.327	**0.069**	278	36.6	38.5	27.5	-	-	-	-	0.928	0.183	**0.077**	-	-	33%
			Length	$ANCOVA_{rank}$	20	23	24	0.035	**0.057**	285	39.6	39.3	28.8	-	-	-	-	0.999	**0.092**	0.100	-	38%	-
Male	Age	Age	-	K-W test	19	30	33	-	0.244	-	2	2	2	-	25%	1.00	11	-	-	-	-	-	-
	Size at age	Total weight	Age 1+	K-W test	1	6	3	-	0.289	-	1.173	0.454	0.448	-	25%	0.20	37	-	-	-	-	-	-
			Age 2+	ANOVA	18	24	30	-	**0.003**	0.187	2.119	1.784	1.657	-		0.97	18	**0.040**	**0.002**	0.536	19%	28%	-
		Length	Age 1+	ANOVA	1	6	3	-	0.187	12.6	47.6	39.9	42.3	Included	-	-	-	-	-	-	-	-	-
				ANOVA	1	6	2	-	**0.053**	5.5	47.6	39.9	39.3	Removed		-	-	**0.052**	**0.061**	0.935	19%	21%	-
			Age 2+	K-W test	18	24	30	-	**0.022**	-	61.9	57.2	58.4	-		-	-	0.574	**0.001**	**0.001**	-	6%	-2%
	Length-frequency	NA	NA	K-S test	19	30	33	-	-	-	-	-	-	-	-	-	-	**0.004**	**0.051**	0.114	51%	38%	-
	Body weight	Total weight	NA	ANOVA	19	30	33	-	**0.003**	0.318	2.069	1.528	1.557	-	-	-	-	**0.004**	**0.006**	0.976	35%	33%	-
	Length	Length	NA	K-W test	19	30	33	-	**0.007**	-	61.7	55.95	58.1	-	25%[a]	1.00	5	**0.011**	**<0.001**	**0.018**	10%	6%	-4%
	Relative gonad size	Gonad weight	Total weight	$ANCOVA_{log}$	19	29	33	0.658	**0.059**	0.054	-2.012	-1.973	-1.864	-	25%	0.78 / 0.86	39 / 31	0.850	**0.088**	0.163	-	-29%	-
			Carcass weight	ANCOVA	19	29	33	0.478	**0.059**	<0.001	0.012	0.013	0.016	-	-	-	-	0.777	**0.080**	0.199	-	-27%	-
			Length	ANCOVA	19	29	33	0.938	0.155	<0.001	0.013	0.013	0.016	-	-	-	-	-	-	-	-	-	-
	Relative body weight	Total weight	Length	ANCOVA	19	30	33	0.326	**<0.001**	0.041	1.789	1.712	1.551	Included	10%	1.00	13	0.435	**<0.001**	**0.008**	-	15%	10%
				ANCOVA	19	30	32	0.185	**<0.001**	0.035	1.788	1.703	1.524	Removed		1.00	10	0.318	**<0.001**	**0.001**	-	17%	11%
		Carcass weight	Length	ANCOVA	19	30	33	<0.001[b]	**<0.001**	0.019	1.361	1.210	1.204	Included	-	-	-	**0.002**	**<0.001**	0.987	13%	13%	-
				ANCOVA	18	30	33	<0.001[b]	**0.002**	0.017	1.334	1.206	1.201	Removed		-	-	**0.006**	**0.002**	0.987	11%	11%	-
	Relative liver size	Liver weight	Total weight	ANCOVA	19	30	33	0.187	**<0.001**	<0.001	0.050	0.030	0.038	-	25%	0.99	15	**<0.001**	**0.002**	**0.027**	65%	33%	-22%
			Carcass weight	ANCOVA	19	30	33	0.164	**<0.001**	<0.001	0.048	0.033	0.036	-	-	-	-	**<0.001**	**<0.001**	0.290	47%	32%	-
			Length	ANCOVA	19	30	33	0.274	**<0.001**	182	53.7	33.9	41.1	-	-	-	-	**<0.001**	**0.007**	0.095	59%	31%	-19%

(a) Threespine Stickleback are short-lived in freshwater so length was used as a surrogate for age (Environment Canada 2012).

(b) Slopes are considered practically similar (Barrett et al. 2010).

Notes: Gonad weights with studentized residual values >4.0 were removed prior to analysis. Statistically significant differences indicated in **bold**. Exact power cannot be calculated for the KW test and was instead estimated based on ANOVA.

n = sample size; *P*-value = probability value; MSE = mean squared error; NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; CES = critical effect size; K-W = Kruskal-Wallis; K-S = Kolmogorov–Smirnov; ANOVA = analysis of variance; ANCOVA = analysis of covariance; log = log_{10} transformed data; rank = rank transformed data; - and NA = not applicable.

Table 6.3-9: Statistical Comparison of Lethal Survey Parameters Measured in Threespine Stickleback Sampled from Meliadine Lake Excluding Fish Parasitized by Tapeworms, 2015 and 2017

Sex	Parameter	Dependent Variable	Covariate	Statistical Test	n			Interaction *P*-value	Model *P*-value	MSE	Least Squares Mean			Outliers	Power Analysis (↑ / ↓)			Post-hoc P-value			Magnitude (%)		
					NF	RA1	RA2				NF	RA1	RA2		CES	Power	n	NF*RA1	NF*RA2	RA1*RA2	NF*RA1	NF*RA2	RA1*RA2
Female	Age	Age	-	K-W test	8	5	4	-	0.278	-	2	2	2	-	25%	0.79	8	-	-	-	-	-	-
	Size at age	Total weight	Age 1+	ISS	1	2	0	-	-	-	-	-	-	-	25%	-	-	-	-	-	-	-	-
			Age 2+	ANOVA	7	3	4	-	0.274	0.435	2.518	2.114	1.828	Included		0.332	21	-	-	-	-	-	-
				ANOVA	6	3	4	-	0.037	0.241	2.756	2.114	1.828	Removed		0.470	12	0.203	**0.037**	0.733	-	51%	-
		Length	Age 1+	ISS	1	2	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			Age 2+	ANOVA	7	3	4	-	0.547	32.3	66.8	63.2	63.4	-		-	-	-	-	-	-	-	-
	Length-frequency	NA	NA	K-S test	8	5	4	-	-	-	-	-	-	-	-	-	-	0.227	0.875	0.405	-	-	-
	Body weight	Total weight	NA	ANOVA	8	5	4	-	0.221	0.663	2.341	1.510	1.828	-	-	-	-	-	-	-	-	-	-
	Length	Length	NA	ANOVA	8	5	4	-	0.157	75.5	64.9	55.0	63.4	-	25%[a]	0.95	5	-	-	-	-	-	-
	Relative gonad size	Gonad weight	Total weight	ANCOVA	7	5	4	0.188	**0.043**	0.001	0.084	0.048	0.049	Included	25%	0.28	37	**0.068**	**0.081**	0.997	74%	70%	-
				ANCOVA	6	5	4	0.107	**0.011**	<0.001	0.073	0.043	0.046	Removed		0.46	17	**0.016**	**0.031**	0.947	69%	58%	-
			Carcass weight	$ANCOVA_{log}$	7	5	4	0.600	**0.019**	0.023	-1.196	-1.483	-1.442	Included	-	-	-	**0.030**	**0.059**	0.921	94%	76%	-
				ANOVA	6	5	4	0.087	**0.007**	<0.001	0.074	0.043	0.044	Removed		-	-	**0.013**	**0.016**	0.999	71%	69%	-
			Length	ANCOVA	7	5	4	0.068	**0.040**	0.001	0.088	0.052	0.037	Included	-	-	-	0.188	**0.041**	0.757	-	135%	-
				$ANCOVA_{log}$	6	5	4	0.551	**0.069**	0.027	-1.249	-1.471	-1.495	Removed		-	-	0.153	**0.095**	0.977	-	76%	-
	Relative fecundity	# eggs/female	Total weight	ANCOVA	6	2	4	0.109	0.105	40327	941	555	730	Included	-	-	-	-	-	-	-	-	-
				ANCOVA	6	2	3	0.105	**0.011**	18479	951	559	583	Removed	-	-	-	**0.023**	**0.027**	0.981	70%	63%	-
			Carcass weight	ANCOVA	6	2	4	0.119	**0.093**	39796	945	555	724	-	-	-	-	**0.099**	0.299	0.625	70%	-	-
			Length	ANCOVA	6	2	4	0.081	**0.071**	35063	949	568	712	-	-	-	-	**0.086**	0.198	0.667	67%	-	-
	Condition	Total weight	Length	$ANCOVA_{rank}$	8	5	4	0.675	0.116	1.732	9.597	9.034	7.764	-	10%	0.55	14	-	-	-	-	-	-
		Carcass weight	Length	ANCOVA	8	5	4	0.129	0.154	0.036	1.584	1.701	1.422	-	-	-	-	-	-	-	-	-	-
	Relative liver size	Liver weight	Total weight	$ANCOVA_{rank}$	8	5	4	0.121	0.500	3.270	8.842	9.685	8.209	-	25%	0.83	7	-	-	-	-	-	-
			Carcass weight	$ANCOVA_{rank}$	8	5	4	0.244	0.632	3.936	9.125	9.314	8.107	-	-	-	-	-	-	-	-	-	-
			Length	$ANCOVA_{rank}$	8	5	4	0.433	0.164	4.673	9.408	9.729	7.023	-	-	-	-	-	-	-	-	-	-
	Relative egg size	Mean egg weight	Total weight	ANCOVA	6	2	4	0.573	0.692	0.001	0.104	0.106	0.083	Included	-	-	-	-	-	-	-	-	-
				$ANCOVA_{log}$	6	2	4	0.402	0.422	0.017	-1.008	-1.0219	-1.130	-	-	-	-	-	-	-	-	-	-
			Carcass weight	ANCOVA	6	2	4	0.581	0.585	0.001	0.106	0.106	0.080	Included	-	-	-	-	-	-	-	-	-
				$ANCOVA_{log}$	5	2	4	0.405	0.310	0.018	-0.999	-1.027	-1.144	-	-	-	-	-	-	-	-	-	-
			Length	ANCOVA	6	2	4	0.551	0.361	0.002	0.111	0.111	0.073	-	-	-	-	-	-	-	-	-	-
Male	Age	Age	-	K-W test	6	6	14	-	**0.005**	-	2	2	2	-	25%	0.79	8	**0.014**	**<0.001**	**<0.001**	0%	0%	0%
	Size at age	Total weight	Age 1+	K-W test	0	5	3	-	0.764	-	-	0.448	0.448	-	25%	ISS	ISS	-	-	-	-	-	-
			Age 2+	ANOVA	6	1	11	-	**0.005**	0.062	1.981	1.384	1.502	-		0.67	17	**0.099**	**0.005**	0.892	43%	32%	-
		Length	Age 1+	K-W test	0	5	3	-	0.368	-	-	38.5	40.1	-	-	-	-	-	-	-	-	-	-
			Age 2+	ANOVA	6	1	11	-	**0.044**	6.2	61.7	56.5	58.6	-		-	-	0.162	**0.062**	0.709	-	5%	-
	Length-frequency	NA	NA	K-S test	6	6	14	-	-	-	-	-	-	-	-	-	-	**<0.001**	**0.014**	**0.014**	100%	71%	71%
	Body weight	Total weight	NA	ANOVA	6	6	14	-	**<0.001**	0.168	1.981	0.599	1.300	-	-	-	-	**<0.001**	**0.007**	**0.005**	231%	52%	-74%
	Length	Length	NA	ANOVA	6	6	14	-	**<0.001**	44.9	61.7	42.0	55.1	Included	25%[a]	1.00	5	**<0.001**	0.129	**0.002**	47%	-	-27%
				ANOVA	6	6	13	-	**<0.001**	33.4	61.7	42.0	56.4	Removed		1.00	4	**<0.001**	0.171	**<0.001**	47%	-	-29%
	Relative gonad size	Gonad weight	Total weight	$ANCOVA_{log}$	6	6	14	0.793	0.677	0.103	-2.165	-2.147	-2.044	-	25%	0.21 / 0.30	104 / 56	-	-	-	-	-	-
			Carcass weight	$ANCOVA_{log}$	6	6	14	0.831	0.744	0.105	-2.135	-2.166	-2.049	-	-	-	-	-	-	-	-	-	-
			Length	$ANCOVA_{log}$	6	6	14	0.953	0.833	0.109	-2.110	-2.169	-2.058	-	-	-	-	-	-	-	-	-	-
	Condition	Total weight	Length	ANCOVA	6	6	14	0.162	**0.001**	0.017	1.509	1.275	1.213	Included	10%	0.78	13	0.105	**0.001**	0.738	-	24%	-
				ANCOVA	6	6	13	0.112	**0.001**	0.014	1.497	1.273	1.224	Removed		0.79	12	**0.091**	**0.001**	0.801	18%	22%	-
		Carcass weight	Length	ANCOVA	6	6	14	0.221	**0.007**	0.008	1.202	1.119	1.047	-	-	-	-	0.524	**0.010**	0.439	-	15%	-
	Relative liver size	Liver weight	Total weight	$ANCOVA_{rank}$	6	6	14	0.456	**0.007**	8.6	18.0	8.6	13.5	Included	25%	0.97	6	**0.005**	**0.063**	**0.020**	110%	33%	-45%
				$ANCOVA_{log}$	6	6	13	0.036[b]	**<0.001**	0.010	-1.337	-1.811	-1.577	Removed		1.00 / 1.00	4 / 4	**<0.001**	**0.001**	**0.004**	198%	74%	-55%
			Carcass weight	$ANCOVA_{log}$	6	6	14	0.031[b]	**<0.001**	0.013	-1.323	-1.803	-1.560	-	-	-	-	**<0.001**	**0.002**	**0.007**	202%	72%	-57%
			Length	$ANCOVA_{log}$	6	6	14	0.060	**<0.001**	0.014	-1.311	-1.797	-1.567	-	-	-	-	**<0.001**	**0.001**	**0.016**	206%	80%	-54%

(a) Threespine Stickleback were short-lived and length was used as a surrogate for age (Environment Canada 2012).

(b) Slopes are considered practically similar (Barrett et al. 2010).

Notes: Gonad weights with studentized residual values >4.0 were removed prior to analysis. Statistically significant differences indicated in **bold**. Exact power cannot be calculated for the KW test and was instead estimated based on ANOVA.

n = sample size; *P*-value = probability value; MSE = mean squared error; NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; CES = critical effect size; K-W = Kruskal-Wallis; K-S = Kolmogorov–Smirnov; ANOVA = analysis of variance; ANCOVA = analysis of covariance; log = log_{10} transformed data; rank = rank transformed data; ISS = Insufficient sample size to conduct analysis; - and NA = not applicable.

6.3.3.1 Length-Frequency

Length-frequency distributions were similar among sampling areas for female Threespine Stickleback (Table 6.3-8, Figure 6.3-6); however significant differences were observed among sampling areas for males. Male fish sampled from the Near-field area were generally larger than those sampled from the reference areas. The maximum percent difference between the Near-field area and Reference Area 1 was 51%, and between the Near-field area and Reference Area 2 was 38%. No significant differences were observed between the reference areas.

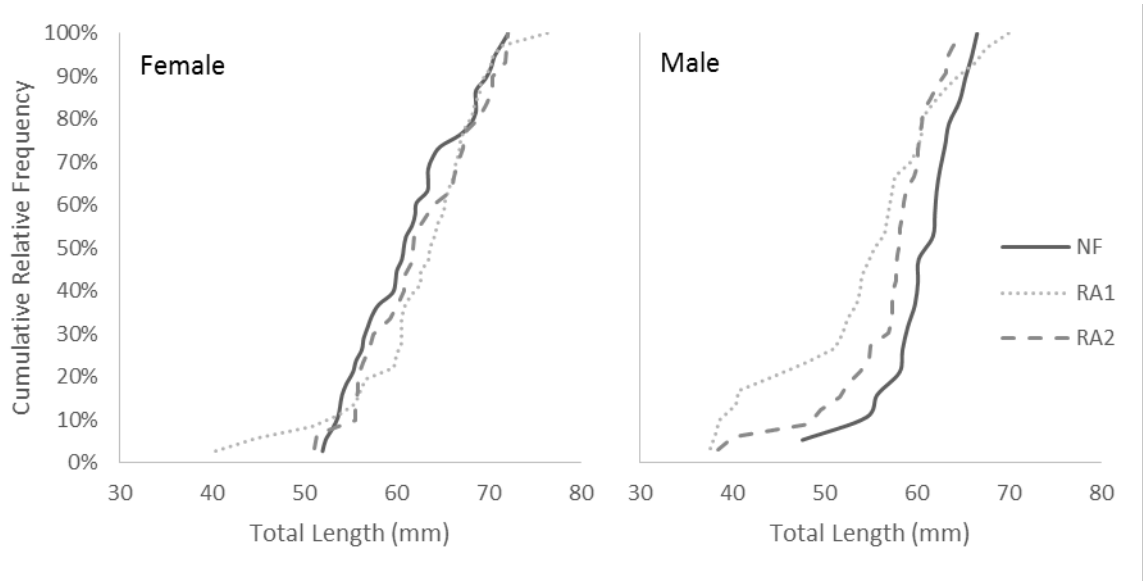

Figure 6.3-6: Cumulative Length-Frequency Distribution of Female and Male Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2.

6.3.3.2 Age

Two age classes were assigned based on a length-frequency analysis of Threespine Stickleback captured during the population survey (Figure 6.3-3). Threespine Stickleback sampled from Meliadine Lake during the lethal survey were determined to range in age from 1 to 2 years (Table 6.3-7), with the majority of fish sampled reaching sexual maturity at age 2+.

The ages of female Threespine Stickleback were significantly different among sampling areas, with significant differences observed between the Near-field area and Reference Area 2, and between the reference areas (Table 6.3-8). While these sampling areas were statistically different from each other, median ages were the same resulting in a magnitude of difference of 0% (thus not exceeding the CES of 25%). No significant differences were observed between the Near-field area and Reference Area 1. No differences in age were observed among sampling areas for males.

6.3.3.3 Size-at-Age

Age 1+ Threespine Stickleback ranged in length from 26.7 to 53.9 mm at the Near-field area, 31.0 to 47.0 mm at Reference Area 1, and 30.0 to 48.8 mm at Reference Area 2. Age 2+ fish ranged in length from 54.1 to 72.1 mm at the Near-field area, 48.0 to 76.5 mm at Reference Area 1, and 49.0 to 74.0 mm at Reference Area 2.

Age 1+ female Threespine Stickleback were significantly larger at the Near-field area when compared to Reference Area 1 (24% length, 105% weight). No age 1+ female fish were sampled from Reference Area 2 for comparison. No significant differences were observed in length or weight among sampling areas for age 2+ female Threespine Stickleback. For male age 1+ fish, significant differences were observed in length; however, no significant differences were observed in weight. Threespine Stickleback sampled from the Near-field area were longer than fish sampled from Reference Area 1 (19%), and Reference Area 2 (21%). No significant differences in length were observed among reference areas. For male age 2+ fish, significant differences were observed in length and weight. Age 2+ male fish sampled from the Near-field area were heavier than fish sampled from Reference Area 1 (19%) and Reference Area 2 (28%). No significant differences were observed in length between the Near-field area and Reference Area 1. Fish sampled from the Near-field area were longer than fish sampled from Reference Area 2 (6%); while fish sampled from Reference Area 1 were shorter than fish sampled from Reference Area 2 (-2%).

6.3.3.4 Size

Lethally sampled Threespine Stickleback ranged in size from 31.1 to 76.5 mm and 0.215 to 4.425 g (Table 6.3-7). No significant differences were observed among sampling areas in length or weight for female Threespine Stickleback sampled during the lethal survey (Table 6.3-8, Figure 6.3-7). Male Threespine Stickleback sampled from the Near-field area were significantly larger than individuals sampled from Reference Area 1 (10% difference in length, 35% difference in weight) and Reference Area 2 (6% difference in length, 33% difference in weight). Significant differences were also observed between Reference Area 1 and Reference Area 2 in length (-4%), but not weight. As Threespine Stickleback are short-lived, and it can be difficult to detect a 25% difference in age, fish length was used as a surrogate effect endpoint (Environment Canada 2012). While significant differences were observed in length among sampling areas for male Threespine Stickleback, differences did not exceed the CES of 25%.

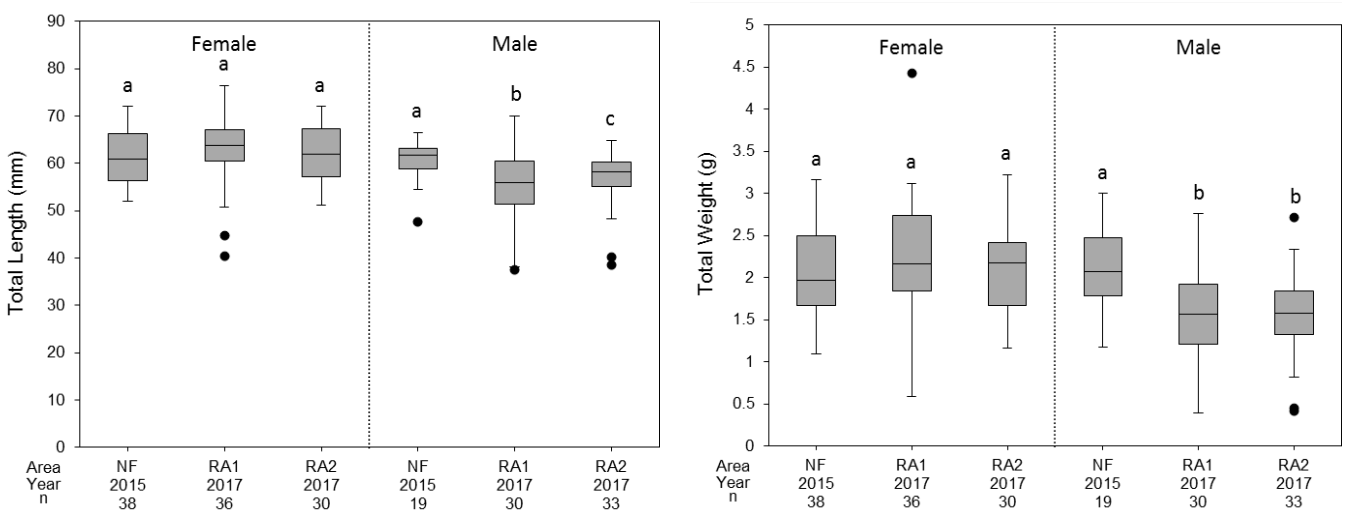

Figure 6.3-7: Length and Weight of Female and Male Threespine Stickleback Lethally Sampled From Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.
NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3.5 Size-at-Maturity

Fish length was a significant predictor of maturity in Threespine Stickleback, based on a binary logistic regression (*P*<0.001). Size at maturity (i.e., the total length at which 50% of the population reaches sexual maturity, or P_{50}) was significantly different among fish parasitized and unparasitized by tapeworms (*P*<0.001), maturing at 49.8 and 42.1 mm, respectively (Figure 6.3-8).

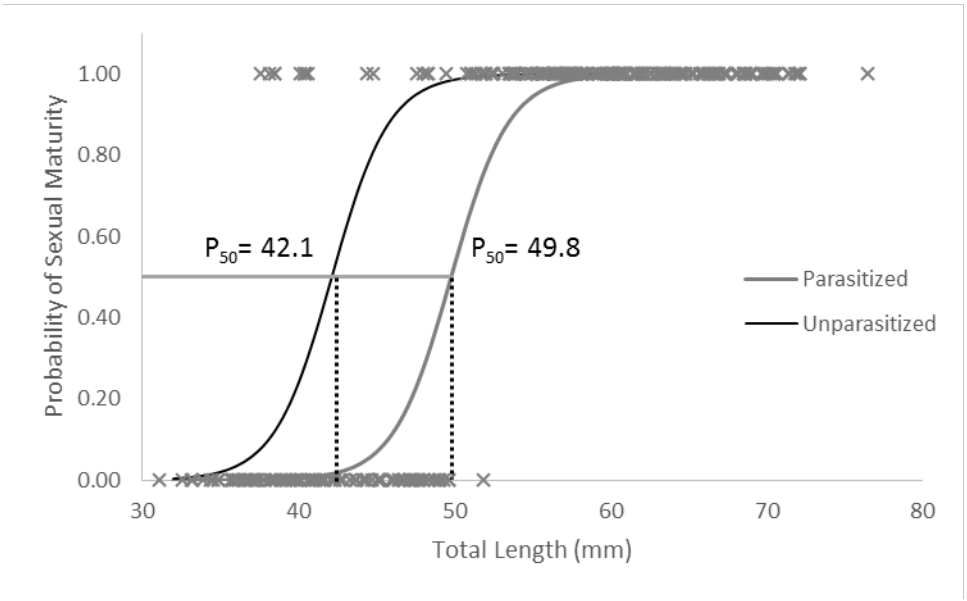

Figure 6.3-8: Size-at-Maturity of Threespine Stickleback With and Without Parasites

Notes: Plotted curve represents the modeled size at maturity. Actual data used in the analysis are represented by the symbol x. P_{50} = the total length at which 50% of the population reach sexual maturity.

6.3.3.6 Gonad Weight

The gonadosomatic index for female Threespine Stickleback ranged from 0.80 to 19.75. No significant differences were observed in relative gonad weight for female Threespine Stickleback among sampling areas (Table 6.3-8, Figure 6.3-9). For male Threespine Stickleback, the gonadosomatic index ranged from 0.16 to 2.58. Relative gonad weight was significantly lower for males sampled from the Near-field area when compared to Reference Area 2 (-29%), with the magnitude of difference exceeding the CES of 25%. No significant differences were observed between the Near-field area and Reference Area 1, or between the references areas.

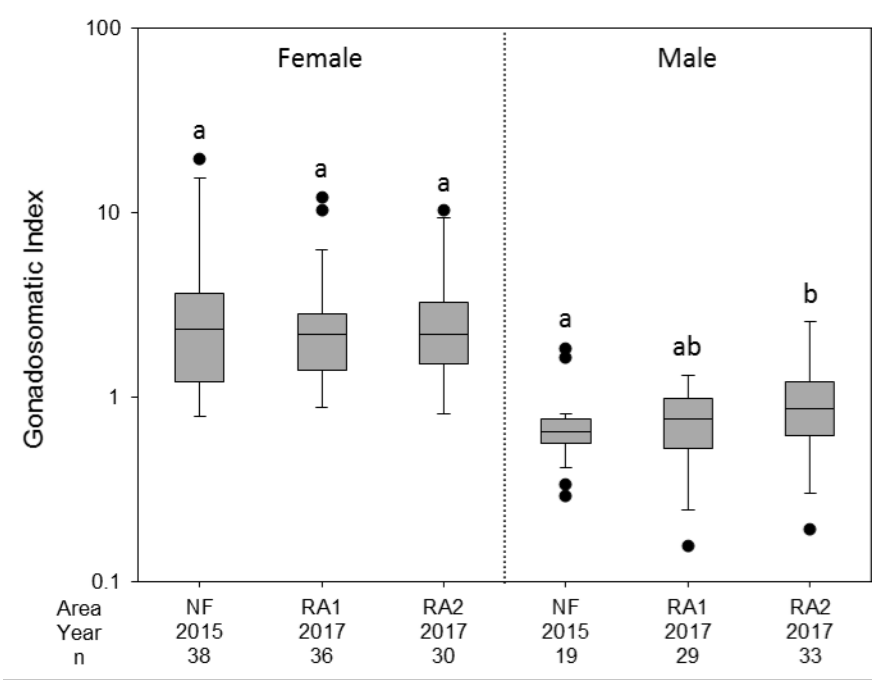

Figure 6.3-9: Gonadosomatic Index (log_{10}) of Female and Male Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3.7 Fecundity

Fecundity for Threespine Stickleback sampled from Meliadine Lake ranged from 143 to 1790 eggs per female (Table 6.3-7). Relative fecundity was significantly greater at the Near-field area when compared to Reference Area 1 (70%), and significantly lower at Reference Area 1 compared to Reference Area 2 (-44%, Table 6.3-8, Figure 6.3-10). No significant differences were observed in fecundity between the Near-field area and Reference Area 2. Mean egg weight for Threespine Stickleback ranged from 0.021 g to 0.557 g (Table 6.3-7), with the exception of one ripe fish at the Near-field area that had a mean egg weight of 4.076 g. No significant differences were observed among sampling areas in mean egg weight (Table 6.3-8, Figure 6.3-10).

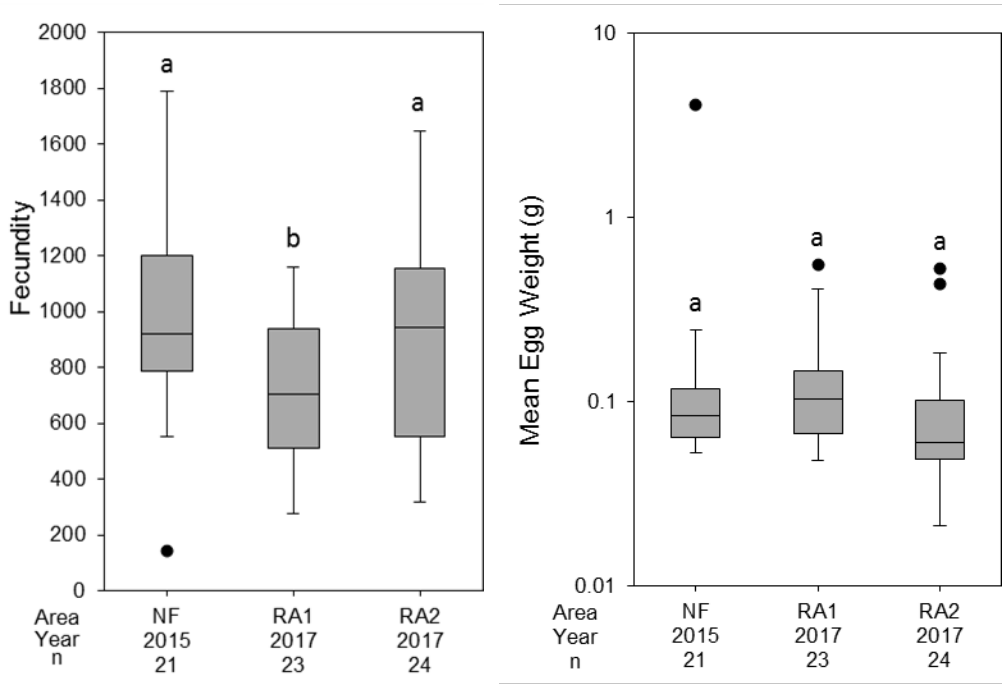

Figure 6.3-10: Fecundity and Egg Weight (log_{10}) for Threespine Stickleback Sampled from Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3.8 Condition

Condition factor for lethally sampled female Threespine Stickleback ranged from 0.65 to 1.18 in Meliadine Lake (Table 6.3-7). No significant differences were observed in relative body weight for female fish among sampling areas (Table 6.3-8, Figure 6.3-11). Condition factor for lethally sampled male Threespine Stickleback ranged from 0.63 to 1.09 in Meliadine Lake (Table 6.3-7). Relative body weight was significantly greater at the Near-field area and Reference Area 1, compared to Reference Area 2 (17% and 11%, respectively, Table 6.3-8, Figure 6.3-11).

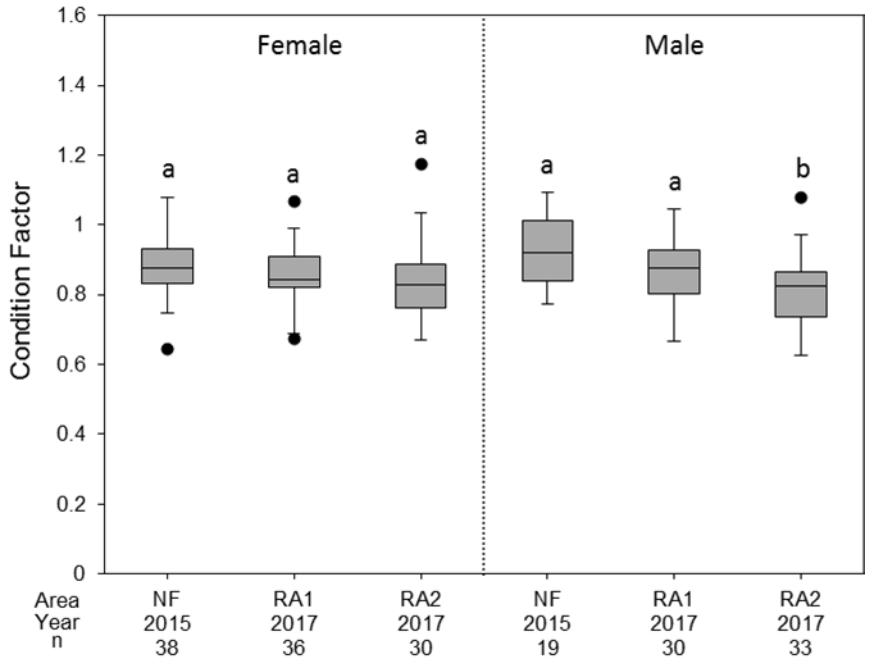

Figure 6.3-11: Condition Factor for Female and Male Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3.9 Liver Weight

The liver somatic index for female Threespine Stickleback ranged from 0.77 to 6.07 (Table 6.3-7). Relative liver weight was significantly greater at the Near-field area when compared to Reference Area 1 (22%, Table 6.3-8). No significant differences were observed between the Near-field area and Reference Area 2, or between Reference Area 1 and Reference Area 2. For male Threespine Stickleback, the liver somatic index ranged from 0.87 to 4.34 (Table 6.3-7). Relative liver weight of male fish was significantly different among sampling areas (Table 6.3-8). Relative liver weight was significantly greater at the Near-field area, when compared to Reference Area 1 (65%), and Reference Area 2 (33%). Relative liver weight of male fish was significantly lower at Reference Area 1 compared to Reference Area 2 (-22%). Differences exceeded the CES of 25%, suggesting energy storage for male Threespine Stickleback was greater at the Near-field area when compared to the reference areas in Meliadine Lake. As the Near-field and reference areas were sampled in different years (i.e., the Near-field area was sampled in 2015, and the reference areas were sampled in 2017), it could not be determined whether differences in relative liver weight were related to geographic or interannual variability.

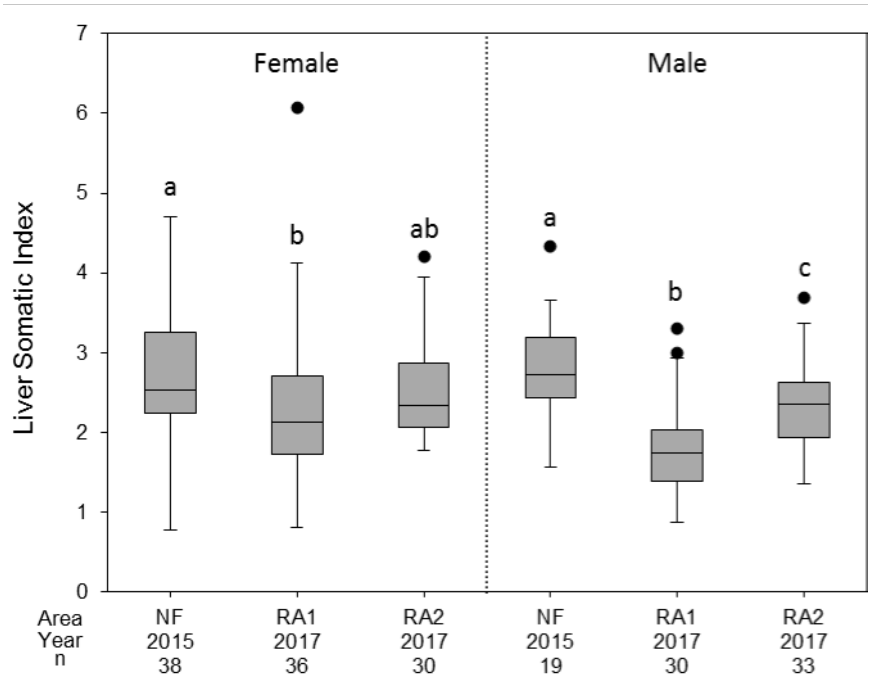

Figure 6.3-12: Liver Somatic Index of Female and Male Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

6.3.3.10 Pathology

External abnormalities observed in Threespine Stickleback sampled from Meliadine Lake included mild abrasion of the thymus and vent, minor skin aberrations (i.e., missing scales), and mild fin erosion (Table 6.3-10). The prevalence of external abnormalities were low, affecting only 2% of the fish sampled in Meliadine Lake, with a similar prevalence among sampling areas (Table 6.3-10). No body deformities or abnormalities of the eyes, gills, pseudobranchs, or opercula were observed.

Internal abnormalities observed in Threespine Stickleback sampled from Meliadine Lake included liver discoloration (i.e., “fatty” livers with a coffee cream colour, or focal discolouration) and swollen kidneys (Table 6.3-12). The prevalence of liver discoloration was similar among sampling areas, while swollen kidneys were more prevalent for fish sampled from Reference Area 2. Swollen kidneys were primarily observed in male Threespine Stickleback (i.e., of fish exhibiting swollen kidneys, 92% were male and 8% were female), suggesting swollen kidneys may be related to spiggin production[3], rather than a physiological response to contaminant exposure. The greater prevalence of swollen kidneys at Reference Area 2 may have been related to a lower prevalence of tapeworms (Section 6.3.3.11), allowing additional resources to be allocated to nest building. These types of external and internal abnormalities are commonly observed in fish populations, and given the low rate of incidence were not considered further. Mesenteric fat content varied significantly among sampling areas (P<0.001), with greater fat content observed in the Near-field area when compared to Reference Area 1 and Reference Area 2 (Table 6.3-11).

[3] Spiggin is a glue like substance produced by male Threespine Stickleback and used in nest construction.

Table 6.3-10: Number of Lethally Sampled Threespine Stickleback Observed with External and Internal Abnormalities, 2015 and 2017

Assessment Type	Category	Near-field Area	Reference Area 1	Reference Area 2	Chi Square *P*-value
External	Body Deformities	0	0	0	0.986
	Eyes	0	0	0	0.986
	Gills	0	0	0	0.986
	Pseudobranchs	0	0	0	0.986
	Thymus	1	0	0	0.359
	Skin	0	0	1	0.370
	Fins	0	2	1	0.370
	Opercula	0	0	0	0.986
	Vent	2	0	0	0.128
Internal	Liver	10	5	10	0.323
	Spleen	0	0	0	0.986
	Gall Bladder	0	0	0	0.986
	Kidney	5	2	18	**<0.001**
Fish with Abnormalities		16%	7%	26%	
Total Number of Fish Surveyed		95	97	97	

Note: Significant difference indicated in **bold**.

P-value = probability value; < = less than.

Table 6.3-11: Relative Mesenteric Fat Content of Threespine Stickleback, 2015 and 2017

Mesenteric Fat	Near-field Area	Reference Area 1	Reference Area 2
0	7	37	16
1	83	55	60
2	3	5	20
3	2	0	1

0 = None; 1 = < 50%; 2 = 50%; 3 = > 50%.

6.3.3.11 Parasites

Internal parasites were frequently observed in Threespine Stickleback sampled from Meliadine Lake, and occurred in 84.2% of Threespine Stickleback from the Near-field area, 80.4% from Reference Area 1, and 64.9% of fish sampled from Reference Area 2 (Table 6.3-12). Among parasitized fish, Threespine Stickleback exhibited a low severity of parasitism in 3.6% of fish (e.g., cysts), a moderate severity of parasitism in 82.4% of fish (e.g., tapeworms), and a high severity of parasitism in 14.0% (e.g., multiple tapeworms) of Threespine Stickleback sampled. Significant differences were observed in the prevalence of parasites among sampling areas (P<0.001), with fewer parasites observed in fish from Reference Area 2 when compared to the Near-field area and Reference Area 1. External parasites were not observed at any of the sampling areas.

A large tapeworm, suspected to be *Schistocephalus solidus,* was the prevalent parasite among Threespine Stickleback captured in Meliadine Lake. The tapeworm infected 221 of the 289 fish sampled. The tapeworm *S. solidus* parasitizes small-bodied fish and fish-eating birds. Small-bodied fish, such as the Threespine Stickleback, serve as an intermediate host for the parasite once the fish become infected after consuming infected copepods. The parasite develops in the body cavity until it is transmitted to the definitive host, fish-eating birds, when the fish is consumed (Barber and Huntingford 1995). Potential definitive hosts for *S. solidus* in the Near-field area of Meliadine Lake are Sandhill crane (*Grus canadensis*), which were observed in the area during the time of sampling. On average, tapeworms accounted for 17.0% of body weight in infected fish.

Table 6.3-12: Number of Threespine Stickleback Observed with External and Internal Parasites, 2015 and 2017

Parasites		Near-field Area	Reference Area 1	Reference Area 2
External	0	95	332	316
	1	0	0	0
	2	0	0	0
	3	0	0	0
Internal	0	15	19	34
	1	2	4	2
	2	78	53	51
	3	0	21	10

0 = no parasites; 1 = few parasites; 2 = moderate parasite infestation; 3 = numerous parasites.

6.3.4 Fish Tissue Chemistry

In 2015 and 2017, a total of 194 Threespine Stickleback carcass samples were analyzed for percent moisture and metals concentrations from the Near-field and reference areas of Meliadine Lake. A total of 60 samples were collected from the Near-field area in 2015, with 67 samples collected from Reference Area 1 and 67 samples collected from Reference Area 2 in 2017. Descriptive statistics for individual parameters separated by sampling area are provided in Table 6.3-13. Data are provided in Appendix 6E, and boxplots are provided in Appendix 6F.

Metals concentrations in fish tissue from the Near-field area were significantly lower than concentrations measured in Reference Area 1 and Reference Area 2 for 17 of the 36 metals examined (Table 6.3-14); the greatest magnitude differences (i.e., greater than 30%) were observed for aluminum, boron, cesium, chromium, cobalt, iron, lithium, molybdenum, nickel, titanium and vanadium concentrations. Greater concentrations were observed in the Near-field area for arsenic and tin. No significant differences were observed between the Near-field area and reference areas in concentrations of cadmium, lead, manganese and thallium. Statistical outliers removed from analyses are provided in Appendix 6D.

As tissue chemistry data for the Near-field area and reference areas were collected during the pre-operational phase of the mine, prior to operational discharge, differences in metals concentrations represent natural variability in these parameters at Meliadine Lake. However, because the Near-field area and reference areas were sampled in different years, it could not be determined whether these differences represent spatial and/or temporal variability in these parameters.

Table 6.3-13: Descriptive Statistics for Threespine Stickleback Fish Tissue Chemistry for Carcass Samples Collected from Meliadine Lake, 2015 and 2017

Parameter	Near-field Area								Reference Area 1								Reference Area 2							
	n	% < DL	Mean	Median	Min	Max	SD	SE	n	% < DL	Mean	Median	Min	Max	SD	SE	n	% < DL	Mean	Median	Min	Max	SD	SE
Moisture (%)	60	100	66	66.1	53.5	71.8	3.49	0.45	67	100	65.4	65.7	57.1	84.8	3.67	0.45	67	100	65.5	65.0	59.6	74.1	2.88	0.35
Aluminum	60	52	1.2	1.0	<1.0	4.7	1.0	0.1	67	88	2.8	2.1	<1.0	11.7	2.2	0.3	67	70	2.7	1.8	<1.0	19.2	3.7	0.5
Antimony	60	5	<0.002	<0.002	<0.002	0.004	0.001	<0.001	67	10	<0.002	<0.002	<0.002	0.008	0.001	<0.001	67	12	<0.002	<0.002	<0.002	0.014	0.002	<0.001
Arsenic	60	100	0.186	0.176	0.120	0.395	0.051	0.007	67	100	0.118	0.115	0.044	0.209	0.041	0.005	67	100	0.156	0.156	0.068	0.239	0.035	0.004
Barium	60	100	4.48	4.37	2.04	7.16	0.97	0.13	67	100	5.55	5.60	3.09	9.05	1.17	0.14	67	100	5.66	5.53	2.89	9.26	1.20	0.15
Beryllium	60	0	<0.002	<0.002	<0.002	<0.002	-	-	67	0	<0.002	<0.002	<0.002	<0.002	-	-	67	0	<0.002	<0.002	<0.002	<0.002	-	-
Bismuth	60	3	<0.002	<0.002	<0.002	0.002	<0.001	<0.001	67	4	<0.002	<0.002	<0.002	0.005	<0.001	<0.001	67	3	<0.002	<0.002	<0.002	0.005	<0.001	<0.001
Boron	60	0	<0.2	<0.2	<0.2	<0.2	-	-	67	33	<0.2	<0.2	<0.2	0.5	0.1	<0.1	67	45	<0.2	<0.2	<0.2	4.20	0.6	0.1
Cadmium	60	100	0.0063	0.0058	0.0027	0.0211	0.0032	0.0004	67	100	0.0066	0.0056	0.0021	0.0285	0.0041	0.0005	67	94	0.0060	0.0055	<0.002	0.0132	0.0025	0.0003
Calcium	60	100	23973	23300	13100	39300	4535	586	67	100	25784	25800	12700	41300	5300	648	67	100	25652	25600	14300	45800	5253	642
Cesium	60	100	0.0180	0.0157	0.0091	0.0513	0.0086	0.0011	67	100	0.0248	0.0241	0.0112	0.0478	0.0072	0.0009	67	100	0.0290	0.0270	0.0145	0.0594	0.0091	0.0011
Chromium	60	40	0.043	<0.040	<0.040	0.207	0.043	0.006	67	94	0.843	0.413	<0.040	5.730	1.173	0.143	67	96	0.513	0.285	<0.040	2.610	0.569	0.070
Cobalt	60	100	0.0080	0.0075	0.0044	0.0141	0.0024	0.0003	67	100	0.0158	0.0128	0.0053	0.0485	0.0085	0.0010	67	99	0.0149	0.0138	<0.008	0.0348	0.0050	0.0006
Copper	60	100	0.561	0.554	0.412	0.844	0.094	0.012	67	100	0.707	0.685	0.318	1.210	0.154	0.019	67	100	0.704	0.703	0.485	1.050	0.104	0.013
Iron	60	100	14.2	13.6	7.8	24.8	3.4	0.4	67	100	27.1	22.2	8.0	82.3	13.5	1.6	67	100	24.3	22.4	13.3	58.7	8.8	1.1
Lead	60	50	0.011	<0.010	<0.010	0.027	0.007	0.001	67	45	0.013	<0.010	<0.010	0.136	0.018	0.002	67	48	0.016	<0.010	<0.010	0.245	0.030	0.004
Lithium	60	0	<0.10	<0.10	<0.10	<0.10	-	-	67	57	0.18	0.12	<0.10	0.75	0.15	0.02	67	0	<0.10	<0.10	<0.10	<0.10	-	-
Magnesium	60	100	493	481	358	710	70	9	67	100	531	532	277	747	86	11	67	100	529	518	330	771	92	11
Manganese	60	100	27.5	27.2	14.7	40.8	5.8	0.7	67	100	28.2	27.9	14.5	48.1	7.5	0.9	67	100	29.6	28.4	18.1	50.4	7.1	0.9
Mercury	60	100	0.113	0.110	0.064	0.174	0.025	0.003	67	100	0.120	0.118	0.041	0.263	0.038	0.005	67	100	0.089	0.080	0.046	0.196	0.027	0.003
Molybdenum	60	100	0.0168	0.0163	0.0088	0.0375	0.0052	0.0007	67	99	0.0383	0.0308	<0.0160	0.1130	0.0233	0.0029	67	94	0.0309	0.0218	<0.0160	0.1660	0.0267	0.0033
Nickel	60	100	0.115	0.090	0.042	0.423	0.083	0.011	67	100	1.790	0.751	0.099	12.000	2.725	0.333	67	100	0.909	0.530	0.089	7.190	1.186	0.145
Phosphorus	60	100	13747	13950	8400	20100	2127	275	67	100	15108	15300	7310	22500	2685	328	67	100	15258	15300	8440	24600	2752	336
Potassium	60	100	2818	2800	2290	3430	251	32	67	100	2747	2720	1360	3450	304	37	67	100	2551	2520	1900	3150	277	34
Rubidium	60	100	2.22	2.19	1.19	3.43	0.52	0.07	67	100	2.87	2.87	1.50	4.35	0.63	0.08	67	100	3.19	3.16	1.73	4.44	0.56	0.07
Selenium	60	100	0.465	0.463	0.360	0.588	0.055	0.007	67	100	0.603	0.593	0.273	0.898	0.093	0.011	67	100	0.592	0.596	0.436	0.714	0.057	0.007
Silver	60	65	0.0018	0.0014	<0.0010	0.0137	0.0021	0.0003	67	42	0.0013	<0.0010	<0.0010	0.0117	0.0015	0.0002	67	24	<0.0010	<0.0010	<0.0010	0.0039	0.0006	0.0001
Sodium	60	100	1400	1385	781	1820	182	24	67	100	1356	1350	706	1850	198	24	67	100	1298	1280	901	2120	203	25
Strontium	60	100	19.1	19.0	10.0	29.1	3.7	0.5	67	100	20.6	20.6	9.1	28.7	4.0	0.5	67	100	19.0	18.8	11.2	31.9	3.7	0.5
Tellurium	60	0	<0.004	<0.004	<0.004	<0.004	-	-	67	0	<0.004	<0.004	<0.004	<0.004	-	-	67	0	<0.004	<0.004	<0.004	<0.004	-	-
Thallium	60	100	0.00587	0.00554	0.00282	0.01260	0.00195	0.00025	67	100	0.00535	0.00478	0.00297	0.01600	0.00234	0.00029	67	100	0.00555	0.00528	0.00322	0.00904	0.00146	0.00018
Tin	60	98	0.078	0.070	<0.020	0.210	0.039	0.005	67	37	0.021	<0.020	<0.020	0.061	0.013	0.002	67	33	0.027	<0.020	<0.020	0.088	0.021	0.003
Titanium	60	23	<0.10	<0.10	<0.10	0.39	0.07	0.01	67	48	0.16	<0.10	<0.10	0.81	0.16	0.02	67	33	0.13	<0.10	<0.10	0.95	0.14	0.02
Uranium	60	100	0.00444	0.00408	0.00216	0.01140	0.00194	0.00025	67	100	0.00457	0.00463	0.00143	0.00879	0.00186	0.00023	67	100	0.00630	0.00569	0.00140	0.01560	0.00279	0.00034
Vanadium	60	12	<0.020	<0.020	<0.020	0.030	0.005	0.001	67	33	<0.020	<0.020	<0.020	0.080	0.016	0.002	67	19	<0.020	<0.020	<0.020	0.073	0.011	0.001
Zinc	60	100	45.4	43.2	24.8	86.9	12.5	1.6	67	100	50.4	50.0	27.6	87.1	10.1	1.2	67	100	53.4	52.4	29.0	85.7	11.1	1.4
Zirconium	60	0	<0.040	<0.040	<0.040	<0.040	-	-	67	15	<0.04	<0.04	<0.04	0.12	0.02	<0.01	67	4	<0.04	<0.04	<0.04	0.49	0.06	0.01

Note: All parameters are measured in milligram per kilogram wet weight (mg/kg ww), unless otherwise specified.

n = sample size; < = less than; DL = detection limit; SD = standard deviation; SE = standard error; - = not applicable.

Table 6.3-14: Statistical Comparison of Fish Tissue Chemistry Parameters Measured in Threespine Stickleback Carcass Samples from Meliadine Lake, 2015 and 2017

Parameter	Statistical Test	n			Model *P*-value	MSE	Least Squares Mean			Outliers	Post-Hoc			Magnitude		
		NF	RA1	RA2			NF	RA1	RA2		NF*RA1	NF*RA2	RA1*RA2	NF*RA1	NF*RA2	RA1*RA2
Moisture	KW test	60	67	67	0.214	-	66.1	65.7	65.0	Included	-	-	-	-	-	-
	ANOVA	58	66	67	**0.043**	7.992	66.4	65.1	65.5	Removed	**0.039**	0.169	0.773	2%	-	-
Aluminum	KW test	60	67	67	**<0.001**	-	1.0	2.1	1.8	-	**<0.001**	**<0.001**	0.138	-52%	-44%	-
Antimony	KW test	60	67	67	**<0.001**	-	0.001	0.001	0.001	-	**0.003**	**<0.001**	0.187	0%	0%	-
Arsenic	KW test	60	67	67	**<0.001**	-	0.176	0.115	0.156	Included	**<0.001**	0.214	**<0.001**	53%	-	-30%
	ANOVA	58	67	67	**<0.001**	0.002	0.180	0.118	0.156	Removed	**<0.001**	**0.002**	**<0.001**	52%	15%	-28%
Barium	$ANOVA_{log}$	60	67	67	**<0.001**	0.009	4.38	5.43	5.54	Included	**<0.001**	**<0.001**	0.860	-19%	-21%	-
	$ANOVA_{log}$	59	67	66	**<0.001**	0.008	4.44	5.43	5.59	Removed	**<0.001**	**<0.001**	0.681	-18%	-21%	-
Beryllium	-	60	67	67	-	-	0.001	0.001	0.001	-	-	-	-	-	-	-
Bismuth	KW test	60	67	67	**0.006**	-	0.001	0.001	0.001	-	**0.011**	**<0.001**	0.398	0%	0%	-
Boron	KW test	60	67	67	**<0.001**	-	0.1	0.2	0.2	-	**<0.001**	**<0.001**	**0.014**	-50%	-50%	0%
Cadmium	KW test	60	67	67	0.921	-	0.0058	0.0056	0.0055	Included	-	-	-	-	-	-
	$ANOVA_{log}$	60	66	66	0.910	0.033	0.0057	0.0057	0.0056	Removed	-	-	-	-	-	-
Calcium	KW test	60	67	67	**0.048**	-	23300	25800	25600	Included	**0.003**	**0.010**	0.925	-10%	-9%	-
	ANOVA	59	66	66	**0.056**	21240417	23714	25548	25347	Removed	**0.070**	0.120	0.966	-7%	-	-
Cesium	KW test	60	67	67	**<0.001**	-	0.0157	0.0241	0.0270	Included	**<0.001**	**<0.002**	**0.043**	-35%	-42%	-12%
	$ANOVA_{log}$	58	67	67	**<0.001**	0.018	0.0160	0.0238	0.0278	Removed	**<0.001**	**<0.001**	**0.011**	-33%	-43%	-15%
Chromium	KW test	60	67	67	**<0.001**	-	0.020	0.413	0.285	-	**<0.001**	**<0.001**	0.938	-95%	-93%	-
Cobalt	KW test	60	67	67	**<0.001**	-	0.0075	0.0128	0.0138	-	**<0.001**	**<0.001**	0.540	-42%	-46%	-
Copper	KW test	60	67	67	**<0.001**	-	0.554	0.685	0.703	Included	**<0.001**	**<0.001**	0.877	-19%	-21%	-
	$ANOVA_{log}$	60	65	67	**<0.001**	0.005	0.554	0.693	0.697	Removed	**<0.001**	**<0.001**	0.977	-20%	-21%	-
Iron	KW test	60	67	67	**<0.001**	-	13.6	22.2	22.4	-	**<0.001**	**<0.001**	0.964	-39%	-39%	-
Lead	KW test	60	67	67	0.330	-	0.008	0.010	0.010	-	-	-	-	-	-	-
Lithium	KW test	60	67	67	**<0.001**	-	0.05	0.12	0.05	-	**<0.001**	**0.001**	**<0.001**	-58%	0%	70%
Magnesium	ANOVA	60	67	67	**0.019**	6999	493	531	529	Included	**0.030**	**0.043**	0.988	-7%	-7%	-
	ANOVA	60	66	67	**0.009**	6691	493	535	529	Removed	**0.012**	**0.038**	0.907	-8%	-7%	-
Manganese	$ANOVA_{log}$	60	67	67	0.194	0.011	26.8	27.2	28.9	-	-	-	-	-	-	-
Mercury	$ANOVA_{log}$	60	67	67	**<0.001**	0.015	0.110	0.114	0.085	Included	0.790	**<0.001**	**<0.001**	-	30%	30%
	$ANOVA_{log}$	60	65	66	**<0.001**	0.012	0.110	0.114	0.084	Removed	0.723	**<0.001**	**<0.001**	-	32%	31%
Molybdenum	KW test	60	67	67	**<0.001**	-	0.0163	0.0308	0.0218	-	**<0.001**	**<0.001**	**0.005**	-47%	-25%	34%
Nickel	KW test	60	67	67	**<0.001**	-	0.090	0.751	0.530	-	**<0.001**	**<0.001**	0.278	-88%	-83%	-
Phosphorus	ANOVA	60	67	67	**0.002**	6506743	13747	15108	15258	Included	**0.009**	**0.003**	0.938	-9%	-10%	-
	ANOVA	60	66	66	**0.001**	5780281	13747	15226	15117	Removed	**0.002**	**0.005**	0.963	-10%	-9%	-
Potassium	KW test	60	67	67	**<0.001**	-	2800	2720	2520	Included	1.000	**<0.001**	**<0.001**	-	11%	8%
	$ANOVA_{log}$	60	66	67	**<0.001**	0.002	2808	2757	2536	Removed	0.544	**<0.001**	**<0.001**	-	11%	8%
Rubidium	ANOVA	60	67	67	**<0.001**	0.328	2.22	2.87	3.19	-	**<0.001**	**<0.001**	**0.003**	-23%	-31%	-11%
Selenium	KW test	60	67	67	**<0.001**	-	0.463	0.593	0.596	Included	**<0.001**	**<0.001**	0.993	-22%	-22%	-
	$ANOVA_{log}$	60	65	67	**<0.001**	0.002	0.462	0.599	0.589	Removed	**<0.001**	**<0.001**	0.705	-23%	-22%	-
Silver	KW test	60	67	67	**0.004**	-	0.0014	0.0010	0.0010	-	0.631	**0.069**	0.389	-	40%	-
Sodium	KW test	60	67	67	**0.004**	-	1385	1350	1280	Included	0.999	**0.079**	**0.072**	-	8%	5%
	ANOVA	59	66	66	**<0.001**	30663	1410	1366	1285	Removed	0.329	**<0.001**	**0.026**	-	10%	6%
Strontium	ANOVA	60	67	67	**0.033**	14.31	19.1	20.6	19.0	Included	**0.085**	0.982	**0.047**	-7%	-	8%
	ANOVA	60	66	66	**0.005**	12.87	19.1	20.7	18.8	Removed	**0.034**	0.873	**0.007**	-8%	-	10%
Tellurium	-	60	67	67	-	-	0.002	0.002	0.002	-	-	-	-	-	-	-
Thallium	KW test	60	67	67	**0.033**	-	0.00554	0.00478	0.00528	-	0.340	0.835	0.121	-	-	-
Tin	KW test	60	67	67	**<0.001**	-	0.070	0.020	0.020	-	**<0.001**	**<0.001**	0.463	248%	248%	-
Titanium	KW test	60	67	67	**<0.001**	-	0.05	0.10	0.10	-	**<0.001**	**<0.001**	0.591	-50%	-50%	-
Uranium	$ANOVA_{log}$	60	67	67	**<0.001**	0.035	0.00410	0.00418	0.00573	Included	0.966	**<0.001**	**<0.001**	-	-28%	-32%
	$ANOVA_{log}$	60	67	66	**<0.001**	0.033	0.00410	0.00418	0.00585	Removed	0.964	**<0.001**	**<0.001**	-	-30%	-34%
Vanadium	KW test	60	67	67	**<0.001**	-	0.010	0.020	0.020	-	**<0.001**	**<0.001**	0.942	-50%	-50%	-
Zinc	$ANOVA_{log}$	60	67	67	**<0.001**	0.009	43.9	49.4	52.3	Included	**0.009**	**<0.001**	0.319	-11%	-16%	-
	$ANOVA_{log}$	59	67	67	**<0.001**	0.009	43.4	49.4	52.3	Removed	**0.003**	**<0.001**	0.303	-12%	-17%	-
Zirconium	KW test	60	67	67	**<0.001**	-	0.02	0.02	0.02	-	**<0.001**	**<0.001**	0.933	0%	0%	-

Note: Statistically significant differences indicated in bold.

n = sample size; *P*-value = probability value; MSE = mean squared error; NF = Near-field area; RA1 = Reference Area 1; RA2 = Reference Area 2; K-W = Kruskal-Wallis; ANOVA = analysis of variance; log = log_{10} transformed data; < = less than; - = not applicable.

6.3.4.1 Comparison to Guidelines

Mercury concentrations in fish tissue of the Threespine Stickleback sampled from Meliadine Lake were below the Canadian Food Inspection Agency (CFIA) human consumption guideline of 0.5 mg/kg ww for commercial sale (CFIA 2014).

6.4 Normal Ranges

Provisional normal ranges were calculated for fish health and tissue chemistry parameters based on data collected from Threespine Stickleback and Lake Trout in the Near-field area in 2015 (Golder 2016a), and Threespine Stickleback collected from the reference areas in 2017. Provisional normal ranges are provided for:

- Threespine Stickleback and Lake Trout fish health parameters (Table 6.4-1)
- Threespine Stickleback metal concentrations in carcass tissue (Table 6.4-2)
- Lake Trout metal concentrations in muscle tissue (Table 6.4-3)
- Lake Trout metal concentrations in liver tissue (Table 6.4-4)
- Lake Trout metal concentrations in kidney tissue (Table 6.4-5)

Differences were observed between baseline data collected from the Near-field area and normal ranges for several Threespine Stickleback fish health and tissue chemistry parameters. Male Threespine Stickleback sampled from the Near-field area exceeded normal ranges for total length, total weight, carcass weight, condition factor, and liver somatic index. No differences in fish health parameters were observed for females. With respect to tissue chemistry parameters, arsenic and tin were elevated in the Near-field area, while chromium, iron, molybdenum, nickel, rubidium, and selenium were below normal ranges. As the Near-field area and reference areas were sampled in separate years, it could not be determined from the baseline data whether these differences reflect spatial or temporal differences in these parameters. Baseline deviations from normal range for Threespine Stickleback health and tissue chemistry parameters may need to be considered during future monitoring.

Table 6.4-1: Normal Ranges for Threespine Stickleback and Lake Trout Fish Health Parameters

Species	Sex	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
							Lower Bound	Upper Bound
THST	Female	Total Length (mm)	2015, 2017	106	0	PI	58.8	65.2
		Total Weight (g)	2015, 2017	105	1	PI	1.780	2.380
		Carcass Weight (g)	2015, 2017	106	0	PI	1.260	1.720
		Condition (CW)	2015, 2017	106	0	PI	0.58	0.63
		Condition (TW)	2015, 2017	106	0	PI	0.81	0.90
		Liver Somatic Index	2015, 2017	105	1	PI	3.02	3.95
		Gonadosomatic Index	2015, 2017	104	2	%ile	2.68	5.40
	Male	Total Length (mm)	2015, 2017	82	0	%ile	53.7	59.9
		Total Weight (g)	2015, 2017	82	0	PI	1.370	1.960
		Carcass Weight (g)	2015, 2017	82	0	PI	1.020	1.460
		Condition (CW)	2015, 2017	81	1	PI	0.61	0.66
		Condition (TW)	2015, 2017	82	0	PI	0.81	0.91
		Liver Somatic Index	2015, 2017	82	0	PI	2.51	3.38
		Gonadosomatic Index	2015, 2017	81	0	logPI	0.77	1.33

Species	Sex	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
							Lower Bound	Upper Bound
LKTR	Female	Fork Length (mm)	2015	32	0	PI	577	695
		Total Weight (g)	2015	32	0	logPI	2017	3371
		Carcass Weight (g)	2015	32	0	logPI	1729	2797
		Condition (CW)	2015	32	0	PI	0.84	0.95
		Condition (TW)	2015	32	0	PI	0.98	1.13
		Liver Somatic Index	2015	32	0	%ile	1.12	1.60
		Gonadosomatic Index	2015	32	0	%ile	0.88	6.46
	Male	Fork Length (mm)	2015	29	0	PI	516	636
		Total Weight (g)	2015	29	0	PI	1574	2854
		Carcass Weight (g)	2015	29	0	PI	1380	2497
		Condition (CW)	2015	29	0	PI	0.90	0.99
		Condition (TW)	2015	29	0	PI	1.01	1.13
		Liver Somatic Index	2015	29	0	PI	0.83	0.99
		Gonadosomatic Index	2015	29	0	%ile	0.80	2.28

THST = Threespine Stickleback; LKTR = Lake Trout; TW = calculated using total weight; CW = calculated using carcass weight; PI = prediction interval; logPI = prediction interval calculated using $\log_{10}$ transformed data; %ile = prediction interval calculated using percentiles.

Table 6.4-2: Normal Ranges for Threespine Stickleback Metal Concentrations in Carcass Tissue

Species	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
						Lower Bound	Upper Bound
THST	Moisture (%)	2015, 2017	192	2	PI	63.5	67.7
	Aluminum (mg/kg ww)	2015, 2017	190	4	%ile	1.1	3.2
	Antimony (mg/kg ww)	2015, 2017	190	4	%ile	0.0010	<0.0020
	Arsenic (mg/kg ww)	2015, 2017	192	2	PI	0.117	0.182
	Barium (mg/kg ww)	2015, 2017	194	0	logPI	4.33	6.05
	Beryllium (mg/kg ww)	2015, 2017	194	0	%ile	0.0010	<0.0020
	Bismuth (mg/kg ww)	2015, 2017	191	3	%ile	0.0010	<0.0020
	Boron (mg/kg ww)	2015, 2017	192	2	%ile	0.11	0.28
	Cadmium (mg/kg ww)	2015, 2017	191	3	logPI	0.0041	0.0075
	Calcium (mg/kg ww)	2015, 2017	193	1	PI	21593	28550
	Cesium (mg/kg ww)	2015, 2017	193	1	logPI	0.0170	0.0293
	Chromium (mg/kg ww)	2015, 2017	191	3	%ile	0.087	0.920
	Cobalt (mg/kg ww)	2015, 2017	191	3	logPI	0.0084	0.0156
	Copper (mg/kg ww)	2015, 2017	193	1	logPI	0.559	0.745
	Iron (mg/kg ww)	2015, 2017	192	2	%ile	16.0	29.6
	Lead (mg/kg ww)	2015, 2017	192	2	%ile	0.007	0.019
	Lithium (mg/kg ww)	2015, 2017	191	3	%ile	0.05	0.16
	Magnesium (mg/kg ww)	2015, 2017	194	0	PI	458	579
	Manganese (mg/kg ww)	2015, 2017	194	0	logPI	23.3	32.9
	Mercury (mg/kg ww)	2015, 2017	193	1	logPI	0.082	0.126
	Molybdenum (mg/kg ww)	2015, 2017	192	2	%ile	0.0172	0.0436
	Nickel (mg/kg ww)	2015, 2017	190	4	%ile	0.242	1.740
	Phosphorus (mg/kg ww)	2015, 2017	193	1	PI	12886	16490
	Potassium (mg/kg ww)	2015, 2017	193	1	PI	2506	2911
	Rubidium (mg/kg ww)	2015, 2017	194	0	PI	2.28	3.27
	Selenium (mg/kg ww)	2015, 2017	193	1	PI	0.490	0.619
	Silver (mg/kg ww)	2015, 2017	191	3	%ile	0.0007	0.0019
	Sodium (mg/kg ww)	2015, 2017	193	1	%ile	1218	1474
	Strontium (mg/kg ww)	2015, 2017	194	0	PI	16.8	22.3
	Tellurium (mg/kg ww)	2015, 2017	194	0	%ile	0.002	<0.004
	Thallium (mg/kg ww)	2015, 2017	192	2	logPI	0.00425	0.00648
	Tin (mg/kg ww)	2015, 2017	192	2	%ile	0.020	0.064

Species	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
						Lower Bound	Upper Bound
	Titanium (mg/kg ww)	2015, 2017	190	4	%ile	0.06	0.19
	Uranium (mg/kg ww)	2015, 2017	192	2	logPI	0.00335	0.00626
	Vanadium (mg/kg ww)	2015, 2017	190	4	%ile	0.011	0.023
	Zinc (mg/kg ww)	2015, 2017	194	0	logPI	41.1	57.4
	Zirconium (mg/kg ww)	2015, 2017	193	1	%ile	0.02	0.04
	Lipid Content (%)	2015, 2017	100	0	PI	3.63	6.92

THST = Threespine Stickleback; mg/kg ww = milligram per kilogram wet weight; PI = prediction interval; logPI = prediction interval calculated using log_{10} transformed data; %ile = prediction interval calculated using percentiles; < = less than.

Table 6.4-3: Normal Ranges for Lake Trout Metal Concentrations in Muscle Tissue

Species	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
						Lower Bound	Upper Bound
LKTR	Moisture (%)	2015	60	0	%ile	74.5	77.6
	Aluminum (mg/kg ww)	2015	59	1	%ile	0.20	0.58
	Antimony (mg/kg ww)	2015	60	0	%ile	0.0010	0.0028
	Arsenic (mg/kg ww)	2015	59	1	%ile	0.049	0.147
	Barium (mg/kg ww)	2015	59	1	%ile	0.005	0.015
	Beryllium (mg/kg ww)	2015	60	0	-	-	-
	Bismuth (mg/kg ww)	2015	60	0	-	-	-
	Boron (mg/kg ww)	2015	60	0	-	-	-
	Cadmium (mg/kg ww)	2015	58	2	%ile	0.0005	<0.0010
	Calcium (mg/kg ww)	2015	59	1	%ile	60.7	220.0
	Cesium (mg/kg ww)	2015	59	1	logPI	0.0380	0.0695
	Chromium (mg/kg ww)	2015	59	1	%ile	0.006	0.025
	Cobalt (mg/kg ww)	2015	59	1	%ile	0.0020	<0.0040
	Copper (mg/kg ww)	2015	60	0	PI	0.184	0.288
	Iron (mg/kg ww)	2015	59	1	logPI	1.95	3.37
	Lead (mg/kg ww)	2015	58	2	%ile	0.0020	0.0037
	Lithium (mg/kg ww)	2015	60	0	-	-	-
	Magnesium (mg/kg ww)	2015	60	0	%ile	261.00	299.00
	Manganese (mg/kg ww)	2015	59	1	logPI	0.071	0.115
	Mercury (mg/kg ww)	2015	59	1	logPI	0.3600	0.6990
	Molybdenum (mg/kg ww)	2015	60	0	%ile	0.0020	<0.0040
	Nickel (mg/kg ww)	2015	59	1	%ile	0.020	<0.040
	Phosphorus (mg/kg ww)	2015	60	0	PI	2386.0	2858.0
	Potassium (mg/kg ww)	2015	60	0	PI	4013.0	4678.0
	Rubidium (mg/kg ww)	2015	60	0	PI	6.150	9.450
	Selenium (mg/kg ww)	2015	60	0	PI	0.391	0.545
	Silver (mg/kg ww)	2015	60	0	-	-	-
	Sodium (mg/kg ww)	2015	59	1	logPI	236.0	298.0
	Strontium (mg/kg ww)	2015	59	1	%ile	0.037	0.211
	Tellurium (mg/kg ww)	2015	60	0	%ile	0.0020	0.0055
	Thallium (mg/kg ww)	2015	60	0	PI	0.00705	0.01070
	Tin (mg/kg ww)	2015	60	0	PI	0.038	0.074
	Titanium (mg/kg ww)	2015	59	1	%ile	0.015	0.042
	Uranium (mg/kg ww)	2015	60	0	-	-	-
	Vanadium (mg/kg ww)	2015	60	0	-	-	-
	Zinc (mg/kg ww)	2015	59	1	logPI	2.75	3.40
	Zirconium (mg/kg ww)	2015	60	0	-	-	-
	Lipid Content (%)	2015	59	1	logPI	0.73	2.48

LKTR = Lake Trout; mg/kg ww = milligram per kilogram wet weight; PI = prediction interval; logPI = prediction interval calculated using log_{10} transformed data; %ile = prediction interval calculated using percentiles; < = less than; - = not applicable.

Table 6.4-4: Normal Ranges for Lake Trout Metal Concentrations in Liver Tissue

Species	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
						Lower Bound	Upper Bound
LKTR	Moisture (%)	2015	60	0	PI	73.8	77.2
	Aluminum (mg/kg ww)	2015	59	1	logPI	0.51	2.27
	Antimony (mg/kg ww)	2015	59	1	%ile	0.0010	0.0025
	Arsenic (mg/kg ww)	2015	59	1	%ile	0.0693	0.1310
	Barium (mg/kg ww)	2015	59	1	%ile	0.005	0.012
	Beryllium (mg/kg ww)	2015	60	0	-	-	-
	Bismuth (mg/kg ww)	2015	59	1	%ile	0.0010	<0.0020
	Boron (mg/kg ww)	2015	60	0	-	-	-
	Cadmium (mg/kg ww)	2015	58	2	logPI	0.0810	0.1910
	Calcium (mg/kg ww)	2015	58	2	%ile	55.6	92.7
	Cesium (mg/kg ww)	2015	59	1	logPI	0.0249	0.0419
	Chromium (mg/kg ww)	2015	59	1	%ile	0.005	0.011
	Cobalt (mg/kg ww)	2015	59	1	logPI	0.0889	0.2470
	Copper (mg/kg ww)	2015	60	0	%ile	14.600	26.500
	Iron (mg/kg ww)	2015	60	0	logPI	87.30	374.00
	Lead (mg/kg ww)	2015	59	1	%ile	0.0020	0.0059
	Lithium (mg/kg ww)	2015	60	0	-	-	-
	Magnesium (mg/kg ww)	2015	60	0	PI	165.00	199.00
	Manganese (mg/kg ww)	2015	60	0	PI	1.530	2.030
	Mercury (mg/kg ww)	2015	59	1	logPI	0.3790	1.0200
	Molybdenum (mg/kg ww)	2015	60	0	PI	0.1410	0.2160
	Nickel (mg/kg ww)	2015	59	1	%ile	0.020	<0.040
	Phosphorus (mg/kg ww)	2015	60	0	PI	3498.0	4081.0
	Potassium (mg/kg ww)	2015	60	0	PI	3013.0	3736.0
	Rubidium (mg/kg ww)	2015	60	0	PI	6.990	11.200
	Selenium (mg/kg ww)	2015	59	1	PI	2.350	3.770
	Silver (mg/kg ww)	2015	59	1	%ile	0.1320	0.3380
	Sodium (mg/kg ww)	2015	60	0	PI	1034.0	1456.0
	Strontium (mg/kg ww)	2015	59	1	logPI	0.055	0.095
	Tellurium (mg/kg ww)	2015	58	2	%ile	0.0020	<0.0040
	Thallium (mg/kg ww)	2015	60	0	logPI	0.08380	0.15800
	Tin (mg/kg ww)	2015	59	1	%ile	0.027	0.053
	Titanium (mg/kg ww)	2015	59	1	%ile	0.013	0.038
	Uranium (mg/kg ww)	2015	58	2	%ile	0.00042	0.00211
	Vanadium (mg/kg ww)	2015	58	2	%ile	0.012	0.047
	Zinc (mg/kg ww)	2015	60	0	PI	29.80	37.70
	Zirconium (mg/kg ww)	2015	60	0	-	-	-
	Lipid Content (%)	2015	60	0	logPI	5.40	9.64

LKTR = Lake Trout; mg/kg ww = milligram per kilogram wet weight; PI = prediction interval; logPI = prediction interval calculated using log_{10} transformed data; %ile = prediction interval calculated using percentiles; < = less than; - = not applicable.

Table 6.4-5: Normal Ranges for Lake Trout Metal Concentrations in Kidney Tissue

Species	Parameter	Baseline Period	Sample Size	Outliers Removed	Calculation Method	Normal Range	
						Lower Bound	Upper Bound
LKTR	Moisture (%)	2015	60	0	%ile	81.2	83.6
	Aluminum (mg/kg ww)	2015	59	1	logPI	0.71	1.85
	Antimony (mg/kg ww)	2015	60	0	%ile	0.0034	0.0077
	Arsenic (mg/kg ww)	2015	59	1	%ile	0.1570	0.3900
	Barium (mg/kg ww)	2015	60	0	%ile	0.035	0.115
	Beryllium (mg/kg ww)	2015	60	0	-	-	-
	Bismuth (mg/kg ww)	2015	58	2	%ile	0.0010	0.0020
	Boron (mg/kg ww)	2015	60	0	-	-	-
	Cadmium (mg/kg ww)	2015	60	0	logPI	0.1890	0.4800
	Calcium (mg/kg ww)	2015	59	1	logPI	123.0	178.0
	Cesium (mg/kg ww)	2015	59	1	logPI	0.0210	0.0353
	Chromium (mg/kg ww)	2015	59	1	%ile	0.009	0.032
	Cobalt (mg/kg ww)	2015	60	0	logPI	0.0738	0.1540
	Copper (mg/kg ww)	2015	59	1	%ile	0.657	0.905
	Iron (mg/kg ww)	2015	59	1	logPI	94.00	165.00
	Lead (mg/kg ww)	2015	59	1	%ile	0.0020	0.0061
	Lithium (mg/kg ww)	2015	60	0	-	-	-
	Magnesium (mg/kg ww)	2015	60	0	PI	117.00	137.00
	Manganese (mg/kg ww)	2015	59	1	logPI	0.278	0.443
	Mercury (mg/kg ww)	2015	59	1	logPI	0.46	1.16
	Molybdenum (mg/kg ww)	2015	60	0	logPI	0.0392	0.0651
	Nickel (mg/kg ww)	2015	59	1	logPI	0.122	0.281
	Phosphorus (mg/kg ww)	2015	60	0	PI	2242.0	2623.0
	Potassium (mg/kg ww)	2015	60	0	PI	2294.0	2782.0
	Rubidium (mg/kg ww)	2015	60	0	PI	4.750	7.390
	Selenium (mg/kg ww)	2015	59	1	logPI	1.610	2.590
	Silver (mg/kg ww)	2015	59	1	%ile	0.0010	0.0028
	Sodium (mg/kg ww)	2015	60	0	PI	1770.0	2205.0
	Strontium (mg/kg ww)	2015	59	1	PI	0.244	0.395
	Tellurium (mg/kg ww)	2015	60	0	%ile	0.0043	0.0113
	Thallium (mg/kg ww)	2015	60	0	PI	0.02190	0.03360
	Tin (mg/kg ww)	2015	59	1	%ile	0.061	0.156
	Titanium (mg/kg ww)	2015	59	1	logPI	0.051	0.131
	Uranium (mg/kg ww)	2015	59	1	logPI	0.00080	0.00303
	Vanadium (mg/kg ww)	2015	59	1	%ile	0.010	0.026
	Zinc (mg/kg ww)	2015	60	0	PI	15.90	20.30
	Zirconium (mg/kg ww)	2015	60	0	-	-	-
	Lipid Content (%)	2015	59	0	logPI	2.98	6.20

LKTR = Lake Trout; mg/kg ww = milligram per kilogram wet weight; PI = prediction interval; logPI = prediction interval calculated using log_{10} transformed data; %ile = prediction interval calculated using percentiles; - = not applicable.

7.0 PLANKTON TARGETED STUDY

Plankton monitoring was conducted as a targeted study to evaluate if plankton will be a useful long-term monitoring tool for the Mine. The plankton study included sampling and analysis of depth-integrated nutrients, chlorophyll *a*, phytoplankton, and zooplankton over three years in Meliadine Lake (2015, 2016, and 2017) and two years in the peninsula lakes[4] (2015 and 2016). Samples were collected from multiple locations in each lake across several seasons and years to assess seasonal, temporal, and spatial variation in potential monitoring endpoints (e.g., plankton abundance, biomass, richness, and community composition). Compiled data from the plankton study were analyzed to characterize baseline plankton communities in Meliadine Lake and to evaluate the usefulness of plankton as a long-term monitoring tool.

This report section provides a summary of data collected during the 2015 to 2017 baseline plankton sampling programs in Meliadine Lake. Statistical analyses of spatial, temporal, and seasonal variability in the plankton community are presented. Analysis of nutrient concentrations in relation to effluent discharges in the Near-field exposure area are discussed, along with an analysis of potential effects on plankton abundance, distribution and community composition. The overall suitability of plankton as a monitoring tool is evaluated with recommendations for potential monitoring endpoints which could be utilized during future monitoring years.

7.1 Methods

The plankton baseline program consisted of three sampling events during open-water conditions in 2015, 2016 and 2017, and was based on the Meliadine AEMP design plan (Golder 2016b). The 2015 program specifically targeted the exposure areas of Meliadine Lake, with additional sampling in the peninsula lakes. The 2016 program targeted both exposure and reference areas of Meliadine Lake, with additional sampling in the peninsula lakes. The 2017 program targeted the exposure and reference areas of Meliadine Lake and included only chlorophyll *a* sampling in the peninsula lakes.

Sampling was conducted in July (late spring), August (summer), and September (fall) during each annual sampling program (Table 7.1-1), in conjunction with the water quality sampling program. Five stations were sampled in each of the Near-field (NF) and Mid-field (MF) exposure areas of Meliadine Lake in all years, and in three reference areas of Meliadine Lake in 2016 and 2017 only. Plankton samples in Meliadine Lake were collected from a target water depth of 8 to 10 m. Three stations in each of the peninsula lakes (A8, B7, and D7) were sampled in 2015 to 2017 from a target water depth of 1.5 to 2.5 m (Figure 1.1-2). Not all stations were consistently sampled during each field program. Weather conditions (e.g., fog, high winds) occasionally resulted in delays in the field programs and loss/damage of sampling equipment (i.e., plankton net) resulted in the inability to collect some zooplankton samples.

The plankton sampling program consisted of the following components:

- measurements of total water depth (m) and Secchi depth (m)
- collection of depth-integrated water samples for nutrient analysis (soluble reactive silica [SRSi], TN, and TP) from the euphotic zone (Meliadine Lake only)
- collection of chlorophyll *a* samples
- collection of phytoplankton and zooplankton samples

[4] Chlorophyll *a* was also sampled at the peninsula lakes in 2017

Table 7.1-1:Plankton Sampling Stations and Sampling Summary in Meliadine Lake

Waterbody	Area	Station	Depth (m)	NAD83, 15V		2015			2016			2017		
				Easting (m)	Northing (m)	Late Spring	Summer	Fall	Late Spring	Summer	Fall	Late Spring	Summer	Fall
Meliadine Lake	Near-field Exposure (MEL-01)	MEL-01-01	10.0	542690	6989132	DIN, Chl, P	DIN, Chl, P	DIN, P, QC-dup[a,b,c]	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]
		MEL-01-02	7.9	542665	6989282	DIN, Chl, P, QC-dup[a,b,c]	DIN, Chl, P	DIN, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
		MEL-01-03	9.5	542638	6988979	DIN, Chl, P,	DIN, Chl, P	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P, QC-dup[a]	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P	DIN, Chl, P
		MEL-01-04	8.8	543145	6989086	DIN, Chl, P	DIN, Chl, P	DIN,, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
		MEL-01-05	9.0	542140	6989358	DIN, Chl, P	DIN, Chl, P, QC-dup[a,b,c]	DIN, P	DIN, Chl, P[d], QC-dup[b,c]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P,	DIN, Chl, P	DIN, Chl, P
	Mid-field Exposure (MEL-02)	MEL-02-01	8.6	537511	6992932	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
		MEL-02-02	8.0	537093	6992642	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P
		MEL-02-03	9.1	537497	6992332	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
		MEL-02-04	7.7	537961	6992341	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]
		MEL-02-05	9.2	537831	6992692	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P	DIN, Chl, P, QC-dup[a]
	Reference Area 1 (MEL-03)	MEL-03-01	7.2	533317	6998541	-	-	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P	DIN, Chl, P
		MEL-03-02	18.8	533256	6998671	-	-	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P, QC-dup[a]	DIN, Chl, P	DIN, Chl, P, QC-dup[b,c]	DIN, Chl, P
		MEL-03-03	10.2	532962	6998844	-	-	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
		MEL-03-04	8.2	533628	6998672	-	-	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P, QC-dup[a]	DIN, Chl, P
		MEL-03-05	8.7	534001	6998272	-	-	-	DIN, Chl, P[d]	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P	DIN, Chl, P
	Reference Area 2 (MEL-04)	MEL-04-01	8.2	525647	7000878	-	-	-	-	DIN, Chl, P	-	-	DIN, Chl, P	-
		MEL-04-02	10.5	526149	7001519	-	-	-	-	DIN, Chl, P, QC-dup[a,b,c]	-	-	DIN, Chl, P	-
		MEL-04-03	9.7	525351	7001359	-	-	-	-	DIN, Chl, P	-	-	DIN, Chl, P	-
		MEL-04-04	9.1	525401	7001085	-	-	-	-	DIN, Chl, P	-	-	DIN, Chl, P	-
		MEL-04-05	7.4	525735	7001129	-	-	-	-	DIN, Chl, P	-	-	DIN, Chl, P	-
	Reference Area 3 (MEL-05)	MEL-05-01	9.3	530926	6990858	-	-	-	-	DIN, Chl, P, QC-dup[c]	-	-	DIN, Chl, P	-
		MEL-05-02	9.4	530669	6990884	-	-	-	-	DIN, Chl, P, QC-dup[a,b]	-	-	DIN, Chl, P, QC-dup[b,c]	-
		MEL-05-03	8.5	530735	6991374	-	-	-	-	DIN, Chl, P, QC-dup[c]	-	-	DIN, Chl, P	-
		MEL-05-04	10.2	530570	6991223	-	-	-	-	DIN, Chl, P, QC-dup[b]	-	-	DIN, Chl, P, QC-dup[a]	-
		MEL-05-05	8.6	530240	6991162	-	-	-	-	DIN, Chl, P	-	-	DIN, Chl, P	-

(a) DIN QC-dup samples.

(b) Phytoplankton QC-dup samples.

(c) Zooplankton QC-dup samples.

(d) Zooplankton samples were not collected during the late spring sampling program in 2016, because the plankton net was misplaced.

NAD = North American Datum; Chl = indicates that chlorophyll *a* samples were collected; DIN = indicates that depth-integrated nutrient samples were collected; N = mid-column nutrient samples were collected; P = plankton samples were collected; - = the site was not included in the sampling plan for a particular field program, or was not sampled due to weather, environment, or schedule limitations; QC-dup = indicates that a quality control duplicate sample was collected.

7.1.1 Field Methods

7.1.1.1 Supporting Environmental Variables, Nutrients, and Chlorophyll a

During the time of sampling, local weather data (i.e., air temperature, wind conditions, and rainfall) was collected. At each sampling station, water depth and physico-chemical measurements were recorded. Total depth of the water column was measured either by using a sounding line or a boat-mounted sonar unit. In situ physico-chemical measurements of specific conductivity, DO, pH, and water temperature were collected at each lake station using a submersible multi-sensor probe system (Hanna HI-9828 multiprobe). In situ physico-chemical measurements were taken just below the surface and every 1 m thereafter throughout the water column, ending at 1 m above the lake bed. Secchi depth was measured using a 20 cm diameter Secchi disk at each station; this information was used to estimate the euphotic zone depth for depth-integrated sample collection.

Depth-integrated composite samples were collected at all Meliadine Lake stations for analysis of chlorophyll *a* and nutrient concentrations. Given the shallow nature of the peninsula lakes, depth-integrated samples were not collected at these locations. Instead, discrete samples at mid-column depth were collected for analysis of chlorophyll *a* and nutrients.

The euphotic zone is defined as the extent of the water column that is exposed to sufficient sunlight for photosynthesis to occur (typically to a depth in the water column where 1% of the surface irradiance is measured). While in the field, the euphotic zone was calculated as two times the Secchi depth (Koenings and Edmundson 1991; AENV 2006).

Once the euphotic depth was determined, a Kemmerer sampler was used to collect discrete water samples starting at the surface, and continuing every 2 m through the extent of the euphotic zone. If the total water column depth was less than two times the Secchi depth, a water sample was collected every 2 m from the surface to 2 m above the lake bed.

Equal volumes of water from each discrete depth were combined into a large, clean bucket to create a composite, depth-integrated sample. From this composite sample, single sub-samples were collected for nutrient analysis, triplicate sub-samples were collected for chlorophyll *a* analysis, and a single subsample was taken for phytoplankton community analysis as described in Section 7.1.1.2.

Sample bottles for nutrient analysis were provided by ALS (Edmonton), which is an analytical laboratory accredited by CALA. Water samples were processed (i.e., filtered and/or preserved as required, and refrigerated) at site according to the instructions provided by ALS. Water samples requiring filtration were filtered through a 0.45 µm Millipore filter in a Nalgene filter tower, using a vacuum pump, before being preserved with laboratory-provided preservative based on the required analysis. Water samples were kept cool through refrigeration before shipping, and during shipping by adding ice-packs to the coolers. Samples were shipped to ALS as soon as possible after sample collection and processing.

Samples were analyzed for TN, dissolved nitrogen, total Kjeldahl nitrogen (TKN), dissolved Kjeldahl nitrogen, total ammonia, nitrate, nitrite, TP, dissolved phosphorus, dissolved orthophosphate, and SRSi.

Water samples for chlorophyll *a* analysis were collected at each station during all field programs. Measurement of chlorophyll *a* concentration in water is a standard method to estimate phytoplankton biomass. Chlorophyll *a* is the primary photosynthetic pigment in phytoplankton and is frequently used as an indicator of phytoplankton biomass and primary production.

Triplicate water samples for chlorophyll *a* analysis were filtered through a 47 mm diameter Whatman glass fiber type-C filter (nominal pore size: 1.2 µm) in a glass filter tower, using a vacuum pump under low light conditions to prevent photo-shock in the algal cells. A volume of 300 to 500 millilitres (mL) of water was filtered for each chlorophyll *a* sample. The filters were folded in half, placed in a pre-labelled Petri dish, wrapped with aluminum foil, and frozen. Frozen filters were submitted to the Biogeochemical Analytical Service Laboratory at the University of Alberta, Edmonton, Alberta, for spectrophotometric analysis of chlorophyll *a*.

7.1.1.2 Phytoplankton Collection

A single water sample for phytoplankton analysis (either depth-integrated [Meliadine Lake stations] or discrete samples [peninsula lake stations]) was used to fill a 250-mL amber Nalgene bottle. Phytoplankton samples were preserved with approximately 4 mL of Lugol's solution. Samples were sealed, labelled, and stored in the dark (inside coolers) for transportation to Plankton R Us, Winnipeg, Manitoba, for taxonomic identification (to the lowest practical taxonomic level), and abundance and biomass estimates.

7.1.1.3 Zooplankton Collection

Zooplankton samples were collected using a 30 cm diameter, 80 µm mesh Nitex zooplankton net with a detachable "dolphin" bucket having a screen mesh size of 73 µm. A single zooplankton sample was collected at each sampling station. At Meliadine Lake stations, vertical hauls were collected from the water column at an ascent rate of approximately 0.5 m/s, starting at approximately 1.5-m from bottom, being careful to avoid disturbing the bottom sediments. The haul depth for each station was recorded. Horizontal hauls, at a 1-m depth below the surface (for a horizontal tow length of 6 m), were used to collect samples from the peninsula lakes.

Zooplankton samples were not collected in July 2016 due to loss of the plankton net (Table 7.1-1).

Zooplankton samples were deposited into wide-mouth 250-mL clear Nalgene sample bottles, filling to approximately half full. Half of an Alka-Seltzer tablet was added to the sample bottle to prevent contortion of organisms from preservation shock, for easier identification. The samples were preserved on the day of sampling in the laboratory by doubling the sample volume with 10% phosphate-buffered formalin solution (i.e., if the zooplankton sample is 125 mL, then 125 mL of formalin was added, for a total sample volume of 250 mL).

Zooplankton samples were sealed, labelled and stored in coolers for transportation to Biologica Environmental Services in Victoria, British Columbia, taxonomic identification (to the lowest practical taxonomic level), and abundance and biomass estimates.

7.1.2 Laboratory Methods

Laboratory methods for nutrient analysis including the laboratory test code, laboratory test description and analytical method references are further described in the laboratory certificate of analysis (Attachment A). Laboratory procedures for chlorophyll *a* analysis include extraction, filtration and spectrophotometric analysis. Chlorophyll concentrations were calculated using the absorbencies at specified wavelengths and the original extraction and filtration volumes. Laboratory methods for phytoplankton and zooplankton enumeration, identification, and QA/QC procedures are further described in Appendix 7A.

7.1.3 Data Analysis

7.1.3.1 Depth-Integrated Samples

Descriptive statistics (i.e., minimum, median, maximum, mean, standard error, standard deviation) for depth-integrated nutrients and chlorophyll *a* were calculated to evaluate spatial and temporal data collected in Meliadine Lake. Where concentrations were below the detection limit (DL), the concentration was set to half the value of the DL for calculating summary statistics. The percentage of non-detect samples in the data set was reported for each parameter.

7.1.3.2 Trophic Status

Trophic status is a useful means of classifying lakes and can be used as an indicator to describe the productivity of a system. Trophic status of a waterbody can be evaluated by examining the concentrations of chlorophyll *a*, nutrients, and water transparency. Chlorophyll *a* is the primary photosynthetic pigment in phytoplankton, and is often used as a surrogate measure of phytoplankton biomass and production in lakes (Franklin et al. 2012). The essential nutrients necessary for phytoplankton growth are nitrogen, phosphorus, carbon, and for some groups (e.g., diatoms), silica. The primary nutrient that often limits phytoplankton growth in lakes is phosphorus (Schindler 1974); therefore, phosphorus is often used to establish the trophic status of lakes. Secchi depth (a measure of water transparency) can be used as a coarse surrogate of phytoplankton biomass, because in many waterbodies, Secchi depth is inversely related to phytoplankton biomass (Dodds and Whiles 2010); therefore, Secchi depth is also considered when evaluating trophic status.

The three main classes of trophic status are the following:

- oligotrophic (nutrient-poor, unproductive systems)
- mesotrophic (moderately productive systems)
- eutrophic (nutrient-rich, highly productive systems)

The trophic status of Meliadine Lake was evaluated by examining the nutrient data (TP), chlorophyll *a* concentrations, and water transparency (Secchi depth). The trophic status was determined using the Vollenweider (1970) trophic classification scheme for lakes (Table 7.1-2), the CCME (2004) trigger ranges (Table 7.1-3), and the Carlson (1977) Trophic State Index (TSI; Table 7.1-4). Of the three commonly used variables to calculate TSI, chlorophyll *a* is considered the best predictor of the overall trophic status of lakes (Carlson and Simpson 1996). As a result, the overall trophic status of Meliadine Lake was determined using the TSI value calculated based on chlorophyll *a* concentrations, and this classification was supported by TSI values calculated based on nutrient availability (TP) and water transparency.

Table 7.1-2:General Trophic Classification of Lakes

Trophic Status	Total Phosphorus (mg/L)		Chlorophyll *a* (µg/L)		Secchi Depth (m)	
	Mean	Range	Mean	Range	Mean	Range
Oligotrophic	0.008	0.003 to 0.018	1.7	0.3 to 4.5	9.9	5.4 to 28.3
Mesotrophic	0.027	0.011 to 0.096	4.7	3.0 to 11.0	4.2	1.5 to 8.1
Eutrophic	0.084	0.016 to 0.386	14.3	3.0 to 78.0	2.5	0.8 to 7.0

Source: Vollenweider 1970.

mg/L = milligrams per litre; µg/L = micrograms per litre.

Table 7.1-3:Trophic Classification of Canadian Lakes Based on Total Phosphorus Trigger Ranges

Trophic Status	Total Phosphorus (mg/L)
Ultra-oligotrophic (very nutrient-poor)	<0.004
Oligotrophic (nutrient-poor)	0.004 to 0.010
Mesotrophic (containing a moderate level of nutrients)	0.010 to 0.020
Meso-eutrophic (containing moderate to high levels of nutrients)	0.020 to 0.035
Eutrophic (nutrient-rich)	0.035 to 0.100
Hyper-eutrophic (very nutrient-rich)	>0.100

Sources: CCME 2004; Environment Canada 2004.

mg/L = milligrams per litre; <= less than; >= greater than.

The TSI is a numerical trophic state index for lakes that classifies lakes on a scale of 0 to 100 (Carlson 1977). The index number is calculated from Secchi depth, chlorophyll *a*, and TP using the following equations (Carlson 1977):

$$TSI\ (TP)\ =\ 10\left(6\ -\ \frac{\ln\frac{48}{TP}}{\ln 2}\right)$$ Equation 1

$$TSI\ (Chl)\ =\ 10\left(6 - \frac{2.04-0.68\ln Chl}{\ln 2}\right)$$ Equation 2

$$TSI\ (Secchi)\ =\ 10\left(6 - \frac{\ln Secchi}{\ln 2}\right)$$ Equation 3

where:

- TSI = trophic state index
- TP = total phosphorus
- ln = the natural log
- Chl = chlorophyll *a*
- Secchi = Secchi depth

Values calculated using these equations are multiplied by 10 to give the scale a range of 0 to 100. The numerical scales for each of the three TSIs are presented in Table 7.1-4.

Table 7.1-4:Comparison of Trophic State Index Classification and General Trophic Classification of Lakes

Trophic State Index	Total Phosphorus (mg/L)	Chlorophyll *a* (µg/L)	Secchi Depth (m)	General Trophic Classification
<30 to 40	0 to 0.012	0 to 2.6	>8.0 to 4	Oligotrophic
40 to 50	0.012 to 0.024	2.6 to 20	4 to 2	Mesotrophic
50 to 70	0.024 to 0.096	20 to 56	2 to 0.5	Eutrophic
70 to 100+	0.096 to 0.38+	56 to 155+	0.5 to <0.25	Hyper-eutrophic

Source: Carlson 1977.

mg/L = milligrams per litre; µg/L = micrograms per litre; < = less than; > = greater than.

7.1.3.3 Phytoplankton and Zooplankton

Phytoplankton and zooplankton data were analyzed separately, but the same approach was used for both datasets. The following variables were calculated for each sample:

- total abundance (abundance as organisms per litre [org/L])
- total biomass (biomass as milligrams per cubic metre [mg/m^3])
- total taxonomic richness (richness as number of taxa [no. of taxa] at a station)
- relative abundances (as percentages) of major taxonomic groups
- relative biomass (as percentages) of major taxonomic groups

Abundance and biomass data were divided into major taxonomic groups. Phytoplankton groups were Cyanobacteria, Chlorophyceae (chlorophytes), Chrysophyceae (chrysophytes), Cryptophyceae (cryptophytes), Dinophyceae (dinoflagellates), Bacillariophyceae (diatoms), and Euglenophyceae (euglenoids). Zooplankton groups were Cladocera (cladocerans), Calanoida (calanoid copepods), Cyclopoida (cyclopoid copepods), Rotifera (rotifers), and copepod nauplii. Cyclopoid and calanoid copepods were considered separately because of taxonomic and ecological differences. Copepod nauplii were not identified as either cyclopoid or calanoid copepods, but occurred in high abundances in certain samples; therefore, they were treated as a unique taxonomic group for plotting purposes.

Mean total abundance and mean total biomass were calculated for each area (e.g., Near-field exposure area) and plotted as bar graphs showing mean and standard error (SE). Zooplankton abundance and biomass (wet weight) values were corrected for volume of water filtered, based on haul depth or length and net dimensions, to obtain comparable values across stations.

Mean taxonomic richness at the species level was summarized for each area and plotted as a bar graph for both phytoplankton and zooplankton. Taxonomic richness provides an indication of the diversity at a station; higher richness values typically indicate more healthy and balanced communities. For stations where duplicate QC samples were collected, total taxonomic richness was calculated as the average richness of the two duplicate samples.

7.1.3.4 Spatial and Temporal Trends

Nutrient concentrations, chlorophyll *a,* and plankton community variables were compared visually among-areas by season and year to explore seasonal, inter-annual and spatial trends. The following variables were plotted for each area and sampling event:

- mean total nitrogen and total phosphorus concentrations
- mean chlorophyll *a* concentration
- mean total phytoplankton and zooplankton abundance and biomass
- total nitrogen, total phosphorus and chlorophyll a concentrations, plotted for each station in the Near-field area
- mean total phytoplankton and zooplankton richness
- mean relative proportion accounted for by each major taxonomic group, based on abundance and biomass, plotted as stacked bars (for phytoplankton and zooplankton)

Scatter plots were used to evaluate the strength of the relationship between chlorophyll *a* concentrations and phytoplankton biomass, and to evaluate the spatial variability of each variable against concentrations of depth-integrated nutrients.

7.1.3.5 Statistical Analysis

The objective of the statistical comparisons of plankton data collected in Meliadine Lake was to compare data collected from the Near-field exposure area (MEL-01) with the Mid-field exposure area (MEL-02) and the three reference areas (MEL-03, MEL-04, and MEL-05). Descriptive statistics (i.e., minimum, maximum, median, mean, standard deviation, standard error) were calculated to compare and evaluate spatial and temporal data collected in Meliadine Lake. Hypothesis testing (e.g., one-way ANOVA or Kruskal-Wallis test) was used to compare plankton endpoints (e.g., abundance, biomass, richness) and nutrient and chlorophyll *a* concentrations among sampling areas, years, and seasons. Multivariate analysis (nMDS) was also used to investigate differences in community structure among areas. Statistical tests were performed using SYSTAT 13.1 for Windows (Systat Software 2009) or PRIMER version 7.0.13 software (Quest Research 2017).

Hypothesis Testing

Univariate hypothesis testing was used to identify differences in plankton community endpoints among areas and years. A significance level (alpha, α) of 0.1 was used for analysis of variance models, and an α of 0.05 was used for testing statistical assumptions (i.e., normality and homogeneity of variances). Prior to conducting ANOVAs, the assumptions of parametric statistical tests were verified using the Shapiro-Wilk test for normality and Levene's test for homogeneity of variances on untransformed and log-transformed data. Data that violated assumptions of normality or equality of variances were transformed and the effectiveness of the transformations was verified. If the assumptions of the ANOVA were not met, the non-parametric equivalent of ANOVA (i.e., Kruskal-Wallis test) was used.

Mean values for each parameter from the exposure and reference areas were initially compared to one another in an overall ANOVA. Tukey's honestly significant difference (HSD) method was used for multiple unplanned (i.e., *a posteriori*) comparisons following the overall ANOVA. This test adopts a conservative approach by employing experiment-wise error rates for the Type I error (Day and Quinn 1989). Therefore, a *P* value of 0.1 was used for these tests.

For variables that did not meet parametric test assumptions (e.g., chlorophyll *a*), the Kruskal-Wallis test was used to test for differences among sampling areas. Kruskal-Wallis tests were considered significant at $P < 0.1$. The multiple-comparison procedure controls the experiment wise error rates for the Type I error and, therefore, holds the probability of correctly finding no difference at 1–α. However, under this scenario, the task of correctly detecting differences that are significant is more difficult (Daniel 1990). To maintain a sufficiently small Type II error (β) with the multiple comparisons, a larger α (or *P*-value) was used. The contrasts were tested at $P = 0.1$, and the multiple comparisons were conducted with $P = 0.15$.

Multivariate Analysis

Non-metric multidimensional scaling (nMDS), a multivariate ordination technique, was used to investigate differences in plankton community structure among areas in 2016 and 2017. nMDS takes a pair-wise matrix of similarities among cases calculated from the original taxonomic data (biomass by station-year), and then reduces it to a small number of underlying dimensions of variation among cases. In this way, nMDS can visually simplify a multidimensional taxonomic data-set in two or three dimensions that capture the major patterns of variation in community composition.

The plankton taxonomic data were analyzed at the lowest taxonomic level. A square root transformation was applied to improve the separation of the data among stations on the nMDS plots. Transforming the data also reduced weighting of the analysis by the most abundant taxa. The appropriate data transformation was determined by examining "shade plots" created in PRIMER. Alternative data transformations were explored; however, stronger transformations (i.e., fourth-root and Log X+1 transformations), heavily down-weighted the data.

Following the data transformation, a Bray-Curtis resemblance matrix was generated, and the nMDS procedure was applied to this matrix. Using rank order information, nMDS determined the relative positions of stations in two dimensions based on community composition. Goodness-of-fit was determined by examining the Shepard diagrams as well as the stress values, which were calculated from the deviations in the Shepard diagrams. Two dimensions were selected for each nMDS after confirming that the final stress value of the two-dimensional configuration was sufficiently low (less than 0.2; Clarke 1993). Points that fall close together on the nMDS ordination plot represent samples with similar community composition; points that are far apart from each other represent samples with dissimilar community composition.

7.2 Quality Assurance and Quality Control

The QA/QC practices applied during this study and detailed results of the QC analyses are provided in Appendix 7A. Quality assurance (QA) components of the program included the use of trained personnel and an accredited analytical laboratory; QC components included assessments of duplicate samples for DIN, phytoplankton, and zooplankton. A summary of key QC results is provided below.

Key QC findings for the 2015 to 2017 plankton monitoring programs are as follows:

- Nutrients and Chlorophyll *a*:
  - A total of 9% of paired concentrations in duplicate DIN samples had a relative percent difference (RPD) greater than 20%. Each of the three RPD exceedances came from duplicate samples collected at MEL-02-05 in September 2017, where RPDs for concentrations of nitrate, and total and dissolved nitrogen, exceeded 20%. DIN samples at most stations in September 2017 had notably higher concentrations of nitrogen than during any other sampling event; results of the QA/QC analyses suggest that elevated nitrate and total nitrogen concentrations should be interpreted with caution, as analyses of these parameters show some variability.
  - All RPDs for the other two sets of DIN duplicate samples collected in 2017 were below 20%.
  - Concentrations of dissolved parameters were generally lower than corresponding total concentrations for the DIN samples. Dissolved concentrations were higher than total concentrations for 1.2% of comparisons.
  - RPDs for total phosphorus concentrations in 2017 were below 20% in all samples.
  - Chlorophyll *a* samples collected in September 2017 were collected using a different type of filter than during previous sampling events. The analytical laboratory was able to analyze chlorophyll *a* concentrations from the filters submitted in September 2017; however, the lab noted that the difference in the filter used may have affected the results of the analysis. As a result, chlorophyll *a* data from the September 2017 sampling event was omitted from statistical analyses presented in this report.
- Phytoplankton:
  - The dominant taxon was consistent between duplicate samples for phytoplankton biomass and abundance.
  - RPDs for total phytoplankton biomass and abundance were below 50% for all duplicates.
  - RPDs above 50% were observed in the majority of duplicates for major phytoplankton taxonomic groups; however, graphical presentation of the relative abundance of major phytoplankton groups showed that variation between duplicates was actually low and that the proportions of major groups were similar between duplicates.
  - Data screening of the phytoplankton taxonomic results identified taxonomic richness in the sample collected in MEL-02-02 in July 2016 to be unusually low. The inconsistency of this sample compared to all other stations in both years suggests a potential error during field collection or processing of this sample.
- Zooplankton:
  - The dominant taxon was consistent between duplicate samples for zooplankton biomass and abundance in 17 of the 20 duplicate samples. In three samples, different taxa were dominant by biomass or abundance between replicate samples; however, RPDs between biomass and abundance estimates for each duplicate sample were below 50% in each case.
  - RPDs for total zooplankton biomass and abundance were below 50% for all duplicates.

- RPDs above 50% were observed in the majority of duplicates for major zooplankton taxonomic groups; however, graphical presentation of the relative abundance of major zooplankton groups showed that variation between duplicates was actually low and that the proportions of major groups were similar between duplicates.

Differences between original and QC samples were deemed minor, and within the range of variability expected in plankton data. Based on this assessment, the plankton monitoring data are considered adequate to meet the needs of the AEMP for the Mine.

7.3 Results and Discussion

The results from the plankton sampling programs completed in Meliadine Lake in 2015 to 2017 are summarized in Sections 7.3.1 to 7.3.4. Chlorophyll *a* sampling results in the peninsula lake are summarized in Section 3.3.2.3. Results from previous sampling programs in the peninsula lakes in 2015 and 2016 were presented in *Aquatic Effects Monitoring Program – 2016 Annual Report* (Golder 2017a). Detailed results are provided in the following appendices:

- Appendix 7B: Depth-Integrated Nutrients and Chlorophyll *a*
- Appendix 7C: Trophic Status
- Appendix 7D: Phytoplankton Community Results
- Appendix 7E: Zooplankton Community Results

7.3.1 Depth-Integrated Nutrients and Chlorophyll *a*

Depth-integrated nutrient and chlorophyll *a* results for samples collected from Meliadine Lake in 2015 to 2017 are provided in Appendix 7B. Summary statistics (count, minimum, median, mean, maximum, standard error, standard deviation) for depth-integrated nutrients are provided in Tables 7B-1 to 7B-3. Summary statistics for chlorophyll *a* are provided in table 7B-4. Raw data for depth-integrated nutrients and chlorophyll *a* are provided in are provided in Tables 7B-5 and 7B-6 respectively.

In general, concentrations of most depth-integrated nutrients were low, with few observable spatial or temporal trends. Concentrations of TN were low in most samples; however, TN was notably higher in samples collected in September 2017 than in other seasons and years (Figure 7.3-1). In 2017, TN ranged from a mean concentration of 0.30 mg-N/L (MEL-03) to 0.31 mg-N/L (MEL-01) in September, compared to a range of 0.12 mg-N/L (MEL-03) to 0.22 mg-N/L (MEL-01) in August and 0.12 mg-N/L (MEL-03) to 0.18 mg-N/L (MEL-01) in July. In September 2017, TN concentrations were relatively similar among the reference and exposure areas, suggesting that TN concentrations may have been naturally elevated in Meliadine Lake during the time of sampling. TN concentrations in 2015 and 2016 were generally slightly lower at most stations than in 2017 with no discernible trend among years or stations in July or August.

Concentrations of TP were generally above detection limits but low throughout the lake in 2015, 2016 and 2017 (Figure 7.3-2). Some variability in TP concentrations was observed across sampling areas and seasons, but no consistent trends were apparent. Across all years, TP concentrations ranged from a mean concentration of 0.0043 mg-P/L (MEL-03) to 0.0068 mg-P/L (MEL-01) in July, from 0.0036 mg-P/L (MEL-05) to 0.0072 mg-P/L (MEL-02) in August, and from 0.0046 mg-P/L (MEL-02) to 0.0072 mg-P/L (MEL-01) in September.

Concentrations of nitrate, nitrite, ammonia, and orthophosphate were below detection limits in the majority of samples collected in 2015, 2016 and 2017. Minor spatial differences were observed in silica concentrations throughout Meliadine Lake, with the highest median concentrations in the Near-field area in July 2017 (0.6 mg/L) and August 2017 (0.55 mg/L) and slightly lower concentrations in the reference areas where the highest median concentration of silica across all seasons and years reached 0.26 mg/L.

Chlorophyll *a* concentrations varied among years in the majority of areas in Meliadine Lake; however, some consistent seasonal and spatial trends were observed (Figure 7.3-3). In July, chlorophyll *a* in the Near-field area was higher in 2015 (2.3 ± 0.07 μg/L) than in 2016 (1.9 ± 0.05 μg/L) and 2017 (1.5 ± 0.09 μg/L), with a similar trend observed in the Mid-field exposure area. In 2016 and 2017, chlorophyll *a* concentrations were higher in the exposure areas than in Reference Area 1, where chlorophyll *a* had a mean concentration of 1.0 ± 0.02 μg/L and 0.5 ± 0.03 μg/L respectively. In August, chlorophyll *a* concentrations were variable among years, with concentrations highest in 2016 in most areas, and among the exposure and reference areas with higher concentrations in the Near-field exposure area than in the reference areas in 2016 and 2017. Chlorophyll *a* concentrations in August 2016 ranged from a high of 1.9 ± 0.07 μg/L at MEL-01 to a low of 0.7 ± 0.03 μg/L at MEL-03. In August 2017, concentrations ranged from a high of 1.3 ± 0.2 μg/L at MEL-01 to a low of 0.6 ± 0.02 μg/L at MEL-03. Chlorophyll *a* in September was highly variable among years in the Near-field exposure area and relatively consistent in the Mid-field exposure area and the reference area. Concentrations ranged from 2.0 ± 0.05 μg/L at MEL-01 to 1.0 ± 0.08 μg/L at MEL-03 in 2016 and from 1.2 ± 0.1 μg/L at MEL-02 to 0.6 ± 0.02 μg/L at MEL-01 in 2017.

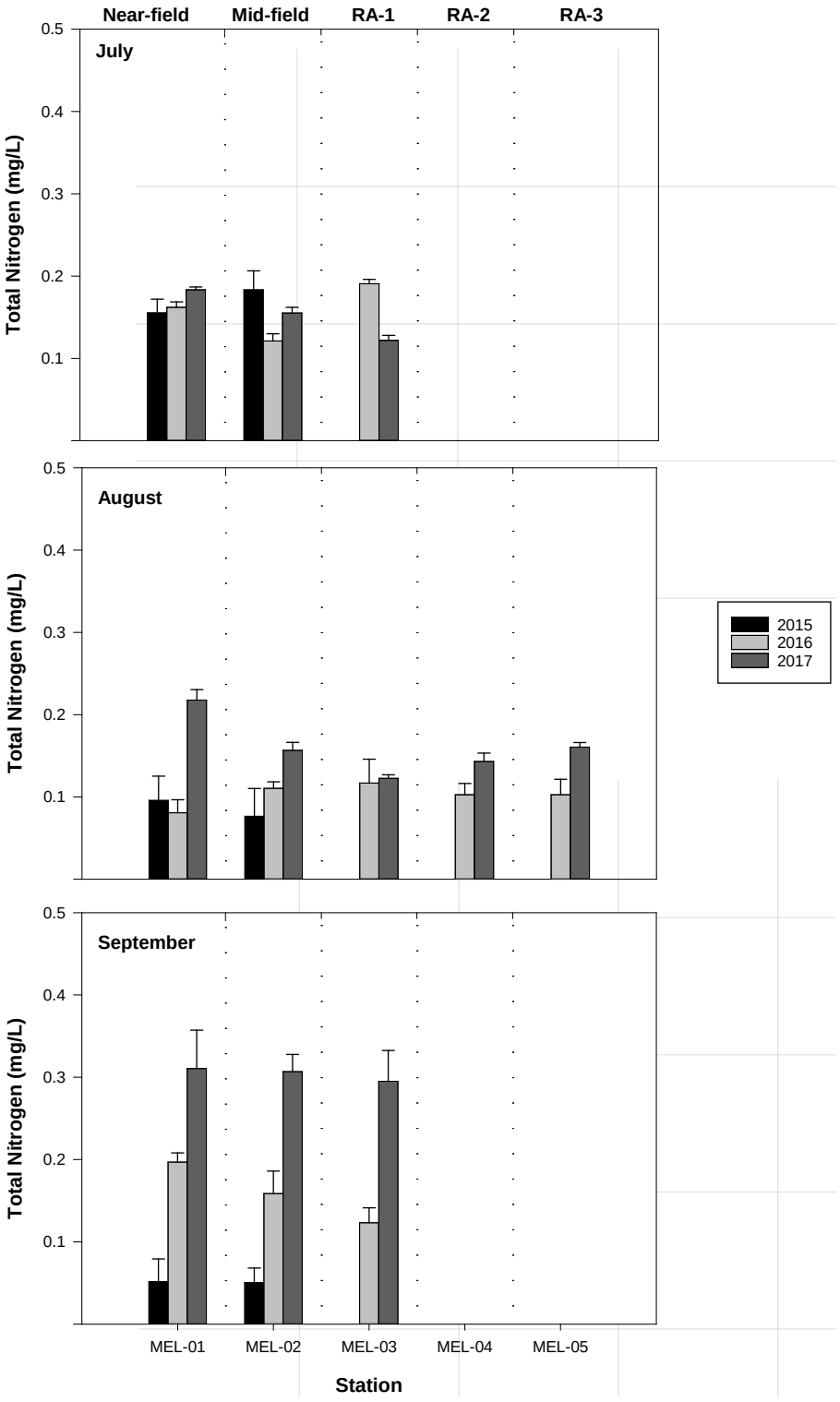

Figure 7.3-1: Mean Total Nitrogen Concentrations in Meliadine Lake, 2015 - 2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September.

RA=Reference Area; mg/L = milligrams per litre.

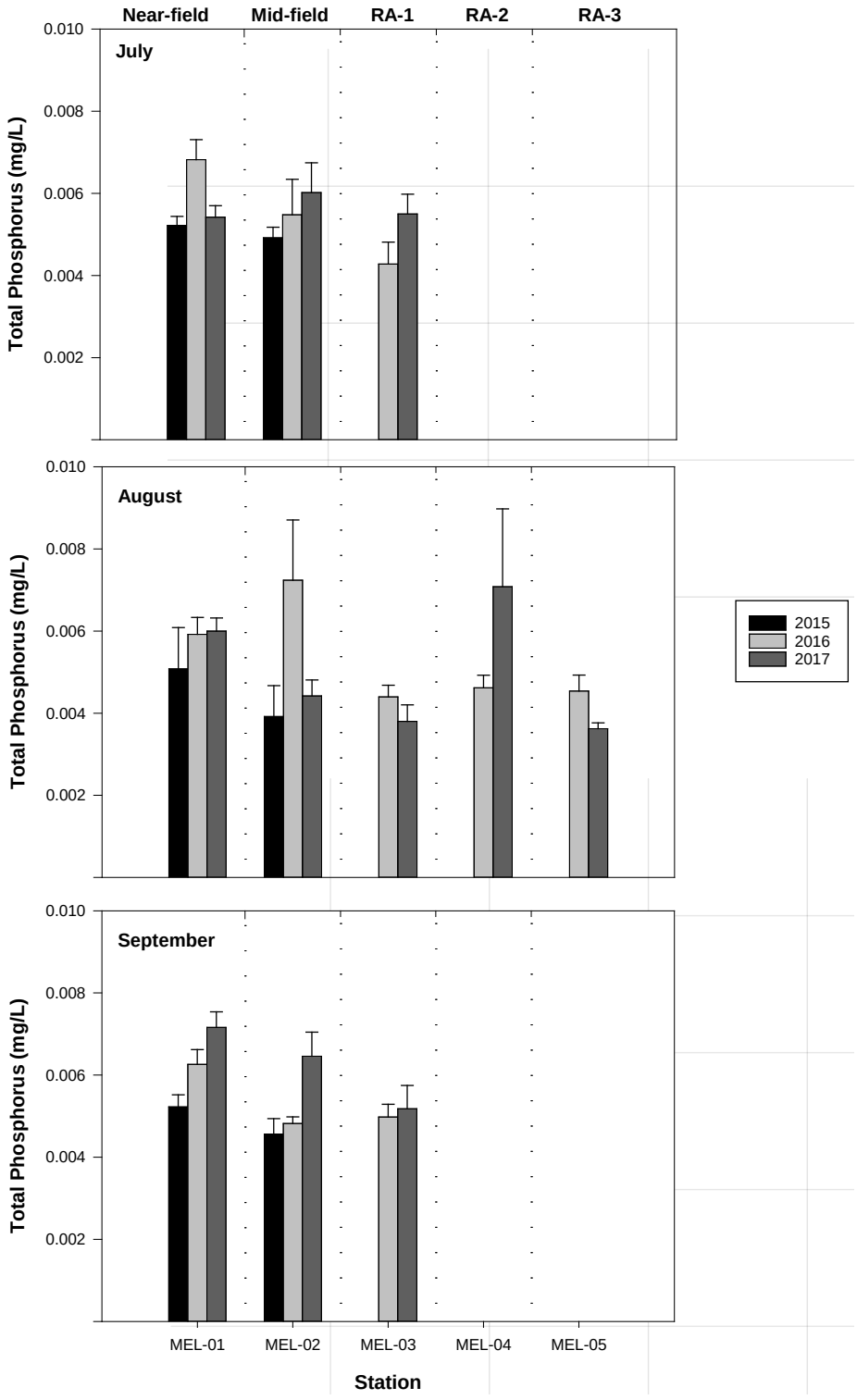

Figure 7.3-2: Mean Total Phosphorus Concentrations in Meliadine Lake, 2015 – 2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September.

RA=Reference Area; mg/L = milligrams per litre.

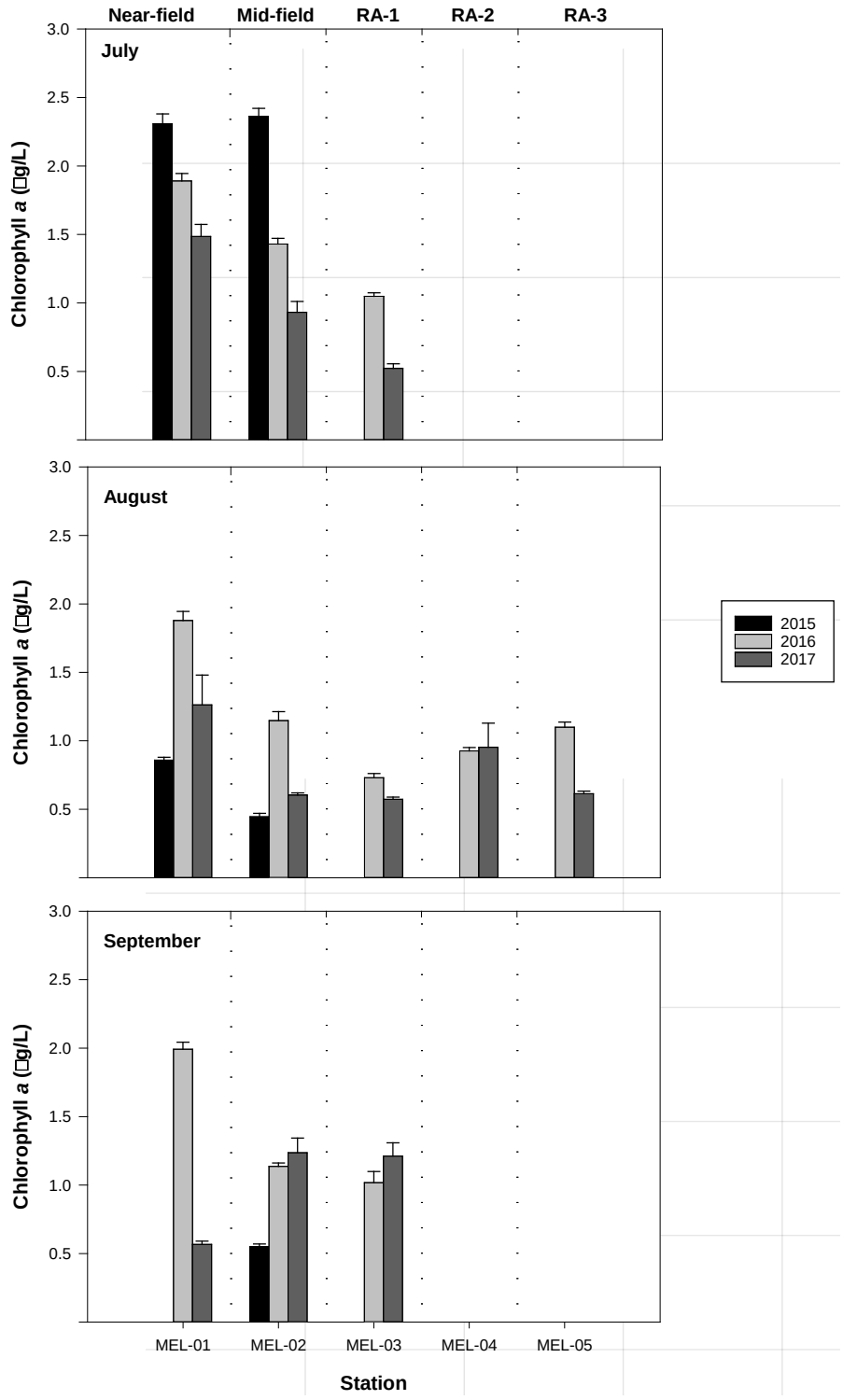

Figure 7.3-3: Mean Chlorophyll *a* Concentrations in Meliadine Lake, 2015 – 2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September. RA=Reference Area; µg/l = micrograms per litre. September 2917 samples were collected with different filters and are not directly comparable to other samples.

7.3.1.1 Statistical Comparisons of Nutrients and Chlorophyll a

Statistical comparisons of depth-integrated nutrients and chlorophyll *a* concentrations were made among years for each sampling area and season Table 7.3-1. Variability among years in all seasons and areas was generally high for concentrations of total nitrogen, total phosphorus, and chlorophyll *a*. Significant differences were observed among years for each variable in at least one area within each season. Several seasonal and annual trends were also evident in nutrient and chlorophyll *a* concentrations in the Near-field and Mid-field exposure areas, for which three years of sampling allowed pairwise comparisons between years (Table 7.3-2).

Table 7.3-1: Results of Statistical Analysis for Nutrients and Chlorophyll a Comparing Years

Station	Variable	Transformation	Statistical Test	July	August	September
				P-value	*P-value*	*P-value*
MEL-01	Total Nitrogen	log(x)	ANOVA	0.187	**0.001**	**<0.001**
	Total Phosphorus	log(x)	ANOVA	**0.014**	0.560	**0.011**
	Chlorophyll *a*	none	ANOVA / t-test	**<0.001**	**<0.001**	**<0.001**
MEL-02	Total Nitrogen	log(x)	ANOVA	**0.035**	**0.052**	**<0.001**
	Total Phosphorus	log(x)	ANOVA	0.525	**0.070**	**0.014**
	Chlorophyll *a*	none	ANOVA	**<0.001**	**<0.001**	**<0.001**
MEL-03	Total Nitrogen	log(x)	t-test	**<0.001**	0.814	**0.004**
	Total Phosphorus	log(x)	t-test	0.129	0.261	0.767
	Chlorophyll *a*	none	t-test	**<0.001**	**<0.001**	**<0.001**
MEL-04	Total Nitrogen	log(x)	t-test	-	**0.048**	-
	Total Phosphorus	log(x)	t-test	-	0.266	-
	Chlorophyll *a*	none	t-test	-	**<0.001**	-
MEL-05	Total Nitrogen	log(x)	t-test	-	0.035	-
	Total Phosphorus	log(x)	t-test	-	0.076	-
	Chlorophyll *a*	none	t-test	-	**<0.001**	-

Note: *P*-values representing significant differences among years (*P*<0.1) are **bolded.**

ANOVA= Analysis of Variance; t-test= Two-sample t-test; *P*-value = probability value; < = less than; - = no samples collected.

Results of statistical analyses for comparisons of nutrients and chlorophyll *a* concentrations among years are summarized below:

- Total nitrogen concentrations were significantly different among years in all areas except in MEL-01 in July and MEL-03 and MEL-05 in August (Table 7.3-1). A significant trend of increasing total nitrogen was observed in each exposure area in September, along with a significant increase in nitrogen from previous years in August 2017 in the Near-field exposure area (Table 7.3-2).
- Total phosphorus concentrations were less variable among years, but significantly different in MEL-01 in July, MEL-02 in August, and MEL-01 and MEL-02 in September (Table 7.3-1). Concentrations of total phosphorus significantly increased from previous years in September 2017 in each exposure area, while total phosphorus in July was significantly higher in 2016 than in 2015 or 2017 (Table 7.3-2).
- Chlorophyll *a* concentrations were significantly different among years within all areas in July, August and September (Table 7.3-1). Chlorophyll *a* concentrations significantly decreased in July from 2015 to 2017 in the Near-field and Mid-field exposure areas (Table 7.3-2). In August, chlorophyll *a* was significantly higher in 2016 than in 2015 or 2017 and in September chlorophyll *a* was significantly lower in 2015 than in 2016 or 2017 in the Mid-field exposure area.

Table 7.3-2: Pairwise Comparisons for Statistical Analyses of Nutrients and Chlorophyll *a* Comparing Years

Year	Variable	Trans-formation[(a)]	Statistical Test	July			August			September		
				2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
MEL-01	Total Nitrogen	log(x)	ANOVA / Tukey's	0.887	0.184	0.362	0.882	**0.004**	**0.002**	**0.007**	**<0.001**	**0.042**
	Total Phosphorus	log(x)	ANOVA / Tukey's	**0.018**	0.914	**0.038**	0.645	0.593	0.996	0.156	**0.008**	0.199
	Chlorophyll *a*	none	ANOVA / Tukey's	**0.002**	**<0.001**	**0.001**	**<0.001**	**<0.001**	**<0.001**	–	–	–
MEL-02	Total Nitrogen	log(x)	ANOVA / Tukey's	**0.028**	0.414	0.252	0.455	**0.042**	0.315	**0.010**	**<0.001**	**0.002**
	Total Phosphorus	log(x)	ANOVA / Tukey's	0.827	0.495	0.837	**0.079**	0.930	0.145	0.897	**0.018**	**0.039**
	Chlorophyll *a*	none	ANOVA / Tukey's	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.026**	**<0.001**	**<0.001**	**<0.001**	0.904

(a) Distributions of all variables violated the assumption of normality even after transformation; however, the results are considered reliable as the assumption of equal variances was not violated and ANOVA is robust against violations of the assumption of normality.

Note: *P*-values representing significant differences between years ($P<0.1$) are **bolded.**

ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; *P*-value = probability value; < = less than; - = September samples omitted from statistical analysis due to use of different filter type.

Samples collected during the August sampling event were carried forward for further evaluation of spatial variability among the five areas of Meliadine Lake. Data collected in 2015 was omitted from statistical comparisons among areas in Meliadine Lake due to a lack of sampling in the reference areas. Differences observed in the concentrations of total nitrogen, total phosphorus, and chlorophyll *a* in August 2016 and August 2017 in Meliadine Lake are summarized below:

- In 2016, total nitrogen concentrations were not significantly different among any of the five sampling areas ($P = 0.695$) (Table 7.3-3). In 2017, total nitrogen was significantly higher in the Near-field exposure area than in the Mid-field and reference areas. Significant differences in nitrogen concentrations were also observed between MEL-02 and MEL-03, and between MEL-03 and MEL-05 in 2017.
- Total phosphorus concentrations varied significantly overall among areas in 2016 ($P = 0.051$) and 2017 ($P = 0.054$); however few significant differences were observed in pairwise comparisons between areas (Table 7.3-3). Significant differences were only observed between MEL-02 and MEL-03 in 2016, and between MEL-04 and MEL-05 in 2017.
- Chlorophyll *a* concentrations were significantly different among areas in both 2016 and 2017 (Table 7.3-3). Pairwise comparisons revealed that chlorophyll *a* concentrations were significantly different between all areas except between MEL-02 and MEL-05 in 2016. In 2017, the Near-field exposure area was significantly higher compare to other areas and there was no significant difference among any of the other areas.

Table 7.3-3: Results of Statistical Analysis and Pairwise Comparisons for Nutrients and Chlorophyll *a* Comparing Areas, August 2016-2017

Year	Variable	Transform[(a)]	Statistical Test	Overall Comparison	MEL-01 / MEL-02	MEL-01 / MEL-03	MEL-01 / MEL-04	MEL-01 / MEL-05	MEL-02 / MEL-03	MEL-02 / MEL-04	MEL-02 / MEL-05	MEL-03 / MEL-04	MEL-03 / MEL-05	MEL-04 / MEL-05
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
2016	Total Nitrogen	log(x)	ANOVA /Tukey's	0.695	0.759	0.646	0.903	0.907	1	0.998	0.997	0.986	0.984	1
	Total Phosphorus	log(x)	ANOVA /Tukey's	**0.051**	0.705	0.585	0.713	0.667	**0.079**	0.119	0.103	0.999	1	1
	Chlorophyll *a*	none	ANOVA /Tukey's	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.016**	0.949	**0.040**	**<0.001**	**0.103**
2017	Total Nitrogen	log(x)	ANOVA /Tukey's	**<0.001**	**0.001**	**<0.001**	**<0.001**	**0.002**	**0.086**	0.817	0.997	0.488	**0.045**	0.634
	Total Phosphorus	log(x)	ANOVA /Tukey's	**0.054**	0.725	0.435	0.913	0.359	0.987	0.261	0.968	0.112	1	**0.085**
	Chlorophyll *a*	none	ANOVA /Tukey's	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	0.778	0.999	0.907	0.608	0.999	0.778

(a) Distributions of all variables violated the assumption of normality even after transformation; however, the results are considered reliable as the assumption of equal variances was not violated and ANOVA is robust against violations of the assumption of normality.

Note: *P*-values representing significant differences between areas (*P*<0.1) are **bolded**.

ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; *P*-value = probability value; < = less than.

7.3.1.2 Evaluation of Variability of Nutrients in Near-field Area Relative to Phytoplankton Biomass and Chlorophyll a

Scatter plots of nutrients, chlorophyll *a*, and phytoplankton biomass were made to assess variability of biomass and chlorophyll *a* in relation to variability in nutrient concentrations (i.e., TN and TP) in the Near-field exposure area (Figure 7.3-4). Spatial variability in nutrient concentrations in the Near-field exposure area during each sampling event was generally lower than the variability among seasons and among years. Temporal variability in concentrations of TN was observed; however, changes in TN did not result in corresponding increases in phytoplankton biomass or chlorophyll *a*. In general, higher concentrations of total phosphorus and total nitrogen did not result in higher phytoplankton biomass or chlorophyll *a*, as evidenced in August, where comparatively high biomass and chlorophyll *a* occurred across a range of nutrient concentrations. Overall, nutrient concentrations were consistently low and varied among seasons with limited spatial variability evident as a result of potential nutrient inputs from treated STP effluent discharge in the Near-field exposure area.

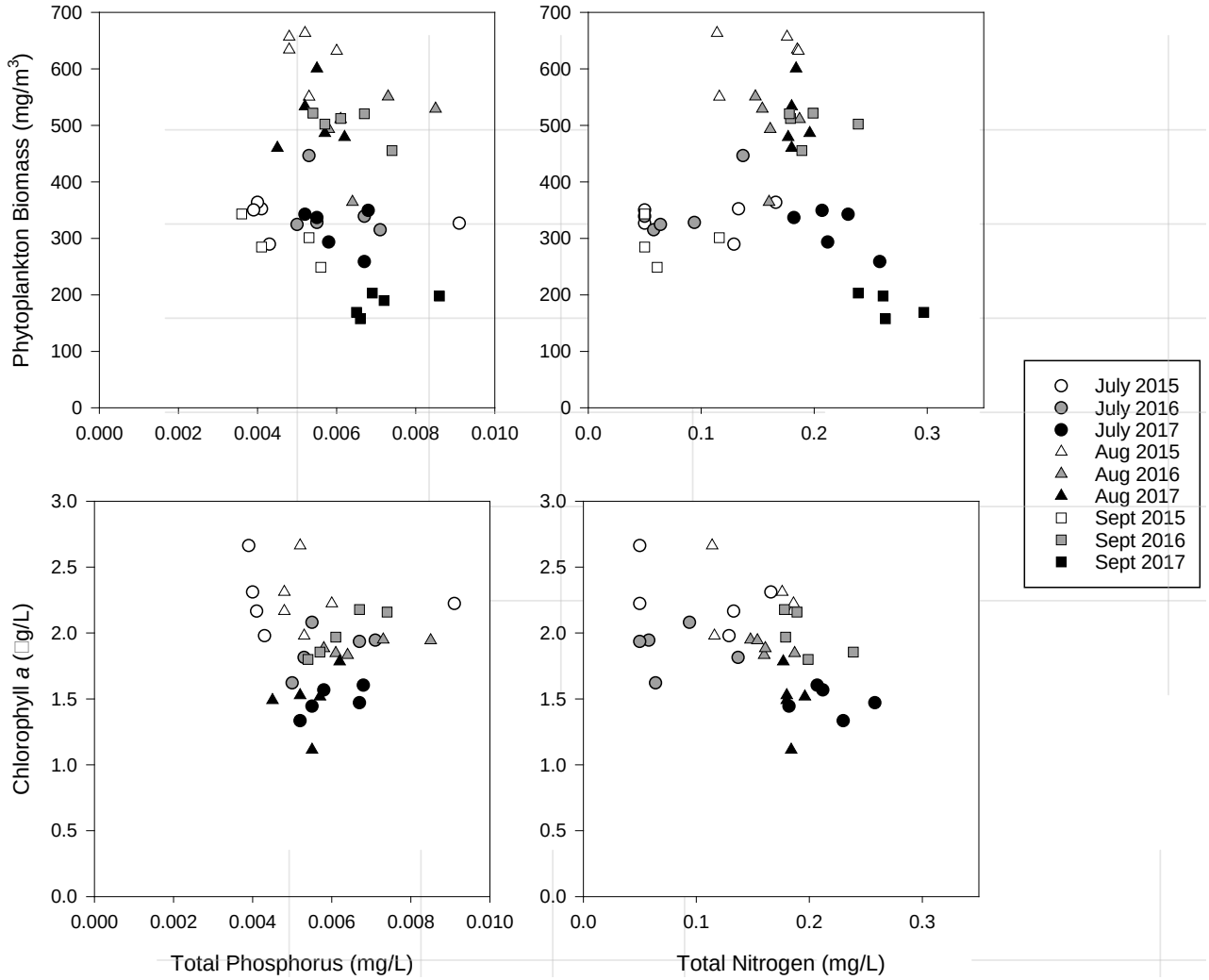

Figure 7.3-4: Nutrients versus Phytoplankton Biomass and Chlorophyll *a* Concentration at MEL-01, 2015 – 2017

Note: Chlorophyll *a* data from September 2017 was excluded due to difference filter used for field collection.

µg/L = micrograms per litre; mg/m^3 = milligrams per cubic metre; mg/L = milligrams per litre.

7.3.2 Trophic Status Classification

Total phosphorus, chlorophyll *a*, and water transparency (Secchi depth) were collected as part of the water quality sampling program and were used to characterize the trophic status of Meliadine Lake. Summary tables for total phosphorus, chlorophyll *a*, Secchi depth and trophic status index are provided in Appendix 7C, Tables 7C-1 and C-2.

Chlorophyll *a* concentrations were within the oligotrophic range throughout Meliadine Lake in 2015, 2016, and 2017, according to the general trophic classification systems of lakes (Table 7.1-2; Vollenweider 1970). Mean chlorophyll *a* concentrations in 2015 ranged from 0.45 μg/L at MEL-02 in August to 2.36 μg/L at MEL-02 in July, in 2016, from 0.73 μg/L at MEL-03 in August to 1.99 μg/L at MEL-01 in September, and in 2017 from 0.52 μg/L at MEL-03 in July to 1.49 μg/L at MEL-01 in July (Appendix 7C, Table 7C-1).

Concentrations of total phosphorus were also consistent with an oligotrophic (nutrient-poor) classification based on the CCME (2004) trigger ranges (i.e., between 0.004 and 0.010 mg/L) at the majority of locations, with the exception of three samples collected at MEL-02 in August 2015, and MEL-03 and MEL-05 in August 2017, each of which indicated an ultra-oligotrophic (very nutrient-poor) classification (i.e., <0.004 mg/L; Table 7.1-3). The mean concentration of total phosphorus in 2015 ranged from 0.0039 mg-P/L at MEL-02 in August to 0.0052 mg-P/L at MEL-01 in September, in 2016, from 0.0043 mg-P/L at MEL-03 in July to 0.0072 mg-P/L at MEL-02 in August, and in 2017 from 0.0036 mg-P/L at MEL-05 in August to 0.0072 mg-P/L at MEL-01 in September (Appendix 7C, Table 7C-1).

Secchi depths collected throughout Meliadine Lake were consistent with an oligotrophic classification (Table 7.1-4). During the 2015 sampling program, mean Secchi depth in Meliadine Lake ranged from 5.3 m at MEL-01 in September to 6.4 m at MEL-02 in August. In 2016, mean Secchi depth ranged from 5.1 m at MEL-02 in July to 7.4 m at MEL-05 in August. In 2017 mean Secchi depth ranged from 5.1 m at MEL-01 in July to 8.9 m at MEL-05 in August.

Based on the TSI calculations for chlorophyll *a* from the open-water sampling period, the overall trophic status of Meliadine Lake was considered to be oligotrophic (Appendix 7C, Table 7C-2). TSI based on chlorophyll *a* concentrations in the Near-field exposure area ranged from 26.2 (August) to 38.6 (July) in 2015, from 36.7 (August) to 37.3 (September) in 2016, and from 33.9 (September) to 34.4 (August) in 2017. TSI (chl) was similarly low in the Mid-field exposure area, ranging from 22.4 (August) to 39 (July) in 2015, from 31.5 (August) to 34.1 (July) in 2016, and from 25.6 (August) to 31.3 (September) in 2017. TSI (chl) reached a maximum of 31 and 25 in the reference areas in 2016 and 2017 respectively. TSI values based on total phosphorus concentrations and secchi depth were also low and supported the oligotrophic classification based on the TSI for chlorophyll *a* in Meliadine Lake (Appendix 7C, Table 7C-2).

7.3.3 Phytoplankton

Descriptive statistics that summarize the phytoplankton abundance, biomass, and richness by season, year and area are provided in Appendix 7D, Table 7D-1. Relative abundance of major phytoplankton groups from samples collected in Meliadine Lake is provided in Appendix 7D, Table 7D-2. Raw phytoplankton taxonomic data for Meliadine Lake are provided in Appendix 7D, Tables 7D-3 to 7D-5.

7.3.3.1 Abundance

Phytoplankton abundance varied spatially and seasonally throughout Meliadine Lake in 2015, 2016 and 2017, with similar spatial and seasonal trends observed during each year (Table 7.3-5). Abundance was notably higher in the Near-field exposure area than in the Mid-field exposure area or the reference areas in all seasons and years. Abundance was also consistently highest in July at all stations, although this trend was mostly evident in the Near-field and Mid-field exposure areas as abundance varied only slightly between seasons in Reference Area 1. Mean phytoplankton abundance in the Near-field exposure area (MEL-01) in July 2015 ranged from 4,370,493 ± 116,312 cells/L in 2017 to 4,910,893 ± 258,185 cells/L in 2015, compared to a maximum of 2,909,414 ± 154,628 cells/L in August and 2,900,894 ± 92,690 cells/L in September. Abundance in the Mid-field exposure area (MEL-02) was similarly high in July 2015 reaching 4,625,510 ± 164,279 cells/L, but was lower in July 2016 and 2017. Mean abundance in Reference Area 1 reached a high of 2,412,771 ± 178,375 cells/L in July compared with 2,087,709 ± 80,645 cells/L in August and 2,182,880 ± 189,068 cells/L in September. Phytoplankton abundance was lower in August and September in both exposure areas and the spatial trend was less apparent than in July; however, abundance remained highest in the Near-field exposure area in all years. Abundance was relatively consistent between the different reference areas in August, ranging from 1,630,267 ± 203,485 cells/L at MEL-04 in 2016 to 2,176,504 ± 169,119 cells/L at MEL-05 in 2017. In September, abundance was highest in the Near-field exposure area but notably lower in 2017 than in 2015 or 2016, ranging from only 1,139,912 ± 56,537 cells/L at MEL-02 to 1,818,246 ± 130,896 cells/L at MEL-01.

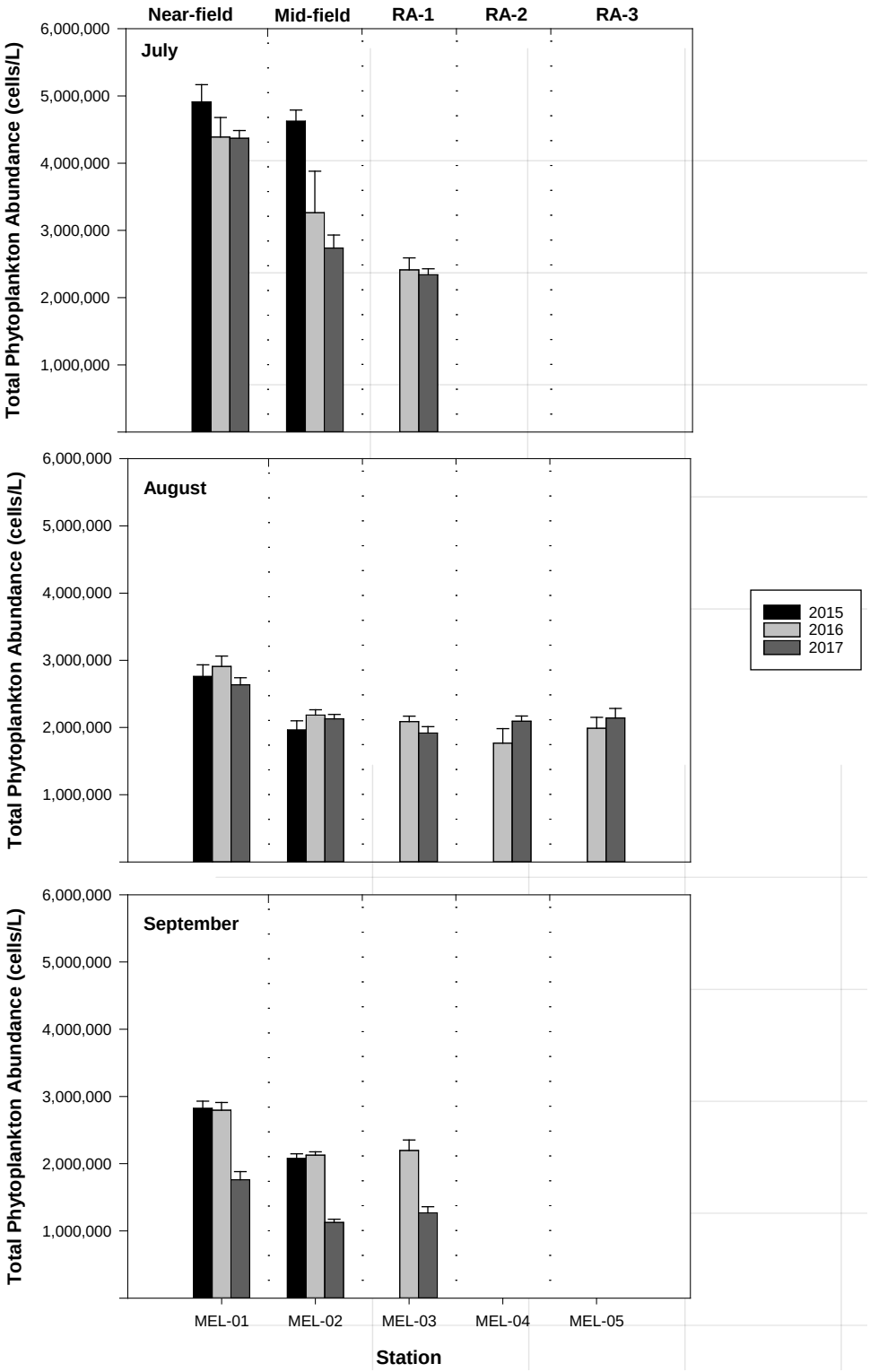

Figure 7.3-5: Total Phytoplankton Abundance in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September.

RA=Reference Area; cells/L = cells per litre.

7.3.3.2 Biomass

Phytoplankton biomass generally followed a similar spatial and seasonal trend as abundance in most years (Figure 7.3-6). Within each season in a given year, biomass was highest in the Near-field exposure area than in the Mid-field exposure area or the reference areas. In July, mean phytoplankton biomass ranged from 490 ± 33 mg/m^3 to 627 ± 20 mg/m^3 in the Near-field exposure area, from 305 ± 26 mg/m^3 to 606 ± 21 mg/m^3 in the Mid-field exposure area, and from 226 ± 7 mg/m^3 to 319 ± 14 mg/m^3 in Reference Area 1. Biomass in August was lower than in July but remained consistently higher in the Near-field exposure area than in the reference areas, ranging from 316 ± 17 mg/m^3 to 351 ± 24 mg/m^3 at MEL-01. By comparison, biomass in the reference areas in August ranged from 156 ± 29 mg/m^3 at MEL-04 in 2016 to 231 ± 8 mg/m^3 at MEL-03 in 2016. In September, biomass followed the same spatial trend; however, biomass was notably higher in 2016 than in 2015 or 2017. Mean biomass in September 2016 ranged from 246 ± 23 mg/m^3 in Reference Area 1 to 503 ± 12 mg/m^3 in the Near-field exposure area. Biomass in September 2015 and 2017 reached a high of 295 ± 20 mg/m^3 and 184 ± 9 mg/m^3 respectively in the Near-field exposure area with lower biomass in the Mid-field exposure area and in Reference Area 1 in 2017.

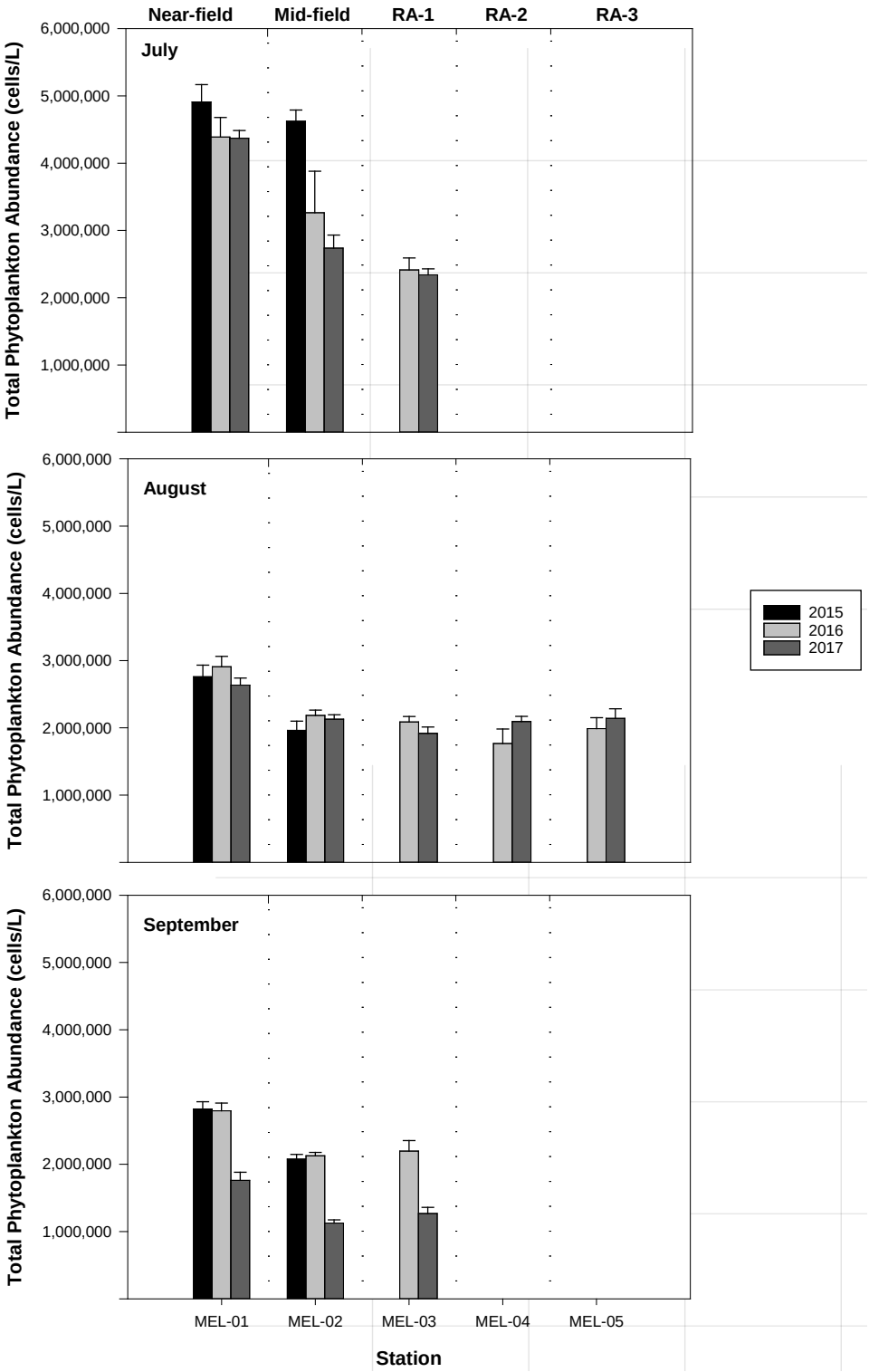

Figure 7.3-6: Total Phytoplankton Biomass in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September.

RA=Reference Area; mg/m3 = milligrams per cubic metre.

7.3.3.3 Community Composition by Abundance

A total of 113 distinct phytoplankton taxa were identified in samples collected in Meliadine Lake in 2015, 2016 and 2017. Overall, the relative abundance of major phytoplankton groups was similar throughout Meliadine Lake during most seasons and years. The most abundant, or dominant, taxa during each sampling program were golden algae of the group Chrysophyceae. Abundant taxa in the majority of samples collected included *Uroglena volvox*, *Chrysococcus sp.*, *Chrysochromulina* sp., and *Dinobryon* sp., all from the group Chrysophyceae (Appendix 7D, Tables 7D-3 and 7D-4). Diatoms (Bacillariophyceae) were generally the next most abundant phytoplankton group in most samples; diatom abundance showed minor spatial and seasonal variation but also variation between sampling years within a given area. Chlorophyte (Chlorophyceae) and cryptomonad (Cryptophyceae) abundance varied seasonally, while cyanobacteria and dinoflagellates (Dinophyceae) were largely absent from the phytoplankton community in Meliadine Lake making up less than 1% the total relative abundance of phytoplankton in most samples.

In July, the relative abundance of most major phytoplankton groups varied slightly between the exposure area and reference area and among years (Figure 7.3-7). Abundance was primarily dominated by chrysophytes which represented between 73% and 89% of all phytoplankton collected in 2015 through 2017 in Meliadine Lake. Diatoms were generally in low abundance; however, a greater proportion of diatoms was present in the Near-field exposure area than in the reference area in 2016 and 2017. Diatoms contributed between 8% and 22% of total phytoplankton abundance in in Near-field exposure area, between 3% and 13% in the Mid-field exposure area, and between 4% and 5% in Reference Area 1 in July. Diatom abundance was also notably lower in the exposure areas in July in 2017 than in 2015 and 2016. Phytoplankton from other major groups including cyanobacteria, dinoflagellates, chlorophytes, and cryptomonads were in low abundance (<5%) in the exposure areas July, while chlorophytes and cryptomonads were slightly more abundant in the reference area in 2016 at 7% and 6% respectively.

In August, the relative abundance of phytoplankton was consistent between exposure and reference areas and among sampling years (Figure 7.3-8). Abundance was again dominated by chrysophytes, which represented between 70% and 81% of phytoplankton in all years. Diatoms were generally in lower abundance in August than in July with the largest proportion of diatoms occurring in the exposure areas in 2015 (8% to 10%). In 2016 and 2017 the proportion of diatoms in the phytoplankton community was consistent between the exposure and reference areas, ranging from 3% to 4% across all areas in each year. Chlorophytes were notably more abundant in August across all areas than in July, ranging from 9% to 14% of total abundance in the exposure areas and between 7% and 14% in the reference areas in 2016 and 2017. Similarly, cryptomonads were also more abundant in August than in July, ranging from 3% to 11% of total abundance in the exposure areas and 9% to 15% in the reference areas.

In September, the relative abundance of phytoplankton varied little between exposure and reference areas with some variability evident between years (Figure 7.3-9). Abundance was dominated by chrysophytes which represented between 70% and 83% of phytoplankton in all years. The relative abundance of diatoms in September was similar to that of July, ranging between 6% and 14% across all areas and years. In contrast with July, a higher proportion of diatoms was collected in the exposure areas in September in 2017 than in 2015 and 2016. The proportion of chlorophytes and cryptomonads varied little by area, ranging from 4% to 12% and 4% to 8% respectively, and the proportions of each group were generally similar to that of August. The Mid-field exposure area in September 2016 contained the highest proportion if cyanobacteria (1.2%) observed during the sampling programs.

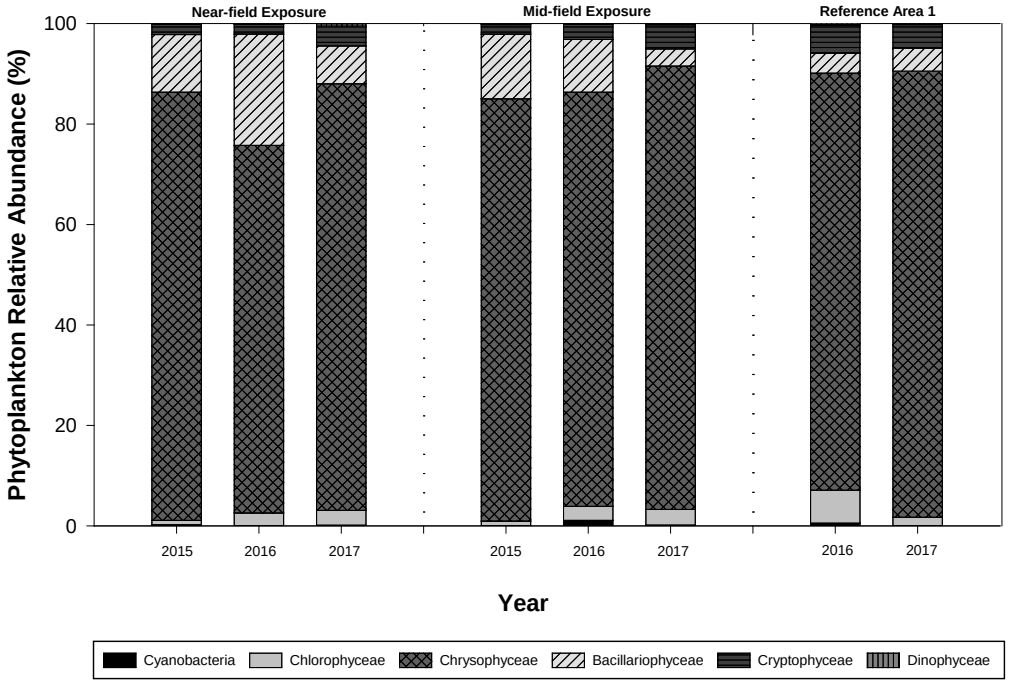

Figure 7.3-7:Relative Abundance of Major Phytoplankton Groups in July, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5). Phytoplankton was not sampled at MEL-01-03 in September 2015.

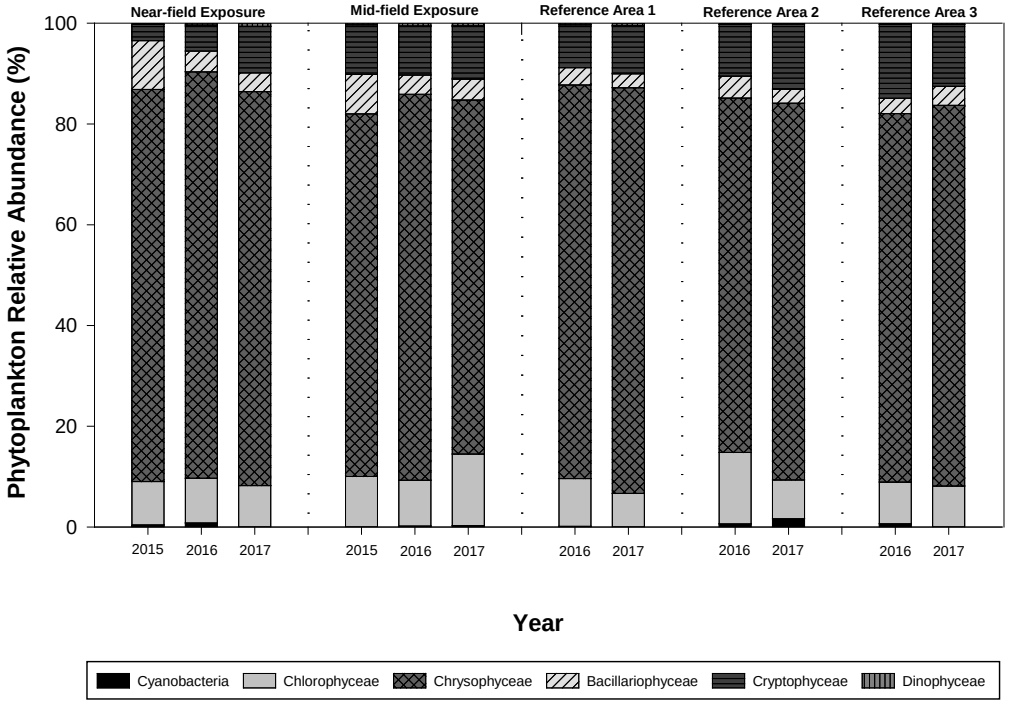

Figure 7.3-8:Relative Abundance of Major Phytoplankton Groups in August, Meliadine Lake, 2015-2017

Note: Bars represent mean values for each area (n=5).

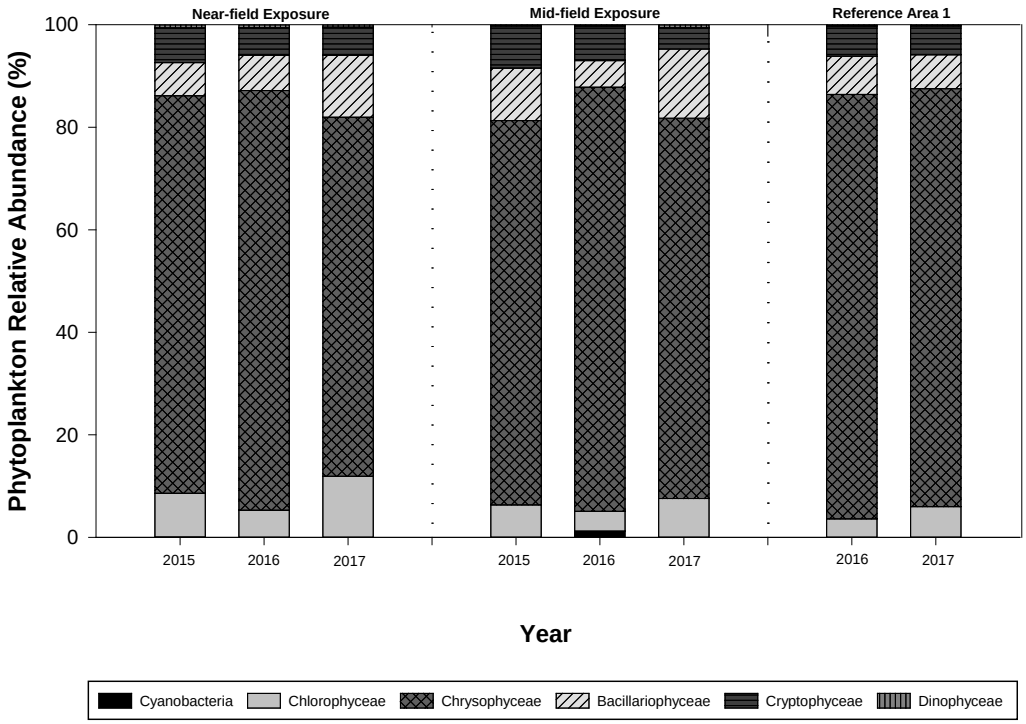

Figure 7.3-9:Relative Abundance of Major Phytoplankton Groups in September, Meliadine Lake, 2015-2017

Note: Bars represent mean values for each area (n=5).

7.3.3.4 Community Composition by Biomass

The relative biomass of major phytoplankton groups in Meliadine Lake followed similar spatial and seasonal trends as relative abundance (Figure 7.3-10 to Figure 7.3-12). In general, variability in relative biomass was as high among years in each area and season as it was among areas or seasons during a given year. As with abundance, chrysophytes contributed the most to relative biomass in all areas in Meliadine Lake in 2015, 2016 and 2017. Chrysophytes contributed between 66% and 83% of total biomass in July, between 55% and 71% in August, and between 50% and 76% in September. Diatom biomass varied among years and seasons with the highest proportion of diatom biomass observed in the exposure areas in July 2016 (18% at MEL-01) and in September 2017 (19% at MEL-01 and 17% at MEL-02). The relative proportions of chlorophytes, cryptomonads and dinoflagellates by biomass followed similar trends as abundance with higher proportions of each group in August and September than in July, and no discernable trends between exposure and reference areas or among years. Dinoflagellates generally contributed more to relative biomass compared to relative abundance (i.e., larger cells but rare), while the relative biomass of other major groups was generally proportional to their relative abundance (i.e., smaller cells but common).

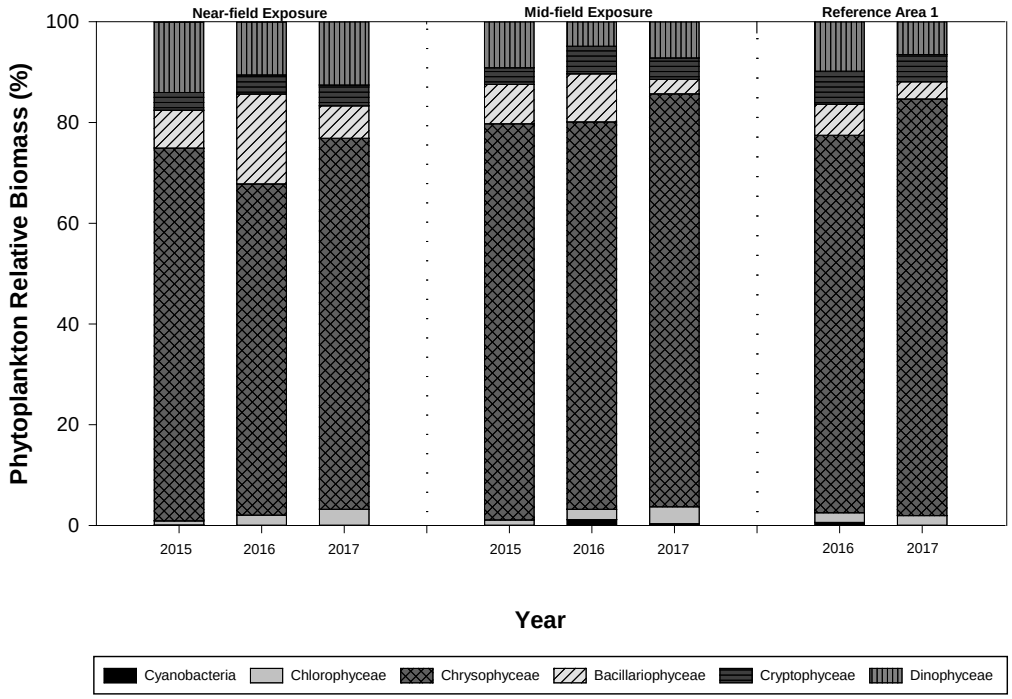

Figure 7.3-10:Relative Biomass of Major Phytoplankton Groups in July, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5). Phytoplankton was not sampled at MEL-01-03 in September 2015.

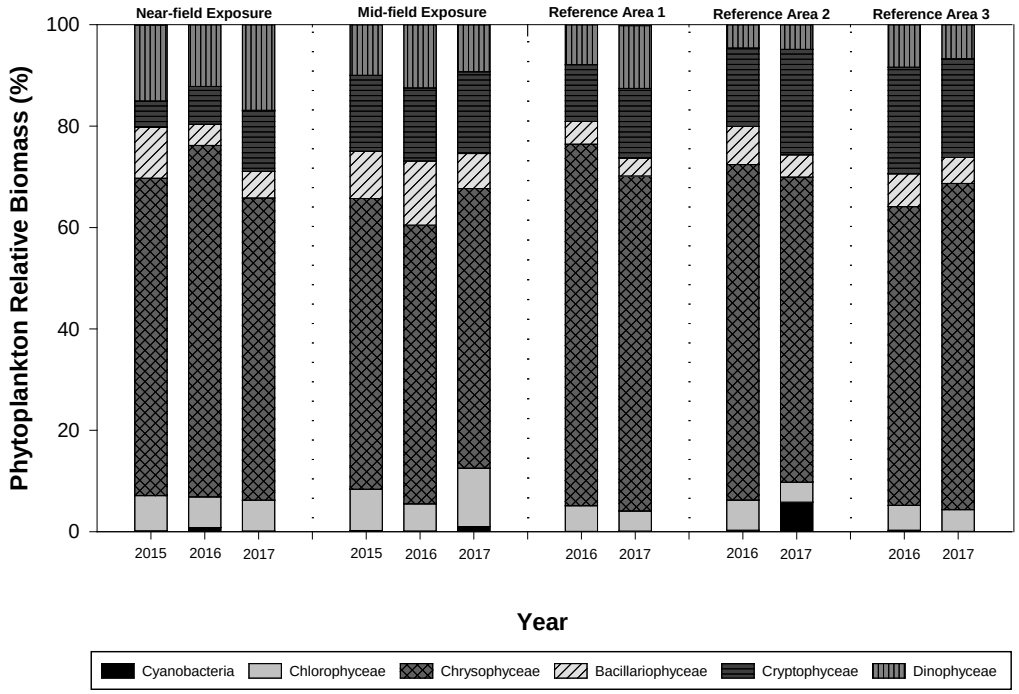

Figure 7.3-11:Relative Biomass of Major Phytoplankton Groups in August, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5).

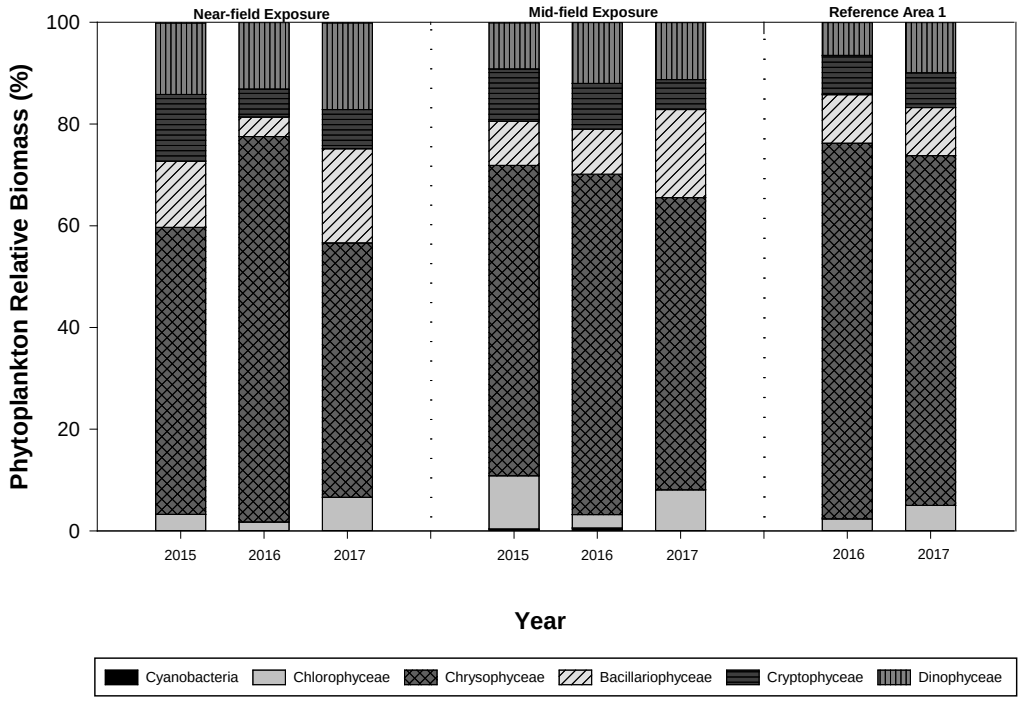

Figure 7.3-12:Relative Biomass of Major Phytoplankton Groups in September, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5).

7.3.3.5 Species Richness

Species richness was relatively consistent throughout much of Meliadine Lake with few observable trends among seasons, years or stations (Figure 7.3-13). Richness in July and August varied little between the exposure areas and the reference areas and among years. Mean richness in July ranged from 34 ± 1 taxa to 41 ± 1 taxa while richness in August ranged from 37 ± 1 taxa to 42 ± 1 taxa. Species richness in September varied slightly among years as richness in 2017 was notably lower than in 2015 or 2016. Richness in September ranged from 28 ± 1 taxa to 33 ± 1 taxa in 2017 and from 37 ± 1 taxa to 40 ± 1 taxa in 2015 and 2016 combined. Species richness also tended to be higher in the exposure areas in September 2017 than in Reference Area 1.

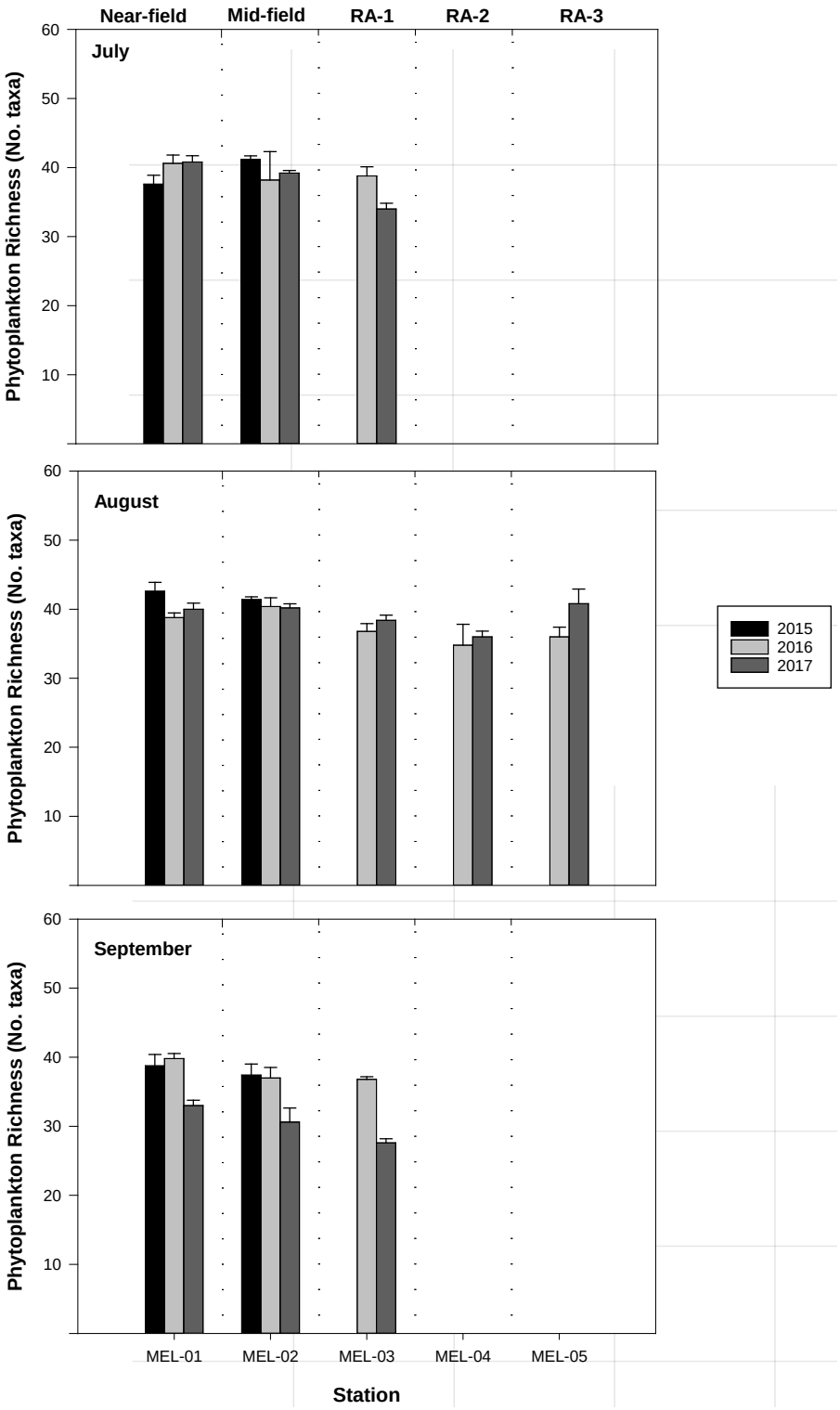

Figure 7.3-13:Total Phytoplankton Species Richness in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September.

RA=Reference Area.

7.3.3.6 Statistical Comparisons of Phytoplankton Community Variables

Statistical comparisons of phytoplankton community variables were made among years for each sampling area and season Table 7.3-4. In general, variability in phytoplankton abundance, biomass, and species richness among years in July and September was high with lower variability among years in August. Several seasonal and annual trends were also evident in the Near-field and Mid-field exposure areas, for which three years of sampling allowed for pairwise comparisons between years (Table 7.3-2).

Table 7.3-4: Results of Statistical Analysis for Phytoplankton Community Variables Comparing Years

Station	Variable	Transform	Statistical Test	July	August	September
				P-value	*P-value*	*P-value*
MEL-01	Abundance	None	ANOVA	0.208	0.379	**0.010**
	Biomass	None	ANOVA	**0.019**	0.613	**0.003**
	Richness	None	ANOVA	0.139	**0.089**	**0.015**
MEL-02	Abundance	None	ANOVA	**0.009**	0.403	**0.008**
	Biomass	None	ANOVA	**0.006**	0.454	**0.002**
	Richness	None	ANOVA	**0.068**	0.270	0.143
MEL-03	Abundance	None	t-test	0.728	0.326	**0.005**
	Biomass	None	t-test	**0.001**	0.114	**0.006**
	Richness	None	t-test	**0.029**	0.141	**<0.001**
MEL-04	Abundance	None	t-test	-	0.133	-
	Biomass	None	t-test	-	0.259	-
	Richness	None	t-test	-	0.188	-
MEL-05	Abundance	None	t-test	-	0.617	-
	Biomass	None	t-test	-	0.752	-
	Richness	None	t-test	-	0.100	-

Note: P-values representing significant differences between years (P<0.1) are bolded.

ANOVA= Analysis of Variance; t-test= Two-sample t-test; P-value = probability value; < = less than; - = no sample collected.

Results of statistical analyses for comparisons of abundance, biomass, and richness of phytoplankton community variables among years are summarized below:

- Phytoplankton abundance was significantly different among years at MEL-02 in July and at MEL-01, MEL-02 and MEL-03 in September (Table 7.3-4). No significant differences in abundance were observed among years in August. In the Near-field exposure area, abundance was significantly lower in 2017 than in 2015 or 2016 in September (Table 7.3-5). In the Mid-field exposure area, abundance was significantly higher in 2015 than in 2016 or 2017 in July.
- Phytoplankton biomass was significantly different among years in all areas in July and September with no significant differences among years in August (Table 7.3-4). In July, biomass was significantly higher among years in the exposure areas in 2015 than in 2016 or 2017 (Table 7.3-5). In September, biomass was significantly higher in 2016 in the exposure areas than in 2015 or 2017.
- Phytoplankton species richness was significantly different among years in at least one area in each season, including in the Near-field exposure area in August (Table 7.3-4). Analysis of the pairwise comparisons between years, however, showed that richness only varied significantly between 2017 and both 2015 and 2016 in September (Table 7.3-5).

Table 7.3-5: Pairwise Comparisons for Statistical Analyses of Phytoplankton Community Variables Comparing Years

Year	Variable	Transform[a]	Statistical Test	July			August			September		
				2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
MEL-01	Abundance	None	ANOVA / Tukey's	0.293	0.270	0.998	0.582	0.969	0.445	0.638	**<0.001**	**<0.001**
	Biomass	None	ANOVA / Tukey's	**0.009**	**0.025**	0.827	0.860	0.731	0.426	**<0.001**	**<0.001**	**<0.001**
	Richness	None	ANOVA / Tukey's	0.247	0.171	0.968	0.062	0.246	0.681	0.837	**0.007**	**0.002**
MEL-02	Abundance	None	ANOVA / Tukey's	**0.067**	**0.012**	0.611	0.296	0.581	0.848	0.833	**<0.001**	**<0.001**
	Biomass	None	ANOVA / Tukey's	**0.016**	**0.003**	0.590	0.440	0.997	0.480	**0.007**	**<0.001**	**<0.001**
	Richness	None	ANOVA / Tukey's	0.659	0.796	0.970	0.324	0.428	0.975	0.986	0.114	0.149

(a) Distributions of all variables violated the assumption of normality even after transformation; however, the results are considered reliable as the assumption of equal variances was not violated and ANOVA is robust against the assumption of normality.

Note: *P*-values representing significant differences between years (*P*<0.1) are **bolded.**

ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; *P*-value = probability value; < = less than.

Samples collected during the August sampling event were carried forward for further evaluation of spatial variability among the five areas of Meliadine Lake. Data collected in 2015 was omitted from statistical comparisons among areas in Meliadine Lake due to a lack of sampling in the reference areas. A summary of statistical comparisons of variables among Near-field and Mid-field areas and the three reference areas in August 2016 and 2017 is presented in Table 7.3-6.

Table 7.3-6: Results of Statistical Analysis for Phytoplankton Community Variables Comparing Areas, August 2016-2017

Year	Variable	Transform	Statistical Test	Overall Comparison	MEL-01 / MEL-02	MEL-01 / MEL-03	MEL-01 / MEL-04	MEL-01 / MEL-05	MEL-02 / MEL-03	MEL-02 / MEL-04	MEL-02 / MEL-05	MEL-03 / MEL-04	MEL-03 / MEL-05	MEL-04 / MEL-05
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
2016	Abundance	None	ANOVA /Tukey's	**<0.001****	**0.035****	**0.014****	**<0.001****	**0.008****	0.993	0.151	0.957	0.304	0.999	0.440
	Biomass	None	ANOVA /Tukey's	**<0.001****	**0.062****	**0.016****	**<0.001****	**0.013****	0.967	**0.068****	0.942	0.219	1.000	0.261
	Chlorophyll *a*	None	KW / DSCF	**<0.001****	**<0.001****	**<0.001****	**<0.001****	**<0.001****	**<0.001****	**0.016****	0.949	**0.040****	**<0.001****	**0.103***
	Richness	None	KW / DSCF	**0.081****	0.866	0.554	0.647	0.500	0.259	0.322	0.211	1.000	1.000	1.000
2017	Abundance	None	ANOVA /Tukey's	**0.004****	**0.025****	**0.003****	**0.021****	**0.062****	0.838	1.000	0.992	0.874	0.593	0.984
	Biomass	None	ANOVA /Tukey's	**<0.001****	**0.001****	**<0.001****	**<0.001****	**0.001****	0.930	0.830	0.998	0.999	0.988	0.943
	Chlorophyll *a*	None	KW / DSCF	**<0.001****	**<0.001****	**<0.001****	**<0.001****	**<0.001****	0.778	0.999	0.907	0.608	0.999	0.778
	Richness	None	KW / DSCF	**0.065****	0.993	0.946	0.170	0.880	0.768	**0.105***	0.878	0.219	0.718	0.516

Note: Significant differences (**bold**) are denoted as: * = *P*<0.15, ** = *P*<0.1.

KW= Kruskal Wallis; DSCF= Dwass-Steel-Chritchlow-Fligner Test for Pairwise Comparisons; ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; *P*-value = probability value; < = less than.

Differences observed in the abundance, biomass, and richness of the phytoplankton community in August 2016 and August 2017 in Meliadine Lake are summarized below:

- In 2016, phytoplankton abundance was significantly different ($P < 0.001$) among the five sampling areas: the Near-field exposure area, the Mid-field exposure area, Reference Area 1, Reference Area 2 and Reference Area 3 (Table 7.3-6). Pairwise comparisons showed that abundance in the Near-field exposure area was significantly higher than in the Mid-field exposure area and each of the three reference areas. There was no significant difference in abundance between the Mid-field exposure area and the reference areas or among the reference areas.
- In 2017, phytoplankton abundance was also significantly different ($P = 0.004$) among all areas (Table 7.3-6). Pairwise comparisons showed the same relationship in abundance among areas in 2017 as observed in 2016, with only the Near-field exposure area being significantly higher than the other areas.
- Phytoplankton biomass in 2016 was significantly different ($P < 0.001$) among the sampling areas (Table 7.3-6). Pairwise comparisons of biomass estimates showed a similar trend as abundance in 2016 with the exception of a significant difference between the Mid-field exposure area and MEL-04 ($P = 0.068$).
- Phytoplankton biomass in 2017 was significantly different ($P < 0.001$) among areas overall (Table 7.3-6). Pairwise comparisons showed the same relationship between areas as abundance in 2017 with the only significant difference occurring between the Near-field exposure area and each of the other four areas.
- Analysis of variance results suggest phytoplankton species richness was significantly different among areas overall in 2016 ($P = 0.081$) and 2017 ($P = 0.065$) (Table 7.3-6). Pairwise comparisons of species richness, however, revealed there was no significant difference among areas in terms of richness, except between MEL-02 and MEL-04 in 2017.

7.3.3.7 Multivariate Analysis

Two nMDS dimensions were derived from the phytoplankton biomass data collected in Meliadine Lake. Phytoplankton biomass in 2016 and 2017 were analyzed separately to enable a good fit of the ordination results. The stress value of the final configuration was 0.17 for August 2016 and 0.15 for August 2017, which represent a “fair” fit (<0.2) of the ordination results to the input data in qualitative terms (Clarke 1993). According to the categories provided by Clarke (1993), some interference may be present which could confound the interpretations made from the plots so results should be interpreted with caution.

The nMDS ordination of the samples by area illustrate the degree of similarity in community composition among stations in each area. Most of the stations in 2016 clustered together by area with more similarities present among the reference areas than among the exposure areas (Figure 7.3-14). Differences in taxonomic composition by biomass were especially apparent between the Near-field exposure area and all other areas in August 2016. The Mid-field exposure area more closely resembled that of the reference areas and stations clustered relatively close together. Some variability in taxonomic composition was apparent in the reference areas, especially in MEL-05, for which individual stations were not closely related. In August 2017, most stations were also clustered together by area (Figure 7.3-15). Stations in the Near-field exposure area were again clustered separately from the Mid-field and reference areas indicating taxa composition by biomass was different in the Near-field area in 2017. Some variability in taxa composition was also evident in MEL-04 in August 2017 where the majority of stations did not cluster together with the other reference areas.

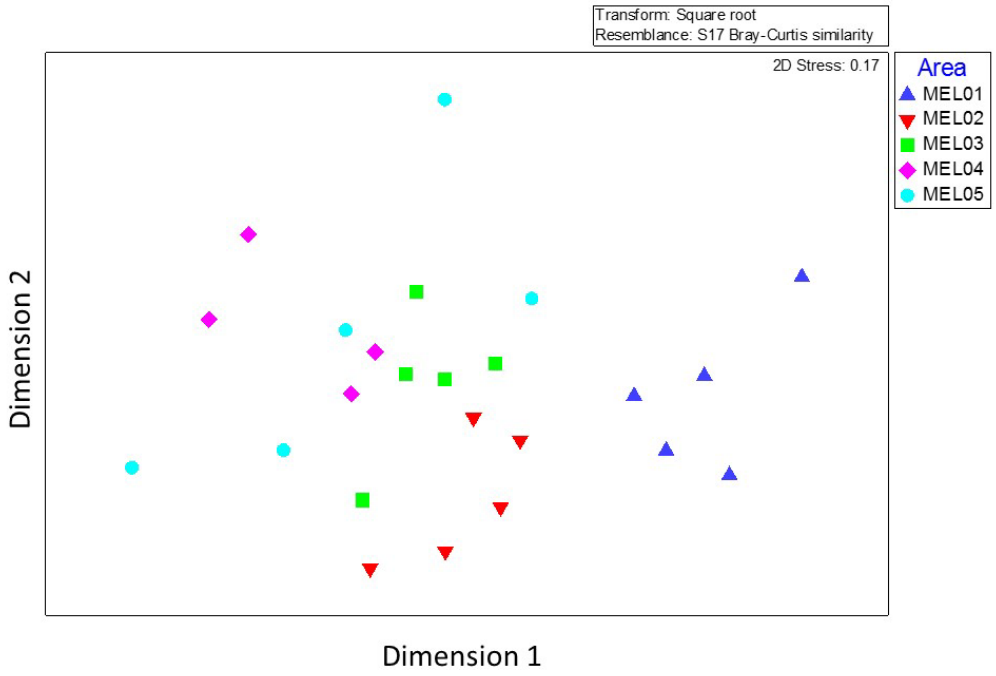

Figure 7.3-14: Ordination Plot of August Phytoplankton Biomass in Meliadine Lake in 2016

Note: MEL-04-03 was excluded from analysis due to major differences in phytoplankton community compared to other locations.

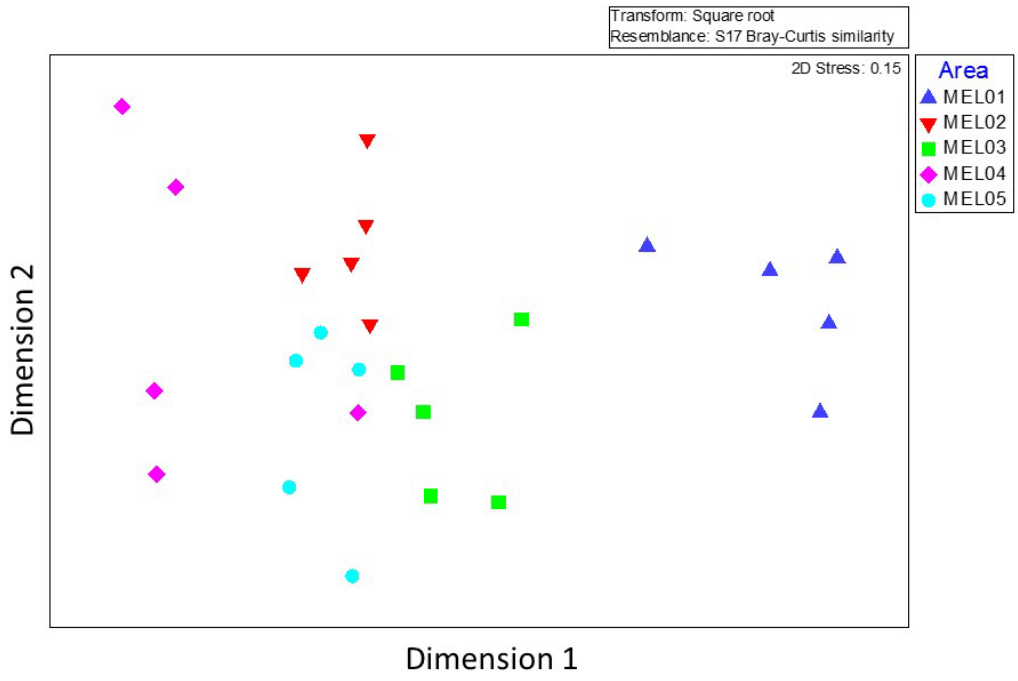

Figure 7.3-15: Ordination Plot of August Phytoplankton Biomass in Meliadine Lake in 2017

7.3.3.8 Relationship Between Phytoplankton Biomass and Chlorophyll a

The correlation between chlorophyll *a* concentration and total phytoplankton biomass based on biovolume was examined to evaluate whether chlorophyll *a* can be used as an indicator of phytoplankton biomass. Data collected in 2015 and September 2017 were excluded from the regression analysis due to reliability concerns (see Section 7.2). Based on data from all years combined, there was a significant but weak linear relationship (P = <0.0001; r^2 = 0.46) between phytoplankton biomass and chlorophyll *a* concentration (Figure 7.3-16). Much of the unexplained variation between the two variables is likely explained by a disproportionate effect by certain phytoplankton groups on the proportion of chlorophyll *a* in phytoplankton wet weight (Kasprzak et al. 2008; Felip and Catalan 2000). For example, dinoflagellates generally have a disproportionately lower amount of chlorophyll *a* for their size when compared with phytoplankton of the groups chlorophyta and cyanobacteria (Kasprzak et al. 2008; Felip and Catalan 2000). Overall, a generally linear trend is apparent, which suggest that chlorophyll *a* is a suitable surrogate for taxonomic estimates of phytoplankton biomass in the future. Additional data points from future monitoring years will help to define the relationship between chlorophyll *a* and phytoplankton biomass in Meliadine Lake, and may produce a more reliable data transformation equation for in situ profiles.

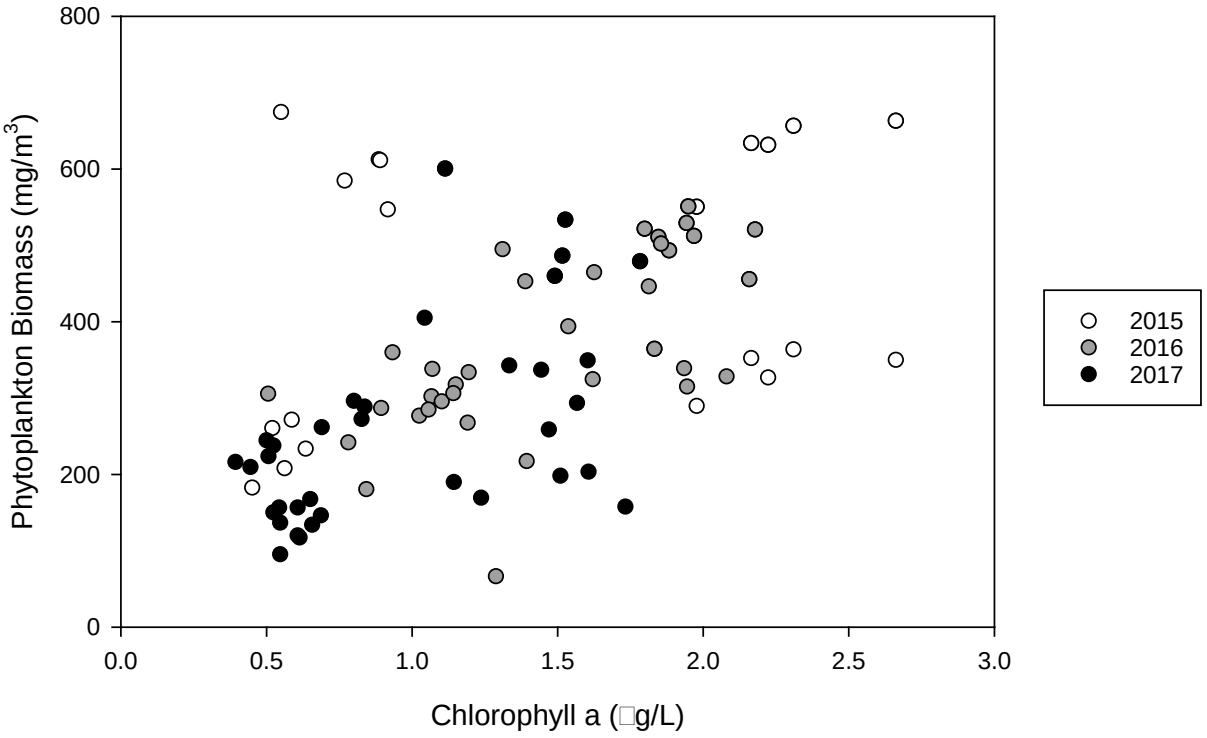

Figure 7.3-16: Chlorophyll a vs. Phytoplankton Biomass in Meliadine Lake, 2016-2017

Note: Chlorophyll *a* and biomass data from September 2017 were excluded due to different filters used for field collection.
mg/m3 = milligrams per cubic metre; µg/L = micrograms per litre.

7.3.4 Zooplankton

Descriptive statistics that summarize the zooplankton abundance, biomass, and richness by season, year and area are provided in Appendix 7E, Table 7E-1. Relative abundance of major zooplankton groups from samples collected in Meliadine Lake is provided in Appendix 7E, Table 7E-2. Raw zooplankton taxonomic data for Meliadine Lake are provided in Appendix 7E, Tables 7E-3 to 7E-5.

7.3.4.1 Abundance

Zooplankton abundance varied spatially, seasonally and among years in Meliadine Lake in 2015 through 2017 (Figure 7.3-17). In July, abundance did not vary considerably among samples collected in 2015 and 2017 or among the exposure and reference areas; zooplankton samples were not collected in July 2016. Mean abundance in July 2017 ranged from 35,983 ± 5,280 org/m^3 at MEL-02 to 43,135 ± 3,845 org/m^3 at MEL-03. Zooplankton abundance in August was highly variable among years within the exposure areas with less variability evident in the reference areas. Abundance in August ranged from 18,313 ± 3,299 org/m^3 (2017) to 72,531 ± 11,361 org/m^3 (2016) in the Near-field exposure area and from 28,570 ± 3,047 org/m^3 (2017) to 51,677 ± 12,467 org/m^3 (2015) in the Mid-field exposure area. Abundance was lower in the reference areas than in the Near-field exposure area in 2016, but was generally higher than in each of the exposure areas in 2017. Zooplankton abundance in September was notably lower than in July and August in most cases, and varied more among years than among the exposure and reference areas. Abundance in September was highest in 2015, reaching 41,509 ± 3,552 org/m^3 at MEL-01 and 27,744 ± 4,306 org/m^3 at MEL-02 compared to a high of 18,991 ± 5,123 org/m^3 in other years.

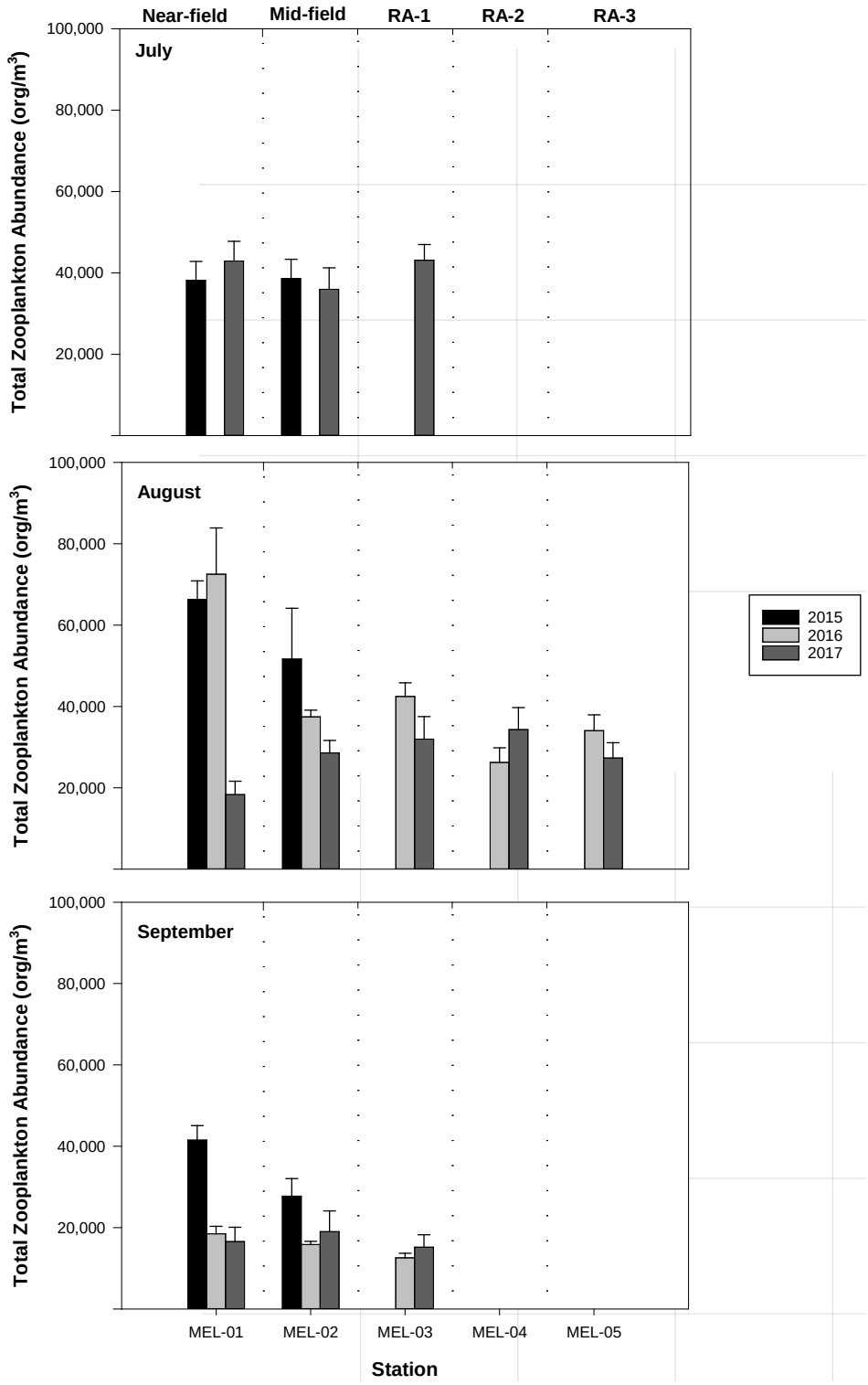

Figure 7.3-17: Total Zooplankton Abundance in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September. No samples could be collected in July 2016 due to loss of plankton net.
RA=Reference Area; org/m3 = organisms per cubic metre.

7.3.4.2 Biomass

Zooplankton biomass generally followed a similar spatial and seasonal trend as abundance in most years, but with considerably higher biomass in 2015 relative to other years (Figure 7.3-18). In July, mean biomass was highest in 2015 in the Near-field exposure area (299 ± 33 mg/m^3) and the Mid-field exposure area (411 ± 34 mg/m^3). Biomass in July 2017 was lower in the Near-field exposure area (106 ± 15 mg/m^3) and the Mid-field exposure area (154 ± 33 mg/m^3) than in the reference area (229 ± 26 mg/m^3). In August, biomass was notably higher in 2015 than in other years reaching 761 ± 71 mg/m^3 at MEL-01 and 816 ± 161 mg/m^3 at MEL-02. Biomass in August in 2016 and 2017 was generally consistent among the Mid-field exposure and reference areas, ranging from 126 ± 18 mg/m^3 (MEL-05 in 2016) to 201 ± 5 mg/m^3 (MEL-02 in 2016). In the Near-field exposure area, biomass was slightly higher and more variable than in the reference areas in 2016 (235 ± 59 mg/m^3) but lower and less variable than in the reference areas in 2017 (106 ± 15 mg/m^3). In September, biomass was lower overall than in July and August and higher in 2015 than in other years. Biomass in 2015 was 289 ± 31 mg/m^3 at MEL-01 and 348 ± 50 mg/m^3 at MEL-02 compared with a range from 34 ± 6 mg/m^3 (MEL-03 in 2016) to 74 ± 9 mg/m^3 (MEL-01 in 2016) in all areas in 2016 and 2017 combined.

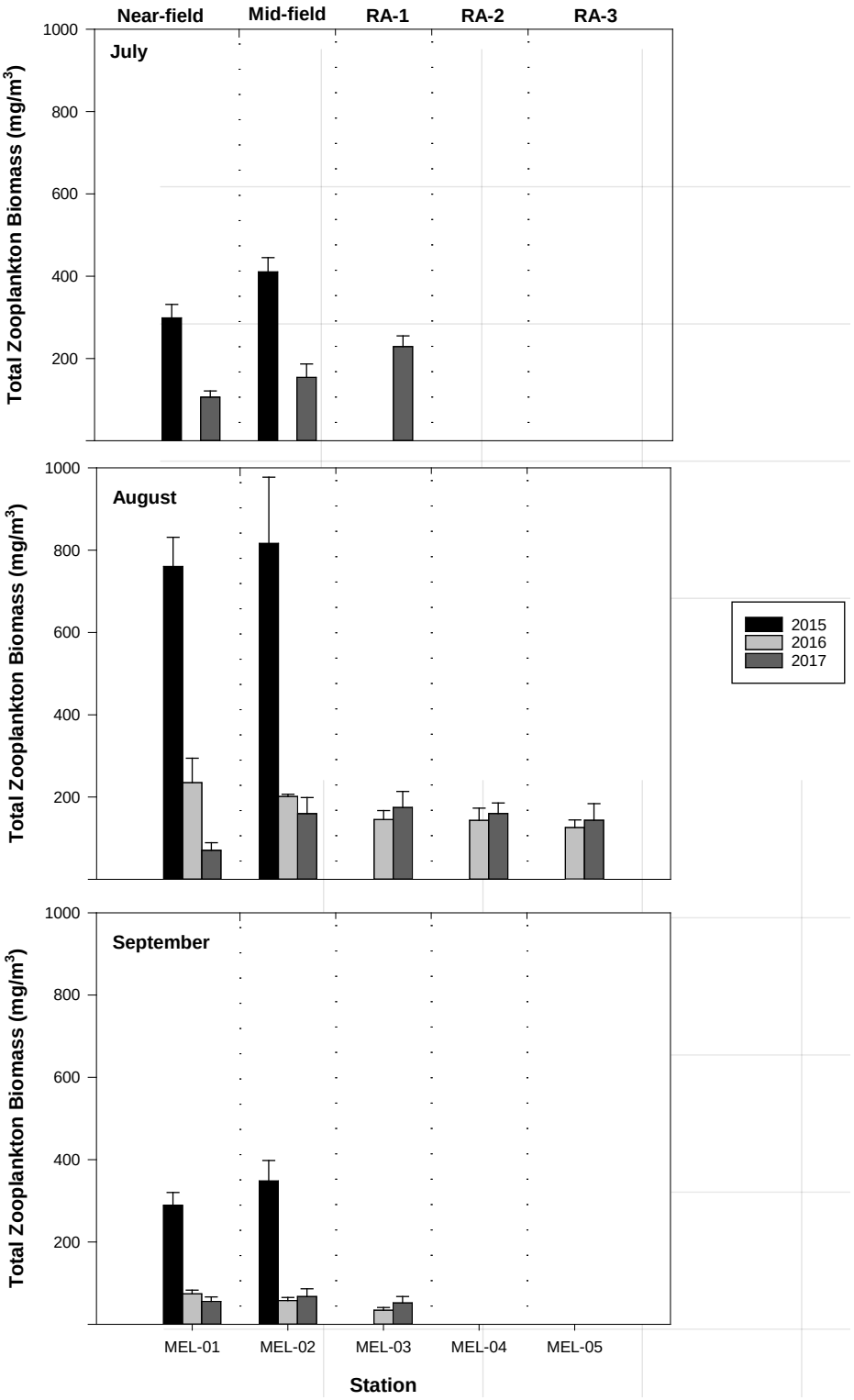

Figure 7.3-18: Total Zooplankton Biomass in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September. No samples could be collected in July 2016 due to loss of plankton net.

RA=Reference Area; mg/m3 = milligram per cubic metre.

7.3.4.3 Community Composition as Abundance

A total of 26 distinct zooplankton taxa were identified in samples collected in Meliadine Lake in 2015, 2016 and 2017 (Appendix 7E, Tables 7E-3 and 7E-4). The overall relative abundance of major zooplankton groups varied spatially, seasonally and among years in Meliadine Lake. The most abundant, or dominant, taxa during each sampling program were generally rotifers, followed by copepod nauplii. Calanoid copepods were generally in low abundance, while the abundance of cladocerans and cyclopoid copepods varied among seasons and sampling locations. Abundant taxa identified included the rotifer taxa *Kellicottia sp.*, *Keratella* sp., *Conochilus* sp., and *Polyarthra sp.*, along with the cladoceran species *Daphnia longiremis*. In terms of biomass, the dominant zooplankton groups in most areas were either cladocerans or rotifers, while the relative biomass of calanoid copepods was notably higher during some sampling events (e.g., August 2017) than during others.

In July, the relative abundance of most major zooplankton groups varied among the exposure and reference areas and varied only slightly between years (Figure 7.3-19). Abundance in the exposure areas was dominated by rotifers which accounted for 76% and 80% of abundance in the Near-field exposure area and 66% and 52% in the Mid-field exposure area in 2015 and 2017 respectively. The relative abundance of rotifers in Reference Area 1 in 2017 was notably lower as rotifers accounted for only 36% of zooplankton abundance while cladocerans (30%) and copepod nauplii (21%) were also abundant. Calanoid and cyclopoid copepods were generally in low abundance in July, though the abundance of each was higher in the reference area (6% and 8%) than in the Near-field exposure area (2% and 1%) in 2017.

In August, relative abundance of zooplankton varied spatially with some variability among years within each area (Figure 7.3-20). Rotifers were relatively more abundant in the Near-field exposure area in each year than in the Mid-field or reference areas. The proportion of rotifers by abundance ranged from 56% to 70% in the Near-field exposure area compared to 35% to 58% in the Mid-field exposure area and 26% to 55% in the reference area. Copepod nauplii were moderately abundant in most areas and were notably more abundant in the reference areas in 2016 (28% to 44%) than in the Near-field exposure area (6%). Cladocerans were also moderately abundant in all areas, with no discernable spatial trend in 2016 and slightly higher relative abundance in the reference areas (28 to 36%) than in the exposure areas (18% to 20%) in 2017. The relative abundance of calanoid and cyclopoid copepods was consistently low (1% to 10%) among all areas in each year.

In September relative abundance followed a similar trend as July with spatial variation among areas and only minor variability between years (Figure 7.3-21). Rotifers accounted for 73% to 79% of total zooplankton abundance in the Near-field exposure area, compared to 49% to 60% in the Mid-field exposure area and 60% to 74% in Reference Area 1. Copepod nauplii were generally the next most abundant group, the relative abundance of which varied among areas and years. Cladocerans were notably more abundant in the Mid-field exposure area (11% to 20%) in each year than in the Near-field exposure area (2% to 12%) or the reference area (7% to 8%). The relative abundance of calanoid and cyclopoid copepods was low (<6%) throughout the exposure and reference areas in September.

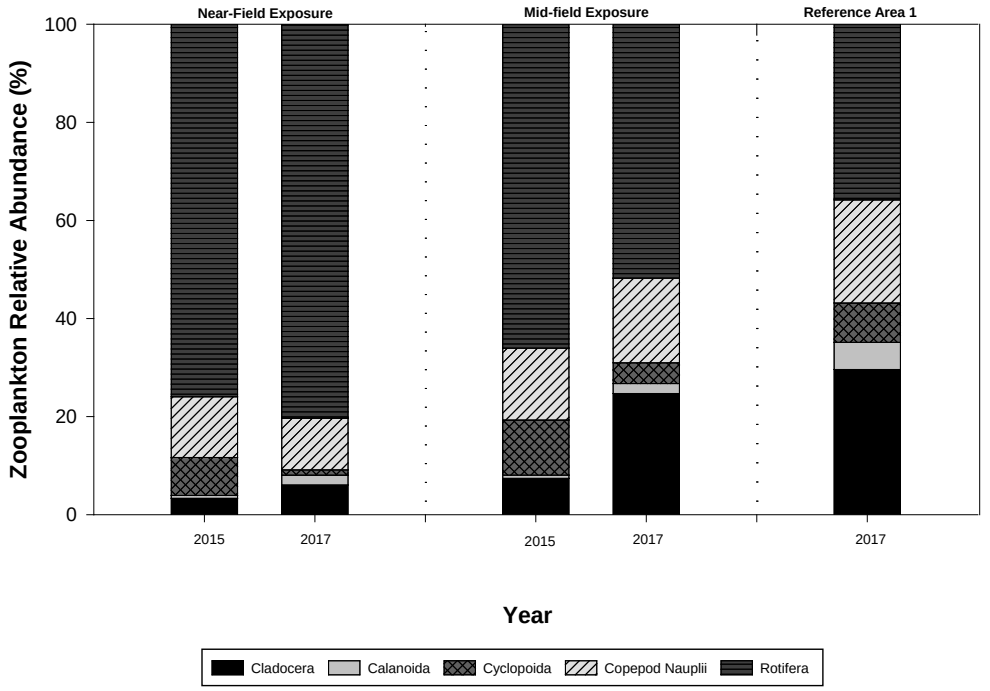

Figure 7.3-19: Relative Abundance of Major Zooplankton Groups in July, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5). Zooplankton was not sampled in July 2016 due to loss of plankton net.

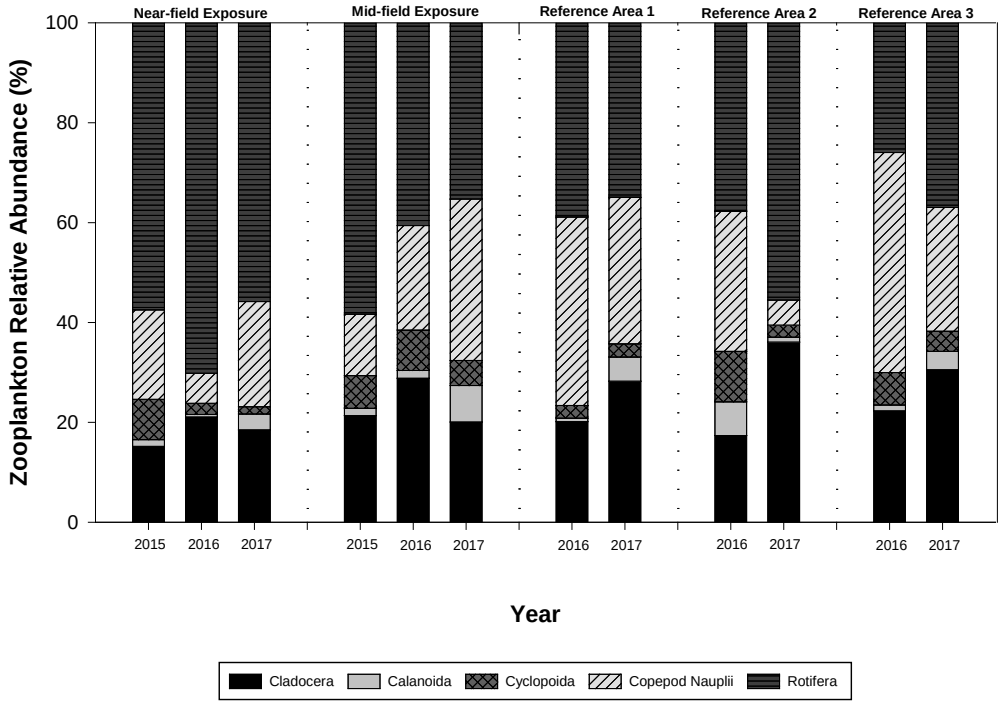

Figure 7.3-20: Relative Abundance of Major Zooplankton Groups in August, Meliadine Lake, 2015-2017

Note: Bars represent mean values for each area (n=5).

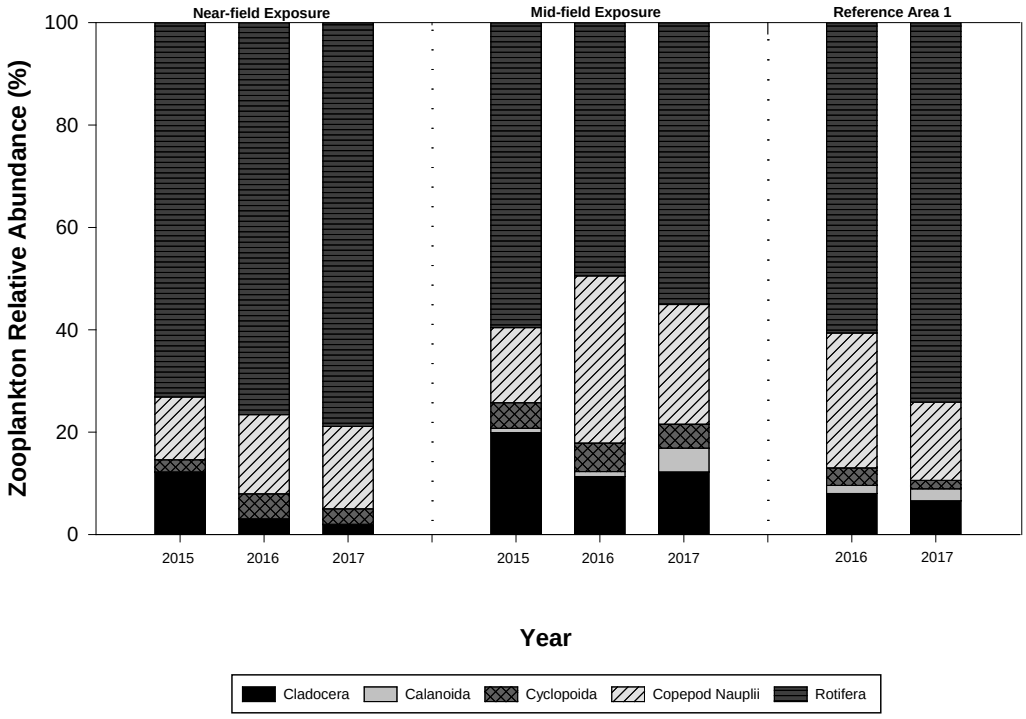

Figure 7.3-21: Relative Abundance of Major Zooplankton Groups in September, Meliadine Lake, 2015-2017

Note: Bars represent mean values for each area (n=5).

7.3.4.4 Community Composition as Biomass

The relative biomass of major zooplankton groups in the Near-field exposure area was generally dominated by smaller zooplankton taxa (rotifers) while biomass in the reference areas was mostly dominated by larger zooplankton taxa (cladocerans) in all seasons and years (Figure 7.3-22 to Figure 7.3-24). Biomass in July was dominated by rotifers in the exposure areas in 2015 (78% at MEL-01and 58% at MEL-02) with cladocerans accounting for the majority of the remaining biomass. In July 2017, biomass was dominated by rotifers in the Near-field exposure area (58%) and by cladocerans in the Mid-field exposure area (63%) and the reference area (62%). Cyclopoid and calanoid copepods combined accounted for a greater proportion of biomass in the reference area (28%) than in the Near-field (15%) or Mid-field (17%) exposure areas.

In August, biomass tended to be dominated by larger taxa in most areas except in the Near-field exposure area in 2015 and 2016. Biomass was dominated by rotifers in the Near-field exposure area in 2015 and 2016 due to an overall high abundance of rotifers during the sampling events. Biomass in the Near-field area in 2017 was dominated by cladocerans (59%) and calanoid copepods (20%) and relative biomass overall was similar to the Mid-field exposure area and the reference areas. Biomass in the reference areas was dominated by cladocerans in 2016 and 2017 and was consistent between years in Reference areas 1 and 3 but varied between years in Reference Area 2. A notably higher proportion of rotifers contributed to overall biomass in 2017 (34%) than in 2016 (2%) in Reference Area 2 while the proportion of cyclopoid and calanoid copepods was much lower in 2017 (9%) than in 2016 (47%).

Relative biomass in September was fairly consistent among years within each area, and was dominated by rotifers in the Near-field exposure area (62 to 90%) and by a mix of rotifers or cladocerans in the Mid-field exposure area and the reference area. In 2017, calanoid copepods accounted for a much larger proportion of overall biomass in the Mid-field exposure area (29%) and the reference area (24%) than in the Near-field exposure area (0.3%).

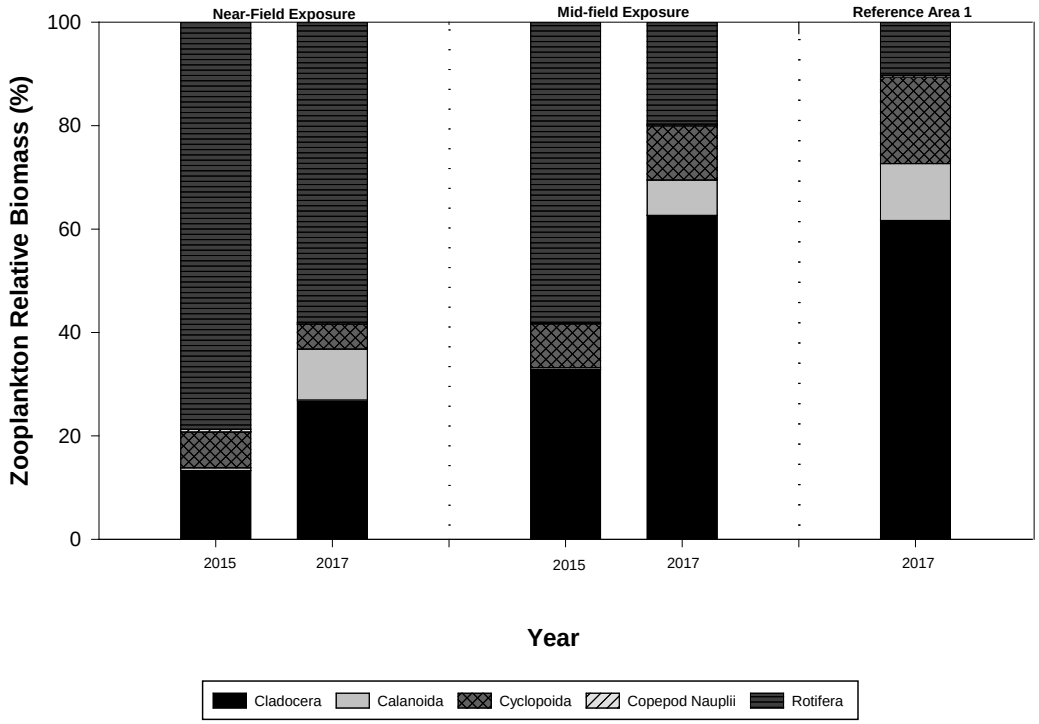

Figure 7.3-22: Relative Biomass of Major Zooplankton Groups in July, Meliadine Lake, 2015-2017

Notes: Bars represent mean values for each area (n=5). Zooplankton was not sampled in July 2016 due to loss of plankton net.

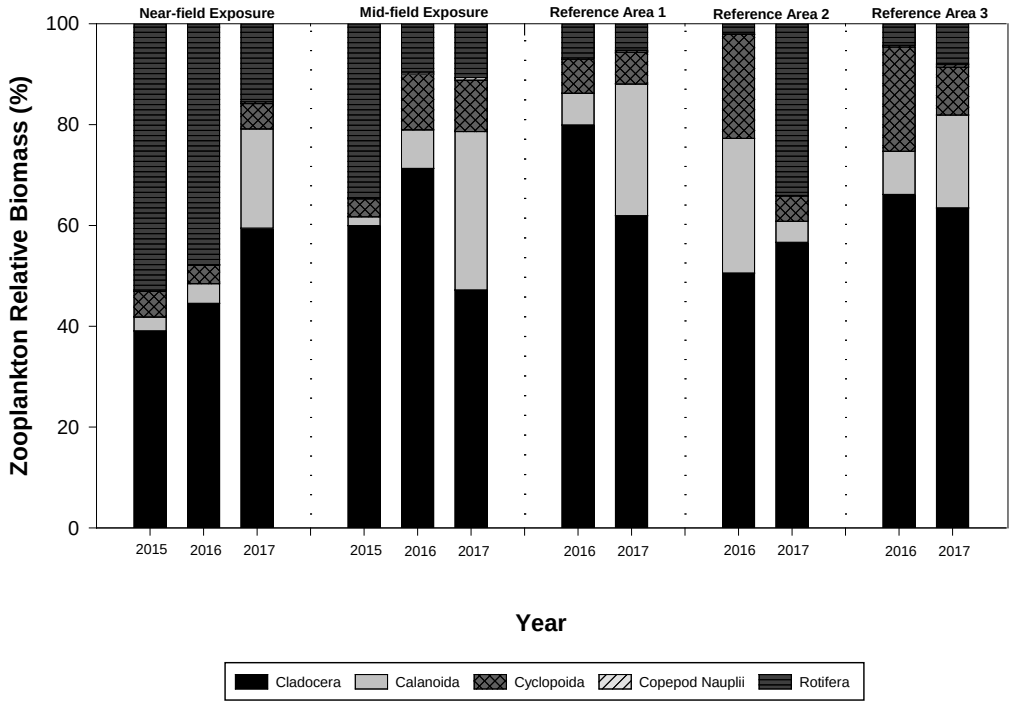

Figure 7.3-23: Relative Biomass of Major Zooplankton Groups in August, Meliadine Lake, 2015

Note: Bars represent mean values for each area (n=5).

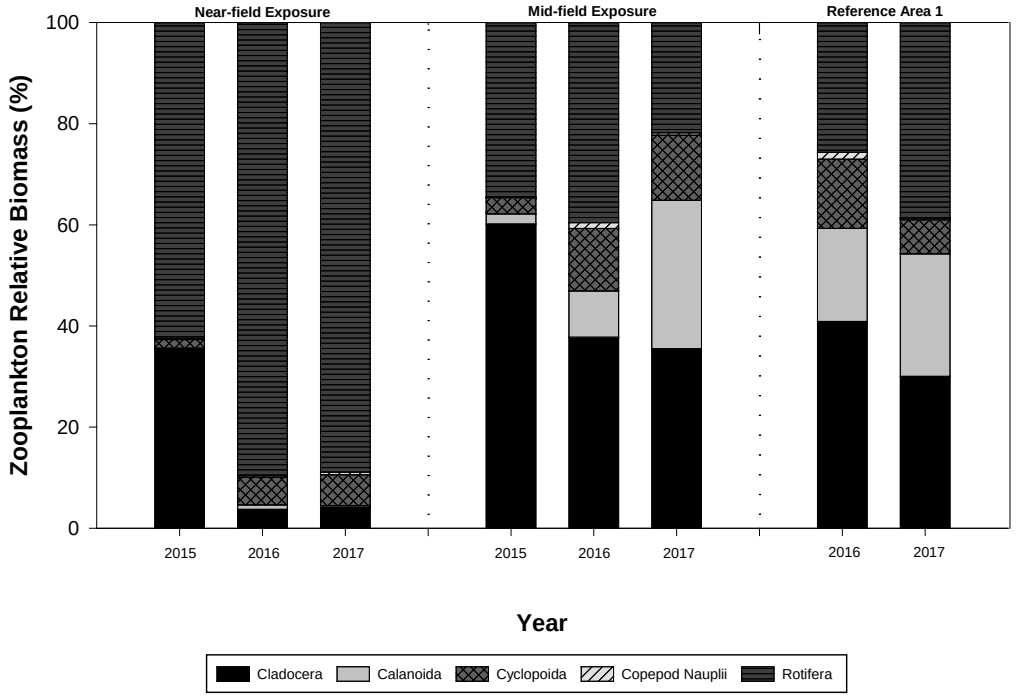

Figure 7.3-24: Relative Biomass of Major Zooplankton Groups in September, Meliadine Lake, 2015-2017

Note: Bars represent mean values for each area (n=5).

7.3.4.5 Species Richness

Zooplankton species richness was relatively consistent throughout Meliadine Lake, with minor variability among years, seasons and areas (Figure 7.3-25). The spatial trend for richness in July varied among years with lower mean richness in the Near-field exposure area than in the Mid-field exposure area in 2015, and higher mean richness in the Near-field exposure area than in the Mid-field or reference areas in 2017. In August, richness was somewhat variable among years in the Near-field exposure area but was relatively consistent overall among the different exposure and reference areas. Mean richness was highest at MEL-01 in 2016 reaching 13 ± 1 taxa compared to a mean of 11 to 12 taxa at other stations in August. Richness in September was lower in the Near-field exposure area than in reference area in each year with a mean richness of 11 ± 1 taxa at MEL-01 compared with a mean richness of 12 to 13 taxa in Reference Area 1.

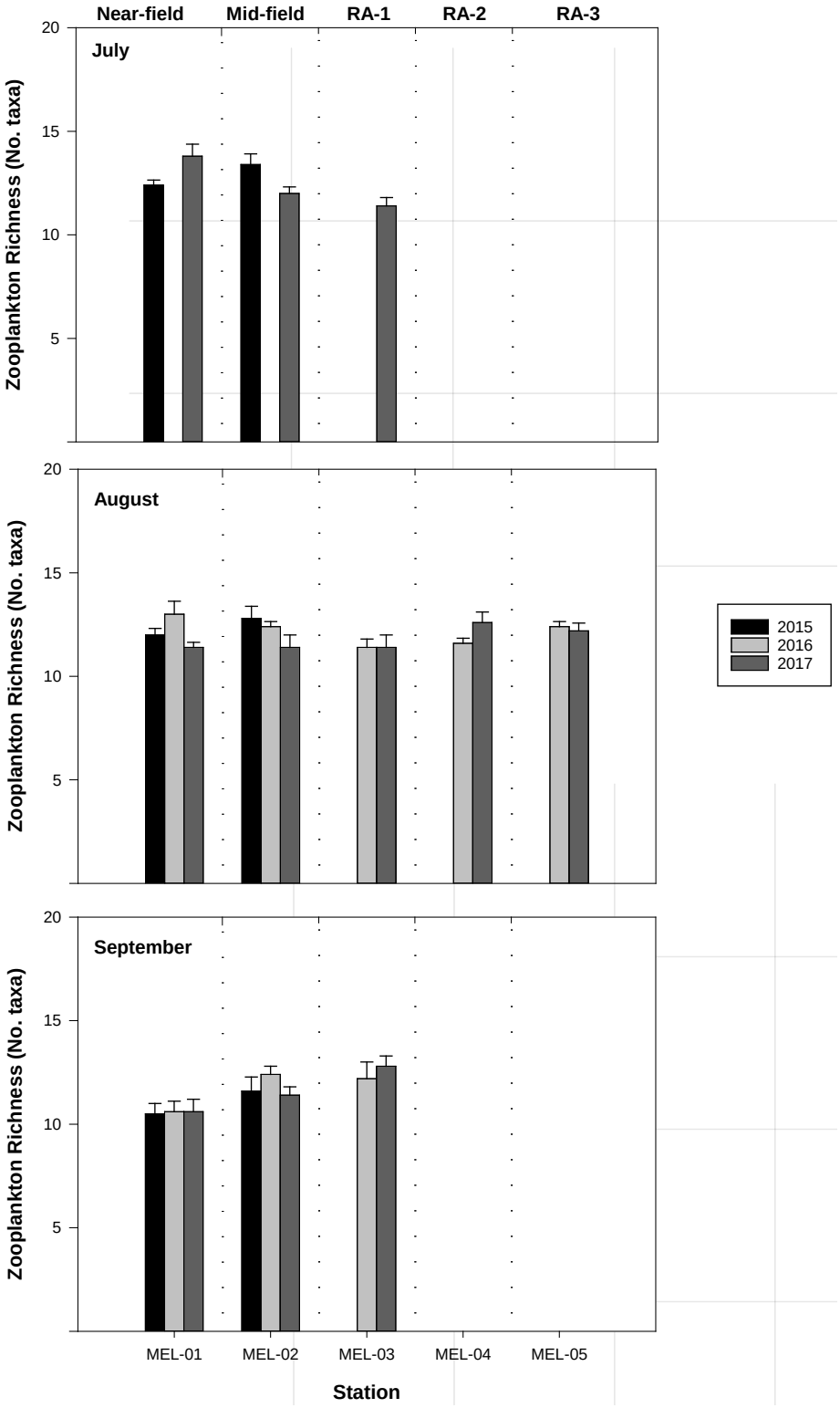

Figure 7.3-25: Zooplankton Species Richness in Meliadine Lake, 2015-2017

Notes: Mean values are presented for each area. Error bars represent standard error (SE). MEL-04 and MEL-05 were not sampled in July or September. No samples could be collected in July 2016 due to loss of plankton net.
RA=Reference Area.

7.3.4.6 Statistical Comparisons of Zooplankton Community Variables

Statistical comparisons of zooplankton community variables were made among different years within each sampling area and season Table 7.3-7. In general, variability in zooplankton abundance, biomass, and richness among years was high in the Near-field and Mid-field exposure areas and lower in the reference areas. Several seasonal and annual trends were evident in the Near-field and Mid-field exposure areas, for which three years of sampling allowed for pairwise comparisons among years (Table 7.3-8).

Table 7.3-7: Results of Statistical Analyses for Zooplankton Community Variables Comparing Years

Station	Variable	Transformation	Statistical Test	July	August	September
				P-value	*P-value*	*P-value*
MEL-01	Abundance	None	ANOVA / t-test	0.497	**<0.001**	0.248
	Biomass	None	ANOVA / t-test	**0.002**	**<0.001**	**<0.001**
	Richness	None	ANOVA / t-test	**0.074**	**0.063**	0.990
MEL-02	Abundance	None	ANOVA / t-test	0.722	0.130	0.122
	Biomass	None	ANOVA / t-test	**0.001**	**0.001**	**<0.001**
	Richness	None	ANOVA / t-test	**0.054**	0.171	0.371
MEL-03	Abundance	None	t-test	-	0.152	0.460
	Biomass	None	t-test	-	0.536	0.331
	Richness	None	t-test	-	1	0.544
MEL-04	Abundance	None	t-test	-	0.255	-
	Biomass	None	t-test	-	0.688	-
	Richness	None	t-test	-	0.130	-
MEL-05	Abundance	None	t-test	-	0.248	-
	Biomass	None	t-test	-	0.704	-
	Richness	None	t-test	-	0.668	-

Note: P-values representing significant differences among years (P<0.1) are bolded.

ANOVA= Analysis of Variance; t-test= Two-sample t-test; P-value = probability value; < = less than; - = no sample collected.

Results of statistical analyses for comparisons of zooplankton abundance, biomass, and richness among years are summarized below:

- Zooplankton abundance was only significantly different among years at MEL-01 in August (Table 7.3-7). No significant differences in abundance were observed among years in July or September or in the Mid-field exposure or reference areas. Abundance at MEL-01 in August was significantly lower in 2017 than in 2015 or 2016 but not significantly different between 2015 and 2016 (Table 7.3-8).
- Zooplankton biomass was significantly different among years in the Near-field and Mid-field exposure areas in all seasons, but not significantly different among years in the reference areas (Table 7.3-7). Biomass was significantly higher in each of the exposure areas in 2015 than in 2016 and 2017 in July, August and September (Table 7.3-8). Biomass was not significantly different between 2016 and 2017 in August or September.
- Zooplankton richness was significantly different among years overall in the Near-field exposure area in July and August and in the Mid-field exposure area in July (Table 7.3-7). Analysis of the pairwise comparisons between years, however, showed that richness did not vary significantly between years at MEL-01 in August (Table 7.3-8).

Table 7.3-8: Pairwise Comparisons for Statistical Analyses of Zooplankton Community Variables Comparing Year

Year	Variable	Trans-formation[(a)]	Statistical Test	July			August			September		
				2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017	2015 / 2016	2015 / 2017	2016 / 2017
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
MEL-01	Abundance	None	ANOVA / Tukey's	–	–	–	0.823	**0.002**	**0.001**	**0.001**	**<0.001**	0.890
	Biomass	None	ANOVA / Tukey's	–	–	–	**<0.001**	**<0.001**	0.124	**<0.001**	**<0.001**	0.727
	Richness	None	ANOVA / Tukey's	–	–	–	0.269	0.602	0.055	0.991	0.991	1
MEL-02	Abundance	None	ANOVA / Tukey's	–	–	–	0.397	0.114	0.688	0.118	0.287	0.836
	Biomass	None	ANOVA / Tukey's	–	–	–	**0.002**	**0.001**	0.949	**<0.001**	**<0.001**	0.972
	Richness	None	ANOVA / Tukey's	–	–	–	0.842	0.163	0.369	0.527	0.959	0.378

(a) Distributions of all variables violated the assumption of normality even after transformation; however, the results are considered reliable as the assumption of equal variances was not violated and ANOVA is robust against violations of the assumption of normality.

Note: P-values representing significant differences between years (P<0.1) are bolded.

ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; P-value = probability value; < = less than; – = no pairwise comparison conducted as only two sampling events were conducted in July and variables were analyzed using a t-test.

Samples collected during the August sampling event were carried forward for further evaluation of spatial variability among the five areas of Meliadine Lake. Data collected in 2015 was omitted from statistical comparisons among areas in Meliadine Lake due to a lack of sampling in the reference areas. A summary of statistical comparisons of variables among Near-field and Mid-field exposure areas and the three reference areas in August 2016 and 2017 is presented in Figure 7.3-9.

Table 7.3-9: Results of Statistical Analyses for Zooplankton Community Variables Comparing Areas

Year	Variable	Transformation	Statistical Test	Overall Comparison	MEL-01 / MEL-02	MEL-01 / MEL-03	MEL-01 / MEL-04	MEL-01 / MEL-05	MEL-02 / MEL-03	MEL-02 / MEL-04	MEL-02 / MEL-05	MEL-03 / MEL-04	MEL-03 / MEL-05	MEL-04 / MEL-05
				P-value	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*	*P-value*
2016	Abundance	log(x)	ANOVA /Tukey's	**<0.001**	**0.020**	**0.076**	**<0.001**	**0.004**	0.964	0.221	0.954	**0.066**	0.662	0.576
	Biomass	None	ANOVA /Tukey's	0.131	0.947	0.323	0.302	0.162	0.738	0.713	0.485	1.000	0.993	0.995
	Richness	log(x)	ANOVA /Tukey's	**0.045**	0.856	**0.054**	0.126	0.856	0.319	0.558	1.000	0.992	0.319	0.558
2017	Abundance	None	ANOVA /Tukey's	0.136	0.474	0.214	0.108	0.597	0.981	0.881	1.000	0.995	0.940	0.785
	Biomass	None	ANOVA /Tukey's	0.242	0.365	0.227	0.365	0.556	0.998	1.000	0.997	0.998	0.965	0.997
	Richness	None	ANOVA /Tukey's	0.284	1.000	1.000	0.430	0.771	1.000	0.430	0.771	0.430	0.771	0.976

Note: P-values representing significant differences between years (P<0.1) are **bolded.**

ANOVA= Analysis of Variance; Tukey's= Tukey's Honestly Significant Difference Test; *P*-value = probability value; < = less than.

Differences observed in the abundance, biomass, and richness of the zooplankton community in August 2016 and August 2017 in Meliadine Lake are summarized below:

- In 2016, zooplankton abundance was significantly different ($P < 0.001$) among the five sampling areas (Table 7.3-9). Abundance in the Near-field exposure area in 2016 was significantly higher than in the Mid-field exposure area and each of the three reference areas. There was no significant difference in abundance between the Mid-field exposure area and the reference areas or among the reference areas, with the exception of a significant difference between MEL-03 and MEL-04 ($P = 0.066$). In 2017, zooplankton abundance was not significantly different among or between any of the sampling areas.
- Zooplankton biomass was not significantly different among the sampling areas in 2016 ($P = 0.131$) or 2017 ($P = 0.242$) (Table 7.3-9).
- Zooplankton species richness was significantly different among areas in August 2016 ($P = 0.045$) but not in August 2017 ($P = 0.284$) (Table 7.3-9). In 2016, richness was only significantly different between MEL-01 and MEL-03 ($P = 0.054$).

7.3.4.7 Multivariate Analyses

Two nMDS dimensions were derived from the zooplankton biomass data collected in Meliadine Lake. Zooplankton biomass is 2016 and 2017 were plotted separately to enable a good fit of the ordination results. The stress value for the final configuration was 0.12 for August 2016 and 0.13 for August 2017. According to the categories provided by Clarke (1993), these stress levels reflect a “fair” ordination with a relatively low risk of drawing false inferences. Stations in the Near-field and Mid-field exposure areas clustered close together by area and separately from the reference area stations in 2016 with a few exceptions (Figure 7.3-26). In the Near-field exposure area, community composition by biomass was relatively consistent among stations except at one station (MEL-01-05) which had comparatively low biomass but a similar distribution of taxa overall. Stations in the Mid-field exposure area also clustered together in 2016 and one station from the MEL-03 area (MEL-03-01) clustered close to the exposure areas, while the majority of other reference stations clustered further from the exposure areas.

In August 2017, clustering of stations by area was less distinct suggesting fewer differences in taxonomic composition among areas (Figure 7.3-27). In both years, the overall spread of stations observed in the nMDS plots suggests that variability in taxonomic composition by biomass was relatively high in August 2016 and 2017.

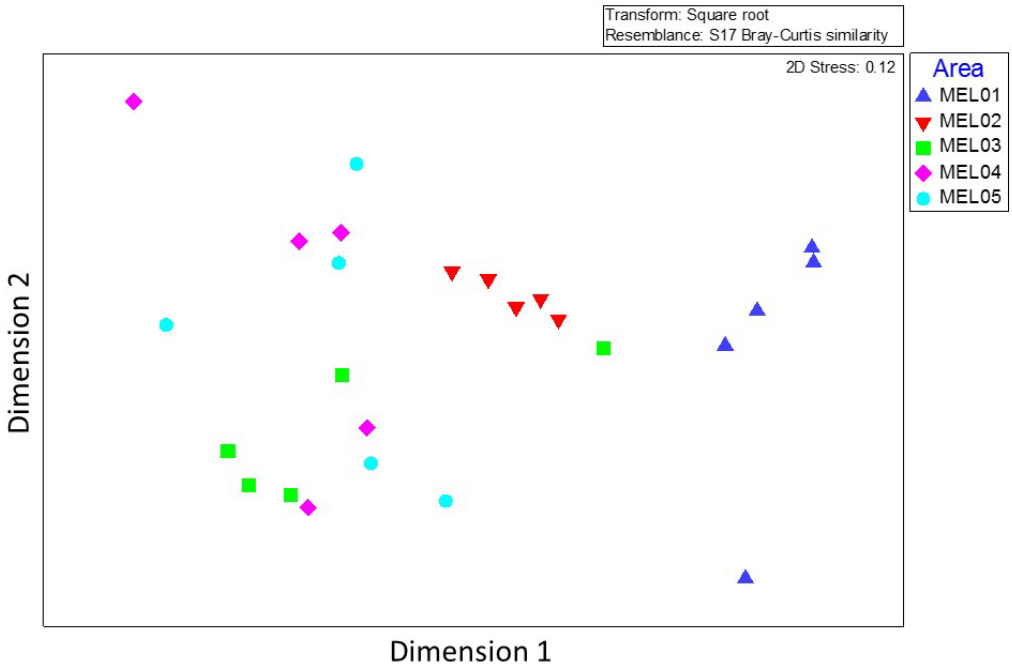

Figure 7.3-26: Ordination Plot of August Zooplankton Biomass in Meliadine Lake in 2016

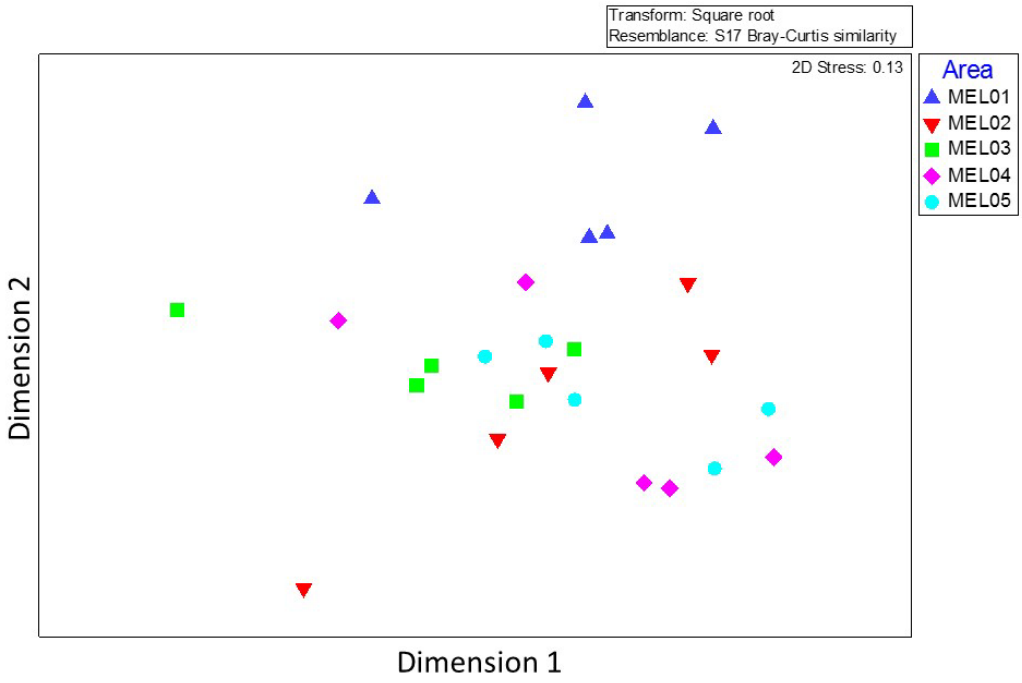

Figure 7.3-27: Ordination Plot of August Zooplankton Biomass in Meliadine Lake in 2016

7.3.5 Utility of Plankton as a Monitoring Tool

Long-term monitoring of plankton communities provides an assimilated measure of effects that integrates changes to biological, physical, and chemical factors over time. Plankton communities can be useful as early indicators of environmental change because of their rapid responses to changing environmental conditions (Bellinger and Sigee 2010; Uday Bhan et al. 2013). Plankton can provide information on seasonal dynamics, changes in nutrient availability, assessment of trophic status, and possible anthropogenic contamination.

Phytoplankton communities dominate primary production in lakes and are of ecological importance as the base of the aquatic food web. Phytoplankton can be particularly effective as early warning indicators of change because of their rapid response to changes in nutrient availability (Paerl et al 2007; Bellinger and Sigee 2010). Routine monitoring of phytoplankton incorporated into the AEMP can be used to characterize existing natural variability in community composition and to provide an indication of potential changes to trophic status in the lake.

Zooplankton also play an important role in the food web by linking primary producers and higher trophic level organisms such as fish. Growth and distribution of zooplankton communities are dependent on both abiotic (e.g., temperature, stratification, and lake size) and biotic (e.g., food limitation, predation, and competition) parameters and responses to environmental change can, therefore, be more difficult to predict (Ferdous and Muktadir 2009). Seasonal succession and natural year-to-year variation also contribute to inherent variability of these communities (Wetzel 2001; Paterson 2002), which can limit their usefulness as a monitoring tool.

Based on the plankton dataset collected from Meliadine Lake, the phytoplankton dataset (i.e., chlorophyll *a*, phytoplankton abundance, biomass, and composition of major taxonomic groups, along with supporting nutrient data collection) is a good monitoring tool for Meliadine Lake to detect potential effects resulting from nutrient enrichment. Due to high variability in zooplankton, it is not a good monitoring tool for Meliadine Lake.

7.3.6 Key Findings from Plankton Monitoring Program

Key findings from the plankton study were as follows:

- Nutrients during plankton sampling events in Meliadine Lake were generally low with variability observed among years and seasons, and spatial variability observed in total nitrogen concentrations in August 2017. Total nitrogen in August 2017 was significantly higher in the Near-field exposure area than in the reference areas; however, concentrations of total phosphorus were not significantly different among areas.
- Chlorophyll *a* exhibited high annual variability and was generally higher in Near-field stations compared to other areas.
- Trophic status calculations indicated conditions were oligotrophic in all areas and years.
- Higher phytoplankton abundance and biomass was observed in the Near-field exposure area compared to other areas.
- Seasonal and temporal variability were potentially confounding factors for the evaluation of spatial trends in the phytoplankton community. Variability among years was generally high in July and September but low in August indicating that August represented the most useful target month for analysis of spatial trends. In August, spatial trends were consistent among years with higher abundance and biomass in the Near-field exposure area than in the Mid-field exposure area or the reference areas.

- Phytoplankton communities in Meliadine Lake were generally dominated by the Chrysophyceae (golden algae). Limited spatial variability was observed in relative abundance and biomass of major taxonomic groups. However, multivariate analysis indicated differences among areas in community composition at the species level.
- Chlorophyll *a* concentrations had a significant, but weak linear relationship with phytoplankton biomass, with a moderate amount of variability between the two measurements, especially in 2015. Given this relationship, the current results suggest chlorophyll *a* is a potentially useful indicator of phytoplankton biomass in Meliadine Lake. The addition of data collected during future studies may help to further refine the relationship and may allow for additional methods such as using variable proportions of biomass and chlorophyll *a* rather than a constant conversion factor to explain the interaction between the two estimates of biomass (Kasprzak et al. 2008).
- Zooplankton biomass was primarily dominated by cladocerans and rotifers in all areas of Meliadine Lake. Among-year variability in the zooplankton community sampled in each area was high. Consistent spatial trends in zooplankton abundance or biomass could not be discerned due to the high temporal and seasonal variability.
- Higher chlorophyll *a* concentration and phytoplankton biomass, and unique phytoplankton community structure (based on multivariate analysis) in the Near-field area may be an indicator of potential effects of nutrient enrichment originating from the exploration camp STP. However, TP concentrations were not unusually elevated in the Near-field area, but were highest in this area in September during each year of monitoring. Further investigation is recommended to evaluate whether annual TP loads were sufficient to result in the observed spatial trend in chlorophyll *a* concentration and phytoplankton biomass, and whether other water chemistry variables also show changes consistent with an effect form the STP discharge.
- Long-term monitoring of plankton communities provides an integrated measure of effects that integrates changes to biological, physical, and chemical factors over time. Plankton communities can be useful as early indicators of environmental change because of their rapid responses to changing environmental conditions. Routine monitoring of phytoplankton incorporated into the AEMP can be used to characterize existing natural variability in community composition and to provide an indication of potential changes to trophic status in the lake.

8.0 CONCLUSIONS

8.1 Summary

8.1.1 Water Quality

Water quality monitoring activities were carried out at Meliadine Lake and the peninsula lakes in 2017 in support of the AEMP and Water License requirements for the Mine. This monitoring was completed to characterize water quality conditions so adaptive management strategies can be identified, as required. Meliadine Lake was sampled at five stations within each of the Near-field area, Mid-field area, and three reference areas during open-water conditions and at the Near-field and Mid-field areas during ice-covered conditions. Three peninsula lakes were sampled during open-water conditions.

Water quality data collected at Meliadine Lake and peninsula lakes in 2015, 2016 and 2017 were assessed to provide information or temporal and spatial variability of water quality in these waterbodies. The assessment consisted of a visual evaluation of time series plots developed for each water quality parameter and statistical analysis and comparison between the Near-field, Mid-field, and reference areas. Water quality results were compared to the applicable Canadian water quality guidelines for the protection of aquatic life, drinking water guidelines, or site-specific objectives developed for the Mine.

Water quality in Meliadine Lake, during ice-covered and open-water conditions, can be characterized as lacking stratification within the water column and being generally well oxygenated. The lake water was circumneutral to basic, with moderate sensitivity to acid deposition. Concentration of TDS, hardness, alkalinity, specific conductivity, nutrients, and metals were low and none of the relevant guidelines or objectives were exceeded.

Water quality in Meliadine Lake was similar across all years. Some spatial and seasonal variability was observed, but concentrations remained low and were orders of magnitude below the guidelines. In 2017 specific conductivity, major cations, chloride, sulphate, and some metals (i.e., total arsenic, barium, cobalt, copper, nickel, silicon, and strontium) concentrations were slightly higher at the exposure areas as compared to the reference areas; among exposure areas, the Near-field area tended to have slightly higher concentrations as compared to the Mid-field area. Also, specific conductivity, hardness, chloride, major cations, ammonia and some metals (e.g., barium, boron, copper, strontium) had slightly higher concentrations during ice-covered conditions as compared to the open-water conditions.

Water quality at peninsula lakes measured similar across all years, with some variability was observed among lakes. Generally, peninsula lakes were well oxygenated, with pH values indicative of slightly basic conditions, low sensitivity to acid deposition, and low to moderate ionic strength. Parameters concentrations at peninsula lakes were low and none of the relevant guidelines were exceeded.

Peninsula Lake A8 had specific conductivity, hardness, and concentrations of TDS (including chloride and sulphate), and some metals such as arsenic, barium, and strontium slightly higher as compared to the other two peninsula lakes. Peninsula Lake D7 had slightly higher concentrations of phosphorus, major ions (bicarbonate and fluoride), and some metals such as boron, lithium, molybdenum, selenium, uranium, and vanadium as compared to the other two lakes. Specific conductivity, hardness, alkalinity, TDS, major ions, and some metals (e.g., arsenic, barium, lithium, and strontium) were generally slightly higher in the peninsula lakes as compared to Meliadine Lake.

Provisional normal range concentrations were calculated for ecologically relevant water quality parameters for Meladine Lake for ice-covered conditions based on data collected at Mid-field area and for open-water conditions based on data collected at the reference areas. Similarly, normal range concentrations were calculated for each peninsula lake. These normal ranges will be used to evaluate the 2018 data collected from the exposure areas. The normal ranges may be updated (annually or every three-years) with new data collected from the reference areas.

8.1.2 Sediment Quality

A total of 35 sediment quality samples from Meliadine Lake, five samples from Lake A8, four samples from Lake B7, and three samples from Lake D7 were collected and analyzed for particle size, nutrients, and metals. The sediment quality data gathered in 2015 and 2016 form a baseline dataset for comparisons to future monitoring of sediment quality trends during the life of the mine.

Under baseline conditions, concentrations of arsenic, chromium, and copper exceed guideline values. Arsenic concentrations in Meliadine Lake were generally highest in the MEL 01 (Near-field exposure) area. Due to the close relation between fine sediments and metals in Melidine Lake, data were normalized to fine sediments prior to running statistical tests. Even after normalization some sediment quality parameters (arsenic, iron, mercury, strontium, and sulfur) were higher in the Near-field as compared to reference areas. The Mid-field area had similar particle size distribution to reference areas, but concentrations of some parameters (arsenic, chromium, cobalt, lead, manganese, molybdenum, nickel, uranium, and zinc) were higher in the Mid-field than in reference areas.

After normalization to grain size, normal range for sediment quality parameters were collected using data for the whole lake. These normal ranges will be used to evaluate the future sediment quality data collected from the exposure areas and may be updated as new data are collected from the reference areas.

Sediment samples from the peninsula lakes were also relatively sandy, with concentrations of arsenic and chromium and copper that exceeded ISQGs and PELs, and concentrations of copper that exceeded the ISQGs). The lowest concentrations of these three parameters were observed in Lake B7.

8.1.3 Benthic Invertebrate Community

Benthic invertebrate communities sampled in Meliadine Lake exposure and reference areas during 2015 and 2016 baseline sampling programs were representative of subarctic systems. These years reflect conditions prior to discharge of the Type A Water Licence effluent to the Near-field area of Meliadine Lake.

In the Meliadine Lake exposure and reference areas, benthic invertebrate communities were characterized by low total density and low to moderate richness. Both community variables were within the ranges expected for subarctic lake environments. SDI values were moderate to high, which indicated the invertebrate communities were diverse. Evenness was more variable and ranged from low to moderate. Collectively, these two indices suggest that baseline benthic communities sampled at most stations in the reference and exposure areas had moderate to high diversity with few taxa that were overly dominant. Benthic communities were dominated by midges (family Chironomidae) with the tribe Chironomini as the most dominant chironomid group in all areas sampled within Meliadine Lake. The bivalve family Pisidiidae was the sub-dominant group at the majority of stations.

Spatial and temporal differences in community structure between Near-field, Mid-field and reference areas were observed during this evaluation of the 2015 and 2016 data. In particular, the benthic invertebrate community of the Near-field area was found to differ from those in the three reference areas in 2016. These differences may be attributed to potential differences in the physical habitat sampled (i.e., substrate type), or possibly, mild nutrient enrichment in the Near-field area from the exploration camp STP discharge. Overall, the Near-field area community was most similar to the community at Reference Area 1.

Within-station variation in total invertebrate density and richness, based on five subsamples collected per station, was found to be generally within acceptable ranges for benthic invertebrate communities characterized by low density in oligotrophic lakes. Collection of both composite samples of five grabs and a subset of individual subsamples will continue to allow evaluation of the within-station variability.

Meaningful normal ranges for the benthic community, as an input to the Response Framework, could not be estimated at this time, due to variability in the available data related to substrate differences between reference and exposure areas, and a potential nutrient enrichment.

8.1.4 Fish Health and Fish Tissue

Threespine Stickleback were captured in sufficient numbers from the Near-field and reference areas of Meliadine Lake to meet sampling requirements for the fish health and tissue chemistry components of the AEMP. Threespine Stickleback were abundant throughout shallow areas of Meliadine Lake (i.e., less than 3 m), and susceptible to capture using minnow traps, and backpack electrofishing. A gear selectivity bias was observed, with larger Threespine Stickleback captured in minnow traps when compared to other gear types.

The timing of sampling during the August 2015 and August 2017 surveys was appropriate for assessing reproductive development in Threespine Stickleback. Threespine Stickleback were determined to be spawning in Meliadine Lake during the August 2015 and 2017 sampling periods, based on the presence of male secondary sex characteristics and the occurrence of ripe and spent individuals of both sexes. Threespine Stickleback are a spring spawning species; however, extended spawning seasons have been observed for some populations (Wootton et al. 1978; Chellappa et al. 1989). Based on this information and our observations, Threespine Stickleback likely spawn from June through to August in Meliadine Lake.

The majority of Threespine Stickleback captured in Meliadine Lake were infected by *S. solidus*, a tapeworm that competes with the host for available resources and has been found to decrease the energy allocated to storage and spawning in Threespine Stickleback (Schultz et al. 2006; Rushbrook et al. 2007), as well as delay sexual maturity. The parasite was abundant at each of the areas sampled (i.e., 76% of fish sampled), and has the potential to confound the detection of changes in energy storage and reproductive endpoints that may result from mine operations.

Population structure for Threespine Stickleback varied among sampling areas, with larger individuals collected from the Near-field area when compared to Reference Area 1 and Reference Area 2 (Table 8.1-1). Fish health endpoints were similar for female Threespine Stickleback among sampling areas (Table 8.1-2). Male Threespine Stickleback sampled from the Near-field area were longer, heavier, and had greater relative liver weights than individuals sampled from the reference areas (Table 8.1-2). Threespine Stickleback sampled from the Near-field area had lower relative gonad weights and greater relative body weights when compared to Reference Area 2, exceeding CES; however these differences were not observed relative to Reference Area 1. Fish health parameters for male Threespine Stickleback sampled from the Near-field area also exceeded normal ranges for

length, body weight, carcass weight, condition factor, and liver somatic index. With respect to tissue chemistry, significant differences were observed between the Near-field and reference areas for the majority of parameters examined, with lower metal concentrations generally observed at the Near-field area (Table 8.1-3). When compared to normal ranges, arsenic and tin were elevated in the Near-field area, while chromium, iron, molybdenum, nickel, rubidium, and selenium were below normal ranges.

Table 8.1-1: Summary of Statistically Significant Differences in Threespine Stickleback Fish Health Endpoints Collected During the Population Survey, 2015 and 2017

Parameter	CES	NF*RA1	NF*RA2
Length-frequency distribution	(a)	↑	↑
Size-at-age 1+	-	↑	↑
Size-at-age 2+	-	-	↑
Total Length	-	↑	↑
Body weight	-	↑	↓
Relative body weight (TW)	10%	↑	↑

(a) Length-frequency is an effect endpoint for non-lethal sampling in the EEM program, however a CES is not defined (Environment Canada 2012).

CES = critical effect size; NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; ↑ = endpoint significantly greater at Near-field Area compared to reference area; ↓ = endpoint significantly lower at the Near-field Area compared to reference area; - = not applicable; TW = calculated using total weight.

Table 8.1-2: Summary of Statistically Significant Differences in Threespine Stickleback Fish Health Endpoints Sampled During the Lethal Survey, 2015 and 2017

Sex	Parameter	CES	NF*RA1	NF*RA2
Female	Age	25%	-	↔
	Size-at-age 1+	25%	↑↑	-
	Size-at-age 2+	25%	-	-
	Length-frequency	-	-	-
	Body Weight	-	-	-
	Length	25%[(a)]	-	-
	Relative gonad size	25%	-	-
	Relative fecundity	-	↑	-
	Relative body weight	10%	-	-
	Relative liver size	25%	↑	-
	Relative egg size	-	-	-
Male	Age	25%	-	-
	Size-at-age 1+	25%	-	-
	Size-at-age 2+	25%	↑	↑↑
	Length-frequency	-	↑	↑
	Body Weight	-	↑	↑
	Length	25%[(a)]	↑	↑
	Relative gonad size	25%	-	↓↓
	Relative body weight	10%	-	↑↑
	Relative liver size	25%	↑↑	↑↑

(a) Threespine Stickleback are short-lived in freshwater so length was used as a surrogate for age (Environment Canada 2012).

CES = critical effect size; NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; ↑ = endpoint significantly greater at Near-field Area compared to reference area; ↑↑ = endpoint significantly greater at Near-field Area compared to reference area and exceeded CES; ↓ = endpoint significantly lower at Near-field Area compared to reference area; ↓↓ = endpoint significantly lower at Near-field Area compared to reference area and exceeded CES; ↔ = distributions were significantly different, but magnitude was zero; - = no difference, or not applicable.

Table 8.1-3: Summary of Statistically Significant Differences in Threespine Stickleback Fish Tissue Chemistry Endpoints for Fish Sampled During the Lethal Survey, 2015 and 2017

Parameter	NF*RA1	NF*RA2
Moisture	↑	-
Aluminum	↓	↓
Antimony	↔	↔
Arsenic	↑	↑
Barium	↓	↓
Beryllium	-	-
Bismuth	↔	↔
Boron	↓	↓
Cadmium	-	-
Calcium	↓	-
Cesium	↓	↓
Chromium	↓	↓
Cobalt	↓	↓
Copper	↓	↓
Iron	↓	↓
Lead	-	-
Lithium	↓	↔
Magnesium	↓	↓
Manganese	-	-
Mercury	-	↑
Molybdenum	↓	↓
Nickel	↓	↓
Phosphorus	↓	↓
Potassium	-	↑
Rubidium	↓	↓
Selenium	↓	↓
Silver	-	↑
Sodium	-	↑
Strontium	↓	-
Tellurium	-	-
Thallium	-	-
Tin	↑	↑
Titanium	↓	↓
Uranium	-	↓
Vanadium	↓	↓
Zinc	↓	↓
Zirconium	↔	↔

NF = Near-field Area; RA1 = Reference Area 1; RA2 = Reference Area 2; ↑ = endpoint significantly greater at Near-field Area compared to reference area; ↓ = endpoint significantly lower at Near-field Area compared to reference area; ↔ = distributions were significantly different, but magnitude was zero; - = no difference, or not applicable.

In general, Threespine Stickleback were similar between the Near-field and reference areas; however, differences were observed in population structure and tissue chemistry parameters. Threespine Stickleback sampled from the Near-field area were generally larger and exhibited lower metal concentrations relative to fish sampled from the reference areas. It could not be determined from the baseline data whether these differences resulted from geographic or interannual variation, as the Near-field and references areas were sampled in separate years. For example, differences in growth and energy storage may reflect better or more rapid growing conditions in 2015, rather than differences between sampling areas. As a consequence, it was difficult to assess the similarity of the Near-field and reference areas in Meliadine Lake with respect to these endpoints. During future AEMP sampling, the Near-field and reference areas will be sampled in the same year and at the same time (i.e., August), controlling for this factor.

Power analyses of fish health endpoints indicated that lethal sampling of 30 female and 30 male Threespine Stickleback would be sufficient to reliably detect differences that met or exceeded CES (Table 6.3-8); with the exception of relative gonad size for male fish, which would require 39 samples. Power analyses were based on all fish sampled in the baseline dataset, and fewer fish may be required if parasitized fish were excluded from data analyses, subsequently reducing endpoint variability. Sample size requirements for unparasitized fish were not estimated using the baseline dataset, as insufficient samples were obtained to adequately describe endpoint variation.

In summary, Threespine Stickleback were confirmed to be a suitable sentinel species for the Meliadine Gold Project AEMP. Baseline data were reported for fish health and fish tissue chemistry parameters for the Near-field area, Reference Area 1, and Reference Area 2. Provisional normal ranges were developed for Threespine Stickleback and Lake Trout using the baseline dataset, and will be modified in the future, as necessary, to include future reference area data.

8.1.5 Plankton

Plankton monitoring was conducted as a targeted study to characterize baseline conditions for the plankton community in Meliadine Lake and to evaluate the usefulness of plankton as a potential long-term monitoring tool. Plankton sampling was carried out during the 2015 to 2017 open-water seasons: July, August and September. Samples of phytoplankton, zooplankton, chlorophyll *a*, and nutrients were collected in five areas of Meliadine Lake (Near-field, Mid-field and three reference areas). Spatial and temporal trends observed in plankton communities were compared to changes in nutrient concentrations, and potentially confounding factors for future effluent monitoring studies were evaluated. Results from the targeted study show that there is spatial and seasonal variability observed in the majority of plankton endpoints. However, the use of phytoplankton communities and chlorophyll *a* are expected to be the most useful monitoring tools to be carried forward to provide an integrated measure of biological effects.

Trophic status calculations indicated conditions in Meliadine Lake were oligotrophic in all areas and years. Of the three commonly used variables to calculate TSI (i.e., total phosphorus, chlorophyll a, and Secchi Depth), chlorophyll *a* is considered the best predictor of the overall trophic status of lakes (Carlson and Simpson 1996). The strength of the relationship between chlorophyll *a* and phytoplankton biomass was also investigated to assess the suitability of chlorophyll *a* concentration as a potential surrogate for estimating phytoplankton biomass. The results suggest that chlorophyll *a* is a potentially useful indicator of phytoplankton biomass in this system.

Higher chlorophyll *a* concentrations and phytoplankton biomass, and unique phytoplankton community structure (based on multivariate analysis) in the Near-field area may be an indicator of potential effects of nutrient enrichment originating from the exploration camp STP-effluent outfall. However, TP concentrations were not unusually elevated in the Near-field area, but were highest in this area in September during each year of monitoring.

Zooplankton biomass was primarily dominated by cladocerans and rotifers in all areas of Meliadine Lake. Among-year variability in the zooplankton community sampled in each area was high. Consistent spatial trends in zooplankton abundance or biomass could not be discerned due to the high temporal and seasonal variability. Inherent variability in the zooplankton community may limit the usefulness of zooplankton community endpoints for long-term monitoring.

The targeted study provided useful information to characterize plankton communities in Meliadine Lake and to inform selection of monitoring tools for incorporation into the AEMP.

8.2 2018 Monitoring Plan

As per the AEMP design plan, water quality monitoring in Meliadine Lake and the peninsula lakes is an annual program, while monitoring for sediment quality, BIC, and fish health and fish tissue moves to the EEM schedule after pre-operations data have been collected. Pre-operations data (or pre-discharge of effluent from CP1) were collected in 2015 to 2017 following the AEMP design plan (Golder 2016b) approved under Water Licence 2AM-MEL-1631.

Meliadine Mine triggered under the MMER in 2016 after dewatering of Lake H17. The Cycle 1 study design was submitted to Environment and Climate Change Canada (ECCC) in August 2017 and is currently under review by the technical advisory panel. The field program will be conducted in August 2018 once the study design has been approved by the technical advisory panel.

The first discharge from CP1 was planned during September to October 2017 but did not occur.
Agnico Eagle anticipates initiating the first discharge from CP1 in June 2018. As per the AEMP design plan, sediment quality, BIC, and fish health and fish tissue data may need to be collected to monitor the potential effects of this discharge.

9.0 CLOSURE

This report for Agnico Eagle is confidential and proprietary to Golder Associates Ltd., and is provided for the sole and express purpose of permitting the recipient to evaluate the report. In receipt of this report, the recipient agrees to maintain the information contained in this report (“Proprietary Information”) in confidence and to not modify, reproduce, distribute, use (except as expressly permitted herein) or otherwise disclose the Proprietary Information to any person outside the group or team directly responsible for evaluation of its contents, without the prior and express written consent of Golder Associates Ltd. The Proprietary Information of Golder Associates Ltd. is protected under law in Canada and other countries throughout the world and under international treaties.

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If you have any questions or require additional clarification, please contact Colleen Prather by email to colleen_prather@golder.com. Thank you for considering the services of Golder Associates Ltd.

REFERENCES

AENV (Alberta Environment). 2006. Aquatic Ecosystems Field Sampling Protocols. Edmonton, AB, Canada.

Agnico Eagle (Agnico Eagle Mines Ltd.). 2014. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

Agnico Eagle. 2015. Environmental Management and Protection Plan (EEMP) for the Meliadine Gold Project. Version 4. April 2015.

Barber I, Huntingford FA. 1995. The effect of *Schistocephalus solidus* (Cestoda: Pseudophyllidea) on the foraging and shoaling behaviour of Three-spined Sticklebacks, *Gasterosteus aculeatus*. Behaviour, 132:15-16.

Barrett TJ, Tingley MA, Munkittrick MR, Lowell RB. 2010. Dealing with heterogeneous regression slopes in analysis of covariance: new methodology applied to environmental effects monitoring fish survey data. Environmental Monitoring and Assessment, 166: 279-291.

Barrett TJ, Sharpe, RL, Azim ME. 2014. A novel approach for graphing censored environmental data. Integrated Environmental Assessment and Management, 10(4):595-596.

Barrett TJ, Hille KA, Sharpe RL, Harris KM, Machtans HM, Chapman PM. 2015. Quantifying natural variablility as a method to detect environmental change: definitions of the normal range for the single observation and the mean of m observations. Environmental Toxicology and Chemistry, 34(5):1185-1195.

Beaty SR, Fortino K, Hershey AE. 2006. Distribution and Growth of Benthic Macroinvertebrates Among Different Patch Types of the Littoral Zones of Two Arctic Lakes. Freshwater Biol. 51: 2347-2361.

Bellinger EG, Sigee DC. 2010. Freshwater Algae: Identification and Use as Bioindicators. John Wiley & Sons, Ltd.

Bianchi, T. S., Pennock, J. R., & Twilley, R. R. (1999). Biogeochemistry of Gulf of Mexico estuaries. New York: Wiley.

Brown-Peterson NJ, Wyanski DM, Saborido-Rey F, Macewicz BJ, Lowerre-Barbieri SK. 2011. A standardized terminology for describing reproductive development in fishes. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science, 3: 52-70.

Carlson RE. 1977. A trophic state index for lakes. Limnol. Oceanogr. 22: 361-369.

CCME (Canadian Council of Ministers of the Environment) 1999, with updates to 2017. Canadian Environmental Quality Guidelines. Winnipeg, MB, Canada.

CCME. 2001. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life: Introduction. Updated. Canadian Environmental Quality Guidelines, 1999. Winnipeg, MB, Canada.

CCME. 2004. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater System. In: Canadian Environmental Quality Guidelines, 2004. Winnipeg, MB, Canada.

CCME. 2010. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Ammonia. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CFIA (Canadian Food Inspection Agency). 2014. Canadian Food Inspection Agency Fish Products Standards and Methods Manual: Appendix 3 Canadian Guidelines for Chemical Contaminants and Toxins in Fish and Fish Products. Ottawa, ON Canada. Available online: http://www.inspection.gc.ca/food/fish-and-seafood/manuals/standards-and-methods/eng/1348608971859/1348609209602?chap=0#s20c7.

Chellappa S, Huntingford FA, Strang RHC, Thomson RY. 1989. Annual variation in energy reserves in male three-spined stickleback, *Gasterosteus aculeatus* L. (Pisces, Gasterosteidae). Journal of Fish Biology, 35:275-286.

Clarke, K.R. 1993. Non-parametric multivariate analyses of changes in community structure. Aust. J. Ecol. 18:117-143.

Clarke KR, Gorley RN, Somerfield PJ, Warwick RM. 2014. Change in marine communities: an approach to statistical analysis and interpretation, 3rd edition. Plymouth, UK: PRIMER-E. 260 pp.

Clarke KR, Gorley RN. 2016. PRIMER v7.0.11. PRIMER-E Ltd., Plymouth, UK.

Cowardin LM, Carter V, Golet FC, LaRoe ET. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Performed for U.S. Department of Interior, Fish and Wildlife Service, Washington, DC. Available at: http://el.erdc.usace.army.mil/emrrp/emris/emrishelp2/cowardin_report.htm.

Daniel, W.W. 1990. Applied nonparametric statistics (2nd ed.). Boston: PWS-Kent Publishing Company

Day, R. W., and G. P. Quinn. 1989. Comparisons of treatments after an analysis of variance in ecology. Ecological Monographs 59:433-463.

De Beers. 2017. Gahcho Kué Mine 2016 Aquatic Effects Monitoring Program Report, Section 8. Submitted to the Mackenzie Valley Land and Water Board, Yellowknife, NWT, Canada, May 2017.

Dillon, RT Jr. 2000. The Ecology of Freshwater Molluscs. Cambridge University Press, New York, NY, USA. 509 pp.

Dodds WK, and Whiles MR. 2010. Freshwater ecology: concepts and environmental applications of limnology. Elsevier Inc. Burlington, MA.

Elliott, J. M. 1971. Some methods for the statistical analysis of samples of benthic invertebrates. Sci. Publ. 25. Freshwater Biol. Ass., Ambleside, Westmorland, U.K. 144 p

Environment Canada. 2004. Canadian Guidance Framework for the Management of Phosphorus in Freshwater Systems. Ecosystem Health: Science-based Solutions Report No. 1-8. National Guidelines and Standards Office, Water Policy and Coordination Directorate, Environment Canada, pp. 114.

Environment Canada. 2012. Metal Mining Technical Guidance for Environmental Effects Monitoring. National EEM Office, Ottawa, ON, Canada.

Faul F, Erdfelder E, Lang AG, Buchner A. 2007. G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. Behavior Research Methods, 39:175-191.

Felip, M. and J. Catalan. 2000. The relationship between phytoplankton biovolume and chlorophyll in a deep oligotrophic lake: decoupling in their spatial and temporal maxima. J. Plankton Res. 22 (1): 91-106.

Ferdous Z and Muktadir AKM. 2009. A Review: Potentiality of Zooplankton as Bioindicator. American Journal of Applied Sciences 6 (10): 1815-1819.

Franklin DJ, Airs RL, Fernandes M, Bell TG, Bongaerts RJ, Berges JA, Malin G. 2012. Identification of senescence and death in *Emiliania huxleyi* and *Thalassiosira pseudonana*: cell staining, chlorophyll alterations, and dimethylsulfoniopropionate (DMSP) metabolism. Limnol Oceanogr 57:305-317.

Furness, R. W & Rainbow, P. S (1990). Heavy metals in the marine environment. CRC Press, Boca Raton, Fla.

Golder (Golder Associates Ltd.). Technical Procedures 8.6-1: Benthic invertebrate Sampling (unpublished file information, unreferenced).

Golder. 2013. Reinstated Draft Site-Specific Water Quality Objective (SSWQO) Assessment, Meliadine Gold Project, Nunavut. Technical Memorandum. Submitted to Agnico Eagle Mines Ltd.

Golder. 2014. Benthic Invertebrate Report in Support of the 2013 AEMP Annual Report for the Diavik Diamond Mine, NT. Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT, Canada.

Golder. 2016a. 2015 Meliadine Fish Health Summary Report. Submitted to Agnico Eagle Mines Limited, February 2016.

Golder. 2016b. Meliadine Gold Project, Nunavut Aquatic Effects Monitoring Program (AEMP) Design Plan 6513-REP-03 Version 1. Prepared for Agnico Eagle Mines Limited, Rouyn Noranda, Quebec.

Golder. 2017a. Aquatic Effects Monitoring Program – 2016 Annual Report, Meliadine Gold Project. Prepared for Agnico Eagle Mines Limited. Document Number 623-1663489.March 2017.Golder 2017b. AEMP 2016 Annual Report, Section 7. Prepared for Diavik Diamond Mines (2012) Inc. Yellowknife, NT. April 2017.Health Canada 2014. Guidelines for Canadian Drinking Water Quality Summary Table. Prepared by the
Federal-Provincial-Territorial Subcommittee on Drinking Water. Ottawa, ON, Canada.

Hershey, A. 1992. Effects of Experimental Fertilization on the Benthic Macroinvertebrate Community of an Arctic Lake. Journal of the North American Benthological Society. Vol. 11, No. 2 (Jun. 1992), pp. 204-217.

Hillebrand H. 2003. Opposing effects of grazing and nutrients on diversity. Oikos. Vol 100, No 3, pp 592-600.

Hoke RA, Geisy JP, Adams JR. 1990. Use of linear orthogonal contrasts in environmental data. Environmental Toxicology and Chemistry 9:815-819.

Holopainen IJ. 1987. Seasonal variation of survival time in anoxic water and the glycogen content of Sphaerium corneum and Pisidium amnicum (Bivalvia, Pisidiidae). American Malacological Bulletin 5(1):41-48.

Hubert, DB, McKernam M, Paquette C. 2011. Canada's Environmental Effect's Monitoring Program: areas for improvement. Interreg Environ Assess Manage 7:143-144.

Hynes, H.B.N. 1970. The ecology of running water. University of Toronto Press, Toronto, ON. 55 p.

Kasprzak, P., Padisak, J., Koschel, R., Krienitz, L. and F. Gervais. 2008. Chlorophyll a concentration across a trophic gradient of lakes: An estimator of phytoplankton biomass? Limnologica – Ecology and Management of Inland Waters. 38 (3-4): 327-338.

Koenings JP, Edmundson JA. 1991. Secchi disk and photometer estimates of light regimes in Alaskan lakes: Effects of yellow color and turbidity. Limnol Oceanogr 36: 91-105.

Krebs, C.J. (1999) Ecological Methodology. 2nd Edition, Benjamin Cummings, Menlo Park, 620 p.Government of Canada. 2012. Metal Mining Effluent Regulations. S0R/2002-222; current to 18 November 2012.

Legendre L, Legendre P. 1983. Numerical ecology. Amsterdam (NL): Elsevier.

Mackay WC, Ash GR, Norris HJ. 1990. Fish Ageing Methods for Alberta. R.L. & L. Environmental Services Ltd. in association with Alberta Fish and Wildlife Division and the University of Alberta, Edmonton. 113 pp.

McNeely RN, Neimanis VP, Dwyer L. 1979. Water Quality Sourcebook – A Guide to Water Quality Parameters. Inland Waters Directorate, Water Quality Branch, Minister of Supply and Services Canada.

Minshall GW, B Shafii, WJ Price, C Holderman, PJ Anders, G lester and P Barrett. 2014. Effects of nutrient replacement on benthic macroinvertebrates in an ultraoligotrophic Reach of the Kootenai River, 2003 -2010. Freshwater Science. 2014. 33 (4):1009-1023.

Namayandeh, Armin and Roberto Quinlan. 2011. Benthic Macroinvertebrate Communities in Arctic Lakes and Ponds of Central Nunavut, Canada. Arctic, Antarctic, and Alpine Research. Vol. 43, No. 3 pp. 417-428.

Northington RM, Keyse MD, Beaty SR, Whalen SC, Sokol ER, Hershey AE. 2010. Benthic secondary production in eight oligotrophic arctic Alaskan lakes. J N Am Benthol Soc 29: 465-479.

Paerl HW, Valdes-Weaver LM, Joyner AR, Winkelmann V. 2007. Phytoplankton Indicators of Ecological Change in the Eutrophying Pamlico Sounds System, North Carolina. Ecological Applications, 17(5) Supplement, 2007, pp. S88–S101.

Petersen CGJ. 1892. Fiskenbiologiske forhold i Holboek Fjord, 1890-91. Beretning fra de Danske Biologiske Station fur 1890 (91), 1: 121-183.

Quest Research. 2017. PRIMER version 7.0.13 software.

Quigley MA. 1982. Freshwater Macroinvertebrates. Water Pollution Control Federation Journal. Vol 54, No 6, pp 868-877.

Resh, V.H., and D.M Rosenberg (editors). 1984. The ecology of aquatic insects. Prager Publishers, New York, NY. 625 p.

Rosenberg, D.M., and V.H. Resh.1993. Freshwater biomonitoring and benthic macroinvertebrates. Routledge, Chapman & Hall, Inc., New York, NY. 488 p.

Rushbrook BJ, Katsiadaki I, Barber I. 2007. Spiggin levels are reduced in male sticklebacks infected with Schistocephalus *solidus*. Journal of Fish Biology, 71:298-303.

Saffran KA, Trew DO. 1996. Sensitivity of Alberta Lakes to Acidifying Deposition: An Update of Maps with Emphesis on 109 Northern Lakes. Water Management Division. Alberta Environment Protection. W9603.

Schindler DW. 1974. Eutrophication and recovery in experimental lakes: Implications for lake management. Science 184 (No.4135): 897-899.

Schultz ET, Topper M, Heins DC. 2006. Decreased reproductive investment of female threespine stickleback Gasterosteus aculeatus infected with the cestode *Schistocephalus solidus*: parasite adaptation, host adaptation, or side effect? Oikos, 114:303-310.

Simpson EH. Measurement of diversity. Nature. 1949; 163:688.

Straskraba, V. and R.E. Moran, 1990. Environmental Occurrence and Impacts of Arsenic at Gold Mining Sites in the Western United States: Proceedings, International Symposium on Acid Mine Water in Pyritic Environments, Lisbon, Portugal. September 16-19, 1990; in Mine Water and the Environment, Volume 9, Numbers 1-4 / March, 1990.

Systat, Inc. 2009. SYSTAT® 13: Language reference, 417p.

Tetra Tech. 2017a. Construction Summary (As-Built) Report for Dike D-CP1, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Ltd. October 2017.

Tetra Tech. 2017b. Construction Summary (As-Built) Report for Dike D-CP5, Meliadine Gold Project, Nunavut. Prepared for Agnico Eagle Mines Ltd. October 2017.

Thorp JH and AP Covich. 2001. Ecology and Classification of North American Freshwater Invertebrates, 2nd Edition. Academic Press.

Uday Bhan S, Ahluwalia AS, Sharma C, Jindal R, Thakur RK. 2013. Planktonic indicators: A promising tool for monitoring water quality (early-warning signals). Ecology Environment & Conservation 19 (3): 793-800.

Vollenweider RA. 1970, Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters, with Particular Reference to Nitrogen and Phosphorus as Factors in Eutrophication. OECD, Paris. Tech. Rpt. DA 5/SCI/68.27. 250 pp.

Wootton RJ, Evans GW, Mills L. 1978. Annual cycle in female Three-spined sticklebacks (*Gasterosteus aculeatus* L.) from an upland and lowland population. Journal of Fish Biology, 12:331-343.

Zar, J. H. 1996. Biostatistical Analysis. 3rd edn. London: Prentice-Hall.

GLOSSARY

Term	Definition
Abundance	The number or quantity of cells or organisms in a particular area or volume of sample.
Alkalinity	A measure of the acid-neutralizing capacity carbonates, bicarbonates and hydroxides present in water. Alkalinity is typically reported in units of mg/L calcium carbonate ($CaCO_3$).
Aquatic Effects Monitoring Program	A monitoring program designed to evaluate the effect of mining activities and mitigation on the aquatic environment. Mg.
Benthic Invertebrates	Aquatic animals without backbones (e.g., insects, worms, snails, clams crustaceans) that live on/in the bottom substrate of a waterbody.
Biomass	The mass of all the cells or organisms in a particular area or volume of sample.
Bray-Curtis Index	An index used to summarize the overall difference in community structure between reference and exposure areas.
Canadian Water Quality Guideline (CWQG) for the Protection of Aquatic Life	Guidelines established by the Canadian Council of Ministers of the Environment to protect aquatic life (i.e., fish, aquatic plants, and benthic invertebrates) in Canadian surface waters.
Chlorophyll *a*	A photosynthetic pigment found in plants, responsible for the conversion of inorganic carbon and water into organic carbon. The concentration of chlorophyll *a* is often used as an indicator of algal biomass.
Community	The groups of organisms living together in the same area, usually interacting or depending on each other for existence.
Community composition	The species present and their relative proportions in an assemblage of organisms.
Dominance	The predominance of one or more species in a community.
Drinking Water Quality Guidelines (DWQG)	Health Canada guidelines used to evaluate the suitability of water for human consumption.
Effluent	The out-flow water or wastewater from a water processing system or device, or the final water which is discharged from a treatment plant. For purposes of this document, effluent is the water that is discharged from the water treatment plant to Meliadine Lake.
Ekman grab	A sampling device used to collect a discrete sample of bottom sediment.

Term	Definition
Euphotic zone	The extent of the water column that is exposed to sufficient sunlight for photosynthesis to occur (typically to a depth in the water column where 1% of the irradiance is measured, or two times the Secchi depth).
Exposure area	An area that receives direct discharge from mining operations.
Homogeneity of variance	Statistical term for the assumption that the variance within each of the groupings/populations is equal.
In situ	Refers to measurements or data recorded in the field, at the sampling site.
Interim Sediment Quality Guideline (ISQG)	In reference to the Canadian sediment quality guidelines (CCME 2001), the concentration above which adverse effects may occur, and below which they are not expected to occur.
Kemmerer	A plastic or Teflon water sampling device that is opened, lowered into the water to the desired sample collection depth; a weighted messenger device is used to close the Kemmerer and sample water from the desired depth.
Metalloid	A class of chemical elements intermediate in properties between metals and non-metals; e.g., arsenic and boron.
Mean	Arithmetic average value.
Metals	A class of chemical elements that are good conductors of electricity and heat, and have the capacity to form positive ions in solution; e.g., aluminum, copper, iron, and zinc.
Normal Range	An estimate of natural variability.
Nutrients	Substances (elements or compounds) such as nitrogen or phosphorus, which are necessary for the growth and development of plants and animals.
Nutrient Enrichment	The type of effect resulting from an increase in the nutrients to an ecosystem, which may impact primary productivity.
Oligotrophic	Trophic state classification for lakes characterized by low concentration of nutrients and low organic productivity. OligotrophicTrophic state classification for lakes characterized by low concentration of nutrients and low organic productivity.
Otolith	A calcified structure that can be used to estimate fish age.
P–value	Statistical value used to determine the significance of a relationship or difference, e.g., $P < 0.1$.
Parameter	A particular physical, chemical, or biological property that is being measured.

Term	Definition
pH	The negative logarithm of the concentration of the hydronium ion (H^+). The pH is a measure of the acidity or alkalinity of an aqueous solution, expressed on a scale from 0 to 14, where 7 is neutral, values below 7 are acidic, and values over 7 are alkaline.
Phytoplankton	Small, free-floating algae that are suspended in the water column.
Probable Effects Level (PEL)	Canadian sediment quality guideline for the protection of freshwater quality life (CCME 2001), representing the concentration above which adverse effects may but will not always occur.
Oxic	Relates to the amount of dissolved oxygen in a water column relative to the guideline to support aquatic life (CCME 1999); water described as oxic has oxygen above the guideline.
R^2	A coefficient of determination, a statistical measure of how well a regression line approximates the real data points.
Reference area	An area that is reasonably similar in terms of monitored components and features to the exposure area, though not necessarily identical, but has no potential to be affected by the mine.
Richness	The number of different taxonomic groups present in a given area or sample volume.
Secchi Depth	A parameter used to determine the clarity of surface waters. The measurement is made with a Secchi disk, a black and white disk that is lowered into the water and the depth is recorded at which it is no longer visible. Higher Secchi depth readings indicate clearer water that allows sunlight to penetrate to a greater depth. Lower readings indicate turbid water that can reduce the penetration of sunlight. Limited light penetration can be a factor in diminished aquatic plant growth beneath the surface, thus reducing the biological re-aeration at greater depths.
Sediment	Solid material that is transported by, suspended in, or deposited from water. It originates mostly from disintegrated rocks; it also includes chemical and biochemical precipitates and decomposed organic material.
Standard deviation (SD)	A measure of the variability or spread of the measurements about the mean. It is calculated as the positive square root of the variance.
Simpson's Diversity Index	A measure of the number of taxonomic groups or species present within an area of habitat or in a sample, as well as the abundance of each of those groups. Index values range from 0 to 1; the greater the diversity, the greater the index value.

Term	Definition
Standard error (SE)	The standard deviation (positive square-root of the variation) of the errors associated with a series of measurements.
Simpson's Evenness Index	A measure of how evenly the total invertebrate density is distributed among the taxa in an area or sample. Index values range from 0 to 1; higher numbers indicate a greater equality among all taxa present in a sample and low values represent low evenness (i.e., a high degree of dominance by one or a few organisms).
Specific conductivity	A temperature-corrected measure of a water sample's ability to conduct electricity; measurements are corrected to 25°C. Waters with higher concentrations of dissolved ions conduct electricity more efficiently than waters with low ionic concentrations.
Taxa	A group of organisms of any taxonomic rank (e.g., family, genus, species).
Total dissolved solids (TDS)	Organic and inorganic substances that are dissolved in water and will pass through a 0.45 micrometre (µm) filter.
Total Kjeldahl nitrogen	A measure of ammonia and organic nitrogen. It is used as an indicator of biologically available nitrogen.
Total suspended solids (TSS)	A measurement of the concentration of particulate matter found in water.
Transformation	The process of converting data through replacement of a variable by a function of that variable.
Variable	A characteristic, number or quantity whose associated value may change or be studied.
Water Column	The water in any waterbody from the surface down to the substrate.
Zooplankton	Small, sometimes microscopic animals that live suspended in the water column.

ABBREVIATIONS AND ACRONYMS

Term	Definition
#	number
<	less than
>	greater than
≤	less than or equal to
±	plus or minus
Σ	sum
%SE	percent standard error of the mean
5X	five times
α	alpha
%ile	Prediction interval calculated using percentiles
AEMP	Aquatic Effects Monitoring Program
AENV	Alberta Environment
Agnico Eagle	Agnico Eagle Mines Limited
ALS	ALS Environmental Laboratory
ANCOVA	analysis of covariance
ANOVA	analysis of variance
ANOSIM	Analysis of similarities
AVC	Atlantic Veterinary College
BCI	Bray-Curtis index
BCMoE	British Columbia Ministry of Environment
BURB	Burbot (*Lota lota*)
BP	Backpack Electrofishing
CA	cortical alveolar

Term	Definition
$CaCO_3$	calcium carbonate
CALA	Canadian Association for Laboratory Accreditation Inc.
CCME	Canadian Council of Ministers of the Environment
CES	Critical effects sizes
CFIA	Canadian Food Inspection Agency
Chl	chlorophyll *a* sample
CISCO	Cisco
CPUE	Catch-per-unit-effort
CV	Coefficient of variation
CW	Calculated using carcass weight
CWQG	Canadian Water Quality Guidelines
BIC	Benthic Invertebrate Community
DELT	Deformities, Erosions, Lesions, Tumours
DIN	depth-integrated nutrient
DL	detection limit
DO	dissolved oxygen
DOC	dissolved organic carbon
DSCE	Dwass-Steel-Chritchlow-Fligner Test for Pairwise Comparision
dup	duplicate
DWQG	Drinking Water Quality Guidelines
ECCC	Environment and Climate Change Canada
EEM	Environmental Effects Monitoring
Feb	February
FEIS	Final Environmental Impact Statement

Term	Definition
GE	Germinal epithelium
Golder	Golder Associates Ltd.
GPS	global positioning system
GSI	gonadosomatic index
GVBD	germinal vesicle breakdown
GVM	germinal vesicle migration
HP	Hoop Net
ID	identifier
K-S	Kolmogorov-Smirnov test
K-W	Kruskal Wallis test
INAC	Indigenous and Northern Affairs Canada
ISS	Insufficient Sample Size
ISQG	Interim Sediment Quality Guideline
LKTR	Lake Trout (*Salvelinus namaycush*)
LogPi	95% prediction intervals were defined calculated using log transformed data and then upper and lower by back transforming boundaries were back-transformed to the original data scale
Log_{10}	Logarithm base 10
LSI	liversomatic index
LTL	lowest taxonomic level
Max	maximum
MSE	Mean squared error
MF	Mid-field
Min	minimum
Mine	Meliadine Gold Mine

Term	Definition
MMER	Metal Mining Effluent Regulations
MT	Minnow Trap
M-W U	Mann-Whitney U Statistical Test
n	Number / Sample Size
N	North
	Mid-column nutrient sample
NA	not applicable
NAD 83	North American Datum 1983
NE	northeast
NF	Near-field
nMDS	Non-metric Multidimensional Scaling
NNST	Ninespine Stickleback (*Pungitius pungitius*)
NW	northwest
OM	oocyte maturation
P	plankton sample
Pi	the proportion of the ith taxon
P-value	Probability value
P_{50}	50% probability
P	Probability
PI	95% prediction intervals
PEL	Probable Effect Level
PG	Primary growth
POF	postovulatory follicle complex
QA	quality assurance

Term	Definition
QC	quality control
R	R statistic
r^2	coefficient of determination
RA1	Reference Area 1
RA2	Reference Area 2
REP	replicate
RNWH	Round Whitefish (*Prosopium cylindraceum*)
RPD	relative percent difference
S	south
Sc1	primary spermatocyte
Sc2	secondary spermatocyte
SD	standard deviation
SDI	Simpson's Diversity Index
SE	southeast
	standard error
SEI	Simpson's Evenness Index
Sg1	primary spermatogonia
Sg2	secondary spermatogonia
SLSC	Slimy Sculpin (*Cottus cognatus*)
SN	Seine Net
SQ	Sediment Quality Samples
SR	studentized residuals
SRSi	soluble reactive silica
SSW	south-southwest

Term	Definition
SSWQO	Site-Specific Water Quality Objectives
St	spermatid
STP	Sewage Treatment Plant
SW	southwest
Sz	spermatozoa
TDP	Total Dissolved Phosphorus
TDS	total dissolved solids
THST	Threespine Stickleback (*Gasterosteus aculeatus*)
TKN	Total Kjeldahl Nitrogen
TN	total nitrogen
TOC	total organic carbon
TP	total phosphorus
TSI	Trophic State Index
TSS	total suspended solids
T-test	Two-sample t-test
Tukey's HSD	Tukey's Honest Significant Difference Test
TW	Calculated using total weight
UTM	Universal Transverse Mercator
Vtg1	primary vitellogenic
Vtg2	secondary vitellogenic
Vtg3	tertiary vitellogenic
W	west
WAD	weak acid dissociable
WNW	west-northwest

Term	Definition
WRS	Pairwise Wilcox Rank Sum Test
WSW	west-southwest

UNITS OF MEASURE

Unit	Definition
°C	degrees Celsius
cells/L	number of cells per litre
cm	Centimetre
g	Gram
h/hr	hours
m^2	square metres
Kg	Kilogram
Km	kilometre
m^2	square metres
mg	milligram
mg $CaCO_3$/L	milligrams calcium carbonate per litre
mg/kg dw	Milligram per kilogram dry weight
mg/kg ww	milligrams per kilogram wet weight
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
mg-N/L	milligrams of nitrogen per litre
mg-P/L	milligrams of phosphorus per litre
mL	millilitre
mm	millimetre
Mt	Million tonnes
Org/L	Organism per litre
org/m^2	organisms per square metre
org/m^3	organisms per cubic metre
µg/g dw	micrograms per gram dry weight

Unit	Definition
µg/L	micrograms per litre
µm	micrometre
µS/cm	microsiemens per centimetre
NTU	nephelometric turbidity units
s	seconds
y/yr	years

Signature Page

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APPENDIX 2A

Meliadine Mine Layout

NO. DESSIN
DRAWING NO.

FORMAT ANSI B–11x17

EMULSION PLANT
TEMPORARY OVERBURDEN STOCKPILE
SEWAGE TREATMENT PLANT
CHANNEL2
FRESH WATER INTAKE CAUSEWAY
MELIADINE ESKER
WATER TREATMENT PLANT
WTP INTAKE CAUSEWAY
TREATED SEWAGE DISCHARGE
INDUSTRIAL SITE PAD
LANDFARM
ORE STOCKPILE 3
ORE STOCKPILE 1
ORE STOCKPILE 2
CHANNEL1
CULVERT3
CULVERT1
CULVERT2
CHANNEL3
LANDFILL
BERM1
CHANNEL8
CHANNEL7
CHANNEL4
EVAPORATORS
WASTE ROCK & OVERBURDEN STORAGE FACILITY 2 (WRSF2)
WASTE ROCK & OVERBURDEN STORAGE FACILITY 1 (WRSF1)
CULVERT4
CULVERT5
CHANNEL6
CP6 JETTY
CULVERT6
CHANNEL5
TIRIGANIAQ PIT 1 (TIRI_1000_01)
BERM3
TIRIGANIAQ PIT 2 (TIRI_1000_02)
SALINE POND
CP5 JETTY
WASTE ROCK & OVERBURDEN STORAGE FACILITY 3 (WRSF3)
ANFO PLANT
AWAR
BERM2
TAILINGS
TAILINGS STORAGE FACILITY (TSF)
WASTE ROCK COVER
MELIADINE LAKE
CP1
CP3
CP4
CP5
CP6
P1
P2
P3
P-AREA
D-CP3
D-CP1
D-CP4
D-CP5
D-CP6
G2
B0
B5
B6
B7
B30
B31
B32
B33
B33A
A9
A12
A13
A35
A36
A37
A38
A40
A54
H1
H2
H3
H4
H5
H7A
H7B
H7C
H8
H9
H10
H11
H12
H13
H14
H15
H15E
H15G
H16
H17
H19
J2
J3
J4
J5
J6
J7
0
500 m
Scale: 1: 12 500

LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

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AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE 1.2 GENERAL MINE SITE PLAN LAYOUT

ÉCHELLE/SCALE	FICHIER/FILE	REVISION	FEUILLE/SHT
1:12500	.DWG		
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APPENDIX 3A – 3F

Water Quality

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3A1.0 INTRODUCTION

This appendix describes the quality assurance and quality control (QA/QC) procedures implemented during the 2017 water quality monitoring program completed in support of the Aquatic Effects Monitoring Program (AEMP) for the Meliadine Gold Mine Project (Project). An evaluation of the QC data and implications for the interpretation of the AEMP study results is also included, along with procedures implemented to improve accuracy of in-situ measurements and to minimize data gaps.

Data integrity is determined by the QA/QC procedures that are applied during all aspects of a monitoring program, from sample collection to data analysis and reporting. Quality assurance (QA) procedures include training of personnel, data management, and other technical practices designed to confirm that high quality data are consistently generated. Quality control (QC) procedures include steps to measure and evaluate data quality, as well as the corrective actions that are applied when data quality objectives are not achieved.

3A2.0 QUALITY ASSURANCE

Quality assurance procedures implemented during the 2017 water quality monitoring program activities are classified into three categories of data management: field operations, laboratory analyses, and office operations.

3A2.1 Field Operations

Quality assurance procedures for field operations involve field crew training, pre-field meetings, and the use of standardized methods and explicit instructions for collecting and handling field data. Field staff for the Project were trained to be proficient in standardized field sampling procedures, data recording, and equipment operation. Field work was completed according to approved specific work instructions that were developed for the Project based on standardized technical procedures developed by Golder Associates Ltd. (Golder). Golder's technical procedures are consistent with information and field protocols described in relevant scientific literature (e.g., CCME 2011).

The specific work instructions for the water sampling programs included the exact locations of sampling sites and detailed step-by-step instructions for field tasks, including:

- equipment calibration and maintenance
- sample collection, handling, preservation, labelling, storage, and shipping
- record keeping and sample tracking

Contact information for members of the Project team and the analytical laboratory were also included in the work instructions, along with references to applicable technical procedures. Field data were recorded on standardized field data sheets or in a bound field notebook. Chain-of-custody forms were used to track samples sent to the analytical laboratory, and receipt of the samples at the laboratory was confirmed. The crew lead was responsible for tracking samples to confirm that all required samples were collected, chain-of-custody and analytical request forms were complete and correct, and that labelling and documentation procedures were followed. Field crews checked in with component managers, as needed, and submitted daily reports to provide updates on completed tasks.

Quality assurance procedures also included pre-field meetings held with the field crew and project/component manager prior to the start of each field program. The purpose of the field program, role of each crew member, specific details of the work instructions, equipment needs, field logistics, and contingency plans were discussed at each meeting.

3A2.2 Laboratory Analyses

Water samples collected in 2017 were analyzed by a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory; therefore, confidence in the reliability of the analytical data produced by the laboratory is considered high. To receive accreditation, a laboratory must pass an evaluation of its internal procedures, analytical methods, and QC processes.

A designated member of the Project team was responsible for liaising with the analytical laboratory.

3A2.3 Office Operations

Quality assurance procedures implemented for office-based tasks included the following:

- having trained personnel complete data management, analysis, and reporting tasks
- using standardized data storage, manipulation, and summary tools, as required
- establishing a data management system to support consistency, QC, and data retrieval
- senior review of data deliverables at appropriate milestones

3A3.0 QUALITY CONTROL

Similar to QA procedures, QC procedures implemented during the 2017 water quality monitoring program activities can be classified into three categories: field operations, laboratory analyses, and office operations.

3A3.1 Field Operations

Quality control procedures implemented during field operations included the collection of QC samples, including the following:

- **Travel blanks:** These samples were used to detect sample contamination that could have resulted from ambient conditions in the field, during shipping, or at the laboratory. Travel blanks were provided by the laboratory and consisted of sample bottles filled with deionized water. They accompanied the water samples during all stages of storage and transportation, but were not exposed to sampling or filtering equipment.
- **Equipment blanks:** These samples were used to assess the adequacy of the decontamination of sample collection and filtration equipment. Equipment blanks consisted of deionized water provided by the analytical laboratory that has been rinsed through the field sampling equipment. The rinsate was then distributed to sample bottles, and handled in the same manner as the collected water samples (e.g., filtered for dissolved parameters and preserved, as required).

- **Field blanks:** These samples were used to detect potential sample contamination during sample collection, handling, shipping, and analysis. Field blanks consisted of deionized water provided by the analytical laboratory; the water was transported to a field sampling site, processed the same as the other surface water quality samples (e.g., filtered, preserved), and then submitted along with the other samples for analysis.
- **Duplicate samples:** These samples were used to check the precision of field sampling methods and laboratory analyses. Duplicate samples consisted of paired water samples collected at the same time and location, using the same methods.

Quality control samples collected in 2017 represented approximately 24% the total number of water samples submitted for analysis. All QC samples were submitted “blind” to the analytical laboratory and analyzed for the same set of parameters as the other water samples.

Winkler samples were collected periodically throughout the 2017 open-water (i.e., July and August) programs to confirm the reliability of in situ measurements. A Kemmerer was used to collect water from a depth at which a DO measurement was taken; water was then transferred to a biochemical oxygen demand bottle. Bottles were filled so that no air space was present in the sample bottle. Each DO titration was performed as soon as possible after sample collection. Dissolved oxygen (DO) concentrations determined based on the Winkler titrations were compared to corresponding meter readings.

3A3.2 Laboratory Analysis

Quality control samples were prepared by the analytical laboratory and analyzed along with the field-collected samples to confirm the quality and reliability of the analytical results. Quality control sample types included duplicate analyses, spiked samples, and method blanks.

The laboratory QC results were reviewed to confirm the quality of the data and to determine if the laboratory identified any questionable results or specific parameters. The laboratory QC results are not presented or discussed in this report.

3A3.3 Office Operations

Quality control operations implemented in the office focussed on confirming and maintaining the quality of in situ measurement data and analytical results, as well as verifying the accuracy of data summaries (i.e., summary statistics and plots). Field data entered into the Project database were compared against the field data sheets and field notebook to confirm their accuracy. Unaltered data files from the laboratory were saved to the Project directory and were used as a reference to confirm the accuracy of the data entered into the Project database. Laboratory data were also screened for quality (Section 3A-3.3.1). Backup files were created before each major data analysis operation and calculations were reviewed to confirm the accuracy of the results.

3A3.3.1 Laboratory Data Screening

A series of standard data screening steps were completed upon receipt of water chemistry results from the analytical laboratory to identify potential data quality issues including:

- verification that all requested parameters and samples were analyzed
- verification that the appropriate detection limits (DLs) were used and data were reported in the appropriate units
- verification that data for measured in situ field and laboratory parameters (e.g., specific conductivity)[1] were similar
- data logic checks (e.g., comparison of measured and calculated results for total dissolved solids; comparison of dissolved to total metals)
- identification of outliers
- review of the travel, field, and equipment blanks (Section 3A-3.5.2.1) for evidence of contamination
- review of duplicate sample results (Section 3A-3.5.2.2) for unacceptable variation
- review of laboratory QC results (i.e., sample temperature and integrity of containers upon receipt, holding times, laboratory blanks and recoveries from spiked samples, internal duplicates, ion balance, review of laboratory qualifiers and notes)
- review of the final dataset for completeness, and confirmation that sources of unexpected values and trends have been identified

Prompt completion of the screening steps allowed for potential re-analysis of samples by the laboratory to verify questionable data or to generate data for missing parameters. If samples were re-analyzed by the laboratory and the data were still considered questionable, qualifiers for consideration during data summary and analysis steps were added to the dataset, or the data were excluded from further analyses.

3A3.4 Quality Control Data Evaluation

3A3.4.1 Blanks

Analytical results for travel, field, and equipment blanks were reviewed and considered notable if concentrations were greater than or equal to five times the corresponding DL. This criterion is based on the United States Environmental Protection Agency (US EPA) Practical Quantitation Limit, which accounts for the potential for reduced accuracy when concentrations approach or are below DLs (Alberta Environment 2006; US EPA 2000). Because DLs do not apply to the pH in the deionized water used to prepare field blanks, pH is considered an exception to this criterion.

[1] If large discrepancies were identified, the laboratory data were considered correct.

In the event that parameter concentrations in the blank samples exceeded five times the DL, the results were examined to determine if:

- the concentration in a blank QC sample was higher than the concentrations measured in corresponding surface water samples
- the result is limited to a single blank sample or if it is apparent in corresponding water samples
- there was a consistent bias in the results for the parameter across all samples
- if the notable result was severe enough to warrant invalidating the affected data

3A3.4.2 Duplicate Samples

Differences between concentrations measured in duplicate water samples were evaluated based on the relative percent difference (RPD):

$$RPD = \frac{C1 - C2}{\frac{(C1 + C2)}{2}} * 100$$

Where: RPD is relative percentage difference

C1 is the concentrations in the first sample

C2 is the concentration in the second or duplicate sample

The RPD was only calculated if both of the paired concentrations in the duplicate samples were greater than five times the DL. The RPD for a given parameter was flagged if it was greater than 20%. The number of flagged parameters was compared to the total number of analyzed parameters to evaluate analytical precision. Analytical precision was rated as follows:

- high, if fewer than 10% of parameters were flagged
- moderate, if 10 to 30% of parameters were flagged
- low, if more than 30% were flagged

3A3.4.3 Dissolved and Total Concentrations

Dissolved nutrient and metal concentrations were compared to total concentrations as a measure of analytical precision (Section 3A-3.5.2.3). Where results of the total and dissolved concentrations were more than five times the DL and the RPD between the dissolved and total concentration was more than or equal to 20%, the dissolved concentration was flagged as suspicious.

3A3.4.4 Notable Results

For any notable results identified, the laboratory was contacted as soon as possible to confirm the results and re-run the analyses (if necessary). If the original results were confirmed by the laboratory, data were reviewed further to identify other causes for the notable results, including field sampling procedures, and where necessary, implementation of corrective measures before the subsequent sampling event. Invalidation of data, where necessary, was not completed on samples from a single sampling event but rather was based on the results for all samples collected during the annual program.

3A3.5 Quality Control Results

3A3.5.1 Water Quality Field Measurements

The multi-parameter Manta II water quality meter was used to collect in situ measurements of water temperature, pH, DO, and specific conductivity throughout the water column at each sampling site in 2017. Although maintenance and calibration procedures were completed, as specified in the specific work instructions (Section 3A-2.1), these meters occasionally did not function reliably for DO during ice-covered conditions, when cold conditions can affect the functionality of the probes (Table 3A-1). Dissolved oxygen concentrations determined based on the Winkler titrations that were completed during the open-water sampling programs were in good agreement with corresponding in situ meter readings (the average RPD between paired DO results was 8.27%; Table 3A-2).

Table 3A-1: In-Situ Measurements Data Quality Summary

Quality Criteria	Deficiencies		Decision
	Affected Sampling Station	Description	
Probes are in working order	MEL-01 and MEL-02	Maintenance and calibration was completed, but once in the field, the DO probe was not functioning properly during ice-covered conditions (January and February)	Collect samples for Winkler titration and compare results
Data are within expected ranges for northern lakes	MEL-01	86% of the DO concentrations measured during ice-covered conditions (January and February) were above the expected range[(a)]	DO concentrations above the expected range were excluded from analyses
	MEL-02	92% of the DO concentrations measured during ice-covered conditions (January and February) were above the expected range[(a)]	

Notes: [(a)] the expected or acceptable range of DO values included a maximum concentration of 14 mg/L; DO = dissolved oxygen.

To confirm that the final dataset of in-situ measurements was of the highest quality possible, it was determined that the in situ DO concentrations greater than 14 mg/L recorded in winter of 2017 during ice-covered conditions would be excluded from the baseline report.

Table 3A-2: Comparison of Winkler Tests Results and Dissolved Oxygen Probe Results

Station	Date	Winkler DO Result (mg/L)	DO Probe Result (mg/L)	RPD (%)
MEL-01-04	16 July 2017	10.6	10.6	0
MEL-03-04	21 July 2017	11.2	11.1	0.90
A8-03	17 July 2017	10.3	10.1	1.96
D7-01	22 July 2017	11.0	11.2	1.80
MEL-01-05	9 August 2017	8.7	10.5	18.75
MEL-03-05	13 August 2017	10.2	10.9	6.64
MEL-04-05	15 August 2017	9.7	10.7	9.80
MEL-05-05	12 August 2017	10.0	10.8	7.69
A8-03	14 August 2017	9.9	10.8	8.70
B7-03	8 August 2017	9.4	10.9	14.78
D7-03	10 August 2017	9.0	11.0	20.00
Average				**8.27**

Notes: DO – dissolved oxygen; RPD = relative percent difference; mg/L = milligrams per litre; % = percent.

3A3.5.2 Laboratory Results

To maintain sample integrity, water samples for laboratory analyses were submitted as soon as possible after collection. However, holding time exceedances are a common issue for unpreserved water samples collected during water quality programs in remote areas, because transport of samples to the laboratory is subject to the availability of scheduled charter flights. Holding times may also be exceeded for preserved and unpreserved samples if the laboratory is unable to initiate testing promptly following sample receipt. Analytical hold times were met for most parameters, with the exception of pH, total dissolved solids, total suspended solids, turbidity, nitrate, nitrite, and orthophosphate for some or all samples.

Through the 2017 water quality program, 12 blank samples and 10 discrete duplicate samples were collected at Meliadine Lake and Peninsula lakes (Table 3A-3). Review of results are provided in Sections 3A-3.5.2.1 and 3A-3.5.2.2 and a comparison of dissolved to total concentrations provided in Section 3A-3.5.2.3.

Table 3A-3: Count of Quality Control Samples Collected During the 2017 Water Quality Programs

QC Type	Ice-covered Conditions		Open-water Conditions			Total
	19 to 20 January	18 to 19 February	16 to 23 July	8 to 15 August	1 to 5 September	
Blank Samples						**12**
Field Blank	0	2	0	2	1	5
Equipment Blank	0	2	1	1	1	5
Travel Blank	0	2	0	0	0	2
Duplicates	0	2	3	4	1	**10**

3A3.5.2.1 Blank Samples

A total of 12 blank QC samples were collected and analyzed during the 2017 water quality monitoring program, including five field blanks, five equipment blanks, and two travel blanks (Table 3A-3). All parameter concentrations in the blank samples that were above the corresponding DL were reviewed individually (Table 3A-4). Of all the parameters analyzed in the 12 QC samples, notable detections (i.e., parameter concentrations that were measured at more than five times the DL) were 2.1% of all blank sample results. Results by each type of blank sample are reviewed below.

Equipment blanks had the highest number of notable detections (i.e., 3.1%; concentrations more than five times the DL). Of the notable detections, most were found in the equipment blank during the ice-covered conditions program in February. Parameters with notable detections in equipment blank samples were: ions (calcium and sodium), nutrients (nitrate, dissolved and total phosphorus), total metals (antimony, manganese and zinc), and dissolved metals (antimony, barium, lead and zinc) from equipment blanks collected in February, July, August, and September (Table 3A-4).

Field blanks had 1.3% notable detections and were limited to sodium, total and dissolved phosphorus, and dissolved antimony from field blanks collected in February and September; there were no notable detections in the August field blank (Table 3A-4).

Travel blanks had 1.2% notable results and were related to total and dissolved phosphorus from one of the February travel blanks (Table 3A-4).

The notable detections in the water quality field, equipment, and travel blank samples were not of a magnitude that would be expected to have any influence on the results for the surface water quality samples (i.e., the results for the field blanks were considered acceptable). With the exception of total and dissolved phosphorus, notable results measured in blank samples were in concentrations considerably (one or two orders of magnitude) lower than concentrations in the water quality samples collected during the program. Total and dissolved phosphorus results measured during the February sampling program were deemed unreliable and excluded from data analysis due to potential contamination as indicated by the blank samples results.

3A3.5.2.2 Discrete Water Quality Duplicate Samples

During the 2017 sampling program, 10 duplicate discrete samples were collected (Tables 3A-3 and 3A-5). Of the 10 pairs of duplicate samples, three duplicates (i.e., MEL-05-01 [August], MEL-04-05 [August], and MEL-02-05 [September]) had moderate analytical precision (between 10 and 25% of the duplicate parameters were notable); the rest of duplicate samples had high analytical precision (between 1 and 7% of the duplicate parameters were notable).

Parameters that had notable results (i.e., parameter concentration higher than five time DL and RPD greater than 20%) in at least one duplicate sample included the following:

- Calcium (September), total suspended solids (September), total alkalinity (February), dissolved organic carbon (August)
- Nutrients (nitrate [September], total phosphorus [February and July] and dissolved phosphorus [February and September])
- Total metals (aluminum [July, August, and September], arsenic [August and September], cobalt [August], copper [July and August], iron [August and September], lead[August and September], manganese [August], nickel [August], tin [September], and zinc [July, August, and September])
- Dissolved metals (aluminum [July and September], cobalt [July and August], copper [September], iron [July, August, and September], lead [August and September], manganese [July, August, and September], nickel [September], tin [August and September], uranium [August], and zinc [July, August, and September])

The overall analytical precision for 2017 water quality program was 7.3 % and was considered high.

3A3.5.2.3 Dissolved to Total Results Comparison

Dissolved concentrations measured in the discrete water quality samples were compared to their corresponding total concentrations. During the 2017 sampling program, 2.7% of the dissolved parameter concentrations in the dataset failed to meet quality criteria (i.e., total and dissolved concentrations were more than five times the DL, and dissolved concentrations were more than 20% higher than total concentrations). These parameters included dissolved aluminum, arsenic, cesium, copper, cobalt, iron, lead, manganese, nickel, tin, uranium, zinc, and zirconium.

Based on these results, the overall precision of the discrete water quality dataset is considered high.

Table 3A-4: Results of Water Quality Blank Samples Collected in 2017

Sample Type	Units	DL1[(a)]	DL2[(a)]	DL3[(a)]	Alert Limit	Field Blank	Equipment Blank	Travel Blank	Field Blank	Equipment Blank	Trip Blank	Equipment Blank	Field Blank	Field Blank	Equipment Blank	Equipment Blank	Field Blank
Sampling Season						Ice-covered	Ice-covered	Ice-covered	Ice-covered	Ice-covered	Ice-covered	Open-water	Open-water	Open-water	Open-water	Open-water	Open-water
Sample Collection Date						18-Feb-17	18-Feb-17	18-Feb-17	19-Feb-17	19-Feb-17	19-Feb-17	18-Jul-17	14-Aug-17	15-Aug-17	16-Aug-17	1-Sep-17	5-Sep-17
Conventional Parameters																	
Hardness, as $CaCO_3$	mg/L	1.0	-	-	>5X DL	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
pH	pH units	0.1	-	-	>5X DL	4.62	5.34	5.11	5.37	5.15	5.04	5.57	5.31	5.18	5.23	5.2	5.03
Specific conductivity	µS/cm	0.2	2.0	-	>5X DL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total alkalinity, as $CaCO_3$	mg/L	2.0	-	-	>5X DL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total dissolved solids	mg/L	3.0	4.0	10	>5X DL	<4.0	<4.0	<4.0	4.9	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
Total dissolved solids (calculated)	mg/L	1.0	-	-	>5X DL	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total suspended solids	mg/L	5.0	1.0	-	>5X DL	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	0.10	-	-	>5X DL	0.15	0.13	<0.10	0.14	0.16	<0.10	0.1	0.23	0.26	0.27	0.15	0.16
Major Ions																	
Bicarbonate	mg/L	5.0	-	-	>5X DL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Calcium	mg/L	0.020	-	-	>5X DL	<0.020	0.026	<0.020	0.044	**0.306**	<0.020	0.058	<0.020	<0.020	0.036	<0.020	0.031
Carbonate	mg/L	5.0	-	-	>5X DL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	mg/L	0.50	-	-	>5X DL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride	mg/L	0.020	-	-	>5X DL	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Hydroxide	mg/L	5.0	-	-	>5X DL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	mg/L	0.0040	-	-	>5X DL	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Potassium	mg/L	0.020	-	-	>5X DL	<0.020	<0.020	<0.020	0.033	<0.020	<0.020	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Sodium	mg/L	0.0050	-	-	>5X DL	<0.0050	<0.0050	<0.0050	**0.0337**	<0.0050	<0.0050	**0.145**	<0.010	<0.010	0.028	<0.010	0.014
Sulphate	mg/L	0.050	-	-	>5X DL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Other Parameters																	
Cyanide	mg/L	0.0020	0.0050	-	>5X DL	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nutrients and Chlorophyll *a*																	
Dissolved phosphorus	mg/L	0.0010	-	-	>5X DL	**0.0169**	**0.0134**	0.0016	**0.0293**	0.0016	**0.0222**	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Nitrate	mg/L	0.0050	-	-	>5X DL	<0.0050	<0.0050	<0.0050	<0.0050	**0.0304**	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate + nitrite	mg/L	0.0051	-	-	>5X DL	<0.0051	<0.0051	<0.0051	<0.0051	0.0304	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
Nitrite	mg/L	0.0010	-	-	>5X DL	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Orthophosphate	mg/L	0.0010	-	-	>5X DL	<0.0010	0.0031	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total ammonia	mg/L	0.0050	-	-	>5X DL	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total Kjeldahl nitrogen	mg/L	0.050	-	-	>5X DL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total nitrogen	mg/L	0.050	-	-	>5X DL	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total phosphorus	mg/L	0.0010	-	-	>5X DL	**0.0058**	**0.0466**	0.0024	**0.0054**	**0.0224**	**0.0357**	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total organic carbon	mg/L	0.50	-	-	>5X DL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Dissolved organic carbon	mg/L	0.50	0.56	-	>5X DL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Reactive silica, as SiO_2	mg/L	0.010	-	-	>5X DL	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Silica	mg/L	0.010	-	-	>5X DL	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																	
Aluminum	mg/L	0.00030	-	-	>5X DL	<0.00030	0.00079	<0.00030	<0.00030	<0.00030	<0.00030	<0.00070	<0.00070	<0.00070	0.00078	<0.00070	<0.00070
Antimony	mg/L	0.000020	-	-	>5X DL	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	**0.000527**	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Arsenic	mg/L	0.000020	-	-	>5X DL	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Barium	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000049	<0.000020	<0.000020	0.000028	<0.000020	<0.000020
Beryllium	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Bismuth	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Boron	mg/L	0.0010	-	-	>5X DL	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cadmium	mg/L	0.0000050	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	0.00006	-	-	>5X DL	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Copper	mg/L	0.00010	-	-	>5X DL	<0.00010	0.00015	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Iron	mg/L	0.0010	-	-	>5X DL	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lead	mg/L	0.000010	-	-	>5X DL	<0.000010	0.000044	<0.000010	<0.000010	0.000038	<0.000010	<0.000010	<0.000010	<0.000010	0.000018	<0.000010	<0.000010
Lithium	mg/L	0.00050	-	-	>5X DL	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Manganese	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00009	<0.000050	<0.000050	**0.000263**	<0.000050	<0.000050
Mercury	ug/L	0.00050	0.00060	-	>5X DL	<0.50	0.7	<0.50	<0.50	<0.50	<0.50	0.6	<0.50	<0.50	1.9	0.7	<0.50
Molybdenum	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel	mg/L	0.000060	-	-	>5X DL	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Selenium	mg/L	0.000040	-	-	>5X DL	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040
Silicon	mg/L	0.050	-	-	>5X DL	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver	mg/L	0.000005	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Strontium	mg/L	0.000050	-	-	>5X DL	<0.000050	0.0001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sulphur	mg/L	0.50	-	-	>5X DL	-	-	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thallium	mg/L	0.000005	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020
Tin	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020

Sample Type	Units	DL1[(a)]	DL2[(a)]	DL3[(a)]	Alert Limit	Field Blank	Equipment Blank	Travel Blank	Field Blank	Equipment Blank	Trip Blank	Equipment Blank	Field Blank	Field Blank	Equipment Blank	Equipment Blank	Field Blank
Sampling Season						Ice-covered	Ice-covered	Ice-covered	Ice-covered	Ice-covered	Ice-covered	Open-water	Open-water	Open-water	Open-water	Open-water	Open-water
Sample Collection Date						18-Feb-17	18-Feb-17	18-Feb-17	19-Feb-17	19-Feb-17	19-Feb-17	18-Jul-17	14-Aug-17	15-Aug-17	16-Aug-17	1-Sep-17	5-Sep-17
Titanium	mg/L	0.00010	-	-	>5X DL	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Uranium	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000030	<0.0000030	<0.0000030	<0.0000030	<0.0000030	<0.0000030
Vanadium	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc	mg/L	0.00080	-	-	>5X DL	<0.00080	**0.00495**	<0.00080	<0.00080	0.00342	<0.00080	0.00068	<0.00050	<0.00050	0.00204	0.00163	<0.00050
Zirconium	mg/L	0.00030	-	-	>5X DL	-	-	-	-	-	-	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060
Dissolved Metals																	
Aluminum	mg/L	0.00030	-	-	>5X DL	<0.00030	0.00031	<0.00030	<0.00030	0.00043	<0.00030	0.00109	<0.00050	<0.00050	0.00076	0.00051	<0.00050
Antimony	mg/L	0.000020	-	-	>5X DL	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	**0.000218**	**0.000174**
Arsenic	mg/L	0.000020	-	-	>5X DL	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020	<0.000020
Barium	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	0.000085	<0.000050	<0.000050	0.000083	<0.000020	<0.000020	**0.000147**	0.000032	<0.000020
Beryllium	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Bismuth	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Boron	mg/L	0.0010	-	-	>5X DL	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.0000050	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	0.0000055	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Chromium	mg/L	0.000060	-	-	>5X DL	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Cobalt	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.0000143	<0.0000050	<0.0000050	0.0000246	<0.0000050	<0.0000050
Copper	mg/L	0.00010	-	-	>5X DL	<0.00010	0.00013	<0.00010	0.00039	0.00039	<0.00010	0.00014	<0.00010	<0.00010	0.00012	<0.00010	<0.00010
Iron	mg/L	0.0010	-	-	>5X DL	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Lead	mg/L	0.000010	-	-	>5X DL	<0.000010	**0.000079**	<0.000010	0.000015	<0.000010	<0.000010	0.0000099	<0.0000050	0.0000182	0.0000205	<0.0000050	0.0000074
Lithium	mg/L	0.00050	-	-	>5X DL	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00074	<0.00050	<0.00050
Manganese	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	0.000069	<0.000050	<0.000050	0.000087	<0.000050	<0.000050	0.00022	0.000201	<0.000050
Mercury	µg/L	0.00050	-	-	>5X DL	<0.50	0.7	<0.50	<0.50	<0.50	<0.50	0.5	<0.50	<0.50	2	0.6	<0.50
Molybdenum	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel	mg/L	0.000060	-	-	>5X DL	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Selenium	mg/L	0.000040	-	-	>5X DL	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040	<0.000040
Silicon	mg/L	0.050	-	-	>5X DL	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver	mg/L	0.0000050	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Strontium	mg/L	0.000050	-	-	>5X DL	<0.000050	0.000116	<0.000050	0.000114	0.000168	<0.000050	0.00019	<0.00010	<0.00010	0.00011	<0.00010	<0.00010
Sulphur	mg/L	0.50	-	-	>5X DL	-	-	-	-	-	-	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thallium	mg/L	0.0000050	-	-	>5X DL	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020
Tin	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000037	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Titanium	mg/L	0.00010	-	-	>5X DL	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Uranium	mg/L	0.000010	-	-	>5X DL	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020	<0.0000020
Vanadium	mg/L	0.000050	-	-	>5X DL	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Zinc	mg/L	0.00080	-	-	>5X DL	<0.00080	**0.00799**	<0.00080	0.00179	<0.00080	<0.00080	0.00185	<0.00050	<0.00050	0.00107	0.00062	<0.00050
Zirconium	mg/L	0.00030	-	-	>5X DL	-	-	-	-	-	-	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060	<0.000060

(a) Samples were typically analyzed at DL1; however, a second (DL2) or third (DL3) DL was required for some parameters.
Note: **Bolded** values were over fives times the DL and therefore failed the QC check.
DL = detection limit; mg/L = milligrams per litre; - = no data/not applicable; >5X = greater than five times; < = less than; $CaCO_3$ = calcium carbonate; µS/cm = microSiemens per centimetre; NTU = Nephelometric Turbidity Units; SiO_2 = silicon dioxide; µg/L = micrograms per litre.

Table 3A-5: Water Quality Results in Duplicate Samples Collected in 2017

Location							MEL-01-05			MEL-02-04			MEL-01-05			A8-01			B7-03			MEL-02-01			MEL-05-01			MEL-03-01			MEL-04-05			MEL-02-05		
Sample Name	Units	DL1[a]	DL2[a]	DL3[a]	DL4[a]	RPD Alert Limit	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)	Sample	Duplicate	RPD (%)
Sampling Season							Ice-covered			Ice-covered			Open-water			Open-water			Open-water			Open-water			Open-water			Open-water			Open-water			Open-water		
Sample Collection Date							18-Feb-17			19-Feb-17			16-Jul-17			17-Jul-17			20-Jul-17			11-Aug-17			12-Aug-17			13-Aug-17			15-Aug-17			05-Sep-17		
Conventional Parameters																																			
Hardness, as $CaCO_3$	mg/L	1.0	-	-	-	>20%	28.2	28.4	0.7	26.9	26.3	2.3	24.4	24.3	0.4	113	114	0.9	63.2	64.2	1.6	23	22.2	3.5	22.6	22.4	0.9	20	20.2	1	20.7	20.2	2.4	22.3	26.6	17.6
pH	pH units	0.1	-	-	-	>20%	7	6.98	0.3	6.98	6.99	0.1	7.19	7.22	0.4	7.67	7.78	1.4	7.63	7.66	0.4	7.31	7.41	1.4	7.44	7.45	0.1	7.41	7.3	1.5	7.13	7.15	0.3	7.27	7.21	0.8
Specific conductivity	µS/cm	0.2	2	-	-	>20%	96.5	95.3	1.3	88	88.3	0.3	79.3	78.8	0.6	305	300	1.7	161	161	0	74.9	76	1.5	73.3	73	0.4	69	70.2	1.7	68.4	67.5	1.3	73.5	76.3	3.7
Total alkalinity, as $CaCO_3$	mg/L	2.0	-	-	-	>20%	13	16.6	**24.3**	16.5	17.6	6.5	16.7	16.3	2.4	47.4	46	3	37.3	37.7	1.1	16.3	16.5	1.2	17.5	17.4	0.6	15.9	16.1	1.3	15.8	15.5	1.9	16.9	17.2	1.8
Total dissolved solids	mg/L	13	4.0	20	10	>20%	53	52	n/c	62	58	n/c	51	45	n/c	197	194	1.5	102	105	2.9	46	47	n/c	41	40	n/c	43	34	n/c	32	30	n/c	53	52	n/c
Total dissolved solids (calculated)	mg/L	1.0	-	-	-	>20%	44	46	4.4	42.9	43.2	0.7	40.8	40.5	0.7	151	150	0.7	76.7	77.8	1.4	38	37.4	1.6	36.3	36.3	0	33.7	34.1	1.2	34.6	33.8	2.3	38.6	41.4	7
Total suspended solids	mg/L	3.0	5.0	1.0	-	>20%	<1.0	1.3	n/c	1.1	<1.0	n/c	<1.0	1.2	n/c	<1.0	<1.0	n/c	1.1	<1.0	n/c	1.1	1	n/c	<1.0	<1.0	n/c	<1.0	<1.0	n/c	<1.0	1	n/c	3.3	6.6	**66.7**
Turbidity	NTU	0.10	-	-	-	>20%	0.15	0.15	n/c	0.18	0.18	n/c	0.37	0.34	n/c	0.5	0.52	3.9	0.44	0.38	n/c	0.28	0.35	n/c	0.25	0.25	n/c	0.29	0.26	n/c	0.29	0.4	n/c	0.53	0.5	5.8
Major Ions																																			
Bicarbonate	mg/L	5.0	-	-	-	>20%	15.8	20.3	n/c	20.1	21.5	n/c	20.4	19.9	n/c	57.8	56.1	3	45.5	46	1.1	19.9	20.1	n/c	21.4	21.2	n/c	19.4	19.6	n/c	19.3	18.9	n/c	20.6	21	n/c
Calcium	mg/L	0.020	-	-	-	>20%	8.92	8.76	1.8	8.21	8.18	0.4	7.73	7.68	0.6	37.4	37.5	0.3	20.7	21.6	4.3	7.15	6.91	3.4	7.14	7.06	1.1	6.25	6.39	2.2	6.57	6.42	2.3	7	8.64	**21**
Carbonate	mg/L	5.00	-	-	-	>20%	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c
Chloride	mg/L	0.50	-	-	-	>20%	12.5	12.3	1.6	11.1	11.1	0	10.5	10.5	0	60	60.2	0.3	20.3	20.3	0	9.48	9.36	1.3	8.34	8.41	0.8	8.19	8.16	0.4	8.17	8.13	0.5	9.39	9.57	1.9
Fluoride	mg/L	0.020	-	-	-	>20%	0.029	0.028	n/c	0.027	0.027	n/c	0.026	0.025	n/c	0.036	0.035	n/c	<0.020	0.025	n/c	0.032	0.027	n/c	0.028	0.026	n/c	0.024	0.029	n/c	0.029	0.028	n/c	0.024	0.026	n/c
Hydroxide	mg/L	5.00	-	-	-	>20%	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c	<5.0	<5.0	n/c
Magnesium	mg/L	0.0040	-	-	-	>20%	1.54	1.55	0.6	1.39	1.4	0.7	1.24	1.24	0	4.99	4.94	1	2.36	2.5	5.8	1.25	1.21	3.3	1.15	1.15	0	1.07	1.02	4.8	1.04	1.01	2.9	1.18	1.21	2.5
Potassium	mg/L	0.020	-	-	-	>20%	1.07	1.09	1.9	1.02	1.04	1.9	0.899	0.904	0.6	2.02	2.02	0	1.23	1.39	12.2	0.957	0.935	2.3	0.907	0.905	0.2	0.875	0.824	6	0.845	0.814	3.7	0.989	1.05	6
Sodium	mg/L	0.0050	-	-	-	>20%	5.83	6.08	4.2	5.43	5.53	1.8	4.97	4.95	0.4	8.27	8.25	0.2	3.95	4.11	4	4.77	4.61	3.4	4.27	4.39	2.8	4.07	4.09	0.5	4.17	3.98	4.7	4.85	5.14	5.8
Sulphate	mg/L	0.30	0.050	-	-	>20%	5.47	5.46	0.2	4.71	4.68	0.6	4.72	4.7	0.4	8.54	8.58	0.5	4.71	4.74	0.6	4.12	3.98	3.5	3.63	3.6	0.8	3.35	3.6	7.2	3.94	3.83	2.8	3.94	4.06	3
Other Parameters																																			
Cyanide	mg/L	0.0050	0.0020	-	-	>20%	<0.0020	<0.0020	n/c	<0.0020	<0.0020	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c
Nutrients and Chlorophyll a																																			
Dissolved phosphorus	mg/L	0.0010	-	-	-	>20%	0.0155	0.0336	**73.7**	0.0105	0.0176	**50.5**	0.0023	0.0039	n/c	0.002	0.0025	n/c	0.0028	0.0027	n/c	0.0026	0.0038	n/c	0.0022	0.0018	n/c	0.0015	0.0019	n/c	0.0014	0.0022	n/c	0.0035	0.0072	**69.2**
Nitrate	mg/L	0.0050	-	-	-	>20%	0.0071	0.0095	n/c	0.0069	0.0097	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	0.144	0.211	**37.7**
Nitrate + nitrite	mg/L	0.0051	-	-	-	>20%	0.0071	0.0107	n/c	0.0069	0.0097	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	<0.0051	<0.0051	n/c	0.144	0.211	n/c
Nitrite	mg/L	0.0010	-	-	-	>20%	<0.0010	0.0012	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	0.0011	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c
Orthophosphate	mg/L	0.0010	-	-	-	>20%	0.0014	<0.0010	n/c	0.0011	0.0012	n/c	0.0011	0.0011	n/c	<0.0010	<0.0010	n/c	0.0012	0.0012	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	<0.0010	n/c	<0.0010	0.0011	n/c	<0.0010	<0.0010	n/c
Total ammonia	mg/L	0.0050	-	-	-	>20%	0.0238	0.0239	n/c	0.0186	0.022	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	0.0084	0.0097	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	0.0085	n/c
Total Kjeldahl nitrogen	mg/L	0.050	-	-	-	>20%	0.19	0.16	n/c	0.124	0.094	n/c	0.176	0.218	n/c	0.304	0.348	13.5	0.341	0.359	5.1	0.159	0.163	n/c	0.138	0.114	n/c	0.129	0.135	n/c	0.137	0.121	n/c	0.22	0.255	14.7
Total nitrogen	mg/L	0.050	-	-	-	-	0.197	0.17	n/c	0.131	0.104	n/c	0.176	0.218	n/c	0.304	0.348	13.5	0.341	0.359	5.1	0.159	0.163	n/c	0.138	0.114	n/c	0.13	0.135	n/c	0.137	0.121	n/c	0.364	0.466	**24.6**
Total phosphorus	mg/L	0.0010	-	-	-	>20%	0.0251	0.0322	**24.8**	0.0221	0.0164	**29.6**	0.0052	0.0057	9.2	0.0074	0.0057	**26**	0.0056	0.0073	**26.4**	0.0043	0.0037	n/c	0.0031	0.0034	n/c	0.003	0.0041	n/c	0.0031	0.0028	n/c	0.0079	0.0074	6.5
Total organic carbon	mg/L	0.50	0.74	-	-	>20%	3.58	3.61	0.8	3.03	3.06	1	3.03	3.1	2.3	3.61	3.6	0.3	4.79	4.23	12.4	2.92	3	2.7	2.66	2.09	**24**	2.14	2.29	n/c	2.29	2.34	n/c	2.91	3.08	5.7
Dissolved organic carbon	mg/L	0.50	1.0	-	-	>20%	3.57	3.59	0.6	2.94	2.98	1.4	3.27	3.13	4.4	3.94	3.53	11	5.06	4.95	2.2	3.05	2.96	3	2.71	2.05	**27.7**	1.96	2.11	n/c	2.21	2.25	n/c	2.8	3.04	8.2
Silica	mg/L	0.010	0.020	0.050	-	>20%	0.594	0.604	1.7	0.458	0.455	0.7	0.538	0.572	6.1	0.599	0.603	0.7	0.367	0.366	0.3	0.359	0.345	4	0.269	0.269	0	0.244	0.243	0.4	0.255	0.258	1.2	0.342	0.364	6.2
Total Metals																																			
Aluminum	mg/L	0.00030	0.0030	-	-	>20%	0.00149	0.00111	n/c	0.00089	0.00074	n/c	0.00272	0.00279	n/c	0.00451	0.00282	**46.1**	0.00403	0.0019	**71.8**	0.00399	0.00264	**40.7**	0.00302	0.00331	n/c	0.00249	0.00234	n/c	0.00154	0.00197	n/c	0.00794	0.0105	**27.8**
Antimony	mg/L	0.000020	0.00010	-	-	>20%	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	0.000026	0.000026	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c
Arsenic	mg/L	0.000020	0.00010	-	-	>20%	0.000385	0.000356	7.8	0.000309	0.000328	6	0.000386	0.000382	1	0.00228	0.00221	3.1	0.00137	0.00135	1.5	0.000278	0.00025	10.6	0.000281	0.000228	**20.8**	0.000165	0.000183	10.3	0.000163	0.000211	**25.7**	0.000308	0.000251	**20.4**
Barium	mg/L	0.000050	-	-	-	>20%	0.00897	0.00881	1.8	0.00928	0.00905	2.5	0.0083	0.00856	3.1	0.0301	0.0304	1	0.0184	0.0188	2.2	0.008	0.0075	6.5	0.00802	0.00763	5	0.00699	0.00735	5	0.00716	0.00741	3.4	0.00838	0.0073	13.8
Beryllium	mg/L	0.000010	0.00010	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c
Bismuth	mg/L	0.000010	0.000050	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c
Boron	mg/L	0.0010	0.010	-	-	>20%	0.0045	0.0046	n/c	0.0044	0.0038	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	0.0066	n/c	0.0057	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	<0.0050	n/c	<0.0050	0.0061	n/c
Cadmium	mg/L	0.000005	-	-	-	>20%	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	0.0000051	<0.0000050	n/c	<0.0000050	0.0000069	n/c	<0.0000050	<0.0000050	n/c	0.0000077	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	0.0000084	n/c
Chromium	mg/L	0.000060	0.00010	-	-	>20%	<0.000060	<0.000060	n/c	<0.000060	<0.000060	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c
Cobalt	mg/L	0.000010	0.00010	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	0.0000241	0.0000231	n/c	0.0000454	0.0000378	18.3	0.0000364	0.0000351	3.6	0.0000177	0.0000122	n/c	0.0000139	0.0000101	n/c	0.0000073	0.0000075	n/c	0.0000374	0.000009	**122.4**	0.000019	0.0000239	n/c
Copper	mg/L	0.00010	0.00050	-	-	>20%	0.00093	0.00088	5.5	0.00085	0.00089	4.6	0.00117	0.00083	**34**	0.00071	0.00069	2.9	0.00076	0.00093	**20.1**	0.00103	0.00077	**28.9**	0.001	0.00075	**28.6**	0.00076	0.00079	3.9	0.00065	0.00071	8.8	0.00091	0.00098	7.4
Iron	mg/L	0.0010	0.010	-	-	>20%	0.0097	0.0095	2.1	0.0046	0.0047	n/c	0.0279	0.0264	5.5	0.0594	0.0577	2.9	0.0551	0.0554	0.5	0.0131	0.0126	3.9	0.0076	0.0078	2.6	0.0082	0.0073	11.6	0.0032	0.007	**74.5**	0.0215	0.0265	**20.8**
Lead	mg/L	0.000010	0.000050	-	-	>20%	<0.000010	<0.000010	n/c	0.000014	<0.000010	n/c	0.000011	<0.000010	n/c	0.00003	<0.000010	n/c	0.000015	0.000014	n/c	0.000032	0.000164	**134.7**	0.00007	0.000016	**125.6**	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	0.000122	0.00036	**98.8**
Lithium	mg/L	0.00050	0.0010	-	-	>20%	0.00102	0.00098	n/c	0.00108	0.00064	n/c	0.00064	0.00056	n/c	0.00911	0.00907	0.4	0.00385	0.00376	2.4	0.00072	0.00081	n/c	0.00093	0.00073	n/c	0.00067	0.0007	n/c	0.00072	0.00061	n/c	0.00066	0.00067	n/c
Manganese	mg/L	0.000050	0.00010	-	-	>20%	0.00176	0.00171	2.9	0.0013	0.00128	1.6	0.00711	0.00738	3.7	0.0123	0.012	2.5	0.00439	0.0046	4.7	0.00427	0.00385	10.3	0.00334	0.00266	**22.7**	0.00193	0.00209	8	0.000287	0.00217	**153.3**	0.00449	0.00411	8.8
Mercury	µg/L	0.00050	-	-	-	>20%	0.6	0.7	n/c	0.5	0.6	n/c	1.1	1.1	n/c	1	0.9	n/c	1	1	n/c	0.7	0.6	n/c	0.5	0.5	n/c	0.6	1	n/c	0.8	0.6	n/c	0.9	1	n/c
Molybdenum	mg/L	0.000050	-	-	-	>20%	0.000083	0.000059	n/c	0.000077	0.000067	n/c	0.00007	0.000073	n/c	0.000221	0.000208	n/c	0.000167	0.000154	n/c	0.000079	0.000078	n/c	0.000078	0.000083	n/c	0.000073	0.000062	n/c	0.000074	0.000063	n/c	0.000086	0.000159	n/c
Nickel	mg/L	0.000060	0.00050	-	-	>20%	0.000705	0.000707	0.3	0.000568	0.000575	1.2	0.000729	0.000717	1.7	0.000867	0.000857	1.2	0.00121	0.00112	7.7	0.000529	0.00048	9.7	0.000499	0.000361	**32.1**	0.000315	0.000333	5.6	0.00034	0.000348	2.3	0.00054	0.000554	2.6
Selenium	mg/L	0.000040	0.000050	-	-	>20%	<0.000040	0.00005	n/c	0.000042	<0.000040	n/c	<0.000040	<0.000040	n/c	<0.000040	<0.000040	n/c	<0.000040	<0.000040	n/c	0.000044	0.000042	n/c	0.000043	<0.000040	n/c	<0.000040	<0.000040	n/c	<0.000040	<0.000040	n/c	<0.000040	<0.000040	n/c
Silver	mg/L	0.000005	-	-	-	>20%	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c
Strontium	mg/L	0.000050	0.00020	-	-	>20%	0.0449	0.0439	2.3	0.0395	0.0387	2	0.0369	0.0377	2.1	0.266	0.261	1.9	0.137	0.134	2.2	0.0355	0.035	1.4	0.0341	0.0328	3.9	0.0316	0.0315	0.3	0.0307	0.0311	1.3	0.0369	0.0362	1.9
Thallium	mg/L	0.000005	0.000010	-	-	>20%	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000020	<0.0000020	n/c	0.0000036	0.0000038	n/c	0.0000028	0.0000023	n/c	<0.0000020	<0.0000020	n/c	<0.0000020	<0.0000020	n/c	<0.0000020	<0.0000020	n/c	<0.0000020	0.0000022	n/c	<0.0000020	0.0000021	n/c
Tin	mg/L	0.000050	0.00010	-	-	>20%	<0.000050	<0.000050	n/c	<0.000050	<0.000050	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	0.000096	0.000177	**59.3**
Titanium	mg/L	0.00010	0.00030	-	-	>20%	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c
Uranium	mg/L	0.000010	-	-	-	>20%	0.000018	0.000016	n/c	0.000015	0.000014	n/c	0.0000191	0.0000171	11	0.000048	0.0000479	0.2	0.0000249	0.0000252	1.2	0.0000162	0.0000178	9.4	0.0000154	0.0000157	1.9	0.0000164	0.0000143	13.7	0.0000132	0.0000152	14.1	0.0000193	0.0000189	2.1
Vanadium	mg/L	0.00050	0.00050	-	-	>20%	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c	<0.00050	<0.00050	n/c
Zinc	mg/L	0.0080	0.0030	-	-	>20%	<0.00080	<0.00080	n/c	0.00095	<0.00080	n/c	0.00077	0.00392	**134.3**	0.00284	0.00145	**64.8**	0.00193	0.00368	**62.4**	0.00198	0.00105	n/c	0.00578	0.00202	**96.4**	0.00142	0.00092	n/c	0.00151	0.00094	n/c	0.00999	0.0128	**24.7**
Dissolved Metals																																			
Aluminum	mg/L	0.0003	-	-	-	>20%	0.00123	0.0013	n/c	0.00061	0.00071	n/c	0.00156	0.00143	n/c	0.00177	0.0019	n/c	0.00148	0.00293	**65.8**	0.00242	0.00188	n/c	0.00158	0.00158	n/c	0.00177	0.00186	n/c	0.0027	0.0029	7.1	0.00186	0.00467	**86.1**
Antimony	mg/L	0.00002	-	-	-	>20%	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	0.000024	0.00003	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	<0.000020	n/c	<0.000020	0.000032	n/c
Arsenic	mg/L	0.00002	-	-	-	>20%	0.000357	0.000382	6.8	0.000317	0.000305	3.9	0.00034	0.000319	6.4	0.00177	0.0019	7.1	0.0012	0.00127	5.7	0.000261	0.000263	0.8	0.000251	0.000244	2.8	0.000212	0.00018	16.3	0.000193	0.000187	3.2	0.000249	0.000279	11.4
Barium	mg/L	0.00005	-	-	-	>20%	0.00907	0.0086	5.3	0.00881	0.00906	2.8	0.00727	0.00743	2.2	0.0293	0.0298	1.7	0.0182	0.0193	5.9	0.00763	0.00737	3.5	0.00763	0.00768	0.7	0.00697	0.00714	2.4	0.00751	0.00715	4.9	0.00762	0.00788	3.4
Beryllium	mg/L	0.00001	-	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c
Bismuth	mg/L	0.00001	-	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c
Boron	mg/L	0.001	-	-	-	>20%	0.0046	0.0044	n/c	0.0042	0.0041	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c	<0.010	<0.010	n/c
Cadmium	mg/L	0.000005	-	-	-	>20%	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	<0.0000050	n/c	<0.0000050	0.0000186	n/c
Chromium	mg/L	0.00006	-	-	-	>20%	<0.000060	<0.000060	n/c	<0.000060	<0.000060	n/c	<0.00010	<0.00010	n/c	0.00017	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c	<0.00010	<0.00010	n/c
Cobalt	mg/L	0.00001	-	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	0.0000081	0.0000068	n/c	0.0000179	0.0000315	**55.1**	0.0000353	0.0000358	1.4	0.0000351	0.0000353	0.6	0.0000319	0.0000327	2.5	0.0000361	0.0000252	**35.6**	0.0000122	0.0000353	**97.3**	0.0000079	0.0000234	n/c
Copper	mg/L	0.0001	-	-	-	>20%	0.00089	0.00087	2.3	0.0008	0.0008	0	0.00126	0.00124	1.6	0.001	0.00096	4.1	0.00108	0.00104	3.8	0.00074	0.00079	6.5	0.0007	0.00076	8.2	0.00075	0.00082	8.9	0.00075	0.00089	17.1	0.00072	0.00111	**42.6**
Iron	mg/L	0.001	-	-	-	>20%	0.0043	0.0043	n/c	0.0017	0.0019	n/c	0.0123	0.0081	**41.2**	0.0147	0.0287	**64.5**	0.0297	0.029	2.4	0.0064	0.0059	8.1	0.0039	0.0039	n/c	0.0041	0.0038	n/c	0.0041	0.0038	n/c	0.0075	0.0038	**65.5**	0.0043	0.0096	**76.3**
Lead	mg/L	0.00001	-	-	-	>20%	<0.000010	<0.000010	n/c	<0.000010	<0.000010	n/c	0.0000136	0.0000105	n/c	0.0000092	0.0000141	n/c	0.00001	0.

3A3.6 Data Quality Summary

The results of the QC review (Section 3A-3.5) indicated that the water quality data recorded in the field and reported by the laboratory were of generally high quality. Key findings are summarized in Table 3A-6.

Table 3A-6: Data Quality Summary during 2017 Water Quality Programs

QC Criteria	QC Sample Type	Findings
Probes functioning as intended and measurements are within expected ranges and in agreement with corresponding laboratory results	Review of in-situ measurements	20% of DO measurements were above the expected range; all exceedances occurred in winter
Parameters concentration should be less than five time detection limit	Equipment blanks	3.1% of parameters failed to meet the criteria
		Affected parameters included calcium, sodium, nitrate, total and dissolved phosphorus, total and dissolved antimony, total manganese, total and dissolved zinc, dissolved barium, and dissolved lead
	Field blanks	1.3% of parameters failed to meet the criteria
		Affected parameters included sodium, total and dissolved phosphorus, and dissolved antimony
	Travel blanks	1.2% of parameters failed to meet the criteria
		Affected parameters included total and dissolved phosphorus
Parameters with concentrations greater than five time detection limit should not differ by more than 20% in duplicate samples	Duplicates – discrete samples	7.5% of paired concentrations in duplicate samples failed this criteria
		Affected parameters included calcium, total suspended solids, total alkalinity, dissolved organic carbon, nitrate, total and dissolved phosphorus, total and dissolved aluminum, total arsenic, total and dissolved cobalt, total and dissolved copper, total and dissolved iron, total and dissolved lead, total and dissolved manganese, total and dissolved nickel, total and dissolved tin, total and dissolved zinc, and dissolved uranium.
Parameters with total and dissolved concentrations greater than five times detection limit, the dissolved concentration should be no more than 20% higher than the total concentration	Dissolved to total comparison – discrete samples	2.7% of parameters failed to meet the criteria
		Affected parameters included dissolved aluminum, arsenic, cesium, copper, cobalt, iron, lead, manganese, nickel, tin, uranium, zinc, and zirconium.
	Dissolved to total comparison – blanks	1.7% of parameters failed to meet the criteria
		Affected parameters included dissolved antimony and barium.

The water quality data are considered adequate to meet the needs of the AEMP for the Project.

REFERENCES

Alberta Environment. 2006. Guidelines for Quality Assurance and Quality Control in Surface Water Quality Programs in Alberta. Edmonton, AB, Canada. 67 pp. ISBN: 0-7785-5081-8 (Print Edition); 0-7785-5082-6 (On-line Edition).

CCME (Canadian Council of Ministers of the Environment) 2011. Protocol Manual for Water Quality Sampling in Canada. Canadian Council of Ministers of the Environment. 2011.

USEPA (United Sates Environmental Protection Agency). 2000. EPA Quality Manual for Environmental Programs. CIO 2105-P-01-0 (formerly 5360 A1).

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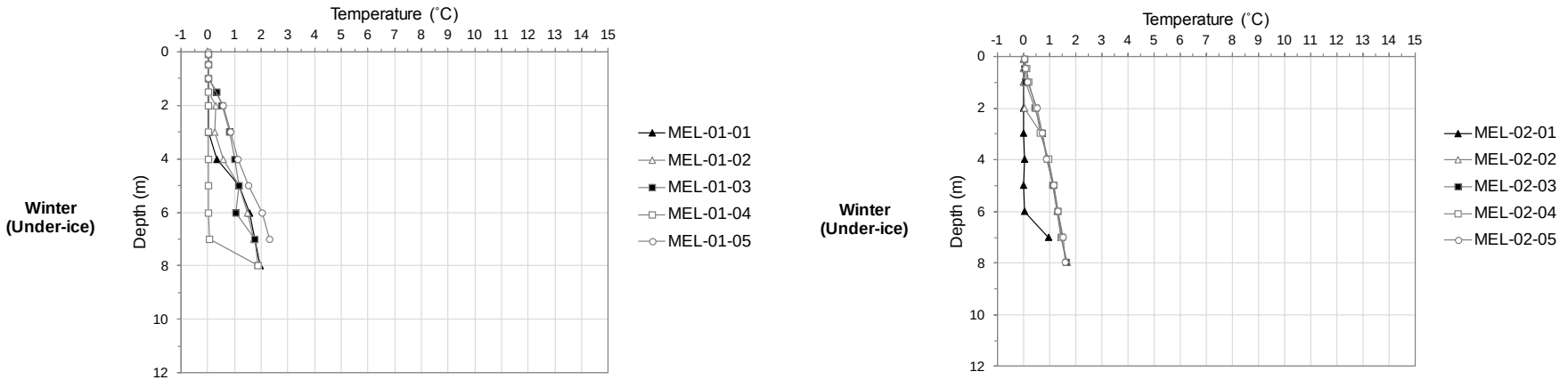
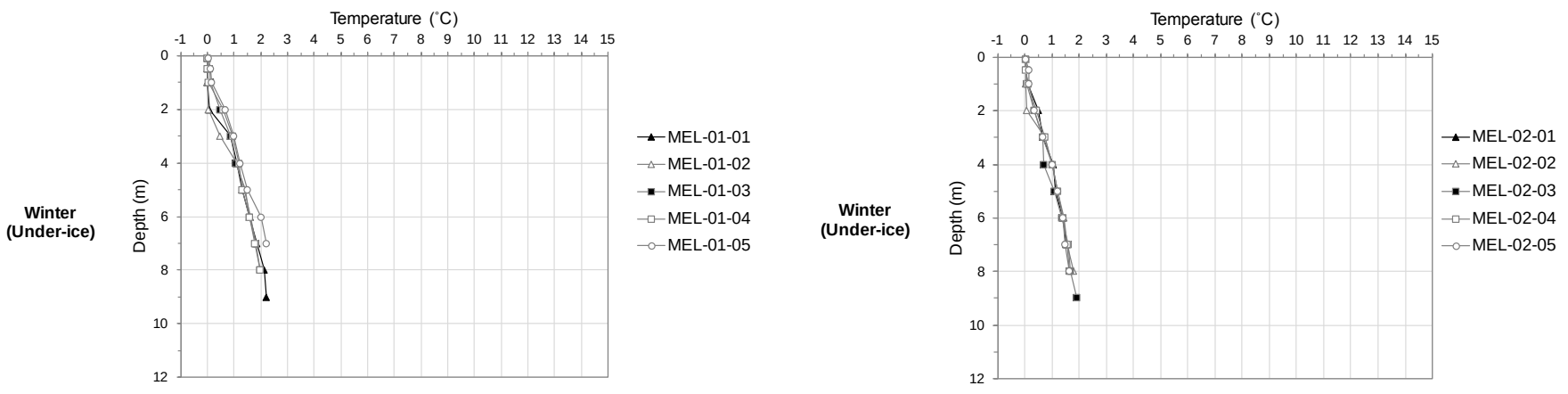
3B1.0 MELIADINE LAKE

3B1.1 TEMPERATURE



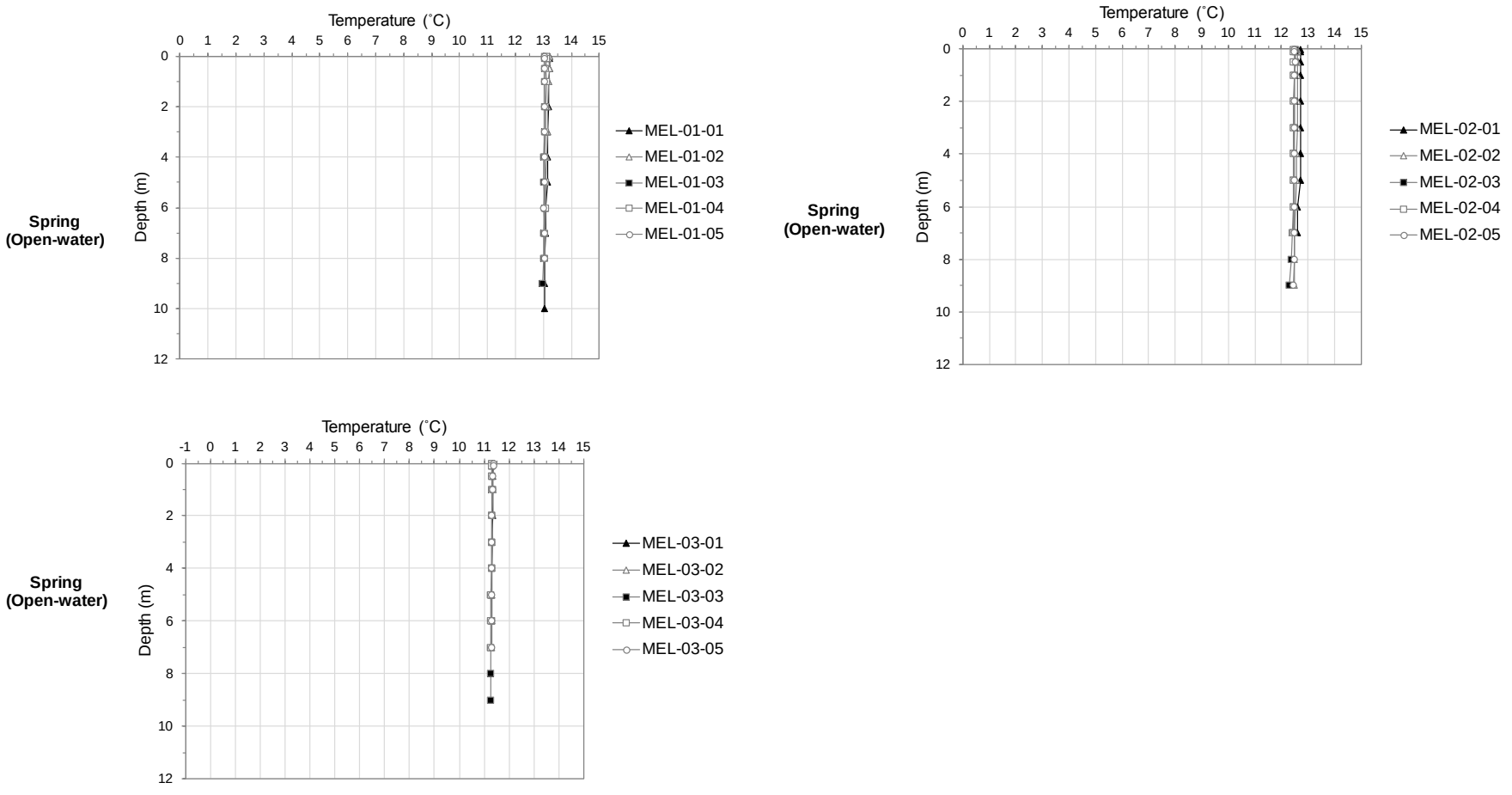
m = metre; °C = degrees Celsius; MEL-01 = near-field; MEL-02 = mid-field.

Figure 3B.1-1: Temperature (°C) Profiles at Stations on Meliadine Lake, Under-ice (January) 2017



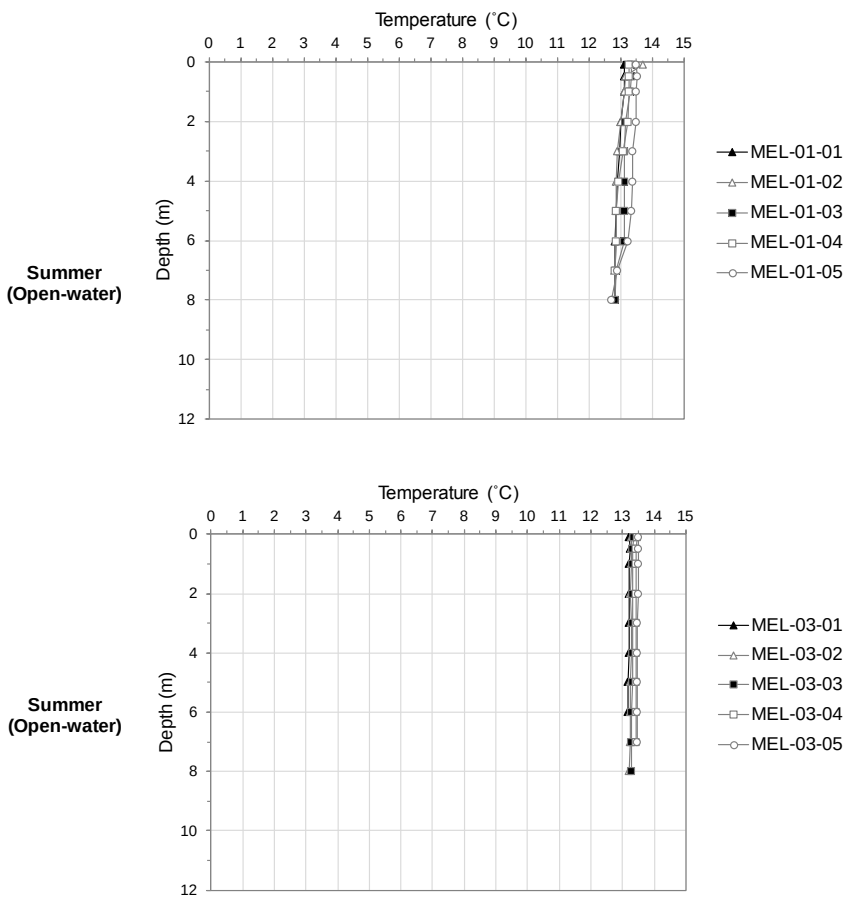
m = metre; °C = degrees Celsius; MEL-01 = near-field; MEL-02 = mid-field.

Figure 3B.1-2: Temperature (°C) Profiles at Stations on Meliadine Lake, Under-ice (February) 2017



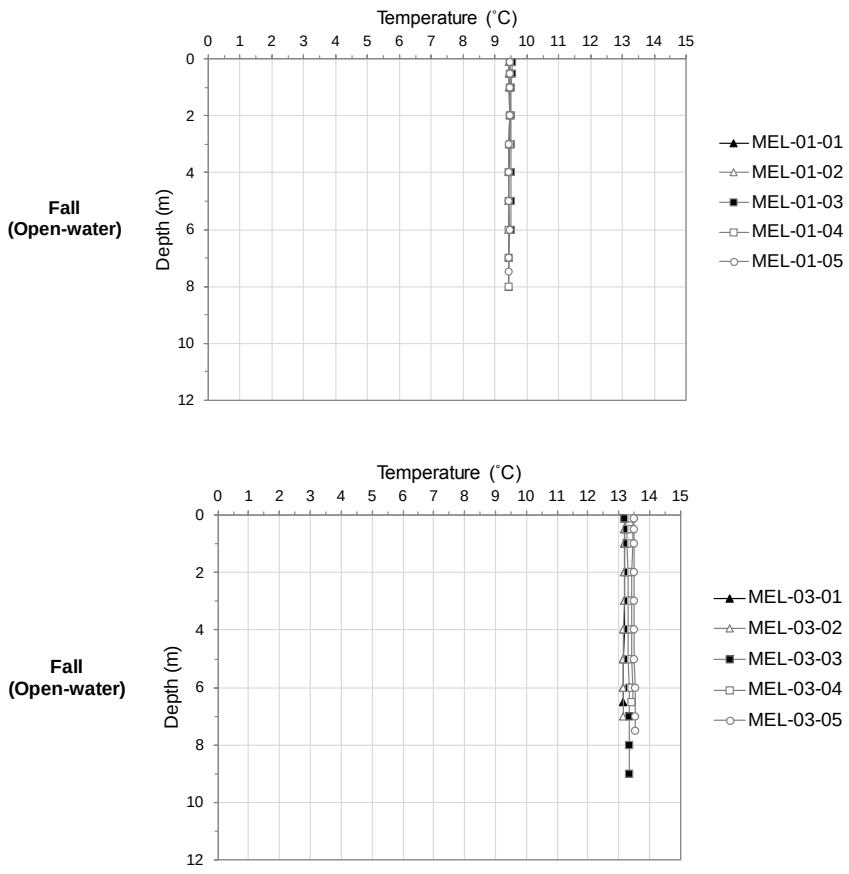
m = metre; °C = degrees Celsius; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

Figure 3B.1-3: Temperature (°C) Profiles at Stations on Meliadine Lake, Open-Water (July) 2017



m = metre; °C = degrees Celsius; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1; MEL-04 = reference area 2; MEL-05 = reference area 3.

Figure 3B.1-4: Temperature (°C) Profiles at Stations on Meliadine Lake, Open-water (August) 2017

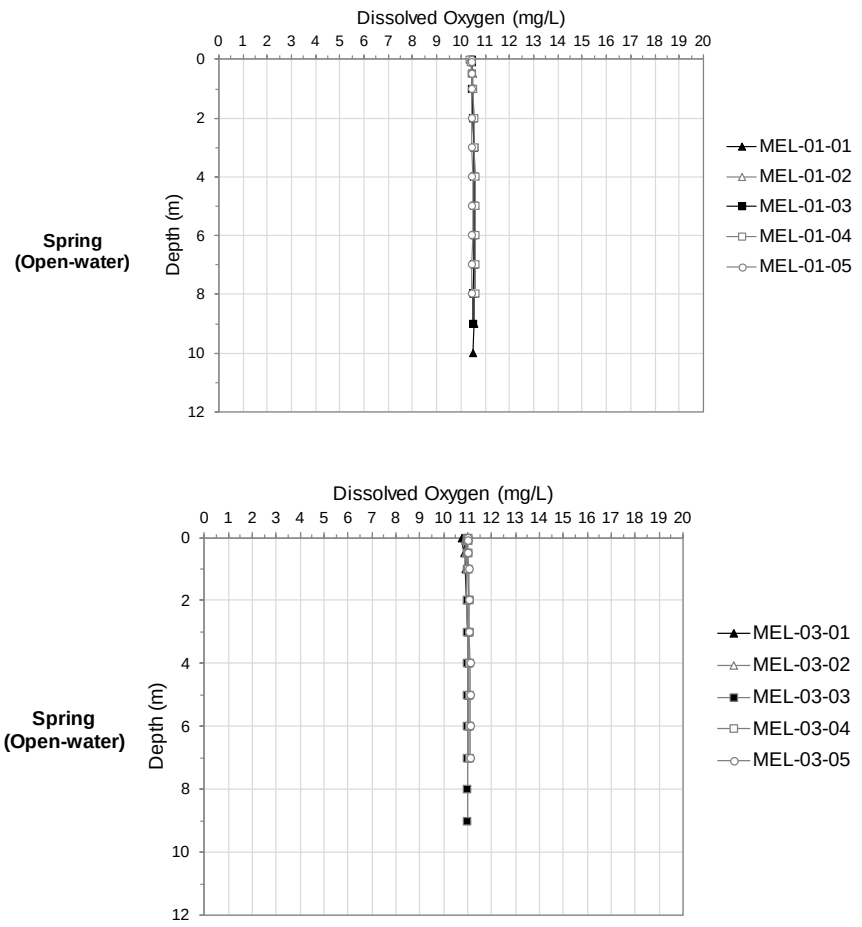


m = metre; °C = degrees Celsius; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

Figure 3B.1-5: Temperature (°C) Profiles at Stations on Meliadine Lake, Open-water (September) 2017

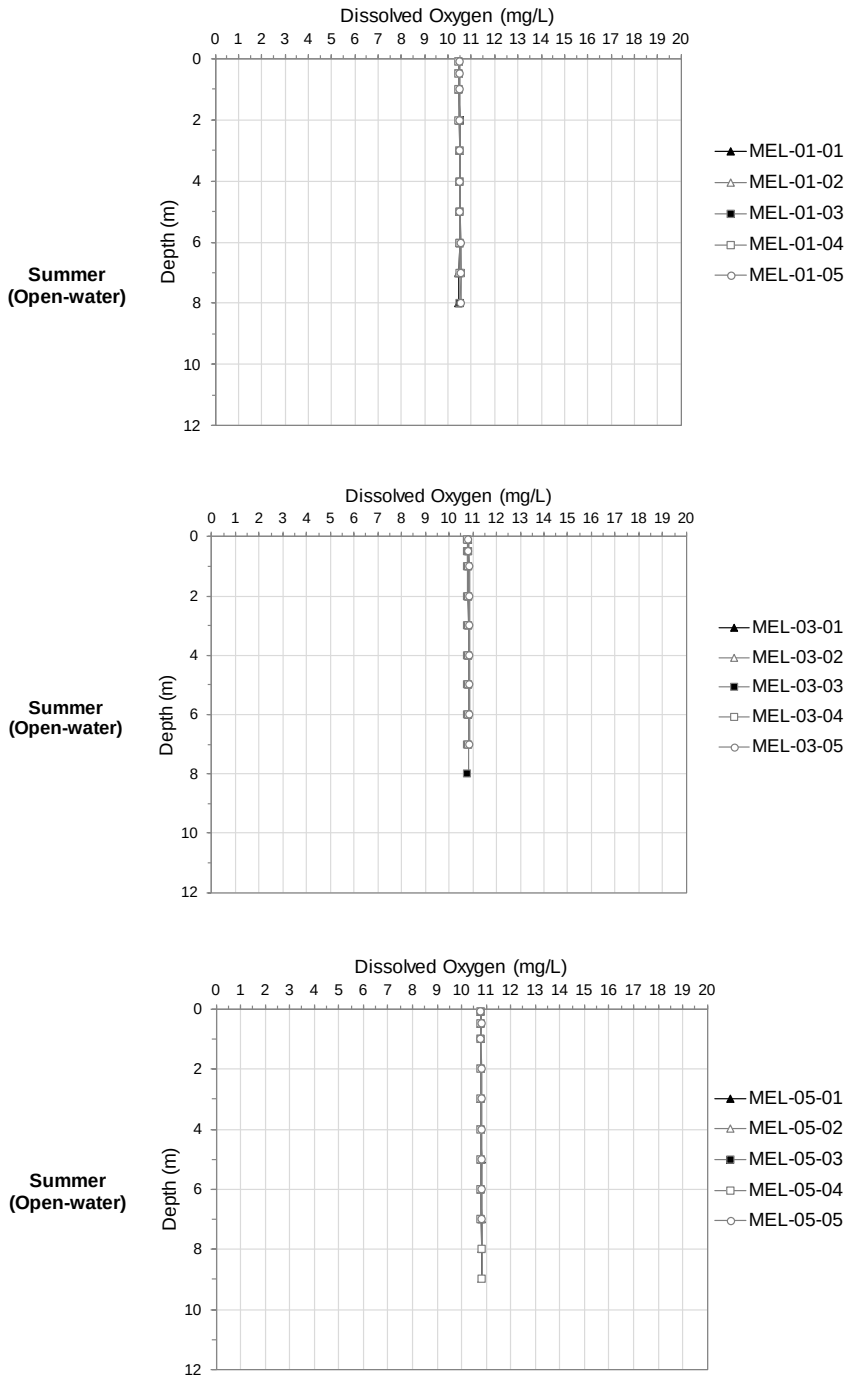
3B1.2 DISSOLVED OXYGEN

Dissolved oxygen measured during under-ice conditions were outside the acceptable range. Data was deemed unreliable and excluded.



m = metre; mg/L = milligrams per litre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

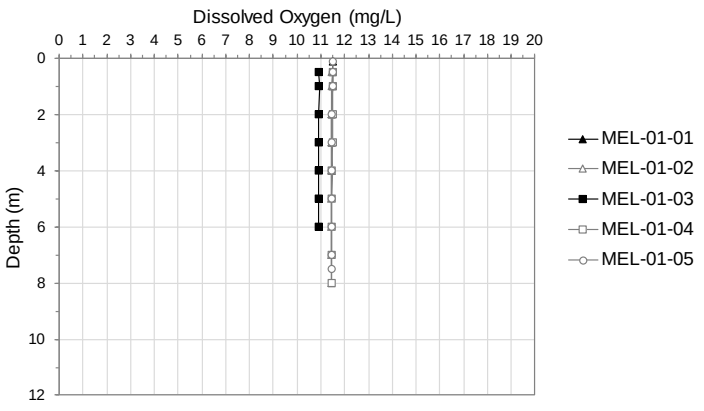
Figure 3B.2-1: Dissolved Oxygen (mg/L) Profiles at Stations on Meliadine Lake, Open-water (July) 2017



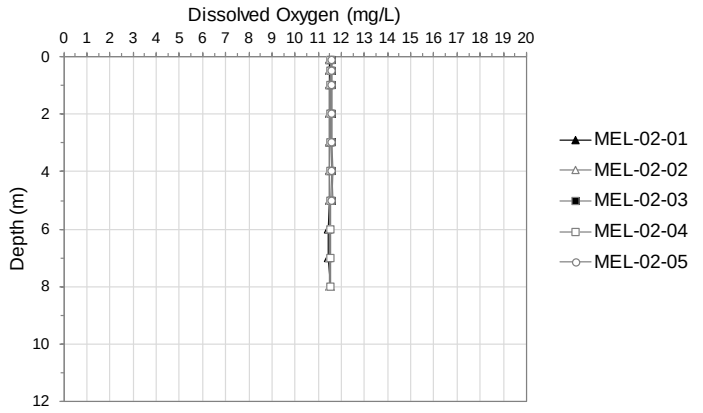
m = metre; mg/L = milligrams per litre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1; MEL-04 = reference area 2; MEL-05 = reference area 3.

Figure 3B.2-2: Dissolved Oxygen (mg/L) Profiles at Stations on Meliadine Lake, Open-water (August) 2017

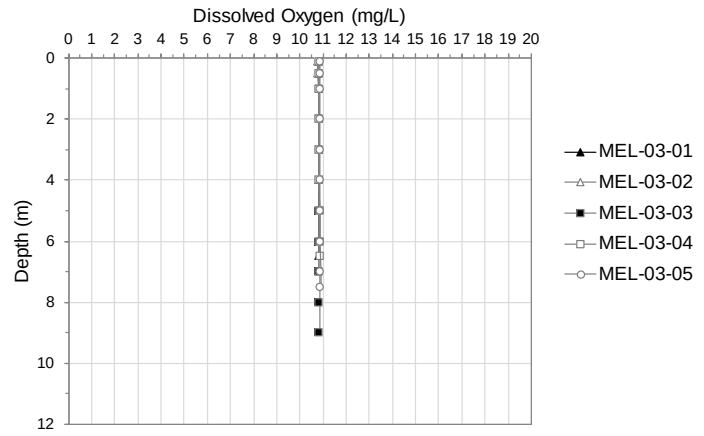
Fall (Open-water)



Fall (Open-water)



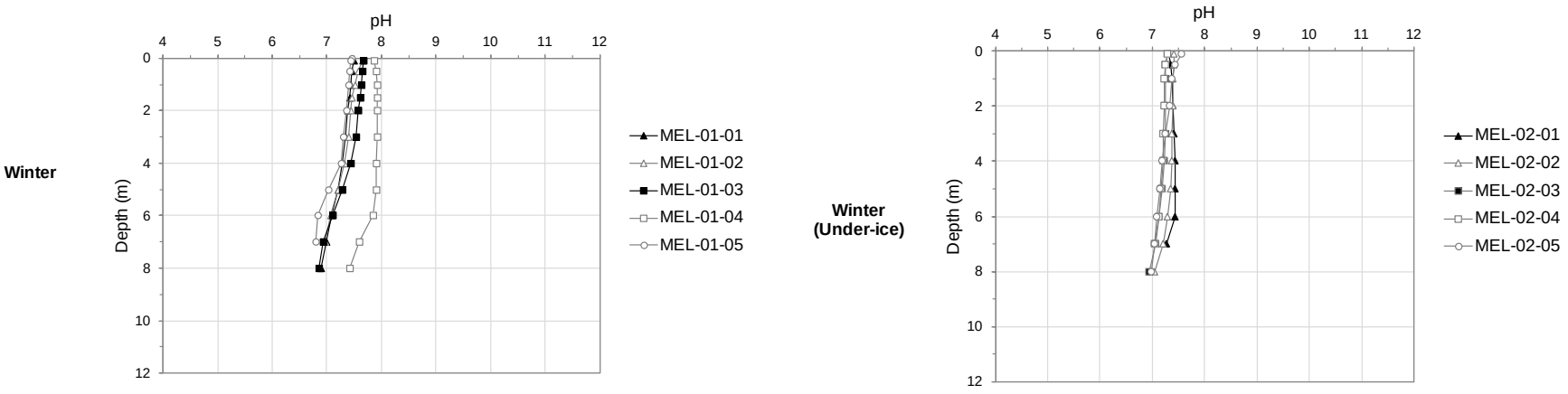
Fall (Open-water)



m = metre; mg/L = milligrams per litre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

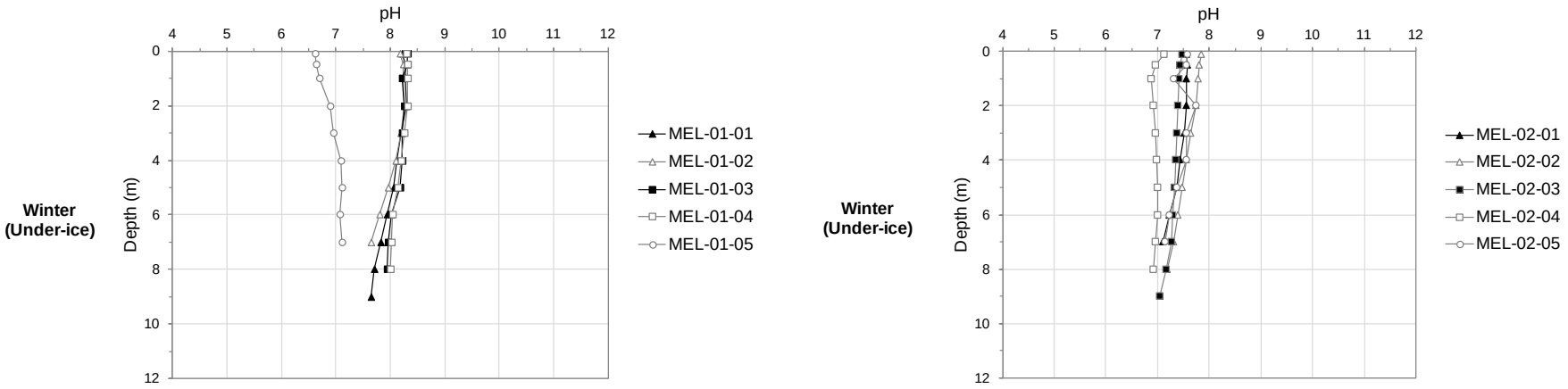
Figure 3B.2-3: Dissolved Oxygen (mg/L) Profiles at Stations on Meliadine Lake, Open-water (September) 2017

3B1.3 pH



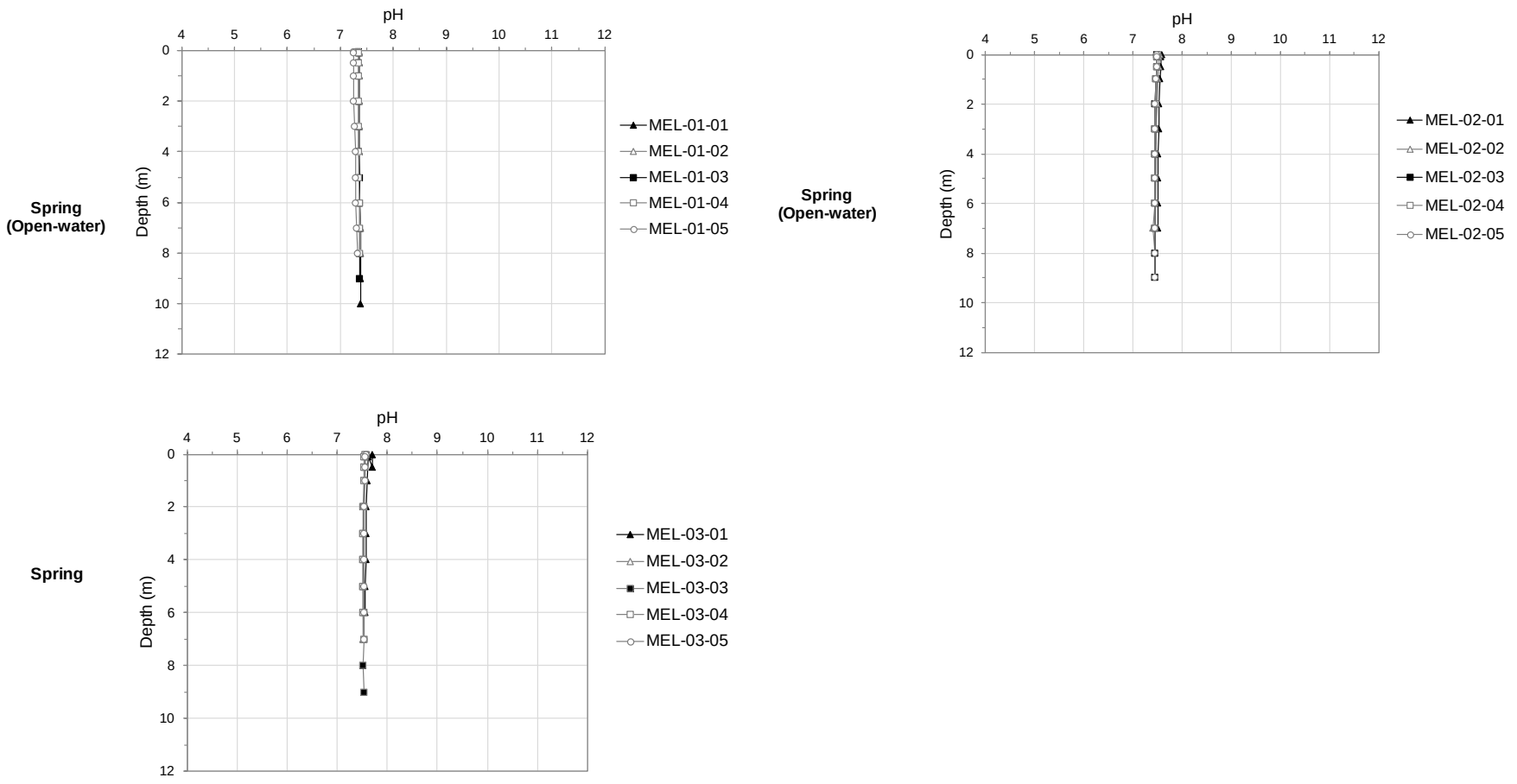
m = metre; MEL-01 = near-field; MEL-02 = mid-field.

Figure 3B.3-1: pH Profiles at Stations on Meliadine Lake, Under-ice (January) 2017



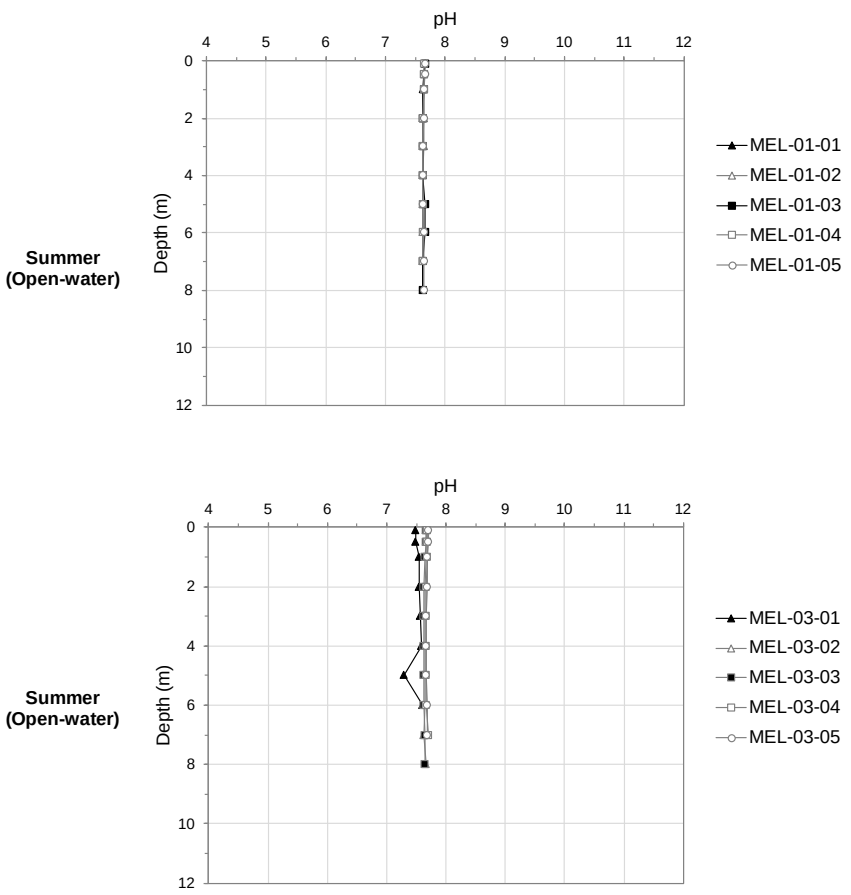
m = metre; MEL-01 = near-field; MEL-02 = mid-field.

Figure 3B.3-2: pH Profiles at Stations on Meliadine Lake, Under-ice (February) 2017



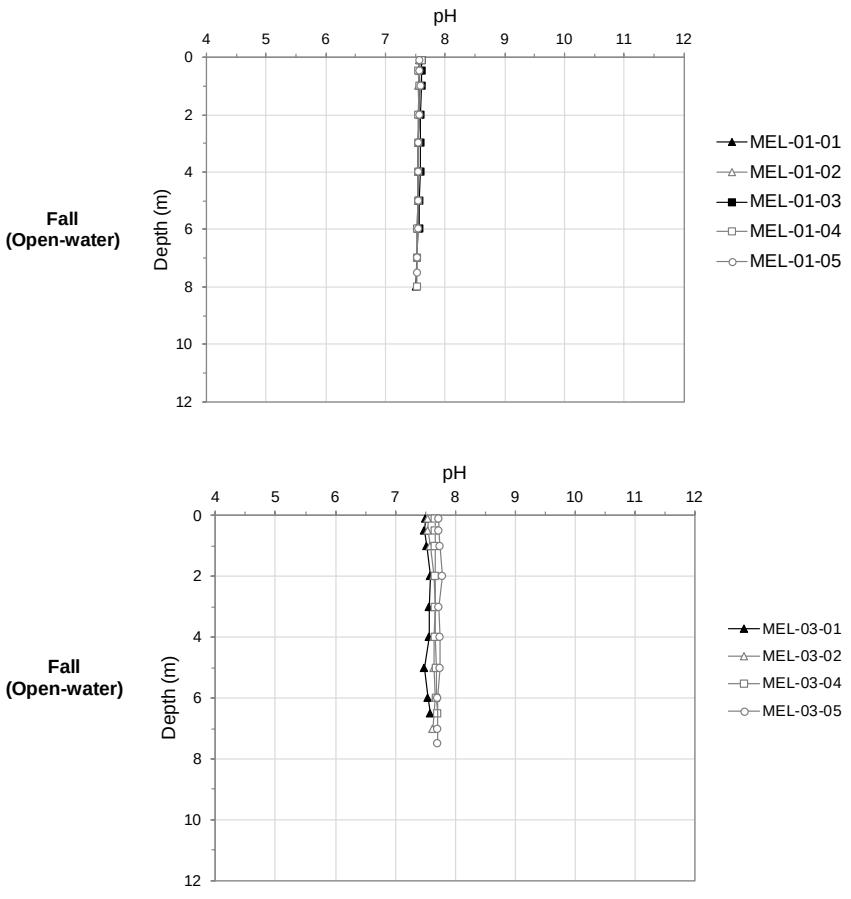
m = metre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

Figure 3B.3-3: pH Profiles at Stations on Meliadine Lake, Open-water (July) 2017



m = metre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1; MEL-04 = reference area 2; MEL-05 = reference area 3.

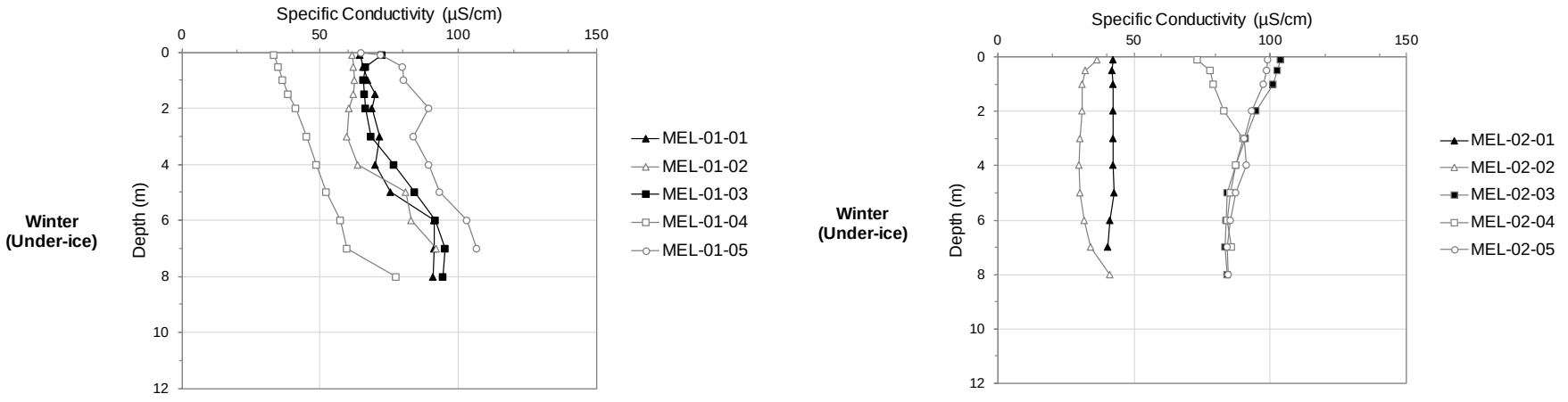
Figure 3B.3-4: pH Profiles at Stations on Meliadine Lake, Open-water (August) 2017



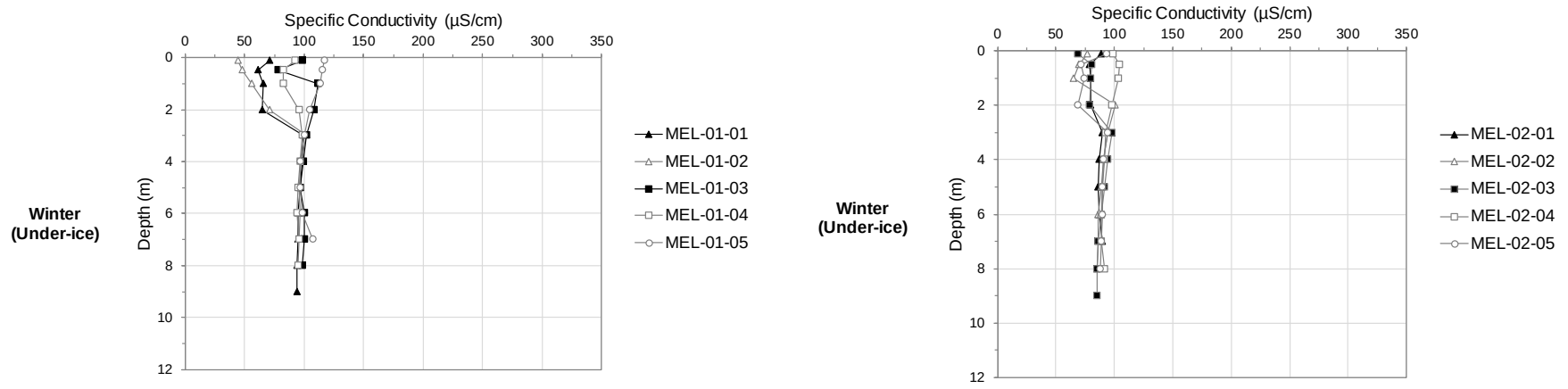
m = metre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

Figure 3B.3-5: pH Profiles at Stations on Meliadine Lake, Open-water (September) 2017

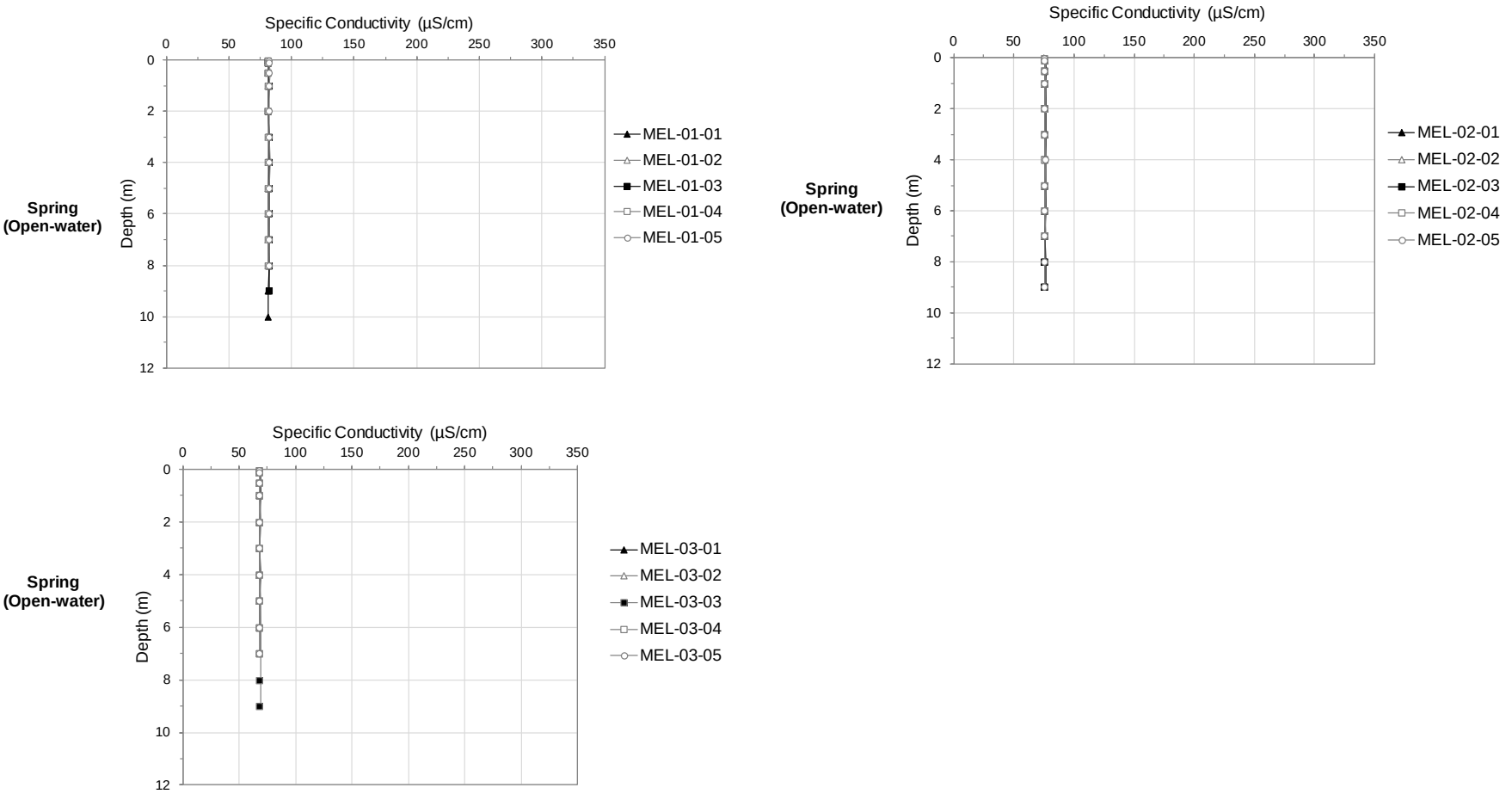
3B1.4 SPECIFIC CONDUCTIVITY



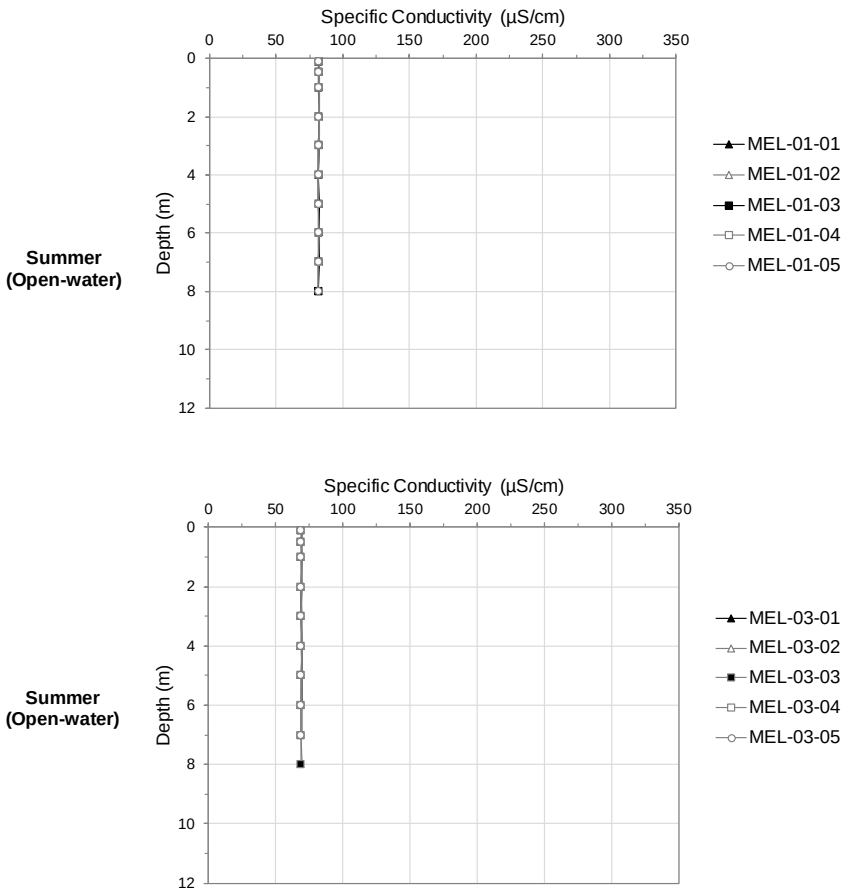
m = metre; µS/cm = microSiemens per centimetre; MEL-01 = near-field; MEL-02 = mid-field.
Figure 3B.4-1: Specific Conductivity (µS/cm) Profiles at Stations on Meliadine Lake, Under-ice (January) 2017



m = metre; µS/cm = microSiemens per centimetre; MEL-01 = near-field; MEL-02 = mid-field.
Figure 3B.4-2: Specific Conductivity (µS/cm) Profiles at Stations on Meliadine Lake, Under-ice (February) 2017

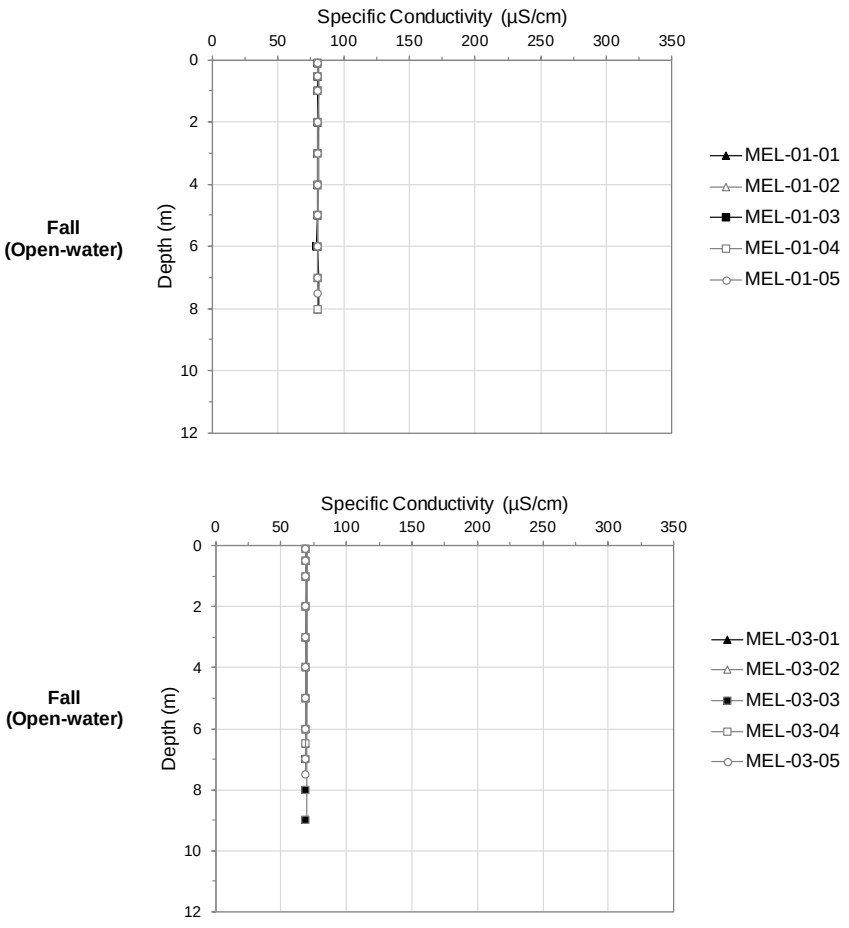


m = metre; µS/cm = microSiemens per centimetre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.
Figure 3B.4-3: Specific Conductivity (µS/cm) Profiles at Stations on Meliadine Lake, Open-water (July) 2017



M = Metre; µs/Cm = microSiemens per centimetre; MEL-01 = Near-Field; MEL-02 = Mid-Field; MEL-03 = reference area 1; MEL-04 = reference area 2; MEL-05 = reference area 3.

Figure 3B.4-4: Specific Conductivity (µS/cm) Profiles at Stations on Meliadine Lake, Open-water (August) 2017

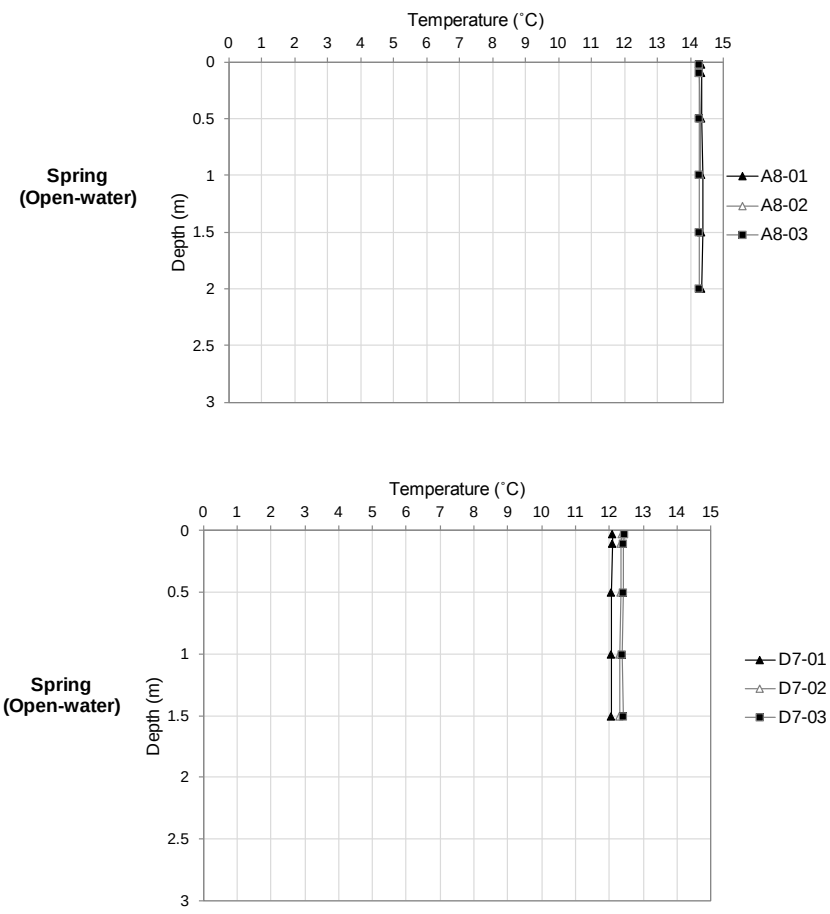


m = metre; µS/cm = microSiemens per centimetre; MEL-01 = near-field; MEL-02 = mid-field; MEL-03 = reference area 1.

Figure 3B.4-5: Specific Conductivity (µS/cm) Profiles at Stations on Meliadine Lake, Open-water (September) 2017

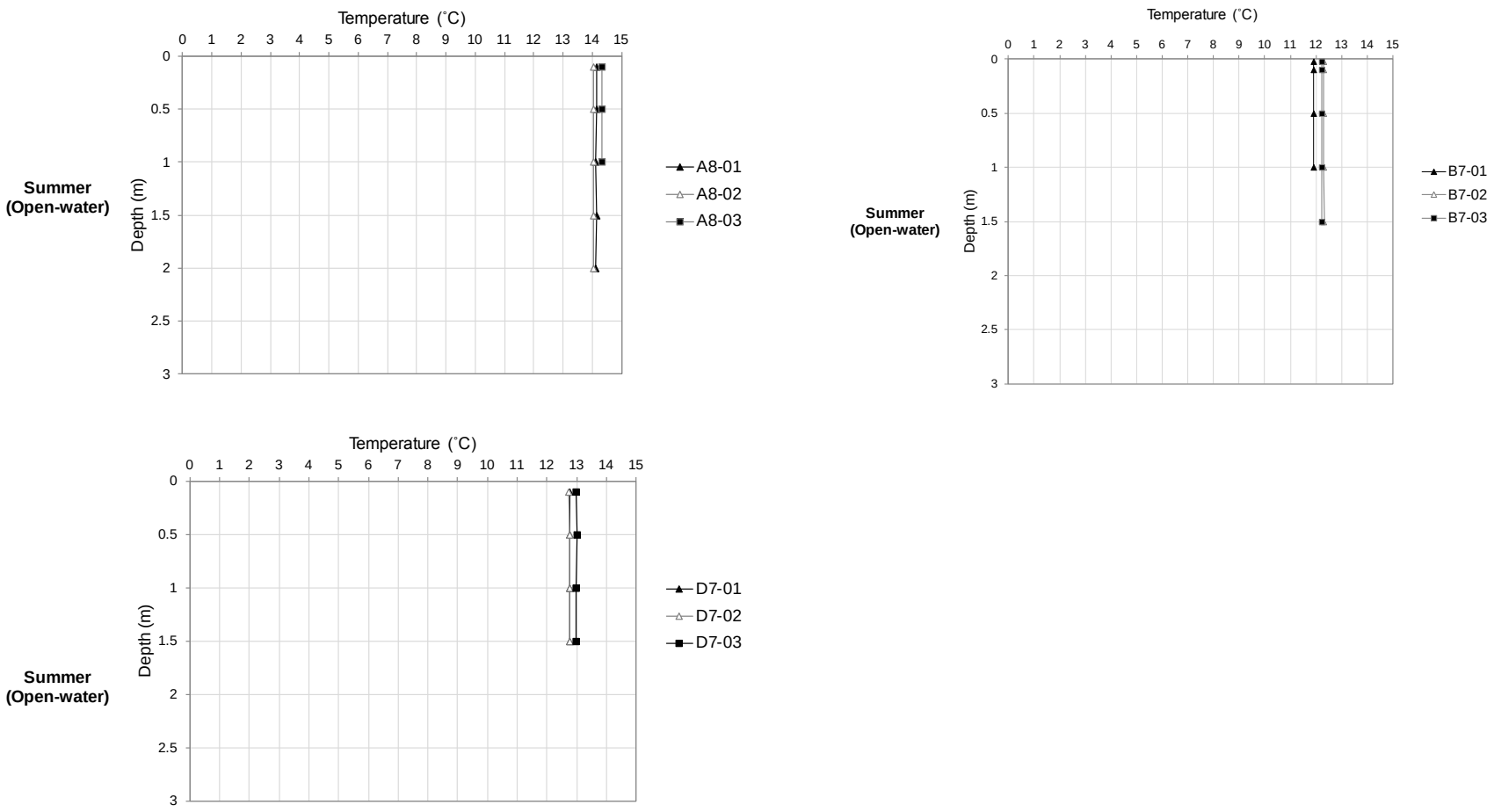
3B2.0 PENINSULA LAKES

3B2.1 TEMPERATURE



m = metre; °C = degrees Celsius; A8, B7 and D7 = Peninsula Lakes

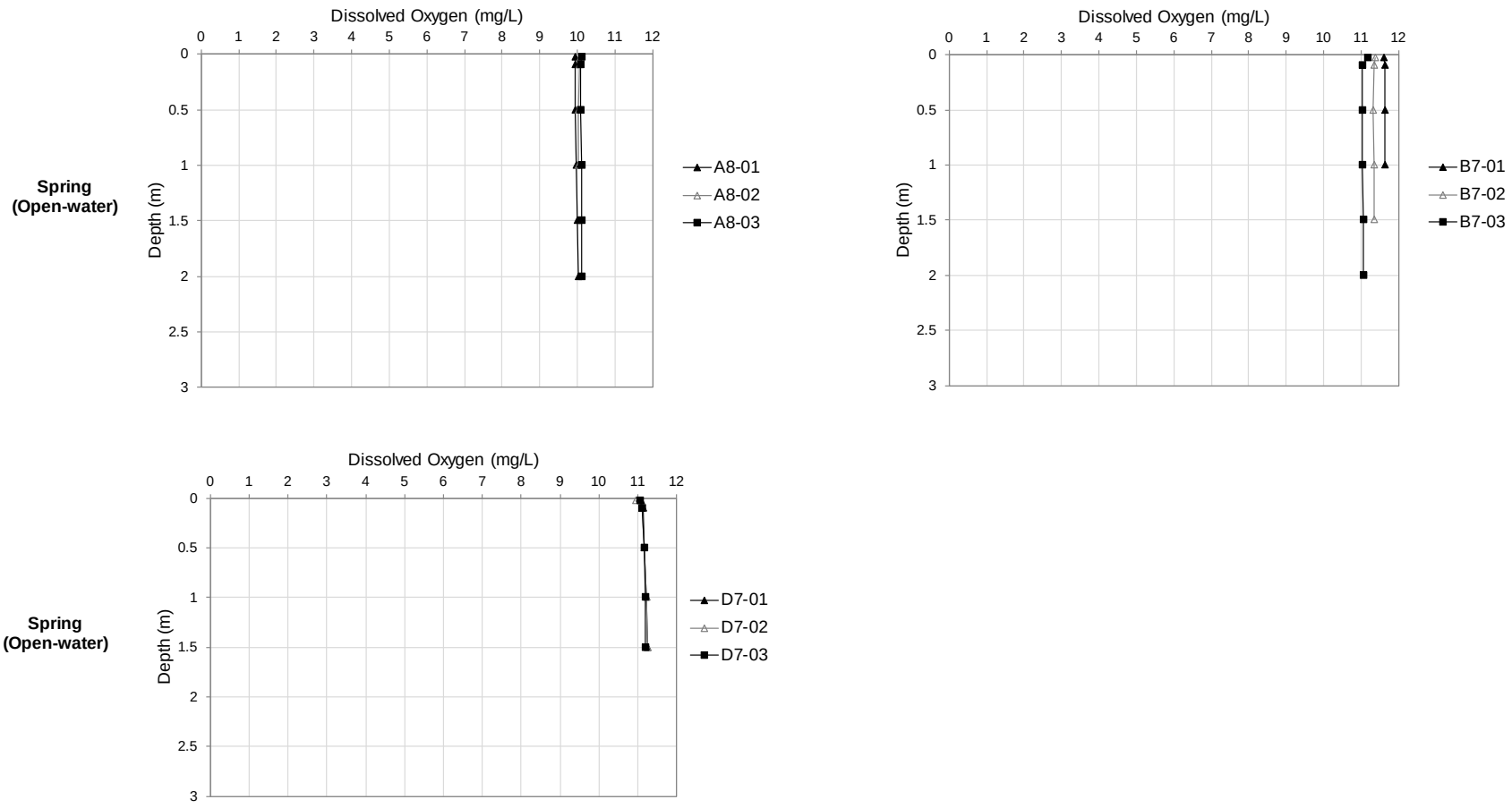
Figure 3B.5-1: Temperature (°C) Profiles at Stations on Peninsula Lake, Open-water (July) 2017



m = metre; °C = degrees Celsius; A8, B7 and D7 = Peninsula.

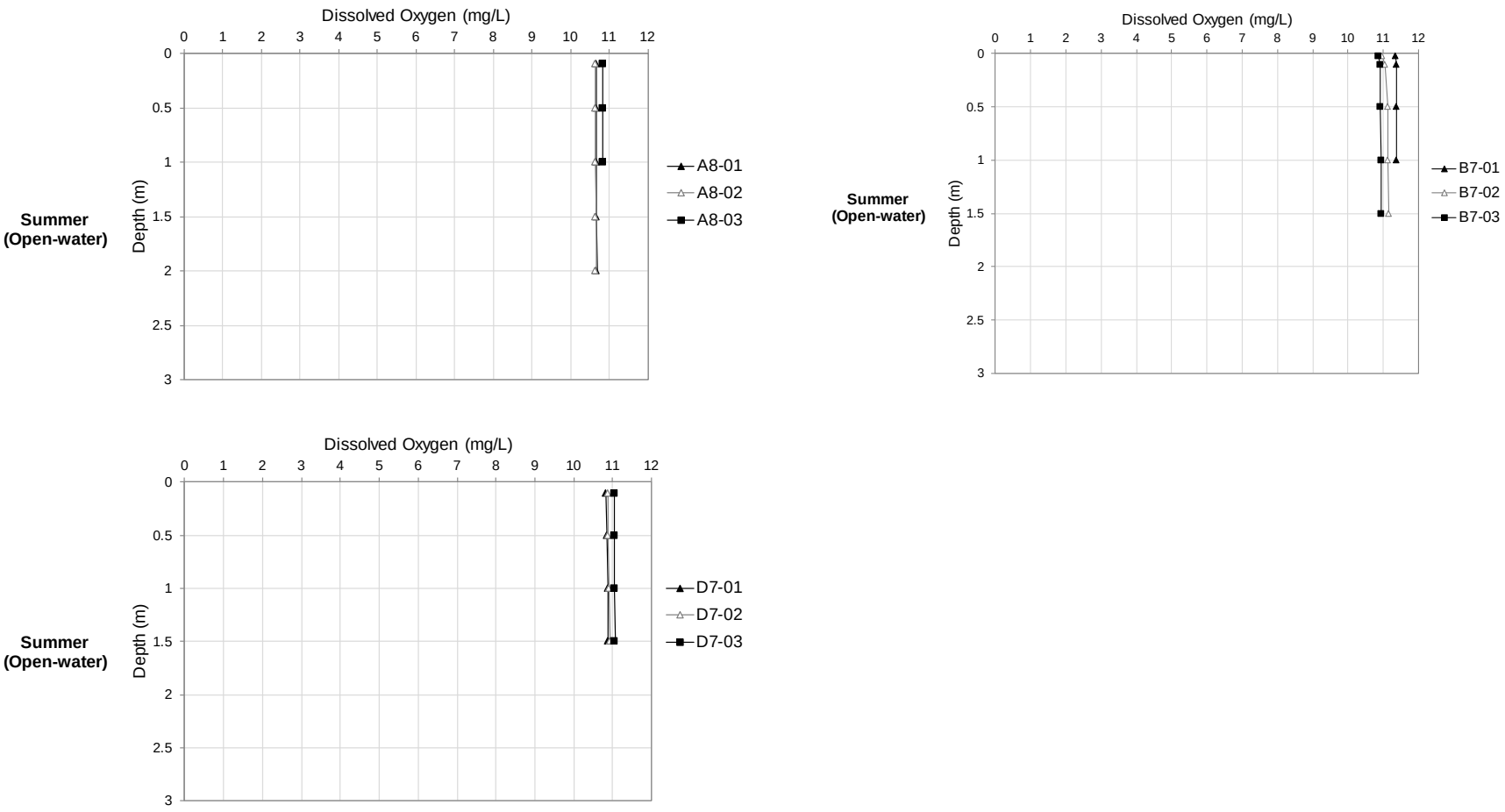
Figure 3B.5-2: Temperature (°C) Profiles at Stations on Peninsula Lake, Open-water (August) 2017

3B2.2 DISSOLVED OXYGEN



m = metre; mg/L = milligrams per litre; A8, B7 and D7 = Peninsula Lakes

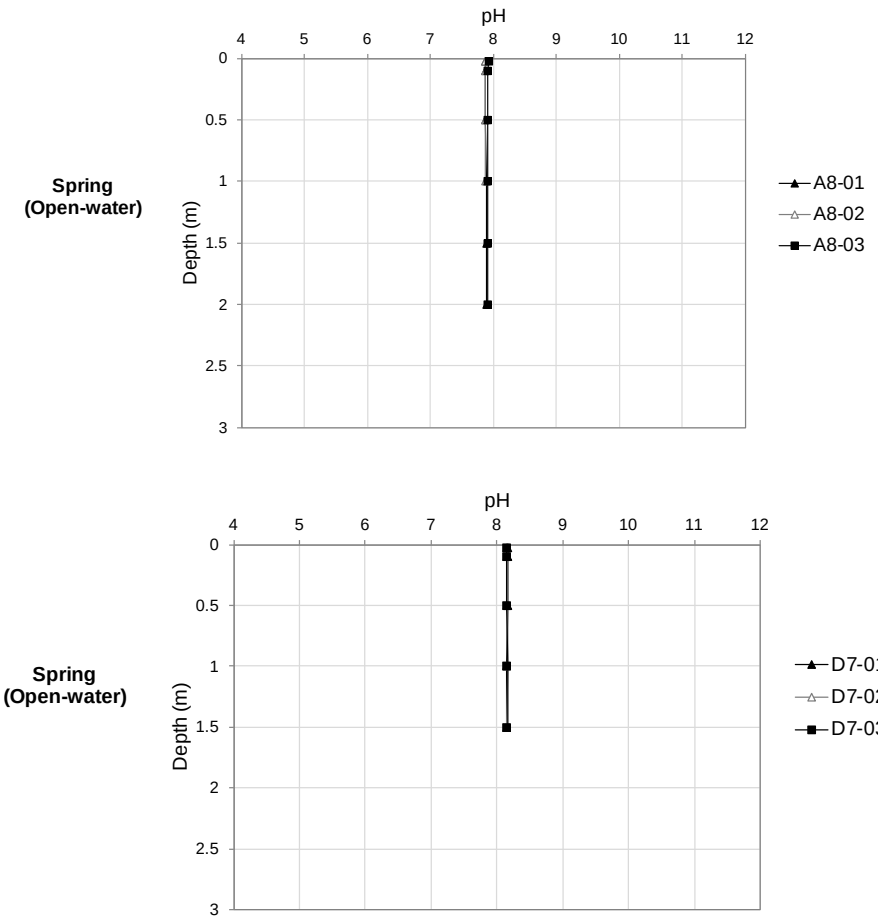
Figure 3B.6-1: Dissolved Oxygen (mg/L) Profiles at Stations on Peninsula Lake, Open-water (July) 2017



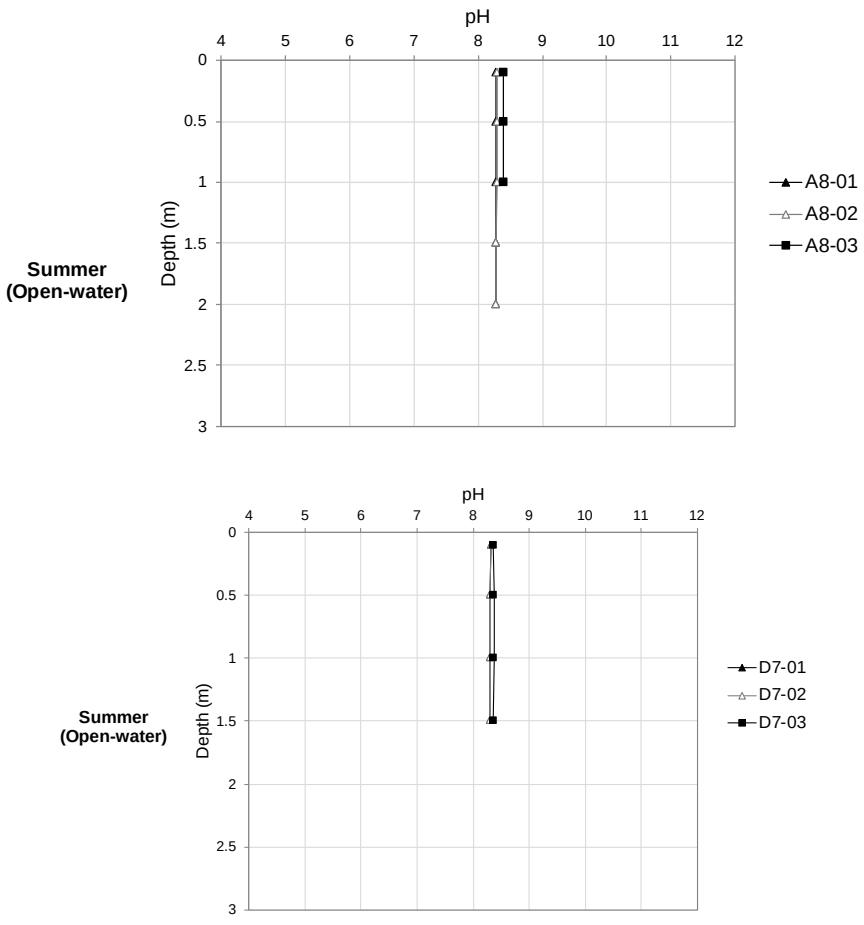
m = metre; mg/L = milligrams per litre; A8, B7 and D7 = Peninsula Lakes

Figure 3B.6-2: Dissolved Oxygen (mg/L) Profiles at Stations on Peninsula Lake, Open-water (August) 2017

3B2.3 pH

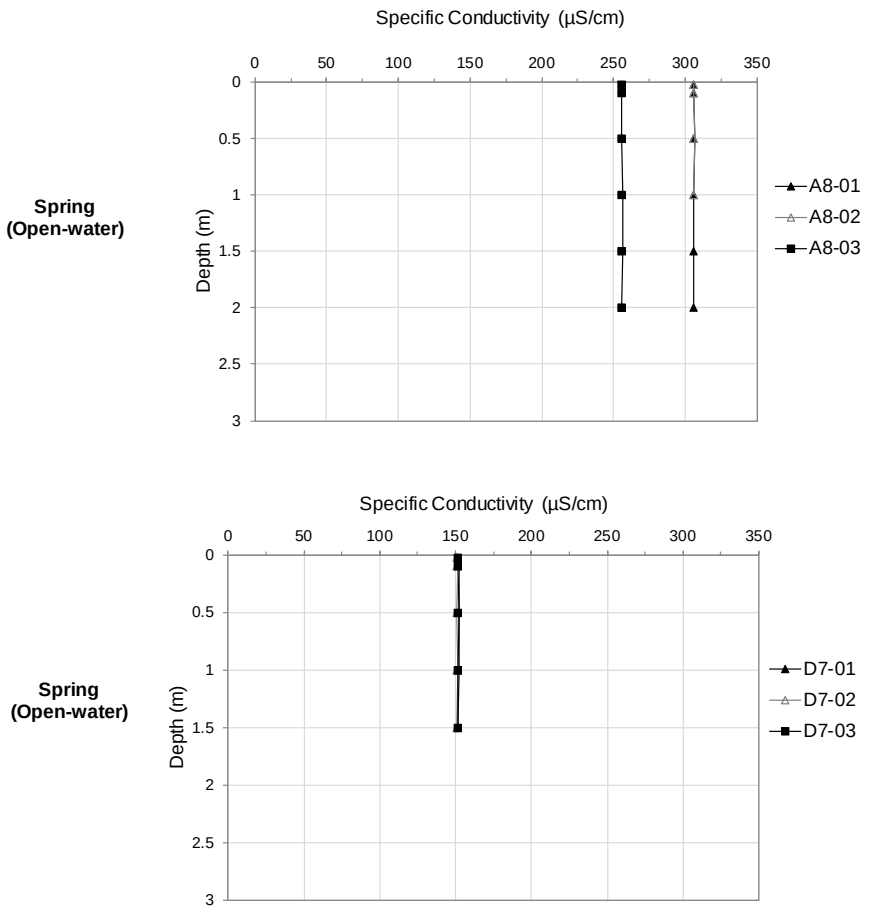


m = metre; MEL-01 = near-field; A8, B7 and D7 = Peninsual Lakes.
Figure 3B.7-1: pH Profiles at Stations on Peninsula Lake, Open-water (July) 2017



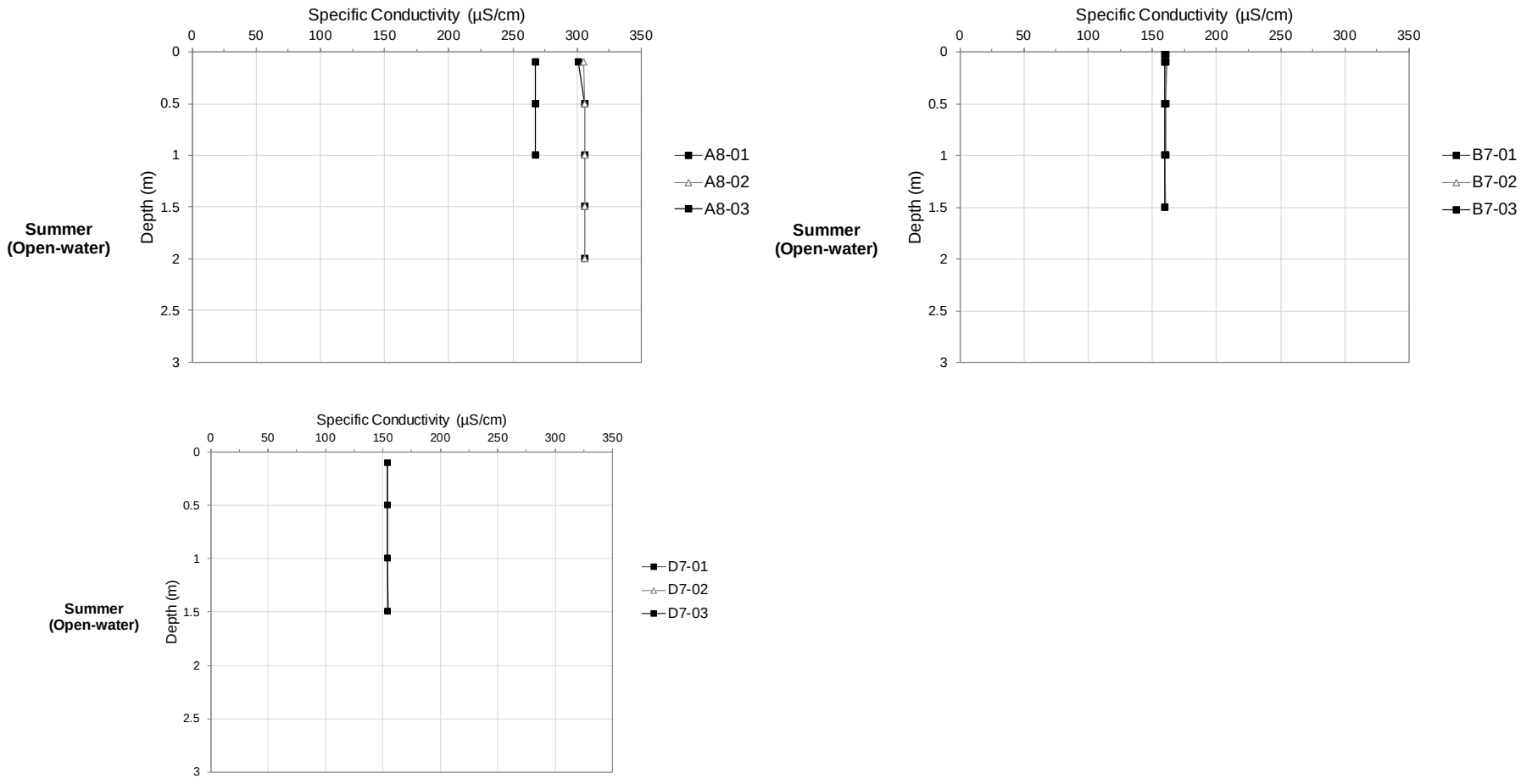
m = metre; MEL-01 = near-field; MEL-02 = mid-field; A8, B7 and D7 = Peninsual Lakes.
Figure 3B.7-2: pH Profiles at Stations on Peninsula Lake, Open-water (August) 2017

3B2.4 SPECIFIC CONDUCTIVITY



m = metre; µS/cm = microSiemens per centimetre; A8, B7 and D8 = Peninsula Lakes.

Figure 3B.8-1: Specific Conductivity (µS/cm) Profiles at Stations on Peninsula Lake, Open-water (July) 2017



M = Metre; µs/Cm = microSiemens per centimetre; A8, B7 and D7 = Peninsula Lakes.

Figure 3B.8-2: Specific Conductivity (µS/cm) Profiles at Stations on Peninsula Lake, Open-water (August) 2017

Table 3B.1-1: Field Profiles at Meliadine Near-Field, January 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-01-01							
MEL-01-01	19-Jan-17	0.1	0.0	108	-(a)	64	7.5
MEL-01-01	19-Jan-17	0.5	0.0	110	-(a)	66	7.5
MEL-01-01	19-Jan-17	1.0	0.0	111	-(a)	67	7.4
MEL-01-01	19-Jan-17	1.5	0.0	114	-(a)	70	7.4
MEL-01-01	19-Jan-17	2.0	0.0	118	-(a)	69	7.4
MEL-01-01	19-Jan-17	3.0	0.0	125	-(a)	71	7.3
MEL-01-01	19-Jan-17	4.0	0.4	130	-(a)	70	7.3
MEL-01-01	19-Jan-17	5.0	1.2	134	-(a)	76	7.2
MEL-01-01	19-Jan-17	6.0	1.6	137	-(a)	91	7.1
MEL-01-01	19-Jan-17	7.0	1.8	137	-(a)	91	7.0
MEL-01-01	19-Jan-17	8.0	2.0	134	-(a)	91	6.9
MEL-01-02							
MEL-01-02	19-Jan-17	0.1	0.0	112	-(a)	62	7.7
MEL-01-02	19-Jan-17	0.5	0.0	112	-(a)	62	7.6
MEL-01-02	19-Jan-17	1.0	0.0	113	-(a)	63	7.5
MEL-01-02	19-Jan-17	1.5	0.0	116	-(a)	62	7.5
MEL-01-02	19-Jan-17	2.0	0.3	117	-(a)	61	7.4
MEL-01-02	19-Jan-17	3.0	0.3	118	-(a)	60	7.4
MEL-01-02	19-Jan-17	4.0	0.6	119	-(a)	64	7.3
MEL-01-02	19-Jan-17	5.0	1.2	113	-(a)	81	7.2
MEL-01-02	19-Jan-17	6.0	1.5	106	-(a)	83	7.1
MEL-01-02	19-Jan-17	7.0	1.7	98	13.3	92	7.0
MEL-01-03							
MEL-01-03	19-Jan-17	0.1	0.0	112	-(a)	72	7.7
MEL-01-03	19-Jan-17	0.5	0.0	111	-(a)	67	7.7
MEL-01-03	19-Jan-17	1.0	0.0	112	-(a)	66	7.6
MEL-01-03	19-Jan-17	1.5	0.3	114	-(a)	66	7.6
MEL-01-03	19-Jan-17	2.0	0.6	116	-(a)	66	7.6
MEL-01-03	19-Jan-17	3.0	0.8	117	-(a)	68	7.5
MEL-01-03	19-Jan-17	4.0	1.0	117	-(a)	77	7.4
MEL-01-03	19-Jan-17	5.0	1.2	116	-(a)	84	7.3
MEL-01-03	19-Jan-17	6.0	1.0	111	-(a)	92	7.1
MEL-01-03	19-Jan-17	7.0	1.8	107	-(a)	95	6.9
MEL-01-03	19-Jan-17	8.0	1.9	103	14.0	95	6.9
MEL-01-04							
MEL-01-04	19-Jan-17	0.1	0.0	119	-(a)	33	7.9
MEL-01-04	19-Jan-17	0.5	0.0	115	-(a)	35	7.9
MEL-01-04	19-Jan-17	1.0	0.0	115	-(a)	36	7.9
MEL-01-04	19-Jan-17	1.5	0.0	115	-(a)	39	7.9
MEL-01-04	19-Jan-17	2.0	0.0	115	-(a)	41	7.9
MEL-01-04	19-Jan-17	3.0	0.0	116	-(a)	45	7.9
MEL-01-04	19-Jan-17	4.0	0.0	116	-(a)	49	7.9
MEL-01-04	19-Jan-17	5.0	0.0	117	-(a)	52	7.9
MEL-01-04	19-Jan-17	6.0	0.0	117	-(a)	58	7.9
MEL-01-04	19-Jan-17	7.0	0.1	111	-(a)	60	7.6
MEL-01-04	19-Jan-17	8.0	1.9	110	13.9	77	7.4
MEL-01-05							
MEL-01-05	19-Jan-17	0.0	0.0	116	-(a)	65	7.5
MEL-01-05	19-Jan-17	0.1	0.0	115	-(a)	72	7.4
MEL-01-05	19-Jan-17	0.5	0.0	114	-(a)	80	7.4
MEL-01-05	19-Jan-17	1.0	0.0	115	-(a)	80	7.4
MEL-01-05	19-Jan-17	2.0	0.6	117	-(a)	89	7.4
MEL-01-05	19-Jan-17	3.0	0.9	118	-(a)	84	7.3
MEL-01-05	19-Jan-17	4.0	1.1	115	-(a)	89	7.3
MEL-01-05	19-Jan-17	5.0	1.5	110	-(a)	93	7.0
MEL-01-05	19-Jan-17	6.0	2.1	91	12.3	103	6.8
MEL-01-05	19-Jan-17	7.0	2.3	84	11.3	107	6.8

Table 3B.1-2: Field Profiles at Meliadine Near-Field, February 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-01-01							
MEL-01-01	18-Feb-17	0.1	0.0	114	-(a)	71	8.2
MEL-01-01	18-Feb-17	0.5	0.0	111	-(a)	61	8.3
MEL-01-01	18-Feb-17	1.0	0.0	110	-(a)	66	8.3
MEL-01-01	18-Feb-17	2.0	0.1	111	-(a)	64	8.3
MEL-01-01	18-Feb-17	3.0	0.9	111	-(a)	99	8.2
MEL-01-01	18-Feb-17	4.0	1.1	108	-(a)	98	8.1
MEL-01-01	18-Feb-17	5.0	1.3	106	-(a)	97	8.1
MEL-01-01	18-Feb-17	6.0	1.6	104	13.6	94	8.0
MEL-01-01	18-Feb-17	7.0	1.9	98	13.5	94	7.8
MEL-01-01	18-Feb-17	8.0	2.1	98	13.4	94	7.7
MEL-01-01	18-Feb-17	9.0	2.2	98	13.4	94	7.7
MEL-01-02							
MEL-01-02	18-Feb-17	0.1	0.0	112	-(a)	45	8.2
MEL-01-02	18-Feb-17	0.5	0.0	110	-(a)	48	8.2
MEL-01-02	18-Feb-17	1.0	0.0	110	-(a)	56	8.2
MEL-01-02	18-Feb-17	2.0	0.0	110	-(a)	71	8.3
MEL-01-02	18-Feb-17	3.0	0.5	110	-(a)	102	8.2
MEL-01-02	18-Feb-17	4.0	1.1	109	-(a)	98	8.1
MEL-01-02	18-Feb-17	5.0	1.4	109	-(a)	96	8.0
MEL-01-02	18-Feb-17	6.0	1.6	105	-(a)	96	7.8
MEL-01-02	18-Feb-17	7.0	1.8	105	-(a)	96	7.6
MEL-01-03							
MEL-01-03	18-Feb-17	0.1	0.0	105	-(a)	98	8.3
MEL-01-03	18-Feb-17	0.5	0.1	109	-(a)	78	8.3
MEL-01-03	18-Feb-17	1.0	0.1	111	-(a)	112	8.2
MEL-01-03	18-Feb-17	2.0	0.5	111	-(a)	108	8.3
MEL-01-03	18-Feb-17	3.0	0.9	118	-(a)	102	8.2
MEL-01-03	18-Feb-17	4.0	1.1	118	-(a)	99	8.2
MEL-01-03	18-Feb-17	5.0	1.4	120	-(a)	96	8.2
MEL-01-03	18-Feb-17	6.0	1.6	116	-(a)	100	8.0
MEL-01-03	18-Feb-17	7.0	1.8	101	13.9	100	8.0
MEL-01-03	18-Feb-17	8.0	2.0	94	12.9	98	8.0
MEL-01-04							
MEL-01-04	18-Feb-17	0.1	0.0	113	-(a)	92	8.3
MEL-01-04	18-Feb-17	0.5	0.0	112	-(a)	83	8.3
MEL-01-04	18-Feb-17	1.0	0.0	110	-(a)	82	8.3
MEL-01-04	18-Feb-17	2.0	0.6	110	-(a)	96	8.3
MEL-01-04	18-Feb-17	3.0	0.9	110	-(a)	98	8.3
MEL-01-04	18-Feb-17	4.0	1.2	108	-(a)	96	8.2
MEL-01-04	18-Feb-17	5.0	1.3	104	-(a)	95	8.1
MEL-01-04	18-Feb-17	6.0	1.6	104	-(a)	94	8.0
MEL-01-04	18-Feb-17	7.0	1.8	104	12.4	96	8.0
MEL-01-04	18-Feb-17	8.0	2.0	84	11.5	95	8.0
MEL-01-05							
MEL-01-05	18-Feb-17	0.1	0.1	102	-(a)	117	6.6
MEL-01-05	18-Feb-17	0.5	0.1	110	-(a)	115	6.6
MEL-01-05	18-Feb-17	1.0	0.1	114	-(a)	114	6.7
MEL-01-05	18-Feb-17	2.0	0.7	117	-(a)	105	6.9
MEL-01-05	18-Feb-17	3.0	1.0	117	-(a)	100	7.0
MEL-01-05	18-Feb-17	4.0	1.2	117	-(a)	97	7.1
MEL-01-05	18-Feb-17	5.0	1.5	116	-(a)	97	7.1
MEL-01-05	18-Feb-17	6.0	2.0	107	-(a)	98	7.1
MEL-01-05	18-Feb-17	7.0	2.2	81	10.8	107	7.1

-(a) = values were not included as they did not pass the QC criteria (i.e., were outside the acceptable range)

Table 3B.1-3: Field Profiles at Meliadine Near-Field, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-01-01							
MEL-01-01	16-Jul-17	0.0	13.2	103	10.4	82	7.3
MEL-01-01	16-Jul-17	0.1	13.2	103	10.4	82	7.4
MEL-01-01	16-Jul-17	0.5	13.2	103	10.5	82	7.4
MEL-01-01	16-Jul-17	1.0	13.2	103	10.5	82	7.4
MEL-01-01	16-Jul-17	2.0	13.2	103	10.5	82	7.4
MEL-01-01	16-Jul-17	3.0	13.1	104	10.5	82	7.4
MEL-01-01	16-Jul-17	4.0	13.1	104	10.5	82	7.4
MEL-01-01	16-Jul-17	5.0	13.2	104	10.5	82	7.4
MEL-01-01	16-Jul-17	6.0	13.1	104	10.5	82	7.4
MEL-01-01	16-Jul-17	7.0	13.1	104	10.5	82	7.4
MEL-01-01	16-Jul-17	8.0	13.1	103	10.5	82	7.4
MEL-01-01	16-Jul-17	9.0	13.1	103	10.5	82	7.4
MEL-01-01	16-Jul-17	10.0	13.1	103	10.5	82	7.4
MEL-01-02							
MEL-01-02	16-Jul-17	0.0	13.2	102	10.4	82	7.4
MEL-01-02	16-Jul-17	0.1	13.2	103	10.5	82	7.4
MEL-01-02	16-Jul-17	0.5	13.2	103	10.5	82	7.4
MEL-01-02	16-Jul-17	1.0	13.2	103	10.5	82	7.4
MEL-01-02	16-Jul-17	2.0	13.2	104	10.5	82	7.4
MEL-01-02	16-Jul-17	3.0	13.1	104	10.6	82	7.4
MEL-01-02	16-Jul-17	4.0	13.1	104	10.6	82	7.4
MEL-01-02	16-Jul-17	5.0	13.1	104	10.6	82	7.4
MEL-01-02	16-Jul-17	6.0	13.1	104	10.6	82	7.4
MEL-01-02	16-Jul-17	7.0	13.1	104	10.6	82	7.4
MEL-01-02	16-Jul-17	8.0	13.0	104	10.6	82	7.4
MEL-01-03							
MEL-01-03	16-Jul-17	0.0	13.1	103	10.4	82	7.3
MEL-01-03	16-Jul-17	0.1	13.1	103	10.4	82	7.3
MEL-01-03	16-Jul-17	0.5	13.0	103	10.4	82	7.3
MEL-01-03	16-Jul-17	1.0	13.1	103	10.5	82	7.3
MEL-01-03	16-Jul-17	2.0	13.1	103	10.5	82	7.3
MEL-01-03	16-Jul-17	3.0	13.0	103	10.5	82	7.3
MEL-01-03	16-Jul-17	4.0	13.0	103	10.5	82	7.3
MEL-01-03	16-Jul-17	5.0	13.0	103	10.5	82	7.4
MEL-01-03	16-Jul-17	6.0	13.0	103	10.5	82	7.4
MEL-01-03	16-Jul-17	7.0	13.0	103	10.5	82	7.4
MEL-01-03	16-Jul-17	8.0	13.0	103	10.5	82	7.4
MEL-01-03	16-Jul-17	9.0	13.0	103	10.5	82	7.4
MEL-01-04							
MEL-01-04	16-Jul-17	0.0	13.1	102	10.3	82	7.3
MEL-01-04	16-Jul-17	0.1	13.1	102	10.4	82	7.3
MEL-01-04	16-Jul-17	0.5	13.1	103	10.5	82	7.3
MEL-01-04	16-Jul-17	1.0	13.1	103	10.5	82	7.3
MEL-01-04	16-Jul-17	2.0	13.1	103	10.5	82	7.3
MEL-01-04	16-Jul-17	3.0	13.1	104	10.6	82	7.3
MEL-01-04	16-Jul-17	4.0	13.1	104	10.6	82	7.4
MEL-01-04	16-Jul-17	5.0	13.1	104	10.6	82	7.4
MEL-01-04	16-Jul-17	6.0	13.1	104	10.6	82	7.4
MEL-01-04	16-Jul-17	7.0	13.1	104	10.6	82	7.4
MEL-01-04	16-Jul-17	8.0	13.1	104	10.6	82	7.4
MEL-01-05							
MEL-01-05	16-Jul-17	0.0	13.0	102	10.4	82	7.3
MEL-01-05	16-Jul-17	0.1	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	0.5	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	1.0	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	2.0	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	3.0	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	4.0	13.0	103	10.5	82	7.3
MEL-01-05	16-Jul-17	5.0	13.0	103	10.5	82	7.3
MEL-01-05	16-Jul-17	6.0	13.0	103	10.5	82	7.3
MEL-01-05	16-Jul-17	7.0	13.0	103	10.4	82	7.3
MEL-01-05	16-Jul-17	8.0	13.0	103	10.4	82	7.3

Table 3.B.1-4: Field Profiles at Meliadine Near-Field, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-01-01							
MEL-01-01	09-Aug-17	0.1	13.1	100	10.4	82	7.7
MEL-01-01	09-Aug-17	0.5	13.1	100	10.5	82	7.6
MEL-01-01	09-Aug-17	1.0	13.1	101	10.5	82	7.6
MEL-01-01	09-Aug-17	2.0	13.0	101	10.5	82	7.6
MEL-01-01	09-Aug-17	3.0	13.0	101	10.5	82	7.6
MEL-01-01	09-Aug-17	4.0	12.9	101	10.5	82	7.6
MEL-01-01	09-Aug-17	5.0	12.8	100	10.5	81	7.6
MEL-01-01	09-Aug-17	6.0	12.8	100	10.5	82	7.6
MEL-01-01	09-Aug-17	7.0	12.8	100	10.5	82	7.6
MEL-01-01	09-Aug-17	8.0	12.8	100	10.5	82	7.6
MEL-01-01	09-Aug-17	9.0	12.8	100	10.5	82	7.6
MEL-01-01	09-Aug-17	10.0	12.8	100	10.5	82	7.6
MEL-01-02							
MEL-01-02	09-Aug-17	0.1	13.7	101	10.5	82	7.7
MEL-01-02	09-Aug-17	0.5	13.1	101	10.5	82	7.6
MEL-01-02	09-Aug-17	1.0	13.1	101	10.5	82	7.6
MEL-01-02	09-Aug-17	2.0	13.0	101	10.5	82	7.6
MEL-01-02	09-Aug-17	3.0	12.9	100	10.5	82	7.6
MEL-01-02	09-Aug-17	4.0	12.9	100	10.5	82	7.6
MEL-01-02	09-Aug-17	5.0	12.9	100	10.5	82	7.6
MEL-01-02	09-Aug-17	6.0	12.8	100	10.5	82	7.6
MEL-01-02	09-Aug-17	7.0	12.8	100	10.5	81	7.6
MEL-01-02	09-Aug-17	8.0	12.8	100	10.5	81	7.6
MEL-01-03							
MEL-01-03	09-Aug-17	0.1	13.3	101	10.4	82	7.7
MEL-01-03	09-Aug-17	0.5	13.3	101	10.5	82	7.7
MEL-01-03	09-Aug-17	1.0	13.3	101	10.5	82	7.7
MEL-01-03	09-Aug-17	2.0	13.2	101	10.5	82	7.6
MEL-01-03	09-Aug-17	3.0	13.1	101	10.5	82	7.6
MEL-01-03	09-Aug-17	4.0	13.1	101	10.5	82	7.6
MEL-01-03	09-Aug-17	5.0	13.1	101	10.5	82	7.7
MEL-01-03	09-Aug-17	6.0	13.1	101	10.5	82	7.7
MEL-01-03	09-Aug-17	7.0	12.9	101	10.5	82	7.6
MEL-01-03	09-Aug-17	8.0	12.8	101	10.5	82	7.6
MEL-01-03	09-Aug-17	9.0	12.8	100	10.5	82	7.6
MEL-01-04							
MEL-01-04	09-Aug-17	0.1	13.3	101	10.5	82	7.6
MEL-01-04	09-Aug-17	0.5	13.3	101	10.5	82	7.6
MEL-01-04	09-Aug-17	1.0	13.3	101	10.5	82	7.6
MEL-01-04	09-Aug-17	2.0	13.2	101	10.5	82	7.6
MEL-01-04	09-Aug-17	3.0	13.1	101	10.5	82	7.6
MEL-01-04	09-Aug-17	4.0	12.9	101	10.5	82	7.6
MEL-01-04	09-Aug-17	5.0	12.9	100	10.5	82	7.6
MEL-01-04	09-Aug-17	6.0	12.9	100	10.5	82	7.6
MEL-01-04	09-Aug-17	7.0	12.8	100	10.5	82	7.6
MEL-01-04	09-Aug-17	8.0	12.8	100	10.5	82	7.6
MEL-01-05							
MEL-01-05	09-Aug-17	0.1	13.5	102	10.5	82	7.7
MEL-01-05	09-Aug-17	0.5	13.5	102	10.5	82	7.7
MEL-01-05	09-Aug-17	1.0	13.5	102	10.5	82	7.7
MEL-01-05	09-Aug-17	2.0	13.5	102	10.5	82	7.7
MEL-01-05	09-Aug-17	3.0	13.4	102	10.5	82	7.6
MEL-01-05	09-Aug-17	4.0	13.4	102	10.5	82	7.6
MEL-01-05	09-Aug-17	5.0	13.3	102	10.5	82	7.6
MEL-01-05	09-Aug-17	6.0	13.2	101	10.5	82	7.6
MEL-01-05	09-Aug-17	7.0	12.9	101	10.6	82	7.7
MEL-01-05	09-Aug-17	8.0	12.7	101	10.6	82	7.7

Table 3B.1-5: Field Profiles at Meliadine Near-Field, September 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-01-01							
MEL-01-01	04-Sep-17	0.1	9.5	102	11.5	80	7.6
MEL-01-01	04-Sep-17	0.5	9.5	102	11.5	80	7.6
MEL-01-01	04-Sep-17	1.0	9.5	102	11.5	80	7.6
MEL-01-01	04-Sep-17	2.0	9.5	102	11.5	80	7.6
MEL-01-01	04-Sep-17	3.0	9.5	102	11.5	80	7.6
MEL-01-01	04-Sep-17	4.0	9.4	102	11.5	80	7.6
MEL-01-01	04-Sep-17	5.0	9.4	101	11.5	80	7.5
MEL-01-01	04-Sep-17	6.0	9.4	102	11.5	80	7.5
MEL-01-01	04-Sep-17	7.0	9.4	101	11.5	80	7.5
MEL-01-01	04-Sep-17	8.0	9.4	101	11.5	80	7.5
MEL-01-02							
MEL-01-02	04-Sep-17	0.1	9.4	102	11.5	80	7.6
MEL-01-02	04-Sep-17	0.5	9.4	102	11.5	80	7.6
MEL-01-02	04-Sep-17	1.0	9.4	102	11.5	80	7.6
MEL-01-02	04-Sep-17	2.0	9.5	102	11.5	80	7.6
MEL-01-02	04-Sep-17	3.0	9.4	102	11.5	80	7.5
MEL-01-02	04-Sep-17	4.0	9.4	102	11.5	80	7.5
MEL-01-02	04-Sep-17	5.0	9.4	102	11.4	80	7.5
MEL-01-02	04-Sep-17	6.0	9.4	101	11.4	80	7.5
MEL-01-02	04-Sep-17	7.0	9.4	101	11.4	80	7.5
MEL-01-03							
MEL-01-03	04-Sep-17	0.1	9.6	103	10.9	80	7.6
MEL-01-03	04-Sep-17	0.5	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	1.0	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	2.0	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	3.0	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	4.0	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	5.0	9.5	103	10.9	80	7.6
MEL-01-03	04-Sep-17	6.0	9.5	103	10.9	80	7.6
MEL-01-04							
MEL-01-04	04-Sep-17	0.1	9.5	101	11.5	80	7.6
MEL-01-04	04-Sep-17	0.5	9.5	101	11.5	80	7.6
MEL-01-04	04-Sep-17	1.0	9.5	101	11.5	80	7.6
MEL-01-04	04-Sep-17	2.0	9.5	101	11.5	80	7.6
MEL-01-04	04-Sep-17	3.0	9.5	102	11.5	80	7.5
MEL-01-04	04-Sep-17	4.0	9.4	101	11.5	80	7.6
MEL-01-04	04-Sep-17	5.0	9.4	101	11.5	80	7.5
MEL-01-04	04-Sep-17	6.0	9.4	101	11.5	80	7.5
MEL-01-04	04-Sep-17	7.0	9.4	101	11.5	80	7.5
MEL-01-04	04-Sep-17	8.0	9.4	101	11.5	80	7.5
MEL-01-05							
MEL-01-05	04-Sep-17	0.1	9.5	102	11.5	80	7.6
MEL-01-05	04-Sep-17	0.5	9.5	102	11.5	80	7.6
MEL-01-05	04-Sep-17	1.0	9.5	102	11.5	80	7.6
MEL-01-05	04-Sep-17	2.0	9.5	102	11.5	80	7.6
MEL-01-05	04-Sep-17	3.0	9.4	102	11.5	80	7.6
MEL-01-05	04-Sep-17	4.0	9.4	102	11.5	80	7.6
MEL-01-05	04-Sep-17	5.0	9.4	102	11.5	80	7.5
MEL-01-05	04-Sep-17	6.0	9.5	101	11.5	80	7.5
MEL-01-05	04-Sep-17	7.0	9.4	101	11.5	80	7.5
MEL-01-05	04-Sep-17	7.5	9.4	101	11.5	80	7.5

Table 3B.2-1: Field Profiles at Meliadine Mid-Field, January 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-02-01							
MEL-02-01	20-Jan-17	0.1	0.0	113	-(a)	42	7.3
MEL-02-01	20-Jan-17	0.5	0.0	112	-(a)	42	7.4
MEL-02-01	20-Jan-17	1.0	0.0	113	-(a)	43	7.4
MEL-02-01	20-Jan-17	2.0	0.0	114	-(a)	42	7.4
MEL-02-01	20-Jan-17	3.0	0.0	115	-(a)	43	7.4
MEL-02-01	20-Jan-17	4.0	0.0	116	-(a)	42	7.4
MEL-02-01	20-Jan-17	5.0	0.0	117	-(a)	43	7.4
MEL-02-01	20-Jan-17	6.0	0.0	116	-(a)	41	7.4
MEL-02-01	20-Jan-17	7.0	1.0	110	-(a)	41	7.3
MEL-02-02							
MEL-02-02	20-Jan-17	0.1	0.0	120	-(a)	36	7.4
MEL-02-02	20-Jan-17	0.5	0.0	114	-(a)	32	7.4
MEL-02-02	20-Jan-17	1.0	0.0	114	-(a)	31	7.4
MEL-02-02	20-Jan-17	2.0	0.1	114	-(a)	31	7.4
MEL-02-02	20-Jan-17	3.0	0.7	115	-(a)	30	7.4
MEL-02-02	20-Jan-17	4.0	0.9	114	-(a)	30	7.4
MEL-02-02	20-Jan-17	5.0	1.1	112	-(a)	30	7.4
MEL-02-02	20-Jan-17	6.0	1.3	108	-(a)	32	7.3
MEL-02-02	20-Jan-17	7.0	1.5	104	-(a)	34	7.2
MEL-02-02	20-Jan-17	8.0	1.7	96	13.1	41	7.0
MEL-02-03							
MEL-02-03	20-Jan-17	0.1	0.0	105	-(a)	104	7.3
MEL-02-03	20-Jan-17	0.5	0.0	109	-(a)	102	7.3
MEL-02-03	20-Jan-17	1.0	0.1	111	-(a)	101	7.2
MEL-02-03	20-Jan-17	2.0	0.5	114	-(a)	95	7.2
MEL-02-03	20-Jan-17	3.0	0.7	115	-(a)	91	7.2
MEL-02-03	20-Jan-17	4.0	0.9	114	-(a)	87	7.2
MEL-02-03	20-Jan-17	5.0	1.1	112	-(a)	84	7.2
MEL-02-03	20-Jan-17	6.0	1.3	109	-(a)	84	7.1
MEL-02-03	20-Jan-17	7.0	1.4	103	-(a)	83	7.1
MEL-02-03	20-Jan-17	8.0	1.7	97	-(a)	84	7.0
MEL-02-04							
MEL-02-04	20-Jan-17	0.1	0.1	110	-(a)	73	7.3
MEL-02-04	20-Jan-17	0.5	0.1	111	-(a)	78	7.2
MEL-02-04	20-Jan-17	1.0	0.2	112	-(a)	79	7.2
MEL-02-04	20-Jan-17	2.0	0.5	113	-(a)	83	7.2
MEL-02-04	20-Jan-17	3.0	0.7	114	-(a)	90	7.2
MEL-02-04	20-Jan-17	4.0	1.0	112	-(a)	87	7.2
MEL-02-04	20-Jan-17	5.0	1.2	111	-(a)	85	7.2
MEL-02-04	20-Jan-17	6.0	1.3	105	-(a)	84	7.1
MEL-02-04	20-Jan-17	7.0	1.5	102	14.0	86	7.1
MEL-02-05							
MEL-02-05	20-Jan-17	0.1	0.1	111	-(a)	99	7.6
MEL-02-05	20-Jan-17	0.5	0.1	113	-(a)	99	7.4
MEL-02-05	20-Jan-17	1.0	0.2	115	-(a)	98	7.4
MEL-02-05	20-Jan-17	2.0	0.5	117	-(a)	93	7.3
MEL-02-05	20-Jan-17	3.0	0.7	116	-(a)	90	7.3
MEL-02-05	20-Jan-17	4.0	0.9	113	-(a)	91	7.2
MEL-02-05	20-Jan-17	5.0	1.2	109	-(a)	87	7.1
MEL-02-05	20-Jan-17	6.0	1.3	104	-(a)	86	7.1
MEL-02-05	20-Jan-17	7.0	1.5	102	14.0	84	7.0
MEL-02-05	20-Jan-17	8.0	1.6	96	13.3	85	7.0

Table 3B.2-2: Field Profiles at Meliadine Mid-Field, February 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-02-01							
MEL-02-01	19-Feb-17	0.1	0.0	-(a)	-(a)	89	7.6
MEL-02-01	19-Feb-17	0.5	0.0	-(a)	-(a)	79	7.6
MEL-02-01	19-Feb-17	1.0	0.1	-(a)	-(a)	79	7.6
MEL-02-01	19-Feb-17	2.0	0.5	-(a)	-(a)	80	7.6
MEL-02-01	19-Feb-17	3.0	0.7	-(a)	-(a)	89	7.5
MEL-02-01	19-Feb-17	4.0	1.1	-(a)	-(a)	87	7.4
MEL-02-01	19-Feb-17	5.0	1.1	103	-(a)	86	7.4
MEL-02-01	19-Feb-17	6.0	1.4	95	-(a)	87	7.2
MEL-02-01	19-Feb-17	7.0	1.5	95	-(a)	90	7.1
MEL-02-02							
MEL-02-02	19-Feb-17	0.1	0.0	113	-(a)	77	7.9
MEL-02-02	19-Feb-17	0.5	0.0	109	-(a)	70	7.8
MEL-02-02	19-Feb-17	1.0	0.0	109	-(a)	65	7.8
MEL-02-02	19-Feb-17	2.0	0.1	109	-(a)	101	7.8
MEL-02-02	19-Feb-17	3.0	0.7	109	-(a)	94	7.7
MEL-02-02	19-Feb-17	4.0	1.0	109	-(a)	91	7.6
MEL-02-02	19-Feb-17	5.0	1.2	109	-(a)	88	7.5
MEL-02-02	19-Feb-17	6.0	1.4	106	-(a)	87	7.4
MEL-02-02	19-Feb-17	7.0	1.6	106	-(a)	86	7.3
MEL-02-02	19-Feb-17	8.0	1.8	106	-(a)	85	7.2
MEL-02-03							
MEL-02-03	19-Feb-17	0.1	0.0	107	-(a)	69	7.5
MEL-02-03	19-Feb-17	0.5	0.1	107	-(a)	81	7.4
MEL-02-03	19-Feb-17	1.0	0.1	107	-(a)	80	7.4
MEL-02-03	19-Feb-17	2.0	0.4	107	-(a)	79	7.4
MEL-02-03	19-Feb-17	3.0	0.7	111	-(a)	98	7.4
MEL-02-03	19-Feb-17	4.0	0.7	111	-(a)	94	7.4
MEL-02-03	19-Feb-17	5.0	1.1	110	-(a)	91	7.3
MEL-02-03	19-Feb-17	6.0	1.4	110	-(a)	89	7.3
MEL-02-03	19-Feb-17	7.0	1.6	110	-(a)	86	7.3
MEL-02-03	19-Feb-17	8.0	1.7	110	-(a)	86	7.2
MEL-02-03	19-Feb-17	9.0	1.9	110	-(a)	85	7.0
MEL-02-04							
MEL-02-04	19-Feb-17	0.1	0.0	106	-(a)	99	7.1
MEL-02-04	19-Feb-17	0.5	0.0	107	-(a)	104	7.0
MEL-02-04	19-Feb-17	1.0	0.1	109	-(a)	103	6.9
MEL-02-04	19-Feb-17	2.0	0.4	109	-(a)	98	6.9
MEL-02-04	19-Feb-17	3.0	0.8	109	-(a)	93	7.0
MEL-02-04	19-Feb-17	4.0	1.0	110	-(a)	91	7.0
MEL-02-04	19-Feb-17	5.0	1.2	106	-(a)	90	7.0
MEL-02-04	19-Feb-17	6.0	1.4	103	-(a)	89	7.0
MEL-02-04	19-Feb-17	7.0	1.6	103	-(a)	89	7.0
MEL-02-04	19-Feb-17	8.0	1.7	90	12.6	92	6.9
MEL-02-05							
MEL-02-05	19-Feb-17	0.1	0.0	115	-(a)	94	7.6
MEL-02-05	19-Feb-17	0.5	0.2	111	-(a)	72	7.6
MEL-02-05	19-Feb-17	1.0	0.1	111	-(a)	75	7.3
MEL-02-05	19-Feb-17	2.0	0.4	111	-(a)	68	8.1
MEL-02-05	19-Feb-17	3.0	0.7	112	-(a)	94	7.7
MEL-02-05	19-Feb-17	4.0	1.0	112	-(a)	91	7.6
MEL-02-05	19-Feb-17	5.0	1.2	112	-(a)	90	7.6
MEL-02-05	19-Feb-17	6.0	1.4	112	-(a)	89	7.4
MEL-02-05	19-Feb-17	7.0	1.5	96	13.5	89	7.2
MEL-02-05	19-Feb-17	8.0	1.7	96	13.4	88	7.2

-(a) = values were not included as they did not pass the QC criteria (i.e., were outside the acceptable range)

Table 3B.2-3: Field Profiles at Meliadine Mid-Field, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-02-01							
MEL-02-01	23-Jul-17	0.0	12.7	105	10.8	76	7.6
MEL-02-01	23-Jul-17	0.1	12.7	105	10.8	76	7.6
MEL-02-01	23-Jul-17	0.5	12.7	105	10.8	76	7.6
MEL-02-01	23-Jul-17	1.0	12.7	105	10.8	76	7.6
MEL-02-01	23-Jul-17	2.0	12.7	105	10.8	76	7.5
MEL-02-01	23-Jul-17	3.0	12.7	105	10.8	76	7.5
MEL-02-01	23-Jul-17	4.0	12.7	105	10.8	76	7.5
MEL-02-01	23-Jul-17	5.0	12.7	105	10.8	76	7.5
MEL-02-01	23-Jul-17	6.0	12.6	105	10.8	76	7.5
MEL-02-01	23-Jul-17	7.0	12.6	105	10.8	76	7.5
MEL-02-02							
MEL-02-02	23-Jul-17	0.0	12.6	104	10.7	76	7.5
MEL-02-02	23-Jul-17	0.1	12.6	104	10.7	76	7.5
MEL-02-02	23-Jul-17	0.5	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	1.0	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	2.0	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	3.0	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	4.0	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	5.0	12.6	105	10.8	76	7.5
MEL-02-02	23-Jul-17	6.0	12.5	105	10.8	76	7.5
MEL-02-02	23-Jul-17	7.0	12.5	105	10.8	76	7.4
MEL-02-02	23-Jul-17	8.0	12.5	104	10.8	76	7.5
MEL-02-02	23-Jul-17	9.0	12.5	104	10.8	76	7.5
MEL-02-03							
MEL-02-03	23-Jul-17	0.0	12.5	104	10.7	76	7.5
MEL-02-03	23-Jul-17	0.1	12.5	104	10.8	76	7.5
MEL-02-03	23-Jul-17	0.5	12.5	104	10.8	76	7.5
MEL-02-03	23-Jul-17	1.0	12.5	104	10.8	76	7.5
MEL-02-03	23-Jul-17	2.0	12.5	104	10.8	76	7.5
MEL-02-03	23-Jul-17	3.0	12.5	105	10.8	76	7.4
MEL-02-03	23-Jul-17	4.0	12.5	105	10.8	76	7.4
MEL-02-03	23-Jul-17	5.0	12.5	105	10.8	76	7.4
MEL-02-03	23-Jul-17	6.0	12.5	105	10.8	76	7.4
MEL-02-03	23-Jul-17	7.0	12.4	105	10.8	76	7.4
MEL-02-03	23-Jul-17	8.0	12.4	105	10.8	76	7.5
MEL-02-03	23-Jul-17	9.0	12.3	105	10.9	76	7.5
MEL-02-04							
MEL-02-04	23-Jul-17	0.0	12.5	104	10.7	76	7.5
MEL-02-04	23-Jul-17	0.1	12.5	104	10.7	76	7.5
MEL-02-04	23-Jul-17	0.5	12.5	104	10.8	76	7.5
MEL-02-04	23-Jul-17	1.0	12.5	104	10.8	76	7.5
MEL-02-04	23-Jul-17	2.0	12.5	105	10.8	76	7.5
MEL-02-04	23-Jul-17	3.0	12.5	105	10.8	76	7.5
MEL-02-04	23-Jul-17	4.0	12.5	105	10.8	76	7.5
MEL-02-04	23-Jul-17	5.0	12.5	105	10.9	76	7.5
MEL-02-04	23-Jul-17	6.0	12.5	105	10.9	76	7.5
MEL-02-04	23-Jul-17	7.0	12.5	105	10.9	76	7.5
MEL-02-05							
MEL-02-05	23-Jul-17	0.0	12.5	104	10.7	76	7.5
MEL-02-05	23-Jul-17	0.1	12.5	104	10.8	76	7.5
MEL-02-05	23-Jul-17	0.5	12.5	105	10.8	76	7.5
MEL-02-05	23-Jul-17	1.0	12.5	105	10.8	76	7.5
MEL-02-05	23-Jul-17	2.0	12.5	105	10.8	76	7.4
MEL-02-05	23-Jul-17	3.0	12.5	105	10.8	76	7.4
MEL-02-05	23-Jul-17	4.0	12.5	105	10.8	77	7.4
MEL-02-05	23-Jul-17	5.0	12.5	105	10.9	76	7.4
MEL-02-05	23-Jul-17	6.0	12.5	105	10.8	76	7.4
MEL-02-05	23-Jul-17	7.0	12.5	105	10.8	76	7.5
MEL-02-05	23-Jul-17	8.0	12.5	105	10.8	76	7.5
MEL-02-05	23-Jul-17	9.0	12.5	105	10.8	76	7.4

Table 3B.2-4: Field Profiles at Meliadine Mid-Field, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-02-01							
MEL-02-01	11-Aug-17	0.1	13.0	102	10.7	75	7.5
MEL-02-01	11-Aug-17	0.5	13.0	102	10.7	75	7.5
MEL-02-01	11-Aug-17	1.0	13.0	102	10.7	75	7.5
MEL-02-01	11-Aug-17	2.0	13.0	102	10.7	75	7.5
MEL-02-01	11-Aug-17	3.0	13.0	102	10.7	75	7.5
MEL-02-01	11-Aug-17	4.0	13.0	102	10.7	75	7.6
MEL-02-01	11-Aug-17	5.0	13.0	102	10.7	75	7.6
MEL-02-01	11-Aug-17	6.0	13.0	102	10.7	75	7.6
MEL-02-01	11-Aug-17	7.0	12.9	102	10.7	76	7.6
MEL-02-02							
MEL-02-02	11-Aug-17	0.1	13.3	102	10.6	75	7.5
MEL-02-02	11-Aug-17	0.5	13.3	102	10.6	76	7.6
MEL-02-02	11-Aug-17	1.0	13.3	102	10.6	76	7.6
MEL-02-02	11-Aug-17	2.0	13.1	102	10.7	76	7.6
MEL-02-02	11-Aug-17	3.0	13.1	102	10.7	76	7.6
MEL-02-02	11-Aug-17	4.0	13.0	102	10.7	75	7.6
MEL-02-02	11-Aug-17	5.0	13.0	102	10.7	76	7.6
MEL-02-02	11-Aug-17	6.0	13.0	102	10.7	76	7.6
MEL-02-02	11-Aug-17	7.0	13.0	101	10.7	76	7.6
MEL-02-02	11-Aug-17	8.0	13.0	101	10.7	76	7.6
MEL-02-02	11-Aug-17	9.0	13.0	101	10.7	76	7.6
MEL-02-03							
MEL-02-03	11-Aug-17	0.1	13.5	102	10.6	76	7.6
MEL-02-03	11-Aug-17	0.5	13.4	102	10.6	76	7.6
MEL-02-03	11-Aug-17	1.0	13.4	102	10.7	76	7.6
MEL-02-03	11-Aug-17	2.0	13.1	102	10.7	76	7.6
MEL-02-03	11-Aug-17	3.0	13.1	102	10.7	76	7.6
MEL-02-03	11-Aug-17	4.0	13.0	102	10.7	76	7.6
MEL-02-03	11-Aug-17	5.0	13.0	102	10.7	76	7.6
MEL-02-03	11-Aug-17	6.0	13.0	102	10.7	76	7.6
MEL-02-03	11-Aug-17	7.0	13.0	102	10.7	76	7.6
MEL-02-03	11-Aug-17	8.0	13.0	102	10.7	76	7.6
MEL-02-04							
MEL-02-04	11-Aug-17	0.1	13.6	103	10.6	76	7.7
MEL-02-04	11-Aug-17	0.5	13.6	103	10.6	76	7.7
MEL-02-04	11-Aug-17	1.0	13.5	103	10.6	76	7.6
MEL-02-04	11-Aug-17	2.0	13.3	102	10.7	75	7.6
MEL-02-04	11-Aug-17	3.0	13.1	102	10.7	75	7.6
MEL-02-04	11-Aug-17	4.0	13.0	102	10.7	75	7.6
MEL-02-04	11-Aug-17	5.0	13.0	102	10.7	75	7.7
MEL-02-04	11-Aug-17	6.0	13.0	102	10.7	75	7.7
MEL-02-04	11-Aug-17	7.0	13.0	102	10.7	75	7.7
MEL-02-04	11-Aug-17	8.0	13.0	102	10.7	75	7.7
MEL-02-05							
MEL-02-05	11-Aug-17	0.1	13.6	103	10.6	76	7.7
MEL-02-05	11-Aug-17	0.5	13.6	103	10.6	76	7.7
MEL-02-05	11-Aug-17	1.0	13.5	103	10.6	76	7.6
MEL-02-05	11-Aug-17	2.0	13.3	102	10.7	75	7.6
MEL-02-05	11-Aug-17	3.0	13.1	102	10.7	75	7.6
MEL-02-05	11-Aug-17	4.0	13.0	102	10.7	75	7.6
MEL-02-05	11-Aug-17	5.0	13.0	102	10.7	75	7.7
MEL-02-05	11-Aug-17	6.0	13.0	102	10.7	75	7.7
MEL-02-05	11-Aug-17	7.0	13.0	102	10.7	75	7.7
MEL-02-05	11-Aug-17	8.0	13.0	102	10.7	75	7.7

Table 3B.2-5: Field Profiles at Meliadine Mid-Field, September 2017

Station	Date	Depth	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-02-01							
MEL-02-01	05-Sep-17	0.1	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	0.5	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	1.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	2.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	3.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	4.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	5.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	6.0	9.6	102	11.5	73	7.6
MEL-02-01	05-Sep-17	7.0	9.6	102	11.5	73	7.5
MEL-02-01	05-Sep-17	8.0	9.6	102	11.5	73	7.6
MEL-02-02							
MEL-02-02	05-Sep-17	0.1	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	0.5	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	1.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	2.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	3.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	4.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	5.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	6.0	9.6	103	11.5	73	7.6
MEL-02-02	05-Sep-17	7.0	9.6	103	11.5	73	7.5
MEL-02-02	05-Sep-17	8.0	9.6	103	11.5	73	7.6
MEL-02-03							
MEL-02-03	05-Sep-17	0.1	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	0.5	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	1.0	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	2.0	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	3.0	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	4.0	9.5	103	11.6	75	7.6
MEL-02-03	05-Sep-17	5.0	9.5	103	11.6	75	7.6
MEL-02-04							
MEL-02-04	05-Sep-17	0.1	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	0.5	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	1.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	2.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	3.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	4.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	5.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	6.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	7.0	9.6	103	11.5	74	7.6
MEL-02-04	05-Sep-17	8.0	9.6	103	11.5	74	7.6
MEL-02-05							
MEL-02-05	05-Sep-17	0.1	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	0.5	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	1.0	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	2.0	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	3.0	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	4.0	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	5.0	9.5	103	11.6	75	7.6
MEL-02-05	05-Sep-17	5.5	9.5	103	11.6	75	7.6

Table 3B.3-1: Field Profiles at Meliadine Mid-Field Reference Area 1, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (uS/cm)	pH
MEL-03-01							
MEL-03-01	21-Jul-17	0.0	11.3	102	10.8	68	7.7
MEL-03-01	21-Jul-17	0.5	11.3	102	10.9	68	7.7
MEL-03-01	21-Jul-17	0.1	11.3	103	10.9	68	7.6
MEL-03-01	21-Jul-17	1.0	11.3	103	10.9	68	7.6
MEL-03-01	21-Jul-17	2.0	11.3	103	11.0	68	7.6
MEL-03-01	21-Jul-17	3.0	11.3	104	11.0	68	7.6
MEL-03-01	21-Jul-17	4.0	11.3	104	11.0	68	7.6
MEL-03-01	21-Jul-17	5.0	11.3	104	11.0	68	7.6
MEL-03-01	21-Jul-17	6.0	11.3	104	11.0	68	7.6
MEL-03-02							
MEL-03-02	21-Jul-17	0.0	11.3	103	10.9	68	7.6
MEL-03-02	21-Jul-17	0.1	11.3	103	10.9	68	7.6
MEL-03-02	21-Jul-17	0.5	11.3	103	10.9	68	7.6
MEL-03-02	21-Jul-17	1.0	11.3	103	11.0	68	7.5
MEL-03-02	21-Jul-17	2.0	11.3	103	11.0	68	7.5
MEL-03-02	21-Jul-17	3.0	11.3	104	11.0	68	7.5
MEL-03-02	21-Jul-17	4.0	11.3	104	11.0	68	7.5
MEL-03-02	21-Jul-17	5.0	11.3	104	11.0	68	7.5
MEL-03-02	21-Jul-17	6.0	11.3	104	11.0	68	7.5
MEL-03-02	21-Jul-17	7.0	11.3	104	11.0	68	7.5
MEL-03-03							
MEL-03-03	21-Jul-17	0.0	11.3	103	11.0	68	7.6
MEL-03-03	21-Jul-17	0.1	11.3	103	10.9	68	7.6
MEL-03-03	21-Jul-17	0.5	11.3	103	10.9	68	7.5
MEL-03-03	21-Jul-17	1.0	11.3	103	10.9	68	7.5
MEL-03-03	21-Jul-17	2.0	11.3	103	11.0	68	7.5
MEL-03-03	21-Jul-17	3.0	11.3	103	11.0	68	7.5
MEL-03-03	21-Jul-17	4.0	11.3	104	11.0	68	7.5
MEL-03-03	21-Jul-17	5.0	11.3	104	11.0	68	7.5
MEL-03-03	21-Jul-17	6.0	11.3	104	11.0	68	7.5
MEL-03-03	21-Jul-17	7.0	11.3	104	11.0	68	7.5
MEL-03-03	21-Jul-17	8.0	11.3	104	11.0	68	7.5
MEL-03-03	21-Jul-17	9.0	11.3	103	11.0	68	7.5
MEL-03-04							
MEL-03-04	21-Jul-17	0.0	11.3	104	11.0	68	7.6
MEL-03-04	21-Jul-17	0.1	11.3	104	11.0	68	7.5
MEL-03-04	21-Jul-17	0.5	11.3	104	11.0	68	7.5
MEL-03-04	21-Jul-17	1.0	11.3	104	11.0	68	7.5
MEL-03-04	21-Jul-17	2.0	11.3	104	11.0	68	7.5
MEL-03-04	21-Jul-17	3.0	11.3	104	11.0	68	7.5
MEL-03-04	21-Jul-17	4.0	11.3	104	11.1	68	7.5
MEL-03-04	21-Jul-17	5.0	11.3	104	11.1	68	7.5
MEL-03-04	21-Jul-17	6.0	11.3	104	11.1	68	7.5
MEL-03-04	21-Jul-17	7.0	11.3	104	11.1	68	7.5
MEL-03-05							
MEL-03-05	21-Jul-17	0.0	11.4	104	11.0	68	7.6
MEL-03-05	21-Jul-17	0.1	11.4	104	11.0	68	7.6
MEL-03-05	21-Jul-17	0.5	11.3	104	11.0	68	7.6
MEL-03-05	21-Jul-17	1.0	11.3	104	11.0	68	7.6
MEL-03-05	21-Jul-17	2.0	11.3	104	11.1	68	7.5
MEL-03-05	21-Jul-17	3.0	11.3	105	11.1	68	7.5
MEL-03-05	21-Jul-17	4.0	11.3	105	11.1	68	7.5
MEL-03-05	21-Jul-17	5.0	11.3	105	11.1	68	7.5
MEL-03-05	21-Jul-17	6.0	11.3	105	11.1	68	7.5
MEL-03-05	21-Jul-17	7.0	11.3	105	11.1	68	7.5

Table 3B.3-2: Field Profiles at Meliadine Reference Area 1, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-03-01							
MEL-03-01	13-Aug-17	0.1	13.2	104	10.8	69	7.5
MEL-03-01	13-Aug-17	0.5	13.2	104	10.8	69	7.5
MEL-03-01	13-Aug-17	1.0	13.2	104	10.8	69	7.5
MEL-03-01	13-Aug-17	2.0	13.2	104	10.8	69	7.6
MEL-03-01	13-Aug-17	3.0	13.2	104	10.8	69	7.6
MEL-03-01	13-Aug-17	4.0	13.2	104	10.8	69	7.6
MEL-03-01	13-Aug-17	5.0	13.2	104	10.8	69	7.3
MEL-03-01	13-Aug-17	6.0	13.2	104	10.8	69	7.6
MEL-03-02							
MEL-03-02	13-Aug-17	0.1	13.3	104	10.8	69	7.7
MEL-03-02	13-Aug-17	0.5	13.3	104	10.8	69	7.7
MEL-03-02	13-Aug-17	1.0	13.3	104	10.8	69	7.7
MEL-03-02	13-Aug-17	2.0	13.3	104	-	69	7.7
MEL-03-02	13-Aug-17	3.0	13.3	104	10.8	69	7.7
MEL-03-02	13-Aug-17	4.0	13.3	104	10.8	69	7.6
MEL-03-02	13-Aug-17	5.0	13.3	104	10.8	69	7.7
MEL-03-02	13-Aug-17	6.0	13.2	104	10.8	69	7.7
MEL-03-02	13-Aug-17	7.0	13.2	104	10.8	69	7.6
MEL-03-02	13-Aug-17	8.0	13.2	104	10.8	69	7.7
MEL-03-03							
MEL-03-03	13-Aug-17	0.1	13.3	104	10.8	69	7.7
MEL-03-03	13-Aug-17	0.5	13.3	104	10.8	69	7.7
MEL-03-03	13-Aug-17	1.0	13.3	104	10.8	69	7.7
MEL-03-03	13-Aug-17	2.0	13.3	104	10.8	69	7.6
MEL-03-03	13-Aug-17	3.0	13.3	104	10.8	69	7.6
MEL-03-03	13-Aug-17	4.0	13.3	104	10.8	69	7.6
MEL-03-03	13-Aug-17	5.0	13.3	104	10.8	69	7.6
MEL-03-03	13-Aug-17	6.0	13.3	104	10.8	68	7.6
MEL-03-03	13-Aug-17	7.0	13.3	104	10.8	69	7.7
MEL-03-03	13-Aug-17	8.0	13.3	104	10.8	69	7.7
MEL-03-04							
MEL-03-04	13-Aug-17	0.1	13.5	104	10.8	69	7.7
MEL-03-04	13-Aug-17	0.5	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	1.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	2.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	3.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	4.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	5.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	6.0	13.4	104	10.8	69	7.7
MEL-03-04	13-Aug-17	7.0	13.4	104	10.8	69	7.7
MEL-03-05							
MEL-03-05	13-Aug-17	0.1	13.5	105	10.8	69	7.7
MEL-03-05	13-Aug-17	0.5	13.5	105	10.8	69	7.7
MEL-03-05	13-Aug-17	1.0	13.5	105	10.9	69	7.7
MEL-03-05	13-Aug-17	2.0	13.5	105	10.9	69	7.7
MEL-03-05	13-Aug-17	3.0	13.5	105	10.9	68	7.7
MEL-03-05	13-Aug-17	4.0	13.5	105	10.9	69	7.7
MEL-03-05	13-Aug-17	5.0	13.5	105	10.9	69	7.7
MEL-03-05	13-Aug-17	6.0	13.5	105	10.9	69	7.7
MEL-03-05	13-Aug-17	7.0	13.5	105	10.9	69	7.7

Table 3B.3-3: Field Profiles at Meliadine Reference Area 1, September 2017

Station	Date	Depth	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-03-01							
MEL-03-01	01-Sep-17	0.1	13.2	104	10.8	69	7.5
MEL-03-01	01-Sep-17	0.5	13.2	104	10.8	69	7.5
MEL-03-01	01-Sep-17	1.0	13.2	104	10.8	69	7.5
MEL-03-01	01-Sep-17	2.0	13.2	104	10.8	69	7.6
MEL-03-01	01-Sep-17	3.0	13.2	104	10.8	69	7.6
MEL-03-01	01-Sep-17	4.0	13.2	104	10.8	69	7.6
MEL-03-01	01-Sep-17	5.0	13.2	104	10.8	69	7.5
MEL-03-01	01-Sep-17	6.0	13.2	104	10.8	69	7.6
MEL-03-02	01-Sep-17	6.5	13.2	104	10.8	69	7.6
MEL-03-02							
MEL-03-02	01-Sep-17	0.1	13.2	104	10.8	69	7.5
MEL-03-02	01-Sep-17	0.5	13.2	104	10.8	69	7.6
MEL-03-02	01-Sep-17	1.0	13.2	104	10.8	69	7.6
MEL-03-02	01-Sep-17	2.0	13.2	104	10.8	69	7.6
MEL-03-02	01-Sep-17	3.0	13.2	104	10.8	69	7.7
MEL-03-02	01-Sep-17	4.0	13.2	104	10.8	69	7.7
MEL-03-02	01-Sep-17	5.0	13.2	104	10.8	69	7.6
MEL-03-02	01-Sep-17	6.0	13.2	104	10.8	69	7.7
MEL-03-02	01-Sep-17	7.0	13.2	104	10.8	69	7.6
MEL-03-03							
MEL-03-03	01-Sep-17	0.1	13.2	104	10.8	69	7.0
MEL-03-03	01-Sep-17	0.5	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	1.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	2.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	3.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	4.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	5.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	6.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	7.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	8.0	13.3	104	10.8	69	7.0
MEL-03-03	01-Sep-17	9.0	13.3	104	10.8	69	7.0
MEL-03-04							
MEL-03-04	01-Sep-17	0.1	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	0.5	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	1.0	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	2.0	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	3.0	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	4.0	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	5.0	13.4	109	10.8	69	7.7
MEL-03-04	01-Sep-17	6.0	13.4	109	10.9	69	7.7
MEL-03-04	01-Sep-17	6.5	13.4	110	10.9	69	7.7
MEL-03-05							
MEL-03-05	01-Sep-17	0.1	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	0.5	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	1.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	2.0	13.5	110	10.9	69	7.8
MEL-03-05	01-Sep-17	3.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	4.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	5.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	6.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	7.0	13.5	110	10.9	69	7.7
MEL-03-05	01-Sep-17	7.5	13.5	110	10.9	69	7.7

Table 3B.4-1: Field Profiles at Meliadine Reference Area 2, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-04-01							
MEL-04-01	15-Aug-17	0.1	13.6	104	10.7	68	7.8
MEL-04-01	15-Aug-17	0.5	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	1.0	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	2.0	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	3.0	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	4.0	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	5.0	13.6	104	10.7	69	7.7
MEL-04-01	15-Aug-17	6.0	13.6	104	10.7	68	7.7
MEL-04-01	15-Aug-17	7.0	13.6	104	10.7	69	7.7
MEL-04-02							
MEL-04-02	15-Aug-17	0.1	13.7	104	10.7	68	7.7
MEL-04-02	15-Aug-17	0.5	13.7	104	10.7	68	7.7
MEL-04-02	15-Aug-17	1.0	13.6	104	10.7	68	7.7
MEL-04-02	15-Aug-17	2.0	13.6	104	10.7	68	7.7
MEL-04-02	15-Aug-17	3.0	13.6	104	10.7	68	7.7
MEL-04-02	15-Aug-17	4.0	13.6	104	10.7	68	7.7
MEL-04-02	15-Aug-17	5.0	13.6	104	10.7	68	7.7
MEL-04-02	15-Aug-17	6.0	13.5	104	10.7	68	7.7
MEL-04-02	15-Aug-17	7.0	13.5	104	10.7	68	7.7
MEL-04-02	15-Aug-17	8.0	13.5	104	10.7	68	-
MEL-04-02	15-Aug-17	9.0	13.5	104	10.6	68	7.6
MEL-04-03							
MEL-04-03	15-Aug-17	0.1	13.7	104	10.7	68	7.8
MEL-04-03	15-Aug-17	0.5	13.7	104	10.7	68	7.7
MEL-04-03	15-Aug-17	1.0	13.7	104	10.7	68	7.7
MEL-04-03	15-Aug-17	2.0	13.6	104	10.7	68	7.7
MEL-04-03	15-Aug-17	3.0	13.6	104	10.7	68	7.7
MEL-04-03	15-Aug-17	4.0	13.6	104	10.7	68	7.7
MEL-04-03	15-Aug-17	5.0	13.6	104	10.7	68	7.7
MEL-04-03	15-Aug-17	6.0	13.6	104	10.7	68	7.7
MEL-04-03	15-Aug-17	7.0	13.5	104	10.7	68	7.7
MEL-04-03	15-Aug-17	8.0	13.5	104	10.7	68	7.7
MEL-04-03	15-Aug-17	9.0	13.5	104	10.7	68	7.7
MEL-04-04							
MEL-04-04	15-Aug-17	0.1	13.6	104	10.7	68	7.7
MEL-04-04	15-Aug-17	0.5	13.6	104	10.7	68	7.7
MEL-04-04	15-Aug-17	1.0	13.6	104	10.7	68	7.7
MEL-04-04	15-Aug-17	2.0	13.6	104	10.7	68	7.7
MEL-04-04	15-Aug-17	3.0	13.6	104	10.7	68	7.6
MEL-04-04	15-Aug-17	4.0	13.6	105	10.7	68	7.6
MEL-04-04	15-Aug-17	5.0	13.6	105	10.7	68	7.6
MEL-04-04	15-Aug-17	6.0	13.6	105	10.7	68	7.6
MEL-04-04	15-Aug-17	7.0	13.6	105	10.7	68	7.7
MEL-04-04	15-Aug-17	8.0	13.6	106	10.7	68	7.7
MEL-04-05							
MEL-04-05	15-Aug-17	0.1	13.7	104	10.7	68	7.7
MEL-04-05	15-Aug-17	0.5	13.6	104	10.7	68	7.7
MEL-04-05	15-Aug-17	1.0	13.6	104	10.7	68	7.7
MEL-04-05	15-Aug-17	2.0	13.6	104	10.7	68	7.7
MEL-04-05	15-Aug-17	3.0	13.6	104	10.7	68	7.7
MEL-04-05	15-Aug-17	4.0	13.5	104	10.7	68	7.6
MEL-04-05	15-Aug-17	5.0	13.5	104	10.7	68	7.6
MEL-04-05	15-Aug-17	6.0	13.5	104	10.7	68	7.6
MEL-04-05	15-Aug-17	7.0	13.5	104	10.7	68	7.6
MEL-04-05	15-Aug-17	8.0	13.5	104	10.7	68	7.7

Table 3B.5-1: Field Profiles at Meliadine Reference Area 3, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
MEL-05-01							
MEL-05-01	12-Aug-17	0.1	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	0.5	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	1.0	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	2.0	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	3.0	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	4.0	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	5.0	13.1	103	10.8	73	7.6
MEL-05-01	12-Aug-17	6.0	13.0	103	10.8	73	7.7
MEL-05-01	12-Aug-17	7.0	13.0	103	10.8	73	7.7
MEL-05-01	12-Aug-17	8.0	13.0	103	10.8	73	7.7
MEL-05-01	12-Aug-17	9.0	12.9	103	10.8	73	7.7
MEL-05-02							
MEL-05-02	12-Aug-17	0.1	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	0.5	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	1.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	2.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	3.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	4.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	5.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	6.0	13.1	103	10.8	73	7.7
MEL-05-02	12-Aug-17	7.0	13.1	103	10.8	72	7.7
MEL-05-02	12-Aug-17	8.0	13.0	103	10.8	72	7.7
MEL-05-03							
MEL-05-03	12-Aug-17	0.1	13.2	103	10.8	73	7.7
MEL-05-03	12-Aug-17	0.5	13.2	103	10.8	72	7.7
MEL-05-03	12-Aug-17	1.0	13.2	103	10.8	72	7.7
MEL-05-03	12-Aug-17	2.0	13.2	103	10.8	72	7.7
MEL-05-03	12-Aug-17	3.0	13.2	103	10.8	72	7.7
MEL-05-03	12-Aug-17	4.0	13.2	103	10.8	73	7.7
MEL-05-03	12-Aug-17	5.0	13.2	103	10.8	73	7.7
MEL-05-03	12-Aug-17	6.0	13.1	103	10.8	73	7.7
MEL-05-03	12-Aug-17	7.0	13.1	103	10.8	72	7.7
MEL-05-04							
MEL-05-04	12-Aug-17	0.1	13.2	103	10.8	72	7.7
MEL-05-04	12-Aug-17	0.5	13.2	103	10.8	72	7.7
MEL-05-04	12-Aug-17	1.0	13.2	104	10.8	72	7.7
MEL-05-04	12-Aug-17	2.0	13.2	103	10.8	72	7.7
MEL-05-04	12-Aug-17	3.0	13.2	103	10.8	72	7.7
MEL-05-04	12-Aug-17	4.0	13.1	103	10.8	72	7.7
MEL-05-04	12-Aug-17	5.0	13.1	103	10.8	72	7.7
MEL-05-04	12-Aug-17	6.0	13.1	103	10.8	72	7.7
MEL-05-04	12-Aug-17	7.0	13.1	103	10.8	72	7.7
MEL-05-04	12-Aug-17	8.0	13.0	103	10.8	72	7.7
MEL-05-04	12-Aug-17	9.0	13.0	103	10.8	72	7.7
MEL-05-05							
MEL-05-05	12-Aug-17	0.1	13.2	103	10.8	74	7.7
MEL-05-05	12-Aug-17	0.5	13.2	103	10.8	73	7.7
MEL-05-05	12-Aug-17	1.0	13.2	103	10.8	72	7.7
MEL-05-05	12-Aug-17	2.0	13.2	103	10.8	73	7.7
MEL-05-05	12-Aug-17	3.0	13.2	103	10.8	72	7.7
MEL-05-05	12-Aug-17	4.0	13.2	103	10.8	73	7.7
MEL-05-05	12-Aug-17	5.0	13.2	103	10.8	73	7.7
MEL-05-05	12-Aug-17	6.0	13.2	103	10.8	73	7.7
MEL-05-05	12-Aug-17	7.0	13.2	103	10.8	72	7.7

Table 3B.6-1: Field Profiles at Meliadine Lake A8, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
A8-01							
A8-01	17-Jul-17	0.0	14.3	100	9.9	306	7.9
A8-01	17-Jul-17	0.1	14.3	101	9.9	306	7.9
A8-01	17-Jul-17	0.5	14.3	101	10.0	306	7.9
A8-01	17-Jul-17	1.0	14.3	101	10.0	306	7.9
A8-01	17-Jul-17	1.5	14.3	101	10.0	306	7.9
A8-01	17-Jul-17	2.0	14.3	101	10.0	306	7.9
A8-02							
A8-02	17-Jul-17	0.0	14.3	102	10.1	306	7.9
A8-02	17-Jul-17	0.1	14.3	101	10.0	306	7.9
A8-02	17-Jul-17	0.5	14.3	101	10.0	306	7.9
A8-02	17-Jul-17	1.0	14.3	101	10.0	306	7.9
A8-03							
A8-03	17-Jul-17	0.0	14.3	102	10.1	255	7.9
A8-03	17-Jul-17	0.1	14.3	102	10.1	255	7.9
A8-03	17-Jul-17	0.5	14.3	102	10.1	255	7.9
A8-03	17-Jul-17	1.0	14.3	102	10.1	255	7.9
A8-03	17-Jul-17	1.5	14.3	102	10.1	255	7.9
A8-03	17-Jul-17	2.0	14.3	102	10.1	255	7.9

Table 3B.6-2: Field Profiles at Meliadine Lake A8, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
A8-01							
A8-01	14-Aug-17	0.1	14.1	105	10.7	301	8.3
A8-01	14-Aug-17	0.5	14.1	105	10.7	306	8.3
A8-01	14-Aug-17	1.0	14.1	105	10.7	306	8.3
A8-01	14-Aug-17	1.5	14.1	105	10.7	306	8.3
A8-01	14-Aug-17	2.0	14.1	105	10.7	306	8.3
A8-02							
A8-02	14-Aug-17	0.1	14.1	109	10.6	306	8.3
A8-02	14-Aug-17	0.5	14.1	105	10.6	306	8.3
A8-02	14-Aug-17	1.0	14.1	105	10.6	306	8.3
A8-02	14-Aug-17	1.5	14.1	105	10.7	306	8.3
A8-02	14-Aug-17	2.0	14.1	105	10.7	306	8.3
A8-03							
A8-03	14-Aug-17	0.1	14.3	107	10.8	268	8.4
A8-03	14-Aug-17	0.5	14.3	107	10.8	268	8.4
A8-03	14-Aug-17	1.0	14.3	107	10.8	268	8.4

Table 3B.7-1: Field Profiles at Meliadine Lake B7, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
B7-01							
B7-01	20-Jul-17	0.0	9.4	105	11.6	157	7.9
B7-01	20-Jul-17	0.1	9.4	105	11.6	157	7.9
B7-01	20-Jul-17	0.5	9.4	105	11.6	158	7.9
B7-01	20-Jul-17	1.0	9.4	105	11.6	158	7.9
B7-02							
B7-02	20-Jul-17	0.0	9.7	104	11.4	157	7.9
B7-02	20-Jul-17	0.1	9.7	103	11.3	157	7.9
B7-02	20-Jul-17	0.5	9.7	103	11.3	157	7.9
B7-02	20-Jul-17	1.0	9.7	103	11.3	157	7.9
B7-02	20-Jul-17	1.5	9.7	103	11.3	157	7.9
B7-03							
B7-03	20-Jul-17	0.0	10.3	102	11.2	158	7.9
B7-03	20-Jul-17	0.1	10.3	102	11.0	158	7.9
B7-03	20-Jul-17	0.5	10.3	102	11.0	158	7.9
B7-03	20-Jul-17	1.0	10.3	102	11.0	158	7.9
B7-03	20-Jul-17	1.5	10.3	102	11.1	158	7.9
B7-03	20-Jul-17	2.0	10.3	102	11.1	158	7.9

Table 3B.7-2: Field Profiles at Meliadine Lake B7, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
B7-01							
B7-01	08-Aug-17	0.0	11.9	106	11.3	160	8.2
B7-01	08-Aug-17	0.1	11.9	106	11.4	160	8.2
B7-01	08-Aug-17	0.5	11.9	106	11.4	160	8.2
B7-01	08-Aug-17	1.0	11.9	106	11.4	160	8.2
B7-02							
B7-02	08-Aug-17	0.0	12.3	102	11.0	159	8.2
B7-02	08-Aug-17	0.1	12.3	104	11.1	160	8.2
B7-02	08-Aug-17	0.5	12.3	105	11.1	160	8.2
B7-02	08-Aug-17	1.0	12.3	105	11.1	159	8.2
B7-02	08-Aug-17	1.5	12.3	105	11.2	160	8.2
B7-03							
B7-03	08-Aug-17	0.0	12.2	102	10.9	160	8.1
B7-03	08-Aug-17	0.1	12.2	103	10.9	160	8.1
B7-03	08-Aug-17	0.5	12.2	103	10.9	160	8.1
B7-03	08-Aug-17	1.0	12.2	103	10.9	160	8.1
B7-03	08-Aug-17	1.5	12.2	103	10.9	160	8.1

Table 3B.8-1: Field Profiles at Meliadine Lake D7, July 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
D7-01							
D7-01	22-Jul-17	0.0	12.1	106	11.1	152	8.2
D7-01	22-Jul-17	0.1	12.1	107	11.1	151	8.2
D7-01	22-Jul-17	0.5	12.1	107	11.2	152	8.2
D7-01	22-Jul-17	1.0	12.1	108	11.2	152	8.2
D7-01	22-Jul-17	1.5	12.1	108	11.2	152	8.2
D7-02							
D7-02	22-Jul-17	0.0	12.4	105	10.9	151	8.1
D7-02	22-Jul-17	0.1	12.3	107	11.1	151	8.2
D7-02	22-Jul-17	0.5	12.3	108	11.2	151	8.2
D7-02	22-Jul-17	1.0	12.3	108	11.2	151	8.2
D7-02	22-Jul-17	1.5	12.3	109	11.2	151	8.1
D7-03							
D7-03	22-Jul-17	0.0	12.4	107	11.1	152	8.1
D7-03	22-Jul-17	0.1	12.4	108	11.1	152	8.1
D7-03	22-Jul-17	0.5	12.4	108	11.2	152	8.1
D7-03	22-Jul-17	1.0	12.4	108	11.2	151	8.2
D7-03	22-Jul-17	1.5	12.4	108	11.2	151	8.2

Table 3B.8-2: Field Profiles at Meliadine Lake D7, August 2017

Station	Date	Depth (m)	Temperature (˚C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/L)	Specific Conductivity (µS/cm)	pH
D7-01							
D7-01	10-Aug-17	0.1	12.8	102	10.8	154	8.3
D7-01	10-Aug-17	0.5	12.8	103	10.9	154	8.3
D7-01	10-Aug-17	1.0	12.8	103	10.9	154	8.3
D7-01	10-Aug-17	1.5	12.8	103	10.9	154	8.3
D7-02							
D7-02	10-Aug-17	0.1	12.7	103	10.9	154	8.3
D7-02	10-Aug-17	0.5	12.8	103	10.9	154	8.3
D7-02	10-Aug-17	1.0	12.8	103	10.9	154	8.3
D7-02	10-Aug-17	1.5	12.8	104	10.9	154	8.3
D7-03							
D7-03	10-Aug-17	0.1	13.0	105	11.0	154	8.4
D7-03	10-Aug-17	0.5	13.0	105	11.0	154	8.4
D7-03	10-Aug-17	1.0	13.0	105	11.0	154	8.4
D7-03	10-Aug-17	1.5	13.0	105	11.1	154	8.4

Table 3C.1: Field and Laboratory Water Quality Data from MEL-01 (near-field) in 2017

Station		Guidelines for the protection of:					MEL-01-01					MEL-01-02					MEL-01-03					MEL-01-04					MEL-01-05				
Sample Date		Aquatic Life		Drinking Water	Aesthetic	SSWQO	19/01/2017	18/02/2017	16/07/2017	09/08/2017	04/09/2017	19/01/2017	18/02/2017	16/07/2017	09/08/2017	04/09/2017	19/01/2017	18/02/2017	16/07/2017	09/08/2017	04/09/2017	19/01/2017	18/02/2017	16/07/2017	09/08/2017	04/09/2017	19/01/2017	18/02/2017	16/07/2017	09/08/2017	04/09/2017
Sample Depth		Acute	Chronic				4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameters	**Unit**																													
Field Measured																														
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.3	8.1	7.4	7.6	7.6	7.3	8.1	7.4	7.6	7.5	7.4	8.2	7.3	7.6	7.6	7.9	8.2	7.4	7.6	7.6	7.3	7.1	7.3	7.6	7.6
Specific conductivity	µS/cm	-	-	-	-	-	70	98	82	82	80	64	98	82	82	80	77	99	82	82	80	49	96	82	82	80	89	97	82	82	80
Temperature	°C	-	-	-	15	-	0.35	1.1	13	13	9.4	0.57	1.1	13	13	9.4	1.0	1.1	13	13	9.5	0.020	1.2	13	13	9.4	1.1	1.2	13	13	9.4
Dissolved oxygen	mg/L	-	6.5	-	-	-	-	-	11	11	11	-	-	11	11	11	-	-	11	11	11	-	-	11	11	11	-	-	10	11	11
Dissolved oxygen	%	-	-	-	-	-	-	-	104	101	102	-	-	104	100	102	-	-	103	101	103	-	-	104	101	101	-	-	103	102	102
Secchi depth	m	-	-	-	-	-	-	-	5.0	8.9	5.0	-	-	5.5	8.5	5.5	-	-	5.0	7.5	5.5	-	-	5.0	6.5	6.0	-	-	5.0	6.5	5.5
Air temperature	deg c	-	-	-	-	-	-	<20	-	15	15	-	<20	-	15	-	-	<20	-	15	-	-	<20	-	-	-	-	<20	-	15	-
Total depth	m	-	-	-	-	-	9.1	9.1	10	10	8.5	7.9	7.6	8.3	9.0	7.5	8.9	8.5	9.6	9.2	8.6	8.4	8.6	8.9	8.5	8.5	7.3	7.3	8.7	8.6	8.0
Ice thickness	m	-	-	-	-	-	0.90	1.1	-	-	-	0.90	1.4	-	-	-	0.86	1.1	-	-	-	0.86	1.2	-	-	-	0.90	1.2	-	-	-
Conventional Parameters																														
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	**6.9**[(5)]	7.0	7.2	7.3	7.2	**6.9**[(5)]	7.0	7.2	7.3	7.2	**6.9**[(5)]	7.0	7.2	7.4	7.3	**6.9**[(5)]	7.0	7.2	7.4	7.3	**6.9**[(5)]	7.0	7.2	7.4	7.3
Specific conductivity	µS/cm	-	-	-	-	-	94	98	78	82	80	94	96	78	82	82	93	97	79	83	84	93	95	78	82	81	95	97	79	82	81
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	30	29	23	24	24	28	29	24	25	25	27	32	24	24	25	29	29	24	24	24	28	28	24	24	24
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	20	16	20	17	17	18	17	17	17	18	18	17	17	17	18	21	16	17	17	17	18	13	17	17	17
Total dissolved solids	mg/L	-	-	-	500	-	67	61	54	50	53	41	64	53	53	55	47	65	55	51	61	56	60	51	49	57	59	53	51	49	59
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	48	46	42	41	42	47	47	41	41	43	46	48	41	41	43	48	46	41	41	42	47	44	41	41	42
Total suspended solids	mg/L	-	-	-	-	-	<1.0	<1.0	1.2	<1.0	2.6	<1.0	<1.0	1.2	<1.0	<1.0	<1.0	<1.0	1.0	<1.0	3.7	<1.0	<1.0	1.5	<1.0	1.7	<1.0	<1.0	<1.0	1.1	3.3
Turbidity	NTU	-	-	-	-	-	0.42	0.25	0.44	0.23	0.46	0.17	0.24	0.39	0.35	0.41	0.17	0.20	0.41	0.36	0.40	0.20	0.19	0.35	0.35	0.37	0.17	0.15	0.37	0.34	0.40
Major Ions																															
Bicarbonate	mg/L	-	-	-	-	-	25	20	25	21	21	22	21	21	21	22	22	21	20	21	22	25	20	20	21	21	22	16	20	21	21
Calcium	mg/L	-	-	-	-	-	9.4	9.0	7.2	7.4	7.5	8.8	8.9	7.7	7.6	7.8	8.4	10	7.6	7.3	7.7	8.9	9.1	7.5	7.3	7.3	8.9	8.9	7.7	7.4	7.5
Chloride	mg/L	640	120	-	250	-	12	13	11	11	11	13	13	10	11	11	12	13	10	11	11	12	12	10	11	11	13	13	11	11	11
Fluoride	mg/L	-	0.12	1.5	-	2.8	0.028	0.029	0.028	0.032	0.028	0.027	0.029	0.027	0.027	0.030	0.027	0.029	0.027	0.026	0.026	0.027	0.028	0.026	0.027	0.026	0.028	0.029	0.026	0.027	0.026
Magnesium	mg/L	-	-	-	-	-	1.5	1.5	1.2	1.4	1.4	1.6	1.6	1.3	1.4	1.3	1.5	1.6	1.3	1.3	1.3	1.5	1.5	1.2	1.4	1.3	1.6	1.5	1.2	1.3	1.3
Potassium	mg/L	-	-	-	-	-	1.1	1.1	0.87	0.96	1.1	1.1	1.1	0.93	0.98	1.1	1.1	1.1	0.92	0.95	1.0	1.1	1.1	0.92	0.96	0.99	1.1	1.1	0.90	0.96	0.99
Sodium	mg/L	-	-	-	200	-	5.9	5.9	4.7	5.1	5.6	5.9	6.1	5.1	5.2	5.4	5.8	6.3	5.0	5.0	5.4	6.0	5.9	5.0	5.1	5.4	5.9	5.8	5.0	5.2	5.4
Sulphate	mg/L	-	-	-	500	-	5.2	5.4	4.9	4.9	4.7	5.3	5.4	4.8	4.6	4.8	5.2	5.5	4.8	4.6	4.7	5.2	5.3	4.7	4.7	4.7	5.4	5.5	4.7	4.7	4.6
Reactive silica, as SiO2	mg/L	-	-	-	-	-	0.54	0.62	0.60	0.55	0.52	0.52	0.60	0.60	0.55	0.50	0.52	0.60	0.55	0.55	0.50	0.49	0.60	0.58	0.57	0.50	0.51	0.59	0.54	0.58	0.51
Cyanide Species																															
Cyanide	mg/L	-	0.005	0.2	-	-	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001
Nutrients																															
Nitrate	mg-N/L	124	2.9	10	-	-	0.0058	0.012	<0.005	<0.005	0.0065	0.010	0.0091	<0.005	<0.005	0.015	0.0052	0.013	<0.005	<0.005	0.073	0.0093	0.015	<0.005	<0.005	0.061	<0.005	0.0071	<0.005	<0.005	0.073
Nitrite	mg-N/L	-	0.06	1	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0036	<0.001	<0.001	<0.001	<0.001	0.0014	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	-	0.026	0.029	<0.005	0.0074	0.011	0.026	0.029	<0.005	0.0060	0.0097	0.025	0.024	<0.005	<0.005	0.0071	0.026	0.030	<0.005	<0.005	<0.005	0.024	0.024	<0.005	<0.005	<0.005
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	0.24	0.11	0.17	0.24	0.39	0.25	0.14	0.17	0.19	0.37	0.20	0.16	0.16	0.22	0.24	0.24	0.16	0.18	0.22	0.20	0.28	0.19	0.18	0.20	0.21
Total phosphorus	mg-P/L	-	-	-	-	-	0.0037	~~0.027~~	0.0050	0.0054	0.0084	0.0054	~~0.023~~	0.0055	0.0051	0.013	0.0044	~~0.015~~	0.0057	0.0054	0.0081	0.0044	~~0.023~~	0.0056	0.0067	0.0061	0.0045	~~0.025~~	0.0052	0.0069	0.0062
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0017	~~0.0046~~	0.0016	0.0025	0.0056	0.0017	~~0.0091~~	0.0018	0.0021	0.0040	0.0020	~~0.0124~~	0.0019	0.0022	0.0035	0.0022	~~0.0213~~	0.0017	0.0021	0.0033	0.0021	~~0.0155~~	0.0023	0.0020	0.0028
Orthophosphate	mg-P/L	-	-	-	-	-	0.0017	0.0013	0.0012	<0.001	<0.001	0.0015	0.0012	0.0010	0.0011	<0.001	0.0016	0.0013	<0.001	<0.001	<0.001	<0.001	0.0019	<0.001	<0.001	<0.001	<0.001	0.0014	0.0011	<0.001	<0.001
Total organic carbon	mg/L	-	-	-	-	-	3.2	3.4	3.0	3.4	4.3	3.3	3.4	3.1	3.5	3.7	3.2	3.6	3.0	3.5	3.4	3.2	3.4	3.0	3.0	3.3	3.2	3.6	3.0	2.8	3.3
Dissolved organic carbon	mg/L	-	-	-	-	-	3.1	3.5	3.1	3.4	4.1	3.0	3.5	3.2	3.5	3.8	3.1	3.6	3.2	3.5	3.3	3.4	3.3	3.5	2.8	3.4	3.2	3.6	3.3	2.6	3.3
Total Metals																															
Aluminum	µg/L	-	5.0 - 100	-	200	-	0.65	1.1	3.7	3.3	22	5.2	1.0	3.1	3.7	7.2	0.93	1.0	3.0	3.9	13	1.3	1.0	3.5	4.1	7.0	2.2	1.5	2.7	2.8	7.0
Antimony	µg/L	-	-	6	-	-	<0.02	0.025	<0.02	<0.02	0.054	<0.02	0.025	<0.02	<0.02	<0.02	<0.02	0.024	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.064	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5	10	-	25	0.43	0.44	0.41	0.43	0.55	0.46	0.44	0.40	0.39	0.48	0.40	0.39	0.38	0.41	0.49	0.43	0.40	0.40	0.45	0.49	0.43	0.39	0.39	0.35	0.49
Barium	µg/L	-	-	1,000	-	-	8.8	9.5	8.5	7.3	7.9	9.0	8.8	8.6	7.4	7.8	8.6	9.2	8.5	7.7	7.9	9.2	8.7	8.7	7.8	8.0	9.1	9.0	8.3	7.3	7.8
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	-	6.7	4.6	<5.0	<5.0	<5.0	5.9	4.5	<5.0	<5.0	<5.0	6.9	4.6	<5.0	<5.0	<5.0	6.1	4.5	<5.0	5.4	<5.0	4.5	4.5	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	-	<0.005	<0.005	<0.005	<0.005	0.0082	<0.005	<0.005	<0.005	<0.005	0.0057	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	-	-	<0.01	<0.01	0.020	-	-	<0.01	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	-	-	<0.01	0.011	<0.01	-	-	<0.01	<0.01	<0.01
Chromium	µg/L	-	1.0	50	-	-	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	0.014	0.012	0.023	0.020	0.044	0.012	0.014	0.021	0.015	0.026	<0.01	0.012	0.022	0.015	0.029	0.012	<0.01	0.019	0.020	0.024	0.015	0.015	0.024	0.016	0.022
Copper	µg/L	-	2	-	1,000	-	0.89	0.88	0.95	1.0	1.4	0.92	0.89	0.96	0.87	1.2	0.89	0.91	0.84	0.99	0.91	0.91	0.92	0.88	0.89	1.0	1.0	0.93	1.2	0.80	0.91
Iron	µg/L	-	300	-	300	1,060	8.6	8.4	26	18	45	6.7	9.5	26	18	28	7.0	9.0	26	19	28	7.8	8.5	27	20	26	7.9	9.7	28	18	28
Lead	µg/L	-	1	10	-	-	<0.01	<0.01	<0.01	<0.01	0.90	0.018	<0.01	<0.01	0.016	0.17	<0.01	<0.01	<0.01	0.011	0.090	<0.01	0.014	<0.01	0.028	0.078	0.031	<0.01	0.011	<0.01	0.079
Lithium	µg/L	-	-	-	-	-	0.84	1.1	0.55	0.60	0.66	1.1	0.96	0.73	0.86	0.68	1.0	0.96	0.63	0.85	0.67	1.1	0.86	0.61	0.82	0.72	1.2	1.0	0.64	0.73	0.69
Manganese	µg/L	-	-	-	50	-	2.8	1.6	6.9	5.1	5.6	1.6	1.7	6.9	5.1	5.3	1.7	1.7	7.1	5.5	5.5	1.7	1.5	7.3	5.5	5.0	1.6	1.8	7.1	5.1	4.8
Mercury	µg/L	-	0.026	1	-	-	0.00050	0.00070	0.0010	0.00060	0.0015	0.00060	0.00050	0.0010	<0.0005	0.0015	0.00050	0.00060	0.0010	0.00060	0.0013	0.00050	0.00060	0.0011	0.00070	0.0019	0.00060	0.00060	0.0011	0.0012	0.00090
Molybdenum	µg/L	-	73	-	-	-	0.093	0.082	0.077	0.089	0.12	0.081	0.083	0.072	0.078	0.083	0.090	0.088	0.072	0.080	0.089	0.091	0.073	0.073	0.091	0.081	0.099	0.083	0.070	0.083	0.084
Nickel	µg/L	-	25	-	-	-	0.71	0.70	0.70	0.64	0.83	0.71	0.68	0.70	0.61	0.71	0.65	0.70	0.72	0.64	0.68	0.71	0.71	0.77	0.67	0.77	0.70	0.71	0.73	0.62	0.71
Rubidium	µg/L	-	-	-	-	-	-	-	1.4	1.4	1.6	-	-	1.4	1.3	1.6	-	-	1.4	1.4	1.6	-	-	1.5	1.4	1.7	-	-	1.4	1.3	1.5
Selenium	µg/L	-	1	50	-	-	<0.04	0.043	<0.04	<0.04	<0.04	<0.04	0.042	<0.04	<0.04	<0.04	0.041	0.040	<0.04	<0.04	<0.04	0.042	0.043	<0.04	<0.04	0.041	0.049	<0.04	<0.04	0.044	<0.04
Silicon	µg/L	-	-	-	-	-	-	-	287	258	313	-	-	284	261	261	-	-	281	264	264	-	-	290	262	259	-	-	287	258	292
Silver	µg/L	-	0.25	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	46	45	36	36	40	46	44	36	37	39	46	44	37	37	38	45	44	37	38	38	47	45	37	37	37
Sulphur	µg/L	-	-	-	-	-	-	-	1,300	1,640	1,660	-	-	1,300	1,400	1,400	-	-	1,330	1,560	1,490	-	-	1,400	1,460	1,460	-	-	1,380	1,400	1,520
Tellurium	µg/L	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	-	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	0.0021	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.002	<0.005	<0.005	<0.002	<0.002	<0.002
Thorium	µg/L	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.05	<0.05	<0.02	<0.02	0.035	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	<0.02	<0.05	<0.05	<0.02	<0.02	0.052	<0.05	<0.05	<0.02	<0.02	0.027
Titanium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.5	<0.5	0.81	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	-	0.017	0.017	0.017	0.018	0.021	0.014	0.016	0.016	0.018	0.017	0.016	0.018	0.019	0.019	0.020	0.016	0.016	0.018	0.020	0.019	0.018	0.018	0.019	0.018	0.019
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	0.11	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	-	<0.8	2.9	2.3	0.62	7.5	<0.8	<0.8	1.1	1.8	9.5	<0.8	<0.8	1.4	1.3	7.2	<0.8	<0.8	2.7	1.9	4.9	0.91	<0.8	0.77	0.90	6.1
Zirconium	µg/L	-	-	-	-	-	-	-	<0.06	<0.06	0.068	-	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	<0.06
Dissolved Metals																															
Aluminum	µg/L	-	-	-	-	-	0.76	0.61	1.8	2.3	5.0	1.9	0.71	0.88	1.8	1.5	0.91	1.8	0.94	2.0	0.98	0.61	0.77	1.7	2.0	15.4	0.88	1.2	1.6	1.6	1.3
Antimony	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	0.048	<0.02	0.031	<0.02	<0.02	0.026	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	-	0.41	0.39	0.32	0.43	0.47	0.43	0.39	0.33	0.42	0.48	0.37	0.37	0.33	0.41	0.41	0.40	0.39	0.30	0.41	0.40	0.41	0.36	0.34	0.41	0.45
Barium	µg/L	-	-	-	-	-	9.3	9.4	7.0	7.4	7.9	9.1	9.1	7.6	7.5	7.6	8.8	9.1	7.4	7.5	7.6	9.1	8.7	7.3	7.3	7.5	9.0	9.1	7.3	7.8	7.5
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	-	8.1	4.4	<10	<10	<10	6.0	4.5	<10	<10	<10	4.9	4.5	<10	<10	<10	5.1	4.5	<10	<10	<10	6.1	4.6	<10	<10	<10
Cadmium	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	0.0086	<0.005	<0.005	<0.005	<0.005	0.0068	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	-	-	<0.01	<0.01	0.011	-	-	<0.01	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	-	-	<0.01	<0.01	<0.01	-	-	<0.01	<0.01	0.010
Chromium	µg/L	-	-	-	-	-	<0.06	<0.06	0.12	<0.1	<0.1	<0.06	<0.06	0.16	<0.1	<0.1	<0.06	<0.06	0.14	<0.1	<0.1	<0.06	<0.06	0.11	<0.1	<0.1	<0.06	<0.06	0.16	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	<0.01	<0.01	0.011	0.036	0.018	0.013	<0.01	<0.005	0.054	0.016	<0.01	0.013	0.0060	0.035	0.011	<0.01	<0.01	<0.005	0.037	0.011	0.010	<0.01	0.0081	0.023	0.012
Copper	µg/L	-	-	-	-	-	0.98	0.85	1.08	0.87	1.45	0.90	0.88	1.2	0.81	1.3	0.86	1.0	1.2	0.92	0.81	0.90	0.78	1.3	0.88	0.89	0.92	0.89	1.3	1.3	0.87
Iron	µg/L	-	-	-	-	-	4.2	3.5	9.1	8.4	7.6	7.0	3.8	7.2	7.2	5.1	2.7	5.4	7.4	7.3	4.1	2.7	3.6	8.4	7.8	4.4	2.5	4.3	12	7.7	4.7
Lead	µg/L	-	-	-	-	-	<0.01	<0.01	0.047	0.024	0.18	0.051	0.028	0.012	0.011	0.16	<0.01	0.016	0.0062	0.012	0.13	<0.01	<0.01	0.0096	0.0096	0.024	<0.01	<0.01	0.014	0.0095	0.14
Lithium	µg/L	-	-	-	-	-	0.87	1.0	0.57	0.90	0.70	0.94	1.0	0.66	0.81	0.74	0.73	1.1	0.66	0.88	0.73	1.1	1.2	0.63	0.96	0.74	1.1	1.1	0.64	0.93	0.77
Manganese	µg/L	-	-	-	-	-	0.44	0.16	0.81	0.79	0.87	0.24	0.18	0.64	0.60	0.78	0.15	0.40	0.51	0.76	0.53	0.16	0.19	0.72	0.73	0.57	0.17	0.22	0.81	0.66	0.61
Mercury	µg/L	-	-	-	-	-	0.00050	0.00070	0.0010	0.00060	0.00090	0.00060	0.00050	0.0011	0.00080	0.00070	0.00050	0.00060	0.00090	0.00070	0.00080	0.00050	0.00060	0.00090	0.00080	0.00070	0.00060	0.00060	0.00070	0.0010	0.00070
Molybdenum	µg/L	-	-	-	-	-	0.090	0.082	0.078	0.090	0.17	0.093	0.081	0.078	0.18	0.12	0.077	0.073	0.074	0.12	0.15	0.089	0.066	0.077	0.12	0.12	0.095	0.082	0.079	0.087	0.14
Nickel	µg/L	-	-	-	-	-	0.67	0.68	0.64	0.57	0.60

Table 3C.2: Field and Laboratory Water Quality Data from MEL-02 (mid-field) 2017

Station		Guidelines for the protection of:					MEL-02-01					MEL-02-02					MEL-02-03					MEL-02-04					MEL-02-05				
Sample Date		Aquatic Life		Drinking Water	Aesthetic	SSWQO	01/20/2017	02/19/2017	07/23/2017	08/11/2017	09/05/2017	01/20/2017	02/19/2017	07/23/2017	08/11/2017	09/05/2017	01/20/2017	02/19/2017	07/23/2017	08/11/2017	09/05/2017	01/20/2017	02/19/2017	07/23/2017	08/11/2017	09/05/2017	01/20/2017	02/19/2017	07/23/2017	08/11/2017	09/05/2017
Sample Depth		Acute	Chronic				4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameters	Unit																														
Field Measured																															
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.4	7.4	7.5	7.6	7.6	7.4	7.6	7.5	7.6	7.6	7.2	7.4	7.4	7.6	7.6	7.2	7.0[5]	7.5	7.6	7.6	7.2	7.6	7.4	7.6	7.6
Specific conductivity	µS/cm	-	-	-	-	-	42	87	76	75	73	30	91	76	75	73	87	94	76	76	75	87	91	76	75	74	91	91	77	75	75
Temperature	°C	-	-	-	15	-	0.03	1.1	13	13	9.6	0.92	1.0	13	13	9.6	0.94	0.72	12	13	9.5	0.95	1.0	12	13	9.6	0.89	1.0	13	13	9.5
Dissolved oxygen	mg/L	-	6.5	-	-	-	-	-	11	11	11	-	-	11	11	11	-	-	11	11	12	-	-	11	11	12	-	-	11	11	12
Dissolved oxygen	%	-	-	-	-	-	-	-	105	102	102	-	-	105	102	103	-	-	105	102	103	-	-	105	102	103	-	-	105	102	75
Secchi depth	m	-	-	-	-	-	-	-	7.0	7.5	6.5	-	-	7.5	9.1	6.0	-	-	7.0	8.5	5.5	-	-	7.0	8.6	6.5	-	-	6.5	8.6	5.0
Air temperature	deg c	-	-	-	-	-	-	<28	-	10	-	-	<28	-	15	-	-	<28	-	18	-	-	<28	-	18	-	-	<28	-	18	-
Total depth	m	-	-	-	-	-	7.0	7.4	8.1	7.5	9.0	9.0	8.9	9.5	9.1	9.0	9.1	9.3	9.8	8.5	9.2	7.5	8.2	8.0	8.6	8.5	8.7	8.1	9.6	8.6	9.0
Ice thickness	m	-	-	-	-	-	0.90	1.3	-	-	-	0.86	1.1	-	-	-	0.86	1.2	-	-	-	1.0	1.3	-	-	-	1.0	1.1	-	-	-
Conventional Parameters																															
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	6.9[5]	6.8[5]	6.7[5]	7.3	7.3	6.9[5]	7.0	6.7[5]	7.4	7.3	6.8[5]	7.0	6.7[5]	7.4	7.3	6.9[5]	7.0	6.7[5]	7.4	7.3	6.9[5]	7.0[5]	6.7[5]	7.4	7.3
Specific conductivity	µS/cm	-	-	-	-	-	83	84	75	75	71	84	87	75	75	74	85	90	75	77	74	86	88	75	76	74	90	86	75	76	74
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	25	26	22	23	23	26	27	22	22	23	27	28	21	23	23	26	27	20	23	23	27	27	21	22	22
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	21	15	17	16	17	17	15	17	16	17	17	16	18	17	17	18	17	18	17	17	21	15	17	17	17
Total dissolved solids	mg/L	-	-	-	500	-	47	30	50	46	45	49	34	49	49	47	49	43	56	44	49	49	62	52	48	50	53	44	52	42	53
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	43	40	38	38	38	41	42	38	37	39	42	43	38	38	38	43	43	37	38	39	46	41	38	37	39
Total suspended solids	mg/L	-	-	-	-	-	<1.0	<1.0	<1.0	1.1	6.8	<1.0	<1.0	<1.0	1.0	6.2	<1.0	<1.0	<1.0	<1.0	3.2	<1.0	1.1	<1.0	1.4	7.6	<1.0	<1.0	<1.0	1.2	3.3
Turbidity	NTU	-	-	-	-	-	0.14	0.15	0.30	0.28	0.85	0.23	0.17	0.30	0.30	0.36	0.16	0.14	0.36	0.29	0.35	0.15	0.18	0.39	0.36	0.47	0.18	0.14	0.27	0.37	0.53
Major Ions																															
Bicarbonate	mg/L	-	-	-	-	-	25	18	21	20	20	21	18	21	20	21	21	19	22	21	21	22	20	22	21	21	26	18	21	20	21
Calcium	mg/L	-	-	-	-	-	7.9	8.2	6.6	7.2	7.2	7.9	8.6	6.7	6.9	7.1	8.4	8.7	6.9	7.0	7.1	8.2	8.2	6.7	7.0	7.5	8.6	8.4	6.6	6.9	7.0
Chloride	mg/L	640	120	-	250	-	10	11	9.5	9.5	9.0	11	11	9.4	9.4	9.4	11	11	9.5	9.4	9.4	11	11	9.5	9.2	9.5	11	11	9.5	9.2	9.4
Fluoride	mg/L	-	0.12	1.5	-	2.8	0.034	0.027	0.027	0.032	0.031	0.029	0.030	0.026	0.028	0.029	0.026	0.029	0.031	0.027	0.025	0.027	0.027	0.029	0.028	0.025	0.028	0.026	0.026	0.027	0.024
Magnesium	mg/L	-	-	-	-	-	1.3	1.3	1.1	1.3	1.2	1.4	1.4	1.1	1.2	1.2	1.4	1.4	1.1	1.2	1.2	1.4	1.4	1.1	1.2	1.2	1.5	1.4	1.1	1.2	1.2
Potassium	mg/L	-	-	-	-	-	1.0	0.98	0.82	0.96	0.95	1.0	1.0	0.84	0.92	1.0	1.1	1.1	0.79	0.93	0.98	1.1	1.0	0.81	0.93	0.98	1.1	1.0	0.81	0.92	0.99
Sodium	mg/L	-	-	-	200	-	4.9	5.2	4.3	4.8	4.7	5.1	5.4	4.4	4.5	5.1	5.3	5.5	4.3	4.8	4.9	5.3	5.4	4.6	4.6	4.9	5.5	5.2	4.3	4.7	4.9
Sulphate	mg/L	-	-	-	500	-	5.0	4.7	4.1	4.1	4.0	4.3	4.8	4.1	4.0	4.1	4.4	4.9	4.2	4.0	3.9	4.5	4.7	4.2	4.1	3.9	4.7	4.5	4.1	4.1	3.9
Reactive silica, as SiO2	mg/L	-	-	-	-	-	0.36	0.42	0.36	0.36	0.30	0.39	0.46	0.36	0.35	0.33	0.41	0.49	0.36	0.36	0.34	0.41	0.46	0.37	0.34	0.35	0.40	0.40	0.35	0.35	0.34
Cyanide Species																															
Cyanide	mg/L	-	0.005	0.2	-	-	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.005	<0.005	<0.005	<0.001	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.001	<0.001
Nutrients																															
Nitrate	mg-N/L	124	2.9	10	-	-	0.0063	<0.005	<0.005	<0.005	0.14	<0.005	0.0088	<0.005	<0.005	0.11	0.0052	0.010	<0.005	<0.005	0.081	<0.005	0.0069	<0.005	<0.005	0.17	0.0076	0.0058	<0.005	<0.005	0.14
Nitrite	mg-N/L	-	0.06	1	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0010	<0.001	<0.001	<0.001	<0.001	0.0015	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	0.0012	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	-	0.021	0.023	<0.005	<0.005	0.0066	0.022	0.018	<0.005	0.0079	<0.005	0.022	0.017	<0.005	<0.005	<0.005	0.022	0.019	0.0073	<0.005	0.0098	0.020	0.019	0.0097	<0.005	<0.005
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	0.18	0.13	0.15	0.16	0.16	0.22	0.11	0.12	0.17	0.18	0.23	0.14	0.17	0.16	0.19	0.21	0.12	0.16	0.18	0.22	0.27	0.11	0.15	0.16	0.22
Total phosphorus	mg-P/L	-	-	-	-	-	0.0038	~~0.054~~	0.0042	0.0043	0.0048	0.0031	~~0.012~~	0.0047	0.0042	0.0068	0.0032	~~0.024~~	0.0038	0.0064	0.0052	0.0034	~~0.022~~	0.0049	0.0044	0.0064	0.0045	~~0.035~~	0.0057	0.0038	0.0079
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0019	~~0.011~~	0.0017	0.0026	0.0024	<0.001	~~0.036~~	0.0018	0.0023	0.0044	0.0023	~~0.039~~	0.0027	0.0018	0.0034	0.0012	~~0.011~~	0.0017	0.0012	0.0045	0.0036	~~0.011~~	0.0017	0.0018	0.0035
Orthophosphate	mg-P/L	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	0.0016	0.0012	<0.001	<0.001	<0.001	0.0011	0.0012	0.0011	<0.001	0.0011	0.0011	0.0014	0.0011	0.0011	0.0013	0.0012	0.0014	0.0015	<0.001
Total organic carbon	mg/L	-	-	-	-	-	2.7	2.9	2.9	2.9	2.8	2.6	2.8	2.9	3.1	2.9	2.8	3.0	2.9	3.0	2.8	2.8	3.0	2.9	3.0	3.4	3.0	2.8	2.9	3.1	2.9
Dissolved organic carbon	mg/L	-	-	-	-	-	2.9	2.8	2.6	3.1	2.7	2.7	2.9	2.7	2.9	3.1	3.0	3.1	2.6	2.9	3.0	2.8	2.9	2.7	3.3	3.1	2.9	2.9	2.6	3.2	2.8
Total Metals																															
Aluminum	µg/L	-	5.0 - 100	-	200	-	1.1	1.2	2.3	4.0	9.3	1.2	0.95	2.0	2.6	9.1	1.1	0.87	1.9	3.0	6.2	0.95	0.89	2.5	3.6	6.0	0.94	1.5	2.7	2.9	7.9
Antimony	µg/L	-	-	6	-	-	<0.02	<0.02	<0.02	<0.02	0.028	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	25	0.28	0.29	0.25	0.28	0.28	0.30	0.28	0.25	0.24	0.29	0.29	0.30	0.24	0.26	0.26	0.28	0.31	0.26	0.27	0.28	0.28	0.28	0.28	0.25	0.31
Barium	µg/L	-	-	1,000	-	-	8.2	8.4	7.7	8.0	7.8	8.7	8.9	7.9	7.7	7.5	9.0	9.2	7.7	7.5	7.5	9.0	9.3	7.8	7.9	7.7	10	8.5	7.9	7.4	8.4
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	0.0052	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	-	5.1	4.0	<5.0	5.7	<5.0	6.3	4.3	<5.0	5.2	<5.0	6.7	4.4	<5.0	<5.0	<5.0	5.2	4.4	<5.0	<5.0	<5.0	7.2	4.1	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	-	<0.005	<0.005	<0.005	<0.005	0.0061	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	-	-	<0.01	<0.01	0.028	-	-	<0.01	<0.01	0.033	-	-	<0.01	0.011	0.022	-	-	<0.01	<0.01	0.039	-	-	<0.01	<0.01	0.012
Chromium	µg/L	-	1.0	50	-	-	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	<0.01	<0.01	0.010	0.018	0.021	<0.01	<0.01	0.018	0.013	0.023	0.010	0.010	0.012	0.011	0.018	<0.01	<0.01	0.017	0.012	0.024	0.014	<0.01	0.015	0.0097	0.019
Copper	µg/L	-	2	-	1,000	-	0.80	0.77	0.83	1.0	1.3	0.82	0.82	0.89	0.97	0.94	0.80	0.85	0.76	0.84	0.86	0.84	0.85	0.80	1.5	0.89	0.86	0.84	0.83	0.73	0.91
Iron	µg/L	-	300	-	300	1,060	3.5	3.8	14	13	19	4.4	4.8	13	13	21	10	4.7	14	11	18	4.6	4.6	15	12	21	7.8	4.9	15	11	22
Lead	µg/L	-	1	10	-	-	<0.01	0.012	<0.01	0.032	0.17	<0.01	0.030	<0.01	0.014	0.11	<0.01	0.011	<0.01	0.011	0.080	0.012	0.014	<0.01	0.048	0.067	<0.01	0.020	<0.01	<0.01	0.12
Lithium	µg/L	-	-	-	-	-	1.1	1.0	<0.5	0.72	0.63	0.90	1.1	<0.5	0.76	0.51	0.96	0.97	<0.5	0.79	0.51	0.97	1.1	<0.5	0.85	0.55	1.1	0.98	<0.5	0.94	0.66
Manganese	µg/L	-	-	-	50	-	1.3	1.1	4.3	4.3	3.1	1.6	1.3	4.4	3.8	4.0	1.9	1.3	4.3	3.6	3.8	1.5	1.3	4.1	3.7	4.2	2.5	1.4	4.2	7.7	4.5
Mercury	µg/L	-	0.026	1	-	-	<0.0005	0.00050	0.00070	0.00070	0.00090	<0.0005	0.00060	0.00080	0.00060	0.0016	<0.0005	0.00060	0.00070	0.00060	0.0010	0.00050	0.00050	0.0010	0.00080	0.00070	<0.0005	0.00050	0.00070	0.00080	0.00090
Molybdenum	µg/L	-	73	-	-	-	0.076	0.059	0.073	0.079	0.13	0.075	0.069	0.067	0.081	0.097	0.077	0.067	0.075	0.071	0.097	0.081	0.077	0.070	0.088	0.10	0.082	0.068	0.064	0.071	0.086
Nickel	µg/L	-	25	-	-	-	0.52	0.55	0.48	0.53	0.58	0.55	0.52	0.55	0.48	0.55	0.56	0.57	0.50	0.51	0.53	0.58	0.57	0.55	0.53	0.56	0.54	0.54	0.54	0.48	0.54
Rubidium	µg/L	-	-	-	-	-	-	-	1.4	1.5	1.5	-	-	1.3	1.5	1.5	-	-	1.3	1.4	1.5	-	-	1.3	1.4	1.5	-	-	1.4	1.5	1.6
Selenium	µg/L	-	1	50	-	-	<0.04	0.044	<0.04	0.044	<0.04	<0.04	0.043	<0.04	<0.04	<0.04	0.041	<0.04	<0.04	<0.04	<0.04	<0.04	0.042	<0.04	<0.04	<0.04	0.046	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	-	-	-	178	171	257	-	-	169	176	188	-	-	173	163	186	-	-	176	177	205	-	-	185	164	177
Silver	µg/L	-	0.25	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	42	41	35	36	37	40	42	35	35	37	41	41	35	35	37	43	40	34	35	37	45	42	34	35	37
Sulphur	µg/L	-	-	-	-	-	-	-	1,340	1,220	1,160	-	-	1,350	1,360	1,330	-	-	1,330	1,230	1,360	-	-	1,350	1,170	1,390	-	-	1,310	1,190	1,250
Tellurium	µg/L	-	-	-	-	-	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2	-	-	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	-	<0.005	<0.005	<0.002	<0.002	0.0025	<0.005	<0.005	<0.002	0.0021	<0.002	<0.005	<0.005	<0.002	<0.002	0.0022	<0.005	<0.005	<0.002	<0.002	0.0022	<0.005	<0.005	<0.002	<0.002	<0.002
Thorium	µg/L	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.05	<0.05	<0.02	<0.02	0.072	<0.05	<0.05	<0.02	<0.02	0.15	<0.05	<0.05	<0.02	<0.02	0.086	<0.05	<0.05	<0.02	0.021	0.11	<0.05	<0.05	<0.02	<0.02	0.096
Titanium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5	<0.1	<0.1	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	-	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	-	0.013	0.012	0.014	0.016	0.019	0.014	0.014	0.015	0.017	0.018	0.014	0.013	0.015	0.016	0.019	0.015	0.015	0.013	0.017	0.022	0.014	0.015	0.013	0.016	0.019
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	-	<0.8	1.5	0.60	2.0	11	<0.8	<0.8	0.52	4.2	7.7	<0.8	<0.8	<0.5	4.3	5.9	<0.8	0.95	2.2	2.1	7.7	<0.8	27	1.8	0.57	10.0
Zirconium	µg/L	-	-	-	-	-	-	-	<0.06	<0.06	0.097	-	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	<0.06	-	-	<0.06	<0.06	0.063	-	-	<0.06	<0.06	0.10
Dissolved Metals																															
Aluminum	µg/L	-	-	-	-	-	0.63	0.83	1.9	2.4	2.9	0.58	1.0	2.0	2.1	2.6	0.82	0.68	1.2	2.3	2.4	<0.3	0.61	0.87	1.9	4.7	0.88	0.98	0.83	2.2	1.9
Antimony	µg/L	-	-	-	-	-	0.059	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.029	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.021	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	-	0.28	0.25	0.24	0.26	0.23	0.29	0.27	0.23	0.27	0.25	0.30	0.29	0.22	0.28	0.24	0.30	0.32	0.24	0.26	0.26	0.28	0.29	0.22	0.27	0.25
Barium	µg/L	-	-	-	-	-	8.2	8.7	7.1	7.6	7.9	8.7	8.9	7.2	7.3	7.5	8.9	9.3	7.3	7.3	7.6	8.7	8.8	7.3	7.5	7.7	9.8	8.7	7.1	7.3	7.6
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005	<0.01	<0.01	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	-	4.5	3.8	<10	<10	<10	5.6	4.4	<10	<10	<10	5.3	4.6	<10	<10	<10	4.7	4.2	<10	<10	<10	6.2	4.0	<10	<10	<10
Cadmium	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0062	<0.005	<0.005	<0.005	<0.005	0.0071	<0.005	<0.005	<0.005	<0.005	0.0079	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	-	-	<0.01	<0.01	0.026	-	-	<0.01	<0.01	0.053	-	-	<0.01	<0.01	0.026	-	-	<0.01	<0.01	0.042	-	-	<0.01	<0.01	0.011
Chromium	µg/L	-	-	-	-	-	<0.06	<0.06	0.19	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1	<0.06	<0.06	0.12	<0.1	<0.1	<0.06	<0.06	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	<0.01	<0.01	0.022	0.035	0.011	<0.01	<0.01	0.024	0.027	0.011	<0.01	<0.01	0.023	0.032	0.0086	<0.01	<0.01	0.024	0.034	0.018	<0.01	<0.01	0.035	0.037	0.0079
Copper	µg/L	-	-	-	-	-	0.74	0.75	1.2	0.74	1.5	0.77	0.84	1.1	0.81	0.96	0.79	0.81	1.1	0.81	0.94	0.78	0.80	1.1	0.75	0.98	0.82	0.80	0.98	0.77	0.72
Iron	µg/L	-	-	-	-	-	<1.0	1.2	7.0	6.4	3.5	1.3	2.2	5.5	6.1	4.9	1.2	1.9	5.9	7.2	5.4	<1.0	1.7	5.6	6.1	9.8	1.9	1.4	5.6	6.8	4.3
Lead	µg/L	-	-	-	-	-	<0.01	<0.01	0.012	0.014	0.045	<0.01	<0.01	0.0054	0.0080	0.098	<0.01	<0.01	0.0062	0.023	0.070	<0.01	<0.01	<0.005	0.0088	0.080	<0.01	<0.01	0.0060	0.019	0.039
Lithium	µg/L	-	-	-	-	-	0.99	1.0	0.64	0.94	0.74	0.87	1.0	0.63	0.80	0.79	1.1	1.2	0.67	1.2	0.68	1.1	0.85	0.58	0.85	0.89	0.99	1.1	0.81	0.78	0.75
Manganese	µg/L	-	-	-	-	-	0.11	0.16	0.58	0.71	0.51	0.14	0.17	0.87	0.72	0.78	0.14	0.16	0.61	3.6	0.63	0.13	0.17	0.58	0.73	0.76	0.21	0.17	1.5	1.0	0.55
Mercury	µg/L	-	-	-	-	-	<0.0005	0.00050	0.0012	0.00070	0.0011	<0.0005	0.00060	0.0012	0.00070	0.00060	<0.0005	0.00060	0.0012	0.00070	0.00070	0.00050	0.00050	0.0010	0.00080	0.00090	<0.0005	0.00050	0.0012	0.00080	0.00060
Molybdenum	µg/L	-	-	-	-	-	0.079	0.074	0.072	0.089	0.15	0.072	0.069	0.11	0.099	0.23	0.083	0.074	0.075	0.28	0.20	0.077	0.053	0.076	0.085	0.20	0.071	0.072	0.066	0.12	0.10
Nick

Table 3C.3: Field and Laboratory Water Quality Data from MEL-03 (reference area 1) in 2017

Station		Guidelines for the protection of:					MEL-03-01			MEL-03-02			MEL-03-03			MEL-03-04			MEL-03-05		
Sample Date		Aquatic Life		Drinking Water	Aesthetic	SSWQO	07/21/2017	08/13/2017	09/01/2017	07/21/2017	08/13/2017	09/01/2017	07/21/2017	08/13/2017	09/01/2017	07/21/2017	08/13/2017	09/01/2017	07/21/2017	08/13/2017	09/01/2017
Sample Depth		Acute	Chronic				4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameters	Unit																				
Field Measured																					
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.6	7.6	7.6	7.5	7.6	7.7	7.5	7.6	7.0	7.5	7.7	7.7	7.5	7.7	7.7
Specific conductivity	µS/cm	-	-	-	-	-	68	69	69	68	69	69	68	69	69	68	69	69	68	69	69
Temperature	°C	-		-	15	-	11	13	13	11	13	13	11	13	13	11	13	13	11	13	13.5
Dissolved oxygen	mg/L	-	6.5	-	-	-	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
Dissolved oxygen	%	-	-	-	-	-	104	104	104	104	104	104	131	104	104	104	104	109	105	105	110
Air temperature	deg c	-	-	-	-	-	-	12	-	-	12	-	-	13	-	-	12	-	-	12	-
Secchi depth	m	-	-	-	-	-	6.5	6.6	7.0	7.0	8.5	8.0	7.0	9.0	9.5	7.5	7.5	7.0	7.8	8.0	6.7
Total depth	m	-	-	-	-	-	7.1	6.6	7.0	8.7	8.5	8.0	10	9.0	9.5	8.4	7.5	8.4	7.8	8.0	6.7
Wind speed	km/H	-	-	-	-	-	20	15	30	-	15	-	20	20	-	-	20	-	-	20	-
Conventional Parameters																					
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	**6.6**[(5)]	7.4	7.3	**6.7**[(5)]	7.4	7.3	**6.7**[(5)]	7.1	7.1	**6.6**[(5)]	7.2	7.3	**6.7**[(5)]	7.2	7.31
Specific conductivity	µS/cm	-	-	-	-	-	67	69	69	67	70	69	67	67	71	67	68	68	67	69	67
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	21	20	22	20	21	23	21	20	24	19	21	22	19	20	22
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	16	16	16	17	16	16	17	16	16	16	16	16	17	16	16
Total dissolved solids	mg/L	-	-	-	500	-	43	43	45	37	40	33	43	40	44	42	39	42	47	40	38
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	35	34	35	34	34	37	34	34	37	34	34	36	34	34	35
Total suspended solids	mg/L	-	-	-	-	-	<1.0	<1.0	1.5	<1.0	<1.0	1.5	<1.0	1.0	1.2	<1.0	<1.0	1.2	<1.0	1.0	<1.0
Turbidity	NTU	-	-	-	-	-	0.29	0.29	0.37	0.25	0.31	0.32	0.37	0.32	0.31	0.24	0.29	0.34	0.28	0.35	0.32
Major Ions																					
Bicarbonate	mg/L	-	-	-	-	-	20	19	19	21	19	20	20	19	19	20	20	20	20	20	20
Calcium	mg/L	-	-	-	-	-	6.4	6.3	7.0	6.4	6.5	7.3	6.5	6.3	7.9	6.2	6.6	7.0	6.2	6.4	6.9
Chloride	mg/L	640	120	-	250	-	8.1	8.2	8.4	8.0	8.2	8.4	8.0	8.1	8.4	8.4	8.2	8.5	8.1	8.2	8.3
Fluoride	mg/L	-	0.12	1.5	-	2.8	0.030	0.024	0.026	0.026	0.025	0.028	0.026	0.026	0.029	<0.02	0.027	0.029	0.024	0.025	0.03
Magnesium	mg/L	-	-	-	-	-	1.0	1.1	1.1	1.0	1.1	1.1	1.0	1.1	1.1	0.99	1.1	1.1	1.0	1.1	1.1
Potassium	mg/L	-	-	-	-	-	0.78	0.88	0.97	0.79	0.89	0.97	0.80	0.87	0.98	0.78	0.90	1.00	0.78	0.87	0.92
Sodium	mg/L	-	-	-	200	-	4.1	4.1	4.6	4.1	4.2	4.6	4.2	4.1	4.7	4.1	4.2	4.6	4.1	4.1	4.4
Sulphate	mg/L	-	-	-	500	-	3.7	3.4	3.5	3.6	3.4	3.5	3.5	3.4	3.7	3.8	3.4	3.6	3.4	3.4	3.5
Reactive silica, as SiO2	mg/L	-	-	-	-	-	0.22	0.24	0.25	0.21	0.25	0.25	0.22	0.25	0.26	0.22	0.24	0.26	0.21	0.24	0.25
Cyanide Species																					
Cyanide	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	-	<0.005	<0.001	<0.001	<0.005	<0.001	<0.001	<0.005	<0.001	<0.001	<0.005	<0.001	<0.001	<0.005	<0.001	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients																					
Nitrate	mg-N/L	124	2.9	10	-	-	<0.005	<0.005	0.014	<0.005	<0.005	0.14	<0.005	<0.005	0.011	<0.005	<0.005	0.020	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	-	<0.001	0.0011	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	-	<0.005	<0.005	<0.005	0.0056	<0.005	<0.005	<0.005	0.0080	<0.005	0.0069	<0.005	0.0078	0.0079	0.0058	<0.005
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	0.13	0.13	0.19	0.15	0.13	0.20	0.11	0.14	0.22	0.11	0.16	0.26	0.096	0.14	0.21
Total phosphorus	mg-P/L	-	-	-	-	-	0.0060	0.0030	0.0044	0.0086	0.0035	0.0047	0.0037	0.0033	0.0046	0.0069	0.0034	0.0058	0.0043	0.0042	0.0038
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0027	0.0015	0.0031	0.0016	0.0010	0.0036	0.0020	0.0026	0.0034	0.0023	0.0018	0.0041	0.0020	0.0018	0.0022
Orthophosphate	mg-P/L	-	-	-	-	-	<0.001	<0.001	<0.001	0.0016	<0.001	<0.001	<0.001	<0.001	<0.001	0.0015	<0.001	<0.001	<0.001	<0.001	<0.001
Total organic carbon	mg/L	-	-	-	-	-	2.4	2.1	2.2	2.5	2.1	2.3	2.4	2.3	2.1	2.4	2.3	2.3	2.4	2.3	2.1
Dissolved organic carbon	mg/L	-	-	-	-	-	2.3	2.0	2.2	2.2	2.1	2.5	2.4	2.2	2.2	2.2	2.2	2.3	2.3	2.2	2.1
Total Metals																					
Aluminum	µg/L	-	5.0 - 100	-	200	-	3.7	2.5	7.4	4.5	2.3	6.5	3.5	2.3	6.6	4.5	2.6	8.6	4.7	2.6	2.6
Antimony	µg/L	-	-	6	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.022	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	25	0.18	0.17	0.21	0.20	0.19	0.22	0.19	0.19	0.22	0.19	0.21	0.26	0.19	0.17	0.20
Barium	µg/L	-	-	1,000	-	-	7.2	7.0	7.8	7.7	7.5	7.7	7.6	7.7	7.7	7.5	7.5	7.9	7.1	7.3	7.3
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
Boron	µg/L	29,000	1,500	5,000	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	-	<0.005	<0.005	0.0054	<0.005	<0.005	0.0068	0.010	<0.005	0.0089	0.035	<0.005	0.016	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	<0.01	<0.01	0.018	<0.01	<0.01	0.12	<0.01	<0.01	0.032	<0.01	0.011	0.044	<0.01	<0.01	<0.01
Chromium	µg/L	-	1.0	50	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Cobalt	µg/L	-	-	-	-	-	0.010	0.0073	0.0087	0.0096	0.0094	0.0098	0.011	0.0089	0.012	0.015	0.011	0.013	0.0073	0.0054	<0.005
Copper	µg/L	-	2	-	1,000	-	0.78	0.76	0.80	0.80	0.79	0.97	0.83	0.72	0.77	0.99	0.78	0.82	0.78	0.69	0.65
Iron	µg/L	-	300	-	300	1,060	12	8.2	15	11	8.5	14	11	7.0	12	12	9.6	16	13	7.7	7
Lead	µg/L	-	1	10	-	-	<0.01	<0.01	0.081	<0.01	<0.01	0.10	<0.01	<0.01	0.090	0.010	<0.01	0.21	<0.01	0.012	<0.010
Lithium	µg/L	-	-	-	-	-	0.92	0.67	<0.5	<0.5	0.66	<0.5	<0.5	0.71	<0.5	0.92	0.67	<0.5	<0.5	0.73	<0.50
Manganese	µg/L	-	-	-	50	-	2.2	1.9	2.5	2.3	2.1	2.6	2.4	2.1	2.5	2.3	2.1	2.7	2.1	2.1	2.2
Mercury	µg/L	-	0.026	1	-	-	0.00090	0.00060	0.00050	0.00050	0.00060	0.00090	<0.0005	0.00080	0.00090	0.0011	0.0010	0.00060	0.00080	0.00090	0.0006
Molybdenum	µg/L	-	73	-	-	-	0.063	0.073	0.079	0.060	0.074	0.077	0.077	0.066	0.078	0.058	0.065	0.11	0.071	0.078	0.060
Nickel	µg/L	-	25	-	-	-	0.39	0.32	0.35	0.41	0.37	0.39	0.40	0.36	0.33	0.98	0.36	0.43	0.39	0.34	0.27
Rubidium	µg/L	-	-	-	-	-	1.4	1.4	1.5	1.4	1.5	1.4	1.4	1.4	1.5	1.3	1.4	1.5	1.3	1.2	1.37
Selenium	µg/L	-	1	50	-	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.045	<0.040
Silicon	µg/L	-	-	-	-	-	112	122	127	107	118	130	111	126	127	109	124	134	115	110	120
Silver	µg/L	-	0.25	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	30	32	32	31	31	33	31	32	32	30	32	33	30	32	32
Sulphur	µg/L	-	-	-	-	-	990	1,020	1,160	1,100	1,130	1,080	1,110	1,220	1,160	1,250	1,150	1,170	1,150	1,080	1140
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-0.2
Thallium	µg/L	-	0.8	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0021	<0.002
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-0.1
Tin	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.063	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-0.1
Uranium	µg/L	33	15	20	-	-	0.014	0.016	0.014	0.014	0.016	0.014	0.013	0.016	0.014	0.016	0.017	0.017	0.014	0.018	0.014
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	-	0.85	1.4	2.7	<1.5	0.94	2.5	11	0.65	4.1	4.9	<0.5	5.8	0.68	1.1	2.3
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.11	<0.06	<0.06	-0.06
Dissolved Metals																					
Aluminum	µg/L	-	-	-	-	-	1.6	1.8	2.3	1.7	2.7	2.0	2.4	1.8	3.8	1.9	1.9	2.7	2.14	1.76	1.81
Antimony	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.022	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	-	0.20	0.21	0.23	0.17	0.20	0.22	0.19	0.20	0.21	0.18	0.20	0.20	0.20	0.21	0.19
Barium	µg/L	-	-	-	-	-	7.0	7.0	7.1	6.9	7.4	7.3	7.4	7.3	7.3	7.0	7.4	7.2	7.1	6.8	7.1
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.01
Boron	µg/L	-	-	-	-	-	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10.0
Cadmium	µg/L	-	-	-	-	-	<0.005	<0.005	0.0058	<0.005	<0.005	0.0088	<0.005	<0.005	0.019	<0.005	<0.005	0.012	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	<0.01	<0.01	0.018	<0.01	0.011	0.084	<0.01	0.016	0.031	<0.01	<0.01	0.045	<0.010	<0.01	0.014
Chromium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.10
Cobalt	µg/L	-	-	-	-	-	0.025	0.036	0.011	0.021	0.038	0.0077	0.021	0.026	0.019	0.020	0.036	0.0085	0.006	0.025	0.03
Copper	µg/L	-	-	-	-	-	1.1	0.75	0.58	0.98	0.77	0.58	0.95	0.75	0.51	0.95	0.74	0.63	0.65	0.91	0.70
Iron	µg/L	-	-	-	-	-	5.7	4.1	3.5	6.0	3.9	3.3	6.6	5.2	3.9	5.8	5.2	4.2	3.1	6.2	4.0
Lead	µg/L	-	-	-	-	-	<0.005	<0.005	0.021	0.0053	0.0065	0.027	0.011	0.017	0.053	<0.005	0.0095	0.032	0.0084	<0.005	0.007
Lithium	µg/L	-	-	-	-	-	0.53	0.67	0.81	0.69	0.63	0.89	0.59	0.70	0.85	0.58	0.75	0.89	0.74	0.83	0.72
Manganese	µg/L	-	-	-	-	-	0.83	0.50	0.57	0.79	0.46	0.69	0.78	0.52	0.94	0.81	0.53	0.67	0.56	1.8	0.41
Mercury	µg/L	-	-	-	-	-	0.0015	0.00060	0.0016	0.0011	0.00060	0.0014	0.0012	0.00090	0.0020	0.0011	0.0010	0.0014	0.0015	0.0012	0.0012
Molybdenum	µg/L	-	-	-	-	-	0.078	0.066	0.12	0.070	0.10	0.16	0.071	0.085	0.10	0.078	0.073	0.16	0.067	0.066	0.073
Nickel	µg/L	-	-	-	-	-	0.45	0.32	0.41	0.41	0.31	0.44	0.37	0.31	0.19	0.32	0.32	0.52	0.36	0.44	0.29
Rubidium	µg/L	-	-	-	-	-	1.3	1.3	1.4	1.3	1.4	1.4	1.2	1.4	1.4	1.2	1.4	1.4	1.4	1.3	1.36
Selenium	µg/L	-	-	-	-	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.042	<0.040
Silicon	µg/L	-	-	-	-	-	109	116	136	112	117	134	115	116	126	111	121	131	131	101	116
Silver	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	29	29	31	29	31	31	30	29	32	28	31	31	31	28	30
Sulphur	µg/L	-	-	-	-	-	1,080	1,240	1,470	1,170	1,220	1,330	1,320	1,210	1,380	1,080	1,250	1,430	1,410	1,110	1200
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-0.2
Thallium	µg/L	-	-	-	-	-	<0.002	0.0020	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0028	<0.002	<0.002	<0.002	<0.0020	<0.002	0.002
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-0.1
Tin	µg/L	-	-	-	-	-	0.054	<0.01	0.025	0.033	<0.01	0.076	0.046	<0.01	0.17	0.015	<0.01	0.076	0.02	0.013	<0.01
Titanium	µg/L	-	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-0.1
Uranium	µg/L	-	-	-	-	-	0.012	0.015	0.015	0.013	0.016	0.015	0.013	0.015	0.015	0.013	0.017	0.015	0.014	0.015	0.015
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	-	-	-	-	1.9	2.2	4.2	1.2	0.71	3.8	2.1	0.57	9.8	2.0	1.8	5.0	4.6	0.85	<0.5
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	0.16	<0.06	0.17	0.19	<0.06	<0.06	<0.06	<0.06	<0.06	0.12	<0.06	<0.06	-0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
(5) = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.
Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent;
CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3C.4: Field and Laboratory Water Quality Data from MEL-04 (Reference area 2) in 2017

Station		Guidelines for the protection of:					MEL-04-01	MEL-04-02	MEL-04-03	MEL-04-04	MEL-04-05
Sample Date		Aquatic Life		Drinking Water	Aesthetic	SSWQO	08/15/2017	08/15/2017	08/15/2017	08/15/2017	08/15/2017
Sample Depth		Acute	Chronic				4 m	4 m	4 m	4 m	4 m
Parameters	Unit										
Field Measured											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.7	7.7	7.7	7.6	7.6
Specific conductivity	µS/cm	-	-	-	-	-	68	68	68	68	68
Temperature	°C	-	-	-	15	-	14	14	14	14	14
Dissolved oxygen	mg/L	-	6.5	-	-	-	11	11	11	11	11
Dissolved oxygen	%	-	-	-	-	-	104	104	104	105	104
Secchi depth	m	-	-	-	-	-	7.5	9.5	9.5	8.1	8.4
Total depth	m	-	-	-	-	-	7.5	9.5	9.5	8.1	8.4
Wind direction	km/H	-	-	-	-	-	-	-	-	5.0	10
Wind speed	deg c	-	-	-	-	-	16	16	14	15	15
Conventional Parameters											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.0	7.1	7.1	7.2	7.1
Specific conductivity	µS/cm	-	-	-	-	-	67	67	68	69	68
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	22	22	22	20	21
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	16	16	16	17	16
Total dissolved solids	mg/L	-	-	-	500	-	41	40	41	29	32
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	35	35	35	34	35
Total suspended solids	mg/L	-	-	-	-	-	1.7	<1.0	1.1	1.1	<1.0
Turbidity	NTU	-	-	-	-	-	0.29	0.28	0.30	0.30	0.29
Major Ions											
Bicarbonate	mg/L	-	-	-	-	-	19	20	19	20	19
Calcium	mg/L	-	-	-	-	-	6.4	6.4	6.3	6.3	6.6
Chloride	mg/L	640	120	-	250	-	8.1	8.2	8.1	8.2	8.2
Fluoride	mg/L	-	0.12	1.5	-	2.8	0.029	0.028	0.028	0.031	0.029
Magnesium	mg/L	-	-	-	-	-	1.0	1.0	1.0	0.99	1.0
Potassium	mg/L	-	-	-	-	-	0.81	0.82	0.82	0.81	0.85
Sodium	mg/L	-	-	-	200	-	4.0	4.1	4.0	3.9	4.2
Sulphate	mg/L	-	-	-	500	-	3.6	3.6	3.6	3.6	3.9
Reactive silica, as SiO2	mg/L	-	-	-	-	-	0.26	0.26	0.25	0.26	0.26
Cyanide Species											
Cyanide	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients											
Nitrate	mg-N/L	124	2.9	10	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	0.14	0.15	0.16	0.15	0.14
Total phosphorus	mg-P/L	-	-	-	-	-	0.0032	0.0035	0.0033	0.0042	0.0031
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0024	0.0024	0.0012	0.0027	0.0014
Orthophosphate	mg-P/L	-	-	-	-	-	<0.001	0.0010	0.0010	<0.001	<0.001
Total organic carbon	mg/L	-	-	-	-	-	2.3	2.3	2.1	2.3	2.3
Dissolved organic carbon	mg/L	-	-	-	-	-	2.3	2.1	2.3	2.2	2.2
Total Metals											
Aluminum	µg/L	-	5.0 - 100	-	200	-	3.2	1.7	2.2	2.4	1.5
Antimony	µg/L	-	-	6	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	25	0.17	0.16	0.18	0.19	0.16
Barium	µg/L	-	-	1,000	-	-	7.6	7.3	7.7	7.4	7.2
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	-	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	0.011	0.012	<0.01	<0.01	<0.01
Chromium	µg/L	-	1.0	50	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	0.0091	<0.005	0.0072	0.0080	0.037
Copper	µg/L	-	2	-	1,000	-	0.84	0.70	0.76	0.75	0.65
Iron	µg/L	-	300	-	300	1,060	7.3	6.7	6.7	7.1	3.2
Lead	µg/L	-	1	10	-	-	0.013	<0.01	<0.01	<0.01	<0.01
Lithium	µg/L	-	-	-	-	-	0.66	0.67	0.65	0.68	0.72
Manganese	µg/L	-	-	-	50	-	2.2	2.1	2.2	2.1	0.29
Mercury	µg/L	-	0.026	1	-	-	0.00070	0.00050	0.00060	0.00080	0.00080
Molybdenum	µg/L	-	73	-	-	-	0.072	0.069	0.067	0.069	0.074
Nickel	µg/L	-	25	-	-	-	0.41	0.34	0.37	0.37	0.34
Rubidium	µg/L	-	-	-	-	-	1.4	1.4	1.4	1.4	1.4
Selenium	µg/L	-	1	50	-	-	<0.04	<0.04	<0.04	0.045	<0.04
Silicon	µg/L	-	-	-	-	-	131	129	129	128	122
Silver	µg/L	-	0.25	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	31	31	32	32	31
Sulphur	µg/L	-	-	-	-	-	1,060	1,140	1,040	1,150	1,150
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	-	0.015	0.015	0.015	0.017	0.013
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	-	2.5	<0.5	<0.5	1.5	1.5
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Metals											
Aluminum	µg/L	-	-	-	-	-	1.4	1.4	1.4	1.4	2.7
Antimony	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	-	0.28	0.22	0.19	0.19	0.19
Barium	µg/L	-	-	-	-	-	7.3	7.4	7.4	7.5	7.5
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	-	<10	<10	<10	<10	<10
Cadmium	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	<0.01	0.014	0.010	0.014	0.34
Chromium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	0.029	0.031	0.024	0.035	0.012
Copper	µg/L	-	-	-	-	-	0.73	0.73	0.71	0.71	0.75
Iron	µg/L	-	-	-	-	-	3.4	3.3	3.6	3.5	7.5
Lead	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	0.032
Lithium	µg/L	-	-	-	-	-	0.76	0.78	0.66	0.72	0.76
Manganese	µg/L	-	-	-	-	-	0.40	0.47	0.44	0.42	2.3
Mercury	µg/L	-	-	-	-	-	0.00080	0.00080	0.0012	0.0014	0.00090
Molybdenum	µg/L	-	-	-	-	-	0.072	0.071	0.065	0.082	0.097
Nickel	µg/L	-	-	-	-	-	0.43	0.34	0.46	0.35	0.38
Rubidium	µg/L	-	-	-	-	-	1.3	1.3	1.3	1.3	1.4
Selenium	µg/L	-	-	-	-	-	<0.04	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	-	114	114	120	117	124
Silver	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	31	31	30	31	31
Sulphur	µg/L	-	-	-	-	-	1,020	1,040	1,110	1,040	1,070
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	-	-	-	-	<0.002	<0.002	<0.002	<0.002	0.0021
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	0.074
Titanium	µg/L	-	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	-	-	-	-	-	0.015	0.014	0.015	0.015	0.017
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	-	-	-	-	<0.5	0.85	<0.5	<0.5	1.4
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.
Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent;
CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3C.5: Field and Laboratory Water Quality Data from MEL-05 (Reference area 3) in 2017

Station		Guidelines for the protection of:					MEL-05-01	MEL-05-02	MEL-05-03	MEL-05-04	MEL-05-05
Sample Date		Aquatic Life		Drinking Water	Aesthetic	SSWQO	08/12/2017	08/12/2017	08/12/2017	08/12/2017	08/12/2017
Sample Depth		Acute	Chronic				4 m	4 m	4 m	4 m	4 m
Parameters	Unit										
Field Measured											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.6	7.7	7.7	7.7	7.7
Specific conductivity	µS/cm	-	-	-	-	-	73	73	73	72	73
Temperature	°C	-	-	-	15	-	13	13	13	13	13
Dissolved oxygen	mg/L	-	6.5	-	-	-	11	11	11	11	11
Dissolved oxygen	%	-	-	-	-	-	103	103	103	103	103
Secchi depth	m	-	-	-	-	-	10	8.7	8.0	10	7.8
Air temperature	deg c	-	-	-	-	-	15	15	13	13	13
Total depth	m	-	-	-	-	-	10	8.7	8.0	10	7.8
Wind speed	km/H	-	-	-	-	-	15	25	25	30	20
Conventional Parameters											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	7.4	7.4	7.4	7.4	7.4
Specific conductivity	µS/cm	-	-	-	-	-	73	73	73	73	73
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	23	22	22	23	22
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	18	17	17	17	17
Total dissolved solids	mg/L	-	-	-	500	-	41	45	44	46	43
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	36	36	36	36	36
Total suspended solids	mg/L	-	-	-	-	-	<1.0	<1.0	<1.0	<1.0	<1.0
Turbidity	NTU	-	-	-	-	-	0.25	0.24	0.26	0.25	0.27
Major Ions											
Bicarbonate	mg/L	-	-	-	-	-	21	21	21	21	21
Calcium	mg/L	-	-	-	-	-	7.1	6.9	6.9	7.2	6.9
Chloride	mg/L	640	120	-	250	-	8.3	8.4	8.4	8.4	8.4
Fluoride	mg/L	-	0.12	1.5	-	2.8	0.028	0.026	0.026	0.026	0.023
Magnesium	mg/L	-	-	-	-	-	1.2	1.1	1.1	1.1	1.1
Potassium	mg/L	-	-	-	-	-	0.91	0.89	0.90	0.92	0.91
Sodium	mg/L	-	-	-	200	-	4.3	4.2	4.3	4.3	4.3
Sulphate	mg/L	-	-	-	500	-	3.6	3.6	3.5	3.6	3.2
Reactive silica, as SiO2	mg/L	-	-	-	-	-	0.27	0.27	0.27	0.26	0.27
Cyanide Species											
Cyanide	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients											
Nitrate	mg-N/L	124	2.9	10	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	0.14	0.16	0.14	0.12	0.14
Total phosphorus	mg-P/L	-	-	-	-	-	0.0031	0.0030	0.0032	0.0047	0.0036
Dissolved phosphorus	mg-P/L	-	-	-	-	-	0.0022	0.0026	0.0019	0.0033	0.0026
Orthophosphate	mg-P/L	-	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001
Total organic carbon	mg/L	-	-	-	-	-	2.7	2.0	2.3	2.2	2.3
Dissolved organic carbon	mg/L	-	-	-	-	-	2.7	2.1	2.2	2.4	2.1
Total Metals											
Aluminum	µg/L	-	5.0 - 100	-	200	-	3.0	2.7	2.7	2.5	1.8
Antimony	µg/L	-	-	6	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	25	0.28	0.22	0.25	0.22	0.25
Barium	µg/L	-	-	1,000	-	-	8.0	7.5	7.8	7.4	7.7
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	-	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	-	0.0077	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	0.028	0.013	0.011	0.016	0.014
Chromium	µg/L	-	1.0	50	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	0.014	0.014	0.013	0.010	0.010
Copper	µg/L	-	2	-	1,000	-	1.0	0.71	0.86	0.74	0.83
Iron	µg/L	-	300	-	300	1,060	7.6	7.0	7.5	6.6	6.8
Lead	µg/L	-	1	10	-	-	0.070	0.010	0.011	<0.01	<0.01
Lithium	µg/L	-	-	-	-	-	0.93	0.68	0.67	0.68	0.63
Manganese	µg/L	-	-	-	50	-	3.3	2.5	2.5	2.4	2.8
Mercury	µg/L	-	0.026	1	-	-	0.00050	0.00050	<0.0005	0.00060	0.00070
Molybdenum	µg/L	-	73	-	-	-	0.078	0.082	0.074	0.078	0.073
Nickel	µg/L	-	25	-	-	-	0.50	0.36	0.37	0.31	0.41
Rubidium	µg/L	-	-	-	-	-	1.5	1.3	1.4	1.4	1.4
Selenium	µg/L	-	1	50	-	-	0.043	0.041	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	-	131	130	130	123	134
Silver	µg/L	-	0.25	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	34	33	33	33	32
Sulphur	µg/L	-	-	-	-	-	1,150	1,070	1,070	1,150	1,200
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	-	0.015	0.015	0.017	0.014	0.015
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	-	5.8	1.4	1.3	2.0	0.56
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Metals											
Aluminum	µg/L	-	-	-	-	-	1.6	1.5	1.9	1.6	1.6
Antimony	µg/L	-	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	-	0.25	0.23	0.24	0.26	0.26
Barium	µg/L	-	-	-	-	-	7.6	7.4	7.7	7.6	7.5
Beryllium	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	-	<10	<10	<10	<10	<10
Cadmium	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	-	0.043	0.022	0.077	0.028	0.014
Chromium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	-	0.032	0.031	0.037	0.034	0.037
Copper	µg/L	-	-	-	-	-	0.70	0.69	0.77	0.78	0.74
Iron	µg/L	-	-	-	-	-	3.9	4.1	4.1	4.3	4.4
Lead	µg/L	-	-	-	-	-	0.011	0.0059	0.0085	0.0061	0.014
Lithium	µg/L	-	-	-	-	-	0.78	0.70	0.66	0.79	0.72
Manganese	µg/L	-	-	-	-	-	0.51	0.59	0.63	0.62	0.62
Mercury	µg/L	-	-	-	-	-	0.00060	0.00060	0.00050	0.00060	0.00060
Molybdenum	µg/L	-	-	-	-	-	0.075	0.079	0.087	0.075	0.089
Nickel	µg/L	-	-	-	-	-	0.31	0.31	0.32	0.32	0.31
Rubidium	µg/L	-	-	-	-	-	1.4	1.3	1.3	1.3	1.4
Selenium	µg/L	-	-	-	-	-	<0.04	<0.04	<0.04	<0.04	0.044
Silicon	µg/L	-	-	-	-	-	124	124	128	124	124
Silver	µg/L	-	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	-	31	31	30	31	31
Sulphur	µg/L	-	-	-	-	-	1,200	1,190	1,160	1,240	1,240
Tellurium	µg/L	-	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	-	-	-	-	<0.002	0.0021	<0.002	<0.002	<0.002
Thorium	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	µg/L	-	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	-	-	-	-	-	0.015	0.014	0.014	0.015	0.014
Vanadium	µg/L	-	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	-	-	-	-	1.3	1.4	1.3	0.80	0.84
Zirconium	µg/L	-	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.
Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3C.6: Field and Laboratory Water Quality Data from Lake A8 in 2017

Station		Guidelines for the protection of:				A8-01		A8-02		A8-03	
Sample Date		Aquatic Life		Drinking Water	Aesthetic	07/17/2017	08/14/2017	07/17/2017	08/14/2017	07/17/2017	08/14/2017
Sample Depth		Acute	Chronic			1 m	1 m	1 m	1 m	1 m	1 m
Parameters	Unit										
Field Measured											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	7.9	8.3	7.9	8.3	7.9	8.4
Specific conductivity	µS/cm	-	-	-	-	306	306	306	306	255	268
Temperature	°C	-	-	-	15	14	14	14	14	14	14
Dissolved oxygen	mg/L	-	6.5	-	-	10.0	11	10	11	10	11
Dissolved oxygen	%	-	-	-	-	101	105	101	105	102	107
Secchi depth	m	-	-	-	-	2.5	2.5	1.8	2.4	2.3	1.4
Air temperature	deg c	-	-	-	-	-	16	-	16	-	16
Total depth	m	-	-	-	-	2.5	2.5	1.8	2.4	2.3	1.4
Wind speed	km/H	-	-	-	-	-	15	-	10	-	10
Conventional Parameters											
pH	-	-	6.5 - 9.0	-	7.0 - 11	7.7	7.7	7.8	7.7	7.9	7.7
Specific conductivity	µS/cm	-	-	-	-	305	318	300	307	250	269
Hardness, as $CaCO_3$	mg/L	-	-	-	-	113	108	110	115	98	104
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	47	48	45	46	50	51
Total dissolved solids	mg/L	-	-	-	500	197	219	213	229	166	194
Total dissolved solids (calculated)	mg/L	-	-	-	500	151	150	148	152	127	134
Total suspended solids	mg/L	-	-	-	-	<1.0	1.9	<1.0	3.4	1.0	2.0
Turbidity	NTU	-	-	-	-	0.50	0.38	0.49	0.39	0.61	0.46
Major Ions											
Bicarbonate	mg/L	-	-	-	-	58	59	55	56	61	62
Calcium	mg/L	-	-	-	-	37	35	36	36	32	33
Carbonate	mg/L	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	mg/L	640	120	-	250	60	61	60	61	43	48
Fluoride	mg/L	-	0.12	1.5	-	0.036	0.034	0.036	0.035	0.039	0.038
Hydroxide	mg/L	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	mg/L	-	-	-	-	5.0	4.8	4.9	4.8	4.3	4.5
Potassium	mg/L	-	-	-	-	2.0	2.2	2.2	2.2	1.9	1.9
Sodium	mg/L	-	-	-	200	8.3	8.4	8.4	8.2	6.8	7.1
Sulphate	mg/L	-	-	-	500	8.5	8.2	8.6	8.3	6.6	6.7
Reactive silica, as SiO2	mg/L	-	-	-	-	0.60	0.69	0.59	0.69	1.2	1.4
Cyanide Species											
Cyanide	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	<0.005	<0.001	<0.005	<0.001	<0.005	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients											
Nitrate	mg-N/L	124	2.9	10	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	<0.005	0.015	0.0089	0.0050	0.0053	0.011
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	0.30	0.31	0.30	0.31	0.38	0.31
Total phosphorus	mg-P/L	-	-	-	-	0.0074	0.0049	0.0062	0.0046	0.0097	0.0072
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0020	0.0024	0.0017	0.0021	0.0025	0.0024
Orthophosphate	mg-P/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	0.0012
Total organic carbon	mg/L	-	-	-	-	3.6	4.1	3.7	4.3	4.5	4.8
Dissolved organic carbon	mg/L	-	-	-	-	3.9	3.9	3.9	4.2	5.0	4.8
Total Metals											
Aluminum	µg/L	-	5.0 - 100	-	200	4.5	1.6	1.2	1.8	1.1	2.0
Antimony	µg/L	-	-	6	-	0.026	<0.02	0.40	<0.02	0.41	<0.02
Arsenic	µg/L	-	5.0	10	-	2.3	1.9	2.1	2.0	2.5	2.2
Barium	µg/L	-	-	1,000	-	30	28	31	29	27	26
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	0.0051	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	0.016	0.017	0.016	0.016	0.015	0.015
Chromium	µg/L	-	1.0	50	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	0.045	0.021	0.024	0.028	0.027	0.037
Copper	µg/L	-	2	-	1,000	0.71	0.63	0.61	0.85	0.66	0.75
Iron	µg/L	-	300	-	300	59	31	28	31	44	48
Lead	µg/L	-	1	10	-	0.030	<0.01	<0.01	<0.01	<0.01	0.016
Lithium	µg/L	-	-	-	-	9.1	10	10	10	7.4	8.3
Manganese	µg/L	-	-	-	50	12	6.7	6.0	7.3	8.1	10
Mercury	µg/L	-	0.026	1	-	0.0010	0.00060	0.0010	0.00080	0.0013	0.00090
Molybdenum	µg/L	-	73	-	-	0.22	0.22	0.22	0.22	0.22	0.23
Nickel	µg/L	-	25	-	-	0.87	0.82	0.82	0.77	0.94	0.90
Rubidium	µg/L	-	-	-	-	2.2	2.1	2.2	2.2	2.0	2.1
Selenium	µg/L	-	1	50	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	284	320	276	339	570	677
Silver	µg/L	-	0.25	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	266	270	266	270	200	219
Sulphur	µg/L	-	-	-	-	2,810	2,710	2,660	2,740	2,080	2,400
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	0.0036	0.0030	0.0031	0.0029	0.0040	0.0036
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.02	<0.02	0.030	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	0.048	0.052	0.054	0.050	0.048	0.051
Vanadium	µg/L	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	2.8	1.1	<0.5	1.2	1.2	1.2
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Metals											
Aluminum	µg/L	-	-	-	-	1.8	2.7	2.4	3.1	7.2	1.9
Antimony	µg/L	-	-	-	-	0.024	0.096	0.020	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	1.8	1.9	1.8	1.8	2.1	2.2
Barium	µg/L	-	-	-	-	29	28	29	29	25	25
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	<10	<10	<10	<10	<10	<10
Cadmium	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	0.016	0.020	0.017	0.021	0.014	0.023
Chromium	µg/L	-	-	-	-	0.17	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	0.018	0.050	0.017	0.040	0.037	0.058
Copper	µg/L	-	-	-	-	1.0	0.84	0.92	0.75	1.1	0.90
Iron	µg/L	-	-	-	-	15	15	16	19	29	29
Lead	µg/L	-	-	-	-	0.0092	0.15	0.014	0.034	0.030	0.020
Lithium	µg/L	-	-	-	-	10	9.6	9.8	9.7	6.8	7.8
Manganese	µg/L	-	-	-	-	1.50	2.82	1.10	1.48	1.76	2.89
Mercury	µg/L	-	-	-	-	0.00090	0.0011	0.00090	0.00090	0.0010	0.0010
Molybdenum	µg/L	-	-	-	-	0.23	0.26	0.22	0.25	0.21	0.29
Nickel	µg/L	-	-	-	-	0.81	0.74	0.81	0.73	1.2	0.84
Rubidium	µg/L	-	-	-	-	2.0	2.2	2.1	2.2	2.0	2.0
Selenium	µg/L	-	-	-	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	338	327	304	331	553	656
Silver	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	271	251	256	253	194	206
Sulphur	µg/L	-	-	-	-	2,860	3,000	2,790	2,840	2,160	2,390
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	-	-	-	0.0042	0.0038	0.0037	0.0039	0.0047	0.0037
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.01	0.016	<0.01	0.011	<0.01	0.012
Titanium	µg/L	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	-	-	-	-	0.049	0.055	0.053	0.056	0.046	0.053
Vanadium	µg/L	-	-	-	-	<0.05	<0.05	<0.05	<0.05	0.055	<0.05
Zinc	µg/L	-	-	-	-	0.71	1.8	2.0	1.9	8.3	2.0
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances.
Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3C.7: Field and Laboratory Water Quality Data from Lake B7 in 2017

Station		Guidelines for the protection of:				B7-01		B7-02		B7-03	
Sample Date		Aquatic Life		Drinking Water	Aesthetic	07/20/2017	08/08/2017	07/20/2017	08/08/2017	07/20/2017	08/08/2017
Sample Depth		Acute	Chronic			1 m	1 m	1 m	1 m	1 m	1 m
Parameters	Unit										
Field Measured											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	7.9	8.2	7.9	8.2	7.9	8.1
Specific conductivity	µS/cm	-	-	-	-	158	160	157	159	158	160
Temperature	°C	-	-	-	15	9.4	12	9.7	12	10	12
Dissolved oxygen	mg/L	-	6.5	-	-	12	11	11	11	11	11
Dissolved oxygen	%	-	-	-	-	105	106	103	105	102	103
Secchi depth	m	-	-	-	-	1.5	1.4	2.1	1.8	2.1	1.9
Air temperature	deg c	-	-	-	-	-	10	-	10	-	10
Total depth	m	-	-	-	-	1.5	1.4	2.1	1.8	2.1	1.9
Conventional Parameters											
pH	-	-	6.5 - 9.0	-	7.0 - 11	7.7	7.7	7.7	7.6	7.6	7.6
Specific conductivity	µS/cm	-	-	-	-	162	163	161	162	161	163
Hardness, as $CaCO_3$	mg/L	-	-	-	-	63	62	65	61	63	60
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	38	38	37	37	37	38
Total dissolved solids	mg/L	-	-	-	500	109	95	101	96	102	98
Total dissolved solids (calculated)	mg/L	-	-	-	500	77	81	78	80	77	80
Total suspended solids	mg/L	-	-	-	-	2.2	2.2	1.0	<1.0	1.1	<1.0
Turbidity	NTU	-	-	-	-	0.45	0.47	0.33	0.41	0.44	0.42
Major Ions											
Bicarbonate	mg/L	-	-	-	-	46	46	45	45	46	46
Calcium	mg/L	-	-	-	-	20	21	21	21	21	20
Chloride	mg/L	640	120	-	250	20	23	20	23	20	23
Fluoride	mg/L	-	0.12	1.5	-	0.022	0.037	<0.02	0.037	<0.02	0.037
Magnesium	mg/L	-	-	-	-	2.5	2.5	2.6	2.5	2.4	2.5
Potassium	mg/L	-	-	-	-	1.4	1.4	1.4	1.4	1.2	1.3
Sodium	mg/L	-	-	-	200	4.0	4.2	4.0	4.4	4.0	4.1
Sulphate	mg/L	-	-	-	500	4.8	6.0	4.7	5.9	4.7	5.9
Reactive silica, as SiO2	mg/L	-	-	-	-	0.30	0.34	0.34	0.36	0.37	0.37
Cyanide Species											
Cyanide	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	<0.005	<0.001	<0.005	<0.001	<0.005	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients											
Nitrate	mg-N/L	124	2.9	10	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	<0.005	0.042	<0.005	0.025	0.0084	0.0095
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	0.33	0.39	0.36	0.41	0.34	0.44
Total phosphorus	mg-P/L	-	-	-	-	0.0056	0.0065	0.0069	0.0059	0.0056	0.0061
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0035	0.0034	0.0029	0.0036	0.0028	0.0029
Orthophosphate	mg-P/L	-	-	-	-	<0.001	<0.001	<0.001	<0.001	0.0012	<0.001
Total organic carbon	mg/L	-	-	-	-	5.5	5.4	5.4	5.4	4.8	5.4
Dissolved organic carbon	mg/L	-	-	-	-	5.6	5.3	5.3	5.2	5.1	5.1
Total Metals											
Aluminum	µg/L	-	5.0 - 100	-	200	3.0	3.1	5.7	2.6	4.0	1.9
Antimony	µg/L	-	-	6	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	1.3	1.4	1.3	1.3	1.4	1.3
Barium	µg/L	-	-	1,000	-	18	19	19	19	18	18
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	<0.005	<0.005	0.0070	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	0.012
Chromium	µg/L	-	1.0	50	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	0.035	0.034	0.039	0.035	0.036	0.035
Copper	µg/L	-	2	-	1,000	0.72	0.77	1.1	0.94	0.76	0.72
Iron	µg/L	-	300	-	300	61	66	56	60	55	57
Lead	µg/L	-	1	10	-	<0.01	0.011	0.084	0.019	0.015	<0.01
Lithium	µg/L	-	-	-	-	5.1	4.9	4.0	4.7	3.9	4.2
Manganese	µg/L	-	-	-	50	4.1	4.2	4.5	4.9	4.4	4.7
Mercury	µg/L	-	0.026	1	-	0.0021	0.00050	0.0017	0.00050	0.0010	0.00050
Molybdenum	µg/L	-	73	-	-	0.17	0.16	0.17	0.18	0.17	0.17
Nickel	µg/L	-	25	-	-	1.1	0.99	1.3	0.94	1.2	0.93
Rubidium	µg/L	-	-	-	-	1.4	1.6	1.4	1.5	1.4	1.4
Selenium	µg/L	-	1	50	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	154	169	170	176	174	174
Silver	µg/L	-	0.25	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	140	139	136	148	137	138
Sulphur	µg/L	-	-	-	-	1,980	1,770	1,920	1,910	1,840	1,960
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	0.0035	0.0033	0.0030	0.0030	0.0028	0.0027
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	0.028	0.026	0.025	0.026	0.025	0.029
Vanadium	µg/L	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	30	-	5,000	1.5	0.54	10	0.99	1.9	0.65
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	0.31	<0.06
Dissolved Metals											
Aluminum	µg/L	-	-	-	-	3.5	3.4	1.5	1.6	1.5	3.8
Antimony	µg/L	-	-	-	-	<0.02	<0.02	<0.02	0.036	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	1.2	1.2	1.2	1.2	1.2	1.2
Barium	µg/L	-	-	-	-	18	17	18	18	18	18
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	<10	<10	<10	19	<10	<10
Cadmium	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	0.012	0.010	0.011
Chromium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	0.16	<0.1	0.19
Cobalt	µg/L	-	-	-	-	0.037	0.053	0.036	0.038	0.035	0.064
Copper	µg/L	-	-	-	-	0.94	0.77	0.96	1.16	1.08	~~1.31~~
Iron	µg/L	-	-	-	-	38	38	31	34	30	22
Lead	µg/L	-	-	-	-	0.064	-	0.016	0.036	0.010	0.24
Lithium	µg/L	-	-	-	-	4.6	4.6	4.5	4.6	4.6	4.5
Manganese	µg/L	-	-	-	-	1.9	0.87	0.89	0.82	0.85	2.7
Mercury	µg/L	-	-	-	-	0.00070	0.00050	0.00060	0.00060	0.00070	0.00060
Molybdenum	µg/L	-	-	-	-	0.17	0.23	0.18	0.27	0.17	0.21
Nickel	µg/L	-	-	-	-	0.96	0.96	1.1	1.0	1.0	1.0
Rubidium	µg/L	-	-	-	-	1.4	1.4	1.4	1.5	1.3	1.4
Selenium	µg/L	-	-	-	-	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Silicon	µg/L	-	-	-	-	156	157	170	199	206	196
Silver	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	132	139	134	138	133	129
Sulphur	µg/L	-	-	-	-	1,960	1,910	1,970	2,100	1,930	1,980
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	-	-	-	0.0034	0.0029	0.0039	0.0026	0.0033	0.0032
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.01	<0.01	<0.01	0.037	0.015	0.088
Titanium	µg/L	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	-	-	-	-	0.030	0.029	0.027	0.030	0.027	0.032
Vanadium	µg/L	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	-	-	-	1.5	0.96	2.3	1.5	<0.5	3.2
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
(C) = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3C.8: Field and Laboratory Water Quality Data from Lake D7 in 2017

Station		Guidelines for the protection of:				D7-01		D7-02		D7-03	
Sample Date		Aquatic Life		Drinking Water	Aesthetic	07/21/2017	08/10/2017	07/21/2017	08/10/2017	07/22/2017	08/10/2017
Sample Depth		Acute	Chronic			1 m	1 m	1 m	1 m	1 m	1 m
Parameters	Unit										
Field Measured											
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	8.2	8.3	8.2	8.3	8.2	8.4
Specific conductivity	µS/cm	-	-	-	-	152	154	151	154	151	154
Temperature	°C	-	-	-	15	12	13	12	13	12	13
Dissolved oxygen	mg/L	-	6.5	-	-	11	11	11	11	11	11
Dissolved oxygen	%	-	-	-	-	108	103	108	103	108	105
Secchi depth	m	-	-	-	-	1.7	1.7	1.8	1.9	2.0	1.7
Total depth	m	-	-	-	-	1.7	1.7	1.8	1.9	2.0	1.7
Conventional Parameters											
pH	-	-	6.5 - 9.0	-	7.0 - 11	7.3	7.8	7.3	7.9	7.3	7.9
Specific conductivity	µS/cm	-	-	-	-	152	160	152	158	151	157
Hardness, as $CaCO_3$	mg/L	-	-	-	-	53	56	52	56	52	58
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	55	55	55	55	54	54
Total dissolved solids	mg/L	-	-	-	500	95	89	89	90	100	91
Total dissolved solids (calculated)	mg/L	-	-	-	500	79	81	78	81	78	79
Total suspended solids	mg/L	-	-	-	-	<1.0	2.2	1.0	<1.0	<1.0	1.6
Turbidity	NTU	-	-	-	-	0.82	0.95	0.82	1.0	0.79	1.0
Major Ions											
Bicarbonate	mg/L	-	-	-	-	67	68	67	67	66	66
Calcium	mg/L	-	-	-	-	16	17	15	16	15	17
Carbonate	mg/L	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Chloride	mg/L	640	120	-	250	12	12	12	12	12	12
Fluoride	mg/L	-	0.12	1.5	-	0.043	0.044	0.043	0.047	0.043	0.052
Hydroxide	mg/L	-	-	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Magnesium	mg/L	-	-	-	-	2.9	3.4	2.9	3.3	2.9	3.2
Potassium	mg/L	-	-	-	-	1.3	1.5	1.3	1.5	1.3	1.5
Sodium	mg/L	-	-	-	200	8.0	8.7	8.1	8.6	7.8	8.5
Sulphate	mg/L	-	-	-	500	5.0	5.2	4.9	5.2	5.0	3.8
Reactive silica, as SiO2	mg/L	-	-	-	-	0.14	0.14	0.14	0.14	0.13	0.14
Cyanide Species											
Cyanide	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cyanide (free)	mg/L	-	0.005	0.2	-	<0.005	<0.001	<0.005	<0.001	<0.005	<0.001
Cyanide (WAD)	mg/L	-	0.005	0.2	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nutrients											
Nitrate	mg-N/L	124	2.9	10	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrite	mg-N/L	-	0.06	1	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Total ammonia	mg-N/L	-	0.66 - 427	-	-	0.0057	0.012	0.0059	0.0077	0.0069	0.0056
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	0.24	0.45	0.27	0.34	0.24	0.37
Total phosphorus	mg-P/L	-	-	-	-	0.014	0.011	0.013	0.012	0.017	0.012
Dissolved phosphorus	mg-P/L	-	-	-	-	0.0040	0.0061	0.0040	0.0064	0.0041	0.0052
Orthophosphate	mg-P/L	-	-	-	-	0.0018	<0.001	<0.001	<0.001	0.0013	<0.001
Total organic carbon	mg/L	-	-	-	-	4.8	5.2	4.8	5.2	4.9	5.2
Dissolved organic carbon	mg/L	-	-	-	-	4.5	5.1	4.5	5.1	4.4	5.1
Total Metals											
Aluminum	µg/L	-	5.0 - 100	-	200	4.2	5.6	4.7	6.4	5.1	6.7
Antimony	µg/L	-	-	6	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	5.0	10	-	0.98	0.93	1.0	0.94	1.1	0.90
Barium	µg/L	-	-	1,000	-	16	16	17	17	17	15
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	29,000	1,500	5,000	-	11	13	11	13	12	13
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5	-	<0.005	<0.005	<0.005	<0.005	0.011	<0.005
Cesium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	-	1.0	50	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	-	-	-	-	0.043	0.046	0.039	0.047	0.044	0.043
Copper	µg/L	-	2	-	1,000	0.97	0.79	0.81	0.90	1.0	1.2
Iron	µg/L	-	300	-	300	43	49	44	52	42	50
Lead	µg/L	-	1	10	-	<0.01	0.015	<0.01	0.019	<0.02	0.023
Lithium	µg/L	-	-	-	-	1.3	1.8	1.3	1.8	1.6	1.8
Manganese	µg/L	-	-	-	50	10	12	9.2	13	9.3	11
Mercury	µg/L	-	0.026	1	-	0.0011	0.00080	0.0011	0.00080	<0.0005	0.00070
Molybdenum	µg/L	-	73	-	-	0.43	0.46	0.41	0.46	0.43	0.48
Nickel	µg/L	-	25	-	-	0.67	0.64	0.68	0.73	0.80	0.69
Rubidium	µg/L	-	-	-	-	1.4	1.5	1.2	1.4	1.4	1.4
Selenium	µg/L	-	1	50	-	<0.04	0.059	0.040	0.050	<0.04	0.050
Silicon	µg/L	-	-	-	-	83	76	79	83	78	78
Silver	µg/L	-	0.25	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	79	82	78	81	82	81
Sulphur	µg/L	-	-	-	-	1,840	1,740	1,780	1,900	1,790	1,650
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	0.8	-	-	<0.002	<0.002	<0.002	<0.002	0.0042	0.0022
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Titanium	µg/L	-	-	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	33	15	20	-	0.087	0.098	0.084	0.10	0.089	0.10
Vanadium	µg/L	-	-	-	-	<0.05	0.057	0.054	0.069	0.061	0.052
Zinc	µg/L	-	30	-	5,000	1.2	2.0	0.57	2.9	<3.0	1.9
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Dissolved Metals											
Aluminum	µg/L	-	-	-	-	2.0	4.6	3.9	5.7	2.3	3.0
Antimony	µg/L	-	-	-	-	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Arsenic	µg/L	-	-	-	-	0.79	0.87	0.79	0.91	0.80	0.88
Barium	µg/L	-	-	-	-	15	16	16	16	15	16
Beryllium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Bismuth	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	µg/L	-	-	-	-	11	12	11	11	10	11
Cadmium	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cesium	µg/L	-	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	0.19	<0.1
Cobalt	µg/L	-	-	-	-	0.040	0.063	0.065	0.058	0.034	0.054
Copper	µg/L	-	-	-	-	1.09	0.85	1.03	0.91	~~1.11~~	0.79
Iron	µg/L	-	-	-	-	16	25	12	36	16	19
Lead	µg/L	-	-	-	-	0.0081	0.039	0.17	0.025	0.010	0.014
Lithium	µg/L	-	-	-	-	1.6	1.8	1.5	1.8	1.6	1.9
Manganese	µg/L	-	-	-	-	0.71	1.5	3.0	5.7	0.63	0.91
Mercury	µg/L	-	-	-	-	0.0016	0.00090	0.0013	0.00090	0.0014	0.00090
Molybdenum	µg/L	-	-	-	-	0.42	0.51	0.40	0.52	0.39	0.51
Nickel	µg/L	-	-	-	-	0.60	0.68	0.62	0.66	0.61	0.66
Rubidium	µg/L	-	-	-	-	1.1	1.3	1.2	1.4	1.2	1.3
Selenium	µg/L	-	-	-	-	<0.04	<0.04	0.046	0.047	0.044	0.041
Silicon	µg/L	-	-	-	-	81	75	64	86	94	73
Silver	µg/L	-	-	-	-	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Strontium	µg/L	-	-	-	-	70	78	70	76	67	76
Sulphur	µg/L	-	-	-	-	1,660	1,930	1,660	1,810	1,610	1,890
Tellurium	µg/L	-	-	-	-	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	-	-	-	-	<0.002	0.0027	<0.002	<0.002	<0.002	0.0021
Thorium	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	-	-	-	-	<0.01	0.012	0.013	<0.01	0.020	<0.01
Titanium	µg/L	-	-	-	-	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	-	-	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	-	-	-	-	0.098	0.10	0.093	0.098	0.095	0.10
Vanadium	µg/L	-	-	-	-	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Zinc	µg/L	-	-	-	-	1.1	1.5	1.4	1.0	1.4	<0.5
Zirconium	µg/L	-	-	-	-	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06

Note: Concentration data values that failed the QC screening are crossed out in the table (e.g., ~~2.1~~). These values were not included in the calculations of summary statistics.
(C) = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
Water quality data and guidelines represented in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
m = metres; °C = degrees Celsius; - = not applicable/not recorded; NW = northwest; S = south; SE = southeast; S/SW = south-southwest; SW = southwest; N = north; W/SW = west-southwest; µS/cm = microSiemens per centimetre; mg/L = milligrams per litre; % = percent; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid

Table 3D.1-1: Field and Laboratory Statistical Summaries from MEL-01 (near-field) Under-ice Conditions, 2016 to 2017

Parameter	Unit	Guidelines for the protection of:					Under-Ice											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	2015-2017											
		Acute	Chronic				Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
														A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	20	**6.0**[C,S]	7.3	7.3	8.2	0.62	0	-	15	-	35	-
Specific conductivity	µS/cm	-	-	-	-	-	16	49	75	79	99	16	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	20	0.02	1.1	1.2	2.1	0.49	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	9	**5.0**[C]	8.9	8.6	13	3.2	0	-	44	-	-	-
Dissolved oxygen	%	-	-	-	-	-	9	38	64	62	90	21	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	15	<20	<29	13	<32	2.7	15	-	-	-	-	-
Total depth	m	-	-	-	-	-	20	7.2	8.4	8.4	9.6	0.68	0	-	-	-	-	-
Ice thickness	m	-	-	-	-	-	20	0.75	1.0	0.99	1.4	0.16	0	-	-	-	-	-
Snow depth	m	-	-	-	-	-	10	0.070	0.15	0.14	0.25	0.051	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	20	**6.9**[S]	7.0	7.0	7.3	0.12	0	-	-	-	35	-
Specific conductivity	µS/cm	-	-	-	-	-	20	83	91	90	98	5.4	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	20	24	27	27	32	2.1	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	20	13	17	18	21	1.7	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	20	28	54	52	67	10	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	20	41	45	44	48	2.8	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	20	<1.0	<1.0	0.50	<1.0	0	20	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	20	0.14	0.18	0.20	0.42	0.062	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	20	16	21	21	25	2.1	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	15	7.5	8.9	8.6	10	0.75	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	20	10	12	12	13	0.98	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	20	0.025	0.027	0.027	0.029	0.0014	0	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	15	1.3	1.5	1.5	1.6	0.090	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	15	0.96	1.1	1.1	1.1	0.065	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	15	5.8	5.9	5.9	6.3	0.14	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	20	4.6	5.2	5.1	6.8	0.51	0	-	-	-	-	-
Silica	mg/L	-	-	-	-	-	10	0.33	0.38	0.38	0.44	0.032	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	10	0.49	0.57	0.56	0.62	0.048	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.005	0.2	-	-	20	<0.002	<0.005	0.0018	<0.005	0.00077	20	-	-	-	-	-
Cyanide (free)	mg/L	-	0.005	0.2	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	20	<0.002	<0.005	0.0018	<0.005	0.00077	20	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	20	<0.005	0.010	0.023	0.27	0.057	1	-	-	-	-	-
Nitrite	mg-N/L	-	0.06	1	-	-	20	<0.001	<0.001	0.00080	0.0036	0.00072	15	-	-	-	-	-
Total ammonia	mg-N/L	-	0.66 - 157	-	-	-	20	0.014	0.024	0.023	0.030	0.0050	0	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	20	0.11	0.20	0.20	0.28	0.040	0	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	15	0.0018	0.003	0.0033	0.005	0.0010	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	15	<0.001	0.001	0.0015	0.004	0.0011	5	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	10	<0.001	0.001	0.0013	0.0019	0.00047	2	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	17	3.0	3.2	3.3	3.6	0.17	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	17	3.0	3.2	3.2	3.6	0.18	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	20	0.65	1.1	1.4	5.2	1.0	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	20	<0.02	<0.02	0.015	0.064	0.013	16	-	-	-	-	-
Arsenic	µg/L	-	5	10	-	25	20	0.32	0.38	0.39	0.46	0.037	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	20	8.2	8.8	8.8	9.5	0.31	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	20	4.5	5.4	5.6	8.1	1.1	0	-	-	-	-	-
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5.0	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Chromium	µg/L	-	1	50	-	-	20	<0.06	<0.06	0.030	<0.06	0	20	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	20	<0.01	0.013	0.013	0.015	0.0028	2	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	20	0.81	0.89	0.91	1.1	0.068	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	20	6.7	8.6	8.5	11	1.3	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	20	<0.01	<0.01	0.086	**1.2**[C]	0.28	12	-	5.0	-	-	-
Lithium	µg/L	-	-	-	-	-	20	0.51	0.85	0.84	1.2	0.21	0	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	20	1.5	2.3	2.4	3.8	0.79	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	20	<0.0005	0.00050	0.00041	0.00070	0.00017	10	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	20	0.059	0.080	0.079	0.099	0.011	0	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	20	0.59	0.67	0.67	0.71	0.038	0	-	-	-	-	-
Selenium	µg/L	-	1	50	-	-	20	<0.04	0.040	0.032	0.049	0.012	10	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	20	35	42	41	47	4.4	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	20	<0.1	<0.1	0.050	<0.1	0	20	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	20	0.012	0.015	0.015	0.018	0.0017	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	20	<0.8	<0.8	0.62	2.9	0.59	16	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	20	0.59	0.83	0.95	1.9	0.36	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	20	<0.02	<0.02	0.011	0.031	0.0047	19	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	20	0.34	0.37	0.37	0.43	0.027	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	20	8.2	8.8	8.8	9.4	0.33	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	20	4.4	5.3	5.7	8.1	1.2	0	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0026	0.0050	0.00056	19	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	20	<0.06	<0.06	0.030	<0.06	0	20	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0064	0.013	0.0028	16	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	20	0.78	0.87	0.88	1.0	0.061	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	20	2.4	3.3	3.6	7.0	1.1	0	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	19	<0.01	0.011	0.038	0.32	0.074	9	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	20	0.57	0.79	0.85	1.2	0.19	0	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	20	0.15	0.34	0.33	0.63	0.15	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	20	<0.0005	0.00050	0.00041	0.00070	0.00017	10	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	20	0.065	0.079	0.079	0.095	0.0090	0	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	19	0.60	0.65	0.66	0.71	0.035	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	20	<0.04	<0.04	0.029	0.055	0.014	14	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	20	35	41	41	48	4.2	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	20	<0.1	<0.1	0.050	<0.1	0	20	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	20	0.012	0.014	0.015	0.017	0.0015	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	20	<0.8	<0.8	1.1	11	2.5	16	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
[C] = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
[S] = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.1-2: Field and Laboratory Statistical Summaries from MEL-01 (near-field) Open-water Conditions, 2015 to 2017

Parameter	Unit	Guidelines for the protection of:					Open Water 2015-2017											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
		Acute	Chronic											A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	43	**7.0**$^{(S)}$	7.5	7.5	8.1	0.27	0	-	-	-	2.0	-
Specific conductivity	µS/cm	-	-	-	-	-	44	64	72	74	82	6.3	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	44	6.2	12.6	11.2	14	2.3	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	44	7.4	10.5	10	13	1.2	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	42	71	101	96	112	9.6	0	-	-	-	-	-
Secchi depth	m	-	-	-	-	-	40	4.8	5.8	6.1	8.9	1.0	0	-	-	-	-	-
Total depth	m	-	-	-	-	-	42	7.3	8.7	8.7	10	0.69	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	44	7.2	7.3	7.3	7.7	0.14	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	44	67	74	75	84	5.0	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	44	19	23	22	25	1.9	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	44	13	15	16	20	1.7	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	44	25	47	46	61	8.4	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	44	32	37	37	43	3.6	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	44	<1.0	1.2	1.5	<5.0	1.0	34	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	44	0.23	0.41	0.44	1.2	0.19	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	44	16	19	19	25	2.1	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	44	5.8	7.1	6.9	7.8	0.59	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	44	8.2	9.4	9.5	11	0.89	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	44	<0.02	0.024	0.020	0.032	0.0080	17	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	44	1.0	1.2	1.2	1.4	0.11	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	44	0.78	0.89	0.89	1.1	0.073	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	43	4.1	4.9	4.8	6.3	0.45	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	44	3.2	4.1	4.1	4.9	0.50	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	44	0.093	0.47	0.45	0.60	0.10	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.005	0.2	-	-	44	<0.001	<0.002	0.00086	0.0023	0.00033	43	-	-	-	-	-
Cyanide (free)	mg/L	-	0.005	0.2	-	-	44	<0.001	<0.005	0.0020	<0.005	0.00085	44	-	-	-	-	-
Cyanide (WAD)	mg/L	-	0.005	0.2	-	-	44	<0.001	<0.002	0.00083	<0.002	0.00024	44	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	44	<0.005	<0.005	0.0075	0.073	0.017	38	-	-	-	-	-
Nitrite	mg-N/L	-	0.06	1	-	-	44	<0.001	<0.001	0.00050	<0.001	0	44	-	-	-	-	-
Total ammonia	mg-N/L	-	0.66 - 157	-	-	-	44	<0.005	<0.005	0.0045	0.019	0.0040	32	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	44	<0.05	0.17	0.17	0.39	0.076	2	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	44	0.0038	0.006	0.0072	0.036	0.0052	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	44	<0.001	0.002	0.0022	0.0056	0.00095	1	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	44	<0.001	<0.001	0.00073	0.0020	0.00042	32	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	44	2.3	2.9	3.0	4.3	0.41	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	44	2.3	2.9	3.0	4.1	0.40	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	44	1.7	2.9	3.9	22	3.4	1	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	44	<0.02	<0.02	0.015	0.11	0.018	41	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	44	0.29	0.39	0.39	0.55	0.059	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	44	6.6	7.3	7.4	8.7	0.56	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	44	<0.01	<0.01	0.0060	<0.1	0.0068	44	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	44	<0.005	<0.01	0.0046	<0.05	0.0034	44	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	44	3.3	<5.0	4.7	<10	1.9	15	-	-	-	-	-
Cadmium	µg/L	0.38 - 0.66	0.039 - 0.062	5.0	-	-	44	<0.005	<0.005	0.0027	0.0082	0.00098	42	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	44	<0.06	<0.06	0.037	<0.1	0.0097	44	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	44	0.015	0.021	0.022	<0.1	0.0067	1	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	44	0.67	0.74	0.82	1.4	0.17	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	44	15	21	22	45	5.6	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	44	<0.01	<0.01	0.037	0.90	0.14	30	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	44	<0.5	0.69	0.72	1.5	0.27	4	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	44	3.8	5.5	6.3	11	2.0	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	44	<0.0005	0.00060	0.00070	0.0019	0.00037	8	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	44	<0.05	0.066	0.064	0.12	0.020	6	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	44	0.49	0.59	0.60	0.83	0.086	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	44	<0.04	<0.04	0.024	<0.05	0.0087	37	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	44	<0.005	<0.005	0.0027	<0.01	0.00078	43	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	44	27	33	33	40	3.7	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	44	<0.002	<0.005	0.0022	<0.01	0.0011	42	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	44	<0.02	<0.05	0.022	<0.1	0.0095	41	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	44	<0.1	0.13	0.16	0.81	0.14	33	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	44	0.012	0.015	0.016	0.022	0.0026	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	44	<0.05	<0.05	0.032	<0.5	0.036	43	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	44	0.62	<0.8	1.5	9.5	2.2	27	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	38	0.48	1.2	1.4	4.1	0.67	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	44	<0.02	<0.02	0.016	0.16	0.023	37	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	44	0.26	0.35	0.36	0.48	0.055	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	44	6.5	7.2	7.2	7.9	0.36	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	44	<0.01	<0.01	0.0050	<0.01	0	44	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	44	<0.005	<0.01	0.0041	<0.01	0.0012	44	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	44	3.4	6.6	5.5	<10	1.1	15	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	44	<0.005	<0.005	0.0031	0.0086	0.0017	39	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	44	<0.06	0.070	0.059	0.23	0.046	34	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	44	<0.005	0.010	0.012	0.054	0.011	19	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	31	0.55	0.77	0.87	2.6	0.37	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	44	2.6	6.5	6.5	12	1.9	0	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	44	0.0062	<0.01	0.040	0.36	0.071	20	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	44	<0.5	0.70	0.80	2.7	0.47	4	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	44	0.44	0.78	1.1	4.3	0.98	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	44	<0.0005	0.00050	0.00063	0.0018	0.00043	18	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	44	<0.05	0.072	0.079	0.18	0.036	4	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	42	0.46	0.57	0.58	0.71	0.055	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	44	<0.04	<0.04	0.021	0.052	0.0060	42	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	44	<0.005	<0.005	0.0025	<0.005	0	44	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	44	27	32	32	38	3.1	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	44	<0.002	<0.005	0.0022	<0.005	0.00062	38	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	44	<0.01	<0.05	0.097	3.1	0.46	33	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	44	<0.1	<0.1	0.092	<0.3	0.050	40	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	44	<0.01	0.014	0.014	0.019	0.0030	2	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	44	<0.05	<0.05	0.026	0.086	0.0092	43	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	44	<0.5	<0.8	2.4	17	3.7	21	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
$^{(C)}$ = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
$^{(S)}$ = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; - = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.2-1: Field and Laboratory Statistical Summaries from MEL-02 (mid-field) Under-ice Conditions, 2016 to 2017

Parameter	Unit	Guidelines for the protection of:					Under-Ice 2015-2017											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
		Acute	Chronic											A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	20	**6.6**(S)	7.1	7.1	7.6	0.31	0	-	-	-	45	-
Specific conductivity	µS/cm	-	-	-	-	-	15	30	87	69	94	24	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	20	0.03	1.1	1.2	2.0	0.48	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	10	8.9	11	11	12	1.3	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	10	66	84	80	88	8.1	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	15	<28	<39	18	<40	2.9	15	-	-	-	-	-
Total depth	m	-	-	-	-	-	20	7.0	8.9	8.7	11	0.79	0	-	-	-	-	-
Ice thickness	m	-	-	-	-	-	19	0.86	1.0	1.0	1.3	0.13	0	-	-	-	-	-
Snow depth	m	-	-	-	-	-	10	0.075	0.15	0.18	0.30	0.075	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 10.5	-	20	**6.8**(S)	7.0	7.0	7.3	0.16	0	-	-	-	45	-
Specific conductivity	µS/cm	-	-	-	-	-	20	74	83	83	90	4.0	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	20	23	26	26	28	1.4	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	20	15	17	17	21	1.9	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	20	<10	45	43	66	13	1	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	20	37	41	41	46	2.1	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	20	<1.0	<1.0	0.53	1.1	0.13	19	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	20	0.13	0.15	0.15	0.23	0.023	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	20	18	21	21	26	2.3	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	15	7.1	8.2	8.1	8.7	0.50	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	20	8.6	10	10	11	0.80	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	20	0.021	0.026	0.027	0.034	0.0026	0	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	15	1.2	1.4	1.3	1.5	0.083	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	15	0.92	1.0	1.0	1.1	0.052	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	15	4.9	5.3	5.3	5.5	0.19	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	20	3.8	4.4	4.4	5.0	0.31	0	-	-	-	-	-
Silica	mg/L	-	-	-	-	-	10	0.21	0.30	0.29	0.31	0.031	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	10	0.36	0.41	0.42	0.49	0.036	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.0050	0.20	-	-	20	<0.002	<0.005	0.0018	<0.005	0.00077	20	-	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	-	20	<0.002	<0.005	0.0018	<0.005	0.00077	20	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	20	<0.005	0.006	0.0063	0.017	0.0041	8	-	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	-	20	<0.001	<0.001	0.00064	0.0015	0.00030	16	-	-	-	-	-
Total ammonia	mg-N/L	-	0.69 - 50	-	-	-	20	0.0086	0.016	0.016	0.023	0.0048	0	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	20	0.11	0.18	0.17	0.27	0.040	0	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	15	0.0013	0.003	0.0048	0.035	0.008	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	15	<0.001	0.002	0.0023	0.011	0.003	4	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	10	<0.001	0.001	0.0010	0.0016	0.00038	3	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	19	2.6	2.9	2.9	3.1	0.14	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	19	2.6	2.9	2.9	3.1	0.12	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	20	0.70	0.96	1.0	1.5	0.19	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	20	<0.02	<0.02	0.010	<0.02	0	20	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	20	0.23	0.28	0.28	0.31	0.020	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	20	8.2	8.8	8.9	10	0.43	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	20	4.0	5.1	5.3	7.2	0.93	0	-	-	-	-	-
Cadmium	µg/L	0.40 - 0.57	0.041 - 0.054	5.0	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	20	<0.06	<0.06	0.030	<0.06	0	20	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0066	0.014	0.0029	15	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	20	0.77	0.82	0.83	0.94	0.041	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	20	2.4	4.1	4.4	10	1.8	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	20	<0.01	0.012	0.014	0.042	0.011	9	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	20	0.55	0.84	0.83	1.1	0.21	0	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	20	0.83	1.4	1.4	2.5	0.34	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	20	<0.0005	<0.0005	0.00034	0.00060	0.00014	14	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	20	0.059	0.074	0.071	0.082	0.0071	0	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	20	0.45	0.53	0.53	0.58	0.029	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	20	<0.04	<0.04	0.030	0.050	0.012	12	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	20	33	39	39	45	3.2	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	20	<0.1	<0.1	0.050	<0.1	0	20	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	20	0.012	0.013	0.013	0.015	0.0012	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	20	<0.8	<0.8	1.8	27	5.9	17	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	20	<0.3	0.65	0.67	1.0	0.20	1	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	20	<0.02	<0.02	0.012	0.059	0.011	19	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	20	0.23	0.28	0.27	0.32	0.022	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	20	8.2	8.8	8.9	9.8	0.41	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	20	3.8	5.0	5.0	6.2	0.67	0	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	20	<0.06	<0.06	0.030	<0.06	0	20	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.0050	<0.01	0	20	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	20	0.74	0.80	0.80	0.94	0.041	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	20	<1.0	1.2	1.3	2.2	0.48	3	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	20	<0.01	<0.01	0.015	0.086	0.020	14	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	20	0.53	0.86	0.83	1.2	0.21	0	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	20	0.11	0.21	0.22	0.33	0.070	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	20	<0.0005	<0.0005	0.00034	0.00060	0.00014	14	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	20	0.053	0.072	0.071	0.083	0.0074	0	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	20	0.43	0.52	0.53	0.59	0.035	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	20	<0.04	<0.04	0.027	0.048	0.011	14	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	20	33	39	39	45	3.2	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	20	<0.005	<0.005	0.0025	<0.005	0	20	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	20	<0.1	<0.1	0.050	<0.1	0	20	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	20	0.010	0.013	0.013	0.015	0.0013	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	20	<0.05	<0.05	0.025	<0.05	0	20	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	20	<0.8	<0.8	0.61	2.2	0.48	16	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
(S) = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.2-2: Field and Laboratory Statistical Summaries from MEL-02 (mid-field) Open-water Conditions, 2015 to 2017

Parameter	Unit	Guidelines for the protection of:					Open Water											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	2015-2017											
		Acute	Chronic				Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
														A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	45	**6.6**[(S)]	7.6	7.5	8.1	0.29	0	-	-	-	4.0	-
Specific conductivity	µS/cm	-	-	-	-	-	45	59	69	69	77	5.3	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	45	8.8	12.5	11.4	14	1.8	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	45	8.1	10.8	10.7	13	1.1	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	43	75	102	98	111	9.2	0	-	-	-	-	-
Secchi depth	m	-	-	-	-	-	45	5.0	6.8	6.8	9.1	1.1	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	21	6.0	8.0	9.9	18	4.0	0	-	-	-	-	-
Total depth	m	-	-	-	-	-	45	7.2	9.0	8.8	10	0.71	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	45	**6.7**[(S)]	7.3	7.3	7.7	0.24	0	-	-	-	11	-
Specific conductivity	µS/cm	-	-	-	-	-	45	66	70	72	119	7.9	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	45	19	21	21	23	1.2	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	45	13	16	16	18	1.2	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	45	29	45	44	69	7.9	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	45	32	35	35	51	3.3	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	45	<1.0	1.1	1.8	7.6	1.7	36	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	45	0.22	0.31	0.36	0.86	0.15	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	45	16	19	19	22	1.5	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	45	6.1	6.7	6.6	7.5	0.36	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	45	7.8	8.6	8.9	21.5	2	0	-	-	-	-	-
Fluoride	mg/L	-	0	1.5	-	2.8	45	<0.02	0.03	0.02	0.03	0.01	6	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	45	1.0	1.1	1.1	1.3	0	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	45	0.79	0.9	0.9	1.0	0.058	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	45	4.01	4.38	4.45	5.73	0.331	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	45	3.2	3.7	3.8	5.5	0.38	0	-	-	-	-	-
Silica	mg/L	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	45	0.21	0.29	0.30	0.4	0.042	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.0050	0.20	-	-	45	<0.001	<0.002	0.00083	<0.002	0.00024	45	-	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	-	45	<0.001	<0.005	0.0021	<0.005	0.00084	45	-	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	-	45	<0.001	<0.002	0.00083	<0.002	0.00024	45	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	45	<0.005	<0.005	0.017	0.17	0.041	37	-	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	-	45	<0.001	<0.001	0.00050	<0.001	0	45	-	-	-	-	-
Total ammonia	mg-N/L	-	0.69 - 50	-	-	-	45	<0.005	<0.005	0.0037	0.012	0.0026	36	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	45	<0.05	0.17	0.17	0.61	0.082	1	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	45	0.0031	0.004	0.0050	0.015	0.0020	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	45	<0.001	0.002	0.0019	0.0045	0.00080	1	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	45	<0.001	<0.001	0.00074	0.0016	0.00036	30	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	45	2.2	2.6	2.7	3.4	0.28	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	45	2.1	2.6	2.7	3.3	0.30	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	45	1.5	2.4	3.8	41	6.0	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	45	<0.02	<0.02	0.011	0.028	0.0031	43	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	45	0.22	0.26	0.26	0.32	0.021	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	45	7.0	7.5	7.6	8.4	0.32	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	45	<0.01	<0.01	0.0050	<0.01	0	45	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	45	<0.005	<0.01	0.0042	<0.01	0.0012	44	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	45	3.1	<5.0	4.5	8.4	1.8	13	-	-	-	-	-
Cadmium	µg/L	0.40 - 0.57	0.041 - 0.054	5.0	-	-	45	<0.005	<0.005	0.0026	0.0061	0.00054	44	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	45	<0.06	<0.06	0.038	<0.1	0.013	44	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	45	0.0097	0.015	0.016	0.074	0.0095	1	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	45	0.65	0.74	0.83	1.8	0.22	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	45	9.2	13	16	90	12	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	45	<0.01	<0.01	0.021	0.17	0.038	33	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	45	<0.5	0.62	0.62	1.5	0.29	10	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	45	2.6	4.2	4.2	7.7	1.3	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	45	<0.0005	0.00060	0.00060	0.0016	0.00029	13	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	45	<0.05	0.063	0.060	0.13	0.026	12	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	45	0.40	0.51	0.50	0.74	0.058	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	45	<0.04	<0.04	0.025	0.048	0.0094	35	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	45	<0.005	<0.005	0.0026	0.0073	0.00072	44	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	45	26	31	32	37	3.0	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	45	<0.002	<0.005	0.0021	<0.005	0.00064	41	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	45	<0.02	<0.05	0.031	0.15	0.028	39	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	45	<0.1	<0.1	0.18	2.8	0.41	43	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	45	0.013	0.014	0.015	0.034	0.0034	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	45	<0.05	<0.05	0.028	0.14	0.018	44	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	45	<0.5	<0.8	1.7	11	2.8	30	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	42	0.43	1.2	1.4	4.7	0.83	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	45	<0.02	<0.02	0.011	0.029	0.0039	42	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	45	0.21	0.24	0.24	0.30	0.018	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	45	6.9	7.3	7.4	7.9	0.25	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	45	<0.01	<0.01	0.0051	0.011	0.00089	44	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	45	<0.005	<0.01	0.0042	<0.01	0.0012	45	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	45	3.3	6.1	5.0	<10	1.1	15	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	45	<0.005	<0.005	0.0030	0.0095	0.0015	41	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	45	<0.06	0.065	0.076	0.71	0.11	34	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	45	0.0079	<0.01	0.012	0.037	0.010	27	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	37	0.62	0.77	0.81	1.2	0.14	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	44	2.9	4.8	5.2	11	1.7	0	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	45	<0.005	<0.01	0.036	0.81	0.12	20	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	45	<0.5	0.66	0.68	1.5	0.29	7	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	45	0.35	0.72	0.85	3.6	0.61	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	43	<0.0005	0.00050	0.00058	0.0016	0.00039	20	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	45	<0.05	0.066	0.078	0.28	0.055	9	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	45	0.38	0.47	0.48	0.58	0.047	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	45	<0.04	<0.04	0.022	0.042	0.0067	40	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	45	<0.005	<0.005	0.0025	<0.005	0	45	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	45	27	31	31	37	2.3	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	45	<0.002	<0.005	0.0023	<0.005	0.00052	35	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	45	<0.01	<0.05	0.041	0.35	0.066	39	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	45	<0.1	<0.1	0.085	<0.3	0.048	44	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	45	<0.01	0.014	0.014	0.017	0.0024	1	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	45	<0.05	<0.05	0.025	<0.05	0	45	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	45	0.65	<0.8	2.8	45	7.2	26	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
[(S)] = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.3: Field and Laboratory Statistical Summaries from MEL-03 (Reference area 1) Open-water Conditions, 2016 to 2017

Parameter	Unit	Guidelines for the protection of:					Open-Water 2016-2017											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
		Acute	Chronic											A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	30	7.0	7.6	7.6	8.0	0.18	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	30	61	67	66	69	2.3	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	30	5.7	12.6	12	14	2.1	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	30	9.1	10.8	11	12	0.88	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	30	88	104	100	131	9.6	0	-	-	-	-	-
Secchi depth	m	-	-	-	-	-	29	6.5	7.5	7.5	9.5	0.80	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	6	5.0	12	11	13	3.0	0	-	-	-	-	-
Total depth	m	-	-	-	-	-	30	3.8	8.3	8.1	10	1.3	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	30	**6.6**$^{(S)}$	7.2	7.2	7.7	0.31	0	-	-	-	20	-
Specific conductivity	µS/cm	-	-	-	-	-	30	66	67	68	71	1.4	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	30	19	21	21	24	1.0	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	30	13	16	16	18	0.81	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	30	18	43	41	54	7.6	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	30	31	34	34	37	1.2	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	30	<1.0	<1.0	0.65	1.5	0.31	24	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	30	0.17	0.27	0.28	0.80	0.12	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	30	16	19	19	22	0.98	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	30	6.2	6.5	6.6	7.9	0.35	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	30	7.6	8.0	8.0	8.5	0.27	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	30	<0.02	0.026	0.023	0.030	0.0067	6	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	30	0.99	1.1	1.1	1.1	0.034	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	30	0.78	0.87	0.87	1.00	0.064	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	30	4.1	4.2	4.3	4.7	0.18	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	30	3.1	3.4	3.4	3.8	0.18	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	30	0.18	0.22	0.22	0.26	0.023	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.0050	0.20	-	-	30	<0.001	<0.002	0.00075	<0.002	0.00025	30	-	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	-	30	<0.001	<0.005	0.0018	<0.005	0.00096	30	-	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	-	30	<0.001	<0.002	0.00075	<0.002	0.00025	30	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	30	<0.005	<0.005	0.0083	0.14	0.025	26	-	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	-	30	<0.001	<0.001	0.00056	0.0016	0.00023	28	-	-	-	-	-
Total ammonia	mg-N/L	-	0.85 - 6.5	-	-	-	30	<0.005	<0.005	0.0047	0.016	0.0037	20	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	30	<0.05	0.14	0.15	0.33	0.057	1	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	30	0.0030	0.004	0.0047	0.0090	0.0014	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	30	<0.001	0.002	0.0020	0.0041	0.00078	1	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	30	<0.001	<0.001	0.00060	0.0016	0.00030	27	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	30	2.1	2.3	2.3	2.5	0.11	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	30	2.0	2.2	2.3	2.5	0.15	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	30	1.9	2.7	3.7	8.6	1.8	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	30	<0.02	<0.02	0.010	0.022	0.0022	29	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	30	0.17	0.20	0.20	0.26	0.019	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	30	7.0	7.5	7.5	7.9	0.22	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	30	<0.01	<0.01	0.0050	<0.01	0	30	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	30	<0.005	<0.01	0.0038	<0.01	0.0013	30	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	30	4.3	<5.0	4.4	8.0	2.1	15	-	-	-	-	-
Cadmium	µg/L	0.39 - 0.50	0.040 - 0.049	5.0	-	-	30	<0.005	<0.005	0.0047	0.035	0.0064	24	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	30	<0.06	<0.1	0.040	<0.1	0.010	30	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	30	<0.005	0.010	0.010	0.016	0.0036	5	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	30	0.65	0.71	0.74	0.99	0.084	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	30	6.8	11	12	35	5.1	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	30	<0.01	<0.01	0.023	0.21	0.045	23	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	30	<0.5	<0.5	0.44	0.92	0.23	16	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	30	1.9	2.3	2.5	3.7	0.51	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	30	<0.0005	0.00060	0.00057	0.0011	0.00025	8	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	30	<0.05	0.062	0.059	0.11	0.021	6	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	30	0.27	0.37	0.38	0.98	0.12	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	30	<0.04	<0.04	0.024	0.050	0.0098	25	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	30	<0.005	<0.005	0.0025	<0.005	0	30	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	30	29	31	31	33	1.1	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	30	<0.002	0.0021	0.0018	<0.005	0.00075	29	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	30	<0.02	<0.05	0.019	0.063	0.011	29	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	30	<0.1	0.34	0.18	<0.5	0.10	26	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	30	0.013	0.014	0.015	0.018	0.0013	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	30	<0.05	<0.05	0.025	<0.05	0	30	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	30	<0.5	<0.8	1.5	11	2.3	17	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	27	0.85	1.8	1.7	3.3	0.59	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	30	<0.02	<0.02	0.011	0.036	0.0052	28	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	30	0.17	0.20	0.20	0.23	0.011	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	30	6.8	7.3	7.2	7.6	0.21	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	30	<0.01	<0.01	0.0050	<0.01	0	30	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	30	<0.005	<0.01	0.0040	0.011	0.0018	29	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	29	4.1	<10	5.3	<10	0.65	15	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	30	<0.005	<0.005	0.0037	0.019	0.0035	26	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	30	<0.06	<0.1	0.055	0.15	0.031	24	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	30	0.0059	<0.01	0.013	0.038	0.011	15	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	26	0.51	0.74	0.74	0.95	0.11	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	30	2.7	3.9	4.2	6.6	1.0	0	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	30	<0.005	<0.01	0.011	0.053	0.011	15	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	30	<0.5	0.62	0.79	6.4	1.1	5	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	29	0.41	0.65	0.71	1.8	0.27	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	30	<0.0005	0.00075	0.00083	0.0020	0.00055	11	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	30	<0.05	0.071	0.077	0.16	0.032	2	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	30	0.19	0.36	0.36	0.52	0.060	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	30	<0.04	<0.04	0.025	0.053	0.011	24	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	30	<0.005	<0.005	0.0025	<0.005	0	30	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	30	28	30	30	32	1.1	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	30	<0.002	0.0028	0.0020	0.0068	0.0012	26	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	30	<0.01	<0.05	0.031	0.17	0.032	20	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	30	<0.1	<0.3	0.10	<0.3	0.051	30	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	30	0.011	0.013	0.014	0.017	0.0014	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	30	<0.05	<0.05	0.025	<0.05	0	30	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	30	<0.5	0.85	1.6	9.8	2.1	13	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
$^{(S)}$ = concentration is higher than the aesthetic Health Canada guideline or outside the recommended pH range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.4: Field and Laboratory Statistical Summaries from MEL-04 (Reference area 2) Open-water Conditions, 2016 to 2017

Parameter	Unit	Guidelines for the protection of:					Open-Water											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	2016-2017											
		Acute	Chronic				Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
														A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	10	7.6	7.6	7.6	7.7	0.031	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	10	65	67	67	68	1.5	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	10	14	13.6	14	14	0.10	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	10	8.7	10.2	10	11	0.77	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	10	85	99	98	105	7.6	0	-	-	-	-	-
Secchi depth	m	-	-	-	-	-	10	7.4	8.8	8.7	11	1.1	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	5	14	15	15	16	0.84	0	-	-	-	-	-
Total depth	m	-	-	-	-	-	10	7.4	8.8	8.7	11	1.1	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	10	7.0	7.2	7.2	7.3	0.076	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	10	67	67	67	69	0.87	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	10	20	21	21	22	0.73	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	10	15	16	16	17	0.50	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	10	29	41	39	52	6.9	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	10	33	34	34	35	0.80	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	10	<1.0	<1.0	0.74	1.7	0.42	7	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	10	0.17	0.25	0.24	0.30	0.053	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	10	18	19	19	21	0.60	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	10	6.2	6.4	6.4	6.7	0.16	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	10	7.9	8.1	8.0	8.2	0.15	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	10	0.024	0.028	0.027	0.031	0.0022	0	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	10	0.99	1.1	1.0	1.1	0.031	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	10	0.79	0.82	0.82	0.85	0.017	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	10	3.9	4.1	4.1	4.3	0.10	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	10	3.3	3.5	3.5	3.9	0.20	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	10	0.19	0.22	0.22	0.26	0.035	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.0050	0.20	-	-	10	<0.001	<0.002	0.00075	<0.002	0.00026	10	-	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	-	10	<0.001	<0.005	0.0015	<0.005	0.0011	10	-	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	-	10	<0.001	<0.002	0.00075	<0.002	0.00026	10	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	-	10	<0.001	<0.001	0.00050	<0.001	0	10	-	-	-	-	-
Total ammonia	mg-N/L	-	1.3 - 1.7	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	10	<0.05	0.14	0.12	0.16	0.048	1	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	10	0.0031	0.004	0.0043	0.0079	0.0014	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	10	0.0012	0.002	0.0020	0.0027	0.00056	0	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	10	<0.001	<0.001	0.00066	0.0011	0.00026	7	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	10	2.1	2.3	2.2	2.4	0.12	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	10	2.1	2.2	2.2	2.3	0.067	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	10	1.5	2.2	2.2	3.2	0.50	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	10	<0.02	<0.02	0.011	0.024	0.0044	9	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	10	0.16	0.18	0.18	0.21	0.018	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	10	7.2	7.6	7.5	7.8	0.21	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	10	<0.01	<0.01	0.0050	<0.01	0	10	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	10	<0.005	<0.01	0.0038	<0.01	0.0013	10	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	10	4.4	<5.0	4.5	7.3	2.2	5	-	-	-	-	-
Cadmium	µg/L	0.40 - 0.45	0.041 - 0.045	5.0	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	10	<0.06	<0.1	0.040	<0.1	0.011	10	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	10	<0.005	0.011	0.011	0.037	0.0096	2	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	10	0.65	0.69	0.71	0.84	0.059	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	10	3.2	7.2	6.8	7.8	1.3	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	10	<0.01	<0.01	0.0058	0.013	0.0025	9	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	10	<0.5	0.67	0.60	0.90	0.21	2	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	10	0.29	2.6	2.4	3.1	0.84	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	10	<0.0005	<0.0006	0.00048	0.00080	0.00023	5	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	10	0.051	0.065	0.065	0.074	0.0069	0	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	10	0.34	0.37	0.37	0.41	0.023	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	10	<0.04	<0.04	0.025	0.047	0.011	8	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	10	29	31	31	32	1.1	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	10	<0.002	<0.005	0.0018	<0.005	0.00079	10	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	10	<0.02	<0.05	0.018	<0.05	0.0079	10	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	10	<0.1	<0.5	0.15	<0.5	0.11	10	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	10	0.011	0.014	0.014	0.017	0.0019	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	10	<0.05	<0.05	0.025	<0.05	0	10	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	10	<0.5	<0.8	0.80	2.5	0.77	7	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	10	0.78	1.4	1.3	2.7	0.55	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	10	<0.02	<0.02	0.014	0.034	0.0091	8	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	10	0.18	0.19	0.20	0.28	0.030	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	10	7.2	7.4	7.4	7.7	0.13	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	10	<0.01	<0.01	0.0050	<0.01	0	10	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	10	<0.005	<0.01	0.0038	<0.01	0.0013	10	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	10	3.4	6.3	5.1	<10	0.81	5	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	10	<0.06	<0.1	0.040	<0.1	0.011	10	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	10	<0.01	0.012	0.016	0.035	0.013	5	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	8	0.63	0.71	0.70	0.75	0.041	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	10	<1.0	3.1	2.9	7.5	2.0	1	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	10	<0.005	<0.01	0.0067	0.032	0.0089	9	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	10	<0.5	0.73	0.65	0.78	0.17	1	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	10	0.061	0.43	0.61	2.3	0.66	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	10	<0.0005	0.00085	0.00087	0.0014	0.00048	3	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	10	0.058	0.072	0.072	0.097	0.011	0	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	8	0.34	0.39	0.40	0.47	0.047	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	10	<0.04	<0.04	0.022	0.041	0.0066	9	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	10	28	31	31	32	0.86	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	10	<0.002	0.0021	0.0019	<0.005	0.00075	9	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	10	<0.01	<0.05	0.022	0.074	0.021	9	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	10	<0.1	<0.3	0.10	<0.3	0.053	10	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	10	<0.01	0.013	0.013	0.017	0.0034	1	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	10	<0.05	<0.05	0.025	<0.05	0	10	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	10	<0.5	<0.8	0.50	1.4	0.37	8	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.5: Field and Laboratory Statistical Summaries from MEL-05 (Reference area 3) Open-water Conditions, 2016 to 2017

Parameter	Unit	Guidelines for the protection of:					Open-Water											
		Aquatic Life		Drinking Water	Aesthetic	SSWQO	2016-2017											
		Acute	Chronic				Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline				
														A	C	D	S	Q
Field Measured																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	10	7.6	7.7	7.7	7.7	0.033	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	10	68	70	70	73	2.4	0	-	-	-	-	-
Temperature	°C	-	-	-	15	-	10	13	13.3	13	14	0.19	0	-	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	-	10	9.8	10.6	10	11	0.39	0	-	-	-	-	-
Dissolved oxygen	%	-	-	-	-	-	10	95	102	101	103	3.0	0	-	-	-	-	-
Secchi depth	m	-	-	-	-	-	10	7.8	8.6	8.8	10	0.74	0	-	-	-	-	-
Air temperature	deg c	-	-	-	-	-	5	13	13	14	15	1.1	0	-	-	-	-	-
Total depth	m	-	-	-	-	-	10	7.8	9.0	9.1	10	0.86	0	-	-	-	-	-
Conventional Parameters																		
pH	-	-	6.5 - 9.0	-	7.0 - 11	-	10	7.2	7.3	7.3	7.4	0.12	0	-	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	-	10	69	71	71	73	2.0	0	-	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	-	10	21	22	22	23	0.40	0	-	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	-	10	16	17	17	18	0.49	0	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	-	10	41	44	44	46	1.6	0	-	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	-	10	34	35	35	36	0.77	0	-	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	-	10	<1.0	<1.0	0.50	<1.0	0	10	-	-	-	-	-
Turbidity	NTU	-	-	-	-	-	10	0.21	0.25	0.25	0.27	0.020	0	-	-	-	-	-
Major Ions																		
Bicarbonate	mg/L	-	-	-	-	-	10	20	21	21	21	0.60	0	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	10	6.7	6.9	7.0	7.2	0.14	0	-	-	-	-	-
Chloride	mg/L	640	120	-	250	-	10	8.0	8.2	8.2	8.4	0.17	0	-	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	2.8	10	0.023	0.026	0.026	0.028	0.0013	0	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	10	1.1	1.1	1.1	1.2	0.024	0	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	10	0.80	0.86	0.86	0.92	0.048	0	-	-	-	-	-
Sodium	mg/L	-	-	-	200	-	10	4.2	4.3	4.3	4.3	0.028	0	-	-	-	-	-
Sulphate	mg/L	-	-	-	500	-	10	3.2	3.5	3.5	3.6	0.11	0	-	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	-	10	0.20	0.24	0.24	0.27	0.034	0	-	-	-	-	-
Cyanide Species																		
Cyanide	mg/L	-	0.0050	0.20	-	-	10	<0.001	<0.002	0.00075	<0.002	0.00026	10	-	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	-	10	<0.001	<0.005	0.0015	<0.005	0.0011	10	-	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	-	10	<0.001	<0.002	0.00075	<0.002	0.00026	10	-	-	-	-	-
Nutrients																		
Nitrate	mg-N/L	124	2.9	10	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	-	10	<0.001	<0.001	0.00050	<0.001	0	10	-	-	-	-	-
Total ammonia	mg-N/L	-	1.2 - 1.6	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	-	10	<0.05	0.11	0.092	0.16	0.054	3	-	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	-	10	0.0030	0.004	0.0042	0.0056	0.00093	0	-	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	-	10	0.0019	0.003	0.0026	0.0033	0.00044	0	-	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	-	10	<0.001	<0.001	0.00055	0.0010	0.00016	9	-	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	-	10	2.0	2.4	2.4	2.7	0.18	0	-	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	-	10	2.1	2.2	2.3	2.7	0.18	0	-	-	-	-	-
Total Metals																		
Aluminum	µg/L	-	5.0 - 100	-	200	-	10	1.8	1.9	2.2	3.0	0.49	0	-	-	-	-	-
Antimony	µg/L	-	-	6.0	-	-	10	<0.02	<0.02	0.010	<0.02	0	10	-	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	25	10	0.22	0.25	0.24	0.28	0.019	0	-	-	-	-	-
Barium	µg/L	-	-	1,000	-	-	10	7.4	7.7	7.7	8.0	0.16	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	10	<0.01	<0.01	0.0050	<0.01	0	10	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	10	<0.005	<0.01	0.0038	<0.01	0.0013	10	-	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	-	10	<5.0	5.0	4.3	6.6	2.0	5	-	-	-	-	-
Cadmium	µg/L	0.44 - 0.46	0.044 - 0.046	5.0	-	-	10	<0.005	<0.005	0.0030	0.0077	0.0016	9	-	-	-	-	-
Chromium	µg/L	-	1.0	50	-	-	10	<0.06	<0.1	0.040	<0.1	0.011	10	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	10	<0.01	0.011	0.011	0.014	0.0025	1	-	-	-	-	-
Copper	µg/L	-	2	-	1,000	-	10	0.65	0.70	0.75	1.0	0.12	0	-	-	-	-	-
Iron	µg/L	-	300	-	300	1,060	10	6.6	7.6	7.4	8.0	0.45	0	-	-	-	-	-
Lead	µg/L	-	1	10	-	-	10	<0.01	<0.01	0.013	0.070	0.020	7	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	10	<0.5	0.60	0.55	0.93	0.23	3	-	-	-	-	-
Manganese	µg/L	-	-	-	50	-	10	2.4	2.8	2.8	3.3	0.28	0	-	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	-	10	<0.0005	<0.0005	0.00038	0.00070	0.00018	6	-	-	-	-	-
Molybdenum	µg/L	-	73	-	-	-	10	0.060	0.073	0.072	0.082	0.0065	0	-	-	-	-	-
Nickel	µg/L	-	25	-	-	-	10	0.31	0.37	0.38	0.50	0.050	0	-	-	-	-	-
Selenium	µg/L	-	1.0	50	-	-	10	<0.04	<0.04	0.029	0.049	0.012	6	-	-	-	-	-
Silver	µg/L	-	0.25	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	10	31	32	32	34	1.0	0	-	-	-	-	-
Thallium	µg/L	-	0.80	-	-	-	10	<0.002	<0.005	0.0018	<0.005	0.00079	10	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	10	<0.02	<0.05	0.018	<0.05	0.0079	10	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	10	<0.1	<0.5	0.15	<0.5	0.11	10	-	-	-	-	-
Uranium	µg/L	33	15	20	-	-	10	0.012	0.014	0.014	0.017	0.0018	0	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	10	<0.05	<0.05	0.025	<0.05	0	10	-	-	-	-	-
Zinc	µg/L	-	30	-	5,000	-	10	0.56	1.3	1.4	5.8	1.6	4	-	-	-	-	-
Dissolved Metals																		
Aluminum	µg/L	-	-	-	-	-	10	0.87	1.3	1.3	1.9	0.39	0	-	-	-	-	-
Antimony	µg/L	-	-	-	-	-	10	<0.02	<0.02	0.010	<0.02	0	10	-	-	-	-	-
Arsenic	µg/L	-	-	-	-	-	10	0.23	0.25	0.25	0.26	0.012	0	-	-	-	-	-
Barium	µg/L	-	-	-	-	-	10	7.4	7.6	7.5	7.7	0.11	0	-	-	-	-	-
Beryllium	µg/L	-	-	-	-	-	10	<0.01	<0.01	0.0050	<0.01	0	10	-	-	-	-	-
Bismuth	µg/L	-	-	-	-	-	10	<0.005	<0.01	0.0038	<0.01	0.0013	10	-	-	-	-	-
Boron	µg/L	-	-	-	-	-	9	5.2	<10	5.5	<10	0.92	5	-	-	-	-	-
Cadmium	µg/L	-	-	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Chromium	µg/L	-	-	-	-	-	10	<0.06	<0.1	0.040	<0.1	0.011	10	-	-	-	-	-
Cobalt	µg/L	-	-	-	-	-	10	<0.01	0.021	0.020	0.037	0.015	4	-	-	-	-	-
Copper	µg/L	-	-	-	-	-	10	0.60	0.68	0.69	0.78	0.063	0	-	-	-	-	-
Iron	µg/L	-	-	-	-	-	10	<1.0	2.7	2.5	4.4	1.8	3	-	-	-	-	-
Lead	µg/L	-	-	-	-	-	10	0.0059	<0.01	0.0071	0.014	0.0033	5	-	-	-	-	-
Lithium	µg/L	-	-	-	-	-	10	<0.5	0.60	0.55	0.79	0.22	3	-	-	-	-	-
Manganese	µg/L	-	-	-	-	-	10	0.066	0.32	0.35	0.63	0.26	0	-	-	-	-	-
Mercury	µg/L	-	-	-	-	-	10	<0.0005	0.00050	0.00042	0.00060	0.00018	5	-	-	-	-	-
Molybdenum	µg/L	-	-	-	-	-	10	0.070	0.077	0.078	0.089	0.0074	0	-	-	-	-	-
Nickel	µg/L	-	-	-	-	-	6	0.31	0.31	0.34	0.47	0.064	0	-	-	-	-	-
Selenium	µg/L	-	-	-	-	-	10	<0.04	<0.04	0.027	0.047	0.012	7	-	-	-	-	-
Silver	µg/L	-	-	-	-	-	10	<0.005	<0.005	0.0025	<0.005	0	10	-	-	-	-	-
Strontium	µg/L	-	-	-	-	-	10	30	31	31	32	0.60	0	-	-	-	-	-
Thallium	µg/L	-	-	-	-	-	10	<0.002	0.0021	0.0019	<0.005	0.00075	9	-	-	-	-	-
Tin	µg/L	-	-	-	-	-	10	<0.01	<0.05	0.015	<0.05	0.011	10	-	-	-	-	-
Titanium	µg/L	-	-	-	-	-	10	<0.1	<0.3	0.10	<0.3	0.053	10	-	-	-	-	-
Uranium	µg/L	-	-	-	-	-	10	<0.01	0.014	0.0097	0.015	0.0050	5	-	-	-	-	-
Vanadium	µg/L	-	-	-	-	-	10	<0.05	<0.05	0.025	<0.05	0	10	-	-	-	-	-
Zinc	µg/L	-	-	-	-	-	10	<0.8	0.80	0.76	1.4	0.42	5	-	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; - = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.6: Field and Laboratory Water Quality Statistical Summaries for Lake A8, Open-water Conditions 2015 to 2017

Parameter	Unit	Guidelines for the protection of:				Open-Water 2015-2017										
		Aquatic Life		Drinking Water	Aesthetic	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline			
		Acute	Chronic										A	C	D	S
Field Measured																
pH	-	-	6.5 - 9.0	-	7.0 - 11	15	7.6	8.2	8.1	8.4	0.22	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	15	183	289	280	306	32	0	-	-	-	-
Temperature	°C	-	-	-	15	15	12	14	14	15	0.80	0	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	15	7.6	9.8	9.7	11	0.96	0	-	-	-	-
Dissolved oxygen	%	-	-	-	-	15	79	96	96	107	9.0	0	-	-	-	-
Secchi depth	m	-	-	-	-	15	1.4	2.3	2.2	2.6	0.34	0	-	-	-	-
Air temperature	deg c	-	-	-	-	7	10	16	15	20	4.1	0	-	-	-	-
Total depth	m	-	-	-	-	15	1.4	2.3	2.2	2.7	0.35	0	-	-	-	-
Conventional Parameters																
pH	-	-	6.5 - 9.0	-	7.0 - 11	15	7.6	7.8	7.8	8.1	0.16	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	15	188	285	278	318	31	0	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	15	73	108	106	115	10	0	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	15	36	45	44	51	4.4	0	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	15	120	197	201	250	34	0	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	15	90	140	137	152	15	0	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	15	<1.0	<1.0	1.3	<5.0	1.0	11	-	-	-	-
Turbidity	NTU	-	-	-	-	15	0.36	0.50	0.54	1.2	0.22	0	-	-	-	-
Major Ions																
Bicarbonate	mg/L	-	-	-	-	15	44	54	54	62	5.3	0	-	-	-	-
Calcium	mg/L	-	-	-	-	15	24	36	35	38	3.3	0	-	-	-	-
Chloride	mg/L	640	120	-	250	15	28	57	54	61	8.8	0	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	15	0.024	0.032	0.032	0.039	0.0042	0	-	-	-	-
Magnesium	mg/L	-	-	-	-	15	3.1	4.5	4.5	5.0	0.46	0	-	-	-	-
Potassium	mg/L	-	-	-	-	15	1.4	2.0	2.0	2.2	0.21	0	-	-	-	-
Sodium	mg/L	-	-	-	200	15	4.6	7.8	7.5	8.4	0.97	0	-	-	-	-
Sulphate	mg/L	-	-	-	500	15	4.6	6.6	7.0	8.6	1.0	0	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	15	<0.01	0.58	0.61	1.4	0.34	1	-	-	-	-
Cyanide Species																
Cyanide	mg/L	-	0.0050	0.20	-	15	<0.001	<0.002	0.00080	<0.002	0.00025	15	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	15	<0.001	<0.005	0.0021	<0.005	0.00083	15	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	15	<0.001	<0.002	0.00080	<0.002	0.00025	15	-	-	-	-
Nutrients																
Nitrate	mg-N/L	124	2.9	10	-	15	<0.005	<0.005	0.0043	0.017	0.0048	13	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	15	<0.001	<0.001	0.00050	<0.001	0	15	-	-	-	-
Total ammonia	mg-N/L	-	0.26 - 1.8	-	-	15	<0.005	0.0050	0.0057	0.015	0.0039	7	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	15	0.21	0.31	0.32	0.44	0.057	0	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	15	0.0046	0.0062	0.0064	0.0097	0.0012	0	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	15	0.0017	0.0024	0.0024	0.0032	0.00045	0	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	15	<0.001	<0.001	0.00068	0.0013	0.00031	11	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	15	3.4	4.0	4.0	4.9	0.43	0	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	15	3.5	4.0	4.1	5.1	0.50	0	-	-	-	-
Total Metals																
Aluminum	µg/L	-	5.0 - 100	-	200	15	0.99	1.7	1.8	4.5	0.83	0	-	-	-	-
Antimony	µg/L	-	-	6.0	-	15	<0.02	<0.02	0.064	0.41	0.14	11	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	15	1.5	2.1	2.1	2.5	0.25	0	-	-	-	-
Barium	µg/L	-	-	1,000	-	15	20	29	28	31	2.8	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	15	<0.01	<0.01	0.0050	<0.01	0	15	-	-	-	-
Bismuth	µg/L	-	-	-	-	15	<0.005	<0.01	0.0040	<0.01	0.0013	15	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	15	2.5	<5.0	3.8	6.9	1.6	6	-	-	-	-
Cadmium	µg/L	1.5 - 2.4	0.12 - 0.18	5.0	-	15	<0.005	<0.005	0.0027	0.0051	0.00067	14	-	-	-	-
Chromium	µg/L	-	1.0	50	-	15	<0.06	<0.06	0.044	0.12	0.022	14	-	-	-	-
Cobalt	µg/L	-	-	-	-	15	0.017	0.033	0.033	0.051	0.011	0	-	-	-	-
Copper	µg/L	-	2.0 - 2.7	-	1,000	15	0.57	0.66	0.70	0.98	0.12	0	-	-	-	-
Iron	µg/L	-	300	-	300	15	15	46	44	72	17	0	-	-	-	-
Lead	µg/L	-	2.1 - 3.8	10	-	15	<0.01	<0.01	0.010	0.034	0.0097	11	-	-	-	-
Lithium	µg/L	-	-	-	-	15	6.0	9.9	9.4	11	1.3	0	-	-	-	-
Manganese	µg/L	-	-	-	50	15	0.61	8.8	8.5	13	3.6	0	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	15	<0.0005	0.00080	0.00077	0.0013	0.00031	2	-	-	-	-
Molybdenum	µg/L	-	73	-	-	15	0.16	0.21	0.20	0.23	0.024	0	-	-	-	-
Nickel	µg/L	-	75 - 106	-	-	15	0.77	0.81	0.83	0.94	0.056	0	-	-	-	-
Selenium	µg/L	-	1.0	50	-	15	<0.04	<0.04	0.020	<0.04	0	15	-	-	-	-
Silver	µg/L	-	0.25	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Strontium	µg/L	-	-	-	-	15	152	257	244	270	32	0	-	-	-	-
Thallium	µg/L	-	0.80	-	-	15	0.0029	<0.005	0.0028	<0.005	0.00051	9	-	-	-	-
Tin	µg/L	-	-	-	-	15	<0.02	<0.05	0.020	<0.05	0.0077	14	-	-	-	-
Titanium	µg/L	-	-	-	-	15	<0.1	<0.1	0.13	<0.5	0.10	15	-	-	-	-
Uranium	µg/L	33	15	20	-	15	0.023	0.043	0.042	0.054	0.0099	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	15	<0.05	<0.05	0.025	<0.05	0	15	-	-	-	-
Zinc	µg/L	-	30	-	5,000	15	<0.5	<0.8	0.80	2.8	0.67	9	-	-	-	-
Dissolved Metals																
Aluminum	µg/L	-	-	-	-	13	0.56	1.8	2.0	7.2	1.8	0	-	-	-	-
Antimony	µg/L	-	-	-	-	15	<0.02	<0.02	0.018	0.096	0.022	11	-	-	-	-
Arsenic	µg/L	-	-	-	-	15	1.6	1.8	1.8	2.3	0.21	0	-	-	-	-
Barium	µg/L	-	-	-	-	15	20	29	27	30	2.6	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	15	<0.01	<0.01	0.0050	<0.01	0	15	-	-	-	-
Bismuth	µg/L	-	-	-	-	15	<0.005	<0.01	0.0043	0.010	0.0020	14	-	-	-	-
Boron	µg/L	-	-	-	-	14	2.7	5.5	4.7	<10	0.83	6	-	-	-	-
Cadmium	µg/L	-	-	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Chromium	µg/L	-	-	-	-	15	<0.06	0.074	0.058	0.17	0.046	12	-	-	-	-
Cobalt	µg/L	-	-	-	-	15	0.012	0.019	0.027	0.058	0.015	0	-	-	-	-
Copper	µg/L	-	-	-	-	13	0.55	0.75	0.79	1.1	0.18	0	-	-	-	-
Iron	µg/L	-	-	-	-	13	2.2	19	17	29	8.7	0	-	-	-	-
Lead	µg/L	-	-	-	-	15	0.0092	0.014	0.038	0.23	0.065	6	-	-	-	-
Lithium	µg/L	-	-	-	-	15	5.7	9.7	9.2	10	1.3	0	-	-	-	-
Manganese	µg/L	-	-	-	-	13	0.064	1.1	1.2	2.9	0.90	0	-	-	-	-
Mercury	µg/L	-	-	-	-	15	<0.0005	0.00050	0.00059	0.0011	0.00034	6	-	-	-	-
Molybdenum	µg/L	-	-	-	-	15	0.16	0.21	0.21	0.29	0.038	0	-	-	-	-
Nickel	µg/L	-	-	-	-	15	0.71	0.81	0.83	1.2	0.11	0	-	-	-	-
Selenium	µg/L	-	-	-	-	15	<0.04	<0.04	0.020	<0.04	0	15	-	-	-	-
Silver	µg/L	-	-	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Strontium	µg/L	-	-	-	-	15	141	251	240	271	34	0	-	-	-	-
Thallium	µg/L	-	-	-	-	15	0.0037	<0.005	0.0031	<0.005	0.00080	9	-	-	-	-
Tin	µg/L	-	-	-	-	15	<0.01	<0.05	0.019	<0.05	0.0086	12	-	-	-	-
Titanium	µg/L	-	-	-	-	15	<0.1	<0.1	0.090	<0.3	0.051	15	-	-	-	-
Uranium	µg/L	-	-	-	-	15	0.022	0.044	0.043	0.056	0.010	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	15	<0.05	<0.05	0.031	0.083	0.016	13	-	-	-	-
Zinc	µg/L	-	-	-	-	15	0.71	<0.8	2.4	16	4.2	8	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; - = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.7: Field and Laboratory Water Quality Statistical Summaries for Lake B7, Open-water Conditions 2015 to 2017

Parameter	Unit	Guidelines for the protection of:				Open-Water 2015-2017										
		Aquatic Life		Drinking Water	Aesthetic	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline			
		Acute	Chronic										A	C	D	S
Field Measured																
pH	-	-	6.5 - 9.0	-	7.0 - 11	16	7.2	7.9	7.9	8.3	0.31	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	16	149	159	158	167	5.5	0	-	-	-	-
Temperature	°C	-	-	-	15	16	9	12	12	14	1.9	0	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	16	**6.3**[(C)]	9.8	9.8	12	1.6	0	-	6.0	-	-
Dissolved oxygen	%	-	-	-	-	16	61	96	92	106	14	0	-	-	-	-
Secchi depth	m	-	-	-	-	16	1.3	1.9	1.8	2.3	0.32	0	-	-	-	-
Air temperature	deg c	-	-	-	-	7	10	10	10	10	0	0	-	-	-	-
Total depth	m	-	-	-	-	16	1.3	1.9	1.8	2.3	0.32	0	-	-	-	-
Conventional Parameters																
pH	-	-	6.5 - 9.0	-	7.0 - 11	16	7.4	7.6	7.7	8.1	0.19	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	16	161	163	163	166	1.8	0	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	16	60	63	64	69	2.6	0	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	16	32	37	36	38	1.7	0	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	16	95	108	107	120	8.3	0	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	16	77	80	80	82	1.7	0	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	16	<1.0	1.1	1.4	<5.0	0.87	10	-	-	-	-
Turbidity	NTU	-	-	-	-	16	0.32	0.43	0.44	0.64	0.084	0	-	-	-	-
Major Ions																
Bicarbonate	mg/L	-	-	-	-	16	39	45	44	46	2.1	0	-	-	-	-
Calcium	mg/L	-	-	-	-	16	20	21	22	23	1.2	0	-	-	-	-
Chloride	mg/L	640	120	-	250	16	20	24	23	26	1.8	0	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	16	<0.02	0.031	0.028	0.037	0.0081	2	-	-	-	-
Magnesium	mg/L	-	-	-	-	16	2.3	2.4	2.4	2.6	0.082	0	-	-	-	-
Potassium	mg/L	-	-	-	-	16	1.2	1.3	1.3	1.4	0.050	0	-	-	-	-
Sodium	mg/L	-	-	-	200	16	3.4	3.9	3.9	4.4	0.25	0	-	-	-	-
Sulphate	mg/L	-	-	-	500	16	4.1	4.6	4.7	6.0	0.64	0	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	16	0.30	0.83	0.72	1.1	0.31	0	-	-	-	-
Cyanide Species																
Cyanide	mg/L	-	0.0050	0.20	-	16	<0.001	<0.002	0.00081	<0.002	0.00025	16	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	16	<0.001	<0.005	0.0021	<0.005	0.00081	16	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	16	<0.001	<0.002	0.00081	<0.002	0.00025	16	-	-	-	-
Nutrients																
Nitrate	mg-N/L	124	2.9	10	-	16	<0.005	<0.005	0.0038	0.018	0.0040	14	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	16	<0.001	<0.001	0.00050	<0.001	0	16	-	-	-	-
Total ammonia	mg-N/L	-	0.35 - 5.0	-	-	16	<0.005	0.0061	0.0093	0.042	0.011	7	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	16	0.25	0.33	0.34	0.46	0.064	0	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	16	0.0056	0.0065	0.0067	0.0094	0.0011	0	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	16	0.0015	0.0025	0.0025	0.0036	0.00067	0	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	16	<0.001	<0.001	0.00059	0.0013	0.00026	14	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	16	4.8	5.3	8.2	53	12	0	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	16	2.9	5.2	5.1	5.6	0.61	0	-	-	-	-
Total Metals																
Aluminum	µg/L	-	5.0 - 100	-	200	16	1.3	1.8	2.9	12	2.6	0	-	-	-	-
Antimony	µg/L	-	-	6.0	-	16	<0.02	<0.02	0.010	<0.02	0	16	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	16	1.3	1.4	1.5	2.0	0.21	0	-	-	-	-
Barium	µg/L	-	-	1,000	-	16	18	19	19	20	0.73	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	16	<0.01	<0.01	0.0050	<0.01	0	16	-	-	-	-
Bismuth	µg/L	-	-	-	-	16	<0.005	<0.01	0.0041	<0.01	0.0013	16	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	16	3.6	<5.0	4.8	8.4	2.3	6	-	-	-	-
Cadmium	µg/L	1.3 - 1.4	0.10 - 0.12	5.0	-	16	<0.005	<0.005	0.0038	0.019	0.0042	14	-	-	-	-
Chromium	µg/L	-	1.0	50	-	16	<0.06	<0.06	0.038	<0.1	0.010	16	-	-	-	-
Cobalt	µg/L	-	-	-	-	16	0.034	0.039	0.052	0.23	0.048	0	-	-	-	-
Copper	µg/L	-	2	-	1,000	16	0.59	0.71	0.74	1.1	0.15	0	-	-	-	-
Iron	µg/L	-	300	-	300	16	55	74	77	110	19	0	-	-	-	-
Lead	µg/L	-	1.7 - 2.0	10	-	16	<0.01	0.011	0.019	0.086	0.026	8	-	-	-	-
Lithium	µg/L	-	-	-	-	16	3.9	5.3	5.6	12	1.9	0	-	-	-	-
Manganese	µg/L	-	-	-	50	16	4.1	6.4	6.5	9.5	1.9	0	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	16	<0.0005	0.00065	0.00078	0.0021	0.00052	3	-	-	-	-
Molybdenum	µg/L	-	73	-	-	16	0.13	0.17	0.16	0.21	0.020	0	-	-	-	-
Nickel	µg/L	-	65 - 72	-	-	16	0.81	0.92	0.99	1.5	0.19	0	-	-	-	-
Selenium	µg/L	-	1.0	50	-	16	<0.04	<0.04	0.025	0.049	0.0099	13	-	-	-	-
Silver	µg/L	-	0.25	-	-	16	<0.005	<0.005	0.0027	0.0062	0.00093	15	-	-	-	-
Strontium	µg/L	-	-	-	-	16	136	147	146	156	6.8	0	-	-	-	-
Thallium	µg/L	-	0.80	-	-	16	0.0027	<0.005	0.0031	0.0064	0.0011	8	-	-	-	-
Tin	µg/L	-	-	-	-	16	<0.02	<0.05	0.023	0.078	0.016	15	-	-	-	-
Titanium	µg/L	-	-	-	-	16	<0.1	0.12	0.15	<0.5	0.11	14	-	-	-	-
Uranium	µg/L	33	15	20	-	16	0.020	0.026	0.026	0.029	0.0025	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	16	<0.05	<0.05	0.027	0.050	0.0063	15	-	-	-	-
Zinc	µg/L	-	30	-	5,000	16	0.54	<0.8	3.7	**40**[(C)]	9.9	9	-	6.0	-	-
Dissolved Metals																
Aluminum	µg/L	-	-	-	-	16	0.73	1.4	1.7	3.8	0.96	0	-	-	-	-
Antimony	µg/L	-	-	-	-	16	<0.02	<0.02	0.012	0.036	0.0065	15	-	-	-	-
Arsenic	µg/L	-	-	-	-	16	1.2	1.3	1.3	1.5	0.11	0	-	-	-	-
Barium	µg/L	-	-	-	-	16	17	18	18	20	0.70	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	16	<0.01	<0.01	0.0050	<0.01	0	16	-	-	-	-
Bismuth	µg/L	-	-	-	-	16	<0.005	<0.01	0.0041	<0.01	0.0013	16	-	-	-	-
Boron	µg/L	-	-	-	-	16	2.7	6.7	6.0	19	3.7	5	-	-	-	-
Cadmium	µg/L	-	-	-	-	16	<0.005	<0.005	0.0025	<0.005	0	16	-	-	-	-
Chromium	µg/L	-	-	-	-	16	<0.06	<0.1	0.082	0.19	0.063	10	-	-	-	-
Cobalt	µg/L	-	-	-	-	16	0.017	0.022	0.030	0.064	0.014	0	-	-	-	-
Copper	µg/L	-	-	-	-	9	0.65	0.84	0.86	1.2	0.18	0	-	-	-	-
Iron	µg/L	-	-	-	-	16	22	34	33	51	7.1	0	-	-	-	-
Lead	µg/L	-	-	-	-	15	<0.01	0.019	0.036	0.24	0.058	3	-	-	-	-
Lithium	µg/L	-	-	-	-	16	4.5	5.3	5.6	12	1.9	0	-	-	-	-
Manganese	µg/L	-	-	-	-	16	0.74	0.92	1.5	5.6	1.3	0	-	-	-	-
Mercury	µg/L	-	-	-	-	16	<0.0005	0.00060	0.00051	0.00070	0.00016	4	-	-	-	-
Molybdenum	µg/L	-	-	-	-	16	0.14	0.17	0.18	0.27	0.039	0	-	-	-	-
Nickel	µg/L	-	-	-	-	16	0.82	0.89	0.91	1.1	0.078	0	-	-	-	-
Selenium	µg/L	-	-	-	-	16	<0.04	<0.04	0.020	<0.04	0	16	-	-	-	-
Silver	µg/L	-	-	-	-	16	<0.005	<0.005	0.0025	<0.005	0	16	-	-	-	-
Strontium	µg/L	-	-	-	-	16	129	142	142	154	7.9	0	-	-	-	-
Thallium	µg/L	-	-	-	-	16	0.0026	<0.005	0.0028	<0.005	0.00044	10	-	-	-	-
Tin	µg/L	-	-	-	-	16	<0.01	<0.05	0.025	0.088	0.019	13	-	-	-	-
Titanium	µg/L	-	-	-	-	16	<0.1	<0.1	0.088	<0.3	0.050	16	-	-	-	-
Uranium	µg/L	-	-	-	-	16	0.019	0.027	0.027	0.032	0.0029	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	16	<0.05	<0.05	0.025	<0.05	0	16	-	-	-	-
Zinc	µg/L	-	-	-	-	16	<0.5	<0.8	0.91	3.2	0.84	10	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
[(C)] = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

Table 3D.8: Field and Laboratory Water Quality Statistical Summaries for Lake D7, Open-water Conditions 2015 to 2017

Parameter	Unit	Guidelines for the protection of:				Open-Water 2015-2017										
		Aquatic Life		Drinking Water	Aesthetic	Count	Minimum	Median	Mean	Maximum	Standard Deviation	N.D.	% Above Guideline			
		Acute	Chronic										A	C	D	S
Field Measured																
pH	-	-	6.5 - 9.0	-	7.0 - 11	15	7.8	8.3	8.2	8.4	0.16	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	15	110	147	141	154	16	0	-	-	-	-
Temperature	°C	-	-	-	15	15	12	13	13	15	0.86	0	-	-	-	-
Dissolved oxygen	mg/L	-	6.5	-	-	15	**6.2**[(C)]	11	9.7	11	1.9	0	-	20	-	-
Dissolved oxygen	%	-	-	-	-	15	62	103	95	108	17	0	-	-	-	-
Secchi depth	m	-	-	-	-	15	1.7	1.9	1.9	2.3	0.14	0	-	-	-	-
Air temperature	deg c	-	-	-	-	3	8.0	9.0	9.0	10	1.0	0	-	-	-	-
Total depth	m	-	-	-	-	15	1.7	1.9	1.9	2.3	0.14	0	-	-	-	-
Conventional Parameters																
pH	-	-	6.5 - 9.0	-	7.0 - 11	15	7.3	7.8	7.8	8.2	0.30	0	-	-	-	-
Specific conductivity	µS/cm	-	-	-	-	15	111	146	142	160	17	0	-	-	-	-
Hardness, as $CaCO_3$	mg/L	-	-	-	-	15	41	52	51	58	5.1	0	-	-	-	-
Total alkalinity, as $CaCO_3$	mg/L	-	-	-	-	15	38	52	50	55	6.1	0	-	-	-	-
Total dissolved solids	mg/L	-	-	-	500	15	52	90	87	103	15	0	-	-	-	-
Total dissolved solids (calculated)	mg/L	-	-	-	500	15	56	75	73	81	8.5	0	-	-	-	-
Total suspended solids	mg/L	-	-	-	-	15	<1.0	<1.0	0.97	<3.0	0.58	11	-	-	-	-
Turbidity	NTU	-	-	-	-	15	0.41	0.82	0.76	1.0	0.19	0	-	-	-	-
Major Ions																
Bicarbonate	mg/L	-	-	-	-	15	46	63	60	68	7.5	0	-	-	-	-
Calcium	mg/L	-	-	-	-	15	13	16	15	17	1.4	0	-	-	-	-
Chloride	mg/L	640	120	-	250	15	8.6	12	11	12	1.3	0	-	-	-	-
Fluoride	mg/L	-	0.12	1.5	-	15	0.030	0.043	0.041	0.052	0.0061	0	-	-	-	-
Magnesium	mg/L	-	-	-	-	15	2.2	2.9	2.8	3.4	0.35	0	-	-	-	-
Potassium	mg/L	-	-	-	-	15	1.00	1.3	1.3	1.5	0.16	0	-	-	-	-
Sodium	mg/L	-	-	-	200	15	5.9	8.0	7.7	8.7	0.94	0	-	-	-	-
Sulphate	mg/L	-	-	-	500	15	2.9	4.3	4.2	5.2	0.78	0	-	-	-	-
Silica	mg/L	-	-	-	-	3	0.17	0.18	0.18	0.19	0.0098	0	-	-	-	-
Reactive silica, as SiO2	mg/L	-	-	-	-	12	0.13	0.21	0.21	0.28	0.071	0	-	-	-	-
Cyanide Species																
Cyanide	mg/L	-	0.0050	0.20	-	15	<0.001	<0.002	0.0011	<0.005	0.00076	15	-	-	-	-
Cyanide (free)	mg/L	-	-	-	-	15	<0.001	<0.005	0.0021	<0.005	0.00083	15	-	-	-	-
Cyanide (WAD)	mg/L	-	-	-	-	15	<0.001	<0.002	0.0011	<0.005	0.00076	15	-	-	-	-
Nutrients																
Nitrate	mg-N/L	124	2.9	10	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Nitrite	mg-N/L	-	0.060	1.0	-	15	<0.001	<0.001	0.00050	<0.001	0	15	-	-	-	-
Total ammonia	mg-N/L	-	0.31 - 1.1	-	-	15	<0.005	0.0064	0.0060	0.012	0.0023	3	-	-	-	-
Total Kjeldahl nitrogen	mg-N/L	-	-	-	-	15	0.24	0.35	0.34	0.45	0.056	0	-	-	-	-
Total phosphorus	mg-P/L	-	-	-	-	15	0.011	0.013	0.014	0.033	0.0052	0	-	-	-	-
Dissolved phosphorus	mg-P/L	-	-	-	-	15	0.0024	0.0040	0.0042	0.0064	0.0011	0	-	-	-	-
Orthophosphate	mg-P/L	-	-	-	-	15	<0.001	0.0012	0.0013	0.0042	0.0010	7	-	-	-	-
Total organic carbon	mg/L	-	-	-	-	15	3.4	4.8	4.6	5.2	0.63	0	-	-	-	-
Dissolved organic carbon	mg/L	-	-	-	-	15	1.9	4.5	4.3	5.1	0.82	0	-	-	-	-
Total Metals																
Aluminum	µg/L	-	5.0 - 100	-	200	15	3.1	5.1	5.2	7.1	1.0	0	-	-	-	-
Antimony	µg/L	-	-	6.0	-	15	<0.02	<0.02	0.013	0.035	0.0074	13	-	-	-	-
Arsenic	µg/L	-	5.0	10	-	15	0.90	1.0	1.0	1.2	0.086	0	-	-	-	-
Barium	µg/L	-	-	1,000	-	15	15	16	16	17	0.71	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	15	<0.01	<0.01	0.0050	<0.01	0	15	-	-	-	-
Bismuth	µg/L	-	-	-	-	15	<0.005	<0.01	0.0040	<0.01	0.0013	15	-	-	-	-
Boron	µg/L	29,000	1,500	5,000	-	15	9.0	13	13	18	2.7	0	-	-	-	-
Cadmium	µg/L	0.85 - 1.2	0.076 - 0.10	5.0	-	15	<0.005	<0.005	0.0031	0.011	0.0021	14	-	-	-	-
Chromium	µg/L	-	1.0	50	-	15	<0.06	<0.06	0.040	<0.1	0.012	14	-	-	-	-
Cobalt	µg/L	-	-	-	-	15	0.035	0.044	0.043	0.047	0.0044	0	-	-	-	-
Copper	µg/L	-	2	-	1,000	15	0.58	0.75	0.79	1.2	0.17	0	-	-	-	-
Iron	µg/L	-	300	-	300	15	42	52	68	127	31	0	-	-	-	-
Lead	µg/L	-	1	10	-	15	<0.01	<0.01	0.0091	0.023	0.0060	10	-	-	-	-
Lithium	µg/L	-	-	-	-	15	1.2	1.6	1.6	2.0	0.24	0	-	-	-	-
Manganese	µg/L	-	-	-	50	15	8.4	10	11	13	1.4	0	-	-	-	-
Mercury	µg/L	-	0.026	1.0	-	15	<0.0005	0.00070	0.00069	0.0011	0.00021	1	-	-	-	-
Molybdenum	µg/L	-	73	-	-	15	0.24	0.43	0.39	0.48	0.083	0	-	-	-	-
Nickel	µg/L	-	25	-	-	15	0.54	0.65	0.65	0.80	0.069	0	-	-	-	-
Selenium	µg/L	-	1.0	50	-	15	<0.04	0.043	0.038	0.059	0.016	6	-	-	-	-
Silver	µg/L	-	0.25	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Strontium	µg/L	-	-	-	-	15	55	78	74	82	9.6	0	-	-	-	-
Thallium	µg/L	-	0.80	-	-	15	<0.002	<0.005	0.0022	<0.005	0.00087	13	-	-	-	-
Tin	µg/L	-	-	-	-	15	<0.02	<0.05	0.019	<0.05	0.0076	15	-	-	-	-
Titanium	µg/L	-	-	-	-	15	0.14	0.28	0.24	<0.5	0.071	6	-	-	-	-
Uranium	µg/L	33	15	20	-	15	0.056	0.081	0.081	0.10	0.014	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	15	<0.05	0.057	0.055	0.070	0.013	2	-	-	-	-
Zinc	µg/L	-	30	-	5,000	15	0.57	<0.8	0.90	<3.0	0.79	10	-	-	-	-
Dissolved Metals																
Aluminum	µg/L	-	-	-	-	15	1.6	2.0	2.7	5.7	1.2	0	-	-	-	-
Antimony	µg/L	-	-	-	-	15	<0.02	<0.02	0.015	0.047	0.012	12	-	-	-	-
Arsenic	µg/L	-	-	-	-	15	0.79	0.87	0.87	0.97	0.060	0	-	-	-	-
Barium	µg/L	-	-	-	-	15	15	16	16	16	0.44	0	-	-	-	-
Beryllium	µg/L	-	-	-	-	15	<0.01	<0.01	0.0050	<0.01	0	15	-	-	-	-
Bismuth	µg/L	-	-	-	-	15	<0.005	<0.01	0.0044	0.011	0.0022	14	-	-	-	-
Boron	µg/L	-	-	-	-	15	10	12	12	16	1.9	0	-	-	-	-
Cadmium	µg/L	-	-	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Chromium	µg/L	-	-	-	-	15	<0.06	<0.1	0.079	0.19	0.055	9	-	-	-	-
Cobalt	µg/L	-	-	-	-	15	0.012	0.018	0.030	0.065	0.020	0	-	-	-	-
Copper	µg/L	-	-	-	-	9	0.56	0.79	0.80	1.1	0.19	0	-	-	-	-
Iron	µg/L	-	-	-	-	15	12	16	23	47	13	0	-	-	-	-
Lead	µg/L	-	-	-	-	15	0.0081	<0.01	0.023	0.17	0.041	7	-	-	-	-
Lithium	µg/L	-	-	-	-	15	1.3	1.6	1.6	1.9	0.19	0	-	-	-	-
Manganese	µg/L	-	-	-	-	15	0.51	0.74	1.3	5.7	1.4	0	-	-	-	-
Mercury	µg/L	-	-	-	-	15	<0.0005	0.00090	0.0011	0.0026	0.00083	3	-	-	-	-
Molybdenum	µg/L	-	-	-	-	15	0.25	0.40	0.39	0.52	0.091	0	-	-	-	-
Nickel	µg/L	-	-	-	-	15	0.54	0.62	0.62	0.69	0.042	0	-	-	-	-
Selenium	µg/L	-	-	-	-	15	<0.04	<0.04	0.034	0.067	0.016	8	-	-	-	-
Silicon	µg/L	-	-	-	-	6	64	78	79	94	11	0	-	-	-	-
Silver	µg/L	-	-	-	-	15	<0.005	<0.005	0.0025	<0.005	0	15	-	-	-	-
Strontium	µg/L	-	-	-	-	15	55	72	70	78	7.8	0	-	-	-	-
Thallium	µg/L	-	-	-	-	15	<0.002	<0.005	0.0028	0.013	0.0029	12	-	-	-	-
Tin	µg/L	-	-	-	-	15	<0.01	<0.05	0.019	<0.05	0.0084	12	-	-	-	-
Titanium	µg/L	-	-	-	-	15	<0.1	<0.1	0.090	<0.3	0.051	15	-	-	-	-
Uranium	µg/L	-	-	-	-	15	0.047	0.082	0.081	0.10	0.019	0	-	-	-	-
Vanadium	µg/L	-	-	-	-	15	<0.05	<0.05	0.027	0.052	0.0070	14	-	-	-	-
Zinc	µg/L	-	-	-	-	15	<0.5	<0.8	0.68	1.5	0.45	10	-	-	-	-

Notes:
Concentrations greater than relevant water quality guidelines or objectives are bolded and identified based on the following:
[(C)] = concentration is higher than the chronic aquatic life CCME guideline or outside the recommended pH, DO or total alkalinity range.
Water quality data and guidelines shown in this table were rounded to reflect laboratory or field instrument precision after comparisons to guidelines. Therefore, values slightly above guidelines may be displayed as being equal to the guidelines and identified as exceedances. Measured concentrations equal to the guideline values were not identified as exceedances.
SSWQO = draft site specific water quality objectives; % = percent; = no guideline or data; µS/cm = microSiemens per centimetre; °C = degrees Celsius; mg/L = milligrams per litre; % = percent; m = metre; CaCO3 = calcium carbonate; < = less than; NTU = nephelometric turbidity units; SiO2 = silicon dioxide; WAD = weak acid dissociable; mg N/L = milligrams of nitrogen per litre; mg P/L = milligrams of phosphorus per litre; µg/L = micrograms per litre; CCME = Canadian Council of Ministers of the Environment; Golder = Golder Associates
N.D. = number of samples with non-detectable results

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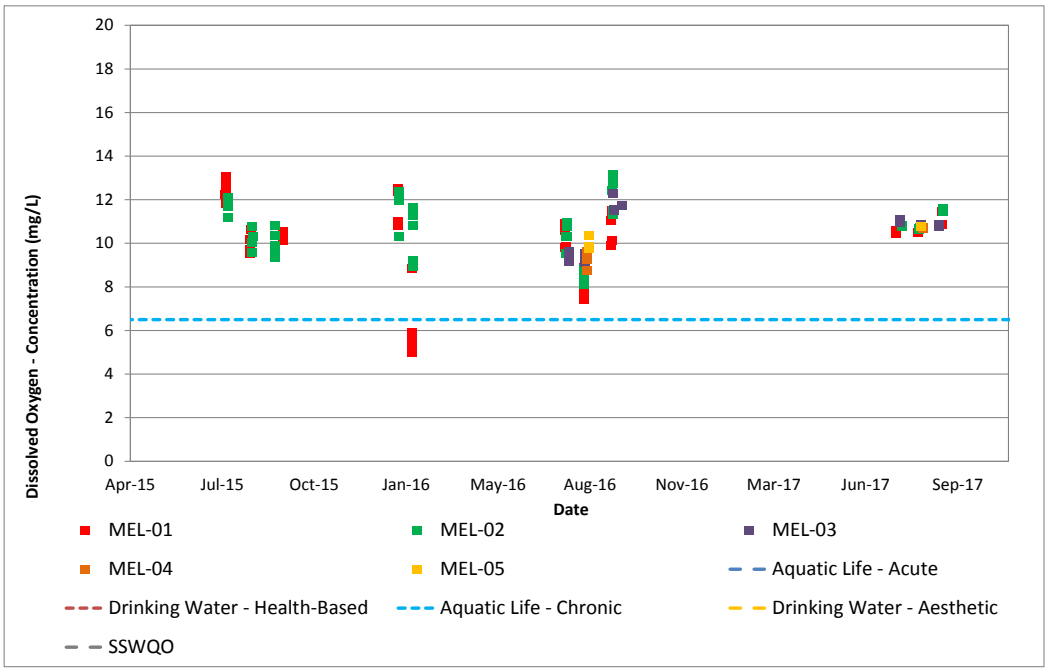
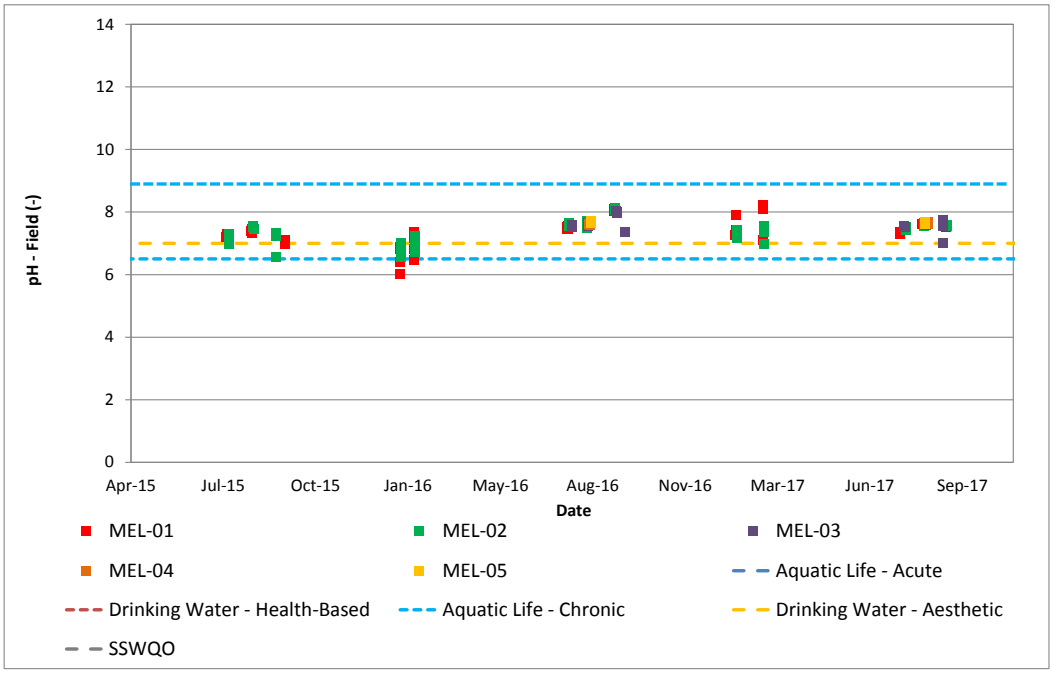
3E1.0 MELIADINE LAKE

3E1.1 Field-measured Parameters



mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

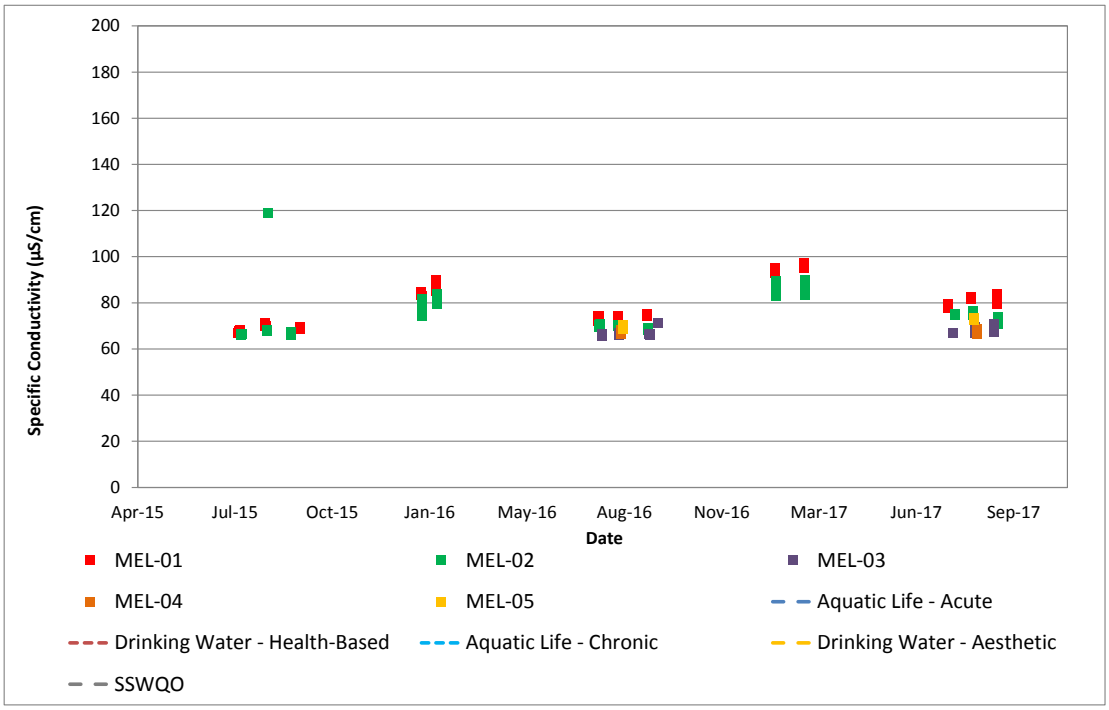
Figure 3E.1-1a: Dissolved Oxygen Concentrations Measured at Meliadine Lake Stations between 2015 and 2017



SSWQO = site-specific Water Quality Objectives.

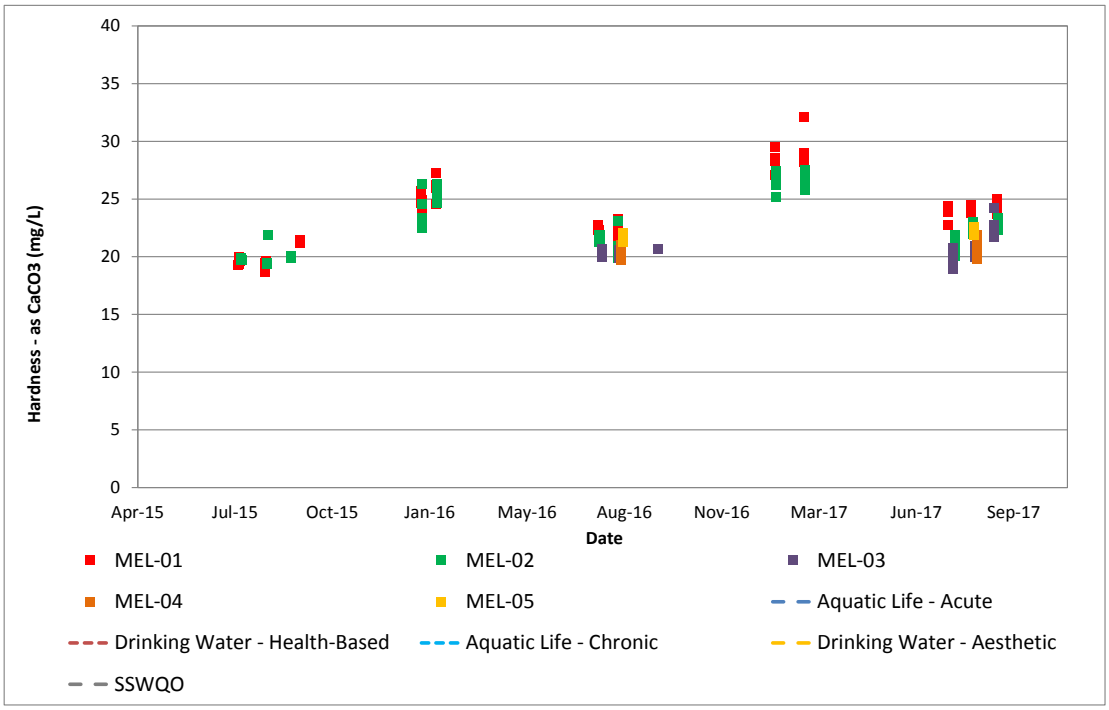
Figure 3E.1-1b: Field pH Measurements at Meliadine Lake Stations between 2015 and 2017

3E1.2 Conventional Parameters



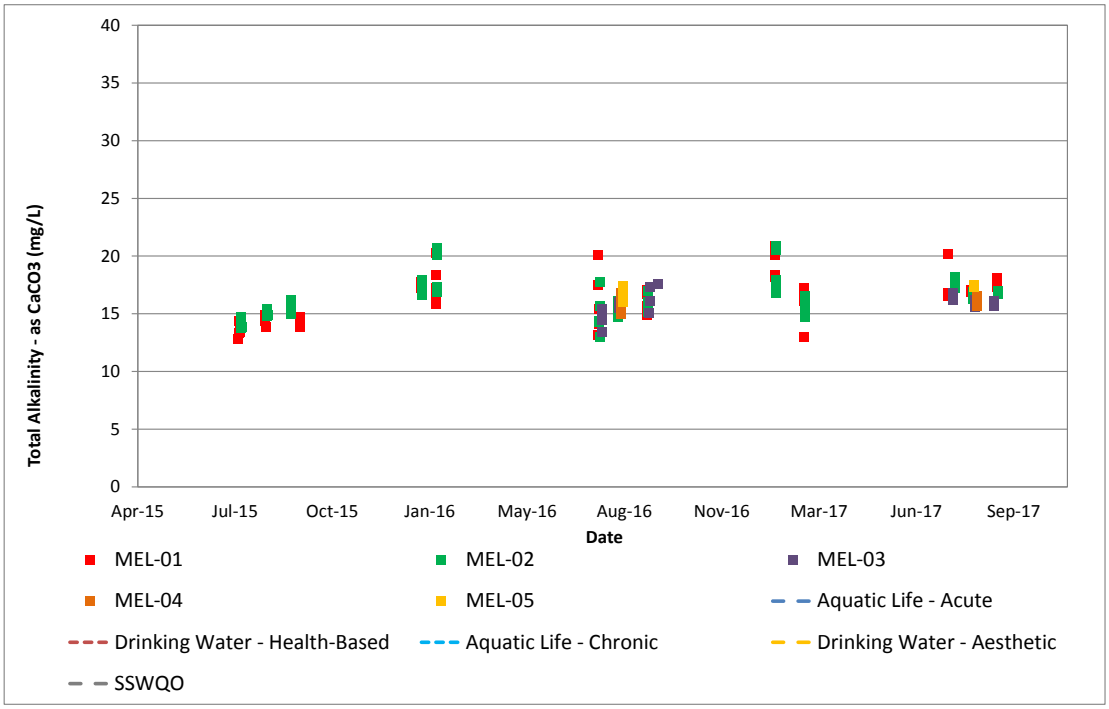
µS/cm = microSiemens per centimetre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-2a: Specific Conductivity (laboratory) for Meliadine Lake Stations between 2015 and 2017



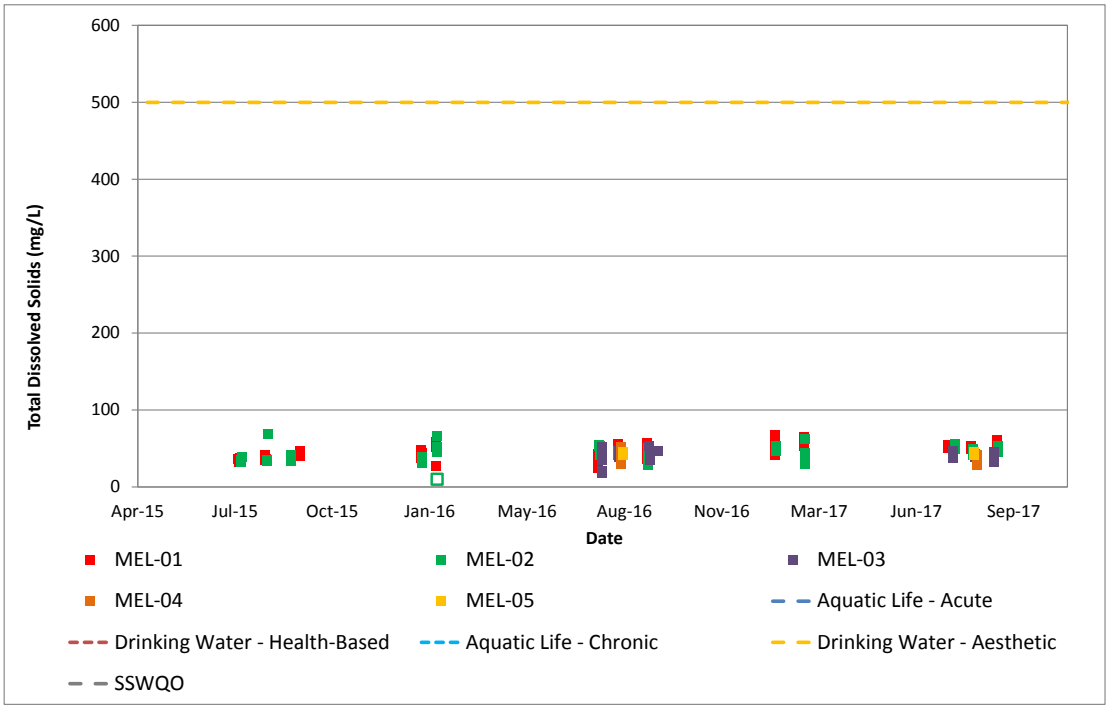
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-2b: Total Hardness (as CaCO3) at Meliadine Lake Stations between 2015 and 2017



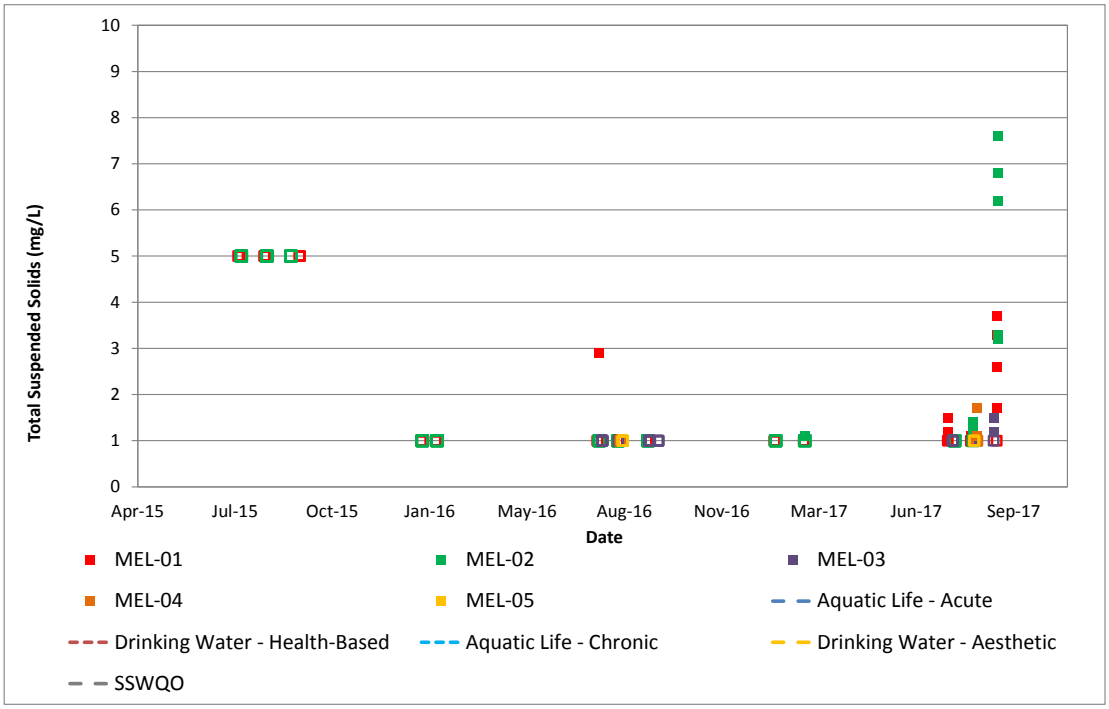
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-2c: Total Alkalinity (as CaCO3) at Meliadine Lake Stations between 2015 and 2017



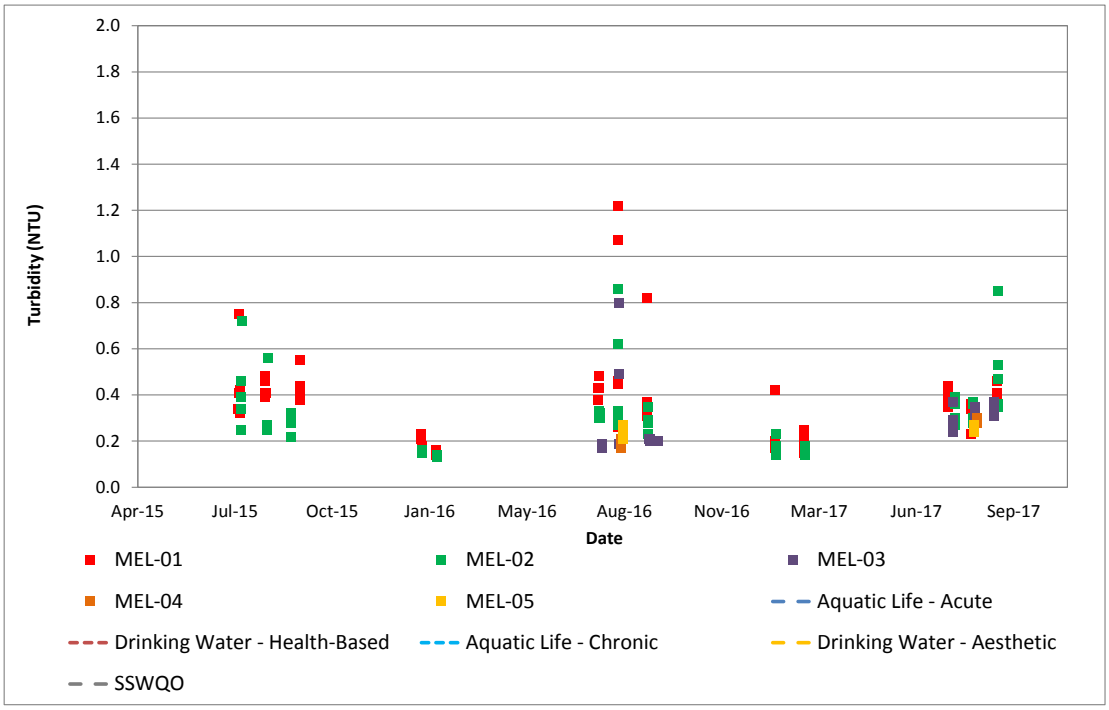
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-2d: Concentrations of Total Dissolved Solids at Meliadine Lake Stations between 2015 and 2017



mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

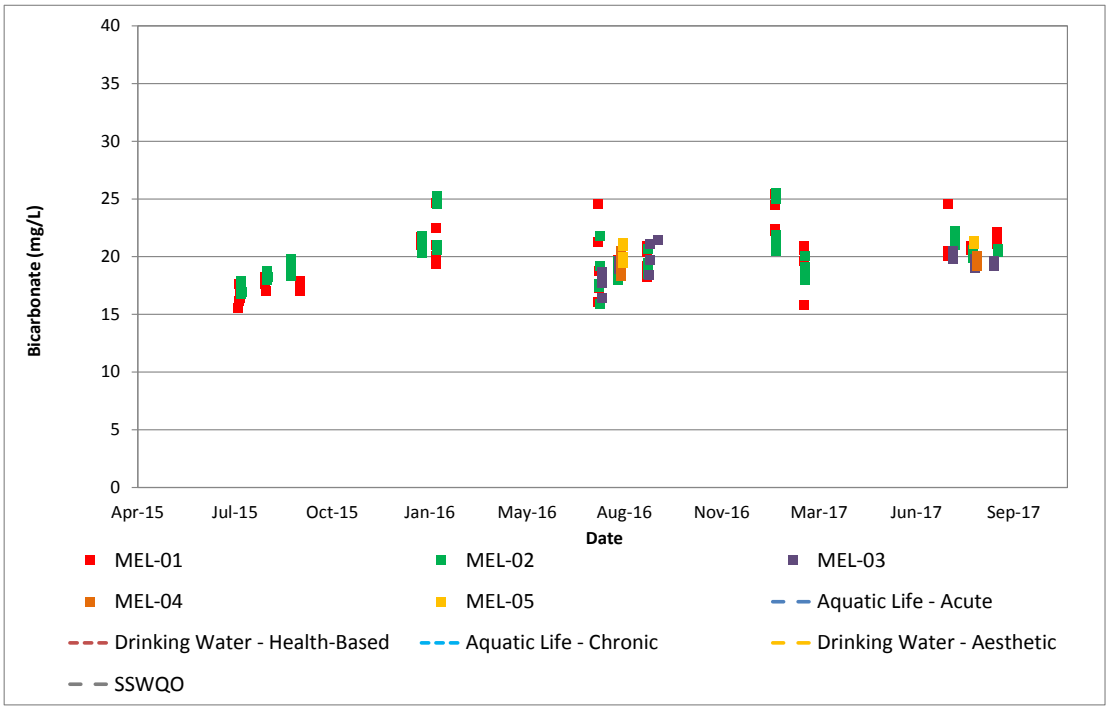
Figure 3E.1-2e: Concentrations of Total Suspended Solids at Meliadine Lake Stations between 2015 and 2017



NTU = Nephelometric Turbidy Units; SSWQO = site-specific Water Quality Objectives.

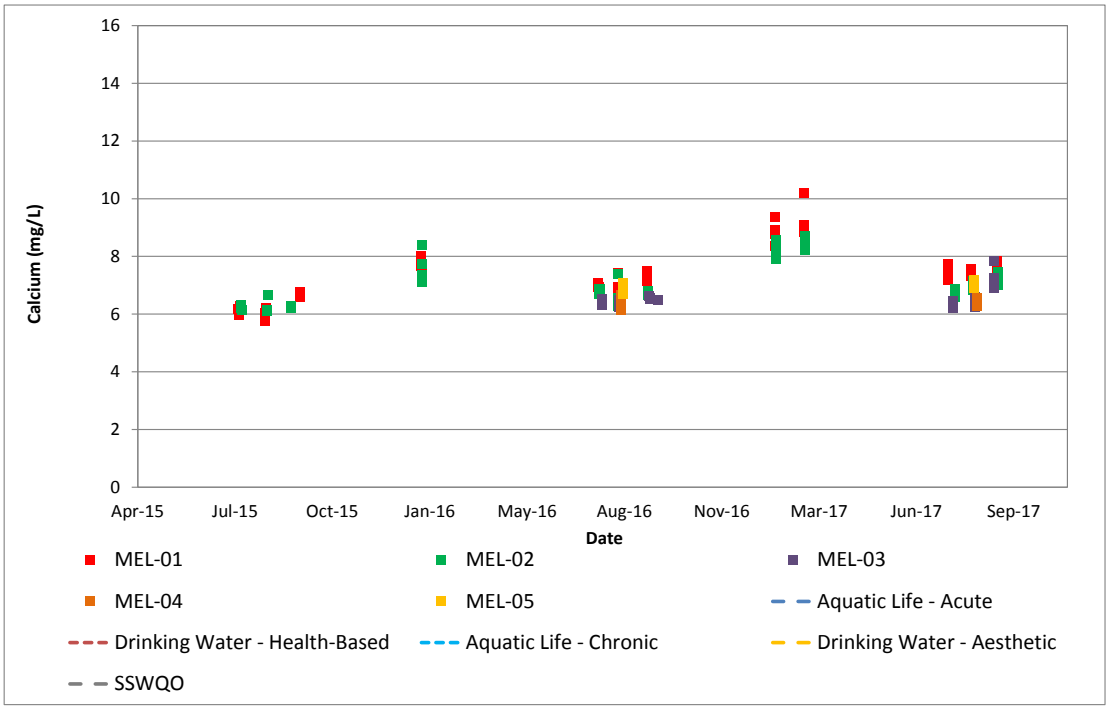
Figure 3E.1-2f: Concentrations of Turbidity at Meliadine Lake Stations between 2015 and 2017

3E1.3 Major Ions



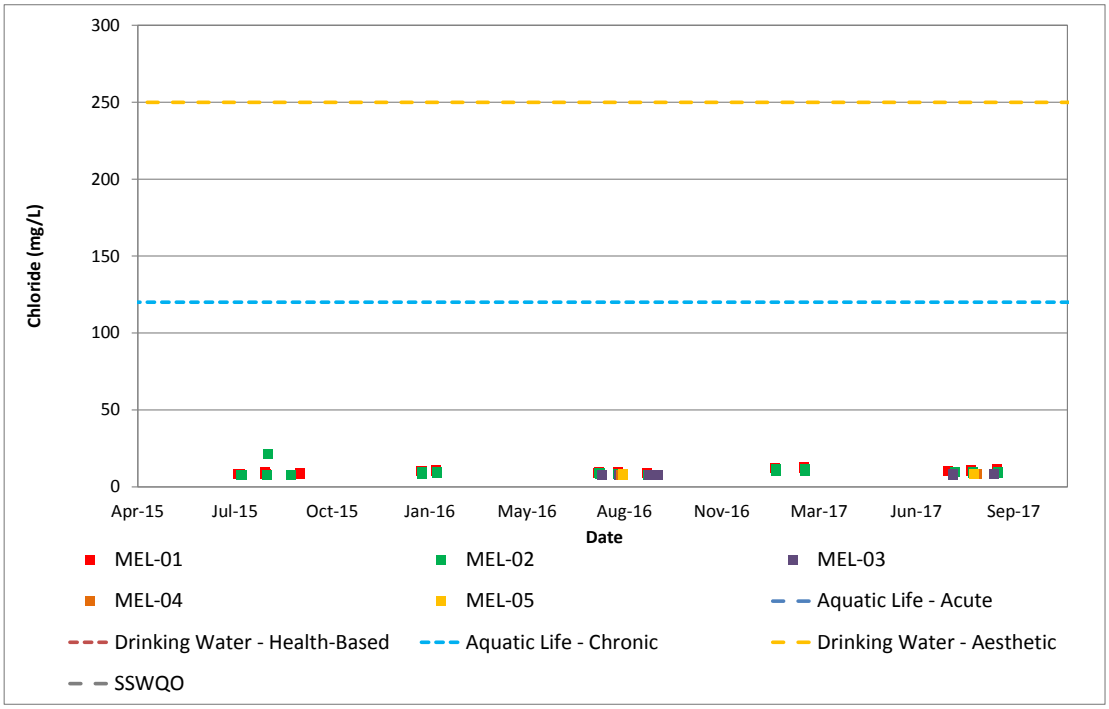
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3a: Concentrations of Bicarbonate at Meliadine Lake Stations between 2015 and 2017



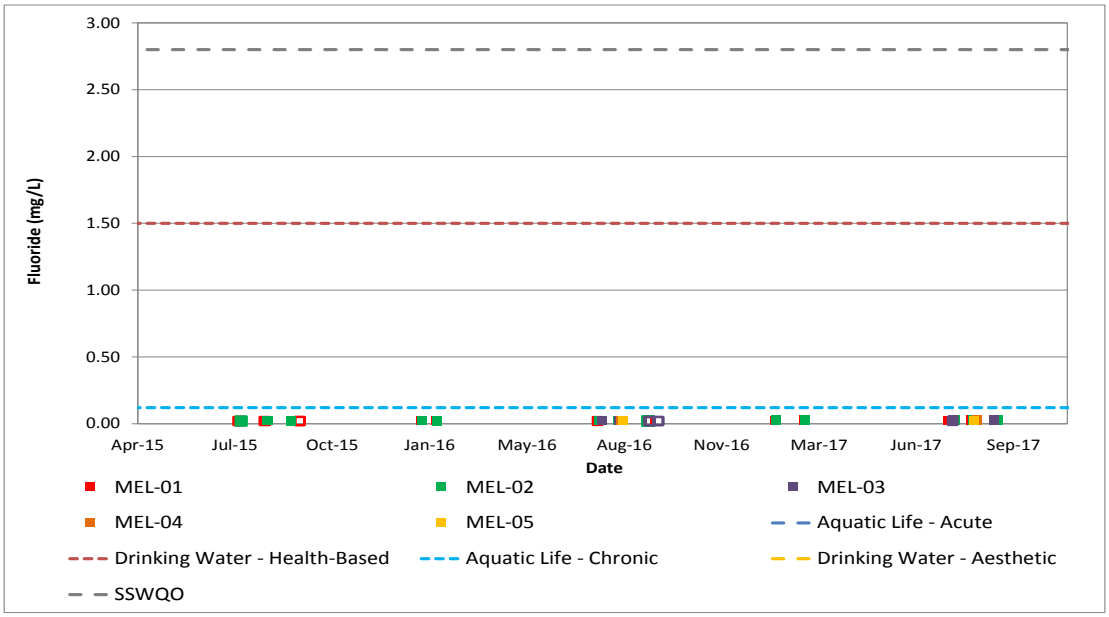
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3b: Concentrations of Calcium at Meliadine Lake Stations between 2015 and 2017



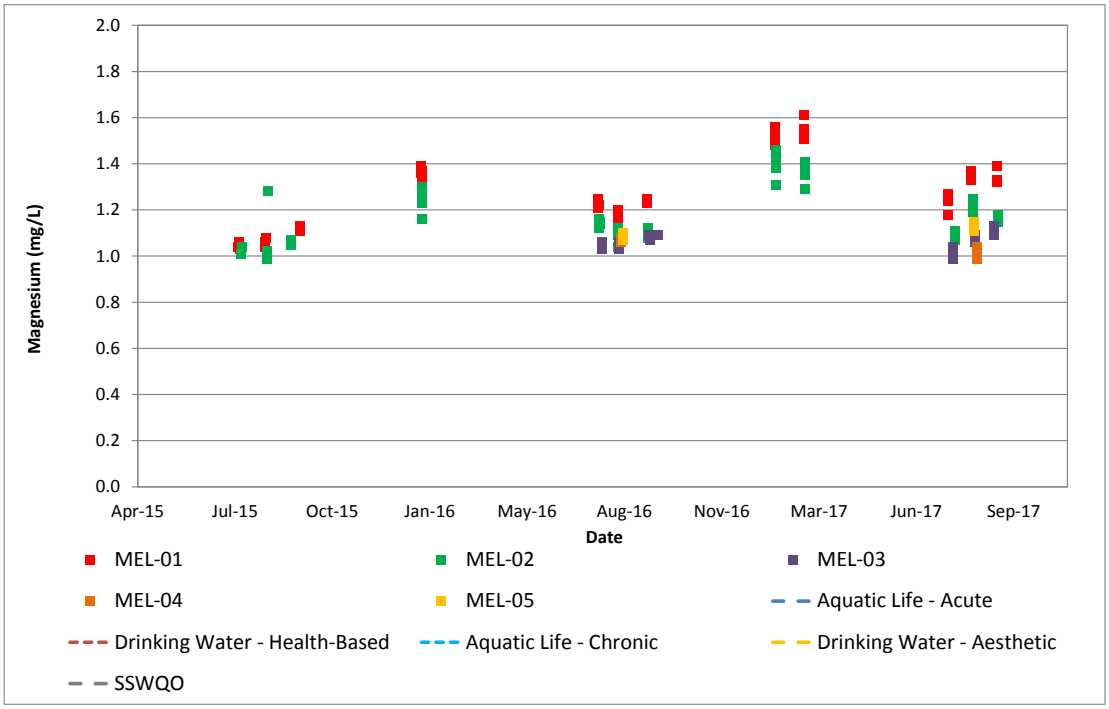
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3c: Concentrations of Chloride at Meliadine Lake Stations between 2015 and 2017



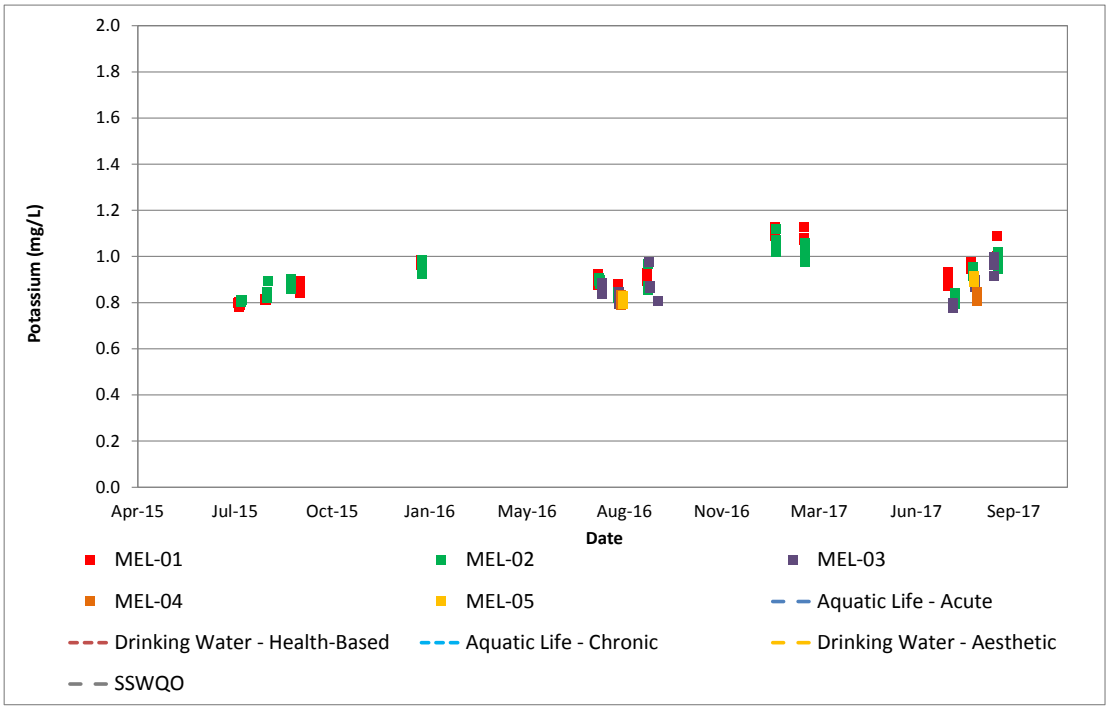
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-3d: Concentrations of Fluoride at Meliadine Lake Stations between 2015 and 2017



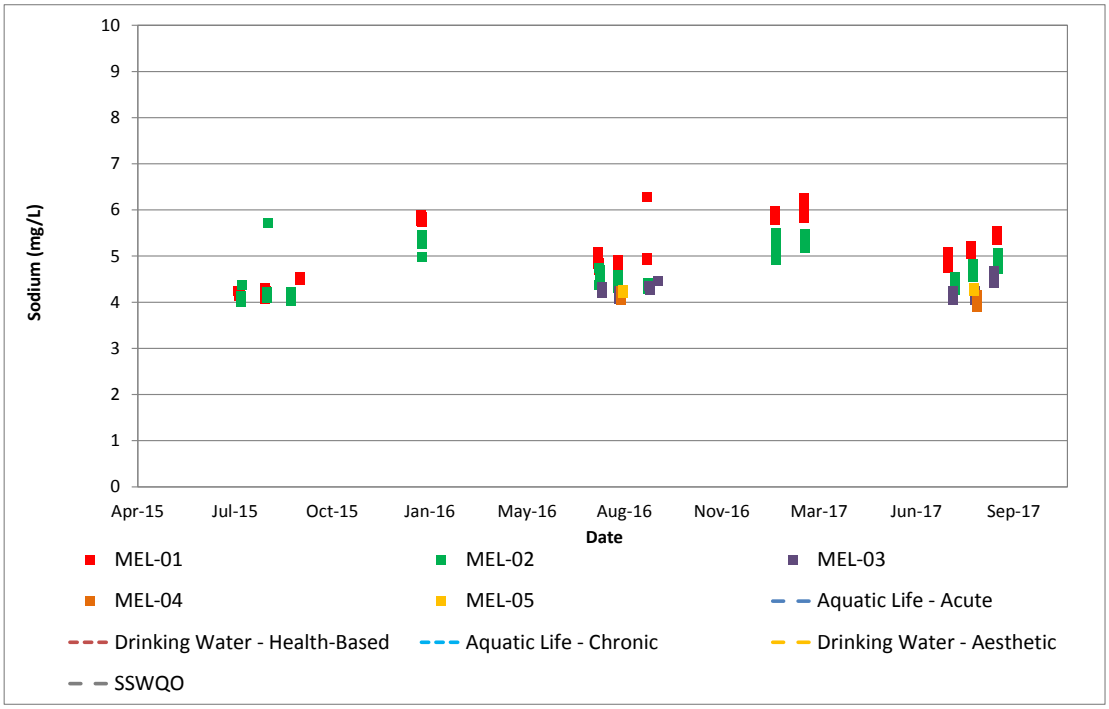
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3e: Concentrations of Magnesium at Meliadine Lake Stations between 2015 and 2017



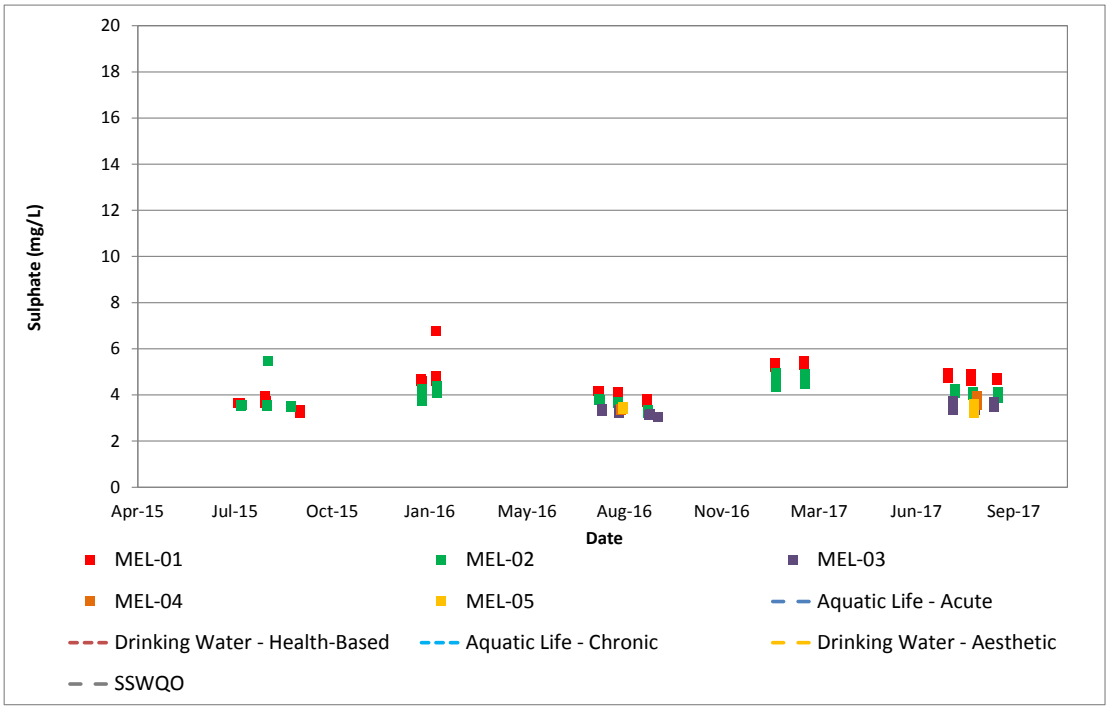
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3f: Concentrations of Potassium at Meliadine Lake Stations between 2015 and 2017



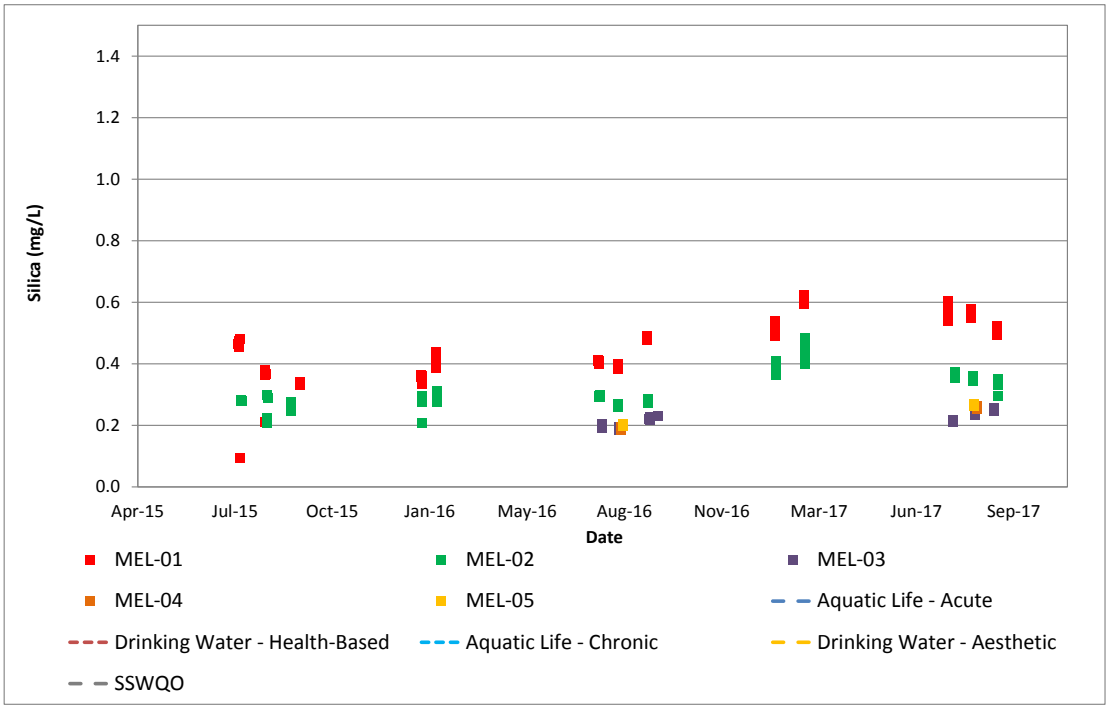
mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-3g: Concentrations of Sodium at Meliadine Lake Stations between 2015 and 2017



mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

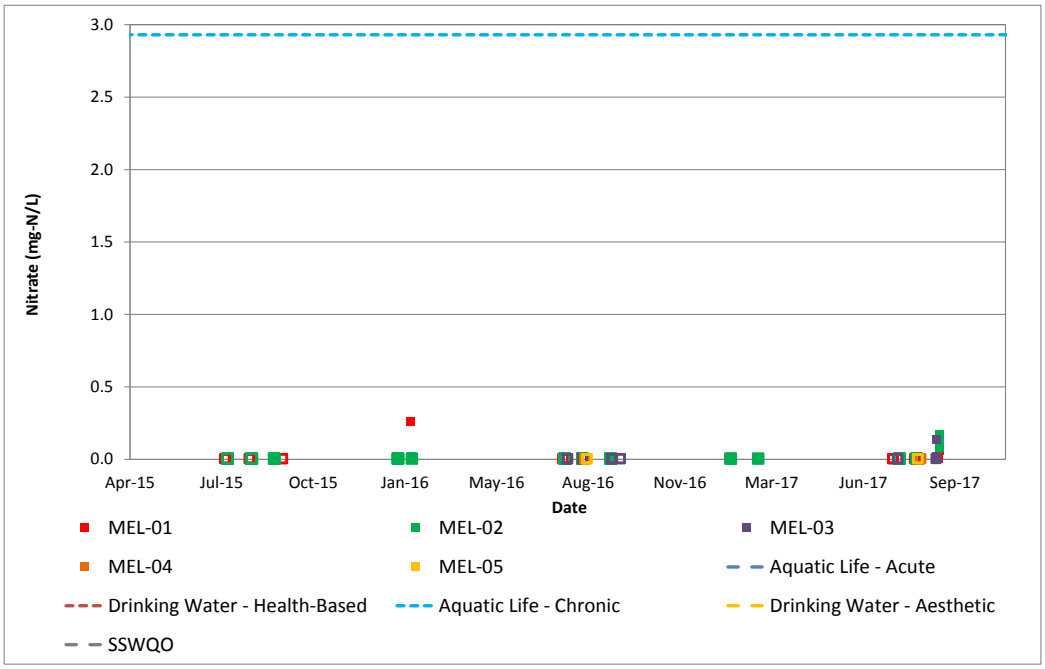
Figure 3E.1-3h: Concentrations of Sulphate at Meliadine Lake Stations between 2015 and 2017



mg/L = milligrams per litre; SSWQO = site-specific Water Quality Objectives.

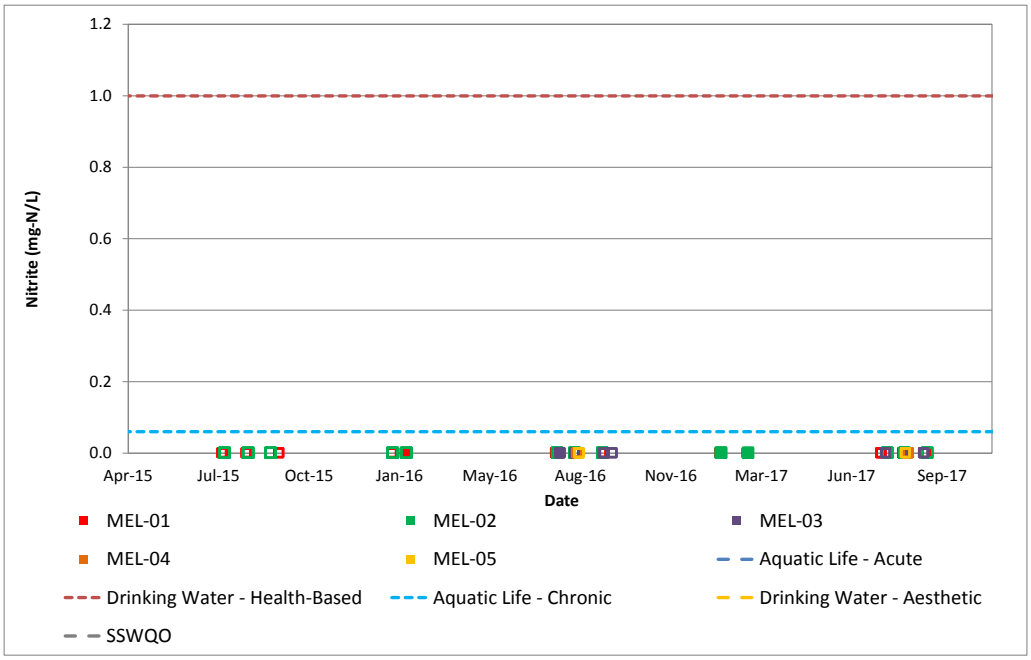
Figure 3E.1-3i: Concentrations of Silica at Meliadine Lake Stations between 2015 and 2017

3E1.4 Nutrients



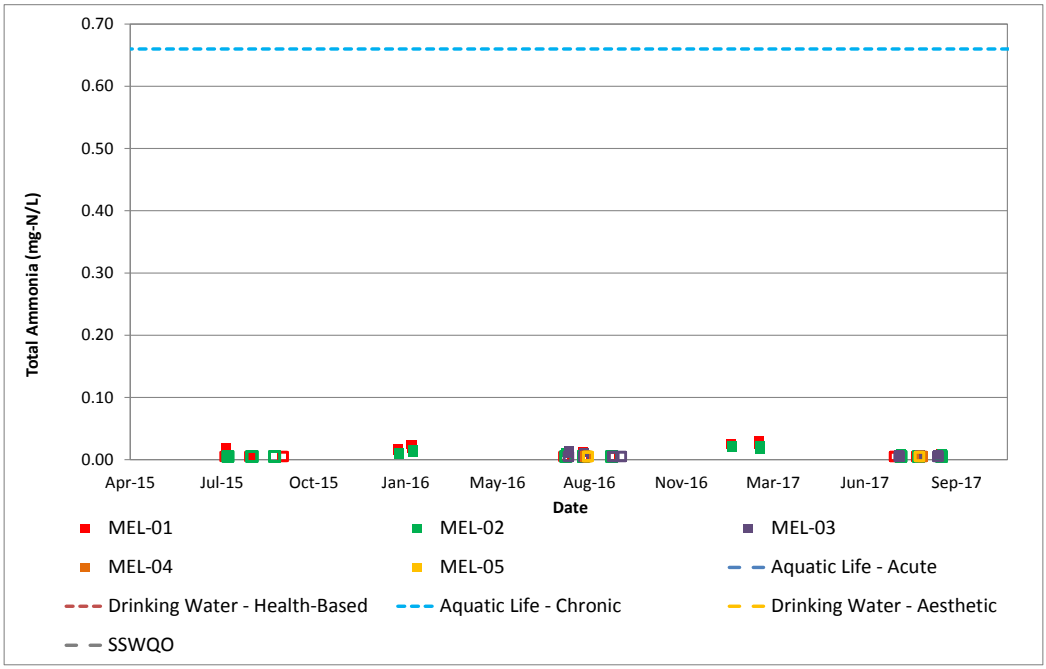
mg-N/L = milligrams as nitrogen per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-4a: Concentrations of Nitrate at Meliadine Lake Stations between 2015 and 2017



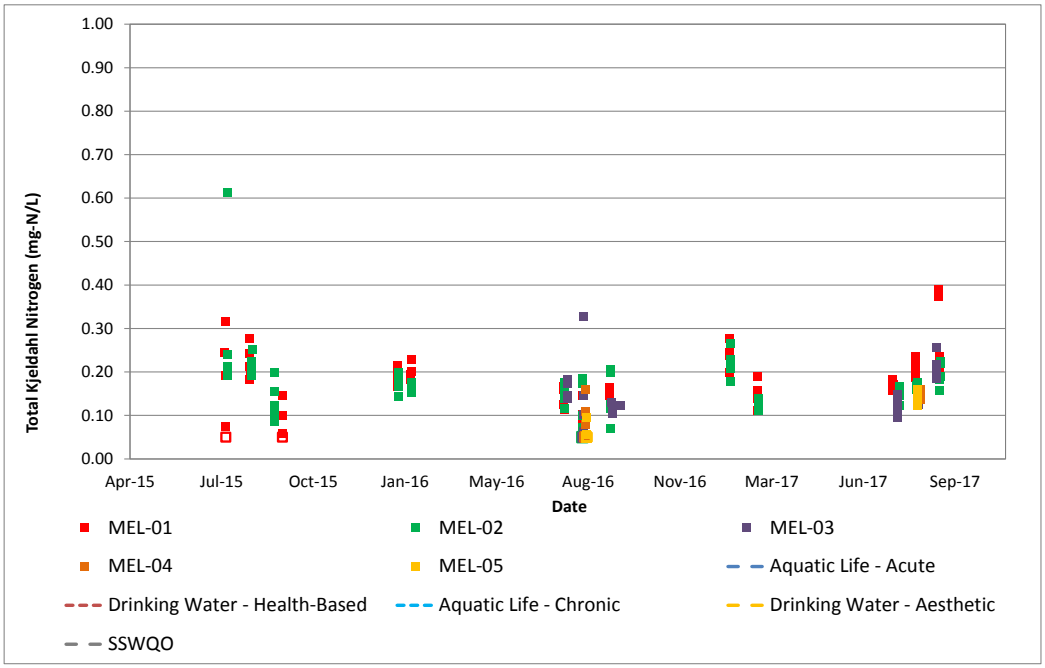
mg-N/L = milligrams as nitrogen per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-4b: Concentrations of Nitrite at Meliadine Lake Stations between 2015 and 2017



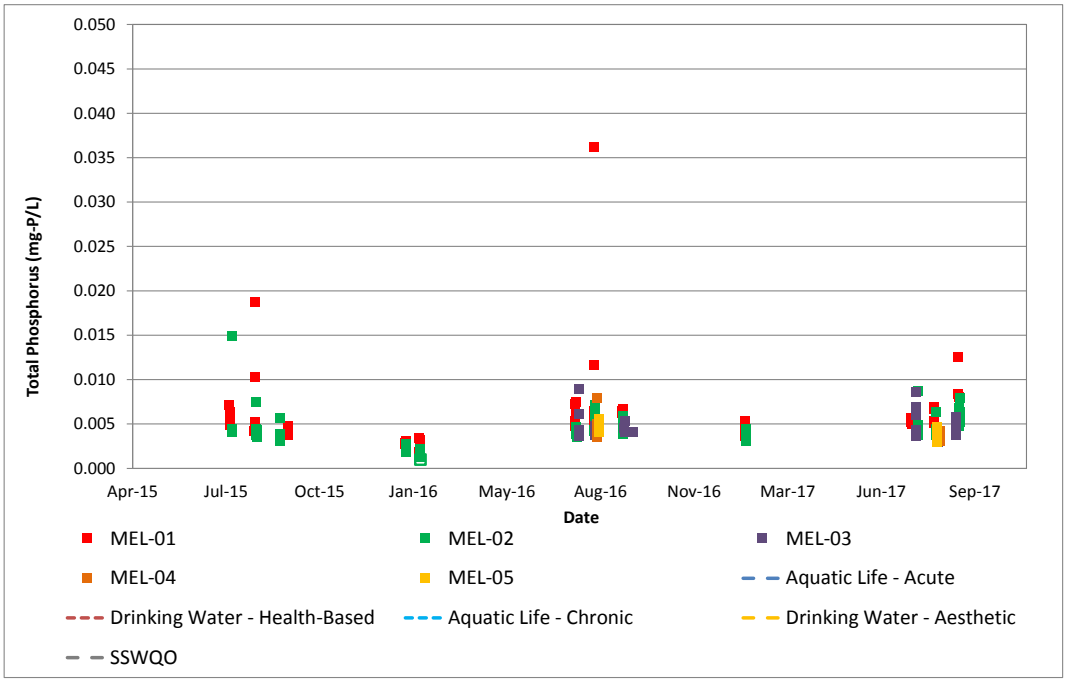
mg-N/L = milligrams as nitrogen per litre; SSWQO = site-specific Water Quality Objectives. Guideline is dependent on pH and temperature; guideline presented in the graph represents the minimum value. Open symbols represent results that are less than the detection limit.

Figure 3E.1-4c: Concentrations of Ammonia at Meliadine Lake Stations between 2015 and 2017



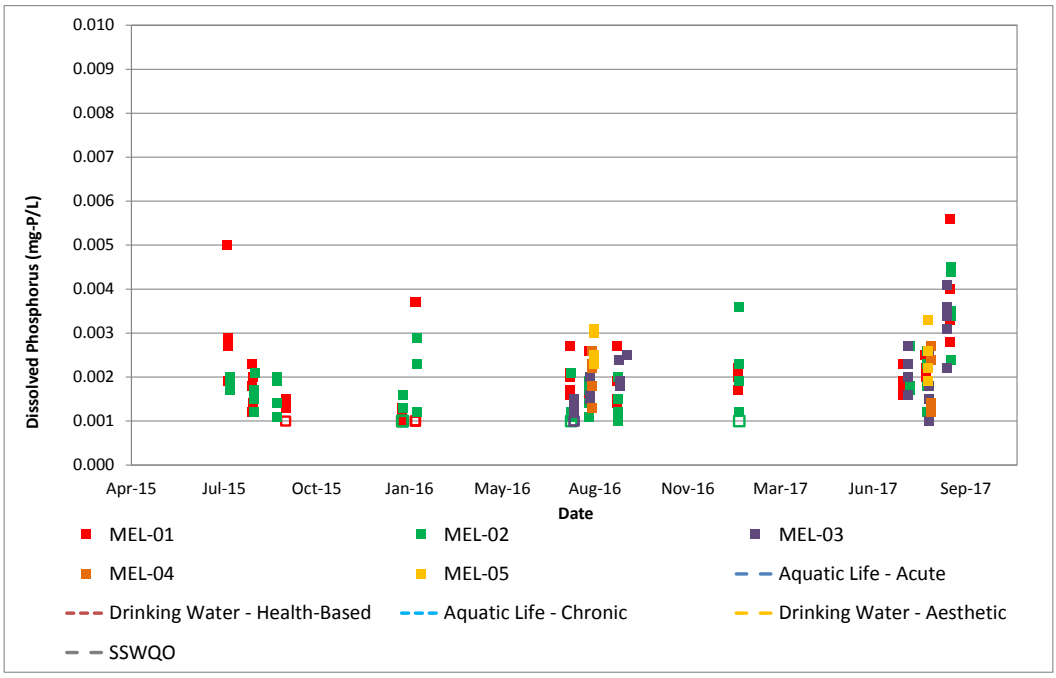
mg-N/L = milligrams as nitrogen per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-4d: Concentrations of Total Kjeldahl Nitrogen at Meliadine Lake Stations between 2015 and 2017



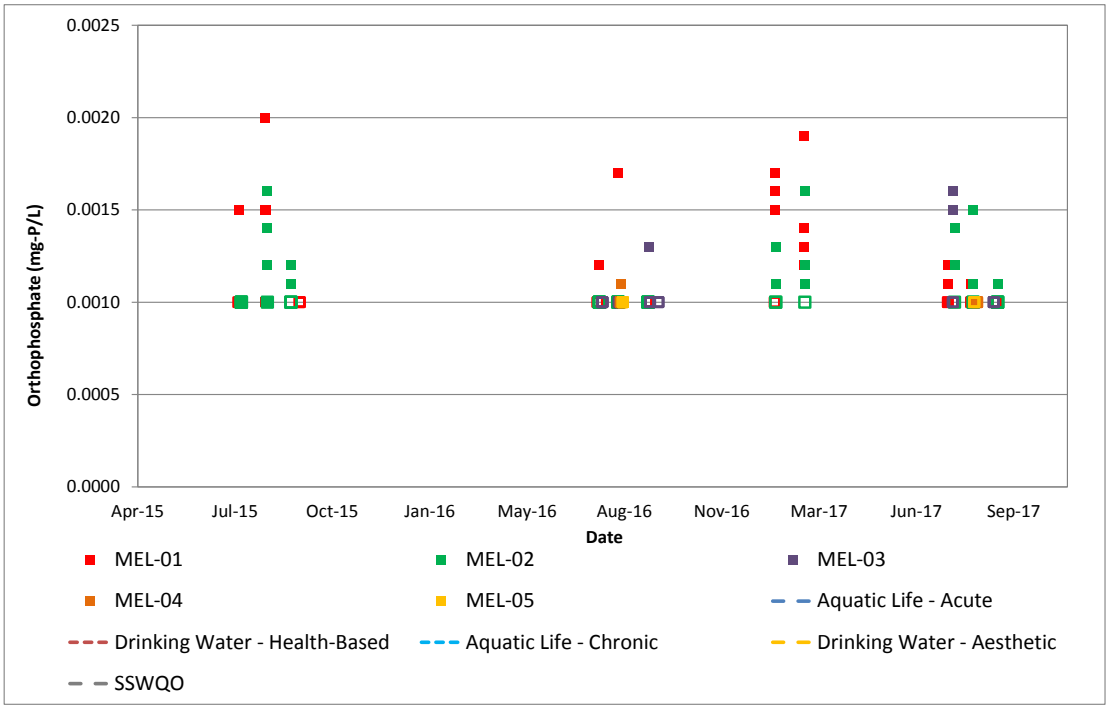
mg-P/L = milligrams as phosphorus per litre; SSWQO = site-specific Water Quality Objectives. Total phosphorus results measured in February 2017 did not pass QC criteria and were omitted from the plot.

Figure 3E.1-4e: Concentrations of Total Phosphorus at Meliadine Lake Stations between 2015 and 2017



mg-P/L = milligrams as phosphorus per litre; SSWQO = site-specific Water Quality Objectives. Dissolved phosphorus results measured in February 2017 did not pass QC criteria and were omitted from the plot.

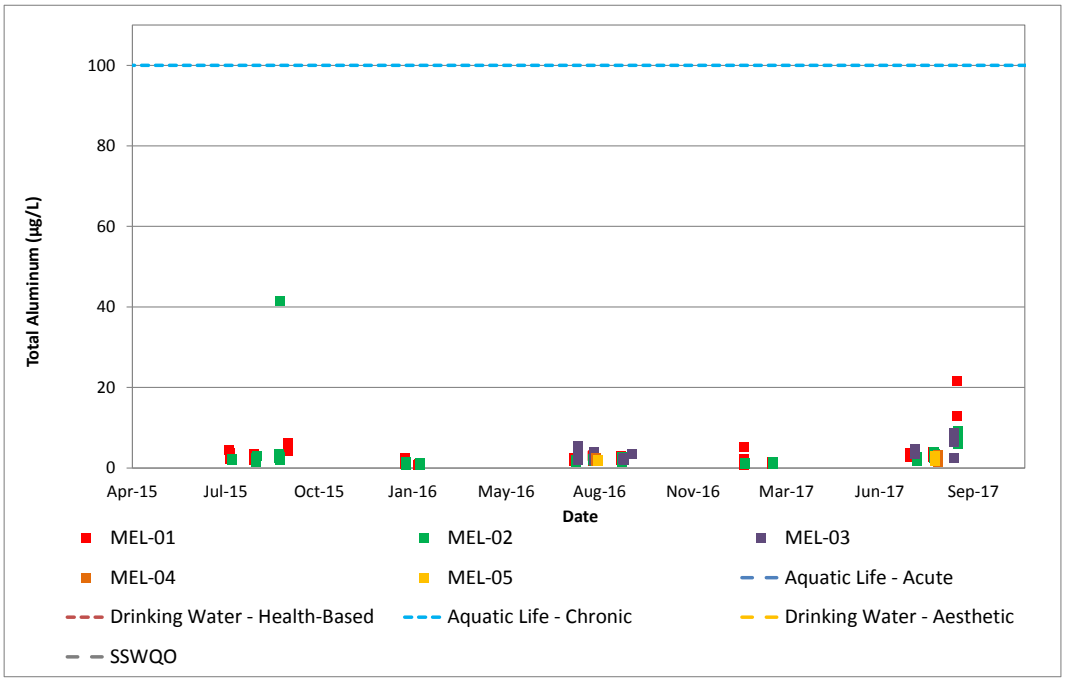
Figure 3E.1-4f: Concentrations of Dissolved Phosphorus at Meliadine Lake Stations between 2015 and 2017



mg-P/L = milligrams as phosphorus per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

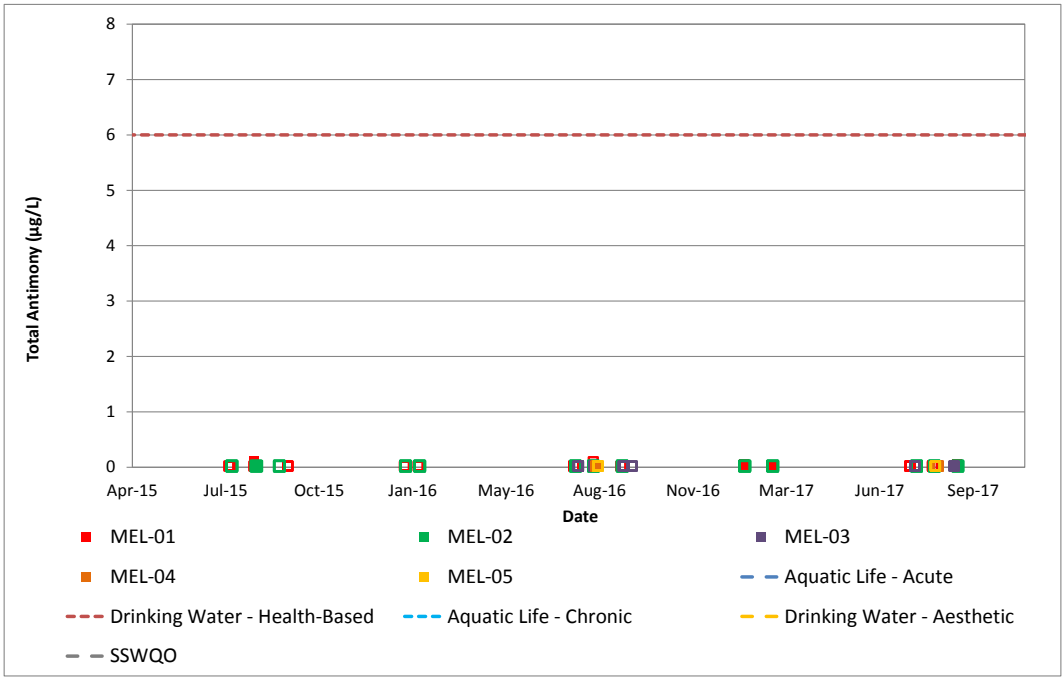
Figure 3E.1-4g: Concentrations of Orthophosphate at Meliadine Lake Stations between 2015 and 2017

3E1.5 Total Metals



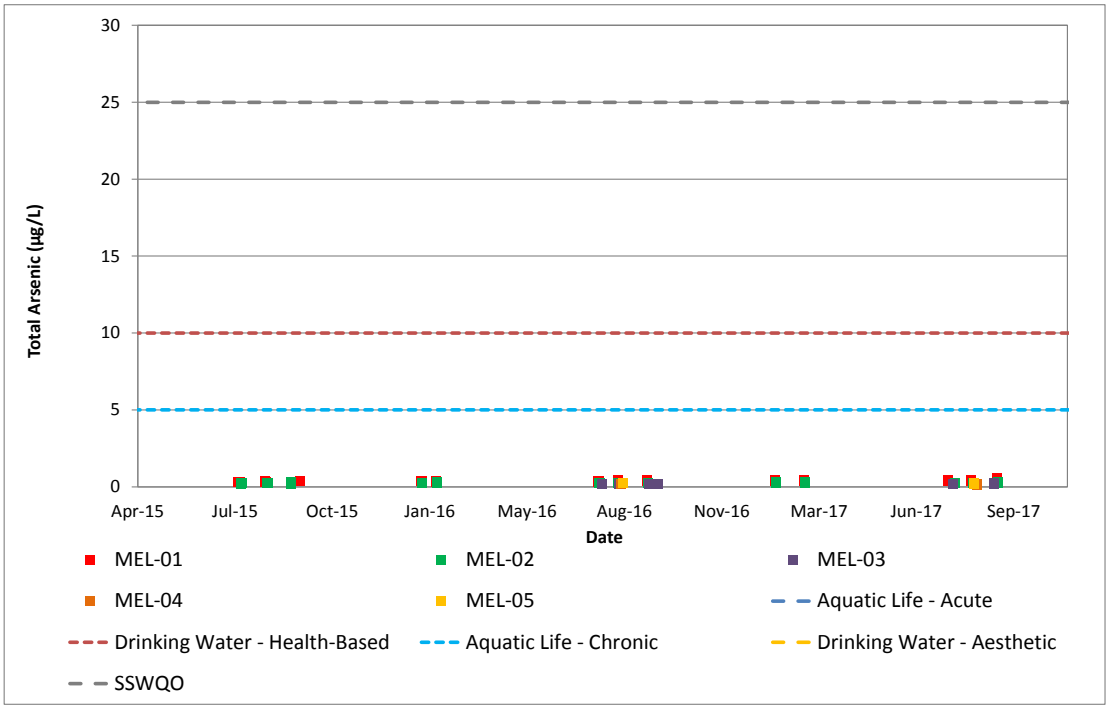
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5a: Concentrations of Total Aluminum at Meliadine Lake Stations between 2015 and 2017



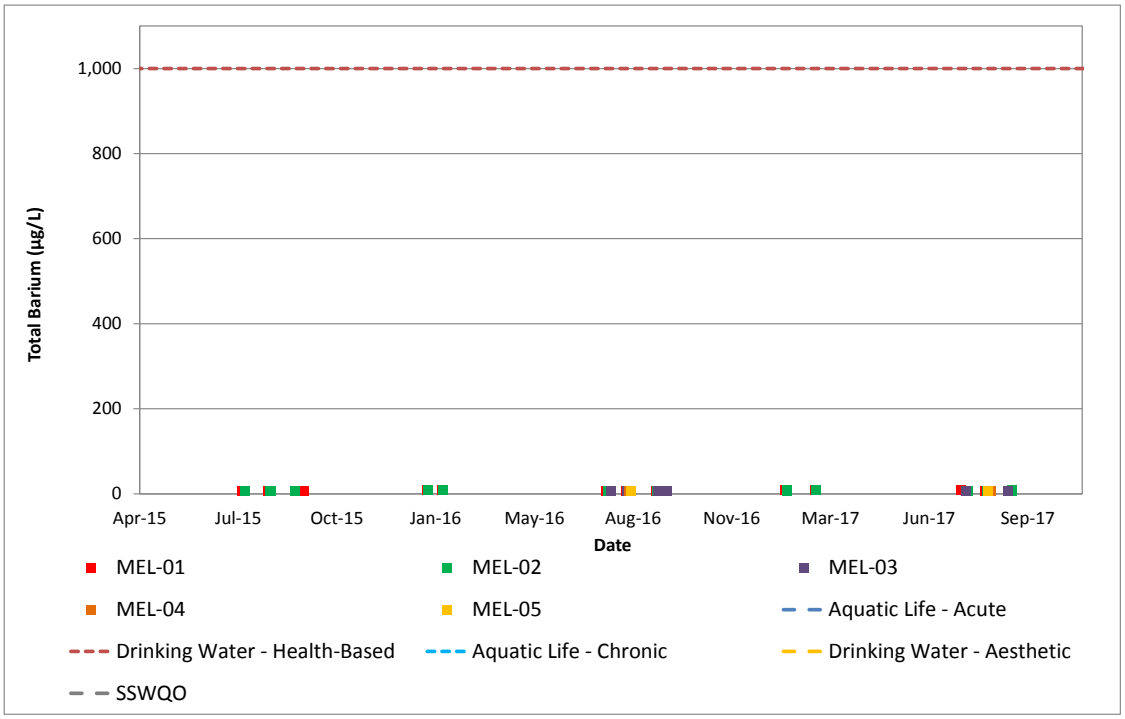
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5b: Concentrations of Total Antimony at Meliadine Lake Stations between 2015 and 2017



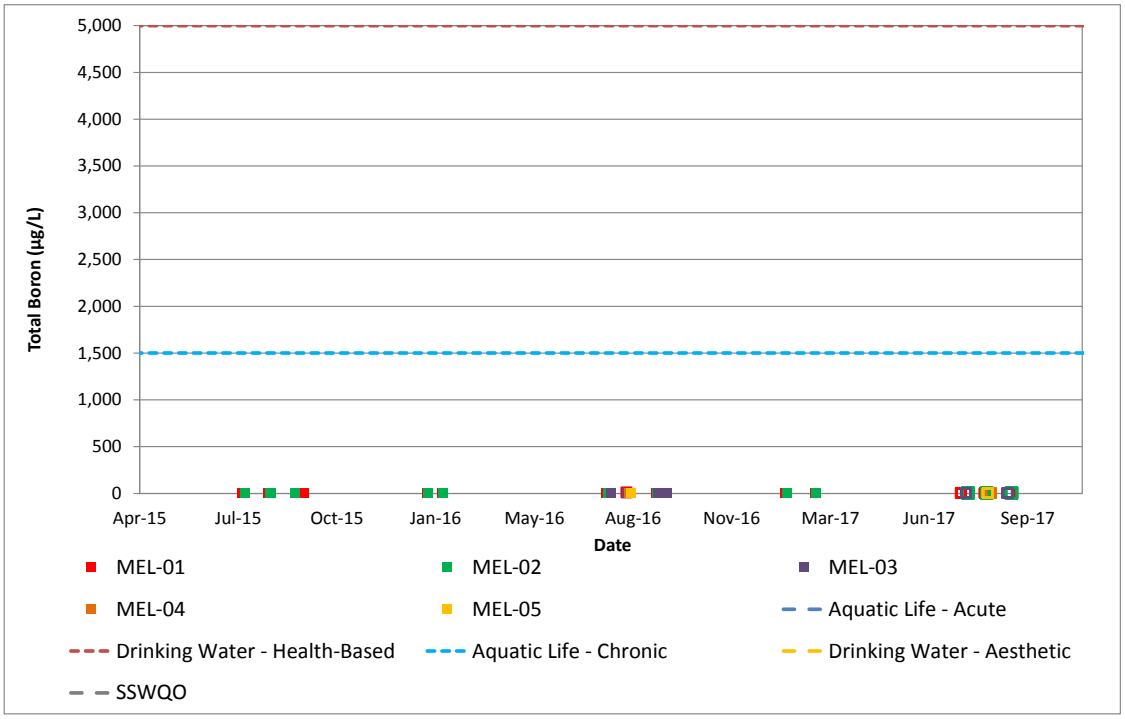
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5c: Concentrations of Total Arsenic at Meliadine Lake Stations between 2015 and 2017



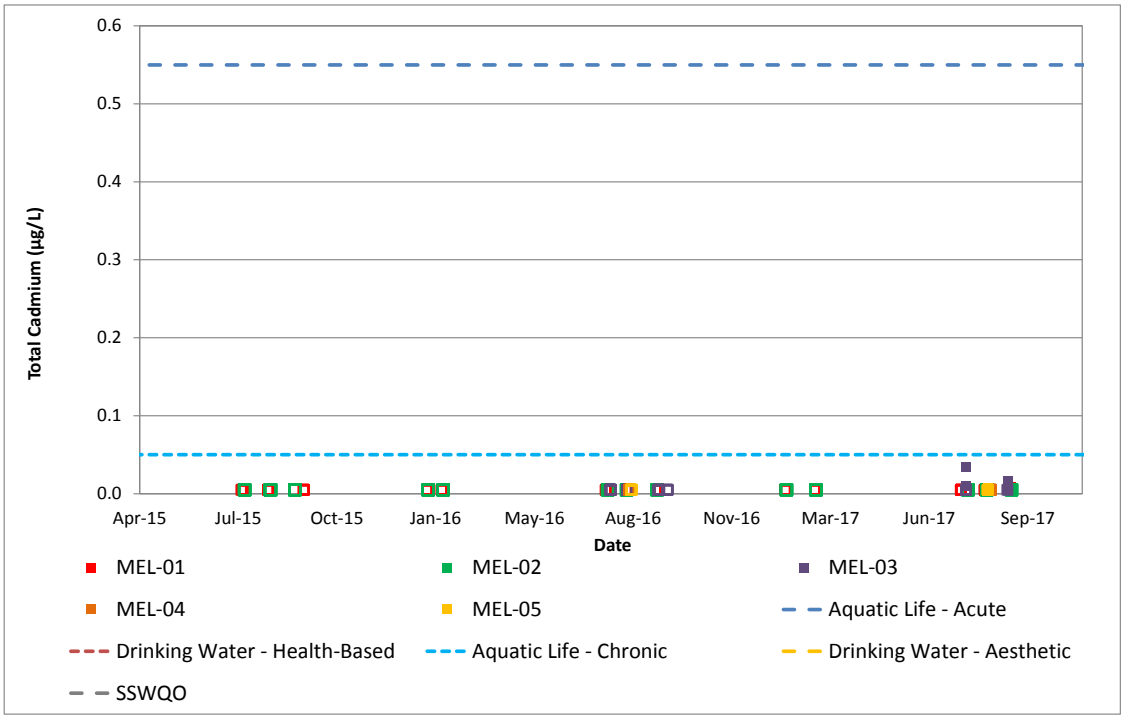
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5d: Concentrations of Total Barium at Meliadine Lake Stations between 2015 and 2017



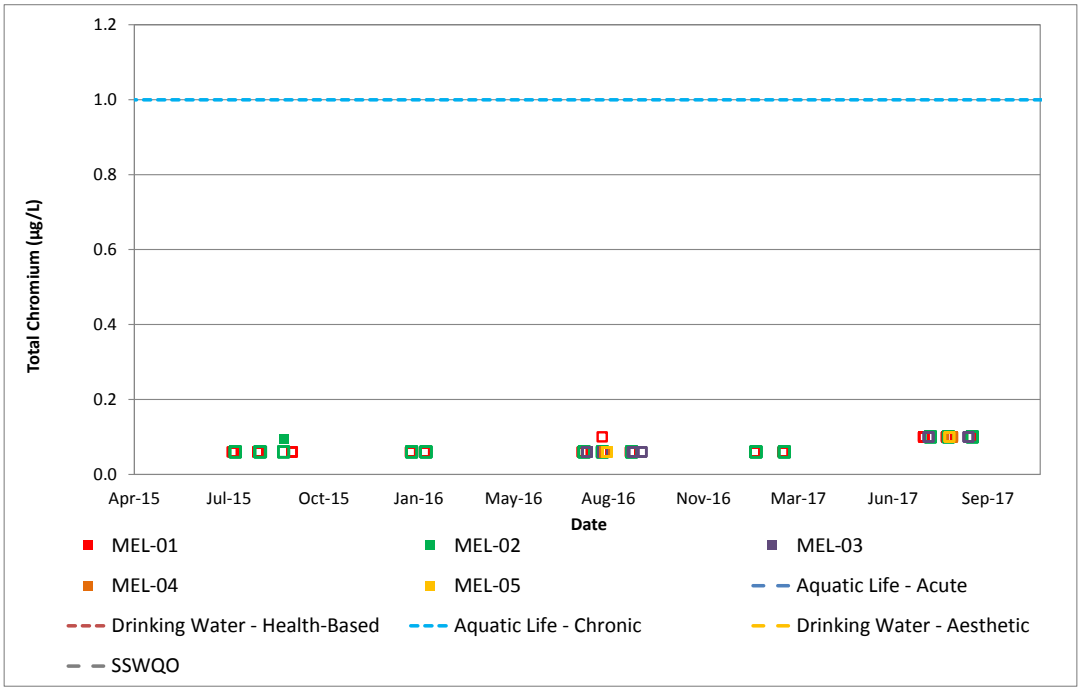
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5e: Concentrations of Total Boron at Meliadine Lake Stations between 2015 and 2017



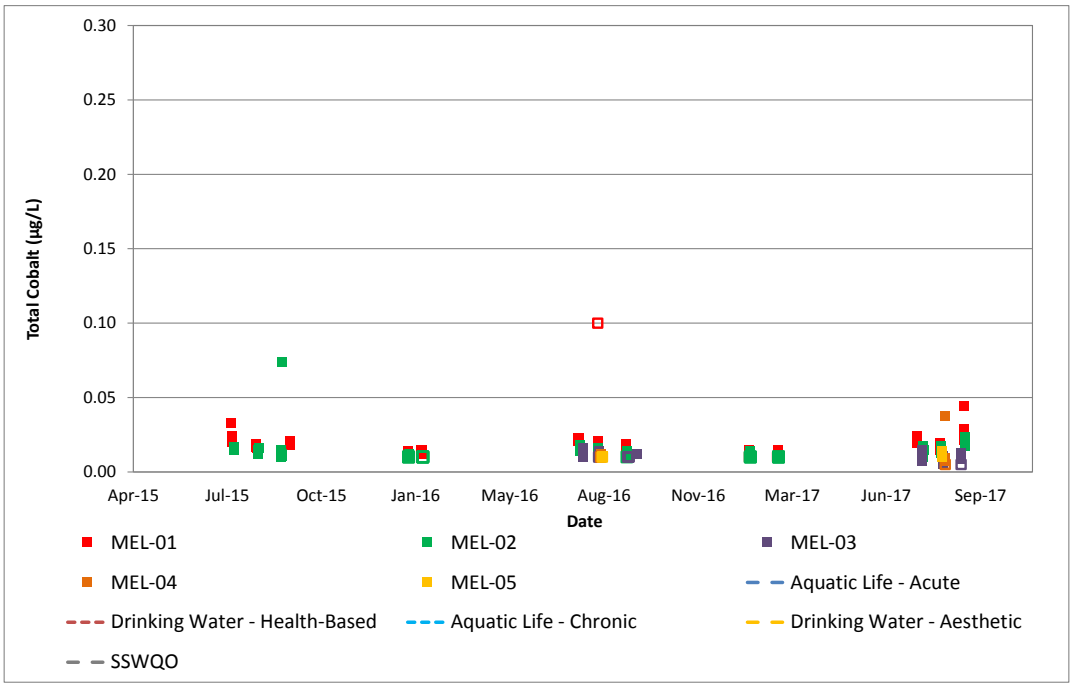
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5f: Concentrations of Total Cadmium at Meliadine Lake Stations between 2015 and 2017



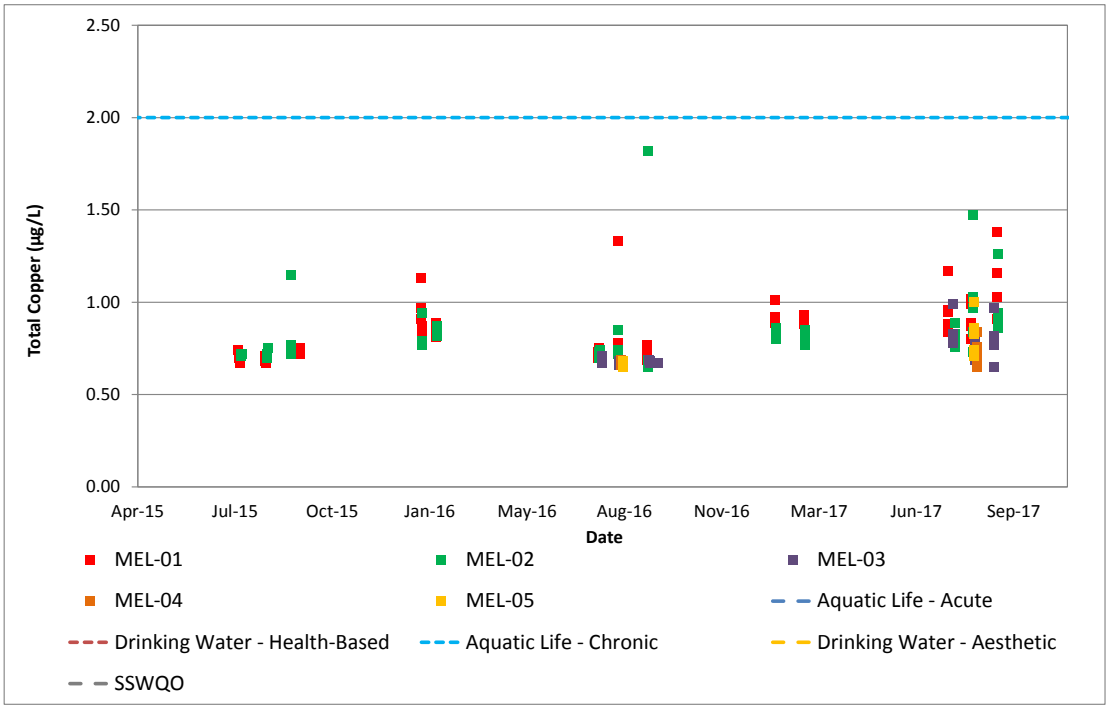
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5g: Concentrations of Total Chromium at Meliadine Lake Stations between 2015 and 2017



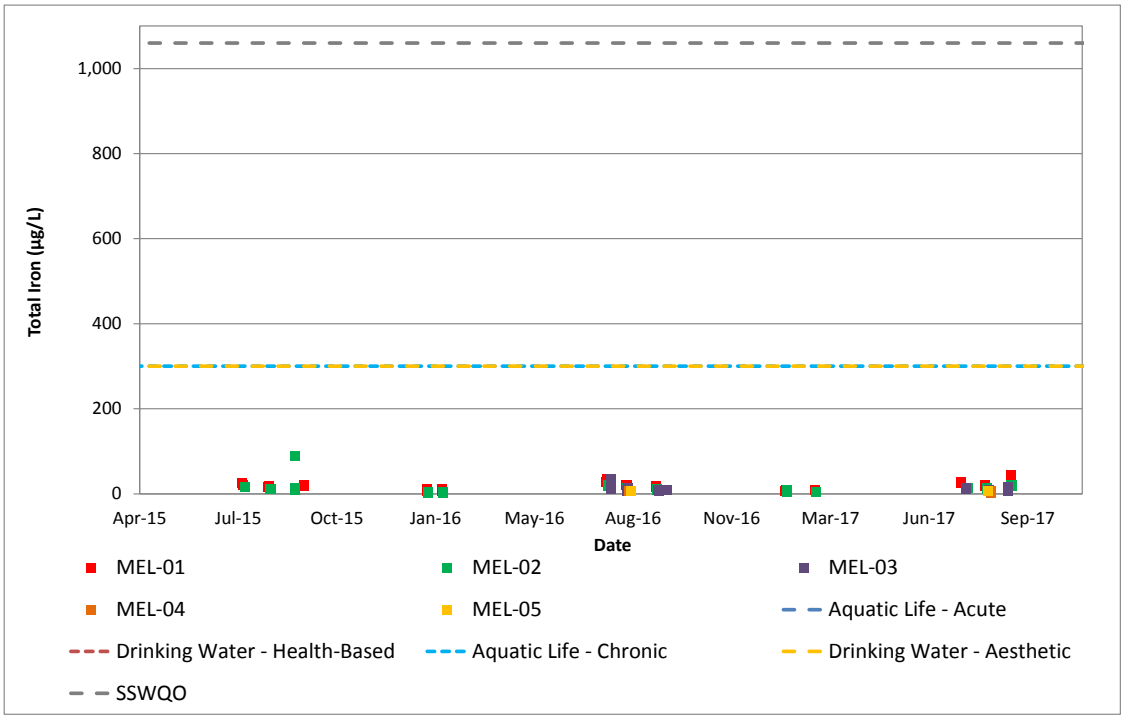
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5h: Concentrations of Total Cobalt at Meliadine Lake Stations between 2015 and 2017



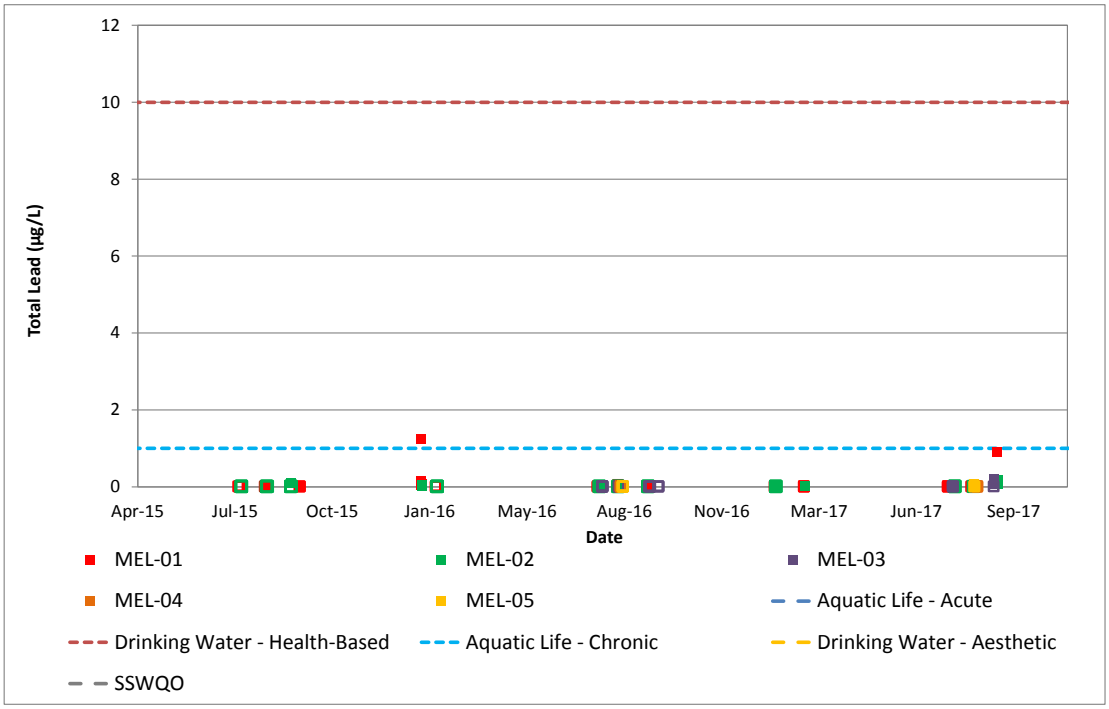
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5i: Concentrations of Total Copper at Meliadine Lake Stations between 2015 and 2017



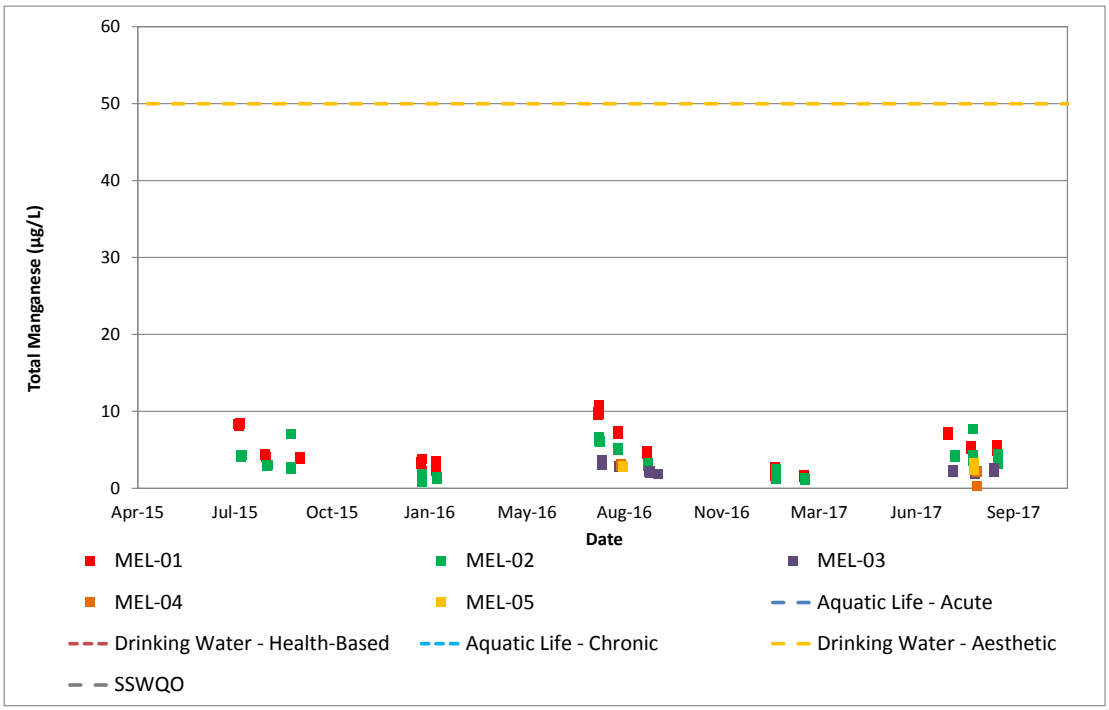
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5j: Concentrations of Total Iron at Meliadine Lake Stations between 2015 and 2017



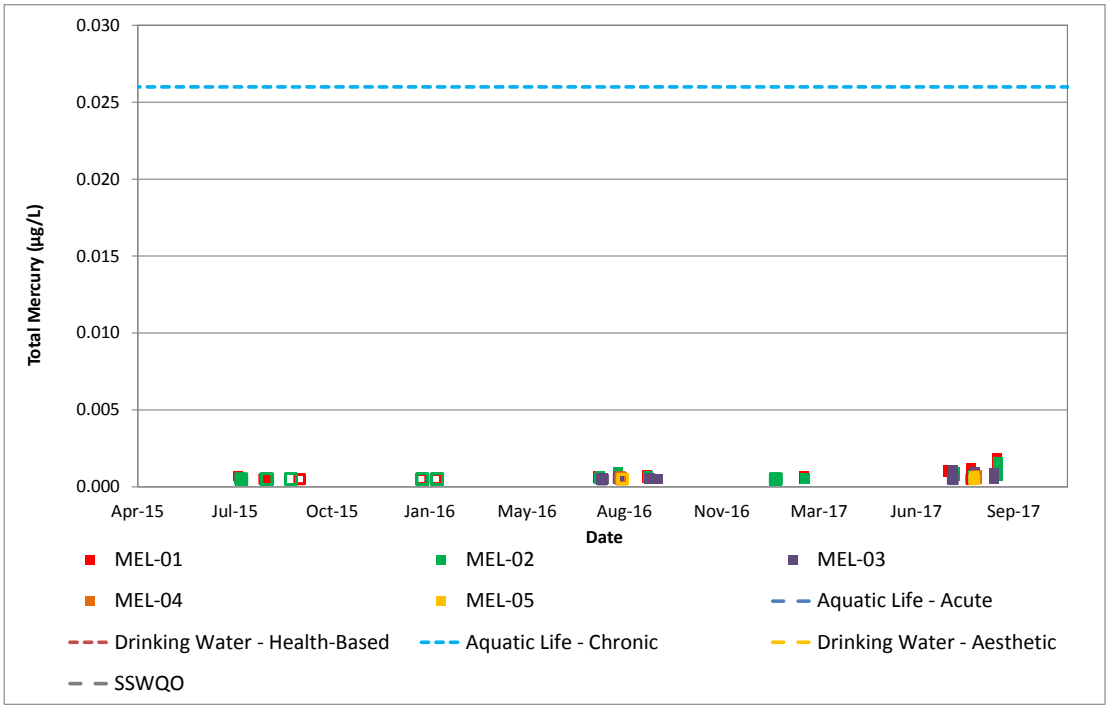
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5k: Concentrations of Total Lead at Meliadine Lake Stations between 2015 and 2017



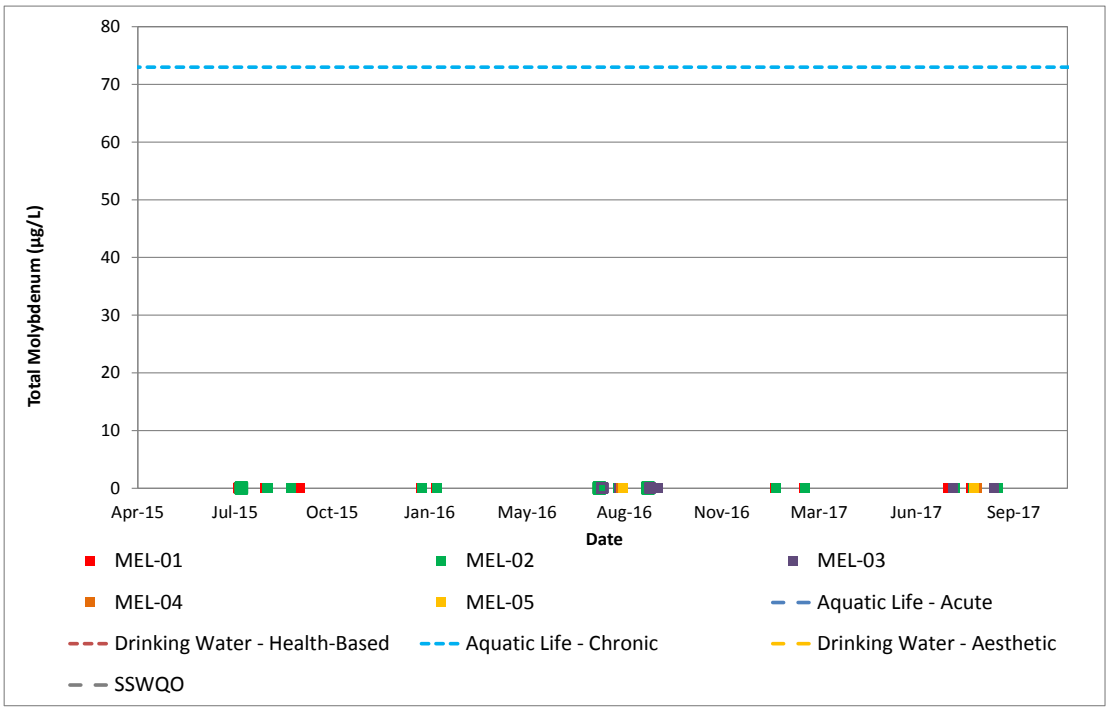
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5l: Concentrations of Total Manganese at Meliadine Lake Stations between 2015 and 2017



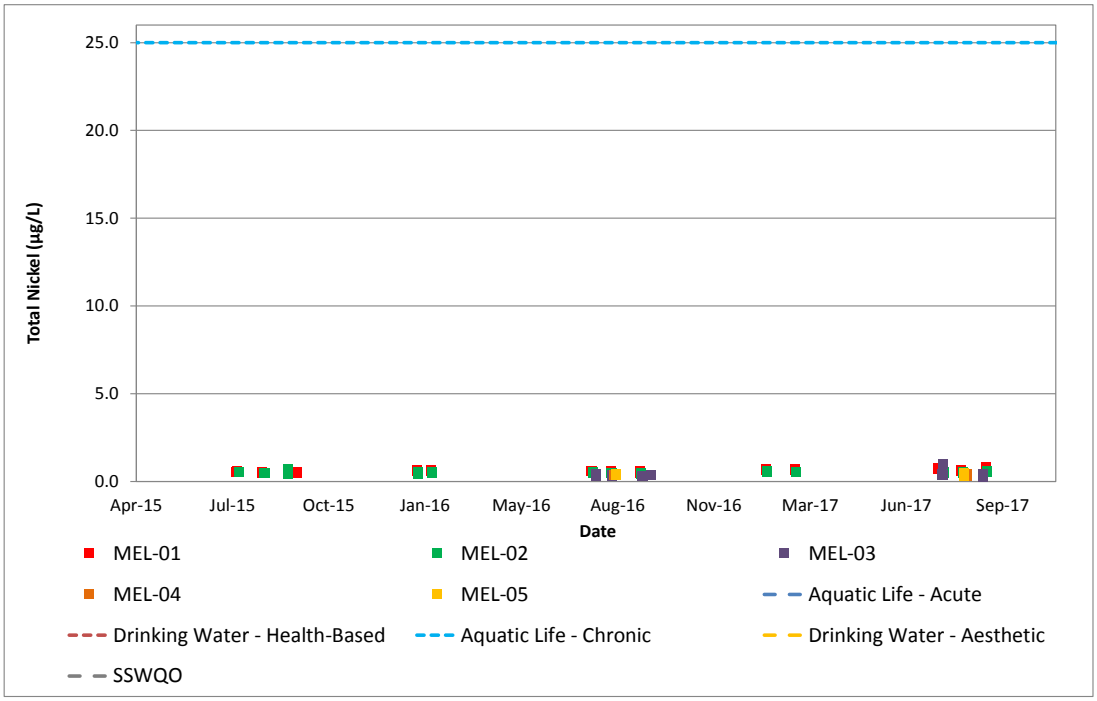
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5m: Concentrations of Total Mercury at Meliadine Lake Stations between 2015 and 2017



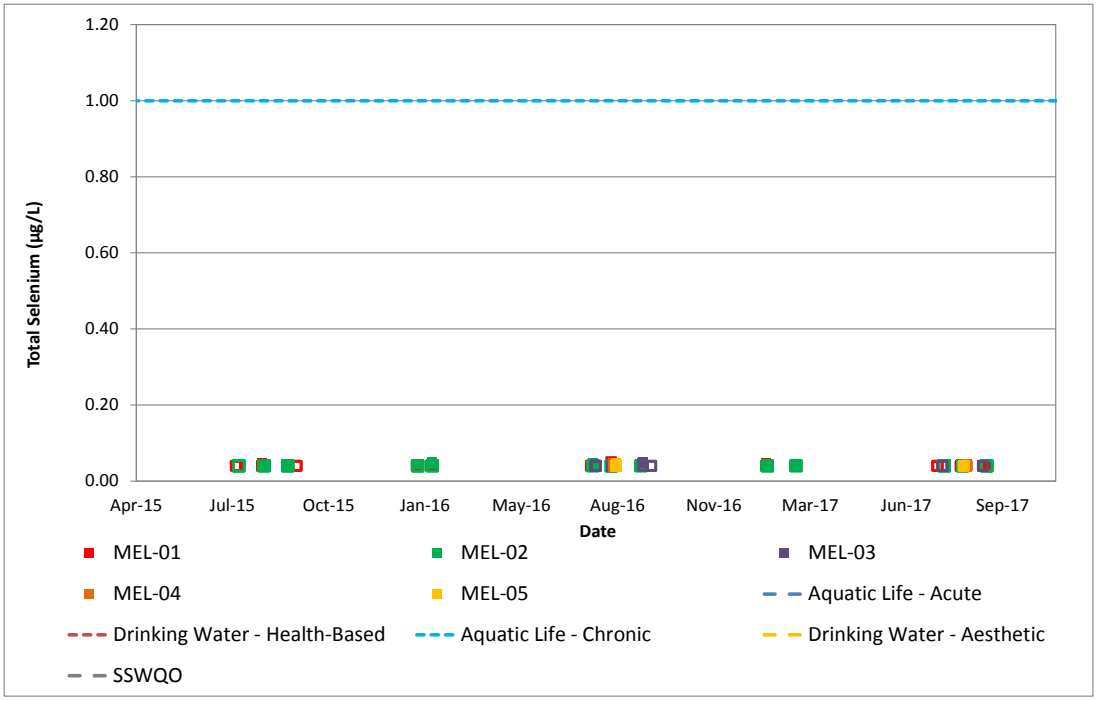
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5n: Concentrations of Total Molybdenum at Meliadine Lake Stations between 2015 and 2017



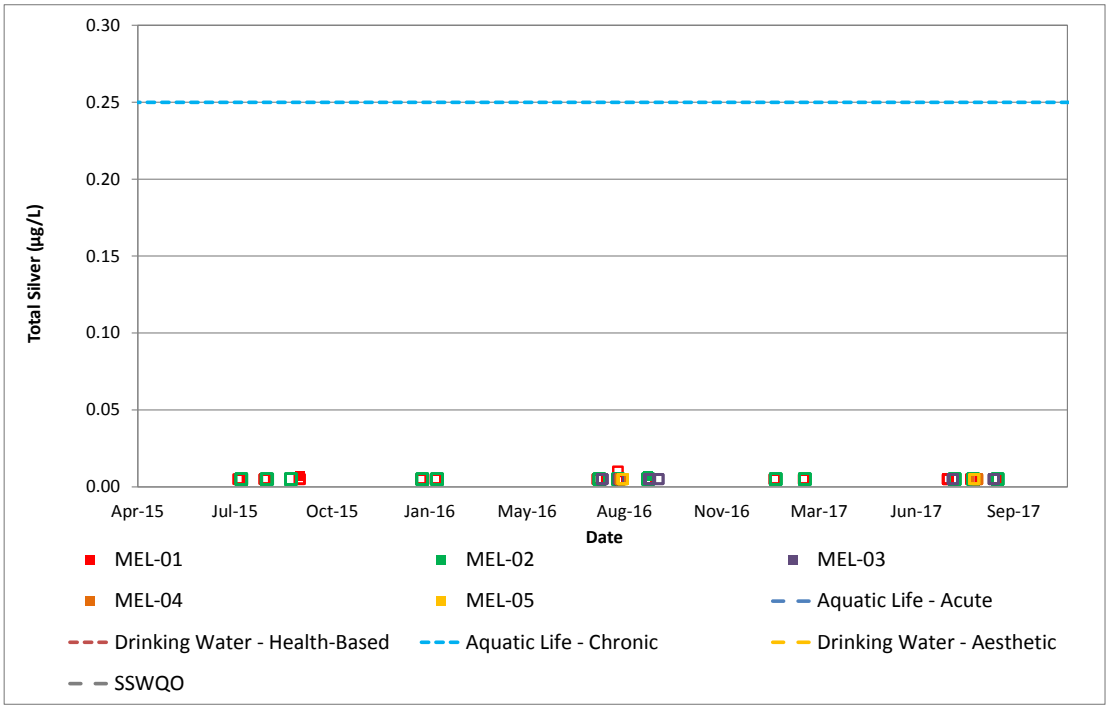
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5o: Concentrations of Total Nickel at Meliadine Lake Stations between 2015 and 2017



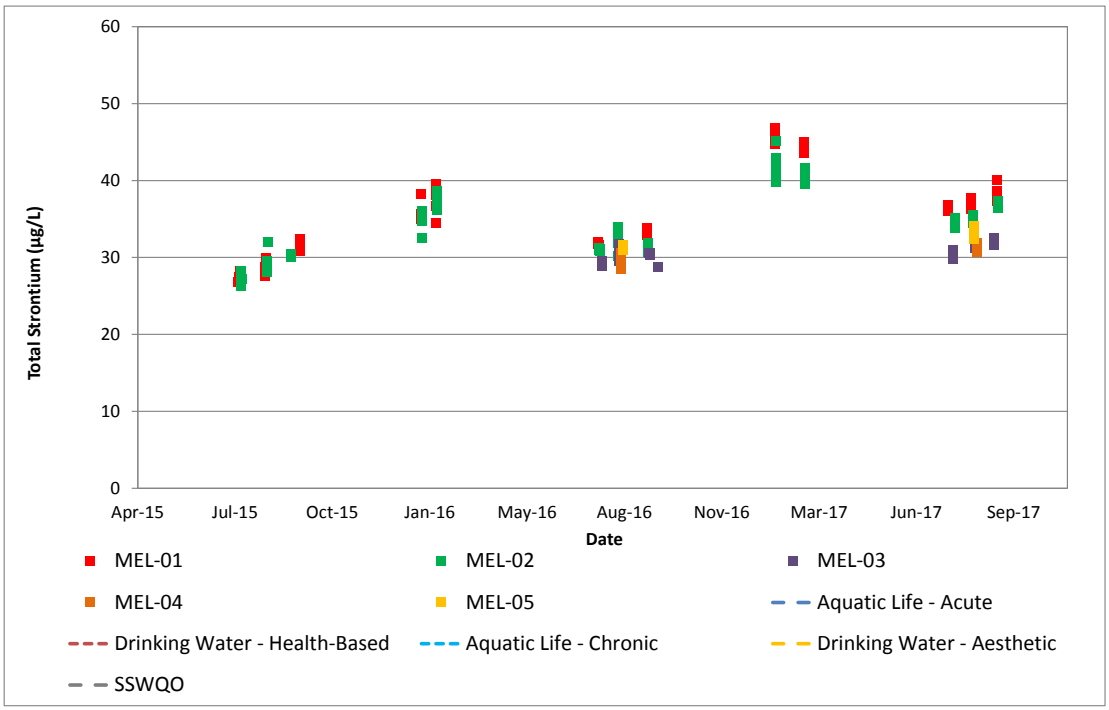
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5p: Concentrations of Total Selenium at Meliadine Lake Stations between 2015 and 2017



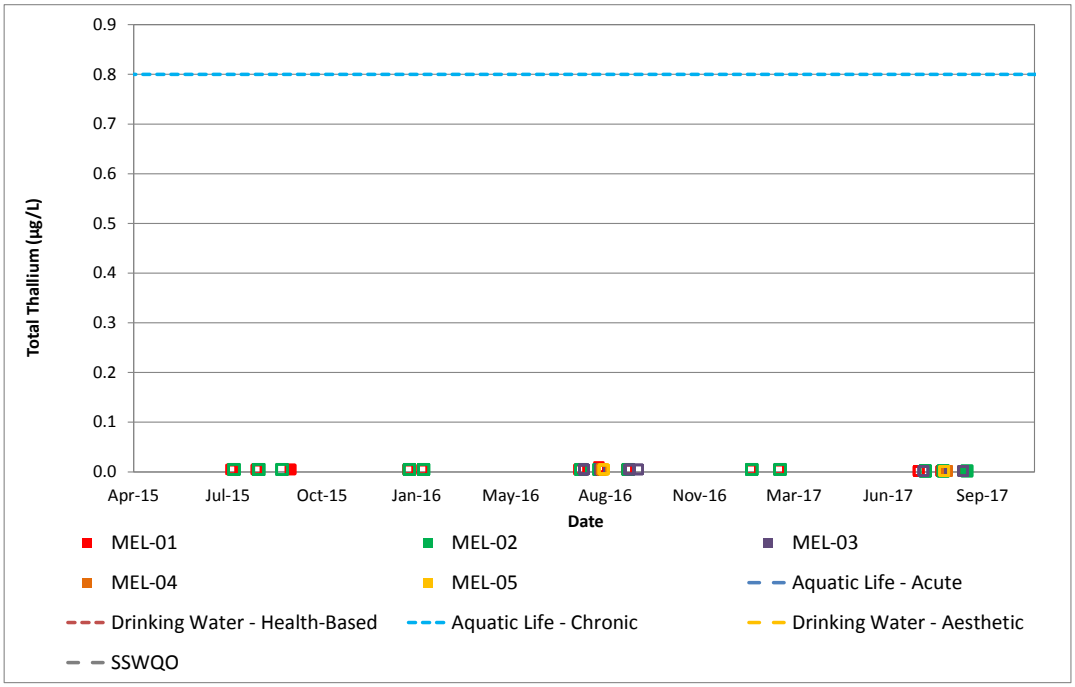
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5q: Concentrations of Total Silver at Meliadine Lake Stations between 2015 and 2017



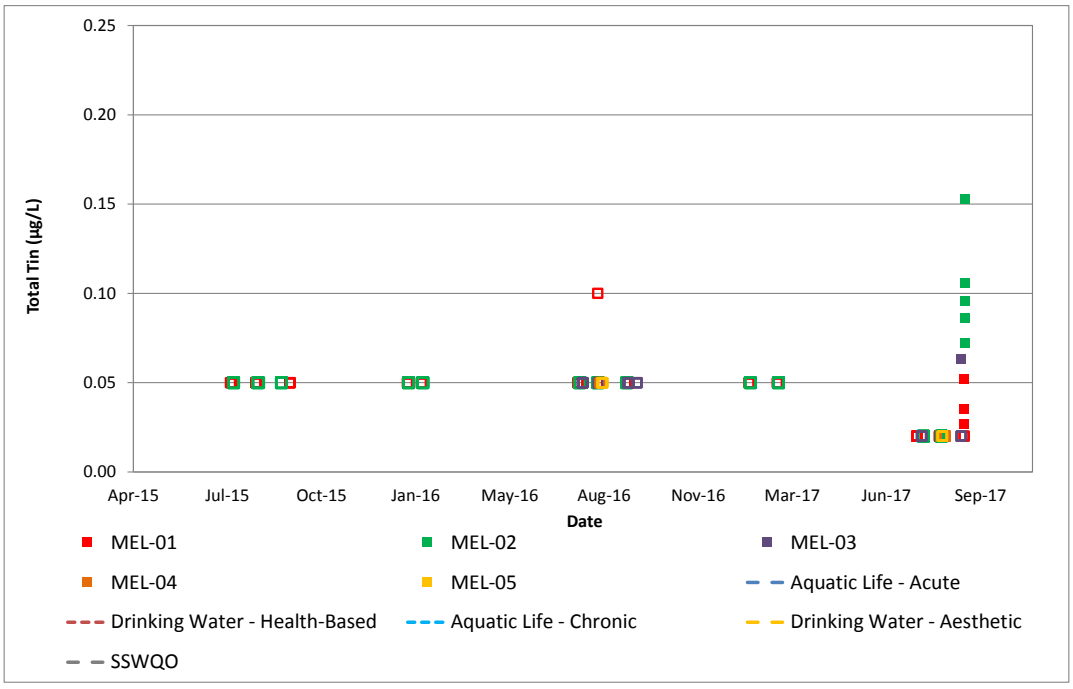
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-5r: Concentrations of Total Strontium at Meliadine Lake Stations between 2015 and 2017



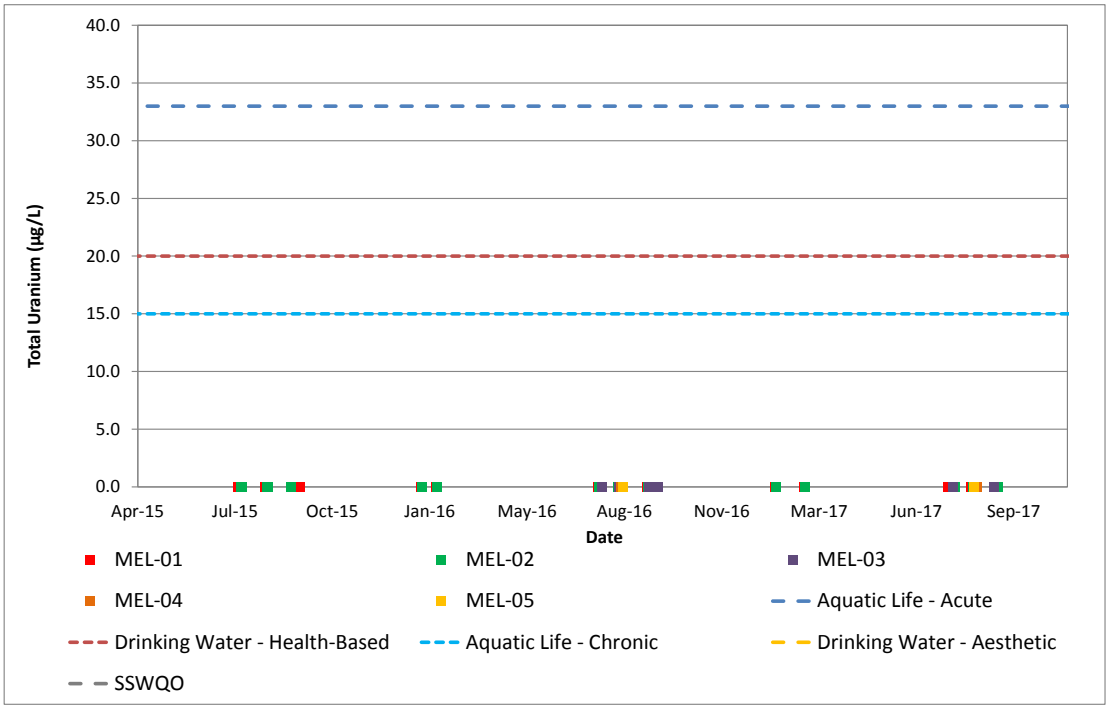
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5s: Concentrations of Total Thallium at Meliadine Lake Stations between 2015 and 2017



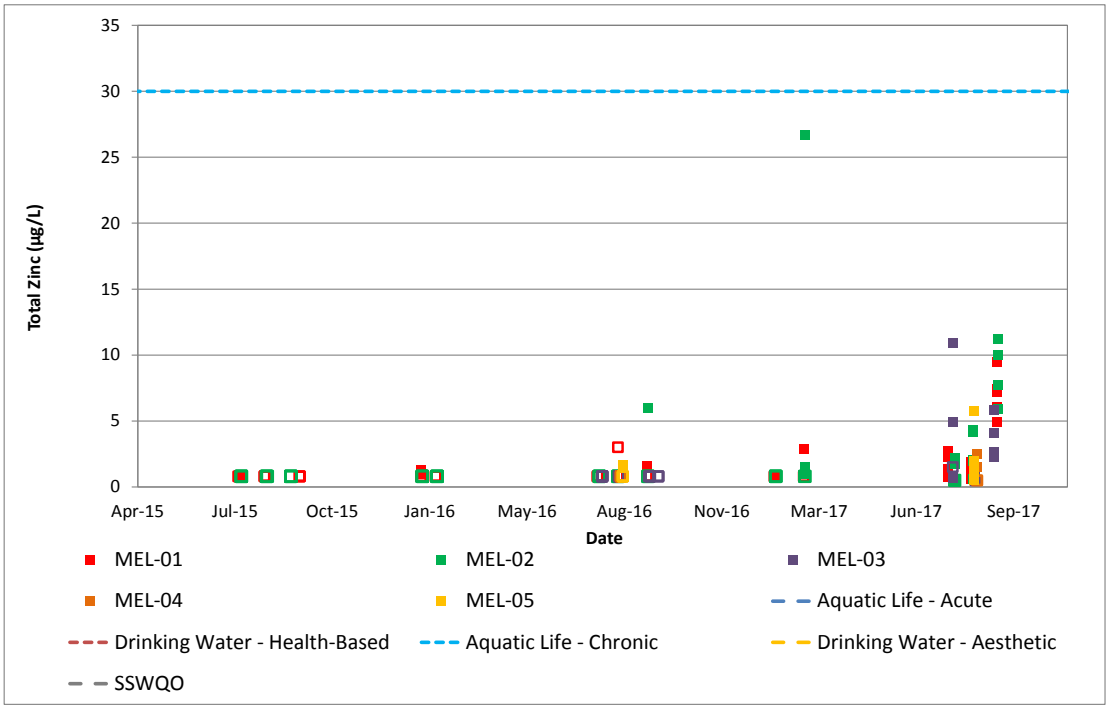
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-5t: Concentrations of Total Tin at Meliadine Lake Stations between 2015 and 2017



µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

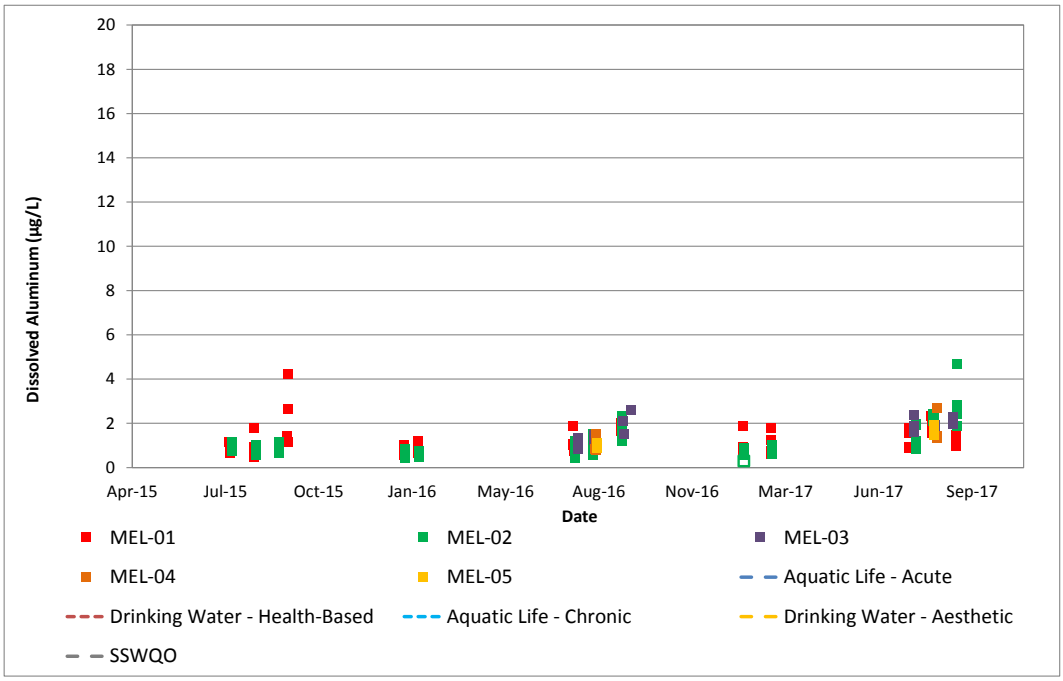
Figure 3E.1-5u: Concentrations of Total Uranium at Meliadine Lake Stations between 2015 and 2017



µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

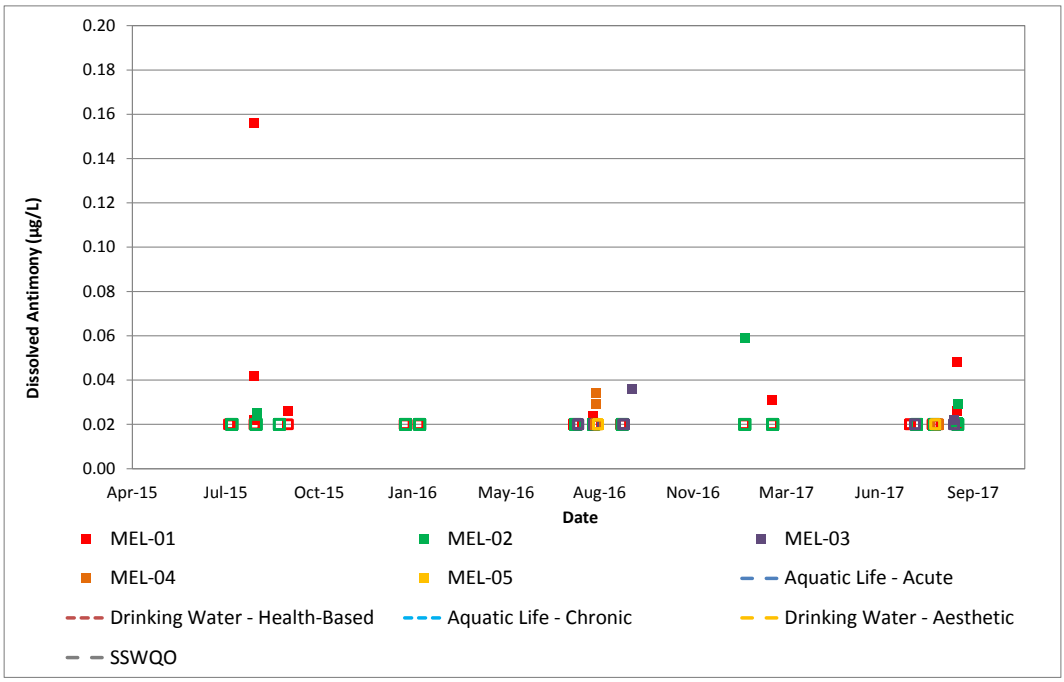
Figure 3E.1-5v: Concentrations of Total Zinc at Meliadine Lake Stations between 2015 and 2017

3E1.6 Dissolved Metals



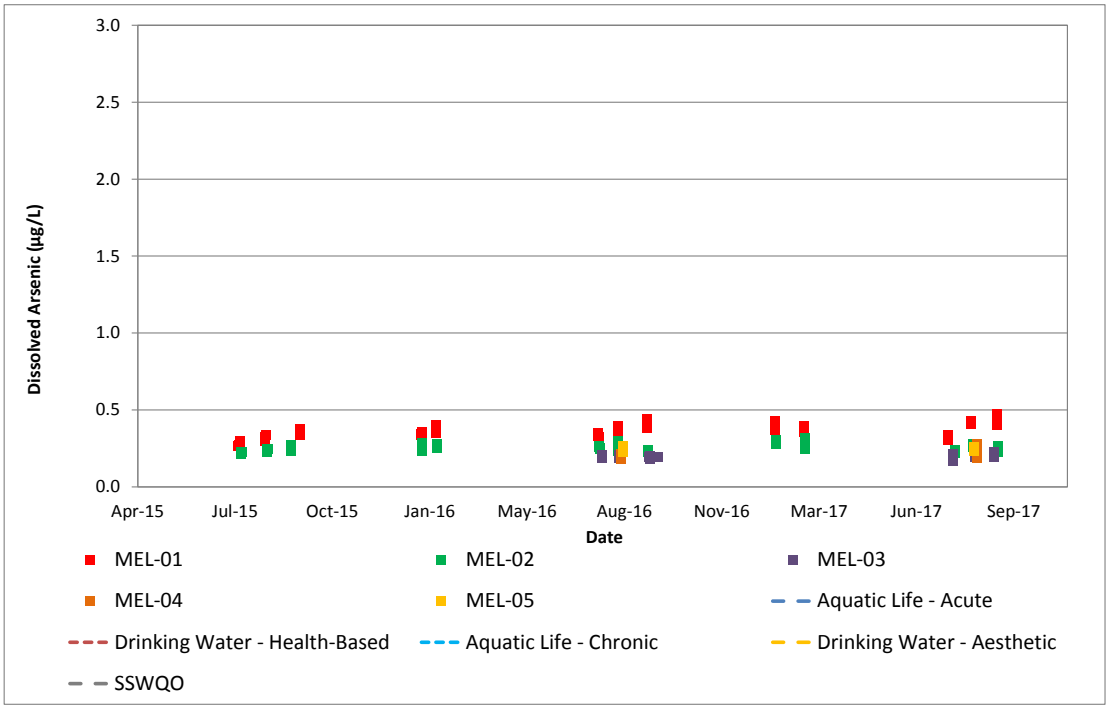
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6a: Concentrations of Dissolved Aluminum at Meliadine Lake Stations between 2015 and 2017



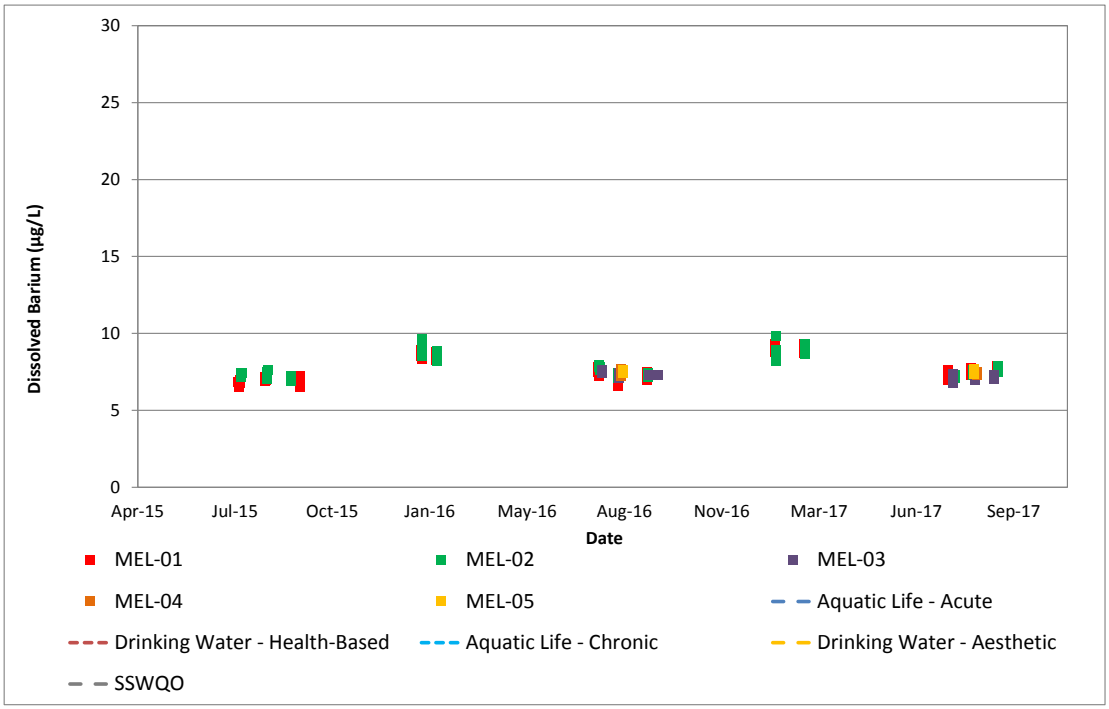
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6b: Concentrations of Dissolved Antimony at Meliadine Lake Stations between 2015 and 2017



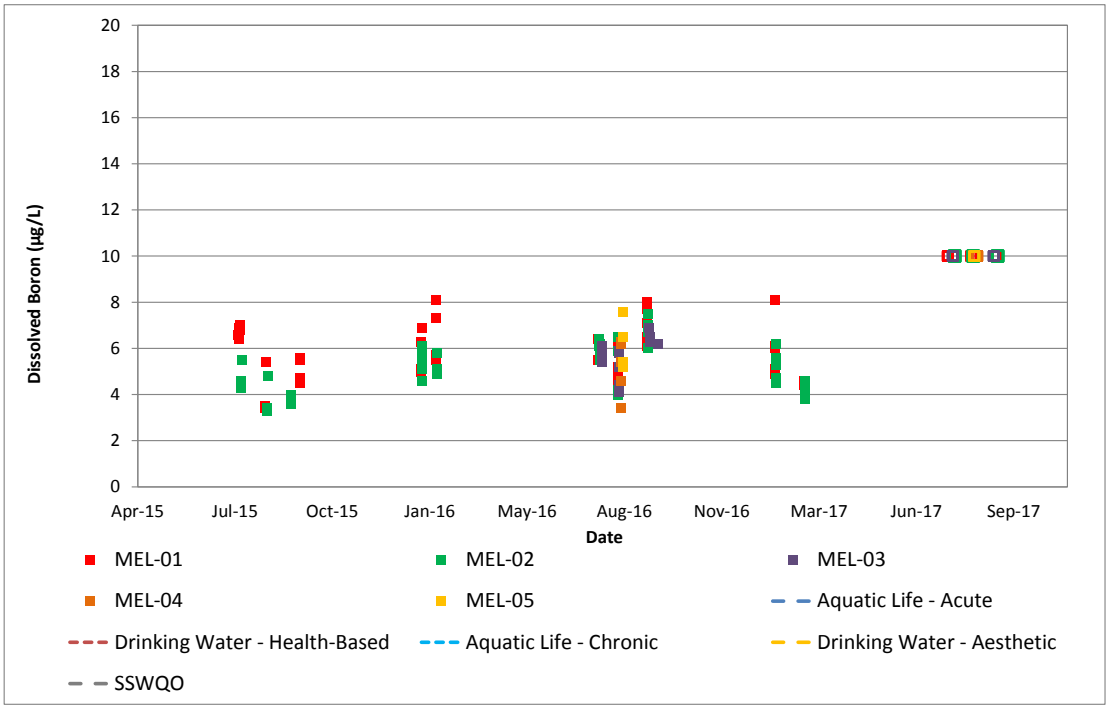
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6c: Concentrations of Dissolved Arsenic at Meliadine Lake Stations between 2015 and 2017



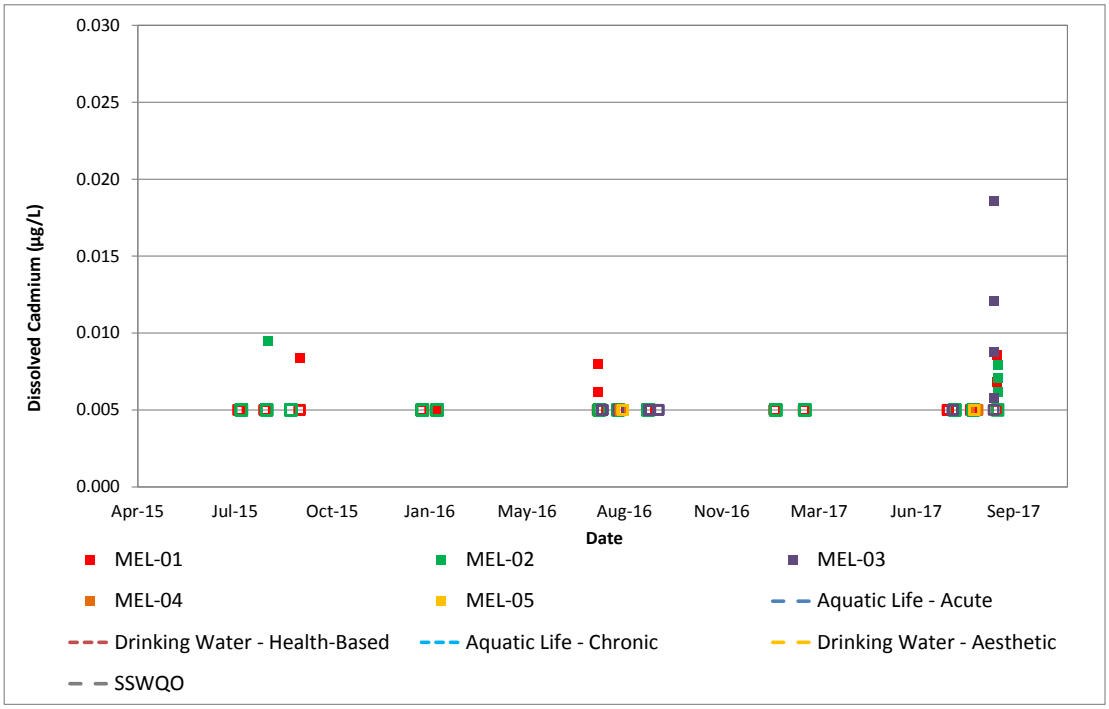
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6d: Concentrations of Dissolved Barium at Meliadine Lake Stations between 2015 and 2017



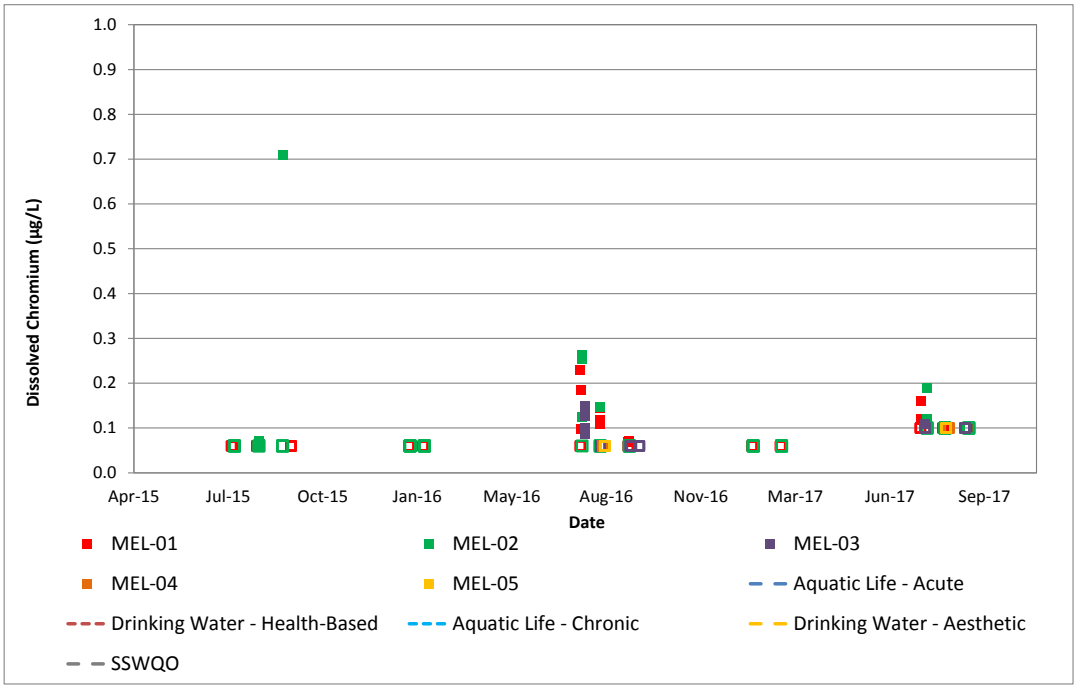
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6e: Concentrations of Dissolved Boron at Meliadine Lake Stations between 2015 and 2017



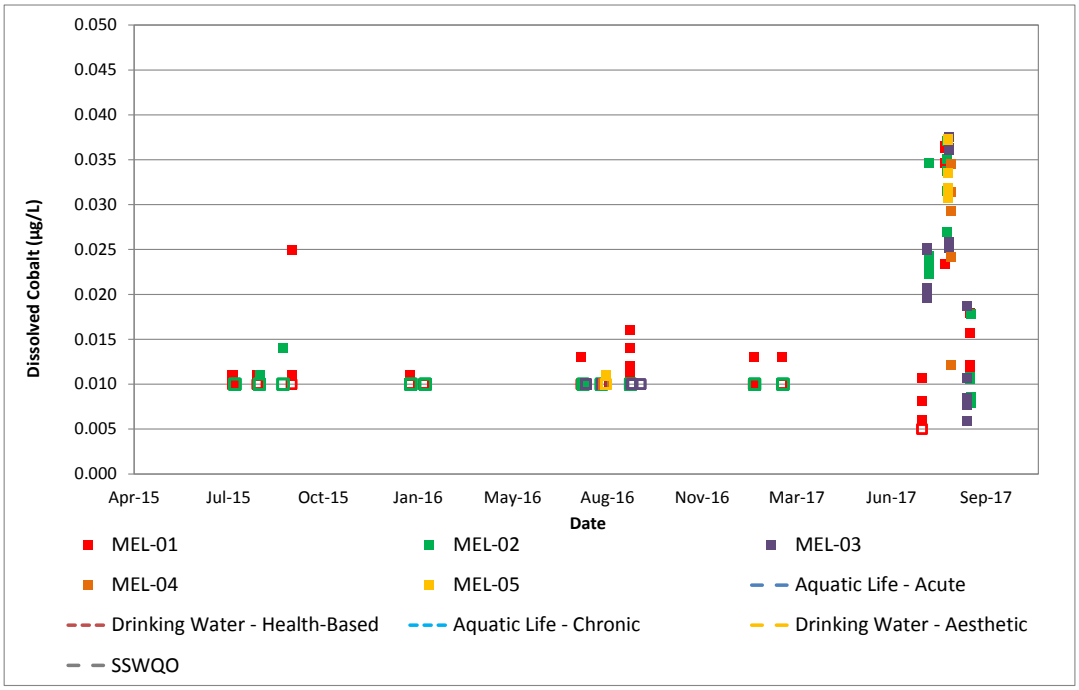
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6f: Concentrations of Dissolved Cadmium at Meliadine Lake Stations between 2015 and 2017



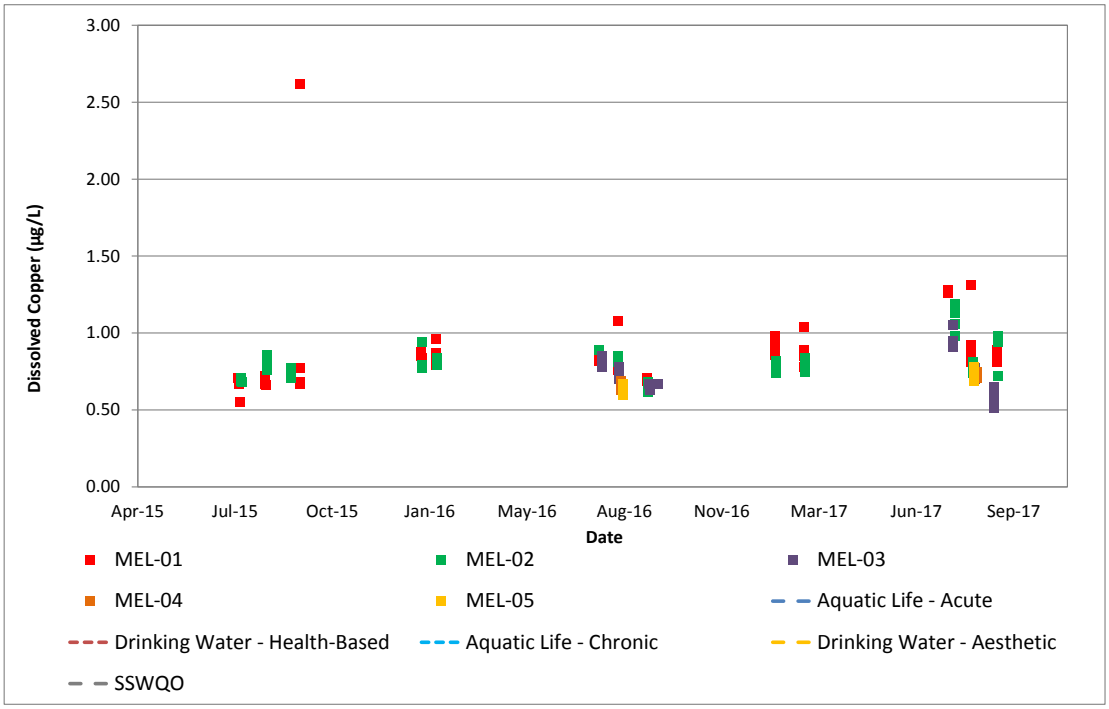
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6g: Concentrations of Dissolved Chromium at Meliadine Lake Stations between 2015 and 2017



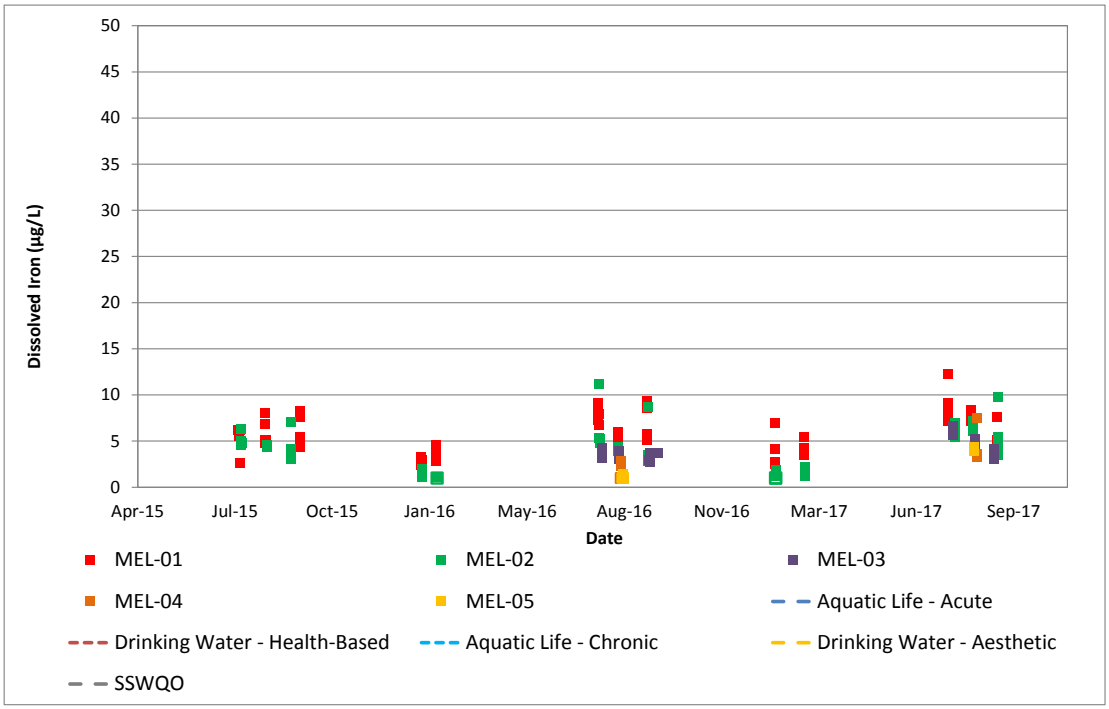
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6h: Concentrations of Dissolved Cobalt at Meliadine Lake Stations between 2015 and 2017



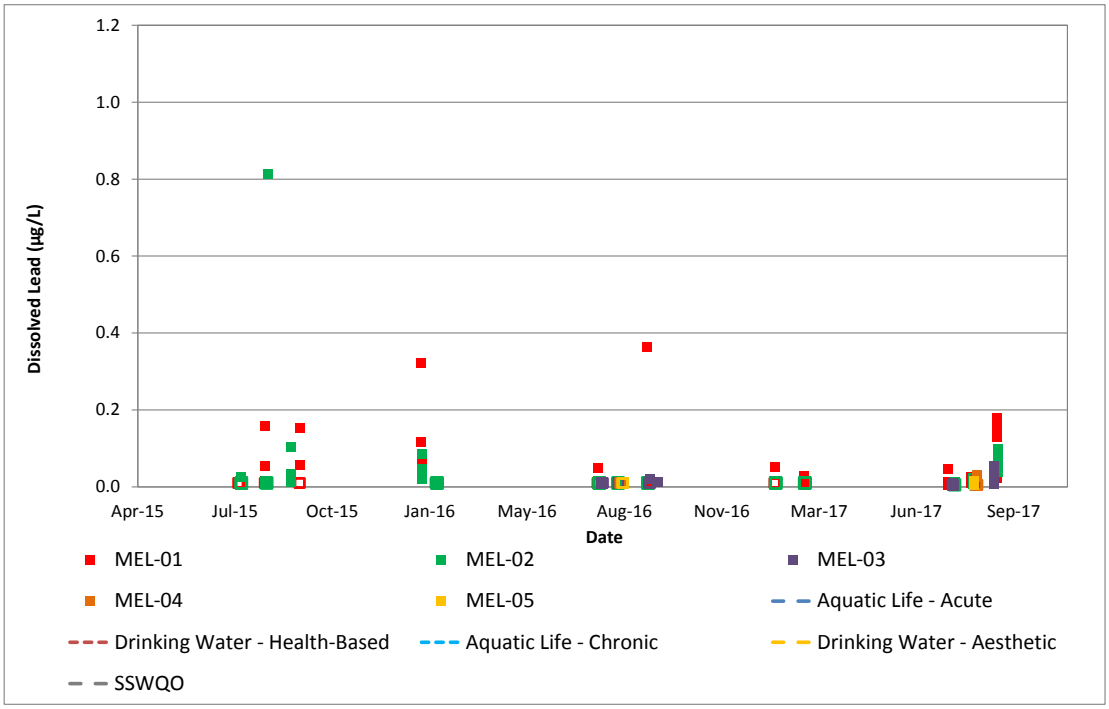
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6i: Concentrations of Dissolved Copper at Meliadine Lake Stations between 2015 and 2017



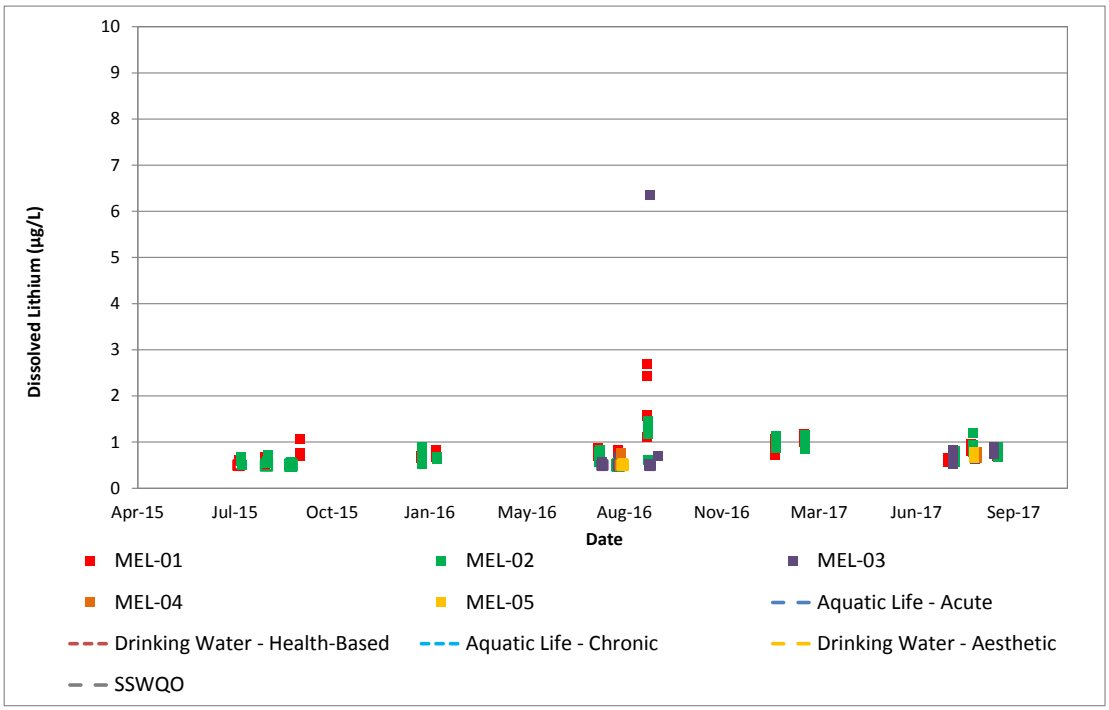
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6j: Concentrations of Dissolved Iron at Meliadine Lake Stations between 2015 and 2017



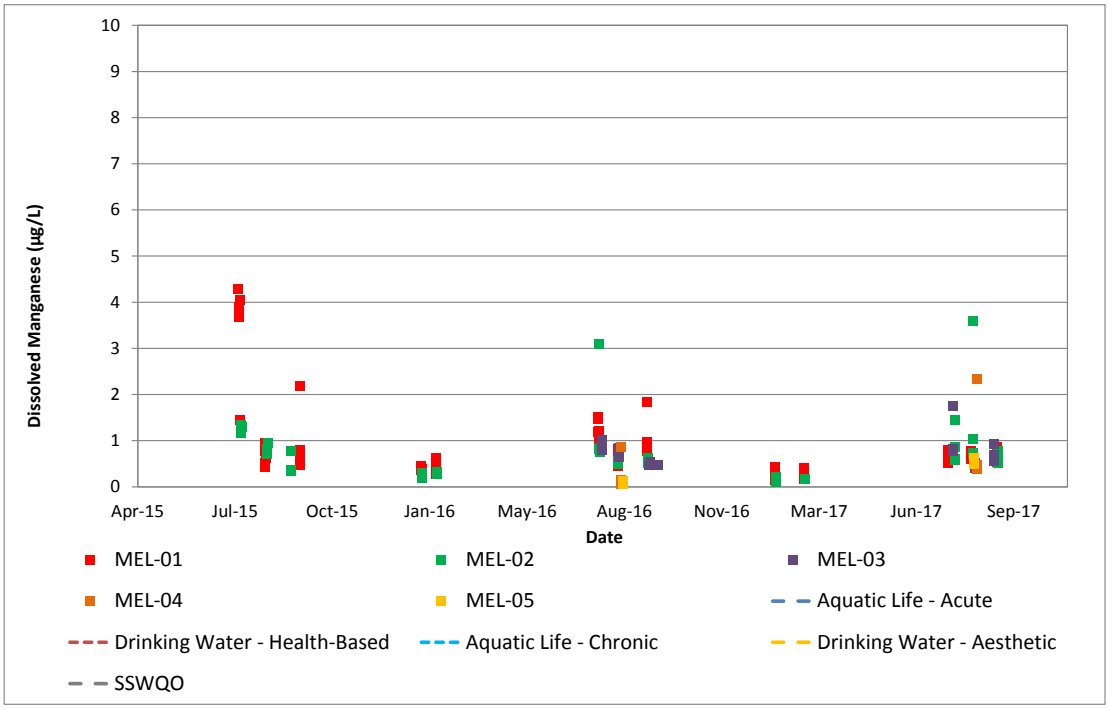
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6k: Concentrations of Dissolved Lead at Meliadine Lake Stations between 2015 and 2017



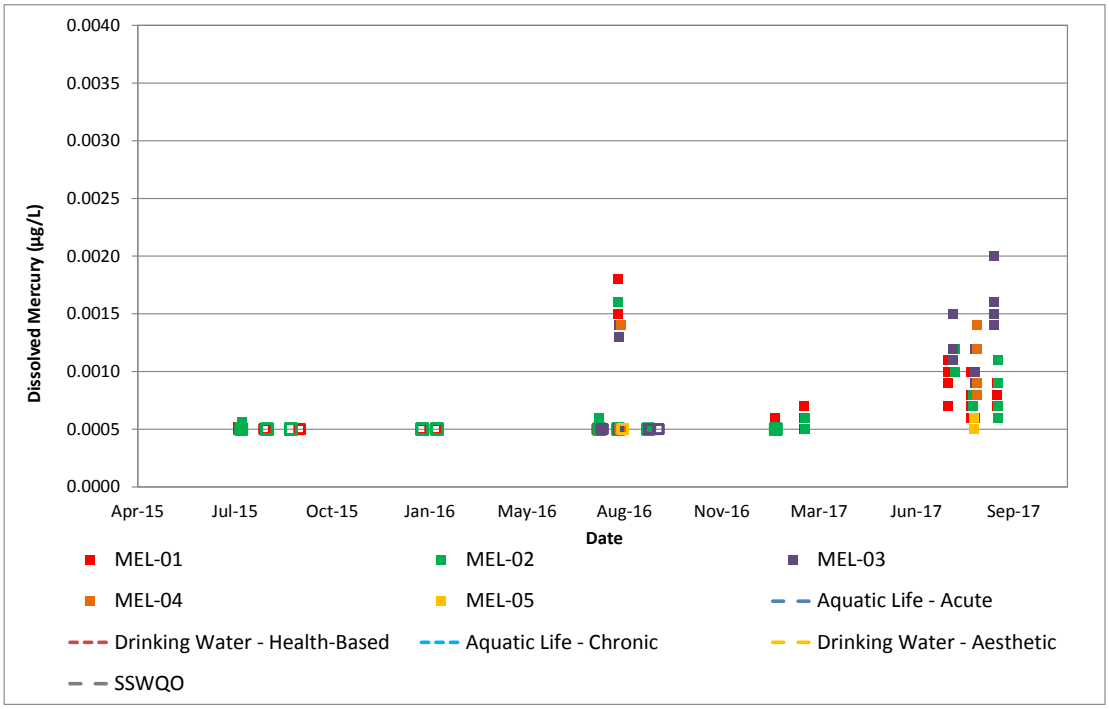
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6l: Concentrations of Dissolved Lithium at Meliadine Lake Stations between 2015 and 2017



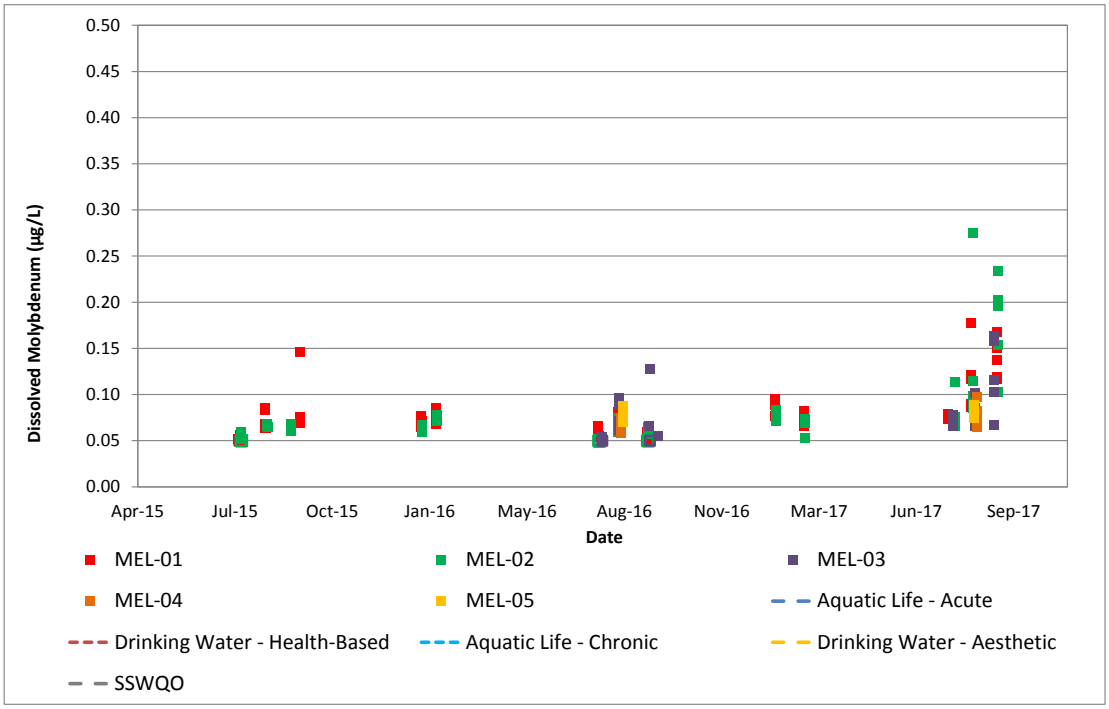
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6m: Concentrations of Dissolved Manganese at Meliadine Lake Stations between 2015 and 2017



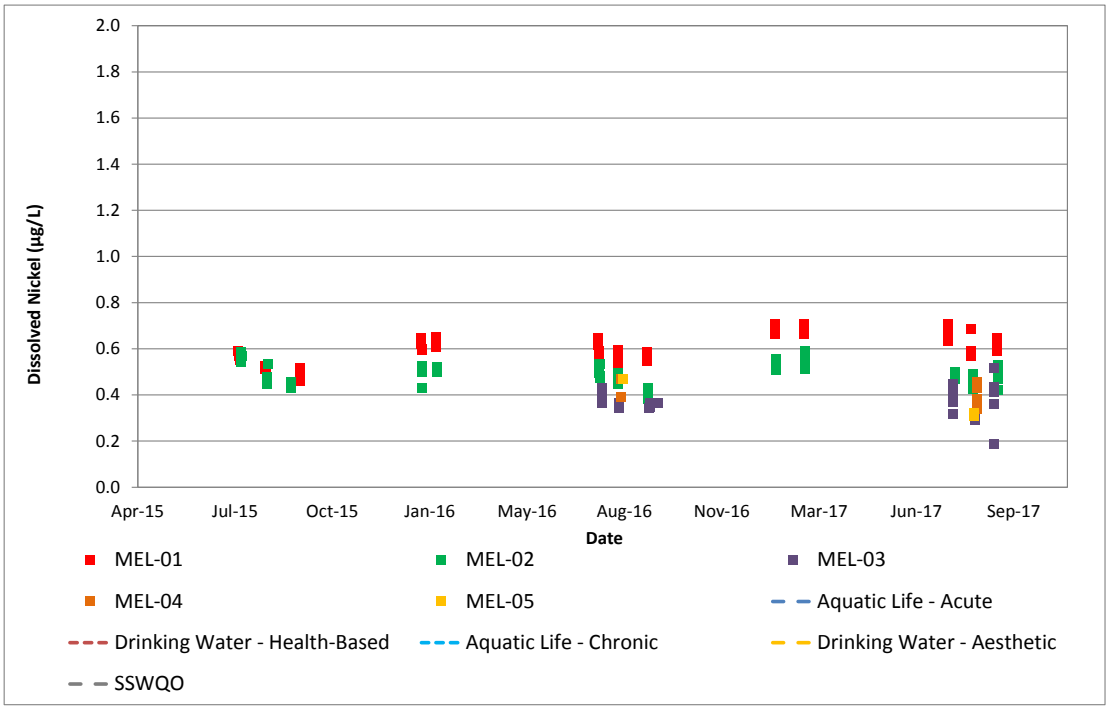
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6n: Concentrations of Dissolved Mercury at Meliadine Lake Stations between 2015 and 2017



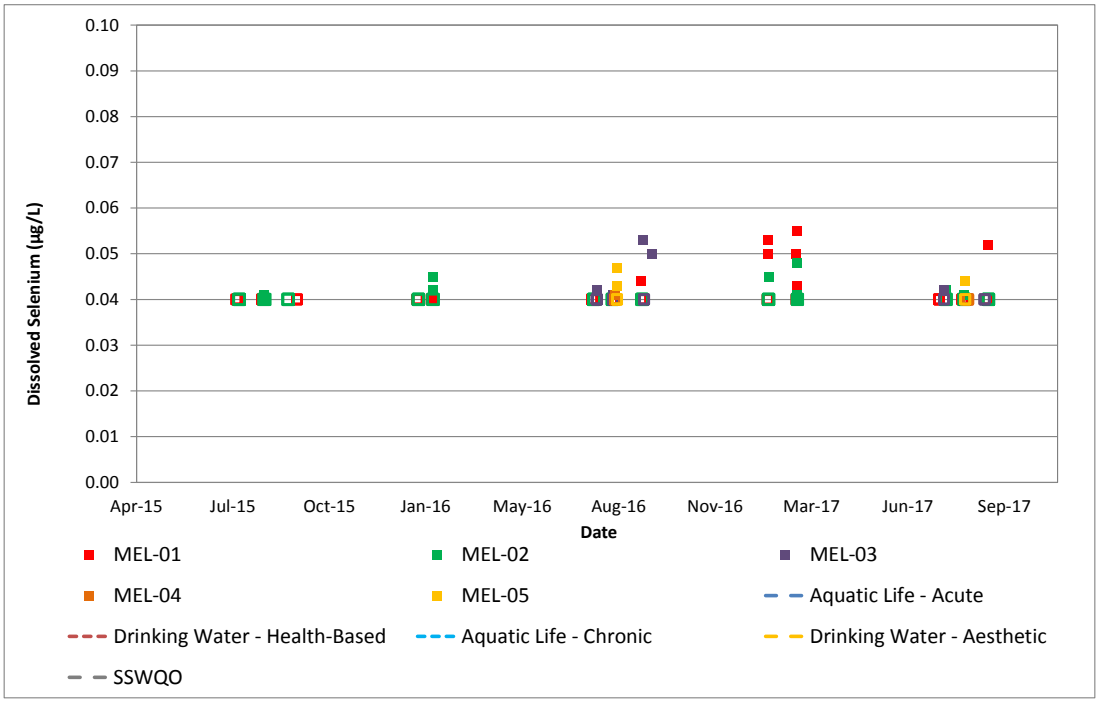
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6o: Concentrations of Dissolved Molybdenum at Meliadine Lake Stations between 2015 and 2017



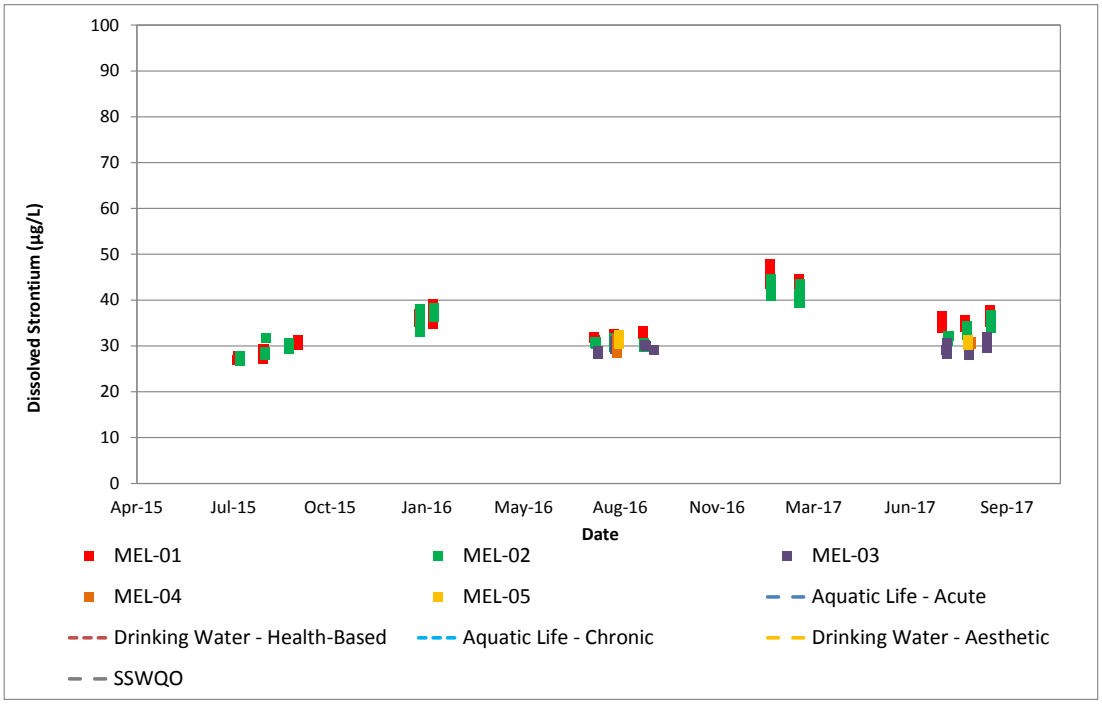
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6p: Concentrations of Dissolved Nickel at Meliadine Lake Stations between 2015 and 2017



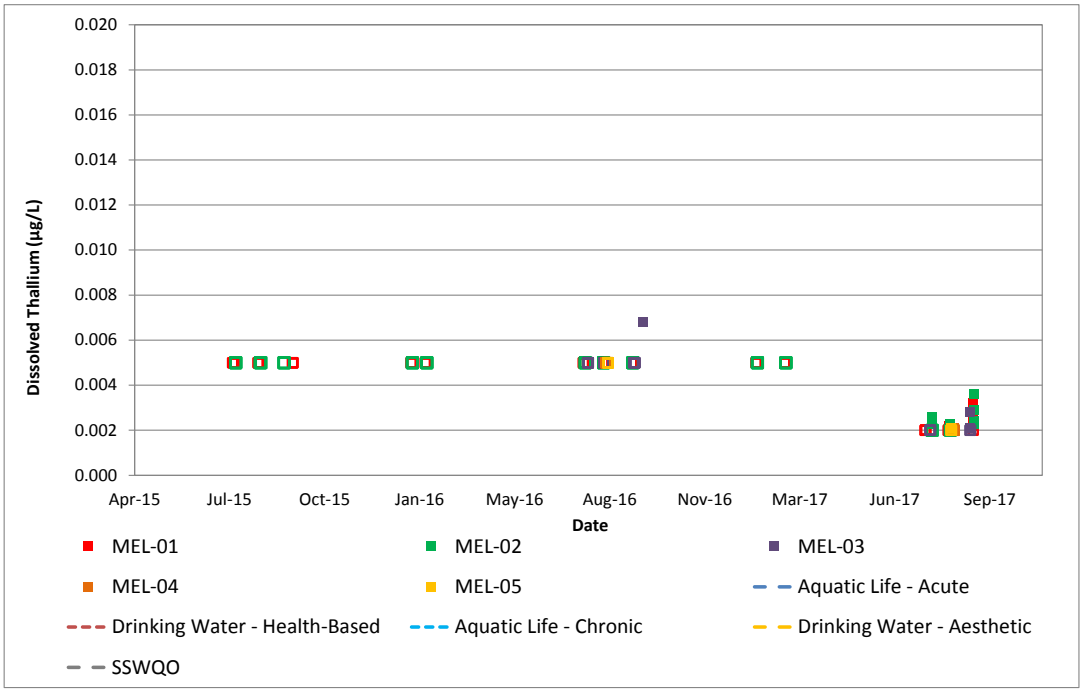
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6q: Concentrations of Dissolved Selenium at Meliadine Lake Stations between 2015 and 2017



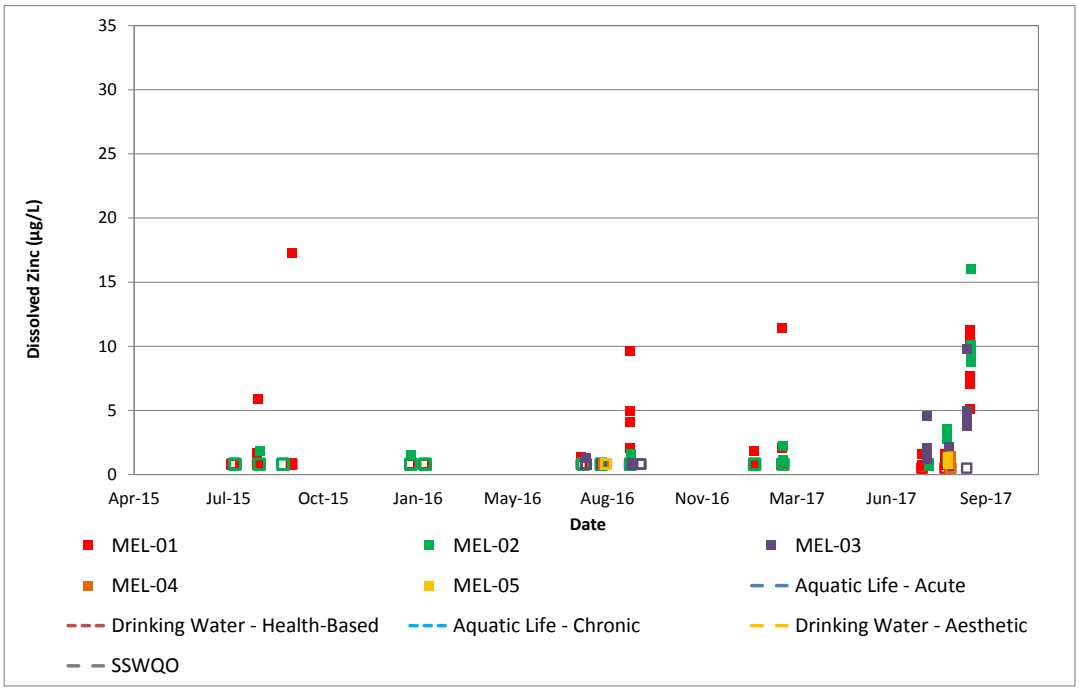
µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives.

Figure 3E.1-6r: Concentrations of Dissolved Strontium at Meliadine Lake Stations between 2015 and 2017



µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6s: Concentrations of Dissolved Thallium at Meliadine Lake Stations between 2015 and 2017

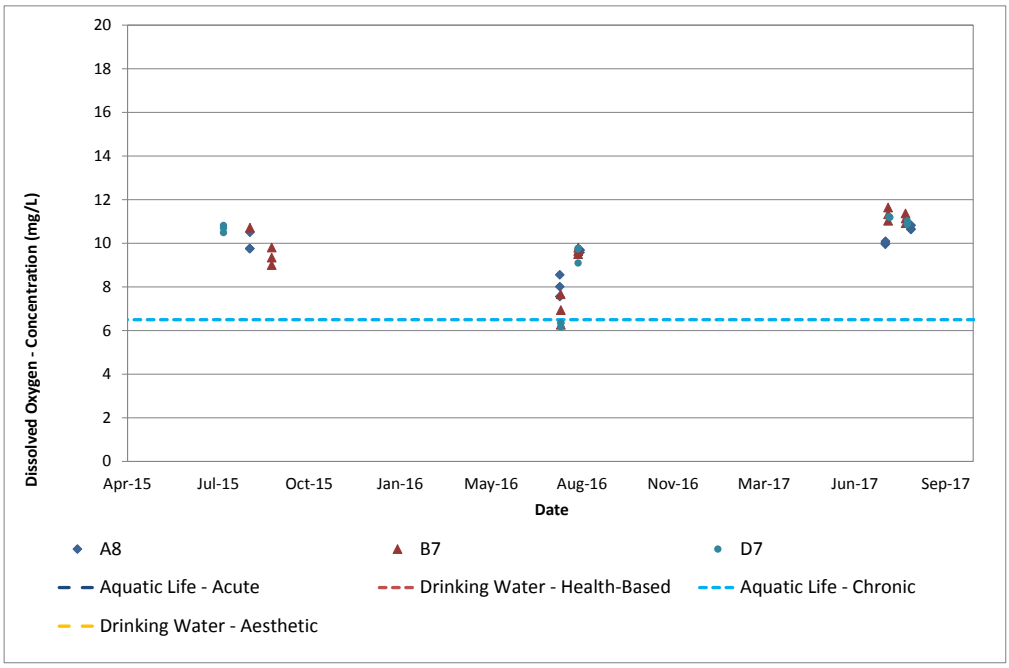


µg/L = micrograms per litre; SSWQO = site-specific Water Quality Objectives. Open symbols represent results that are less than the detection limit.

Figure 3E.1-6t: Concentrations of Dissolved Zinc at Meliadine Lake Stations between 2015 and 2017

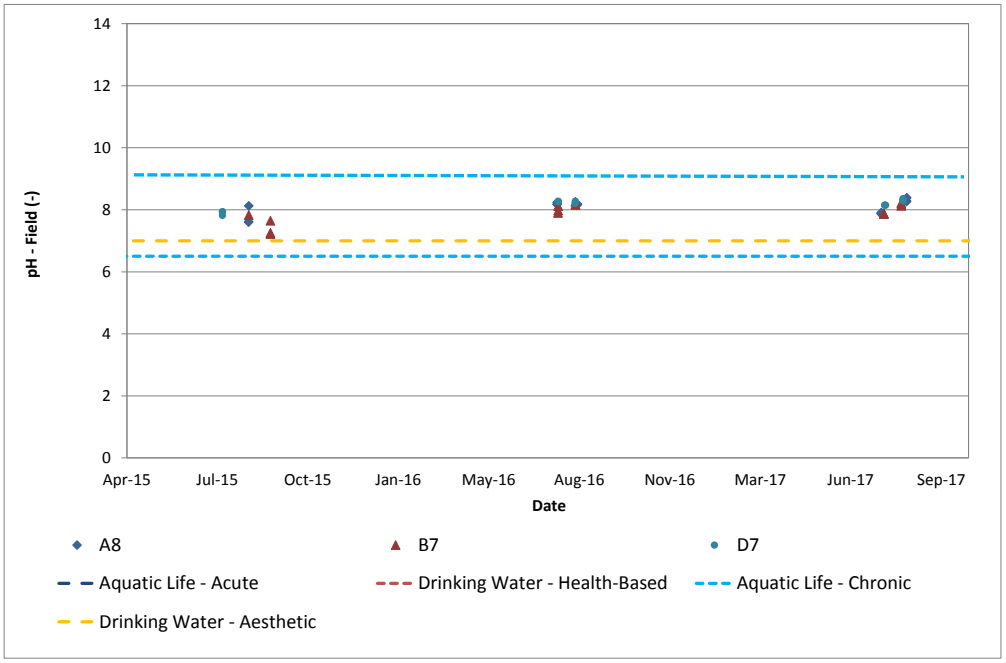
3E2.0 PENINSULA LAKES

3E2.1 Field-measured Parameters



mg/L = milligrams per litre.

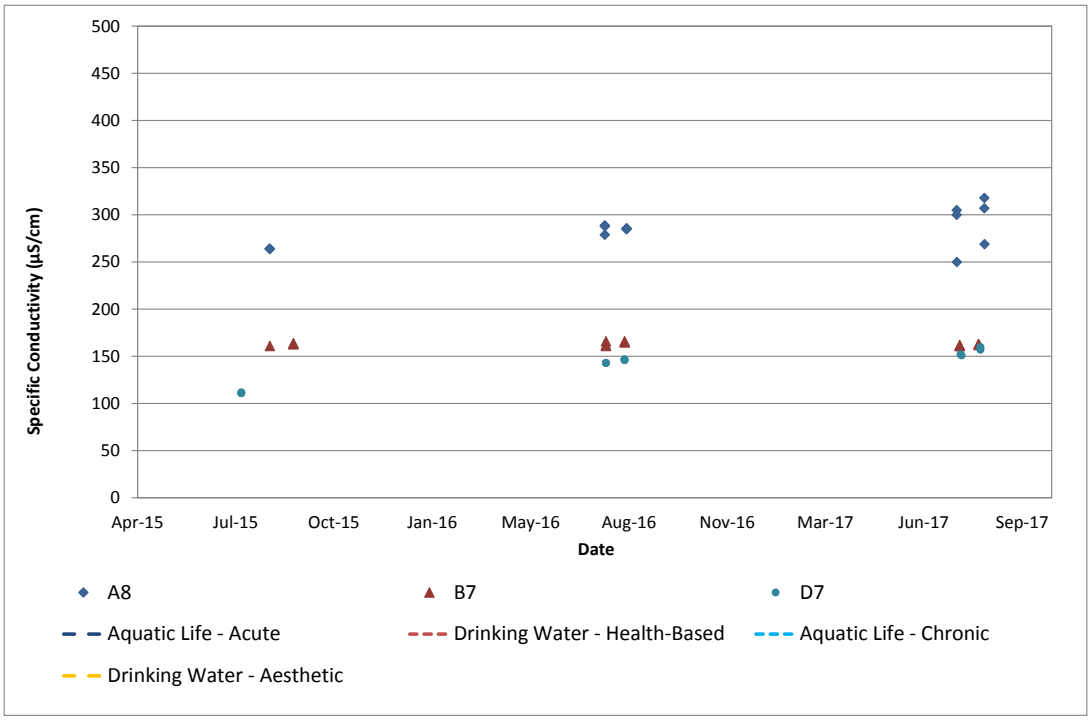
Figure 3E.2-1a: Dissolved Oxygen Concentrations Measured at Peninsula Lakes between 2015 and 2017



mg/L = milligrams per litre.

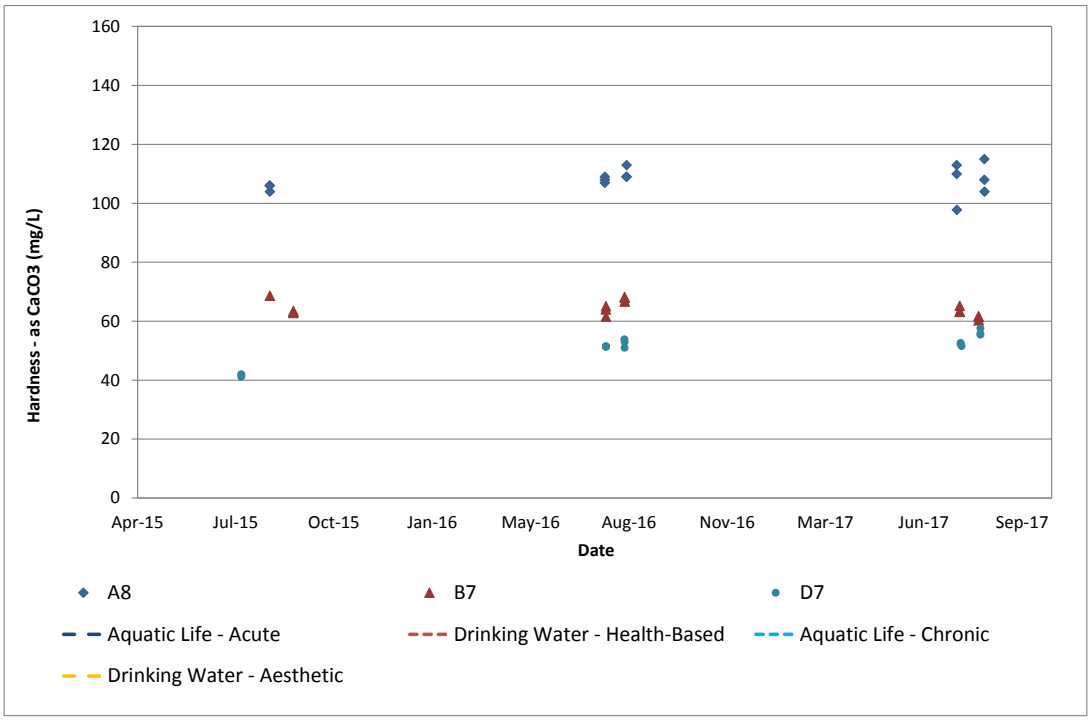
Figure 3E.2-1b: pH Values Measured at Peninsula Lakes between 2015 and 2017

3E2.2 Conventional Parameters



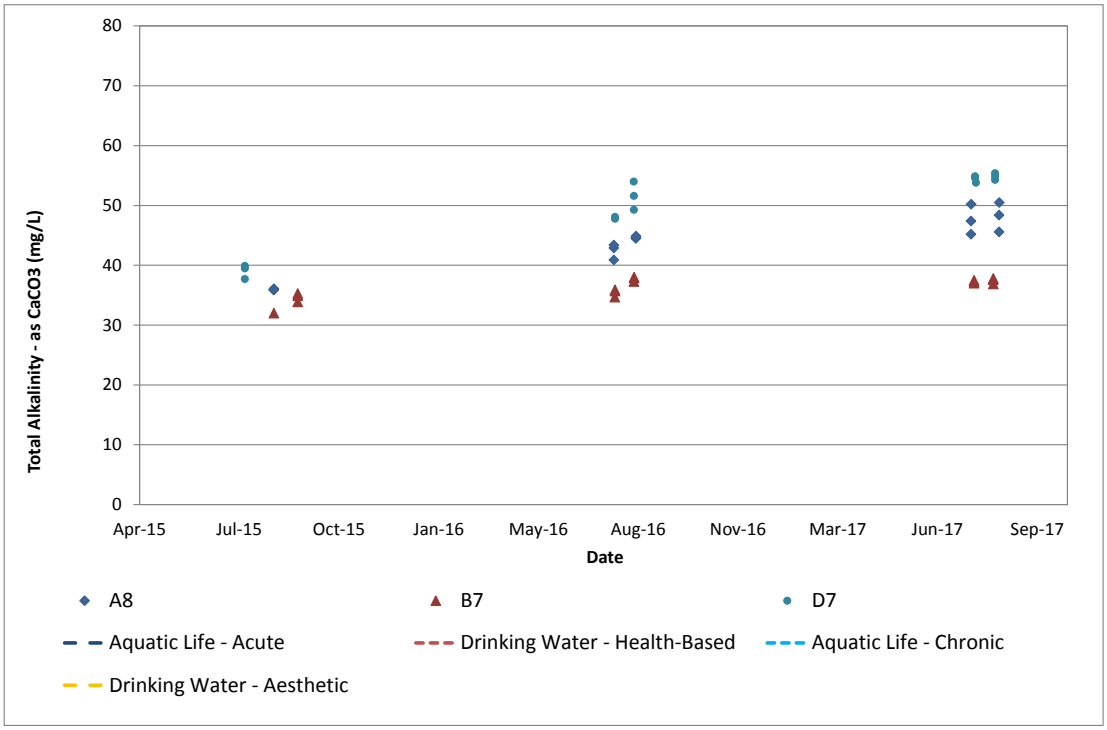
µS/cm = microSiemens per centimetre.

Figure 3E.2-2a: Specific Conductivity (laboratory) at Peninsula Lakes between 2015 and 2017



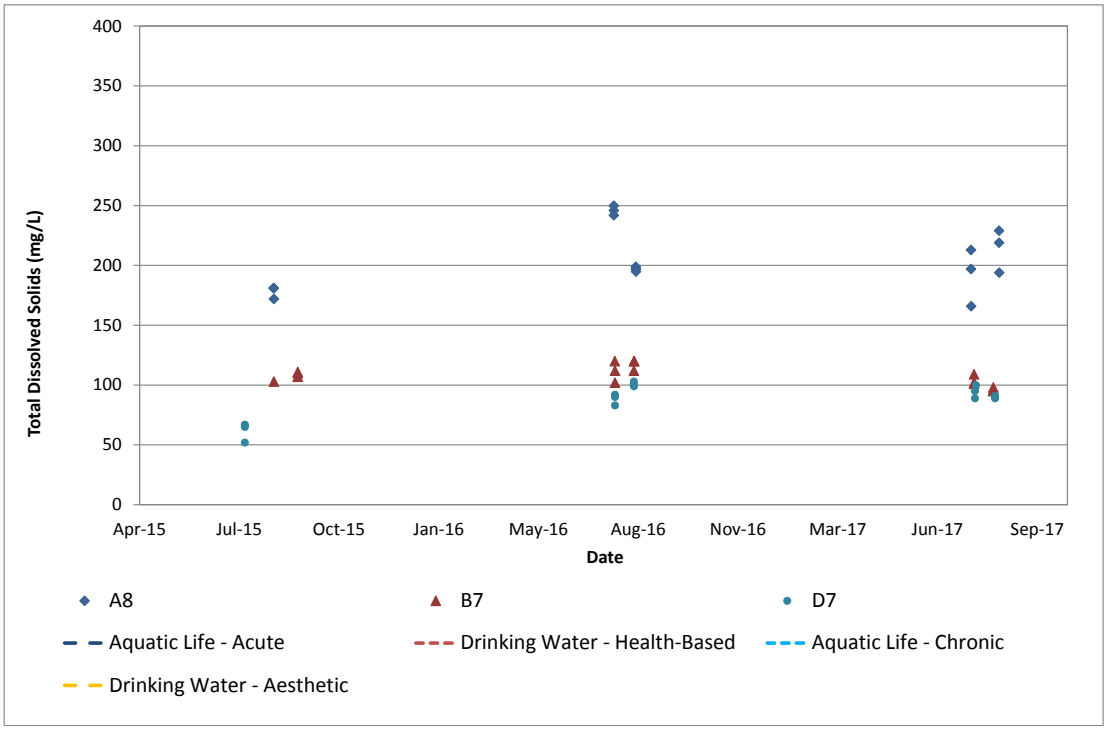
mg/L = milligrams per litre.

Figure 3E.2-2b: Total Hardness (as $CaCO_3$) at Peninsula Lakes between 2015 and 2017



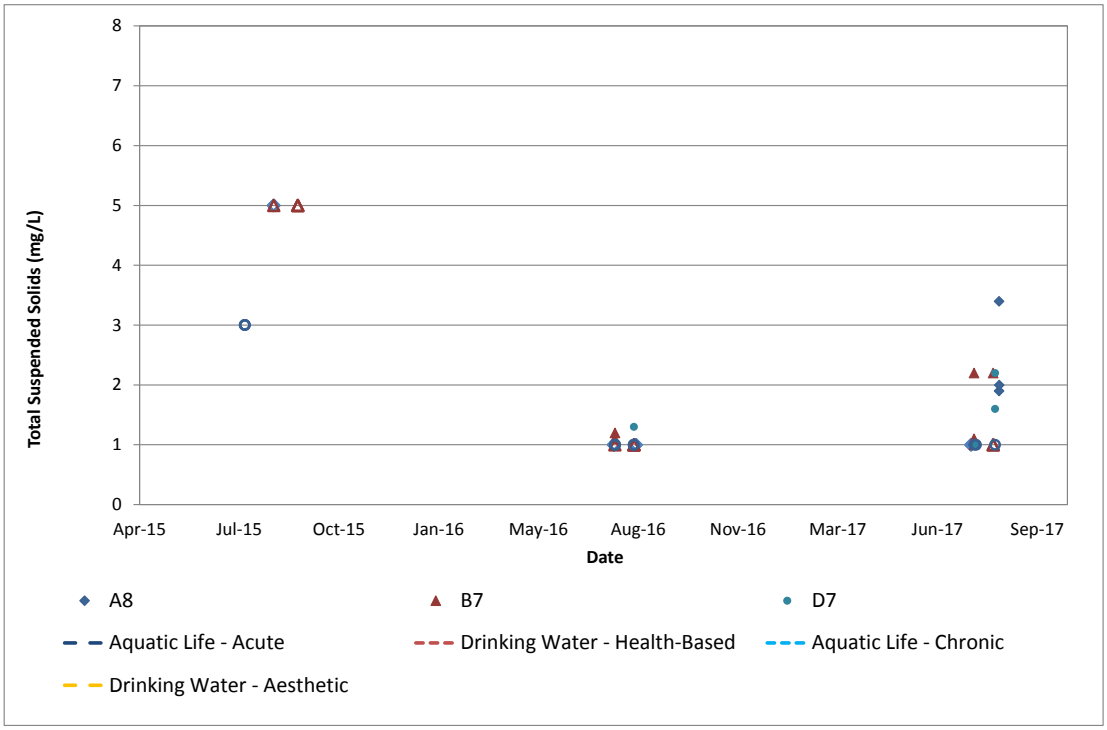
mg/L = milligrams per litre.

Figure 3E.2-2c: Total Alkalinity (as $CaCO_3$) at Peninsula Lakes between 2015 and 2017



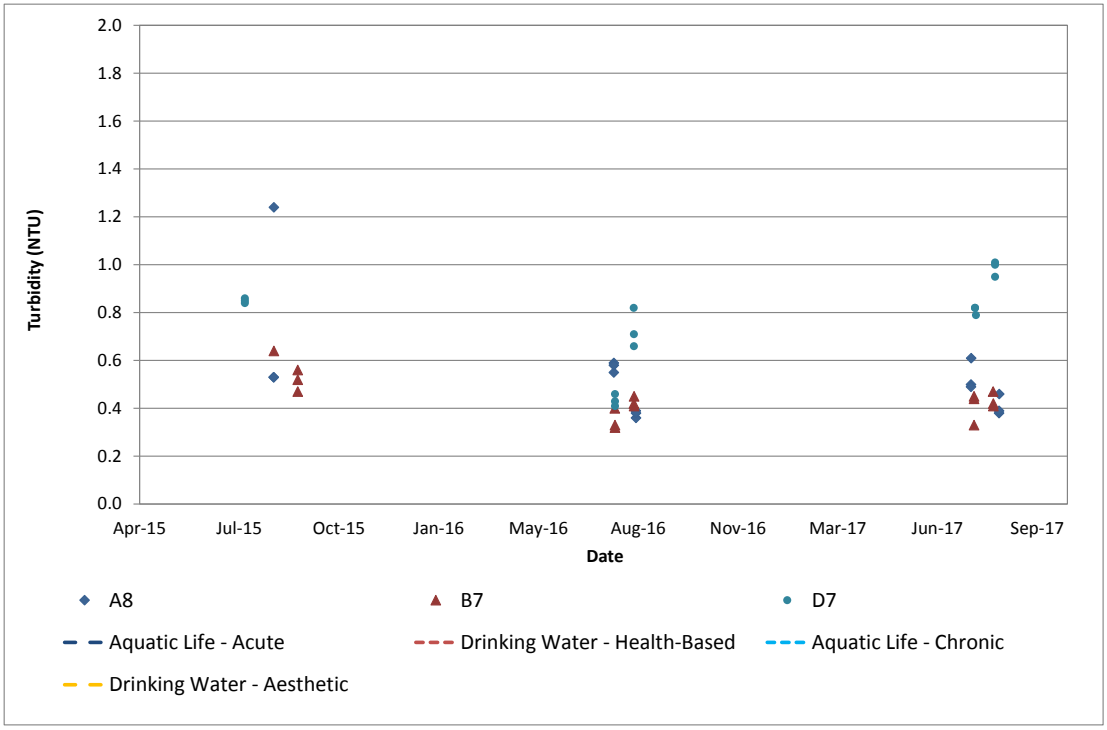
mg/L = milligrams per litre.

Figure 3E.2-2d: Concentrations of Total Dissolved Solids at Peninsula Lakes between 2015 and 2017



mg/L = milligrams per litre. Open symbols represent results that are less than the detection limit.

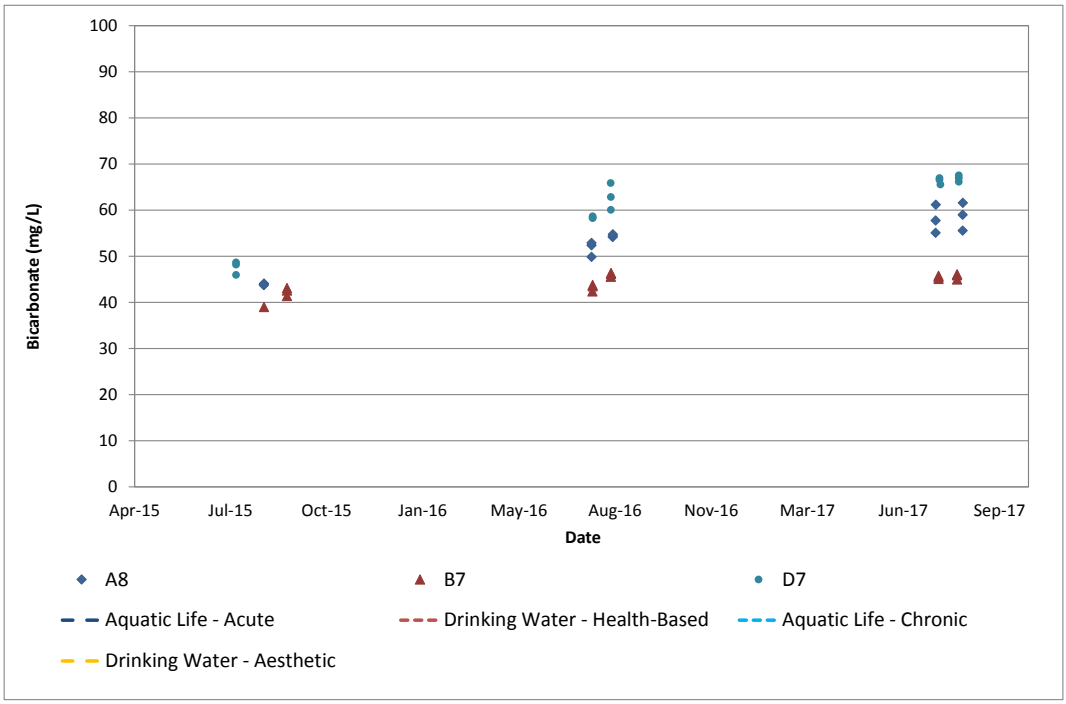
Figure 3E.2-2e: Concentrations of Total Suspended Solids at Peninsula Lakes between 2015 and 2017



NTU = Nephelometric Turbidy Units.

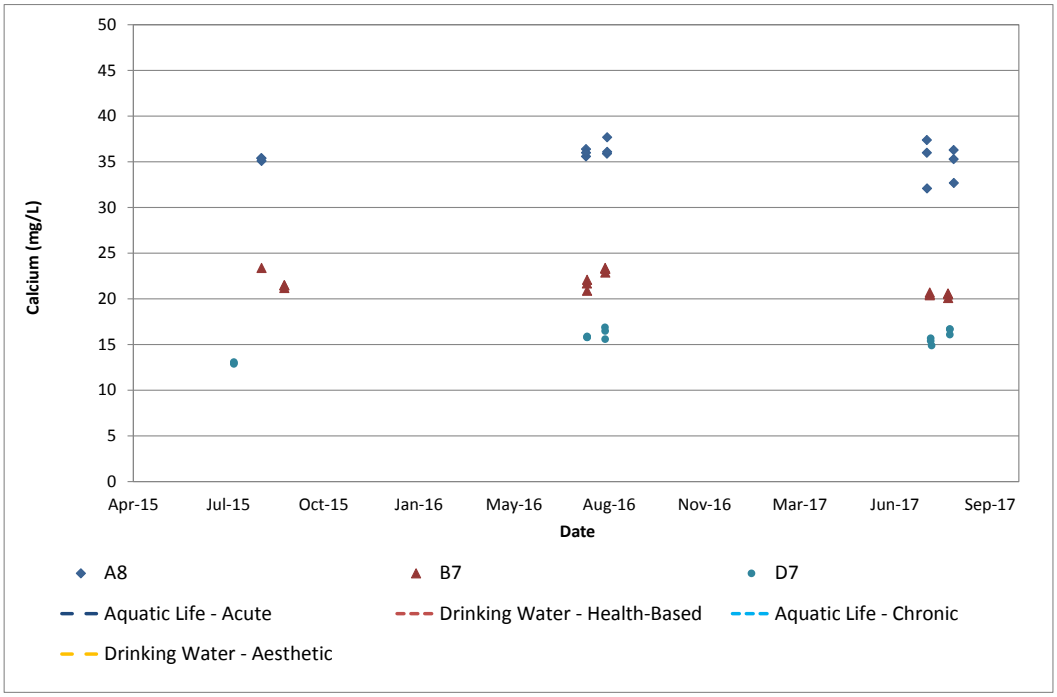
Figure 3E.2-2f: Concentrations of Turbidity at Peninsula Lakes between 2015 and 2017

3E2.3 Major Ions



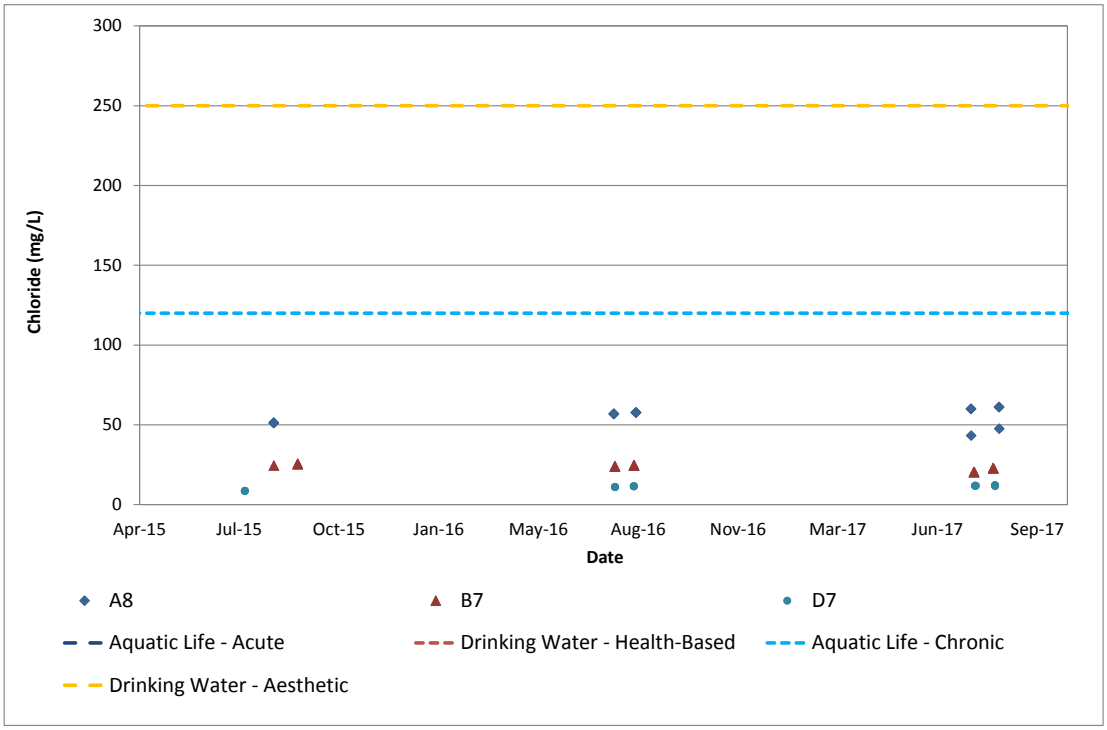
mg/L = milligrams per litre.

Figure 3E.2-3a: Concentrations of Bicarbonate at Peninsula Lakes between 2015 and 2017



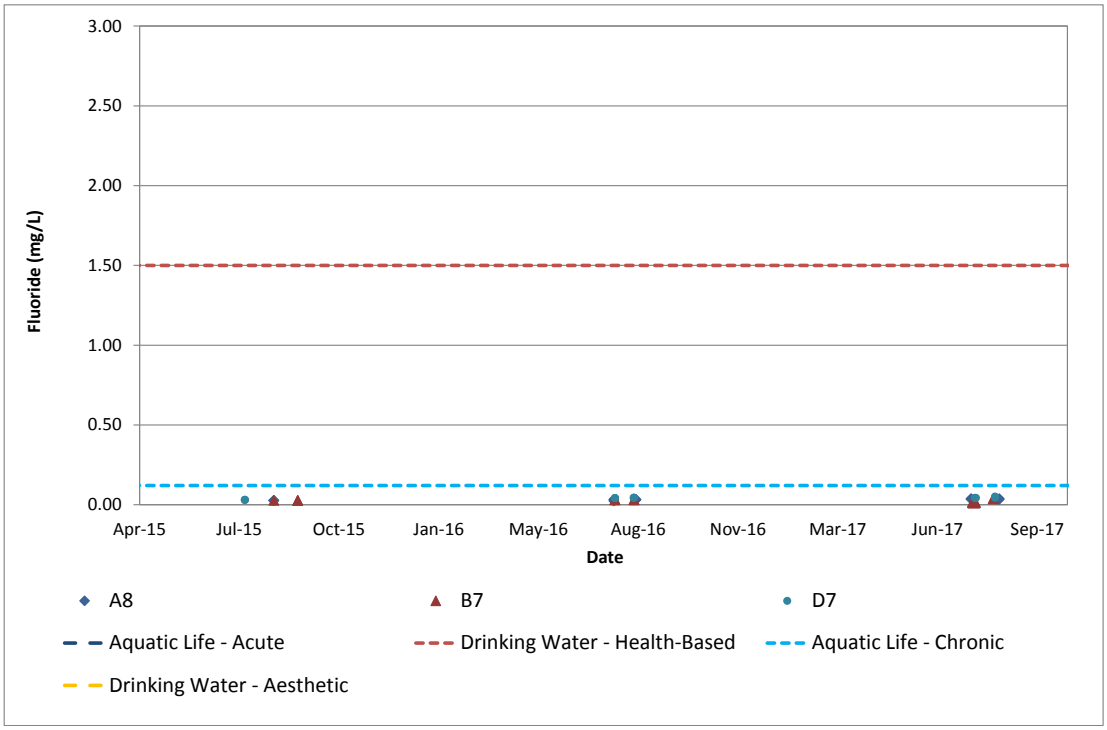
mg/L = milligrams per litre.

Figure 3E.2-3b: Concentrations of Calcium at Peninsula Lakes between 2015 and 2017



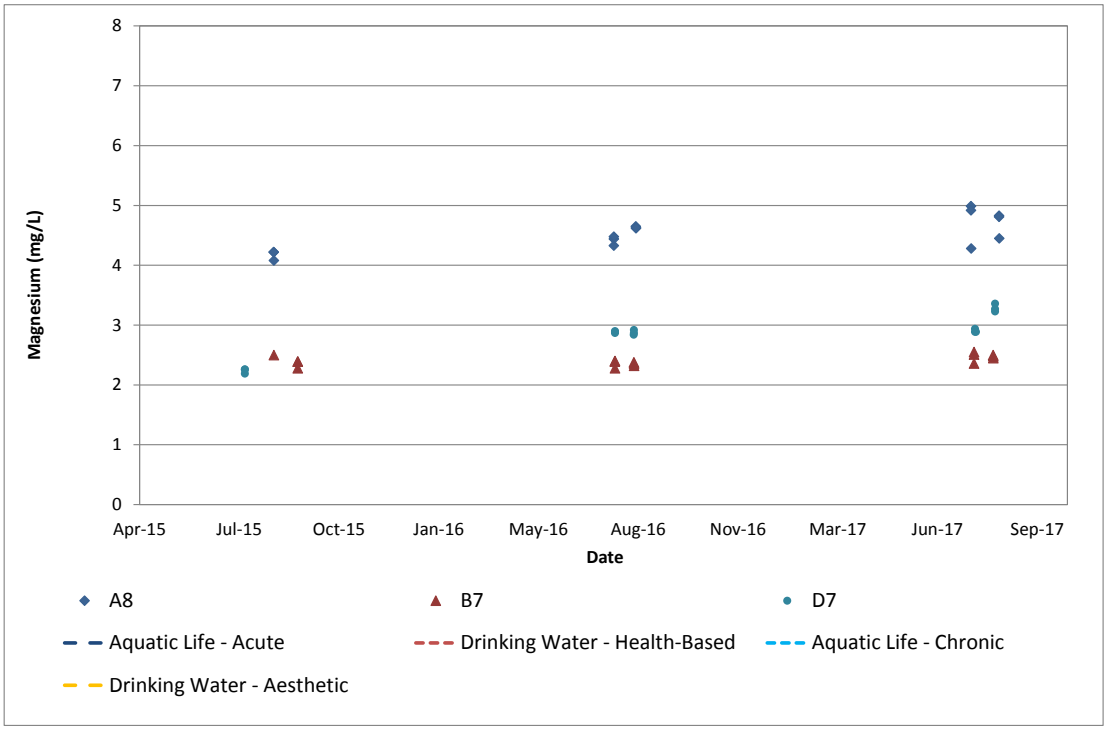
mg/L = milligrams per litre.

Figure 3E.2-3c: Concentrations of Chloride at Peninsula Lakes between 2015 and 2017



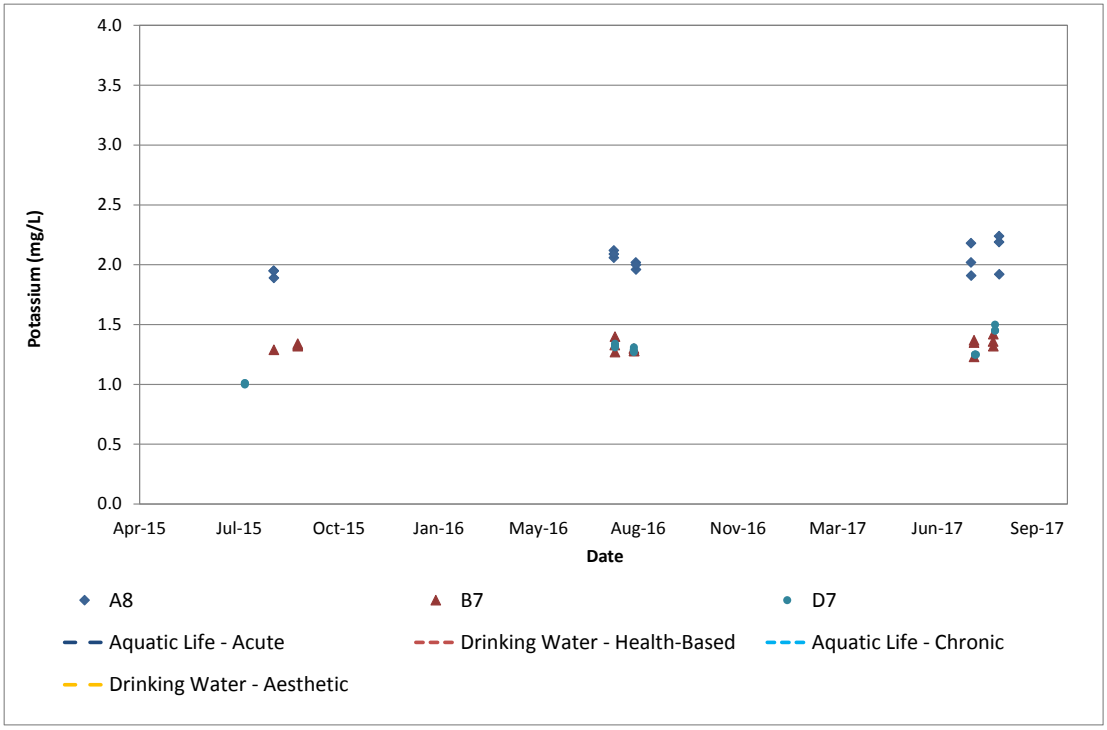
mg/L = milligrams per litre.

Figure 3E.2-3d: Concentrations of Chloride at Peninsula Lakes between 2015 and 2017



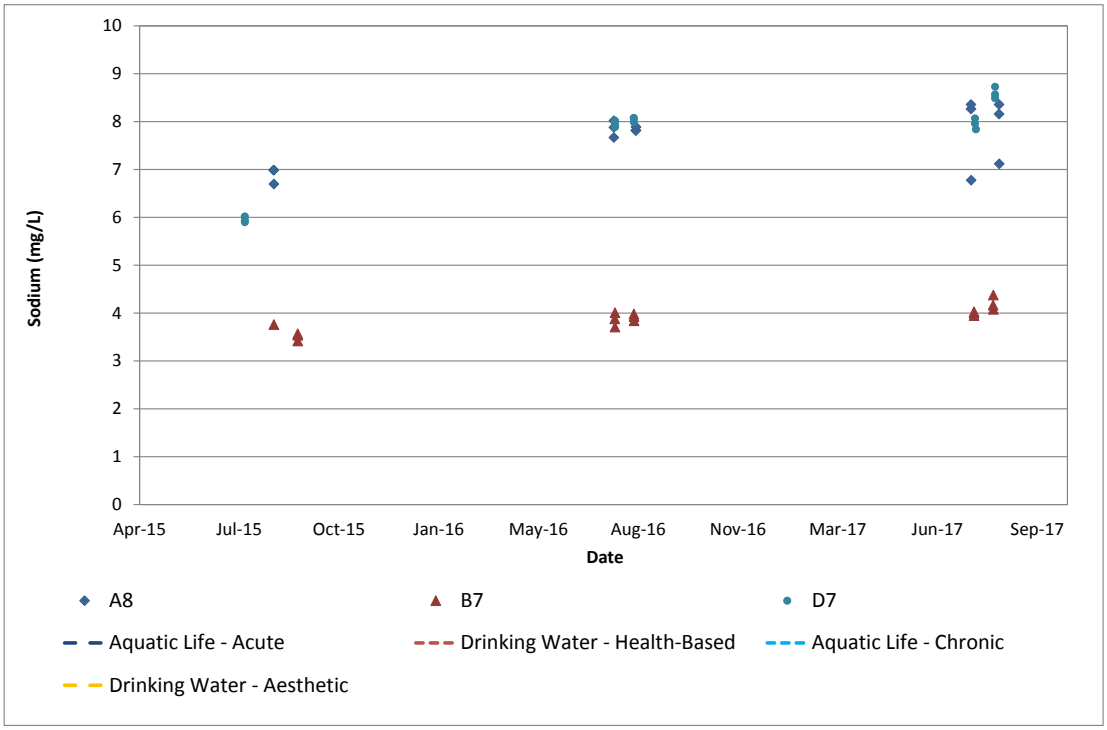
mg/L = milligrams per litre.

Figure 3E.2-3e: Concentrations of Magnesium at Peninsula Lakes between 2015 and 2017



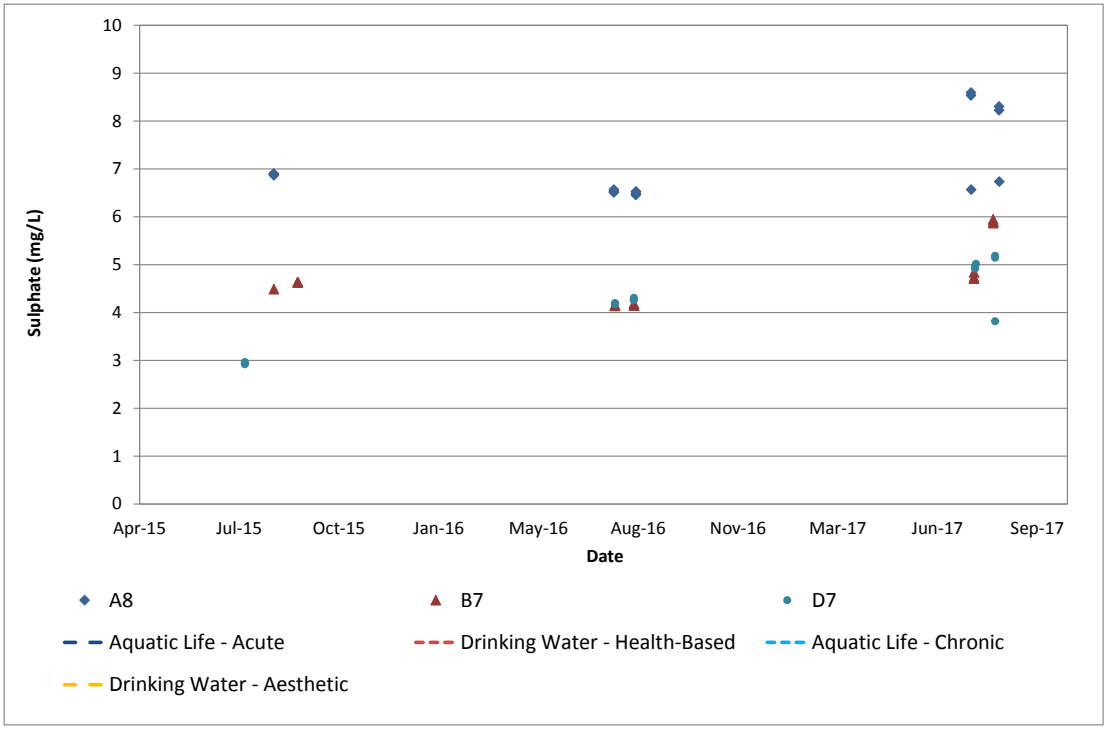
mg/L = milligrams per litre.

Figure 3E.2-3f: Concentrations of Potassium at Peninsula Lakes between 2015 and 2017



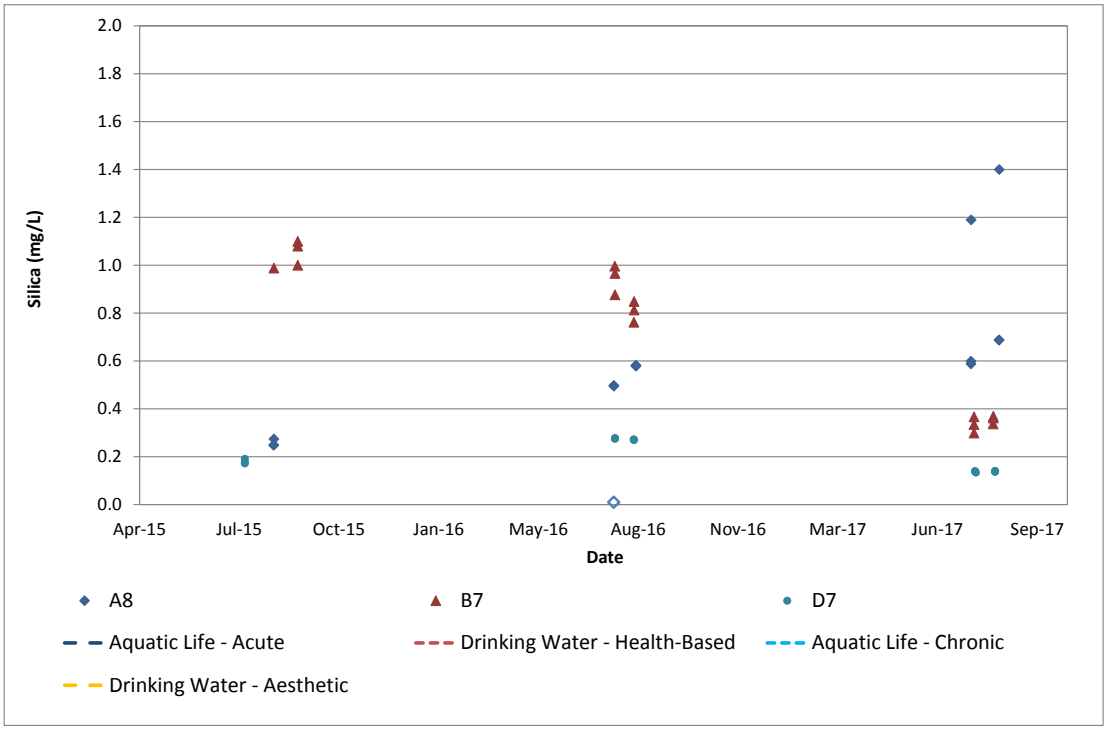
mg/L = milligrams per litre.

Figure 3E.2-3g: Concentrations of Sodium at Peninsula Lakes between 2015 and 2017



mg/L = milligrams per litre.

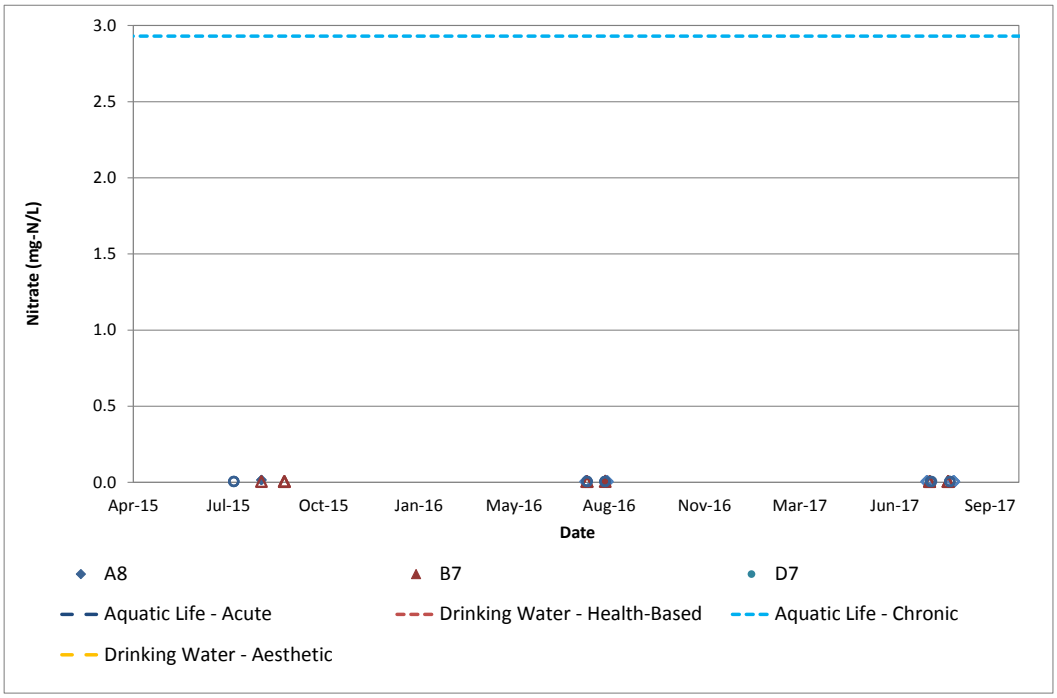
Figure 3E.2-3h: Concentrations of Sulphate at Peninsula Lakes between 2015 and 2017



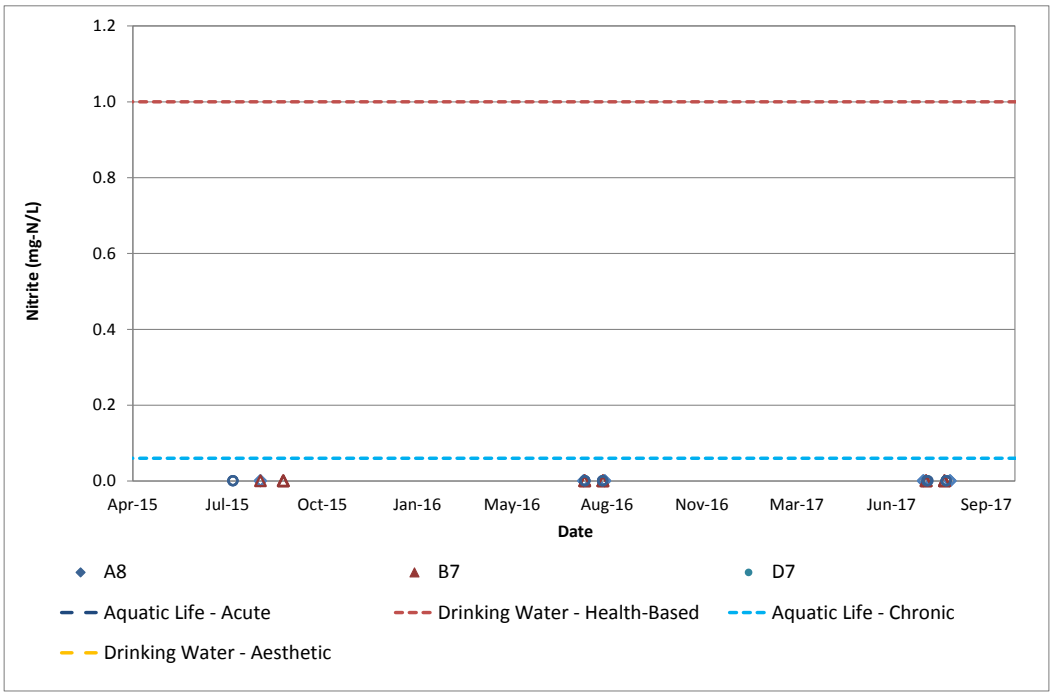
mg/L = milligrams per litre.

Figure 3E.2-3i: Concentrations of Silica at Peninsula Lakes between 2015 and 2017

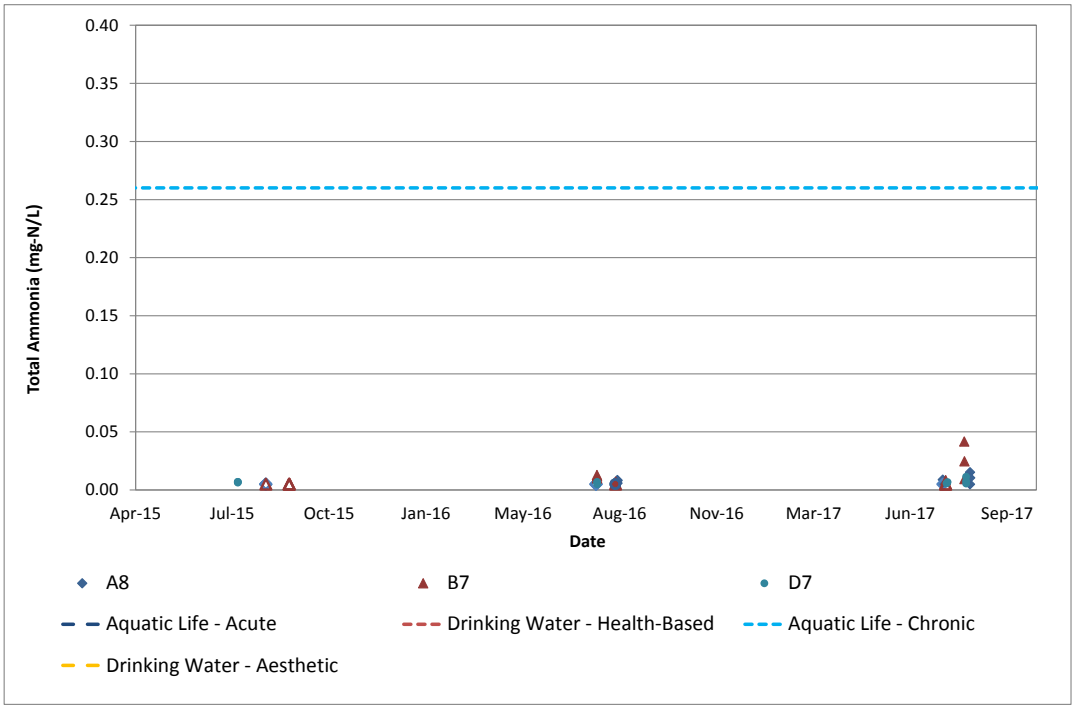
3E2.4 Nutrients



mg-N/L = milligrams as nitrogen per litre. Open symbols represent results that are less than the detection limit.
Figure 3E.2-4a: Concentrations of Nitrate at Peninsula Lakes between 2015 and 2017

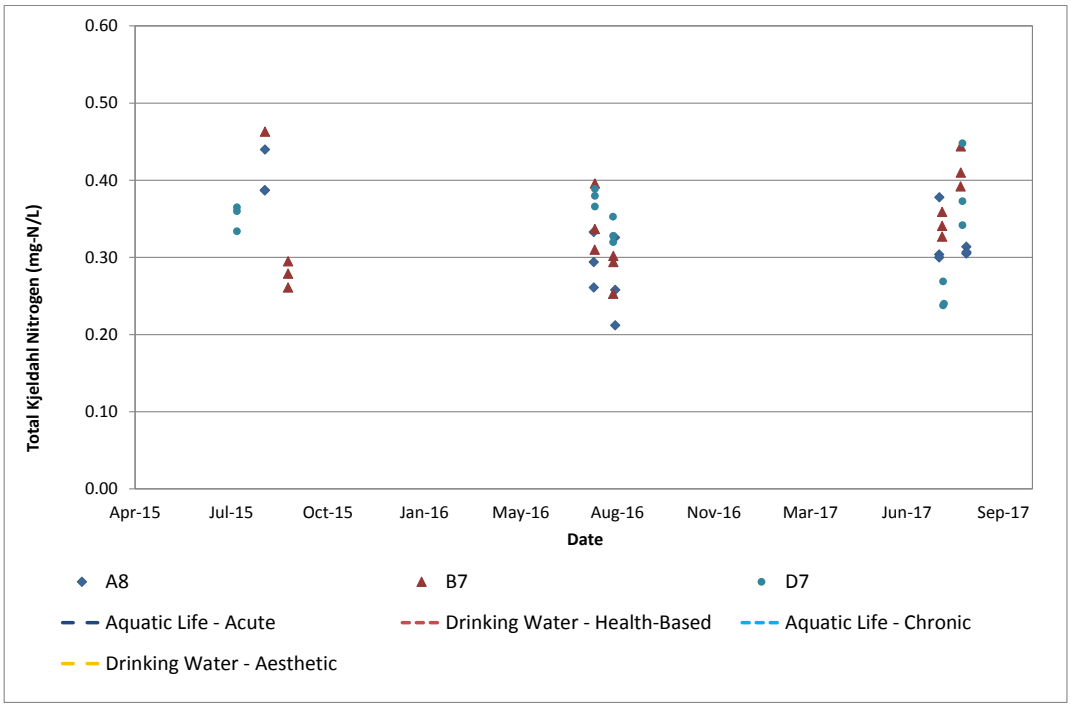


mg-N/L = milligrams as nitrogen per litre. Open symbols represent results that are less than the detection limit.
Figure 3E.2-4b: Concentrations of Nitrite at Peninsula Lakes between 2015 and 2017



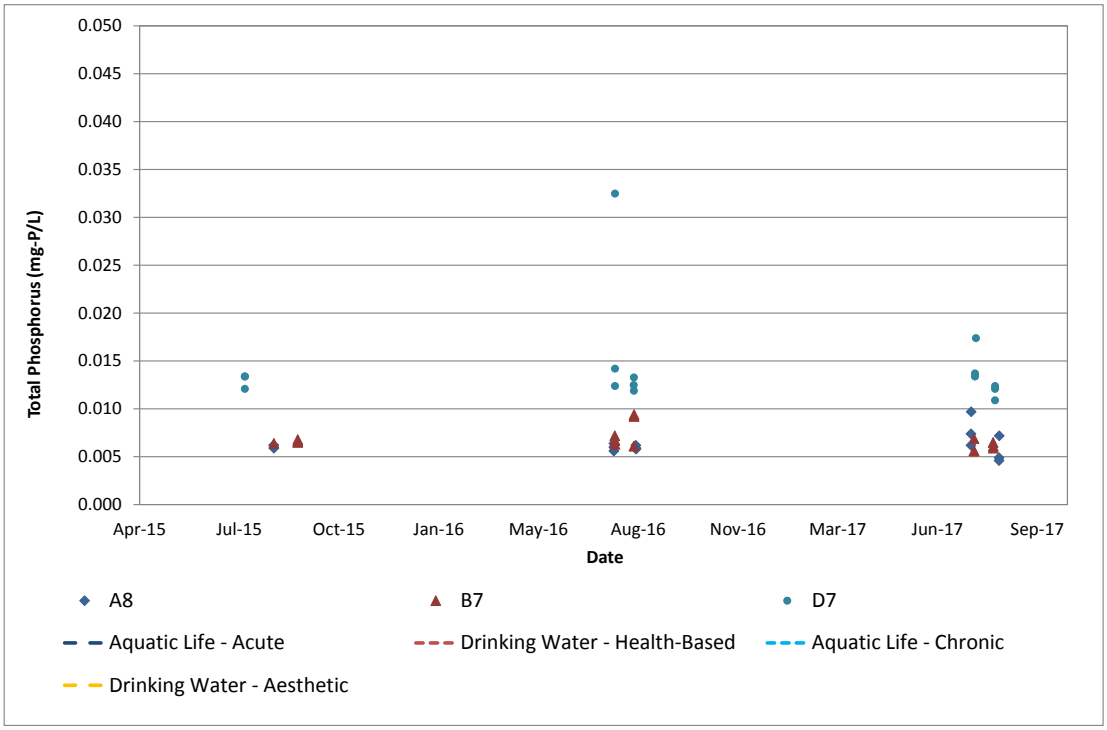
mg-N/L = milligrams as nitrogen per litre. Guideline is dependent on pH and temperature; the guideline presented in the graph represents the minimum value. Open symbols represent results that are less than the detection limit.

Figure 3E.2-4c: Concentrations of Ammonia at Peninsula Lakes between 2015 and 2017



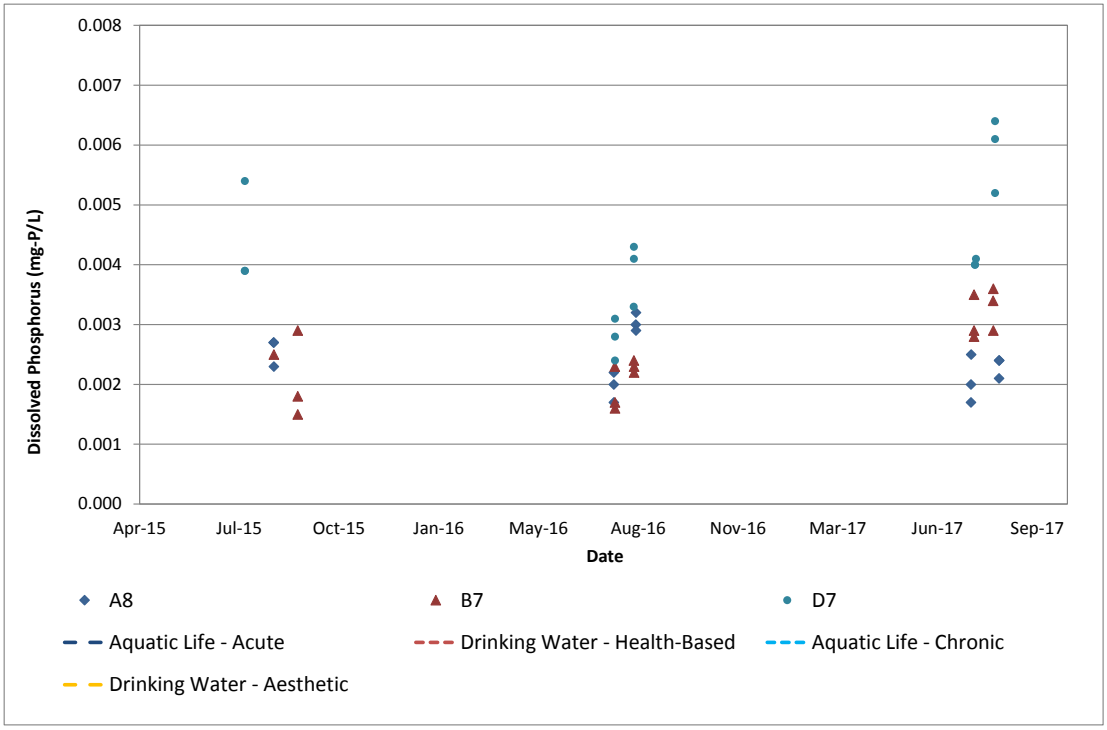
mg-N/L = milligrams as nitrogen per litre.

Figure 3E.2-4d: Concentrations of Total Kjeldahl Nitrogen at Peninsula Lakes between 2015 and 2017



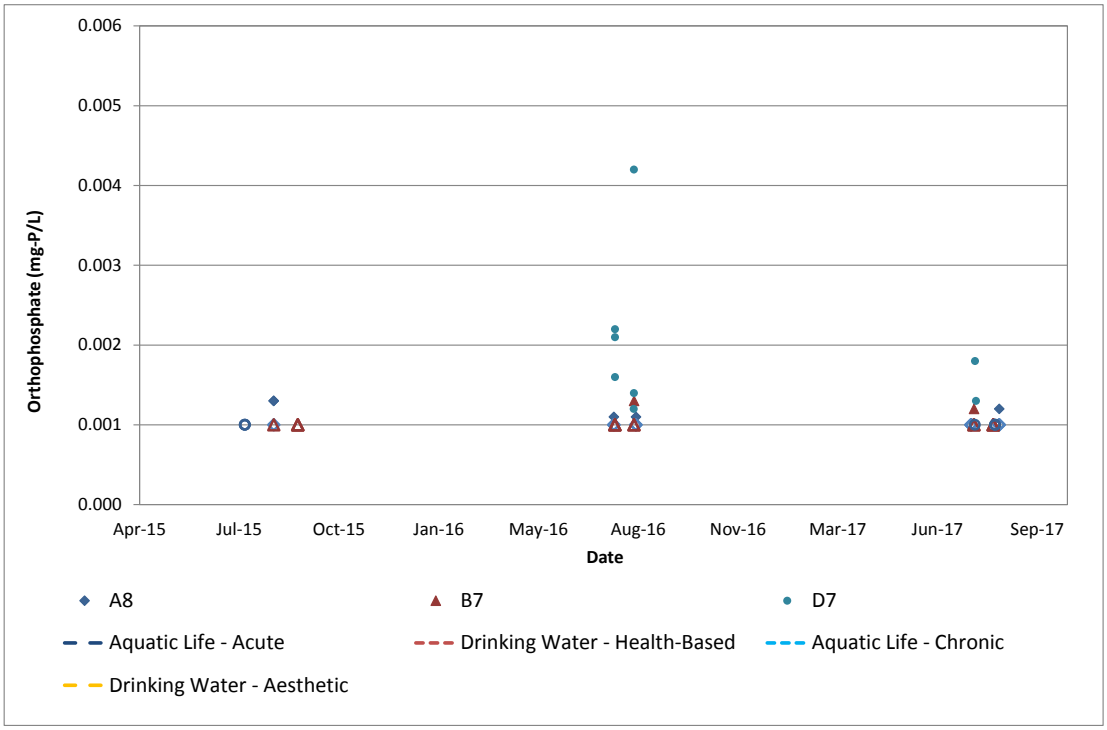
mg-P/L = milligrams as phosphorus per litre.

Figure 3E.2-4e: Concentrations of Total Phosphorus at Peninsula Lakes between 2015 and 2017



mg-P/L = milligrams as phosphorus per litre.

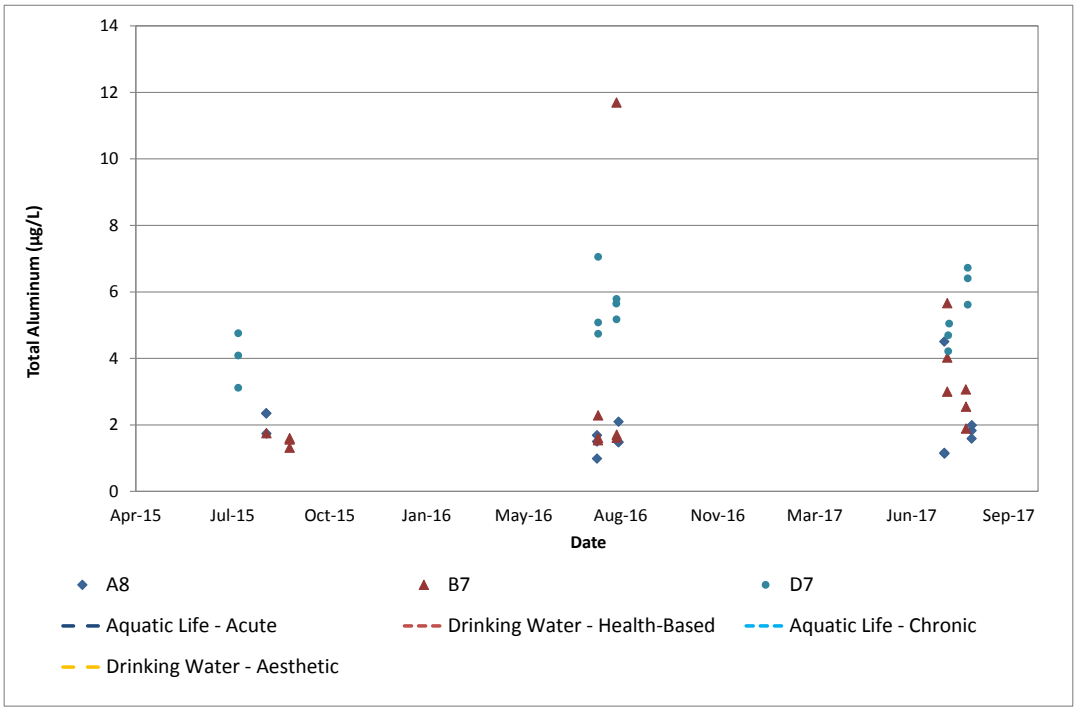
Figure 3E.2-4f: Concentrations of Dissolved Phosphorus at Peninsula Lakes between 2015 and 2017



mg-P/L = milligrams as phosphorus per litre. Open symbols represent results that are less than the detection limit.

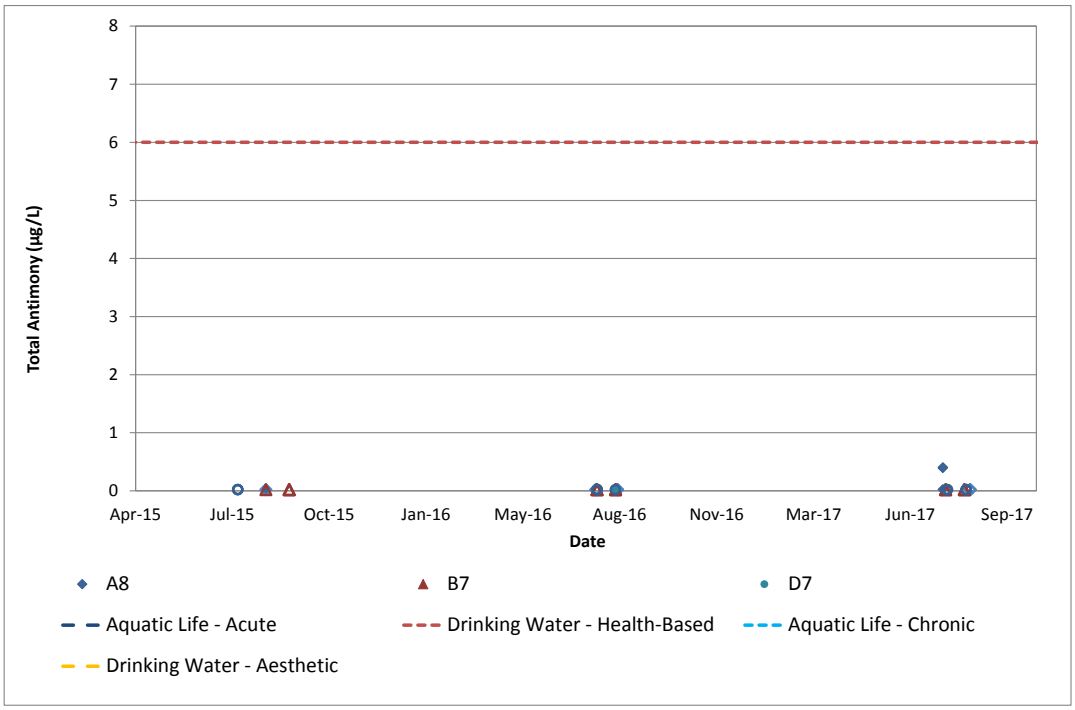
Figure 3E.2-4g: Concentrations of Orthophosphate at Peninsula Lakes between 2015 and 2017

3E2.5 Total Metals



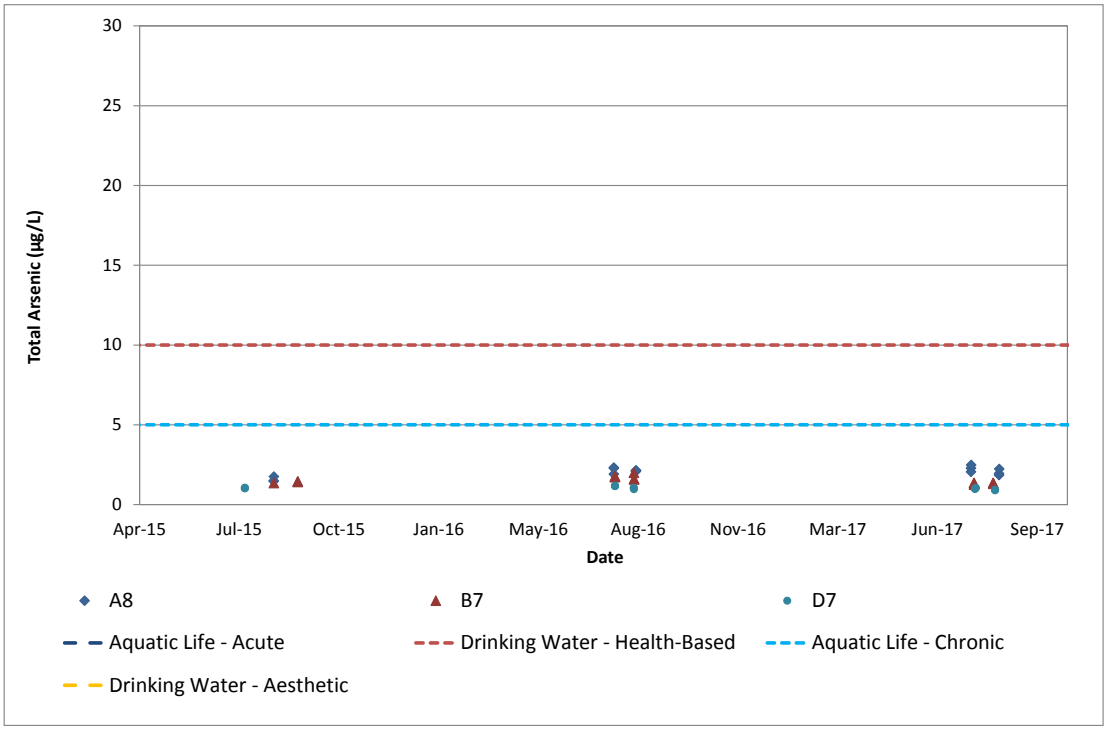
µg/L = micrograms per litre.

Figure 3E.2-5a: Concentrations of Total Aluminum at Peninsula Lakes between 2015 and 2017



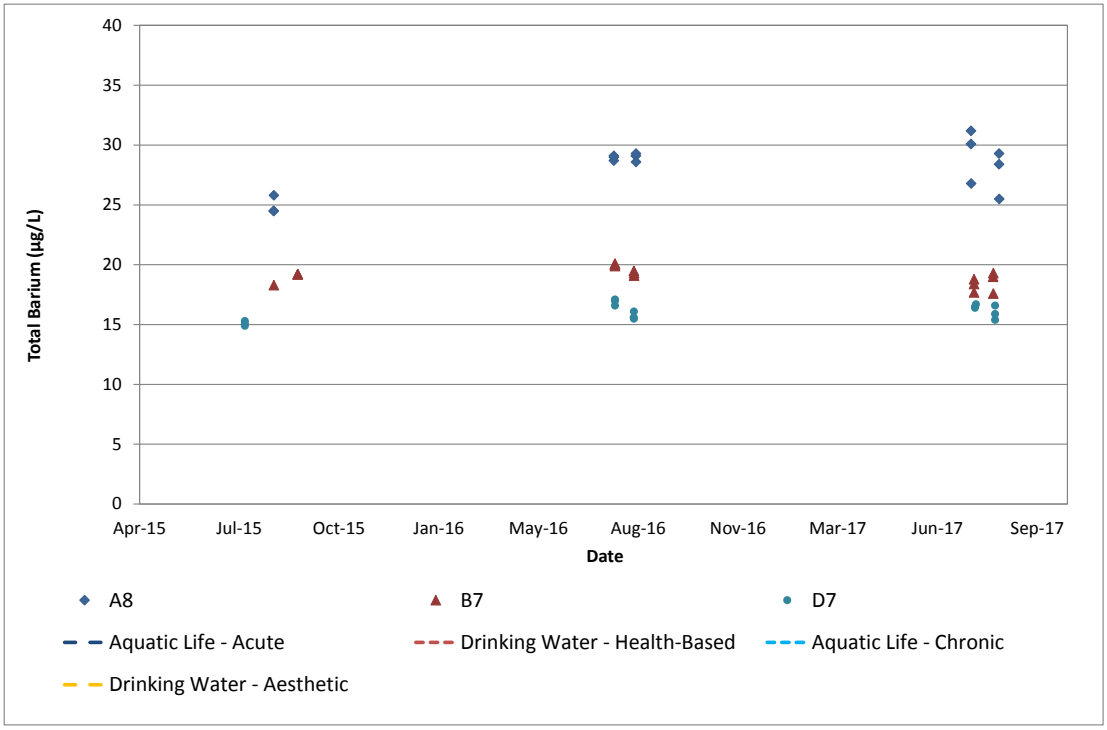
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5b: Concentrations of Total Antimony at Peninsula Lakes between 2015 and 2017



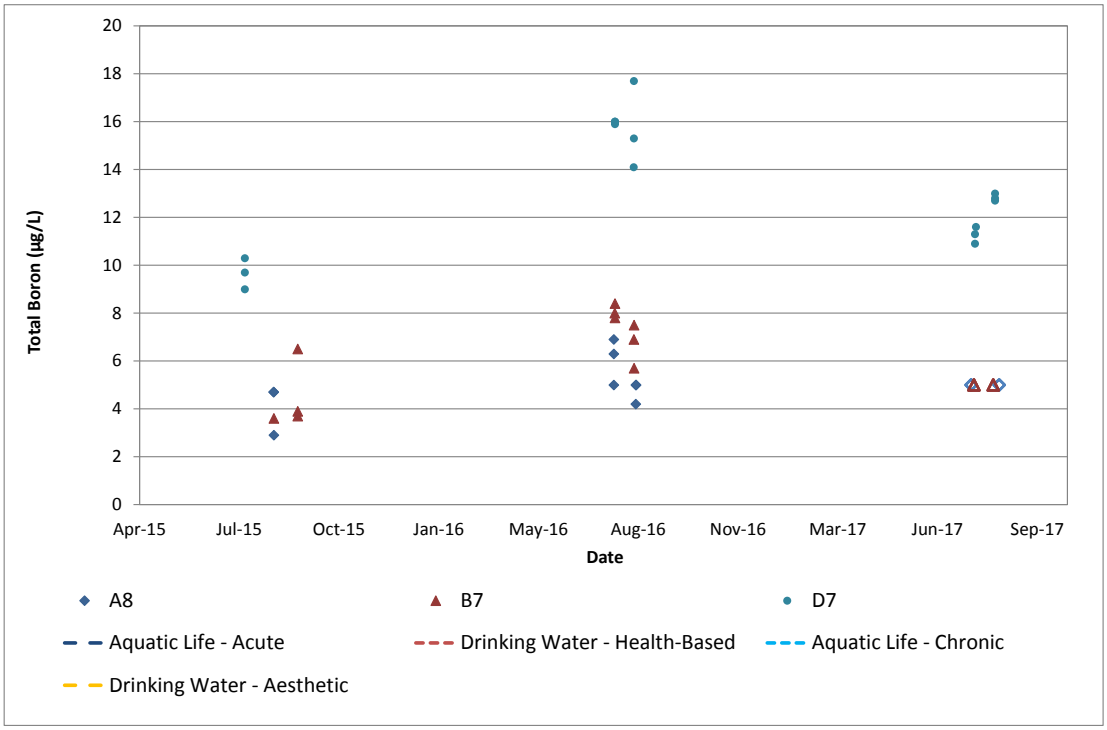
µg/L = micrograms per litre.

Figure 3E.2-5c: Concentrations of Total Arsenic at Peninsula Lakes between 2015 and 2017



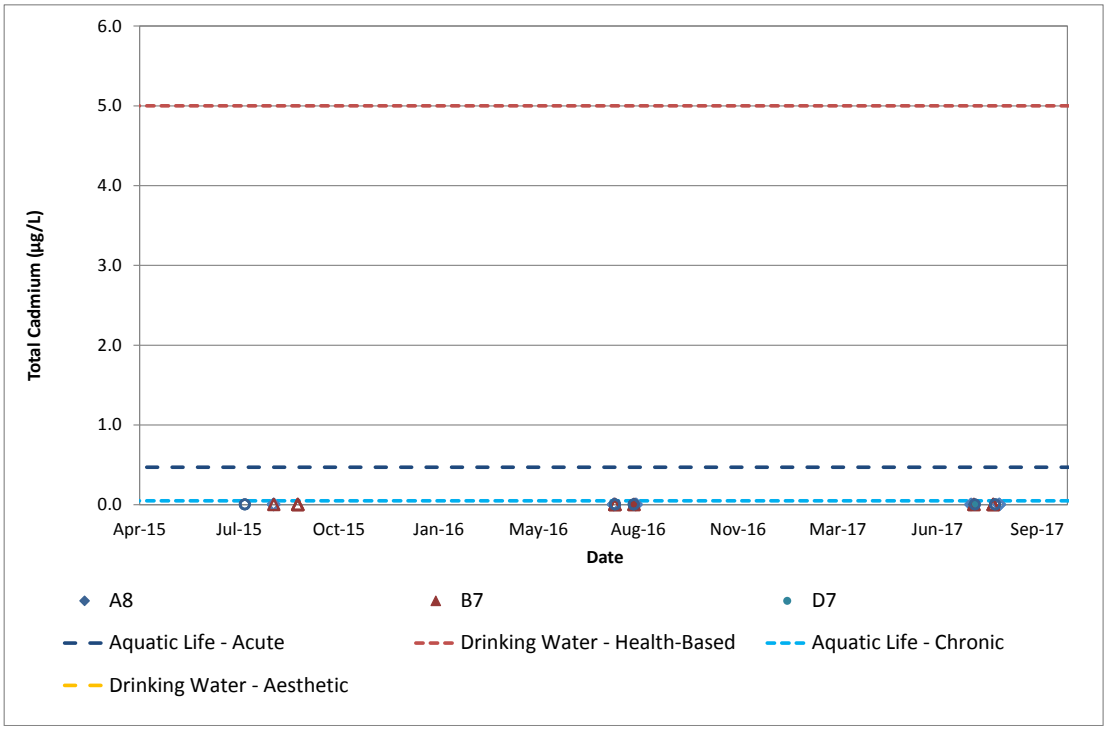
µg/L = micrograms per litre.

Figure 3E.2-5d: Concentrations of Total Barium at Peninsula Lakes between 2015 and 2017



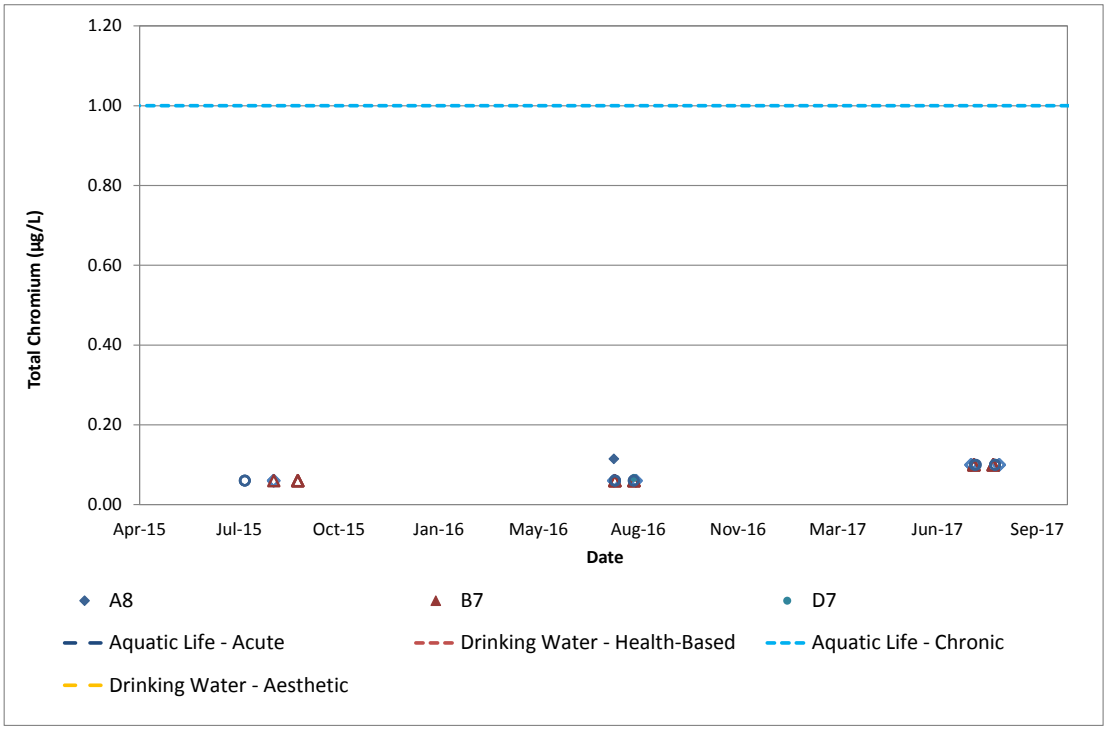
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5e: Concentrations of Total Boron at Peninsula Lakes between 2015 and 2017



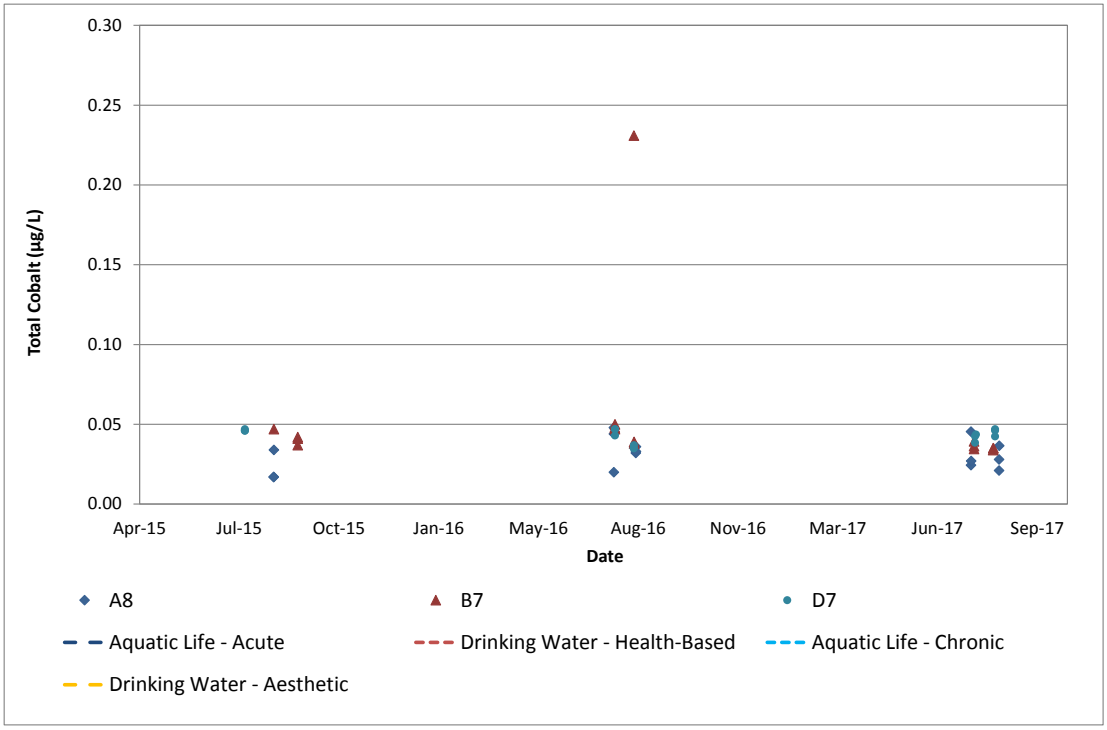
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5f: Concentrations of Total Cadmium at Peninsula Lakes between 2015 and 2017



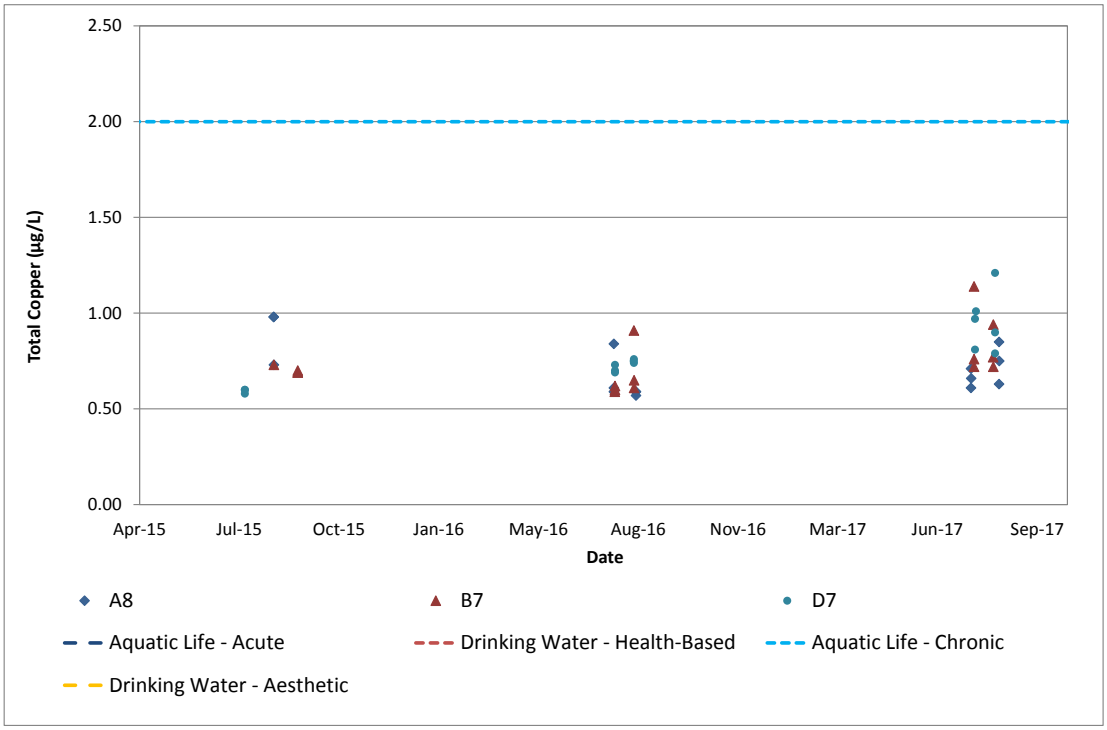
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5g: Concentrations of Total Chromium at Peninsula Lakes between 2015 and 2017



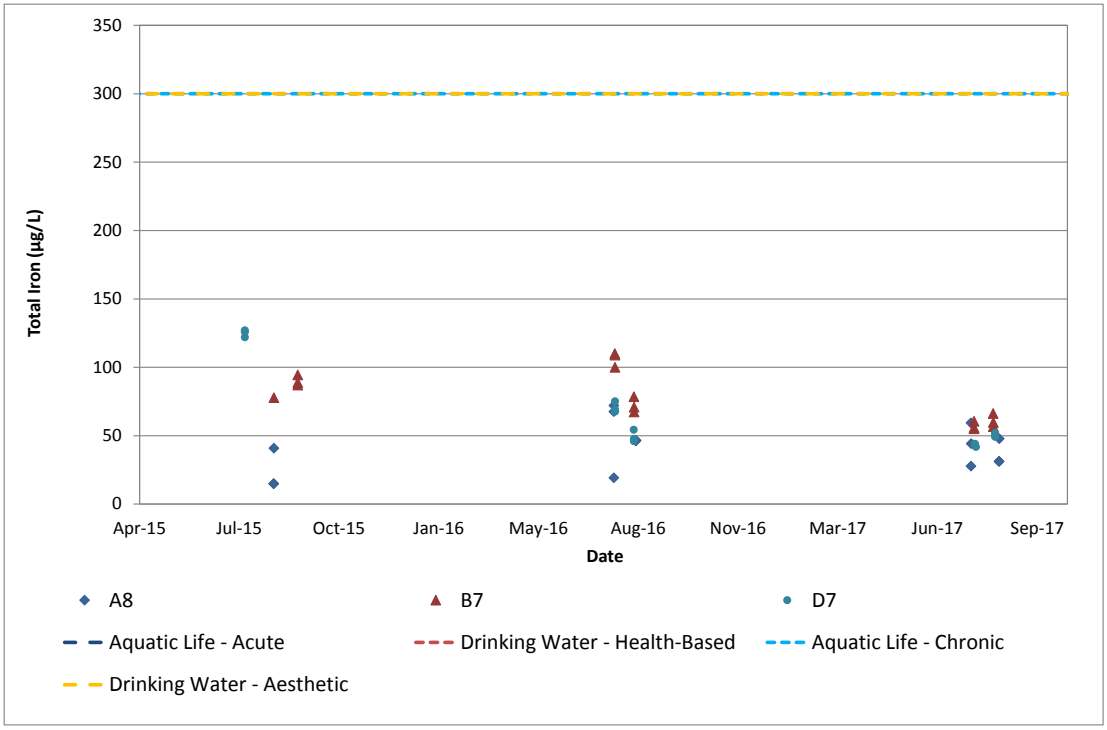
µg/L = micrograms per litre.

Figure 3E.2-5h: Concentrations of Total Cobalt at Peninsula Lakes between 2015 and 2017



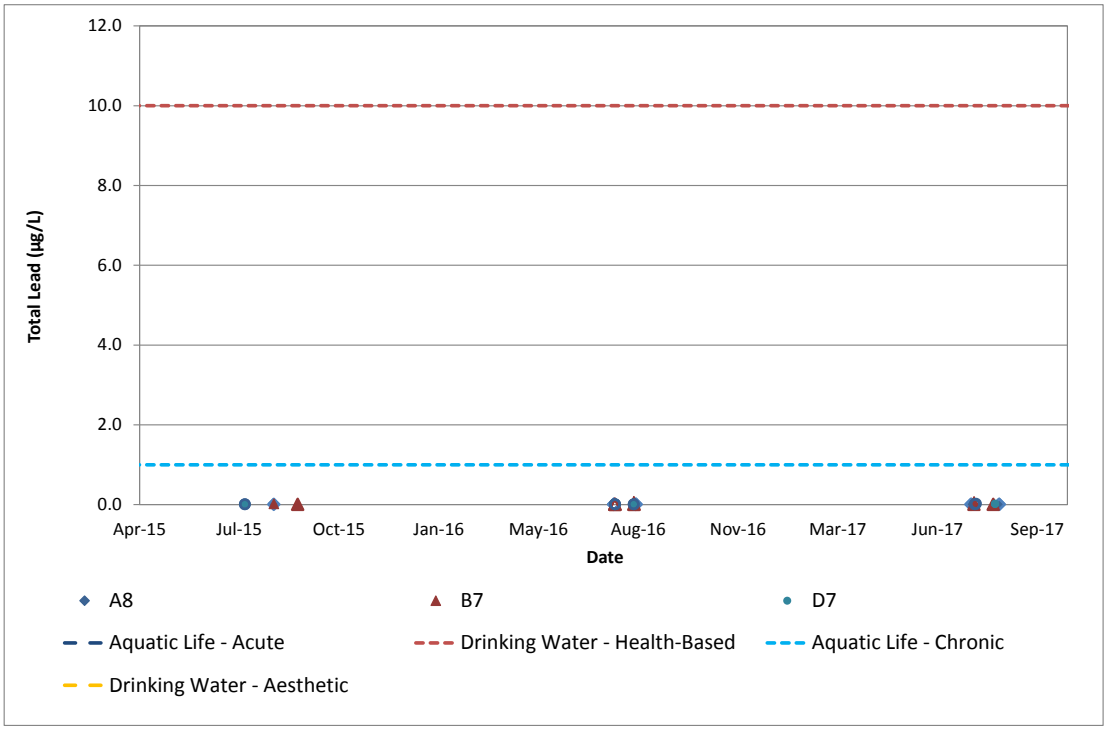
µg/L = micrograms per litre.

Figure 3E.2-5i: Concentrations of Total Copper at Peninsula Lakes between 2015 and 2017



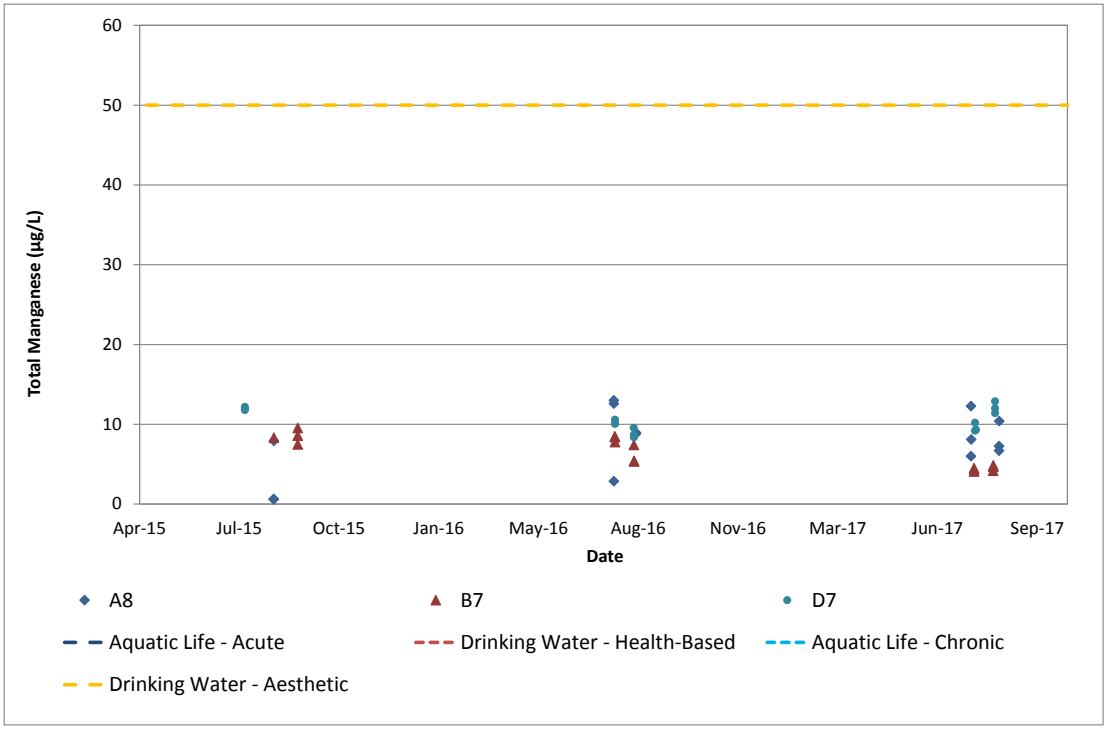
µg/L = micrograms per litre.

Figure 3E.2-5j: Concentrations of Total Iron at Peninsula Lakes between 2015 and 2017



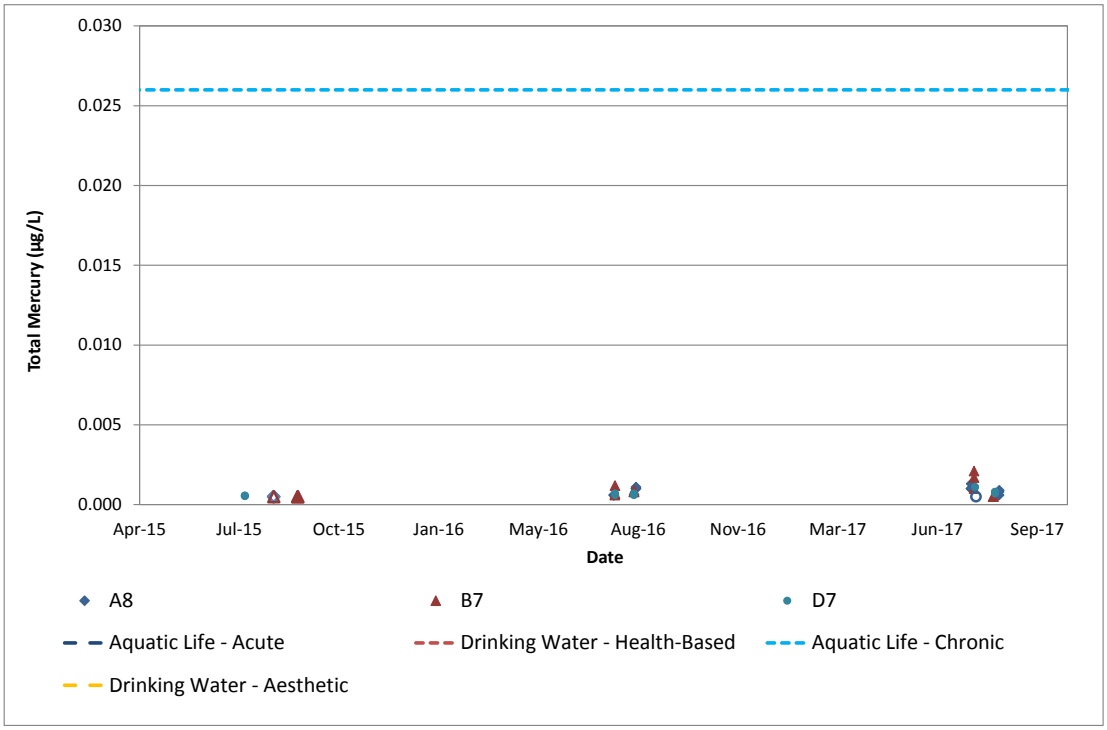
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5k: Concentrations of Total Lead at Peninsula Lakes between 2015 and 2017



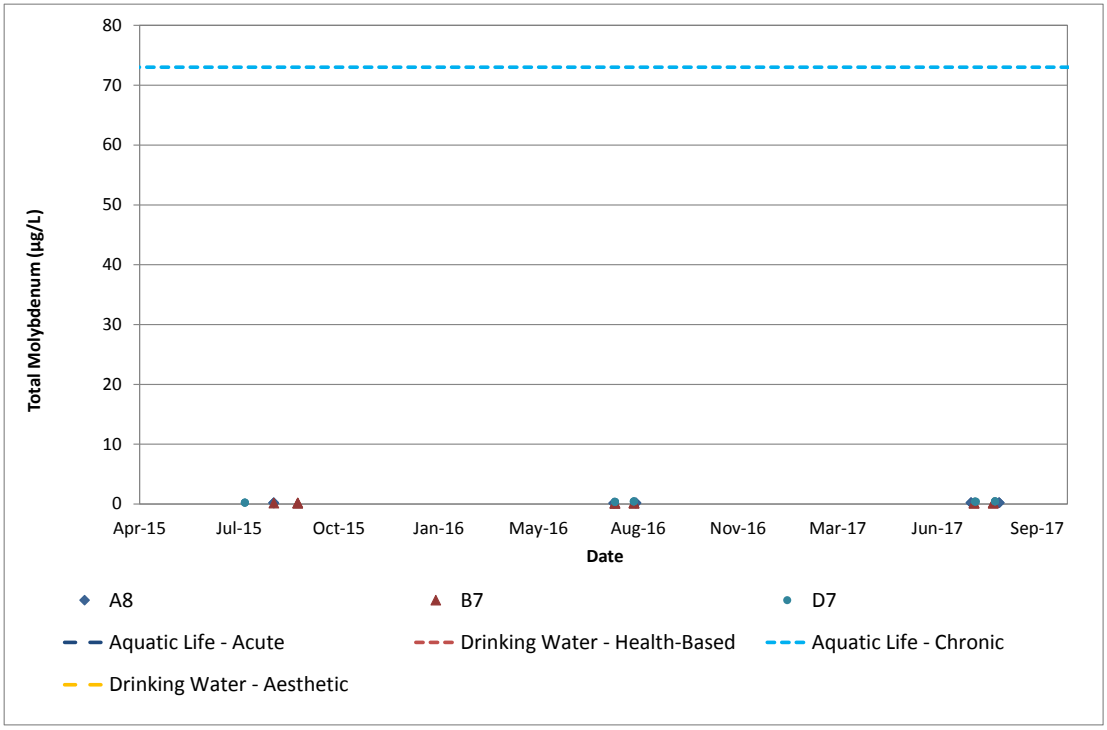
µg/L = micrograms per litre.

Figure 3E.2-5l: Concentrations of Total Manganese at Peninsula Lakes between 2015 and 2017



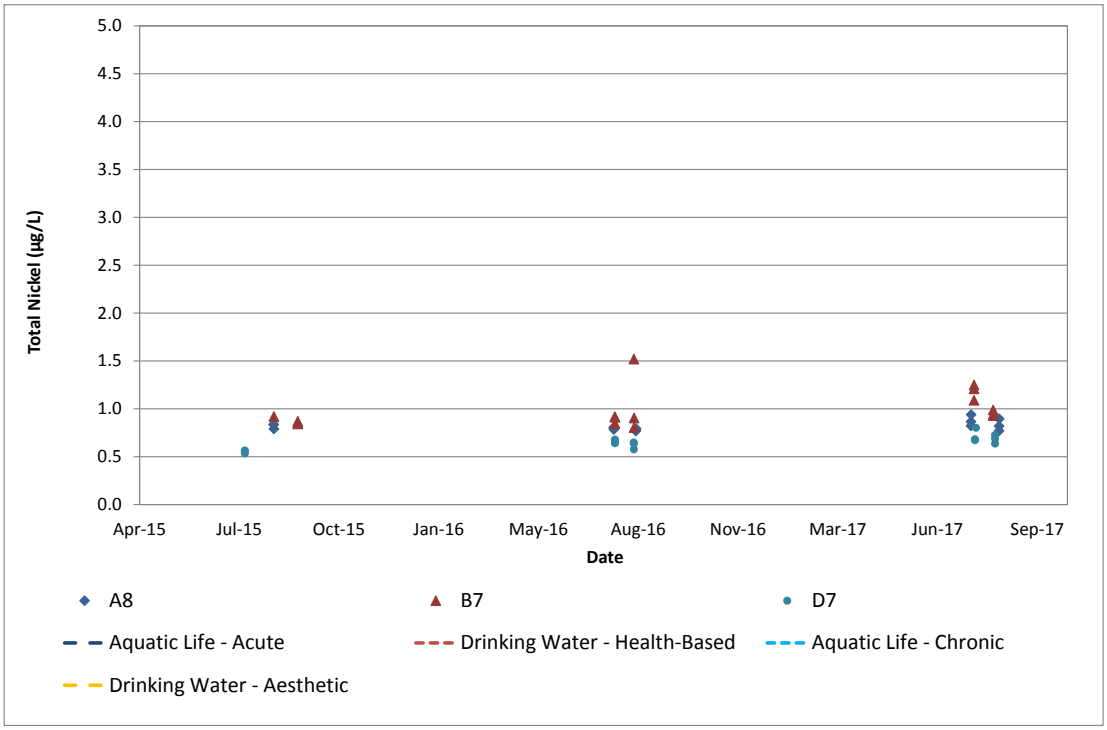
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5m: Concentrations of Total Mercury at Peninsula Lakes between 2015 and 2017



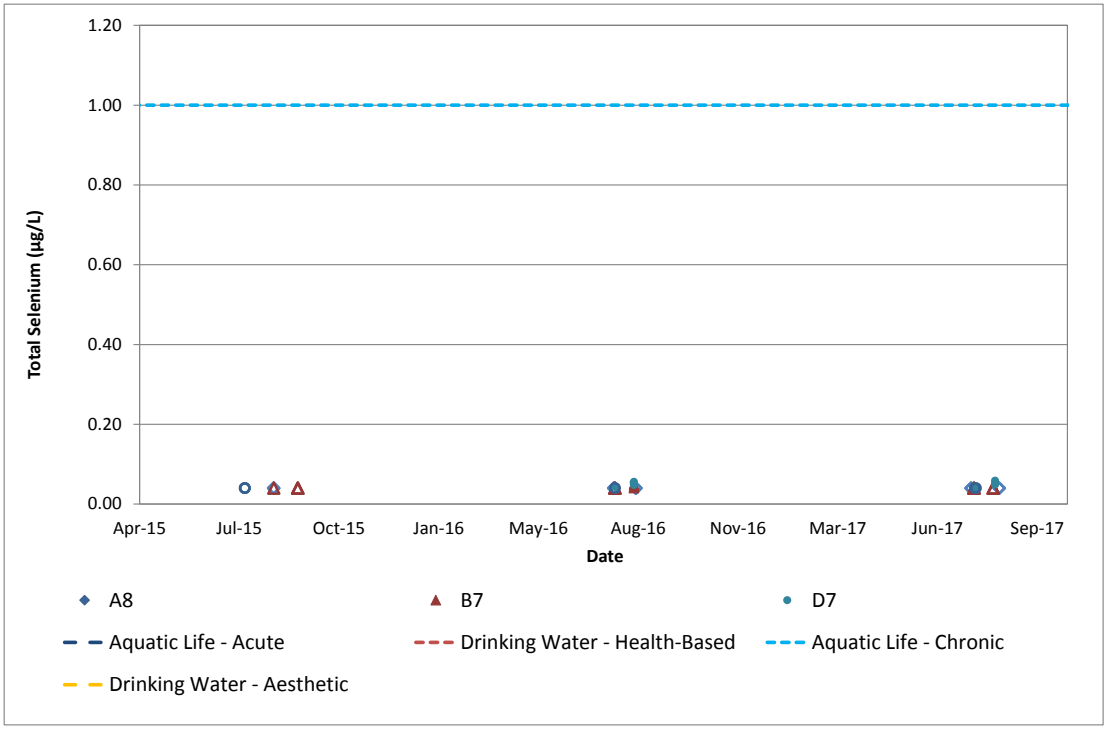
µg/L = micrograms per litre.

Figure 3E.2-5n: Concentrations of Total Molybdenum at Peninsula Lakes between 2015 and 2017



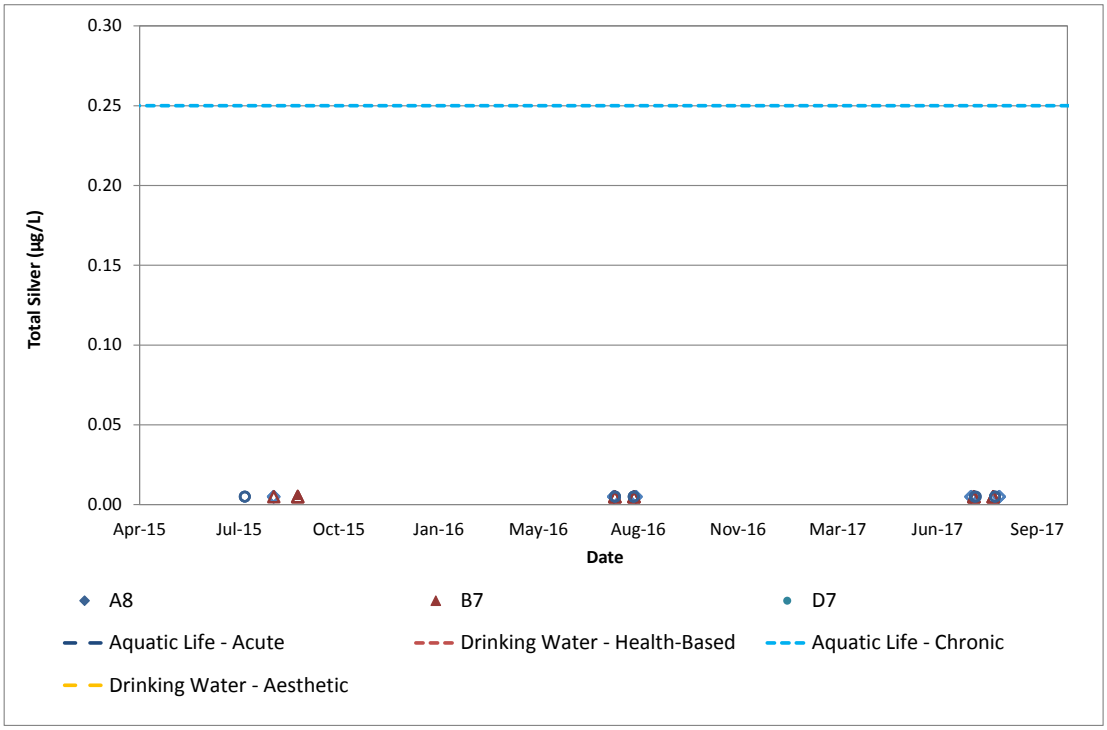
µg/L = micrograms per litre.

Figure 3E.2-5o: Concentrations of Total Nickel at Peninsula Lakes between 2015 and 2017



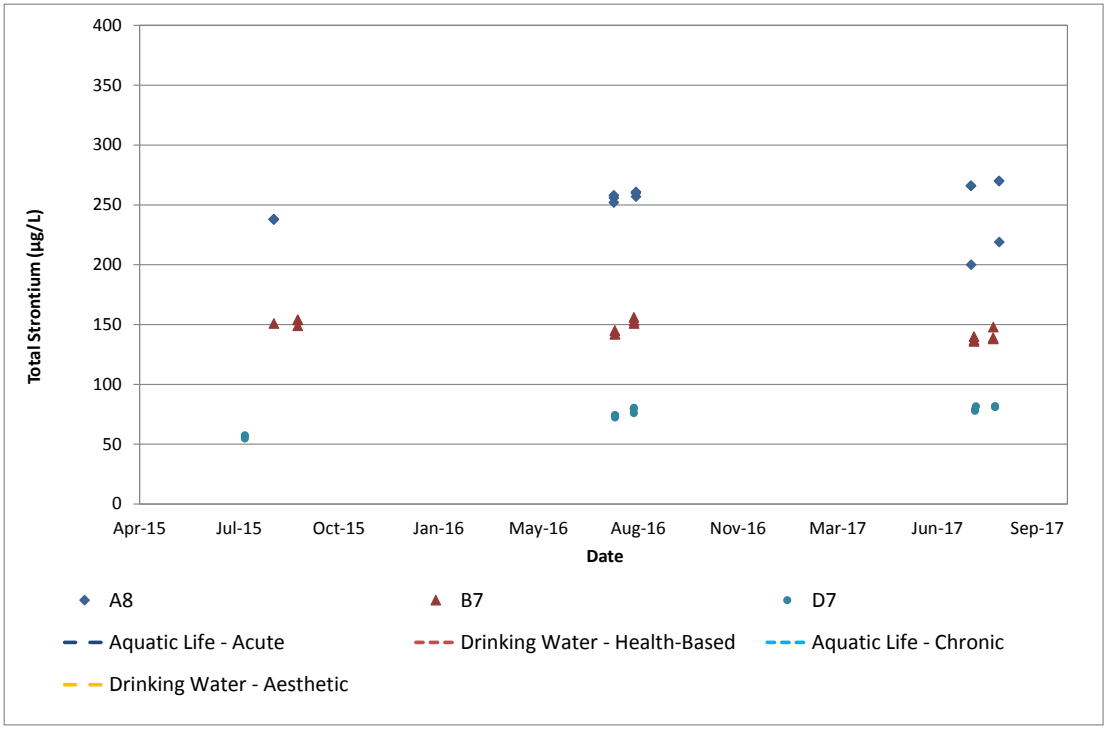
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5p: Concentrations of Total Selenium at Peninsula Lakes between 2015 and 2017



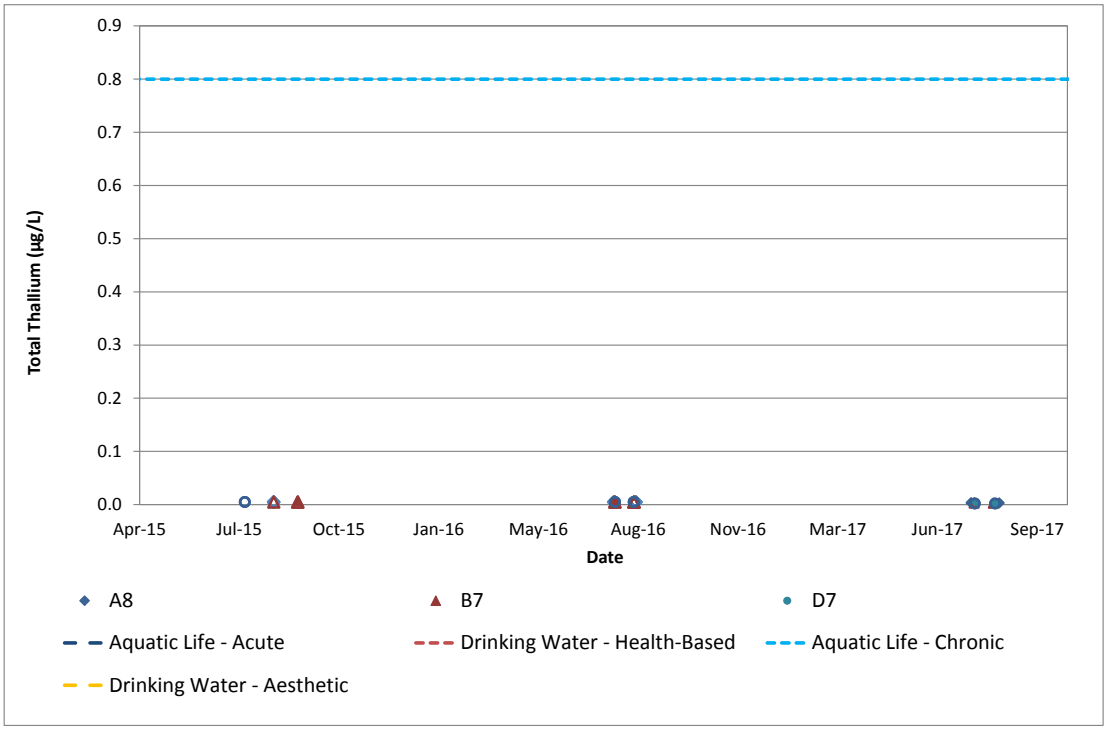
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5q: Concentrations of Total Silver at Peninsula Lakes between 2015 and 2017



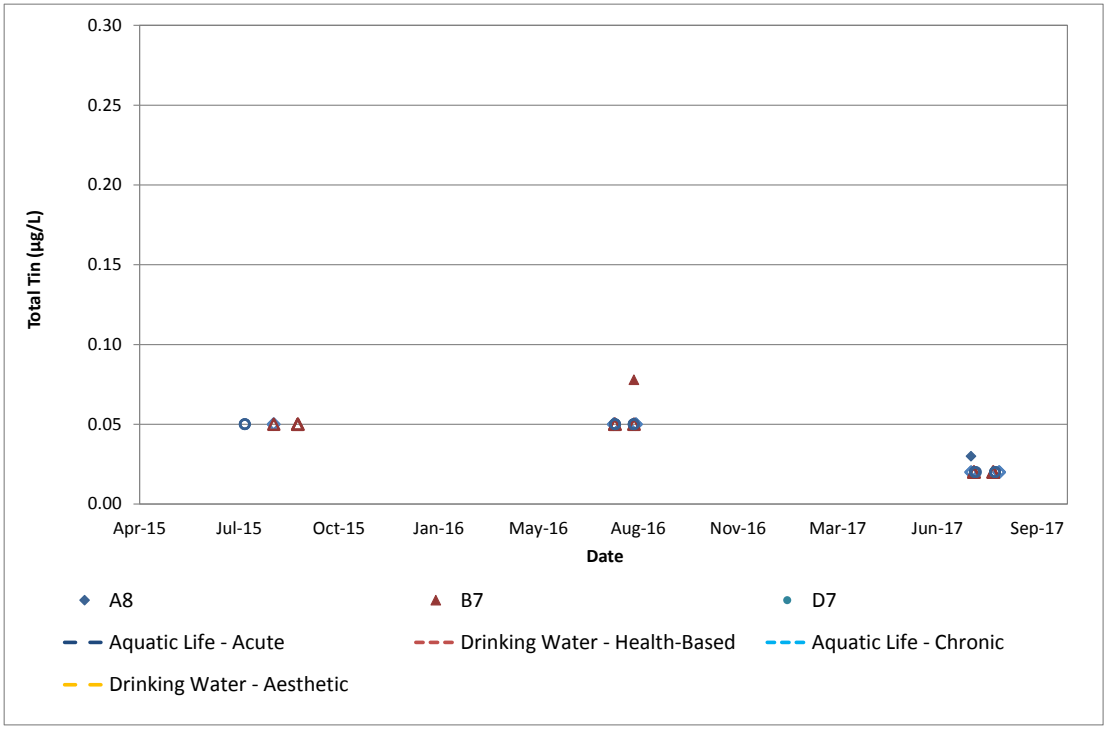
µg/L = micrograms per litre.

Figure 3E.2-5r: Concentrations of Total Strontium at Peninsula Lakes between 2015 and 2017



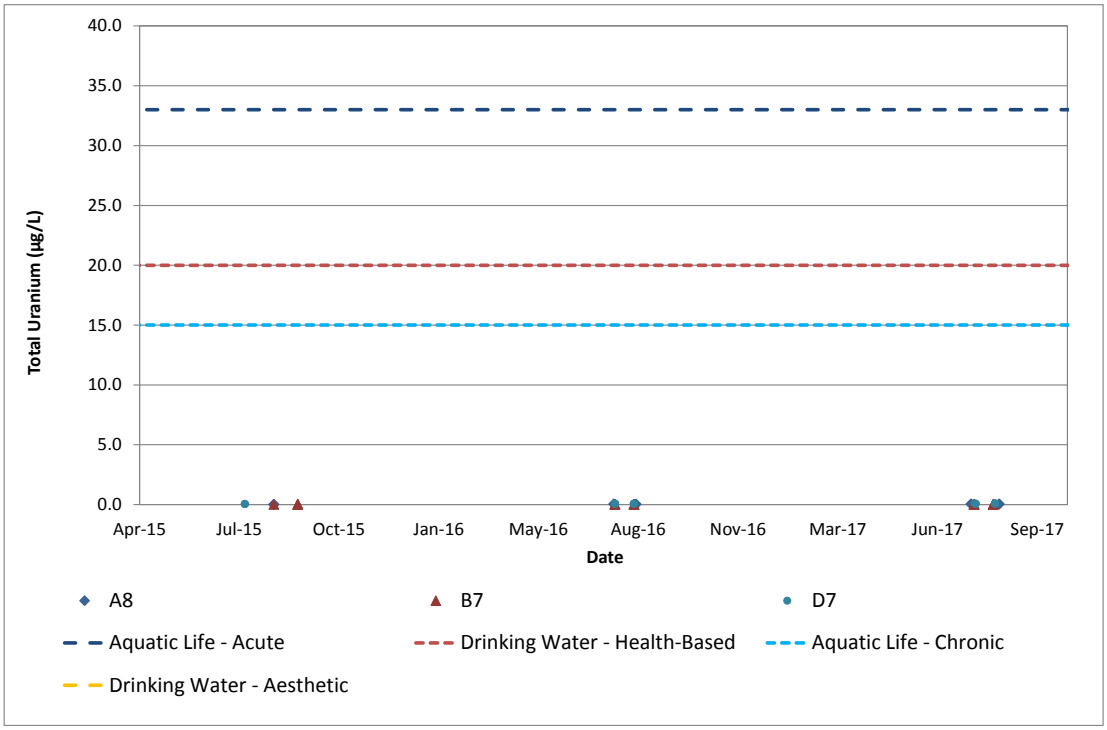
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5s: Concentrations of Total Thallium at Peninsula Lakes between 2015 and 2017



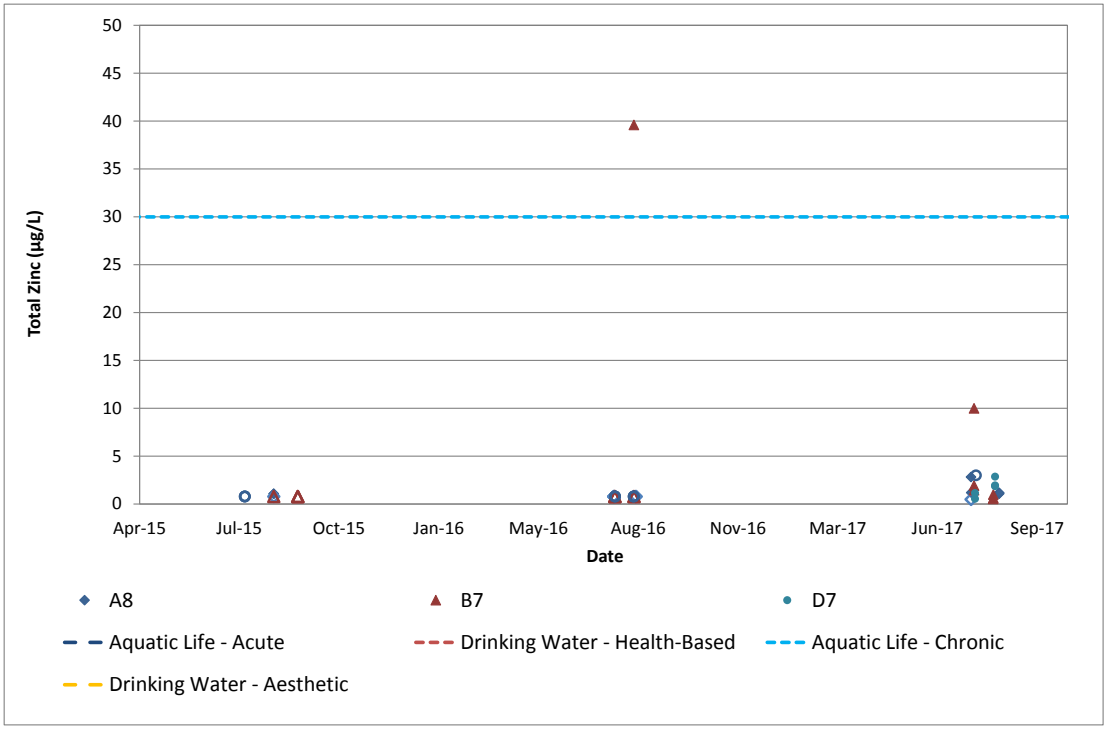
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-5t: Concentrations of Total Tin at Peninsula Lakes between 2015 and 2017



µg/L = micrograms per litre.

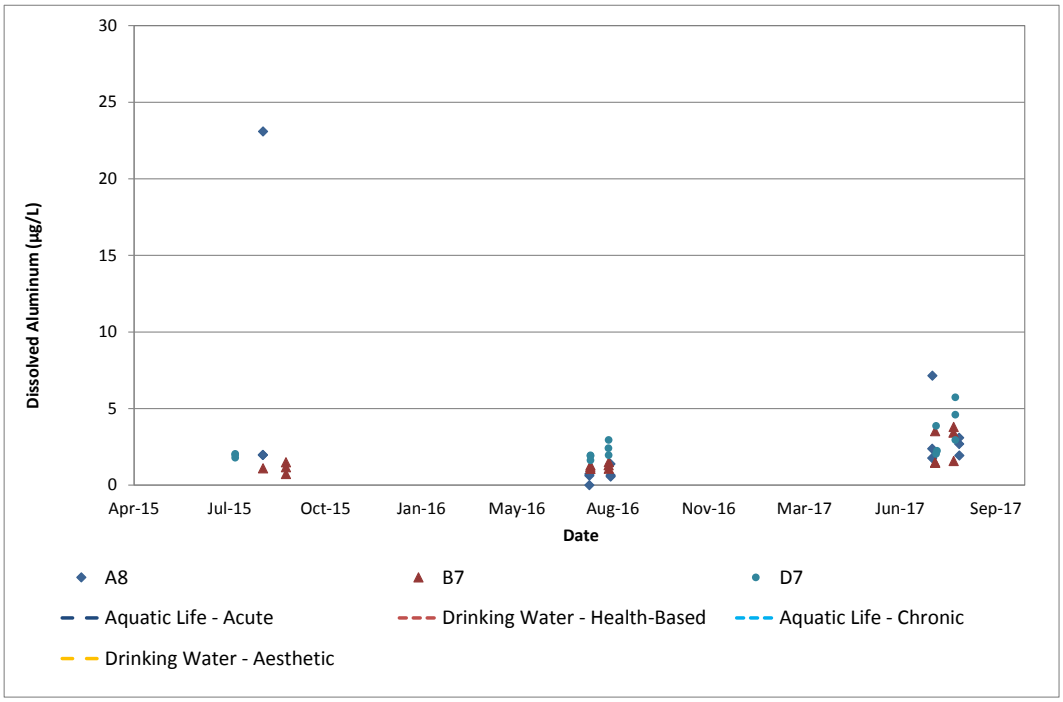
Figure 3E.2-5u: Concentrations of Total Uranium at Peninsula Lakes between 2015 and 2017



µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

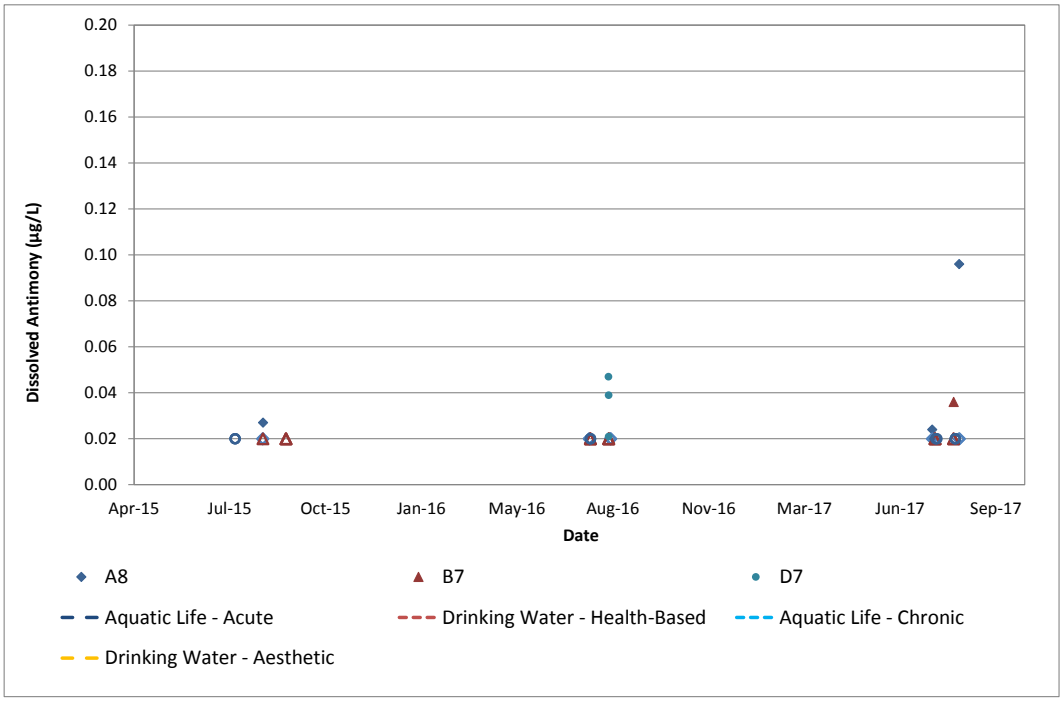
Figure 3E.2-5v: Concentrations of Total Zinc at Peninsula Lakes between 2015 and 2017

3E2.6 Dissolved Metals



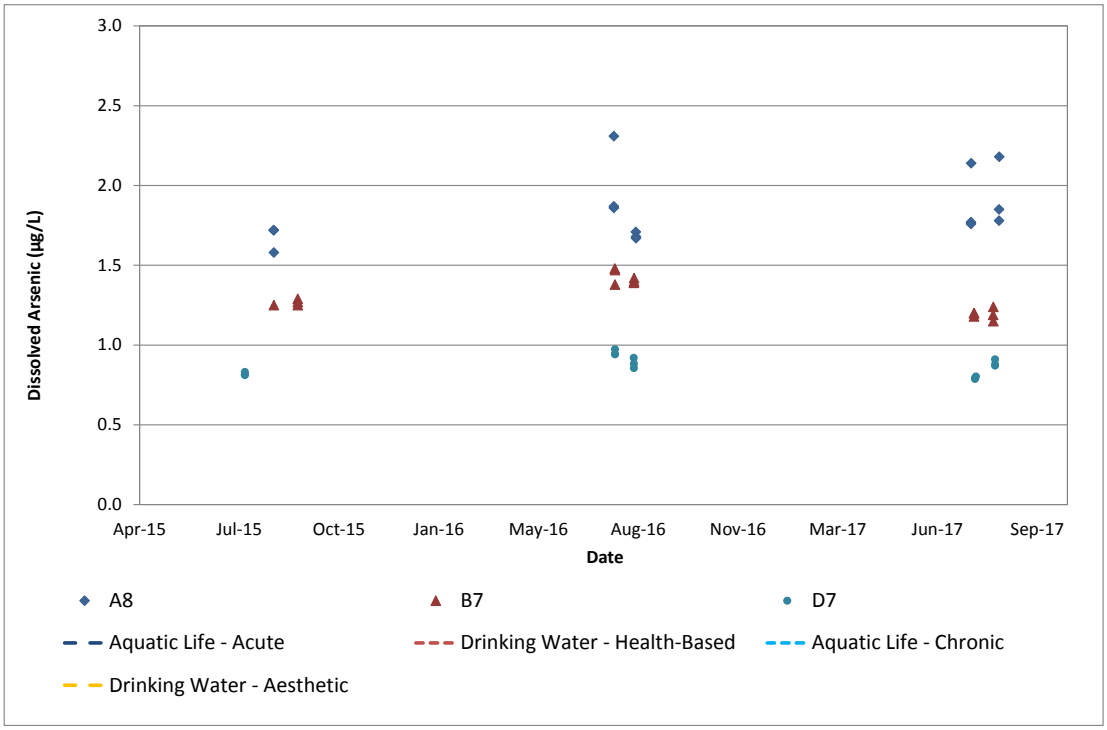
µg/L = micrograms per litre.

Figure 3E.2-6a: Concentrations of Dissolved Aluminum at Peninsula Lakes between 2015 and 2017



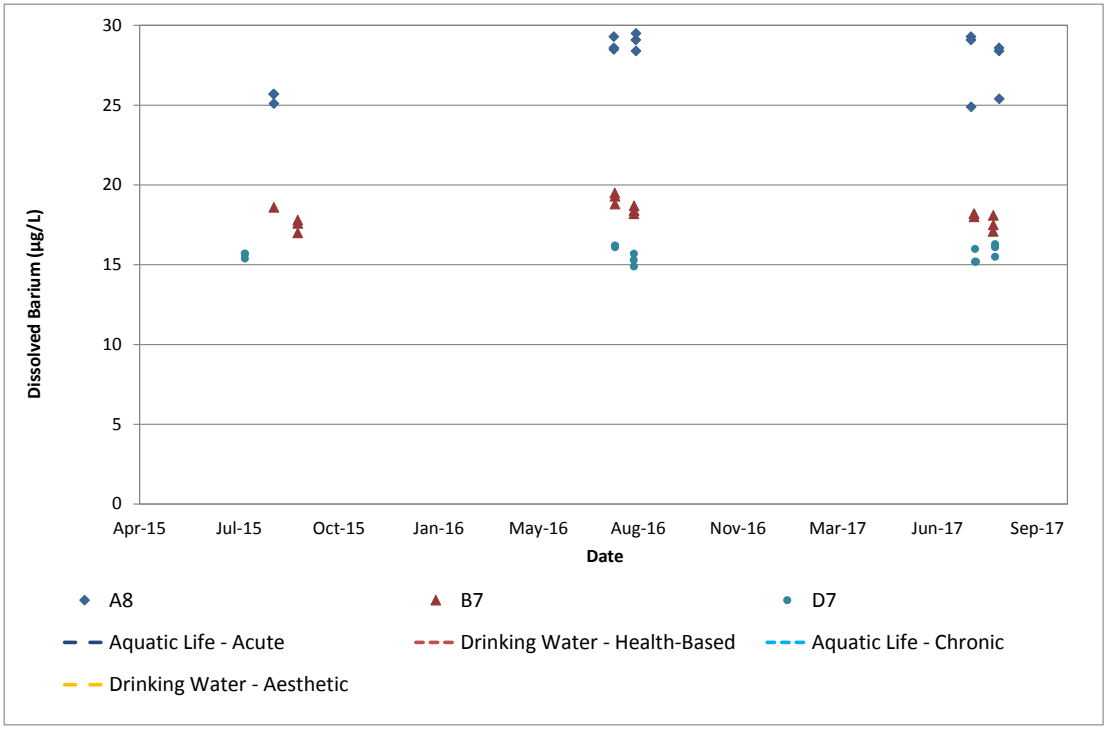
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6b: Concentrations of Dissolved Antimony at Peninsula Lakes between 2015 and 2017



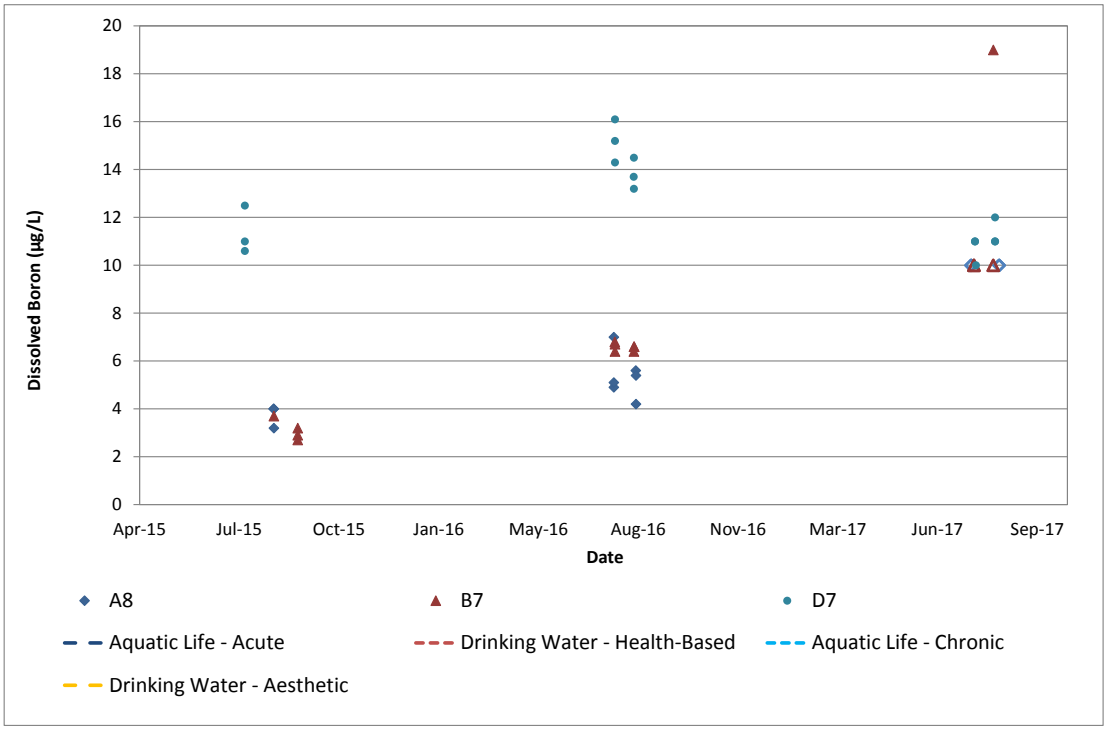
µg/L = micrograms per litre.

Figure 3E.2-6c: Concentrations of Dissolved Arsenic at Peninsula Lakes between 2015 and 2017



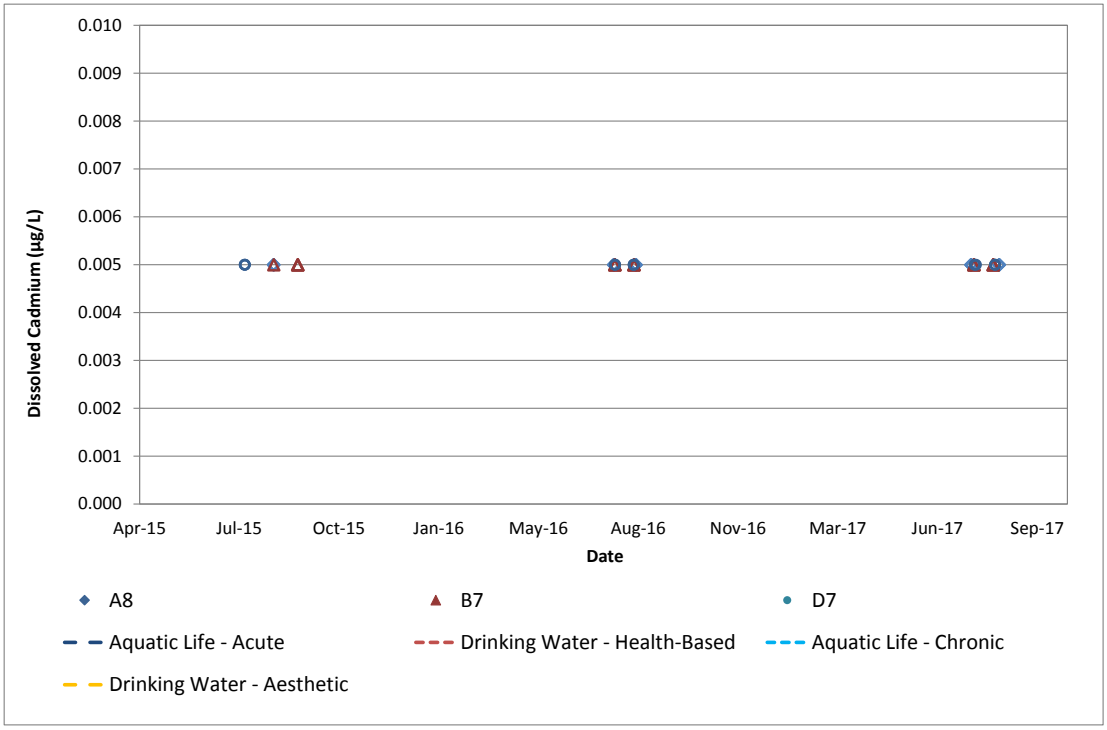
µg/L = micrograms per litre.

Figure 3E.2-6d: Concentrations of Dissolved Barium at Peninsula Lakes between 2015 and 2017



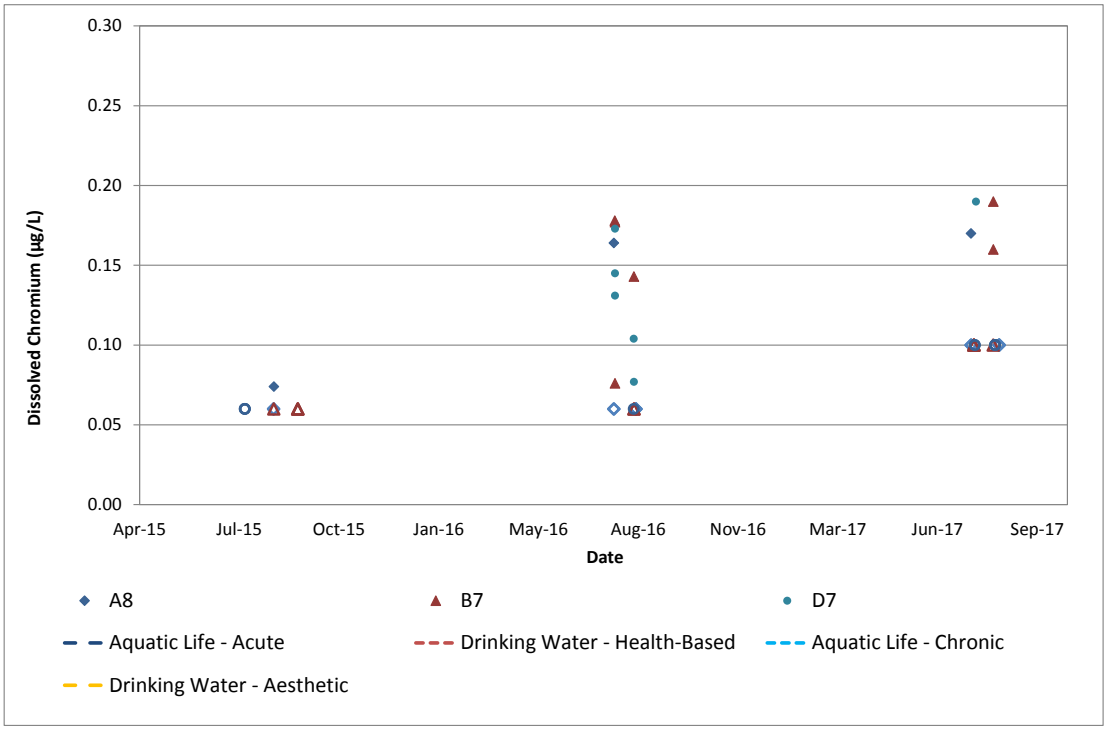
µg/L = micrograms per litre.

Figure 3E.2-6e: Concentrations of Dissolved Boron at Peninsula Lakes between 2015 and 2017



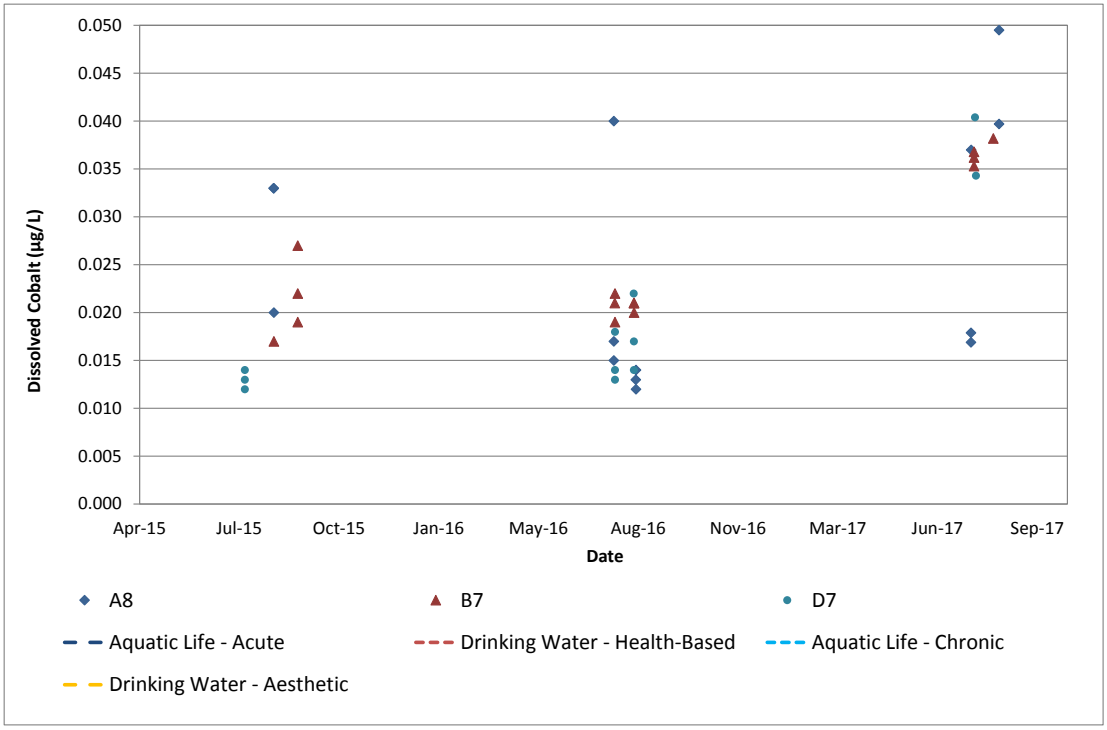
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6f: Concentrations of Dissolved Cadmium at Peninsula Lakes between 2015 and 2017



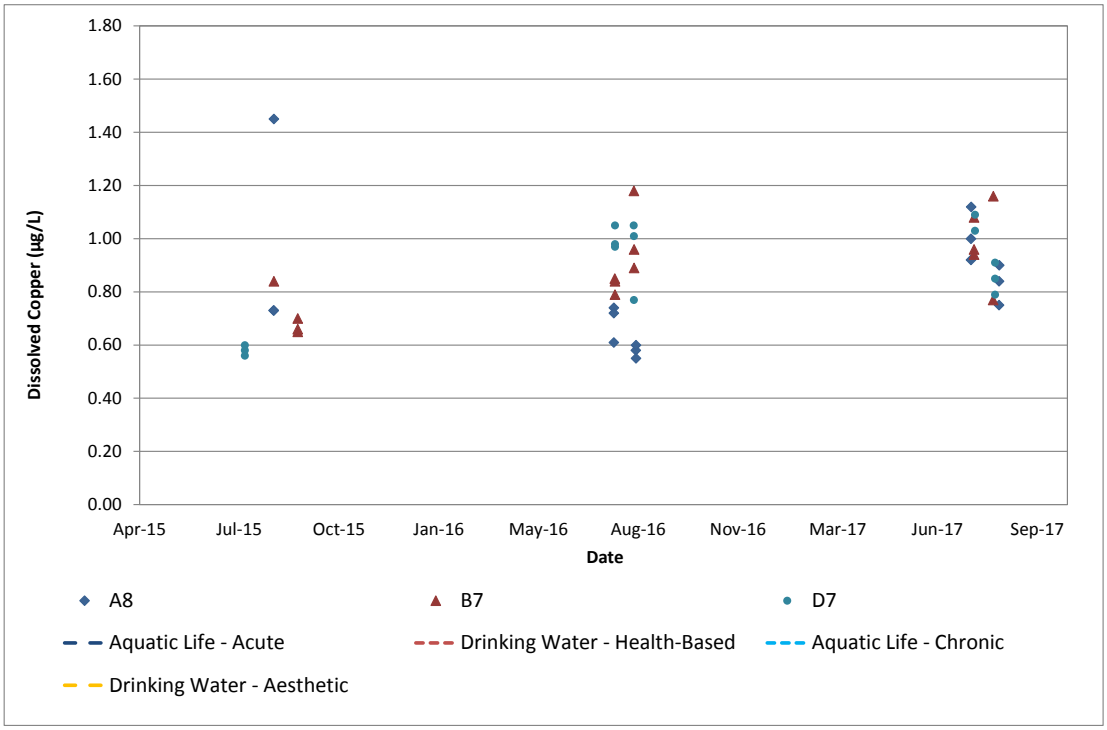
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6g: Concentrations of Dissolved Chromium at Peninsula Lakes between 2015 and 2017



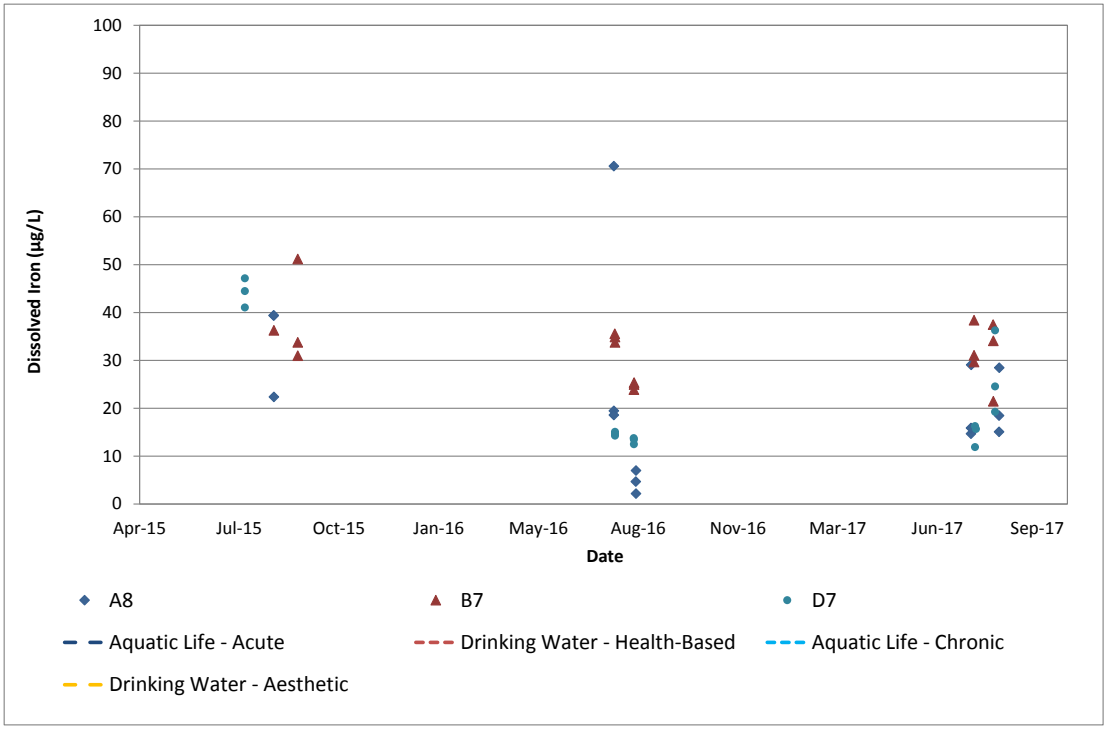
µg/L = micrograms per litre.

Figure 3E.2-6h: Concentrations of Dissolved Cobalt at Peninsula Lakes between 2015 and 2017



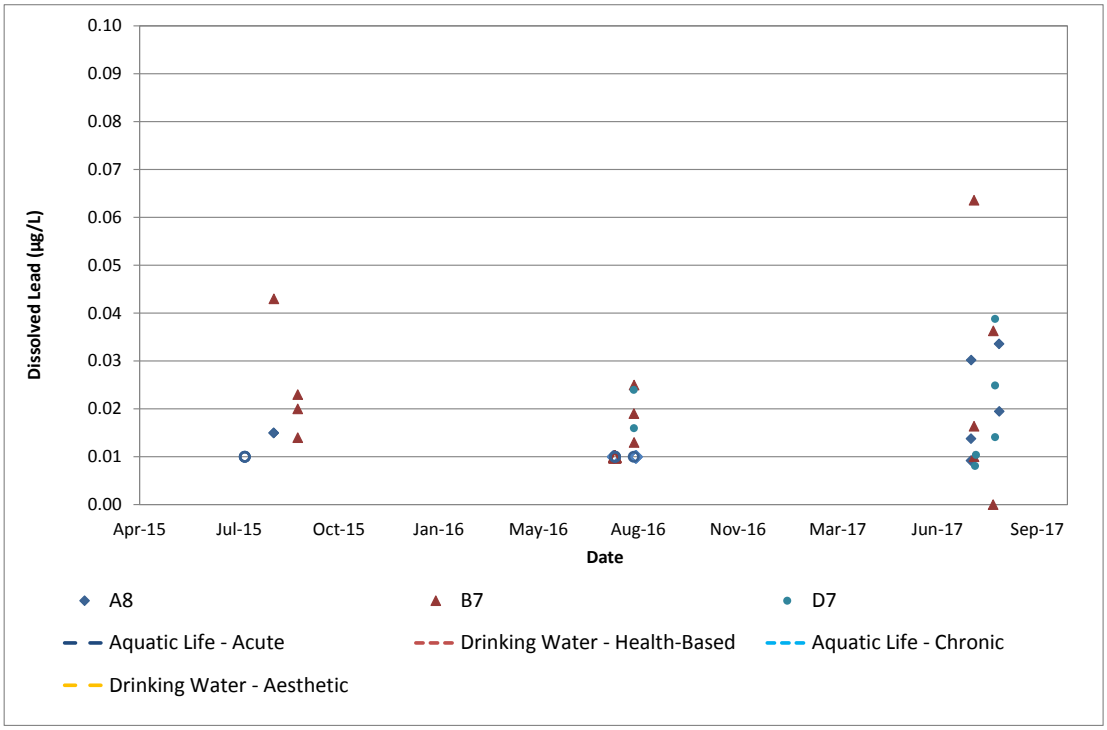
µg/L = micrograms per litre.

Figure 3E.2-6i: Concentrations of Dissolved Copper at Peninsula Lakes between 2015 and 2017



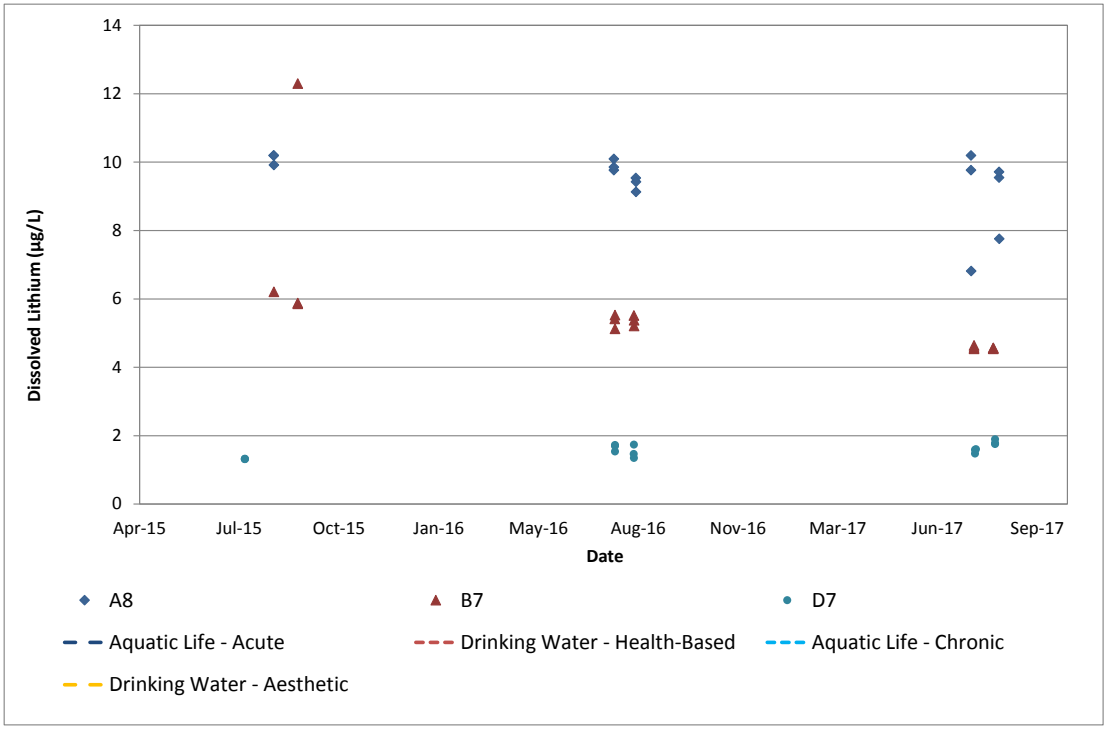
µg/L = micrograms per litre.

Figure 3E.2-6j: Concentrations of Dissolved Iron at Peninsula Lakes between 2015 and 2017



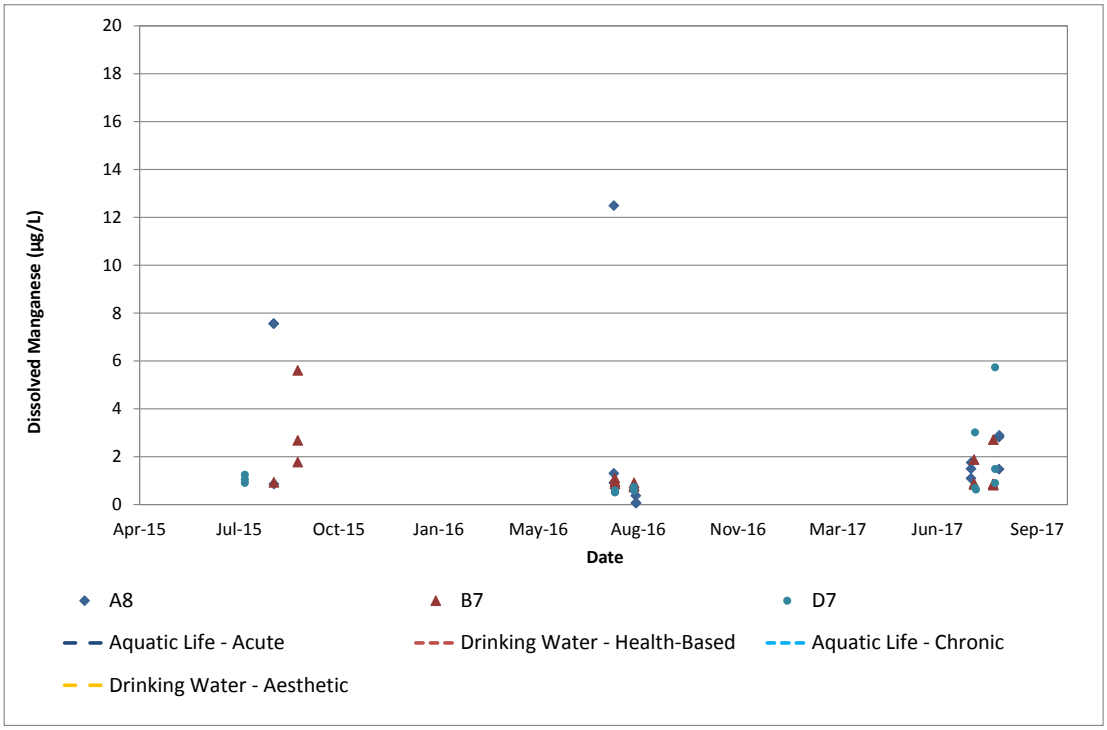
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6k: Concentrations of Dissolved Lead at Peninsula Lakes between 2015 and 2017



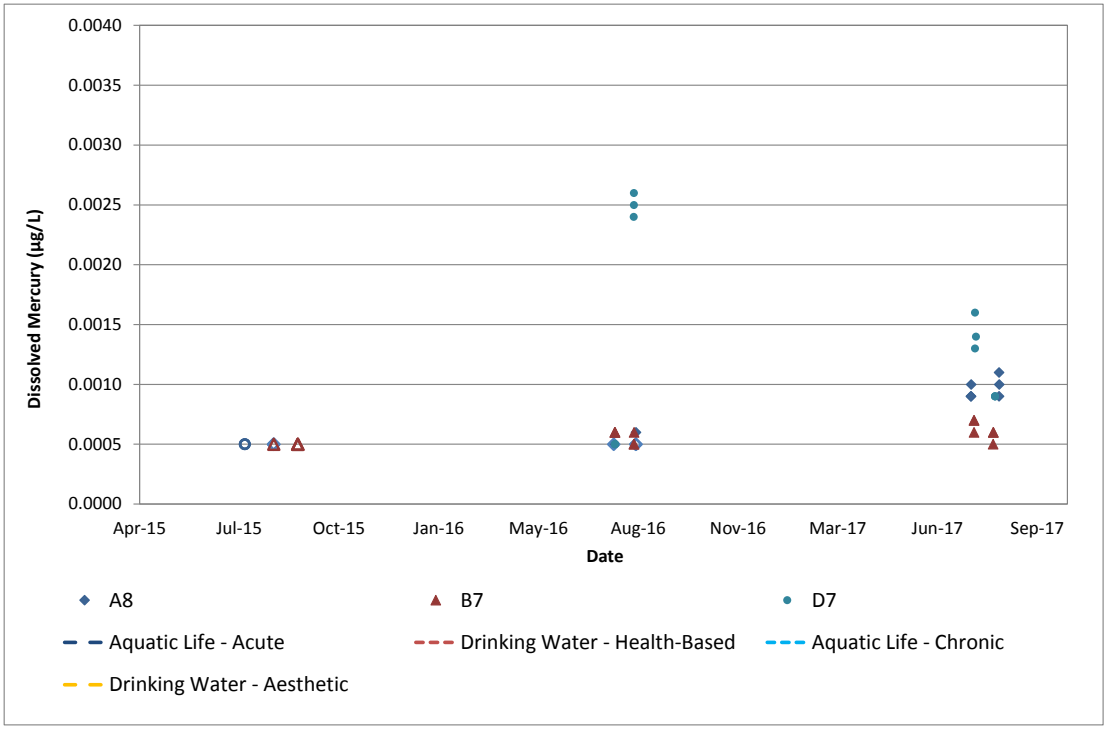
µg/L = micrograms per litre.

Figure 3E.2-6l: Concentrations of Dissolved Lithium at Peninsula Lakes between 2015 and 2017



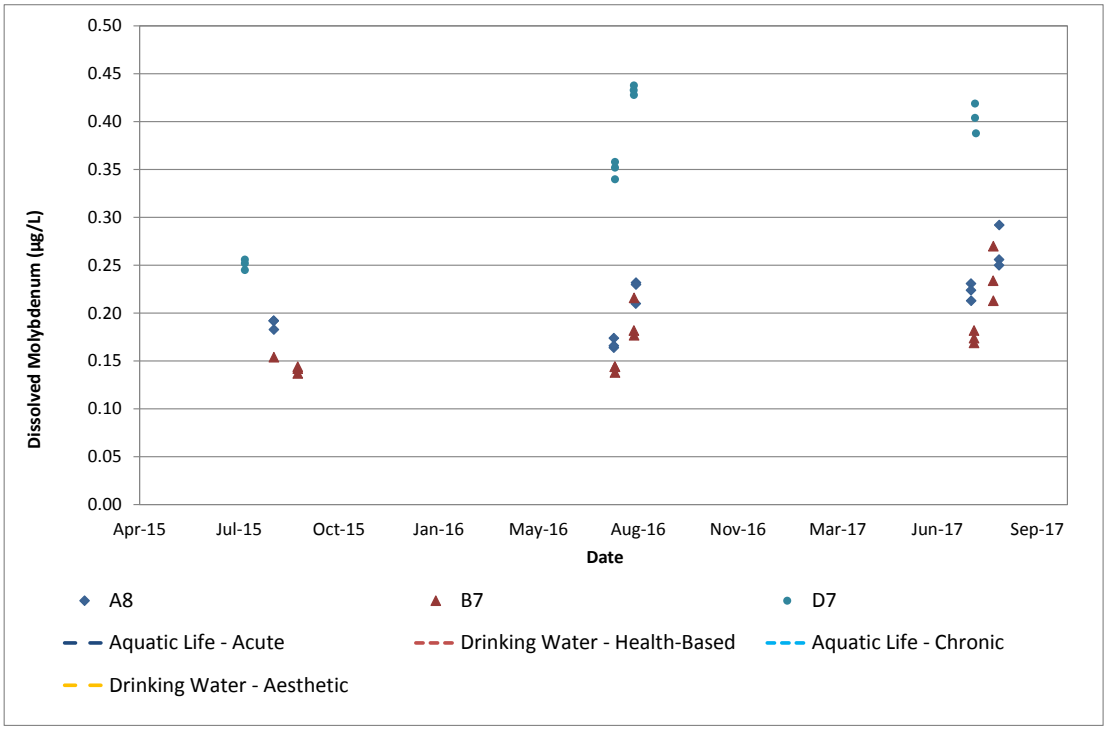
µg/L = micrograms per litre.

Figure 3E.2-6m: Concentrations of Dissolved Manganese at Peninsula Lakes between 2015 and 2017



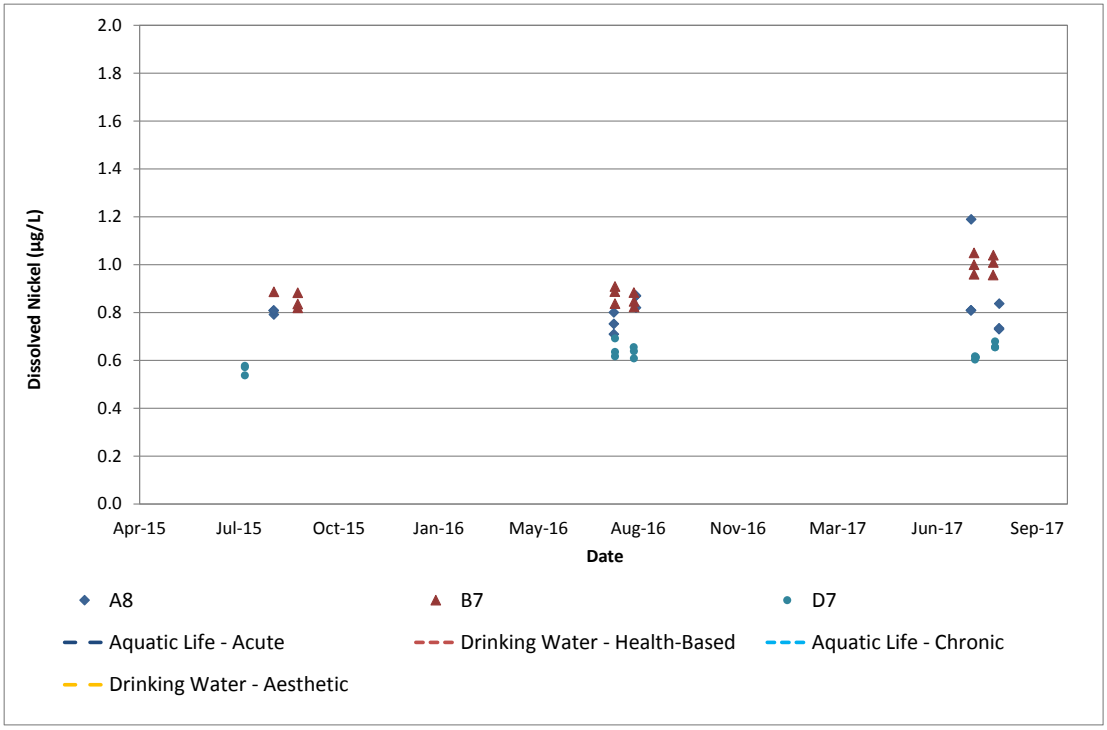
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6n: Concentrations of Dissolved Mercury at Peninsula Lakes between 2015 and 2017



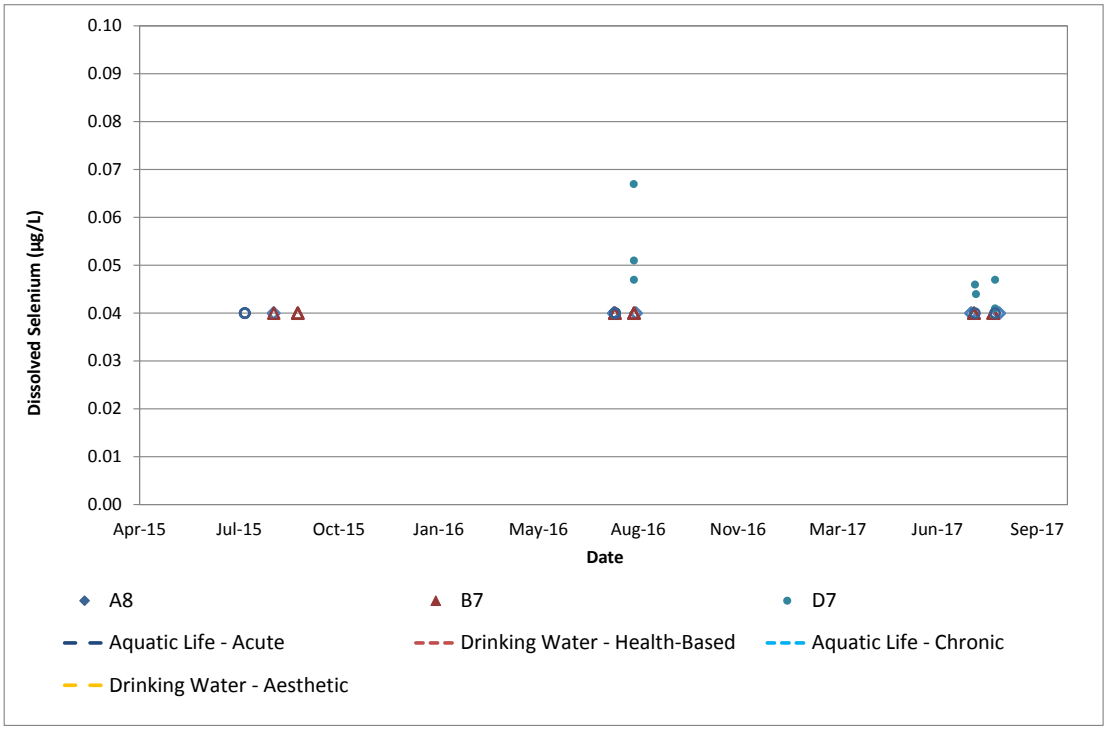
µg/L = micrograms per litre.

Figure 3E.2-6o: Concentrations of Dissolved Molybdenum at Peninsula Lakes between 2015 and 2017



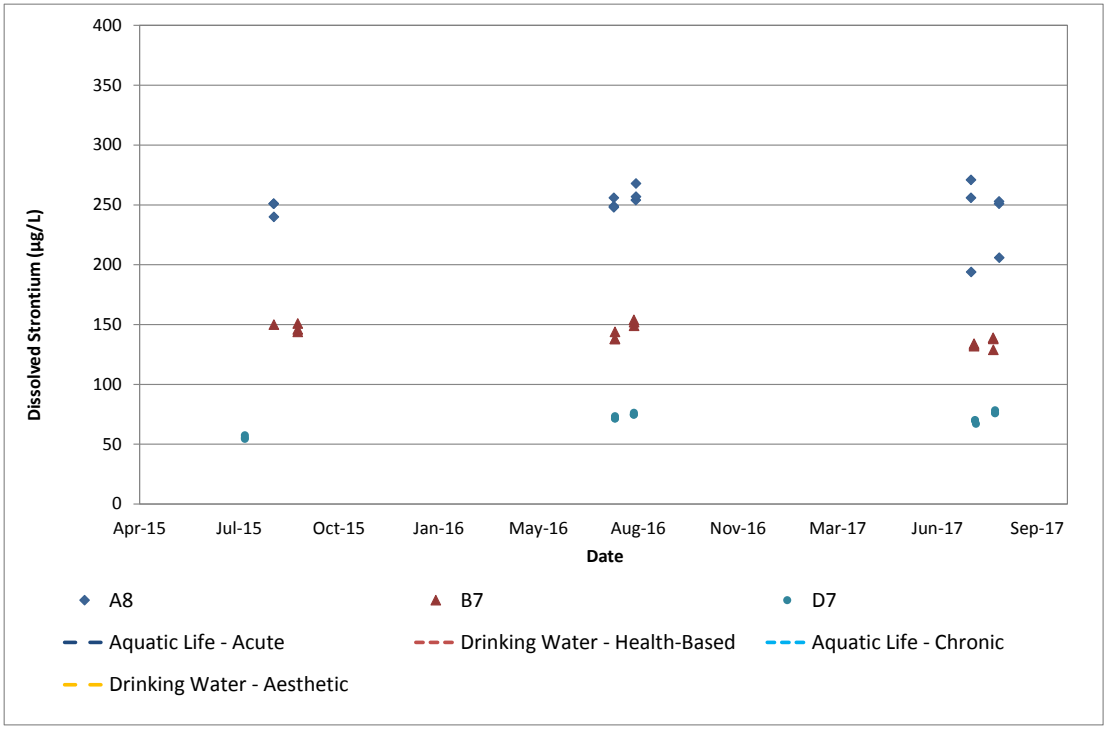
µg/L = micrograms per litre.

Figure 3E.2-6p: Concentrations of Dissolved Nickel at Peninsula Lakes between 2015 and 2017



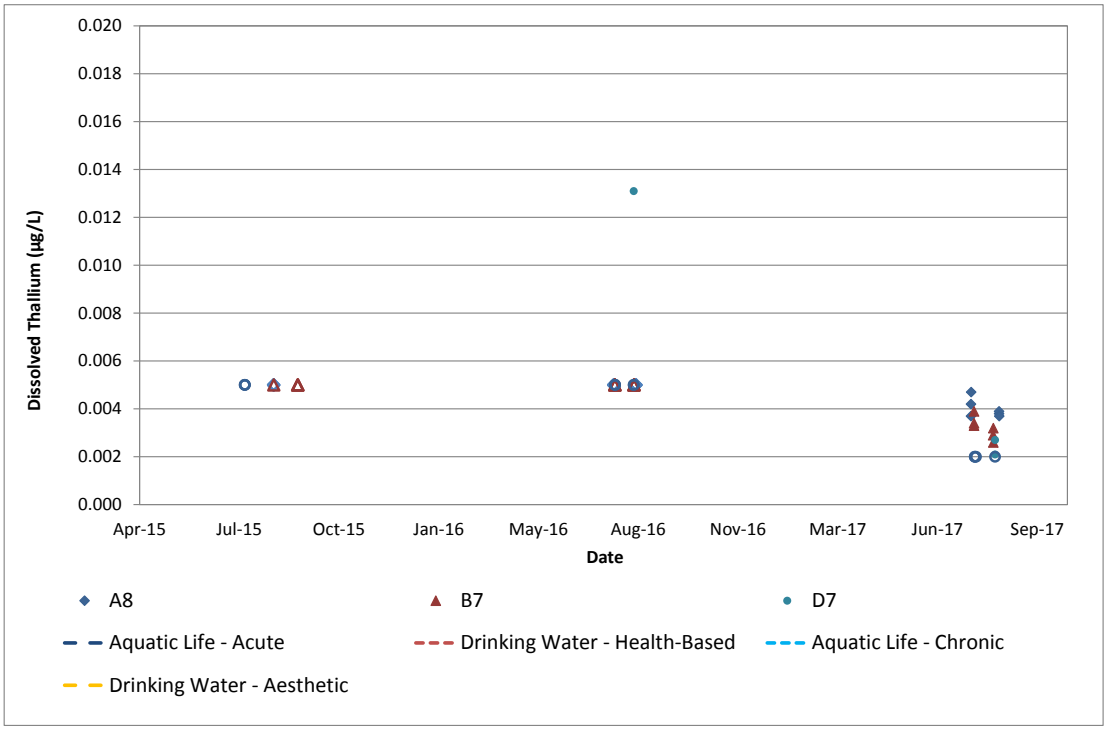
µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6q: Concentrations of Dissolved Selenium at Peninsula Lakes between 2015 and 2017



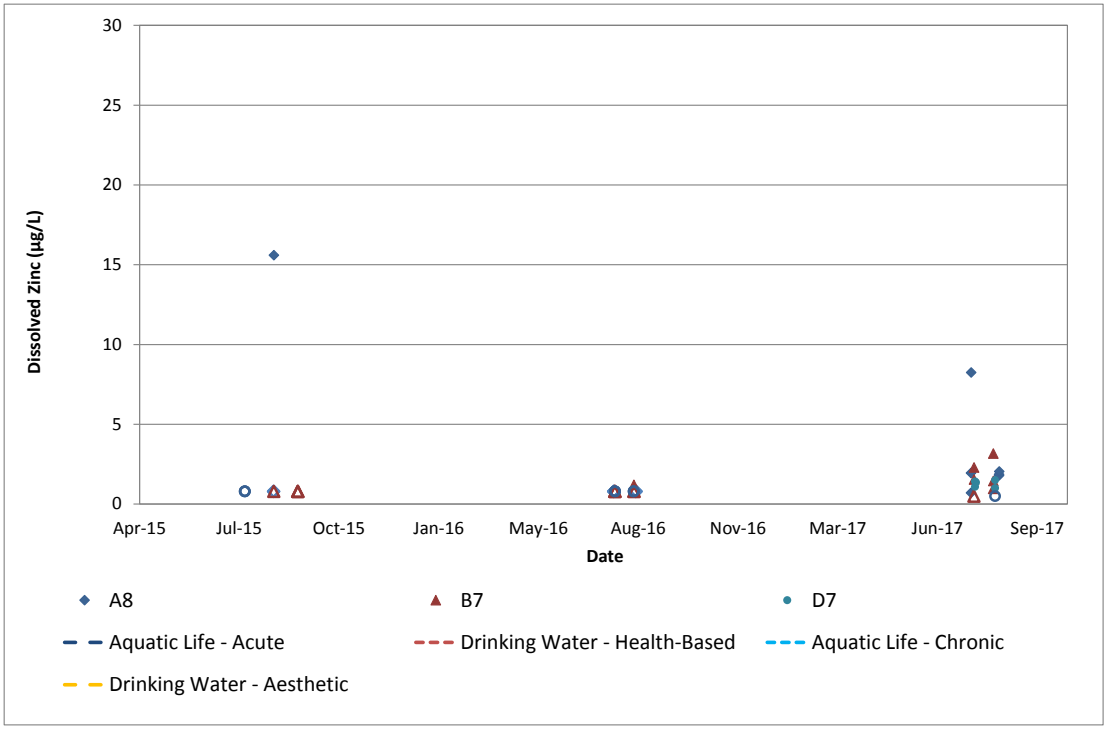
µg/L = micrograms per litre.

Figure 3E.2-6r: Concentrations of Dissolved Strontium at Peninsula Lakes between 2015 and 2017



µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6s: Concentrations of Dissolved Thallium at Peninsula Lakes between 2015 and 2017



µg/L = micrograms per litre. Open symbols represent results that are less than the detection limit.

Figure 3E.2-6t: Concentrations of Dissolved Zinc at Peninsula Lakes between 2015 and 2017

Table 3F.1-1: Statitstical Tests between Near-field Area (MEL-01) and Mid-field Area (MEL-02) during Ice-Covered Conditions on Selected Parameters

Parameter	*p* -value	Test
Field Measured		
Dissolved oxygen	0.035	ANOVA
pH	0.334	ANOVA
Specific conductivity	0.271	ANOVA
Conventional Parameters		
Specific conductivity	<0.001	ANOVA
Hardness, as $CaCO_3$	0.010	ANOVA
Total alkalinity, as $CaCO_3$	0.937	ANOVA
Total dissolved solids	0.022	ANOVA
Major Ions		
Chloride	<0.001	Mann-Whitney U test
Fluoride	0.447	Mann-Whitney U test
Calcium	0.027	ANOVA
Magnesium	<0.001	ANOVA
Potassium	0.057	ANOVA
Sodium	<0.001	ANOVA
Sulphate	<0.001	ANOVA
Reactive silica, as SiO2	<0.001	ANOVA
Nutrients		
Nitrate	0.006	ANOVA
Total ammonia	<0.001	ANOVA
Total Kjeldahl nitrogen	0.052	ANOVA
Total phosphorus	0.051	ANOVA
Dissolved phosphorus	0.770	ANOVA
Total Metals		
Aluminum	0.101	ANOVA
Antimony	-	
Arsenic	<0.001	ANOVA
Barium	0.464	ANOVA
Beryllium	-	
Bismuth	-	
Boron	0.306	ANOVA
Cadmium	-	
Chromium	-	
Cobalt	<0.001	ANOVA
Copper	<0.001	ANOVA
Iron	<0.001	ANOVA
Lead	-	
Lithium	0.855	ANOVA
Manganese	<0.001	ANOVA
Mercury	-	
Molybdenum	0.015	ANOVA
Nickel	<0.001	ANOVA
Selenium	-	
Silver	-	
Strontium	0.093	ANOVA
Thallium	-	
Tin	-	
Titanium	-	
Uranium	-	
Vanadium	-	
Zinc	-	

Grey highlighted values were statistically different (p <0.05)

"-" statistical test not completed as more than 50% of results were non-detect

Table 3F.1-2: Statitstical Tests between Near-field Area (MEL-01) and Mid-field Area (MEL-02) during Open-Water Conditions on Selected Parameters

Parameter	*p* -value	Test
Field Measured		
Dissolved oxygen	0.330	ANOVA
pH	0.744	ANOVA
Specific conductivity	0.001	ANOVA
Conventional Parameters		
Specific conductivity	<0.001	ANOVA
Hardness, as $CaCO_3$	0.001	ANOVA
Total alkalinity, as $CaCO_3$	0.869	ANOVA
Total dissolved solids	0.449	ANOVA
Major Ions		
Chloride	<0.001	Mann-Whitney U test
Fluoride	0.223	Mann-Whitney U test
Calcium	0.005	ANOVA
Magnesium	<0.001	ANOVA
Potassium	0.230	ANOVA
Sodium	<0.001	ANOVA
Sulphate	<0.001	ANOVA
Reactive silica, as SiO2	<0.001	ANOVA
Nutrients		
Nitrate	0.402	ANOVA
Total ammonia	0.456	ANOVA
Total Kjeldahl nitrogen	0.394	ANOVA
Total phosphorus	0.005	ANOVA
Dissolved phosphorus	0.304	ANOVA
Total Metals		
Aluminum	0.200	ANOVA
Antimony	-	
Arsenic	<0.001	ANOVA
Barium	0.044	ANOVA
Beryllium	-	
Bismuth	-	
Boron	0.751	ANOVA
Cadmium	-	
Chromium	-	
Cobalt	<0.001	ANOVA
Copper	0.288	ANOVA
Iron	<0.001	ANOVA
Lead	-	
Lithium	0.073	ANOVA
Manganese	<0.001	ANOVA
Mercury	0.263	ANOVA
Molybdenum	0.453	ANOVA
Nickel	<0.001	ANOVA
Selenium	-	
Silver	-	
Strontium	0.115	ANOVA
Thallium	-	
Tin	-	
Titanium	-	
Uranium	0.119	ANOVA
Vanadium	-	
Zinc	-	

Grey highlighted values were statistically different (p <0.05)

"-" statistical test not completed as more than 50% of results were non-detect

Table 3F.1-3: Statitstical Tests between Near-field Area (MEL-01) and Reference Areas on Selected Parameters for Open-Water Conditions

Parameter	*p* -value	Test
Field Measured		
Dissolved oxygen	0.737	ANOVA
pH	0.009	ANOVA
Specific conductivity	<0.001	ANOVA
Conventional Parameters		
Specific conductivity	<0.001	ANOVA
Hardness, as $CaCO_3$	<0.001	ANOVA
Total alkalinity, as $CaCO_3$	0.229	ANOVA
Total dissolved solids	<0.001	ANOVA
Major Ions		
Chloride	<0.001	Mann-Whitney U test
Fluoride	0.025	Mann-Whitney U test
Calcium	<0.001	ANOVA
Magnesium	<0.001	ANOVA
Potassium	0.006	ANOVA
Sodium	<0.001	ANOVA
Sulphate	<0.001	ANOVA
Reactive silica, as SiO2	<0.001	ANOVA
Nutrients		
Nitrate	0.087	ANOVA
Total ammonia	0.357	ANOVA
Total Kjeldahl nitrogen	<0.001	ANOVA
Total phosphorus	<0.001	ANOVA
Total Metals		
Aluminum	0.168	Mann-Whitney U test
Antimony	0.699	Mann-Whitney U test
Arsenic	<0.001	Mann-Whitney U test
Barium	0.018	Mann-Whitney U test
Beryllium	1.000	Mann-Whitney U test
Bismuth	0.144	Mann-Whitney U test
Boron	0.432	Mann-Whitney U test
Cadmium	0.284	Mann-Whitney U test
Chromium	0.186	Mann-Whitney U test
Cobalt	<0.001	Mann-Whitney U test
Copper	0.001	Mann-Whitney U test
Iron	<0.001	Mann-Whitney U test
Lead	0.282	Mann-Whitney U test
Lithium	<0.001	Mann-Whitney U test
Manganese	<0.001	Mann-Whitney U test
Mercury	0.023	Mann-Whitney U test
Molybdenum	0.690	Mann-Whitney U test
Nickel	<0.001	Mann-Whitney U test
Selenium	0.524	Mann-Whitney U test
Silver	1.000	Mann-Whitney U test
Strontium	<0.001	Mann-Whitney U test
Thallium	0.111	Mann-Whitney U test
Tin	0.023	Mann-Whitney U test
Titanium	0.481	Mann-Whitney U test
Uranium	0.008	Mann-Whitney U test
Vanadium	1.000	Mann-Whitney U test
Zinc	0.844	Mann-Whitney U test

statistically different values are highlighted (p<0.05)

Table 3F1-4: Statitstical Tests between Mid-field Area (MEL-02) and Reference Areas on Selected Parameters

Parameter	*p* -value	Test
Field Measured		
Dissolved oxygen	0.172	Mann-Whitney U test
pH	0.035	ANOVA
Specific conductivity	0.045	ANOVA
Conventional Parameters		
Specific conductivity	<0.001	ANOVA
Hardness, as $CaCO_3$	0.774	Mann-Whitney U test
Total alkalinity, as $CaCO_3$	0.231	Mann-Whitney U test
Total dissolved solids	0.067	Mann-Whitney U test
Major Ions		
Chloride	<0.001	Mann-Whitney U test
Fluoride	0.118	Mann-Whitney U test
Calcium	0.657	ANOVA
Magnesium	0.002	ANOVA
Potassium	0.082	ANOVA
Sodium	<0.001	ANOVA
Sulphate	<0.001	ANOVA
Reactive silica, as SiO2	<0.001	ANOVA
Nutrients		
Nitrate	0.559	Mann-Whitney U test
Total ammonia	0.834	Mann-Whitney U test
Total Kjeldahl nitrogen	0.006	ANOVA
Total phosphorus	0.163	Mann-Whitney U test
Dissolved phosphorus	0.015	Mann-Whitney U test
Total Metals		
Aluminum	0.168	Mann-Whitney U test
Antimony	0.699	Mann-Whitney U test
Arsenic	<0.001	Mann-Whitney U test
Barium	0.018	Mann-Whitney U test
Beryllium	1.000	Mann-Whitney U test
Bismuth	0.144	Mann-Whitney U test
Boron	0.432	Mann-Whitney U test
Cadmium	0.284	Mann-Whitney U test
Chromium	0.186	Mann-Whitney U test
Cobalt	<0.001	Mann-Whitney U test
Copper	0.001	Mann-Whitney U test
Iron	<0.001	Mann-Whitney U test
Lead	0.282	Mann-Whitney U test
Lithium	<0.001	Mann-Whitney U test
Manganese	<0.001	Mann-Whitney U test
Mercury	0.023	Mann-Whitney U test
Molybdenum	0.690	Mann-Whitney U test
Nickel	<0.001	Mann-Whitney U test
Selenium	0.524	Mann-Whitney U test
Silver	1.000	Mann-Whitney U test
Strontium	<0.001	Mann-Whitney U test
Thallium	0.111	Mann-Whitney U test
Tin	0.023	Mann-Whitney U test
Titanium	0.481	Mann-Whitney U test
Uranium	0.008	Mann-Whitney U test
Vanadium	1.000	Mann-Whitney U test
Zinc	0.844	Mann-Whitney U test

statistically different values are highlighted (p<0.05)

APPENDIX 5A – 5B

Benthic

Table 5A-1: Summary of Baseline Benthic Invertebrate Community Habitat Characteristics in Meliadine Lake Exposure and Reference Areas, August 2015 and 2016

Area	Year	Station	Station Depth (m)	Field Water Quality		Water Quality		Sediment Composition			
				Conductivity (µS/cm)	Temperature (°C)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Total Organic Carbon (%)	Sand (%)	Silt (%)	Clay (%)
Near-field Area	2015	**MEL-01-01**	9.6	67	12.6	0.005	0.184	4.2	35.8	58.8	5.5
		MEL-01-02	8.2	68	12.6	0.010	0.242	5.7	16.9	74.4	8.7
		MEL-01-03	8.3	67	12.5	0.004	0.212	4.8	31.9	63.5	4.6
		MEL-01-04	8.9	68	12.6	0.019	0.276	6.1	10.4	80.6	9.0
		MEL-01-05	7.9	68	12.6	-	-	0.4	88.6	10.8	0.6
		Min	7.9	67	12.5	0.004	0.184	0.4	10.4	10.8	0.6
		Max	9.6	68	12.6	0.019	0.276	6.1	88.6	80.6	9.0
		Median	8.3	68	12.6	0.008	0.227	4.8	31.9	63.5	5.5
		Mean	8.6	67.6	12.6	0.010	0.229	4.2	36.7	57.6	5.7
		SE	0.3	0.2	0.02	0.003	0.02	1.0	13.8	12.3	1.5
		SD	0.7	0.5	0.04	0.01	0.04	2.3	30.8	27.6	3.5
	2016	**MEL-01-01**	8.6	72	12.5	0.006	0.146	3.7	29.6	55.6	14.8
		MEL-01-02	7.7	73	12.5	0.007	0.094	5.4	12.0	75.4	12.6
		MEL-01-03	8.8	73	12.5	0.012	0.102	4.6	22.9	66.8	10.3
		MEL-01-04	8.8	73	12.5	0.036	0.097	6.8	3.4	83.4	13.2
		MEL-01-05	8.2	73	12.5	0.005	0.146	2.1	22.3	68.4	9.3
		Min	7.7	72	12.5	0.005	0.094	2.1	3.4	55.6	9.3
		Max	8.8	73	12.5	0.036	0.146	6.8	29.6	83.4	14.8
		Median	8.6	73	12.5	0.007	0.102	4.6	22.3	68.4	12.6
		Mean	8.4	72.8	12.5	0.013	0.117	4.5	18.0	69.9	12.0
		SE	0.2	0.2	-	0.01	0.01	0.8	4.6	4.6	1.0
		SD	0.5	0.4	-	0.01	0.03	1.8	10.3	10.4	2.2
Mid-field Area	2015	**MEL-02-01**	9.0	66	12.8	0.005	0.191	5.2	37.5	56.5	6.1
		MEL-02-02	9.6	66	12.7	0.004	0.209	11.0	24.7	60.4	14.9
		MEL-02-03	9.2	66	12.9	0.008	0.205	7.2	42.5	49.3	8.2
		MEL-02-04	8.4	-	-	-	-	0.5	92.4	7.2	0.4
		MEL-02-05	9.0	65	12.9	-	-	0.1	79.7	17.9	2.4
		Min	8.4	65	12.7	0.004	0.191	0.1	24.7	7.2	0.4
		Max	9.6	66	12.9	0.008	0.209	11.0	92.4	60.4	14.9
		Median	9.0	66	12.9	0.005	0.205	5.2	42.5	49.3	6.1
		Mean	9.0	65.75	12.8	0.005	0.202	4.8	55.4	38.3	6.4
		SE	0.2	0.3	0.05	0.001	0.005	2.1	13.0	10.8	2.5
		SD	0.4	0.5	0.1	0.002	0.009	4.6	29.1	24.1	5.6
	2016	**MEL-02-01**	7.9	69	12.6	0.004	<.050	0.4	64.2	32.2	3.6
		MEL-02-02	9.0	68	12.6	0.004	0.101	7.6	51.9	35.9	12.1
		MEL-02-03	9.0	69	12.6	0.007	0.073	4.2	61.0	28.1	10.9
		MEL-02-04	9.3	69	12.5	0.005	0.186	5.2	43.0	42.0	15.0
		MEL-02-05	10.1	69	12.6	0.006	0.174	5.8	49.9	35.2	14.9
		Min	7.9	68	12.5	0.004	0.073	0.4	43.0	28.1	3.6
		Max	10.1	69	12.6	0.007	0.186	7.6	64.2	42.0	15.0
		Median	9.0	69	12.6	0.005	0.138	5.2	51.9	35.2	12.1
		Arithmetic Mean	9.1	68.8	12.6	0.005	0.134	4.6	54.0	34.7	11.3
		SE	0.4	0.2	0.02	0.001	0.03	1.2	3.8	2.3	2.1
		SD	0.8	0.4	0.04	0.001	0.06	2.7	8.6	5.1	4.7

Appendix 5A Table 5A-1

Area	Year	Station	Station Depth (m)	Field Water Quality		Water Quality		Sediment Composition			
				Conductivity (µS/cm)	Temperature (°C)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Total Organic Carbon (%)	Sand (%)	Silt (%)	Clay (%)
Reference Area 1	**2016**	**MEL-03-01**	7.2	66	12.6	0.004	0.329	1.3	85.2	14.1	0.8
		MEL-03-02	9.5	66	12.6	0.005	0.145	1.0	81.2	18.5	0.3
		MEL-03-03	9.8	66	12.5	0.004	0.064	6.5	42.6	48.7	8.7
		MEL-03-04	7.8	65	12.6	0.005	0.102	5.6	41.0	47.5	11.5
		MEL-03-05	7.6	65	12.6	0.004	<.05	4.3	61.7	32.7	5.7
		Min	7.2	65	12.5	0.004	0.064	1.0	41.0	14.1	0.3
		Max	9.8	66	12.6	0.005	0.329	6.5	85.2	48.7	11.5
		Median	7.8	66	12.6	0.004	0.124	4.3	61.7	32.7	5.7
		Mean	8.4	65.6	12.6	0.004	0.160	3.7	62.3	32.3	5.4
		SE	0.5	0.2	0.02	0.0002	0.06	1.1	9.3	7.1	2.2
		SD	1.2	0.5	0.04	0.0005	0.12	2.5	20.8	16.0	4.9
Reference Area 2	**2016**	**MEL-04-01**	8.2	67	13.5	0.008	0.054	3.0	65.5	30.1	4.4
		MEL-04-02	10.5	66	13.0	0.004	<.05	0.8	40.9	49.7	9.4
		MEL-04-03	9.7	66	13.7	0.005	0.080	3.4	68.3	24.7	7.0
		MEL-04-04	9.1	66	13.6	0.005	0.109	4.9	49.7	40.4	9.9
		MEL-04-05	7.4	66	13.8	0.004	0.161	0.5	92.9	6.3	1.0
		Min	7.4	66	13.0	0.004	0.054	0.5	40.9	6.3	1.0
		Max	10.5	67	13.8	0.008	0.161	4.9	92.9	49.7	9.9
		Median	9.1	66	13.6	0.005	0.095	3.0	65.5	30.1	7.0
		Mean	9.0	66.2	13.5	0.005	0.101	2.5	63.5	30.2	6.3
		SE	0.5	0.2	0.1	0.001	0.02	0.8	8.9	7.4	1.7
		SD	1.2	0.4	0.3	0.002	0.05	1.9	20.0	16.5	3.7
Reference Area 3	**2016**	**MEL-05-01**	9.2	68	13.3	0.005	<.05	0.9	93.0	6.9	0.1
		MEL-05-02	9.2	68	13.4	0.006	<.05	4.8	49.0	42.7	8.3
		MEL-05-03	8.3	68	13.5	0.005	<.05	7.4	46.6	44.4	9.0
		MEL-05-04	9.9	68	13.5	0.005	0.095	4.0	74.2	21.6	4.2
		MEL-05-05	8.4	68	13.6	0.004	0.056	7.9	50.0	39.7	10.3
		Min	8.3	68	13.3	0.004	0.056	0.9	46.6	6.9	0.1
		Max	9.9	68	13.6	0.006	0.095	7.9	93.0	44.4	10.3
		Median	9.2	68	13.5	0.005	0.076	4.8	50.0	39.7	8.3
		Mean	9.0	68	13.5	0.005	0.076	5.0	62.6	31.1	6.4
		SE	0.3	0.0	0.1	0.000	0.02	1.3	9.1	7.3	1.9
		SD	0.7	0	0.1	0.001	0.03	2.8	20.4	16.3	4.2

Table 5A-2: Baseline Benthic Invertebrate Density Data (500 µm mesh) for Stations Sampled in Meliadine Lake Exposure Areas, August 2015

Major Taxon	Order	Family	Subfamily	Tribe	Genus/Species	Meliadine Lake Near-field Area					Meliadine Lake Mid-field Area				
						MEL-01 - 1	MEL-01 - 2	MEL-01 - 3	MEL-01 - 4	MEL-01 - 5	MEL-02 - 1	MEL-02 - 2	MEL-02 - 3	MEL-02 - 4	MEL-02 - 05
						org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2
Class Insecta	Ephemeroptera	Baetidae	-	-	-	0	0	9	0	0	0	0	0	0	0
	Plecoptera	Nemouridae	-	-	*Zapada* sp.	0	0	9	0	0	0	0	0	0	0
			-	-	*Zapada columbiana*	0	0	9	0	0	0	0	0	0	0
		Perlodidae	-	-	-	0	0	0	0	0	0	0	0	0	0
	Trichoptera	Limnephilidae	-	-	-	0	0	0	0	9	0	0	0	0	0
		Uenoidae	-	-	*Oligophlebodes* sp.	0	0	9	0	0	0	0	0	0	0
	Diptera	Chironomidae	-	-	-	9	9	17	9	43	9	0	17	43	0
			Chironominae	Chironomini	*Chironomus* sp.	0	0	9	0	0	0	0	0	0	0
					Cryptochironomus sp.	0	0	9	17	0	0	0	0	0	0
					Cryptotendipes sp.	0	0	0	0	0	0	0	0	0	0
					Dicrotendipes sp.	0	0	0	0	0	0	0	0	0	0
					Microtendipes pedellus group	34	26	17	17	17	78	9	0	129	60
					Pagastiella sp.	0	9	26	0	17	9	9	17	9	17
					Polypedilum sp.	0	0	0	0	0	0	0	0	0	0
					Stictochironomus	103	155	224	34	0	9	0	69	0	9
				Tanytarsini	*Corynocera* sp.	9	26	52	60	0	0	0	0	34	9
					Micropsectra sp.	17	0	26	34	9	0	9	9	34	0
					Rheotanytarsus sp.	0	0	0	0	0	0	0	0	0	9
			Diamesinae	-	*Protanypus* sp.	0	0	0	0	0	0	0	9	0	0
			Orthocladiinae	-	*Orthocladius complex*	0	0	0	0	0	0	0	0	0	0
				-	*Psectrocladius* sp.	0	0	0	0	9	0	0	0	17	0
			Prodiamesinae	-	*Monodiamesa* sp.	17	0	0	9	17	34	0	17	9	26
			Tanypodinae	Procladiini	*Procladius* sp.	78	34	60	26	17	9	0	0	9	9
		Psychodidae	-	-	*Pericoma/Telmatoscopus* sp.	0	0	9	0	0	0	0	0	0	0
		Tipulidae	-	-	*Limnophila* sp.	0	0	0	0	0	0	0	0	0	0
Class Malacostraca	Amphipoda	-	-	-	-	0	0	9	0	0	9	0	0	0	9
		Gammaridae	-	-	-	0	0	0	0	9	0	0	0	0	0
			-	-	*Gammarus* sp.	0	0	17	0	0	9	9	0	9	0
		Hyalellidae	-	-	*Hyalella* sp.	0	0	0	0	0	0	9	0	0	0
Class Arachnida	Trombidiformes	Hygrobatidae	-	-	*Hygrobates* sp.	0	0	0	0	0	0	0	0	0	0
		Lebertiidae	-	-	*Lebertia* sp.	0	0	26	17	9	9	0	0	0	0
		Oxidae	-	-	*Oxus* sp.	0	0	34	0	0	0	0	0	9	0
Class Bivalvia	Veneroida	Pisidiidae	-	-	*Pisidium* sp.	78	112	172	52	26	34	17	17	69	52
			-	-	*Sphaerium* sp.	112	95	60	138	9	17	0	17	17	9
Class Gastropoda	-	-	-	-	-	0	0	0	0	0	0	0	0	17	0
	Heterostropha	Valvatidae	-	-	*Valvata* sp.	0	0	9	17	0	0	0	0	0	0
			-	-	*Valvata sincera*	34	17	0	34	0	0	0	0	43	0
Class Oligochaeta	Lumbriculida	Lumbriculidae	-	-	-	0	17	17	0	0	0	0	0	0	0
	Tubificida	Naididae	-	-	-	9	0	0	9	0	0	0	0	9	0
					Total Density	**500**	**500**	**828**	**474**	**190**	**224**	**60**	**172**	**457**	**207**
					Total Abundance	**58**	**58**	**96**	**55**	**22**	**26**	**7**	**20**	**53**	**24**

Notes:

Samples collected with a standard Ekman grab (15.24 centimetre [cm] × 15.24 cm: bottom sampling area of 0.0232 square metre [m^2]).

Data are reported as density (number of organisms per square metre).

Table 5A-3: Benthic Invertebrate Density Data (500 µm mesh) for Stations Sampled in Meliadine Lake Exposure and Reference Areas, August 2016

Major Taxon	Order	Family	Subfamily	Tribe	Genus/Species	Meliadine Lake Near-field Area					Meliadine Lake Mid-field Area					Meliadine Lake Reference Area 1					Meliadine Lake Reference Area 2					Meliadine Lake Reference Area 3				
						MEL-01-01	MEL-01-02	MEL-01-03	MEL-01-04	MEL-01-05	MEL-02-01	MEL-02-02	MEL-02-03	MEL-02-04	MEL-02-05	MEL-03-01	MEL-03-02	MEL-03-03	MEL-03-04	MEL-03-05	MEL-04-01	MEL-04-02	MEL-04-03	MEL-04-04	MEL-04-05	MEL-05-01	MEL-05-02	MEL-05-03	MEL-05-04	MEL-05-05
						org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2	org/m^2
Class Insecta	Trichoptera	Limnephilidae	-	-	*Grensia praeterita*	0	0	0	0	0	0	0	0	0	0	9	0	0	0	9	0	0	0	9	0	9	0	0	0	9
	Diptera	Ceratopogonidae	-	-	*Bezzia / Palpomyia*	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Chironomidae	-	-	-	52	26	43	9	147	0	0	0	0	17	17	9	34	0	0	0	0	0	0	0	138	0	9	0	0
			Chironominae	Chironomini	*Chironomus* sp.	0	0	0	224	34	0	0	0	0	9	0	0	52	0	0	0	0	0	0	0	0	0	0	0	0
					Cladopelma sp.	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Cryptochironomus sp.	0	0	0	9	17	0	0	0	0	9	0	0	9	0	0	0	0	0	0	0	0	0	0	9	0
					Dicrotendipes sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Microtendipes sp.	164	9	233	34	0	34	95	224	147	276	43	52	0	147	60	17	0	17	121	9	78	17	9	26	0
					Pagastiella sp.	52	138	95	103	17	17	43	52	60	17	207	17	103	241	345	86	0	26	69	0	207	129	69	181	52
					Phaenopsectra sp.	0	0	0	34	26	0	0	0	0	0	9	0	0	0	0	0	17	0	0	0	0	0	0	0	0
					Polypedilum sp.	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Stictochironomus sp.	138	534	569	26	0	60	121	147	34	69	138	397	34	172	655	112	155	155	241	0	86	69	52	112	95
				Tanytarsini	*Corynocera* sp.	0	0	0	276	129	0	0	17	0	17	9	0	793	172	1,164	0	17	233	95	9	52	69	379	190	9
					Micropsectra sp.	78	190	155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Paratanytarsus sp.	0	0	26	17	60	0	0	0	0	26	138	9	121	0	0	0	0	0	0	0	0	0	0	0	0
					Stempellinella sp.	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Tanytarsus sp.	52	17	422	379	1,414	0	17	17	0	155	241	43	431	34	164	9	0	0	0	34	34	26	147	86	0
			Diamesinae	-	*Protanypus* sp.	26	9	34	0	0	0	9	0	0	0	0	0	0	0	0	0	0	9	9	0	9	0	0	9	0
			Orthocladiinae		*Heterotrissocladius* sp.	0	17	0	9	26	0	0	0	0	0	0	17	0	0	0	0	0	0	0	17	34	0	0	0	0
					Paracladius sp.	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Psectrocladius sp.	0	0	0	0	26	0	0	0	0	0	26	9	60	0	69	0	0	9	9	0	9	9	9	9	0
					Pseudosmittia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
					Zalutschia sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0
			Prodiamesinae	-	*Monodiamesa* sp.	0	0	0	0	0	26	0	9	17	0	26	26	0	9	0	26	60	9	0	52	60	0	0	0	0
			Tanypodinae	-	*Ablabesmyia* sp.	0	9	0	0	9	0	17	0	0	17	34	17	26	9	0	0	0	0	0	9	34	0	9	17	0
				-	*Zavrelimyia* sp.	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
				Pentaneurini	*Thienemannimyia* group	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0
				Procladiini	*Procladius* sp.	86	69	103	103	250	17	43	26	17	78	43	43	216	26	69	0	9	69	69	26	34	26	121	86	34
Class Arachnida	Trombidiformes	-	-	-	-	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0
		Lebertiidae	-	-	*Lebertia* sp.	26	0	0	9	0	0	9	0	9	9	0	17	0	0	0	9	17	0	0	0	0	0	0	0	0
		Oxidae	-	-	*Oxus* sp.	0	0	0	0	17	0	9	0	0	0	9	17	0	0	0	0	9	0	0	0	43	0	9	0	0
		Pionidae	-	-	*Piona* sp.	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Amphipoda	-	-	-	-	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	9	0	0	34	0	17	0	0	0	0
		Gammaridae	-	-	*Gammarus* sp.	78	43	60	0	0	0	60	26	26	0	86	26	0	95	26	9	0	155	112	0	164	17	0	26	17
Class Bivalvia	Veneroida	Pisidiidae	-	-	-	103	112	164	336	259	0	112	69	26	259	60	147	52	52	34	52	26	78	86	34	121	17	0	69	60
			-	-	*Pisidium* sp.	293	629	457	724	991	17	224	103	69	448	103	241	147	138	121	250	43	310	293	34	216	103	138	181	224
Class Gastropoda	-	-	-	-	*Sphaerium* sp.	0	0	60	26	9	0	9	0	0	129	0	9	43	0	9	9	0	34	17	0	9	0	9	9	17
	Heterostropha	Valvatidae	-	-	-	0	0	0	17	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			-	-	*Valvata* sp.	9	43	26	60	9	26	17	0	0	129	0	0	17	9	9	0	0	0	0	17	0	17	60	17	0
Class Oligochaeta	Lumbriculida	Lumbriculidae	-	-	-	0	0	0	0	0	0	9	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
			-	-	*Lumbriculus* sp.	0	0	17	17	17	0	0	0	9	0	17	0	9	9	34	26	0	26	34	34	34	0	69	9	17
	Tubificida	Naididae	-	-	*Tubifex* sp.	9	26	9	0	17	0	0	0	0	0	17	9	0	0	0	0	0	0	0	0	0	0	0	9	0
Grand Total Density						1,172	1,879	2,483	2,431	3,491	224	793	690	414	1,672	1,233	1,112	2,155	1,112	2,767	612	353	1,138	1,207	276	1,388	500	1,086	1,043	534
Raw Abundance						**136**	**218**	**288**	**282**	**405**	**26**	**92**	**80**	**48**	**194**	**143**	**129**	**250**	**129**	**321**	**71**	**41**	**132**	**140**	**32**	**161**	**58**	**126**	**121**	**62**

Notes;
Samples collected with a standard Ekman grab (15.24 centimetre [cm] × 15.24 cm: bottom sampling area of 0.0232 square metre [m²])
Data are reported as density (number of organisms per square metre).

Table 5A-4: Benthic Invertebrate Baseline Presence/Absence Data for Stations Sampled in Meliadine Lake Exposure and Reference Areas, August 2015 and 2016

Major Taxon	Order	Family	Subfamily	Tribe	Genus/Species	2016					2015	
						Near-field Area	Mid-field Area	Reference Area 1	Reference Area 2	Reference Area 3	Near-field Area	Mid-field Area
						MEL-01	MEL-02	MEL-03	MEL-04	MEL-05	MEL-01	MEL-02
Class Insecta	Ephemeroptera	Baetidae	-	-	-	-	-	-	-	-	X	-
	Plecoptera	Nemouridae	-	-	*Zapada sp.*	-	-	-	-	-	-	-
					Zapada columbiana	-	-	-	-	-	X	-
		Perlodidae	-	-	-	-	-	-	-	-	-	-
	Trichoptera	Limnephilidae	-	-	-	-	-	-	-	-	X	-
					Grensia praeterita	-	-	X	X	X	-	-
		Uenoidae	-	-	*Oligophlebodes*	-	-	-	-	-	X	-
	Diptera	Ceratopogonidae	-	-	*Bezzia/ Palpomyia*	-	-	-	-	-	-	-
		Chironomidae	-	-	-	-	-	-	-	-	-	-
			Chironominae	Chironomini	*Chironomus sp.*	X	X	X	-	-	X	-
					Cladopelma sp.	X	-	-	-	-	-	-
					Cryptochironomus sp.	X	X	X	-	X	X	-
					Cryptotendipes sp.	-	-	-	-	-	-	-
					Dicrotendipes sp.	-	-	-	-	-	-	-
					Microtendipes sp.	X	X	X	X	X	-	-
					Microtendipes pedellus group	-	-	-	-	-	X	X
					Pagastiella sp.	X	X	X	X	X	X	X
					Phaenopsectra sp.	X	-	X	X	-	-	-
					Polypedilum sp.	X	-	-	-	-	-	-
					Stictochironomus sp.	X	X	X	X	X	X	X
				Tanytarsini	*Corynocera sp.*	X	X	X	X	X	X	X
					Micropsectra sp.	X	-	-	-	-	X	X
					Paratanytarsus sp.	X	X	X	-	-	-	-
					Stempellinella sp.	X	-	-	-	-	-	-
					Rheotanytarsus	-	-	-	-	-	-	X
					Tanytarsus sp.	X	X	X	X	X	-	-
			Diamesinae	-	*Protanypus sp.*	X	X	-	X	X	-	X
			Orthocladiinae	-	*Heterotrissocladius sp.*	X	-	X	X	X	-	-
					Orthocladius complex	-	-	-	-	-	-	-
					Paracladius sp.	X	-	-	-	-	-	-
					Psectrocladius sp.	X	-	X	X	X	X	X
					Pseudosmittia sp.	-	-	-	-	-	-	-
					Zalutschia sp.	-	-	-	X	-	-	-
			Prodiamesinae	-	*Monodiamesa sp.*	-	X	X	X	X	X	X
			Tanypodinae	Pentaneurini	*Ablabesmyia sp.*	X	X	X	X	X	-	-
					Thienemannimyia group	-	-	-	X	-	-	-
					Zavrelimyia sp.	X	-	-	-	-	-	-
				Procladiini	*Procladius sp.*	X	X	X	X	X	X	X
		Psychodidae	-	-	*Pericoma/Telmatoscopus sp.*	-	-	-	-	-	X	-
		Tipulidae	-	-	*Limnophila sp.*	-	-	-	-	-	-	-

Major Taxon	Order	Family	Subfamily	Tribe	Genus/Species	2016					2015	
						Near-field Area	Mid-field Area	Reference Area 1	Reference Area 2	Reference Area 3	Near-field Area	Mid-field Area
						MEL-01	MEL-02	MEL-03	MEL-04	MEL-05	MEL-01	MEL-02
Class Malacostraca	Amphipoda	-	-	-	-	-	X	-	-	-	-	X
		Gammaridae	-	-	-	-	-	-	-	-	X	-
					Gammarus sp.	X	X	X	X	X	X	X
		Hyalellidae	-	-	*Hyalella sp.*	-	-	-	-	-	-	X
Class Arachnida	Trombidiformes	-	-	-	-	-	-	X	-	-	-	-
		Hygrobatidae	-	-	*Hygrobates sp.*	-	-	-	-	-	-	-
		Lebertiidae	-	-	*Lebertia sp.*	X	X	X	X	-	X	X
		Oxidae	-	-	*Oxus sp.*	X	X	X	X	X	X	X
		Pionidae	-	-	*Piona sp.*	-	X	-	-	-	-	-
Class Bivalvia	Veneroida	Pisidiidae	-	-	-	-	-	-	-	-	-	-
					Pisidium sp.	X	X	X	X	X	X	X
					Sphaerium sp.	X	X	X	X	X	X	X
Class Gastropoda	-	-	-	-	-	-	-	-	-	-	-	-
	Heterostropha	Valvatidae	-	-	-	X	-	-	-	-	-	-
					Valvata sp.	X	X	X	X	X	X	-
					Valvata sincera	-	-	-	-	-	X	X
Class Oligochaeta	Lumbriculida	Lumbriculidae	-	-	-	-	X	X	-	-	X	-
					Lumbriculus sp.	X	X	X	X	X	-	-
	Tubificida	Naididae	-	-	*Tubifex sp.*	X	-	X	-	X	X	X

Notes;

'X' = present; '-' = absent

Table 5A-5: Summary of Baseline Benthic Invertebrate Community Indices Calculated for Meliadine Lake Exposure and Reference Areas, August 2015 and 2016

Area	Year	Station	Total Density (org/m^2)	Richness - Family level	Richness - LTL	SDI - Family level	SDI - LTL	SEI - Family level	SEI - LTL	BCI (EEM) - Family level	BCI (EEM) - LTL	BCI (PW) - Family level	BCI (PW) - LTL
Near-field Area	2015	**MEL-01-01**	500	3	11	0.57	0.85	0.77	0.59	-	-	-	-
		MEL-01-02	500	4	10	0.56	0.80	0.57	0.51	-	-	-	-
		MEL-01-03	828	12	22	0.63	0.86	0.23	0.33	-	-	-	-
		MEL-01-04	474	4	14	0.64	0.86	0.69	0.52	-	-	-	-
		Min	474	3	10	0.56	0.80	0.23	0.33	-	-	-	-
		Max	828	12	22	0.64	0.86	0.77	0.59	-	-	-	-
		Median	500	4	13	0.60	0.85	0.63	0.51	-	-	-	-
		Mean	575	6	14	0.60	0.84	0.56	0.49	-	-	-	-
		SE	75	2	2	0.02	0.01	0.11	0.05	-	-	-	-
		SD	169	4	5	0.04	0.03	0.24	0.11	-	-	-	-
	2016	**MEL-01-01**	1,172	6	15	0.57	0.88	0.39	0.53	0.14	0.47	0.31	0.52
		MEL-01-02	1,879	5	16	0.55	0.78	0.44	0.29	0.35	0.60	0.43	0.62
		MEL-01-03	2,483	6	17	0.46	0.86	0.31	0.43	0.46	0.65	0.48	0.62
		MEL-01-04	2,431	5	20	0.53	0.84	0.43	0.32	0.47	0.67	0.51	0.65
		MEL-01-05	3,491	6	20	0.48	0.74	0.32	0.19	0.59	0.80	0.59	0.78
		Min	1,172	5	15	0.46	0.74	0.31	0.19	0.14	0.47	0.31	0.52
		Max	3,491	6	20	0.57	0.88	0.44	0.53	0.59	0.80	0.59	0.78
		Median	2,431	6	17	0.53	0.84	0.39	0.32	0.46	0.65	0.48	0.62
		Mean	2,291	6	18	0.52	0.82	0.38	0.35	0.40	0.64	0.46	0.64
		SE	382	0	1	0.02	0.03	0.03	0.06	0.08	0.05	0.05	0.04
		SD	854	1	2	0.04	0.06	0.06	0.13	0.17	0.12	0.10	0.09
Mid-field Area	2015	**MEL-02-01**	224	5	11	0.51	0.82	0.41	0.50	-	-	-	-
		MEL-02-02	60	4	6	0.69	0.82	0.82	0.91	-	-	-	-
		MEL-02-03	172	2	8	0.32	0.79	0.74	0.58	-	-	-	-
		Min	60	2	6	0.32	0.79	0.41	0.50	-	-	-	-
		Max	224	5	11	0.69	0.82	0.82	0.91	-	-	-	-
		Median	172	4	8	0.51	0.82	0.74	0.58	-	-	-	-
		Mean	152	4	8	0.51	0.81	0.65	0.66	-	-	-	-
		SE	37	1	1	0.08	0.01	0.10	0.10	-	-	-	-
		SD	84	2	3	0.19	0.02	0.21	0.22	-	-	-	-
	2016	**MEL-02-01**	224	3	9	0.36	0.85	0.52	0.75	0.67	0.68	0.64	0.75
		MEL-02-02	793	7	15	0.62	0.85	0.37	0.44	0.28	0.34	0.35	0.48
		MEL-02-03	690	3	10	0.43	0.81	0.58	0.52	0.14	0.35	0.34	0.53
		MEL-02-04	414	5	10	0.50	0.81	0.40	0.52	0.39	0.49	0.44	0.63
		MEL-02-05	1,672	5	17	0.57	0.85	0.47	0.40	0.32	0.64	0.45	0.64
		Min	224	3	9	0.36	0.81	0.37	0.40	0.14	0.34	0.34	0.48
		Max	1,672	7	17	0.62	0.85	0.58	0.75	0.67	0.68	0.64	0.75
		Median	690	5	10	0.50	0.85	0.47	0.52	0.32	0.49	0.44	0.63
		Mean	759	5	12	0.50	0.83	0.47	0.52	0.36	0.50	0.44	0.61
		SE	250	1	2	0.05	0.01	0.04	0.06	0.09	0.07	0.05	0.05
		SD	558	2	4	0.10	0.02	0.09	0.14	0.20	0.16	0.12	0.10

Area	Year	Station	Total Density (org/m^2)	Richness - Family level	Richness - LTL	SDI - Family level	SDI - LTL	SEI - Family level	SEI - LTL	BCI (EEM) - Family level	BCI (EEM) - LTL	BCI (PW) - Family level	BCI (PW) - LTL
Reference Area 1	**2016**	**MEL-03-01**	1,233	7	19	0.41	0.89	0.24	0.48	0.22	0.44	0.39	0.55
		MEL-03-02	1,112	7	19	0.54	0.80	0.31	0.26	0.10	0.45	0.31	0.53
		MEL-03-03	2,155	5	17	0.23	0.80	0.26	0.30	0.42	0.64	0.57	0.69
		MEL-03-04	1,112	5	13	0.43	0.86	0.35	0.55	0.15	0.33	0.34	0.47
		MEL-03-05	2,767	6	14	0.16	0.74	0.20	0.28	0.54	0.66	0.65	0.69
		Min	1,112	5	13	0.16	0.74	0.20	0.26	0.10	0.33	0.31	0.47
		Max	2,767	7	19	0.54	0.89	0.35	0.55	0.54	0.66	0.65	0.69
		Median	1,233	6	17	0.41	0.80	0.26	0.30	0.22	0.45	0.39	0.55
		Mean	1,676	6	16	0.35	0.82	0.27	0.37	0.29	0.50	0.45	0.58
		SE	336	0	1	0.07	0.03	0.03	0.06	0.08	0.06	0.07	0.05
		SD	750	1	3	0.16	0.06	0.06	0.13	0.19	0.14	0.15	0.10
Reference Area 2	**2016**	**MEL-04-01**	612	5	12	0.56	0.77	0.46	0.36	0.31	0.26	0.43	0.51
		MEL-04-02	353	4	9	0.42	0.75	0.43	0.44	0.49	0.57	0.55	0.71
		MEL-04-03	1,138	4	14	0.62	0.84	0.66	0.44	0.21	0.40	0.34	0.49
		MEL-04-04	1,207	5	15	0.60	0.86	0.49	0.49	0.16	0.38	0.31	0.48
		MEL-04-05	276	4	11	0.60	0.88	0.63	0.78	0.60	0.60	0.63	0.74
		Min	276	4	9	0.42	0.75	0.43	0.36	0.16	0.26	0.31	0.48
		Max	1,207	5	15	0.62	0.88	0.66	0.78	0.60	0.60	0.63	0.74
		Median	612	4	12	0.60	0.84	0.49	0.44	0.31	0.40	0.43	0.51
		Mean	717	4	12	0.56	0.82	0.53	0.50	0.35	0.44	0.45	0.59
		SE	194	0	1	0.04	0.03	0.05	0.07	0.08	0.06	0.06	0.06
		SD	434	1	2	0.08	0.06	0.10	0.16	0.18	0.14	0.14	0.13
Reference Area 3	**2016**	**MEL-05-01**	1,388	6	20	0.60	0.91	0.42	0.54	0.20	0.42	0.34	0.52
		MEL-05-02	500	4	11	0.46	0.84	0.47	0.57	0.32	0.23	0.43	0.58
		MEL-05-03	1,086	5	14	0.43	0.82	0.35	0.39	0.20	0.47	0.37	0.60
		MEL-05-04	1,043	6	17	0.46	0.87	0.31	0.47	0.07	0.26	0.33	0.48
		MEL-05-05	534	5	10	0.55	0.76	0.45	0.42	0.36	0.26	0.45	0.53
		Min	500	4	10	0.43	0.76	0.31	0.39	0.07	0.23	0.33	0.48
		Max	1,388	6	20	0.60	0.91	0.47	0.57	0.36	0.47	0.45	0.60
		Median	1,043	5	14	0.46	0.84	0.42	0.47	0.20	0.26	0.37	0.53
		Mean	910	5	14	0.50	0.84	0.40	0.48	0.23	0.33	0.39	0.54
		SE	171	0	2	0.03	0.02	0.03	0.03	0.05	0.05	0.03	0.02
		SD	383	1	4	0.07	0.06	0.07	0.08	0.11	0.11	0.06	0.05

SDI = Simpson's Diversity Index; SEI = Simpson's Evenness index; BCI = Bray-Curtis Index; BCD = Bray-Curtis Distance; - = not calculated.

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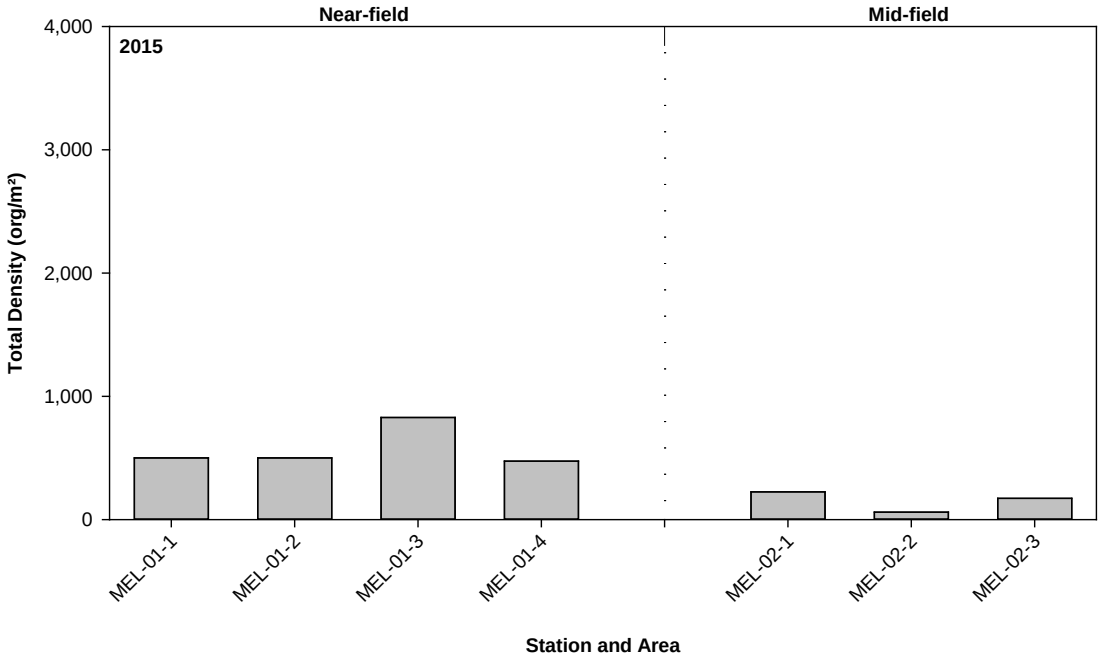


Figure 5B-1: Total Invertebrate Density in the Near-field and Mid-Field Areas, August 2015

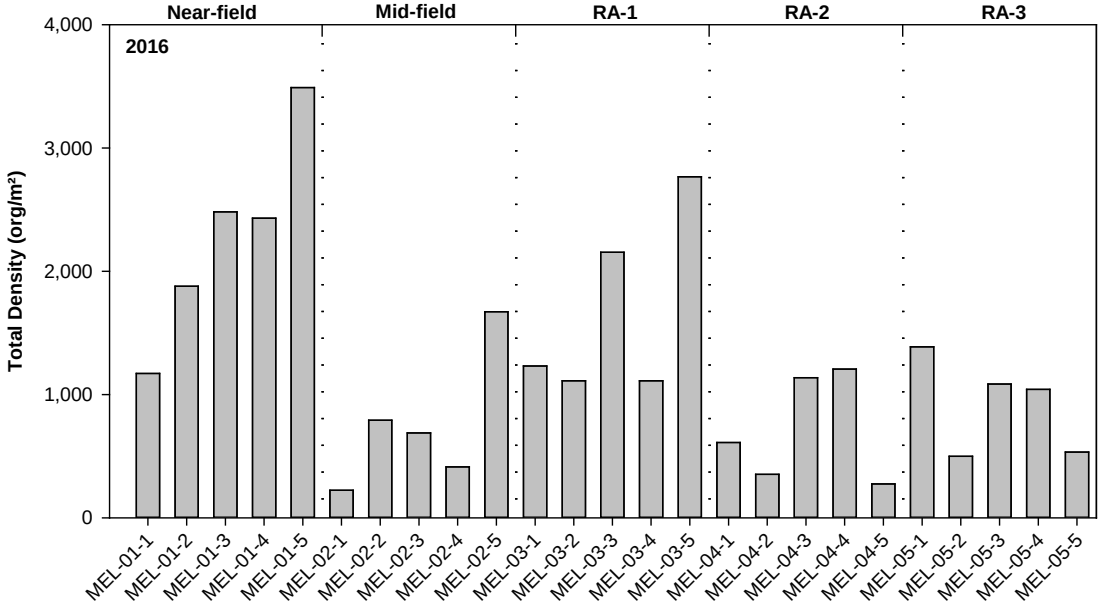
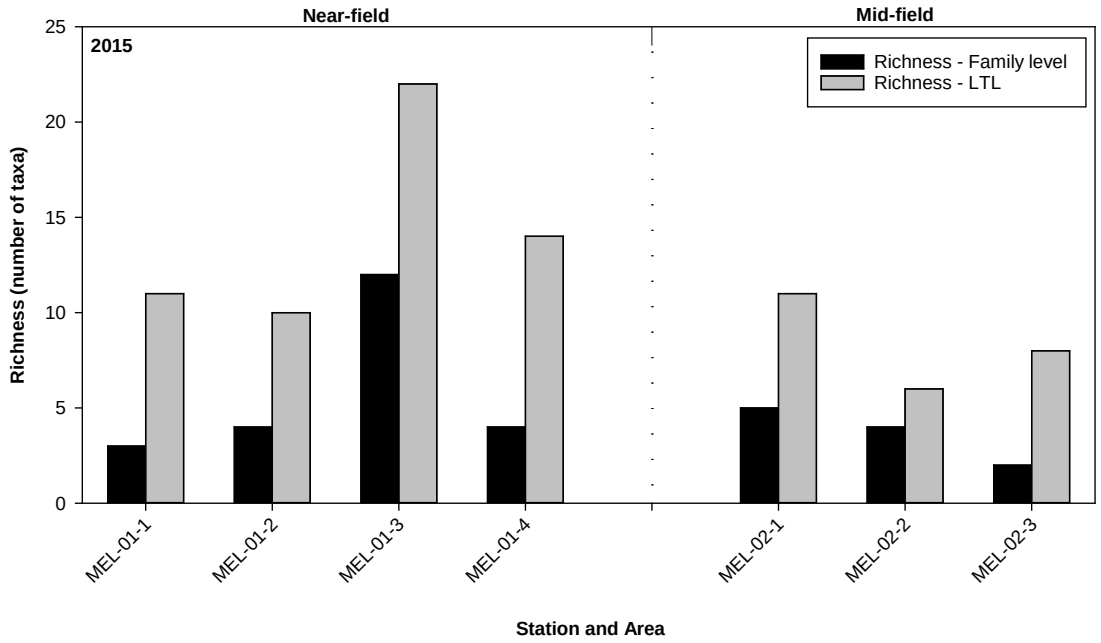
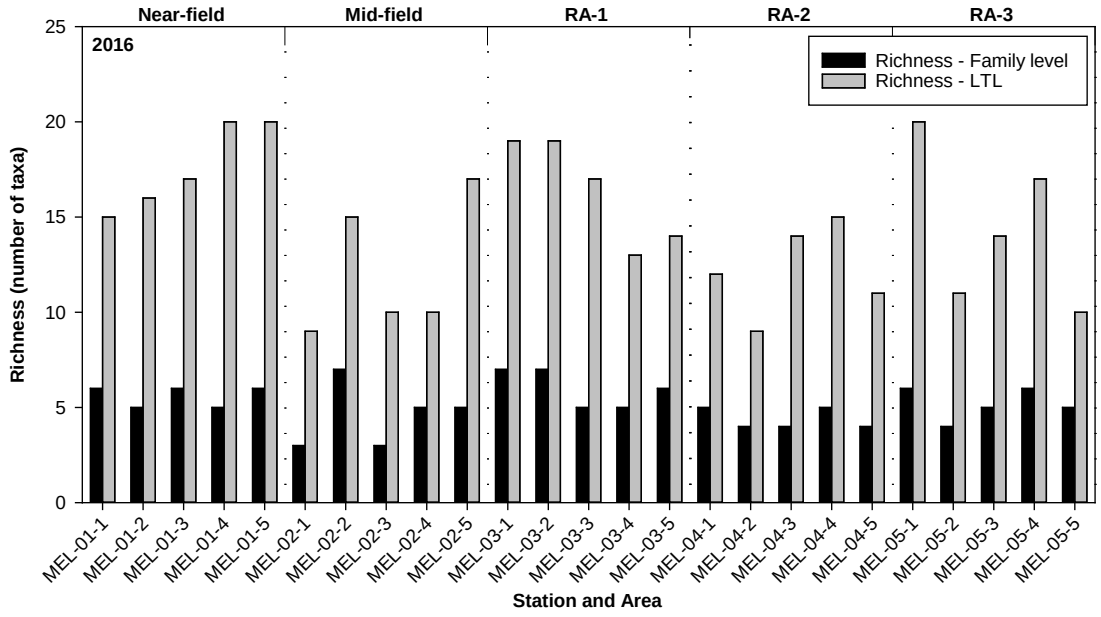


Figure 5B-2: Total Invertebrate Density by Station, August 2016



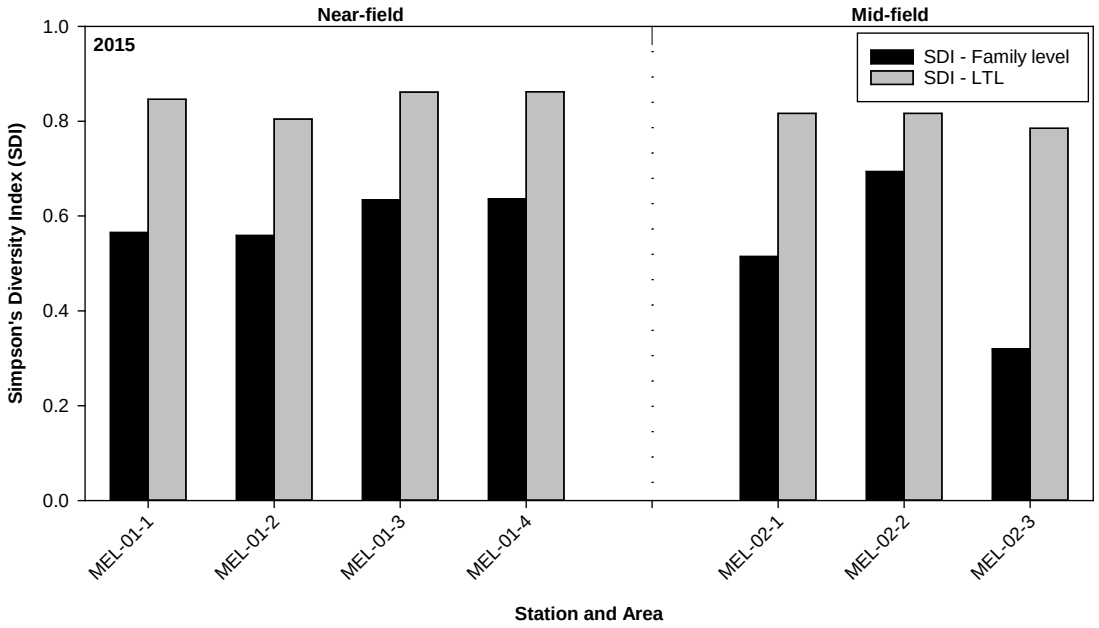
LTL = lowest taxonomic level.

Figure 5B-3: Richness in the Near-field and Mid-field Areas, August 2015



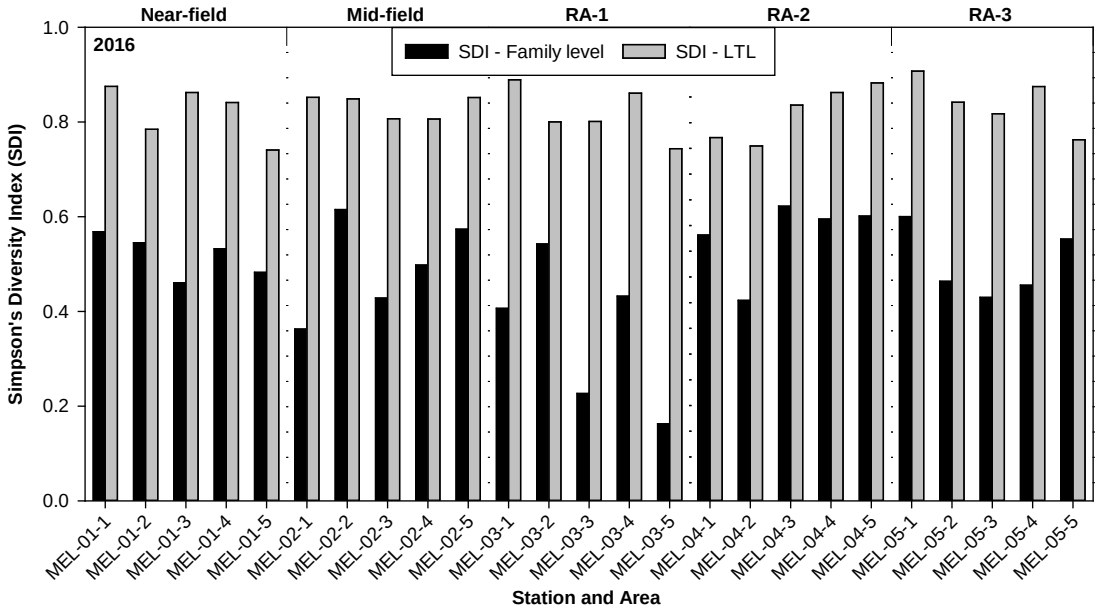
LTL = lowest taxonomic level; RA-1 = Reference area 1; RA-2 = Reference area 2; RA-3 = Reference area 3.

Figure 5B-4: Richness by Station, August 2016



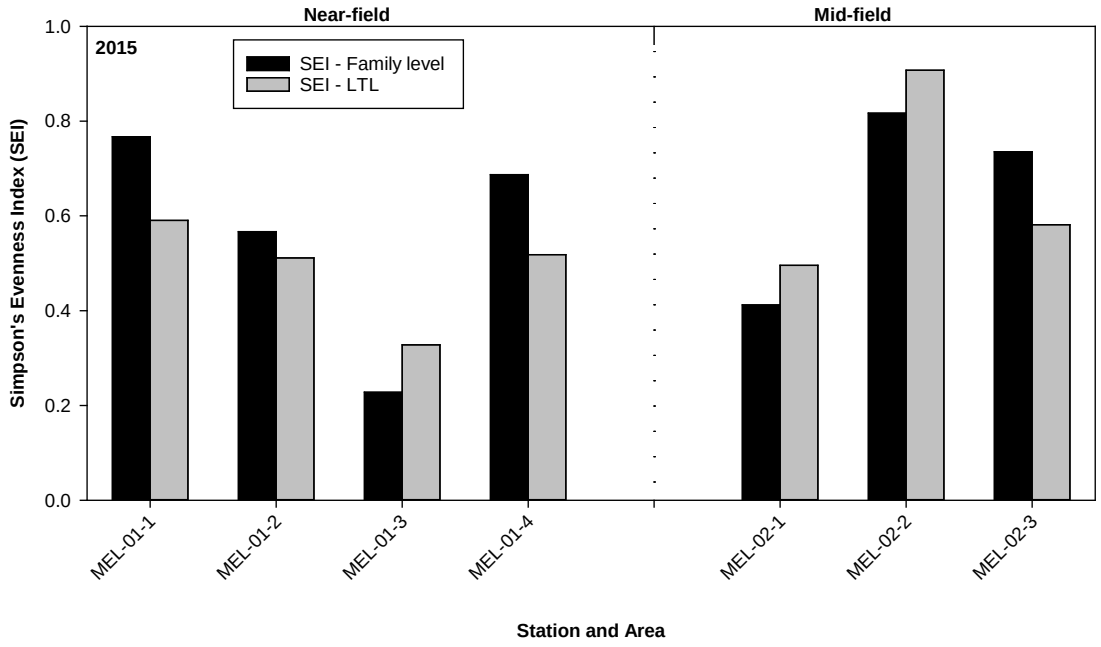
LTL = lowest taxonomic level.

Figure 5B-5: Simpson's Diversity Index in the Near-field and Mid-field Areas, August 2015



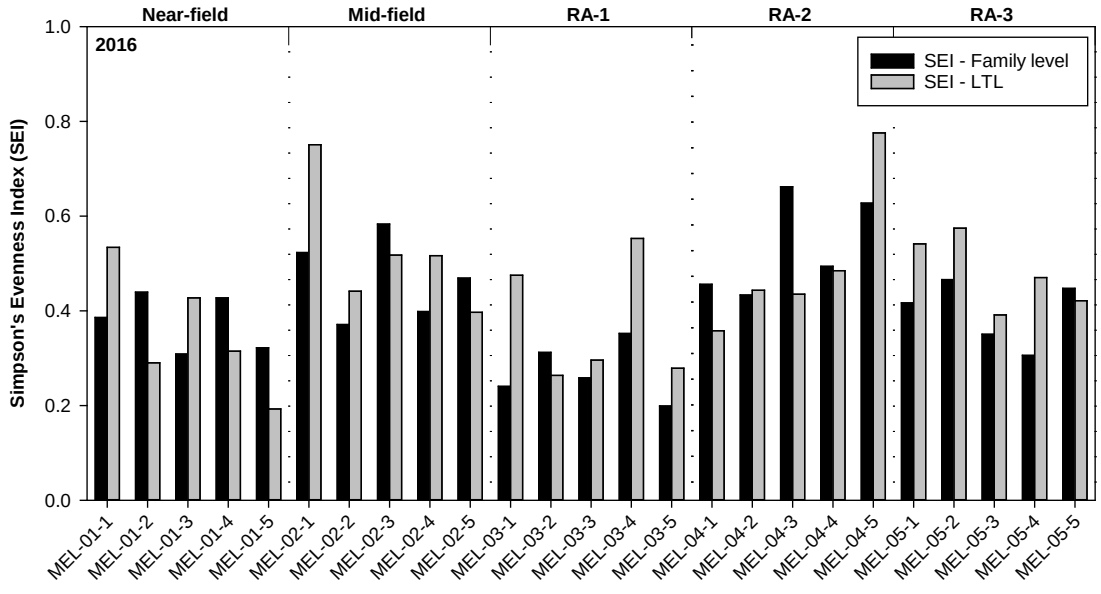
LTL = lowest taxonomic level; RA-1 = Reference area 1; RA-2 = Reference area 2; RA-3 = Reference area 3.

Figure 5B-6: Simpson's Diversity Index by Station, August 2016



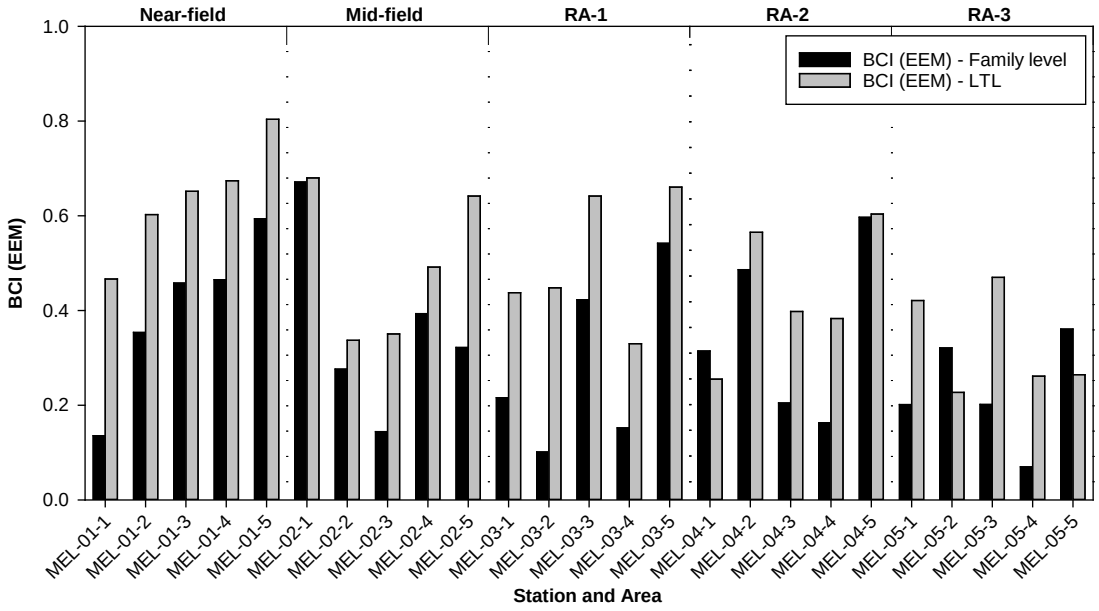
LTL = lowest taxonomic level.

Figure 5B-7: Simpson's Evenness Index in the Near-field and Mid-field Areas, August 2015



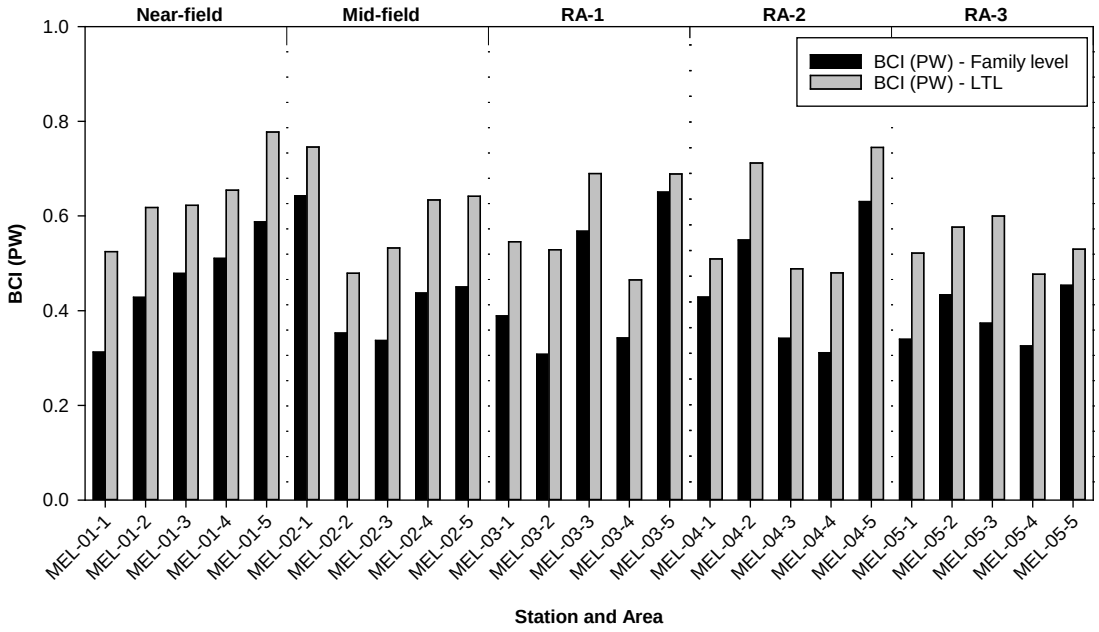
LTL = lowest taxonomic level; RA-1 = Reference area 1; RA-2 = Reference area 2; RA-3 = Reference area 3.

Figure 5B-8: Simpson's Evenness Index by Station, August 2016



LTL = lowest taxonomic level; RA-1 = Reference area 1; RA-2 = Reference area 2; RA-3 = Reference area 3; BCI = Bray-Curtis index; EEM = Environmental Effects Monitoring.

Figure 5B-9: Bray-Curtis Index (EEM method) by Station, August 2016



LTL = lowest taxonomic level; RA-1 = Reference area 1; RA-2 = Reference area 2; RA-3 = Reference area 3; BCI = Bray-Curtis index; PW = pairwise.

Figure 5B-10: Bray-Curtis Index (pairwise method) by Station, August 2016

APPENDIX 6A – 6E

Fish

Table 6A-1: Fish Sampling Effort for Meliadine Lake, 2015 and 2017

Sampling Area	Effort Number	Gear Type	Zone	Start		End		Habitat Description	Minimum Depth (m)	Max Depth (m)	Set Date (d/m/y)	Lift Date (d/m/y)	Duration (h)	Effort[(a)]	Fish Captured							
				Easting	Northing	Easting	Northing								THST	RNWH	LKTR	SLSC	BURB	NNST	CISC	Total
NF	ML15FHNFBP1000	Electrofishing	15V	542210	6991482	542187	6991385	Boulder, cobble, silt	0.1	0.7	14/08/2015	14/08/2015	1.33	2825 s	35	-	5	2	-	2	-	44
NF	ML15FHNFBP1001	Electrofishing	15V	544086	6987045	543762	6987079	Boulder, cobble, silt	0.1	0.7	15/08/2015	15/08/2015	1.08	2345 s	45	1	1	6	-	1	-	54
NF	ML15FHNFMT1300	Minnow Trap	15V	541733	6988953	-	-	Cobble	0.2	0.6	16/08/2015	17/08/2015	36.42	401 h	120	-	-	-	-	16	1	137
NF	ML15FHNFMT1301	Minnow Trap	15V	541671	6988988	-	-	Boulder, cobble	0.4	1.0	16/08/2015	17/08/2015	13.08	183 h	44	-	-	-	1	3	-	48
NF	ML15FHNFSN1400	Seine Net	15V	542232	6991483	542273	6991457	Boulder, cobble, silt	0.1	0.8	14/08/2015	14/08/2015	0.25	150 m^2	2	-	-	-	-	-	-	2
RA1	ML17FHRA1BP2000	Electrofishing	15V	533239	6998103	533202	6998082	Rocky shoreline with organics	0.1	0.5	09/08/2017	09/08/2017	-	210 s	34	2	-	-	-	-	-	36
RA1	ML17FHRA1BP2001	Electrofishing	15V	533238	6998108	533147	6998109	Cobble, boulder shoreline with fines	0.1	0.4	12/08/2017	12/08/2017	-	609 s	60	-	-	-	-	-	-	60
RA1	ML17FHRA1BP2002	Electrofishing	15V	533198	6998083	533131	6998124	Cobble, boulder with sand	0.1	0.5	13/08/2017	13/08/2017	-	422 s	60	-	-	-	-	-	-	60
RA1	ML17FHRA1HP2200	Hoop Net	15V	535077	6996933	-	-	Deep, clear, with large boulders	0.9	1.1	09/08/2017	10/08/2017	22.08	22 h	117	-	-	-	-	1	-	118
RA1	ML17FHRA1HP2201	Hoop Net	15V	535551	6998405	-	-	Large embedded boulders	0.9	1.5	09/08/2017	10/08/2017	20.68	21 h	1	-	-	-	-	-	-	1
RA1	ML17FHRA1MT2300	Minnow Trap	15V	534343	6997898	534399	6997826	Rock and boulder	0.2	0.8	09/08/2017	10/08/2017	23.80	190 h	38	-	-	-	-	-	-	38
RA1	ML17FHRA1MT2301	Minnow Trap	15V	534973	6996873	535026	6996846	Sheltered bay with cobble and shale. No vegetation.	0.3	0.5	09/08/2017	10/08/2017	22.60	136 h	17	-	-	-	-	-	-	17
RA1	ML17FHRA1MT2302	Minnow Trap	15V	535560	6998404	535529	6998405	Shale, boulder and fines; no vegetation	0.2	0.5	09/08/2017	11/08/2017	45.30	272 h	74	-	1	-	-	6	-	81
RA1	ML17FHRA1MT2303	Minnow Trap	15V	534785	6997177	534765	6997162	Boulder, cobble with lots of periphyton	0.2	0.4	10/08/2017	11/08/2017	23.40	140 h	19	-	-	-	-	-	-	19
RA1	ML17FHRA1MT2304	Minnow Trap	15V	533990	6997761	534030	6997738	Boulder with fines and periphyton	0.3	0.5	10/08/2017	12/08/2017	46.60	373 h	58	-	-	-	-	-	-	58
RA1	ML17FHRA1MT2305	Minnow Trap	15V	533699	6998961	533628	6999011	Rocky shoreline, mostly round boulder	0.2	0.4	11/08/2017	13/08/2017	46.52	279 h	163	-	-	-	-	6	-	169
RA1	ML17FHRA1MT2306	Minnow Trap	15V	532840	6999706	532900	6999715	Embedded boulder; more uniform shoreline	0.2	0.4	11/08/2017	13/08/2017	46.72	280 h	99	-	-	-	-	2	-	101
RA1	ML17FHRA1MT2307	Minnow Trap	15V	533158	6998280	533217	6998256	Embedded cobble and boulder with periphyton	0.1	0.5	12/08/2017	13/08/2017	23.87	191 h	118	-	-	-	1	2	-	121
RA1	ML17FHRA1SN2400	Seine Net	15V	534328	6997926	534334	6997911	Cobble beach with embedded flat boulders; no vegetation	0.1	0.6	09/08/2017	09/08/2017	0.42	340 m^2	2	4	7	1	-	-	-	14
RA2	ML17FHRA2BP3000	Electrofishing	15V	526129	7001238	526127	7001304	-	0.1	0.6	14/08/2017	14/08/2017	-	339 s	24	-	-	-	2	9	-	35
RA2	ML17FHRA2MT3300	Minnow Trap	15V	526118	7001228	526094	7001235	Embedded boulder; submerged vegetation	0.2	0.4	14/08/2017	16/08/2017	46.17	277 h	31	-	-	-	-	4	-	35
RA2	ML17FHRA2MT3301	Minnow Trap	15V	525155	7001053	525195	7000993	Cobble, boulder shoal with sand	0.1	0.3	14/08/2017	16/08/2017	46.78	374 h	59	-	-	-	2	1	-	62
RA2	ML17FHRA2MT3302	Minnow Trap	15V	525888	7002290	525895	7002306	Cobble, boulder with some gravel	0.2	0.5	14/08/2017	16/08/2017	45.80	275 h	45	-	-	-	-	2	-	47
RA2	ML17FHRA2MT3303	Minnow Trap	15V	526334	7002402	526333	7002383	Cobble, boulder with periphyton; sand/organic at shoreline	0.2	0.5	16/08/2017	18/08/2017	50.25	302 h	70	-	-	-	-	6	-	76
RA2	ML17FHRA2MT3304	Minnow Trap	15V	525048	7002031	525078	7002025	Boulder with interspersed cobble. Small bay.	0.1	0.5	16/08/2017	18/08/2017	50.05	300 h	69	-	-	-	1	-	-	70
RA2	ML17FHRA2MT3305	Minnow Trap	15V	524648	7001233	524650	7001217	-	0.2	0.4	16/08/2017	18/08/2017	49.67	397 h	149	-	-	-	-	20	-	169

a) Minnow Trap = trap hours; Electrofishing = seconds; Siene Net = square metres; Gill Net = net hours; Hoop Net = net hours.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; m = metre; d = day; m = month; y = year; h = hour; s = second; m^2 = square metre; THST = Threespine Stickleback; RNWH = Round Whitefish; LKTR = Lake Trout; SLSC = Slimy Sculpin; BURB = Burbot; NNST = Ninespine Stickleback; CISC = Cisco; - = not recorded or not applicable.

Table 6A-2: Environmental Data for Meliadine Lake, 2015 and 2017

Effort Number	Year	Air Temp (°C)	Cloud Cover (%)	Wind Direction	Wind Speed (km/h)	Precipitation	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductivity (µS/cm)	pH
ML15FHNFBP1000	2015	12	40	NNW	-	0	9.23	11.15	97.2	49	6.30
ML15FHNFBP1001	2015	10	10	SSE	-	0	8.82	11.99	103.4	52	6.30
ML15FHNFMT1300	2015	8	5	SSW	-	0	8.34	11.14	95.2	52	6.60
ML15FHNFMT1301	2015	-	-	-	-	-	9.66	11.25	99.1	51	6.60
ML15FHNFSN1400	2015	12	40	NNW	-	0	9.23	11.15	97.2	49	6.20
ML17FHRA1BP2000	2017	15	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1BP2001	2017	13	5	NNW	18	0	13.70	8.70	-	59	8.56
ML17FHRA1BP2002	2017	12	5	SSE	15	0	13.22	10.80	103.7	69	7.48
ML17FHRA1HP2200	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1HP2201	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2300	2017	17	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2301	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2302	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2303	2017	10	100	NE	25	0	11.00	-	-	88	8.19
ML17FHRA1MT2304	2017	10	100	NE	25	0	11.00	-	-	88	8.19
ML17FHRA1MT2305	2017	15	50	NNW	8	0	13.30	-	-	55	8.84
ML17FHRA1MT2306	2017	16	50	NNW	8	0	13.30	-	-	55	8.84
ML17FHRA1MT2307	2017	13	5	NNW	18	0	13.70	8.70	-	59	8.56
ML17FHRA1SN2400	2017	15	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA2BP3000	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3300	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3301	2017	11	75	S	15	0	13.59	10.67	104.4	68	7.75
ML17FHRA2MT3302	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3303	2017	10	100	N	13	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3304	2017	11	100	N	13	0	13.69	10.65	104.0	68	7.76
ML17FHRA2MT3305	2017	11	100	N	13	0	13.69	10.65	104.0	68	7.76

°C = degree Celsius; % = percent; km/h = kilometre per hour; mg/L = milligram per litre; µS/cm = microsiemen per centimetre; N = north; NE = northeast; NW = northwest; NNW = north-northwest; S = south; SSE = south-southeast; SSW = south-southwest; - = not recorded or not applicable.

Table 6B-1: Fish Health Data for Threespine Stickleback Collected During Non-lethal Sampling at Meliadine Lake, 2015 and 2017

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
14/8/2015	NF	Seine Net	ML15FHNFSN1400	ML15UNFTHST1002	32.6	0.227	0.66	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1025	40.2	0.638	0.98	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1026	42.6	0.705	0.91	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1027	52.5	1.465	1.01	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1028	41.6	0.683	0.95	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1029	31.4	0.177	0.57	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1030	47.0	1.053	1.01	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1031	43.9	0.812	0.96	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1032	47.8	0.978	0.90	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1033	50.0	1.578	1.26	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1034	47.1	1.044	1.00	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1035	44.0	0.807	0.95	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1036	30.2	0.186	0.67	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1037	68.0	2.443	0.78	2
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1039	48.0	0.736	0.67	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1040	31.2	0.273	0.90	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1041	36.3	0.323	0.67	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1042	35.0	0.358	0.83	1
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	ML15UNFTHST1043	35.5	0.282	0.63	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1091	33.4	0.352	0.95	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1092	39.9	0.564	0.88	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1093	42.7	0.652	0.84	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1094	41.6	0.656	0.91	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1095	32.2	0.212	0.64	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1096	33.0	0.244	0.68	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1097	40.3	0.631	0.96	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1098	45.3	0.761	0.82	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1099	46.8	0.870	0.85	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1100	45.2	0.824	0.89	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1101	41.8	0.629	0.86	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1102	26.7	-	-	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1103	32.8	0.261	0.74	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1104	35.9	0.386	0.83	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1105	41.3	0.607	0.86	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1106	47.6	1.098	1.02	1
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	ML15UNFTHST1107	45.2	0.799	0.86	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1117	46.9	1.077	1.04	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1121	46.2	1.066	1.08	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1137	37.7	0.459	0.86	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1150	38.9	0.455	0.78	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1163	43.9	0.768	0.91	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1164	44.3	0.773	0.89	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1166	50.1	1.070	0.85	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1167	39.4	0.612	1.00	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1168	42.0	0.737	1.00	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1169	44.7	0.805	0.90	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1170	39.8	0.682	1.08	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1171	44.2	0.872	1.01	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1172	37.3	0.380	0.73	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1173	47.7	1.035	0.95	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1174	45.0	0.653	0.72	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1175	49.4	0.929	0.77	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1176	47.5	1.042	0.97	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1177	45.0	0.864	0.95	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1178	41.7	0.632	0.87	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1179	36.8	0.385	0.77	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1180	44.2	0.958	1.11	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1181	37.7	0.412	0.77	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1182	44.6	0.831	0.94	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1183	45.1	0.864	0.94	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1184	39.5	0.476	0.77	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1185	47.0	1.024	0.98	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1187	45.3	0.669	0.72	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1188	39.7	0.492	0.78	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1189	47.2	0.817	0.78	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1190	48.5	0.874	0.77	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1191	36.3	0.398	0.83	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1192	37.6	0.384	0.72	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1193	44.2	0.711	0.83	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1194	38.0	0.456	0.83	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1195	42.2	0.566	0.75	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1196	35.9	0.429	0.93	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1197	35.2	0.415	0.95	1

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1203	44.0	0.837	0.98	1
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1206	35.6	0.340	0.75	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1224	44.9	0.680	0.75	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1225	33.1	0.320	0.88	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1226	40.6	0.481	0.72	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1227	37.2	0.384	0.75	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1228	29.6	0.217	0.84	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1229	47.1	0.912	0.87	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1230	46.4	0.796	0.80	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1231	42.8	0.515	0.66	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1232	46.3	0.916	0.92	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1234	34.9	0.332	0.78	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1255	55.7	1.421	0.82	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1256	47.6	0.919	0.85	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1257	50.4	0.937	0.73	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1258	50.2	1.166	0.92	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1263	44.0	0.734	0.86	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1264	48.4	1.071	0.94	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1265	41.3	0.699	0.99	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1266	45.0	0.832	0.91	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1267	43.7	0.853	1.02	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1268	32.7	0.293	0.84	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1269	49.7	0.951	0.78	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1273	46.8	0.972	0.95	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1275	42.3	0.707	0.94	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1276	41.3	0.673	0.96	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1277	42.1	0.785	1.06	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1278	41.9	0.732	1.00	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1279	46.5	0.909	0.90	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1280	36.1	0.399	0.85	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1282	53.8	1.138	0.73	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1283	33.0	0.240	0.67	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1284	47.2	0.971	0.92	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1285	47.2	0.865	0.82	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1286	52.1	1.319	0.93	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1287	49.3	0.937	0.78	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1288	45.5	0.918	0.98	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1289	42.4	0.669	0.88	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1290	36.8	0.387	0.78	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1291	35.4	0.386	0.87	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1292	53.9	1.375	0.88	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1293	44.8	0.827	0.92	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1294	41.6	0.647	0.90	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1295	42.4	0.489	0.64	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	ML15UNFTHST1296	31.0	0.283	0.95	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1297	54.1	1.453	0.92	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1298	58.1	1.755	0.89	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1299	46.9	0.953	0.92	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1300	47.0	0.785	0.76	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1301	55.2	1.463	0.87	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1302	56.3	1.557	0.87	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1303	52.1	1.291	0.91	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1304	54.8	1.595	0.97	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1305	48.9	0.952	0.81	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1306	36.2	0.378	0.80	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1307	41.8	0.529	0.73	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1308	43.7	0.806	0.97	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1309	45.5	0.769	0.82	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1310	41.4	0.702	0.99	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1311	41.9	0.841	1.15	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1312	44.8	0.802	0.89	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1313	43.2	0.689	0.85	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1315	49.0	1.023	0.87	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1316	43.1	0.586	0.73	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1317	37.8	0.516	0.96	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1318	37.3	0.492	0.95	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1319	48.3	0.989	0.88	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1320	47.5	0.863	0.81	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1321	44.6	0.707	0.80	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1322	45.2	0.718	0.78	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1323	57.4	1.583	0.84	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1324	45.8	1.178	1.23	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1325	44.7	0.677	0.76	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1327	56.2	1.458	0.82	2

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1328	51.3	0.986	0.73	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1329	57.3	1.994	1.06	2
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1330	44.7	0.844	0.94	1
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	ML15UNFTHST1331	38.1	0.422	0.76	1
9/8/2017	RA1	Minnow Trap	ML17FHRA1SN2400	ML17URA1THST2002	52.0	1.415	1.01	2
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2003	62.0	1.637	0.69	2
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2004	52.0	0.861	0.61	2
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2005	59.0	1.645	0.80	2
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2006	53.0	0.960	0.64	2
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2007	42.0	0.508	0.69	1
9/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2008	67.0	2.335	0.78	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2009	41.0	0.612	0.89	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2010	64.0	2.235	0.85	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2011	63.0	2.105	0.84	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2012	37.0	0.332	0.66	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2013	44.0	0.744	0.87	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2016	60.0	1.703	0.79	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2017	41.0	0.503	0.73	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2018	42.0	0.583	0.79	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2019	38.0	0.362	0.66	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2020	57.0	1.544	0.83	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2021	53.0	1.443	0.97	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2022	58.0	1.573	0.81	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2023	36.0	0.342	0.73	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2024	67.0	2.370	0.79	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2025	59.0	1.826	0.89	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2026	47.0	0.909	0.88	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2028	39.0	0.416	0.70	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2029	39.0	0.409	0.69	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2030	43.0	0.548	0.69	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2031	37.0	0.361	0.71	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2032	45.0	0.653	0.72	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2033	38.0	0.385	0.70	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2034	39.0	0.427	0.72	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2035	36.0	0.327	0.70	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2036	39.0	0.398	0.67	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2037	57.0	1.589	0.86	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2038	37.0	0.364	0.72	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2039	37.0	0.386	0.76	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2040	44.0	0.657	0.77	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2041	53.0	0.882	0.59	2
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2042	45.0	0.810	0.89	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2043	42.0	0.577	0.78	1
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	ML17URA1THST2044	36.0	0.326	0.70	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2201	ML17URA1THST2081	53.0	1.119	0.75	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2082	42.0	0.548	0.74	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2083	37.0	0.479	0.95	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2084	60.0	1.778	0.82	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2085	39.0	0.603	1.02	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2086	63.0	2.221	0.89	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2087	40.0	0.596	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2088	37.0	0.469	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2089	39.0	0.559	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2090	65.0	2.392	0.87	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2091	59.0	1.771	0.86	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2092	60.0	2.335	1.08	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2093	56.0	1.752	1.00	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2094	72.0	3.211	0.86	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2095	39.0	0.649	1.09	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2096	64.0	2.639	1.01	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2097	63.0	2.169	0.87	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2098	32.0	0.305	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2099	56.0	1.741	0.99	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2100	39.0	0.519	0.87	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2101	34.0	0.410	1.04	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2102	62.0	1.682	0.71	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2103	60.0	2.136	0.99	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2104	41.0	0.590	0.86	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2105	39.0	0.540	0.91	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2106	41.0	0.652	0.95	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2107	58.0	1.359	0.70	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2108	40.0	0.513	0.80	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2109	70.0	2.981	0.87	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2110	42.0	0.647	0.87	1

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2111	40.0	0.522	0.82	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2112	41.0	0.720	1.04	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2113	37.0	0.480	0.95	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2114	40.0	0.471	0.74	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2115	72.0	2.580	0.69	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2116	38.0	0.377	0.69	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2117	42.0	0.616	0.83	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2118	36.0	0.371	0.80	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2119	41.0	0.518	0.75	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2120	63.0	2.218	0.89	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2121	67.0	3.117	1.04	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2122	43.0	0.728	0.92	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2123	35.0	0.359	0.84	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2124	39.0	0.536	0.90	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2125	38.0	0.543	0.99	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2126	36.0	0.435	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2127	42.0	0.635	0.86	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2128	36.0	0.413	0.89	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2129	57.0	1.990	1.07	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2130	41.0	0.760	1.10	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2131	35.0	0.367	0.86	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2132	38.0	0.460	0.84	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2133	36.0	0.411	0.88	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2134	37.0	0.374	0.74	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2135	35.0	0.444	1.04	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2136	46.0	0.858	0.88	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2137	63.0	2.022	0.81	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2138	38.0	0.511	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2139	60.0	2.074	0.96	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2140	65.0	2.680	0.98	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2141	43.0	0.784	0.99	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2142	36.0	0.338	0.72	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2143	37.0	0.452	0.89	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2144	38.0	0.517	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2145	42.0	0.674	0.91	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2146	38.0	0.500	0.91	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2147	35.0	0.363	0.85	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2148	33.0	0.310	0.86	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2149	35.0	0.326	0.76	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2150	36.0	0.350	0.75	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2151	65.0	2.570	0.94	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2152	60.0	1.958	0.91	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2153	60.0	2.157	1.00	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2154	40.0	0.587	0.92	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2155	67.0	2.456	0.82	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2156	60.0	1.770	0.82	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2157	55.0	1.797	1.08	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2158	53.0	1.270	0.85	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2159	59.0	1.418	0.69	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2160	31.0	0.350	1.17	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2161	61.0	2.246	0.99	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2162	66.0	2.281	0.79	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2163	45.0	0.697	0.76	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2164	38.0	0.412	0.75	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2165	39.0	0.557	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2166	43.0	0.708	0.89	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2167	69.0	2.342	0.71	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2168	60.0	1.946	0.90	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2169	37.0	0.513	1.01	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2170	62.0	1.877	0.79	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2171	66.0	2.670	0.93	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2172	38.0	0.512	0.93	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2173	36.0	0.415	0.89	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2174	42.0	0.695	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2175	33.0	0.312	0.87	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2176	40.0	0.511	0.80	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2177	38.0	0.526	0.96	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2179	61.0	2.420	1.07	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2180	38.0	0.529	0.96	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2181	34.0	0.397	1.01	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2182	36.0	0.358	0.77	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2183	64.0	2.110	0.80	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2184	44.0	0.804	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2185	61.0	1.841	0.81	2

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2186	42.0	0.618	0.83	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2187	42.0	0.612	0.83	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2188	35.0	0.379	0.88	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2189	37.0	0.400	0.79	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2190	35.0	0.328	0.77	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2191	37.0	0.392	0.77	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2192	39.0	0.399	0.67	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2193	39.0	0.518	0.87	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2194	38.0	0.514	0.94	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2195	39.0	0.472	0.80	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2196	35.0	0.394	0.92	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2197	38.0	0.467	0.85	1
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2198	48.0	0.874	0.79	2
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	ML17URA1THST2199	40.0	0.482	0.75	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2200	37.0	0.479	0.95	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2201	32.0	0.267	0.81	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2202	45.0	0.673	0.74	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2203	34.0	0.374	0.95	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2204	33.0	0.309	0.86	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2205	34.0	0.342	0.87	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2206	36.0	0.376	0.81	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2207	32.0	0.266	0.81	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2208	34.0	0.338	0.86	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2209	41.0	0.497	0.72	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2210	33.0	0.302	0.84	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2211	36.0	0.294	0.63	1
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2301	ML17URA1THST2212	41.0	0.450	0.65	1
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2235	55.0	1.549	0.93	2
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2236	53.0	1.557	1.05	2
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2241	40.0	0.495	0.77	1
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	ML17URA1THST2242	44.0	0.563	0.66	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	ML17URA1THST2274	55.0	1.426	0.86	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	ML17URA1THST2275	65.0	2.392	0.87	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	ML17URA1THST2276	56.0	1.858	1.06	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	ML17URA1THST2277	38.0	0.587	1.07	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2278	65.0	2.932	1.07	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2280	64.0	2.090	0.80	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2281	58.0	1.651	0.85	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2282	53.0	1.579	1.06	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2283	57.0	1.479	0.80	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2284	62.0	1.955	0.82	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2286	60.0	1.757	0.81	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2287	52.0	1.725	1.23	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2288	75.0	3.510	0.83	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2289	63.0	2.438	0.98	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2290	66.0	2.033	0.71	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2291	52.0	0.951	0.68	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2292	65.0	2.209	0.80	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2293	46.0	0.919	0.94	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2294	60.0	1.742	0.81	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2295	53.0	1.050	0.71	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2297	40.0	0.478	0.75	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2298	58.0	1.488	0.76	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2299	52.0	1.126	0.80	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2300	60.0	1.996	0.92	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2301	54.0	1.140	0.72	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2302	60.0	1.843	0.85	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2303	45.0	0.678	0.74	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2304	52.0	1.070	0.76	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2305	64.0	1.980	0.76	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2307	65.0	2.407	0.88	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2308	38.0	0.442	0.81	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2310	41.0	0.500	0.73	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2311	62.0	2.033	0.85	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2312	57.0	1.712	0.92	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2313	44.0	0.605	0.71	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2314	56.0	1.462	0.83	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2315	69.0	2.711	0.83	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2316	56.0	1.524	0.87	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2318	62.0	1.825	0.77	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2319	69.0	2.444	0.74	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2320	44.0	0.688	0.81	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2321	38.0	0.417	0.76	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2322	37.0	0.419	0.83	1

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2323	57.0	1.742	0.94	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2324	45.0	0.750	0.82	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2325	56.0	1.255	0.71	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2326	55.0	1.201	0.72	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2327	55.0	1.357	0.82	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2328	45.0	0.796	0.87	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2329	51.0	1.164	0.88	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2330	51.0	1.178	0.89	2
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2331	43.0	0.472	0.59	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2332	47.0	0.834	0.80	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2333	42.0	0.578	0.78	1
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2334	43.0	0.558	0.70	1
13/8/2017	RA1	Minnow Trap	ML17FHRA1MT2307	ML17URA1THST2358	31.0	0.408	1.37	1
13/8/2017	RA1	Minnow Trap	ML17FHRA1MT2307	ML17URA1THST2359	38.0	0.519	0.95	1
13/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2360	63.0	2.170	0.87	2
13/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2361	51.0	1.018	0.77	2
13/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	ML17URA1THST2362	60.0	1.826	0.85	2
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3016	33.0	0.264	0.74	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3022	30.0	0.175	0.65	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3023	45.0	0.697	0.76	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3024	43.0	0.765	0.96	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3027	53.0	0.762	0.51	2
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3028	35.0	0.235	0.55	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3029	41.0	0.435	0.63	1
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	ML17URA2THST3030	41.0	0.434	0.63	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3056	52.0	1.115	0.79	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3057	60.0	1.738	0.80	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3059	52.0	1.593	1.13	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3060	54.0	1.036	0.66	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3061	57.0	1.310	0.71	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3062	54.0	1.391	0.88	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3063	57.0	1.577	0.85	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3064	50.0	0.865	0.69	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3065	57.0	1.453	0.78	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3066	60.0	1.936	0.90	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3067	56.0	1.460	0.83	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3068	54.0	1.575	1.00	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3069	61.0	1.610	0.71	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3070	55.0	1.532	0.92	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3071	68.0	2.433	0.77	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3072	52.0	1.164	0.83	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3073	60.0	1.593	0.74	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3074	59.0	1.435	0.70	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3075	45.0	1.150	1.26	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3076	60.0	1.515	0.70	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3077	51.0	0.957	0.72	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3078	55.0	1.590	0.96	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3079	52.0	1.214	0.86	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3080	61.0	1.990	0.88	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3081	58.0	1.709	0.88	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3082	66.0	2.433	0.85	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	ML17URA2THST3083	45.0	0.799	0.88	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3085	44.0	0.502	0.59	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3086	60.0	1.563	0.72	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3087	60.0	1.668	0.77	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3088	39.0	0.405	0.68	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3089	39.0	0.476	0.80	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3090	43.0	0.477	0.60	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3092	40.0	0.541	0.85	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3093	40.0	0.529	0.83	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3094	44.0	0.686	0.81	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3095	65.0	1.936	0.70	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3096	43.0	0.553	0.70	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3097	48.0	0.781	0.71	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3098	62.0	2.063	0.87	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3099	45.0	0.681	0.75	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3100	54.0	1.227	0.78	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3101	36.0	0.442	0.95	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3102	54.0	1.393	0.88	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3104	39.0	0.392	0.66	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3105	41.0	0.462	0.67	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3106	58.0	1.699	0.87	2
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3107	40.0	0.428	0.67	1
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3108	40.0	0.390	0.61	1

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3129	55.0	1.719	1.03	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3130	60.0	2.114	0.98	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3131	50.0	1.188	0.95	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3145	46.0	0.598	0.61	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3146	32.0	0.208	0.63	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3147	39.0	0.441	0.74	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3148	42.0	0.503	0.68	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3149	37.0	0.378	0.75	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3150	39.0	0.406	0.68	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3151	39.0	0.384	0.65	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3152	45.0	0.573	0.63	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3153	39.0	0.517	0.87	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3154	43.0	0.588	0.74	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3155	40.0	0.425	0.66	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	ML17URA2THST3156	54.0	1.435	0.91	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3158	49.0	1.074	0.91	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3159	67.0	2.312	0.77	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3160	61.0	2.017	0.89	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3161	58.0	1.600	0.82	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3162	59.0	1.552	0.76	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3163	60.0	1.739	0.81	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3164	58.0	1.724	0.88	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3165	37.0	0.288	0.57	1
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3166	55.0	1.389	0.83	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3167	54.0	1.507	0.96	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3168	58.0	1.440	0.74	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3169	65.0	2.004	0.73	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3170	60.0	1.609	0.74	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3171	70.0	3.237	0.94	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3172	60.0	1.789	0.83	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3173	62.0	2.206	0.93	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3174	61.0	1.951	0.86	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3175	63.0	2.088	0.84	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3176	62.0	2.015	0.85	2
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	ML17URA2THST3177	54.0	1.209	0.77	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3182	49.4	1.073	0.89	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3199	35.0	0.475	1.11	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3200	37.0	0.525	1.04	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3201	56.0	1.394	0.79	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3202	54.0	1.318	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3203	66.0	2.422	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3204	64.0	1.839	0.70	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3205	55.0	1.525	0.92	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3208	53.0	0.739	0.50	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3209	46.0	0.946	0.97	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3211	58.0	1.666	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3212	59.0	1.573	0.77	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3213	64.0	1.923	0.73	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3214	56.0	1.463	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3215	52.0	1.196	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3216	61.0	2.321	1.02	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3217	45.0	0.820	0.90	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3218	59.0	2.149	1.05	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3219	57.0	1.825	0.99	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3220	50.0	1.003	0.80	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3221	50.0	1.228	0.98	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3222	51.0	1.124	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3223	57.0	1.593	0.86	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	ML17URA2THST3224	54.0	1.349	0.86	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3225	64.0	2.273	0.87	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3226	58.0	1.521	0.78	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3227	48.0	0.925	0.84	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3228	54.0	1.384	0.88	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3229	55.0	1.502	0.90	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3230	48.0	0.869	0.79	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3231	36.0	0.536	1.15	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3232	58.0	1.427	0.73	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3233	62.0	2.200	0.92	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3234	62.0	2.007	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3235	60.0	1.888	0.87	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3236	55.0	1.225	0.74	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3237	49.0	0.997	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3238	69.0	2.609	0.79	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3239	68.0	2.567	0.82	2

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3240	65.0	2.987	1.09	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3241	55.0	1.516	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3242	56.0	1.626	0.93	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3243	59.0	1.568	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3244	55.0	1.311	0.79	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3245	69.0	2.690	0.82	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3246	61.0	2.140	0.94	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3247	56.0	1.496	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3248	51.0	1.147	0.86	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3249	56.0	1.516	0.86	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3250	68.0	2.288	0.73	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3251	64.0	1.968	0.75	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3252	63.0	2.111	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3253	50.0	1.032	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3254	41.0	0.525	0.76	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3255	57.0	1.642	0.89	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3256	58.0	1.783	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3257	68.0	2.546	0.81	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3304	ML17URA2THST3258	63.0	2.208	0.88	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3260	58.0	1.580	0.81	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3261	56.0	1.714	0.98	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3262	70.0	2.855	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3263	65.0	2.488	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3264	68.0	2.669	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3265	50.0	1.131	0.90	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3266	42.0	0.479	0.65	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3267	56.0	1.326	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3268	64.0	2.467	0.94	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3269	62.0	1.800	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3270	64.0	2.549	0.97	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3271	51.0	1.330	1.00	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3272	68.0	2.619	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3273	65.0	2.770	1.01	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3274	59.0	1.847	0.90	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3277	54.0	1.191	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3278	68.0	2.794	0.89	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3279	60.0	1.509	0.70	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3280	63.0	2.197	0.88	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3281	57.0	1.538	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3282	70.0	2.851	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3284	55.0	1.515	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3285	54.0	1.632	1.04	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3286	44.0	0.535	0.63	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3287	56.0	1.479	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3288	60.0	1.758	0.81	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3289	56.0	1.545	0.88	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3290	64.0	2.282	0.87	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3292	60.0	2.059	0.95	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3293	65.0	2.105	0.77	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3294	66.0	2.545	0.89	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3295	63.0	2.077	0.83	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3296	57.0	1.792	0.97	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3297	68.0	2.668	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3298	59.0	1.864	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3299	60.0	1.607	0.74	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3300	52.0	1.362	0.97	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3301	60.0	1.769	0.82	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3302	68.0	2.887	0.92	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3303	66.0	2.670	0.93	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3304	56.0	1.375	0.78	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3305	66.0	2.438	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3306	72.0	2.924	0.78	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3307	74.0	3.233	0.80	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3308	59.0	1.746	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3309	59.0	1.749	0.85	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3310	44.0	0.578	0.68	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3311	63.0	2.096	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3312	69.0	2.607	0.79	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3313	56.0	1.480	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3314	59.0	1.792	0.87	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3315	64.0	2.055	0.78	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3316	60.0	1.960	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3317	66.0	2.493	0.87	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3318	60.0	1.737	0.80	2

Date (d/m/y)	Sampling Area	Gear	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Condition Factor	Age[(a)] (y)
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3319	62.0	1.820	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3320	55.0	1.557	0.94	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3321	65.0	2.024	0.74	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3322	54.0	1.486	0.94	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3323	68.0	2.390	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3324	66.0	2.609	0.91	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3325	55.0	1.402	0.84	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3326	49.0	0.894	0.76	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3327	42.0	0.567	0.77	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3328	60.0	2.068	0.96	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3331	43.0	0.859	1.08	1
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3332	68.0	2.821	0.90	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3333	58.0	1.595	0.82	2
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	ML17URA2THST3334	40.0	0.673	1.05	1

a) Designated based on length-frequency distributions.
d = day; m = month; y = year; NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mm = millimetre; g = gram; - = not recorded or not applicable.

6B-2: Fish Health Data for Bycatch Captured During Non-lethal Sampling at Meliadine Lake, 2015 and 2017

Date (d/m/y)	Sampling Area	Gear	Effort Number	Species	FIN Number	Fork Length (mm)	Total Length (mm)	Total Weight (g)	Condition Factor
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	NNST	ML15FNFNNST038	-	32.5	0.205	0.60
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	SLSC	ML15FNFSLSC044	-	79.0	4.587	0.93
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	LKTR	ML15FNFLKTR045	48.0	50.0	0.611	0.49
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	LKTR	ML15FNFLKTR046	43.0	45.0	0.487	0.53
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	LKTR	ML15FNFLKTR047	48.0	50.0	0.537	0.43
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	LKTR	ML15FNFLKTR048	46.0	48.0	0.883	0.80
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	SLSC	ML15FNFSLSC049	-	42.0	0.543	0.73
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	LKTR	ML15FNFLKTR050	46.0	48.0	0.621	0.56
14/8/2015	NF	Electrofishing	ML15FHNFBP1000	NNST	ML15FNFNNST051	-	46.0	0.572	0.59
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	NNST	ML15FNFNNST090	-	56.7	1.175	0.64
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	RNWH	ML15FNFRNWH109	105	112	7.303	0.52
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	LKTR	ML15FNFLKTR110	93.0	101	6.810	0.66
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC111	-	66.0	3.339	1.16
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC112	-	71.0	3.821	1.07
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC113	-	63.0	2.116	0.85
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC114	-	64.0	2.617	1.00
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC115	-	57.0	1.906	1.03
15/8/2015	NF	Electrofishing	ML15FHNFBP1001	SLSC	ML15FNFSLSC116	-	73.0	3.893	1.00
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST118	-	54.1	1.076	0.68
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST136	-	55.3	1.166	0.69
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	CISC	ML15FNFCISC141	96.0	103	6.984	0.64
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST147	-	52.0	0.945	0.67
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST148	-	46.7	0.731	0.72
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST151	-	49.8	0.731	0.59
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST165	-	49.4	0.692	0.57
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST186	-	49.6	0.736	0.60
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST204	-	53.8	1.049	0.67
16/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST205	-	48.9	0.807	0.69
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	BURB	ML15FNFBURB217	-	150	-	-
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST219	-	55.8	1.019	0.59
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST233	-	53.9	0.946	0.61
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	NNST	ML15FNFNNST240	-	62.3	1.386	0.57
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST270	-	53.5	0.886	0.58
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST271	-	48.4	0.869	0.77
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST272	-	54.1	0.751	0.47
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST274	-	50.5	0.844	0.65
17/8/2015	NF	Minnow Trap	ML15FHNFMT1300	NNST	ML15FNFNNST281	-	51.1	0.947	0.71
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	NNST	ML15FNFNNST314	-	49.4	0.677	0.56
17/8/2015	NF	Minnow Trap	ML15FHNFMT1301	NNST	ML15FNFNNST326	-	49.6	0.774	0.63
17/8/2015	NF	Gill Net	ML15FHNFGN1601	LKWH	ML15FNFLKWH365	429	472	1190	1.13
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	RNWH	ML17URA1RNWH2014	45.0	-	0.664	0.73
9/8/2017	RA1	Electrofishing	ML17FHRA1BP2000	RNWH	ML17URA1RNWH2015	39.0	-	0.366	0.62
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	RNWH	ML17URA1RNWH2045	188	-	55.04	0.83
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	RNWH	ML17URA1RNWH2046	151	-	24.78	0.72
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	RNWH	ML17URA1RNWH2047	90.0	-	4.960	0.68
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2048	40.0	-	0.460	0.72
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	SLSC	ML17URA1SLSC2049	-	38.0	0.510	0.93
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2050	45.0	-	0.640	0.70
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2051	44.0	-	0.660	0.77
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2052	37.0	-	0.260	0.51
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2053	47.0	-	0.710	0.68
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2054	46.0	-	0.660	0.68
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	RNWH	ML17URA1RNWH2055	44.0	-	0.580	0.68
9/8/2017	RA1	Seine Net	ML17FHRA1SN2400	LKTR	ML17URA1LKTR2056	49.0	-	0.670	0.57
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2076	-	54.6	0.890	0.55
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2077	-	57.1	1.132	0.61
10/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	LKTR	ML17URA1LKTR2080	-	82.0	6.087	1.10
10/8/2017	RA1	Hoop Net	ML17FHRA1HP2200	NNST	ML17URA1NNST2178	-	49.0	0.829	0.70
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2237	-	57.0	0.809	0.44
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2238	-	62.0	0.963	0.40
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2243	-	52.0	0.856	0.61
11/8/2017	RA1	Minnow Trap	ML17FHRA1MT2302	NNST	ML17URA1NNST2244	-	55.0	0.931	0.56
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	NNST	ML17URA1NNST2272	-	52.0	0.923	0.66
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2306	NNST	ML17URA1NNST2273	-	51.0	1.282	0.97
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2279	-	59.0	1.522	0.74
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2285	-	62.0	1.751	0.73
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2296	-	56.0	0.883	0.50
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2306	-	54.0	0.836	0.53
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2309	-	59.0	0.998	0.49
12/8/2017	RA1	Minnow Trap	ML17FHRA1MT2305	NNST	ML17URA1NNST2317	-	55.0	0.863	0.52
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3017	-	57.0	1.047	0.57
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	BURB	ML17URA2BURB3018	-	30.0	0.118	0.44
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	BURB	ML17URA2BURB3019	-	29.0	0.133	0.54
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3020	-	51.0	0.696	0.52
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3021	-	61.0	0.983	0.43
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3025	-	52.0	0.783	0.56
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3026	-	52.0	0.653	0.46
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3031	-	55.0	1.008	0.61
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3032	-	37.0	0.372	0.73
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3033	-	32.0	0.193	0.59
14/8/2017	RA2	Electrofishing	ML17FHRA2BP3000	NNST	ML17URA2NNST3034	-	35.0	0.280	0.65
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	NNST	ML17URA2NNST3058	-	56.0	0.848	0.48
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	NNST	ML17URA2NNST3084	-	55.0	0.861	0.52
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	BURB	ML17URA2BURB3091	-	84.0	2.790	0.47
15/8/2017	RA2	Minnow Trap	ML17FHRA2MT3301	NNST	ML17URA2NNST3103	-	58.0	0.876	0.45
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	NNST	ML17URA2NNST3111	-	57.0	1.158	0.63
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	NNST	ML17URA2NNST3112	-	49.0	0.728	0.62
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3300	NNST	ML17URA2NNST3113	-	60.0	1.430	0.66
16/8/2017	RA2	Minnow Trap	ML17FHRA2MT3302	NNST	ML17URA2NNST3157	-	53.0	0.789	0.53
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	NNST	ML17URA2NNST3206	-	60.0	1.150	0.53
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	NNST	ML17URA2NNST3207	-	52.0	1.773	1.26
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3303	NNST	ML17URA2NNST3210	-	62.0	1.349	0.57
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3259	-	53.0	0.928	0.62
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3275	-	50.0	0.740	0.59
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3276	-	55.0	0.964	0.58
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3283	-	63.0	1.493	0.60
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3291	-	65.0	1.376	0.50
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3329	-	69.0	1.392	0.42
17/8/2017	RA2	Minnow Trap	ML17FHRA2MT3305	NNST	ML17URA2NNST3330	-	53.0	0.903	0.61

d = day; m = month; y = year; NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; NNST = Ninespine Stickleback; RNWH = Round Whitefish; LKTR = Lake Trout; SLSC = Slimy Sculpin; CISC = Cisco; BURB = Burbot; mm = millimetre; g = gram; - = not recorded or not applicable.

Table 6B-3: Fish Health Data for Threespine Stickleback Lethally Sampled From Meliadine Lake, 2015 and 2017

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
14/8/2015	NF	ML15FHNFSN1400	ML15UNFTHST1001	49.7	0.888	0.634	0.117	0.72	1	M	J	21	0.022	0.005	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1003	68.0	2.502	1.784	0.294	0.79	2	F	A	13	0.094	0.089	1581	0.056	416
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1004	45.3	0.881	0.523	0.263	0.95	1	F	J	11	0.017	0.007	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1005	47.6	1.173	0.682	0.357	1.09	1	M	A	22	0.025	0.008	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1006	62.2	2.084	1.527	0.290	0.87	2	F	A	12	0.059	0.023	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1007	47.6	1.021	0.625	0.262	0.95	1	U	J	01	0.022	0.002	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1009	54.5	1.362	0.905	0.259	0.84	2	M	A	22	0.032	0.025	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1010	64.6	2.482	1.754	0.419	0.92	2	M	A	24	0.063	0.017	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1012	44.2	0.742	0.523	0.121	0.86	1	M	J	21	0.020	0.002	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1013	47.3	0.958	0.594	0.243	0.90	1	F	J	11	0.016	0.008	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1014	46.5	0.833	0.518	0.206	0.83	1	F	J	11	0.013	0.008	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1016	63.5	1.910	1.561	-	0.75	2	F	A	15	0.060	0.072	906	0.079	387
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1017	53.1	1.610	1.038	0.357	1.08	1	F	A	12	0.040	0.013	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1019	47.2	0.950	0.570	0.288	0.91	1	M	J	21	0.012	0.007	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1020	56.3	1.674	0.970	0.485	0.94	2	F	A	17	0.031	0.017	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1022	59.6	2.027	1.356	0.449	0.96	2	F	A	17	0.036	0.019	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1023	55.7	1.770	1.127	0.439	1.02	2	M	A	25	0.028	0.005	-	-	-
14/8/2015	NF	ML15FHNFBP1000	ML15UNFTHST1024	53.9	1.305	0.885	0.267	0.83	1	F	A	12	0.030	0.014	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1052	59.9	2.009	1.279	0.453	0.93	2	F	A	12	0.041	0.057	680	0.084	452
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1053	47.1	0.919	0.594	0.195	0.88	1	F	J	11	0.019	0.006	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1054	42.3	0.694	0.442	0.139	0.92	1	F	J	11	0.015	0.005	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1055	45.3	0.856	0.553	0.180	0.92	1	F	J	11	0.020	0.009	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1057	39.5	0.604	0.370	0.150	0.98	1	F	J	11	0.016	0.005	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1058	44.4	0.771	0.498	0.161	0.88	1	F	J	11	0.023	0.006	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1059	46.0	0.846	0.533	0.215	0.87	1	F	J	11	0.016	0.006	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1062	60.6	2.045	1.340	0.346	0.92	2	F	A	12	0.053	0.036	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1065	60.8	1.914	1.382	0.253	0.85	2	F	A	13	0.036	0.017	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1067[(a)]	64.8	2.497	1.691	0.416	0.92	2	F	A	23	0.066	0.074	766	0.096	471
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1068[(a)]	54.1	1.463	1.004	0.251	0.92	2	F	A	17	0.036	0.020	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1069	45.2	0.908	0.530	0.248	0.99	1	F	J	11	0.016	0.006	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1070	55.3	1.091	0.872	-	0.65	2	F	A	15	0.038	0.050	851	0.058	419
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1071	46.4	0.934	0.639	0.154	0.93	1	M	J	21	0.019	0.006	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1072	42.8	0.735	0.442	0.190	0.94	1	F	J	11	0.015	0.008	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1073	47.2	0.971	0.642	0.196	0.92	1	M	J	21	0.020	-	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1074	43.4	0.703	0.444	0.150	0.86	1	F	J	11	0.016	0.008	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1075	43.8	0.722	0.460	0.166	0.86	1	F	J	11	0.016	0.007	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1076	58.1	1.861	1.210	0.411	0.95	2	F	A	17	0.029	0.024	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1080	48.3	0.948	0.948	0.244	0.84	1	F	J	11	0.014	0.008	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1081	43.7	0.702	0.431	0.177	0.84	1	F	J	11	0.010	0.003	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1084	57.4	1.794	1.294	0.262	0.95	2	F	A	12	0.043	0.041	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1085	56.5	1.665	1.147	0.292	0.93	2	F	A	17	0.035	0.020	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1086	46.1	0.771	0.547	0.133	0.79	1	F	J	11	0.013	0.008	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1087	47.4	1.107	0.697	0.254	1.04	1	M	J	21	0.029	0.007	-	-	-

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1088	46.8	1.255	0.641	0.458	1.22	1	F	J	11	0.020	0.012	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1089	54.6	1.392	1.030	0.203	0.85	2	F	A	17	0.024	0.017	-	-	-
15/8/2015	NF	ML15FHNFBP1001	ML15UNFTHST1108	45.1	0.849	0.537	0.201	0.92	1	M	J	21	0.021	0.005	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1119[(a)]	63.9	2.478	1.688	0.431	0.95	2	F	A	12	0.060	0.061	551	0.110	462
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1120	46.7	0.997	0.672	0.166	0.98	1	F	J	11	0.026	0.008	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1122[(a)]	65.2	2.154	1.854	-	0.78	2	M	A	24	0.074	0.016	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1123[(a)]	66.0	2.999	2.230	0.328	1.05	2	M	A	24	0.078	0.020	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1124[(a)]	68.6	2.967	2.110	0.370	0.92	2	F	A	13	0.097	0.096	1230	0.078	456
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1125[(a)]	66.5	2.507	1.864	0.294	0.85	2	M	A	24	0.068	0.015	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1126[(a)]	70.6	3.076	2.498	-	0.87	2	F	A	15	0.108	0.125	1199	0.104	462
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1127[(a)]	70.3	2.945	1.925	-	0.85	2	F	A	14	0.128	0.582	143	4.076	1746
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1128	49.1	1.158	0.666	0.374	0.98	1	F	J	11	0.024	0.009	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1129[(a)]	60.1	2.010	1.425	0.341	0.93	2	M	A	23	0.036	0.016	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1138	48.8	1.169	0.739	0.278	1.01	1	F	J	11	0.039	0.012	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1139	52.0	1.197	0.881	0.148	0.85	1	F	A	17	0.033	0.013	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1140	68.7	3.123	2.144	0.385	0.97	2	F	A	14	0.077	0.308	1790	0.172	657
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1142	53.7	1.363	0.915	0.285	0.88	1	F	A	17	0.032	0.015	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1143	45.2	0.886	0.573	0.154	0.96	1	F	J	11	0.025	0.007	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1144	40.7	0.694	0.423	0.212	1.03	1	U	J	01	0.011	-	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1145	41.0	0.633	0.515	0.009	0.92	1	U	J	01	0.019	-	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1146	52.3	1.097	0.872	-	0.77	1	F	A	12	0.040	0.019	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1149	49.7	0.941	0.793	-	0.77	1	M	J	21	0.026	0.022	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1152	46.1	0.863	0.546	0.181	0.88	1	F	J	11	0.013	0.009	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1153	48.0	0.955	0.643	0.197	0.86	1	M	J	21	0.019	0.009	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1154	48.4	1.031	0.670	0.232	0.91	1	U	J	01	0.019	0.007	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1155	49.3	0.976	0.634	0.212	0.81	1	M	J	21	0.015	0.011	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1156	40.1	0.556	0.353	0.119	0.86	1	F	J	11	0.010	0.001	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1162	47.2	0.831	0.599	0.109	0.79	1	F	J	11	0.018	0.009	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1198	61.0	2.098	1.443	0.288	0.92	2	F	A	12	0.058	0.048	893	0.053	342
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1199	62.5	2.074	1.743	-	0.85	2	M	A	23	0.064	0.009	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1200	60.2	1.824	1.500	-	0.84	2	M	A	23	0.060	0.030	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1201	58.4	1.806	1.346	0.239	0.91	2	M	A	25	0.033	0.006	-	-	-
16/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1202	59.0	1.638	1.359	-	0.80	2	M	A	25	0.060	0.009	-	-	-
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1215	62.0	2.207	1.624	0.308	0.93	2	M	A	23	0.067	0.018	-	-	-
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1216	61.7	1.903	1.308	0.341	0.81	2	F	A	12	0.035	0.047	786	0.060	440
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1218	63.3	2.182	1.567	0.292	0.86	2	F	A	13	0.048	0.060	952	0.063	440
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1220	58.1	1.517	1.284	0.002	0.77	2	M	A	23	0.041	0.011	-	-	-
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1221	55.6	1.624	1.102	0.300	0.94	2	F	A	12	0.055	0.026	-	-	-
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1222	68.6	2.989	2.301	-	0.93	2	F	A	15	0.141	0.188	888	0.211	693
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1223	71.4	2.974	2.091	0.374	0.82	2	F	A	16	0.096	0.100	1257	0.080	410
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1235	69.7	2.806	1.976	0.377	0.83	2	F	A	16	0.070	0.141	1333	0.106	454
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1237	63.5	2.411	1.570	0.448	0.94	2	F	A	13	0.067	0.081	1090	0.074	450
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1239	62.1	2.620	2.089	0.195	1.09	2	M	A	22	0.071	0.015	-	-	-
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1241	72.1	3.162	2.503	-	0.84	2	F	A	16	0.148	0.125	1054	0.118	621

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1243	66.9	2.455	1.989	-	0.82	2	F	A	16	0.086	0.115	919	0.125	506
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1244	61.7	2.471	1.805	0.280	1.05	2	M	A	24	0.072	0.019	-	-	-
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1246	63.0	2.503	1.885	0.270	1.00	2	M	A	24	0.075	0.016	-	-	-
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1247	60.1	1.736	1.237	0.347	0.80	2	F	A	12	0.013	0.021	-	-	-
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1249	63.5	2.408	1.787	-	0.94	2	M	A	24	0.087	0.016	-	-	-
17/8/2015	NF	ML15FHNFMT1301	ML15UNFTHST1250	62.1	1.940	1.461	0.229	0.81	2	F	A	12	0.048	0.044	687	0.064	413
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1252	59.8	1.788	1.492	-	0.84	2	M	A	25	0.078	0.008	-	-	-
17/8/2015	NF	ML15FHNFMT1300	ML15UNFTHST1253	56.9	1.696	1.160	0.076	0.92	2	F	A	14	0.054	0.265	1076	0.246	792
9/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2000	64.4	2.425	1.459	0.661	0.91	2	F	A	17	0.051	0.031	-	-	-
9/8/2017	RA1	ML17FHRA1SN2400	ML17URA1THST2001	63.6	2.163	1.621	0.280	0.84	2	F	A	12	0.056	0.045	859	0.053	430
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2057	62.9	1.938	1.454	0.273	0.78	2	M	A	22	0.058	0.018	-	-	-
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2058	42.1	0.825	0.425	0.338	1.10	1	U	J	01	0.008	0.001	-	-	-
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2059	59.3	1.926	1.238	0.451	0.92	2	M	A	24	0.024	0.010	-	-	-
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2060	70.1	3.001	2.208	0.312	0.87	2	F	A	16	0.058	0.091	481	0.190	423
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2061	36.2	0.323	0.263	0.025	0.68	1	U	J	01	0.006	-	-	-	-
10/8/2017	RA1	ML17FHRA1MT2300	ML17URA1THST2062	67.5	2.633	1.968	0.355	0.86	2	M	A	22	0.051	0.021	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2063	60.6	1.875	1.143	0.517	0.84	2	F	A	17	0.021	0.025	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2064	66.4	2.714	1.881	0.559	0.93	2	M	A	25	0.048	0.023	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2065	56.7	1.252	0.993	0.121	0.69	2	F	A	17	0.021	0.020	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2066	60.5	2.312	1.570	0.528	1.04	2	M	A	22	0.036	0.010	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2067	40.7	0.448	0.388	-	0.67	1	M	A	22	0.008	0.002	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2068	68.5	2.164	1.530	0.379	0.67	2	F	A	12	0.033	0.035	276	0.127	411
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2069	61.6	1.839	1.188	0.387	0.79	2	F	A	12	0.015	0.049	476	0.103	420
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2070	66.4	3.115	2.219	0.049	1.07	2	F	A	16	0.057	0.100	961	0.104	419
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2071	44.8	0.621	0.482	-	0.69	1	F	A	17	0.017	0.006	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2072	61.6	2.042	1.485	0.328	0.87	2	M	A	22	0.028	0.013	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2073	60.0	1.748	1.462	-	0.81	2	F	A	17	0.072	0.022	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2074	64.2	2.556	1.773	0.365	0.97	2	F	A	16	0.068	0.161	1161	0.138	493
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2075	38.5	0.459	0.385	-	0.80	1	M	A	22	0.009	0.006	-	-	-
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2078[(a)]	66.3	2.409	1.601	0.471	0.83	2	F	A	12	0.042	0.089	696	0.129	369
10/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2079	76.5	4.425	2.748	0.644	0.99	2	F	A	14	0.079	0.461	1124	0.410	756
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2213	70.5	2.936	2.046	0.236	0.84	2	F	A	14	0.068	0.356	639	0.557	1204
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2214	63.5	1.986	1.466	0.323	0.78	2	F	A	17	0.045	0.025	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2215	44.4	0.814	0.523	0.222	0.93	1	M	A	22	0.007	0.002	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2216	65.7	2.023	1.532	0.240	0.71	2	F	A	17	0.047	0.048	916	0.052	416
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2217	56.1	1.381	0.933	0.304	0.78	2	F	A	17	0.027	0.017	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2218	62.6	1.873	1.310	0.314	0.76	2	F	A	17	0.050	0.027	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2219	53.6	1.144	0.848	0.196	0.75	2	F	A	17	0.018	0.008	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2220	68.2	2.728	1.808	0.486	0.86	2	F	A	12	0.088	0.077	502	0.153	438
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2221	66.8	2.877	1.843	0.646	0.97	2	F	A	12	0.056	0.081	968	0.084	343
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2222	60.6	1.759	1.166	0.430	0.79	2	M	A	22	0.021	0.011	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2223	60.2	1.908	1.506	0.059	0.88	2	M	A	22	0.063	0.025	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2224	53.8	1.494	1.010	0.296	0.96	2	F	A	17	0.041	0.020	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2225	53.5	1.555	0.834	0.606	1.02	2	M	A	23	0.022	-	-	-	-

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11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2226	70.0	2.756	1.925	0.505	0.81	2	M	A	22	0.067	0.009	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2227	57.1	1.572	1.104	0.267	0.85	2	M	A	22	0.032	0.016	-	-	-
11/8/2017	RA1	ML17FHRA1MT2304	ML17URA1THST2228	56.8	1.728	1.190	0.318	0.94	2	M	A	22	0.030	0.013	-	-	-
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2229	43.6	0.662	0.425	0.152	0.80	1	F	J	11	0.008	0.005	-	-	-
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2230	54.7	1.261	0.940	0.189	0.77	2	M	A	22	0.021	0.016	-	-	-
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2231	51.0	1.197	0.809	0.275	0.90	2	M	A	22	0.014	0.004	-	-	-
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2232	60.6	1.834	1.501	-	0.82	2	F	A	17	0.073	0.043	705	0.061	357
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2233	55.4	1.571	1.089	0.302	0.92	2	M	A	23	0.033	0.015	-	-	-
11/8/2017	RA1	ML17FHRA1MT2303	ML17URA1THST2234	60.8	2.040	1.366	0.458	0.91	2	F	A	17	0.032	0.031	-	-	-
11/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2239	52.5	1.322	0.920	0.274	0.91	2	M	A	23	0.014	0.010	-	-	-
11/8/2017	RA1	ML17FHRA1MT2302	ML17URA1THST2240	56.5	1.384	1.249	-	0.77	2	M	A	22	0.012	0.013	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2245	37.6	0.395	0.318	-	0.75	1	M	A	22	0.012	0.002	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2246	31.1	0.215	0.166	0.007	0.72	1	U	J	01	0.006	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2247	54.0	1.359	0.922	0.286	0.87	2	M	A	22	0.023	0.009	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2248	44.2	0.704	0.428	0.192	0.81	1	M	J	21	0.009	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2249	34.9	0.336	0.250	0.017	0.79	1	U	J	01	0.010	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2250	33.2	0.312	0.218	0.043	0.85	1	U	J	01	0.007	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2251	36.6	0.446	0.336	0.045	0.91	1	U	J	01	0.010	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2252	35.8	0.329	0.265	-	0.72	1	U	J	01	0.011	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2253	53.8	1.440	1.051	0.241	0.92	2	M	A	22	0.033	0.015	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2254	52.0	1.328	0.904	0.294	0.95	2	M	A	22	0.029	0.017	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2255	57.3	1.794	1.182	0.417	0.95	2	M	A	22	0.029	0.021	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2256	48.0	1.104	0.682	0.287	1.00	2	M	A	22	0.012	0.010	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2257	33.2	0.332	0.209	0.071	0.91	1	U	J	01	0.005	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2258	55.5	1.614	1.028	0.387	0.94	2	F	A	17	0.026	0.017	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2259	34.8	0.328	0.231	0.021	0.78	1	U	J	01	0.007	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2260	69.0	2.773	2.057	0.328	0.84	2	F	A	12	0.076	0.070	969	0.072	352
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2261	59.7	1.894	1.269	0.360	0.89	2	F	A	17	0.035	0.030	615	0.048	276
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2262	60.5	1.858	1.326	0.285	0.84	2	F	A	12	0.040	0.042	777	0.054	375
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2263	65.1	2.383	1.643	0.399	0.86	2	F	A	12	0.057	0.086	755	0.114	475
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2264	57.6	1.892	1.349	0.295	0.99	2	M	A	23	0.034	0.015	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2265	34.4	0.324	0.223	0.044	0.80	1	U	J	01	0.006	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2266	32.6	0.227	0.178	0.004	0.65	1	U	J	01	0.008	-	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2267	34.6	0.299	0.250	-	0.72	1	F	J	11	0.005	0.001	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2268	48.3	1.033	0.776	0.127	0.92	2	F	A	17	0.019	0.006	-	-	-
12/8/2017	RA1	ML17FHRA1BP2001	ML17URA1THST2269	50.8	1.170	0.726	0.260	0.89	2	F	A	12	0.016	0.012	-	-	-
12/8/2017	RA1	ML17FHRA1MT2306	ML17URA1THST2270	67.3	2.539	1.739	0.551	0.83	2	F	A	12	0.042	0.051	354	0.144	422
12/8/2017	RA1	ML17FHRA1MT2306	ML17URA1THST2271	71.5	3.019	2.268	0.334	0.83	2	F	A	12	0.057	0.146	616	0.237	492
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2335	37.3	0.397	0.281	0.048	0.77	1	F	J	11	0.009	0.001	-	-	-
13/8/2017	RA1	ML17FHRA1BP2002	ML17URA1THST2336	38.2	0.462	0.381	-	0.83	1	M	A	22	0.008	0.005	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2337	38.6	0.430	0.313	0.056	0.75	1	U	J	01	0.013	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2338	35.9	0.346	0.284	0.024	0.75	1	U	J	01	0.007	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2339	37.0	0.379	0.285	0.030	0.75	1	F	J	11	0.012	0.003	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2340	37.9	0.423	0.283	0.061	0.78	1	F	J	11	0.006	0.002	-	-	-

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2341	38.1	0.437	0.307	0.039	0.79	1	U	J	01	0.010	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2342	39.7	0.423	0.340	0.008	0.67	1	F	J	11	0.012	0.005	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2343	37.3	0.416	0.326	-	0.80	1	U	J	01	0.011	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2344	37.8	0.502	0.320	0.117	0.93	1	M	J	21	0.010	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2345	66.9	2.792	1.786	0.576	0.93	2	F	A	17	0.077	0.072	931	0.077	384
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2346	39.9	0.451	0.355	-	0.71	1	F	J	11	0.014	0.006	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2347	62.6	2.280	1.545	0.473	0.93	2	F	A	17	0.039	0.035	517	0.068	316
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2348	41.7	0.511	0.441	-	0.70	1	F	J	11	0.013	0.005	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2349	40.4	0.444	0.379	-	0.67	1	M	A	22	0.009	0.001	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2350	39.9	0.420	0.369	-	0.66	1	F	J	11	0.009	0.003	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2351	40.9	0.472	0.393	-	0.69	1	F	J	11	0.011	0.002	-	-	-
13/8/2017	RA1	ML17FHRA1MT2307	ML17URA1THST2352	40.4	0.587	0.494	-	0.89	1	F	A	17	0.022	0.013	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2353	37.2	0.412	0.344	-	0.80	1	U	J	01	0.015	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2354	38.6	0.442	0.318	0.065	0.77	1	U	J	01	0.023	-	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2355	64.5	2.316	1.469	0.616	0.86	2	M	A	25	0.033	0.012	-	-	-
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2356	69.1	2.759	2.229	-	0.84	2	F	A	16	0.094	0.069	425	0.163	384
13/8/2017	RA1	ML17FHRA1MT2305	ML17URA1THST2357	65.3	2.297	1.779	0.025	0.82	2	F	A	12	0.139	0.063	950	0.066	356
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3000	64.8	2.341	1.856	0.370	0.86	2	M	A	23	0.067	0.017	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3001	60.1	2.555	1.669	0.331	1.18	2	F	A	12	0.053	0.050	1127	0.044	404
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3002	49.5	1.038	0.710	0.197	0.86	2	M	A	22	0.029	0.009	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3003	33.9	0.298	0.240	-	0.76	1	U	J	01	0.006	-	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3004	51.7	1.103	0.850	0.216	0.80	2	M	A	22	0.033	0.018	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3005	55.6	1.317	0.793	0.161	0.77	2	F	A	17	0.029	0.011	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3006	52.5	1.326	0.892	0.286	0.92	2	M	A	22	0.029	0.015	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3007	66.2	2.484	1.866	0.211	0.86	2	F	A	12	0.072	0.064	957	0.067	385
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3008	60.9	1.988	1.448	0.246	0.88	2	F	A	12	0.066	0.034	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3009	54.9	1.606	1.063	0.334	0.97	2	M	A	22	0.032	0.018	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3010	57.1	1.596	1.095	0.328	0.86	2	F	A	12	0.032	0.023	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3011	61.8	1.782	1.475	0.071	0.76	2	F	A	12	0.070	0.034	763	0.044	345
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3012	58.5	1.736	1.476	-	0.87	2	M	A	23	0.064	0.023	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3013	48.0	0.911	0.605	0.206	0.83	1	M	J	21	0.018	0.002	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3014	53.8	1.147	0.972	-	0.74	2	M	A	22	0.028	0.024	-	-	-
14/8/2017	RA2	ML17FHRA2BP3000	ML17URA2THST3015	45.3	0.840	0.450	0.258	0.90	1	F	J	11	0.006	0.007	979	0.007	167
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3035	55.6	1.702	1.028	0.400	0.99	2	F	A	17	0.036	0.033	1554	0.021	301
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3036	65.9	2.371	1.729	0.323	0.83	2	F	A	17	0.046	0.071	1262	0.056	338
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3037	45.2	0.781	0.492	0.178	0.85	1	F	J	11	0.014	0.007	-	-	-
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3038	71.8	2.812	2.002	0.353	0.76	2	F	A	12	0.058	0.098	1648	0.059	395
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3039	58.2	1.732	1.238	0.327	0.88	2	M	A	22	0.032	0.016	-	-	-
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3040	60.2	1.843	1.361	0.241	0.85	2	M	A	22	0.062	0.022	-	-	-
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3041	63.2	2.715	1.642	0.873	1.08	2	M	A	22	0.038	0.021	-	-	-
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3042	51.9	1.108	0.779	0.294	0.79	2	F	J	11	0.016	0.008	328	0.024	210
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3043	63.2	1.857	1.613	-	0.74	2	M	A	22	0.055	0.016	-	-	-
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3044	70.4	2.828	2.120	0.426	0.81	2	F	A	16	0.080	0.093	1524	0.061	381
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3045	60.6	1.932	1.425	0.361	0.87	2	M	A	25	0.039	0.009	-	-	-

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
15/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3046	59.3	1.748	1.179	0.535	0.84	2	F	A	12	0.040	0.050	511	0.099	393
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3047	48.8	1.037	0.716	0.207	0.89	1	F	J	11	0.026	0.010	-	-	-
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3048	64.0	2.325	1.535	0.522	0.89	2	F	A	12	0.045	0.056	496	0.113	461
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3049	57.8	1.512	0.987	0.335	0.78	2	M	A	23	0.021	0.012	-	-	-
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3050	37.4	0.448	0.315	0.098	0.86	1	U	J	01	0.004	-	-	-	-
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3051	57.5	1.753	1.195	0.383	0.92	2	F	A	17	0.031	0.019	319	0.061	284
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3052	66.7	2.392	1.746	0.222	0.81	2	F	A	16	0.054	0.098	1238	0.079	433
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3053	67.4	2.285	1.629	0.269	0.75	2	F	A	13	0.056	0.089	1606	0.055	453
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3054	62.0	2.147	1.402	0.434	0.90	2	F	A	12	0.046	0.049	462	0.106	444
15/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3055	60.9	1.651	1.393	-	0.73	2	F	A	12	0.069	0.026	483	0.055	346
16/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3109	58.5	1.751	1.366	0.111	0.88	2	M	A	22	0.044	0.036	-	-	-
16/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3110	72.1	3.223	2.079	0.424	0.86	2	F	A	15	0.071	0.302	570	0.530	956
16/8/2017	RA2	ML17FHRA2MT3300	ML17URA2THST3114	57.0	1.157	1.005	-	0.63	2	M	A	22	0.039	0.030	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3115	35.8	0.384	0.259	0.048	0.84	1	F	J	11	0.010	0.002	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3116	37.8	0.433	0.313	0.023	0.80	1	U	J	01	0.016	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3117	38.5	0.417	0.342	-	0.73	1	M	A	22	0.010	0.002	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3118	36.9	0.398	0.283	0.050	0.79	1	U	J	01	0.012	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3119	38.9	0.397	0.325	-	0.67	1	U	J	01	0.010	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3120	67.3	2.197	1.856	-	0.72	2	F	A	16	0.053	0.070	682	0.102	372
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3121	36.7	0.364	0.303	-	0.73	1	U	J	01	0.012	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3122	39.2	0.388	0.309	-	0.65	1	F	J	11	0.013	0.003	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3123	39.6	0.453	0.359	-	0.73	1	F	J	11	0.014	0.003	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3124	47.8	0.834	0.544	0.196	0.76	1	F	J	11	0.014	0.007	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3125	55.0	1.397	1.006	0.221	0.84	2	M	A	22	0.033	0.008	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3126	44.7	0.589	0.408	-	0.66	1	F	J	11	0.031	0.006	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3127	41.5	0.506	0.409	-	0.71	1	M	J	21	0.019	0.004	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3128	42.4	0.583	0.452	0.039	0.77	1	M	J	21	0.017	0.005	-	-	-
16/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3132	57.3	1.406	1.236	-	0.75	2	M	A	-	0.036	0.003	-	-	-
16/8/2017	RA2	ML17FHRA2MT3302	ML17URA2THST3133	51.2	1.193	0.815	0.223	0.89	2	F	A	17	0.029	0.015	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3134	38.3	0.385	0.314	-	0.69	1	F	J	01	0.008	0.001	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3135	41.7	0.504	0.493	-	0.70	1	F	J	11	0.015	0.004	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3136	41.1	0.537	0.356	0.110	0.77	1	U	J	01	0.013	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3137	36.0	0.369	0.285	-	0.79	1	U	J	01	0.012	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3138	42.7	0.513	0.428	-	0.66	1	F	J	11	0.018	0.005	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3139	40.6	0.492	0.396	-	0.73	1	F	J	11	0.020	0.004	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3140	40.1	0.451	0.376	-	0.70	1	F	J	11	0.016	0.005	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3141	61.6	2.424	1.481	0.398	1.03	2	F	A	14	0.061	0.252	578	0.436	986
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3142	41.1	0.448	0.382	-	0.64	1	U	J	01	0.016	-	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3143	55.8	1.661	1.171	0.221	0.96	2	F	A	12	0.045	0.025	-	-	-
16/8/2017	RA2	ML17FHRA2MT3301	ML17URA2THST3144	36.6	0.356	0.248	0.030	0.73	1	F	J	11	0.010	0.003	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3178	40.1	0.448	0.386	-	0.69	1	M	A	22	0.011	0.003	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3179	35.7	0.434	0.312	0.049	0.95	1	F	J	11	0.010	0.002	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3180	70.5	2.885	2.058	0.367	0.82	2	F	A	16	0.058	0.173	932	0.186	583
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3181	40.2	0.493	0.418	-	0.76	1	M	J	21	0.015	0.002	-	-	-

Date (d/m/y)	Sampling Area	Effort Number	FIN Number	Total Length (mm)	Total Weight (g)	Carcass Weight (g)	Parasite Weight[(b)] (g)	Condition Factor	Age[(c)]	Sex	Life Stage	Maturity[(d)]	Liver Weight (g)	Gonad Weight (g)	Fecundity	Mean Egg Weight (mg)	Mean Egg Diameter (µm)
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3183	55.9	1.414	1.088	0.185	0.81	2	F	A	17	0.026	0.016	578	0.027	224
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3184	59.7	1.576	1.350	-	0.74	2	M	A	23	0.031	0.008	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3185	39.2	0.465	0.338	0.069	0.77	1	F	J	11	0.014	0.003	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3186	56.4	1.268	1.103	-	0.71	2	F	A	12	0.041	0.023	463	0.050	354
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3187	62.2	2.160	1.789	0.060	0.90	2	M	A	22	0.056	0.030	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3188	38.3	0.417	0.351	-	0.74	1	F	J	11	0.012	0.004	-	-	-
17/8/2017	RA2	ML17FHRA2MT3305	ML17URA2THST3189	72.0	3.081	2.210	0.379	0.83	2	F	A	12	0.095	0.113	1101	0.103	481
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3190	69.8	2.286	1.906	0.008	0.67	2	F	A	12	0.076	0.048	1122	0.043	346
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3191	60.1	1.593	1.402	-	0.73	2	M	A	22	0.025	0.012	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3192	58.2	1.329	1.169	-	0.68	2	M	A	22	0.021	0.007	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3193	57.9	1.311	1.155	0.014	0.68	2	M	A	23	0.021	0.007	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3194	60.3	1.998	1.357	0.438	0.91	2	M	A	22	0.047	0.020	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3195	60.5	1.892	1.374	0.276	0.85	2	M	A	23	0.043	0.022	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3196	61.5	1.690	1.477	-	0.73	2	M	A	25	0.035	0.005	-	-	-
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3197	69.0	2.195	1.822	-	0.67	2	F	A	12	0.073	0.063	1100	0.057	409
17/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3198	63.1	1.977	1.333	0.450	0.79	2	F	A	12	0.039	0.028	1084	0.026	244
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3335	36.2	0.434	0.253	0.110	0.92	1	U	J	01	0.007	-	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3336	57.4	1.505	1.230	0.082	0.80	2	M	A	22	0.030	0.013	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3337	41.4	0.548	0.361	0.126	0.77	1	U	J	01	0.012	-	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3338	57.7	1.582	1.366	-	0.82	2	M	A	22	0.039	0.026	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3339	63.8	2.206	1.566	0.393	0.85	2	M	A	22	0.031	0.026	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3340	58.8	1.820	1.270	0.367	0.89	2	M	A	22	0.025	0.018	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3341	49.0	0.944	0.667	0.196	0.80	2	F	J	11	0.018	0.006	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3342	51.4	1.164	0.831	0.220	0.86	2	F	A	13	0.029	0.010	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3343	57.3	1.454	1.273	-	0.77	2	M	A	22	0.038	0.010	-	-	-
18/8/2017	RA2	ML17FHRA2MT3304	ML17URA2THST3344	48.4	0.814	0.683	-	0.72	1	M	A	22	0.025	0.018	-	-	-

a) Otoliths collected and archived.
b) Suspected to be *Schistocephalus solidus* .
c) Designated based on the length-frequency distributions.
d) Refer to Table 2 for maturity codes designations.
d = day; m = month; y = year; NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mm = millimetre; g = gram; F = female; M = male; U = unknown; A = adult; J = juvenile; mg = milligram; µm = micrometre; - = not recorded or not applicable.

Table 6B-4: Statistical Outliers Omitted from Analysis

Sex	Parasites	Parameter	Dependent	Covariate	Statistical Test	Fish Identification Number	Studentized Residual
Female	Included	Size-at-age	Total weight	Age 1+	ANOVA	ML15UNFTHST1017	3.22
		Body weight	Total weight	-	ANOVA	ML17URA1THST2079	3.72
		Length	Length	-	ANOVA	ML17URA1THST2352	-3.65
		Relative gonad size	Gonad weight	Total weight	ANCOVA	ML15UNFTHST1070	3.72
						ML17URA1THST2352	3.68
		Relative gonad size	Gonad weight	Length	ANCOVA	ML17URA1THST2352	4.44
		Condition	Total weight	Length	ANCOVA	ML17URA1THST2079	4.62
			Carcass weight	Length	ANCOVA	ML17URA1THST2352	3.52
		Relative liver size	Liver weight	Total weight	ANCOVA	ML15UNFTHST1247	-3.93
				Carcass weight	ANCOVA	ML15UNFTHST1247	-4.61
				Length	ANCOVA	ML15UNFTHST1247	-4.29
						ML17URA1THST2069	-3.45
Male	Included	Size-at-age	Length	Age 1+	ANOVA	ML17URA2THST3344	3.16
		Condition	Total weight	Length	ANCOVA	ML17URA2THST3041	3.7
			Carcass weight	Length	ANCOVA	ML15UNFTHST1239	3.5
	Excluded	Size-at-age	Total weight	Age 2+	ANOVA	ML15UNFTHST1070	-3.14
		Relative gonad size	Gonad weight	Total weight	ANCOVA	ML15UNFTHST1222	4.57
				Carcass weight	ANCOVA	ML15UNFTHST1222	4.92
				Length	ANCOVA	ML15UNFTHST1222	4.29
		Length	Length	-	ANCOVA	ML17URA2THST3117	-2.98
		Condition	Total weight	Length	ANCOVA	ML15UNFTHST1249	3.3
		Relative liver size	Liver weight	Total weight	ANCOVA	ML17URA2THST3012	3.14

Note: Outlier threshold defined as a studentized residual greater than |3.0|.
ANOVA = analysis of variance; ANCOVA = analysis of covariance; - = not applicable.

Table 6B-5: Abnormality Assessment for Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

FIN Number	External Assessment										Internal Assessment					
	Body Deformity	Eyes	Skin[a]	Thymus[b]	Opercula	Gills	Pseudo-branchs	Fins[c]	Vent[d]	Parasites[e]	Liver[f]	Spleen[g]	Gall Bladder	Mesentaric Fat[h] (%)	Parasites[e]	Kidney[i]
ML15UNFTHST1001	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1003	N	N	0	0	0	N	N	0	0	0	C	B	0	1	2	N
ML15UNFTHST1004	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML15UNFTHST1005	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1006	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1007	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML15UNFTHST1009	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1010	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1012	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1013	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1014	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1016	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1017	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1019	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1020	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1022	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1023	N	N	0	1	0	N	N	0	1	0	A	B	0	0	2	N
ML15UNFTHST1024	N	N	0	0	0	N	N	0	0	0	C	B	0	0	2	N
ML15UNFTHST1052	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1053	N	N	0	0	0	N	N	0	0	0	C	B	0	1	2	N
ML15UNFTHST1054	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1055	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1057	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1058	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1059	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1062	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1065	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1067	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1068	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1069	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1070	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1071	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1072	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML15UNFTHST1073	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1074	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1075	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1076	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1080	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1081	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML15UNFTHST1084	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1085	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1086	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1087	N	N	0	0	0	N	N	0	0	0	C	B	0	1	2	N
ML15UNFTHST1088	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1089	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1108	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1119	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1120	N	N	0	0	0	N	N	0	0	0	C	B	0	3	2	N
ML15UNFTHST1122	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML15UNFTHST1123	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1124	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1125	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1126	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1127	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1128	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1129	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1138	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1139	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1140	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1142	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1143	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1144	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1145	N	N	0	0	0	N	N	0	0	0	A	B	0	1	1	N
ML15UNFTHST1146	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1149	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1152	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML15UNFTHST1153	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1154	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1155	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1156	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1162	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1198	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1199	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	S
ML15UNFTHST1200	N	N	0	0	0	N	N	0	0	0	C	B	0	3	0	N
ML15UNFTHST1201	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	S
ML15UNFTHST1202	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	S
ML15UNFTHST1215	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML15UNFTHST1216	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1218	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1220	N	N	0	0	0	N	N	0	0	0	A	B	0	1	1	N

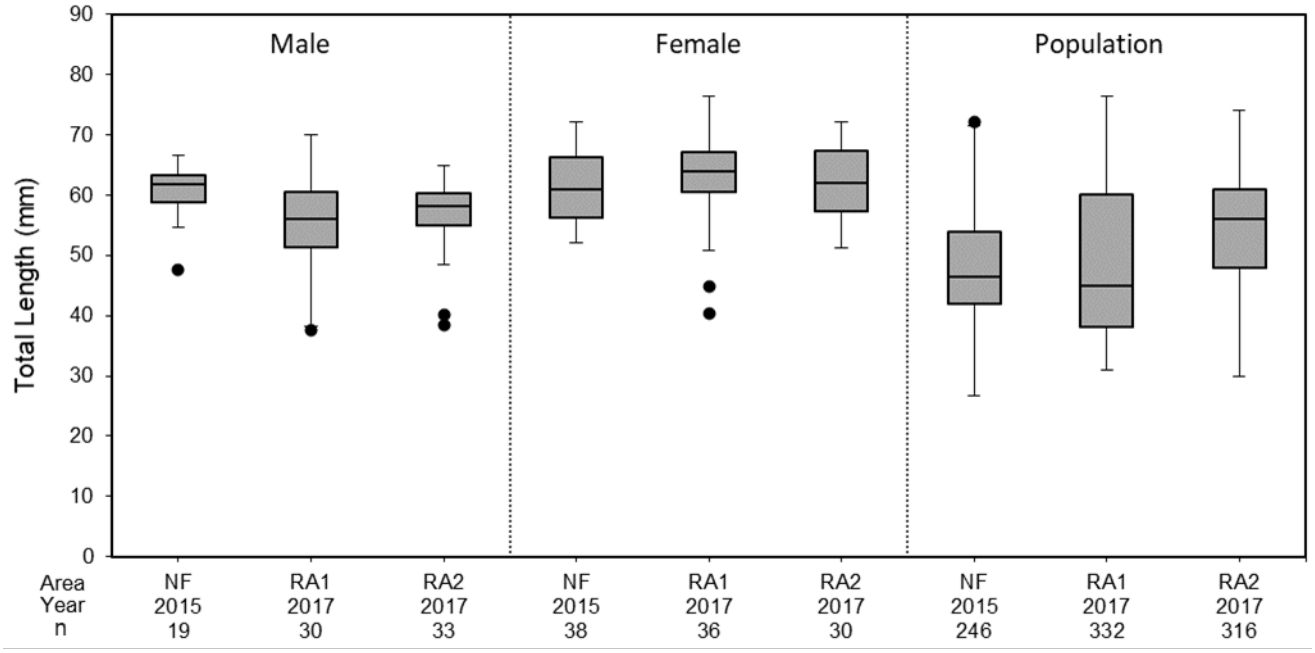
FIN Number	External Assessment										Internal Assessment					
	Body Deformity	Eyes	Skin[a]	Thymus[b]	Opercula	Gills	Pseudo-branchs	Fins[c]	Vent[d]	Parasites[e]	Liver[f]	Spleen[g]	Gall Bladder	Mesentaric Fat[h] (%)	Parasites[e]	Kidney[i]
ML15UNFTHST1221	N	N	0	0	0	N	N	0	0	0	C	B	0	1	2	N
ML15UNFTHST1222	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1223	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1235	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1237	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML15UNFTHST1239	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1241	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1243	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML15UNFTHST1244	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1246	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1247	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1249	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	S
ML15UNFTHST1250	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML15UNFTHST1252	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S
ML15UNFTHST1253	N	N	0	0	0	N	N	0	1	0	A	B	0	1	2	N
ML17URA1THST2000	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA1THST2001	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2057	N	N	0	0	0	N	N	0	0	0	A	B	0	1	1	N
ML17URA1THST2058	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2059	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2060	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2061	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2062	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2063	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2064	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2065	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2066	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2067	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	N
ML17URA1THST2068	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2069	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2070	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2071	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	N
ML17URA1THST2072	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2073	N	N	0	0	0	N	N	0	0	0	C	B	0	2	0	N
ML17URA1THST2074	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2075	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML17URA1THST2078	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2079	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2213	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2214	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2215	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA1THST2216	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2217	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2218	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2219	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2220	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2221	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2222	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2223	N	N	0	0	0	N	N	0	0	0	C	B	0	1	1	S
ML17URA1THST2224	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2225	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2226	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2227	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2228	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2229	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2230	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2231	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2232	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA1THST2233	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2234	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2239	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2240	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML17URA1THST2245	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML17URA1THST2246	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2247	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2248	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2249	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2250	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2251	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2252	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA1THST2253	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2254	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA1THST2255	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA1THST2256	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2257	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2258	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2259	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2260	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2261	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2262	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA1THST2263	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N

FIN Number	External Assessment										Internal Assessment					
	Body Deformity	Eyes	Skin[a]	Thymus[b]	Opercula	Gills	Pseudo-branchs	Fins[c]	Vent[d]	Parasites[e]	Liver[f]	Spleen[g]	Gall Bladder	Mesentaric Fat[h] (%)	Parasites[e]	Kidney[i]
ML17URA1THST2264	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2265	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2266	N	N	0	0	0	N	N	0	0	0	A	B	0	1	1	N
ML17URA1THST2267	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2268	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2269	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2270	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2271	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2335	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2336	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	N
ML17URA1THST2337	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2338	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2339	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2340	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2341	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2342	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2343	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2344	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA1THST2345	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2346	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2347	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA1THST2348	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2349	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2350	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2351	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2352	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2353	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA1THST2354	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA1THST2355	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA1THST2356	N	N	0	0	0	N	N	1	0	0	A	B	0	1	0	N
ML17URA1THST2357	N	N	0	0	0	N	N	1	0	0	A	B	0	2	1	S
ML17URA2THST3000	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	S
ML17URA2THST3001	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3002	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3003	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3004	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3005	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3006	N	N	1	0	0	N	N	0	0	0	A	B	0	1	2	S
ML17URA2THST3007	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3008	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3009	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3010	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3011	N	N	0	0	0	N	N	0	0	0	C	B	0	2	2	N
ML17URA2THST3012	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	S
ML17URA2THST3013	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3014	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	S
ML17URA2THST3015	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA2THST3035	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3036	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3037	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3038	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3039	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3040	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3041	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA2THST3042	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3043	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S
ML17URA2THST3044	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3045	N	N	0	0	0	N	N	0	0	0	C	B	0	1	2	N
ML17URA2THST3046	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3047	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3048	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3049	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3050	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA2THST3051	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3052	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3053	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3054	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3055	N	N	0	0	0	N	N	0	0	0	C	B	0	2	0	N
ML17URA2THST3109	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	S
ML17URA2THST3110	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA2THST3114	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	S
ML17URA2THST3115	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3116	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3117	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3118	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3119	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3120	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3121	N	N	0	0	0	N	N	0	0	0	C	B	0	2	0	N
ML17URA2THST3122	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	N
ML17URA2THST3123	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3124	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N

FIN Number	External Assessment										Internal Assessment					
	Body Deformity	Eyes	Skin[a]	Thymus[b]	Opercula	Gills	Pseudo-branchs	Fins[c]	Vent[d]	Parasites[e]	Liver[f]	Spleen[g]	Gall Bladder	Mesentaric Fat[h] (%)	Parasites[e]	Kidney[i]
ML17URA2THST3125	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3126	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3127	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML17URA2THST3128	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3132	N	N	0	0	0	N	N	0	0	0	C	B	0	3	0	S
ML17URA2THST3133	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3134	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3135	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3136	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3137	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3138	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3139	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3140	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3141	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA2THST3142	N	N	0	0	0	N	N	0	0	0	A	B	0	2	0	N
ML17URA2THST3143	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3144	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3178	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3179	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3180	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3181	N	N	0	0	0	N	N	0	0	0	C	B	0	1	0	N
ML17URA2THST3183	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3184	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S
ML17URA2THST3185	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3186	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3187	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	S
ML17URA2THST3188	N	N	0	0	0	N	N	0	0	0	C	B	0	2	0	N
ML17URA2THST3189	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	S
ML17URA2THST3190	N	N	0	0	0	N	N	0	0	0	A	B	0	2	1	N
ML17URA2THST3191	N	N	0	0	0	N	N	0	0	0	C	B	0	0	0	S
ML17URA2THST3192	N	N	0	0	0	N	N	1	0	0	A	B	0	0	0	S
ML17URA2THST3193	N	N	0	0	0	N	N	0	0	0	C	B	0	1	1	S
ML17URA2THST3194	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA2THST3195	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA2THST3196	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S
ML17URA2THST3197	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	N
ML17URA2THST3198	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA2THST3335	N	N	0	0	0	N	N	0	0	0	A	B	0	1	3	N
ML17URA2THST3336	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3337	N	N	0	0	0	N	N	0	0	0	A	B	0	2	2	N
ML17URA2THST3338	N	N	0	0	0	N	N	0	0	0	A	B	0	0	0	S
ML17URA2THST3339	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3340	N	N	0	0	0	N	N	0	0	0	A	B	0	0	3	N
ML17URA2THST3341	N	N	0	0	0	N	N	0	0	0	A	B	0	1	2	N
ML17URA2THST3342	N	N	0	0	0	N	N	0	0	0	A	B	0	0	2	N
ML17URA2THST3343	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S
ML17URA2THST3344	N	N	0	0	0	N	N	0	0	0	A	B	0	1	0	S

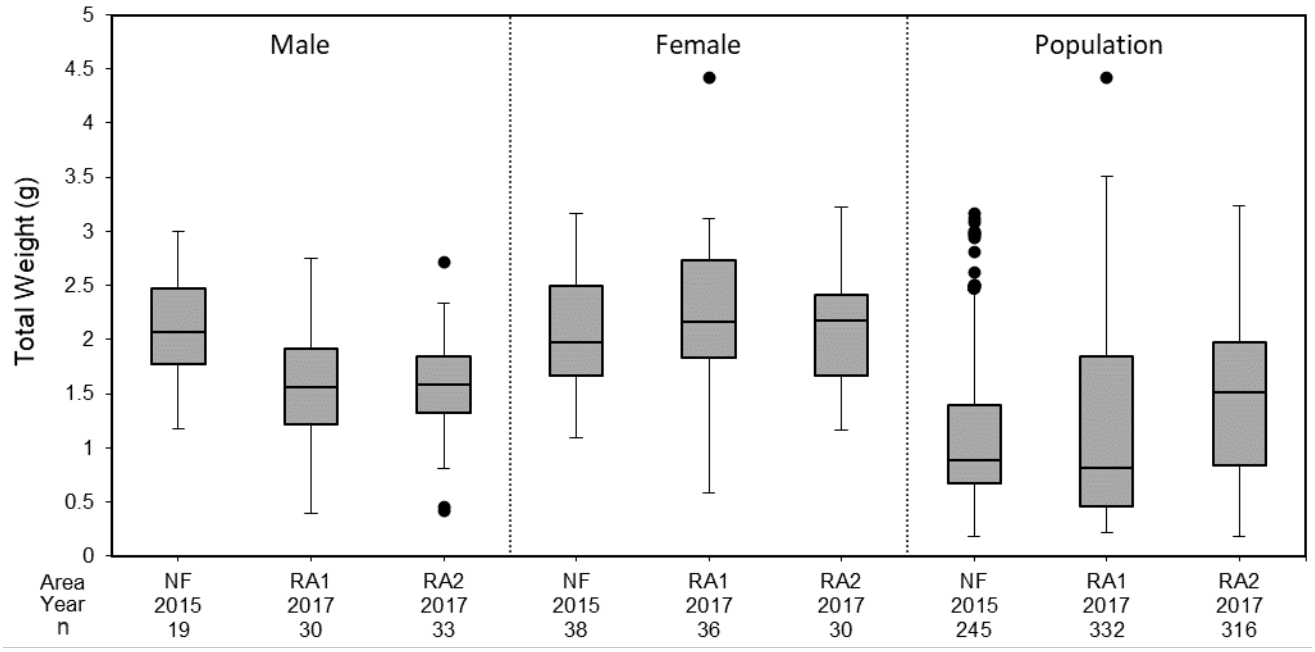
a) 1 = minor skin aberration.
b) 1 = mild hemorrhage.
c) 1 = minor erosion.
d) 1 = slight inflammation or reddening.
e) 1 = few observed parasites; 2 = moderate parasite infestation; 3 = numerous parasites.
f) A = normal; C = "fatty" liver.
g) B = normal.
h) 0 = none; 1 = <50%; 2 = 50%; 3 = >50%.
i) S = swollen
% = percent; N or 0 = normal, no deformities or aberrations observed.

Boxplots



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mm= millimetre; n = sample size.

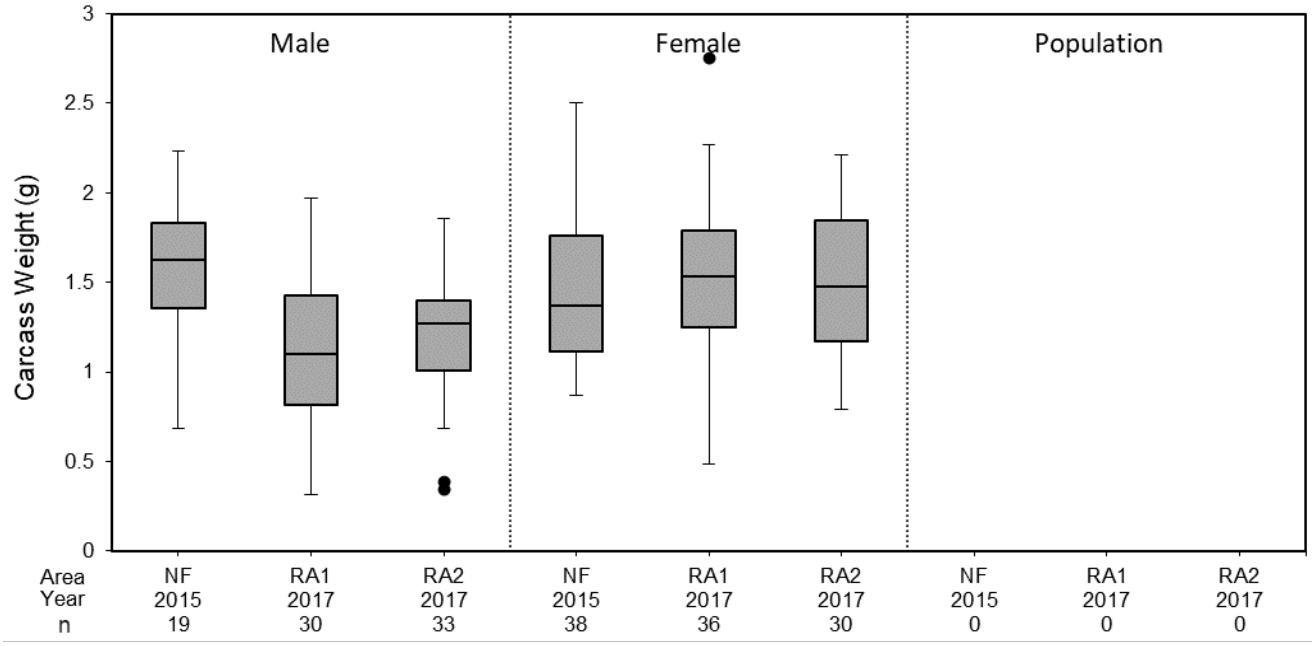
Figure 6C-1: Total Length of Male, Female, and Population of Threespine Stickleback Captured from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

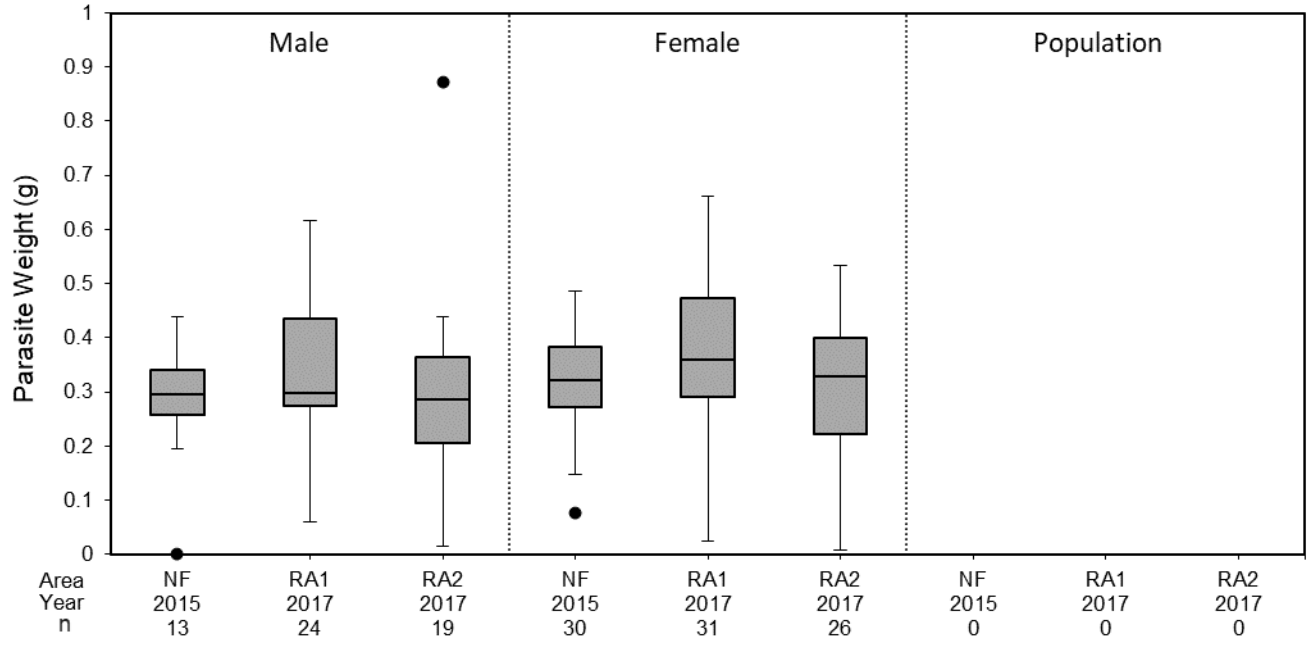
Figure 6C-2: Total Weight of Male, Female, and Population of Threespine Stickleback Captured from Meliadine Lake, 2015 and 2017

Boxplots



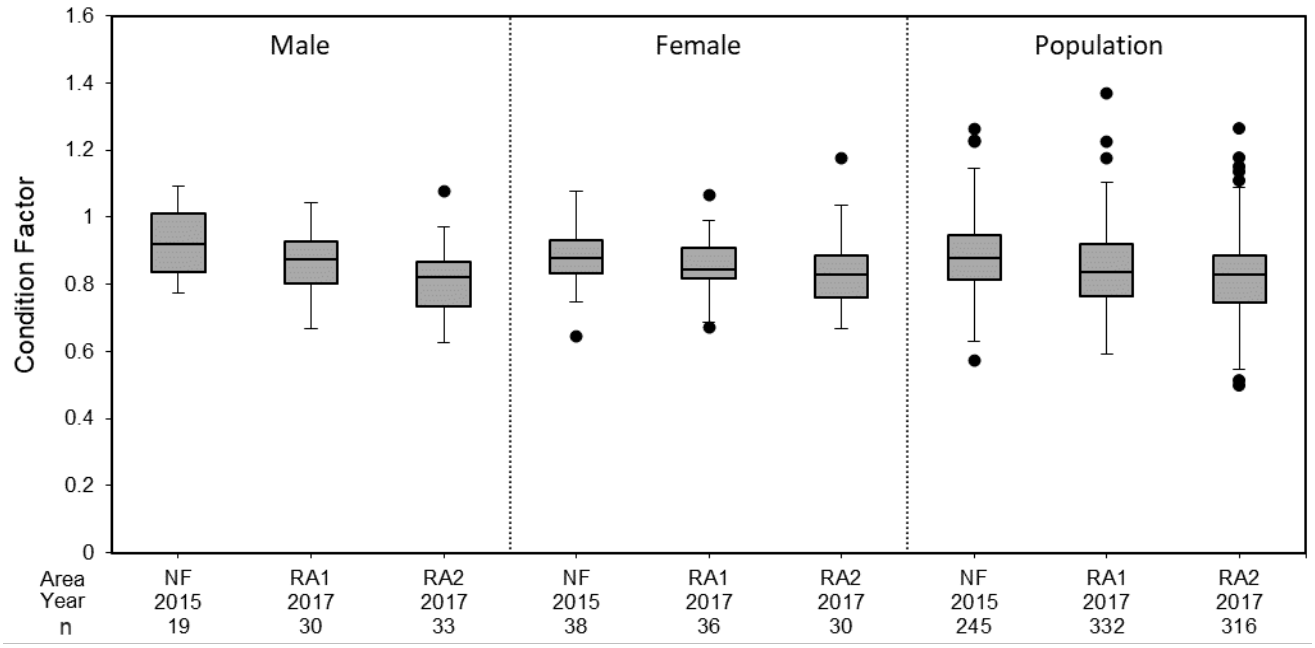
NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

Figure 6C-3: Carcass Weight of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



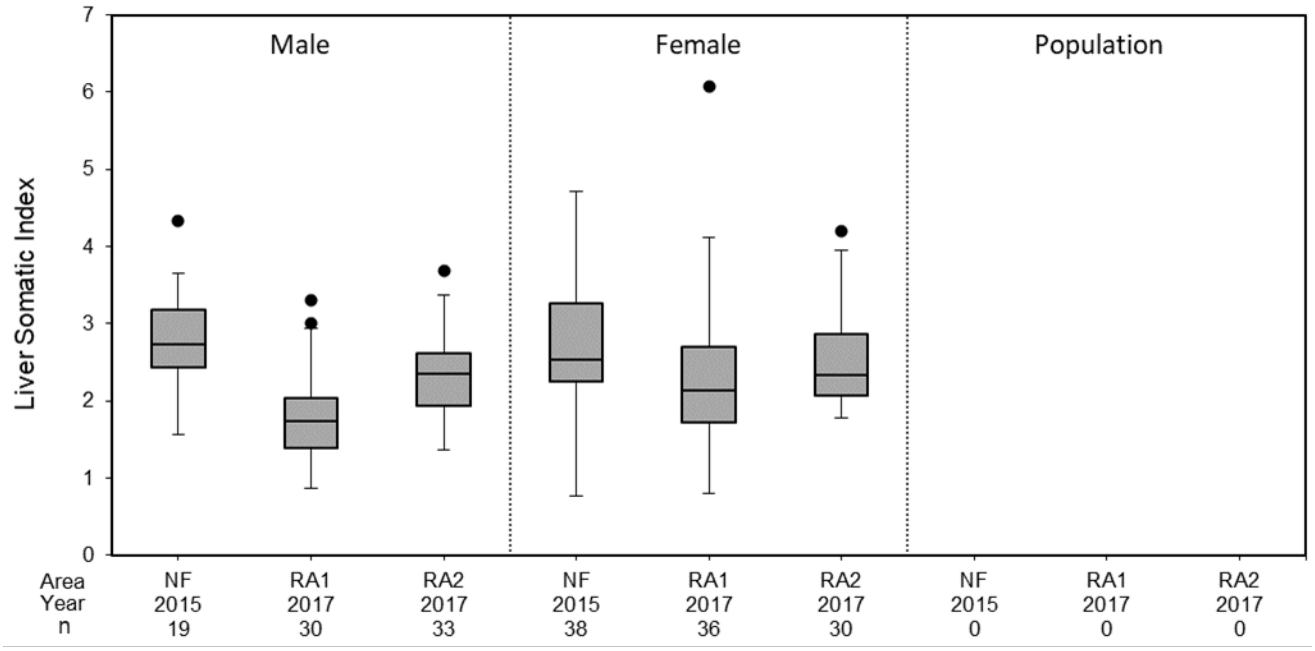
NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

Figure 6C-4: Parasite Weight of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

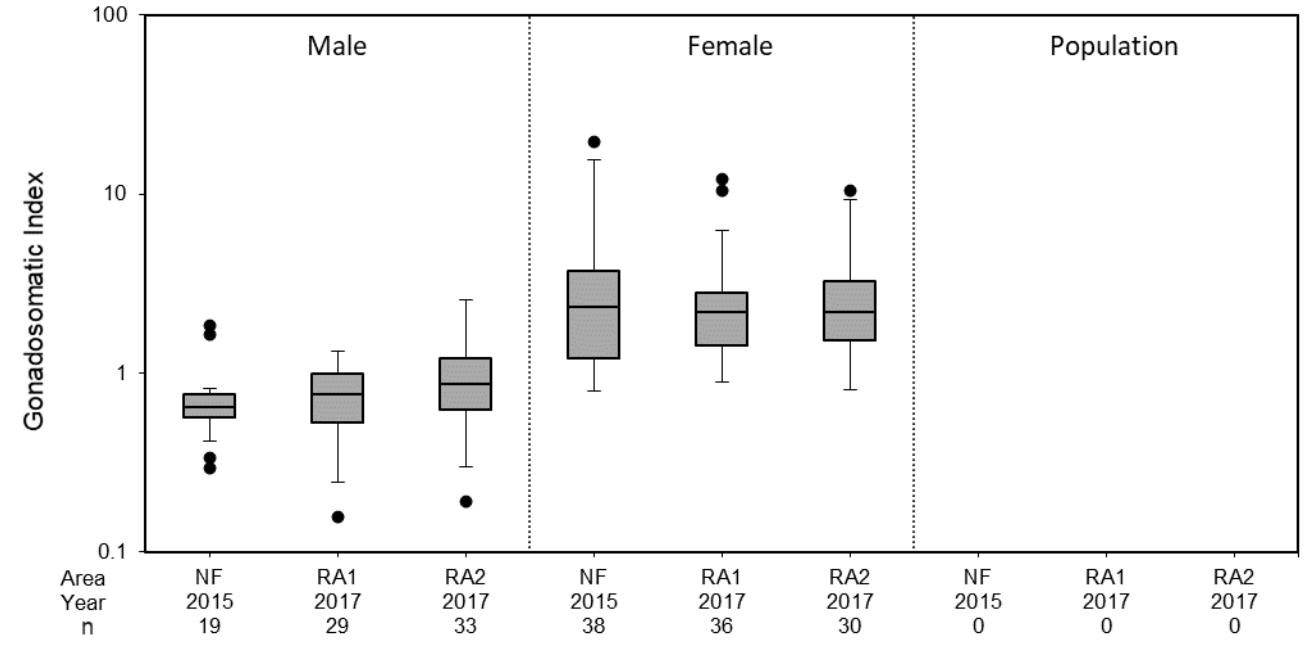
Figure 6C-5: Condition Factors of Male, Female, and Population of Threespine Stickleback Captured from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

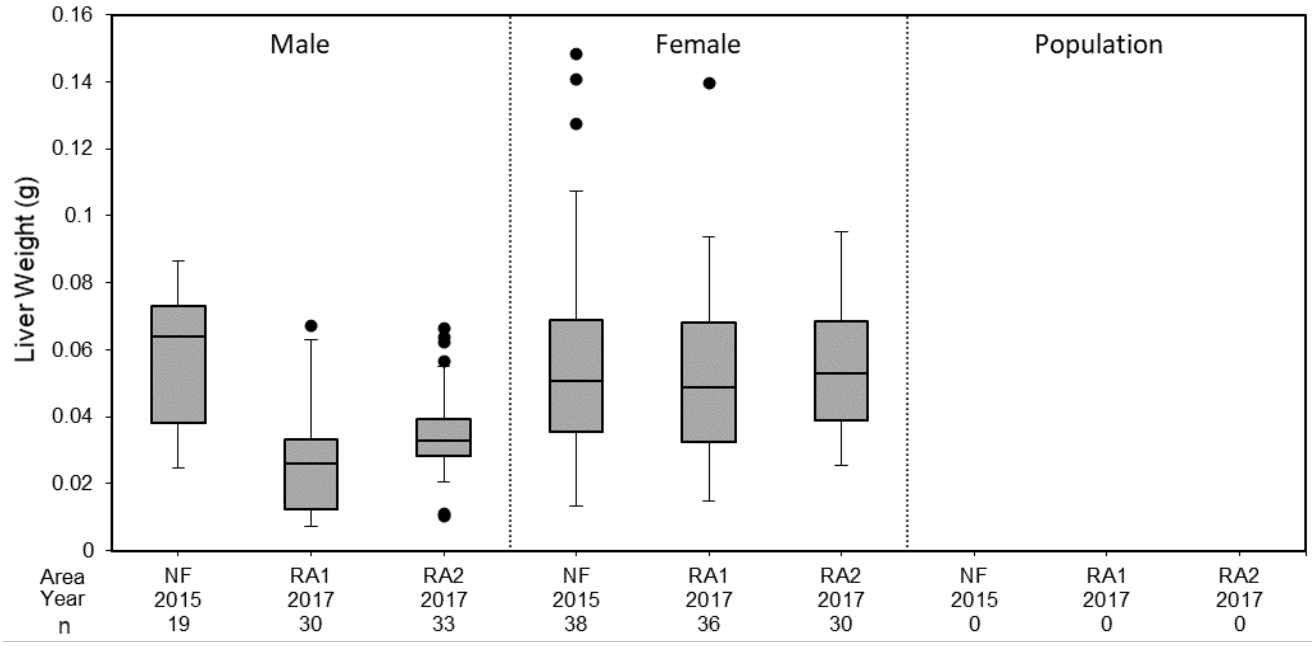
Figure 6C-6: Liver Somatic Index of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Boxplots



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

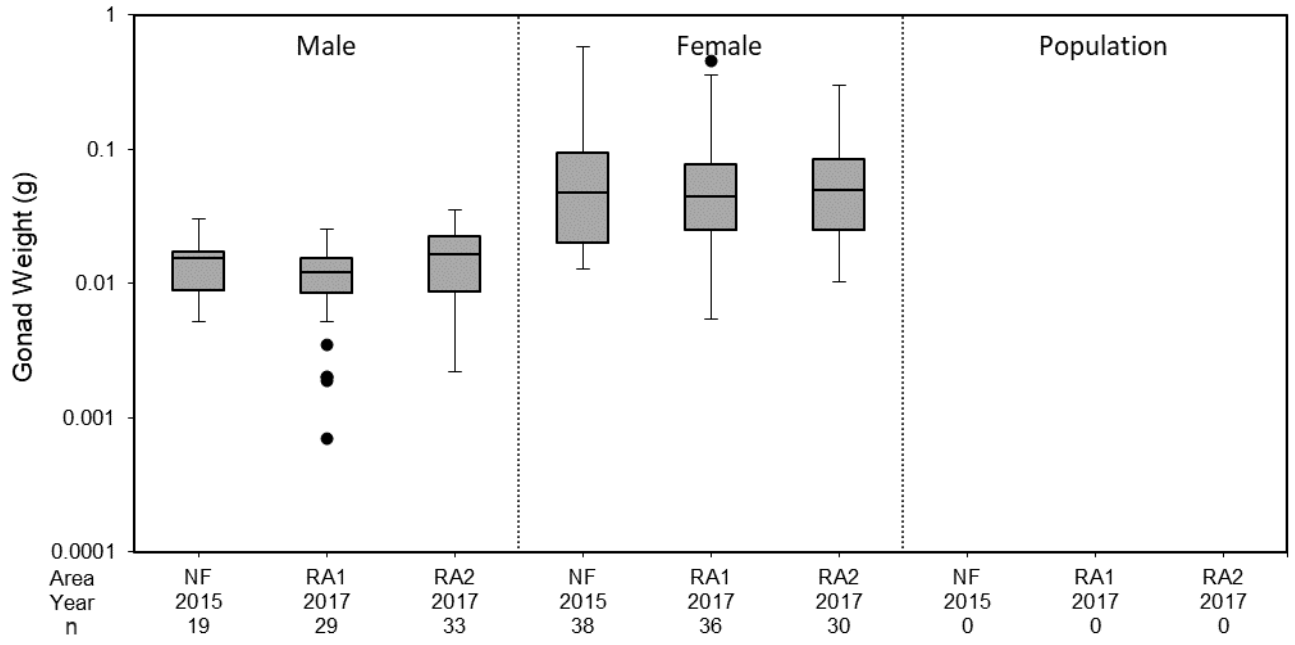
Figure 6C-7: Gonadosomatic Index (log_{10}) of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

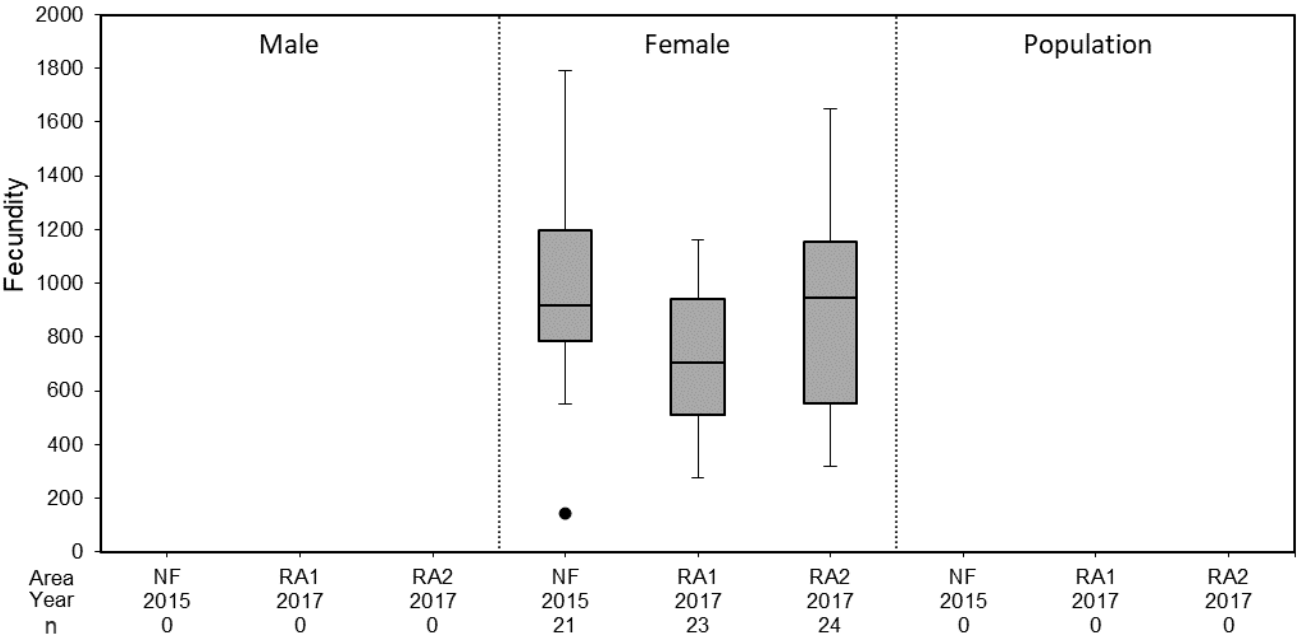
Figure 6C-8: Liver Weight of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Boxplots



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

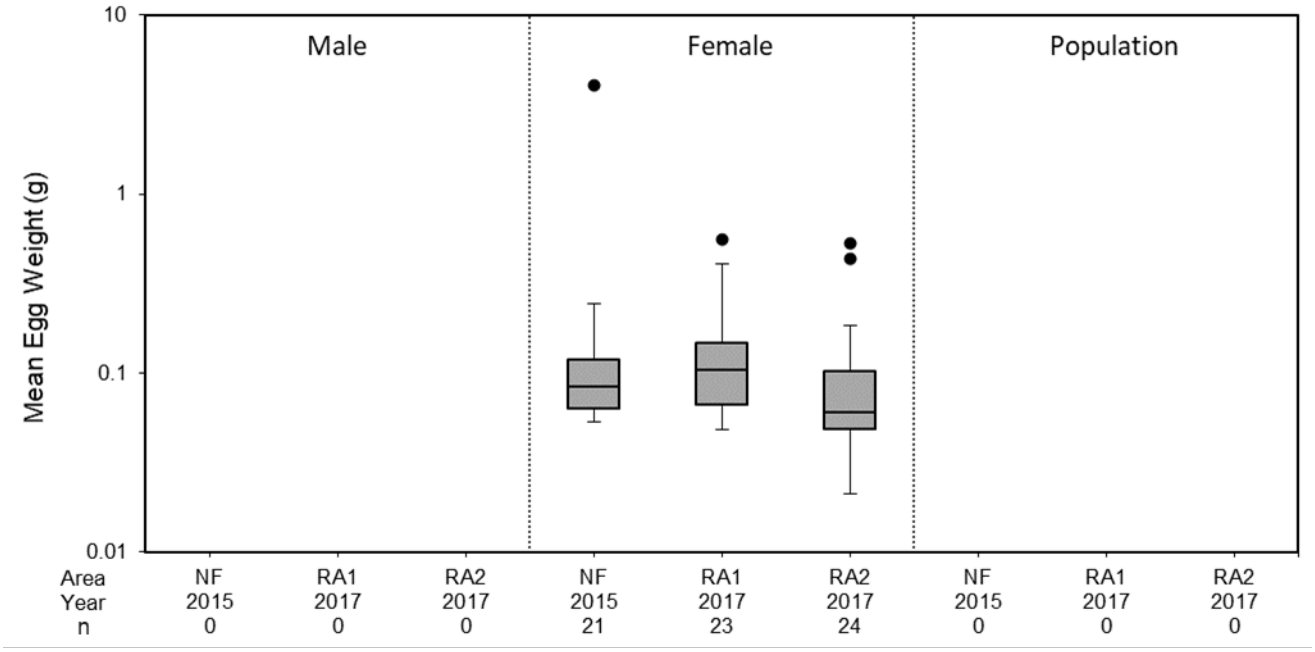
Figure 6C-9: Gonad Weight (log_{10}) of Male and Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; n = sample size.

Figure 6C-5: Fecundity of Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Boxplots



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; g = gram; n = sample size.

Figure 6C-6: Mean Egg Weight (log_{10}) of Female Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017

Table 6D-1: Carcass Chemistry Data for Threespine Stickleback Sampled from the Near-field Area of Meliadine Lake, 2015

FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML15UNFTHST1003	68.0	2.9	<0.002	0.143	4.32	<0.002	<0.002	<0.2	0.0063	26300	0.0391	0.064	0.0047	0.558	11.1	<0.01	<0.1	546	28.7	0.106	0.0269	0.216	14700	2910	2.22	0.508	<0.001	1490	21.5	<0.004	0.00478	0.162	<0.1	0.00436	<0.02	39.1	<0.04	-	66.2
ML15UNFTHST1006	62.2	<1.0	<0.002	0.140	4.91	<0.002	<0.002	<0.2	0.0074	21000	0.0170	<0.04	0.0087	0.492	11.4	<0.01	<0.1	486	26.6	0.119	0.0175	0.096	12300	2890	2.69	0.392	0.0014	1230	18.6	<0.004	0.00457	0.052	0.10	0.00408	<0.02	43.7	<0.04	-	64.1
ML15UNFTHST1009	54.5	<1.0	<0.002	0.135	3.53	<0.002	<0.002	<0.2	0.0066	21100	0.0180	0.050	0.0075	0.686	12.5	<0.01	<0.1	464	34.5	0.102	0.0166	0.062	12600	2930	2.73	0.514	0.0021	1490	15.6	<0.004	0.00769	0.138	<0.1	0.00234	<0.02	42.2	<0.04	-	67.0
ML15UNFTHST1010	64.6	<1.0	<0.002	0.123	3.27	<0.002	<0.002	<0.2	0.0063	19100	0.0106	<0.04	0.0044	0.538	10.1	<0.01	<0.1	412	30.2	0.137	0.0151	0.043	11200	2380	2.00	0.432	0.0018	1190	13.9	<0.004	0.00434	0.065	<0.1	0.00261	<0.02	40.9	<0.04	-	64.3
ML15UNFTHST1016	63.5	<1.0	<0.002	0.194	4.12	<0.002	<0.002	<0.2	0.0115	21100	0.0203	<0.04	0.0099	0.684	18.1	<0.01	<0.1	506	29.1	0.100	0.0197	0.149	12400	3140	1.68	0.542	0.0021	1500	15.8	<0.004	0.00472	0.116	<0.1	0.00323	<0.02	41.7	<0.04	-	70.3
ML15UNFTHST1017	53.1	<1.0	<0.002	0.120	4.04	<0.002	<0.002	<0.2	0.0074	28500	0.0176	<0.04	0.0067	0.485	13.4	<0.01	<0.1	553	32.6	0.108	0.0117	0.042	15700	2610	2.09	0.444	<0.001	1430	22.3	<0.004	0.00356	0.083	<0.1	0.00364	<0.02	50.2	<0.04	-	64.2
ML15UNFTHST1020	56.3	<1.0	<0.002	0.173	6.64	<0.002	<0.002	<0.2	0.0114	23900	0.0182	<0.04	0.0081	0.560	16.1	<0.01	<0.1	433	30.2	0.103	0.0183	0.416	13800	2830	2.44	0.480	0.0017	1530	21.0	<0.004	0.00431	0.080	<0.1	0.00392	<0.02	43.2	<0.04	-	67.7
ML15UNFTHST1022	59.6	<1.0	<0.002	0.137	3.85	<0.002	<0.002	<0.2	0.0111	19900	0.0209	<0.04	0.0107	0.494	13.6	<0.01	<0.1	382	21.9	0.119	0.0116	0.047	11200	2760	2.43	0.442	<0.001	1270	16.2	<0.004	0.00637	0.038	0.39	0.00453	<0.02	36.6	<0.04	-	68.5
ML15UNFTHST1023	55.7	<1.0	<0.002	0.181	3.98	<0.002	<0.002	<0.2	0.0078	21900	0.0210	<0.04	0.0074	0.570	12.4	<0.01	<0.1	432	22.6	0.133	0.0140	0.111	12100	2680	2.59	0.436	<0.001	1530	17.5	<0.004	0.01260	0.055	<0.1	0.00249	<0.02	44.3	<0.04	-	70.1
ML15UNFTHST1052	59.9	1.9	<0.002	0.134	3.73	<0.002	<0.002	<0.2	0.0041	21200	0.0105	0.066	0.0069	0.424	14.2	0.019	<0.1	434	24.6	0.108	0.0165	0.161	11800	2290	1.44	0.360	<0.001	1080	17.9	<0.004	0.00728	0.038	0.16	0.00227	<0.02	29.5	<0.04	-	53.5
ML15UNFTHST1062	60.6	<1.0	<0.002	0.213	4.82	<0.002	<0.002	<0.2	0.0058	25000	0.0095	<0.04	0.0128	0.578	14.0	<0.01	<0.1	439	34.9	0.095	0.0181	0.117	14100	3000	1.97	0.551	0.0023	1670	21.2	<0.004	0.00335	0.077	<0.1	0.00745	<0.02	43.1	<0.04	-	64.6
ML15UNFTHST1065	60.8	1.0	<0.002	0.167	4.11	<0.002	<0.002	<0.2	0.0051	20800	0.0172	0.207	0.0077	0.844	19.0	0.013	<0.1	445	26.4	0.102	0.0296	0.124	12100	3270	2.50	0.564	0.0029	1600	15.5	<0.004	0.00604	0.116	0.28	0.00474	<0.02	45.2	<0.04	-	64.7
ML15UNFTHST1067	64.8	<1.0	<0.002	0.174	4.52	<0.002	<0.002	<0.2	0.0048	23300	0.0120	<0.04	0.0073	0.495	11.3	<0.01	<0.1	480	22.6	0.085	0.0117	0.074	12900	2460	1.88	0.511	0.0011	1240	19.8	<0.004	0.00432	0.054	0.19	0.00389	<0.02	30.8	<0.04	-	55.7
ML15UNFTHST1068	54.1	1.1	0.0044	0.201	3.53	<0.002	<0.002	<0.2	0.0071	23300	0.0116	0.055	0.0078	0.669	17.6	0.015	<0.1	426	19.4	0.102	0.0222	0.096	13200	3160	2.60	0.588	0.0012	1430	17.1	<0.004	0.00554	0.073	0.12	0.00458	<0.02	34.1	<0.04	-	63.0
ML15UNFTHST1070	55.3	3.2	<0.002	0.267	7.04	<0.002	<0.002	<0.2	0.0177	32400	0.0156	0.171	0.0090	0.628	22.3	0.016	<0.1	658	31.5	0.090	0.0375	0.099	19800	2670	1.60	0.451	0.0030	1420	29.1	<0.004	0.00475	0.210	0.16	0.00407	0.023	61.3	<0.04	-	68.8
ML15UNFTHST1071	46.4	3.3	0.0034	0.240	5.14	<0.002	<0.002	<0.2	0.0081	27500	0.0122	0.049	0.0083	0.600	24.8	0.010	<0.1	475	34.4	0.064	0.0189	0.054	15600	2970	3.01	0.502	0.0017	1600	21.0	<0.004	0.00378	0.073	<0.1	0.00450	<0.02	66.3	<0.04	-	63.7
ML15UNFTHST1076	58.1	2.7	<0.002	0.209	4.38	<0.002	<0.002	<0.2	0.0078	25100	0.0115	<0.04	0.0073	0.639	18.7	0.014	<0.1	448	24.0	0.119	0.0175	0.131	15400	2850	1.36	0.475	0.0050	1600	20.1	<0.004	0.00445	0.089	0.11	0.00411	<0.02	45.9	<0.04	-	64.1
ML15UNFTHST1080	48.3	<1.0	<0.002	0.212	4.52	<0.002	<0.002	<0.2	0.0037	26600	0.0145	0.076	0.0059	0.535	12.7	0.013	<0.1	456	32.2	0.094	0.0190	0.095	14700	2830	2.96	0.452	0.0024	1690	19.7	<0.004	0.00409	0.126	<0.1	0.00271	<0.02	44.3	<0.04	-	66.7
ML15UNFTHST1084	57.4	1.8	<0.002	0.244	5.26	<0.002	<0.002	<0.2	0.0058	25700	0.0145	<0.04	0.0141	0.670	16.0	0.019	<0.1	523	29.7	0.139	0.0155	0.085	14300	3070	3.09	0.489	<0.001	1430	20.4	<0.004	0.00699	0.054	<0.1	0.00681	0.023	67.7	<0.04	-	63.4
ML15UNFTHST1085	56.5	1.0	<0.002	0.395	4.21	<0.002	<0.002	<0.2	0.0068	27500	0.0160	<0.04	0.0060	0.599	16.3	0.014	<0.1	514	32.8	0.111	0.0206	0.050	15400	3430	3.26	0.494	0.0036	1820	22.6	<0.004	0.00569	0.033	<0.1	0.00271	<0.02	49.3	<0.04	-	60.9
ML15UNFTHST1087	47.4	<1.0	<0.002	0.200	3.43	<0.002	<0.002	<0.2	0.0066	20000	0.0118	0.044	0.0066	0.550	10.2	0.018	<0.1	404	16.1	0.074	0.0145	0.128	11900	2930	3.43	0.549	<0.001	1410	16.6	<0.004	0.00478	0.068	<0.1	0.00749	<0.02	45.8	<0.04	-	64.2
ML15UNFTHST1088	46.8	2.4	<0.002	0.176	4.89	<0.002	<0.002	<0.2	0.0063	22600	0.0103	<0.04	0.0069	0.419	13.5	0.022	<0.1	481	24.9	0.101	0.0207	0.072	14000	2720	1.60	0.500	0.0012	1820	20.8	<0.004	0.00611	0.169	<0.1	0.00360	<0.02	36.0	<0.04	-	69.7
ML15UNFTHST1089	54.6	2.8	<0.002	0.217	5.78	<0.002	<0.002	<0.2	0.0115	29600	0.0130	0.043	0.0057	0.556	13.7	0.025	<0.1	590	32.5	0.128	0.0213	0.078	16200	2780	2.30	0.401	0.0042	1620	21.6	<0.004	0.00446	0.073	0.12	0.00707	<0.02	47.0	<0.04	-	63.3
ML15UNFTHST1119	63.9	3.3	<0.002	0.168	5.31	<0.002	<0.002	<0.2	0.0044	23200	0.0175	<0.04	0.0067	0.549	17.5	0.027	<0.1	440	34.6	0.094	0.0186	0.195	14100	2480	1.42	0.421	0.0035	781	18.3	<0.004	0.00482	0.061	0.12	0.00474	<0.02	54.0	<0.04	-	62.5
ML15UNFTHST1122	65.2	1.1	<0.002	0.338	6.54	<0.002	<0.002	<0.2	0.0054	39300	0.0202	0.043	0.0131	0.657	15.9	0.012	<0.1	710	35.3	0.174	0.0219	0.183	20100	2880	2.78	0.515	0.0016	1710	28.0	<0.004	0.00666	0.086	<0.1	0.01140	0.027	86.9	<0.04	-	66.6
ML15UNFTHST1123	66.0	1.1	<0.002	0.225	4.62	<0.002	<0.002	<0.2	0.0056	27800	0.0208	<0.04	0.0105	0.616	10.9	0.015	<0.1	512	35.6	0.142	0.0135	0.095	14500	2990	2.61	0.556	0.0014	1400	21.4	<0.004	0.00807	0.046	<0.1	0.00324	<0.02	71.1	<0.04	-	64.5
ML15UNFTHST1124	68.6	3.2	<0.002	0.180	4.38	<0.002	<0.002	<0.2	0.0035	22500	0.0182	<0.04	0.0059	0.503	14.5	<0.01	<0.1	531	25.5	0.137	0.0139	0.063	14000	3020	1.47	0.462	<0.001	1260	17.2	<0.004	0.00651	0.039	<0.1	0.00427	<0.02	37.8	<0.04	-	64.6
ML15UNFTHST1125	66.5	1.0	<0.002	0.189	4.90	<0.002	0.0024	<0.2	0.0038	30000	0.0324	0.047	0.0053	0.575	12.7	0.015	<0.1	564	22.0	0.128	0.0132	0.085	16500	2580	1.92	0.436	0.0012	1370	22.4	<0.004	0.00532	0.043	<0.1	0.00366	<0.02	61.1	<0.04	-	64.1
ML15UNFTHST1126	70.6	1.5	<0.002	0.150	5.69	<0.002	<0.002	<0.2	0.0062	25500	0.0137	<0.04	0.0075	0.543	11.9	<0.01	<0.1	542	37.3	0.171	0.0135	0.044	15300	2610	1.92	0.394	0.0012	1310	19.9	<0.004	0.00758	0.073	<0.1	0.00328	<0.02	41.2	<0.04	-	67.6
ML15UNFTHST1127	70.3	<1.0	<0.002	0.232	4.20	<0.002	0.0021	<0.2	0.0027	18700	0.0127	<0.04	0.0051	0.437	7.8	0.017	<0.1	461	28.5	0.110	0.0170	0.123	11900	2970	1.89	0.415	<0.001	1330	15.5	<0.004	0.00554	0.100	<0.1	0.00344	<0.02	34.8	<0.04	-	71.2
ML15UNFTHST1129	60.1	<1.0	<0.002	0.176	4.54	<0.002	<0.002	<0.2	0.0049	22900	0.0207	<0.04	0.0064	0.484	11.4	<0.01	<0.1	519	27.1	0.108	0.0122	0.050	13600	2770	2.20	0.439	0.0011	1290	16.8	<0.004	0.00909	0.071	<0.1	0.00720	<0.02	44.4	<0.04	-	65.8
ML15UNFTHST1139	52.0	<1.0	<0.002	0.173	4.35	<0.002	<0.002	<0.2	0.0061	21600	0.0184	<0.04	0.0084	0.552	12.4	<0.01	<0.1	461	29.8	0.088	0.0130	0.067	13000	2810	2.03	0.413	0.0012	1280	17.8	<0.004	0.00413	0.059	<0.1	0.00342	<0.02	44.4	<0.04	-	66.0
ML15UNFTHST1140	68.7	<1.0	<0.002	0.155	4.80	<0.002	<0.002	<0.2	0.0036	23500	0.0252	<0.04	0.0049	0.417	9.5	0.015	<0.1	481	27.0	0.136	0.0088	0.042	13900	2600	1.75	0.403	<0.001	1310	18.9	<0.004	0.00587	<0.02	<0.1	0.00343	<0.02	40.8	<0.04	-	67.7
ML15UNFTHST1142	53.7	<1.0	<0.002	0.166	4.27	<0.002	<0.002	<0.2	0.0076	25900	0.0135	0.067	0.0059	0.431	11.3	<0.01	<0.1	459	27.3	0.094	0.0171	0.051	14500	2410	1.19	0.397	0.0020	1360	20.7	<0.004	0.00413	0.081	<0.1	0.00429	<0.02	35.4	<0.04	-	66.6
ML15UNFTHST1146	52.3	1.2	0.0020	0.145	4.65	<0.002	<0.002	<0.2	0.0045	21700	0.0122	0.194	0.0125	0.595	18.8	0.013	<0.1	512	34.1	0.065	0.0339	0.098	14200	3370	2.51	0.583	0.0020	1330	19.0	<0.004	0.00813	0.131	<0.1	0.00482	<0.02	39.7	<0.04	-	64.4
ML15UNFTHST1149	49.7	1.9	<0.002	0.187	4.24	<0.002	<0.002	<0.2	0.0059	25700	0.0160	0.045	0.0132	0.695	16.8	0.023	<0.1	559	37.4	0.085	0.0193	0.110	14900	3380	3.28	0.488	<0.001	1460	20.6	<0.004	0.00434	0.120	<0.1	0.00374	<0.02	49.4	<0.04	-	59.5
ML15UNFTHST1198	61.0	<1.0	<0.002	0.125	2.92	<0.002	<0.002	<0.2	0.0043	17200	0.0110	0.082	0.0047	0.479	10.6	0.011	<0.1	431	22.1	0.106	0.0140	0.104	10900	2550	1.51	0.425	0.0014	1290	14.6	<0.004	0.00300	0.129	<0.1	0.00298	<0.02	35.7	<0.04	-	70.4
ML15UNFTHST1199	62.5	2.0	<0.002	0.153	4.93	<0.002	<0.002	<0.2	0.0082	26900	0.0310	<0.04	0.0098	0.716	16.0	0.017	<0.1	579	22.2	0.130	0.0134	0.077	14200	2650	2.84	0.414	0.0086	1500	20.2	<0.004	0.00458	0.096	<0.1	0.00441	0.021	60.2	<0.04	-	69.6
ML15UNFTHST1200	60.2	1.5	<0.002	0.212	4.47	<0.002	<0.002	<0.2	0.0044	27800	0.0190	0.044	0.0111	0.630	16.2	0.023	<0.1	537	23.3	0.075	0.0196	0.073	15500	2790	1.65	0.438	0.0017	1190	24.6	<0.004	0.00625	0.076	<0.1	0.00595	<0.02	46.9	<0.04	-	62.2

FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML15UNFTHST1201	58.4	1.4	<0.002	0.157	5.34	<0.002	<0.002	<0.2	0.0071	28500	0.0145	<0.04	0.0068	0.545	13.8	<0.01	<0.1	557	40.8	0.138	0.0149	0.079	15500	2650	1.97	0.464	0.0024	1650	22.2	<0.004	0.00392	0.155	0.14	0.00561	<0.02	53.7	<0.04	-	69.6
ML15UNFTHST1202	59.0	1.2	<0.002	0.184	4.95	<0.002	<0.002	<0.2	0.0042	26400	0.0114	0.043	0.0126	0.573	16.5	0.014	<0.1	543	29.7	0.096	0.0165	0.162	15100	2750	2.57	0.489	<0.001	1500	22.7	<0.004	0.00636	0.080	<0.1	0.00813	0.023	61.6	<0.04	-	70.4
ML15UNFTHST1215	62.0	1.9	<0.002	0.155	4.05	<0.002	<0.002	<0.2	0.0060	21900	0.0202	0.157	0.0101	0.660	19.7	0.024	<0.1	468	27.5	0.091	0.0196	0.213	12300	2670	2.41	0.463	0.0016	1240	16.9	<0.004	0.00904	0.109	<0.1	0.00268	<0.02	42.0	<0.04	-	65.0
ML15UNFTHST1216	61.7	<1.0	<0.002	0.147	2.04	<0.002	<0.002	<0.2	0.0032	13100	0.0331	0.101	0.0081	0.438	10.1	0.010	<0.1	358	17.0	0.127	0.0118	0.423	8400	2680	2.83	0.393	<0.001	1200	10.0	<0.004	0.00660	0.037	<0.1	0.00266	<0.02	32.2	<0.04	-	71.8
ML15UNFTHST1218	63.3	1.2	<0.002	0.186	3.99	<0.002	<0.002	<0.2	0.0036	23400	0.0139	0.072	0.0061	0.549	12.6	<0.01	<0.1	466	25.1	0.102	0.0168	0.131	14100	2820	1.52	0.474	0.0027	1350	18.1	<0.004	0.00678	0.052	<0.1	0.00224	<0.02	32.1	<0.04	-	65.0
ML15UNFTHST1220	58.1	<1.0	<0.002	0.172	3.61	<0.002	<0.002	<0.2	0.0039	20700	0.0149	0.067	0.0099	0.505	10.0	<0.01	<0.1	512	20.7	0.126	0.0125	0.322	12100	3370	2.85	0.478	<0.001	1290	16.6	<0.004	0.00400	0.037	<0.1	0.00602	<0.02	48.8	<0.04	-	67.3
ML15UNFTHST1221	55.6	<1.0	<0.002	0.149	3.41	<0.002	<0.002	<0.2	0.0038	20900	0.0141	0.043	0.0059	0.430	9.4	0.018	<0.1	447	18.3	0.116	0.0186	0.344	12800	2690	2.10	0.380	<0.001	1370	17.1	<0.004	0.00282	0.067	<0.1	0.00282	<0.02	31.9	<0.04	-	63.4
ML15UNFTHST1222	68.6	<1.0	<0.002	0.249	4.02	<0.002	<0.002	<0.2	0.0037	22800	0.0117	<0.04	0.0063	0.463	16.1	<0.01	<0.1	521	25.0	0.109	0.0160	0.163	13700	2670	1.67	0.434	0.0017	1370	17.1	<0.004	0.00526	0.084	<0.1	0.00554	<0.02	34.0	<0.04	-	69.2
ML15UNFTHST1223	71.4	1.1	<0.002	0.157	4.91	<0.002	<0.002	<0.2	0.0056	27300	0.0175	<0.04	0.0064	0.445	10.7	<0.01	<0.1	544	20.6	0.122	0.0129	0.130	15500	2830	2.04	0.408	<0.001	1570	20.7	<0.004	0.00717	0.033	<0.1	0.00342	<0.02	35.1	<0.04	-	66.9
ML15UNFTHST1235	69.7	1.5	<0.002	0.129	4.02	<0.002	<0.002	<0.2	0.0040	18100	0.0456	<0.04	0.0051	0.550	11.0	0.014	<0.1	395	23.6	0.125	0.0112	0.078	10700	2690	2.45	0.420	<0.001	1270	14.7	<0.004	0.00639	0.060	<0.1	0.00216	<0.02	39.5	<0.04	-	70.2
ML15UNFTHST1237	63.5	<1.0	<0.002	0.224	3.91	<0.002	<0.002	<0.2	0.0045	21600	0.0091	<0.04	0.0082	0.544	13.4	0.011	<0.1	475	32.7	0.088	0.0181	0.084	13000	2950	2.14	0.490	0.0032	1450	17.8	<0.004	0.00541	0.056	<0.1	0.00435	<0.02	24.8	<0.04	-	65.2
ML15UNFTHST1239	62.1	1.4	<0.002	0.190	7.16	<0.002	<0.002	<0.2	0.0041	31900	0.0513	<0.04	0.0085	0.556	14.0	<0.01	<0.1	615	21.1	0.123	0.0137	0.152	17000	2920	1.96	0.505	<0.001	1370	28.9	<0.004	0.01170	0.049	0.27	0.00533	<0.02	51.3	<0.04	-	63.4
ML15UNFTHST1241	72.1	<1.0	<0.002	0.237	4.44	<0.002	<0.002	<0.2	0.0039	21900	0.0152	<0.04	0.0074	0.412	12.2	<0.01	<0.1	490	27.1	0.116	0.0147	0.052	12900	2640	2.18	0.452	<0.001	1350	16.6	<0.004	0.00540	0.062	<0.1	0.00411	<0.02	38.9	<0.04	-	67.8
ML15UNFTHST1243	66.9	1.3	<0.002	0.183	3.24	<0.002	<0.002	<0.2	0.0046	17700	0.0123	<0.04	0.0077	0.474	14.5	0.014	<0.1	445	19.2	0.131	0.0162	0.063	10900	2630	1.91	0.466	0.0012	1240	13.6	<0.004	0.00696	0.097	<0.1	0.00291	<0.02	31.6	<0.04	-	70.6
ML15UNFTHST1244	61.7	<1.0	<0.002	0.140	3.95	<0.002	<0.002	<0.2	0.0065	28600	0.0154	<0.04	0.0080	0.556	13.3	<0.01	<0.1	552	30.9	0.127	0.0137	0.073	14800	2970	1.82	0.446	0.0015	1420	19.9	<0.004	0.00680	0.126	<0.1	0.00559	<0.02	52.9	<0.04	-	65.3
ML15UNFTHST1246	63.0	1.2	<0.002	0.156	4.55	<0.002	<0.002	<0.2	0.0064	26800	0.0351	<0.04	0.0069	0.650	12.7	<0.01	<0.1	580	27.1	0.162	0.0102	0.065	14400	2980	2.19	0.473	<0.001	1250	21.6	<0.004	0.00689	0.057	<0.1	0.00488	<0.02	60.1	<0.04	-	66.1
ML15UNFTHST1247	60.1	<1.0	<0.002	0.129	4.33	<0.002	<0.002	<0.2	0.0211	19700	0.0247	<0.04	0.0063	0.815	17.0	<0.01	<0.1	409	26.2	0.152	0.0163	0.058	11500	2500	2.32	0.577	0.0137	1440	16.8	<0.004	0.00310	0.046	<0.1	0.00223	<0.02	40.9	<0.04	-	70.7
ML15UNFTHST1249	63.5	<1.0	<0.002	0.294	4.46	<0.002	<0.002	<0.2	0.0051	25800	0.0158	<0.04	0.0092	0.637	16.0	<0.01	<0.1	535	31.4	0.152	0.0136	0.062	13900	3000	2.05	0.520	0.0024	1430	19.0	<0.004	0.00767	0.045	0.11	0.00948	0.031	60.9	<0.04	-	67.6
ML15UNFTHST1250	62.1	<1.0	<0.002	0.154	4.22	<0.002	<0.002	<0.2	0.0070	20000	0.0112	<0.04	0.0083	0.596	17.8	<0.01	<0.1	420	28.7	0.070	0.0166	0.081	11900	2600	2.33	0.479	0.0023	1230	16.5	<0.004	0.00897	0.055	<0.1	0.00343	<0.02	36.1	<0.04	-	65.5
ML15UNFTHST1252	59.8	4.7	<0.002	0.181	6.60	<0.002	<0.002	<0.2	0.0067	32200	0.0181	0.047	0.0121	0.542	19.1	<0.01	<0.1	593	28.1	0.151	0.0145	0.098	16500	3010	2.60	0.385	0.0018	1570	26.0	<0.004	0.00697	0.062	<0.1	0.00885	0.028	77.2	<0.04	-	67.9
ML15UNFTHST1253	56.9	<1.0	<0.002	0.213	3.05	<0.002	<0.002	<0.2	0.0027	15500	0.0100	<0.04	0.0060	0.565	13.6	<0.01	<0.1	369	14.7	0.089	0.0122	0.055	9330	2660	2.30	0.428	<0.001	1170	12.7	<0.004	0.00510	0.060	0.18	0.00263	<0.02	28.1	<0.04	-	67.8

Note: all values in milligram per kilogram wet weight (mg/kg ww) except where indicated.
mm = millimetre; % = percent; < = less than; - = not recorded or not applicable.

Table 6D-2: Carcass Chemistry Data for Threespine Stickleback Sampled from Reference Area 1 of Meliadine Lake, 2017

FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML17URA1THST2000	64.4	2.5	0.0043	0.106	3.93	<0.002	<0.002	<0.2	0.0042	14500	0.0253	0.316	0.0109	0.659	17.0	0.012	<0.1	312	14.5	0.192	0.0724	0.397	9050	2480	2.79	0.584	<0.001	1240	12.1	<0.004	0.00341	0.061	0.10	0.00216	<0.02	42.1	0.112	7.2	71.4
ML17URA1THST2001	63.6	1.4	<0.002	0.137	6.14	<0.002	<0.002	<0.2	0.0033	25600	0.0161	0.189	0.0128	0.794	21.6	<0.01	<0.1	539	42.2	0.102	0.0618	1.18	15700	2470	2.64	0.553	<0.001	1160	19.6	<0.004	0.00612	0.053	<0.1	0.00290	<0.02	46.3	<0.04	7.6	65.5
ML17URA1THST2057	62.9	2.7	<0.002	0.139	5.40	<0.002	<0.002	<0.2	0.0071	28600	0.0207	0.176	0.0141	0.655	22.0	0.020	<0.1	563	38.1	0.087	0.0352	2.25	16900	2820	2.45	0.696	<0.001	1450	21.5	<0.004	0.00517	0.025	<0.1	0.00524	<0.02	44.0	0.088	8.1	63.8
ML17URA1THST2059	59.3	1.9	<0.002	0.111	6.13	<0.002	<0.002	<0.2	0.0073	22500	0.0159	0.134	0.0071	0.622	17.0	0.010	0.24	463	30.5	0.122	0.0418	0.250	13200	2210	1.68	0.553	0.0029	1250	18.3	<0.004	0.00380	0.021	<0.1	0.00689	<0.02	45.8	<0.04	4.8	69.4
ML17URA1THST2060	70.1	1.8	<0.002	0.067	3.95	<0.002	<0.002	<0.2	0.0122	15500	0.0271	0.097	0.0104	1.21	21.2	<0.01	<0.1	410	17.0	0.120	0.0224	0.482	9960	2660	2.30	0.898	0.0117	1180	13.5	<0.004	0.00697	0.047	0.11	0.00171	<0.02	32.5	<0.04	8.4	67.2
ML17URA1THST2062	67.5	2.9	<0.002	0.151	4.63	<0.002	<0.002	<0.2	0.0074	17900	0.0199	0.046	0.0113	0.636	16.3	0.017	0.19	430	26.1	0.117	0.0131	1.37	11100	3000	2.27	0.677	0.0023	1260	13.0	<0.004	0.00591	0.023	0.10	0.00606	<0.02	54.4	<0.04	7.9	68.2
ML17URA1THST2063	60.6	1.8	<0.002	0.068	5.19	<0.002	<0.002	<0.2	0.0061	22500	0.0144	0.090	0.0116	0.603	18.1	0.019	<0.1	409	23.2	0.150	0.0344	0.503	13700	2870	2.33	0.521	0.0015	1560	19.3	<0.004	0.00439	0.051	<0.1	0.00324	<0.02	33.7	<0.04	4.6	67.7
ML17URA1THST2064	66.4	<1.0	0.0022	0.092	3.81	<0.002	<0.002	<0.2	0.0028	17700	0.0199	<0.04	0.0111	0.439	11.5	<0.01	<0.1	420	19.1	0.138	0.0103	1.87	10900	2580	2.73	0.537	<0.001	1090	15.6	<0.004	0.00383	<0.02	<0.1	0.00143	<0.02	38.2	<0.04	7.7	68.2
ML17URA1THST2065	56.7	1.5	<0.002	0.044	4.49	<0.002	<0.002	<0.2	0.0034	21200	0.0234	0.067	0.0076	0.622	17.1	0.011	0.52	486	25.6	0.115	0.0231	0.219	13200	2840	2.50	0.507	0.0016	1270	18.7	<0.004	0.00354	<0.02	<0.1	0.00188	<0.02	43.0	0.050	6.1	67.2
ML17URA1THST2066	60.5	2.0	<0.002	0.057	5.25	<0.002	<0.002	<0.2	0.0034	23900	0.0112	0.073	0.0119	0.595	26.6	<0.01	0.25	447	27.2	0.125	0.0181	3.38	14000	2520	1.64	0.456	0.0011	1340	22.2	<0.004	0.00631	<0.02	<0.1	0.00297	<0.02	36.4	<0.04	6.3	65.3
ML17URA1THST2067	40.7	2.8	0.0034	0.074	7.17	<0.002	<0.002	<0.2	0.0094	26200	0.0182	0.372	0.0221	0.852	24.2	0.015	0.75	623	27.6	0.165	0.0589	0.633	15400	3450	4.35	0.520	0.0016	1340	25.0	<0.004	0.01180	0.024	0.13	0.00471	0.073	60.3	<0.04	-	60.4
ML17URA1THST2068	68.5	1.1	<0.002	0.077	3.80	<0.002	<0.002	<0.2	0.0032	20000	0.0190	0.120	0.0110	0.594	15.3	<0.01	0.11	467	16.0	0.119	0.0112	3.76	11800	2470	2.19	0.582	<0.001	1190	15.6	<0.004	0.00374	<0.02	<0.1	0.00267	<0.02	38.5	<0.04	7.6	67.3
ML17URA1THST2069	61.6	1.8	<0.002	0.060	9.05	<0.002	<0.002	<0.2	0.0036	29500	0.0167	0.120	0.0120	0.642	18.7	<0.01	0.20	560	31.6	0.145	0.0283	0.146	16800	2630	2.33	0.550	<0.001	1510	24.4	<0.004	0.00384	<0.02	0.13	0.00448	<0.02	49.3	<0.04	6.5	63.4
ML17URA1THST2070	66.4	6.2	<0.002	0.057	6.42	<0.002	0.0023	<0.2	0.0040	29100	0.0259	1.65	0.0101	0.509	47.2	0.017	0.20	611	22.7	0.193	0.0247	0.751	16400	2530	2.26	0.466	<0.001	1400	24.3	<0.004	0.00297	<0.02	0.22	0.00558	0.030	42.2	<0.04	3.7	66.4
ML17URA1THST2071	44.8	1.6	<0.002	0.048	5.67	<0.002	<0.002	<0.2	0.0040	23300	0.0127	0.166	0.0171	0.809	21.5	<0.01	0.23	572	29.8	0.105	0.0345	0.215	14700	3270	3.32	0.456	0.0015	1430	23.6	<0.004	0.00611	<0.02	0.30	0.00233	0.026	51.5	<0.04	-	62.1
ML17URA1THST2072	61.6	1.8	<0.002	0.089	5.22	<0.002	<0.002	<0.2	0.0045	25200	0.0189	0.860	0.0128	0.673	23.3	<0.01	0.19	505	28.0	0.140	0.0297	1.79	14800	2640	2.22	0.555	0.0013	1310	19.9	<0.004	0.00513	<0.02	<0.1	0.00278	0.021	52.1	<0.04	8.7	65.1
ML17URA1THST2073	60.0	1.2	<0.002	0.122	4.25	<0.002	<0.002	<0.2	0.0048	16900	0.0191	0.066	0.0130	0.677	18.0	<0.01	0.12	415	23.7	0.079	0.0286	0.401	10600	2580	3.32	0.572	<0.001	792	14.3	<0.004	0.00856	<0.02	<0.1	0.00169	<0.02	40.4	<0.04	10.8	68.6
ML17URA1THST2074	64.2	2.9	<0.002	0.121	5.86	<0.002	<0.002	<0.2	0.0048	29700	0.0393	3.08	0.0295	0.587	50.6	<0.01	0.29	594	27.4	0.153	0.0586	9.82	16800	2910	2.70	0.622	<0.001	1670	23.6	<0.004	0.00415	<0.02	0.13	0.00270	0.029	49.5	<0.04	6.8	62.9
ML17URA1THST2075	38.5	1.4	0.0075	0.065	4.89	<0.002	<0.002	<0.2	0.0041	22100	0.0190	0.170	0.0229	0.872	52.0	0.011	0.30	559	22.0	0.139	0.0290	0.371	13500	2820	3.57	0.548	<0.001	935	21.1	<0.004	0.00625	<0.02	<0.1	0.00185	<0.02	54.2	<0.04	-	64.3
ML17URA1THST2078	66.3	1.9	<0.002	0.061	6.54	<0.002	<0.002	<0.2	0.0031	27700	0.0180	0.459	0.0085	0.465	20.8	<0.01	0.17	532	20.7	0.263	0.0181	0.686	15700	2360	1.92	0.541	<0.001	1440	20.8	<0.004	0.00417	<0.02	<0.1	0.00540	0.020	41.7	<0.04	3.5	65.5
ML17URA1THST2079	76.5	2.1	<0.002	0.086	4.90	<0.002	<0.002	<0.2	0.0065	19700	0.0478	0.073	0.0102	0.647	21.6	0.012	<0.1	473	18.5	0.157	0.0207	0.099	12200	2660	2.99	0.670	0.0012	1400	16.2	<0.004	0.00503	<0.02	<0.1	0.00302	0.022	35.4	<0.04	4.5	67.2
ML17URA1THST2213	70.5	1.6	<0.002	0.209	4.27	<0.002	<0.002	<0.2	0.0050	23200	0.0302	0.532	0.0122	0.904	25.2	0.011	0.30	599	29.3	0.111	0.0693	0.167	15300	2680	3.76	0.626	<0.001	1140	14.9	<0.004	0.00469	0.028	<0.1	0.00652	<0.02	47.6	<0.04	6.5	64.4
ML17URA1THST2214	63.5	9.9	0.0021	0.158	4.44	<0.002	<0.002	<0.2	0.0055	33200	0.0291	0.428	0.0330	0.803	40.3	0.136	0.23	573	35.3	0.112	0.0308	10.4	16800	2910	2.94	0.774	0.0010	1360	21.3	<0.004	0.00452	<0.02	0.44	0.00377	0.035	44.9	<0.04	7.4	59.4
ML17URA1THST2215	44.4	2.3	<0.002	0.142	5.60	<0.002	<0.002	<0.2	0.0144	25900	0.0237	0.544	0.0127	0.881	19.8	0.014	0.29	459	20.9	0.164	0.0924	1.82	14700	2520	2.84	0.700	0.0036	1540	20.4	<0.004	0.00337	0.045	<0.1	0.00560	<0.02	54.0	<0.04	-	66.7
ML17URA1THST2216	65.7	<2.0	<0.004	0.168	4.68	<0.004	<0.004	<0.4	0.0073	27700	0.0317	0.173	0.0170	0.744	18.5	<0.02	0.41	561	39.5	0.090	0.0160	1.72	16500	2840	3.79	0.596	0.0027	1240	20.5	<0.008	0.01170	<0.04	<0.2	0.00429	<0.04	63.0	<0.08	6.1	64.3
ML17URA1THST2217	56.1	<1.0	<0.002	0.108	4.58	<0.002	<0.002	0.30	0.0046	22300	0.0201	0.043	0.0078	0.519	11.9	<0.01	0.13	447	23.8	0.095	0.0229	0.191	12900	2930	2.87	0.552	<0.001	1340	16.5	<0.004	0.00297	<0.02	<0.1	0.00354	<0.02	47.3	<0.04	-	66.0
ML17URA1THST2218	62.6	2.1	<0.004	0.152	7.50	<0.004	<0.004	<0.4	0.0056	36900	0.0234	0.835	0.0115	0.773	26.1	<0.02	<0.2	656	48.1	0.098	0.0520	0.804	19300	2910	2.88	0.784	<0.002	1590	25.4	<0.008	0.00498	<0.04	<0.2	0.00609	<0.04	58.8	<0.08	4.5	59.6
ML17URA1THST2219	53.6	1.5	0.0042	0.091	5.12	<0.002	0.0049	0.21	0.0079	25000	0.0309	0.539	0.0106	0.649	18.0	<0.01	0.17	568	21.7	0.134	0.0836	0.198	15600	3130	2.88	0.604	0.0015	1390	18.2	<0.004	0.00515	0.027	0.11	0.00357	0.045	57.3	<0.04	-	63.6
ML17URA1THST2220	68.2	<2.0	<0.004	0.126	5.94	<0.004	<0.004	<0.4	0.0052	24300	0.0268	0.683	0.0140	0.542	19.5	<0.02	<0.2	502	26.7	0.106	0.0320	2.91	13500	2640	2.76	0.594	<0.002	1360	17.1	<0.008	0.00411	<0.04	<0.2	0.00404	<0.04	54.8	<0.08	5.0	66.2
ML17URA1THST2221	66.8	2.6	<0.004	0.118	7.40	<0.004	<0.004	<0.4	0.0066	41300	0.0370	0.403	0.0134	0.742	25.4	<0.02	0.36	747	41.9	0.150	0.0410	2.06	22500	3280	3.29	0.686	<0.002	1830	28.7	<0.008	0.00733	<0.04	<0.2	0.00480	<0.04	69.7	<0.08	2.5	57.1
ML17URA1THST2222	60.6	<1.0	<0.002	0.062	3.09	<0.002	<0.002	<0.2	0.0021	12700	0.0152	0.049	0.0053	0.318	8.0	<0.01	0.30	277	14.5	0.041	0.0112	0.124	7310	1360	1.50	0.273	<0.001	706	9.12	<0.004	0.00530	<0.02	<0.1	0.00318	<0.02	27.6	<0.04	8.5	84.8
ML17URA1THST2223	60.2	<2.0	<0.004	0.134	6.09	<0.004	<0.004	<0.4	0.0048	30600	0.0265	4.01	0.0372	0.823	51.2	<0.02	<0.2	623	29.3	0.108	0.1130	11.9	17600	2830	2.86	0.593	<0.002	1320	25.0	<0.008	0.00498	<0.04	0.61	0.00521	<0.04	62.1	<0.08	2.2	61.7
ML17URA1THST2224	53.8	<2.0	<0.004	0.138	5.32	<0.004	<0.004	<0.4	0.0052	29800	0.0276	3.37	0.0359	0.795	42.1	<0.02	<0.2	595	27.9	0.109	0.1070	12.0	16600	3000	2.77	0.603	<0.002	1360	23.6	<0.008	0.00504	<0.04	<0.2	0.00526	<0.04	60.4	<0.08	-	63.9
ML17URA1THST2225	53.5	<2.0	<0.004	0.118	6.82	<0.004	<0.004	<0.4	0.0073	30900	0.0201	0.132	0.0095	0.707	13.5	<0.02	0.51	542	40.2	0.119	0.0370	0.427	18100	2520	2.59	0.544	<0.002	1510	25.8	<0.008	0.00463	<0.04	<0.2	0.00487	<0.04	66.2	<0.08	-	65.9
ML17URA1THST2226	70.0	4.7	<0.004	0.170	6.40	<0.004	<0.004	<0.4	0.0051	31600	0.0263	1.08	0.0153	0.740	27.2	<0.02	<0.2	608	39.8	0.119	0.0510	2.97	17900	2590	2.62	0.639	<0.002	1290	23.5	<0.008	0.00529	<0.04	0.22	0.00543	<0.04	73.7	<0.08	7.9	59.2
ML17URA1THST2227	57.1	5.0	<0.004	0.172	5.50	<0.004	<0.004	<0.4	0.0049	27500	0.0207	<0.08	0.0094	0.693	18.8	<0.02	0.24	488	34.8	0.074	0.0260	0.318	16500	2780	3.19	0.555	<0.002	1360	23.0	<0.008	0.00457	<0.04	<0.2	0.00374	<0.04	58.3	<0.08	9.1	62.3
ML17URA1THST2228	56.8	3.1	<0.004	0.110	6.35	<0.004	<0.004	<0.4	0.0053	34100	0.0251	2.14	0.0123	0.564	31.9	<0.02	<0.2	540	35.7	0.074	0.0820	1.40	18000	2710	2.68	0.569	<0.002	1270	25.4	<0.008	0.01050	<0.04	<0.2	0.00384	<0.04	55.8	<0.08	4.9	65.2
ML17URA1THST2229	43.6	3.0	<0.002	0.114	6.16	<0.002	<0.002	<0.2	0.0070	25800	0.0206	0.086	0.0109	0.602	16.5	<0.01	0.14	503	24.1	0.092	0.0185	0.624	16300	3060	3.29	0.541	0.0016	1440	21.9	<0.004	0.00457	<0.02	<0.1	0.00562	<0.02	48.6	<0.04	-	66.1
ML17URA1THST2230	54.7	7.6	<0.004	0.105	3.84	<0.004	<0.004	<0.4	0.0071	21200	0.0227	1.46	0.0110	0.655	27.5	<0.02	<0.2	479	18.0	0.122	0.0360	1.27	12900	2720	2.70	0.626	<0.002	1340	17.1	<0.008	0.00442	<0.04	<0.2	0.00248	<0.04	54.0	<0.08	5.5	65.7
ML17URA1THST2231	51.0	2.4	<0.002	0.111	5.64	<0.002	<0.002	<0.2	0.0067	26400	0.0244	0.050	0.0085	0.566	15.3	0.014	0.10	465	25.9	0.094	0.0193	0.769	14600	3000	2.93	0.593	0.0011	1480	20.1	<0.004	0.00482	<0.02	<0.1	0.00876	<0.02	47.3	0.040	-	67.8

FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML17URA1THST2232	60.6	2.1	<0.004	0.094	4.60	<0.004	<0.004	<0.4	0.0040	26400	0.0280	1.83	0.0176	0.570	29.6	<0.02	<0.2	590	21.9	0.083	0.0370	0.785	15100	3110	3.42	0.582	<0.002	1310	19.5	<0.008	0.01600	<0.04	<0.2	0.00278	<0.04	56.6	<0.08	3.6	66.2
ML17URA1THST2233	55.4	1.4	<0.002	0.109	3.84	<0.002	<0.002	<0.2	0.0069	18100	0.0356	<0.04	0.0089	0.810	19.1	<0.01	0.12	438	23.9	0.120	0.0225	0.304	11500	3030	3.99	0.618	0.0036	1290	13.9	<0.004	0.00369	<0.02	<0.1	0.00275	<0.02	50.7	<0.04	5.4	66.8
ML17URA1THST2234	60.8	1.3	<0.002	0.111	5.33	<0.002	<0.002	0.20	0.0043	23200	0.0241	1.03	0.0098	0.554	18.3	<0.01	<0.1	476	21.1	0.115	0.0263	0.722	14100	2930	3.10	0.552	<0.001	1330	18.8	<0.004	0.01070	<0.02	<0.1	0.00422	<0.02	47.5	<0.04	5.2	65.9
ML17URA1THST2239	52.5	3.2	<0.004	0.046	4.76	<0.004	<0.004	<0.4	0.0061	27400	0.0195	<0.08	0.0087	0.713	16.3	<0.02	<0.2	508	19.8	0.209	<0.016	0.372	15700	2670	1.87	0.585	<0.002	1510	25.3	<0.008	0.00311	<0.04	<0.2	0.00296	<0.04	56.5	<0.08	-	67.1
ML17URA1THST2240	56.5	1.5	<0.002	0.084	6.41	<0.002	0.0022	0.30	0.0041	31800	0.0253	2.76	0.0207	0.688	42.8	0.010	0.17	628	25.5	0.200	0.0638	1.58	17900	2500	2.36	0.511	0.0015	1570	26.8	<0.004	0.00475	0.022	<0.1	0.00486	0.060	57.2	<0.04	1.0	68.5
ML17URA1THST2247	54.0	8.6	<0.002	0.198	6.79	<0.002	<0.002	0.52	0.0072	31200	0.0315	0.104	0.0201	0.960	42.3	0.049	0.31	738	43.0	0.155	0.0226	0.447	19300	2950	3.62	0.754	0.0032	1850	28.1	<0.004	0.00667	0.039	0.81	0.00879	0.034	87.1	<0.04	4.0	58.2
ML17URA1THST2253	53.8	6.2	<0.002	0.162	5.08	<0.002	<0.002	0.38	0.0076	26600	0.0297	0.583	0.0133	0.793	33.0	0.013	0.40	548	33.4	0.083	0.0478	0.201	16300	2490	3.64	0.572	<0.001	1410	22.6	<0.004	0.00350	0.029	0.51	0.00605	0.021	51.0	<0.04	-	67.5
ML17URA1THST2254	52.0	1.7	<0.002	0.186	6.12	<0.002	<0.002	0.49	0.0072	28100	0.0308	5.73	0.0302	0.802	70.9	<0.01	0.21	506	37.3	0.119	0.0666	7.39	16200	2630	3.25	0.695	<0.001	1410	19.9	<0.004	0.00536	0.026	0.17	0.00551	0.058	55.9	<0.04	-	63.4
ML17URA1THST2255	57.3	2.7	<0.002	0.126	4.08	<0.002	<0.002	0.40	0.0076	21500	0.0226	0.073	0.0087	0.676	22.7	<0.01	0.35	468	24.4	0.111	0.0149	0.273	12800	2590	2.92	0.574	<0.001	1240	18.0	<0.004	0.00474	0.022	0.23	0.00320	<0.02	39.9	<0.04	4.8	66.0
ML17URA1THST2256	48.0	2.7	<0.002	0.191	5.65	<0.002	<0.002	0.32	0.0075	30100	0.0214	1.05	0.0169	0.598	29.0	<0.01	<0.1	485	32.4	0.082	0.0469	1.98	17500	2600	3.46	0.567	0.0013	1490	25.5	<0.004	0.00325	0.029	0.16	0.00750	<0.02	55.4	<0.04	-	64.4
ML17URA1THST2258	55.5	2.7	<0.002	0.136	6.33	<0.002	<0.002	0.37	0.0063	27600	0.0310	1.29	0.0164	0.628	30.0	<0.01	<0.1	559	41.2	0.115	0.0303	1.20	16700	2450	2.96	0.570	<0.001	1580	22.3	<0.004	0.00478	<0.02	0.24	0.00557	0.020	46.2	<0.04	-	65.0
ML17URA1THST2260	69.0	1.8	<0.002	0.160	4.53	<0.002	<0.002	<0.2	0.0076	24000	0.0240	0.717	0.0177	0.764	22.2	0.027	0.46	523	30.5	0.082	0.0222	1.06	14200	2380	3.46	0.661	0.0018	1190	18.5	<0.004	0.00490	<0.02	<0.1	0.00463	<0.02	47.2	0.055	7.1	63.7
ML17URA1THST2261	59.7	3.9	<0.002	0.183	4.74	<0.002	<0.002	0.22	0.0065	24800	0.0206	0.456	0.0171	0.900	30.1	0.012	0.18	475	27.0	0.129	0.0240	0.381	14200	2720	2.97	0.648	0.0015	1460	20.1	<0.004	0.00442	<0.02	0.28	0.00364	<0.02	45.0	<0.04	6.0	65.0
ML17URA1THST2262	60.5	2.2	<0.002	0.115	5.04	<0.002	<0.002	<0.2	0.0052	22900	0.0182	1.93	0.0236	0.794	31.9	<0.01	0.13	490	33.4	0.074	0.0369	1.24	13900	2700	3.00	0.576	<0.001	1260	19.6	<0.004	0.00379	<0.02	0.13	0.00292	0.026	49.7	0.099	5.6	64.1
ML17URA1THST2263	65.1	4.9	<0.002	0.119	6.28	<0.002	<0.002	<0.2	0.0059	25400	0.0412	0.511	0.0129	0.779	25.0	<0.01	0.37	599	28.8	0.120	0.0216	0.328	15200	2470	2.60	0.689	<0.001	1330	22.0	<0.004	0.00554	<0.02	0.22	0.00581	<0.02	44.0	<0.04	3.9	66.7
ML17URA1THST2264	57.6	5.2	<0.002	0.166	4.77	<0.002	<0.002	0.22	0.0120	26100	0.0343	2.08	0.0203	0.673	39.9	0.016	<0.1	529	29.5	0.131	0.0541	0.802	14300	2540	3.22	0.553	<0.001	1540	18.3	<0.004	0.00343	<0.02	0.36	0.00757	0.032	56.3	<0.04	4.0	66.3
ML17URA1THST2268	48.3	5.4	<0.002	0.161	6.26	<0.002	<0.002	0.53	0.0090	32000	0.0245	1.27	0.0232	0.814	33.0	0.012	<0.1	653	29.9	0.093	0.0436	3.56	19500	2920	2.50	0.598	0.0024	1270	25.1	<0.004	0.00613	<0.02	0.48	0.00742	0.033	60.2	<0.04	-	61.9
ML17URA1THST2269	50.8	11.7	<0.002	0.144	5.84	<0.002	<0.002	0.30	0.0076	25500	0.0319	0.259	0.0169	0.733	42.6	0.020	0.37	526	26.0	0.110	0.0334	0.363	15300	2970	3.33	0.771	0.0013	1520	20.1	<0.004	0.00528	0.024	0.64	0.00846	0.057	45.6	<0.04	-	67.5
ML17URA1THST2270	67.3	2.8	<0.002	0.120	4.81	<0.002	<0.002	0.24	0.0047	22700	0.0418	0.421	0.0131	0.530	20.0	0.014	<0.1	474	17.9	0.136	0.0265	1.19	13500	2880	3.32	0.596	<0.001	1150	18.4	<0.004	0.00419	0.024	0.18	0.00364	<0.02	41.3	0.077	4.4	68.5
ML17URA1THST2271	71.5	2.8	<0.002	0.095	6.36	<0.002	<0.002	0.22	0.0033	24300	0.0274	0.101	0.0117	0.578	20.6	0.019	0.10	545	22.2	0.131	0.0192	0.275	14100	2690	1.89	0.658	<0.001	1070	18.1	<0.004	0.00572	0.039	0.15	0.00561	0.033	35.7	<0.04	4.1	67.5
ML17URA1THST2336	38.2	5.5	<0.002	0.122	5.61	<0.002	<0.002	0.46	0.0184	21800	0.0242	3.30	0.0391	0.871	82.3	0.016	<0.1	576	28.0	0.059	0.0783	2.06	14000	2910	4.28	0.778	0.0012	1470	20.6	<0.004	0.00721	0.057	0.47	0.00471	0.082	57.1	0.051	-	69.2
ML17URA1THST2345	66.9	1.3	<0.002	0.113	7.24	<0.002	<0.002	0.26	0.0049	33700	0.0197	0.111	0.0122	0.625	17.5	<0.01	<0.1	629	30.1	0.126	0.0178	0.109	19700	2890	2.39	0.596	<0.001	1420	25.2	<0.004	0.00373	0.029	0.12	0.00528	<0.02	57.4	0.118	4.1	64.1
ML17URA1THST2347	62.6	2.1	<0.002	0.105	7.40	<0.002	<0.002	0.30	0.0134	29700	0.0259	0.360	0.0137	0.687	20.0	0.015	<0.1	594	33.6	0.118	0.0277	0.313	16300	3120	2.39	0.745	0.0011	1560	22.6	<0.004	0.00517	0.031	0.12	0.00637	<0.02	52.0	<0.04	7.8	62.1
ML17URA1THST2352	40.4	1.4	<0.002	0.126	5.71	<0.002	<0.002	0.23	0.0285	22500	0.0217	0.633	0.0282	0.775	25.5	0.011	<0.1	524	29.2	0.061	0.0315	6.37	13400	3360	4.28	0.619	<0.001	1350	21.8	<0.004	0.00325	<0.02	0.11	0.00263	<0.02	51.0	<0.04	-	66.1
ML17URA1THST2355	64.5	1.5	<0.002	0.203	6.36	<0.002	<0.002	0.21	0.0140	32300	0.0320	0.423	0.0103	1.04	31.5	0.022	<0.1	581	32.9	0.090	0.0271	0.278	18200	2860	3.03	0.624	0.0035	1680	23.3	<0.004	0.00368	0.037	<0.1	0.00784	<0.02	58.9	<0.04	3.9	64.1
ML17URA1THST2356	69.1	5.8	0.0030	0.099	5.71	<0.002	<0.002	<0.2	0.0038	30600	0.0241	4.06	0.0485	1.14	41.0	0.059	<0.1	652	29.6	0.137	0.0554	3.28	17600	2680	3.15	0.618	0.0011	1310	21.5	<0.004	0.00778	<0.02	0.26	0.00738	0.044	39.7	0.043	4.3	66.0
ML17URA1THST2357	65.3	1.7	<0.002	0.097	8.78	<0.002	<0.002	0.22	0.0026	27500	0.0184	0.413	0.0119	0.685	22.2	0.018	<0.1	647	28.5	0.085	0.0409	0.391	16400	2840	1.95	0.558	<0.001	1180	21.2	<0.004	0.00376	0.023	0.14	0.00559	0.027	50.0	<0.04	5.9	63.7

Note: all values in milligram per kilogram wet weight (mg/kg ww) except where indicated.
mm = millimetre; % = percent; < = less than; - = not recorded or not applicable.

FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML17URA2THST3000	64.8	<2.0	<0.004	0.156	6.46	<0.004	<0.004	<0.4	<0.004	28800	0.0273	1.36	0.0110	0.626	35.7	<0.02	<0.2	646	35.3	0.077	0.0590	0.686	16800	2740	2.90	0.531	<0.002	1450	21.4	<0.008	0.00486	<0.04	<0.2	0.00592	<0.04	73.4	<0.08	5.0	63.4
ML17URA2THST3001	60.1	1.8	<0.002	0.179	5.61	<0.002	<0.002	0.26	0.0063	24800	0.0238	0.205	0.0111	0.707	21.6	0.011	<0.1	518	29.7	0.058	0.0195	0.109	14000	2950	3.95	0.603	0.0014	1270	18.5	<0.004	0.00621	<0.02	0.12	0.00738	<0.02	49.9	<0.04	6.1	65.0
ML17URA2THST3002	49.5	1.3	<0.002	0.219	8.20	<0.002	<0.002	0.35	0.0065	34300	0.0237	0.926	0.0133	0.630	23.8	<0.01	<0.1	660	46.9	0.066	0.0714	1.04	19800	3150	3.88	0.633	<0.001	1530	25.6	<0.004	0.00346	0.024	0.15	0.00615	<0.02	65.8	<0.04	-	62.3
ML17URA2THST3004	51.7	1.6	<0.002	0.202	6.53	<0.002	<0.002	<0.2	0.0101	26700	0.0304	1.03	0.0148	0.882	19.2	0.011	<0.1	570	30.7	0.076	0.0597	1.14	15300	2940	3.45	0.626	<0.001	1350	19.9	<0.004	0.00365	<0.02	0.10	0.00736	<0.02	52.4	<0.04	-	62.0
ML17URA2THST3005	55.6	2.3	<0.002	0.178	4.95	<0.002	<0.002	0.22	0.0072	23800	0.0270	0.423	0.0165	0.837	24.1	0.010	<0.1	543	22.7	0.074	0.0366	0.248	14900	2950	4.44	0.698	0.0011	1260	18.8	<0.004	0.00385	<0.02	0.16	0.00746	<0.02	50.0	<0.04	-	64.1
ML17URA2THST3006	52.5	1.9	<0.002	0.239	6.46	<0.002	<0.002	<0.2	0.0087	31600	0.0251	1.04	0.0158	0.629	27.8	0.015	<0.1	679	38.4	0.070	0.0398	1.04	18700	2600	3.78	0.552	<0.001	1490	22.7	<0.004	0.00499	<0.02	0.12	0.01020	<0.02	62.4	0.053	-	59.6
ML17URA2THST3007	66.2	1.8	<0.002	0.157	4.41	<0.002	<0.002	<0.2	0.0061	25200	0.0273	0.301	0.0129	0.680	21.7	0.011	<0.1	576	26.9	0.061	0.0189	0.225	15300	2440	3.66	0.591	<0.001	1320	18.8	<0.004	0.00860	<0.02	<0.1	0.00736	<0.02	49.5	<0.04	5.6	62.5
ML17URA2THST3008	60.9	2.1	<0.002	0.156	4.43	<0.002	<0.002	<0.2	0.0040	19000	0.0251	0.997	0.0182	0.712	25.8	0.010	<0.1	450	26.9	0.059	0.0332	1.96	11800	2660	3.30	0.579	<0.001	1230	14.4	<0.004	0.00390	<0.02	0.20	0.00448	<0.02	47.5	<0.04	8.5	62.5
ML17URA2THST3009	54.9	2.5	<0.002	0.170	4.09	<0.002	<0.002	0.25	0.0078	20100	0.0231	0.080	0.0097	0.706	22.5	0.016	<0.1	443	24.2	0.057	0.0188	0.240	12500	2100	3.26	0.557	<0.001	1240	16.4	<0.004	0.00473	0.030	0.16	0.00572	<0.02	48.9	<0.04	6.1	68.0
ML17URA2THST3010	57.1	2.8	0.0029	0.165	3.89	<0.002	<0.002	<0.2	0.0055	21800	0.0220	0.413	0.0132	0.605	21.5	0.014	<0.1	417	24.6	0.077	0.0245	1.88	12900	2350	3.16	0.563	<0.001	1280	17.6	<0.004	0.00526	<0.02	0.37	0.00385	<0.02	50.0	<0.04	6.2	64.3
ML17URA2THST3011	61.8	2.5	<0.002	0.123	5.36	<0.002	<0.002	0.24	0.0054	23100	0.0265	0.070	0.0137	0.727	30.4	0.012	<0.1	519	26.4	0.051	0.0137	0.137	13900	2500	2.57	0.580	<0.001	1150	17.4	<0.004	0.00521	<0.02	0.17	0.00477	<0.02	55.5	<0.04	7.9	64.5
ML17URA2THST3012	58.5	3.0	<0.002	0.105	5.14	<0.002	<0.002	<0.2	0.0100	24800	0.0165	0.700	0.0184	0.775	28.2	<0.01	<0.1	508	34.3	0.046	0.0378	1.34	13900	2750	3.06	0.610	0.0014	1320	18.3	<0.004	0.00623	<0.02	0.20	0.01560	0.038	52.3	<0.04	6.1	66.6
ML17URA2THST3013	48.0	2.6	0.0022	0.211	6.10	<0.002	<0.002	<0.2	0.0079	22100	0.0210	0.199	0.0119	0.581	21.2	0.020	<0.1	419	30.6	0.067	0.0308	0.257	12700	2460	3.78	0.540	<0.001	1230	18.9	<0.004	0.00322	<0.02	0.15	0.01160	<0.02	60.5	<0.04	-	64.1
ML17URA2THST3014	53.8	<1.0	<0.002	0.172	4.76	<0.002	<0.002	<0.2	0.0049	22900	0.0159	0.977	0.0299	0.592	21.4	<0.01	<0.1	502	31.5	0.055	0.0650	7.19	12900	2350	3.79	0.478	0.0014	1280	15.9	<0.004	0.00441	<0.02	<0.1	0.00414	<0.02	47.4	<0.04	3.7	66.9
ML17URA2THST3015	45.3	7.7	0.0046	0.183	7.65	<0.002	<0.002	0.24	0.0115	28900	0.0200	0.894	0.0348	0.854	57.3	0.027	<0.1	526	27.0	0.078	0.0247	0.715	16300	2450	3.44	0.608	0.0015	1260	22.8	<0.004	0.00434	<0.02	0.58	0.00910	0.044	52.7	<0.04	-	64.4
ML17URA2THST3035	55.6	1.1	<0.002	0.105	5.14	<0.002	<0.002	0.21	0.0086	21200	0.0204	<0.04	0.0121	0.766	24.8	<0.01	<0.1	381	23.9	0.072	0.0155	0.216	12800	2350	1.93	0.581	0.0021	1270	16.7	<0.004	0.00597	0.028	<0.1	0.00732	0.028	50.5	<0.04	3.7	67.9
ML17URA2THST3036	65.9	1.3	<0.002	0.125	5.75	<0.002	<0.002	0.23	0.0050	31100	0.0364	2.36	0.0195	0.692	49.9	0.011	<0.1	633	36.4	0.085	0.0887	1.50	17700	2340	1.73	0.617	<0.001	1340	21.5	<0.004	0.00707	<0.02	<0.1	0.00790	0.037	51.2	<0.04	2.9	64.7
ML17URA2THST3037	45.2	1.2	<0.002	0.132	5.19	<0.002	<0.002	0.24	0.0102	23300	0.0269	0.396	0.0195	0.819	22.9	0.010	<0.1	459	27.6	0.069	0.0224	0.414	14200	3040	3.50	0.637	0.0025	1590	17.3	<0.004	0.00630	0.023	<0.1	0.00661	0.022	59.0	<0.04	-	64.0
ML17URA2THST3038	71.8	<2.0	<0.004	0.157	5.84	<0.004	<0.004	<0.4	<0.004	27700	0.0266	2.61	0.0149	0.583	39.1	<0.02	<0.2	548	34.7	0.102	0.0890	1.49	15400	2550	2.58	0.635	<0.002	1360	20.7	<0.008	0.00530	<0.04	<0.2	0.00860	0.043	47.8	<0.08	4.4	63.6
ML17URA2THST3039	58.2	<1.0	<0.002	0.226	4.44	<0.002	<0.002	<0.2	0.0054	23700	0.0222	0.134	0.0140	0.639	17.9	<0.01	<0.1	484	24.0	0.078	0.0137	0.111	13900	2270	2.97	0.535	<0.001	1240	18.0	<0.004	0.00415	<0.02	<0.1	0.00468	<0.02	55.3	<0.04	6.5	64.0
ML17URA2THST3040	60.2	<1.0	<0.002	0.172	3.98	<0.002	<0.002	<0.2	0.0050	19300	0.0232	1.27	0.0149	0.634	24.9	<0.01	<0.1	391	25.8	0.072	0.0643	1.62	11300	2350	3.33	0.550	0.0010	1090	14.0	<0.004	0.00467	<0.02	<0.1	0.00394	0.022	50.2	<0.04	6.5	64.5
ML17URA2THST3041	63.2	1.4	<0.002	0.171	4.41	<0.002	<0.002	<0.2	0.0050	23900	0.0202	0.154	0.0103	0.579	22.5	0.024	<0.1	460	28.5	0.064	0.0136	0.150	13100	2070	2.07	0.533	<0.001	1190	17.4	<0.004	0.00446	<0.02	<0.1	0.01110	<0.02	60.3	<0.04	5.7	65.2
ML17URA2THST3042	51.9	<2.0	<0.004	0.144	5.57	<0.004	<0.004	<0.4	0.0091	28200	0.0210	0.371	0.0114	0.720	20.7	<0.02	<0.2	481	22.3	0.070	0.0170	0.163	15500	2700	2.70	0.613	0.0020	1380	21.5	<0.008	0.00468	<0.04	<0.2	0.00567	<0.04	49.7	<0.08	-	63.7
ML17URA2THST3043	63.2	<2.0	<0.004	0.141	5.32	<0.004	<0.004	<0.4	0.0057	30100	0.0277	0.344	0.0114	0.707	14.6	<0.02	<0.2	599	30.5	0.106	0.0170	0.297	17200	2560	3.25	0.508	<0.002	1270	21.5	<0.008	0.00525	<0.04	<0.2	0.00343	<0.04	48.9	<0.08	3.5	66.3
ML17URA2THST3044	70.4	1.4	<0.002	0.149	2.89	<0.002	<0.002	0.32	0.0025	14300	0.0220	1.99	0.0179	0.703	31.8	<0.01	<0.1	330	18.2	0.075	0.0589	2.75	8440	2650	2.92	0.596	<0.001	1260	11.2	<0.004	0.00409	<0.02	<0.1	0.00198	<0.02	34.4	<0.04	6.1	69.6
ML17URA2THST3045	60.6	2.1	<0.002	0.204	4.84	<0.002	<0.002	0.51	0.0055	22800	0.0297	0.314	0.0146	0.789	17.9	<0.01	<0.1	467	29.4	0.097	0.0199	0.228	13400	2950	3.38	0.560	<0.001	1490	17.9	<0.004	0.00461	0.065	<0.1	0.00479	0.023	55.5	<0.04	5.0	64.1
ML17URA2THST3046	59.3	1.7	<0.002	0.193	8.41	<0.002	<0.002	0.63	0.0049	37200	0.0220	1.61	0.0264	0.681	32.8	0.011	<0.1	735	50.4	0.089	0.0588	5.46	20400	3000	3.67	0.540	<0.001	1520	28.7	<0.004	0.00503	0.088	0.12	0.00718	0.027	80.8	<0.04	4.7	63.3
ML17URA2THST3047	48.8	2.7	<0.002	0.199	6.52	<0.002	<0.002	0.46	0.0073	31100	0.0241	0.257	0.0116	0.603	15.7	0.012	<0.1	601	35.9	0.068	0.0178	0.316	16800	3110	4.34	0.698	<0.001	1360	22.1	<0.004	0.00379	0.025	<0.1	0.01100	<0.02	59.2	0.487	-	63.0
ML17URA2THST3048	64.0	<1.0	<0.002	0.105	5.14	<0.002	<0.002	0.35	0.0045	20500	0.0313	0.507	0.0139	0.703	20.9	<0.01	<0.1	461	27.3	0.104	0.0169	0.813	11400	2690	2.71	0.630	<0.001	1060	13.7	<0.004	0.00475	0.037	<0.1	0.00372	<0.02	49.0	<0.04	6.2	67.8
ML17URA2THST3049	57.8	<2.0	<0.004	0.141	6.52	<0.004	<0.004	<0.4	0.0062	26800	0.0204	0.082	0.0096	0.516	19.1	<0.02	<0.2	511	28.8	0.090	<0.016	0.530	16600	2220	2.66	0.551	<0.002	1450	22.7	<0.008	0.00767	<0.04	<0.2	0.00532	<0.04	41.3	<0.08	10.6	66.7
ML17URA2THST3051	57.5	<2.0	<0.004	0.091	4.53	<0.004	<0.004	<0.4	0.0104	23500	0.0196	0.130	0.0112	0.695	20.3	<0.02	<0.2	434	28.4	0.074	0.0190	0.431	15000	2370	2.64	0.630	<0.002	1070	16.5	<0.008	0.00412	<0.04	<0.2	0.00340	<0.04	32.6	<0.08	9.0	63.7
ML17URA2THST3052	66.7	2.3	<0.004	0.194	5.25	<0.004	<0.004	<0.4	0.0057	21500	0.0287	<0.08	0.0106	0.738	25.2	<0.02	<0.2	487	24.6	0.095	0.0170	0.412	13800	2570	3.42	0.714	<0.002	1290	18.3	<0.008	0.00665	<0.04	<0.2	0.00332	<0.04	40.9	<0.08	6.9	65.3
ML17URA2THST3053	67.4	4.9	<0.004	0.198	5.19	<0.004	<0.004	<0.4	0.0086	20300	0.0367	1.38	0.0195	0.805	42.3	<0.02	<0.2	468	20.0	0.081	0.0320	1.52	12700	2440	3.61	0.572	<0.002	992	16.1	<0.008	0.00893	<0.04	0.21	0.00475	<0.04	35.5	<0.08	6.4	65.2
ML17URA2THST3054	62.0	5.6	<0.004	0.133	4.56	<0.004	<0.004	<0.4	0.0044	26400	0.0228	0.589	0.0138	0.670	34.3	<0.02	<0.2	432	27.1	0.084	0.0270	1.24	16300	2410	3.09	0.542	<0.002	1300	20.4	<0.008	0.00453	<0.04	0.26	0.00402	<0.04	41.8	<0.08	5.2	66.1
ML17URA2THST3055	60.9	5.1	<0.004	0.122	4.88	<0.004	<0.004	<0.4	0.0063	21200	0.0255	0.258	0.0163	0.724	23.6	0.054	<0.2	504	22.4	0.066	0.0170	0.330	14400	2500	3.22	0.554	<0.002	901	19.2	<0.008	0.00506	<0.04	0.26	0.00508	<0.04	44.0	<0.08	5.7	65.0
ML17URA2THST3109	58.5	<2.0	<0.004	0.150	4.39	<0.004	<0.004	<0.4	0.0067	22700	0.0230	0.602	0.0138	0.838	20.1	<0.02	<0.2	502	28.4	0.077	0.0180	0.636	14600	2590	3.72	0.638	<0.002	1280	16.7	<0.008	0.00579	<0.04	<0.2	0.00380	<0.04	45.1	<0.08	4.1	65.4
ML17URA2THST3110	72.1	2.8	<0.004	0.141	5.26	<0.004	<0.004	<0.4	<0.004	19800	0.0318	0.477	<0.008	0.485	14.1	<0.02	<0.2	482	19.9	0.122	0.0250	0.566	13000	2630	2.85	0.613	<0.002	1210	15.1	<0.008	0.00598	<0.04	<0.2	0.00535	<0.04	29.0	<0.08	2.8	69.8
ML17URA2THST3114	57.0	<2.0	<0.004	0.156	5.53	<0.004	<0.004	<0.4	0.0055	28100	0.0234	0.990	0.0161	0.780	27.8	<0.02	<0.2	611	30.7	0.071	0.1020	1.29	17100	2280	4.31	0.583	<0.002	1390	20.8	<0.008	0.00691	<0.04	<0.2	0.00426	<0.04	51.5	0.100	-	66.8
ML17URA2THST3120	67.3	<2.0	<0.004	0.180	5.68	<0.004	<0.004	<0.4	0.0093	27000	0.0293	0.326	0.0138	1.05	24.0	<0.02	<0.2	611	38.3	0.106	0.0260	2.36	18000	2760	3.31	0.639	0.0026	1380	18.1	<0.008	0.00641	<0.04	<0.2	0.01090	<0.04	63.3	<0.08	4.0	66.8
ML17URA2THST3125	55.0	2.9	<0.004	0.202	4.41	<0.004	<0.004	<0.4	0.0079	22200	0.0213	0.163	0.0130	0.736	26.4	<0.02	<0.2	505	24.8	0.098	0.0290	0.204	14600	2580	4.01	0.682	<0.002	1370	12.7	<0.008	0.00528	<0.04	<0.2	0.00569	<0.04	53.1	<0.08	-	62.4

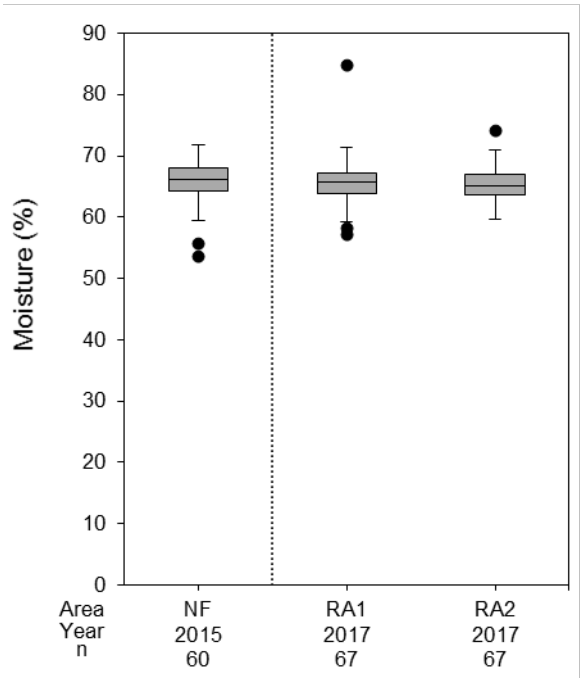
FIN Number	Total Length (mm)	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Cesium	Chromium	Cobalt	Copper	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	Phosphorus	Potassium	Rubidium	Selenium	Silver	Sodium	Strontium	Tellurium	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	Lipid Content (%)	Moisture (%)
ML17URA2THST3132	57.3	2.8	<0.004	0.148	6.41	<0.004	<0.004	<0.4	0.0091	26600	0.0425	1.20	0.0158	0.747	31.0	<0.02	<0.2	569	24.3	0.098	0.0320	0.998	16300	2600	3.16	0.603	<0.002	1440	20.5	<0.008	0.00614	<0.04	<0.2	0.00950	<0.04	59.1	<0.08	<0.8	68.8
ML17URA2THST3133	51.2	3.5	<0.004	0.125	5.35	<0.004	<0.004	<0.4	0.0091	28500	0.0182	0.120	0.0099	0.699	22.8	0.032	<0.2	582	26.9	0.101	0.0220	0.259	16800	2450	2.60	0.642	<0.002	938	21.7	<0.008	0.00540	<0.04	0.26	0.00682	<0.04	54.8	<0.08	-	61.6
ML17URA2THST3141	61.6	<2.0	0.0138	0.179	5.72	<0.004	<0.004	<0.4	0.0047	24800	0.0247	0.140	0.0099	0.727	22.5	<0.02	<0.2	484	33.5	0.079	0.0160	0.158	15700	2440	3.00	0.560	<0.002	1280	17.7	<0.008	0.00904	<0.04	<0.2	0.00458	<0.04	47.4	<0.08	7.2	64.0
ML17URA2THST3143	55.8	<2.0	<0.004	0.146	4.72	<0.004	<0.004	<0.4	0.0090	20300	0.0145	0.285	0.0125	0.782	19.2	<0.02	<0.2	406	28.0	0.080	0.0260	0.255	12900	2510	3.20	0.662	0.0039	1190	16.7	<0.008	0.00542	<0.04	<0.2	0.00588	<0.04	40.9	<0.08	6.1	64.0
ML17URA2THST3180	70.5	3.1	<0.004	0.167	6.15	<0.004	<0.004	<0.4	0.0051	27400	0.0420	0.107	0.0110	0.704	20.1	<0.02	<0.2	553	18.8	0.132	<0.016	0.150	15400	2620	3.34	0.708	<0.002	1480	19.0	<0.008	0.00725	<0.04	<0.2	0.01030	<0.04	36.1	<0.08	4.3	65.9
ML17URA2THST3183	55.9	<2.0	<0.004	0.130	4.96	<0.004	<0.004	<0.4	0.0056	22800	0.0366	0.678	0.0137	0.740	18.8	<0.02	<0.2	458	31.8	0.098	0.0160	0.512	13700	2520	2.98	0.610	<0.002	1100	17.4	<0.008	0.00724	<0.04	<0.2	0.00256	<0.04	44.9	<0.08	5.6	64.2
ML17URA2THST3184	59.7	18.6	<0.004	0.152	6.28	<0.004	0.0054	4.24	0.0060	26800	0.0429	0.138	0.0128	0.638	19.2	0.022	<0.2	550	26.0	0.143	<0.016	0.196	15400	2080	3.67	0.555	<0.002	1400	19.9	<0.008	0.00579	<0.04	0.42	0.00628	<0.04	64.8	<0.08	<2.0	70.9
ML17URA2THST3186	56.4	<2.0	<0.004	0.121	6.08	<0.004	<0.004	<0.4	0.0132	26800	0.0201	0.153	0.0129	0.986	18.7	<0.02	<0.2	604	37.8	0.064	0.0220	0.159	17000	2430	2.99	0.642	0.0025	1020	21.3	<0.008	0.00570	<0.04	<0.2	0.00477	<0.04	57.6	<0.08	9.6	65.6
ML17URA2THST3187	62.2	17.3	<0.004	0.147	7.72	<0.004	0.0040	3.05	0.0046	30400	0.0271	0.218	0.0133	0.673	24.2	<0.02	<0.2	634	26.8	0.127	<0.016	0.113	18300	2310	3.28	0.597	<0.002	1220	25.5	<0.008	0.00706	<0.04	0.35	0.00789	<0.04	63.8	<0.08	3.5	66.8
ML17URA2THST3189	72.0	2.1	<0.002	0.131	5.60	<0.002	<0.002	<0.2	0.0037	20200	0.0305	0.073	0.0160	0.663	22.2	<0.01	<0.1	496	27.8	0.100	0.0160	0.216	12200	2430	2.55	0.649	<0.001	1220	16.5	<0.004	0.00538	<0.02	<0.1	0.00627	<0.02	47.4	<0.04	4.6	67.7
ML17URA2THST3190	69.8	2.1	0.0085	0.134	3.89	<0.002	<0.002	<0.2	0.0027	15500	0.0292	0.062	0.0116	0.635	22.4	0.013	<0.1	432	26.9	0.122	0.0130	0.089	9970	2550	3.13	0.599	<0.001	1040	12.3	<0.004	0.00740	<0.02	0.11	0.00312	<0.02	36.2	<0.04	4.1	69.1
ML17URA2THST3191	60.1	2.7	<0.002	0.129	4.78	<0.002	<0.002	<0.2	0.0044	26800	0.0323	0.082	0.0140	0.622	18.6	0.020	<0.1	566	27.3	0.145	0.0116	0.415	15400	2300	2.47	0.574	<0.001	1140	19.8	<0.004	0.00380	<0.02	<0.1	0.00508	<0.02	56.4	<0.04	0.8	70.7
ML17URA2THST3192	58.2	19.2	0.0032	0.186	5.96	<0.002	<0.002	<0.2	0.0062	31600	0.0391	0.298	0.0289	0.647	58.7	0.245	<0.1	691	33.4	0.134	0.0270	0.649	17500	2370	3.43	0.583	0.0014	1610	24.1	<0.004	0.00453	<0.02	0.95	0.01010	0.073	74.1	<0.04	<0.9	68.0
ML17URA2THST3193	57.9	2.2	0.0079	0.211	6.15	<0.002	<0.002	0.82	0.0044	28500	0.0348	0.212	0.0177	0.792	23.1	0.022	<0.1	648	18.1	0.196	0.0150	0.545	17300	2980	4.27	0.680	0.0015	2120	18.8	<0.004	0.00407	0.083	0.12	0.00513	<0.02	67.5	<0.04	1.4	66.9
ML17URA2THST3194	60.3	1.5	<0.002	0.092	7.25	<0.002	<0.002	0.40	0.0033	36400	0.0470	0.113	0.0141	0.561	13.3	<0.01	<0.1	703	36.3	0.104	0.0144	1.46	21100	2220	2.78	0.436	<0.001	1440	23.7	<0.004	0.00784	0.058	<0.1	0.00349	0.023	51.1	<0.04	6.1	63.7
ML17URA2THST3195	60.5	2.4	<0.002	0.133	6.18	<0.002	<0.002	0.38	0.0030	28300	0.0511	0.288	0.0129	0.660	21.7	0.017	<0.1	521	36.7	0.079	0.0564	0.632	16700	2730	3.14	0.553	<0.001	1060	18.9	<0.004	0.00485	0.081	<0.1	0.00380	<0.02	53.9	<0.04	6.6	63.2
ML17URA2THST3196	61.5	3.7	<0.004	0.167	9.26	<0.004	<0.004	0.46	0.0057	45800	0.0262	0.268	0.0127	0.552	17.2	<0.02	<0.2	771	40.2	0.130	0.0300	0.725	24600	2390	2.99	0.616	<0.002	1790	31.9	<0.008	0.00496	0.047	<0.2	0.00820	<0.04	85.7	<0.08	<1.0	62.0
ML17URA2THST3197	69.0	2.5	<0.002	0.089	6.26	<0.002	<0.002	0.33	0.0042	31400	0.0520	0.277	0.0191	0.726	19.8	0.017	<0.1	686	48.0	0.112	0.0295	0.476	19000	3010	3.11	0.648	<0.001	1370	22.1	<0.004	0.00594	0.049	<0.1	0.00368	<0.02	59.4	<0.04	4.5	61.2
ML17URA2THST3198	63.1	4.1	<0.002	0.133	7.45	<0.002	<0.002	0.40	0.0044	28500	0.0371	0.129	0.0149	0.681	23.1	0.024	<0.1	542	45.3	0.110	0.0188	0.891	17300	2870	3.05	0.644	<0.001	1520	19.7	<0.004	0.00560	0.051	<0.1	0.00552	0.024	65.4	<0.04	6.6	60.8
ML17URA2THST3336	57.4	1.8	<0.002	0.153	7.83	<0.002	<0.002	0.37	0.0054	29400	0.0378	0.161	0.0120	0.555	18.6	0.014	<0.1	596	38.6	0.088	0.0218	0.375	17700	1900	3.06	0.564	0.0013	1370	18.8	<0.004	0.00834	0.040	<0.1	0.01400	<0.02	72.1	<0.04	<0.4	74.1
ML17URA2THST3338	57.7	1.0	<0.002	0.159	5.48	<0.002	<0.002	0.47	0.0044	26200	0.0330	<0.04	0.0110	0.671	16.7	0.017	<0.1	540	29.5	0.091	0.0159	0.274	15400	2140	3.17	0.495	<0.001	909	17.2	<0.004	0.00377	0.043	<0.1	0.00616	<0.02	55.2	<0.04	2.5	69.1
ML17URA2THST3339	63.8	<1.0	<0.002	0.140	5.48	<0.002	<0.002	0.32	0.0042	22100	0.0273	0.085	0.0118	0.601	15.8	0.013	<0.1	424	29.4	0.069	0.0119	0.224	13100	2150	2.57	0.502	<0.001	1120	15.8	<0.004	0.00356	0.075	<0.1	0.00781	<0.02	53.2	<0.04	4.4	70.3
ML17URA2THST3340	58.8	<1.0	<0.002	0.168	6.30	<0.002	<0.002	0.36	0.0037	25600	0.0386	0.066	0.0136	0.748	15.6	<0.01	<0.1	524	21.4	0.098	0.0141	0.677	15200	2700	2.95	0.549	<0.001	1460	18.5	<0.004	0.00714	0.065	<0.1	0.00491	<0.02	53.7	<0.04	5.2	66.1
ML17URA2THST3341	49.0	2.3	<0.002	0.171	7.45	<0.002	<0.002	0.74	0.0063	29800	0.0377	0.450	0.0231	0.788	24.2	0.030	<0.1	564	30.7	0.080	0.0282	3.48	17900	2590	2.97	0.624	0.0013	1230	21.5	<0.004	0.00680	0.042	<0.1	0.00674	<0.02	59.4	<0.04	-	60.4
ML17URA2THST3342	51.4	1.3	0.0044	0.166	5.56	<0.002	<0.002	0.30	0.0045	27400	0.0418	0.127	0.0141	0.844	25.4	<0.01	<0.1	473	35.2	0.076	0.0173	0.869	16700	2500	3.92	0.556	<0.001	1200	17.7	<0.004	0.00383	0.041	<0.1	0.00844	<0.02	67.6	<0.04	-	64.7
ML17URA2THST3343	57.3	1.3	<0.002	0.142	6.38	<0.002	<0.002	0.36	0.0035	23300	0.0594	0.163	0.0168	0.890	17.5	0.013	<0.1	507	23.8	0.140	0.0162	1.70	14300	2950	3.54	0.624	<0.001	1530	17.0	<0.004	0.00858	0.076	<0.1	0.00477	<0.02	61.7	<0.04	1.0	70.1
ML17URA2THST3344	48.4	<1.0	<0.002	0.068	4.68	<0.002	<0.002	0.30	<0.002	15700	0.0315	1.45	0.0205	0.665	20.4	0.011	<0.1	363	19.2	0.059	0.1660	1.16	10100	2830	2.31	0.499	<0.001	1080	12.6	<0.004	0.00586	0.051	<0.1	0.00140	0.025	41.3	<0.04	-	70.3

Note: all values in milligram per kilogram wet weight (mg/kg ww) except where indicated.
mm = millimetre; % = percent; < = less than; - = not recorded or not applicable.

Table 6D-4: Statistical Outliers Omitted from Fish Tissue Chemistry Analysis

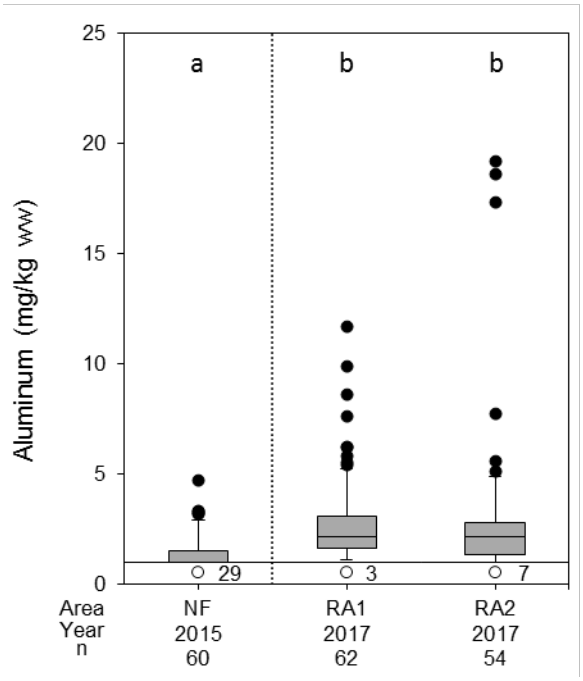
Parameter	Statistical Test	Fish Identification Number	Studentized Residual
Moisture	ANOVA	ML15UNFTHST1052	-3.88
	ANOVA	ML15UNFTHST1067	-3.15
	ANOVA	ML17URA1THST2222	6.36
Arsenic	ANOVA	ML15UNFTHST1085	5.29
	ANOVA	ML15UNFTHST1122	3.72
Barium	$ANOVA_{log}$	ML15UNFTHST1216	-3.74
	$ANOVA_{log}$	ML17URA2THST3044	-3.14
Cadmium	$ANOVA_{log}$	ML17URA1THST2352	3.64
	$ANOVA_{log}$	ML17URA2THST3344	-3.91
Calcium	$ANOVA_{log}$	ML15UNFTHST1122	3.12
	$ANOVA_{log}$	ML17URA1THST2221	3.15
	$ANOVA_{log}$	ML17URA2THST3196	4.18
Cesium	$ANOVA_{log}$	ML15UNFTHST1235	3.23
	$ANOVA_{log}$	ML15UNFTHST1239	3.63
Copper	$ANOVA_{log}$	ML17URA1THST2060	3.21
	$ANOVA_{log}$	ML17URA1THST2222	-4.56
Magnesium	ANOVA	ML17URA1THST2222	-3.11
Mercury	$ANOVA_{log}$	ML17URA1THST2078	3.06
	$ANOVA_{log}$	ML17URA1THST2222	-3.8
	$ANOVA_{log}$	ML17URA2THST3193	3.08
Phosphorus	ANOVA	ML17URA1THST2222	-3.13
	ANOVA	ML17URA2THST3196	3.81
Potassium	$ANOVA_{log}$	ML17URA1THST2222	-7.22
Selenium	$ANOVA_{log}$	ML17URA1THST2060	3.27
	$ANOVA_{log}$	ML17URA1THST2222	-6.72
Sodium	ANOVA	ML15UNFTHST1119	-3.27
	ANOVA	ML17URA1THST2222	-3.43
	ANOVA	ML17URA2THST3193	4.44
Strontium	ANOVA	ML17URA1THST2222	-3.1
	ANOVA	ML17URA2THST3196	3.53
Uranium	$ANOVA_{log}$	ML17URA2THST3344	-3.4
Zinc	$ANOVA_{log}$	ML15UNFTHST1122	3.14

Note: Outlier threshold defined as a studentized residual greater than |3.0|.
ANOVA = analysis of variance; log = log_{10} transformed data.



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; % = percent; n = sample size.

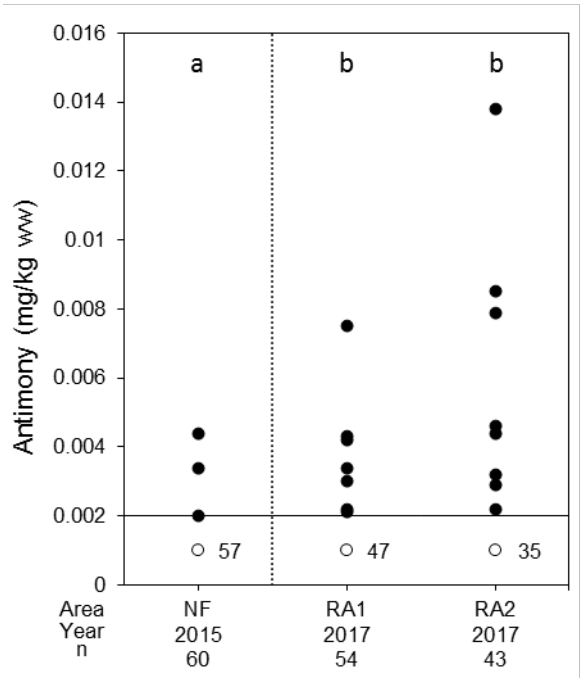
Figure 6E-1: Percent Moisture of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

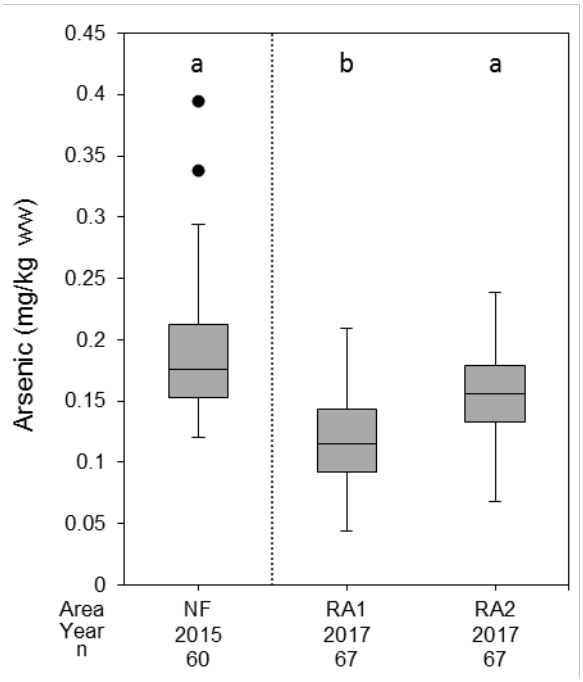
Figure 6E-2: Aluminum Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

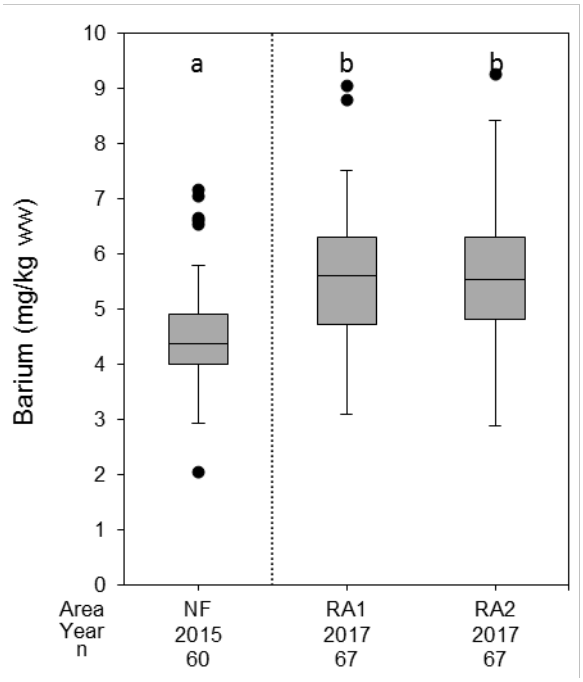
Figure 6E-3: Antimony Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

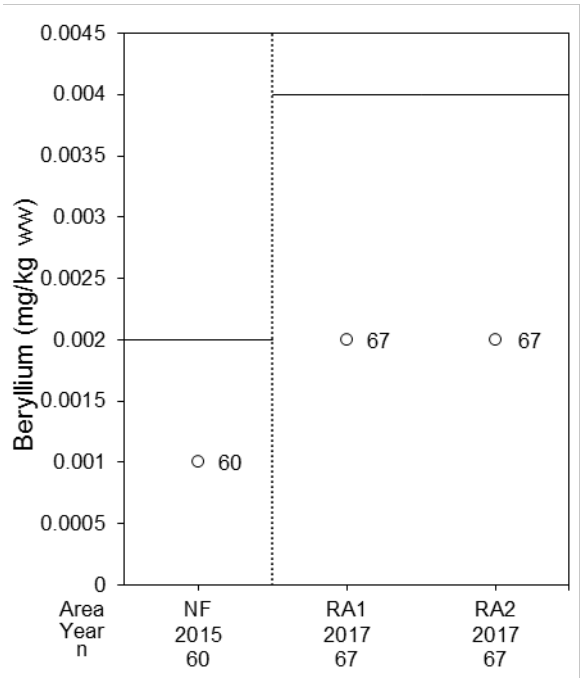
Figure 6E-4: Arsenic Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

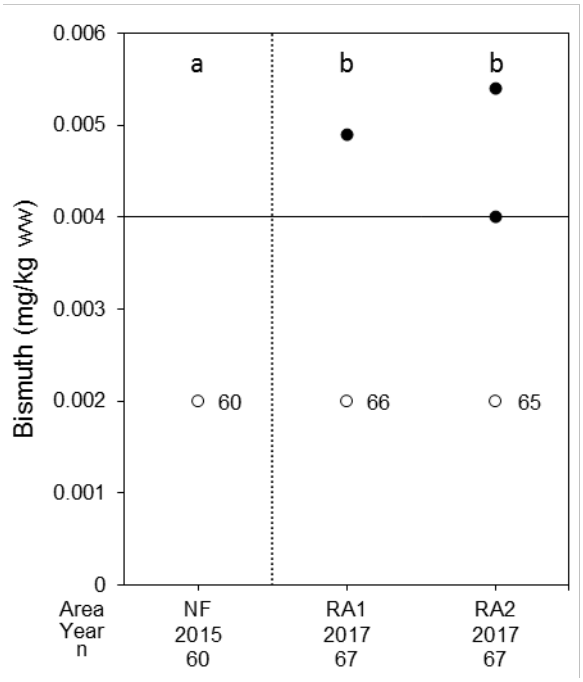
Figure 6E-5: Barium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

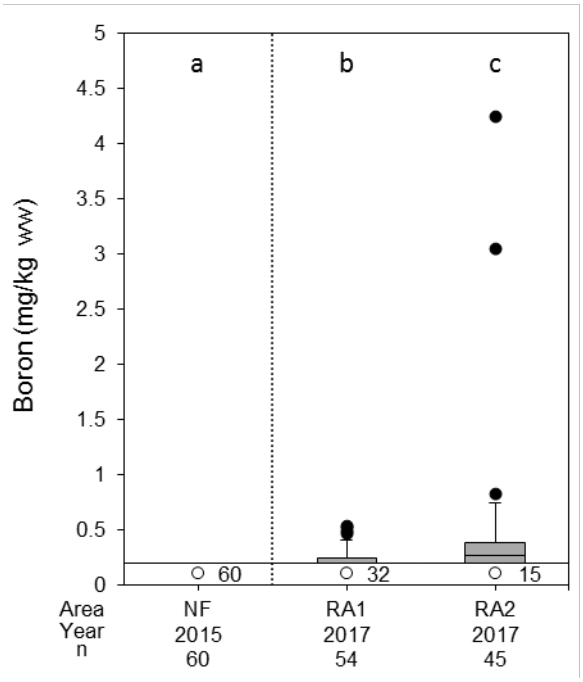
Figure 6E-6: Beryllium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

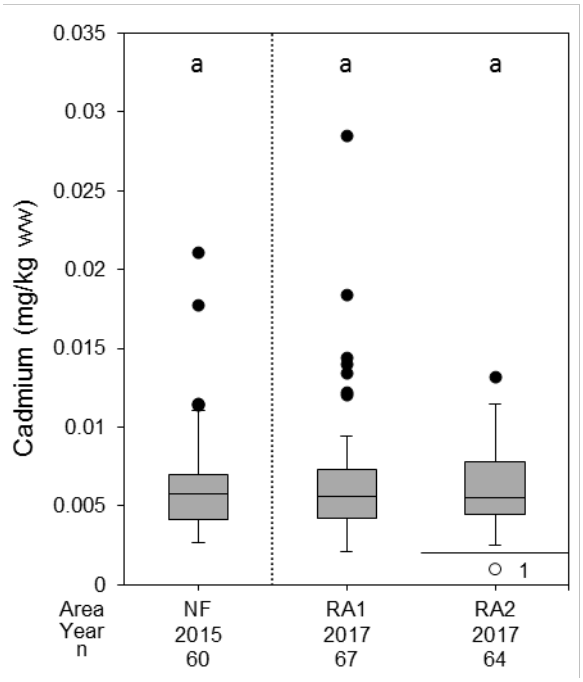
Figure 6E-7: Bismuth Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

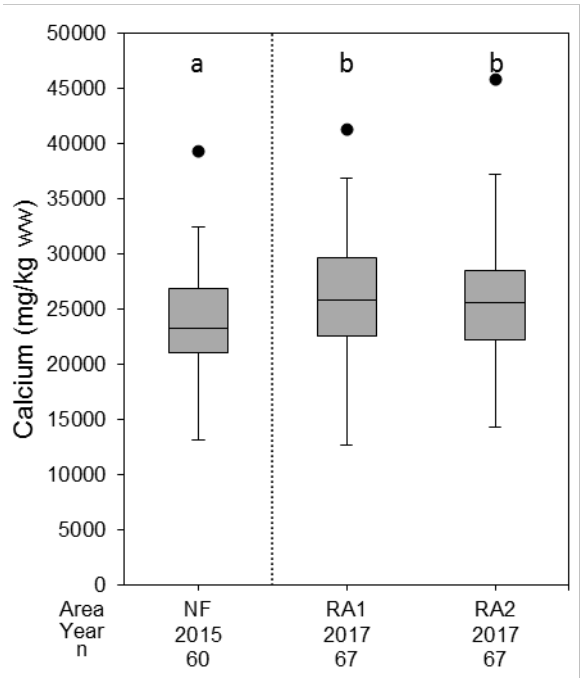
Figure 6E-8: Boron Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

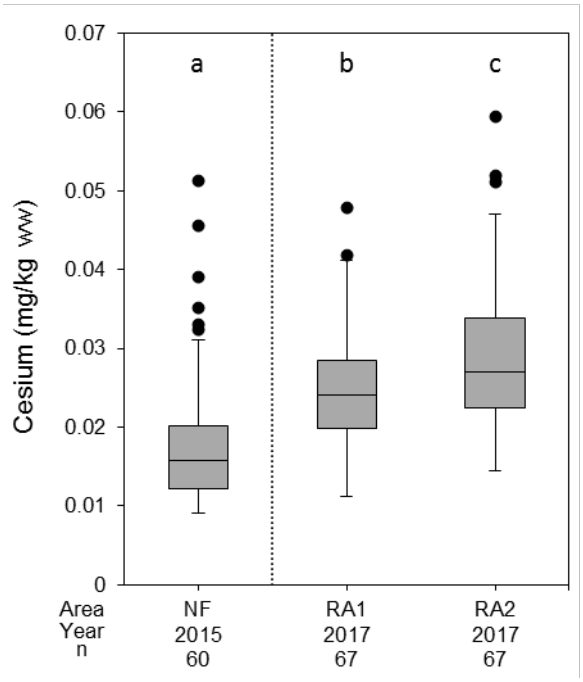
Figure 6E-9: Cadmium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Creek, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

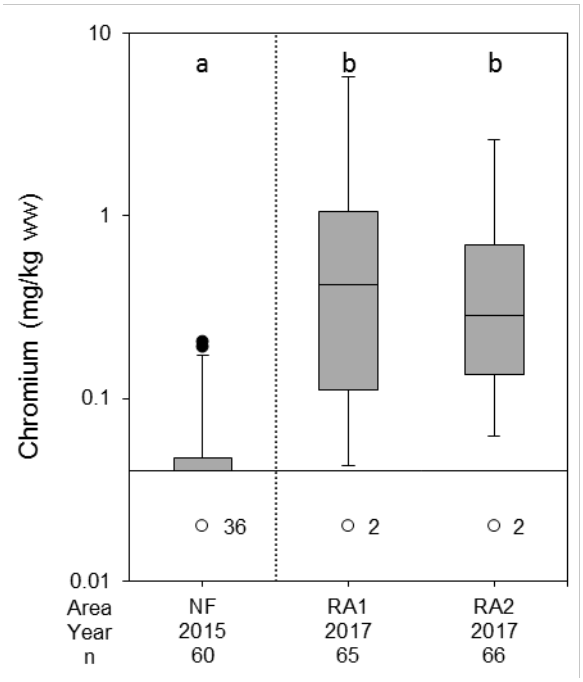
Figure 6E-10: Calcium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

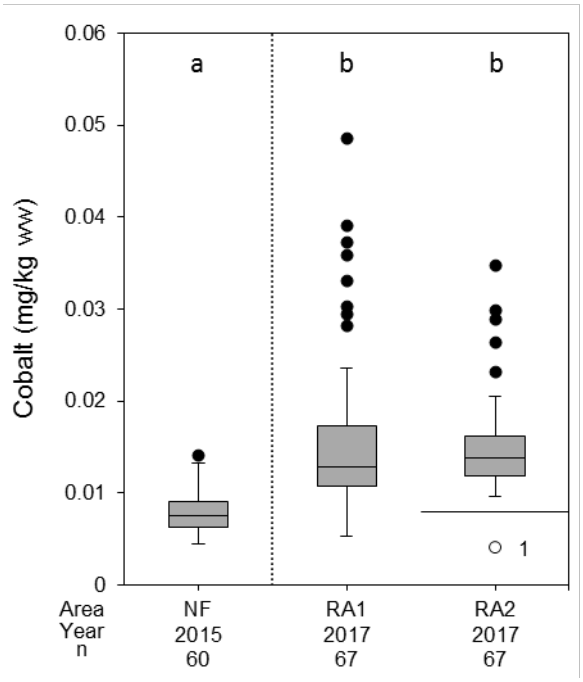
Figure 6E-11: Cesium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

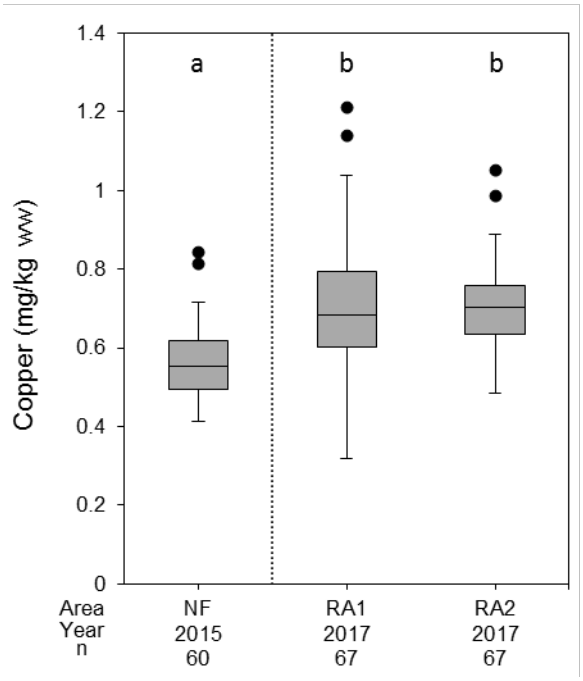
Figure 6E-12: Chromium Concentration (log_{10}) of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

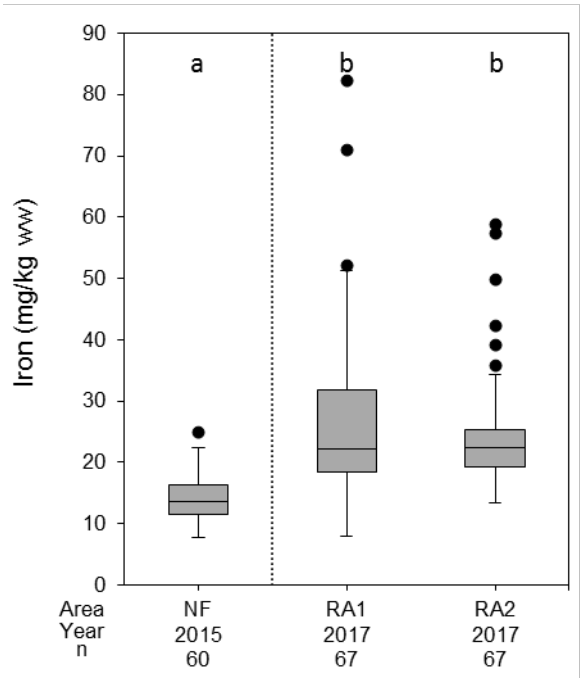
Figure 6E-13: Cobalt Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

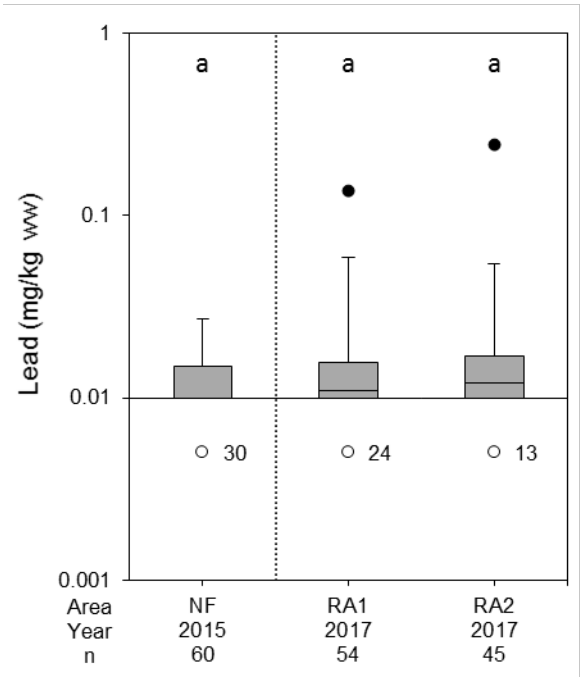
Figure 6E-14: Copper Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

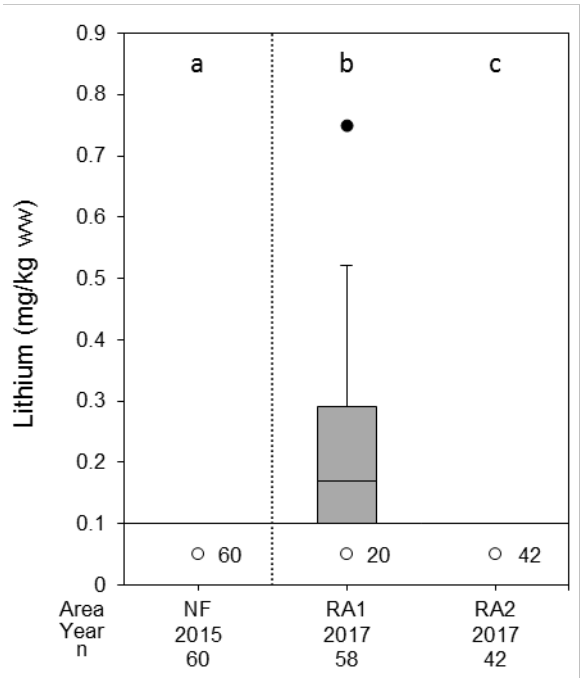
Figure 6E-15: Iron Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

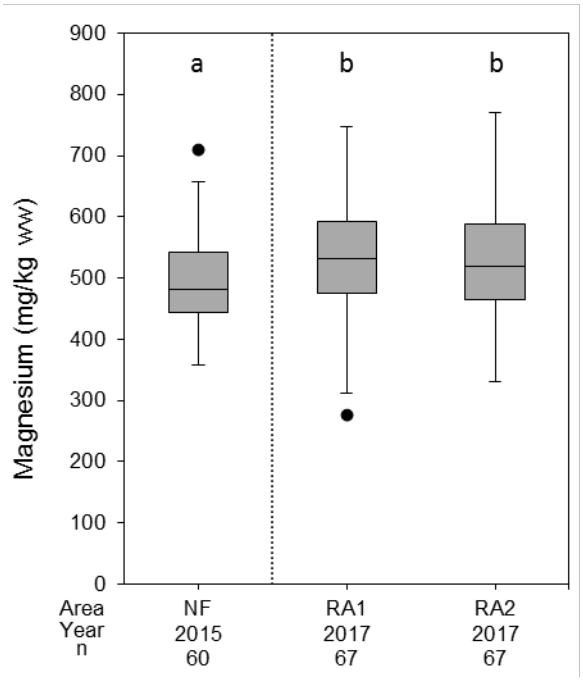
Figure 6E-16: Lead Concentration (log_{10}) of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

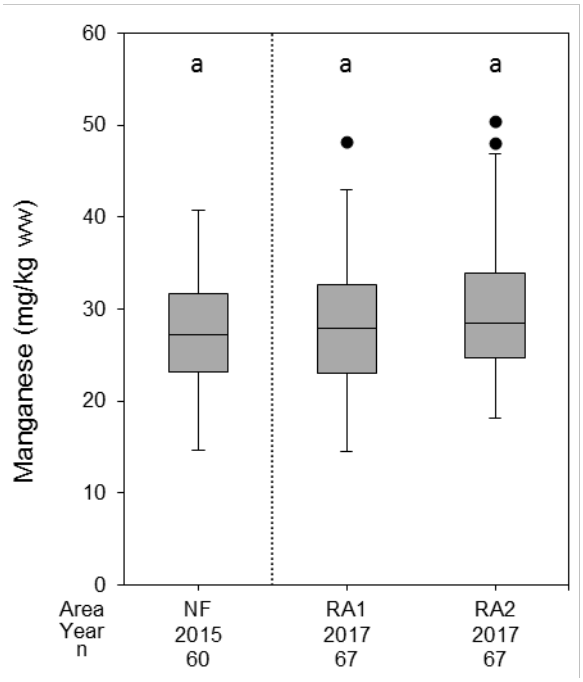
Figure 6E-17: Lithium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

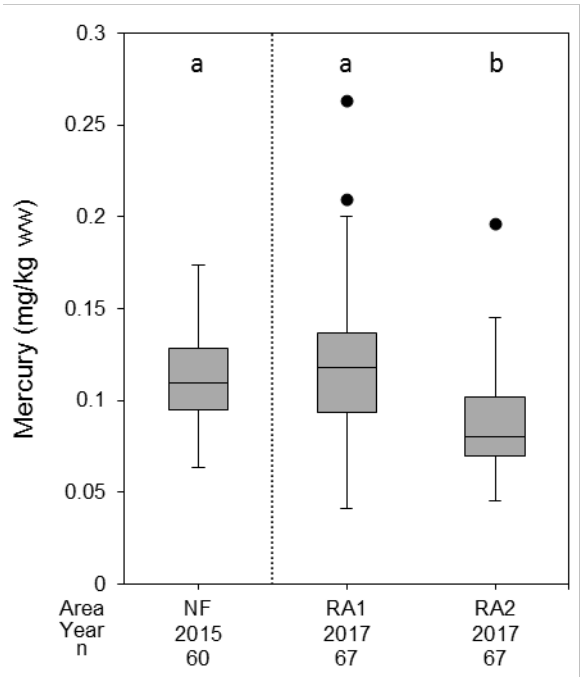
Figure 6E-18: Magnesium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

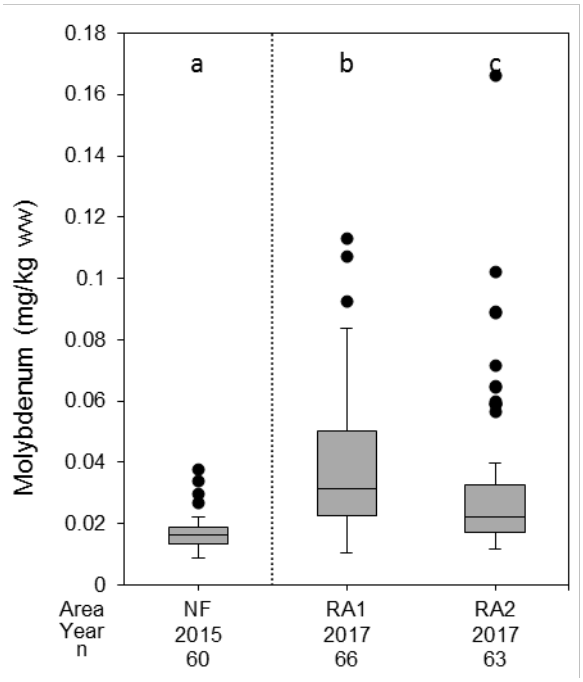
Figure 6E-19: Manganese Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

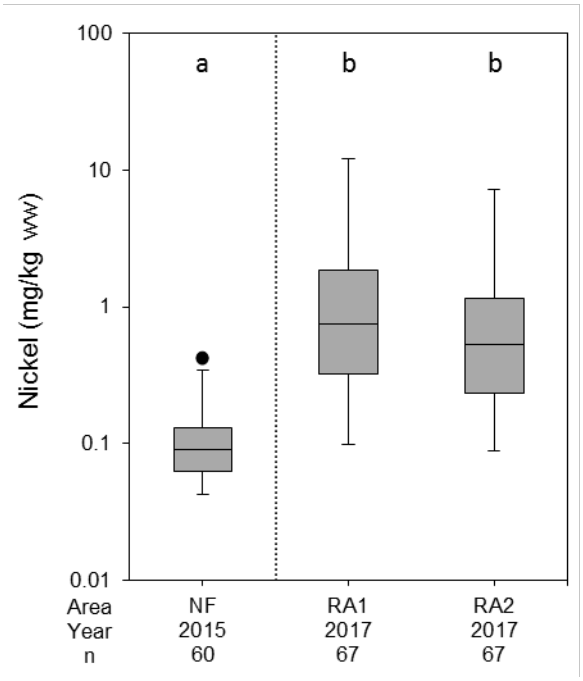
Figure 6E-20: Mercury Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

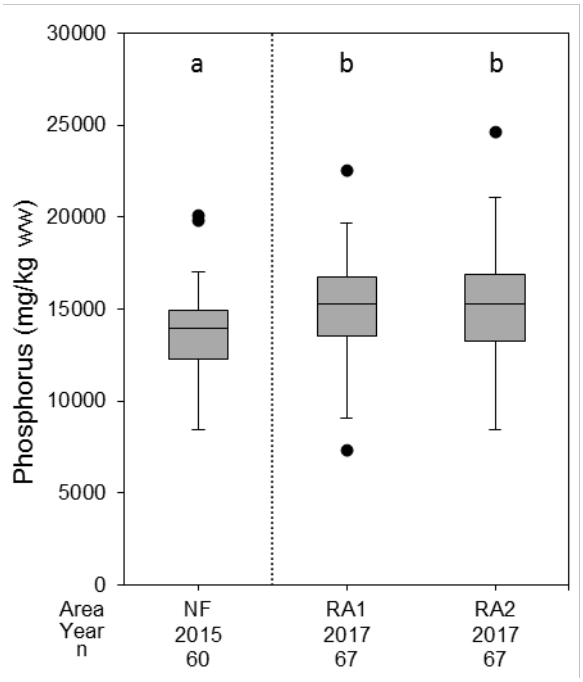
Figure 6E-21: Molybdenum Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

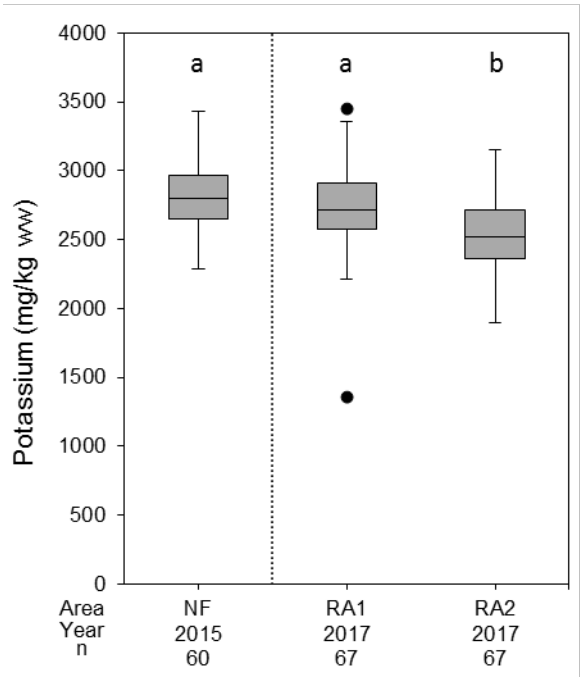
Figure 6E-22: Nickel Concentration (log_{10}) of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

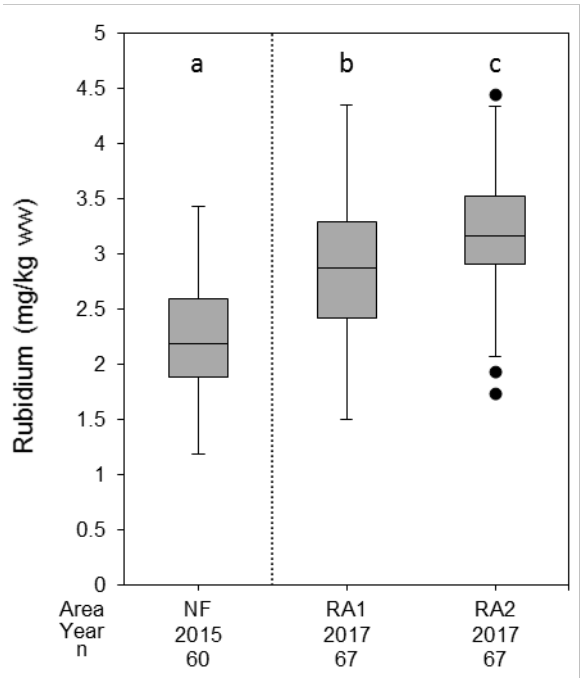
Figure 6E-23: Phosphorus Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

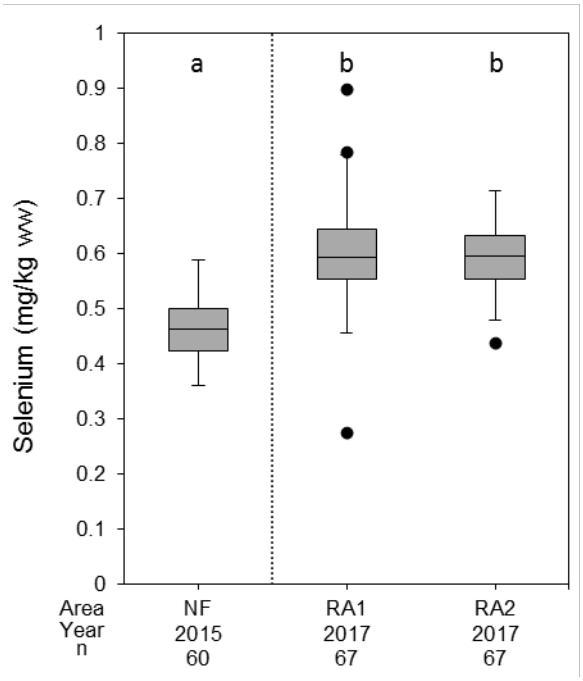
Figure 6E-24: Potassium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

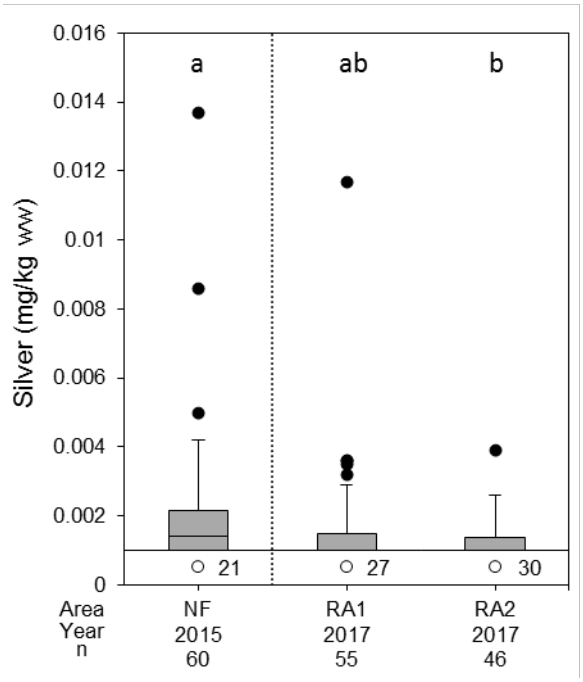
Figure 6E-25: Rubidium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

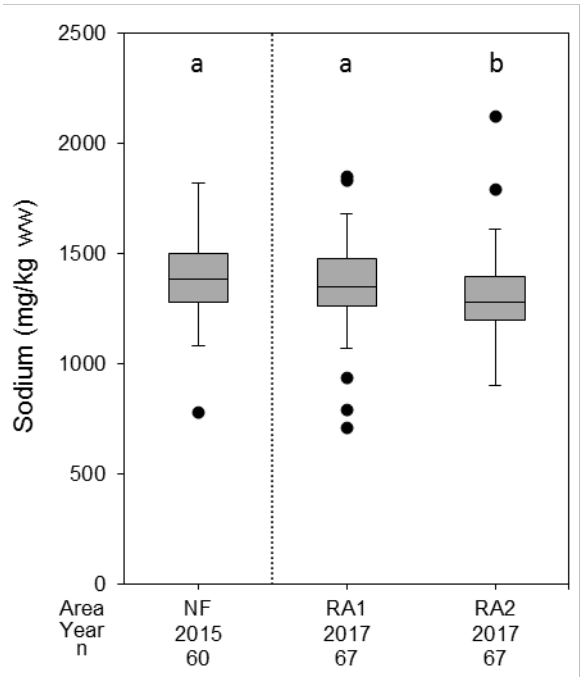
Figure 6E-26: Selenium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

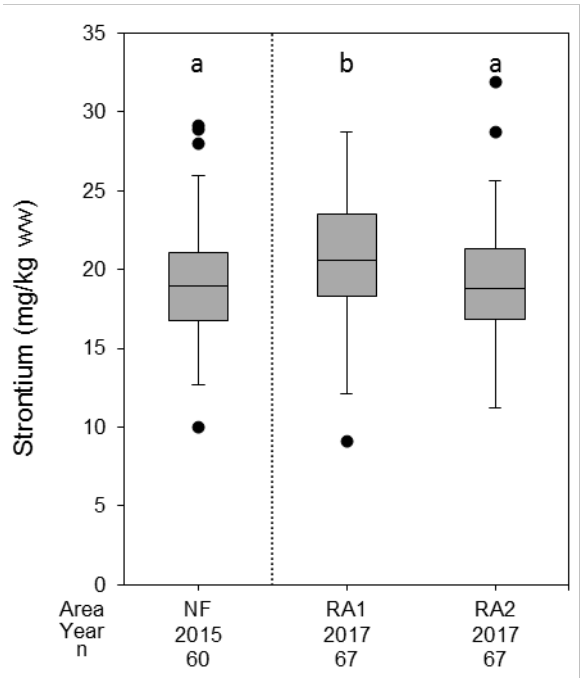
Figure 6E-27: Silver Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

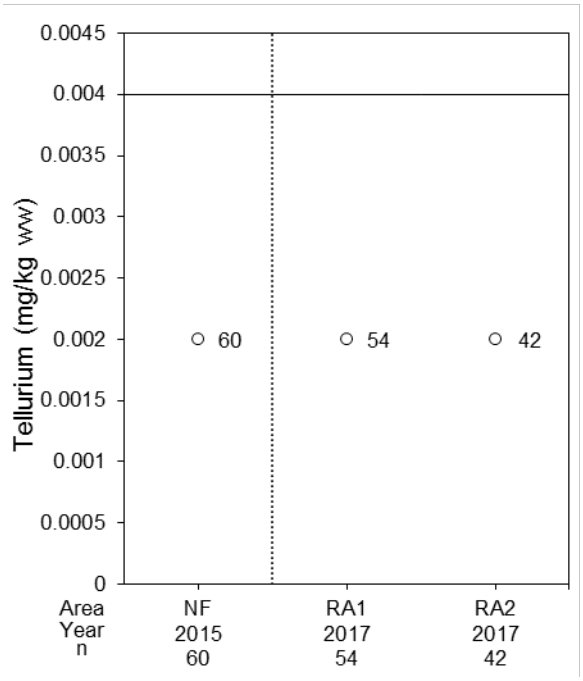
Figure 6E-28: Sodium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

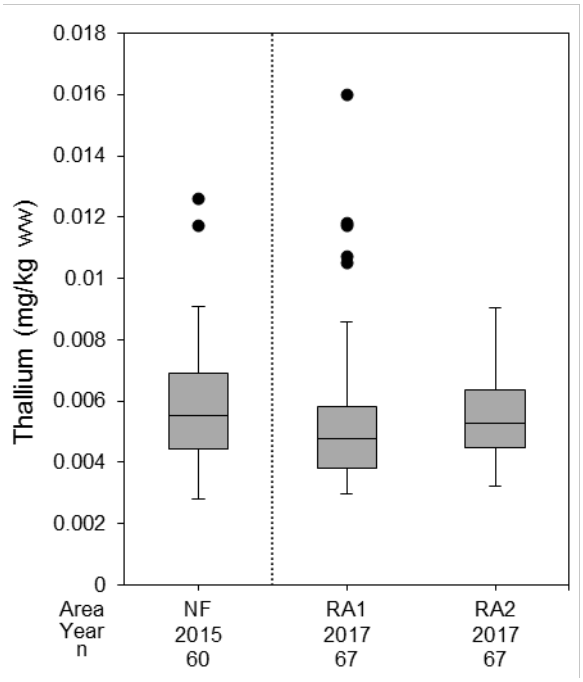
Figure 6E-29: Strontium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Horizontal line indicates detection limit.

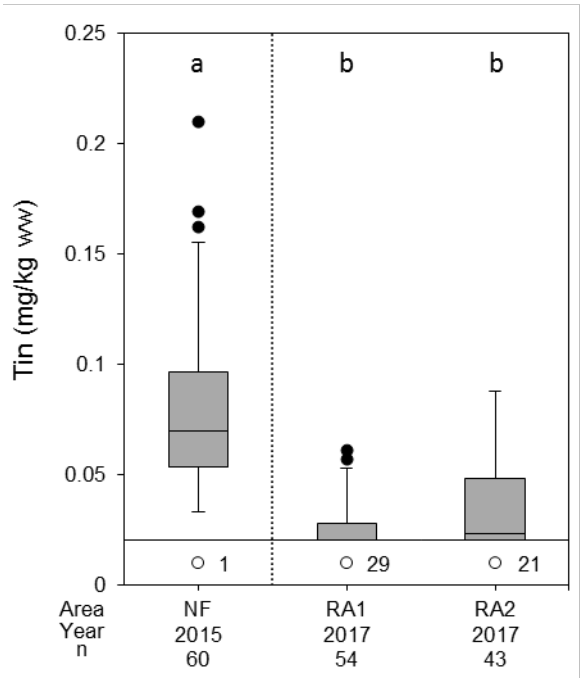
NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

Figure 6E-30: Tellurium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

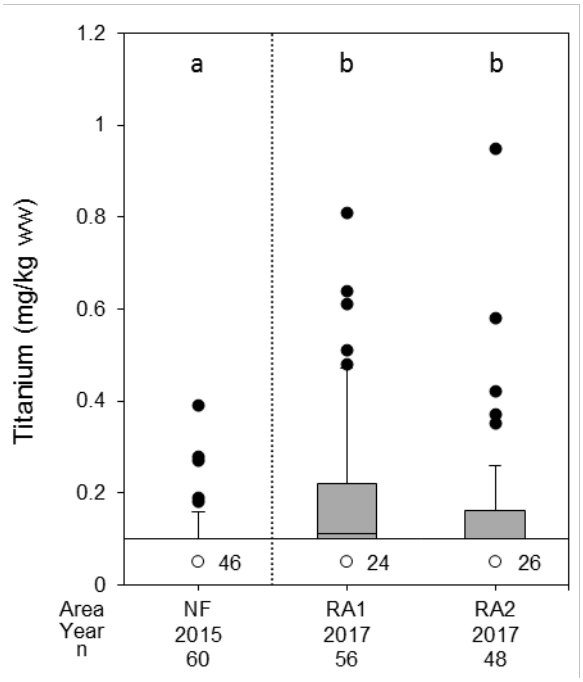
Figure 6E-31: Thallium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

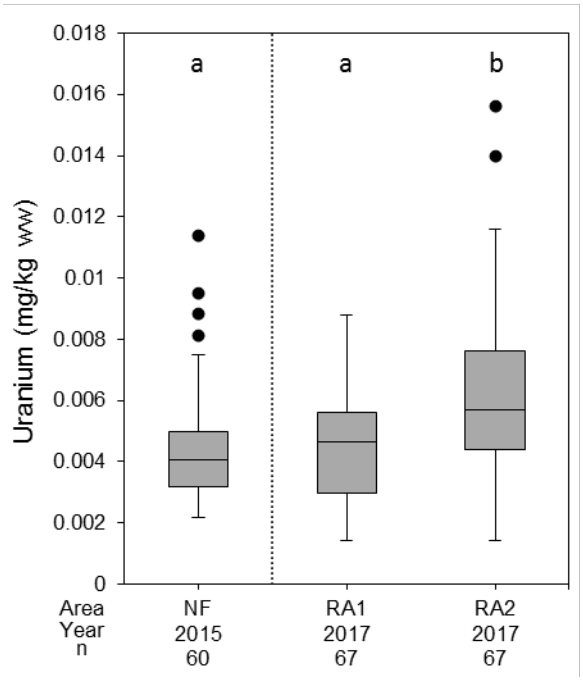
Figure 6E-32: Tin Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

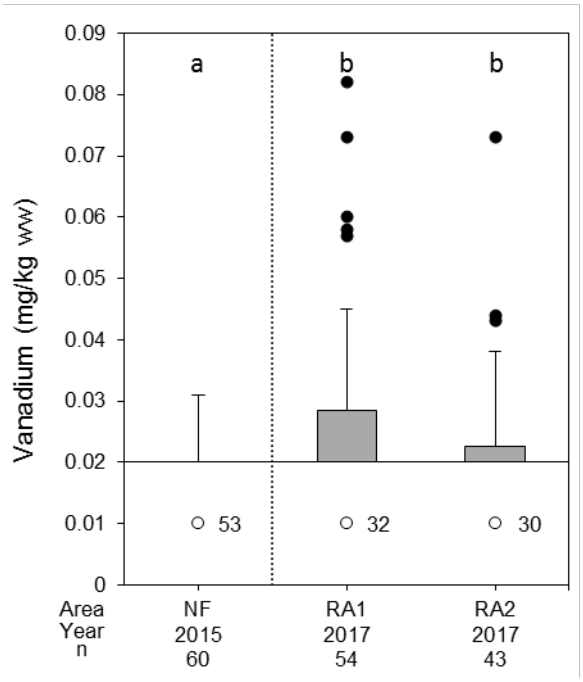
Figure 6E-33: Titanium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

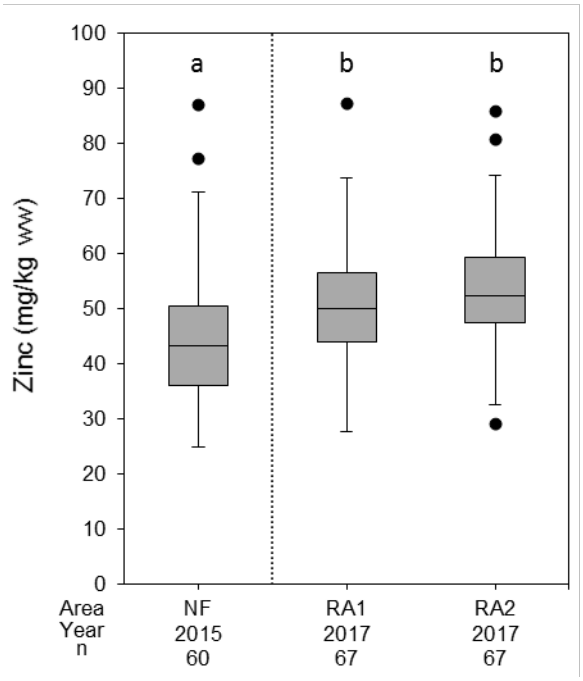
Figure 6E-34: Uranium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

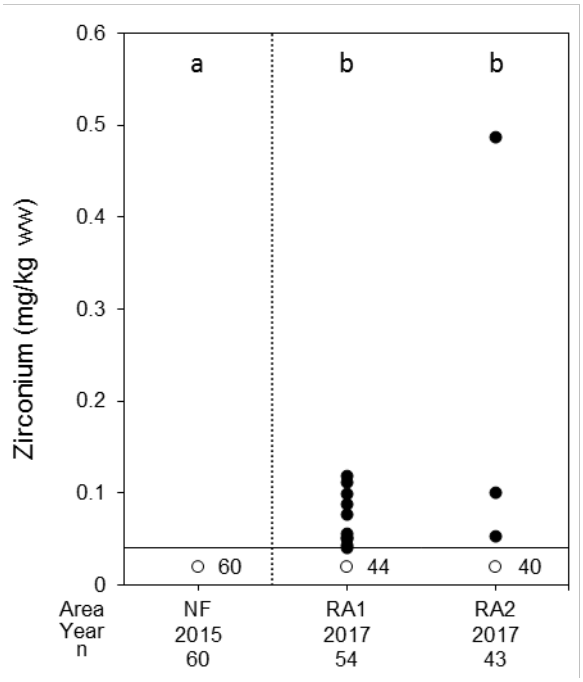
Figure 6E-35: Vanadium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Areas sharing the same letter are not significantly different from one another.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

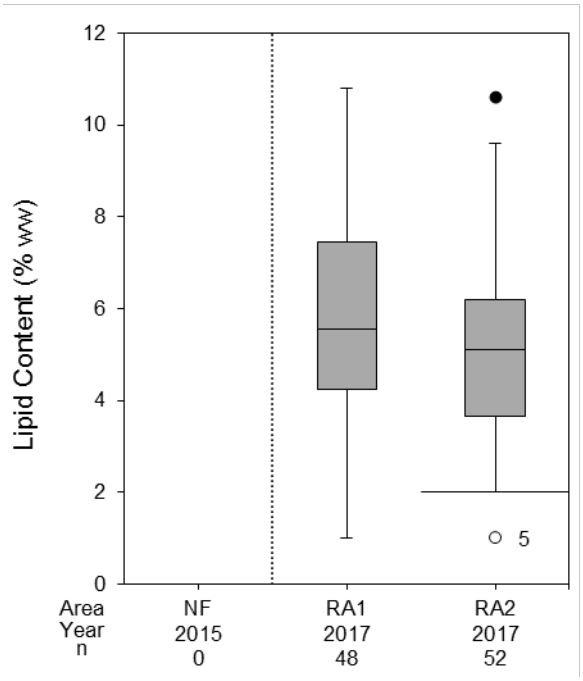
Figure 6E-36: Zinc Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Notes: Areas sharing the same letter are not significantly different from one another. Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; mg/kg ww = milligram per kilogram wet weight; n = sample size.

Figure 6E-37: Zirconium Concentration of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2015 and 2017



Note: Horizontal line indicates detection limit.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; % ww = percent wet weight; n = sample size.

Figure 6E-38: Lipid Content of Threespine Stickleback Lethally Sampled from Meliadine Lake, 2017

APPENDIX 7A – 7E

Plankton

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ATTACHMENTS

ATTACHMENT 6A-1
Laboratory QC Methods and Results Detail

7A1.0 INTRODUCTION

Quality assurance and quality control (QA/QC) procedures are typically applied during all aspects of a monitoring program, and are used to determine data integrity. Quality assurance (QA) procedures include training of personnel, data management, and other technical practices designed to confirm that high quality data are consistently generated. Quality control (QC) procedures include steps to measure and evaluate data quality, as well as the corrective actions that are applied when data quality objectives are not achieved.

The QA/QC procedures implemented during the 2017 plankton monitoring programs under the Aquatic Effects Monitoring Program (AEMP) for the Meliadine Gold Mine Project (Project) are described in the following sections. QA/QC procedures and results for the 2015 and 2016 plankton monitoring programs are reported in Golder (2017). An evaluation of the QC data and implications for the interpretation of the AEMP study results is also included.

7A2.0 QUALITY ASSURANCE

Similar to water quality (Appendix 3A) and sediment quality (Appendix 4A), the QA procedures implemented for the 2017 plankton monitoring programs can be classified into three categories of data management. These include field operations, laboratory analyses, and office operations.

7A2.1 Field Operations

Quality assurance procedures for field operations involve field crew training, pre field meetings, and the use of standardized methods and explicit instructions for collecting and handling field data. Field staff for the Project were trained to be proficient in standardized field sampling procedures, data recording, and equipment operation. Golder Associates Ltd. (Golder) developed specific work instructions (SWI) for the field component of Project, based on standardized technical procedures that are consistent with widely accepted field protocols described in relevant scientific literature (e.g., Environment Canada 1993). Field work was completed according to the SWI, which included the exact locations of sampling sites and detailed step by step instructions for field tasks, including:

- equipment maintenance
- sample collection, handling, preservation, labelling, storage, and shipping
- record keeping and sample tracking

The SWI also included contact information for members of the project team and the analytical laboratory, as well as references to applicable technical procedures. Field data were recorded on standardized field data sheets or in a bound field notebook. Chain of custody forms were used to track samples sent to the analytical laboratory, and receipt of the samples at the laboratory was confirmed. The crew lead was responsible for tracking samples to confirm that all required samples were collected, chain of custody and analytical request forms were complete and correct, and that labelling and documentation procedures were followed. Field crews checked in with component managers, as needed, and submitted daily reports to provide updates on completed tasks.

Pre field meetings were held with the field crew and project/component manager prior to the start of each field program to discuss the purpose of the field program, the role of each crew member, specific details of the SWI, equipment needs, field logistics, and contingency plans.

7A2.2 Laboratory Analyses

Water samples collected in 2017 for depth integrated nutrient (DIN) and chlorophyll a analyses were submitted to a Canadian Association for Laboratory Accreditation Inc. (CALA) accredited laboratory; therefore, confidence in the reliability of the analytical results received from the laboratory is considered high. To receive accreditation, a laboratory must pass an evaluation of its internal procedures, analytical methods, and QC processes.

A designated member of the project team was responsible for liaising with the analytical laboratories.

7A2.3 Office Operations

Quality assurance procedures implemented for office based tasks included the following:

- having trained personnel complete data management, analysis, and reporting tasks
- using standardized data storage, manipulation, and summary tools, as required
- establishing a data management system to support consistency, QC, and data retrieval
- senior review of data deliverables at appropriate milestones

7A3.0 QUALITY CONTROL

Quality Control (QC) steps implemented during the 2017 plankton monitoring program activities can be classified into the same three categories used describe QA procedures: field operations, laboratory analyses, and office operations.

7A3.1 Field Operations

Quality control procedures implemented during field operations included the collection of QC samples that were used to check the precision of field sampling methods and laboratory analyses. Quality control samples collected in support of the plankton monitoring programs included:

- **Duplicate DIN samples:** Duplicate samples consisted of paired, depth integrated water samples collected at the same time and location, using the same methods. Duplicate samples were collected at randomly selected stations in Meliadine Lake, and represented approximately 10% of the total number of DIN samples submitted for analysis. All QC samples were submitted “blind” to the analytical laboratory and analyzed for the same set of parameters as the other DIN samples.
- **Triplicate Chlorophyll a samples:** Triplicate samples were collected at all stations in Meliadine Lake and were kept cool and dark until filtered and frozen prior to sample shipment.

- **Duplicate phytoplankton and zooplankton samples:** These samples were collected at randomly selected stations in Meliadine Lake.

7A3.2 Laboratory Analyses

To support analysis of the DIN samples, the analytical laboratory prepared in house quality control samples and analyzed them along with the field collected samples. The objective was to confirm the quality and reliability of the analytical results. Quality control sample types included duplicate analyses, spiked samples, and method blanks.

Plankton R Us performed an internal QC of the phytoplankton taxonomy by performing replicate counts on 10% of the samples. Replicate phytoplankton samples were chosen at random and processed at different times from the original analysis to reduce bias.

Biologica re analyzed 10% of zooplankton samples in their entirety to allow a comparison of the subsampling method as well as the taxonomic accuracy.

The laboratory QC results were reviewed to confirm the quality of the data and to evaluate whether the laboratory identified any questionable results for specific parameters. Additional details related to laboratory QC methods and results are provided in Attachment 7A 1.

7A3.3 Office Operations

Quality control operations implemented in the office focussed on confirming and maintaining the quality of in situ measurement data and analytical results, as well as verifying the accuracy of data summaries (i.e., summary statistics and plots). Field data entered into the Project database were compared against the field data sheets and field notebook to confirm their accuracy. Unaltered data files from the laboratory were saved to the Project directory and were used as a reference to confirm the accuracy of the data entered into the Project database. Laboratory data were also screened for quality (Section 7A3.4). Backup files were created before each major data analysis operation and calculations were reviewed to confirm the accuracy of the results.

7A3.4 Laboratory Data Screening

A series of standard data screening steps were completed upon receipt of water chemistry results from the analytical laboratory to identify potential issues with the DIN dataset, including:

- verification that all requested parameters and samples were analyzed
- verification that the appropriate detection limits (DLs) were used and data were reported in the appropriate units
- data logic checks (e.g., comparisons of dissolved and total nitrogen and phosphorus concentrations)
- identification of outliers
- review of duplicate sample results for unacceptable variation

- review of laboratory QC results (i.e., sample temperature and integrity of containers upon receipt, holding times, laboratory blanks and recoveries from spiked samples, internal duplicates, review of laboratory qualifiers and notes)
- review of the final dataset for completeness, and confirmation that sources of unexpected values and trends have been identified

Prompt completion of the screening steps allowed for potential re analysis of samples by the laboratory to verify questionable data or to generate data for missing parameters. If samples were re analyzed by the laboratory and the data were still considered questionable, qualifiers for consideration during data summary and analysis steps were added to the dataset, or the data were excluded from further analyses.

7A3.5 Quality Control Data Evaluation

7A3.5.1 Depth-integrated Nutrients

Differences between concentrations measured in duplicate DIN samples were evaluated based on the relative percent difference (RPD), where:

$$RPD = \frac{|C1 - C2|}{\frac{(C1 + C2)}{2}} * 100$$

and C1 is the concentrations in the sample and C2 is the concentration in the second or duplicate sample.

The RPD was only calculated if both of the paired concentrations in the duplicate samples were greater than five times the DL. The RPD for a given parameter was flagged if it was greater than 20%.

7A3.5.2 Chlorophyll *a*

Chlorophyll a data was checked thoroughly for errors or omissions. RPDs were not calculated for chlorophyll a as samples were collected in triplicate at all sampling stations as part of the study design. Anomalous results were clarified with the analytical laboratory and data believed to be recorded in error was flagged and omitted from statistical analyses.

7A3.5.3 Phytoplankton and Zooplankton

The inherent variability associated with the plankton samples prevents the establishment of a QC threshold value. For the purposes of the plankton QC, the proportion of each major group was calculated and the occurrence of dominant species used to assess consistency between the field samples and duplicate samples analyzed. In addition, the RPD was used to assess the overall similarity between the field and duplicate samples. Due to high variability in species occurrence, the comparisons were made at the major group level for both abundance and biomass, rather than the species level. Differences in total abundance and biomass were also evaluated. RPDs greater than 50% were flagged and follow up assessments of the data were performed. Graphical plots of the relative abundance results for the field and duplicate samples were made so that duplicate results could be evaluated on a case by case basis.

7A3.6 Quality Control Results

A summary of the quality control samples collected during the plankton monitoring program is provided in Table 7A 1. Detailed QC results for DIN, phytoplankton, and zooplankton are presented in Section 7A4.0 (Table 7A 2 to Table 7A 6). The results from each type of sample are provided in the sections below.

Table 7A-1: Summary of Quality Control Samples Collected, 2017

Type of Sample	2017		
	16 to 23 July	11 to 13 August	4 to 5 September
	Late Spring	Summer	Fall
Duplicates-DIN		MEL-03-04 MEL-05-04	MEL-02-05
Duplicates-Phytoplankton	MEL-01-03 MEL-02-05 MEL-03-01	MEL-02-02 MEL-03-02 MEL-05-02	MEL-01-01 MEL-02-04
Duplicates-Zooplankton	MEL-01-03 MEL-02-05 MEL-03-01	MEL-02-02 MEL-03-02 MEL-05-02	MEL-01-01 MEL-02-04

Notes: DIN = depth integrated nutrient sample; − = sample not collected.

7A3.6.1 Depth Integrated Nutrients

To maintain sample integrity, DIN samples for laboratory analyses were submitted as soon as possible after collection. However, holding time exceedances are a common issue for water samples collected from remote areas because transport of samples to the laboratory is subject to the availability of scheduled charter flights. Holding times may also be exceeded for preserved and unpreserved samples if the laboratory is unable to initiate testing promptly following sample receipt. Analytical hold times were met for most parameters, with the exception of nitrate, nitrite, and orthophosphate.

Three duplicate DIN samples were collected in support of the 2017 plankton program: two during the summer 2017 program and one during the fall 2017 program (Table 7A 1). In one sample, RPDs could only be calculated for reactive silica while in another sample RPDs could only be calculated for reactive silica and total phosphorus due to concentrations being less than five times the detection limit for other parameters. RPDs in each sample were below 20% (Table 7A 2). In the duplicate samples collected at MEL-02-05 in September 2017, RPDs for concentrations of nitrate, and total and dissolved nitrogen, exceeded 20%. DIN samples at most stations in September 2017 had notably higher concentrations of nitrogen than during any other sampling event; results of the QA/QC analyses suggest that elevated nitrate and nitrogen concentrations should be interpreted with caution as analyses of these parameters show some variability.

Dissolved concentrations measured in the DIN samples, including duplicates, were compared to their corresponding total concentrations. All of the dissolved parameter concentrations in the dataset met quality criteria (i.e., for paired total and dissolved concentrations that were more than five times the DL, the dissolved concentration was no more than 20% higher than the total concentration).

7A3.6.2 Chlorophyll *a*

Chlorophyll a samples collected in September 2017 were collected using a different type of filter than during previous sampling events. The analytical laboratory was able to analyze chlorophyll a concentrations from the filters submitted in September 2017; however, the lab noted that the difference in the filter used may have affected the results of the analysis. As a result, chlorophyll a data from the September 2017 sampling event was omitted from all statistical analyses presented in this report. No other errors or omissions were found in chlorophyll a data reported in 2017.

7A3.6.3 Phytoplankton

A total of eight duplicate phytoplankton samples were collected from Meliadine Lake in 2017 (Table 7A 3 and Table 7A 4). For phytoplankton, RPD values were below 50% when calculated on total biomass (Table 7A 3). However, at the major group level, all eight duplicate samples for phytoplankton biomass had RPDs greater than 50% for one or more taxonomic group. Affected groups included cyanobacteria, chlorophytes, diatoms, and dinoflagellates. Similarly, for phytoplankton abundance, based on total abundance, RPDs were less than 50%, but at the major group level, 7 out of 8 duplicates had RPDs greater than 50% for one or more taxonomic group (Table 7A 4). Affected groups included cyanobacteria, chlorophytes, euglenophytes, diatoms, cryptophytes, and dinoflagellates. In general, where high RPDs were observed, the biomass or abundance of the taxa tended to be low in both samples in comparison with the total biomass or abundance of the sample. A visual examination of relative abundance plots for paired duplicate samples indicates that the general composition of the samples appears to be similar between duplicates (Figure 7A 1 and Figure 7A 2). In addition, the dominant taxon (i.e., the taxon contributing the most biomass or abundance to the sample) was consistent between duplicates.

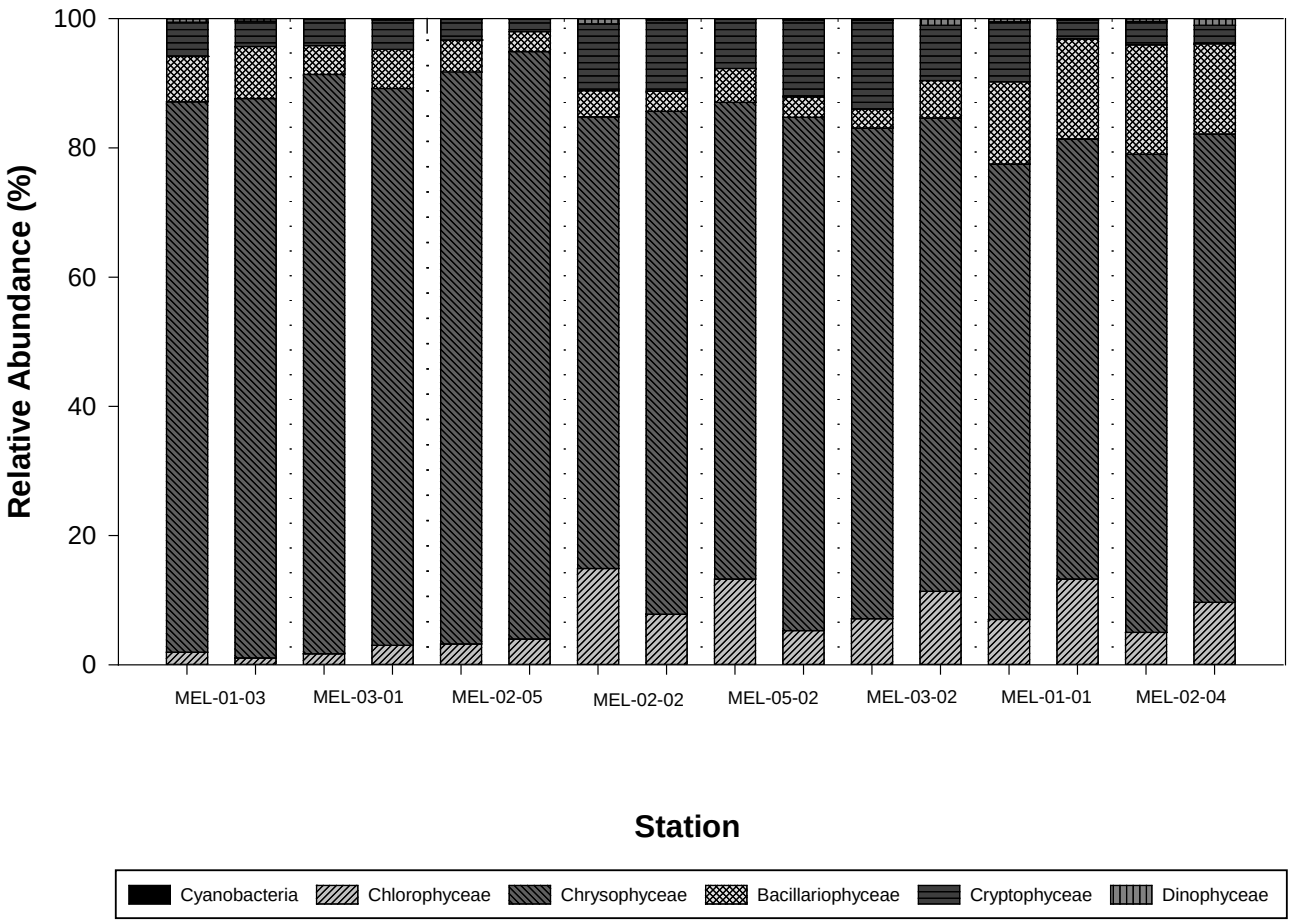

Figure 7A-1: Relative Abundance of Major Phytoplankton Taxonomic Groups in Duplicate Samples, Meliadine Lake, 2017

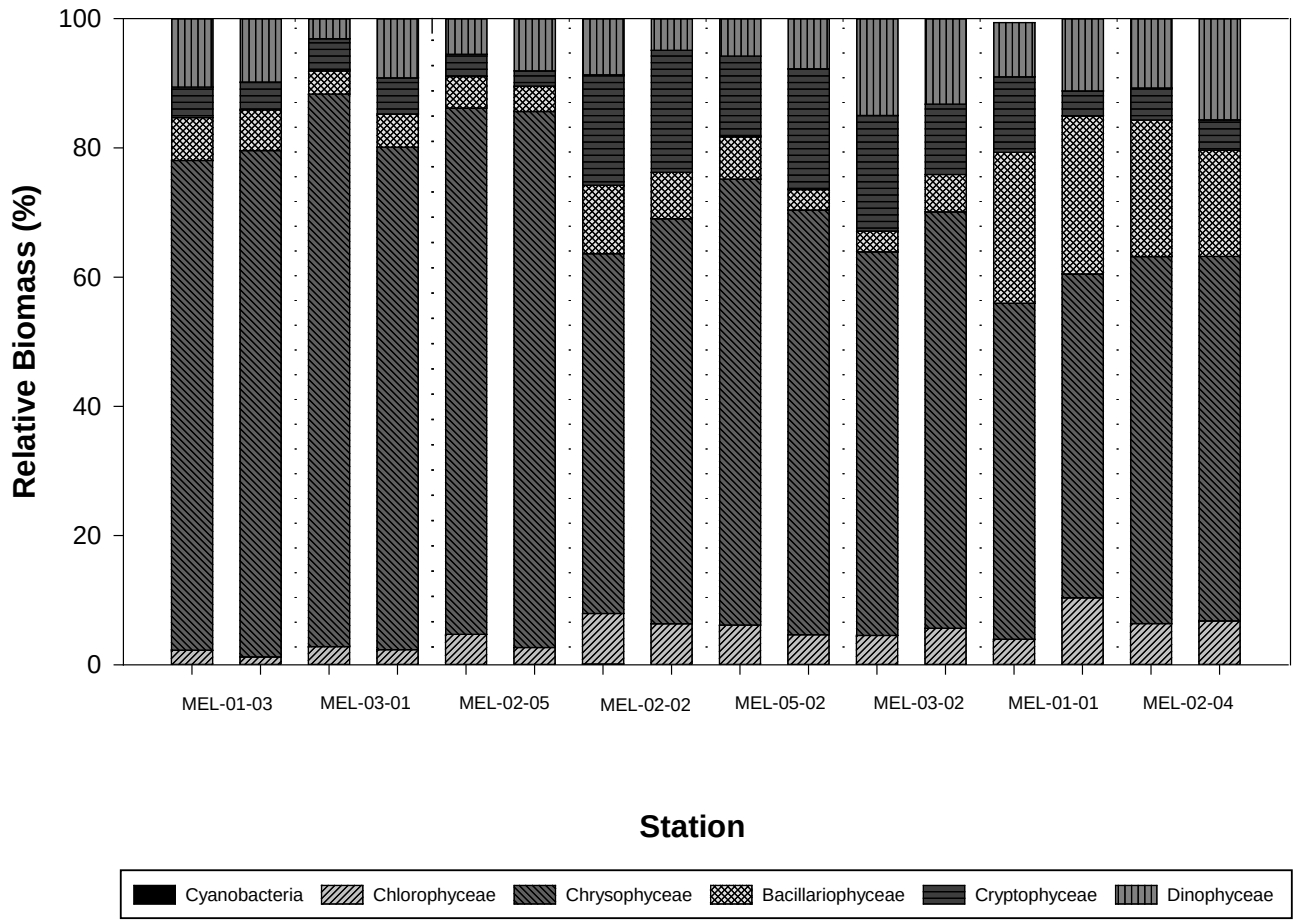

Figure 7A-2: Relative Biomass of Major Phytoplankton Taxonomic Groups in Duplicate Samples, Meliadine Lake, 2017

7A3.6.4 Zooplankton

A total of eight duplicate zooplankton samples were collected from Meliadine Lake in 2017 (Table 7A 5 and Table 7A 6). For zooplankton, RPD values were below 50% when calculated on total wet weight biomass (Table 7A 5). In 6 of 8 duplicate samples, RPDs above 50% were observed for one or more taxonomic group. The dominant taxa was the same in each pair of duplicate samples. RPDs for total zooplankton abundance were also less than 50% (Table 7A 6). In 3 out of 8 duplicate samples, RPDs above 50% were observed for one or more taxonomic group. The dominant taxon was consistent between duplicate samples for zooplankton biomass and abundance in 6 of 8 duplicate samples. In two samples, different taxa were dominant by biomass or abundance between replicate samples; however, RPDs between biomass and abundance estimates for each duplicate sample were below 50% in each case. A visual inspection of relative abundance plots indicates a high degree of similarity in the relative composition of the zooplankton community collected in duplicate samples from Meliadine Lake (Figure 7A 3 and Figure 7A 4).

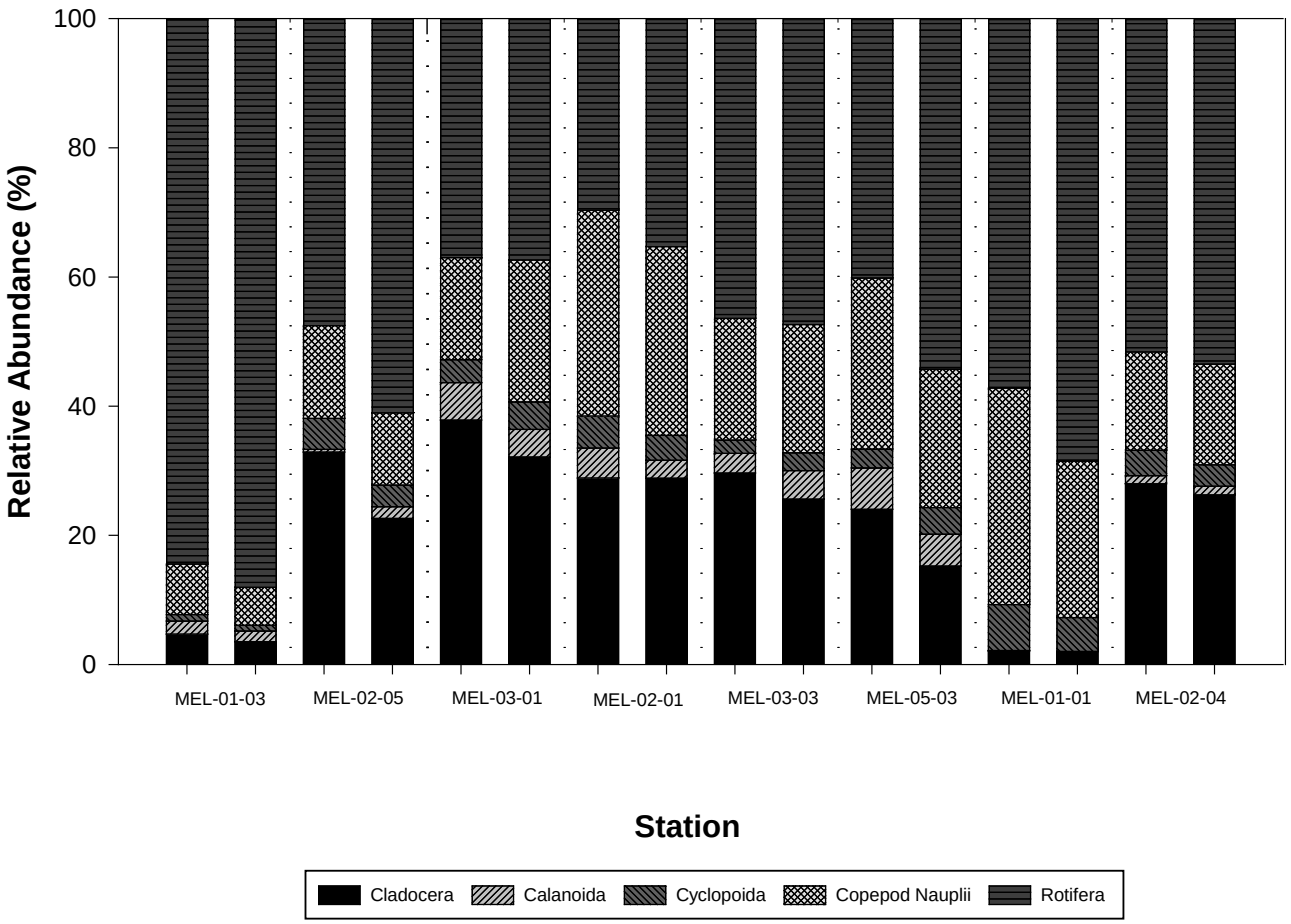

Figure 7A-3: Relative Abundance of Major Zooplankton Taxonomic Groups in Duplicate Samples, Meliadine Lake, 2017

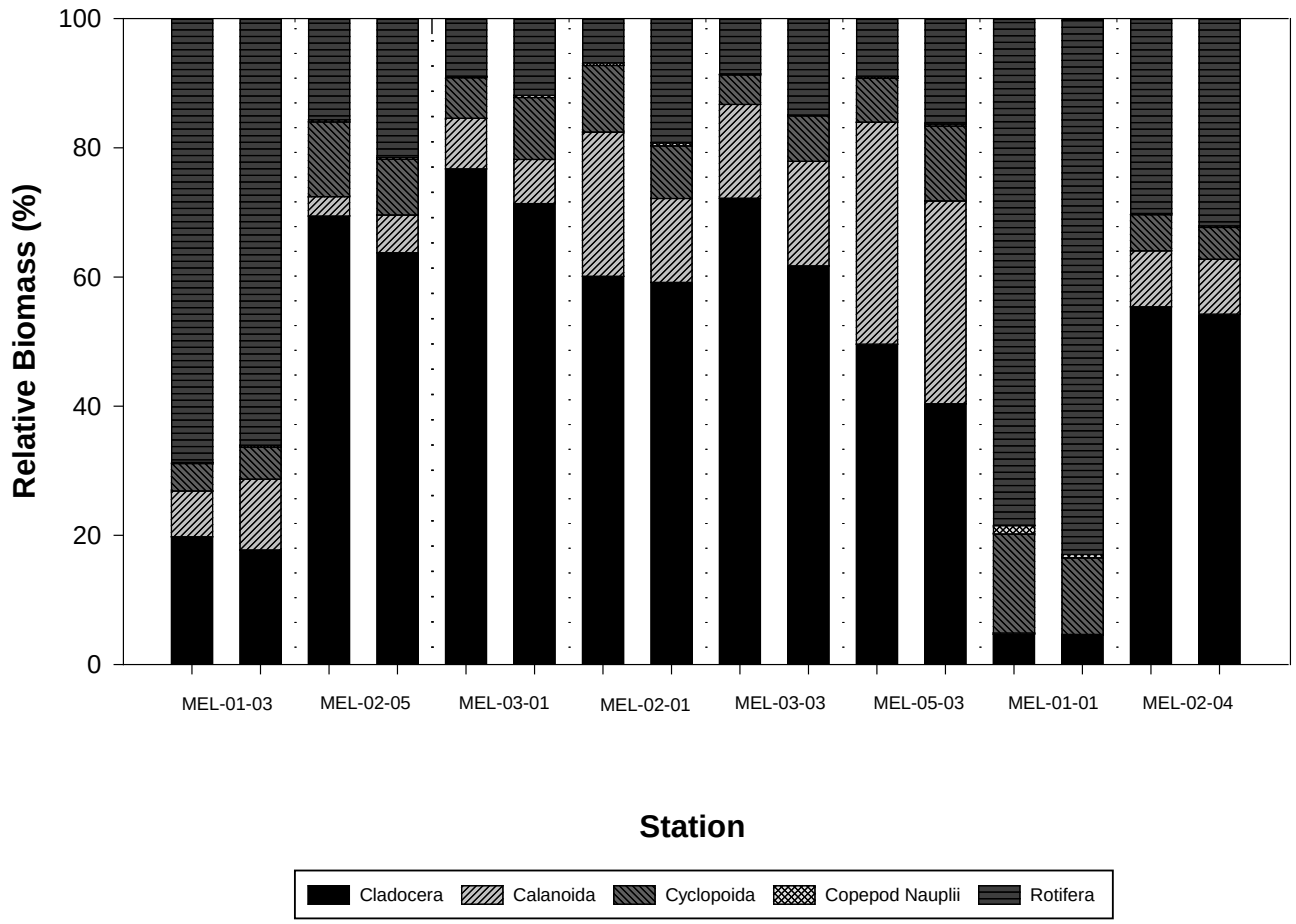

Figure 7A-4: Relative Biomass of Major Zooplankton Taxonomic Groups in Duplicate Samples, Meliadine Lake, 2017

7A3.7 Data Quality Summary

Key QC findings for the 2017 plankton monitoring programs are as follows:

- A total of 9% of paired concentrations in duplicate DIN samples differed by more than 20%. Each of the exceedances of the 20% RPD limit came from duplicate samples collected at MEL-02-05 in September 2017 from which total nitrogen, dissolved nitrogen, and nitrate concentrations differed by more than 20%. DIN samples at most stations in September 2017 had notably higher concentrations of nitrogen than during any other sampling event; results of the QA/QC analyses suggest that elevated nitrate and nitrogen concentrations should be interpreted with caution as analyses of these parameters shows some variability.
- Concentrations of dissolved parameters were generally lower than corresponding total concentrations for the DIN samples. Dissolved concentrations were higher than total concentrations for 1.2% of comparisons.

- Chlorophyll *a* samples collected in September 2017 were collected using a different type of filter than during previous sampling events. The analytical laboratory was able to analyze chlorophyll a concentrations from the filters submitted in September 2017; however, the lab noted that the difference in the filter used may have affected the results of the analysis. As a result, chlorophyll a data from the September 2017 sampling event was omitted from all statistical analyses conducted in 2017.
- The dominant taxon was consistent between duplicate samples for phytoplankton biomass and abundance.
- RPDs for total phytoplankton biomass and abundance were below 50% for all duplicates.
- RPDs above 50% were observed in the majority of duplicates for major phytoplankton taxonomic groups; however, graphical presentation of the relative abundance of major phytoplankton groups showed that variation between duplicates was actually low and that the proportions of major groups were similar between duplicates.
- The dominant taxon was consistent between duplicate samples for zooplankton biomass in all 8 duplicate samples and for zooplankton abundance in 6 of 8 duplicate samples. In two samples, different taxa were dominant by abundance between replicate samples; however, RPDs between abundance estimates for each duplicate sample were below 50% in each case.
- RPDs for total zooplankton biomass and abundance were below 50% for all duplicates.
- RPDs above 50% were observed in the majority of duplicates for major zooplankton taxonomic groups; however, graphical presentation of the relative abundance of major zooplankton groups showed that variation between duplicates was actually low and that the proportions of major groups were similar between duplicates.

Differences between original and QC samples were deemed minor, and within the range of variability expected in plankton data. Based on this assessment, the plankton monitoring data are considered adequate to meet the needs of the AEMP for the Project.

7A4.0 DETAILED RESULTS TABLES

Table 7A-2: Depth integrated Nutrient Water Quality Duplicate Results, 2017

Station	Units	DL	RPD Alert Limit	MEL-05-04		RPD (%)[a]	MEL-03-04		RPD (%)[a]	MEL-02-05		RPD (%)[a]
Sample Name				Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
Sample Collection Date				12-Aug-17			13-Aug-17			01-Sep-17		
Reactive silica, as SiO_2	mg/L	0.010	>20%	0.259	0.268	3	0.25	0.248	1	0.037	0.036	3
Dissolved Kjeldahl nitrogen	mg/L	0.050	>20%	0.163	0.162	nc	0.138	0.135	nc	0.189	0.265	nc
Dissolved nitrogen	mg/L	0.050	>20%	0.163	0.162	nc	0.138	0.135	nc	0.261	0.592	**78**
Dissolved phosphorus	mg/L	0.0010	>20%	0.0014	0.002	nc	0.0017	0.002	nc	0.0039	0.007	nc
Nitrate	mg/L	0.0050	>20%	< 0.0050	< 0.0050	nc	< 0.0050	< 0.0050	nc	0.0718	0.327	**128**
Nitrite	mg/L	0.0010	>20%	< 0.0010	< 0.0010	nc	< 0.0010	< 0.0010	nc	< 0.0010	< 0.0010	nc
Orthophosphate	mg/L	0.0010	>20%	< 0.0010	< 0.0010	nc	0.0012	0.001	nc	< 0.0010	< 0.0010	nc
Total ammonia	mg/L	0.0050	>20%	< 0.0050	< 0.0050	nc	< 0.0050	< 0.0050	nc	< 0.0050	0.0111	nc
Total Kjeldahl nitrogen	mg/L	0.050	>20%	0.178	0.17	nc	0.131	0.122	nc	0.234	0.269	nc
Total nitrogen	mg/L	0.050	>20%	0.178	0.17	nc	0.131	0.122	nc	0.306	0.595	**64**
Total phosphorus	mg/L	0.0010	>20%	0.0032	0.0038	nc	0.0053	0.0056	6	0.0073	0.0088	19

Note: RPDs greater than 20% are shown in **bold**; duplicate concentrations failed the QC check.

a) The RPD was only calculated if both of the paired concentrations was above five times the DL.

DL = detection limit; RPD = relative percent difference; % = percent; SiO_2 = silicon dioxide;

mg/L = milligrams per litre; > = greater than; nc = not calculated; < = less than.

Table 7A-3: Quality Control Comparison of Phytoplankton Biomass Results in Duplicate Samples from Meliadine Lake, 2017

Station	Units	RPD Alert Limit	MEL-01-03		RPD (%)	MEL-03-01		RPD (%)	MEL-02-05		RPD (%)	MEL-02-02		RPD (%)	MEL-05-02		RPD (%)	MEL-03-02		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
Sampling Season			Late Spring			Late Spring			Late Spring			Summer			Summer			Summer		
Sample Collection Date			16-Jul-17			21-Jul-17			23-Jul-17			11-Aug-17			12-Aug-17			13-Aug-17		
Biomass by Taxonomic Group																				
Cyanophytes	mg/m³	>50%	0.00	0.00	0	0.00	0.00	nc	0.00	0.00	nc	0.30	0.00	nc	0.00	0.00	nc	0.00	0.00	nc
Chlorophytes	mg/m³	>50%	10.96	5.81	**61**	6.08	4.47	31	12.80	7.40	**53**	16.20	13.09	21	13.85	9.29	39	9.19	12.03	27
Euglenophytes	mg/m³	>50%	0.00	0.00	0	0.00	0.00	nc	0.00	0.00	nc	0.30	0.00	nc	0.00	0.00	nc	0.00	0.00	nc
Chrysophytes	mg/m³	>50%	368.70	373.04	1	184.87	148.35	22	221.88	229.68	3	115.81	129.02	11	155.89	131.24	17	120.25	137.54	13
Diatoms	mg/m³	>50%	32.31	30.02	7	7.80	9.80	23	13.28	10.82	20	21.97	14.75	39	14.78	6.34	**80**	6.47	12.31	**62**
Cryptophytes	mg/m³	>50%	22.94	20.37	12	10.77	10.69	1	9.35	6.55	35	35.57	38.85	9	28.16	37.31	28	36.24	23.21	44
Dinoflagellates	mg/m³	>50%	51.52	46.75	10	6.69	17.48	**89**	15.03	22.39	39	18.06	10.09	**57**	13.11	15.50	17	30.31	28.25	7
Total	mg/m³	>50%	486.43	475.99	2	216.21	190.78	12	272.33	276.85	2	207.90	205.80	1	225.79	199.69	12	202.45	213.34	5

Station	Units	RPD Alert Limit	MEL-01-01		RPD (%)	MEL-02-04		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate	
Sampling Season			Fall			Fall		
Sample Collection Date			04-Sep-17			05-Sep-17		
Biomass by Taxonomic Group								
Cyanophytes	mg/m^3	>50%	0.00	0.00	nc	0.02	0.06	**93**
Chlorophytes	mg/m^3	>50%	7.82	17.90	**78**	7.45	7.55	1
Euglenophytes	mg/m^3	>50%	0.00	0.00	nc	0.02	0.06	nc
Chrysophytes	mg/m^3	>50%	102.97	86.55	17	66.61	63.31	5
Diatoms	mg/m^3	>50%	46.24	42.24	9	24.75	18.44	29
Cryptophytes	mg/m^3	>50%	23.15	6.64	**111**	5.79	5.28	9
Dinoflagellates	mg/m^3	>50%	16.63	19.33	15	12.60	17.56	33
Total	mg/m^3	>50%	196.81	172.65	13	117.22	112.20	4

Note: RPDs greater than 50% are shown in **bold**; duplicate concentrations failed the QC check.
The dominant taxon (i.e., the taxon contributing the most biomass to the sample) is highlighted in grey.
for each sample and duplicate. RPD = relative percent difference; % = percent.
mg/m3 = milligrams per cubic metre; > = greater than; nc = not calculated if one sample had a
biomass of zero; QC = quality control.

Table 7A-4: Quality Control Comparison of Phytoplankton Abundance Results in Duplicate Samples from Meliadine Lake, 2017

Station	Units	RPD Alert Limit	MEL-01-03		RPD (%)	MEL-03-01		RPD (%)	MEL-02-05		RPD (%)	MEL-02-02		RPD (%)	MEL-05-02		RPD (%)	MEL-03-02		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
Sampling Season			Late Spring			Late Spring			Late Spring			Summer			Summer			Summer		
Sample Collection Date			16-Jul-17			21-Jul-17			23-Jul-17			11-Aug-17			12-Aug-17			13-Aug-17		
Abundance by Taxonomic Group																				
Cyanophytes	cells/L	>50%	0	0	0	0	0	0	0	0	0	600	0	nc	0	0	0	0	0	0
Chlorophytes	cells/L	>50%	80,624	43,904	**59**	36,720	58,472	46	81,624	109,160	29	324,280	175,416	60	319,096	103,776	**102**	131,312	202,952	43
Euglenophytes	cells/L	>50%	0	0	0	0	0	0	0	200	nc	0	0	0	0	0	0	0	0	0
Chrysophytes	cells/L	>50%	3,560,896	3,623,952	2	1,934,296	1,675,472	14	2,237,224	2,496,848	11	1,523,408	1,746,712	14	1,776,048	1,559,928	13	1,396,296	1,309,488	6
Diatoms	cells/L	>50%	293,224	337,344	14	96,192	117,744	20	125,544	84,440	39	88,624	70,456	23	126,128	62,272	**68**	54,088	103,776	**63**
Cryptophytes	cells/L	>50%	220,720	163,448	30	88,608	89,008	0	81,024	51,888	44	224,904	247,656	10	183,600	233,888	24	252,640	152,664	49
Dinoflagellates	cells/L	>50%	23,368	16,784	33	1,400	3,400	**83**	2,400	3,200	29	17,568	4,000	**126**	2,200	3,400	43	4,600	18,368	**120**
Total	cells/L	>50%	4,178,832	4,185,432	0	2,157,216	1,944,096	10	2,527,816	2,745,536	8	2,179,384	2,244,240	3	2,407,072	1,963,264	20	1,838,936	1,787,248	3

Station	Units	RPD Alert Limit	MEL-01-01		RPD (%)	MEL-02-04		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate	
Sampling Season			Fall			Fall		
Sample Collection Date			04-Sep-17			05-Sep-17		
Abundance by Taxonomic Group								
Cyanophytes	cells/L	>50%	0	0	0	200	400	**67**
Chlorophytes	cells/L	>50%	130,712	196,168	40	51,488	101,176	**65**
Euglenophytes	cells/L	>50%	0	0	0	0	0	0
Chrysophytes	cells/L	>50%	1,315,672	1,007,560	27	763,704	762,704	0
Diatoms	cells/L	>50%	237,824	228,856	4	174,696	146,928	17
Cryptophytes	cells/L	>50%	173,016	43,504	**120**	37,120	29,736	22
Dinoflagellates	cells/L	>50%	8,784	2,800	**103**	4,600	10,984	**82**
Total	cells/L	>50%	1,866,008	1,478,888	23	1,031,808	1,051,928	2

Note: RPDs greater than 50% are shown in **bold**; duplicate concentrations failed the QC check.
The dominant or most abundant taxon is highlighted in grey for each sample and duplicate.
RPD = relative percent difference; % = percent; cells/L = cells per litre; > = greater than.
nc = not calculated if one sample had an abundance of zero; QC = quality control.

Table 7A-5: Quality Control Comparison of Zooplankton Biomass Results in Duplicate Samples from Meliadine Lake, 2017

Station	Units	RPD Alert Limit	MEL-01-03		RPD (%)	MEL-03-01		RPD (%)	MEL-02-05		RPD (%)	MEL-02-01		RPD (%)	MEL-05-03		RPD (%)	MEL-03-03		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
Sampling Season			Late Spring			Late Spring			Late Spring			Summer			Summer			Summer		
Sample Collection Date			16-Jul-17			21-Jul-17			23-Jul-17			11-Aug-17			12-Aug-17			13-Aug-17		
Biomass by Taxonomic Group																				
Cladocera	mg/m³ ww	>50%	8.63	7.47	14	81.06	72.69	11	84.28	60.60	33	26.22	30.52	15	21.74	18.55	16	39.61	35.74	10
Calanoida	mg/m³ ww	>50%	3.11	4.64	40	8.29	6.98	17	3.68	5.55	41	9.74	6.71	37	15.08	14.43	4	7.97	9.38	16
Cyclopoida	mg/m³ ww	>50%	1.86	2.11	13	6.67	9.77	38	14.05	8.23	**52**	4.50	4.21	7	2.98	5.34	**57**	2.54	4.09	47
Copepod Nauplii	mg/m³ ww	>50%	0.08	0.12	46	0.20	0.35	**53**	0.41	0.28	37	0.19	0.25	27	0.12	0.15	24	0.09	0.08	12
Rotifera	mg/m³ ww	>50%	29.95	27.82	7	9.41	12.05	25	18.95	20.36	7	2.96	9.89	**108**	3.92	7.47	**62**	4.66	8.61	**60**
Total	mg/m³ ww	>50%	43.62	42.16	3	105.63	101.84	4	121.36	95.02	24	43.62	51.57	17	43.84	45.94	5	54.86	57.89	5

Station	Units	RPD Alert Limit	MEL-01-01		RPD (%)	MEL-02-04		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate	
Sampling Season			Fall			Fall		
Sample Collection Date			04-Sep-17			05-Sep-17		
Biomass by Taxonomic Group								
Cladocera	mg/m^3 ww	>50%	0.58	0.77	27	16.87	16.83	0
Calanoida	mg/m^3 ww	>50%	0.02	0.01	50	2.65	2.64	0
Cyclopoida	mg/m^3 ww	>50%	1.92	2.00	4	1.71	1.53	11
Copepod Nauplii	mg/m^3 ww	>50%	0.16	0.09	**59**	0.06	0.09	31
Rotifera	mg/m^3 ww	>50%	9.79	13.93	35	9.16	9.93	8
Total	mg/m^3 ww	>50%	12.48	16.80	30	30.45	31.02	2

Note: RPDs greater than 50% are shown in **bold**; duplicate concentrations failed the QC check.

The dominant taxon (i.e., the taxon contributing the most biomass to the sample) is highlighted in grey for each sample and duplicate.

RPD = relative percent difference; % = percent; mg/m^3 ww = milligrams per cubic metre wet weight.

nc = not calculated if one sample had a biomass of zero > = greater than.

Table 7A-6: Quality Control Comparison of Zooplankton Abundance Results in Duplicate Samples from Meliadine Lake, 2017

Station	Units	RPD Alert Limit	MEL-01-03		RPD (%)	MEL-03-01		RPD (%)	MEL-02-05		RPD (%)	MEL-02-01		RPD (%)	MEL-05-03		RPD (%)	MEL-03-03		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate		Sample	Duplicate	
Sampling Season			Late Spring			Late Spring			Late Spring			Summer			Summer			Summer		
Sample Collection Date			16-Jul-17			21-Jul-17			23-Jul-17			11-Aug-17			12-Aug-17			13-Aug-17		
Biomass by Taxonomic Group																				
Cladocera	org/m^3	>50%	895	775	14	5740	5260	9	7767	5640	32	2490	2910	16	1950	1492	27	3457	2900	18
Calanoida	org/m^3	>50%	390	365	7	880	700	23	100	460	**129**	400	280	35	520	483	7	357	500	33
Cyclopoida	org/m^3	>50%	195	195	0	540	700	26	1133	840	30	430	390	10	240	408	**52**	243	314	26
Copepod Nauplii	org/m^3	>50%	1500	1300	14	2400	3600	40	3400	2800	19	2750	2950	7	2150	2100	2	2200	2250	2
Rotifera	org/m^3	>50%	16100	19300	18	5600	6100	9	11200	15200	30	2550	3550	33	3250	5300	48	5400	5350	1
Total	org/m^3	>50%	19080	21935	14	15160	16360	8	23600	24940	6	8620	10080	16	8110	9783	19	11657	11314	3

Station	Units	RPD Alert Limit	MEL-01-01		RPD (%)	MEL-02-04		RPD (%)
Sample Name			Sample	Duplicate		Sample	Duplicate	
Sampling Season			Fall			Fall		
Sample Collection Date			04-Sep-17			05-Sep-17		
Biomass by Taxonomic Group								
Cladocera	org/m^3	>50%	83	116	33	1650	1625	2
Calanoida	org/m^3	>50%	3	2	50	75	83	11
Cyclopoida	org/m^3	>50%	283	304	7	233	208	11
Copepod Nauplii	org/m^3	>50%	1333	1400	5	900	967	7
Rotifera	org/m^3	>50%	2267	3950	**54**	3033	3300	8
Total	org/m^3	>50%	3970	5772	37	5892	6183	5

Note: RPDs greater than 50% are shown in **bold**; duplicate concentrations failed the QC check.

The dominant or most abundant taxon is highlighted in grey for each sample and duplicate.

RPD = relative percent difference; % = percent; org/m^3 = organisms per cubic metre.

nc = not calculated if one sample had an abundance of zero; > = greater than.

REFERENCES

CCME (Canadian Council of Ministers of the Environment). 2004. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Phosphorus: Canadian Guidance Framework for the Management of Freshwater System. In: Canadian Environmental Quality Guidelines, 2004. Winnipeg, MB, Canada.

Environment Canada. 1993. Quality Assurance in Water Quality Monitoring. Ecosystem Sciences and Evaluation Directorate Conservation and Protection. Ottawa. ON, Canada.

Golder. 2017. Aquatic Effects Monitoring Program – 2016 Annual Report, Meliadine Gold Project. Prepared for Agnico Eagle Mines Limited. Document Number 623-1663489.March 2017.

ATTACHMENT 6A-1

Laboratory QC Methods and Results Detail

Table 6A-1: Fish Sampling Effort for Meliadine Lake, 2015 and 2017

Sampling Area	Effort Number	Gear Type	Zone	Start		End		Habitat Description	Minimum Depth (m)	Max Depth (m)	Set Date (d/m/y)	Lift Date (d/m/y)	Duration (h)	Effort[(a)]	Fish Captured							
				Easting	Northing	Easting	Northing								THST	RNWH	LKTR	SLSC	BURB	NNST	CISC	Total
NF	ML15FHNFBP1000	Electrofishing	15V	542210	6991482	542187	6991385	Boulder, cobble, silt	0.1	0.7	14/08/2015	14/08/2015	1.33	2825 s	35	-	5	2	-	2	-	44
NF	ML15FHNFBP1001	Electrofishing	15V	544086	6987045	543762	6987079	Boulder, cobble, silt	0.1	0.7	15/08/2015	15/08/2015	1.08	2345 s	45	1	1	6	-	1	-	54
NF	ML15FHNFMT1300	Minnow Trap	15V	541733	6988953	-	-	Cobble	0.2	0.6	16/08/2015	17/08/2015	36.42	401 h	120	-	-	-	-	16	1	137
NF	ML15FHNFMT1301	Minnow Trap	15V	541671	6988988	-	-	Boulder, cobble	0.4	1.0	16/08/2015	17/08/2015	13.08	183 h	44	-	-	-	1	3	-	48
NF	ML15FHNFSN1400	Seine Net	15V	542232	6991483	542273	6991457	Boulder, cobble, silt	0.1	0.8	14/08/2015	14/08/2015	0.25	150 m^2	2	-	-	-	-	-	-	2
RA1	ML17FHRA1BP2000	Electrofishing	15V	533239	6998103	533202	6998082	Rocky shoreline with organics	0.1	0.5	09/08/2017	09/08/2017	-	210 s	34	2	-	-	-	-	-	36
RA1	ML17FHRA1BP2001	Electrofishing	15V	533238	6998108	533147	6998109	Cobble, boulder shoreline with fines	0.1	0.4	12/08/2017	12/08/2017	-	609 s	60	-	-	-	-	-	-	60
RA1	ML17FHRA1BP2002	Electrofishing	15V	533198	6998083	533131	6998124	Cobble, boulder with sand	0.1	0.5	13/08/2017	13/08/2017	-	422 s	60	-	-	-	-	-	-	60
RA1	ML17FHRA1HP2200	Hoop Net	15V	535077	6996933	-	-	Deep, clear, with large boulders	0.9	1.1	09/08/2017	10/08/2017	22.08	22 h	117	-	-	-	-	1	-	118
RA1	ML17FHRA1HP2201	Hoop Net	15V	535551	6998405	-	-	Large embedded boulders	0.9	1.5	09/08/2017	10/08/2017	20.68	21 h	1	-	-	-	-	-	-	1
RA1	ML17FHRA1MT2300	Minnow Trap	15V	534343	6997898	534399	6997826	Rock and boulder	0.2	0.8	09/08/2017	10/08/2017	23.80	190 h	38	-	-	-	-	-	-	38
RA1	ML17FHRA1MT2301	Minnow Trap	15V	534973	6996873	535026	6996846	Sheltered bay with cobble and shale. No vegetation.	0.3	0.5	09/08/2017	10/08/2017	22.60	136 h	17	-	-	-	-	-	-	17
RA1	ML17FHRA1MT2302	Minnow Trap	15V	535560	6998404	535529	6998405	Shale, boulder and fines; no vegetation	0.2	0.5	09/08/2017	11/08/2017	45.30	272 h	74	-	1	-	-	6	-	81
RA1	ML17FHRA1MT2303	Minnow Trap	15V	534785	6997177	534765	6997162	Boulder, cobble with lots of periphyton	0.2	0.4	10/08/2017	11/08/2017	23.40	140 h	19	-	-	-	-	-	-	19
RA1	ML17FHRA1MT2304	Minnow Trap	15V	533990	6997761	534030	6997738	Boulder with fines and periphyton	0.3	0.5	10/08/2017	12/08/2017	46.60	373 h	58	-	-	-	-	-	-	58
RA1	ML17FHRA1MT2305	Minnow Trap	15V	533699	6998961	533628	6999011	Rocky shoreline, mostly round boulder	0.2	0.4	11/08/2017	13/08/2017	46.52	279 h	163	-	-	-	-	6	-	169
RA1	ML17FHRA1MT2306	Minnow Trap	15V	532840	6999706	532900	6999715	Embedded boulder; more uniform shoreline	0.2	0.4	11/08/2017	13/08/2017	46.72	280 h	99	-	-	-	-	2	-	101
RA1	ML17FHRA1MT2307	Minnow Trap	15V	533158	6998280	533217	6998256	Embedded cobble and boulder with periphyton	0.1	0.5	12/08/2017	13/08/2017	23.87	191 h	118	-	-	-	1	2	-	121
RA1	ML17FHRA1SN2400	Seine Net	15V	534328	6997926	534334	6997911	Cobble beach with embedded flat boulders; no vegetation	0.1	0.6	09/08/2017	09/08/2017	0.42	340 m^2	2	4	7	1	-	-	-	14
RA2	ML17FHRA2BP3000	Electrofishing	15V	526129	7001238	526127	7001304	-	0.1	0.6	14/08/2017	14/08/2017	-	339 s	24	-	-	-	2	9	-	35
RA2	ML17FHRA2MT3300	Minnow Trap	15V	526118	7001228	526094	7001235	Embedded boulder; submerged vegetation	0.2	0.4	14/08/2017	16/08/2017	46.17	277 h	31	-	-	-	-	4	-	35
RA2	ML17FHRA2MT3301	Minnow Trap	15V	525155	7001053	525195	7000993	Cobble, boulder shoal with sand	0.1	0.3	14/08/2017	16/08/2017	46.78	374 h	59	-	-	-	2	1	-	62
RA2	ML17FHRA2MT3302	Minnow Trap	15V	525888	7002290	525895	7002306	Cobble, boulder with some gravel	0.2	0.5	14/08/2017	16/08/2017	45.80	275 h	45	-	-	-	-	2	-	47
RA2	ML17FHRA2MT3303	Minnow Trap	15V	526334	7002402	526333	7002383	Cobble, boulder with periphyton; sand/organic at shoreline	0.2	0.5	16/08/2017	18/08/2017	50.25	302 h	70	-	-	-	-	6	-	76
RA2	ML17FHRA2MT3304	Minnow Trap	15V	525048	7002031	525078	7002025	Boulder with interspersed cobble. Small bay.	0.1	0.5	16/08/2017	18/08/2017	50.05	300 h	69	-	-	-	1	-	-	70
RA2	ML17FHRA2MT3305	Minnow Trap	15V	524648	7001233	524650	7001217	-	0.2	0.4	16/08/2017	18/08/2017	49.67	397 h	149	-	-	-	-	20	-	169

a) Minnow Trap = trap hours; Electrofishing = seconds; Siene Net = square metres; Gill Net = net hours; Hoop Net = net hours.

NF = Near-field; RA1 = Reference Area 1; RA2 = Reference Area 2; m = metre; d = day; m = month; y = year; h = hour; s = second; m^2 = square metre; THST = Threespine Stickleback; RNWH = Round Whitefish; LKTR = Lake Trout; SLSC = Slimy Sculpin; BURB = Burbot; NNST = Ninespine Stickleback; CISC = Cisco; - = not recorded or not applicable.

Table 6A-2: Environmental Data for Meliadine Lake, 2015 and 2017

Effort Number	Year	Air Temp (°C)	Cloud Cover (%)	Wind Direction	Wind Speed (km/h)	Precipitation	Water Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	Specific Conductivity (µS/cm)	pH
ML15FHNFBP1000	2015	12	40	NNW	-	0	9.23	11.15	97.2	49	6.30
ML15FHNFBP1001	2015	10	10	SSE	-	0	8.82	11.99	103.4	52	6.30
ML15FHNFMT1300	2015	8	5	SSW	-	0	8.34	11.14	95.2	52	6.60
ML15FHNFMT1301	2015	-	-	-	-	-	9.66	11.25	99.1	51	6.60
ML15FHNFSN1400	2015	12	40	NNW	-	0	9.23	11.15	97.2	49	6.20
ML17FHRA1BP2000	2017	15	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1BP2001	2017	13	5	NNW	18	0	13.70	8.70	-	59	8.56
ML17FHRA1BP2002	2017	12	5	SSE	15	0	13.22	10.80	103.7	69	7.48
ML17FHRA1HP2200	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1HP2201	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2300	2017	17	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2301	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2302	2017	16	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA1MT2303	2017	10	100	NE	25	0	11.00	-	-	88	8.19
ML17FHRA1MT2304	2017	10	100	NE	25	0	11.00	-	-	88	8.19
ML17FHRA1MT2305	2017	15	50	NNW	8	0	13.30	-	-	55	8.84
ML17FHRA1MT2306	2017	16	50	NNW	8	0	13.30	-	-	55	8.84
ML17FHRA1MT2307	2017	13	5	NNW	18	0	13.70	8.70	-	59	8.56
ML17FHRA1SN2400	2017	15	5	NW	5	0	12.70	-	-	58	8.19
ML17FHRA2BP3000	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3300	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3301	2017	11	75	S	15	0	13.59	10.67	104.4	68	7.75
ML17FHRA2MT3302	2017	11	75	S	15	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3303	2017	10	100	N	13	0	13.67	10.66	104.1	68	7.72
ML17FHRA2MT3304	2017	11	100	N	13	0	13.69	10.65	104.0	68	7.76
ML17FHRA2MT3305	2017	11	100	N	13	0	13.69	10.65	104.0	68	7.76

°C = degree Celsius; % = percent; km/h = kilometre per hour; mg/L = milligram per litre; µS/cm = microsiemen per centimetre; N = north; NE = northeast; NW = northwest; NNW = north-northwest; S = south; SSE = south-southeast; SSW = south-southwest; - = not recorded or not applicable.

Table 7B-1: Summary Statistics for Depth-integrated Nutrients from Melidaine Lake, 2015

Parameter	Unit	MEL-01																		
		July							August							September						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions																						
Reactive silica, as SiO2	mg/L	5	0.36	0.39	0.38	0.39	0.012	0.005	5	0.23	0.29	0.31	0.38	0.067	0.030	4	0.31	0.33	0.33	0.34	0.012	0.006
Nutrients																						
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.024	0.088	0.037	0.016	4	<0.005	<0.005	0.0066	0.019	0.0081	0.004
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	4	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.024	0.088	0.037	0.016	4	<0.0051	<0.0051	0.0066	0.019	0.0081	0.004
Total ammonia	mg-N/L	5	0.0059	0.023	0.021	0.032	0.010	0.005	5	<0.005	<0.005	0.0039	0.0093	0.0030	0.001	4	<0.005	<0.005	0.0049	0.012	0.0048	0.002
Total Kjeldahl nitrogen	mg-N/L	5	0.11	0.18	0.16	0.19	0.037	0.017	5	<0.05	0.078	0.078	0.13	0.053	0.024	4	<0.05	0.074	0.052	0.082	0.031	0.015
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.097	0.15	0.13	0.15	0.024	0.011	5	<0.05	<0.05	0.057	0.11	0.044	0.019	4	<0.05	0.075	0.067	0.094	0.033	0.017
Total nitrogen (calculated)	mg-N/L	5	0.11	0.18	0.16	0.19	0.037	0.017	5	0.048	0.13	0.10	0.17	0.060	0.027	4	0.044	0.074	0.056	0.082	0.027	0.013
Total nitrogen	mg-N/L	5	0.11	0.18	0.16	0.19	0.037	0.017	5	<0.05	0.13	0.096	0.17	0.066	0.030	4	<0.05	0.074	0.052	0.082	0.031	0.015
Dissolved nitrogen	mg-N/L	5	0.097	0.15	0.13	0.15	0.024	0.011	5	<0.05	0.088	0.074	0.13	0.047	0.021	4	<0.05	0.075	0.072	0.11	0.039	0.020
Total phosphorus	mg-P/L	5	0.0048	0.0052	0.0052	0.0060	0.00049	0.000	5	0.0039	0.0041	0.0051	0.0091	0.0023	0.001	4	0.0046	0.0052	0.0052	0.0060	0.00059	0.000
Dissolved phosphorus	mg-P/L	5	0.0011	0.0022	0.0019	0.0023	0.00055	0.000	5	<0.001	0.0014	0.0014	0.0021	0.00058	0.000	4	0.0016	0.0020	0.0025	0.0046	0.0014	0.001
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00062	0.0011	0.00027	0.000	5	<0.001	0.0012	0.0010	0.0014	0.00046	0.000	4	<0.001	<0.001	0.00050	<0.001	0	0.000

Parameter	Unit	MEL-02																				
		July							August							September						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Min	Median	Mean	Max	Standard Deviation	Standard Error
Major Ions																						
Reactive silica, as SiO2	mg/L	5	0.28	0.28	0.28	0.28	0.0025	0.001	5	0.22	0.27	0.27	0.30	0.030	0.013	5	0.26	0.27	0.27	0.27	0.0047	0.002
Nutrients																						
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0058	0.019	0.0074	0.003	5	<0.005	<0.005	0.0037	0.0085	0.0027	0.001
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0058	0.019	0.0074	0.003	5	<0.0051	<0.0051	0.0037	0.0085	0.0027	0.001
Total ammonia	mg-N/L	5	<0.005	0.0082	0.0086	0.018	0.0066	0.003	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.014	0.053	0.022	0.010
Total Kjeldahl nitrogen	mg-N/L	5	0.13	0.17	0.18	0.24	0.052	0.023	5	<0.05	<0.05	0.073	0.19	0.073	0.033	5	<0.05	<0.05	0.049	0.12	0.039	0.018
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.14	0.17	0.20	0.29	0.060	0.027	5	<0.05	<0.05	0.051	0.11	0.039	0.017	5	<0.05	<0.05	0.040	0.099	0.033	0.015
Total nitrogen (calculated)	mg-N/L	5	0.13	0.17	0.18	0.24	0.052	0.023	5	<0.05	<0.05	0.076	0.19	0.075	0.034	5	<0.05	<0.05	0.051	0.12	0.040	0.018
Total nitrogen	mg-N/L	5	0.13	0.17	0.18	0.24	0.052	0.023	5	<0.05	<0.05	0.076	0.19	0.075	0.034	5	<0.05	<0.05	0.050	0.12	0.040	0.018
Dissolved nitrogen	mg-N/L	5	0.14	0.17	0.20	0.29	0.060	0.027	5	<0.05	<0.05	0.051	0.11	0.039	0.017	5	<0.05	<0.05	0.040	0.099	0.033	0.015
Total phosphorus	mg-P/L	5	0.0044	0.0048	0.0049	0.0059	0.00057	0.000	5	0.0014	0.0045	0.0039	0.0056	0.0017	0.001	5	0.0036	0.0042	0.0046	0.0056	0.00085	0.000
Dissolved phosphorus	mg-P/L	5	0.0020	0.0020	0.0020	0.0021	0.000045	0.000	5	<0.001	0.0011	0.0019	0.0050	0.0019	0.001	5	0.0012	0.0016	0.0015	0.0016	0.00018	0.000
Orthophosphate	mg-P/L	5		0.0014	0.0012	0.0017	0.00045	0.000	5	<0.001	<0.001	0.00064	0.0012	0.00031	0.000	5	<0.001	<0.001	0.00080	0.0020	0.00067	0.000

Notes: < = parameter below detection limit; mg/L=milligrams per litre;

Values below detection limits were converted to half-detects for the calculation of summary statistics.

Table 7B-2: Summary Statistics for Depth-integrated Nutrients from Melidaine Lake, 2016

Parameter	Unit	MEL-01																				
		July							August							September						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions																						
Reactive silica, as SiO2	mg/L	5	0.39	0.40	0.40	0.40	0.0067	0.003	5	0.38	0.39	0.39	0.40	0.0045	0.002	5	0.48	0.48	0.48	0.49	0.0063	0.003
Nutrients																						
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0034	0.0072	0.0021	0.001	5	<0.005	0.0087	0.0093	0.023	0.0084	0.004
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0035	0.0072	0.0021	0.001	5	<0.0051	0.0087	0.0093	0.023	0.0084	0.004
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.15	0.16	0.16	0.19	0.015	0.007	5	0.050	0.058	0.079	0.14	0.037	0.016	5	0.18	0.18	0.19	0.22	0.016	0.007
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.17	0.21	0.22	0.30	0.047	0.021	5	0.11	0.14	0.13	0.15	0.016	0.007	5	0.18	0.24	0.23	0.28	0.038	0.017
Total nitrogen (calculated)	mg-N/L	5	0.15	0.16	0.16	0.19	0.015	0.007	5	0.050	0.064	0.081	0.14	0.036	0.016	5	0.18	0.19	0.20	0.24	0.025	0.011
Total nitrogen	mg-N/L	5	0.15	0.16	0.16	0.19	0.015	0.007	5	0.050	0.064	0.081	0.14	0.036	0.016	5	0.18	0.19	0.20	0.24	0.025	0.011
Dissolved nitrogen	mg-N/L	5	0.17	0.21	0.22	0.30	0.047	0.021	5	0.11	0.14	0.13	0.16	0.019	0.008	5	0.18	0.25	0.24	0.28	0.042	0.019
Total phosphorus	mg-P/L	5	0.0058	0.0064	0.0068	0.0085	0.0011	0.000	5	0.0050	0.0055	0.0059	0.0071	0.00092	0.000	5	0.0054	0.0061	0.0063	0.0074	0.00080	0.000
Dissolved phosphorus	mg-P/L	5	0.0015	0.0018	0.0019	0.0027	0.00046	0.000	5	0.0019	0.0021	0.0021	0.0023	0.00016	0.000	5	<0.001	0.0014	0.0014	0.0020	0.00064	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00062	0.0011	0.00027	0.000	5	<0.001	<0.001	0.00072	0.0011	0.00030	0.000	5	<0.001	<0.001	0.00064	0.0012	0.00031	0.000

Parameter	Unit	MEL-02																				
		July							August							September						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Min	Median	Mean	Max	Standard Deviation	Standard Error
Major Ions																						
Reactive silica, as SiO2	mg/L	5	0.28	0.29	0.29	0.30	0.0054	0.002	5	0.25	0.26	0.26	0.27	0.0075	0.003	5	0.28	0.28	0.28	0.29	0.0071	0.003
Nutrients																						
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	0.0071	0.0073	0.016	0.0054	0.002
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	0.0071	0.0073	0.016	0.0054	0.002
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0055	0.018	0.0068	0.003	5	<0.005	<0.005	0.0037	0.0086	0.0027	0.001
Total Kjeldahl nitrogen	mg-N/L	5	0.098	0.11	0.12	0.14	0.020	0.009	5	0.092	0.11	0.11	0.13	0.018	0.008	5	0.075	0.17	0.15	0.22	0.061	0.027
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.099	0.17	0.17	0.24	0.049	0.022	5	0.14	0.17	0.17	0.20	0.023	0.010	5	0.10	0.14	0.15	0.21	0.040	0.018
Total nitrogen (calculated)	mg-N/L	5	0.098	0.11	0.12	0.14	0.020	0.009	5	0.092	0.11	0.11	0.13	0.018	0.008	5	0.084	0.19	0.16	0.22	0.061	0.027
Total nitrogen	mg-N/L	5	0.098	0.11	0.12	0.14	0.020	0.009	5	0.092	0.11	0.11	0.13	0.018	0.008	5	0.083	0.19	0.16	0.22	0.061	0.027
Dissolved nitrogen	mg-N/L	5	0.099	0.17	0.17	0.24	0.049	0.022	5	0.14	0.17	0.17	0.20	0.023	0.010	5	0.11	0.14	0.15	0.21	0.039	0.018
Total phosphorus	mg-P/L	5	0.0037	0.0047	0.0055	0.0083	0.0019	0.001	5	0.0040	0.0067	0.0072	0.013	0.0033	0.001	5	0.0044	0.0047	0.0048	0.0052	0.00036	0.000
Dissolved phosphorus	mg-P/L	5	<0.001	0.0015	0.0013	0.0017	0.00048	0.000	5	0.0015	0.0016	0.0018	0.0024	0.00037	0.000	5	0.0019	0.0024	0.0023	0.0028	0.00039	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00090	0.0015	0.00055	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000

Parameter	Unit	MEL-03																				
		July							August							September						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Min	Median	Mean	Max	Standard Deviation	Standard Error
Major Ions																						
Reactive silica, as SiO2	mg/L	5	0.19	0.20	0.20	0.20	0.0049	0.002	5	0.18	0.19	0.19	0.19	0.0049	0.002	5	0.22	0.23	0.23	0.24	0.0084	0.004
Nutrients																						
Nitrate	mg-N/L	5	<0.005	<0.005	0.0041	0.0076	0.0023	0.001	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0054	0.017	0.0065	0.003
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0041	0.0076	0.0023	0.001	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0055	0.017	0.0065	0.003
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0038	0.0090	0.0029	0.001	5	<0.005	<0.005	0.0040	0.010	0.0034	0.002	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.18	0.18	0.19	0.20	0.013	0.006	5	0.055	0.098	0.12	0.22	0.065	0.029	5	0.057	0.13	0.12	0.16	0.039	0.017
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.18	0.24	0.23	0.27	0.041	0.018	5	0.14	0.14	0.16	0.19	0.022	0.010	5	0.099	0.17	0.16	0.19	0.037	0.016
Total nitrogen (calculated)	mg-N/L	5	0.18	0.19	0.19	0.20	0.012	0.005	5	0.055	0.098	0.12	0.22	0.065	0.029	5	0.057	0.13	0.12	0.16	0.040	0.018
Total nitrogen	mg-N/L	5	0.18	0.19	0.19	0.20	0.012	0.005	5	0.055	0.098	0.12	0.22	0.065	0.029	5	0.057	0.13	0.12	0.16	0.040	0.018
Dissolved nitrogen	mg-N/L	5	0.19	0.25	0.23	0.27	0.040	0.018	5	0.14	0.14	0.16	0.19	0.022	0.010	5	0.099	0.17	0.16	0.19	0.039	0.018
Total phosphorus	mg-P/L	5	0.0031	0.0042	0.0043	0.0062	0.0012	0.001	5	0.0034	0.0046	0.0044	0.0051	0.00063	0.000	5	0.0042	0.0047	0.0050	0.0058	0.00069	0.000
Dissolved phosphorus	mg-P/L	5	<0.001	0.0011	0.0012	0.0016	0.00046	0.000	5	0.0013	0.0016	0.0017	0.0024	0.00042	0.000	5	0.0020	0.0022	0.0026	0.0037	0.00075	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00066	0.0013	0.00036	0.000

Parameter	Unit	MEL-04						
		August						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions								
Reactive silica, as SiO2	mg/L	5	0.19	0.19	0.20	0.23	0.020	0.009
Nutrients								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.068	0.11	0.10	0.15	0.030	0.014
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.078	0.11	0.11	0.19	0.045	0.020
Total nitrogen (calculated)	mg-N/L	5	0.068	0.11	0.10	0.15	0.030	0.014
Total nitrogen	mg-N/L	5	0.068	0.11	0.10	0.15	0.030	0.014
Dissolved nitrogen	mg-N/L	5	0.078	0.11	0.11	0.19	0.045	0.020
Total phosphorus	mg-P/L	5	0.0041	0.0043	0.0046	0.0058	0.00068	0.000
Dissolved phosphorus	mg-P/L	5	0.0019	0.0024	0.0025	0.0032	0.00051	0.000
Orthophosphate	mg-P/L	5	<0.001	0.0014	0.0015	0.0028	0.0011	0.000

Parameter	Unit	MEL-05						
		August						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions								
Reactive silica, as SiO2	mg/L	5	0.20	0.20	0.20	0.21	0.0050	0.002
Nutrients								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.061	0.086	0.10	0.16	0.042	0.019
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.076	0.10	0.099	0.11	0.013	0.006
Total nitrogen (calculated)	mg-N/L	5	0.061	0.086	0.10	0.16	0.042	0.019
Total nitrogen	mg-N/L	5	0.061	0.086	0.10	0.16	0.042	0.019
Dissolved nitrogen	mg-N/L	5	0.076	0.10	0.099	0.11	0.013	0.006
Total phosphorus	mg-P/L	5	0.0035	0.0044	0.0045	0.0058	0.00087	0.000
Dissolved phosphorus	mg-P/L	5	0.0023	0.0029	0.0031	0.0048	0.00099	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00080	0.0014	0.00042	0.000

Notes: < = parameter below detection limit; mg/L=milligrams per litre;

Values below detection limits were converted to half-detects for the calculation of summary statistics.

Table 7B-3: Summary Statistics for Depth-integrated Nutrients from Melidaine Lake, 2017

Parameter	Unit	MEL-01																						
		July							August							September								
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error		
Major Ions																								
Reactive silica, as SiO2	mg/L	5	0.58	0.60	0.60	0.61	0.013	0.006	5	0.54	0.55	0.55	0.57	0.012	0.005	5	0.056	0.058	0.057	0.059	0.0013	0.001		
Nutrients																								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	0.0051	0.063	0.068	0.11	0.042	0.019		
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00064	0.0012	0.00031	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	0.0051	0.063	0.068	0.11	0.042	0.019		
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0053	0.011	0.0040	0.002	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	0.0052	0.013	0.044	0.018	0.008		
Total Kjeldahl nitrogen	mg-N/L	5	0.18	0.18	0.18	0.20	0.0075	0.003	5	0.18	0.21	0.22	0.26	0.028	0.013	5	0.18	0.20	0.24	0.39	0.090	0.040		
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.17	0.23	0.21	0.23	0.025	0.011	5	0.16	0.19	0.19	0.20	0.016	0.007	5	0.18	0.18	0.23	0.34	0.075	0.033		
Total nitrogen (calculated)	mg-N/L	5	0.18	0.18	0.18	0.20	0.0075	0.003	5	0.18	0.21	0.22	0.26	0.028	0.013	5	0.24	0.26	0.31	0.49	0.10	0.047		
Total nitrogen	mg-N/L	5	0.18	0.18	0.18	0.20	0.0075	0.003	5	0.18	0.21	0.22	0.26	0.028	0.013	5	0.24	0.26	0.31	0.49	0.10	0.047		
Dissolved nitrogen	mg-N/L	5	0.17	0.23	0.21	0.23	0.025	0.011	5	0.16	0.19	0.19	0.20	0.016	0.007	5	0.24	0.27	0.30	0.44	0.084	0.038		
Total phosphorus	mg-P/L	5	0.0045	0.0055	0.0054	0.0062	0.00063	0.000	5	0.0052	0.0058	0.0060	0.0068	0.00072	0.000	5	0.0065	0.0069	0.0072	0.0086	0.00085	0.000		
Dissolved phosphorus	mg-P/L	5	0.0017	0.0023	0.0024	0.0033	0.00060	0.000	5	0.0020	0.0028	0.0027	0.0035	0.00058	0.000	5	0.0025	0.0030	0.0034	0.0046	0.00092	0.000		
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00064	0.0012	0.00031	0.000	5	<0.001	<0.001	0.00072	0.0016	0.00049	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		

Parameter	Unit	MEL-02																						
		July							August							September								
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error		
Major Ions																								
Reactive silica, as SiO2	mg/L	5	0.35	0.35	0.35	0.36	0.0076	0.003	5	0.34	0.35	0.35	0.35	0.0041	0.002	5	0.032	0.036	0.036	0.037	0.0021	0.001		
Nutrients																								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	0.072	0.12	0.12	0.17	0.038	0.017		
Nitrite	mg-N/L	5	<0.001	<0.001	0.00062	0.0011	0.00027	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	0.072	0.12	0.12	0.17	0.038	0.017		
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0031	0.0054	0.0013	0.001	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000		
Total Kjeldahl nitrogen	mg-N/L	5	0.13	0.16	0.16	0.17	0.015	0.007	5	0.13	0.15	0.16	0.19	0.022	0.010	5	0.15	0.19	0.19	0.23	0.030	0.014		
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.12	0.15	0.15	0.17	0.016	0.007	5	0.14	0.16	0.16	0.17	0.011	0.005	5	0.15	0.19	0.18	0.21	0.025	0.011		
Total nitrogen (calculated)	mg-N/L	5	0.13	0.16	0.16	0.17	0.015	0.007	5	0.13	0.15	0.16	0.19	0.022	0.010	5	0.24	0.31	0.31	0.37	0.047	0.021		
Total nitrogen	mg-N/L	5	0.13	0.16	0.16	0.17	0.016	0.007	5	0.13	0.15	0.16	0.19	0.022	0.010	5	0.24	0.31	0.31	0.37	0.047	0.021		
Dissolved nitrogen	mg-N/L	5	0.12	0.15	0.15	0.17	0.016	0.007	5	0.14	0.16	0.16	0.17	0.011	0.005	5	0.24	0.28	0.29	0.37	0.053	0.024		
Total phosphorus	mg-P/L	5	0.0042	0.0066	0.0060	0.0077	0.0016	0.001	5	0.0035	0.0040	0.0044	0.0055	0.00088	0.000	5	0.0048	0.0067	0.0065	0.0080	0.0013	0.001		
Dissolved phosphorus	mg-P/L	5	0.0019	0.0021	0.0021	0.0027	0.00033	0.000	5	0.0017	0.0023	0.0024	0.0035	0.00070	0.000	5	0.0030	0.0037	0.0037	0.0043	0.00049	0.000		
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		

Parameter	Unit	MEL-03																						
		July							August							September								
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error	Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error		
Major Ions																								
Reactive silica, as SiO2	mg/L	5	0.22	0.22	0.22	0.22	0.0030	0.001	5	0.24	0.25	0.25	0.25	0.0025	0.001	5	0.026	0.027	0.027	0.027	0.00045	0.000		
Nutrients																								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	0.011	0.057	0.24	0.10	0.045		
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000	5	<0.0051	0.011	0.057	0.24	0.10	0.045		
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0035	0.0075	0.0022	0.001	5	<0.005	<0.005	0.0025	<0.005	0	0.000	5	<0.005	0.0062	0.0066	0.015	0.0049	0.002		
Total Kjeldahl nitrogen	mg-N/L	5	0.10	0.13	0.12	0.14	0.014	0.006	5	0.11	0.13	0.12	0.13	0.0093	0.004	5	0.21	0.24	0.24	0.27	0.021	0.010		
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.10	0.13	0.13	0.15	0.018	0.008	5	0.10	0.14	0.13	0.14	0.018	0.008	5	0.22	0.25	0.26	0.33	0.044	0.020		
Total nitrogen (calculated)	mg-N/L	5	0.10	0.13	0.12	0.14	0.014	0.006	5	0.11	0.13	0.12	0.13	0.0093	0.004	5	0.24	0.27	0.30	0.45	0.084	0.038		
Total nitrogen	mg-N/L	5	0.10	0.13	0.12	0.14	0.014	0.006	5	0.11	0.13	0.12	0.13	0.0093	0.004	5	0.24	0.27	0.30	0.44	0.084	0.038		
Dissolved nitrogen	mg-N/L	5	0.10	0.13	0.13	0.15	0.018	0.008	5	0.10	0.14	0.13	0.14	0.018	0.008	5	0.22	0.26	0.31	0.46	0.098	0.044		
Total phosphorus	mg-P/L	5	0.0045	0.0053	0.0055	0.0073	0.0011	0.000	5	0.0030	0.0037	0.0038	0.0053	0.00090	0.000	5	0.0036	0.0052	0.0052	0.0071	0.0013	0.001		
Dissolved phosphorus	mg-P/L	5	0.0016	0.0023	0.0021	0.0026	0.00043	0.000	5	0.0012	0.0017	0.0020	0.0028	0.00067	0.000	5	0.0028	0.0037	0.0035	0.0041	0.00054	0.000		
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00076	0.0012	0.00036	0.000	5	<0.001	0.0010	0.00086	0.0012	0.00034	0.000	5	<0.001	<0.001	0.00050	<0.001	0	0.000		

Parameter	Unit	MEL-04						
		August						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions								
Reactive silica, as SiO2	mg/L	5	0.25	0.26	0.26	0.26	0.0042	0.002
Nutrients								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.12	0.15	0.14	0.17	0.023	0.010
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.13	0.14	0.14	0.17	0.015	0.007
Total nitrogen (calculated)	mg-N/L	5	0.12	0.15	0.14	0.17	0.023	0.010
Total nitrogen	mg-N/L	5	0.12	0.15	0.14	0.17	0.023	0.010
Dissolved nitrogen	mg-N/L	5	0.13	0.14	0.14	0.17	0.015	0.007
Total phosphorus	mg-P/L	5	0.0037	0.0057	0.0071	0.015	0.0042	0.002
Dissolved phosphorus	mg-P/L	5	0.0016	0.0017	0.0018	0.0024	0.00034	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000

Parameter	Unit	MEL-05						
		August						
		Count	Minimum	Median	Mean	Maximum	Standard Deviation	Standard Error
Major Ions								
Reactive silica, as SiO2	mg/L	5	0.26	0.27	0.27	0.27	0.0058	0.003
Nutrients								
Nitrate	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Nitrite	mg-N/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000
Nitrate + nitrite	mg-N/L	5	<0.0051	<0.0051	0.0026	<0.0051	0	0.000
Total ammonia	mg-N/L	5	<0.005	<0.005	0.0025	<0.005	0	0.000
Total Kjeldahl nitrogen	mg-N/L	5	0.15	0.16	0.16	0.18	0.013	0.006
Dissolved Kjeldahl nitrogen	mg-N/L	5	0.15	0.16	0.16	0.19	0.017	0.008
Total nitrogen (calculated)	mg-N/L	5	0.15	0.16	0.16	0.18	0.013	0.006
Total nitrogen	mg-N/L	5	0.15	0.16	0.16	0.18	0.013	0.006
Dissolved nitrogen	mg-N/L	5	0.15	0.16	0.16	0.19	0.017	0.008
Total phosphorus	mg-P/L	5	0.0032	0.0037	0.0036	0.0040	0.00032	0.000
Dissolved phosphorus	mg-P/L	5	0.0014	0.0022	0.0024	0.0040	0.00097	0.000
Orthophosphate	mg-P/L	5	<0.001	<0.001	0.00050	<0.001	0	0.000

Notes: < = parameter below detection limit; mg/L=milligrams per litre;

Values below detection limits were converted to half-detects for the calculation of summary statistics.

Table 7B-4: Summary Statistics for Chlorophyll *a* from Meliadine Lake, 2015-2017

Year	Station	Season	Descriptive Statistic	Chlorophyll *a* (µg/L)
2015	MEL-01	July	Minimum	1.85
			Maximum	2.84
			Median	2.19
			Mean	2.27
			Standard Deviation	0.28
			Standard Error	0.07
		August	Minimum	0.70
			Maximum	0.97
			Median	0.87
			Mean	0.86
			Standard Deviation	0.08
			Standard Error	0.02
		September	Minimum	–
			Maximum	–
			Median	–
			Mean	–
			Standard Deviation	–
			Standard Error	–
	MEL-02	July	Minimum	1.89
			Maximum	2.60
			Median	2.44
			Mean	2.36
			Standard Deviation	0.22
			Standard Error	0.06
		August	Minimum	0.32
			Maximum	0.57
			Median	0.41
			Mean	0.45
			Standard Deviation	0.10
			Standard Error	0.02
		September	Minimum	0.40
			Maximum	0.69
			Median	0.55
			Mean	0.55
			Standard Deviation	0.08
			Standard Error	0.02
2016	MEL-01	July	Minimum	1.42
			Maximum	2.22
			Median	1.90
			Mean	1.89
			Standard Deviation	0.21
			Standard Error	0.05
		August	Minimum	1.33
			Maximum	2.27
			Median	1.90
			Mean	1.88
			Standard Deviation	0.26
			Standard Error	0.07
		September	Minimum	1.62
			Maximum	2.24
			Median	2.02
			Mean	1.99
			Standard Deviation	0.20
			Standard Error	0.05
	MEL-02	July	Minimum	1.22
			Maximum	1.70
			Median	1.40
			Mean	1.43
			Standard Deviation	0.16
			Standard Error	0.04
		August	Minimum	0.34
			Maximum	1.37
			Median	1.21
			Mean	1.15
			Standard Deviation	0.26
			Standard Error	0.07
		September	Minimum	0.96
			Maximum	1.28
			Median	1.15
			Mean	1.14
			Standard Deviation	0.10
			Standard Error	0.02

Year	Station	Season	Descriptive Statistic	Chlorophyll *a* (µg/L)
	MEL-03	July	Minimum	0.76
			Maximum	1.22
			Median	1.06
			Mean	1.05
			Standard Deviation	0.10
			Standard Error	0.03
		August	Minimum	0.46
			Maximum	0.97
			Median	0.74
			Mean	0.73
			Standard Deviation	0.12
			Standard Error	0.03
		September	Minimum	0.69
			Maximum	1.54
			Median	0.90
			Mean	1.02
			Standard Deviation	0.31
			Standard Error	0.09
	MEL-04	August	Minimum	0.78
			Maximum	1.09
			Median	0.92
			Mean	0.93
			Standard Deviation	0.09
			Standard Error	0.02
	MEL-05	August	Minimum	0.87
			Maximum	1.40
			Median	1.08
			Mean	1.10
			Standard Deviation	0.15
			Standard Error	0.04
	MEL-01	July	Minimum	0.85
			Maximum	2.37
			Median	1.52
			Mean	1.49
			Standard Deviation	0.34
			Standard Error	0.09
		August	Minimum	1.27
			Maximum	1.70
			Median	1.47
			Mean	1.48
			Standard Deviation	0.12
			Standard Error	0.03
		September	Minimum	0.87
			Maximum	1.84
			Median	1.46
			Mean	1.45
			Standard Deviation	0.33
			Standard Error	0.09
	MEL-02	July	Minimum	0.65
			Maximum	1.13
			Median	0.81
			Mean	0.84
			Standard Deviation	0.13
			Standard Error	0.03
		August	Minimum	0.46
			Maximum	0.72
			Median	0.62
			Mean	0.61
			Standard Deviation	0.07
			Standard Error	0.02
		September	Minimum	0.47
			Maximum	1.49
			Median	1.11
			Mean	1.11
			Standard Deviation	0.27
			Standard Error	0.07
2017		July	Minimum	0.35
			Maximum	0.57
			Median	0.49
			Mean	0.48
			Standard Deviation	0.06
			Standard Error	0.02

Year	Station	Season	Descriptive Statistic	Chlorophyll *a* (µg/L)
	MEL-03	August	Minimum	0.43
			Maximum	0.69
			Median	0.58
			Mean	0.57
			Standard Deviation	0.07
			Standard Error	0.02
		September	Minimum	0.39
			Maximum	0.76
			Median	0.58
			Mean	0.59
			Standard Deviation	0.10
			Standard Error	0.03
	MEL-04	August	Minimum	0.49
			Maximum	0.71
			Median	0.63
			Mean	0.61
			Standard Deviation	0.07
			Standard Error	0.02
	MEL-05	August	Minimum	0.49
			Maximum	0.68
			Median	0.58
			Mean	0.58
			Standard Deviation	0.04
			Standard Error	0.01

Notes: mg/L=micrograms per litre.

"–" = summary statistics not calculated as no samples were collected

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-01	MEL-01-02
Sample Date		19/07/2015	14/08/2015	19/09/2015	21/07/2016	11/08/2016	10/09/2016	16/07/2017	09/08/2017	04/09/2017	19/07/2015
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.393	0.231	0.339	0.385	0.395	0.482	0.6	0.568	0.056	0.389
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	0.0187	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0051	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	0.0187	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0051	< 0.0051
Total Ammonia	mg/L	0.0322	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0083	< 0.0050	0.0052	0.023
Total Kjeldahl Nitrogen	mg/L	0.116	0.129	< 0.050	0.16	0.058	0.179	0.184	0.212	0.256	0.185
Dissolved Kjeldahl Nitrogen	mg/L	0.097	< 0.050	0.094	0.295	0.135	0.275	0.216	0.192	0.269	0.148
Total Nitrogen	mg/L	0.116	0.129	< 0.050	0.16	0.058	0.179	0.184	0.212	0.261	0.185
Dissolved Nitrogen	mg/L	0.097	< 0.050	0.113	0.295	0.135	0.275	0.216	0.192	0.274	0.148
Total Phosphorus	mg/L	0.0053	0.0043	0.006	0.0064	0.0071	0.0061	0.0055	0.0058	0.0086	0.0048
Dissolved Phosphorus	mg/L	0.0022	0.0016	0.0046	0.0018	0.0022	0.002	0.0017	0.0028	0.0046	0.0023
Orthophosphate	mg/L	< 0.0010	0.0014	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Notes: < = parameter below detection limit; mg/L=milligrams per litre;

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-02	MEL-01-03	MEL-01-03
Sample Date		14/08/2015	19/09/2015	21/07/2016	11/08/2016	10/09/2016	16/07/2017	09/08/2017	04/09/2017	19/07/2015	14/08/2015
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.294	0.337	0.398	0.392	0.483	0.6	0.55	0.056	0.377	0.259
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.023	< 0.0050	< 0.0050	0.0991	< 0.0050	0.0876
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.023	< 0.0051	< 0.0051	0.0991	< 0.0051	0.0876
Total Ammonia	mg/L	< 0.0050	0.0121	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0443	0.0272	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.133	0.082	0.148	0.094	0.216	0.18	0.258	0.394	0.176	0.078
Dissolved Kjeldahl Nitrogen	mg/L	0.103	0.094	0.201	0.135	0.256	0.168	0.202	0.341	0.121	< 0.050
Total Nitrogen	mg/L	0.133	0.082	0.148	0.094	0.239	0.18	0.258	0.493	0.176	0.166
Dissolved Nitrogen	mg/L	0.103	0.094	0.201	0.135	0.279	0.168	0.202	0.44	0.121	0.088
Total Phosphorus	mg/L	0.0041	0.0046	0.0073	0.0055	0.0057	0.0045	0.0067	0.0072	0.0048	0.004
Dissolved Phosphorus	mg/L	0.0013	0.0021	0.0017	0.002	0.0011	0.0033	0.0023	0.0042	0.0015	0.0014
Orthophosphate	mg/L	< 0.0010	< 0.0010	< 0.0010	0.001	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0014

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-01-03	MEL-01-03	MEL-01-03	MEL-01-03	MEL-01-03	MEL-01-03	MEL-01-04	MEL-01-04	MEL-01-04	MEL-01-04
Sample Date		21/07/2016	11/08/2016	10/09/2016	16/07/2017	09/08/2017	04/09/2017	19/07/2015	14/08/2015	19/09/2015	22/07/2016
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.392	0.389	0.478	0.599	0.56	0.058	0.389	0.37	0.332	0.4
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	0.0099	< 0.0050	< 0.0050	0.114	< 0.0050	0.0226	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	0.0099	< 0.0051	< 0.0051	0.114	< 0.0051	0.0226	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0055	0.0144	0.0093	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.161	0.05	0.179	0.196	0.23	0.184	0.114	< 0.050	0.074	0.187
Dissolved Kjeldahl Nitrogen	mg/L	0.232	0.108	0.208	0.227	0.176	0.179	0.148	0.106	< 0.050	0.169
Total Nitrogen	mg/L	0.161	0.05	0.189	0.196	0.23	0.297	0.114	< 0.050	0.074	0.187
Dissolved Nitrogen	mg/L	0.232	0.108	0.217	0.227	0.176	0.293	0.148	0.129	< 0.050	0.169
Total Phosphorus	mg/L	0.0058	0.0067	0.0074	0.0057	0.0052	0.0065	0.0052	0.0039	0.005	0.0061
Dissolved Phosphorus	mg/L	0.0027	0.0019	< 0.0010	0.0027	0.002	0.0028	0.0011	< 0.0010	0.0018	0.0019
Orthophosphate	mg/L	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-01-04	MEL-01-04	MEL-01-04	MEL-01-04	MEL-01-04	MEL-01-05	MEL-01-05	MEL-01-05	MEL-01-05	MEL-01-05
Sample Date		11/08/2016	10/09/2016	16/07/2017	09/08/2017	04/09/2017	18/07/2015	15/08/2015	19/09/2015	22/07/2016	11/08/2016
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.388	0.477	0.608	0.537	0.059	0.364	0.382	0.313	0.401	0.383
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0611	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0072
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0611	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0072
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0059	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.137	0.178	0.18	0.205	0.178	0.186	< 0.050	< 0.050	0.154	0.057
Dissolved Kjeldahl Nitrogen	mg/L	0.122	0.179	0.225	0.198	0.175	0.153	< 0.050	0.055	0.214	0.151
Total Nitrogen	mg/L	0.137	0.178	0.18	0.207	0.239	0.186	< 0.050	< 0.050	0.154	0.064
Dissolved Nitrogen	mg/L	0.122	0.179	0.225	0.199	0.236	0.153	< 0.050	0.055	0.214	0.158
Total Phosphorus	mg/L	0.0053	0.0067	0.0052	0.0068	0.0069	0.006	0.0091	0.0053	0.0085	0.005
Dissolved Phosphorus	mg/L	0.0021	0.0014	0.0023	0.0035	0.0025	0.0023	0.0021	0.0016	0.0015	0.0023
Orthophosphate	mg/L	< 0.0010	< 0.0010	0.0012	0.0016	< 0.0010	0.0011	0.0012	< 0.0010	0.0011	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-01-05	MEL-01-05	MEL-01-05	MEL-01-05	MEL-02-01	MEL-02-01	MEL-02-01	MEL-02-01	MEL-02-01	MEL-02-01
Sample Date		10/09/2016	16/07/2017	09/08/2017	04/09/2017	21/07/2015	16/08/2015	10/09/2015	23/07/2016	11/08/2016	11/09/2016
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.493	0.575	0.552	0.058	0.282	0.288	0.271	0.288	0.257	0.287
Nutrients											
Nitrate	mg/L	0.0087	< 0.0050	< 0.0050	0.0625	< 0.0050	< 0.0050	0.0085	< 0.0050	< 0.0050	0.0087
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	0.0087	< 0.0051	< 0.0051	0.0625	< 0.0051	< 0.0051	0.0085	< 0.0051	< 0.0051	0.0087
Total Ammonia	mg/L	< 0.0050	0.0109	< 0.0050	0.005	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.19	0.177	0.182	0.2	0.173	< 0.050	0.053	0.139	0.105	0.075
Dissolved Kjeldahl Nitrogen	mg/L	0.24	0.226	0.164	0.176	0.17	0.069	< 0.050	0.235	0.197	0.129
Total Nitrogen	mg/L	0.199	0.177	0.182	0.263	0.173	< 0.050	0.061	0.139	0.105	0.083
Dissolved Nitrogen	mg/L	0.249	0.226	0.164	0.238	0.17	0.069	< 0.050	0.235	0.197	0.137
Total Phosphorus	mg/L	0.0054	0.0062	0.0055	0.0066	0.0048	0.005	0.0056	0.0047	0.0125	0.0046
Dissolved Phosphorus	mg/L	0.002	0.0022	0.0029	0.003	0.0021	< 0.0010	0.0016	0.0013	0.0019	0.0024
Orthophosphate	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-02-01	MEL-02-01	MEL-02-01	MEL-02-02	MEL-02-02	MEL-02-02	MEL-02-02	MEL-02-02	MEL-02-02	MEL-02-02
Sample Date		23/07/2017	11/08/2017	05/09/2017	21/07/2015	16/08/2015	10/09/2015	23/07/2016	11/08/2016	11/09/2016	23/07/2017
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.364	0.343	0.032	0.284	0.264	0.263	0.284	0.249	0.282	0.351
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	0.0873	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0071	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	0.0873	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0071	< 0.0051
Total Ammonia	mg/L	0.0054	< 0.0050	< 0.0050	0.012	< 0.0050	0.0528	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.134	0.185	0.154	0.242	< 0.050	< 0.050	0.111	0.092	0.197	0.163
Dissolved Kjeldahl Nitrogen	mg/L	0.156	0.142	0.151	0.291	0.111	< 0.050	0.169	0.158	0.104	0.14
Total Nitrogen	mg/L	0.134	0.185	0.242	0.242	< 0.050	< 0.050	0.111	0.092	0.204	0.163
Dissolved Nitrogen	mg/L	0.156	0.142	0.238	0.291	0.111	< 0.050	0.169	0.158	0.111	0.14
Total Phosphorus	mg/L	0.0072	0.0052	0.0048	0.0059	0.0031	0.0041	0.0037	0.0052	0.0044	0.0044
Dissolved Phosphorus	mg/L	0.0027	0.0023	0.003	0.002	< 0.0010	0.0016	0.0015	0.0024	0.0028	0.0021
Orthophosphate	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.002	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-02-02	MEL-02-02	MEL-02-03	MEL-02-03	MEL-02-03	MEL-02-03	MEL-02-03	MEL-02-03	MEL-02-03	MEL-02-03
Sample Date		11/08/2017	05/09/2017	21/07/2015	16/08/2015	10/09/2015	23/07/2016	11/08/2016	11/09/2016	23/07/2017	11/08/2017
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.35	0.036	0.281	0.301	0.26	0.286	0.254	0.293	0.349	0.348
Nutrients											
Nitrate	mg/L	< 0.0050	0.168	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0157	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	0.168	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0157	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	0.0179	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0086	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.172	0.206	0.232	< 0.050	< 0.050	0.144	0.127	0.171	0.171	0.153
Dissolved Kjeldahl Nitrogen	mg/L	0.163	0.207	0.216	< 0.050	< 0.050	0.099	0.167	0.167	0.167	0.151
Total Nitrogen	mg/L	0.172	0.374	0.232	< 0.050	< 0.050	0.144	0.127	0.187	0.171	0.153
Dissolved Nitrogen	mg/L	0.163	0.374	0.216	< 0.050	< 0.050	0.099	0.167	0.183	0.167	0.151
Total Phosphorus	mg/L	0.004	0.008	0.0048	0.0045	0.0042	0.0083	0.0078	0.0052	0.0066	0.0035
Dissolved Phosphorus	mg/L	0.0017	0.0043	0.002	0.0011	0.0016	0.0016	0.0016	0.0019	0.0019	0.002
Orthophosphate	mg/L	< 0.0010	< 0.0010	0.0014	0.0012	< 0.0010	< 0.0010	0.0015	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-02-03	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04	MEL-02-04
Sample Date		05/09/2017	21/07/2015	17/08/2015	10/09/2015	23/07/2016	11/08/2016	11/09/2016	23/07/2017	11/08/2017	05/09/2017
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.036	0.277	0.268	0.27	0.296	0.269	0.277	0.348	0.346	0.037
Nutrients											
Nitrate	mg/L	0.128	< 0.0050	0.019	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.121
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	0.128	< 0.0051	0.019	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.121
Total Ammonia	mg/L	< 0.0050	0.0082	< 0.0050	0.0081	< 0.0050	0.0176	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.177	0.129	0.096	0.116	0.098	0.131	0.216	0.163	0.138	0.186
Dissolved Kjeldahl Nitrogen	mg/L	0.154	0.164	< 0.050	< 0.050	0.153	0.136	0.135	0.149	0.158	0.194
Total Nitrogen	mg/L	0.305	0.129	0.115	0.116	0.098	0.131	0.216	0.164	0.138	0.307
Dissolved Nitrogen	mg/L	0.282	0.164	< 0.050	< 0.050	0.153	0.136	0.135	0.151	0.158	0.315
Total Phosphorus	mg/L	0.0067	0.0047	0.0014	0.0053	0.0066	0.004	0.0047	0.0042	0.0055	0.0055
Dissolved Phosphorus	mg/L	0.0034	0.002	0.005	0.0014	< 0.0010	0.0016	0.0025	0.0021	0.0035	0.0037
Orthophosphate	mg/L	< 0.0010	0.0014	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-02-05	MEL-03-01
Sample Date		21/07/2015	17/08/2015	10/09/2015	23/07/2016	11/08/2016	11/09/2016	23/07/2017	11/08/2017	05/09/2017	26/07/2016
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.281	0.223	0.268	0.295	0.261	0.276	0.362	0.354	0.037	0.204
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0718	0.0053
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0718	0.0053
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.141	0.192	< 0.050	0.114	0.097	0.103	0.144	0.134	0.234	0.184
Dissolved Kjeldahl Nitrogen	mg/L	0.14	< 0.050	0.099	0.171	0.179	0.207	0.124	0.171	0.189	0.181
Total Nitrogen	mg/L	0.141	0.192	< 0.050	0.114	0.097	0.103	0.144	0.134	0.306	0.189
Dissolved Nitrogen	mg/L	0.14	< 0.050	0.099	0.171	0.179	0.207	0.124	0.171	0.261	0.187
Total Phosphorus	mg/L	0.0044	0.0056	0.0036	0.0041	0.0067	0.0052	0.0077	0.0039	0.0073	0.0044
Dissolved Phosphorus	mg/L	0.002	0.0025	0.0012	0.0017	0.0015	0.0019	0.0019	0.0027	0.0039	0.0016
Orthophosphate	mg/L	0.0017	< 0.0010	< 0.0010	< 0.0010	0.0015	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-03-01	MEL-03-01	MEL-03-01	MEL-03-01	MEL-03-01	MEL-03-01	MEL-03-02	MEL-03-02	MEL-03-02	MEL-03-02
Sample Date		12/08/2016	12/09/2016	21/07/2017	13/08/2017	01/09/2017	05/09/2017	26/07/2016	12/08/2016	13/09/2016	21/07/2017
Sample Depth		4 m	4 m	4m	4m	4m	4m	4 m	4 m	4 m	4m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.181	0.226	0.219	0.244	0.026	0.036	0.204	0.188	0.216	0.217
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0112	0.327	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	0.0112	0.327	< 0.0051	< 0.0051	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0062	0.0111	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.075	0.119	0.128	0.128	0.245	0.269	0.175	0.219	0.163	0.129
Dissolved Kjeldahl Nitrogen	mg/L	0.142	0.174	0.102	0.136	0.248	0.265	0.189	0.194	0.194	0.151
Total Nitrogen	mg/L	0.075	0.119	0.128	0.128	0.256	0.595	0.175	0.219	0.163	0.129
Dissolved Nitrogen	mg/L	0.142	0.174	0.102	0.136	0.259	0.592	0.189	0.194	0.194	0.151
Total Phosphorus	mg/L	0.0051	0.0047	0.0073	0.003	0.0053	0.0088	0.0035	0.0046	0.0046	0.0055
Dissolved Phosphorus	mg/L	0.0017	0.002	0.0023	0.0028	0.0028	0.007	< 0.0010	0.0015	0.0022	0.0023
Orthophosphate	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-03-02	MEL-03-02	MEL-03-03	MEL-03-03	MEL-03-03	MEL-03-03	MEL-03-03	MEL-03-03	MEL-03-04	MEL-03-04
Sample Date		13/08/2017	01/09/2017	26/07/2016	12/08/2016	13/09/2016	21/07/2017	13/08/2017	01/09/2017	26/07/2016	12/08/2016
Sample Depth		4m	4m	4 m	4 m	4 m	4m	4m	4m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.244	0.027	0.199	0.179	0.219	0.223	0.245	0.027	0.196	0.186
Nutrients											
Nitrate	mg/L	< 0.0050	0.238	0.0076	< 0.0050	0.0171	< 0.0050	< 0.0050	0.0078	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	0.238	0.0076	< 0.0051	0.0171	< 0.0051	< 0.0051	0.0078	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	0.0102	< 0.0050	< 0.0050	< 0.0050	0.0073	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.127	0.207	0.177	0.137	0.127	0.117	0.108	0.234	0.202	0.055
Dissolved Kjeldahl Nitrogen	mg/L	0.143	0.225	0.238	0.16	0.173	0.118	0.113	0.25	0.261	0.142
Total Nitrogen	mg/L	0.127	0.444	0.185	0.137	0.144	0.117	0.108	0.241	0.202	0.055
Dissolved Nitrogen	mg/L	0.143	0.463	0.245	0.16	0.19	0.118	0.113	0.258	0.261	0.142
Total Phosphorus	mg/L	0.0032	0.0052	0.0031	0.0046	0.0042	0.0049	0.0038	0.0036	0.0042	0.0034
Dissolved Phosphorus	mg/L	0.0012	0.003	0.0011	0.0024	0.002	0.0026	0.0016	0.0037	0.0016	0.0013
Orthophosphate	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0013	0.0011	0.0011	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-03-04	MEL-03-04	MEL-03-04	MEL-03-04	MEL-03-05	MEL-03-05	MEL-03-05	MEL-03-05	MEL-03-05	MEL-03-05
Sample Date		22/09/2016	21/07/2017	13/08/2017	01/09/2017	26/07/2016	12/08/2016	22/09/2016	21/07/2017	13/08/2017	01/09/2017
Sample Depth		4 m	4m	4m	4m	4 m	4 m	1 m	4m	4m	4m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.237	0.215	0.25	0.027	0.193	0.191	0.23	0.219	0.246	0.027
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	0.0279	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	0.0279	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	0.0075	< 0.0050	< 0.0050	0.009	< 0.0050	< 0.0050	< 0.0050	< 0.0050	0.0145
Total Kjeldahl Nitrogen	mg/L	0.057	0.1	0.131	0.241	0.203	0.098	0.133	0.135	0.119	0.266
Dissolved Kjeldahl Nitrogen	mg/L	0.099	0.135	0.138	0.33	0.271	0.143	0.146	0.131	0.102	0.222
Total Nitrogen	mg/L	0.057	0.1	0.131	0.268	0.203	0.098	0.133	0.135	0.119	0.266
Dissolved Nitrogen	mg/L	0.099	0.135	0.138	0.358	0.271	0.143	0.146	0.131	0.102	0.222
Total Phosphorus	mg/L	0.0056	0.0045	0.0053	0.0047	0.0062	0.0043	0.0058	0.0053	0.0037	0.0071
Dissolved Phosphorus	mg/L	0.003	0.0016	0.0017	0.0041	0.001	0.0016	0.0037	0.0017	0.0025	0.0037
Orthophosphate	mg/L	< 0.0010	< 0.0010	0.0012	< 0.0010	< 0.0010	< 0.0010	< 0.0010	0.0012	0.001	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-04-01	MEL-04-01	MEL-04-02	MEL-04-02	MEL-04-03	MEL-04-03	MEL-04-04	MEL-04-04	MEL-04-05	MEL-04-05
Sample Date		14/08/2016	15/08/2017	14/08/2016	15/08/2017	14/08/2016	15/08/2017	14/08/2016	15/08/2017	14/08/2016	15/08/2017
Sample Depth		4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m	4 m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.232	0.261	0.186	0.256	0.19	0.264	0.189	0.262	0.186	0.254
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.146	0.12	0.112	0.153	0.107	0.118	0.08	0.155	0.068	0.169
Dissolved Kjeldahl Nitrogen	mg/L	0.191	0.126	0.078	0.138	0.106	0.147	0.105	0.168	0.084	0.141
Total Nitrogen	mg/L	0.146	0.12	0.112	0.153	0.107	0.118	0.08	0.155	0.068	0.169
Dissolved Nitrogen	mg/L	0.191	0.126	0.078	0.138	0.106	0.147	0.105	0.168	0.084	0.141
Total Phosphorus	mg/L	0.0058	0.0055	0.0043	0.0037	0.0043	0.0145	0.0046	0.0057	0.0041	0.006
Dissolved Phosphorus	mg/L	0.0019	0.0024	0.0029	0.0019	0.0023	0.0016	0.0024	0.0016	0.0032	0.0017
Orthophosphate	mg/L	0.0014	< 0.0010	0.0028	< 0.0010	< 0.0010	< 0.0010	0.0025	< 0.0010	< 0.0010	< 0.0010

Table 7B-5: Raw Depth-intregrated Nutrients Data from Meliadine Lake, 2015-2017

Station		MEL-05-01	MEL-05-01	MEL-05-02	MEL-05-02	MEL-05-03	MEL-05-03	MEL-05-04	MEL-05-04	MEL-05-05	MEL-05-05
Sample Date		16/08/2016	12/08/2017	16/08/2016	12/08/2017	16/08/2016	12/08/2017	16/08/2016	12/08/2017	16/08/2016	12/08/2017
Sample Depth		4 m	4m	4 m	4m	4 m	4m	4 m	4m	4 m	4m
Parameter	**Unit**										
Major Ions											
Reactive silica, as SiO2	mg/L	0.207	0.27	0.2	0.272	0.199	0.26	0.196	0.259	0.207	0.265
Nutrients											
Nitrate	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Nitrite	mg/L	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Nitrate + Nitrite	mg/L	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051	< 0.0051
Total Ammonia	mg/L	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Total Kjeldahl Nitrogen	mg/L	0.135	0.168	0.086	0.152	0.061	0.157	0.158	0.178	0.073	0.147
Dissolved Kjeldahl Nitrogen	mg/L	0.111	0.149	0.102	0.19	0.076	0.17	0.102	0.163	0.103	0.15
Total Nitrogen	mg/L	0.135	0.168	0.086	0.152	0.061	0.157	0.158	0.178	0.073	0.147
Dissolved Nitrogen	mg/L	0.111	0.149	0.102	0.19	0.076	0.17	0.102	0.163	0.103	0.15
Total Phosphorus	mg/L	0.0049	0.0034	0.0035	0.0037	0.0044	0.004	0.0058	0.0032	0.0041	0.0038
Dissolved Phosphorus	mg/L	0.0048	0.004	0.0025	0.0022	0.0029	0.002	0.0023	0.0014	0.0032	0.0025
Orthophosphate	mg/L	0.0014	< 0.0010	< 0.0010	< 0.0010	0.0011	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Table 7B-6: Raw Chlorophyll *a* Data, 2015-2017

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
2015	A8	A8-01	August	Rep 1	2.019
				Rep 2	1.874
				Rep 3	1.98
		A8-02	August	Rep 1	1.722
				Rep 2	1.502
				Rep 3	1.937
		A8-03	August	Rep 1	2.267
				Rep 2	2.287
				Rep 3	2.437
	B7	B7-01	August	Rep 1	1.436
				Rep 2	1.238
				Rep 3	1.59
			September	Rep 1	0.93
				Rep 2	0.951
				Rep 3	1.029
		B7-02	September	Rep 1	1.093
				Rep 2	1.082
				Rep 3	1.149
		B7-03	September	Rep 1	1.084
				Rep 2	1.11
				Rep 3	1.157
	D7	D7-01	July	Rep 1	4.539
				Rep 2	4.618
				Rep 3	4.563
		D7-02	July	Rep 1	4.771
				Rep 2	5.516
				Rep 3	5.143
		D7-03	July	Rep 1	5.645
				Rep 2	5.41
				Rep 3	4.994
	Meliadine	MEL-01-01	July	Rep 1	1.866
				Rep 2	1.85
				Rep 3	2.218
			August	Rep 1	0.737
				Rep 2	0.866
				Rep 3	0.702
		MEL-01-02	July	Rep 1	2.133
				Rep 2	2.194
				Rep 3	2.168
			August	Rep 1	0.954
				Rep 2	0.862
				Rep 3	0.84
		MEL-01-03	July	Rep 1	2.542
				Rep 2	2.291
				Rep 3	2.098
			August	Rep 1	0.889
				Rep 2	0.751
				Rep 3	<MDL
		MEL-01-04	July	Rep 1	2.636
				Rep 2	2.511
				Rep 3	2.839
			August	Rep 1	0.877
				Rep 2	0.899
				Rep 3	0.973
		MEL-01-05	July	Rep 1	2.134
				Rep 2	2.04
				Rep 3	2.495
			August	Rep 1	0.927
				Rep 2	0.861
				Rep 3	0.883
			July	Rep 1	2.326
				Rep 2	2.629
				Rep 3	2.573
		MEL-02-01	July	Rep 1	1.89
				Rep 2	2.546
				Rep 3	2.601
			August	Rep 1	0.392
				Rep 2	0.412
				Rep 3	0.32
			September	Rep 1	0.559
				Rep 2	0.595
				Rep 3	0.606
		MEL-02-02	July	Rep 1	2.05
				Rep 2	2.443
				Rep 3	2.088
			August	Rep 1	0.349
				Rep 2	0.349
				Rep 3	0.381

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
			September	Rep 1	0.687
				Rep 2	0.675
				Rep 3	0.541
		MEL-02-03	July	Rep 1	2.511
				Rep 2	2.38
				Rep 3	2.063
			August	Rep 1	0.533
				Rep 2	0.327
				Rep 3	0.547
			September	Rep 1	0.453
				Rep 2	0.501
				Rep 3	0.398
		MEL-02-04	July	Rep 1	2.444
				Rep 2	2.54
				Rep 3	2.412
			August	Rep 1	0.42
				Rep 2	0.573
				Rep 3	0.409
			September	Rep 1	0.528
				Rep 2	0.553
				Rep 3	0.605
		MEL-02-05	July	Rep 1	2.551
				Rep 2	2.484
				Rep 3	2.448
			August	Rep 1	0.544
				Rep 2	0.569
				Rep 3	0.551
			September	Rep 1	0.545
				Rep 2	0.52
				Rep 3	0.494
	A8	A8-01	July	Rep 1	3.1
				Rep 2	2.391
				Rep 3	2.7
			August	Rep 1	1.857
				Rep 2	1.923
				Rep 3	2.101
		A8-02	July	Rep 1	2.611
				Rep 2	2.503
				Rep 3	2.455
			August	Rep 1	2.112
				Rep 2	2.185
				Rep 3	2.302
		A8-03	July	Rep 1	2.2
				Rep 2	2.399
				Rep 3	2.082
		A8-04	August	Rep 1	2.2
				Rep 2	1.961
				Rep 3	2.072
	B7	B7-01	July	Rep 1	1.65
				Rep 2	1.569
				Rep 3	1.325
			August	Rep 1	2.984
				Rep 2	2.762
				Rep 3	2.731
		B7-02	July	Rep 1	1.9
				Rep 2	1.865
				Rep 3	2.018
			August	Rep 1	3.236
				Rep 2	2.987
				Rep 3	3.408
		B7-03	July	Rep 1	1.903
				Rep 2	2.044
				Rep 3	1.798
			August	Rep 1	3.039
				Rep 2	3.388
				Rep 3	3.373
	D7	D7-01	July	Rep 1	3.262
				Rep 2	3.682
				Rep 3	3.349
			August	Rep 1	3.804
				Rep 2	3.474
				Rep 3	3.542
		D7-02	July	Rep 1	3.458
				Rep 2	3.549
				Rep 3	3.528
			August	Rep 1	3.866
				Rep 2	3.906
				Rep 3	3.433

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
2016		D7-03	July	Rep 1	3.01
				Rep 2	3.778
				Rep 3	3.905
			August	Rep 1	4.197
				Rep 2	4.209
				Rep 3	3.723
		Mel-01-01	July	Rep 1	1.698
				Rep 2	2.031
				Rep 3	1.769
			August	Rep 1	2.269
				Rep 2	1.653
				Rep 3	1.912
			September	Rep 1	1.815
				Rep 2	1.977
				Rep 3	2.114
		Mel-01-02	July	Rep 1	1.682
				Rep 2	1.959
				Rep 3	2.207
			August	Rep 1	2.044
				Rep 2	2.063
				Rep 3	2.134
			September	Rep 1	1.929
				Rep 2	1.621
				Rep 3	2.016
		Mel-01-03	July	Rep 1	1.746
				Rep 2	2.028
				Rep 3	1.875
			August	Rep 1	1.65
				Rep 2	1.895
				Rep 3	2.259
			September	Rep 1	2.113
				Rep 2	2.243
				Rep 3	2.119
		Mel-01-04	July	Rep 1	1.421
				Rep 2	1.896
				Rep 3	2.222
			August	Rep 1	1.851
				Rep 2	1.781
				Rep 3	1.809
			September	Rep 1	2.216
				Rep 2	2.196
				Rep 3	2.122
		Mel-01-05	July	Rep 1	1.838
				Rep 2	1.935
				Rep 3	2.056
			August	Rep 1	1.334
				Rep 2	1.932
				Rep 3	1.597
			September	Rep 1	1.634
				Rep 2	1.942
				Rep 3	1.821
		Mel-02-01	July	Rep 1	1.493
				Rep 2	1.68
				Rep 3	1.704
			August	Rep 1	1.263
				Rep 2	0.337
				Rep 3	1.086
			September	Rep 1	1.198
				Rep 2	0.962
				Rep 3	1.145
		Mel-02-02	July	Rep 1	1.399
				Rep 2	1.247
				Rep 3	1.217
			August	Rep 1	0.91
				Rep 2	1.208
				Rep 3	1
			September	Rep 1	1.122
				Rep 2	0.957
				Rep 3	1.089
		Mel-02-03	July	Rep 1	1.591
				Rep 2	1.639
				Rep 3	1.381
			August	Rep 1	1.197
				Rep 2	1.372
				Rep 3	1.206
			September	Rep 1	1.22
				Rep 2	1.182
				Rep 3	1.023

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
	Meliadine	Mel-02-04	July	Rep 1	1.272
				Rep 2	1.446
				Rep 3	1.448
			August	Rep 1	1.271
				Rep 2	1.325
				Rep 3	1.184
			September	Rep 1	1.259
				Rep 2	1.145
				Rep 3	1.179
		Mel-02-05	July	Rep 1	1.365
				Rep 2	1.324
				Rep 3	1.243
			August	Rep 1	1.322
				Rep 2	1.249
				Rep 3	1.289
			September	Rep 1	1.283
				Rep 2	1.134
				Rep 3	1.155
		Mel-03-01	July	Rep 1	1.04
				Rep 2	1.037
				Rep 3	0.996
			August	Rep 1	0.763
				Rep 2	0.693
				Rep 3	0.748
			September	Rep 1	0.842
				Rep 2	1.07
				Rep 3	0.769
		Mel-03-02	July	Rep 1	1.106
				Rep 2	1.082
				Rep 3	1.011
			August	Rep 1	0.46
				Rep 2	0.659
				Rep 3	0.744
			September	Rep 1	0.774
				Rep 2	0.713
				Rep 3	0.856
		Mel-03-03	July	Rep 1	1.034
				Rep 2	0.763
				Rep 3	1.001
			August	Rep 1	0.65
				Rep 2	0.757
				Rep 3	0.708
			September	Rep 1	0.901
				Rep 2	0.69
				Rep 3	0.937
		Mel-03-04	July	Rep 1	1.069
				Rep 2	1.058
				Rep 3	1.081
			August	Rep 1	0.701
				Rep 2	0.822
				Rep 3	0.574
			September	Rep 1	1.496
				Rep 2	<MDL
				Rep 3	<MDL
		Mel-03-05	July	Rep 1	1.142
				Rep 2	1.223
				Rep 3	1.085
			August	Rep 1	0.824
				Rep 2	0.879
				Rep 3	0.965
			September	Rep 1	1.104
				Rep 2	1.536
				Rep 3	1.541
		Mel-04-01	August	Rep 1	0.78
				Rep 2	0.826
				Rep 3	0.818
		Mel-04-02	August	Rep 1	0.866
				Rep 2	0.901
				Rep 3	0.863
		Mel-04-03	August	Rep 1	0.891
				Rep 2	0.965
				Rep 3	0.946
		Mel-04-04	August	Rep 1	1.083
				Rep 2	1
				Rep 3	0.943
		Mel-04-05	August	Rep 1	1.092
				Rep 2	1.008
				Rep 3	0.915

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
		Mel-05-01	August	Rep 1	1.401
				Rep 2	1.206
				Rep 3	1.178
		Mel-05-02	August	Rep 1	1.235
				Rep 2	1.296
				Rep 3	1.112
		Mel-05-03	August	Rep 1	1.02
				Rep 2	1.079
				Rep 3	1.048
		Mel-05-04	August	Rep 1	1.044
				Rep 2	0.9
				Rep 3	0.974
		Mel-05-05	August	Rep 1	1.134
				Rep 2	0.984
				Rep 3	0.868
	A8	A8-01	July	Rep 1	1.06
				Rep 2	1.12
				Rep 3	1.17
			August	Rep 1	0.92
				Rep 2	0.92
				Rep 3	0.95
		A8-02	July	Rep 1	1.12
				Rep 2	1.2
				Rep 3	1.16
			August	Rep 1	3.11
				Rep 2	0.96
				Rep 3	0.89
		A8-03	July	Rep 1	1.35
				Rep 2	1.19
				Rep 3	1.12
			August	Rep 1	1.46
				Rep 2	1.44
				Rep 3	0.32
	B7	B7-01	July	Rep 1	0.54
				Rep 2	0.58
				Rep 3	0.47
			August	Rep 1	1.03
				Rep 2	1.18
				Rep 3	1.16
		B7-02	July	Rep 1	0.64
				Rep 2	0.64
				Rep 3	0.62
			August	Rep 1	1.15
				Rep 2	1.27
				Rep 3	1.38
		B7-03	July	Rep 1	0.73
				Rep 2	0.72
				Rep 3	0.78
			August	Rep 1	1.4
				Rep 2	1.56
				Rep 3	1.47
	D7	D7-01	July	Rep 1	1.96
				Rep 2	1.5
				Rep 3	2.08
			August	Rep 1	2.47
				Rep 2	2.32
				Rep 3	1.94
		D7-02	July	Rep 1	1.8
				Rep 2	1.95
				Rep 3	2.08
			August	Rep 1	2.16
				Rep 2	2.29
				Rep 3	2.18
		D7-03	July	Rep 1	2.09
				Rep 2	1.88
				Rep 3	2.14
			August	Rep 1	2.26
				Rep 2	2.25
				Rep 3	2.39
		Mel-01-01	July	Rep 1	1.6
				Rep 2	0.89
				Rep 3	0.85
			August	Rep 1	1.44
				Rep 2	1.7
				Rep 3	1.56
			September	Rep 1	1.84
				Rep 2	1.8
				Rep 3	0.89

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
2017	Meliadine	Mel-01-02	July	Rep 1	1.43
				Rep 2	1.52
				Rep 3	1.52
			August	Rep 1	1.47
				Rep 2	1.42
				Rep 3	1.52
			September	Rep 1	1.13
				Rep 2	0.87
				Rep 3	1.43
		Mel-01-03	July	Rep 1	1.41
				Rep 2	1.59
				Rep 3	1.55
			August	Rep 1	1.34
				Rep 2	1.27
				Rep 3	1.39
			September	Rep 1	1.21
				Rep 2	1.35
				Rep 3	1.15
		Mel-01-04	July	Rep 1	1.42
				Rep 2	1.62
				Rep 3	1.54
			August	Rep 1	1.55
				Rep 2	1.67
				Rep 3	1.59
			September	Rep 1	1.46
				Rep 2	1.68
				Rep 3	1.68
		Mel-01-05	July	Rep 1	2.37
				Rep 2	1.43
				Rep 3	1.55
			August	Rep 1	1.45
				Rep 2	1.4
				Rep 3	1.48
			September	Rep 1	1.77
				Rep 2	1.74
				Rep 3	1.69
		Mel-02-01	July	Rep 1	0.76
				Rep 2	0.66
				Rep 3	0.65
			August	Rep 1	0.66
				Rep 2	0.66
				Rep 3	0.65
			September	Rep 1	0.79
				Rep 2	1.11
				Rep 3	0.96
		Mel-02-02	July	Rep 1	0.75
				Rep 2	0.81
				Rep 3	0.84
			August	Rep 1	0.59
				Rep 2	0.65
				Rep 3	0.58
			September	Rep 1	1
				Rep 2	1.05
				Rep 3	1.45
		Mel-02-03	July	Rep 1	0.94
				Rep 2	1.06
				Rep 3	1.13
			August	Rep 1	0.6
				Rep 2	0.52
				Rep 3	0.51
			September	Rep 1	0.99
				Rep 2	1.49
				Rep 3	0.47
		Mel-02-04	July	Rep 1	0.83
				Rep 2	0.88
				Rep 3	0.8
			August	Rep 1	0.59
				Rep 2	0.63
				Rep 3	0.62
			September	Rep 1	1.19
				Rep 2	1.45
				Rep 3	1.03
		Mel-02-05	July	Rep 1	0.81
				Rep 2	0.78
				Rep 3	0.89
			August	Rep 1	0.72
				Rep 2	0.64
				Rep 3	0.46

Year	Lake	Station	Sampling Period	Replicate	Chlorophyll *a* (µg/L)
			September	Rep 1	1.16
				Rep 2	1.3
				Rep 3	1.22
		Mel-03-01	July	Rep 1	0.4
				Rep 2	0.43
				Rep 3	0.35
			August	Rep 1	0.6
				Rep 2	0.64
				Rep 3	0.64
			September	Rep 1	0.69
				Rep 2	0.73
				Rep 3	0.53
		Mel-03-02	July	Rep 1	0.47
				Rep 2	0.42
			August	Rep 1	0.62
				Rep 2	0.69
				Rep 3	0.61
			September	Rep 1	0.5
				Rep 2	0.55
				Rep 3	0.59
		Mel-03-03	July	Rep 1	0.49
				Rep 2	0.49
				Rep 3	0.52
			August	Rep 1	0.43
				Rep 2	0.51
				Rep 3	0.53
			September	Rep 1	0.54
				Rep 2	0.52
				Rep 3	0.58
		Mel-03-04	July	Rep 1	0.49
				Rep 2	0.5
				Rep 3	0.53
			August	Rep 1	0.51
				Rep 2	0.57
				Rep 3	0.57
			September	Rep 1	0.66
				Rep 2	0.52
				Rep 3	0.39
		Mel-03-05	July	Rep 1	0.56
				Rep 2	0.44
				Rep 3	0.57
			August	Rep 1	0.58
				Rep 2	0.51
				Rep 3	0.58
			September	Rep 1	0.76
				Rep 2	0.72
				Rep 3	0.58
		Mel-04-01	August	Rep 1	0.52
				Rep 2	0.66
				Rep 3	0.49
		Mel-04-02	August	Rep 1	0.52
				Rep 2	0.54
				Rep 3	0.54
		Mel-04-03	August	Rep 1	0.71
				Rep 2	0.63
				Rep 3	0.71
		Mel-04-04	August	Rep 1	0.66
				Rep 2	0.61
				Rep 3	0.62
		Mel-04-05	August	Rep 1	0.67
				Rep 2	0.64
				Rep 3	0.68
		Mel-05-01	August	Rep 1	0.62
				Rep 2	0.63
				Rep 3	0.6
		Mel-05-02	August	Rep 1	0.58
				Rep 2	0.49
				Rep 3	0.6
		Mel-05-03	August	Rep 1	0.68
				Rep 2	0.6
				Rep 3	0.59
		Mel-05-04	August	Rep 1	0.56
				Rep 2	0.54
				Rep 3	0.55
		Mel-05-05	August	Rep 1	0.56
				Rep 2	0.55
				Rep 3	0.56

Notes: mg/L=micrograms per litre;

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Table 7C-1: Summary of Total Phosphorus, Secchi Depth, and Chlorophyll *a* Sampling Results in Meliadine Lake, 2015 to 2017

Year	Area	Sampling Period	Total Phosphorus (mg/L)			Secchi Depth (m)			Chlorophyll *a* (mg/L)		
			Mean	SE	Count	Mean	SE	Count	Mean	SE	Count
2015	MEL-01	July	0.0052	0.0002	5	5.6	0.1	5	2.27	0.07	15
		August	0.0051	0.0010	5	6.0	0.2	5	0.80	0.06	15
		September	0.0052	0.0003	5	5.3	0.2	5	–	–	–
	MEL-02	July	0.0049	0.0003	5	5.7	0.1	5	2.36	0.06	15
		August	0.0039	0.0008	5	6.4	0.4	5	0.45	0.02	15
		September	0.0046	0.0004	5	6.1	0.4	5	0.55	0.02	15
2016	MEL-01	July	0.0068	0.0005	5	5.2	0.1	5	1.89	0.05	15
		August	0.0059	0.0004	5	7.0	0.0	5	1.88	0.07	15
		September	0.0063	0.0004	5	7.2	0.1	5	1.99	0.05	15
	MEL-02	July	0.0055	0.0009	5	5.1	0.1	5	1.43	0.04	15
		August	0.0072	0.0015	5	7.0	0.0	5	1.15	0.07	15
		September	0.0048	0.0002	5	7.0	0.1	5	1.14	0.02	15
	MEL-03	July	0.0043	0.0005	5	5.2	0.2	5	1.05	0.03	15
		August	0.0044	0.0003	5	7.2	0.2	5	0.73	0.03	15
		September	0.0050	0.0003	5	6.8	0.2	5	0.88	0.12	15
	MEL-04	August	0.0046	0.0003	5	7.2	0.2	5	0.93	0.02	15
	MEL-05	August	0.0045	0.0004	5	7.4	0.2	5	1.10	0.04	15
2017	MEL-01	July	0.0054	0.0003	5	5.1	0.1	5	1.49	0.09	15
		August	0.0060	0.0003	5	7.6	0.5	5	1.48	0.03	15
		September	0.0072	0.0004	5	5.5	0.2	5	1.45	0.09	15
	MEL-02	July	0.0060	0.0007	5	7.0	0.2	5	0.84	0.03	15
		August	0.0044	0.0004	5	8.5	0.3	5	0.61	0.02	15
		September	0.0065	0.0006	5	5.9	0.3	5	1.11	0.07	15
	MEL-03	July	0.0055	0.0005	5	7.2	0.2	5	0.48	0.02	14
		August	0.0038	0.0004	5	7.9	0.4	5	0.57	0.02	15
		September	0.0052	0.0006	5	7.6	0.5	5	0.59	0.03	15
	MEL-04	August	0.0071	0.0019	5	8.6	0.4	5	0.61	0.02	15
	MEL-05	August	0.0036	0.0001	5	8.9	0.5	5	0.58	0.01	15

Table 7C-2: Summary of Trophic Status Index in Meliadine Lake, 2015 to 2017

Parameter	2015			2016			2017		
	July	Aug	Sept	July	Aug	Sept	July	Aug	Sept
Near-field Exposure Area (MEL-01)									
TSI (TP)	27.9 ± 0.6	26.7 ± 2.3	27.9 ± 0.8	31.7 ± 1.0	29.7 ± 1.0	30.5 ± 0.8	28.5 ± 0.8	29.9 ± 0.8	32.5 ± 0.7
TSI (TChl)	38.6 ± 0.3	26.2 ± 2.9	-	36.8 ± 0.3	36.7 ± 0.4	37.3 ± 0.3	34.2 ± 0.6	34.4 ± 0.2	33.9 ± 0.6
TSI (Secchi)	35.1 ± 0.2	33.9 ± 0.4	35.9 ± 0.7	36.4 ± 0.4	31.9 ± 0.0	31.6 ± 0.2	36.5 ± 0.3	30.9 ± 0.9	35.4 ± 04
Trophic Status Classification	Oligotrophic[a]			Oligotrophic[a]			Oligotrophic[a]		
Mid-field Exposure Area (MEL-02)									
TSI (TP)	27.1 ± 0.7	22.3 ± 3.6	25.8 ± 1.2	28.0 ± 2.2	31.6 ± 2.8	26.8 ± 0.5	29.6 ± 1.8	25.4 ± 1.3	30.8 ± 1.3
TSI (TChl)	39.0 ± 0.3	22.4 ± 0.5	24.7 ± 0.4	34.1 ± 0.3	31.5 ± 0.9	31.8 ± 0.2	28.8 ± 0.4	25.6 ± 0.3	31.3 ± 0.7
TSI (Secchi)	35.0 ± 0.3	32.8 ± 0.5	29.8 ± 0.4	35.0 ± 0.9	30.8 ± 0.5	33.1 ± 0.5	31.9 ± 0.3	29.2 ± 0.5	34.5 ± 0.7
Trophic Status Classification	Oligotrophic[a]			Oligotrophic[a]			Oligotrophic[a]		
Meliadine Lake Reference Area 1 (MEL-03)									
TSI (TP)	-	-	-	24.7 ± 1.7	25.4 ± 1.0	27.2 ± 0.9	28.5 ± 1.2	23.1 ± 1.4	27.5 ± 1.6
TSI (TChl)	-	-	-	31.0 ± 0.3	27.4 ± 0.5	24.4 ± 3.6	23.2 ± 0.4	25.1 ± 0.3	25.3 ± 0.4
TSI (Secchi)	-	-	-	31.7 ± 0.5	30.2 ± 0.6	31.7 ± 0.6	31.6 ± 0.5	30.2 ± 0.8	30.8 ± 0.9
Trophic Status Classification	-			Oligotrophic[a]			Oligotrophic[a]		
Meliadine Lake Reference Area 2 (MEL-04)									
TSI (TP)	-	-	-	-	26.1 ± 0.9	-	-	30.8 ± 3.2	-
TSI (TChl)	-	-	-	-	29.8 ± 0.3	-	-	25.7 ± 0.3	-
TSI (Secchi)	-	-	-	-	38.6 ± 1.0	-	-	29.0 ± 0.7	-
Trophic Status Classification	-			Oligotrophic[a]			Oligotrophic[a]		
Meliadine Lake Reference Area 3 (MEL-05)									
TSI (TP)	-	-	-	-	25.8 ± 1.2	-	-	22.7 ± 0.6	-
TSI (TChl)	-	-	-	-	31.4 ± 0.3	-	-	25.2 ± 0.2	-
TSI (Secchi)	-	-	-	-	28.9 ± 0.2	-	-	28.5 ± 0.8	-
Trophic Status Classification	-			Oligotrophic[a]			Oligotrophic[a]		

a) Trophic status classification based on Carlson (1977).

TSI mean values plus/minus standard error presented. TSI=Trophic status index; TP = total phosphorus; TChl = total chlorophyll a; Secchi = Secchi Depth; "− " indicates sample not collected.

Table 7D-1: Summary Statistics for Phytoplankton Abundance, Biomass and Richness

Year	Site	Season	Abundance (cells/L)						Biomass (mg/m^3)						Richness (no. of taxa)					
			Min	Max	Median	Mean	SE	SD	Min	Max	Median	Mean	SE	SD	Min	Max	Median	Mean	SE	SD
2015	MEL-01	July	4,128,760	5,490,304	4,936,352	4,910,893	258,185	577,319	551	663	634	627	20	45	33	41	38	38	1	2.95
		August	2,144,496	3,223,312	2,784,272	2,689,406	188,936	422,473	290	364	350	336	13	29	39	46	41	42	1	2.97
		September	2,726,336	3,146,624	2,865,308	2,900,894	92,690	185,381	249	343	293	295	20	39	35	42	39	39	2	3.30
	MEL-02	July	4,219,904	4,930,736	4,862,928	4,625,510	164,279	367,338	547	675	611	606	21	47	40	42	42	41	0	1.10
		August	1,603,880	2,275,392	1,936,376	1,962,499	135,748	303,541	178	262	208	220	16	35	41	43	41	41	0	0.89
		September	1,914,992	2,277,592	2,112,960	2,078,163	67,995	152,042	182	271	234	231	16	37	33	40	40	37	2	3.58
2016	MEL-01	July	3,300,568	4,903,480	4,465,608	4,389,291	289,820	648,058	364	551	511	490	33	73	38	45	40	41	1	2.70
		August	2,572,236	3,422,032	2,885,648	2,909,414	154,628	345,759	315	446	328	351	24	54	37	41	39	39	1	1.48
		September	2,271,688	2,987,288	2,825,440	2,738,395	125,114	279,764	456	522	512	503	12	27	38	42	39	40	1	1.52
	MEL-02	July	831,976	4,251,472	3,784,632	3,264,286	617,165	1,380,023	66	495	453	375	79	176	22	44	42	38	4	9.18
		August	1,989,032	2,415,088	2,200,368	2,184,686	79,091	176,853	192	304	243	252	20	44	38	43	39	40	1	2.00
		September	1,980,664	2,263,240	2,150,496	2,126,480	50,743	113,465	268	333	295	298	11	25	32	41	37	37	2	3.39
	MEL-03	July	1,945,928	2,982,624	2,275,208	2,412,771	178,375	398,859	277	360	318	319	14	32	36	43	39	39	1	2.95
		August	1,859,688	2,284,960	2,084,392	2,087,709	80,645	180,328	208	249	236	231	8	17	33	40	37	37	1	2.49
		September	1,707,640	2,789,656	2,088,824	2,182,880	189,068	422,770	180	305	242	246	23	51	36	38	37	37	0	1.00
	MEL-04	August	944,070	2,048,272	1,847,120	1,630,267	203,485	455,007	42	204	181	156	29	65	23	40	37	35	3	6.76
	MEL-05	August	1,604,464	2,917,584	1,815,000	2,026,913	231,151	516,869	186	352	192	227	32	71	30	39	37	36	2	3.56
2017	MEL-01	July	4,178,832	4,810,456	4,286,160	4,370,493	116,312	260,081	460	600	486	512	25	56	39	44	41	41	1	2.12
		August	2,430,520	3,013,992	2,560,384	2,637,110	104,786	234,310	259	349	337	316	17	39	38	43	39	40	1	2.00
		September	1,371,112	2,128,680	1,866,208	1,818,246	130,896	292,693	158	203	190	184	9	19	32	36	32	33	1	1.73
	MEL-02	July	2,240,456	3,414,848	2,748,520	2,737,509	193,685	433,094	262	405	288	305	26	58	38	40	39	39	0	0.71
		August	1,834,152	2,275,176	2,132,480	2,106,584	73,702	164,802	181	292	209	222	19	42	39	42	40	40	1	1.30
		September	1,031,808	1,327,168	1,087,632	1,139,912	56,537	126,421	117	157	134	137	9	19	24	35	34	32	2	4.64
	MEL-03	July	2,085,792	2,518,416	2,438,192	2,339,656	90,741	202,903	210	244	224	226	7	15	31	36	35	34	1	2.07
		August	1,682,288	2,350,416	1,863,072	1,942,189	112,311	251,136	181	248	202	206	11	25	37	41	39	39	1	1.58
		September	1,027,144	1,569,344	1,273,200	1,268,486	90,327	201,978	95	167	146	139	12	27	26	29	27	28	1	1.34
	MEL-04	August	1,864,872	2,301,896	2,086,976	2,093,600	77,358	172,977	173	233	202	201	10	22	34	39	36	36	1	1.87
	MEL-05	August	1,829,352	2,704,016	2,104,544	2,176,504	169,119	378,161	197	255	204	216	11	25	33	45	42	41	2	4.76

Notes: Min=Minimum; Max=Maximum; SD=Standard deviation; SE=Standard error; cells/L=cells per litre; mg/m^3=milligrams per cubic metre; no. of taxa=number of taxa

Table 7D-2: Relative Abundance of Major Phytoplankton Groups

Year	Site	Season	Relative Abundance (%)						Relative Biomass (%)					
			Cyanophyte	Chlorophyte	Chrysophyte	Diatoms	Cryptophytes	Dinoflagellates	Cyanophyte	Chlorophyte	Chrysophyte	Diatoms	Cryptophytes	Dinoflagellates
2015	MEL-01	July	0.24	0.87	85.26	11.46	2.04	0.14	0.08	0.82	74.02	7.51	3.52	13.95
		August	0.43	8.59	77.85	9.68	3.21	0.24	0.16	6.96	62.61	10.00	5.23	14.95
		September	0.08	8.52	77.58	6.44	6.80	0.58	0.06	3.19	56.45	13.01	13.12	14.02
	MEL-02	July	0.00	0.95	84.08	12.86	1.91	0.19	0.01	1.08	78.66	7.80	3.32	9.07
		August	0.02	10.00	72.02	7.79	9.87	0.30	0.24	8.12	57.38	9.31	14.97	9.99
		September	0.01	6.34	74.96	10.24	8.25	0.20	0.39	10.45	61.03	8.68	10.29	9.05
2016	MEL-01	July	0.00	2.57	73.18	22.16	1.93	0.16	0.01	2.02	65.79	17.83	3.79	10.48
		August	0.81	8.86	80.70	4.10	5.17	0.36	0.80	6.07	69.32	4.19	7.45	12.17
		September	0.00	5.30	81.87	6.89	5.37	0.56	0.04	1.71	75.80	3.83	5.51	13.09
	MEL-02	July	1.09	2.79	82.47	10.48	3.07	0.09	1.15	2.05	76.93	9.55	5.47	4.86
		August	0.20	9.09	76.61	3.83	9.74	0.53	0.10	5.38	54.97	12.65	14.41	12.47
		September	1.22	3.84	82.76	5.18	6.76	0.24	0.57	2.63	66.93	8.86	8.99	12.02
	MEL-03	July	0.54	6.56	83.03	3.95	5.64	0.27	0.61	1.91	74.93	6.20	6.52	9.83
		August	0.14	9.48	78.15	3.41	8.52	0.30	0.06	5.08	71.31	4.47	11.20	7.88
		September	0.00	3.61	82.81	7.45	5.89	0.24	0.00	2.37	73.86	9.55	7.72	6.50
	MEL-04	August	0.62	14.18	70.37	4.34	10.26	0.23	0.27	5.96	66.19	7.52	15.46	4.60
	MEL-05	August	0.64	8.29	73.15	3.05	14.63	0.24	0.28	4.91	58.93	6.48	21.00	8.39
2017	MEL-01	July	0.14	2.95	84.95	7.53	3.92	0.51	0.06	3.16	73.66	6.46	4.10	12.57
		August	0.02	8.19	78.21	3.74	9.24	0.60	0.11	6.10	59.62	5.24	12.03	16.89
		September	0.00	11.91	70.06	12.06	5.50	0.45	0.02	6.59	50.03	18.52	7.69	17.03
	MEL-02	July	0.16	3.11	88.27	3.44	4.81	0.21	0.36	3.36	81.99	2.86	4.26	7.17
		August	0.28	14.20	70.29	4.14	10.58	0.51	1.01	11.52	55.15	6.90	16.14	9.27
		September	0.01	7.57	74.18	13.52	4.16	0.57	0.03	8.05	57.46	17.31	5.90	11.25
	MEL-03	July	0.01	1.70	88.82	4.59	4.70	0.19	0.03	1.93	82.71	3.42	5.42	6.49
		August	0.00	6.66	80.54	2.77	9.58	0.45	0.10	3.98	66.07	3.56	13.72	12.37
		September	0.00	5.98	81.55	6.62	5.62	0.22	0.02	4.98	68.79	9.44	6.86	9.91
	MEL-04	August	1.65	7.70	74.78	2.73	13.01	0.13	5.80	3.97	60.19	4.39	20.79	4.86
	MEL-05	August	0.00	8.15	75.57	3.75	12.28	0.25	0.02	4.33	64.35	5.12	19.48	6.71

Notes: %=percent

Table 7D-3: Raw Phytoplankton Data, 2015

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-01	1	July	Chlorophyceae	*Chlamydomonas* spp.	28,736	0.81
				Chlamydomonas spp.	200	0.61
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	208,336	3.92
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	919,552	60.14
				Chrysococcus sp.	675,296	41.60
				Chrysostephanospaera globulifera Scherffel	21,552	8.50
				Kephyrion sp.	21,552	0.22
				Spiniferomonas sirrata	21,552	1.98
				Dinobryon borgei Lemmermann	14,368	0.75
				Dinobryon bavaricum Imhof	100,576	22.75
				Dinobryon bavaricum Imhof	5,200	11.05
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	2,000	6.78
				Dinobryon sociale Ehrenberg	129,312	29.25
				Dinobryon sociale Ehrenberg	3,000	3.68
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.27
				Uroglena volvox Ehrenberg	1,810,368	204.75
				Uroglena volvox Ehrenberg	1,200	13.56
				Bitrichia chodatii (Reverdin) Chodat	50,288	2.57
				Chrysochromulina laurentiana Kling	136,496	52.10
				Salpingoeca frequentissima (Zach.) Lemmermann	122,128	4.18
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.69
				Rhizosolenia eriense H.L. Smith	330,464	25.71
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.24
				Tabellaria flocculsa (Roth) Kutzing	1,600	1.96
				Synedra acus Kutzing	30,000	2.80
				Asterionella formosa Hassall	4,400	0.44
				Cyclotella michiganiana Skvortzow	86,208	2.11
			Cryptophyceae	*Rhodomonas minuta Skuja*	57,472	8.67
				Cryptomonas erosa Ehrenberg	5,800	7.08
				Cryptomonas reflexa (Marsson) Skuja	1,400	1.03
				Cryptomonas rostratiformis Skuja	1,200	2.71
				Katablepharis ovalis Skuja	35,920	1.45
			Dinophyceae	*Gymnodinium helveticum Penard*	1,600	41.47
				Gymnodinium sp.	2,200	34.32
				Peridinium willei Huitfeldt-Kaas	200	5.13
				Peridinium pusillum (Penard) Lemmermann	1,800	3.86
				Peridinium aciculiferum Lemmermann	1,200	10.86
MEL - 01-01	1	August	Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	400	0.20
				Chlamydomonas spp.	7,184	0.17
				Oocystis lacustris Chodat	21,552	0.57
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	14,368	0.99
				Crucigenia quadrata Morr.	28,736	0.04
				Elakatothrix gelatinosa Willen	50,288	0.87
				Micrasterias sp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.12
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	21,552	4.88
				Botryococcus braunii Kutzing	800	0.42
				Monomastix minuta Skuja	7,184	0.14
			Chrysophyceae	Small chrysophyceae	380,752	5.37
				Large chrysophyceae	7,184	6.50
				Chrysochromulina parva Lackey	100,576	6.58
				Chrysococcus sp.	423,856	21.62
				Kephyrion sp.	93,392	1.20
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sertularia Ehrenberg	28,736	7.17
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	136,496	30.88
				Dinobryon sociale Ehrenberg	600	0.74
				Chrysolkos skuja (Nauwerck) Willen	50,288	1.72
				Uroglena volvox Ehrenberg	280,176	31.69
				Chrysochromulina laurentiana Kling	71,840	28.35
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	129,312	3.88
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	7.97
				Cyclotella ocellata Pant.	7,184	0.51
				Rhizosolenia eriense H.L. Smith	100,576	6.40
				Synedra acus Kutzing	6,200	0.59
				Asterionella formosa Hassall	2,600	0.26
				Cyclotella michiganiana Skvortzow	150,864	2.88

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Rhodomonas minuta Skuja*	57,472	8.67
				Cryptomonas erosa Ehrenberg	2,000	2.37
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
				Cryptomonas rostratiformis Skuja	600	1.23
				Katablepharis ovalis Skuja	7,184	0.35
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	2,400	45.16
				Peridinium pusillum (Penard) Lemmermann	2,200	3.61
				Peridinium aciculiferum Lemmermann	800	7.24
MEL - 01-01	1	September	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.38
				Oocystis lacustris Chodat	158,048	3.62
				Dictyosphaerium simplex Sukja	14,368	0.07
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	71,840	1.91
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	400	0.36
				Monomastix minuta Skuja	7,184	0.11
			Chrysophyceae	Small chrysophyceae	502,880	4.63
				Large chrysophyceae	28,736	4.94
				Chrysochromulina parva Lackey	122,128	7.52
				Chrysococcus sp.	574,720	33.28
				Chrysostephanospaera globulifera Scherffel	7,184	1.65
				Kephyrion boreale Skuja	14,368	1.32
				Kephyrion sp.	136,496	2.57
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	2,200	4.38
				Dinobryon sertularia Ehrenberg	200	1.02
				Dinobryon sociale Ehrenberg	21,552	4.71
				Dinobryon sociale Ehrenberg	800	0.98
				Uroglena volvox Ehrenberg	107,760	12.19
				Chrysochromulina laurentiana Kling	100,576	38.39
				Stichogloea spp.	14,368	0.76
				Salpingoeca frequentissima (Zach.) Lemmermann	237,072	10.53
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.82
				Cyclotella pseudostelligera	7,184	3.55
				Cyclotella ocellata Pant.	7,184	0.48
				Rhizosolenia eriense H.L. Smith	7,184	0.61
				Tabellaria fenestrata (Lyngbye) Kutzing	4,800	4.03
				Tabellaria flocculsa (Roth) Kutzing	200	0.23
				Synedra acus Kutzing	6,200	0.59
				Asterionella formosa Hassall	175,800	17.67
				Cyclotella michiganiana Skvortzow	86,208	1.65
				Rhopalodia gibba (Ehrenberg) O. Muller	200	6.67
			Cryptophyceae	*Rhodomonas minuta Skuja*	251,440	36.96
				Cryptomonas erosa Ehrenberg	2,400	2.80
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,200	0.88
				Cryptomonas rostratiformis Skuja	200	0.40
				Katablepharis ovalis Skuja	50,288	2.30
			Dinophyceae	*Gymnodinium helveticum Penard*	400	8.67
				Peridinium pusillum (Penard) Lemmermann	2,000	3.28
				Peridinium aciculiferum Lemmermann	1,200	10.86
			Cyanobacteria	*Snowella* sp.	400	0.21
			Chlorophyceae	*Carteria* spp.	7,184	1.08
				Chlamydomonas spp.	7,184	0.19
				Sphaerocystis schroeteri Chodat	35,920	1.20
				Pediastrum tetras (Ehrenberg) Ralfs	28,736	0.32
				Oocystis lacustris Chodat	35,920	0.93
				Elakatothrix gelatinosa Willen	50,288	1.34
				Staurodesmus extensus (Andersson) Teiling	400	0.21
				Spondylosium planum (Wolle) W. and G.S. West	64,656	2.44
				Mougeotia sp.	7,184	1.63
				Mougeotia sp.	1,200	1.40
				Scenedesmus ecornis	28,736	0.45
			Chrysophyceae	Small chrysophyceae	395,120	3.64
				Large chrysophyceae	93,392	16.06
				Chrysochromulina parva Lackey	323,280	19.91
				Chrysococcus sp.	272,992	15.81
				Kephyrion boreale Skuja	14,368	1.79
				Kephyrion sp.	57,472	1.08
				Spiniferomonas sirrata	7,184	0.63
				Mallomonas crassisquama (Asmund) Fott	1,000	1.05
				Dinobryon borgei Lemmermann	7,184	0.44
				Dinobryon bavaricum Imhof	21,552	4.88

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-01	2	September		*Dinobryon bavaricum Imhof*	1,800	3.58
				Dinobryon sociale Ehrenberg	43,104	9.67
				Dinobryon sociale Ehrenberg	400	0.49
				Uroglena volvox Ehrenberg	201,152	22.75
				Chrysosphaerella longispina Lauterborn	200	3.52
				Chrysochromulina laurentiana Kling	28,736	10.97
				Salpingoeca frequentissima (Zach.) Lemmermann	466,960	20.73
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,400	6.18
				Cyclotella ocellata Pant.	28,736	1.93
				Tabellaria fenestrata (Lyngbye) Kutzing	600	0.50
				Tabellaria flocculsa (Roth) Kutzing	200	0.25
				Fragilaria crotonensis Kitton	400	0.14
				Synedra acus Kutzing	7,200	0.69
				Asterionella formosa Hassall	14,400	1.45
				Cyclotella michiganiana Skvortzow	50,288	0.96
			Cryptophyceae	*Rhodomonas minuta Skuja*	186,784	27.46
				Cryptomonas erosa Ehrenberg	3,800	4.39
				Cryptomonas reflexa (Marsson) Skuja	400	0.29
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	400	3.72
				Peridinium willei Huitfeldt-Kaas	200	5.30
				Peridinium pusillum (Penard) Lemmermann	2,000	3.28
				Peridinium aciculiferum Lemmermann	2,000	18.10
MEL - 01-02	1	July	Cyanobacteria	*Chroococcus limneticus Lemmermann*	28,736	1.11
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.20
				Elakatothrix gelatinosa Willen	14,368	0.35
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	7,184	1.63
			Chrysophyceae	Small chrysophyceae	330,464	6.21
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	826,160	54.03
				Chrysococcus sp.	581,904	38.06
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	114,944	1.62
				Spiniferomonas sirrata	14,368	2.16
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	35,920	1.86
				Dinobryon bavaricum Imhof	143,680	32.50
				Dinobryon bavaricum Imhof	5,400	13.69
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	3,200	10.85
				Dinobryon sociale Ehrenberg	158,048	35.75
				Dinobryon sociale Ehrenberg	2,200	2.70
				Epiphyxis sp.	21,552	1.73
				Chrysolkos skuja (Nauwerck) Willen	93,392	3.01
				Uroglena volvox Ehrenberg	2,090,544	236.44
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	71,840	27.42
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.98
			Bacillariophyceae	*Cyclotella pseudostelligera*	600	1.09
				Cyclotella ocellata Pant.	14,368	1.05
				Rhizosolenia eriense H.L. Smith	481,328	37.45
				Tabellaria fenestrata (Lyngbye) Kutzing	1,400	1.04
				Fragilaria crotonensis Kitton	4,000	1.44
				Synedra acus Kutzing	40,200	3.92
				Asterionella formosa Hassall	1,400	0.12
				Cyclotella michiganiana Skvortzow	100,576	2.46
			Cryptophyceae	*Rhodomonas minuta Skuja*	50,288	7.58
				Cryptomonas erosa Ehrenberg	8,000	9.73
				Cryptomonas reflexa (Marsson) Skuja	3,000	2.20
				Cryptomonas rostratiformis Skuja	600	1.27
				Katablepharis ovalis Skuja	35,920	1.45
			Dinophyceae	*Gymnodinium helveticum Penard*	1,400	21.84
				Gymnodinium helveticum Penard	1,600	37.70
				Peridinium willei Huitfeldt-Kaas	600	13.47
				Peridinium pusillum (Penard) Lemmermann	600	1.00
				Peridinium aciculiferum Lemmermann	2,400	21.71
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.41
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	14,368	3.25
			Chrysophyceae	Small chrysophyceae	294,544	5.54
				Large chrysophyceae	86,208	15.48
				Chrysochromulina parva Lackey	603,456	39.47

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-02	2	July	Chrysophyceae	*Chrysococcus* sp.	301,728	19.73
				Chrysostephanospaera globulifera Scherffel	35,920	12.82
				Kephyrion sp.	100,576	1.73
				Spiniferomonas sirrata	7,184	0.81
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.44
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	93,392	21.13
				Dinobryon bavaricum Imhof	5,600	11.15
				Dinobryon sertularia Ehrenberg	86,208	19.50
				Dinobryon sertularia Ehrenberg	2,800	9.49
				Dinobryon sociale Ehrenberg	107,760	24.38
				Dinobryon sociale Ehrenberg	2,200	2.70
				Chrysolkos skuja (Nauwerck) Willen	71,840	2.26
				Uroglena volvox Ehrenberg	2,011,520	227.50
				Uroglena volvox Ehrenberg	200	4.72
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.37
				Chrysochromulina laurentiana Kling	100,576	39.69
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	107,760	3.30
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.82
				Cyclotella ocellata Pant.	28,736	3.00
				Rhizosolenia eriense H.L. Smith	431,040	33.53
				Tabellaria fenestrata (Lyngbye) Kutzing	1,400	1.06
				Fragilaria crotonensis Kitton	16,400	5.63
				Synedra acus Kutzing	10,800	1.09
				Asterionella formosa Hassall	4,200	0.44
				Cyclotella michiganiana Skvortzow	100,576	2.32
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	6.18
				Cryptomonas erosa Ehrenberg	4,800	5.79
				Cryptomonas reflexa (Marsson) Skuja	400	0.27
				Cryptomonas rostratiformis Skuja	600	1.27
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	1,800	25.45
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	1,800	3.79
				Peridinium aciculiferum Lemmermann	1,600	14.48
			Cyanobacteria	*Aphanothece* sp.	28,736	1.61
			Chlorophyceae	*Oocystis lacustris Chodat*	28,736	0.81
				Dictyosphaerium simplex Sukja	14,368	0.07
				Crucigenia quadrata Morr.	28,736	0.04
				Quadrigula closterioides (Bohl.) Printz	86,208	2.46
				Elakatothrix gelatinosa Willen	14,368	0.20
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Staurodesmus paradoxum Meyen	200	1.01
				Staurodesmus bullardii G.M. Smith	200	0.46
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	107,760	24.38
				Mougeotia sp.	200	0.31
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Ankistrodesmus spiralis Lemmermann	28,736	1.54
				Monomastix minuta Skuja	7,184	0.13
			Euglenophyceae	*Euglena acus Ehrenberg*	200	1.69
MEL - 01-02	1	August	Chrysophyceae	Small chrysophyceae	510,064	9.59
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	366,384	23.96
				Chrysococcus sp.	402,304	26.31
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	86,208	1.22
				Spiniferomonas sirrata	14,368	2.16
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	3,400	6.77
				Dinobryon sociale Ehrenberg	193,968	43.88
				Dinobryon sociale Ehrenberg	800	0.98
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.93
				Uroglena volvox Ehrenberg	589,088	66.63
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	93,392	35.65
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.74
				Pteridomonas sp.	7,184	1.59
				Cyclotella stelligera Cleve and Grunow	2,800	4.60
				Cyclotella ocellata Pant.	14,368	0.97
				Rhizosolenia eriense H.L. Smith	136,496	10.62

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria fenestrata (Lyngbye) Kutzing*	1,400	1.07
				Fragilaria crotonensis Kitton	3,000	1.11
				Synedra acus Kutzing	10,800	1.03
				Asterionella formosa Hassall	4,000	0.39
				Cyclotella michiganiana Skvortzow	172,416	4.22
				Rhopalodia gibba (Ehrenberg) O. Muller	200	6.97
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	9.75
				Cryptomonas erosa Ehrenberg	4,600	5.41
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.17
				Cryptomonas rostratiformis Skuja	1,200	2.63
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium* sp.	2,400	22.09
				Peridinium pusillum (Penard) Lemmermann	3,200	5.32
			Cyanobacteria	*Nostoc* sp.	200	0.47
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.37
				Sphaerocystis schroeteri Chodat	114,944	3.57
				Oocystis lacustris Chodat	7,184	0.20
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.32
				Elakatothrix gelatinosa Willen	14,368	0.23
				Staurodesmus extensus (Andersson) Teiling	800	0.33
				Staurodesmus bullardii G.M. Smith	400	1.10
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	1,000	1.44
				Euglena acus Ehrenberg	200	1.87
			Chrysophyceae	Small chrysophyceae	481,328	8.28
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	431,040	28.19
				Chrysococcus sp.	531,616	34.77
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	143,680	2.47
				Spiniferomonas sirrata	14,368	1.71
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	21,552	2.82
				Dinobryon bavaricum Imhof	86,208	19.50
				Dinobryon bavaricum Imhof	3,200	6.37
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	14,368	3.25
				Dinobryon sociale Ehrenberg	400	0.49
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.49
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	79,024	31.18
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	136,496	4.67
MEL - 01-02	1	September	Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,800	5.97
				Cyclotella ocellata Pant.	14,368	1.24
				Tabellaria fenestrata (Lyngbye) Kutzing	9,000	6.53
				Fragilaria crotonensis Kitton	2,600	0.96
				Synedra acus Kutzing	2,200	0.21
				Asterionella formosa Hassall	148,600	14.47
				Cyclotella michiganiana Skvortzow	100,576	2.46
				Rhopalodia gibba (Ehrenberg) O. Muller	200	11.15
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	26.00
				Cryptomonas erosa Ehrenberg	5,800	7.06
				Cryptomonas reflexa (Marsson) Skuja	800	0.56
				Cryptomonas rostratiformis Skuja	800	1.62
			Cryptophyceae	*Katablepharis ovalis Skuja*	14,368	0.66
			Dinophyceae	*Gymnodinium* sp.	800	12.48
				Peridinium willei Huitfeldt-Kaas	600	13.47
				Peridinium pusillum (Penard) Lemmermann	400	0.67
				Peridinium aciculiferum Lemmermann	1,400	12.67
			Cyanobacteria	*Chroococcus limneticus Lemmermann*	28,736	1.11
				Snowella sp	200	0.20
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.15
				Oocystis lacustris Chodat	35,920	1.02
				Staurodesmus paradoxum Meyen	200	1.21
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	7,184	1.68
				Mougeotia sp.	3,200	12.82
				Monomastix minuta Skuja	7,184	0.28
			Chrysophyceae	Small chrysophyceae	201,152	3.14
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	898,000	58.73
				Chrysococcus sp.	704,032	46.04
				Kephyrion boreale Skuja	21,552	2.56
				Kephyrion sp.	93,392	1.46
				Spiniferomonas sirrata	28,736	4.32
				Mallomonas crassisquama (Asmund) Fott	200	0.21

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-03	1	July	Chrysophyceae	*Dinobryon borgei Lemmermann*	57,472	3.55
				Dinobryon bavaricum Imhof	150,864	34.13
				Dinobryon bavaricum Imhof	3,000	5.97
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	3,400	11.53
				Dinobryon sociale Ehrenberg	93,392	21.13
				Dinobryon sociale Ehrenberg	2,600	3.19
				Chrysolkos skuja (Nauwerck) Willen	50,288	1.72
				Uroglena volvox Ehrenberg	2,033,072	229.94
				Chrysosphaerella longispina Lauterborn	35,920	18.81
				Bitrichia chodatii (Reverdin) Chodat	21,552	1.08
				Chrysochromulina laurentiana Kling	93,392	38.08
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.85
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	600	0.94
				Rhizosolenia eriense H.L. Smith	589,088	45.83
				Tabellaria fenestrata (Lyngbye) Kutzing	4,600	3.55
				Tabellaria flocculsa (Roth) Kutzing	800	1.19
				Fragilaria crotonensis Kitton	11,200	4.03
				Synedra acus Kutzing	15,000	1.46
				Asterionella formosa Hassall	2,000	0.20
				Cyclotella michiganiana Skvortzow	79,024	1.94
				Cyclotella bodanica Eulenst.	200	1.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	9.18
				Cryptomonas erosa Ehrenberg	4,600	5.60
				Cryptomonas reflexa (Marsson) Skuja	1,400	0.98
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	21,552	0.99
			Dinophyceae	*Gymnodinium helveticum Penard*	800	18.85
				Gymnodinium sp.	1,400	21.84
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	1,400	3.00
				Peridinium aciculiferum Lemmermann	1,600	14.96
			Cyanobacteria	*Chroococcus limneticus Lemmermann*	28,736	1.11
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.13
				Oocystis lacustris Chodat	28,736	0.81
				Elakatothrix gelatinosa Willen	14,368	0.20
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Staurodesmus paradoxum Meyen	600	3.63
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	14,368	3.25
				Mougeotia sp.	2,000	8.01
				Monomastix minuta Skuja	21,552	0.84
			Chrysophyceae	Small chrysophyceae	258,624	4.03
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	854,896	55.91
				Chrysococcus sp.	747,136	48.86
				Chrysostephanospaera globulifera Scherffel	7,184	2.15
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	100,576	1.57
				Spiniferomonas sirrata	50,288	7.57
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	28,736	1.78
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	186,784	42.25
				Dinobryon bavaricum Imhof	2,400	4.78
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	4,200	14.24
MEL - 01-03	1-QA	July		*Dinobryon sociale Ehrenberg*	114,944	26.00
				Dinobryon sociale Ehrenberg	3,800	4.66
				Chrysolkos skuja (Nauwerck) Willen	35,920	1.23
				Uroglena volvox Ehrenberg	1,982,784	224.25
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	86,208	35.15
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.21
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	400	0.63
				Cyclotella ocellata Pant.	7,184	0.78
				Rhizosolenia eriense H.L. Smith	653,744	50.86
				Tabellaria fenestrata (Lyngbye) Kutzing	3,000	2.32
				Fragilaria crotonensis Kitton	8,600	3.10
				Synedra acus Kutzing	14,000	1.36
				Asterionella formosa Hassall	3,200	0.32
				Cyclotella michiganiana Skvortzow	100,576	2.46
				Cyclotella bodanica Eulenst.	200	1.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	10.20
				Cryptomonas erosa Ehrenberg	5,200	6.33
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.70
				Cryptomonas rostratiformis Skuja	800	1.70

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium helveticum Penard*	1,200	28.27
				Gymnodinium sp.	1,400	21.84
				Peridinium willei Huitfeldt-Kaas	400	8.98
				Peridinium pusillum (Penard) Lemmermann	1,000	2.14
				Peridinium aciculiferum Lemmermann	1,800	16.83
MEL - 01-03	1	August	Cyanobacteria	*Chroococcus limneticus Lemmermann*	28,736	1.11
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	400	0.21
				Sphaerocystis schroeteri Chodat	28,736	0.54
				Oocystis lacustris Chodat	50,288	2.53
				Dictyosphaerium simplex Sukja	28,736	0.14
				Elakatothrix gelatinosa Willen	35,920	0.56
				Cosmarium sp.	200	0.20
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.41
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	57,472	11.56
			Chrysophyceae	Small chrysophyceae	474,144	6.69
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	265,808	17.38
				Chrysococcus sp.	366,384	23.96
				Kephyrion boreale Skuja	28,736	3.09
				Kephyrion sp.	35,920	0.51
				Spiniferomonas sirrata	14,368	2.16
				Mallomonas crassisquama (Asmund) Fott	1,600	1.73
				Dinobryon borgei Lemmermann	28,736	1.54
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	2,400	4.78
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	86,208	19.50
				Dinobryon sociale Ehrenberg	400	0.49
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.85
				Uroglena volvox Ehrenberg	459,776	52.00
				Chrysosphaerella longispina Lauterborn	200	4.61
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	50,288	19.19
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.69
				Pteridomonas sp.	7,184	1.33
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,400	5.34
				Cyclotella ocellata Pant.	14,368	1.24
				Rhizosolenia eriense H.L. Smith	150,864	10.67
				Tabellaria fenestrata (Lyngbye) Kutzing	3,800	2.97
				Fragilaria crotonensis Kitton	3,400	1.22
				Synedra acus Kutzing	3,600	0.35
				Asterionella formosa Hassall	1,600	0.16
				Cyclotella michiganiana Skvortzow	129,312	3.17
				Cyclotella bodanica Eulenst.	7,184	53.51
			Cryptophyceae	*Rhodomonas minuta Skuja*	100,576	14.28
				Cryptomonas erosa Ehrenberg	2,000	2.43
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.09
				Cryptomonas rostratiformis Skuja	400	0.82
				Katablepharis ovalis Skuja	21,552	0.99
			Dinophyceae	*Gymnodinium* sp.	1,800	28.08
				Peridinium pusillum (Penard) Lemmermann	4,400	9.44
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Snowella* sp	200	0.22
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.10
				Oocystis lacustris Chodat	7,184	0.20
				Elakatothrix gelatinosa Willen	35,920	0.74
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Mougeotia sp.	7,184	1.53
				Botryococcus braunii Kutzing	200	0.43
			Chrysophyceae	Small chrysophyceae	186,784	2.63
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	625,008	40.88
				Chrysococcus sp.	136,496	6.96
				Kephyrion sp.	114,944	1.98
				Spiniferomonas sirrata	35,920	3.30
				Mallomonas crassisquama (Asmund) Fott	800	0.85
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon bavaricum Imhof	193,968	43.88
				Dinobryon bavaricum Imhof	4,600	15.59
				Dinobryon sertularia Ehrenberg	43,104	9.75
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	43,104	9.75

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-04	1	July		*Dinobryon sociale Ehrenberg*	3,000	5.97
				Chrysolkos skuja (Nauwerck) Willen	79,024	2.37
				Ochromonas sp.	14,368	1.88
				Uroglena volvox Ehrenberg	2,119,280	239.69
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.39
				Chrysochromulina laurentiana Kling	107,760	41.13
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	1.49
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.97
				Cyclotella pseudostelligera	7,184	3.87
				Cyclotella ocellata Pant.	21,552	1.86
				Rhizosolenia eriense H.L. Smith	416,672	32.42
				Fragilaria crotonensis Kitton	22,800	8.21
				Synedra acus Kutzing	6,200	0.59
				Asterionella formosa Hassall	3,800	0.38
				Cyclotella michiganiana Skvortzow	100,576	2.46
			Cryptophyceae	*Rhodomonas minuta Skuja*	93,392	13.38
				Cryptomonas erosa Ehrenberg	10,200	12.61
				Cryptomonas reflexa (Marsson) Skuja	1,200	1.06
				Cryptomonas rostratiformis Skuja	1,200	2.63
				Katablepharis ovalis Skuja	21,552	0.87
			Dinophyceae	*Gymnodinium helveticum Penard*	1,200	28.27
				Gymnodinium sp.	2,000	37.63
				Peridinium pusillum (Penard) Lemmermann	1,400	3.17
				Peridinium aciculiferum Lemmermann	4,000	36.19
MEL - 01-04	1	August	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.34
				Oocystis lacustris Chodat	57,472	2.89
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	28,736	0.54
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Mougeotia sp.	129,312	28.28
				Botryococcus braunii Kutzing	400	0.86
			Chrysophyceae	Small chrysophyceae	495,696	6.99
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	172,416	11.28
				Chrysococcus sp.	251,440	16.44
				Chrysostephanospaera globulifera Scherffel	7,184	2.00
				Kephyrion boreale Skuja	14,368	1.54
				Kephyrion sp.	43,104	0.61
				Spiniferomonas sirrata	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Synura sphagnicola Korschikow	200	3.93
				Dinobryon borgei Lemmermann	7,184	0.40
				Dinobryon bavaricum Imhof	129,312	29.25
				Dinobryon bavaricum Imhof	1,000	3.39
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sociale Ehrenberg	107,760	24.38
				Dinobryon sociale Ehrenberg	600	1.19
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.69
				Ochromonas sp.	7,184	0.55
				Uroglena volvox Ehrenberg	898,000	101.56
				Uroglena volvox Ehrenberg	200	11.26
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.37
				Chrysochromulina laurentiana Kling	21,552	8.50
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.72
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,800	5.31
				Cyclotella ocellata Pant.	7,184	0.48
				Rhizosolenia eriense H.L. Smith	79,024	6.15
				Tabellaria fenestrata (Lyngbye) Kutzing	8,400	6.25
				Fragilaria crotonensis Kitton	6,400	2.20
				Synedra acus Kutzing	2,800	0.28
				Asterionella formosa Hassall	4,600	0.46
				Cyclotella michiganiana Skvortzow	64,656	1.49
			Cryptophyceae	*Rhodomonas minuta Skuja*	57,472	8.67
				Cryptomonas erosa Ehrenberg	5,400	6.54
				Cryptomonas reflexa (Marsson) Skuja	600	0.41
				Cryptomonas rostratiformis Skuja	800	1.81
				Katablepharis ovalis Skuja	21,552	1.01
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	1,400	21.84
				Peridinium pusillum (Penard) Lemmermann	3,400	7.42
				Sphaerocystis schroeteri Chodat	14,368	0.18
				Oocystis lacustris Chodat	21,552	1.08
				Monoraphidium contortum (Thur.) Komarkova-Legnerova	7,184	0.13
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	35,920	0.62

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-04	1	September	Chlorophyceae	*Staurodesmus extensus (Andersson) Teiling*	400	0.17
				Staurodesmus paradoxum Meyen	200	1.67
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	14,368	3.25
				Mougeotia sp.	600	1.63
				Botryococcus braunii Kutzing	2,200	3.16
			Chrysophyceae	Small chrysophyceae	359,200	5.60
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	272,992	17.85
				Chrysococcus sp.	287,360	17.70
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	114,944	1.62
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	2,400	8.14
				Dinobryon sociale Ehrenberg	43,104	9.75
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.46
				Uroglena volvox Ehrenberg	581,904	65.81
				Chrysochromulina laurentiana Kling	14,368	5.86
				Salpingoeca frequentissima (Zach.) Lemmermann	761,504	39.52
				Pteridomonas sp.	7,184	1.43
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	4.71
				Cyclotella ocellata Pant.	21,552	1.58
				Tabellaria fenestrata (Lyngbye) Kutzing	9,400	6.64
				Tabellaria flocculsa (Roth) Kutzing	600	0.74
				Fragilaria crotonensis Kitton	3,200	1.15
				Synedra acus Kutzing	400	0.04
				Asterionella formosa Hassall	162,000	15.78
				Cyclotella michiganiana Skvortzow	107,760	2.64
			Cryptophyceae	*Rhodomonas minuta Skuja*	150,864	22.75
				Cryptomonas erosa Ehrenberg	2,800	3.27
				Cryptomonas reflexa (Marsson) Skuja	2,200	1.54
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	28,736	1.35
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	1,200	18.72
				Peridinium pusillum (Penard) Lemmermann	1,400	3.00
				Peridinium aciculiferum Lemmermann	1,400	12.67
MEL - 01-05	1	July	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.41
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Euglenophyceae	*Euglena acus Ehrenberg*	400	2.74
			Chrysophyceae	Small chrysophyceae	380,752	3.92
				Large chrysophyceae	71,840	12.90
				Chrysochromulina parva Lackey	337,648	22.08
				Chrysococcus sp.	308,912	20.20
				Kephyrion boreale Skuja	14,368	1.88
				Kephyrion sp.	57,472	0.59
				Spiniferomonas sirrata	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	35,920	2.07
				Dinobryon bavaricum Imhof	79,024	17.88
				Dinobryon bavaricum Imhof	3,600	12.20
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	86,208	19.50
				Dinobryon sociale Ehrenberg	3,800	4.66
				Epiphyxis sp.	14,368	1.11
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.29
				Uroglena volvox Ehrenberg	1,853,472	209.63
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.71
				Chrysochromulina laurentiana Kling	150,864	59.53
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.34
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	600	0.99
				Cyclotella ocellata Pant.	14,368	1.05
				Rhizosolenia eriense H.L. Smith	287,360	22.36
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.15
				Tabellaria flocculsa (Roth) Kutzing	800	0.94
				Fragilaria crotonensis Kitton	23,800	8.77
				Synedra acus Kutzing	14,000	1.36
				Asterionella formosa Hassall	2,800	0.28
				Cyclotella michiganiana Skvortzow	86,208	2.11
			Cryptophyceae	*Rhodomonas minuta Skuja*	35,920	5.15
				Cryptomonas erosa Ehrenberg	5,400	6.68
				Cryptomonas reflexa (Marsson) Skuja	2,800	2.05
				Cryptomonas rostratiformis Skuja	1,600	3.39

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Katablepharis ovalis Skuja	35,920	1.65
			Dinophyceae	*Gymnodinium helveticum Penard*	1,200	28.27
				Gymnodinium sp.	1,800	28.08
				Peridinium willei Huitfeldt-Kaas	200	5.43
				Peridinium pusillum (Penard) Lemmermann	2,400	5.15
				Peridinium aciculiferum Lemmermann	1,200	10.86
MEL - 01-05	1	August	Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.11
				Chlamydomonas spp.	7,184	0.17
				Oocystis lacustris Chodat	21,552	0.61
				Elakatothrix gelatinosa Willen	28,736	0.45
				Cosmarium sp.	200	2.12
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	800	0.31
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	86,208	19.50
				Botryococcus braunii Kutzing	600	1.06
			Chrysophyceae	Small chrysophyceae	452,592	5.79
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	93,392	6.11
				Chrysococcus sp.	143,680	9.40
				Chrysostephanospaera globulifera Scherffel	7,184	2.07
				Kephyrion boreale Skuja	14,368	1.63
				Kephyrion sp.	64,656	1.11
				Spiniferomonas sirrata	7,184	0.53
				Mallomonas crassisquama (Asmund) Fott	200	0.22
				Dinobryon borgei Lemmermann	7,184	0.56
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	150,864	34.13
				Dinobryon bavaricum Imhof	1,400	2.79
				Dinobryon sociale Ehrenberg	79,024	17.88
				Dinobryon sociale Ehrenberg	400	2.03
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.90
				Uroglena volvox Ehrenberg	488,512	55.25
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.67
				Chrysochromulina laurentiana Kling	86,208	35.15
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,400	5.58
				Cyclotella ocellata Pant.	21,552	1.52
				Rhizosolenia eriense H.L. Smith	64,656	4.11
				Tabellaria fenestrata (Lyngbye) Kutzing	2,400	2.06
				Fragilaria crotonensis Kitton	4,400	1.59
				Synedra acus Kutzing	600	0.06
				Asterionella formosa Hassall	1,200	0.12
				Cyclotella michiganiana Skvortzow	93,392	2.29
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	6.28
				Cryptomonas erosa Ehrenberg	5,200	6.43
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.71
				Cryptomonas rostratiformis Skuja	1,000	2.26
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	3,800	53.72
				Peridinium pusillum (Penard) Lemmermann	3,600	7.72
				Peridinium aciculiferum Lemmermann	1,400	12.67
			Cyanobacteria	*Snowella* sp	200	0.15
				Nostoc sp.	200	0.70
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.10
				Chlamydomonas spp.	14,368	0.37
				Sphaerocystis schroeteri Chodat	86,208	1.10
				Oocystis lacustris Chodat	43,104	2.17
				Quadrigula closterioides (Bohl.) Printz	114,944	2.46
				Elakatothrix gelatinosa Willen	86,208	1.35
				Cosmarium sp.	800	1.12
				Staurodesmus extensus (Andersson) Teiling	800	0.46
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Mougeotia sp.	79,024	17.88
			Euglenophyceae	*Euglena acus Ehrenberg*	200	0.92
			Chrysophyceae	Small chrysophyceae	596,272	8.41
				Large chrysophyceae	28,736	10.97
				Chrysochromulina parva Lackey	193,968	12.69
				Chrysococcus sp.	179,600	11.75
				Kephyrion boreale Skuja	7,184	0.66
				Kephyrion sp.	100,576	1.89
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Dinobryon borgei Lemmermann	21,552	1.64
				Dinobryon mucronutom Nygaard	35,920	4.70
				Dinobryon bavaricum Imhof	114,944	26.00
				Dinobryon bavaricum Imhof	1,400	2.79

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-05	2	August		*Dinobryon sertularia Ehrenberg*	28,736	6.50
				Dinobryon sociale Ehrenberg	122,128	27.63
				Dinobryon sociale Ehrenberg	600	2.03
				Epiphyxis sp.	7,184	0.58
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.46
				Uroglena volvox Ehrenberg	754,320	85.31
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.35
				Chrysochromulina laurentiana Kling	50,288	19.84
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.49
				Pteridomonas sp.	21,552	4.78
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.03
				Cyclotella ocellata Pant.	7,184	0.51
				Rhizosolenia eriense H.L. Smith	93,392	6.60
				Tabellaria fenestrata (Lyngbye) Kutzing	5,600	4.06
				Fragilaria crotonensis Kitton	4,600	1.66
				Synedra acus Kutzing	1,600	0.15
				Asterionella formosa Hassall	2,200	0.23
				Cyclotella michiganiana Skvortzow	150,864	3.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	9.75
				Cryptomonas erosa Ehrenberg	3,200	3.72
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	28,736	1.19
			Dinophyceae	*Gymnodinium* sp.	2,200	26.39
				Peridinium pusillum (Penard) Lemmermann	3,200	6.86
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.17
				Oocystis lacustris Chodat	28,736	0.81
				Elakatothrix gelatinosa Willen	14,368	0.23
				Cosmarium sp.	200	2.12
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	100,576	22.75
				Botryococcus braunii Kutzing	400	0.71
			Euglenophyceae	*Euglena acus Ehrenberg*	400	2.44
			Chrysophyceae	Small chrysophyceae	330,464	4.23
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	114,944	7.52
				Chrysococcus sp.	165,232	10.81
				Kephyrion boreale Skuja	7,184	0.81
				Kephyrion sp.	57,472	0.99
				Spiniferomonas sirrata	7,184	0.53
				Dinobryon borgei Lemmermann	28,736	2.24
				Dinobryon mucronutom Nygaard	21,552	2.82
				Dinobryon bavaricum Imhof	107,760	24.38
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	50,288	11.38
MEL - 01-05	1-QA	August		*Dinobryon sociale Ehrenberg*	800	4.07
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.42
				Uroglena volvox Ehrenberg	438,224	49.56
				Bitrichia chodatii (Reverdin) Chodat	28,736	1.35
				Chrysochromulina laurentiana Kling	107,760	43.93
				Bicoeca lacustris Clark	7,184	0.50
				Salpingoeca frequentissima (Zach.) Lemmermann	64,656	2.06
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	6.90
				Cyclotella ocellata Pant.	14,368	1.01
				Rhizosolenia eriense H.L. Smith	43,104	2.74
				Tabellaria fenestrata (Lyngbye) Kutzing	3,800	3.26
				Fragilaria crotonensis Kitton	2,000	0.72
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	800	0.08
				Cyclotella michiganiana Skvortzow	143,680	3.52
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	6.28
				Cryptomonas erosa Ehrenberg	7,800	9.64
				Cryptomonas reflexa (Marsson) Skuja	600	0.42
				Cryptomonas rostratiformis Skuja	800	1.81
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium helveticum Penard*	800	18.85
				Gymnodinium sp.	3,000	42.41
				Peridinium pusillum (Penard) Lemmermann	3,000	6.43
				Peridinium aciculiferum Lemmermann	2,000	18.10
			Cyanobacteria	*Snowella* sp	400	0.21
				Chlamydomonas spp.	7,184	0.17
				Pediastrum duplex Meyen	3,200	0.33
				Oocystis lacustris Chodat	50,288	2.53
				Elakatothrix gelatinosa Willen	14,368	0.25

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-05	1	September	Chlorophyceae	*Closterium kuetzingii Brebisson*	200	2.92
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	400	0.17
				Staurodesmus paradoxum Meyen	200	0.57
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
			Chrysophyceae	Small chrysophyceae	352,016	4.96
				Large chrysophyceae	71,840	27.42
				Chrysochromulina parva Lackey	366,384	23.96
				Chrysococcus sp.	258,624	13.19
				Kephyrion boreale Skuja	43,104	4.63
				Kephyrion sp.	150,864	2.35
				Spiniferomonas sirrata	14,368	1.63
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	2,000	6.78
				Dinobryon sociale Ehrenberg	600	0.74
				Uroglena volvox Ehrenberg	344,832	39.00
				Chrysochromulina laurentiana Kling	86,208	35.15
				Salpingoeca frequentissima (Zach.) Lemmermann	510,064	26.47
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.97
				Rhizosolenia eriense H.L. Smith	43,104	3.35
				Tabellaria fenestrata (Lyngbye) Kutzing	4,400	3.40
				Fragilaria crotonensis Kitton	3,800	1.43
				Asterionella formosa Hassall	119,200	12.36
				Cyclotella michiganiana Skvortzow	129,312	2.99
				Rhopalodia gibba (Ehrenberg) O. Muller	200	10.19
			Cryptophyceae	*Rhodomonas minuta Skuja*	244,256	36.83
				Cryptomonas erosa Ehrenberg	5,000	5.93
				Cryptomonas reflexa (Marsson) Skuja	1,200	0.84
				Cryptomonas rostratiformis Skuja	200	0.47
				Katablepharis ovalis Skuja	21,552	1.04
			Dinophyceae	*Gymnodinium* sp.	7,184	2.31
				Gymnodinium sp.	1,800	30.88
				Peridinium willei Huitfeldt-Kaas	400	9.77
				Peridinium pusillum (Penard) Lemmermann	1,600	3.63
				Peridinium aciculiferum Lemmermann	1,400	12.67
MEL - 02-01	1	July	Cyanobacteria	*Snowella* sp	400	0.28
			Chlorophyceae	*Chlamydomonas spp.*	7,184	0.15
				Elakatothrix gelatinosa Willen	21,552	0.37
				Cosmarium sp.	200	0.55
				Staurodesmus bullardii G.M. Smith	200	0.57
				Mougeotia sp.	28,736	6.50
				Botryococcus braunii Kutzing	400	0.36
			Chrysophyceae	Small chrysophyceae	208,336	2.94
				Large chrysophyceae	107,760	19.35
				Chrysochromulina parva Lackey	387,936	25.37
				Chrysococcus sp.	409,488	22.28
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	64,656	1.01
				Spiniferomonas sirrata	14,368	1.54
				Mallomonas crassisquama (Asmund) Fott	1,400	1.47
				Synura sphagnicola Korschikow	400	6.20
				Dinobryon borgei Lemmermann	50,288	3.83
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	150,864	34.13
				Dinobryon bavaricum Imhof	5,400	18.31
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	2,400	6.06
				Dinobryon sociale Ehrenberg	114,944	26.00
				Dinobryon sociale Ehrenberg	3,600	7.17
				Chrysolkos skuja (Nauwerck) Willen	71,840	2.16
				Uroglena volvox Ehrenberg	1,767,264	199.88
				Chrysosphaerella longispina Lauterborn	14,368	7.52
				Chrysochromulina laurentiana Kling	50,288	21.18
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.74
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.52
				Cyclotella ocellata Pant.	14,368	0.97
				Rhizosolenia eriense H.L. Smith	466,960	36.33
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.31
				Fragilaria crotonensis Kitton	15,800	5.69
				Synedra acus Kutzing	11,400	1.09
				Asterionella formosa Hassall	4,200	0.42
				Cyclotella michiganiana Skvortzow	43,104	1.06
				Rhopalodia gibba (Ehrenberg) O. Muller	200	8.44
			Cryptophyceae	*Rhodomonas minuta Skuja*	35,920	5.37
				Cryptomonas erosa Ehrenberg	6,400	7.82
				Cryptomonas ovata Ehrenberg	400	1.81
				Cryptomonas reflexa (Marsson) Skuja	2,200	1.61

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	14,368	0.69
			Dinophyceae	*Gymnodinium helveticum Penard*	800	19.23
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	1,800	33.87
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	600	1.29
				Peridinium aciculiferum Lemmermann	1,600	14.48
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.09
				Pediastrum tetras (Ehrenberg) Ralfs	2,800	0.25
				Oocystis lacustris Chodat	21,552	1.08
				Elakatothrix gelatinosa Willen	21,552	0.34
				Cosmarium sp.	200	0.28
				Euastrum spp.	800	1.49
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Mougeotia sp.	64,656	13.89
				Botryococcus braunii Kutzing	400	0.71
				Monomastix minuta Skuja	14,368	0.29
			Chrysophyceae	Small chrysophyceae	316,096	4.46
				Large chrysophyceae	28,736	8.30
				Chrysochromulina parva Lackey	35,920	1.95
				Chrysococcus sp.	172,416	11.28
				Kephyrion sp.	107,760	1.68
				Spiniferomonas sirrata	14,368	1.54
				Dinobryon borgei Lemmermann	7,184	0.45
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sociale Ehrenberg	35,920	8.13
				Dinobryon sociale Ehrenberg	200	0.25
MEL - 02-01	1	August		*Chrysolkos skuja (Nauwerck) Willen*	14,368	0.42
				Uroglena volvox Ehrenberg	323,280	36.56
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	57,472	22.68
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.36
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,600	6.55
				Cyclotella ocellata Pant.	21,552	1.45
				Rhizosolenia eriense H.L. Smith	14,368	0.91
				Tabellaria fenestrata (Lyngbye) Kutzing	3,200	2.47
				Tabellaria flocculsa (Roth) Kutzing	800	1.34
				Fragilaria crotonensis Kitton	1,600	0.51
				Synedra acus Kutzing	200	0.02
				Asterionella formosa Hassall	1,600	0.16
				Cyclotella michiganiana Skvortzow	79,024	1.51
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	10.83
				Cryptomonas erosa Ehrenberg	4,000	4.75
				Cryptomonas reflexa (Marsson) Skuja	800	0.53
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium* sp.	7,184	2.31
				Gymnodinium sp.	1,600	24.96
				Peridinium willei Huitfeldt-Kaas	200	4.53
				Peridinium pusillum (Penard) Lemmermann	800	1.28
			Cyanobacteria	*Planktothrix*	200	3.18
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	28,736	0.96
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Cosmarium sp.	600	0.84
				Euastrum spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	200	0.10
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	107,760	23.02
				Botryococcus braunii Kutzing	400	0.36
			Euglenophyceae	*Euglena acus Ehrenberg*	200	1.29
			Chrysophyceae	Small chrysophyceae	438,224	6.84
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	215,520	14.10
				Chrysococcus sp.	265,808	17.38
				Kephyrion sp.	107,760	1.85
				Kephyrion sp.	7,184	0.85
				Spiniferomonas sirrata	14,368	1.54
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	1,400	4.75
				Dinobryon sertularia Ehrenberg	7,184	1.63

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-01	1	September		*Dinobryon sertularia Ehrenberg*	200	0.68
				Dinobryon sociale Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	400	0.49
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.22
				Uroglena volvox Ehrenberg	538,800	60.94
				Chrysochromulina laurentiana Kling	50,288	20.50
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.81
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	5,200	10.29
				Cyclotella ocellata Pant.	43,104	2.90
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Fragilaria crotonensis Kitton	800	0.28
				Synedra acus Kutzing	400	0.04
				Asterionella formosa Hassall	11,000	1.11
				Cyclotella michiganiana Skvortzow	64,656	1.40
			Cryptophyceae	*Rhodomonas minuta Skuja*	179,600	27.53
				Cryptomonas erosa Ehrenberg	2,800	3.32
				Cryptomonas reflexa (Marsson) Skuja	800	0.56
				Cryptomonas rostratiformis Skuja	200	0.38
				Katablepharis ovalis Skuja	7,184	0.34
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	7,184	2.41
				Gymnodinium sp.	1,200	15.32
				Peridinium pusillum (Penard) Lemmermann	800	1.29
				Peridinium aciculiferum Lemmermann	800	7.24
			Chlorophyceae	*Elakatothrix gelatinosa Willen*	14,368	0.25
				Cosmarium sp.	200	0.61
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	14,368	3.18
				Mougeotia sp.	800	0.88
				Botryococcus braunii Kutzing	400	0.61
			Euglenophyceae	*Euglena acus Ehrenberg*	200	1.52
			Chrysophyceae	Small chrysophyceae	409,488	4.22
				Large chrysophyceae	107,760	19.35
				Chrysochromulina parva Lackey	574,720	37.59
				Chrysococcus sp.	466,960	28.76
				Chrysostephanospaera globulifera Scherffel	14,368	4.78
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	93,392	1.20
				Spiniferomonas sirrata	35,920	4.27
				Mallomonas crassisquama (Asmund) Fott	600	0.62
				Synura sphagnicola Korschikow	400	6.81
				Dinobryon borgei Lemmermann	71,840	3.96
				Dinobryon bavaricum Imhof	222,704	50.38
				Dinobryon bavaricum Imhof	5,800	19.66
				Dinobryon sertularia Ehrenberg	64,656	14.63
				Dinobryon sertularia Ehrenberg	3,400	11.53
				Dinobryon sociale Ehrenberg	201,152	45.50
				Dinobryon sociale Ehrenberg	3,800	4.66
				Chrysolkos skuja (Nauwerck) Willen	50,288	1.62
MEL - 02-02	1	July		*Uroglena volvox Ehrenberg*	1,645,136	186.06
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.38
				Chrysochromulina laurentiana Kling	50,288	19.84
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.62
				Dinobryon attenatum Hill	7,184	1.00
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	2.87
				Cyclotella pseudostelligera	7,184	3.87
				Cyclotella ocellata Pant.	7,184	0.48
				Rhizosolenia eriense H.L. Smith	459,776	35.77
				Tabellaria fenestrata (Lyngbye) Kutzing	2,600	2.01
				Fragilaria crotonensis Kitton	14,600	4.95
				Synedra acus Kutzing	5,400	0.54
				Asterionella formosa Hassall	3,000	0.31
				Cyclotella michiganiana Skvortzow	193,968	5.04
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	6.50
				Cryptomonas erosa Ehrenberg	3,800	4.64
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.73
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	28,736	1.32
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	14,368	5.10
				Gymnodinium sp.	1,400	21.84
				Peridinium willei Huitfeldt-Kaas	200	5.30
				Peridinium pusillum (Penard) Lemmermann	800	1.72
				Peridinium aciculiferum Lemmermann	1,800	16.83
				Elakatothrix gelatinosa Willen	14,368	0.25

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-02	1-QA	July	Chlorophyceae	*Cosmarium* sp.	200	0.61
				Staurodesmus extensus (Andersson) Teiling	200	0.11
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	21,552	4.77
				Mougeotia sp.	1,800	1.98
				Botryococcus braunii Kutzing	200	0.31
			Euglenophyceae	*Euglena acus Ehrenberg*	600	1.73
			Chrysophyceae	Small chrysophyceae	474,144	4.88
				Large chrysophyceae	79,024	14.19
				Chrysochromulina parva Lackey	438,224	28.66
				Chrysococcus sp.	466,960	28.76
				Chrysostephanospaera globulifera Scherffel	14,368	4.78
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	143,680	1.84
				Spiniferomonas sirrata	21,552	2.56
				Mallomonas crassisquama (Asmund) Fott	400	0.41
				Dinobryon borgei Lemmermann	43,104	2.38
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	208,336	47.13
				Dinobryon bavaricum Imhof	5,000	16.95
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	3,000	10.17
				Dinobryon sociale Ehrenberg	150,864	34.13
				Dinobryon sociale Ehrenberg	4,200	5.15
				Epiphyxis sp.	14,368	1.25
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.93
				Uroglena volvox Ehrenberg	1,731,344	195.82
				Bitrichia chodatii (Reverdin) Chodat	21,552	1.14
				Chrysochromulina laurentiana Kling	50,288	19.84
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.16
				Dinobryon attenatum Hill	14,368	1.99
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.91
				Cyclotella ocellata Pant.	21,552	1.45
				Rhizosolenia eriense H.L. Smith	510,064	39.68
				Tabellaria fenestrata (Lyngbye) Kutzing	1,800	1.39
				Fragilaria crotonensis Kitton	13,400	4.55
				Synedra acus Kutzing	3,800	0.36
				Asterionella formosa Hassall	3,000	0.31
				Cyclotella michiganiana Skvortzow	222,704	5.79
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	6.50
				Cryptomonas erosa Ehrenberg	5,200	6.35
				Cryptomonas reflexa (Marsson) Skuja	400	0.29
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	21,552	0.99
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	7,184	2.55
				Gymnodinium sp.	1,000	15.60
				Peridinium willei Huitfeldt-Kaas	200	5.30
				Peridinium pusillum (Penard) Lemmermann	1,000	2.14
				Peridinium aciculiferum Lemmermann	1,000	9.35
MEL - 02-02	1	August	Cyanobacteria	*Snowella* sp	200	0.15
			Chlorophyceae	*Pediastrum tetras (Ehrenberg) Ralfs*	86,208	0.41
				Oocystis lacustris Chodat	14,368	0.72
				Elakatothrix gelatinosa Willen	50,288	0.79
				Cosmarium sp.	400	0.41
				Staurodesmus extensus (Andersson) Teiling	2,200	1.31
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	43,104	9.75
				Botryococcus braunii Kutzing	400	0.71
				Monomastix minuta Skuja	21,552	0.41
			Chrysophyceae	Small chrysophyceae	474,144	6.69
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	107,760	7.05
				Chrysococcus sp.	244,256	15.97
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	64,656	0.91
				Spiniferomonas sirrata	7,184	0.77
				Mallomonas crassisquama (Asmund) Fott	600	0.57
				Dinobryon borgei Lemmermann	21,552	1.64
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	600	3.05
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	100,576	22.75
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.43
				Ochromonas sp.	7,184	0.52
				Uroglena volvox Ehrenberg	438,224	49.56

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Chrysochromulina laurentiana Kling	64,656	24.68
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.22
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,000	11.87
				Cyclotella pseudostelligera	14,368	7.74
				Cyclotella ocellata Pant.	21,552	1.86
				Rhizosolenia eriense H.L. Smith	21,552	1.68
				Fragilaria crotonensis Kitton	400	0.15
				Synedra acus Kutzing	600	0.06
				Asterionella formosa Hassall	6,200	0.62
				Cyclotella michiganiana Skvortzow	86,208	2.24
			Cryptophyceae	*Rhodomonas minuta Skuja*	222,704	31.33
				Cryptomonas erosa Ehrenberg	3,600	4.20
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.08
				Cryptomonas rostratiformis Skuja	1,600	3.19
				Katablepharis ovalis Skuja	7,184	0.30
			Dinophyceae	*Gymnodinium helveticum Penard*	400	10.37
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	800	10.32
				Peridinium pusillum (Penard) Lemmermann	800	1.54
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Aphanothece* sp.	7,184	0.36
				Snowella sp	200	0.27
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.17
				Sphaerocystis schroeteri Chodat	14,368	0.27
				Oocystis lacustris Chodat	28,736	2.63
				Elakatothrix gelatinosa Willen	14,368	0.25
				Cosmarium sp.	400	0.56
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	57,472	13.00
			Chrysophyceae	Small chrysophyceae	416,672	3.83
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	229,888	15.03
				Chrysococcus sp.	251,440	16.44
				Kephyrion sp.	179,600	2.53
				Spiniferomonas sirrata	14,368	1.25
				Mallomonas crassisquama (Asmund) Fott	400	0.43
				Dinobryon borgei Lemmermann	14,368	0.74
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	2,200	4.38
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	800	2.71
MEL - 02-02	1	September		*Dinobryon sociale Ehrenberg*	14,368	3.25
				Dinobryon sociale Ehrenberg	600	0.74
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	380,752	43.06
				Uroglena volvox Ehrenberg	200	11.26
				Chrysochromulina laurentiana Kling	86,208	32.91
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.25
				Pteridomonas sp.	7,184	1.33
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,400	10.05
				Cyclotella ocellata Pant.	57,472	5.99
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.37
				Fragilaria crotonensis Kitton	2,200	0.73
				Synedra acus Kutzing	600	0.06
				Asterionella formosa Hassall	8,200	0.82
				Cyclotella michiganiana Skvortzow	21,552	0.53
			Cryptophyceae	*Rhodomonas minuta Skuja*	114,944	14.45
				Cryptomonas erosa Ehrenberg	3,000	3.56
				Cryptomonas reflexa (Marsson) Skuja	400	0.28
				Cryptomonas rostratiformis Skuja	200	0.40
			Dinophyceae	*Gymnodinium* sp.	7,184	2.43
				Gymnodinium sp.	400	6.24
				Peridinium pusillum (Penard) Lemmermann	1,000	1.60
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Snowella* sp	200	0.15
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.19
				Staurodesmus extensus (Andersson) Teiling	400	0.24
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	14,368	3.27
				Botryococcus braunii Kutzing	200	0.14
				Bambusina brebissonii Kutzing	1,200	6.72
				Small chrysophyceae	316,096	2.59
				Large chrysophyceae	86,208	15.48
				Chrysochromulina parva Lackey	625,008	40.88

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-03	1	July	Chrysophyceae	*Chrysococcus* sp.	179,600	11.06
				Chrysostephanospaera globulifera Scherffel	7,184	2.07
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	143,680	1.84
				Spiniferomonas sirrata	28,736	3.09
				Mallomonas crassisquama (Asmund) Fott	1,200	1.33
				Synura sphagnicola Korschikow	1,200	18.75
				Dinobryon borgei Lemmermann	35,920	2.19
				Dinobryon bavaricum Imhof	222,704	50.38
				Dinobryon sertularia Ehrenberg	93,392	21.13
				Dinobryon sertularia Ehrenberg	5,600	18.98
				Dinobryon sertularia Ehrenberg	3,800	12.88
				Dinobryon sociale Ehrenberg	208,336	47.13
				Dinobryon sociale Ehrenberg	3,800	4.66
				Epiphyxis sp.	7,184	0.60
				Chrysolkos skuja (Nauwerck) Willen	64,656	2.08
				Uroglena volvox Ehrenberg	1,781,632	201.50
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	186,784	73.70
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.46
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.57
				Cyclotella ocellata Pant.	64,656	4.94
				Rhizosolenia eriense H.L. Smith	466,960	36.33
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.31
				Tabellaria flocculsa (Roth) Kutzing	2,600	3.34
				Fragilaria crotonensis Kitton	4,200	1.46
				Synedra acus Kutzing	30,600	2.92
				Asterionella formosa Hassall	1,800	0.18
				Cyclotella michiganiana Skvortzow	136,496	3.55
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	9.75
				Cryptomonas erosa Ehrenberg	6,000	7.33
				Cryptomonas reflexa (Marsson) Skuja	600	0.44
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	7,184	0.34
			Dinophyceae	*Gymnodinium* sp.	1,800	25.45
				Peridinium willei Huitfeldt-Kaas	400	9.77
				Peridinium pusillum (Penard) Lemmermann	2,200	4.37
				Peridinium aciculiferum Lemmermann	1,800	16.83
MEL - 02-03	1	August	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.19
				Sphaerocystis schroeteri Chodat	50,288	0.52
				Oocystis lacustris Chodat	14,368	0.37
				Elakatothrix gelatinosa Willen	64,656	1.26
				Cosmarium sp.	200	0.20
				Staurodesmus extensus (Andersson) Teiling	800	0.45
				Mougeotia sp.	64,656	14.30
				Botryococcus braunii Kutzing	200	0.18
				Oocystis gigas Archer	200	0.68
			Chrysophyceae	Small chrysophyceae	510,064	5.25
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	50,288	3.29
				Chrysococcus sp.	287,360	17.70
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	71,840	1.01
				Spiniferomonas sirrata	14,368	1.32
				Mallomonas crassisquama (Asmund) Fott	1,000	1.06
				Dinobryon borgei Lemmermann	7,184	0.50
				Dinobryon bavaricum Imhof	93,392	21.13
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sociale Ehrenberg	93,392	21.13
				Epiphyxis sp.	14,368	1.09
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.93
				Uroglena volvox Ehrenberg	7,184	0.36
				Uroglena volvox Ehrenberg	294,544	33.31
				Chrysosphaerella longispina Lauterborn	7,184	3.33
				Chrysochromulina laurentiana Kling	57,472	21.94
				Stichogloea spp.	21,552	1.08
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,600	6.55
				Cyclotella ocellata Pant.	35,920	2.53
				Rhizosolenia eriense H.L. Smith	28,736	2.24
				Tabellaria flocculsa (Roth) Kutzing	1,400	1.87
				Fragilaria crotonensis Kitton	600	0.22
				Synedra acus Kutzing	1,400	0.13
				Asterionella formosa Hassall	7,800	0.76
				Cyclotella michiganiana Skvortzow	114,944	2.66
				Cyclotella bodanica Eulenst.	200	1.44
				Rhodomonas minuta Skuja	208,336	29.58

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Cryptomonas erosa Ehrenberg*	9,200	10.73
				Cryptomonas reflexa (Marsson) Skuja	2,600	1.78
				Cryptomonas rostratiformis Skuja	200	0.40
			Dinophyceae	*Gymnodinium* sp.	1,200	12.37
				Peridinium pusillum (Penard) Lemmermann	4,000	8.42
				Peridinium aciculiferum Lemmermann	200	1.81
MEL - 02-03	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	28,736	0.41
				Oocystis lacustris Chodat	7,184	0.36
				Quadrigula closterioides (Bohl.) Printz	57,472	1.68
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	1,000	0.59
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	79,024	16.98
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	459,776	6.48
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	143,680	9.40
				Chrysococcus sp.	258,624	13.19
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	107,760	1.85
				Spiniferomonas sirrata	7,184	0.66
				Dinobryon mucronutom Nygaard	7,184	0.88
				Dinobryon bavaricum Imhof	50,288	11.38
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sociale Ehrenberg	35,920	7.72
				Dinobryon sociale Ehrenberg	800	1.59
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.22
				Uroglena volvox Ehrenberg	258,624	29.25
				Chrysochromulina laurentiana Kling	50,288	19.19
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.23
				Pteridomonas sp.	21,552	4.30
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,600	5.65
				Cyclotella ocellata Pant.	35,920	2.42
				Tabellaria fenestrata (Lyngbye) Kutzing	1,200	0.94
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	800	0.08
				Asterionella formosa Hassall	13,600	1.42
				Cyclotella michiganiana Skvortzow	93,392	2.16
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	16.25
				Cryptomonas erosa Ehrenberg	1,200	1.35
				Cryptomonas reflexa (Marsson) Skuja	600	0.41
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.90
				Gymnodinium sp.	21,552	7.15
				Gymnodinium sp.	400	4.90
				Peridinium pusillum (Penard) Lemmermann	600	1.22
MEL - 02-04	1	July	Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.36
				Staurodesmus extensus (Andersson) Teiling	600	0.36
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	14,368	3.16
			Chrysophyceae	Small chrysophyceae	301,728	4.25
				Large chrysophyceae	114,944	26.41
				Chrysochromulina parva Lackey	423,856	27.72
				Chrysococcus sp.	258,624	13.19
				Kephyrion sp.	57,472	0.99
				Spiniferomonas sirrata	14,368	1.79
				Mallomonas crassisquama (Asmund) Fott	1,000	0.97
				Synura sphagnicola Korschikow	14,368	8.73
				Dinobryon borgei Lemmermann	35,920	1.86
				Dinobryon bavaricum Imhof	215,520	48.75
				Dinobryon bavaricum Imhof	4,600	9.16
				Dinobryon sertularia Ehrenberg	64,656	14.63
				Dinobryon sertularia Ehrenberg	2,000	6.78
				Dinobryon sociale Ehrenberg	179,600	40.63
				Dinobryon sociale Ehrenberg	4,400	5.39
				Epiphyxis sp.	7,184	0.58
				Chrysolkos skuja (Nauwerck) Willen	71,840	2.03
				Uroglena volvox Ehrenberg	1,616,400	182.81
				Chrysosphaerella longispina Lauterborn	400	5.86
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	93,392	35.65
				Bicoeca lacustris Clark	7,184	0.47
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.60
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.26
				Cyclotella ocellata Pant.	28,736	2.48
				Rhizosolenia eriense H.L. Smith	265,808	20.68
				Fragilaria crotonensis Kitton	600	0.20
				Synedra acus Kutzing	17,200	1.73

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Asterionella formosa Hassall	1,600	0.16
				Cyclotella michiganiana Skvortzow	179,600	4.15
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	15.98
				Cryptomonas erosa Ehrenberg	7,000	8.41
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,200	0.84
				Cryptomonas rostratiformis Skuja	1,000	2.05
				Katablepharis ovalis Skuja	28,736	1.35
			Dinophyceae	*Gymnodinium* sp.	1,600	16.49
				Peridinium willei Huitfeldt-Kaas	600	14.42
				Peridinium pusillum (Penard) Lemmermann	600	0.98
				Peridinium aciculiferum Lemmermann	400	3.62
				Peridinium wisconsiense Eddy	200	6.70
			Cyanobacteria	*Snowella* sp	400	0.40
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.16
				Sphaerocystis schroeteri Chodat	35,920	0.46
				Pediastrum tetras (Ehrenberg) Ralfs	28,736	0.32
				Oocystis lacustris Chodat	14,368	0.38
				Elakatothrix gelatinosa Willen	14,368	0.27
				Euastrum spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	1,200	0.71
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	600	2.45
				Staurodesmus paradoxum Meyen	200	1.05
				Spondylosium planum (Wolle) W. and G.S. West	43,104	1.63
				Mougeotia sp.	21,552	4.88
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	400	1.36
MEL - 02-04	1	August	Chrysophyceae	Small chrysophyceae	466,960	6.58
				Large chrysophyceae	21,552	8.23
				Chrysochromulina parva Lackey	57,472	3.76
				Chrysococcus sp.	272,992	13.92
				Kephyrion boreale Skuja	14,368	1.88
				Kephyrion sp.	71,840	1.01
				Mallomonas crassisquama (Asmund) Fott	1,600	1.68
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sociale Ehrenberg	43,104	9.75
				Epiphyxis sp.	7,184	0.56
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.21
				Uroglena volvox Ehrenberg	165,232	18.69
				Chrysochromulina laurentiana Kling	64,656	25.51
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.20
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,800	9.11
				Cyclotella ocellata Pant.	28,736	2.38
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Fragilaria crotonensis Kitton	4,600	1.66
				Synedra acus Kutzing	2,000	0.19
				Asterionella formosa Hassall	7,800	0.82
				Cyclotella michiganiana Skvortzow	14,368	0.27
			Cryptophyceae	*Rhodomonas minuta Skuja*	244,256	28.38
				Cryptomonas erosa Ehrenberg	3,000	3.56
				Cryptomonas reflexa (Marsson) Skuja	2,400	1.63
				Cryptomonas rostratiformis Skuja	800	1.60
			Dinophyceae	*Gymnodinium* sp.	800	5.79
				Peridinium pusillum (Penard) Lemmermann	600	1.19
				Peridinium aciculiferum Lemmermann	400	3.74
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.16
				Sphaerocystis schroeteri Chodat	21,552	0.16
				Oocystis lacustris Chodat	21,552	0.61
				Staurodesmus extensus (Andersson) Teiling	600	0.31
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Mougeotia sp.	79,024	16.98
				Botryococcus braunii Kutzing	1,400	1.27
			Chrysophyceae	Small chrysophyceae	395,120	3.24
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	179,600	11.75
				Chrysococcus sp.	208,336	13.63
				Chrysostephanospaera globulifera Scherffel	7,184	3.12
				Kephyrion boreale Skuja	21,552	2.82
				Kephyrion sp.	93,392	1.61
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.44
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	600	0.74
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.40

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-04	1	September		*Dinobryon sociale Ehrenberg*	7,184	1.63
				Dinobryon sociale Ehrenberg	1,400	1.72
				Epiphyxis sp.	7,184	0.44
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	380,752	43.06
				Chrysochromulina laurentiana Kling	86,208	32.91
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.39
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,000	12.37
				Cyclotella ocellata Pant.	43,104	3.16
				Synedra acus Kutzing	2,000	0.19
				Asterionella formosa Hassall	15,200	1.50
				Cyclotella michiganiana Skvortzow	93,392	2.16
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	15.30
				Cryptomonas erosa Ehrenberg	2,200	2.67
				Cryptomonas reflexa (Marsson) Skuja	1,200	0.82
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium* sp.	14,368	5.56
				Gymnodinium sp.	600	5.91
				Peridinium pusillum (Penard) Lemmermann	1,000	1.99
				Peridinium aciculiferum Lemmermann	200	1.81
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.15
				Oocystis lacustris Chodat	7,184	0.20
				Elakatothrix gelatinosa Willen	7,184	0.16
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Mougeotia sp.	7,184	1.63
				Botryococcus braunii Kutzing	200	0.29
			Chrysophyceae	Small chrysophyceae	229,888	1.66
				Large chrysophyceae	79,024	14.19
				Chrysochromulina parva Lackey	725,584	47.45
				Chrysococcus sp.	445,408	22.72
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	114,944	1.62
				Spiniferomonas sirrata	21,552	1.88
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Mallomonas spp.	1,000	1.89
				Synura sphagnicola Korschikow	600	9.89
				Dinobryon borgei Lemmermann	35,920	1.84
				Dinobryon bavaricum Imhof	251,440	56.88
				Dinobryon bavaricum Imhof	5,000	16.95
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	2,000	10.17
				Dinobryon sociale Ehrenberg	280,176	63.38
				Dinobryon sociale Ehrenberg	6,400	13.60
				Epiphyxis sp.	28,736	2.19
MEL - 02-05	1	July		*Chrysolkos skuja (Nauwerck) Willen*	93,392	2.59
				Uroglena volvox Ehrenberg	1,623,584	183.63
				Bitrichia chodatii (Reverdin) Chodat	21,552	1.14
				Chrysochromulina laurentiana Kling	100,576	38.39
				Salpingoeca frequentissima (Zach.) Lemmermann	79,024	2.52
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.97
				Cyclotella ocellata Pant.	7,184	0.59
				Rhizosolenia eriense H.L. Smith	373,568	29.06
				Tabellaria flocculsa (Roth) Kutzing	1,800	2.40
				Fragilaria crotonensis Kitton	800	0.29
				Synedra acus Kutzing	28,400	2.83
				Asterionella formosa Hassall	4,400	0.44
				Cyclotella michiganiana Skvortzow	100,576	1.92
			Cryptophyceae	*Rhodomonas minuta Skuja*	50,288	7.58
				Cryptomonas erosa Ehrenberg	6,800	8.07
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.11
				Cryptomonas rostratiformis Skuja	1,200	2.87
				Katablepharis ovalis Skuja	21,552	0.87
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	800	11.31
				Peridinium willei Huitfeldt-Kaas	200	5.05
				Peridinium pusillum (Penard) Lemmermann	600	1.15
				Peridinium aciculiferum Lemmermann	1,400	12.67
			Cyanobacteria	*Snowella* sp	1,400	1.40
				Anabaena solitaria Klebs	200	0.66
				Chlamydomonas spp.	7,184	0.08
				Sphaerocystis schroeteri Chodat	50,288	0.78
				Oocystis lacustris Chodat	14,368	0.41
				Dictyosphaerium simplex Sukja	28,736	0.12
				Elakatothrix gelatinosa Willen	57,472	0.99
				Cosmarium sp.	200	0.61

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-05	1	August	Chlorophyceae	*Euastrum* spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	1,000	0.56
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.87
				Mougeotia sp.	57,472	14.16
				Botryococcus braunii Kutzing	800	0.42
				Spirogyra sp.	3,200	1.29
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	Small chrysophyceae	359,200	3.70
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	79,024	5.17
				Chrysococcus sp.	179,600	11.75
				Kephyrion boreale Skuja	14,368	1.54
				Kephyrion sp.	100,576	1.89
				Spiniferomonas sirrata	7,184	0.56
				Mallomonas crassisquama (Asmund) Fott	1,000	1.06
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sociale Ehrenberg	122,128	27.63
				Uroglena volvox Ehrenberg	294,544	33.31
				Chrysochromulina laurentiana Kling	35,920	13.71
				Salpingoeca frequentissima (Zach.) Lemmermann	71,840	2.29
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.82
				Cyclotella pseudostelligera	14,368	4.40
				Cyclotella ocellata Pant.	57,472	5.99
				Tabellaria fenestrata (Lyngbye) Kutzing	7,400	7.28
				Fragilaria crotonensis Kitton	1,200	0.43
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	10,800	1.13
				Cyclotella michiganiana Skvortzow	122,128	2.65
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	24.48
				Cryptomonas erosa Ehrenberg	2,400	2.80
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.06
				Cryptomonas rostratiformis Skuja	800	1.59
				Katablepharis ovalis Skuja	7,184	0.34
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.42
				Gymnodinium sp.	400	3.68
				Peridinium pusillum (Penard) Lemmermann	1,600	3.09
				Peridinium aciculiferum Lemmermann	400	3.74
MEL - 02-05	1-QA	August	Cyanobacteria	*Snowella* sp	800	0.80
				Anabaena solitaria Klebs	400	1.69
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.08
				Sphaerocystis schroeteri Chodat	28,736	0.45
				Dictyosphaerium simplex Sukja	28,736	0.12
				Elakatothrix gelatinosa Willen	71,840	1.24
				Euastrum spp.	600	1.12
				Staurodesmus extensus (Andersson) Teiling	1,200	0.68
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Mougeotia sp.	71,840	17.69
				Botryococcus braunii Kutzing	400	0.21
				Spirogyra sp.	5,200	2.09
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	316,096	3.26
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	136,496	8.93
				Chrysococcus sp.	208,336	13.63
				Chrysostephanospaera globulifera Scherffel	7,184	2.00
				Kephyrion boreale Skuja	14,368	1.54
				Kephyrion sp.	129,312	2.43
				Mallomonas crassisquama (Asmund) Fott	1,200	1.28
				Dinobryon borgei Lemmermann	21,552	1.55
				Dinobryon mucronutom Nygaard	28,736	5.42
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	107,760	24.38
				Dinobryon sociale Ehrenberg	400	0.80
				Uroglena volvox Ehrenberg	330,464	37.38
				Chrysochromulina laurentiana Kling	21,552	8.23
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	4.36
				Cyclotella pseudostelligera	7,184	2.20
				Cyclotella ocellata Pant.	43,104	4.50
				Tabellaria fenestrata (Lyngbye) Kutzing	8,800	8.66
				Tabellaria flocculsa (Roth) Kutzing	800	1.07
				Fragilaria crotonensis Kitton	800	0.29
				Synedra acus Kutzing	800	0.08
				Asterionella formosa Hassall	12,200	1.28

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 02-05	1	September		*Cyclotella michiganiana Skvortzow*	158,048	3.43
			Cryptophyceae	*Rhodomonas minuta Skuja*	129,312	18.36
				Cryptomonas erosa Ehrenberg	3,400	3.97
				Cryptomonas reflexa (Marsson) Skuja	1,200	0.80
				Cryptomonas rostratiformis Skuja	800	1.59
				Katablepharis ovalis Skuja	7,184	0.34
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.42
				Gymnodinium sp.	800	7.36
				Peridinium pusillum (Penard) Lemmermann	1,400	2.70
				Peridinium aciculiferum Lemmermann	400	3.74
			Cyanobacteria	*Snowella* sp	600	0.66
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Oocystis lacustris Chodat	35,920	0.85
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	14,368	0.99
				Quadrigula closterioides (Bohl.) Printz	28,736	0.80
				Elakatothrix gelatinosa Willen	7,184	0.11
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	1,200	0.57
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Mougeotia sp.	122,128	28.09
				Botryococcus braunii Kutzing	1,000	1.44
			Chrysophyceae	Small chrysophyceae	387,936	2.17
				Large chrysophyceae	35,920	13.71
				Chrysochromulina parva Lackey	215,520	14.10
				Chrysococcus sp.	373,568	24.43
				Kephyrion sp.	57,472	0.74
				Spiniferomonas sirrata	21,552	1.98
				Mallomonas crassisquama (Asmund) Fott	400	0.40
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	1,600	3.19
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	600	3.05
				Dinobryon sociale Ehrenberg	28,736	6.50
				Dinobryon sociale Ehrenberg	1,400	2.79
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	316,096	35.75
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	64,656	24.68
				Bicoeca lacustris Clark	7,184	0.53
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.43
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	9,600	18.22
				Cyclotella pseudostelligera	7,184	3.87
				Cyclotella ocellata Pant.	28,736	3.00
				Tabellaria fenestrata (Lyngbye) Kutzing	4,000	3.43
				Fragilaria crotonensis Kitton	1,000	0.35
				Synedra acus Kutzing	1,200	0.12
				Asterionella formosa Hassall	14,400	1.51
				Cyclotella michiganiana Skvortzow	64,656	1.58
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	26.00
				Cryptomonas erosa Ehrenberg	3,200	3.80
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.70
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium helveticum Penard*	200	5.28
				Gymnodinium sp.	1,000	10.31
				Peridinium pusillum (Penard) Lemmermann	600	1.26

Notes: cells/L=cells per litre; mg/m^3=milligrams per cubic metre

Table 7D-4: Raw Phytoplankton Data, 2016

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 01-01	1	July	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	28,736	0.54
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.40
				Planctonema lauterbornii Schmidle	21,552	2.71
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Mougeotia sp.	600	0.34
				Botryococcus braunii Kutzing	200	0.29
			Chrysophyceae	Small chrysophyceae	459,776	5.89
				Large chrysophyceae	107,760	22.87
				Chrysochromulina parva Lackey	208,336	13.63
				Chrysococcus sp.	581,904	38.06
				Chrysostephanospaera globulifera Scherffel	14,368	4.00
				Kephyrion sp.	114,944	2.16
				*Spiniferomonas sirrata***********	14,368	1.25
				Dinobryon borgei Lemmermann	107,760	5.53
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	14,368	6.01
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.51
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	1,800	3.58
				Dinobryon sociale Ehrenberg	143,680	32.50
				Chrysolkos skuja (Nauwerck) Willen	57,472	1.02
				Uroglena volvox Ehrenberg	402,304	45.50
				Chrysochromulina laurentiana Kling	100,576	43.74
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.25
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,800	3.26
				Cyclotella pseudostelligera	28,736	9.75
				Rhizosolenia eriense H.L. Smith	617,824	48.07
				Tabellaria flocculsa (Roth) Kutzing	2,400	2.99
				Synedra acus Kutzing	23,800	3.02
				Synedra ulna (Nitzsch) Ehrenberg	200	0.45
				Asterionella formosa Hassall	6,200	0.67
				Cyclotella michiganiana Skvortzow	71,840	1.76
			Cryptophyceae	*Rhodomonas minuta Skuja*	14,368	1.20
				Cryptomonas erosa Ehrenberg	3,600	5.69
				Cryptomonas ovata Ehrenberg	800	3.62
				Cryptomonas reflexa (Marsson) Skuja	4,400	3.38
				Katablepharis ovalis Skuja	14,368	0.81
			Dinophyceae	*Gymnodinium* sp.	400	3.68
				Peridinium willei Huitfeldt-Kaas	200	7.22
				Peridinium pusillum (Penard) Lemmermann	4,600	14.76
				Peridinium aciculiferum Lemmermann	600	5.43
			Cyanobacteria	*Snowella* sp	200	0.15
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	86,208	2.89
				Oocystis lacustris Chodat	57,472	2.89
				Elakatothrix gelatinosa Willen	7,184	0.11
				Planctonema lauterbornii Schmidle	86,208	10.84
				Cosmarium sp.	600	3.20
				Euastrum spp.	800	1.49
				Staurodesmus extensus (Andersson) Teiling	800	0.33
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.57
	1	August	Chrysophyceae	Small chrysophyceae	646,560	10.09
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	129,312	8.46
				Chrysococcus sp.	567,536	37.12
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	64,656	0.59
				*Spiniferomonas sirrata***********	35,920	3.30
				Mallomonas crassisquama (Asmund) Fott	200	0.20
				Synura sphagnicola Korschikow	200	4.73
				Dinobryon borgei Lemmermann	14,368	0.58
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	1,400	2.79
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	2.95
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	800	5.20
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	400	0.80
				Chrysolkos skuja (Nauwerck) Willen	79,024	2.37
				Uroglena volvox Ehrenberg	79,024	8.94
				Chrysochromulina laurentiana Kling	165,232	69.60
				Stichogloea spp.	7,184	0.36
				Pteridomonas sp.	43,104	10.61
				Cyclotella stelligera Cleve and Grunow	3,200	5.82

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Rhizosolenia eriense H.L. Smith*	21,552	1.83
				Tabellaria fenestrata (Lyngbye) Kutzing	5,600	4.80
				Synedra acus Kutzing	4,000	0.42
				Asterionella formosa Hassall	4,000	0.42
				Cyclotella michiganiana Skvortzow	57,472	1.25
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	14.21
				Cryptomonas erosa Ehrenberg	6,400	7.75
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
				Cryptomonas rostratiformis Skuja	200	0.38
				Katablepharis ovalis Skuja	35,920	1.45
			Dinophyceae	*Gymnodinium* sp.	2,000	15.03
				Peridinium pusillum (Penard) Lemmermann	3,800	9.60
	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.15
				Oocystis lacustris Chodat	43,104	2.17
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	14,368	0.27
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Mougeotia sp.	200	0.63
				Botryococcus braunii Kutzing	800	0.72
				Ankistrodesmus spiralis Lemmermann	7,184	0.46
			Euglenophyceae	*Trachelomonas volvocina Ehrenberg*	200	0.41
			Chrysophyceae	Small chrysophyceae	301,728	4.25
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	373,568	24.43
				Chrysococcus sp.	617,824	40.41
				Chrysostephanospaera globulifera Scherffel	14,368	7.52
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	28,736	0.30
				*Spiniferomonas sirrata***********	14,368	1.06
				Mallomonas crassisquama (Asmund) Fott	400	0.40
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	400	2.03
				Dinobryon sociale Ehrenberg	71,840	16.25
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	35,920	1.08
				Uroglena volvox Ehrenberg	244,256	27.63
				Chrysochromulina laurentiana Kling	481,328	252.02
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	107,760	2.79
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,200	4.06
				Rhizosolenia eriense H.L. Smith	43,104	3.66
				Tabellaria fenestrata (Lyngbye) Kutzing	5,400	4.12
				Fragilaria crotonensis Kitton	2,800	0.90
				Synedra acus Kutzing	19,800	1.78
				Asterionella formosa Hassall	9,600	1.01
				Cyclotella michiganiana Skvortzow	28,736	0.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	93,392	11.74
				Cryptomonas erosa Ehrenberg	8,600	10.38
				Cryptomonas rostratiformis Skuja	400	0.88
				Katablepharis ovalis Skuja	35,920	1.85
			Dinophyceae	*Gymnodinium helveticum Penard*	1,200	28.27
				Gymnodinium sp.	2,200	22.67
				Peridinium pusillum (Penard) Lemmermann	3,400	7.02
				Peridinium aciculiferum Lemmermann	1,600	14.48
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.08
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	14,368	0.81
				Elakatothrix gelatinosa Willen	21,552	0.34
				Planctonema lauterbornii Schmidle	129,312	16.25
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	600	0.22
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
			Chrysophyceae	Small chrysophyceae	445,408	5.70
				Large chrysophyceae	79,024	14.81
				Chrysochromulina parva Lackey	237,072	15.50
				Chrysococcus sp.	1,185,360	77.52
				Chrysostephanospaera globulifera Scherffel	43,104	15.38
				Kephyrion sp.	93,392	1.76
				*Spiniferomonas sirrata***********	28,736	3.09
				Mallomonas crassisquama (Asmund) Fott	200	0.19
				Dinobryon borgei Lemmermann	114,944	5.63
				Dinobryon bavaricum Imhof	158,048	35.75
				Dinobryon bavaricum Imhof	7,200	14.34
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.01
				Dinobryon sertularia Ehrenberg	143,680	32.50
				Dinobryon sertularia Ehrenberg	4,200	8.36

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0102	1	July		*Epiphyxis* sp.	21,552	1.55
				Chrysolkos skuja (Nauwerck) Willen	71,840	1.58
				Uroglena volvox Ehrenberg	941,104	106.44
				Chrysochromulina laurentiana Kling	100,576	43.74
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.85
				Dinobryon attenatum Hill	14,368	2.44
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,600	3.29
				Cyclotella pseudostelligera	14,368	4.88
				Rhizosolenia eriense H.L. Smith	696,848	54.21
				Tabellaria fenestrata (Lyngbye) Kutzing	5,400	4.53
				Synedra acus Kutzing	21,800	2.76
				Asterionella formosa Hassall	7,000	0.76
				Cyclotella michiganiana Skvortzow	100,576	2.46
			Cryptophyceae	*Rhodomonas minuta Skuja*	35,920	3.01
				Cryptomonas erosa Ehrenberg	4,000	6.35
				Cryptomonas ovata Ehrenberg	400	1.81
				Cryptomonas reflexa (Marsson) Skuja	800	0.59
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	57,472	3.25
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	2,400	30.65
				Peridinium pusillum (Penard) Lemmermann	5,400	16.77
				Peridinium aciculiferum Lemmermann	400	3.74
	1	August	Cyanobacteria	*Anabaena cf heterospora Nygarrd*	114,944	13.00
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	71,840	2.41
				Oocystis lacustris Chodat	21,552	0.61
				Paulschulzia pseudovolvox (Schulz and Teiling) Skuja	200	1.13
				Crucigenia quadrata Morr.	28,736	0.32
				Elakatothrix gelatinosa Willen	14,368	0.23
				Planctonema lauterbornii Schmidle	79,024	9.93
				Cosmarium sp.	200	0.28
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.48
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	1,000	1.44
			Chrysophyceae	Small chrysophyceae	1,070,416	11.03
				Large chrysophyceae	43,104	8.78
				Chrysochromulina parva Lackey	272,992	17.85
				Chrysococcus sp.	373,568	19.05
				Kephyrion boreale Skuja	28,736	2.64
				Kephyrion sp.	208,336	1.92
				*Spiniferomonas sirrata***********	43,104	1.29
				Dinobryon borgei Lemmermann	7,184	0.32
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	1.30
				Dinobryon sertularia Ehrenberg	79,024	17.88
				Dinobryon sertularia Ehrenberg	1,400	4.75
				Dinobryon sociale Ehrenberg	143,680	32.50
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.99
				Uroglena volvox Ehrenberg	129,312	14.63
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	208,336	87.75
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.27
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	4.36
				Rhizosolenia eriense H.L. Smith	21,552	1.68
				Tabellaria fenestrata (Lyngbye) Kutzing	4,000	3.43
				Synedra acus Kutzing	3,600	0.41
				Asterionella formosa Hassall	800	0.08
				Cyclotella michiganiana Skvortzow	107,760	2.64
			Cryptophyceae	*Rhodomonas minuta Skuja*	150,864	18.96
				Cryptomonas erosa Ehrenberg	3,800	4.51
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.70
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	7,184	0.37
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	7,184	2.72
				Gymnodinium sp.	1,600	14.72
				Peridinium pusillum (Penard) Lemmermann	2,400	6.39
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.10
				Chlamydomonas spp.	14,368	0.41
				Sphaerocystis schroeteri Chodat	7,184	0.09
				Pediastrum duplex Meyen	3,200	0.32
				Oocystis lacustris Chodat	14,368	0.41
				Elakatothrix gelatinosa Willen	7,184	0.14
				Planctonema lauterbornii Schmidle	21,552	2.71

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	September		*Cosmarium* sp.	200	0.20
				Staurodesmus paradoxum Meyen	200	1.01
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Mougeotia sp.	400	0.52
				Botryococcus braunii Kutzing	200	0.35
				Ankistrodesmus spiralis Lemmermann	7,184	0.55
			Chrysophyceae	Small chrysophyceae	323,280	4.56
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	625,008	40.88
				Chrysococcus sp.	423,856	27.72
				Chrysostephanospaera globulifera Scherffel	21,552	11.28
				Kephyrion boreale Skuja	7,184	0.81
				Kephyrion sp.	71,840	0.74
				*Spiniferomonas sirrata***********	7,184	0.81
				Dinobryon borgei Lemmermann	7,184	0.33
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	14,368	5.71
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	200	1.02
				Dinobryon sociale Ehrenberg	86,208	19.50
				Dinobryon sociale Ehrenberg	200	0.25
				Chrysolkos skuja (Nauwerck) Willen	57,472	1.02
				Uroglena volvox Ehrenberg	201,152	22.75
				Chrysochromulina laurentiana Kling	416,672	238.42
				Salpingoeca frequentissima (Zach.) Lemmermann	71,840	1.72
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,800	5.09
				Rhizosolenia eriense H.L. Smith	100,576	6.40
				Tabellaria fenestrata (Lyngbye) Kutzing	1,000	0.83
				Synedra acus Kutzing	20,400	2.14
				Asterionella formosa Hassall	8,200	0.86
				Cyclotella michiganiana Skvortzow	28,736	0.55
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	18.42
				Cryptomonas erosa Ehrenberg	8,200	13.30
				Katablepharis ovalis Skuja	43,104	1.97
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	1,000	11.01
				Peridinium willei Huitfeldt-Kaas	400	13.40
				Peridinium pusillum (Penard) Lemmermann	3,400	7.43
				Peridinium aciculiferum Lemmermann	400	3.62
	2	September	Cyanobacteria	*Aphanocapsa delicatissima W. and G.S. West*	200	0.42
				Anabaena solitaria Klebs	200	0.05
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.14
				Sphaerocystis schroeteri Chodat	7,184	0.07
				Oocystis lacustris Chodat	7,184	0.17
				Crucigenia quadrata Morr.	28,736	0.32
				Elakatothrix gelatinosa Willen	28,736	0.54
				Planctonema lauterbornii Schmidle	50,288	6.95
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	600	0.23
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	200	0.10
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
			Chrysophyceae	Small chrysophyceae	323,280	4.56
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	438,224	28.66
				Chrysococcus sp.	510,064	33.36
				Chrysostephanospaera globulifera Scherffel	14,368	5.30
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	43,104	0.61
				*Spiniferomonas sirrata***********	43,104	4.88
				Mallomonas crassisquama (Asmund) Fott	400	0.41
				Dinobryon borgei Lemmermann	14,368	0.66
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	1,200	2.39
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.86
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sertularia Ehrenberg	200	1.02
				Dinobryon sociale Ehrenberg	57,472	13.00
				Chrysolkos skuja (Nauwerck) Willen	50,288	0.89
				Uroglena volvox Ehrenberg	502,880	56.88
				Chrysochromulina laurentiana Kling	387,936	221.98
				Salpingoeca frequentissima (Zach.) Lemmermann	93,392	2.24
				Cyclotella stelligera Cleve and Grunow	3,200	5.03
				Rhizosolenia eriense H.L. Smith	79,024	6.70

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria fenestrata (Lyngbye) Kutzing*	6,000	4.92
				Fragilaria crotonensis Kitton	2,000	0.58
				Synedra acus Kutzing	22,000	2.10
				Asterionella formosa Hassall	6,200	0.65
				Cyclotella michiganiana Skvortzow	64,656	1.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	93,392	11.74
				Cryptomonas erosa Ehrenberg	8,800	14.45
				Cryptomonas rostratiformis Skuja	1,000	2.33
				Katablepharis ovalis Skuja	50,288	2.59
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	1,400	19.59
				Peridinium pusillum (Penard) Lemmermann	1,200	2.57
				Peridinium aciculiferum Lemmermann	1,400	12.67
	1	July	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	0.46
				Scenedesmus denticulatus Lagerhiem	28,736	0.98
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	50,288	6.32
				Staurodesmus extensus (Andersson) Teiling	400	0.15
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	200	0.18
			Euglenophyceae	*Euglena acus Ehrenberg*	200	1.85
			Chrysophyceae	Small chrysophyceae	632,192	8.91
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	352,016	23.02
				Chrysococcus sp.	718,400	46.98
				Chrysostephanospaera globulifera Scherffel	35,920	18.81
				Kephyrion sp.	79,024	1.11
				*Spiniferomonas sirrata***********	28,736	2.64
				Mallomonas crassisquama (Asmund) Fott	400	0.41
				Dinobryon borgei Lemmermann	71,840	3.69
				Dinobryon bavaricum Imhof	186,784	42.25
				Dinobryon bavaricum Imhof	5,600	6.86
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	28,736	10.76
				Dinobryon sertularia Ehrenberg	107,760	24.38
				Dinobryon sertularia Ehrenberg	2,200	4.38
				Epiphyxis sp.	64,656	4.77
				Chrysolkos skuja (Nauwerck) Willen	93,392	1.82
				Uroglena volvox Ehrenberg	510,064	57.69
				Chrysochromulina laurentiana Kling	86,208	37.49
				Stichogloea spp.	57,472	2.89
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.00
				Pteridomonas sp.	14,368	3.19
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,000	3.14
				Cyclotella pseudostelligera	14,368	5.12
				Rhizosolenia eriense H.L. Smith	876,448	68.19
				Synedra acus Kutzing	24,000	3.04
				Synedra ulna (Nitzsch) Ehrenberg	1,000	2.07
				Asterionella formosa Hassall	4,000	0.42
				Cyclotella michiganiana Skvortzow	71,840	1.76
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	6.02
				Cryptomonas erosa Ehrenberg	2,000	3.16
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.68
				Cryptomonas rostratiformis Skuja	200	0.41
				Katablepharis ovalis Skuja	21,552	1.11
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.42
				Gymnodinium sp.	1,600	16.31
				Peridinium willei Huitfeldt-Kaas	600	21.65
				Peridinium pusillum (Penard) Lemmermann	7,600	23.21
			Cyanobacteria	*Snowella* sp	200	0.10
				Anabaena solitaria Klebs	2,800	0.55
			Chlorophyceae	*Carteria* spp.	800	1.81
				Sphaerocystis schroeteri Chodat	57,472	1.08
				Oocystis lacustris Chodat	57,472	2.89
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	21,552	1.22
				Elakatothrix gelatinosa Willen	28,736	0.45
				Planctonema lauterbornii Schmidle	122,128	15.35
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	400	0.57
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	Small chrysophyceae	524,432	5.40
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	222,704	14.56
				Chrysococcus sp.	567,536	37.12
				Chrysostephanospaera globulifera Scherffel	7,184	3.65

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0103	1	August	Chrysophyceae	*Kephyrion boreale Skuja*	28,736	3.59
				Kephyrion sp.	57,472	0.74
				*Spiniferomonas sirrata***********	57,472	6.50
				Mallomonas crassisquama (Asmund) Fott	2,100	2.20
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	1,800	3.58
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	1.30
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	400	0.80
				Dinobryon sociale Ehrenberg	93,392	21.13
				Dinobryon sociale Ehrenberg	200	0.25
				Chrysolkos skuja (Nauwerck) Willen	50,288	1.51
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	229,888	99.98
				Stichogloea spp.	14,368	0.72
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.51
				Rhizosolenia eriense H.L. Smith	14,368	0.91
				Synedra acus Kutzing	5,400	0.62
				Cyclotella michiganiana Skvortzow	71,840	1.76
			Cryptophyceae	*Rhodomonas minuta Skuja*	143,680	18.06
				Cryptomonas erosa Ehrenberg	4,200	5.00
				Cryptomonas ovata Ehrenberg	200	0.65
				Cryptomonas reflexa (Marsson) Skuja	800	0.53
				Cryptomonas rostratiformis Skuja	1,600	3.28
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.70
				Gymnodinium sp.	7,184	2.41
				Gymnodinium sp.	1,800	25.45
				Peridinium pusillum (Penard) Lemmermann	3,400	9.38
	1	September	Cyanobacteria	*Snowella* sp	400	0.40
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.10
				Chlamydomonas spp.	7,184	0.17
				Sphaerocystis schroeteri Chodat	14,368	0.20
				Elakatothrix gelatinosa Willen	7,184	0.15
				Planctonema lauterbornii Schmidle	28,736	3.97
				Staurodesmus extensus (Andersson) Teiling	400	0.14
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	400	0.37
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	1,000	0.90
				Ankistrodesmus spiralis Lemmermann	7,184	0.46
			Euglenophyceae	*Trachelomonas volvocina Ehrenberg*	200	0.41
			Chrysophyceae	Small chrysophyceae	373,568	5.27
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	387,936	25.37
				Kephyrion boreale Skuja	14,368	1.32
				Kephyrion sp.	50,288	0.46
				*Spiniferomonas sirrata***********	28,736	0.69
				Mallomonas crassisquama (Asmund) Fott	800	0.84
				Synura sphagnicola Korschikow	200	3.10
				Dinobryon bavaricum Imhof	100,576	22.75
				Dinobryon bavaricum Imhof	2,600	5.18
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sociale Ehrenberg	28,736	6.50
				Epiphyxis sp.	7,184	0.52
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.14
				Uroglena volvox Ehrenberg	208,336	23.56
				Chrysochromulina laurentiana Kling	502,880	263.31
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.74
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	3.56
				Cyclotella ocellata Pant.	14,368	1.61
				Rhizosolenia eriense H.L. Smith	79,024	6.70
				Tabellaria fenestrata (Lyngbye) Kutzing	800	0.62
				Synedra acus Kutzing	23,400	2.23
				Asterionella formosa Hassall	24,600	2.58
				Cyclotella michiganiana Skvortzow	79,024	1.94
			Cryptophyceae	*Rhodomonas minuta Skuja*	100,576	12.64
				Cryptomonas erosa Ehrenberg	3,800	6.01
				Cryptomonas rostratiformis Skuja	600	1.35
				Katablepharis ovalis Skuja	50,288	2.36
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.70
				Gymnodinium sp.	1,200	12.37
				Peridinium pusillum (Penard) Lemmermann	2,200	4.72
				Peridinium aciculiferum Lemmermann	800	7.24
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Sphaerocystis schroeteri Chodat	7,184	0.22
				Planctonema lauterbornii Schmidle	57,472	7.22
				Botryococcus braunii Kutzing	600	0.54

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Ankistrodesmus spiralis Lemmermann	7,184	0.49
			Chrysophyceae	Small chrysophyceae	431,040	6.08
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	445,408	29.13
				Chrysococcus sp.	984,208	53.54
				Chrysostephanospaera globulifera Scherffel	14,368	7.52
				Kephyrion sp.	79,024	1.36
				*Spiniferomonas sirrata***********	50,288	4.63
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Synura sphagnicola Korschikow	7,184	2.89
				Dinobryon borgei Lemmermann	79,024	4.05
				Dinobryon bavaricum Imhof	150,864	34.13
				Dinobryon bavaricum Imhof	4,400	5.39
				Dinobryon sertularia Ehrenberg	114,944	26.00
				Dinobryon sertularia Ehrenberg	2,200	5.56
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.52
				Uroglena volvox Ehrenberg	747,136	84.50
	1	July		*Chrysochromulina laurentiana Kling*	143,680	62.49
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.36
				Dinobryon attenatum Hill	14,368	2.44
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,000	3.64
				Cyclotella pseudostelligera	14,368	5.64
				Rhizosolenia eriense H.L. Smith	847,712	65.95
				Tabellaria fenestrata (Lyngbye) Kutzing	3,600	3.09
				Tabellaria flocculsa (Roth) Kutzing	2,000	2.60
				Synedra acus Kutzing	19,800	2.45
				Synedra ulna (Nitzsch) Ehrenberg	4,600	10.40
				Asterionella formosa Hassall	13,800	1.44
				Cyclotella michiganiana Skvortzow	57,472	1.41
				Cyclotella bodanica Eulenst.	600	4.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	14,368	1.20
				Cryptomonas erosa Ehrenberg	5,800	9.36
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.23
				Cryptomonas rostratiformis Skuja	2,000	4.24
				Katablepharis ovalis Skuja	35,920	2.08
			Dinophyceae	*Gymnodinium helveticum Penard*	200	5.00
				Gymnodinium sp.	1,400	21.84
				Peridinium willei Huitfeldt-Kaas	200	7.76
				Peridinium pusillum (Penard) Lemmermann	3,600	8.16
				Peridinium aciculiferum Lemmermann	400	3.74
			Cyanobacteria	*Snowella* sp	400	0.20
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.11
				Chlamydomonas spp.	7,184	0.09
				Sphaerocystis schroeteri Chodat	14,368	0.45
				Oocystis lacustris Chodat	28,736	1.45
				Paulschulzia pseudovolvox (Schulz and Teiling) Skuja	200	0.54
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	57,472	0.90
				Planctonema lauterbornii Schmidle	122,128	15.35
				Cosmarium sp.	800	3.77
				Staurodesmus extensus (Andersson) Teiling	1,000	0.36
				Botryococcus braunii Kutzing	200	0.29
			Chrysophyceae	Small chrysophyceae	301,728	3.86
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	323,280	21.14
				Chrysococcus sp.	581,904	38.06
				Kephyrion boreale Skuja	43,104	5.12
				Kephyrion sp.	129,312	2.43
				*Spiniferomonas sirrata***********	79,024	8.94
				Dinobryon borgei Lemmermann	50,288	2.62
				Dinobryon bavaricum Imhof	57,472	13.00
				Dinobryon bavaricum Imhof	1,400	2.79
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	3.11
MEL - 0104	1	August		*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	400	2.03
				Dinobryon sertularia Ehrenberg	64,656	14.63
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	179,600	40.63
				Chrysolkos skuja (Nauwerck) Willen	86,208	1.65
				Uroglena volvox Ehrenberg	186,784	21.13
				Chrysochromulina laurentiana Kling	215,520	99.83
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.47
				Pteridomonas sp.	28,736	7.07
				Cyclotella stelligera Cleve and Grunow	4,000	8.59

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Cyclotella ocellata Pant.*	50,288	3.69
				Rhizosolenia eriense H.L. Smith	14,368	1.22
				Tabellaria fenestrata (Lyngbye) Kutzing	12,000	10.08
				Synedra acus Kutzing	5,000	0.51
				Cyclotella michiganiana Skvortzow	50,288	1.09
				Cyclotella bodanica Eulenst.	400	2.50
			Cryptophyceae	*Rhodomonas minuta Skuja*	193,968	26.81
				Cryptomonas erosa Ehrenberg	5,800	6.59
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.70
				Cryptomonas rostratiformis Skuja	800	1.70
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.83
				Gymnodinium sp.	7,184	2.38
				Gymnodinium sp.	2,200	37.75
				Peridinium pusillum (Penard) Lemmermann	5,600	12.93
			Cyanobacteria	*Anabaena flos-aquae (Lyngb.) Breb. & Bornet*	200	0.51
			Chlorophyceae	*Carteria* spp.	200	0.40
				Sphaerocystis schroeteri Chodat	14,368	0.20
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Crucigenia quadrata Morr.	79,024	0.89
				Elakatothrix gelatinosa Willen	43,104	0.81
				Planctonema lauterbornii Schmidle	43,104	5.96
				Cosmarium sp.	600	0.84
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Staurodesmus paradoxum Meyen	200	0.87
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	600	0.54
			Chrysophyceae	Small chrysophyceae	237,072	3.03
				Large chrysophyceae	28,736	10.97
				Chrysochromulina parva Lackey	352,016	23.02
				Chrysococcus sp.	538,800	35.24
				Chrysostephanospaera globulifera Scherffel	7,184	3.76
				Kephyrion boreale Skuja	7,184	0.66
				Kephyrion sp.	50,288	0.95
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	1,400	2.79
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	21,552	8.63
				Dinobryon sertularia Ehrenberg	200	1.02
				Dinobryon sociale Ehrenberg	107,760	24.38
				Uroglena volvox Ehrenberg	244,256	27.63
				Chrysochromulina laurentiana Kling	452,592	236.98
				Salpingoeca frequentissima (Zach.) Lemmermann	143,680	3.65
				Dinobryon attenatum Hill	7,184	0.94
	1	September	Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	5.09
				Rhizosolenia eriense H.L. Smith	71,840	6.09
				Tabellaria fenestrata (Lyngbye) Kutzing	1,200	0.93
				Tabellaria flocculsa (Roth) Kutzing	400	0.57
				Synedra acus Kutzing	26,000	2.34
				Asterionella formosa Hassall	8,000	0.84
				Cyclotella michiganiana Skvortzow	114,944	2.82
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	15.35
				Cryptomonas erosa Ehrenberg	8,000	12.70
				Cryptomonas rostratiformis Skuja	600	1.27
				Katablepharis ovalis Skuja	28,736	1.48
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	14,368	6.09
				Gymnodinium sp.	2,600	28.62
				Peridinium willei Huitfeldt-Kaas	200	6.70
				Peridinium pusillum (Penard) Lemmermann	5,200	9.75
				Peridinium aciculiferum Lemmermann	600	5.43
			Cyanobacteria	*Snowella* sp	200	0.30
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.11
				Sphaerocystis schroeteri Chodat	7,184	0.24
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	50,288	6.32
				Euastrum spp.	800	1.49
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	416,672	5.88
				Large chrysophyceae	100,576	18.06
				Chrysochromulina parva Lackey	481,328	31.48
				Chrysococcus sp.	833,344	45.33
				Chrysostephanospaera globulifera Scherffel	43,104	22.57
				Kephyrion boreale Skuja	7,184	0.66
				Kephyrion sp.	122,128	1.56
				*Spiniferomonas sirrata***********	21,552	2.56
				Mallomonas caudata Ivanov	200	1.07
				Synura sphagnicola Korschikow	200	3.70

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	July	Chrysophyceae	*Dinobryon borgei Lemmermann*	143,680	7.04
				Dinobryon bavaricum Imhof	122,128	27.63
				Dinobryon bavaricum Imhof	8,200	16.33
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.40
				Dinobryon sertularia Ehrenberg	100,576	22.75
				Dinobryon sertularia Ehrenberg	2,400	5.04
				Epiphyxis sp.	21,552	1.55
				Chrysolkos skuja (Nauwerck) Willen	86,208	2.34
				Uroglena volvox Ehrenberg	660,928	74.75
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.17
				Chrysochromulina laurentiana Kling	79,024	34.37
				Stichogloea spp.	71,840	3.61
				Salpingoeca frequentissima (Zach.) Lemmermann	57,472	1.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.91
				Cyclotella pseudostelligera	21,552	7.31
				Rhizosolenia eriense H.L. Smith	1,149,440	73.10
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.17
				Tabellaria flocculsa (Roth) Kutzing	4,000	5.38
				Synedra acus Kutzing	29,800	3.59
				Synedra ulna (Nitzsch) Ehrenberg	5,400	11.20
				Asterionella formosa Hassall	11,400	1.21
				*Eunotia zazumenensis **********	5,200	0.16
				Cyclotella michiganiana Skvortzow	71,840	1.87
				Cyclotella bodanica Eulenst.	400	2.34
			Cryptophyceae	*Rhodomonas minuta Skuja*	86,208	7.22
				Cryptomonas erosa Ehrenberg	9,400	14.86
				Cryptomonas ovata Ehrenberg	400	1.81
				Cryptomonas reflexa (Marsson) Skuja	2,600	1.91
				Cryptomonas rostratiformis Skuja	2,400	5.09
				Katablepharis ovalis Skuja	28,736	1.48
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.90
				Gymnodinium sp.	1,600	24.96
				Peridinium willei Huitfeldt-Kaas	200	4.69
				Peridinium pusillum (Penard) Lemmermann	2,400	7.33
				Peridinium aciculiferum Lemmermann	600	5.61
			Cyanobacteria	*Aphanothece* sp.	14,368	0.76
				Snowella sp	400	0.60
			Chlorophyceae	*Oocystis lacustris Chodat*	43,104	0.76
				Elakatothrix gelatinosa Willen	14,368	0.25
				Planctonema lauterbornii Schmidle	28,736	3.61
				Euastrum spp.	200	0.37
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Ankistrodesmus spiralis Lemmermann	14,368	0.97
				Small chrysophyceae	244,256	3.44
				Large chrysophyceae	64,656	11.61
				Chrysochromulina parva Lackey	438,224	28.66
				Chrysococcus sp.	926,736	50.41
				Chrysostephanospaera globulifera Scherffel	50,288	26.33
				Kephyrion boreale Skuja	14,368	1.32
				Kephyrion sp.	79,024	1.01
				*Spiniferomonas sirrata**********	28,736	3.41
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	200	0.22
	2	July	Chrysophyceae	*Dinobryon borgei Lemmermann*	172,416	8.45
				Dinobryon bavaricum Imhof	79,024	17.88
				Dinobryon bavaricum Imhof	8,000	15.93
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	800	2.80
				Dinobryon sertularia Ehrenberg	100,576	22.75
				Dinobryon sertularia Ehrenberg	1,800	3.78
				Epiphyxis sp.	28,736	2.07
				Chrysolkos skuja (Nauwerck) Willen	107,760	2.93
				Uroglena volvox Ehrenberg	617,824	69.88
				Chrysochromulina laurentiana Kling	71,840	31.24
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,000	3.64
				Rhizosolenia eriense H.L. Smith	1,048,864	66.71
				Tabellaria fenestrata (Lyngbye) Kutzing	1,200	1.03
				Tabellaria flocculsa (Roth) Kutzing	3,200	4.32
				Synedra acus Kutzing	34,200	4.12
				Synedra ulna (Nitzsch) Ehrenberg	5,000	10.37
				Asterionella formosa Hassall	12,800	1.35
				*Eunotia zazumenensis **********	2,800	0.09
				Cyclotella michiganiana Skvortzow	57,472	1.49
				Cyclotella bodanica Eulenst.	200	1.17
				Rhodomonas minuta Skuja	86,208	7.22
				Cryptomonas erosa Ehrenberg	10,200	16.12

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0105	1	August	Cryptophyceae	*Cryptomonas ovata Ehrenberg*	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,800	1.32
				Cryptomonas rostratiformis Skuja	1,800	3.82
				Katablepharis ovalis Skuja	28,736	1.48
			Dinophyceae	*Gymnodinium* sp.	1,600	24.96
				Gymnodinium sp.	400	9.80
				Peridinium willei Huitfeldt-Kaas	600	14.06
				Peridinium pusillum (Penard) Lemmermann	1,600	4.89
				Peridinium aciculiferum Lemmermann	600	5.61
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	21,552	0.53
				Oocystis lacustris Chodat	28,736	0.70
				Dictyosphaerium simplex Sukja	21,552	0.10
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.45
				Elakatothrix gelatinosa Willen	43,104	0.75
				Planctonema lauterbornii Schmidle	93,392	11.74
				Cosmarium sp.	200	0.32
				Staurodesmus extensus (Andersson) Teiling	400	0.12
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	200	0.10
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	Small chrysophyceae	725,584	10.23
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	251,440	16.44
				Chrysococcus sp.	581,904	38.06
				Chrysostephanospaera globulifera Scherffel	7,184	3.12
				Kephyrion sp.	71,840	1.12
				*Spiniferomonas sirrata***********	64,656	7.31
				Dinobryon borgei Lemmermann	7,184	0.43
				Dinobryon mucronutom Nygaard	7,184	0.88
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	1,600	3.19
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	1.02
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	143,680	32.50
				Dinobryon sociale Ehrenberg	200	0.40
				Chrysolkos skuja (Nauwerck) Willen	79,024	2.54
				Uroglena volvox Ehrenberg	129,312	14.63
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	143,680	62.49
				Stichogloea spp.	50,288	2.53
				Bicoeca lacustris Clark	7,184	0.63
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.63
				Pteridomonas sp.	28,736	5.95
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	4.93
				Rhizosolenia eriense H.L. Smith	21,552	1.37
				Tabellaria fenestrata (Lyngbye) Kutzing	4,200	3.25
				Synedra acus Kutzing	4,800	0.50
				Asterionella formosa Hassall	4,000	0.42
				Cyclotella michiganiana Skvortzow	93,392	2.29
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	9.93
				Cryptomonas erosa Ehrenberg	5,200	6.27
				Cryptomonas reflexa (Marsson) Skuja	600	0.38
				Cryptomonas rostratiformis Skuja	800	1.53
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.90
				Gymnodinium sp.	2,400	33.93
				Peridinium pusillum (Penard) Lemmermann	4,800	11.50
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.11
				Carteria spp.	400	1.24
				Chlamydomonas spp.	21,552	0.27
				Sphaerocystis schroeteri Chodat	57,472	0.90
				Pediastrum duplex Meyen	2,400	0.24
				Oocystis lacustris Chodat	35,920	0.93
				Crucigenia quadrata Morr.	28,736	0.32
				Kichnerella lunaris (Kirchn.) Moeb.	57,472	0.81
				Planctonema lauterbornii Schmidle	35,920	4.52
				Cosmarium sp.	200	0.94
				Staurodesmus extensus (Andersson) Teiling	600	0.25
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	600	0.54
				Monomastix minuta Skuja	7,184	0.14
			Chrysophyceae	Small chrysophyceae	495,696	6.34
				Large chrysophyceae	21,552	4.39
				Chrysochromulina parva Lackey	330,464	21.61
				Chrysococcus sp.	617,824	40.41
				Chrysostephanospaera globulifera Scherffel	14,368	5.67
				Kephyrion boreale Skuja	14,368	1.32

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	September	Chrysophyceae	*Kephyrion* sp.	21,552	0.28
				Dinobryon bavaricum Imhof	57,472	13.00
				Dinobryon bavaricum Imhof	1,200	2.39
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	2.86
				Dinobryon sertularia Ehrenberg	600	3.05
				Dinobryon sociale Ehrenberg	71,840	16.25
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.77
				Uroglena volvox Ehrenberg	136,496	15.44
				Chrysochromulina laurentiana Kling	380,752	211.55
				Salpingoeca frequentissima (Zach.) Lemmermann	129,312	3.17
				Dinobryon attenatum Hill	14,368	1.69
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	8,800	16.00
				Cyclotella ocellata Pant.	14,368	1.19
				Rhizosolenia eriense H.L. Smith	50,288	3.20
				Fragilaria crotonensis Kitton	1,600	0.54
				Synedra acus Kutzing	24,800	2.36
				Asterionella formosa Hassall	200	0.02
				Cyclotella michiganiana Skvortzow	122,128	2.99
			Cryptophyceae	*Rhodomonas minuta Skuja*	86,208	10.84
				Cryptomonas erosa Ehrenberg	8,400	13.56
				Cryptomonas ovata Ehrenberg	200	1.12
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	14,368	0.74
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.61
				Gymnodinium sp.	21,552	7.37
				Gymnodinium sp.	2,200	22.67
				Peridinium willei Huitfeldt-Kaas	400	10.27
				Peridinium pusillum (Penard) Lemmermann	4,800	9.36
				Peridinium aciculiferum Lemmermann	5,200	47.05
	1	July	Cyanobacteria	*Anabaena solitaria Klebs*	12,600	2.46
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	14,368	0.22
				Oocystis lacustris Chodat	14,368	0.84
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.45
				Elakatothrix gelatinosa Willen	14,368	0.27
				Planctonema lauterbornii Schmidle	43,104	5.42
				Cosmarium sp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	600	0.86
			Chrysophyceae	Small chrysophyceae	596,272	9.30
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	581,904	38.06
				Chrysococcus sp.	495,696	32.42
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	165,232	2.84
				*Spiniferomonas sirrata***********	43,104	3.17
				Mallomonas caudata Ivanov	400	2.14
				Mallomonas crassisquama (Asmund) Fott	1,600	1.68
				Dinobryon borgei Lemmermann	43,104	2.21
				Dinobryon mucronutom Nygaard	64,656	8.38
				Dinobryon bavaricum Imhof	287,360	65.00
				Dinobryon bavaricum Imhof	3,000	3.68
				Dinobryon sertularia Ehrenberg	114,944	26.00
				Dinobryon sertularia Ehrenberg	4,800	12.12
				Epiphyxis sp.	21,552	1.68
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.22
				Uroglena volvox Ehrenberg	890,816	100.75
				Chrysochromulina laurentiana Kling	79,024	34.37
				Stichogloea spp.	28,736	1.66
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,800	6.91
				Rhizosolenia eriense H.L. Smith	423,856	32.98
				Tabellaria fenestrata (Lyngbye) Kutzing	7,400	6.21
				Synedra acus Kutzing	8,800	1.06
				Asterionella formosa Hassall	5,600	0.53
				Cyclotella michiganiana Skvortzow	35,920	0.93
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	11.02
				Cryptomonas erosa Ehrenberg	7,400	11.95
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	200	0.13
				Cryptomonas rostratiformis Skuja	800	1.70
				Katablepharis ovalis Skuja	28,736	1.62
			Dinophyceae	*Gymnodinium* sp.	400	6.24
				Peridinium pusillum (Penard) Lemmermann	4,600	11.63
				Peridinium aciculiferum Lemmermann	200	1.81
				Chlamydomonas spp.	14,368	0.22
				Sphaerocystis schroeteri Chodat	14,368	0.22
				Elakatothrix gelatinosa Willen	129,312	3.69

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0201	1	August	Chlorophyceae	*Planctonema lauterbornii Schmidle*	71,840	9.03
				Euastrum spp.	800	1.93
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.21
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	653,744	3.66
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	143,680	9.40
				Chrysococcus sp.	359,200	18.32
				Chrysostephanospaera globulifera Scherffel	7,184	2.83
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	64,656	0.83
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	400	0.80
				Dinobryon sociale Ehrenberg	64,656	14.63
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	71,840	30.26
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.20
				Pteridomonas sp.	21,552	5.30
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,400	8.00
				Cyclotella pseudostelligera	7,184	3.87
				Cyclotella ocellata Pant.	14,368	1.24
				Tabellaria fenestrata (Lyngbye) Kutzing	6,400	5.31
				Fragilaria crotonensis Kitton	2,000	0.59
				Synedra acus Kutzing	1,600	0.18
				Cyclotella michiganiana Skvortzow	43,104	1.00
				Cyclotella bodanica Eulenst.	1,800	10.53
				Diatoma elongatum Agardh	600	0.03
			Cryptophyceae	*Rhodomonas minuta Skuja*	150,864	20.85
				Cryptomonas erosa Ehrenberg	4,200	4.90
				Cryptomonas reflexa (Marsson) Skuja	2,400	1.64
				Cryptomonas rostratiformis Skuja	400	0.77
				Katablepharis ovalis Skuja	14,368	0.74
			Dinophyceae	*Gymnodinium* sp.	7,184	3.35
				Gymnodinium sp.	600	4.68
				Peridinium pusillum (Penard) Lemmermann	1,600	4.19
				Peridinium aciculiferum Lemmermann	200	1.81
	1	September	Cyanobacteria	*Snowella* sp	200	0.15
				Planktothrix	200	2.62
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.10
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	14,368	0.82
				Planctonema lauterbornii Schmidle	28,736	3.61
				Cosmarium sp.	200	0.55
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	400	0.36
			Chrysophyceae	Small chrysophyceae	488,512	6.89
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	330,464	21.61
				Chrysococcus sp.	466,960	30.54
				Kephyrion sp.	28,736	0.70
				*Spiniferomonas sirrata***********	35,920	3.30
				Mallomonas crassisquama (Asmund) Fott	600	0.60
				Dinobryon borgei Lemmermann	7,184	0.35
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	3,200	6.37
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	2,600	13.22
				Dinobryon sociale Ehrenberg	64,656	14.63
				Dinobryon sociale Ehrenberg	1,000	1.25
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.82
				Uroglena volvox Ehrenberg	57,472	6.50
				Uroglena volvox Ehrenberg	200	14.52
				Bitrichia chodatii (Reverdin) Chodat	21,552	1.08
				Chrysochromulina laurentiana Kling	79,024	41.38
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.62
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	12,200	24.14
				Cyclotella ocellata Pant.	35,920	3.75
				Synedra acus Kutzing	3,200	0.37
				Asterionella formosa Hassall	19,000	2.01
				Cyclotella michiganiana Skvortzow	21,552	0.39

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Cyclotella bodanica Eulenst.	600	5.50
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	18.42
				Cryptomonas erosa Ehrenberg	4,800	7.75
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	7,184	0.37
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.61
				Gymnodinium sp.	1,000	10.65
				Peridinium willei Huitfeldt-Kaas	200	5.13
				Peridinium pusillum (Penard) Lemmermann	3,800	8.46
				Peridinium aciculiferum Lemmermann	800	7.24
	1	July	Chlorophyceae	*Pediastrum duplex Meyen*	3,600	0.37
				Dictyosphaerium simplex Sukja	28,736	0.14
				Cosmarium sp.	200	0.61
				Botryococcus braunii Kutzing	200	0.29
			Chrysophyceae	Small chrysophyceae	308,912	5.81
				Large chrysophyceae	35,920	6.18
				Chrysochromulina parva Lackey	43,104	2.82
				Chrysococcus sp.	114,944	7.52
				Chrysostephanospaera globulifera Scherffel	21,552	11.28
				Kephyrion sp.	21,552	0.20
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Uroglena volvox Ehrenberg	14,368	1.63
				Chrysochromulina laurentiana Kling	7,184	3.33
				Salpingoeca frequentissima (Zach.) Lemmermann	64,656	2.08
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.45
				Tabellaria fenestrata (Lyngbye) Kutzing	5,000	4.05
				Tabellaria flocculsa (Roth) Kutzing	1,600	2.55
				Synedra acus Kutzing	800	0.10
				Cyclotella michiganiana Skvortzow	50,288	1.09
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Cryptomonas erosa Ehrenberg*	200	0.34
				Katablepharis ovalis Skuja	71,840	3.69
			Dinophyceae	*Peridinium pusillum (Penard) Lemmermann*	400	1.26
			Cyanobacteria	*Aphanothece* sp.	7,184	0.18
				Snowella sp	200	0.11
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	43,104	1.44
				Oocystis lacustris Chodat	14,368	0.38
				Elakatothrix gelatinosa Willen	43,104	0.75
				Planctonema lauterbornii Schmidle	50,288	6.32
				Cosmarium sp.	200	0.28
				Euastrum spp.	600	1.12
				Staurodesmus extensus (Andersson) Teiling	600	0.26
				Oocystis gigas Archer	200	0.68
			Chrysophyceae	Small chrysophyceae	517,248	7.29
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	122,128	7.99
				Chrysococcus sp.	366,384	23.96
				Kephyrion sp.	114,944	1.79
				*Spiniferomonas sirrata***********	35,920	4.27
				Dinobryon borgei Lemmermann	14,368	0.61
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	143,680	32.50
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	71,840	8.13
				Chrysochromulina laurentiana Kling	64,656	29.95
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.18
				Pteridomonas sp.	14,368	3.19
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	8,000	15.83
				Cyclotella pseudostelligera	28,736	15.48
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Tabellaria fenestrata (Lyngbye) Kutzing	800	0.65
				Synedra acus Kutzing	1,000	0.12
				Asterionella formosa Hassall	2,600	0.26
				Cyclotella michiganiana Skvortzow	50,288	1.23
				Cyclotella bodanica Eulenst.	2,600	20.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	23.83
				Cryptomonas erosa Ehrenberg	3,600	4.36
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.17
				Cryptomonas rostratiformis Skuja	600	1.35
				Katablepharis ovalis Skuja	7,184	0.52
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	400	4.60
				Peridinium pusillum (Penard) Lemmermann	4,000	9.93
MEL - 0202			Cyanobacteria	*Snowella* sp	200	0.15

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cyanobacteria	*Anabaena flos-aquae (Lyngb.) Breb. & Bornet*	200	0.47
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.24
				Elakatothrix gelatinosa Willen	14,368	0.32
				Planctonema lauterbornii Schmidle	57,472	7.22
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	400	0.17
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	1,800	1.63
			Chrysophyceae	Small chrysophyceae	510,064	7.19
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	251,440	16.44
				Chrysococcus sp.	323,280	21.14
				Chrysostephanospaera globulifera Scherffel	7,184	2.65
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	86,208	2.10
				*Spiniferomonas sirrata***********	14,368	1.32
				Mallomonas crassisquama (Asmund) Fott	400	0.44
				Dinobryon borgei Lemmermann	14,368	0.75
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	1,200	2.39
				Dinobryon sertularia Ehrenberg	21,552	4.88
	1	September		*Dinobryon sertularia Ehrenberg*	1,400	7.12
				Dinobryon sociale Ehrenberg	114,944	26.00
				Dinobryon sociale Ehrenberg	1,000	1.25
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.33
				Uroglena volvox Ehrenberg	150,864	17.06
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	129,312	67.71
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.39
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	8,600	17.02
				Cyclotella ocellata Pant.	35,920	3.75
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Tabellaria fenestrata (Lyngbye) Kutzing	2,400	1.99
				Synedra acus Kutzing	800	0.10
				Asterionella formosa Hassall	8,800	0.92
				Cyclotella michiganiana Skvortzow	86,208	1.87
			Cryptophyceae	*Rhodomonas minuta Skuja*	129,312	16.25
				Cryptomonas erosa Ehrenberg	6,200	10.01
				Cryptomonas reflexa (Marsson) Skuja	800	0.53
				Cryptomonas rostratiformis Skuja	400	0.85
			Dinophyceae	*Gymnodinium* sp.	1,800	19.18
				Peridinium pusillum (Penard) Lemmermann	1,200	2.67
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Chroococcus limneticus Lemmermann*	114,944	12.36
			Chlorophyceae	*Oocystis lacustris Chodat*	14,368	0.37
				Dictyosphaerium simplex Sukja	14,368	0.07
				Elakatothrix gelatinosa Willen	35,920	0.62
				Planctonema lauterbornii Schmidle	64,656	8.13
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	400	2.31
				Botryococcus braunii Kutzing	200	0.29
				Ankistrodesmus spiralis Lemmermann	7,184	0.56
			Chrysophyceae	Small chrysophyceae	610,640	12.58
				Large chrysophyceae	86,208	32.91
				Chrysochromulina parva Lackey	452,592	29.60
				Chrysococcus sp.	409,488	5.77
				Chrysostephanospaera globulifera Scherffel	21,552	11.28
				Kephyrion sp.	86,208	0.79
				*Spiniferomonas sirrata***********	21,552	2.56
				Mallomonas crassisquama (Asmund) Fott	400	0.43
				Dinobryon borgei Lemmermann	64,656	3.33
				Dinobryon mucronutom Nygaard	14,368	1.45
				Dinobryon bavaricum Imhof	237,072	53.63
				Dinobryon bavaricum Imhof	7,200	8.82
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	2.03
	1	July		*Dinobryon sertularia Ehrenberg*	79,024	17.88
				Dinobryon sertularia Ehrenberg	2,600	5.18
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.03
				Uroglena volvox Ehrenberg	739,952	83.69
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	28,736	11.72
				Bicoeca lacustris Clark	7,184	0.50
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.53
				Pteridomonas sp.	14,368	3.19

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0203	1	August	Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	400	0.73
				Rhizosolenia eriense H.L. Smith	344,832	26.83
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.48
				Synedra acus Kutzing	1,800	0.21
				Asterionella formosa Hassall	5,000	0.53
				Cyclotella michiganiana Skvortzow	107,760	2.64
			Cryptophyceae	*Rhodomonas minuta Skuja*	93,392	12.32
				Cryptomonas erosa Ehrenberg	3,400	5.49
				Cryptomonas reflexa (Marsson) Skuja	400	0.29
				Cryptomonas rostratiformis Skuja	800	1.67
				Katablepharis ovalis Skuja	14,368	0.59
			Dinophyceae	*Gymnodinium* sp.	800	7.36
				Peridinium willei Huitfeldt-Kaas	400	14.43
				Peridinium pusillum (Penard) Lemmermann	1,200	3.03
				Peridinium aciculiferum Lemmermann	200	1.87
			Cyanobacteria	*Aphanothece* sp.	14,368	0.73
				Snowella sp	600	0.30
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.18
				Sphaerocystis schroeteri Chodat	14,368	0.48
				Oocystis lacustris Chodat	57,472	1.36
				Elakatothrix gelatinosa Willen	28,736	0.41
				Planctonema lauterbornii Schmidle	50,288	6.32
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	600	0.29
				Staurodesmus paradoxum Meyen	200	0.82
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.28
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	603,456	8.51
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	71,840	4.70
				Chrysococcus sp.	495,696	32.42
				Chrysostephanospaera globulifera Scherffel	7,184	3.33
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	114,944	1.06
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas crassisquama (Asmund) Fott	400	0.40
				Synura sphagnicola Korschikow	7,184	4.51
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	1,200	6.10
				Dinobryon sociale Ehrenberg	158,048	35.75
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.51
				Uroglena volvox Ehrenberg	107,760	12.19
				Chrysochromulina laurentiana Kling	79,024	34.37
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.43
				Pteridomonas sp.	28,736	6.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	5,200	11.79
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Synedra acus Kutzing	3,000	0.33
				Asterionella formosa Hassall	3,200	0.34
				Cyclotella michiganiana Skvortzow	21,552	0.53
				Cyclotella bodanica Eulenst.	1,000	8.42
			Cryptophyceae	*Rhodomonas minuta Skuja*	165,232	20.77
				Cryptomonas erosa Ehrenberg	7,200	8.54
				Cryptomonas reflexa (Marsson) Skuja	2,000	1.33
				Cryptomonas rostratiformis Skuja	200	0.40
				Katablepharis ovalis Skuja	7,184	0.51
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.80
				Gymnodinium sp.	800	7.62
				Peridinium pusillum (Penard) Lemmermann	17,600	48.55
			Cyanobacteria	*Chroococcus limneticus Lemmermann*	129,312	5.02
			Chlorophyceae	*Oocystis lacustris Chodat*	28,736	0.80
				Planctonema lauterbornii Schmidle	57,472	7.22
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.36
				Botryococcus braunii Kutzing	400	0.36
			Chrysophyceae	Small chrysophyceae	395,120	5.57
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	265,808	17.38
				Chrysococcus sp.	380,752	24.90
				Kephyrion sp.	100,576	2.45
				*Spiniferomonas sirrata***********	14,368	1.32
				Mallomonas crassisquama (Asmund) Fott	800	0.85
				Dinobryon borgei Lemmermann	35,920	1.81
				Dinobryon mucronutom Nygaard	7,184	0.93

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	September	Chrysophyceae	*Dinobryon bavaricum Imhof*	35,920	8.13
				Dinobryon bavaricum Imhof	1,800	3.58
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	1,800	9.15
				Dinobryon sociale Ehrenberg	64,656	14.63
				Dinobryon sociale Ehrenberg	400	0.50
				Uroglena volvox Ehrenberg	251,440	28.44
				Uroglena volvox Ehrenberg	400	21.04
				Chrysochromulina laurentiana Kling	86,208	45.14
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.58
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	12,400	22.87
				Cyclotella ocellata Pant.	21,552	1.65
				Synedra acus Kutzing	3,000	0.36
				Asterionella formosa Hassall	18,200	1.91
				Cyclotella michiganiana Skvortzow	86,208	1.99
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	13.55
				Cryptomonas erosa Ehrenberg	4,000	6.46
				Cryptomonas reflexa (Marsson) Skuja	400	0.27
				Cryptomonas rostratiformis Skuja	600	1.23
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	2,200	12.77
				Peridinium willei Huitfeldt-Kaas	200	6.70
				Peridinium pusillum (Penard) Lemmermann	3,200	6.86
				Peridinium aciculiferum Lemmermann	1,600	14.48
	1	July	Cyanobacteria	*Radiocystis geminata Skuja*	7,184	1.26
			Chhlorophyceae	*Chlamydomonas* spp.	21,552	0.23
				Elakatothrix gelatinosa Willen	14,368	0.27
				Planctonema lauterbornii Schmidle	28,736	3.61
				Cosmarium sp.	400	2.74
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	800	0.30
				Staurodesmus paradoxum Meyen	200	0.41
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.46
			Chrysophyceae	Small chrysophyceae	481,328	7.51
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	445,408	29.13
				Chrysococcus sp.	416,672	24.13
				Chrysostephanospaera globulifera Scherffel	7,184	3.76
				Kephyrion sp.	86,208	0.99
				*Spiniferomonas sirrata***********	14,368	1.25
				Mallomonas crassisquama (Asmund) Fott	1,600	1.64
				Dinobryon borgei Lemmermann	79,024	4.07
				Dinobryon mucronutom Nygaard	57,472	6.37
				Dinobryon bavaricum Imhof	294,544	66.63
				Dinobryon bavaricum Imhof	4,800	5.88
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	4,400	8.76
				Epiphyxis sp.	21,552	1.37
				Chrysolkos skuja (Nauwerck) Willen	100,576	2.60
				Uroglena volvox Ehrenberg	761,504	86.13
				Chrysochromulina laurentiana Kling	150,864	69.88
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.20
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,200	4.00
				Cyclotella pseudostelligera	35,920	19.35
				Rhizosolenia eriense H.L. Smith	287,360	22.36
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.17
				Tabellaria flocculsa (Roth) Kutzing	200	0.23
				Synedra acus Kutzing	5,600	0.67
				Asterionella formosa Hassall	4,200	0.44
				Cyclotella michiganiana Skvortzow	28,736	0.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	11.57
				Cryptomonas erosa Ehrenberg	4,400	7.29
				Cryptomonas reflexa (Marsson) Skuja	800	0.59
				Cryptomonas rostratiformis Skuja	1,400	2.87
				Katablepharis ovalis Skuja	14,368	0.81
			Dinophyceae	*Gymnodinium helveticum Penard*	200	5.18
				Gymnodinium sp.	800	7.36
				Peridinium pusillum (Penard) Lemmermann	3,200	10.27
				Peridinium aciculiferum Lemmermann	200	1.87
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	1.20
				Oocystis lacustris Chodat	21,552	1.08
				Elakatothrix gelatinosa Willen	93,392	1.47
				Planctonema lauterbornii Schmidle	71,840	9.03
				Cosmarium sp.	600	0.43

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0204	1	August	Chlorophyceae	*Euastrum* spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	800	0.28
				Staurodesmus sp.	400	1.27
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	800	1.15
			Chrysophyceae	Small chrysophyceae	639,376	6.59
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	57,472	3.76
				Chrysococcus sp.	344,832	22.55
				Chrysostephanospaera globulifera Scherffel	7,184	2.74
				Kephyrion boreale Skuja	14,368	1.47
				Kephyrion sp.	122,128	2.30
				*Spiniferomonas sirrata***********	43,104	1.18
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	21,552	0.94
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	107,760	24.38
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.57
				Uroglena volvox Ehrenberg	50,288	5.69
				Chrysochromulina laurentiana Kling	64,656	28.12
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.21
				Pteridomonas sp.	28,736	7.07
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,600	6.55
				Rhizosolenia eriense H.L. Smith	14,368	0.91
				Tabellaria fenestrata (Lyngbye) Kutzing	2,800	2.08
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	2,800	0.29
				Cyclotella michiganiana Skvortzow	43,104	1.12
				Cyclotella bodanica Eulenst.	1,800	12.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	265,808	36.73
				Cryptomonas erosa Ehrenberg	6,200	6.98
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.06
				Cryptomonas rostratiformis Skuja	1,000	2.19
				Katablepharis ovalis Skuja	14,368	0.93
			Dinophyceae	*Gymnodinium* sp.	2,000	18.41
				Peridinium pusillum (Penard) Lemmermann	4,000	9.58
	1	September	Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	400	0.21
				Sphaerocystis schroeteri Chodat	35,920	1.20
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.32
				Elakatothrix gelatinosa Willen	21,552	0.57
				Planctonema lauterbornii Schmidle	43,104	5.42
				Closterium sp.	200	0.28
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
			Chrysophyceae	Small chrysophyceae	416,672	5.88
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	352,016	23.02
				Chrysococcus sp.	431,040	28.19
				Kephyrion sp.	57,472	1.79
				*Spiniferomonas sirrata***********	7,184	1.08
				Mallomonas crassisquama (Asmund) Fott	600	0.65
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	2,400	4.78
				Dinobryon sertularia Ehrenberg	2,200	11.19
				Dinobryon sociale Ehrenberg	100,576	22.75
				Dinobryon sociale Ehrenberg	1,200	1.50
				Epiphyxis sp.	14,368	1.09
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.38
				Uroglena volvox Ehrenberg	114,944	13.00
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	229,888	120.37
				Salpingoeca frequentissima (Zach.) Lemmermann	86,208	2.50
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	2.12
				Cyclotella ocellata Pant.	28,736	2.11
				Synedra acus Kutzing	3,000	0.35
				Asterionella formosa Hassall	14,000	1.47
				Cyclotella michiganiana Skvortzow	64,656	1.58
				Cyclotella bodanica Eulenst.	1,200	10.99
			Cryptophyceae	*Rhodomonas minuta Skuja*	150,864	18.96
				Cryptomonas erosa Ehrenberg	4,200	6.87
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.70
				Cryptomonas rostratiformis Skuja	800	1.64
				Katablepharis ovalis Skuja	7,184	0.42

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	800	6.78
				Peridinium willei Huitfeldt-Kaas	400	13.40
				Peridinium pusillum (Penard) Lemmermann	1,800	4.01
				Peridinium aciculiferum Lemmermann	400	3.62
	1	July	Cyanobacteria	*Chroococcus limneticus Lemmermann*	43,104	5.12
				Snowella sp	600	0.33
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Sphaerocystis schroeteri Chodat	7,184	0.22
				Oocystis lacustris Chodat	14,368	0.72
				Elakatothrix gelatinosa Willen	35,920	0.68
				Planctonema lauterbornii Schmidle	28,736	3.61
				Cosmarium sp.	200	0.28
				Micrasterias sp.	200	0.20
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	445,408	8.37
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	359,200	20.80
				Chrysochromulina parva Lackey	589,088	38.53
				Chrysostephanospaera globulifera Scherffel	7,184	3.76
				Kephyrion boreale Skuja	7,184	0.66
				Kephyrion sp.	79,024	1.11
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Synura sphagnicola Korschikow	200	3.10
				Dinobryon borgei Lemmermann	86,208	3.98
				Dinobryon mucronutom Nygaard	35,920	4.70
				Dinobryon bavaricum Imhof	387,936	87.75
				Dinobryon bavaricum Imhof	5,400	6.62
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	2.88
				Dinobryon sertularia Ehrenberg	114,944	26.00
				Dinobryon sertularia Ehrenberg	4,200	8.36
				Epiphyxis sp.	14,368	1.06
				Chrysolkos skuja (Nauwerck) Willen	50,288	1.33
				Uroglena volvox Ehrenberg	790,240	89.38
				Chrysochromulina laurentiana Kling	165,232	76.54
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.16
				Dinobryon attenatum Hill	7,184	1.22
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	6.27
				Cyclotella pseudostelligera	7,184	3.87
				Rhizosolenia eriense H.L. Smith	316,096	24.59
				Tabellaria fenestrata (Lyngbye) Kutzing	1,400	1.08
				Synedra acus Kutzing	4,800	0.59
				Asterionella formosa Hassall	800	0.08
				Cyclotella michiganiana Skvortzow	7,184	0.18
				Cyclotella bodanica Eulenst.	200	2.51
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	12.72
				Cryptomonas erosa Ehrenberg	5,200	9.11
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	400	0.27
				Cryptomonas rostratiformis Skuja	1,600	3.28
				Katablepharis ovalis Skuja	21,552	1.22
			Dinophyceae	*Gymnodinium* sp.	1,000	14.14
				Peridinium pusillum (Penard) Lemmermann	1,800	4.55
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.13
				Sphaerocystis schroeteri Chodat	50,288	1.68
				Tetraedron minimum (Brunow) Hansgrig	7,184	1.25
				Elakatothrix gelatinosa Willen	43,104	1.10
				Planctonema lauterbornii Schmidle	57,472	7.22
				Staurodesmus extensus (Andersson) Teiling	600	0.25
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.28
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Monomastix minuta Skuja	7,184	0.33
MEL - 0205			Chrysophyceae	Small chrysophyceae	696,848	10.87
				Large chrysophyceae	28,736	6.60
				Chrysochromulina parva Lackey	43,104	2.82
				Chrysococcus sp.	488,512	31.95
				Chrysostephanospaera globulifera Scherffel	7,184	4.35
				Kephyrion sp.	64,656	1.01
				*Spiniferomonas sirrata***********	43,104	3.97
				Dinobryon borgei Lemmermann	21,552	1.41
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	35,920	8.13

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	August		*Dinobryon sertularia Ehrenberg*	1,200	4.07
				Dinobryon sociale Ehrenberg	107,760	24.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	93,392	10.56
				Chrysochromulina laurentiana Kling	107,760	46.86
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.29
				Pteridomonas sp.	28,736	6.84
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,000	11.87
				Cyclotella ocellata Pant.	14,368	1.44
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Tabellaria fenestrata (Lyngbye) Kutzing	1,200	1.00
				Synedra acus Kutzing	1,600	0.17
				Cyclotella michiganiana Skvortzow	93,392	1.78
				Cyclotella bodanica Eulenst.	1,600	12.35
			Cryptophyceae	*Rhodomonas minuta Skuja*	208,336	26.19
				Cryptomonas erosa Ehrenberg	9,800	11.43
				Cryptomonas reflexa (Marsson) Skuja	2,400	1.68
				Cryptomonas rostratiformis Skuja	1,000	2.12
				Katablepharis ovalis Skuja	14,368	0.84
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	14,368	5.30
				Gymnodinium sp.	1,000	12.25
				Peridinium pusillum (Penard) Lemmermann	2,800	7.72
	1	September	Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.10
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	28,736	3.97
				Staurodesmus extensus (Andersson) Teiling	600	0.24
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	200	0.10
				Monomastix minuta Skuja	7,184	0.13
			Chrysophyceae	Small chrysophyceae	466,960	6.58
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	287,360	18.79
				Chrysococcus sp.	308,912	20.20
				Kephyrion sp.	86,208	2.10
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	7,184	0.35
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	1,600	3.19
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	1,000	5.09
				Dinobryon sociale Ehrenberg	64,656	14.63
				Dinobryon sociale Ehrenberg	1,200	1.50
				Epiphyxis sp.	14,368	1.03
				Uroglena volvox Ehrenberg	158,048	17.88
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	129,312	67.71
				Salpingoeca frequentissima (Zach.) Lemmermann	71,840	2.08
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	7,600	16.11
				Cyclotella ocellata Pant.	7,184	0.55
				Synedra acus Kutzing	1,400	0.16
				Asterionella formosa Hassall	9,600	1.00
				Cyclotella michiganiana Skvortzow	28,736	0.70
				Cyclotella bodanica Eulenst.	400	3.66
			Cryptophyceae	*Rhodomonas minuta Skuja*	165,232	20.77
				Cryptomonas erosa Ehrenberg	3,600	5.91
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.67
				Cryptomonas rostratiformis Skuja	600	1.27
			Dinophyceae	*Gymnodinium* sp.	1,200	10.06
				Peridinium willei Huitfeldt-Kaas	200	6.21
				Peridinium pusillum (Penard) Lemmermann	1,600	3.43
				Peridinium aciculiferum Lemmermann	1,600	14.48
			Cyanobacteria	*Planktothrix*	200	5.54
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Sphaerocystis schroeteri Chodat	21,552	0.44
				Dictyosphaerium simplex Sukja	28,736	0.45
				Elakatothrix gelatinosa Willen	43,104	0.91
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	1,000	0.35
				Botryococcus braunii Kutzing	200	0.29
			Chrysophyceae	Small chrysophyceae	280,176	5.27
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	158,048	10.34
				Chrysococcus sp.	366,384	23.96
				Chrysostephanospaera globulifera Scherffel	14,368	7.52

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	July	Chrysophyceae	*Kephyrion* sp.	86,208	1.34
				*Spiniferomonas sirrata***********	14,368	1.25
				Mallomonas crassisquama (Asmund) Fott	1,000	1.05
				Dinobryon borgei Lemmermann	7,184	0.32
				Dinobryon bavaricum Imhof	114,944	26.00
				Dinobryon bavaricum Imhof	6,000	7.35
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	1,800	6.10
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.53
				Uroglena volvox Ehrenberg	251,440	28.44
				Chrysosphaerella longispina Lauterborn	200	3.00
				Chrysochromulina laurentiana Kling	129,312	56.24
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.42
			Bacillariophyceae	*Pteridomonas* sp.	28,736	6.84
				Cyclotella stelligera Cleve and Grunow	400	0.63
				Rhizosolenia eriense H.L. Smith	50,288	3.20
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.33
				Tabellaria flocculsa (Roth) Kutzing	200	0.25
				Synedra acus Kutzing	4,600	0.58
				Synedra ulna (Nitzsch) Ehrenberg	200	0.41
				Asterionella formosa Hassall	1,400	0.15
				Cyclotella michiganiana Skvortzow	28,736	0.48
				Cyclotella bodanica Eulenst.	400	3.09
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	8.94
				Cryptomonas erosa Ehrenberg	4,400	7.83
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	200	0.41
				Katablepharis ovalis Skuja	21,552	1.22
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.42
				Gymnodinium sp.	7,184	3.05
				Gymnodinium sp.	1,400	11.32
				Peridinium pusillum (Penard) Lemmermann	1,600	3.83
	1	August	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.08
				Sphaerocystis schroeteri Chodat	28,736	0.41
				Elakatothrix gelatinosa Willen	7,184	0.13
				Planctonema lauterbornii Schmidle	43,104	5.42
				Euastrum spp.	200	0.37
				Staurodesmus paradoxum Meyen	200	0.73
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
			Chrysophyceae	Small chrysophyceae	495,696	4.06
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	215,520	14.10
				Chrysococcus sp.	380,752	24.90
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	43,104	0.40
				*Spiniferomonas sirrata***********	14,368	1.25
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	7,184	0.36
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	400	1.36
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	215,520	48.75
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.54
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	79,024	36.60
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.38
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	5.94
				Fragilaria crotonensis Kitton	3,000	0.97
				Synedra acus Kutzing	1,400	0.15
				Cyclotella michiganiana Skvortzow	7,184	0.19
				Cyclotella bodanica Eulenst.	800	6.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	13.55
				Cryptomonas erosa Ehrenberg	1,800	2.08
				Cryptomonas reflexa (Marsson) Skuja	200	0.14
				Cryptomonas rostratiformis Skuja	400	0.85
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	400	4.08
				Peridinium pusillum (Penard) Lemmermann	400	0.99
MEL - 0301				*Pyramidomonas tetrarhynchus Schmarda*	200	0.08
				Sphaerocystis schroeteri Chodat	28,736	0.54
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	7,184	0.16
				Planctonema lauterbornii Schmidle	64,656	8.13

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	September	Chlorophyceae	*Cosmarium* sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	200	0.48
				Monomastix minuta Skuja	7,184	0.10
			Chrysophyceae	Small chrysophyceae	373,568	4.78
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	395,120	25.84
				Chrysococcus sp.	409,488	26.78
				Chrysostephanospaera globulifera Scherffel	21,552	7.95
				Kephyrion sp.	79,024	1.01
				*Spiniferomonas sirrata***********	7,184	0.66
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Mallomonas akrokomos Asmund and Kristiansen	7,184	1.63
				Dinobryon borgei Lemmermann	28,736	1.36
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	2,600	13.22
				Dinobryon sociale Ehrenberg	114,944	26.00
				Dinobryon sociale Ehrenberg	200	0.25
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	107,760	12.19
				Chrysochromulina laurentiana Kling	107,760	56.42
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,400	7.55
				Cyclotella ocellata Pant.	258,624	26.97
				Synedra acus Kutzing	4,600	0.41
				Asterionella formosa Hassall	3,400	0.36
				Cyclotella michiganiana Skvortzow	57,472	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	201,152	25.79
				Cryptomonas erosa Ehrenberg	1,800	2.86
				Cryptomonas rostratiformis Skuja	600	1.23
				Katablepharis ovalis Skuja	14,368	0.67
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	14,368	4.62
				Gymnodinium sp.	800	6.95
				Peridinium pusillum (Penard) Lemmermann	800	1.75
				Peridinium aciculiferum Lemmermann	200	1.81
	2	September	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.24
				Elakatothrix gelatinosa Willen	14,368	0.30
				Planctonema lauterbornii Schmidle	28,736	3.61
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Ankistrodesmus spiralis Lemmermann	7,184	0.42
				Monomastix minuta Skuja	7,184	0.14
			Chrysophyceae	Small chrysophyceae	445,408	5.70
				Large chrysophyceae	57,472	10.32
				Chrysochromulina parva Lackey	409,488	26.78
				Chrysococcus sp.	409,488	26.78
				Chrysostephanospaera globulifera Scherffel	7,184	3.33
				Kephyrion sp.	100,576	1.29
				*Spiniferomonas sirrata***********	21,552	2.32
				Mallomonas crassisquama (Asmund) Fott	400	0.41
				Dinobryon borgei Lemmermann	35,920	1.61
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	1,800	3.58
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	1,200	6.10
				Dinobryon sociale Ehrenberg	158,048	35.75
				Dinobryon sociale Ehrenberg	1,000	1.25
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.26
				Uroglena volvox Ehrenberg	129,312	14.63
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	64,656	33.85
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	64,656	1.63
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,800	8.85
				Synedra acus Kutzing	3,800	0.38
				Asterionella formosa Hassall	3,000	0.30
				Cyclotella michiganiana Skvortzow	14,368	0.27
				Cyclotella bodanica Eulenst.	600	4.63
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	15.35
				Cryptomonas erosa Ehrenberg	4,200	6.61
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Dinophyceae	*Gymnodinium* sp.	14,368	5.30
				Gymnodinium sp.	600	5.72
				Peridinium pusillum (Penard) Lemmermann	1,800	3.79
				Peridinium aciculiferum Lemmermann	200	1.81
	1	July	Cyanobacteria	*Aphanothece* sp.	14,368	0.73
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	165,232	5.96
				Oocystis lacustris Chodat	43,104	1.22
				Dictyosphaerium simplex Sukja	28,736	0.12
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	21,552	2.71
				Staurodesmus extensus (Andersson) Teiling	1,400	0.49
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.18
			Chrysophyceae	Small chrysophyceae	150,864	2.84
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	222,704	14.56
				Chrysococcus sp.	287,360	18.79
				Kephyrion sp.	50,288	0.71
				Mallomonas crassisquama (Asmund) Fott	400	0.43
				Dinobryon borgei Lemmermann	57,472	2.63
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	5,200	6.37
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	3,400	6.77
				Uroglena volvox Ehrenberg	603,456	68.25
				Uroglena volvox Ehrenberg	200	2.26
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	79,024	36.60
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.21
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	2.55
				Cyclotella pseudostelligera	43,104	23.22
				Rhizosolenia eriense H.L. Smith	21,552	1.68
				Tabellaria fenestrata (Lyngbye) Kutzing	6,000	4.98
				Synedra acus Kutzing	6,000	0.75
				Asterionella formosa Hassall	2,000	0.21
				Eunotia zazumenensis **********	800	0.03
				Cyclotella michiganiana Skvortzow	21,552	0.53
			Cryptophyceae	*Rhodomonas minuta Skuja*	100,576	11.01
				Cryptomonas erosa Ehrenberg	3,400	5.82
				Cryptomonas reflexa (Marsson) Skuja	200	0.14
				Katablepharis ovalis Skuja	14,368	0.83
			Dinophyceae	*Gymnodinium helveticum Penard*	600	15.55
				Gymnodinium sp.	600	5.52
				Peridinium pusillum (Penard) Lemmermann	2,000	6.11
MEL - 0302	1	August	Cyanobacteria	*Aphanothece* sp.	7,184	0.37
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Pediastrum duplex Meyen	4,200	0.39
				Oocystis lacustris Chodat	14,368	0.34
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	35,920	0.62
				Planctonema lauterbornii Schmidle	57,472	7.22
				Staurodesmus extensus (Andersson) Teiling	200	0.14
				Spondylosium planum (Wolle) W. and G.S. West	43,104	1.63
			Chrysophyceae	Small chrysophyceae	416,672	5.33
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	215,520	14.10
				Chrysococcus sp.	359,200	22.13
				Kephyrion boreale Skuja	7,184	0.90
				Kephyrion sp.	57,472	0.81
				*Spiniferomonas sirrata***********	14,368	1.00
				Mallomonas crassisquama (Asmund) Fott	600	0.62
				Dinobryon borgei Lemmermann	21,552	0.80
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	400	0.39
				Dinobryon sertularia Ehrenberg	43,104	9.75
				Dinobryon sertularia Ehrenberg	1,200	2.39
				Dinobryon sociale Ehrenberg	143,680	32.50
				Dinobryon sociale Ehrenberg	200	0.25
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.23
				Uroglena volvox Ehrenberg	79,024	8.94
				Chrysochromulina laurentiana Kling	114,944	49.99
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.19
				Pteridomonas sp.	28,736	6.61
				Cyclotella stelligera Cleve and Grunow	3,000	5.46

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Cyclotella ocellata Pant.*	14,368	1.44
				Synedra acus Kutzing	1,800	0.19
				Asterionella formosa Hassall	1,200	0.12
				Cyclotella michiganiana Skvortzow	64,656	1.58
				Cyclotella bodanica Eulenst.	1,000	7.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	100,576	12.64
				Cryptomonas erosa Ehrenberg	2,200	2.55
				Cryptomonas reflexa (Marsson) Skuja	600	0.41
				Cryptomonas rostratiformis Skuja	400	0.77
			Dinophyceae	*Gymnodinium* sp.	600	5.52
				Peridinium pusillum (Penard) Lemmermann	1,400	3.73
	1	September	Chlorophyceae	*Elakatothrix gelatinosa Willen*	21,552	0.41
				Planctonema lauterbornii Schmidle	35,920	4.52
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	800	0.92
			Chrysophyceae	Small chrysophyceae	359,200	4.60
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	452,592	29.60
				Chrysococcus sp.	323,280	21.14
				Chrysostephanospaera globulifera Scherffel	14,368	5.67
				Kephyrion boreale Skuja	7,184	0.81
				Kephyrion sp.	79,024	1.36
				*Spiniferomonas sirrata***********	7,184	0.85
				Dinobryon borgei Lemmermann	35,920	1.78
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	1,600	3.19
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	2,400	12.20
				Dinobryon sociale Ehrenberg	143,680	32.50
				Dinobryon sociale Ehrenberg	200	0.25
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.19
				Uroglena volvox Ehrenberg	179,600	20.31
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	57,472	30.09
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	79,024	2.16
				Pteridomonas sp.	7,184	1.77
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	9.02
				Cyclotella ocellata Pant.	7,184	0.78
				Rhizosolenia eriense H.L. Smith	7,184	0.61
				Tabellaria fenestrata (Lyngbye) Kutzing	4,000	3.36
				Fragilaria crotonensis Kitton	2,400	0.77
				Synedra acus Kutzing	2,600	0.26
				Asterionella formosa Hassall	9,600	1.01
				Cyclotella michiganiana Skvortzow	43,104	1.06
				Cyclotella bodanica Eulenst.	1,000	9.16
			Cryptophyceae	*Rhodomonas minuta Skuja*	86,208	10.84
				Cryptomonas erosa Ehrenberg	2,400	3.81
			Dinophyceae	*Gymnodinium* sp.	600	5.09
				Peridinium pusillum (Penard) Lemmermann	1,600	3.50
				Peridinium aciculiferum Lemmermann	200	1.81
			Cyanobacteria	*Aphanothece* sp.	14,368	0.72
				Snowella sp	400	0.68
			Chlorophyceae	*Chlamydomonas* spp.	28,736	0.29
				Sphaerocystis schroeteri Chodat	21,552	0.72
				Oocystis lacustris Chodat	7,184	0.17
				Elakatothrix gelatinosa Willen	14,368	0.29
				Planctonema lauterbornii Schmidle	14,368	1.81
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
			Chrysophyceae	Small chrysophyceae	581,904	11.99
				Large chrysophyceae	64,656	11.61
				Chrysochromulina parva Lackey	395,120	25.84
				Chrysococcus sp.	359,200	23.49
				Kephyrion sp.	93,392	1.20
				Mallomonas crassisquama (Asmund) Fott	1,400	1.51
				Dinobryon borgei Lemmermann	21,552	0.92
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	280,176	63.38
				Dinobryon bavaricum Imhof	6,800	8.33
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	2,800	5.57
	1	July		*Chrysolkos skuja (Nauwerck) Willen*	64,656	1.82
				Uroglena volvox Ehrenberg	481,328	54.44

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0303	1	August		*Chrysosphaerella longispina Lauterborn*	200	3.02
				Chrysochromulina laurentiana Kling	129,312	56.24
				Bicoeca lacustris Clark	7,184	0.70
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.43
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	2.55
				Cyclotella pseudostelligera	14,368	7.74
				Rhizosolenia eriense H.L. Smith	43,104	3.35
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.33
				Tabellaria flocculsa (Roth) Kutzing	4,000	5.34
				Synedra acus Kutzing	3,400	0.42
				Asterionella formosa Hassall	2,400	0.25
				Cyclotella michiganiana Skvortzow	43,104	1.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	21.45
				Cryptomonas erosa Ehrenberg	2,800	4.64
				Cryptomonas reflexa (Marsson) Skuja	400	0.27
				Katablepharis ovalis Skuja	21,552	1.22
			Dinophyceae	*Gymnodinium* sp.	7,184	3.35
				Gymnodinium sp.	200	3.12
				Peridinium willei Huitfeldt-Kaas	400	13.40
				Peridinium pusillum (Penard) Lemmermann	2,400	6.07
			Chlorophyceae	*Chlamydomonas* spp.	21,552	0.30
				Pediastrum duplex Meyen	4,800	0.40
				Oocystis lacustris Chodat	14,368	0.72
				Elakatothrix gelatinosa Willen	93,392	1.47
				Planctonema lauterbornii Schmidle	57,472	7.22
				Cosmarium sp.	400	1.88
				Staurodesmus extensus (Andersson) Teiling	200	0.11
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
			Chrysophyceae	Small chrysophyceae	431,040	5.52
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	301,728	22.21
				Chrysococcus sp.	301,728	19.73
				Chrysostephanospaera globulifera Scherffel	14,368	7.52
				Kephyrion sp.	71,840	1.01
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Mallomonas akrokomos Asmund and Kristiansen	7,184	1.90
				Dinobryon borgei Lemmermann	28,736	1.17
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	400	2.03
				Dinobryon sociale Ehrenberg	143,680	32.50
				Dinobryon sociale Ehrenberg	200	0.20
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.74
				Uroglena volvox Ehrenberg	79,024	8.94
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	114,944	53.24
				Stichogloea spp.	28,736	1.45
				Pteridomonas sp.	28,736	5.74
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.18
				Cyclotella ocellata Pant.	7,184	1.03
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Synedra acus Kutzing	2,800	0.34
				Cyclotella michiganiana Skvortzow	79,024	1.51
				Cyclotella bodanica Eulenst.	600	3.51
				Diatoma elongatum Agardh	400	0.08
			Cryptophyceae	*Rhodomonas minuta Skuja*	294,544	37.02
				Cryptomonas erosa Ehrenberg	1,200	1.39
				Cryptomonas reflexa (Marsson) Skuja	600	0.41
				Cryptomonas rostratiformis Skuja	200	0.39
			Dinophyceae	*Gymnodinium* sp.	1,200	9.02
				Peridinium pusillum (Penard) Lemmermann	1,400	3.48
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.84
				Sphaerocystis schroeteri Chodat	35,920	0.74
				Oocystis lacustris Chodat	35,920	1.02
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.50
				Planctonema lauterbornii Schmidle	7,184	0.90
				Cosmarium sp.	600	0.84
				Cosmarium sp.	200	0.32
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	200	0.18
				Small chrysophyceae	395,120	5.57
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	359,200	23.49
				Chrysococcus sp.	308,912	20.20
				Chrysostephanospaera globulifera Scherffel	28,736	14.60

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
	1	September	Chrysophyceae	*Kephyrion* sp.	64,656	0.91
				*Spiniferomonas sirrata***********	14,368	1.54
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	14,368	0.79
				Dinobryon mucronutom Nygaard	7,184	0.94
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	1,600	8.14
				Dinobryon sociale Ehrenberg	43,104	9.75
				Dinobryon sociale Ehrenberg	200	0.25
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	28,736	3.25
				Chrysochromulina laurentiana Kling	57,472	30.09
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.58
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,000	7.27
				Cyclotella ocellata Pant.	21,552	2.17
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.34
				Synedra acus Kutzing	1,200	0.12
				Asterionella formosa Hassall	5,200	0.54
				Cyclotella michiganiana Skvortzow	35,920	0.88
				Cyclotella bodanica Eulenst.	400	3.66
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	13.55
				Cryptomonas erosa Ehrenberg	2,000	2.31
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	200	1.50
				Peridinium pusillum (Penard) Lemmermann	1,000	2.14
				Peridinium aciculiferum Lemmermann	400	3.62
	1	July	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Sphaerocystis schroeteri Chodat	43,104	1.56
				Oocystis lacustris Chodat	7,184	0.36
				Elakatothrix gelatinosa Willen	71,840	1.48
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	200	0.10
			Chrysophyceae	Small chrysophyceae	201,152	2.84
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	395,120	25.84
				Chrysococcus sp.	373,568	24.43
				Kephyrion sp.	129,312	1.66
				*Spiniferomonas sirrata***********	7,184	1.08
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	35,920	1.57
				Dinobryon bavaricum Imhof	330,464	74.75
				Dinobryon bavaricum Imhof	4,800	5.88
				Dinobryon sertularia Ehrenberg	64,656	14.63
				Dinobryon sertularia Ehrenberg	2,600	5.18
				Chrysolkos skuja (Nauwerck) Willen	57,472	1.85
				Uroglena volvox Ehrenberg	459,776	52.00
				Chrysosphaerella longispina Lauterborn	200	3.62
				Chrysochromulina laurentiana Kling	122,128	56.57
				Stichogloea spp.	14,368	0.72
				Bicoeca lacustris Clark	7,184	0.63
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.48
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	2.18
				Rhizosolenia eriense H.L. Smith	57,472	4.47
				Tabellaria fenestrata (Lyngbye) Kutzing	3,200	2.74
				Synedra acus Kutzing	1,800	0.21
				Asterionella formosa Hassall	400	0.04
				Cyclotella michiganiana Skvortzow	35,920	0.88
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	9.93
				Cryptomonas erosa Ehrenberg	3,200	5.25
				Cryptomonas reflexa (Marsson) Skuja	200	0.14
				Katablepharis ovalis Skuja	14,368	0.84
			Dinophyceae	*Gymnodinium* sp.	800	7.36
				Peridinium willei Huitfeldt-Kaas	200	7.22
				Peridinium pusillum (Penard) Lemmermann	2,600	6.23
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Aphanothece* sp.	7,184	0.28
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.18
				Sphaerocystis schroeteri Chodat	57,472	0.66
				Oocystis lacustris Chodat	7,184	0.36
				Oocystis lacustris Chodat	7,184	0.42
				Elakatothrix gelatinosa Willen	86,208	1.23
				Planctonema lauterbornii Schmidle	57,472	7.22
				Cosmarium sp.	200	0.28

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0304	1	August		*Euastrum* spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	600	0.28
				Spondylosium planum (Wolle) W. and G.S. West	64,656	2.44
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Oocystis gigas Archer	400	0.93
			Chrysophyceae	Small chrysophyceae	459,776	5.89
				Large chrysophyceae	14,368	1.88
				Chrysochromulina parva Lackey	179,600	11.75
				Chrysococcus sp.	344,832	21.24
				Chrysostephanospaera globulifera Scherffel	7,184	3.33
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	57,472	0.53
				*Spiniferomonas sirrata***********	28,736	3.25
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	400	0.40
				Dinobryon borgei Lemmermann	28,736	1.32
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	400	0.39
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	800	1.59
				Dinobryon sociale Ehrenberg	150,864	34.13
				Uroglena volvox Ehrenberg	28,736	3.25
				Uroglena volvox Ehrenberg	200	11.26
				Chrysochromulina laurentiana Kling	86,208	37.49
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.65
				Pteridomonas sp.	50,288	10.04
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	3.01
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Synedra acus Kutzing	1,200	0.14
				Asterionella formosa Hassall	200	0.02
				Cyclotella michiganiana Skvortzow	43,104	1.00
				Cyclotella bodanica Eulenst.	200	1.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	186,784	19.22
				Cryptomonas erosa Ehrenberg	3,600	4.34
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
			Dinophyceae	*Gymnodinium* sp.	1,400	15.41
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	3,000	7.45
	1	September	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.42
				Sphaerocystis schroeteri Chodat	7,184	0.18
				Cosmarium sp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	400	0.17
				Staurodesmus paradoxum Meyen	200	0.82
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Ankistrodesmus spiralis Lemmermann	7,184	0.54
			Chrysophyceae	Small chrysophyceae	574,720	8.10
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	366,384	23.96
				Chrysococcus sp.	545,984	35.71
				Chrysostephanospaera globulifera Scherffel	21,552	10.95
				Kephyrion sp.	150,864	2.84
				*Spiniferomonas sirrata***********	7,184	0.81
				Mallomonas crassisquama (Asmund) Fott	200	0.22
				Dinobryon borgei Lemmermann	57,472	2.78
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,800	9.15
				Dinobryon sociale Ehrenberg	237,072	53.63
				Dinobryon sociale Ehrenberg	200	0.25
				Uroglena volvox Ehrenberg	193,968	21.94
				Bitrichia chodatii (Reverdin) Chodat	21,552	1.50
				Chrysochromulina laurentiana Kling	122,128	63.95
				Salpingoeca frequentissima (Zach.) Lemmermann	71,840	1.86
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,400	9.20
				Cyclotella ocellata Pant.	35,920	3.61
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Fragilaria crotonensis Kitton	2,000	0.63
				Synedra acus Kutzing	4,400	0.44
				Asterionella formosa Hassall	13,600	1.41
				Cyclotella michiganiana Skvortzow	122,128	2.65
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	9.93
				Cryptomonas erosa Ehrenberg	1,400	1.59
				Katablepharis ovalis Skuja	7,184	0.29
				Gymnodinium sp.	200	1.86

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Dinophyceae	*Peridinium willei Huitfeldt-Kaas*	400	9.37
				Peridinium pusillum (Penard) Lemmermann	1,200	2.39
				Peridinium aciculiferum Lemmermann	200	1.81
			Cyanobacteria	*Aphanothece* sp.	35,920	2.12
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.15
				Sphaerocystis schroeteri Chodat	64,656	2.17
				Pediastrum duplex Meyen	3,200	0.37
				Elakatothrix gelatinosa Willen	35,920	0.73
				Cosmarium sp.	200	0.28
				Euastrum spp.	200	0.32
				Staurodesmus extensus (Andersson) Teiling	400	0.15
				Staurodesmus bullardii G.M. Smith	200	0.44
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	400	1.92
			Chrysophyceae	Small chrysophyceae	294,544	3.77
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	294,544	19.26
				Chrysococcus sp.	265,808	17.38
				Kephyrion sp.	100,576	1.04
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	800	0.81
				Synura sphagnicola Korschikow	7,184	2.41
				Dinobryon borgei Lemmermann	14,368	0.62
				Dinobryon bavaricum Imhof	258,624	58.50
				Dinobryon bavaricum Imhof	4,800	5.88
				Dinobryon sertularia Ehrenberg	21,552	4.88
	1	July		*Dinobryon sertularia Ehrenberg*	2,800	9.49
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	366,384	41.44
				Chrysochromulina laurentiana Kling	71,840	33.28
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.46
				Dinobryon attenatum Hill	14,368	1.50
				Pteridomonas sp.	35,920	6.91
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.82
				Cyclotella pseudostelligera	28,736	15.48
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Synedra acus Kutzing	4,600	0.57
				Asterionella formosa Hassall	3,600	0.38
				Cyclotella michiganiana Skvortzow	28,736	0.70
				Cyclotella bodanica Eulenst.	400	3.66
			Cryptophyceae	*Rhodomonas minuta Skuja*	129,312	14.63
				Cryptomonas erosa Ehrenberg	3,600	5.71
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	800	1.70
				Katablepharis ovalis Skuja	28,736	1.62
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.61
				Gymnodinium sp.	800	6.54
				Peridinium willei Huitfeldt-Kaas	600	21.65
				Peridinium pusillum (Penard) Lemmermann	2,800	8.69
			Chlorophyceae	*Chlamydomonas* spp.	35,920	0.46
				Oocystis lacustris Chodat	7,184	0.36
				Chodatella sp.	7,184	0.36
				Elakatothrix gelatinosa Willen	43,104	0.81
				Planctonema lauterbornii Schmidle	64,656	8.13
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	800	1.15
				Oocystis gigas Archer	200	0.51
			Chrysophyceae	Small chrysophyceae	531,616	3.40
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	193,968	12.69
				Chrysococcus sp.	395,120	20.15
				Chrysostephanospaera globulifera Scherffel	7,184	3.76
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	143,680	2.24
				*Spiniferomonas sirrata***********	28,736	2.00
MEL - 0305				*Mallomonas caudata Ivanov*	200	1.02
				Dinobryon borgei Lemmermann	35,920	1.46
				Dinobryon bavaricum Imhof	21,552	4.88
	1	August		*Dinobryon bavaricum Imhof*	800	1.59
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,000	1.25
				Dinobryon sertularia Ehrenberg	800	1.59
				Dinobryon sociale Ehrenberg	222,704	50.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.25

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Uroglena volvox Ehrenberg	35,920	4.06
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	64,656	28.12
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.18
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,200	4.35
				Rhizosolenia eriense H.L. Smith	14,368	1.22
				Synedra acus Kutzing	1,000	0.11
				Cyclotella michiganiana Skvortzow	79,024	1.94
			Cryptophyceae	*Rhodomonas minuta Skuja*	179,600	22.58
				Cryptomonas erosa Ehrenberg	6,800	8.20
				Cryptomonas reflexa (Marsson) Skuja	800	0.51
				Cryptomonas rostratiformis Skuja	400	0.77
			Dinophyceae	*Gymnodinium* sp.	14,368	4.77
				Gymnodinium sp.	1,200	9.02
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	5,200	12.91
	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.10
				Elakatothrix gelatinosa Willen	7,184	0.14
				Cosmarium sp.	200	0.28
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	600	1.03
			Chrysophyceae	Small chrysophyceae	337,648	3.48
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	387,936	25.37
				Chrysococcus sp.	265,808	17.38
				Chrysostephanospaera globulifera Scherffel	7,184	3.33
				Kephyrion sp.	129,312	2.22
				*Spiniferomonas sirrata***********	14,368	1.25
				Dinobryon borgei Lemmermann	35,920	1.61
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sertularia Ehrenberg	1,000	5.09
				Dinobryon sociale Ehrenberg	150,864	34.13
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	71,840	8.13
				Bitrichia chodatii (Reverdin) Chodat	14,368	0.72
				Chrysochromulina laurentiana Kling	71,840	37.62
				Stichogloea spp.	7,184	0.36
				Bicoeca lacustris Clark	7,184	0.50
				Salpingoeca frequentissima (Zach.) Lemmermann	57,472	1.49
				Dinobryon attenatum Hill	7,184	0.66
				Pteridomonas sp.	7,184	1.77
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	8.31
				Cyclotella ocellata Pant.	21,552	2.69
				Rhizosolenia eriense H.L. Smith	7,184	0.61
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.17
				Synedra acus Kutzing	4,000	0.42
				Asterionella formosa Hassall	13,600	1.42
				Cyclotella michiganiana Skvortzow	93,392	2.29
				Cyclotella bodanica Eulenst.	800	5.64
			Cryptophyceae	*Rhodomonas minuta Skuja*	136,496	17.16
				Cryptomonas erosa Ehrenberg	2,800	4.60
			Dinophyceae	*Gymnodinium* sp.	1,000	8.68
				Peridinium pusillum (Penard) Lemmermann	1,600	3.50
				Peridinium aciculiferum Lemmermann	600	5.43
			Cyanobacteria	*Aphanothece* sp.	14,368	0.73
				Snowella sp	200	0.15
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	57,472	1.93
				Oocystis lacustris Chodat	35,920	0.41
				Dictyosphaerium simplex Sukja	50,288	0.24
				Elakatothrix gelatinosa Willen	35,920	0.68
				Planctonema lauterbornii Schmidle	21,552	2.71
				Cosmarium sp.	400	0.56
				Staurodesmus bullardii G.M. Smith	200	0.64
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	600	0.54
				Oocystis gigas Archer	200	0.49
			Chrysophyceae	Small chrysophyceae	294,544	2.71
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	50,288	3.29
				Chrysococcus sp.	208,336	13.63
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	64,656	0.59
				*Spiniferomonas sirrata***********	21,552	1.98

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0401	1	August	Chrysophyceae	*Mallomonas crassisquama (Asmund) Fott*	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	200	0.68
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	71,840	16.25
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.13
				Uroglena volvox Ehrenberg	35,920	4.06
				Chrysochromulina laurentiana Kling	100,576	43.74
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	4.73
				Cyclotella ocellata Pant.	14,368	1.44
				Synedra acus Kutzing	400	0.04
				Cyclotella michiganiana Skvortzow	14,368	0.24
			Cryptophyceae	*Rhodomonas minuta Skuja*	179,600	27.08
				Cryptomonas erosa Ehrenberg	600	0.70
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.66
			Dinophyceae	*Gymnodinium* sp.	1,000	8.78
				Peridinium pusillum (Penard) Lemmermann	1,200	2.98
				Peridinium aciculiferum Lemmermann	200	1.81
			Cyanobacteria	*Aphanothece* sp.	7,184	0.25
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.07
				Sphaerocystis schroeteri Chodat	7,184	0.18
				Oocystis lacustris Chodat	21,552	0.58
				Dictyosphaerium simplex Sukja	50,288	0.24
				Elakatothrix gelatinosa Willen	86,208	1.22
				Planctonema lauterbornii Schmidle	64,656	8.13
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	800	0.38
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	200	0.18
				Ankistrodesmus spiralis Lemmermann	7,184	0.45
				Oocystis gigas Archer	200	0.42
				Monomastix minuta Skuja	7,184	0.20
	1	August	Chrysophyceae	Small chrysophyceae	517,248	4.76
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	229,888	15.03
				Chrysococcus sp.	193,968	12.69
				Chrysostephanospaera globulifera Scherffel	7,184	3.33
				Kephyrion sp.	122,128	1.72
				*Spiniferomonas sirrata***********	7,184	0.73
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	14,368	0.70
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	600	2.03
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.40
				Dinobryon sertularia Ehrenberg	800	2.71
				Dinobryon sociale Ehrenberg	107,760	24.38
				Uroglena volvox Ehrenberg	79,024	8.94
				Chrysochromulina laurentiana Kling	71,840	30.26
				Stichogloea spp.	21,552	1.08
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	3.39
				Cyclotella ocellata Pant.	28,736	2.89
				Synedra acus Kutzing	2,400	0.25
				Cyclotella michiganiana Skvortzow	57,472	1.10
				Cyclotella bodanica Eulenst.	600	4.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	208,336	26.19
				Cryptomonas erosa Ehrenberg	3,400	3.93
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.06
				Cryptomonas rostratiformis Skuja	400	0.81
MEL - 0402			Dinophyceae	*Gymnodinium* sp.	7,184	3.35
				Gymnodinium sp.	400	5.65
				Peridinium pusillum (Penard) Lemmermann	600	1.31
			Cyanobacteria	*Aphanothece* sp.	14,368	0.50
				Planktolyngbya limnetica	200	0.04
				Snowella sp	400	0.30
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	21,552	0.53
				Oocystis lacustris Chodat	21,552	0.38
				Dictyosphaerium simplex Sukja	71,840	0.34
				Elakatothrix gelatinosa Willen	107,760	1.52
				Staurodesmus extensus (Andersson) Teiling	200	0.10
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Mougeotia sp.	200	0.83
				Botryococcus braunii Kutzing	200	0.18
				Oocystis gigas Archer	200	0.42
				Monomastix minuta Skuja	21,552	0.61
			Chrysophyceae	Small chrysophyceae	531,616	4.89
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	272,992	17.85
				Chrysococcus sp.	445,408	29.13
				Kephyrion sp.	193,968	2.73
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon bavaricum Imhof	400	1.36
	2	August		*Dinobryon sertularia Ehrenberg*	7,184	1.63
				Dinobryon sertularia Ehrenberg	800	2.71
				Dinobryon sociale Ehrenberg	186,784	42.25
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.89
				Uroglena volvox Ehrenberg	57,472	6.50
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.33
				Chrysochromulina laurentiana Kling	79,024	33.28
				Stichogloea spp.	57,472	2.89
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.33
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	1.98
				Cyclotella ocellata Pant.	7,184	0.72
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Synedra acus Kutzing	2,800	0.29
				Cyclotella michiganiana Skvortzow	14,368	0.27
				Cyclotella bodanica Eulenst.	400	2.82
				Diatoma elongatum Agardh	400	0.02
			Cryptophyceae	*Rhodomonas minuta Skuja*	215,520	27.09
				Cryptomonas erosa Ehrenberg	1,200	1.39
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
			Dinophyceae	*Gymnodinium* sp.	7,184	3.81
				Peridinium pusillum (Penard) Lemmermann	1,000	2.19
			Chlorophyceae	*Chlamydomonas* spp.	3,546	0.08
				Oocystis lacustris Chodat	60,284	1.07
				Dictyosphaerium simplex Sukja	113,475	0.48
				Elakatothrix gelatinosa Willen	3,546	0.06
				Cosmarium sp.	200	0.32
				Spondylosium planum (Wolle) W. and G.S. West	3,546	0.13
				Collodictyon sp	3,546	2.47
MEL - 0403	1	August	Chrysophyceae	Small chrysophyceae	170,213	1.40
				Large chrysophyceae	10,638	1.91
				Chrysochromulina parva Lackey	92,199	6.03
				Chrysococcus sp.	187,943	9.59
				Kephyrion sp.	39,007	0.36
				Dinobryon sertularia Ehrenberg	200	0.40
				Dinobryon sociale Ehrenberg	14,184	3.21
				Chrysolkos skuja (Nauwerck) Willen	3,546	0.09
				Uroglena volvox Ehrenberg	3,546	0.40
				Stichogloea spp.	28,369	1.43
				Salpingoeca frequentissima (Zach.) Lemmermann	85,106	2.40
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,100	3.30
				Tabellaria fenestrata (Lyngbye) Kutzing	4,800	4.12
				Synedra acus Kutzing	400	0.04
				Cyclotella michiganiana Skvortzow	88,653	1.92
				Diatoma elongatum Agardh	100	0.02
			Cryptophyceae	*Cryptomonas erosa Ehrenberg*	100	0.12
				Katablepharis ovalis Skuja	24,823	1.14
			Cyanobacteria	*Aphanothece* sp.	7,184	0.25
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.16
				Sphaerocystis schroeteri Chodat	28,736	1.28
				Dictyosphaerium simplex Sukja	50,288	0.21
				Elakatothrix gelatinosa Willen	28,736	0.41
				Planctonema lauterbornii Schmidle	64,656	8.13
				Cosmarium sp.	200	0.48
				Staurodesmus extensus (Andersson) Teiling	200	0.09
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Small chrysophyceae	272,992	2.81
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	193,968	12.69
				Chrysococcus sp.	344,832	22.55
				Kephyrion boreale Skuja	21,552	2.20
				Kephyrion sp.	64,656	0.59
				*Spiniferomonas sirrata***********	7,184	0.66
				*Spiniferomonas sirrata***********	14,368	1.32
				Mallomonas caudata Ivanov	200	1.07

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0404	1	August	Chrysophyceae	*Mallomonas crassisquama (Asmund) Fott*	800	0.84
				Dinobryon borgei Lemmermann	7,184	0.39
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	400	1.36
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,400	7.12
				Dinobryon sociale Ehrenberg	158,048	35.75
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.18
				Uroglena volvox Ehrenberg	50,288	5.69
				Chrysochromulina laurentiana Kling	79,024	32.22
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.13
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.03
				Rhizosolenia eriense H.L. Smith	14,368	0.91
				Synedra acus Kutzing	3,200	0.35
				Synedra ulna (Nitzsch) Ehrenberg	200	0.48
				Cyclotella michiganiana Skvortzow	50,288	1.23
				Cyclotella bodanica Eulenst.	600	3.72
			Cryptophyceae	*Rhodomonas minuta Skuja*	208,336	26.19
				Cryptomonas erosa Ehrenberg	3,600	4.22
				Cryptomonas reflexa (Marsson) Skuja	800	0.55
			Dinophyceae	*Gymnodinium* sp.	200	3.12
				Peridinium pusillum (Penard) Lemmermann	200	0.48
MEL - 0405	1	August	Cyanobacteria	*Aphanothece* sp.	21,552	0.75
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.16
				Sphaerocystis schroeteri Chodat	79,024	1.23
				Dictyosphaerium simplex Sukja	28,736	0.12
				Elakatothrix gelatinosa Willen	79,024	1.24
				Elakatothrix gelatinosa Willen	21,552	0.34
				Cosmarium sp.	600	1.12
				Staurodesmus extensus (Andersson) Teiling	400	0.19
				Staurodesmus bullardii G.M. Smith	400	1.12
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	800	0.72
				Ankistrodesmus spiralis Lemmermann	7,184	0.40
			Chrysophyceae	Small chrysophyceae	402,304	5.15
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	150,864	9.87
				Chrysococcus sp.	265,808	17.38
				Kephyrion sp.	86,208	0.79
				*Spiniferomonas sirrata***********	21,552	1.88
				Mallomonas crassisquama (Asmund) Fott	200	0.20
				Dinobryon borgei Lemmermann	28,736	1.43
				Dinobryon bavaricum Imhof	50,288	11.38
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	800	2.71
				Dinobryon sociale Ehrenberg	150,864	34.13
				Dinobryon sociale Ehrenberg	200	0.25
				Epiphyxis sp.	7,184	0.48
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.35
				Uroglena volvox Ehrenberg	93,392	10.56
				Chrysochromulina laurentiana Kling	28,736	12.10
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.22
				Pteridomonas sp.	7,184	1.28
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,400	6.18
				Cyclotella ocellata Pant.	7,184	0.55
				Synedra acus Kutzing	200	0.02
				Cyclotella michiganiana Skvortzow	50,288	1.09
				Cyclotella bodanica Eulenst.	800	4.33
				Rhopalodia gibba (Ehrenberg) O. Muller	200	6.94
			Cryptophyceae	*Rhodomonas minuta Skuja*	201,152	25.28
				Cryptomonas erosa Ehrenberg	2,000	2.27
				Cryptomonas reflexa (Marsson) Skuja	200	0.13
			Dinophyceae	*Gymnodinium* sp.	7,184	2.50
				Gymnodinium sp.	200	4.49
				Peridinium pusillum (Penard) Lemmermann	600	1.31
			Chlorophyceae	*Chlamydomonas* spp.	21,552	0.27
				Sphaerocystis schroeteri Chodat	50,288	0.95
				Oocystis lacustris Chodat	21,552	0.51
				Elakatothrix gelatinosa Willen	14,368	0.25
				Planctonema lauterbornii Schmidle	28,736	3.61
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	800	0.38
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0501	1	August		*Mougeotia* sp.	600	2.64
				Botryococcus braunii Kutzing	1,200	1.72
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	581,904	7.45
				Large chrysophyceae	35,920	13.71
				Chrysochromulina parva Lackey	344,832	22.55
				Chrysococcus sp.	474,144	31.01
				Kephyrion sp.	143,680	1.32
				*Spiniferomonas sirrata***********	21,552	2.44
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	1,000	0.99
				Dinobryon borgei Lemmermann	21,552	1.06
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	200	0.25
				Dinobryon sertularia Ehrenberg	1,000	1.99
				Dinobryon sociale Ehrenberg	172,416	39.00
				Epiphyxis sp.	7,184	0.54
				Chrysolkos skuja (Nauwerck) Willen	21,552	1.12
				Uroglena volvox Ehrenberg	122,128	13.81
				Chrysochromulina laurentiana Kling	79,024	34.37
				Stichogloea spp.	43,104	2.17
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,000	7.92
				Cyclotella ocellata Pant.	21,552	1.45
				Synedra acus Kutzing	1,800	0.19
				Cyclotella michiganiana Skvortzow	71,840	1.56
				Cyclotella bodanica Eulenst.	1,800	13.89
			Cryptophyceae	*Rhodomonas minuta Skuja*	481,328	60.50
				Cryptomonas erosa Ehrenberg	12,200	14.23
				Cryptomonas reflexa (Marsson) Skuja	2,800	1.92
				Cryptomonas rostratiformis Skuja	2,600	5.51
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	2,200	22.67
				Peridinium pusillum (Penard) Lemmermann	3,200	8.68
				Peridinium aciculiferum Lemmermann	200	1.81
MEL - 0502	1	August	Cyanobacteria	*Aphanothece* sp.	7,184	0.25
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.27
				Dictyosphaerium simplex Sukja	35,920	0.15
				Elakatothrix gelatinosa Willen	35,920	0.51
				Planctonema lauterbornii Schmidle	35,920	4.52
				Cosmarium sp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.18
			Chrysophyceae	Small chrysophyceae	488,512	6.89
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	107,760	7.05
				Chrysococcus sp.	380,752	22.05
				Kephyrion sp.	64,656	0.67
				*Spiniferomonas sirrata***********	21,552	1.98
				Dinobryon borgei Lemmermann	14,368	0.65
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	114,944	26.00
				Uroglena volvox Ehrenberg	14,368	1.63
				Chrysochromulina laurentiana Kling	57,472	24.99
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.53
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,000	3.50
				Fragilaria crotonensis Kitton	1,200	0.38
				Synedra acus Kutzing	1,800	0.19
				Cyclotella michiganiana Skvortzow	50,288	1.23
				Cyclotella bodanica Eulenst.	800	4.24
			Cryptophyceae	*Rhodomonas minuta Skuja*	251,440	31.61
				Cryptomonas erosa Ehrenberg	7,600	8.75
				Cryptomonas reflexa (Marsson) Skuja	1,400	0.93
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.61
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	1,400	13.18
				Peridinium pusillum (Penard) Lemmermann	1,600	4.04
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.14
				Oocystis lacustris Chodat	43,104	1.06
				Elakatothrix gelatinosa Willen	114,944	1.62
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	200	0.07

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Staurodesmus sp.	200	2.54
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	200	0.18
			Chrysophyceae	Small chrysophyceae	344,832	4.86
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	179,600	11.75
				Chrysococcus sp.	229,888	13.31
				Kephyrion sp.	43,104	0.40
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Dinobryon borgei Lemmermann	21,552	1.06
				Dinobryon sertularia Ehrenberg	28,736	6.50
	2	August		*Dinobryon sertularia Ehrenberg*	1,200	4.07
				Dinobryon sociale Ehrenberg	237,072	53.63
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	79,024	34.37
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.60
				Pteridomonas sp.	21,552	5.30
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,400	6.27
				Synedra acus Kutzing	600	0.06
				Synedra ulna (Nitzsch) Ehrenberg	200	0.81
				Cyclotella michiganiana Skvortzow	64,656	1.58
				Cyclotella bodanica Eulenst.	800	4.24
			Cryptophyceae	*Rhodomonas minuta Skuja*	222,704	27.99
				Cryptomonas erosa Ehrenberg	5,200	5.99
				Cryptomonas reflexa (Marsson) Skuja	1,400	0.93
				Katablepharis ovalis Skuja	7,184	0.51
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	600	5.72
				Peridinium pusillum (Penard) Lemmermann	400	1.01
			Cyanobacteria	*Aphanothece* sp.	35,920	1.83
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.15
				Sphaerocystis schroeteri Chodat	71,840	1.01
				Elakatothrix gelatinosa Willen	21,552	0.37
				Elakatothrix gelatinosa Willen	50,288	3.16
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Staurodesmus paradoxum Meyen	500	2.04
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	517,248	4.24
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	143,680	9.40
				Chrysococcus sp.	208,336	9.29
				Kephyrion sp.	79,024	0.81
				*Spiniferomonas sirrata***********	28,736	3.25
				Mallomonas crassisquama (Asmund) Fott	800	0.84
				Dinobryon borgei Lemmermann	28,736	1.32
				Dinobryon mucronutom Nygaard	14,368	1.81
MEL - 0503	1	August		*Dinobryon bavaricum Imhof*	200	0.25
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	400	0.80
				Dinobryon sociale Ehrenberg	208,336	47.13
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.23
				Uroglena volvox Ehrenberg	71,840	8.13
				Chrysochromulina laurentiana Kling	57,472	24.99
				Bicoeca lacustris Clark	7,184	0.56
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.43
				Pteridomonas sp.	50,288	12.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	2.55
				Tabellaria fenestrata (Lyngbye) Kutzing	600	0.50
				Synedra acus Kutzing	1,400	0.16
				Asterionella formosa Hassall	1,400	0.15
				Cyclotella michiganiana Skvortzow	43,104	1.12
				Cyclotella bodanica Eulenst.	400	2.34
			Cryptophyceae	*Rhodomonas minuta Skuja*	229,888	30.05
				Cryptomonas erosa Ehrenberg	4,000	4.46
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
				Katablepharis ovalis Skuja	14,368	0.93
			Dinophyceae	*Gymnodinium* sp.	800	0.82
				Peridinium pusillum (Penard) Lemmermann	1,000	2.53
			Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.20
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	28,736	0.45
				Planctonema lauterbornii Schmidle	57,472	7.22
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	800	0.30
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Scourfieldia cordiformis Takeda	7,184	0.17
				Botryococcus braunii Kutzing	600	0.42

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0504	1	August	Chrysophyceae	Small chrysophyceae	330,464	6.81
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	172,416	12.69
				Chrysococcus sp.	244,256	17.98
				Kephyrion sp.	57,472	0.90
				*Spiniferomonas sirrata***********	7,184	1.08
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	14,368	0.78
				Dinobryon mucronutom Nygaard	14,368	1.77
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	200	0.68
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	200	1.02
				Dinobryon sociale Ehrenberg	114,944	26.00
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.23
				Uroglena volvox Ehrenberg	107,760	12.19
				Chrysochromulina laurentiana Kling	28,736	11.72
				Stichogloea spp.	57,472	2.89
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.17
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,600	6.55
				Cyclotella ocellata Pant.	35,920	5.14
				Synedra acus Kutzing	1,000	0.08
				Asterionella formosa Hassall	400	0.03
				Cyclotella bodanica Eulenst.	800	5.85
			Cryptophyceae	*Rhodomonas minuta Skuja*	179,600	25.50
				Cryptomonas erosa Ehrenberg	3,800	4.32
				Cryptomonas reflexa (Marsson) Skuja	1,200	3.02
				Cryptomonas rostratiformis Skuja	600	1.19
				Katablepharis ovalis Skuja	7,184	0.51
			Dinophyceae	*Gymnodinium* sp.	400	4.12
				Peridinium pusillum (Penard) Lemmermann	2,600	4.99
	2	August	Cyanobacteria	*Aphanocapsa* sp.	200	0.30
			Chlorophyceae	*Oocystis lacustris Chodat*	43,104	1.22
				Dictyosphaerium simplex Sukja	86,208	0.36
				Elakatothrix gelatinosa Willen	7,184	0.11
				Planctonema lauterbornii Schmidle	43,104	5.42
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	466,960	9.62
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	57,472	4.23
				Chrysococcus sp.	316,096	23.26
				Kephyrion boreale Skuja	7,184	0.66
				Kephyrion sp.	64,656	0.91
				*Spiniferomonas sirrata***********	28,736	4.32
				Mallomonas crassisquama (Asmund) Fott	600	0.62
				Dinobryon borgei Lemmermann	14,368	0.78
				Dinobryon mucronutom Nygaard	21,552	2.65
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	200	0.68
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	800	4.07
				Dinobryon sociale Ehrenberg	122,128	27.63
				Epiphyxis sp.	7,184	0.56
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	193,968	21.94
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	57,472	23.43
				Stichogloea spp.	114,944	5.78
				Bicoeca lacustris Clark	7,184	0.56
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.17
				Pteridomonas sp.	14,368	3.42
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	5,000	9.09
				Cyclotella ocellata Pant.	64,656	9.25
				Tabellaria fenestrata (Lyngbye) Kutzing	800	0.62
				Synedra acus Kutzing	200	0.02
				Asterionella formosa Hassall	800	0.09
				Cyclotella bodanica Eulenst.	1,200	8.78
			Cryptophyceae	*Rhodomonas minuta Skuja*	165,232	23.46
				Cryptomonas erosa Ehrenberg	6,200	7.04
				Cryptomonas reflexa (Marsson) Skuja	2,200	1.46
				Cryptomonas rostratiformis Skuja	1,000	1.98
				Katablepharis ovalis Skuja	7,184	0.51
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	800	8.24

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Peridinium pusillum (Penard) Lemmermann	1,000	1.92
MEL - 0505	1	August	Cyanobacteria	*Aphanothece* sp.	21,552	1.08
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.18
				Sphaerocystis schroeteri Chodat	57,472	1.08
				Oocystis lacustris Chodat	43,104	1.03
				Planctonema lauterbornii Schmidle	64,656	8.13
				Planctonema lauterbornii Schmidle	57,472	7.94
				Cosmarium sp.	200	0.07
				Cosmarium sp.	200	0.28
				Euastrum spp.	200	0.37
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	200	0.29
				Monomastix minuta Skuja	7,184	0.23
			Chrysophyceae	Small chrysophyceae	373,568	5.27
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	79,024	5.17
				Chrysococcus sp.	158,048	10.34
				Kephyrion sp.	57,472	0.53
				*Spiniferomonas sirrata***********	7,184	0.81
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	800	0.78
				Dinobryon borgei Lemmermann	14,368	0.66
				Dinobryon mucronutom Nygaard	7,184	0.86
				Dinobryon bavaricum Imhof	143,680	32.50
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon sertularia Ehrenberg	43,104	9.75
				Dinobryon sertularia Ehrenberg	400	0.80
				Uroglena volvox Ehrenberg	129,312	14.63
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	35,920	15.62
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.18
				Pteridomonas sp.	21,552	5.30
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	7.55
				Cyclotella ocellata Pant.	21,552	1.45
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.15
				Synedra acus Kutzing	600	0.06
				Cyclotella michiganiana Skvortzow	35,920	0.69
				Cyclotella bodanica Eulenst.	600	4.63
			Cryptophyceae	*Rhodomonas minuta Skuja*	272,992	34.32
				Cryptomonas erosa Ehrenberg	5,400	6.05
				Cryptomonas reflexa (Marsson) Skuja	2,400	1.59
				Cryptomonas rostratiformis Skuja	1,200	2.46
			Dinophyceae	*Gymnodinium* sp.	1,400	10.78
				Peridinium pusillum (Penard) Lemmermann	1,800	4.55

Notes: cells/L=cells per litre; mg/m^3=milligrams per cubic metre

Table 7D-5: Raw Phytoplankton Data, 2017

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL - 0101	1	July	Cyanobacteria	*Chroococcus limneticus Lemmermann*	28,736	0.70
				Snowella sp.	200	0.10
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.15
				Chlamydomonas spp.	7,184	0.12
				Sphaerocystis schroeteri Chodat	21,552	0.48
				Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova	7,184	0.50
				Planctonema lauterbornii Schmidle	35,920	9.03
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.72
				Staurodesmus paradoxum Meyen	200	0.37
				Botryococcus braunii Kutzing	200	0.10
			Chrysophyceae	Small chrysophyceae	517,248	6.62
				Large chrysophyceae	158,048	28.39
				Chrysochromulina parva Lackey	797,424	52.15
				Chrysococcus sp.	287,360	18.79
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	64,656	1.22
				*Spiniferomonas sirrata***********	43,104	3.55
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Dinobryon borgei Lemmermann	57,472	2.95
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.55
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	4,800	9.56
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	107,760	24.38
				Dinobryon sociale Ehrenberg	200	0.25
				Epiphyxis sp.	57,472	4.48
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	1,796,000	203.13
				Chrysochromulina laurentiana Kling	93,392	36.85
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.19
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.82
				Rhizosolenia eriense H.L. Smith	193,968	15.09
				Tabellaria fenestrata (Lyngbye) Kutzing	7,200	5.97
				Synedra acus Kutzing	9,000	1.04
				Asterionella formosa Hassall	8,000	0.80
				Cyclotella michiganiana Skvortzow	64,656	1.58
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	11.49
				Cryptomonas erosa Ehrenberg	6,200	7.48
				Cryptomonas reflexa (Marsson) Skuja	600	0.44
				Cryptomonas rostratiformis Skuja	800	1.81
				Katablepharis ovalis Skuja	35,920	2.03
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	28,736	10.59
				Gymnodinium sp.	5,200	44.09
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	4,600	9.87
				Peridinium aciculiferum Lemmermann	24,000	16.69
				Peridinium aciculiferum Lemmermann	1,000	9.05
MEL - 0102	1	July	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.11
				Oocystis lacustris Chodat	43,104	1.22
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	71,840	18.05
				Staurodesmus paradoxum Meyen	200	0.56
				Botryococcus braunii Kutzing	600	0.31
				Ankistrodesmus spiralis Lemmermann	7,184	0.25
			Chrysophyceae	Small chrysophyceae	531,616	6.80
				Large chrysophyceae	71,840	12.90
				Chrysochromulina parva Lackey	790,240	51.68
				Chrysococcus sp.	452,592	29.60
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion sp.	57,472	1.08
				*Spiniferomonas sirrata***********	50,288	4.14
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	21,552	1.11
				Dinobryon mucronutom Nygaard	7,184	0.85
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	7,200	14.34
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.09
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	107,760	24.38
				Dinobryon sociale Ehrenberg	1,400	1.75
				Epiphyxis sp.	21,552	1.68
				Chrysolkos skuja (Nauwerck) Willen	35,920	1.15

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Uroglena volvox Ehrenberg	1,084,784	122.69
				Chrysochromulina laurentiana Kling	21,552	8.50
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.16
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	600	1.09
				Rhizosolenia eriense H.L. Smith	301,728	23.47
				Fragilaria crotonensis Kitton	32,000	11.13
				Synedra acus Kutzing	9,000	1.04
				Asterionella formosa Hassall	7,400	0.73
				Cyclotella michiganiana Skvortzow	50,288	1.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	129,312	12.17
				Cryptomonas erosa Ehrenberg	4,200	4.98
				Cryptomonas reflexa (Marsson) Skuja	1,400	1.03
				Cryptomonas rostratiformis Skuja	200	0.45
				Katablepharis ovalis Skuja	71,840	4.06
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	1,800	28.08
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	3,800	8.15
				Peridinium aciculiferum Lemmermann	1,400	12.67
			Chlorophyceae	*Oocystis lacustris Chodat*	21,552	1.08
				Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova	14,368	1.07
				Planctonema lauterbornii Schmidle	28,736	7.22
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	1,200	0.49
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.10
				Ankistrodesmus spiralis Lemmermann	7,184	0.34
			Chrysophyceae	Small chrysophyceae	438,224	5.61
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	567,536	37.12
				Chrysococcus sp.	136,496	8.93
				Kephyrion sp.	150,864	2.59
				*Spiniferomonas sirrata***********	28,736	2.37
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	28,736	1.47
				Dinobryon bavaricum Imhof	79,024	17.88
				Dinobryon bavaricum Imhof	8,200	16.33
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	35,920	14.38
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.09
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	1,000	3.39
				Dinobryon sociale Ehrenberg	79,024	17.88
				Dinobryon sociale Ehrenberg	2,200	2.75
MEL-0103	1	July		*Epiphyxis* sp.	14,368	1.25
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.35
				Ochromonas sp.	7,184	0.54
				Uroglena volvox Ehrenberg	1,831,920	207.19
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	28,736	11.34
				Stichogloea spp.	28,736	1.45
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	400	0.73
				Rhizosolenia eriense H.L. Smith	172,416	13.41
				Tabellaria fenestrata (Lyngbye) Kutzing	8,800	7.30
				Tabellaria flocculsa (Roth) Kutzing	800	1.03
				Fragilaria crotonensis Kitton	20,200	7.02
				Synedra acus Kutzing	600	0.06
				Synedra ulna (Nitzsch) Ehrenberg	400	0.98
				Asterionella formosa Hassall	3,400	0.34
				Cyclotella michiganiana Skvortzow	86,208	1.44
			Cryptophyceae	*Rhodomonas minuta Skuja*	150,864	14.80
				Cryptomonas erosa Ehrenberg	3,200	3.86
				Cryptomonas reflexa (Marsson) Skuja	400	0.27
				Cryptomonas rostratiformis Skuja	1,600	0.36
				Katablepharis ovalis Skuja	64,656	3.65
			Dinophyceae	*Gymnodinium* sp.	14,368	4.81
				Gymnodinium sp.	2,800	23.74
				Peridinium pusillum (Penard) Lemmermann	4,800	10.29
				Peridinium aciculiferum Lemmermann	1,400	12.67
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.15
				Chlamydomonas spp.	7,184	0.17
				Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova	14,368	1.07
				Planctonema lauterbornii Schmidle	14,368	3.61
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	625,008	8.00
				Large chrysophyceae	28,736	5.16

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0103	2	July	Chrysophyceae	*Chrysochromulina parva Lackey*	459,776	30.07
				Chrysococcus sp.	158,048	10.34
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	122,128	2.10
				*Spiniferomonas sirrata***********	14,368	1.18
				Mallomonas caudata Ivanov	200	1.07
				Dinobryon borgei Lemmermann	43,104	2.21
				Dinobryon bavaricum Imhof	100,576	22.75
				Dinobryon bavaricum Imhof	7,000	13.94
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	21,552	8.63
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	800	2.18
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	136,496	30.88
				Dinobryon sociale Ehrenberg	2,000	2.50
				Epiphyxis sp.	21,552	1.88
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.88
				Uroglena volvox Ehrenberg	1,731,344	195.82
				Chrysochromulina laurentiana Kling	50,288	19.84
				Stichogloea spp.	14,368	0.72
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	400	0.73
				Cyclotella ocellata Pant.	14,368	0.97
				Rhizosolenia eriense H.L. Smith	150,864	11.74
				Tabellaria fenestrata (Lyngbye) Kutzing	5,400	4.48
				Tabellaria flocculsa (Roth) Kutzing	600	0.77
				Fragilaria crotonensis Kitton	22,200	7.72
				Synedra acus Kutzing	8,200	0.86
				Asterionella formosa Hassall	6,000	0.60
				Cyclotella michiganiana Skvortzow	129,312	2.16
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	10.57
				Cryptomonas erosa Ehrenberg	4,400	5.31
				Cryptomonas reflexa (Marsson) Skuja	400	0.29
				Cryptomonas rostratiformis Skuja	600	1.35
				Katablepharis ovalis Skuja	50,288	2.84
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	2,600	22.05
				Peridinium pusillum (Penard) Lemmermann	6,400	13.73
				Peridinium aciculiferum Lemmermann	400	3.62
MEL-0104	1	July	Cyanobacteria	*Snowella* sp	200	0.10
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.17
				Dictyosphaerium simplex Sukja	86,208	0.41
				Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova	7,184	0.54
				Planctonema lauterbornii Schmidle	79,024	19.86
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
			Chrysophyceae	Small chrysophyceae	387,936	4.97
				Large chrysophyceae	100,576	18.06
				Chrysochromulina parva Lackey	811,792	53.09
				Chrysococcus sp.	193,968	12.69
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	114,944	1.98
				*Spiniferomonas sirrata***********	28,736	2.64
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	64,656	3.32
				Dinobryon bavaricum Imhof	57,472	13.00
				Dinobryon bavaricum Imhof	7,200	14.34
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	2.88
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	165,232	37.38
				Dinobryon sociale Ehrenberg	1,400	1.75
				Epiphyxis sp.	64,656	4.93
				Chrysolkos skuja (Nauwerck) Willen	35,920	1.04
				Uroglena volvox Ehrenberg	1,558,928	176.31
				Chrysochromulina laurentiana Kling	122,128	48.19
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.91
				Rhizosolenia eriense H.L. Smith	215,520	16.77
				Tabellaria fenestrata (Lyngbye) Kutzing	5,400	4.48
				Tabellaria flocculsa (Roth) Kutzing	400	0.53
				Fragilaria crotonensis Kitton	23,200	8.07
				Synedra acus Kutzing	3,600	0.38
				Synedra ulna (Nitzsch) Ehrenberg	200	0.48
				Asterionella formosa Hassall	8,400	0.84
				Cyclotella michiganiana Skvortzow	57,472	1.10
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	6.34
				Cryptomonas erosa Ehrenberg	5,800	7.00

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Cryptomonas ovata Ehrenberg*	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.66
				Cryptomonas rostratiformis Skuja	1,400	2.87
				Katablepharis ovalis Skuja	71,840	4.06
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	3,000	25.44
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	4,600	9.87
				Peridinium aciculiferum Lemmermann	600	5.43
MEL - 0105	1	July	Cyanobacteria	*Aphanocapsa* sp.	200	0.24
				Snowella sp	400	0.30
			Chlorophyceae	*Dictyosphaerium simplex Sukja*	71,840	0.34
				Monoraphidium komarkovae (Nyg.) Komarkova-Legnerova	14,368	1.00
				Planctonema lauterbornii Schmidle	57,472	14.44
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	610,640	7.82
				Large chrysophyceae	50,288	9.03
				Chrysochromulina parva Lackey	639,376	41.82
				Chrysococcus sp.	193,968	12.69
				Chrysostephanospaera globulifera Scherffel	14,368	4.78
				Kephyrion sp.	50,288	0.86
				*Spiniferomonas sirrata***********	50,288	4.38
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Dinobryon borgei Lemmermann	50,288	2.58
				Dinobryon bavaricum Imhof	79,024	17.88
				Dinobryon bavaricum Imhof	3,600	7.17
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	136,496	30.88
				Dinobryon sociale Ehrenberg	1,200	1.50
				Epiphyxis sp.	7,184	0.54
				Chrysolkos skuja (Nauwerck) Willen	100,576	3.02
				Uroglena volvox Ehrenberg	1,587,664	179.56
				Chrysochromulina laurentiana Kling	64,656	25.51
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	600	1.09
				Cyclotella ocellata Pant.	21,552	2.17
				Rhizosolenia eriense H.L. Smith	258,624	20.12
				Tabellaria flocculsa (Roth) Kutzing	400	0.51
				Fragilaria crotonensis Kitton	20,000	6.87
				Synedra acus Kutzing	4,600	0.48
				Asterionella formosa Hassall	3,200	0.31
				Cyclotella michiganiana Skvortzow	43,104	0.82
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	7.05
				Cryptomonas erosa Ehrenberg	2,400	2.90
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.06
				Cryptomonas rostratiformis Skuja	400	0.82
				Katablepharis ovalis Skuja	43,104	2.44
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	3,000	26.35
				Peridinium willei Huitfeldt-Kaas	200	5.30
				Peridinium pusillum (Penard) Lemmermann	2,800	6.01
				Peridinium aciculiferum Lemmermann	600	5.43
MEL-0301	1	July	Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.20
				Paulschulzia pseudovolvox (Schulz and Teiling) Skuja	200	0.70
				Planctonema lauterbornii Schmidle	14,368	3.61
				Staurodesmus paradoxum Meyen	200	0.82
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	244,256	1.56
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	359,200	23.49
				Chrysococcus sp.	229,888	15.03
				Chrysostephanospaera globulifera Scherffel	14,368	5.13
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	136,496	2.35
				*Spiniferomonas sirrata***********	14,368	1.25
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	86,208	4.42
				Dinobryon mucronutom Nygaard	21,552	2.77
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	1,400	2.79
				Dinobryon sociale Ehrenberg	107,760	24.38
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	57,472	1.49

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Uroglena volvox Ehrenberg	488,512	55.25
				Chrysochromulina laurentiana Kling	64,656	25.51
				Stichogloea spp.	14,368	0.72
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	2.18
				Cyclotella ocellata Pant.	14,368	1.44
				Rhizosolenia eriense H.L. Smith	21,552	1.68
				Fragilaria crotonensis Kitton	400	0.13
				Synedra acus Kutzing	1,000	0.10
				Cyclotella michiganiana Skvortzow	57,472	1.10
				Cyclotella bodanica Eulenst.	200	1.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	7.18
				Cryptomonas erosa Ehrenberg	1,800	2.20
				Cryptomonas reflexa (Marsson) Skuja	200	0.14
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	7,184	0.41
			Dinophyceae	*Gymnodinium* sp.	1,000	5.73
				Peridinium pusillum (Penard) Lemmermann	400	0.96
			Chlorophyceae	*Oocystis lacustris Chodat*	14,368	0.41
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	7,184	1.81
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	400	0.15
				Staurodesmus paradoxum Meyen	200	0.58
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	280,176	1.79
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	258,624	16.91
				Chrysococcus sp.	222,704	14.56
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	150,864	2.59
				*Spiniferomonas sirrata***********	7,184	0.63
				Dinobryon borgei Lemmermann	71,840	3.69
				Dinobryon mucronutom Nygaard	7,184	0.93
				Dinobryon bavaricum Imhof	400	0.50
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	100,576	22.75
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	71,840	1.86
				Uroglena volvox Ehrenberg	373,568	42.25
				Chrysochromulina laurentiana Kling	50,288	19.84
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.19
MEL-0301	2	July	Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.45
				Cyclotella ocellata Pant.	28,736	2.89
				Rhizosolenia eriense H.L. Smith	43,104	3.35
				Tabellaria fenestrata (Lyngbye) Kutzing	1,600	1.24
				Synedra acus Kutzing	400	0.04
				Cyclotella michiganiana Skvortzow	43,104	0.82
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	5.87
				Cryptomonas erosa Ehrenberg	2,600	3.18
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	21,552	1.22
			Dinophyceae	*Gymnodinium* sp.	2,800	16.04
				Peridinium pusillum (Penard) Lemmermann	600	1.44
			Chlorophyceae	*Oocystis lacustris Chodat*	21,552	1.08
				Paulschulzia pseudovolvox (Schulz and Teiling) Skuja	200	0.70
				Elakatothrix gelatinosa Willen	14,368	0.25
				Planctonema lauterbornii Schmidle	7,184	1.63
				Cosmarium sp.	200	1.14
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
			Chrysophyceae	*Small chrysophyceae*	301,728	2.17
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	208,336	13.63
				Chrysococcus sp.	265,808	17.38
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	107,760	1.68
				Dinobryon borgei Lemmermann	93,392	4.79
				Dinobryon mucronutom Nygaard	7,184	0.93
				Dinobryon bavaricum Imhof	400	0.50
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,600	5.42
				Dinobryon sociale Ehrenberg	100,576	22.75
MEL-0302	1	July		*Chrysolkos skuja (Nauwerck) Willen*	71,840	1.76
				Uroglena volvox Ehrenberg	524,432	59.31
				Chrysochromulina laurentiana Kling	43,104	17.01

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	200	0.36
				Cyclotella ocellata Pant.	21,552	2.17
				Rhizosolenia eriense H.L. Smith	28,736	2.24
				Tabellaria fenestrata (Lyngbye) Kutzing	4,800	3.80
				Fragilaria crotonensis Kitton	600	0.20
				Synedra acus Kutzing	800	0.08
				Asterionella formosa Hassall	2,400	0.24
				Cyclotella michiganiana Skvortzow	35,920	0.83
			Cryptophyceae	*Rhodomonas minuta Skuja*	143,680	13.05
				Cryptomonas erosa Ehrenberg	1,400	1.70
				Cryptomonas rostratiformis Skuja	200	0.45
				Katablepharis ovalis Skuja	7,184	0.42
			Dinophyceae	*Gymnodinium* sp.	1,000	6.37
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	2,000	4.37
				Peridinium aciculiferum Lemmermann	600	5.43
			Cyanobacteria	*Planktolyngbya limnetica*	200	0.03
				Snowella sp	400	0.31
			Chlorophyceae	*Oocystis lacustris Chodat*	14,368	0.37
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	7,184	1.63
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Mougeotia sp.	400	1.32
			Chrysophyceae	Small chrysophyceae	280,176	1.79
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	402,304	26.31
				Chrysococcus sp.	244,256	15.97
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion boreale Skuja	21,552	2.69
				Kephyrion sp.	158,048	2.72
				*Spiniferomonas sirrata***********	7,184	0.66
				Dinobryon borgei Lemmermann	71,840	5.15
				Dinobryon bavaricum Imhof	600	2.03
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	150,864	34.13
				Chrysolkos skuja (Nauwerck) Willen	93,392	2.47
				Uroglena volvox Ehrenberg	675,296	76.38
				Chrysochromulina laurentiana Kling	35,920	14.17
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.37
MEL-0303	1	July	Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.57
				Cyclotella ocellata Pant.	28,736	3.23
				Rhizosolenia eriense H.L. Smith	21,552	1.37
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.15
				Fragilaria crotonensis Kitton	800	0.27
				Synedra acus Kutzing	800	0.08
				Cyclotella michiganiana Skvortzow	79,024	1.51
			Cryptophyceae	*Rhodomonas minuta Skuja*	129,312	11.74
				Cryptomonas erosa Ehrenberg	1,400	1.71
				Cryptomonas reflexa (Marsson) Skuja	400	0.28
				Cryptomonas rostratiformis Skuja	1,000	2.12
				Katablepharis ovalis Skuja	7,184	0.41
			Dinophyceae	*Gymnodinium* sp.	1,200	7.25
				Peridinium willei Huitfeldt-Kaas	200	4.89
				Peridinium pusillum (Penard) Lemmermann	1,200	2.87
			Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.19
				Planctonema lauterbornii Schmidle	7,184	1.63
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	600	0.22
				Staurodesmus paradoxum Meyen	200	0.82
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	600	0.42
			Chrysophyceae	Small chrysophyceae	466,960	2.99
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	452,592	29.60
				Chrysococcus sp.	272,992	17.85
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	122,128	2.52
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	100,576	4.86
				Dinobryon mucronutom Nygaard	14,368	1.81
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	57,472	13.00
MEL-0304	1	July		*Chrysolkos skuja (Nauwerck) Willen*	93,392	2.47

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL 0304	1	July		*Uroglena volvox Ehrenberg*	560,352	63.38
				Uroglena volvox Ehrenberg	200	2.32
				Chrysochromulina laurentiana Kling	71,840	28.35
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.74
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.45
				Rhizosolenia eriense H.L. Smith	35,920	2.28
				Fragilaria crotonensis Kitton	600	0.20
				Synedra acus Kutzing	800	0.09
				Asterionella formosa Hassall	800	0.08
				Cyclotella michiganiana Skvortzow	28,736	0.55
			Cryptophyceae	*Rhodomonas minuta Skuja*	50,288	4.57
				Cryptomonas erosa Ehrenberg	1,800	2.19
				Cryptomonas reflexa (Marsson) Skuja	600	0.42
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	7,184	0.41
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	1,600	8.10
				Peridinium pusillum (Penard) Lemmermann	2,000	4.97
				Peridinium aciculiferum Lemmermann	200	1.81
MEL - 0305	1	July	Cyanobacteria	*Planktolyngbya limnetica*	200	0.04
			Chlorophyceae	*Elakatothrix gelatinosa Willen*	14,368	0.25
				Cosmarium sp.	600	0.84
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	474,144	3.03
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	272,992	17.85
				Chrysococcus sp.	165,232	10.81
				Kephyrion sp.	28,736	0.45
				*Spiniferomonas sirrata***********	7,184	0.66
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	93,392	4.79
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	2,200	11.19
				Dinobryon sociale Ehrenberg	107,760	24.38
				Chrysolkos skuja (Nauwerck) Willen	71,840	1.90
				Uroglena volvox Ehrenberg	754,320	85.31
				Chrysochromulina laurentiana Kling	79,024	31.18
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	200	0.31
				Cyclotella ocellata Pant.	14,368	1.92
				Rhizosolenia eriense H.L. Smith	71,840	4.57
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	1,400	0.15
				Cyclotella michiganiana Skvortzow	57,472	1.10
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	6.52
				Cryptomonas erosa Ehrenberg	800	0.97
				Cryptomonas reflexa (Marsson) Skuja	400	0.28
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	35,920	2.03
			Dinophyceae	*Gymnodinium* sp.	600	3.35
				Peridinium pusillum (Penard) Lemmermann	2,400	5.54
			Chlorophyceae	*Pyramidomonas tetrarhynchus Schmarda*	200	0.11
				Elakatothrix gelatinosa Willen	21,552	0.37
				Planctonema lauterbornii Schmidle	21,552	5.42
				Cosmarium sp.	200	2.23
				Euastrum spp.	600	1.12
				Staurodesmus extensus (Andersson) Teiling	600	0.25
				Staurodesmus paradoxum Meyen	200	0.55
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	352,016	4.51
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	193,968	12.69
				Chrysococcus sp.	215,520	14.10
				Kephyrion sp.	100,576	1.73
				*Spiniferomonas sirrata***********	14,368	1.79
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	28,736	1.47
				Dinobryon mucronutom Nygaard	43,104	5.64
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	2,400	8.14
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	14,368	5.90
				Dinobryon sertularia Ehrenberg	43,104	9.75

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0201	1	July		*Dinobryon sertularia Ehrenberg*	1,000	5.09
				Dinobryon sociale Ehrenberg	114,944	26.00
				Dinobryon sociale Ehrenberg	200	0.40
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	531,616	60.13
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	0.93
				Chrysolykos anulatus	79,024	31.18
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	2.20
				Cyclotella ocellata Pant.	7,184	0.53
				Rhizosolenia eriense H.L. Smith	35,920	2.79
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.17
				Fragilaria crotonensis Kitton	800	0.26
				Synedra acus Kutzing	3,400	0.36
				Asterionella formosa Hassall	1,200	0.12
				Cyclotella michiganiana Skvortzow	100,576	1.92
			Cryptophyceae	*Rhodomonas minuta Skuja*	179,600	14.10
				Cryptomonas erosa Ehrenberg	2,000	2.46
				Cryptomonas rostratiformis Skuja	400	0.88
				Katablepharis ovalis Skuja	14,368	0.81
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	2,600	17.00
				Peridinium pusillum (Penard) Lemmermann	2,600	5.58
MEL-0202	1	July	Chlorophyceae	*Elakatothrix gelatinosa Willen*	21,552	0.37
				Planctonema lauterbornii Schmidle	50,288	12.64
				Cosmarium sp.	200	0.28
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	800	0.29
				Mougeotia sp.	200	0.41
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	545,984	6.99
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	387,936	25.37
				Chrysococcus sp.	193,968	12.69
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	129,312	2.22
				*Spiniferomonas sirrata***********	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	43,104	2.21
				Dinobryon mucronutom Nygaard	14,368	1.88
				Dinobryon bavaricum Imhof	50,288	11.38
				Dinobryon bavaricum Imhof	1,800	6.10
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.55
				Dinobryon sertularia Ehrenberg	43,104	9.75
				Dinobryon sertularia Ehrenberg	3,000	15.26
				Dinobryon sociale Ehrenberg	100,576	22.75
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.22
				Uroglena volvox Ehrenberg	790,240	89.38
				Chrysochromulina laurentiana Kling	93,392	36.85
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.88
				Cyclotella ocellata Pant.	7,184	0.53
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Tabellaria flocculsa (Roth) Kutzing	400	0.53
				Fragilaria crotonensis Kitton	1,600	0.53
				Synedra acus Kutzing	1,600	0.17
				Asterionella formosa Hassall	1,600	0.16
				Cyclotella michiganiana Skvortzow	28,736	0.55
			Cryptophyceae	*Rhodomonas minuta Skuja*	93,392	7.33
				Cryptomonas erosa Ehrenberg	1,800	2.22
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.66
				Cryptomonas rostratiformis Skuja	400	0.85
				Katablepharis ovalis Skuja	14,368	0.81
			Dinophyceae	*Gymnodinium* sp.	7,184	2.31
				Gymnodinium sp.	600	4.18
				Peridinium pusillum (Penard) Lemmermann	1,600	3.43
			Cyanobacteria	*Planktolyngbya limnetica*	21,552	5.42
			Chlorophyceae	*Oocystis lacustris Chodat*	21,552	0.61
				Dictyosphaerium simplex Sukja	14,368	0.06
				Crucigenia quadrata Morr.	28,736	0.32
				Elakatothrix gelatinosa Willen	57,472	0.99
				Staurodesmus extensus (Andersson) Teiling	800	0.29
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	452,592	5.79

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0203	1	July	Chrysophyceae	Large chrysophyceae	258,624	46.45
				Chrysochromulina parva Lackey	459,776	30.07
				Chrysococcus sp.	344,832	22.55
				Kephyrion sp.	71,840	1.24
				Mallomonas caudata Ivanov	200	1.07
				Dinobryon borgei Lemmermann	50,288	2.58
				Dinobryon mucronutom Nygaard	71,840	9.03
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	2,200	4.38
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.09
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	2,800	9.49
				Dinobryon sociale Ehrenberg	100,576	22.75
				Chrysolkos skuja (Nauwerck) Willen	43,104	1.29
				Uroglena volvox Ehrenberg	847,712	95.88
				Chrysochromulina laurentiana Kling	129,312	51.03
				Stichogloea spp.	71,840	3.61
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.88
				Cyclotella ocellata Pant.	14,368	1.56
				Rhizosolenia eriense H.L. Smith	35,920	2.79
				Fragilaria crotonensis Kitton	2,000	0.66
				Synedra acus Kutzing	1,400	0.15
				Asterionella formosa Hassall	2,400	0.24
				Cyclotella michiganiana Skvortzow	14,368	0.27
			Cryptophyceae	*Rhodomonas minuta Skuja*	136,496	10.71
				Cryptomonas erosa Ehrenberg	1,600	1.97
				Cryptomonas reflexa (Marsson) Skuja	600	0.40
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	21,552	1.22
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	3,800	26.49
				Peridinium pusillum (Penard) Lemmermann	3,800	8.15
				Peridinium aciculiferum Lemmermann	200	1.81
MEL-0204	1	July	Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.17
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	28,736	7.22
				Staurodesmus extensus (Andersson) Teiling	1,200	0.46
				Staurodesmus paradoxum Meyen	200	0.22
				Botryococcus braunii Kutzing	200	0.14
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	445,408	5.70
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	538,800	35.24
				Chrysococcus sp.	222,704	14.56
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	122,128	2.10
				*Spiniferomonas sirrata***********	28,736	3.41
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	35,920	1.52
				Dinobryon mucronutom Nygaard	7,184	0.85
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	1,200	2.39
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.55
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	107,760	24.38
				Epiphyxis sp.	7,184	0.55
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	725,584	82.06
				Chrysochromulina laurentiana Kling	86,208	34.02
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	7,184	0.22
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	2.83
				Cyclotella ocellata Pant.	35,920	3.89
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Tabellaria fenestrata (Lyngbye) Kutzing	600	0.50
				Fragilaria crotonensis Kitton	1,400	0.47
				Synedra acus Kutzing	1,600	0.17
				Asterionella formosa Hassall	2,800	0.28
				Cyclotella michiganiana Skvortzow	14,368	0.27
			Cryptophyceae	*Rhodomonas minuta Skuja*	86,208	6.77
				Cryptomonas erosa Ehrenberg	1,800	2.22
				Cryptomonas reflexa (Marsson) Skuja	200	0.13
				Cryptomonas rostratiformis Skuja	200	0.45
				Katablepharis ovalis Skuja	21,552	1.22

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Dinophyceae	*Gymnodinium* sp.	1,200	11.04
				Peridinium pusillum (Penard) Lemmermann	2,200	4.72
MEL-0205	1	July	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	14,368	0.48
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	28,736	7.22
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	1,000	0.38
				Staurodesmus paradoxum Meyen	400	1.63
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.10
				Oocystis gigas Archer	800	1.93
			Chrysophyceae	Small chrysophyceae	459,776	5.89
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	387,936	25.37
				Chrysococcus sp.	215,520	14.10
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	86,208	1.48
				*Spiniferomonas sirrata***********	14,368	1.32
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	21,552	1.11
				Dinobryon mucronutom Nygaard	43,104	5.64
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.09
				Dinobryon sertularia Ehrenberg	43,104	9.75
				Dinobryon sertularia Ehrenberg	1,600	5.42
				Dinobryon sociale Ehrenberg	93,392	21.13
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.88
				Uroglena volvox Ehrenberg	653,744	73.94
				Chrysochromulina laurentiana Kling	100,576	39.69
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.43
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,000	3.14
				Cyclotella ocellata Pant.	7,184	0.75
				Rhizosolenia eriense H.L. Smith	35,920	2.79
				Tabellaria fenestrata (Lyngbye) Kutzing	3,200	2.62
				Fragilaria crotonensis Kitton	1,600	0.53
				Synedra acus Kutzing	1,600	0.17
				Asterionella formosa Hassall	2,000	0.20
				Cyclotella michiganiana Skvortzow	71,840	1.66
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	6.27
				Cryptomonas erosa Ehrenberg	1,800	2.22
				Cryptomonas rostratiformis Skuja	200	0.45
				Katablepharis ovalis Skuja	7,184	0.41
			Dinophyceae	*Gymnodinium* sp.	1,400	12.88
				Peridinium pusillum (Penard) Lemmermann	1,000	2.14
MEL-0205	2	July	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.24
				Sphaerocystis schroeteri Chodat	28,736	0.96
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	28,736	0.50
				Planctonema lauterbornii Schmidle	14,368	3.61
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	600	0.23
				Oocystis gigas Archer	600	1.45
			Chrysophyceae	Small chrysophyceae	567,536	7.26
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	452,592	29.60
				Chrysococcus sp.	251,440	16.44
				Chrysostephanospaera globulifera Scherffel	14,368	3.85
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	64,656	1.11
				*Spiniferomonas sirrata***********	35,920	3.30
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	43,104	2.21
				Dinobryon mucronutom Nygaard	43,104	5.64
				Dinobryon bavaricum Imhof	28,736	6.50
				Dinobryon bavaricum Imhof	64,656	14.63
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	800	2.18
				Dinobryon sertularia Ehrenberg	2,400	8.14
				Dinobryon sociale Ehrenberg	71,840	16.25
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.35
				Uroglena volvox Ehrenberg	725,584	82.06
				Chrysochromulina laurentiana Kling	64,656	25.51
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.08
			Cryptophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.88
				Rhizosolenia eriense H.L. Smith	28,736	2.24

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria fenestrata (Lyngbye) Kutzing*	6,200	5.08
				Fragilaria crotonensis Kitton	400	0.13
				Synedra acus Kutzing	2,000	0.21
				Asterionella formosa Hassall	2,800	0.28
				Cyclotella michiganiana Skvortzow	43,104	1.00
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	3.76
				Cryptomonas erosa Ehrenberg	1,200	1.48
				Cryptomonas rostratiformis Skuja	400	0.90
				Katablepharis ovalis Skuja	7,184	0.41
			Dinophyceae	*Gymnodinium* sp.	2,200	20.25
				Peridinium pusillum (Penard) Lemmermann	1,000	2.14
			Cyanobacteria	*Snowella* sp	200	0.11
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.72
				Pediastrum duplex Meyen	200	0.85
				Oocystis lacustris Chodat	21,552	0.56
				Elakatothrix gelatinosa Willen	129,312	2.24
				Planctonema lauterbornii Schmidle	79,024	17.88
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.18
				Ankistrodesmus spiralis Lemmermann	7,184	0.39
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	423,856	1.78
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	251,440	16.44
				Chrysococcus sp.	632,192	41.35
				Kephyrion boreale Skuja	28,736	3.41
				Kephyrion sp.	86,208	1.10
				*Spiniferomonas sirrata***********	7,184	1.08
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	114,944	26.00
				Dinobryon bavaricum Imhof	1,000	1.25
MEL-0101	1	August		*Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger*	7,184	2.80
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.84
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.23
				Uroglena volvox Ehrenberg	114,944	13.00
				Chrysochromulina laurentiana Kling	79,024	31.18
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.69
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.88
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Tabellaria fenestrata (Lyngbye) Kutzing	8,000	11.13
				Fragilaria crotonensis Kitton	10,800	3.76
				Synedra acus Kutzing	4,200	0.48
				Asterionella formosa Hassall	5,600	0.56
				Cyclotella michiganiana Skvortzow	64,656	1.58
			Cryptophyceae	*Rhodomonas minuta Skuja*	165,232	24.92
				Cryptomonas erosa Ehrenberg	2,400	2.85
				Cryptomonas reflexa (Marsson) Skuja	400	0.31
				Katablepharis ovalis Skuja	28,736	1.48
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	3,400	39.92
				Peridinium pusillum (Penard) Lemmermann	4,600	10.43
			Cyanobacteria	*Snowella* sp	1,400	0.77
			Chlorophyceae	*Pediastrum duplex Meyen*	200	0.85
				Elakatothrix gelatinosa Willen	93,392	1.62
				Planctonema lauterbornii Schmidle	71,840	16.25
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	1,200	0.55
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.33
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	600	0.54
				Oocystis gigas Archer	200	0.48
				Monomastix minuta Skuja	7,184	0.14
			Chrysophyceae	Small chrysophyceae	481,328	6.16
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	201,152	13.16
				Chrysococcus sp.	840,528	54.97
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	71,840	0.92
				*Spiniferomonas sirrata***********	7,184	1.08
				Dinobryon borgei Lemmermann	7,184	0.37

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0102	1	August	Chrysophyceae	*Dinobryon bavaricum Imhof*	79,024	17.88
				Dinobryon bavaricum Imhof	800	1.00
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,000	3.39
				Dinobryon sociale Ehrenberg	35,920	8.13
				Chrysolkos skuja (Nauwerck) Willen	28,736	0.93
				Uroglena volvox Ehrenberg	43,104	4.88
				Chrysochromulina laurentiana Kling	107,760	43.93
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.60
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,400	2.20
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Fragilaria crotonensis Kitton	11,200	3.89
				Synedra acus Kutzing	4,000	0.46
				Asterionella formosa Hassall	10,200	1.03
				Cyclotella michiganiana Skvortzow	21,552	0.53
			Cryptophyceae	*Rhodomonas minuta Skuja*	215,520	32.50
				Cryptomonas erosa Ehrenberg	1,200	1.42
				Cryptomonas ovata Ehrenberg	200	0.90
				Cryptomonas reflexa (Marsson) Skuja	800	0.61
				Katablepharis ovalis Skuja	21,552	1.11
			Dinophyceae	*Gymnodinium* sp.	21,552	7.94
				Gymnodinium sp.	400	3.12
				Peridinium pusillum (Penard) Lemmermann	3,600	8.16
MEL-0103	1	August	Cyanobacteria	*Snowella* sp	200	0.11
			Chlorophyceae	*Oocystis lacustris Chodat*	14,368	0.37
				Dictyosphaerium simplex Sukja	14,368	0.06
				Elakatothrix gelatinosa Willen	64,656	1.12
				Planctonema lauterbornii Schmidle	14,368	3.61
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Staurodesmus paradoxum Meyen	600	2.45
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	800	0.42
			Chrysophyceae	Small chrysophyceae	402,304	5.15
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	323,280	21.14
				Chrysococcus sp.	538,800	35.24
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	14,368	0.18
				*Spiniferomonas sirrata***********	14,368	1.06
				Mallomonas crassisquama (Asmund) Fott	800	0.84
				Dinobryon bavaricum Imhof	150,864	34.13
				Dinobryon bavaricum Imhof	1,000	1.25
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.68
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	43,104	9.75
				Uroglena volvox Ehrenberg	186,784	21.13
				Chrysochromulina laurentiana Kling	150,864	59.53
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.85
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,600	4.08
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Tabellaria fenestrata (Lyngbye) Kutzing	12,600	17.52
				Tabellaria flocculsa (Roth) Kutzing	200	0.23
				Fragilaria crotonensis Kitton	10,200	3.46
				Synedra acus Kutzing	2,400	0.28
				Asterionella formosa Hassall	13,000	1.31
				Cyclotella michiganiana Skvortzow	57,472	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	251,440	37.92
				Cryptomonas erosa Ehrenberg	4,400	5.22
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	3,200	36.78
				Peridinium pusillum (Penard) Lemmermann	5,400	12.02
				Peridinium aciculiferum Lemmermann	200	1.81
			Cyanobacteria	*Snowella* sp	200	0.11
			Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.19
				Tetraedron minimum (Brunow) Hansgrig	7,184	1.25
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.50
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	14,368	3.61

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0104	1	August	Chlorophyceae	*Cosmarium* sp.	200	0.94
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	600	0.54
				Tetraedron caudatum (Corda) Hansgrig	28,736	0.32
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	452,592	5.79
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	466,960	30.54
				Chrysococcus sp.	402,304	26.31
				Chrysostephanospaera globulifera Scherffel	7,184	2.00
				Kephyrion boreale Skuja	21,552	2.56
				Kephyrion sp.	93,392	1.20
				*Spiniferomonas sirrata***********	14,368	2.16
				Mallomonas crassisquama (Asmund) Fott	800	0.84
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon bavaricum Imhof	79,024	17.88
				Dinobryon bavaricum Imhof	2,200	2.75
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	400	1.68
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.46
				Uroglena volvox Ehrenberg	208,336	23.56
				Chrysochromulina laurentiana Kling	114,944	45.36
				Stichogloea spp.	50,288	2.53
				Salpingoeca frequentissima (Zach.) Lemmermann	57,472	1.70
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	3.77
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Fragilaria crotonensis Kitton	5,000	1.74
				Synedra acus Kutzing	2,000	0.23
				Asterionella formosa Hassall	11,200	1.13
				Cyclotella michiganiana Skvortzow	50,288	1.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	308,912	46.58
				Cryptomonas erosa Ehrenberg	2,200	2.65
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.23
				Cryptomonas rostratiformis Skuja	200	0.45
				Katablepharis ovalis Skuja	35,920	1.65
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	4,000	46.97
				Peridinium pusillum (Penard) Lemmermann	7,800	17.69
				Peridinium wisconsiense Eddy	600	5.61
MEL-0105	1	August	Cyanobacteria	*Snowella* sp	1,200	0.66
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	57,472	2.23
				Pediastrum tetras (Ehrenberg) Ralfs	28,736	0.32
				Oocystis lacustris Chodat	7,184	0.19
				Crucigenia quadrata Morr.	28,736	0.14
				Elakatothrix gelatinosa Willen	100,576	1.74
				Planctonema lauterbornii Schmidle	107,760	24.38
				Staurodesmus extensus (Andersson) Teiling	1,200	0.55
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	800	0.72
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	589,088	7.54
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	294,544	19.26
				Chrysococcus sp.	560,352	36.65
				Kephyrion boreale Skuja	21,552	2.56
				Kephyrion sp.	71,840	0.92
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon bavaricum Imhof	136,496	30.88
				Dinobryon bavaricum Imhof	800	1.00
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.84
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	21,552	4.88
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.65
				Uroglena volvox Ehrenberg	395,120	44.69
				Chrysochromulina laurentiana Kling	114,944	45.36
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.65
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	2.83
				Rhizosolenia eriense H.L. Smith	35,920	2.79
				Tabellaria fenestrata (Lyngbye) Kutzing	2,000	2.78
				Fragilaria crotonensis Kitton	13,000	4.52
				Synedra acus Kutzing	2,400	0.28

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Asterionella formosa Hassall	10,600	1.07
				Cyclotella michiganiana Skvortzow	71,840	1.37
			Cryptophyceae	*Rhodomonas minuta Skuja*	143,680	21.67
				Cryptomonas erosa Ehrenberg	3,000	3.62
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.77
				Cryptomonas rostratiformis Skuja	200	0.42
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.61
				Gymnodinium sp.	7,184	2.67
				Gymnodinium sp.	1,800	21.14
				Peridinium pusillum (Penard) Lemmermann	5,800	13.15
				Peridinium aciculiferum Lemmermann	400	3.74
			Cyanobacteria	*Snowella* sp	200	0.20
			Chlorophyceae	*Chlamydomonas* spp.	28,736	0.59
				Sphaerocystis schroeteri Chodat	79,024	1.93
				Oocystis lacustris Chodat	7,184	0.18
				Crucigenia quadrata Morr.	57,472	0.64
				Elakatothrix gelatinosa Willen	57,472	0.99
				Planctonema lauterbornii Schmidle	28,736	6.50
				Cosmarium sp.	200	0.28
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Oocystis gigas Archer	600	1.45
				Nephrocytiun lunatum W. West	400	1.07
			Chrysophyceae	Small chrysophyceae	344,832	4.41
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	158,048	10.34
				Chrysococcus sp.	531,616	34.77
				Chrysostephanospaera globulifera Scherffel	7,184	2.15
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	93,392	0.96
				*Spiniferomonas sirrata***********	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sociale Ehrenberg	35,920	8.13
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	86,208	9.75
				Chrysochromulina laurentiana Kling	100,576	41.00
				Stichogloea spp.	28,736	1.45
				Bicoeca lacustris Clark	7,184	0.37
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.82
				Cyclotella ocellata Pant.	57,472	6.69
				Rhizosolenia eriense H.L. Smith	7,184	0.46
				Fragilaria crotonensis Kitton	1,400	0.49
				Synedra acus Kutzing	600	0.07
				Cyclotella michiganiana Skvortzow	86,208	1.65
				Cyclotella bodanica Eulenst.	600	4.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	186,784	28.17
				Cryptomonas erosa Ehrenberg	2,200	2.65
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.74
				Cryptomonas rostratiformis Skuja	400	0.60
				Katablepharis ovalis Skuja	7,184	0.36
			Dinophyceae	*Gymnodinium* sp.	14,368	5.10
				Gymnodinium sp.	1,200	14.24
				Peridinium pusillum (Penard) Lemmermann	1,000	1.99
MEL-0201	1	August	Cyanobacteria	*Snowella* sp	600	0.30
			Chlorophyceae	*Chlamydomonas* spp.	35,920	0.86
				Sphaerocystis schroeteri Chodat	14,368	0.48
				Oocystis lacustris Chodat	50,288	1.23
				Dictyosphaerium simplex Sukja	14,368	0.06
				Quadrigula closterioides (Bohl.) Printz	57,472	2.03
				Elakatothrix gelatinosa Willen	93,392	1.62
				Planctonema lauterbornii Schmidle	28,736	7.22
				Staurodesmus extensus (Andersson) Teiling	200	0.09
				Staurodesmus paradoxum Meyen	200	0.58
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Mougeotia sp.	200	0.28
				Botryococcus braunii Kutzing	200	0.18
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	237,072	3.03
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	143,680	9.40
				Chrysococcus sp.	632,192	41.35
				Kephyrion boreale Skuja	7,184	0.85

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0202	1	August	Chrysophyceae	*Kephyrion* sp.	129,312	1.33
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	28,736	6.50
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.59
				Uroglena volvox Ehrenberg	186,784	21.13
				Chrysochromulina laurentiana Kling	57,472	23.43
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.74
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	5,000	9.09
				Cyclotella ocellata Pant.	50,288	5.65
				Tabellaria flocculsa (Roth) Kutzing	1,600	2.05
				Fragilaria crotonensis Kitton	600	0.21
				Synedra acus Kutzing	200	0.02
				Asterionella formosa Hassall	1,600	0.16
				Cyclotella michiganiana Skvortzow	28,736	0.55
				Cyclotella bodanica Eulenst.	600	4.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	215,520	32.50
				Cryptomonas erosa Ehrenberg	2,000	2.41
				Cryptomonas rostratiformis Skuja	200	0.30
				Katablepharis ovalis Skuja	7,184	0.36
			Dinophyceae	*Gymnodinium* sp.	14,368	5.30
				Gymnodinium sp.	600	7.58
				Peridinium pusillum (Penard) Lemmermann	2,600	5.18
MEL-0202	1	August	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.34
				Sphaerocystis schroeteri Chodat	7,184	0.24
				Oocystis lacustris Chodat	21,552	0.53
				Dictyosphaerium simplex Sukja	14,368	0.06
				Elakatothrix gelatinosa Willen	71,840	1.24
				Planctonema lauterbornii Schmidle	28,736	6.50
				Cosmarium sp.	600	0.84
				Euastrum spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	800	0.37
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	800	0.72
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	Small chrysophyceae	330,464	4.23
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	222,704	14.56
				Chrysococcus sp.	581,904	38.06
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	107,760	1.11
				*Spiniferomonas sirrata***********	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	600	0.63
				Dinobryon borgei Lemmermann	28,736	1.47
				Dinobryon mucronutom Nygaard	21,552	2.71
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	43,104	9.75
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.59
				Uroglena volvox Ehrenberg	229,888	26.00
				Chrysochromulina laurentiana Kling	50,288	20.50
				Stichogloea spp.	14,368	0.72
				Bicoeca lacustris Clark	14,368	0.73
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.12
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	5.46
				Cyclotella ocellata Pant.	35,920	4.03
				Fragilaria crotonensis Kitton	1,000	0.35
				Synedra acus Kutzing	400	0.05
				Asterionella formosa Hassall	800	0.08
				Cyclotella michiganiana Skvortzow	28,736	0.55
				Cyclotella bodanica Eulenst.	600	4.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	222,704	33.58
				Cryptomonas erosa Ehrenberg	2,600	3.14
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	600	0.89
				Katablepharis ovalis Skuja	21,552	1.09
			Dinophyceae	*Gymnodinium* sp.	200	2.53
				Peridinium pusillum (Penard) Lemmermann	3,800	7.57
			Cyanobacteria	*Chroococcus turgidus (Kutzing) Nageli*	28,736	10.59
				Chlamydomonas spp.	14,368	0.34
				Pediastrum duplex Meyen	200	0.88
				Oocystis lacustris Chodat	7,184	0.18
				Dictyosphaerium simplex Sukja	14,368	0.08

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0203	1	August	Chlorophyceae	*Elakatothrix gelatinosa Willen*	265,808	5.85
				Planctonema lauterbornii Schmidle	57,472	14.44
				Cosmarium sp.	400	0.56
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Monomastix minuta Skuja	7,184	0.16
				Nephrocytiun lunatum W. West	200	0.54
			Chrysophyceae	Small chrysophyceae	272,992	3.49
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	93,392	6.11
				Chrysococcus sp.	553,168	36.18
				Kephyrion boreale Skuja	21,552	2.56
				Kephyrion sp.	100,576	1.04
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	28,736	6.50
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	186,784	21.13
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.58
				Chrysochromulina laurentiana Kling	86,208	35.15
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
				Pteridomonas sp.	14,368	3.19
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	5,000	9.09
				Fragilaria crotonensis Kitton	400	0.14
				Synedra acus Kutzing	400	0.05
				Cyclotella michiganiana Skvortzow	21,552	0.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	201,152	30.33
				Cryptomonas erosa Ehrenberg	2,000	2.41
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	200	0.30
				Katablepharis ovalis Skuja	14,368	0.72
			Dinophyceae	*Gymnodinium* sp.	800	10.11
				Peridinium pusillum (Penard) Lemmermann	1,600	3.19
MEL-0204	1	August	Cyanobacteria	*Snowella* sp	200	0.10
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	14,368	0.52
				Oocystis lacustris Chodat	7,184	0.18
				Elakatothrix gelatinosa Willen	229,888	5.06
				Planctonema lauterbornii Schmidle	14,368	3.61
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	1,000	0.48
				Staurodesmus paradoxum Meyen	200	0.63
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	50,288	45.50
				Ankistrodesmus spiralis Lemmermann	7,184	0.41
				Nephrocytiun lunatum W. West	200	0.54
			Chrysophyceae	Small chrysophyceae	265,808	3.40
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	603,456	39.47
				Kephyrion sp.	71,840	0.74
				*Spiniferomonas sirrata***********	14,368	1.71
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	1,400	4.75
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	258,624	29.25
				Chrysochromulina laurentiana Kling	100,576	39.69
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.56
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,000	7.27
				Cyclotella ocellata Pant.	57,472	7.18
				Fragilaria crotonensis Kitton	1,600	0.54
				Synedra acus Kutzing	800	0.09
				Asterionella formosa Hassall	1,200	0.12
				Cyclotella michiganiana Skvortzow	35,920	0.88
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	237,072	35.75
				Cryptomonas erosa Ehrenberg	3,000	3.62

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Cryptomonas rostratiformis Skuja*	200	0.29
				Katablepharis ovalis Skuja	14,368	0.72
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	1,200	14.39
				Peridinium pusillum (Penard) Lemmermann	3,200	6.37
MEL-0205	1	August	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.34
				Sphaerocystis schroeteri Chodat	7,184	0.24
				Oocystis lacustris Chodat	28,736	0.70
				Elakatothrix gelatinosa Willen	50,288	1.11
				Planctonema lauterbornii Schmidle	28,736	7.22
				Cosmarium sp.	400	0.56
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	400	0.19
				Staurodesmus paradoxum Meyen	200	0.59
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	600	0.54
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	*Small chrysophyceae*	272,992	3.49
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	136,496	8.93
				Chrysococcus sp.	538,800	35.24
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	107,760	1.11
				*Spiniferomonas sirrata***********	7,184	0.85
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	14,368	0.74
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	7,184	1.63
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	201,152	22.75
				Chrysochromulina laurentiana Kling	43,104	17.57
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.37
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.91
				Cyclotella ocellata Pant.	21,552	2.42
				Fragilaria crotonensis Kitton	400	0.14
				Synedra acus Kutzing	800	0.09
				Asterionella formosa Hassall	1,400	0.15
				Cyclotella michiganiana Skvortzow	35,920	0.88
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	208,336	31.42
				Cryptomonas erosa Ehrenberg	3,800	4.58
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Katablepharis ovalis Skuja	7,184	0.36
			Dinophyceae	*Gymnodinium* sp.	1,200	13.94
				Peridinium pusillum (Penard) Lemmermann	4,000	7.96
			Cyanobacteria	*Snowella sp*	400	0.20
			Chlorophyceae	*Chlamydomonas* spp.	21,552	0.47
				Sphaerocystis schroeteri Chodat	28,736	0.96
				Oocystis lacustris Chodat	14,368	0.37
				Elakatothrix gelatinosa Willen	107,760	1.86
				Planctonema lauterbornii Schmidle	7,184	1.81
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	800	0.37
				Staurodesmus bullardii G.M. Smith	200	0.50
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	400	0.95
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	200	0.48
				Nephrocytiun lunatum W. West	200	0.54
MEL-0501	1	August	Chrysophyceae	Small chrysophyceae	589,088	7.54
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	100,576	6.58
				Chrysococcus sp.	610,640	39.94
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	64,656	0.91
				*Spiniferomonas sirrata***********	28,736	2.50
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	28,736	1.47
				Dinobryon mucronutom Nygaard	28,736	3.72
				Dinobryon bavaricum Imhof	50,288	11.38
				Dinobryon bavaricum Imhof	600	0.75
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	7,184	1.63

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	337,648	38.19
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	71,840	28.35
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.06
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,200	3.46
				Cyclotella ocellata Pant.	57,472	6.45
				Synedra acus Kutzing	1,400	0.16
				Asterionella formosa Hassall	1,200	0.12
				Cyclotella michiganiana Skvortzow	57,472	1.41
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	352,016	50.87
				Cryptomonas erosa Ehrenberg	3,200	3.96
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.77
				Cryptomonas rostratiformis Skuja	800	1.17
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	7,184	3.14
				Gymnodinium sp.	1,200	12.23
				Peridinium pusillum (Penard) Lemmermann	2,000	3.98
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.14
				Sphaerocystis schroeteri Chodat	28,736	0.96
				Oocystis lacustris Chodat	14,368	0.34
				Elakatothrix gelatinosa Willen	244,256	4.23
				Planctonema lauterbornii Schmidle	14,368	3.25
				Cosmarium sp.	400	0.56
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	1,400	0.67
				Staurodesmus paradoxum Meyen	400	2.21
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	200	0.48
MEL-0502	1	August	Chrysophyceae	Small chrysophyceae	380,752	4.87
				Large chrysophyceae	57,472	10.32
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	668,112	43.69
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	79,024	1.11
				*Spiniferomonas sirrata***********	28,736	3.41
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Mallomonas akrokomos Asmund and Kristiansen	7,184	0.93
				Dinobryon borgei Lemmermann	7,184	0.37
				Dinobryon mucronutom Nygaard	7,184	0.93
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	800	1.00
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	222,704	25.19
				Chrysochromulina laurentiana Kling	93,392	36.85
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.64
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,600	4.08
				Cyclotella ocellata Pant.	93,392	9.74
				Fragilaria crotonensis Kitton	400	0.13
				Synedra acus Kutzing	1,000	0.12
				Cyclotella michiganiana Skvortzow	28,736	0.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	158,048	22.84
				Cryptomonas erosa Ehrenberg	1,800	2.23
				Cryptomonas reflexa (Marsson) Skuja	1,600	1.23
				Cryptomonas rostratiformis Skuja	600	0.88
				Katablepharis ovalis Skuja	21,552	0.99
			Dinophyceae	*Gymnodinium* sp.	800	10.32
				Peridinium pusillum (Penard) Lemmermann	1,400	2.79
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.14
				Pediastrum duplex Meyen	200	0.74
				Oocystis lacustris Chodat	28,736	0.69
				Elakatothrix gelatinosa Willen	57,472	0.99
				Cosmarium sp.	600	0.84
				Euastrum spp.	200	1.50
				Staurodesmus extensus (Andersson) Teiling	1,000	0.48
				Staurodesmus paradoxum Meyen	400	2.32
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	400	0.97
				Small chrysophyceae	287,360	3.68

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0502	2	August	Chrysophyceae	Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	107,760	7.05
				Chrysococcus sp.	574,720	37.59
				Chrysostephanospaera globulifera Scherffel	14,368	5.13
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	79,024	1.11
				*Spiniferomonas sirrata***********	50,288	5.97
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Mallomonas akrokomos Asmund and Kristiansen	7,184	0.97
				Dinobryon borgei Lemmermann	21,552	1.11
				Dinobryon mucronutom Nygaard	7,184	0.93
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	600	0.75
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	57,472	13.00
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	179,600	20.31
				Chrysochromulina laurentiana Kling	35,920	14.17
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.64
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,200	3.46
				Cyclotella ocellata Pant.	14,368	1.44
				Fragilaria crotonensis Kitton	400	0.13
				Synedra acus Kutzing	2,200	0.25
				Cyclotella michiganiana Skvortzow	43,104	1.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	222,704	32.18
				Cryptomonas erosa Ehrenberg	3,400	4.20
				Cryptomonas reflexa (Marsson) Skuja	400	0.31
				Cryptomonas rostratiformis Skuja	200	0.29
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	800	10.32
				Peridinium pusillum (Penard) Lemmermann	2,600	5.18
			Chlorophyceae	*Pediastrum duplex Meyen*	200	0.84
				Oocystis lacustris Chodat	14,368	0.37
				Elakatothrix gelatinosa Willen	57,472	0.99
				Planctonema lauterbornii Schmidle	14,368	3.61
				Cosmarium sp.	200	0.28
				Euastrum spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	400	0.19
				Staurodesmus paradoxum Meyen	400	2.21
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.18
				Tetraedron caudatum (Corda) Hansgrig	7,184	0.03
				Oocystis gigas Archer	200	0.48
				Nephrocytiun lunatum W. West	200	0.54
			Chrysophyceae	Small chrysophyceae	229,888	2.94
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	129,312	8.46
				Chrysococcus sp.	567,536	37.12
				Kephyrion sp.	57,472	0.81
				*Spiniferomonas sirrata***********	7,184	1.08
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	21,552	1.11
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	14,368	3.25
MEL-0503	1	August		*Dinobryon bavaricum Imhof*	200	0.25
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	43,104	9.75
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.17
				Uroglena volvox Ehrenberg	208,336	23.56
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	71,840	28.35
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.74
				Pteridomonas sp.	21,552	4.78
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.51
				Cyclotella ocellata Pant.	28,736	2.78
				Rhizosolenia eriense H.L. Smith	7,184	0.61
				Tabellaria flocculsa (Roth) Kutzing	600	0.77
				Synedra acus Kutzing	400	0.05
				Cyclotella michiganiana Skvortzow	7,184	0.18
				Cyclotella bodanica Eulenst.	400	2.82
			Cryptophyceae	*Rhodomonas minuta Skuja*	229,888	33.22
				Cryptomonas erosa Ehrenberg	2,800	3.32

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Cryptomonas reflexa (Marsson) Skuja*	800	0.61
				Cryptomonas rostratiformis Skuja	200	0.30
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	400	5.16
				Peridinium pusillum (Penard) Lemmermann	2,800	5.54
MEL-0504	1	August	Chlorophyceae	*Chlamydomonas* spp.	14,368	0.39
				Sphaerocystis schroeteri Chodat	21,552	0.41
				Oocystis lacustris Chodat	28,736	0.74
				Elakatothrix gelatinosa Willen	64,656	1.12
				Planctonema lauterbornii Schmidle	7,184	1.63
				Cosmarium sp.	400	1.88
				Euastrum spp.	400	0.74
				Staurodesmus extensus (Andersson) Teiling	400	0.19
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Botryococcus braunii Kutzing	200	0.18
				Ankistrodesmus spiralis Lemmermann	7,184	0.41
			Chrysophyceae	Small chrysophyceae	510,064	6.53
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	129,312	8.46
				Chrysococcus sp.	524,432	34.30
				Chrysostephanospaera globulifera Scherffel	7,184	2.65
				Kephyrion sp.	79,024	1.11
				*Spiniferomonas sirrata***********	21,552	1.98
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon mucronutom Nygaard	7,184	0.93
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.43
				Uroglena volvox Ehrenberg	158,048	17.88
				Chrysochromulina laurentiana Kling	71,840	28.35
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.12
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,600	4.08
				Cyclotella ocellata Pant.	28,736	3.59
				Fragilaria crotonensis Kitton	2,400	0.80
				Synedra acus Kutzing	400	0.05
				Asterionella formosa Hassall	200	0.02
				Cyclotella michiganiana Skvortzow	14,368	0.35
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	215,520	31.14
				Cryptomonas erosa Ehrenberg	2,200	2.65
				Cryptomonas reflexa (Marsson) Skuja	800	0.61
				Cryptomonas rostratiformis Skuja	200	0.30
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	7,184	2.46
				Gymnodinium sp.	1,000	13.04
				Peridinium pusillum (Penard) Lemmermann	1,800	3.52
MEL-0505	1	August	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	1.20
				Oocystis lacustris Chodat	21,552	0.56
				Elakatothrix gelatinosa Willen	14,368	0.25
				Cosmarium sp.	200	0.20
				Staurodesmus extensus (Andersson) Teiling	600	0.29
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	294,544	3.77
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	57,472	3.76
				Chrysococcus sp.	330,464	21.61
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	57,472	0.81
				*Spiniferomonas sirrata***********	14,368	1.32
				Mallomonas caudata Ivanov	200	1.07
				Dinobryon borgei Lemmermann	35,920	1.84
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	200	0.95
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	100,576	22.75
				Uroglena volvox Ehrenberg	237,072	26.81
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	79,024	31.18
				Stichogloea spp.	43,104	2.17
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.63
				Cyclotella stelligera Cleve and Grunow	2,400	3.77

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Cyclotella ocellata Pant.*	21,552	2.42
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	200	0.02
				Cyclotella michiganiana Skvortzow	43,104	1.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	316,096	45.68
				Cryptomonas erosa Ehrenberg	4,200	4.92
				Cryptomonas reflexa (Marsson) Skuja	600	0.46
				Cryptomonas rostratiformis Skuja	600	0.88
			Dinophyceae	*Gymnodinium* sp.	600	7.74
				Peridinium pusillum (Penard) Lemmermann	1,200	2.39
MEL-0301	1	August	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	7,184	0.18
				Oocystis lacustris Chodat	57,472	1.49
				Elakatothrix gelatinosa Willen	28,736	0.50
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	400	0.18
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	400	0.21
				Ankistrodesmus spiralis Lemmermann	14,368	0.90
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	229,888	3.24
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	79,024	5.17
				Chrysococcus sp.	409,488	26.78
				Chrysostephanospaera globulifera Scherffel	21,552	7.18
				Kephyrion sp.	28,736	0.41
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	7,184	0.30
				Dinobryon bavaricum Imhof	2,000	2.50
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	28,736	6.50
				Uroglena volvox Ehrenberg	136,496	15.44
				Chrysochromulina laurentiana Kling	107,760	42.52
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	122,128	3.38
				Pteridomonas sp.	7,184	0.80
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	3.27
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	1,400	0.16
				Asterionella formosa Hassall	1,400	0.15
				Cyclotella michiganiana Skvortzow	21,552	0.53
			Cryptophyceae	*Rhodomonas minuta Skuja*	172,416	24.91
				Cryptomonas erosa Ehrenberg	1,800	2.17
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	400	0.60
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium* sp.	14,368	5.30
				Gymnodinium sp.	1,400	16.26
				Peridinium pusillum (Penard) Lemmermann	3,000	5.94
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.30
				Sphaerocystis schroeteri Chodat	28,736	0.70
				Oocystis lacustris Chodat	21,552	0.56
				Quadrigula closterioides (Bohl.) Printz	7,184	0.17
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	14,368	3.61
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	1,000	0.46
				Staurodesmus cuspidatus (Brebisson and Ralfs) Teiling	200	0.14
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
				Botryococcus braunii Kutzing	200	0.10
				Ankistrodesmus spiralis Lemmermann	14,368	0.90
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	287,360	4.05
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	488,512	31.95
				Kephyrion sp.	79,024	1.11
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	7,184	0.30
MEL-0302	1	August		*Dinobryon mucronutom Nygaard*	21,552	2.71
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	1,600	2.00
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	600	2.03

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Dinobryon sociale Ehrenberg	7,184	1.63
				Uroglena volvox Ehrenberg	136,496	15.44
				Chrysochromulina laurentiana Kling	93,392	36.85
				Stichogloea spp.	28,736	1.45
				Salpingoeca frequentissima (Zach.) Lemmermann	93,392	2.59
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	3.27
				Cyclotella ocellata Pant.	14,368	1.61
				Tabellaria fenestrata (Lyngbye) Kutzing	600	0.50
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	1,200	0.14
				Cyclotella michiganiana Skvortzow	35,920	0.88
			Cryptophyceae	*Rhodomonas minuta Skuja*	237,072	34.26
				Cryptomonas erosa Ehrenberg	1,000	1.18
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Katablepharis ovalis Skuja	14,368	0.66
			Dinophyceae	*Gymnodinium* sp.	2,200	25.56
				Peridinium pusillum (Penard) Lemmermann	2,400	4.75
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.30
				Sphaerocystis schroeteri Chodat	7,184	0.18
				Oocystis lacustris Chodat	21,552	0.56
				Elakatothrix gelatinosa Willen	100,576	1.74
				Planctonema lauterbornii Schmidle	21,552	5.42
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	1,000	0.46
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Ankistrodesmus spiralis Lemmermann	7,184	0.45
				Oocystis gigas Archer	200	0.48
				Nephrocytiun lunatum W. West	200	0.54
			Chrysophyceae	Small chrysophyceae	114,944	1.62
				Large chrysophyceae	64,656	11.61
				Chrysochromulina parva Lackey	122,128	7.99
				Chrysococcus sp.	416,672	27.25
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion sp.	57,472	0.81
				*Spiniferomonas sirrata***********	35,920	4.06
				Dinobryon mucronutom Nygaard	21,552	2.71
				Dinobryon bavaricum Imhof	800	1.00
MEL-0302	2	August		*Dinobryon sertularia Ehrenberg*	14,368	3.25
				Dinobryon sertularia Ehrenberg	1,200	4.07
				Dinobryon sociale Ehrenberg	71,840	16.25
				Uroglena volvox Ehrenberg	186,784	21.13
				Chrysochromulina laurentiana Kling	71,840	28.35
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	107,760	2.98
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.91
				Cyclotella ocellata Pant.	57,472	6.45
				Tabellaria fenestrata (Lyngbye) Kutzing	200	0.17
				Fragilaria crotonensis Kitton	800	0.27
				Synedra acus Kutzing	400	0.05
				Cyclotella michiganiana Skvortzow	43,104	1.06
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	143,680	20.76
				Cryptomonas erosa Ehrenberg	1,800	2.12
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	14,368	4.91
				Gymnodinium sp.	1,600	18.59
				Peridinium pusillum (Penard) Lemmermann	2,400	4.75
			Chlorophyceae	*Chlamydomonas* spp.	14,368	0.63
				Sphaerocystis schroeteri Chodat	7,184	0.18
				Oocystis lacustris Chodat	14,368	0.37
				Elakatothrix gelatinosa Willen	86,208	1.49
				Planctonema lauterbornii Schmidle	14,368	3.61
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Staurodesmus paradoxum Meyen	200	0.52
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
			Euglenophyceae	*Trachelomonas hispida (Perty) Stein*	200	2.08
				Small chrysophyceae	352,016	4.96
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	481,328	31.48
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	28,736	0.41
				*Spiniferomonas sirrata***********	28,736	3.41
				Dinobryon borgei Lemmermann	14,368	0.61
				Dinobryon mucronutom Nygaard	7,184	0.90

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0303	1	August	Chrysophyceae	*Dinobryon bavaricum Imhof*	200	0.25
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	28,736	6.50
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.98
				Uroglena volvox Ehrenberg	193,968	21.94
				Chrysochromulina laurentiana Kling	79,024	31.18
				Stichogloea spp.	21,552	1.08
				Bicoeca lacustris Clark	7,184	0.37
				Salpingoeca frequentissima (Zach.) Lemmermann	64,656	1.79
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.82
				Cyclotella ocellata Pant.	21,552	2.25
				Fragilaria crotonensis Kitton	200	0.07
				Synedra acus Kutzing	400	0.05
				Asterionella formosa Hassall	400	0.04
				Cyclotella michiganiana Skvortzow	43,104	1.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	136,496	19.72
				Cryptomonas erosa Ehrenberg	2,200	2.65
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium* sp.	1,400	16.26
				Peridinium pusillum (Penard) Lemmermann	2,200	4.35
			Cyanobacteria	*Snowella* sp	200	0.10
			Chlorophyceae	*Chlamydomonas spp.*	14,368	0.96
				Oocystis lacustris Chodat	7,184	0.19
				Dictyosphaerium simplex Sukja	14,368	0.06
				Elakatothrix gelatinosa Willen	35,920	0.62
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	200	0.09
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
				Botryococcus braunii Kutzing	600	0.54
				Ankistrodesmus spiralis Lemmermann	7,184	0.45
				Oocystis gigas Archer	400	0.97
MEL-0304	1	August	Chrysophyceae	Small chrysophyceae	308,912	4.36
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	136,496	8.93
				Chrysococcus sp.	445,408	29.13
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	107,760	1.52
				*Spiniferomonas sirrata***********	14,368	1.71
				Mallomonas crassisquama (Asmund) Fott	600	0.62
				Dinobryon borgei Lemmermann	28,736	1.22
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	1,800	2.25
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	50,288	11.38
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	265,808	30.06
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	100,576	39.69
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	93,392	2.42
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,000	1.82
				Cyclotella ocellata Pant.	21,552	2.25
				Rhizosolenia eriense H.L. Smith	7,184	0.56
				Tabellaria fenestrata (Lyngbye) Kutzing	2,400	1.99
				Synedra acus Kutzing	1,000	0.12
				Cyclotella michiganiana Skvortzow	21,552	0.53
			Cryptophyceae	*Rhodomonas minuta Skuja*	122,128	17.65
				Cryptomonas erosa Ehrenberg	800	0.97
				Cryptomonas reflexa (Marsson) Skuja	1,000	0.73
				Cryptomonas rostratiformis Skuja	200	0.31
			Dinophyceae	*Gymnodinium* sp.	7,184	2.55
				Gymnodinium sp.	200	2.35
				Peridinium pusillum (Penard) Lemmermann	3,600	7.13
			Cyanobacteria	*Anabaena solitaria Klebs*	200	0.93
			Chlorophyceae	*Elakatothrix gelatinosa Willen*	57,472	0.99
				Planctonema lauterbornii Schmidle	35,920	9.03
				Cosmarium sp.	200	0.94
				Staurodesmus extensus (Andersson) Teiling	1,000	0.46
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Ankistrodesmus spiralis Lemmermann	7,184	0.45
				Oocystis gigas Archer	400	0.97
				Small chrysophyceae	287,360	4.05
				Large chrysophyceae	14,368	2.58

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0305	1	August	Chrysophyceae	*Chrysochromulina parva Lackey*	100,576	6.58
				Chrysococcus sp.	718,400	46.98
				Kephyrion boreale Skuja	7,184	0.81
				Kephyrion sp.	57,472	0.81
				*Spiniferomonas sirrata***********	21,552	2.56
				Mallomonas crassisquama (Asmund) Fott	400	0.42
				Dinobryon borgei Lemmermann	337,648	14.32
				Dinobryon bavaricum Imhof	2,800	3.50
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	43,104	9.75
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	86,208	9.75
				Chrysochromulina laurentiana Kling	86,208	35.15
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	129,312	3.35
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	1.88
				Cyclotella ocellata Pant.	21,552	2.25
				Rhizosolenia eriense H.L. Smith	14,368	0.91
				Tabellaria fenestrata (Lyngbye) Kutzing	7,600	6.30
				Fragilaria crotonensis Kitton	400	0.14
				Synedra acus Kutzing	200	0.02
				Cyclotella michiganiana Skvortzow	21,552	0.53
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	215,520	31.14
				Cryptomonas erosa Ehrenberg	1,800	2.17
				Cryptomonas reflexa (Marsson) Skuja	200	0.15
				Cryptomonas rostratiformis Skuja	400	0.59
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	1,800	21.14
				Peridinium pusillum (Penard) Lemmermann	3,200	6.33
MEL-0401	1	August	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	28,736	0.96
				Pediastrum duplex Meyen	200	0.92
				Oocystis lacustris Chodat	7,184	0.19
				Elakatothrix gelatinosa Willen	86,208	1.49
				Cosmarium sp.	600	0.84
				Staurodesmus extensus (Andersson) Teiling	800	0.37
				Staurodesmus paradoxum Meyen	200	0.64
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	200	0.38
				Botryococcus braunii Kutzing	400	0.36
				Oocystis gigas Archer	200	0.48
				Monomastix minuta Skuja	7,184	0.14
			Chrysophyceae	Small chrysophyceae	265,808	2.74
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	79,024	5.17
				Chrysococcus sp.	625,008	40.88
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	71,840	0.92
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	14,368	0.62
				Dinobryon bavaricum Imhof	400	0.50
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	14,368	3.25
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.38
				Ochromonas sp.	7,184	0.55
				Uroglena volvox Ehrenberg	86,208	9.75
				Chrysochromulina laurentiana Kling	57,472	22.68
				Salpingoeca frequentissima (Zach.) Lemmermann	50,288	1.21
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	3.27
				Cyclotella ocellata Pant.	28,736	2.20
				Rhizosolenia eriense H.L. Smith	7,184	0.61
				Tabellaria flocculsa (Roth) Kutzing	200	0.24
				Synedra acus Kutzing	600	0.07
				Asterionella formosa Hassall	1,600	0.17
				Cyclotella michiganiana Skvortzow	7,184	0.17
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	316,096	45.68
				Cryptomonas erosa Ehrenberg	2,400	2.90
				Cryptomonas rostratiformis Skuja	200	0.30
			Dinophyceae	*Gymnodinium* sp.	400	4.70
				Peridinium pusillum (Penard) Lemmermann	600	1.19
			Cyanobacteria	*Chroococcus turgidus (Kutzing) Nageli*	57,472	19.26
				Chlamydomonas spp.	7,184	0.36

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0402	1	August	Chlorophyceae	*Oocystis lacustris Chodat*	7,184	0.19
				Elakatothrix gelatinosa Willen	93,392	1.62
				Planctonema lauterbornii Schmidle	14,368	3.25
				Cosmarium sp.	800	1.12
				Staurodesmus extensus (Andersson) Teiling	400	0.19
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	200	0.10
				Nephrocytiun lunatum W. West	400	1.07
			Chrysophyceae	Small chrysophyceae	452,592	5.79
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	114,944	7.52
				Chrysococcus sp.	510,064	33.36
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	86,208	1.10
				*Spiniferomonas sirrata***********	35,920	4.06
				Dinobryon mucronutom Nygaard	14,368	1.81
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	400	1.36
				Dinobryon sociale Ehrenberg	64,656	14.63
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.20
				Uroglena volvox Ehrenberg	57,472	6.50
				Chrysochromulina laurentiana Kling	64,656	25.51
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.52
				Pteridomonas sp.	7,184	1.71
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	5.46
				Cyclotella ocellata Pant.	35,920	4.03
				Fragilaria crotonensis Kitton	200	0.07
				Large diatoms	200	0.02
				Cyclotella michiganiana Skvortzow	14,368	0.33
				Cyclotella bodanica Eulenst.	200	1.45
			Cryptophyceae	*Rhodomonas minuta Skuja*	222,704	32.18
				Cryptomonas erosa Ehrenberg	1,400	1.69
				Cryptomonas erosa Ehrenberg	400	3.13
				Katablepharis ovalis Skuja	7,184	0.34
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Peridinium pusillum (Penard) Lemmermann	800	1.58
MEL-0403	1	August	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	14,368	0.48
				Dictyosphaerium simplex Sukja	28,736	0.12
				Elakatothrix gelatinosa Willen	57,472	0.99
				Planctonema lauterbornii Schmidle	7,184	1.63
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	600	0.27
				Staurodesmus paradoxum Meyen	200	0.82
				Spondylosium planum (Wolle) W. and G.S. West	7,184	0.27
				Botryococcus braunii Kutzing	400	0.36
			Chrysophyceae	Small chrysophyceae	452,592	4.66
				Large chrysophyceae	35,920	6.45
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	553,168	36.18
				Kephyrion sp.	93,392	1.20
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas caudata Ivanov	200	1.07
				Dinobryon borgei Lemmermann	43,104	1.83
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	200	0.68
				Dinobryon sociale Ehrenberg	28,736	6.50
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.60
				Uroglena volvox Ehrenberg	50,288	5.69
				Chrysochromulina laurentiana Kling	86,208	34.02
				Bicoeca lacustris Clark	7,184	0.37
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	0.86
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	4.36
				Cyclotella ocellata Pant.	14,368	1.10
				Synedra acus Kutzing	600	0.07
				Asterionella formosa Hassall	600	0.06
				Cyclotella michiganiana Skvortzow	57,472	1.33
				Cyclotella bodanica Eulenst.	600	3.51
			Cryptophyceae	*Rhodomonas minuta Skuja*	359,200	51.90
				Cryptomonas erosa Ehrenberg	1,600	1.93
				Cryptomonas reflexa (Marsson) Skuja	800	0.61
				Cryptomonas rostratiformis Skuja	200	0.30
				Katablepharis ovalis Skuja	7,184	0.33
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	200	2.35

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
				Peridinium pusillum (Penard) Lemmermann	1,600	3.19
MEL-0404	1	August	Cyanobacteria	*Chroococcus turgidus (Kutzing) Nageli*	114,944	38.52
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.17
				Sphaerocystis schroeteri Chodat	28,736	0.96
				Oocystis lacustris Chodat	50,288	1.30
				Monoraphidium minutum (Nag.) Komarkova-Legnerova	7,184	0.41
				Elakatothrix gelatinosa Willen	86,208	1.49
				Planctonema lauterbornii Schmidle	14,368	3.25
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	1,200	0.55
				Spondylosium planum (Wolle) W. and G.S. West	35,920	1.35
				Botryococcus braunii Kutzing	200	0.18
				Nephrocytiun lunatum W. West	200	0.54
			Chrysophyceae	Small chrysophyceae	402,304	4.14
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	122,128	7.99
				Chrysococcus sp.	660,928	43.22
				Kephyrion sp.	114,944	1.47
				*Spiniferomonas sirrata***********	21,552	2.44
				Mallomonas crassisquama (Asmund) Fott	200	0.21
				Dinobryon borgei Lemmermann	21,552	0.92
				Dinobryon bavaricum Imhof	400	0.50
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	35,920	8.13
				Uroglena volvox Ehrenberg	93,392	10.56
				Chrysochromulina laurentiana Kling	93,392	36.85
				Stichogloea spp.	14,368	0.72
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.03
				Pteridomonas sp.	28,736	6.84
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,000	5.46
				Cyclotella ocellata Pant.	28,736	2.20
				Fragilaria crotonensis Kitton	1,400	0.48
				Synedra acus Kutzing	200	0.02
				Cyclotella michiganiana Skvortzow	35,920	0.83
				Cyclotella bodanica Eulenst.	200	1.24
			Cryptophyceae	*Rhodomonas minuta Skuja*	208,336	30.10
				Cryptomonas erosa Ehrenberg	1,400	1.66
				Cryptomonas reflexa (Marsson) Skuja	400	0.29
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	7,184	2.55
				Gymnodinium sp.	400	4.70
MEL-0405	1	August	Cyanobacteria	*Aphanocapsa delicatissima W. and G.S. West*	200	0.43
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.17
				Sphaerocystis schroeteri Chodat	28,736	0.96
				Oocystis lacustris Chodat	64,656	1.67
				Elakatothrix gelatinosa Willen	43,104	0.75
				Planctonema lauterbornii Schmidle	14,368	3.25
				Cosmarium sp.	400	0.56
				Staurodesmus extensus (Andersson) Teiling	1,000	0.46
				Spondylosium planum (Wolle) W. and G.S. West	21,552	0.81
			Chrysophyceae	Small chrysophyceae	366,384	3.77
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	100,576	6.58
				Chrysococcus sp.	553,168	36.18
				Kephyrion boreale Skuja	7,184	0.85
				Kephyrion sp.	136,496	1.75
				*Spiniferomonas sirrata***********	14,368	1.63
				Mallomonas crassisquama (Asmund) Fott	800	0.84
				Dinobryon borgei Lemmermann	14,368	0.62
				Dinobryon mucronutom Nygaard	14,368	1.81
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	200	0.25
				Dinobryon sertularia Ehrenberg	600	2.03
				Dinobryon sociale Ehrenberg	71,840	16.25
				Uroglena volvox Ehrenberg	150,864	17.06
				Chrysochromulina laurentiana Kling	86,208	34.02
				Stichogloea spp.	50,288	2.53
				Salpingoeca frequentissima (Zach.) Lemmermann	136,496	3.28
				Pteridomonas sp.	21,552	5.13
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,200	2.18
				Cyclotella ocellata Pant.	14,368	1.10
				Synedra acus Kutzing	200	0.02
				Asterionella formosa Hassall	1,400	0.15
				Cyclotella michiganiana Skvortzow	21,552	0.50
			Cryptophyceae	*Rhodomonas minuta Skuja*	229,888	33.22
				Cryptomonas erosa Ehrenberg	1,200	1.45

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Cryptophyceae	*Cryptomonas reflexa (Marsson) Skuja*	600	0.46
				Cryptomonas rostratiformis Skuja	200	0.30
			Dinophyceae	*Gymnodinium* sp.	1,000	11.74
				Peridinium pusillum (Penard) Lemmermann	1,200	2.39
MEL-0301	1	September	Chlorophyceae	*Oocystis lacustris Chodat*	35,920	1.08
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	200	0.28
				Euastrum spp.	200	0.37
				Staurodesmus extensus (Andersson) Teiling	200	0.08
			Chrysophyceae	Small chrysophyceae	122,128	1.72
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	21,552	1.41
				Chrysococcus sp.	711,216	41.18
				Chrysostephanospaera globulifera Scherffel	14,368	4.78
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	21,552	0.20
				*Spiniferomonas sirrata***********	21,552	1.98
				Dinobryon borgei Lemmermann	14,368	0.62
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon sertularia Ehrenberg	71,840	16.25
				Dinobryon sertularia Ehrenberg	400	1.36
				Epiphyxis sp.	28,736	2.19
				Chrysochromulina laurentiana Kling	57,472	22.68
				Salpingoeca frequentissima (Zach.) Lemmermann	100,576	3.24
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	6.60
				Cyclotella ocellata Pant.	43,104	5.38
				Tabellaria flocculsa (Roth) Kutzing	800	1.07
				Fragilaria crotonensis Kitton	800	0.25
				Synedra acus Kutzing	1,400	0.15
				Asterionella formosa Hassall	5,600	0.59
				Cyclotella michiganiana Skvortzow	43,104	1.06
				Cyclotella bodanica Eulenst.	600	4.63
			Cryptophyceae	*Rhodomonas minuta Skuja*	136,496	18.86
				Cryptomonas erosa Ehrenberg	600	0.78
			Dinophyceae	*Gymnodinium* sp.	800	8.24
				Peridinium pusillum (Penard) Lemmermann	1,400	3.48
MEL-0302	1	September	Chlorophyceae	*Oocystis lacustris Chodat*	28,736	0.87
				Planctonema lauterbornii Schmidle	7,184	1.63
				Cosmarium sp.	200	0.28
			Chrysophyceae	Small chrysophyceae	136,496	1.92
				Large chrysophyceae	57,472	10.32
				Chrysochromulina parva Lackey	28,736	1.88
				Chrysococcus sp.	366,384	21.21
				Kephyrion sp.	21,552	0.20
				*Spiniferomonas sirrata***********	7,184	0.66
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	7,184	1.63
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	200	1.02
				Ochromonas sp.	14,368	0.88
				Chrysochromulina laurentiana Kling	43,104	17.01
				Salpingoeca frequentissima (Zach.) Lemmermann	251,440	8.10
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,200	5.03
				Cyclotella ocellata Pant.	7,184	0.90
				Tabellaria flocculsa (Roth) Kutzing	200	0.27
				Synedra acus Kutzing	200	0.02
				Synedra ulna (Nitzsch) Ehrenberg	200	1.47
				Asterionella formosa Hassall	1,800	0.19
				Cyclotella michiganiana Skvortzow	57,472	1.41
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	14,368	1.99
				Cryptomonas erosa Ehrenberg	1,000	1.31
				Katablepharis ovalis Skuja	64,656	2.34
			Dinophyceae	*Gymnodinium* sp.	200	2.06
				Peridinium pusillum (Penard) Lemmermann	800	1.99
			Cyanobacteria	*Snowella* sp	200	0.15
			Chlorophyceae	*Oocystis lacustris Chodat*	50,288	1.52
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	1,200	0.46
				Staurodesmus paradoxum Meyen	200	1.05
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	193,968	2.73
				Large chrysophyceae	7,184	1.29

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0303	1	September	Chrysophyceae	*Chrysochromulina parva Lackey*	64,656	4.23
				Chrysococcus sp.	524,432	30.36
				Chrysostephanospaera globulifera Scherffel	14,368	4.78
				Kephyrion sp.	35,920	0.88
				*Spiniferomonas sirrata***********	7,184	0.66
				Dinobryon mucronutom Nygaard	7,184	0.90
				Dinobryon bavaricum Imhof	57,472	13.00
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	800	1.00
				Chrysochromulina laurentiana Kling	79,024	31.18
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	86,208	2.78
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	6.60
				Cyclotella ocellata Pant.	7,184	0.90
				Fragilaria crotonensis Kitton	200	0.06
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	1,800	0.19
				Cyclotella michiganiana Skvortzow	35,920	0.88
				Cyclotella bodanica Eulenst.	200	1.41
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	5.96
				Cryptomonas erosa Ehrenberg	600	0.78
			Dinophyceae	*Gymnodinium* sp.	200	2.06
				Peridinium pusillum (Penard) Lemmermann	4,400	10.92
MEL-0304	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	0.56
				Oocystis lacustris Chodat	28,736	0.87
				Planctonema lauterbornii Schmidle	28,736	6.50
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	1,400	0.54
				Botryococcus braunii Kutzing	200	0.10
			Chrysophyceae	Small chrysophyceae	100,576	1.42
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	28,736	1.88
				Chrysococcus sp.	395,120	22.88
				Kephyrion sp.	35,920	0.88
				*Spiniferomonas sirrata***********	7,184	0.66
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,600	11.62
				Chrysochromulina laurentiana Kling	100,576	39.69
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.93
				Pteridomonas sp.	7,184	1.38
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,600	2.51
				Cyclotella ocellata Pant.	35,920	4.49
				Fragilaria crotonensis Kitton	200	0.06
				Synedra acus Kutzing	1,400	0.15
				Asterionella formosa Hassall	2,200	0.23
				Cyclotella michiganiana Skvortzow	43,104	1.06
				Cyclotella bodanica Eulenst.	400	3.09
			Cryptophyceae	*Rhodomonas minuta Skuja*	28,736	3.97
				Cryptomonas erosa Ehrenberg	1,000	1.31
			Dinophyceae	*Gymnodinium* sp.	1,600	16.49
				Peridinium pusillum (Penard) Lemmermann	1,600	3.97
MEL-0305	1	September	Chlorophyceae	*Elakatothrix gelatinosa Willen*	35,920	0.68
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	600	0.84
				Staurodesmus extensus (Andersson) Teiling	400	0.14
				Spondylosium planum (Wolle) W. and G.S. West	28,736	1.08
			Chrysophyceae	Small chrysophyceae	208,336	2.94
				Large chrysophyceae	64,656	11.61
				Chrysochromulina parva Lackey	35,920	2.35
				Chrysococcus sp.	466,960	27.04
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	107,760	0.99
				*Spiniferomonas sirrata***********	21,552	1.98
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	1,200	6.10
				Chrysochromulina laurentiana Kling	86,208	34.02
				Salpingoeca frequentissima (Zach.) Lemmermann	14,368	0.46
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	2,400	3.77
				Cyclotella ocellata Pant.	50,288	6.28
				Rhizosolenia eriense H.L. Smith	7,184	0.56

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria flocculsa (Roth) Kutzing*	600	0.80
				Fragilaria crotonensis Kitton	1,400	0.45
				Synedra acus Kutzing	600	0.06
				Asterionella formosa Hassall	2,000	0.21
				Cyclotella michiganiana Skvortzow	50,288	1.23
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	8.94
				Cryptomonas erosa Ehrenberg	800	1.05
				Cryptomonas reflexa (Marsson) Skuja	600	0.41
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	1,000	10.31
				Peridinium pusillum (Penard) Lemmermann	2,000	4.62
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	57,472	0.53
				Oocystis lacustris Chodat	21,552	0.57
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	200	0.94
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Botryococcus braunii Kutzing	800	0.42
			Euglenphyceae	*Euglena acus Ehrenberg*	200	1.19
			Chrysophyceae	Small chrysophyceae	122,128	1.72
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	86,208	5.64
				Chrysococcus sp.	445,408	22.72
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	7,184	0.11
				Dinobryon borgei Lemmermann	28,736	1.39
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	800	1.59
MEL-0101	1	September		*Chrysochromulina laurentiana Kling*	79,024	31.18
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	431,040	13.88
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	2.83
				Rhizosolenia eriense H.L. Smith	50,288	3.91
				Tabellaria fenestrata (Lyngbye) Kutzing	4,600	3.73
				Tabellaria flocculsa (Roth) Kutzing	11,000	18.06
				Fragilaria crotonensis Kitton	4,200	1.27
				Synedra acus Kutzing	3,800	0.38
				Asterionella formosa Hassall	133,200	13.81
				Cyclotella michiganiana Skvortzow	28,736	0.70
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	158,048	21.84
				Cryptomonas erosa Ehrenberg	600	0.78
				Katablepharis ovalis Skuja	14,368	0.52
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	200	2.83
				Peridinium pusillum (Penard) Lemmermann	800	2.83
				Peridinium aciculiferum Lemmermann	400	3.62
			Chlorophyceae	*Carteria* spp.	7,184	2.65
				Chlamydomonas spp.	7,184	0.24
				Sphaerocystis schroeteri Chodat	50,288	0.46
				Oocystis lacustris Chodat	50,288	1.33
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	50,288	11.38
				Cosmarium sp.	200	0.28
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Staurodesmus paradoxum Meyen	400	0.42
				Botryococcus braunii Kutzing	1,400	0.73
			Chrysophyceae	Small chrysophyceae	57,472	0.81
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	50,288	3.29
				Chrysococcus sp.	502,880	25.65
				Chrysostephanospaera globulifera Scherffel	14,368	5.13
				Dinobryon borgei Lemmermann	7,184	0.35
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	7,184	2.88
MEL-0101	2	September		*Dinobryon sertularia Ehrenberg*	35,920	8.13
				Dinobryon sertularia Ehrenberg	1,000	1.99
				Chrysochromulina laurentiana Kling	43,104	17.01
				Salpingoeca frequentissima (Zach.) Lemmermann	229,888	7.40
				Cyclotella stelligera Cleve and Grunow	2,200	3.46
				Cyclotella ocellata Pant.	7,184	0.90
				Rhizosolenia eriense H.L. Smith	28,736	2.24
				Tabellaria fenestrata (Lyngbye) Kutzing	9,400	7.62

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria flocculsa (Roth) Kutzing*	7,200	11.82
				Fragilaria crotonensis Kitton	2,200	0.66
				Synedra acus Kutzing	3,400	0.34
				Asterionella formosa Hassall	139,800	14.50
				Cyclotella michiganiana Skvortzow	28,736	0.70
			Cryptophyceae	*Rhodomonas minuta Skuja*	43,104	5.96
				Cryptomonas erosa Ehrenberg	200	0.26
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	200	2.83
				Peridinium pusillum (Penard) Lemmermann	1,800	6.36
				Peridinium aciculiferum Lemmermann	600	5.43
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	100,576	0.93
				Oocystis lacustris Chodat	43,104	1.14
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	50,288	11.38
				Staurodesmus extensus (Andersson) Teiling	200	0.08
				Botryococcus braunii Kutzing	200	0.10
			Chrysophyceae	Small chrysophyceae	43,104	0.61
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	43,104	2.82
				Chrysococcus sp.	495,696	25.28
				Chrysostephanospaera globulifera Scherffel	14,368	4.15
				Kephyrion boreale Skuja	7,184	0.77
				Kephyrion sp.	7,184	0.11
				*Spiniferomonas sirrata***********	21,552	1.98
				Dinobryon borgei Lemmermann	7,184	0.31
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	400	0.80
				Dinobryon bavaricum v vanhoeffenii (Bachmann) Krieger	14,368	5.75
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	1,000	1.99
MEL-0102	1	September		*Chrysochromulina laurentiana Kling*	57,472	22.68
				Stichogloea spp.	35,920	1.81
				Salpingoeca frequentissima (Zach.) Lemmermann	646,560	20.82
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	1,800	2.83
				Cyclotella ocellata Pant.	7,184	0.90
				Rhizosolenia eriense H.L. Smith	35,920	2.79
				Tabellaria fenestrata (Lyngbye) Kutzing	3,600	2.92
				Fragilaria crotonensis Kitton	6,400	1.98
				Synedra acus Kutzing	7,200	0.72
				Asterionella formosa Hassall	130,400	13.52
				Cyclotella michiganiana Skvortzow	35,920	0.88
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	71,840	9.93
				Cryptomonas erosa Ehrenberg	1,200	1.57
				Cryptomonas rostratiformis Skuja	200	0.41
				Katablepharis ovalis Skuja	7,184	0.26
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.81
				Gymnodinium sp.	200	2.83
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	4,200	14.85
				Peridinium aciculiferum Lemmermann	400	3.62
			Cyanobacteria	*Snowella* sp	200	0.15
			Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	0.33
				Oocystis lacustris Chodat	79,024	2.09
				Elakatothrix gelatinosa Willen	14,368	0.25
				Planctonema lauterbornii Schmidle	21,552	4.88
				Staurodesmus extensus (Andersson) Teiling	800	0.29
			Chrysophyceae	Small chrysophyceae	64,656	0.91
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	14,368	0.94
				Chrysococcus sp.	510,064	26.01
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	7,184	0.11
				Kephyrion sp.	7,184	0.81
				*Spiniferomonas sirrata***********	14,368	1.32
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	600	1.19
				Epiphyxis sp.	43,104	3.25
MEL-0103	1	September		*Chrysochromulina laurentiana Kling*	28,736	11.34
				Salpingoeca frequentissima (Zach.) Lemmermann	538,800	17.35
				Cyclotella stelligera Cleve and Grunow	2,200	3.46
				Cyclotella ocellata Pant.	7,184	0.90
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Tabellaria fenestrata (Lyngbye) Kutzing	14,600	11.83

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Fragilaria crotonensis Kitton*	3,600	1.12
				Synedra acus Kutzing	7,400	0.74
				Asterionella formosa Hassall	133,600	13.85
				Cyclotella michiganiana Skvortzow	14,368	0.35
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	79,024	10.92
				Cryptomonas erosa Ehrenberg	200	0.26
				Cryptomonas rostratiformis Skuja	200	0.41
				Katablepharis ovalis Skuja	7,184	0.26
			Dinophyceae	*Gymnodinium helveticum Penard*	400	9.42
				Gymnodinium sp.	1,000	14.14
				Peridinium pusillum (Penard) Lemmermann	3,800	13.43
				Peridinium aciculiferum Lemmermann	200	1.81
MEL-0104	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	193,968	3.03
				Oocystis lacustris Chodat	21,552	0.61
				Elakatothrix gelatinosa Willen	7,184	0.12
				Planctonema lauterbornii Schmidle	21,552	4.88
				Staurodesmus extensus (Andersson) Teiling	200	0.09
				Staurodesmus paradoxum Meyen	200	0.55
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	43,104	0.61
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	93,392	6.11
				Chrysococcus sp.	359,200	18.32
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion boreale Skuja	14,368	1.71
				Kephyrion sp.	28,736	0.45
				*Spiniferomonas sirrata***********	7,184	0.66
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	57,472	13.00
				Dinobryon sertularia Ehrenberg	400	0.80
				Chrysochromulina laurentiana Kling	79,024	31.18
				Salpingoeca frequentissima (Zach.) Lemmermann	768,688	24.75
				Pteridomonas sp.	7,184	1.59
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	800	1.45
				Rhizosolenia eriense H.L. Smith	21,552	1.68
				Tabellaria fenestrata (Lyngbye) Kutzing	5,200	4.21
				Tabellaria flocculsa (Roth) Kutzing	3,200	4.93
				Fragilaria crotonensis Kitton	3,000	0.95
				Synedra acus Kutzing	5,400	0.54
				Asterionella formosa Hassall	166,400	17.26
				Cyclotella michiganiana Skvortzow	43,104	1.06
			Cryptophyceae	*Rhodomonas minuta Skuja*	107,760	14.89
				Cryptomonas erosa Ehrenberg	600	0.78
				Katablepharis ovalis Skuja	7,184	0.26
			Dinophyceae	*Gymnodinium helveticum Penard*	600	14.14
				Gymnodinium sp.	7,184	2.65
				Gymnodinium i	400	5.65
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	1,600	5.66
				Peridinium aciculiferum Lemmermann	200	1.81
MEL-0105	1	September	Bacillariophyceae	*Chlamydomonas* spp.	43,104	1.42
				Sphaerocystis schroeteri Chodat	86,208	0.79
				Oocystis lacustris Chodat	107,760	2.84
				Crucigenia quadrata Morr.	28,736	0.14
				Planctonema lauterbornii Schmidle	50,288	11.38
				Cosmarium sp.	200	0.94
				Staurodesmus extensus (Andersson) Teiling	400	0.16
				Spondylosium planum (Wolle) W. and G.S. West	14,368	0.54
				Mougeotia sp.	1,200	3.00
				Botryococcus braunii Kutzing	400	0.21
			Chrysophyceae	Small chrysophyceae	57,472	0.81
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	7,184	0.47
				Chrysococcus sp.	258,624	13.19
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	7,184	0.11
				Dinobryon bavaricum Imhof	21,552	4.88
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	35,920	8.13
				Dinobryon sertularia Ehrenberg	400	0.80
				Chrysochromulina laurentiana Kling	43,104	17.01
				Salpingoeca frequentissima (Zach.) Lemmermann	330,464	10.64
				Cyclotella ocellata Pant.	7,184	0.78
				Rhizosolenia eriense H.L. Smith	14,368	1.12
				Tabellaria fenestrata (Lyngbye) Kutzing	8,400	6.81

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
			Bacillariophyceae	*Tabellaria flocculsa (Roth) Kutzing*	2,400	3.94
				Fragilaria crotonensis Kitton	4,400	1.33
				Synedra acus Kutzing	4,000	0.40
				Asterionella formosa Hassall	136,000	14.10
				Cyclotella michiganiana Skvortzow	7,184	0.18
			Cryptophyceae	*Rhodomonas minuta Skuja*	35,920	4.96
				Cryptomonas erosa Ehrenberg	1,400	1.83
				Cryptomonas rostratiformis Skuja	200	0.41
				Katablepharis ovalis Skuja	7,184	0.26
			Dinophyceae	*Gymnodinium* sp.	7,184	2.65
				Gymnodinium sp.	1,600	22.62
				Peridinium pusillum (Penard) Lemmermann	3,000	10.61
MEL-0201	1	September	Cyanobacteria	*Planktolyngbya limnetica*	200	0.05
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.36
				Oocystis lacustris Chodat	50,288	1.44
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	600	0.84
				Staurodesmus extensus (Andersson) Teiling	400	0.15
				Botryococcus braunii Kutzing	200	0.10
				Oocystis gigas Archer	400	0.97
			Chrysophyceae	Small chrysophyceae	79,024	1.11
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	14,368	0.94
				Chrysococcus sp.	431,040	21.98
				Kephyrion sp.	14,368	0.25
				Mallomonas caudata Ivanov	200	1.07
				Dinobryon borgei Lemmermann	28,736	1.23
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	50,288	11.38
				Dinobryon sertularia Ehrenberg	400	0.80
				Epiphyxis sp.	7,184	0.54
				Chrysolkos skuja (Nauwerck) Willen	21,552	0.60
				Chrysochromulina laurentiana Kling	64,656	25.51
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.39
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,000	9.42
				Cyclotella ocellata Pant.	21,552	2.25
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.32
				Fragilaria crotonensis Kitton	600	0.19
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	19,800	2.09
				Cyclotella michiganiana Skvortzow	79,024	1.94
				Cyclotella bodanica Eulenst.	1,400	10.80
			Cryptophyceae	*Rhodomonas minuta Skuja*	50,288	6.95
				Cryptomonas erosa Ehrenberg	1,400	1.83
			Dinophyceae	*Gymnodinium* sp.	600	6.18
				Peridinium pusillum (Penard) Lemmermann	2,800	6.71
				Peridinium wisconsiense Eddy	200	4.49
MEL-0202	1	September	Chlorophyceae	*Oocystis lacustris Chodat*	14,368	0.38
				Planctonema lauterbornii Schmidle	50,288	11.38
				Closterium sp.	200	0.30
			Chrysophyceae	Small chrysophyceae	136,496	1.92
				Large chrysophyceae	28,736	5.16
				Chrysochromulina parva Lackey	35,920	2.35
				Chrysococcus sp.	359,200	18.32
				Kephyrion sp.	28,736	0.49
				Mallomonas crassisquama (Asmund) Fott	200	0.20
				Dinobryon bavaricum Imhof	43,104	9.75
				Dinobryon bavaricum Imhof	600	2.03
				Dinobryon sertularia Ehrenberg	28,736	6.50
				Dinobryon sertularia Ehrenberg	1,000	5.09
				Chrysolkos skuja (Nauwerck) Willen	35,920	0.94
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	57,472	22.68
				Salpingoeca frequentissima (Zach.) Lemmermann	21,552	0.69
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,800	5.97
				Cyclotella ocellata Pant.	43,104	4.50
				Tabellaria fenestrata (Lyngbye) Kutzing	400	0.32
				Synedra acus Kutzing	400	0.04
				Asterionella formosa Hassall	14,200	1.50
				Cyclotella michiganiana Skvortzow	143,680	3.12
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	28,736	3.97
				Cryptomonas erosa Ehrenberg	800	1.05
			Dinophyceae	*Gymnodinium* sp.	400	4.12
				Peridinium pusillum (Penard) Lemmermann	2,200	5.27
			Cyanobacteria	*Snowella* sp	200	0.14

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0203	1	September	Chlorophyceae	*Sphaerocystis schroeteri Chodat*	35,920	0.56
				Oocystis lacustris Chodat	21,552	0.57
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	800	1.12
				Staurodesmus paradoxum Meyen	600	2.45
				Botryococcus braunii Kutzing	800	0.42
				Zygnema sp.	600	1.97
			Chrysophyceae	Small chrysophyceae	64,656	0.91
				Large chrysophyceae	21,552	3.87
				Chrysochromulina parva Lackey	57,472	3.76
				Chrysococcus sp.	510,064	26.01
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion sp.	28,736	0.49
				Mallomonas caudata Ivanov	400	2.14
				Mallomonas crassisquama (Asmund) Fott	200	0.20
				Dinobryon borgei Lemmermann	21,552	0.95
				Dinobryon mucronutom Nygaard	7,184	0.86
				Dinobryon bavaricum Imhof	71,840	16.25
				Dinobryon bavaricum Imhof	800	1.59
				Dinobryon sertularia Ehrenberg	7,184	1.63
				Dinobryon sertularia Ehrenberg	2,000	6.78
				Chrysolkos skuja (Nauwerck) Willen	14,368	0.39
				Uroglena volvox Ehrenberg	28,736	3.25
				Chrysochromulina laurentiana Kling	35,920	14.17
				Salpingoeca frequentissima (Zach.) Lemmermann	43,104	1.39
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	6,600	10.37
				Cyclotella ocellata Pant.	28,736	3.00
				Tabellaria fenestrata (Lyngbye) Kutzing	800	0.65
				Fragilaria crotonensis Kitton	1,400	0.45
				Synedra acus Kutzing	1,200	0.12
				Asterionella formosa Hassall	16,000	1.69
				Cyclotella michiganiana Skvortzow	79,024	1.51
				Cyclotella bodanica Eulenst.	1,000	7.72
			Cryptophyceae	*Rhodomonas minuta Skuja*	50,288	6.95
				Cryptomonas erosa Ehrenberg	2,000	2.61
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	14,368	5.30
				Gymnodinium sp.	400	4.12
				Peridinium pusillum (Penard) Lemmermann	3,400	8.14
MEL-0204	1	September	Cyanobacteria	*Planktolyngbya limnetica*	200	0.02
			Chlorophyceae	*Chlamydomonas* spp.	7,184	0.85
				Sphaerocystis schroeteri Chodat	21,552	0.34
				Planctonema lauterbornii Schmidle	21,552	4.88
				Cosmarium sp.	600	0.84
				Staurodesmus extensus (Andersson) Teiling	200	0.07
				Staurodesmus paradoxum Meyen	200	0.37
				Botryococcus braunii Kutzing	200	0.10
			Chrysophyceae	Small chrysophyceae	28,736	0.41
				Large chrysophyceae	14,368	2.58
				Chrysochromulina parva Lackey	7,184	0.47
				Chrysococcus sp.	524,432	26.75
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	21,552	0.37
				Dinobryon borgei Lemmermann	7,184	0.32
				Dinobryon mucronutom Nygaard	7,184	0.86
				Dinobryon bavaricum Imhof	35,920	8.13
				Dinobryon bavaricum Imhof	600	1.19
				Dinobryon sertularia Ehrenberg	14,368	3.25
				Dinobryon sertularia Ehrenberg	1,600	3.19
				Bitrichia chodatii (Reverdin) Chodat	7,184	0.36
				Chrysochromulina laurentiana Kling	35,920	14.17
				Stichogloea spp.	21,552	1.08
				Salpingoeca frequentissima (Zach.) Lemmermann	28,736	0.93
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,400	6.91
				Cyclotella ocellata Pant.	28,736	2.89
				Tabellaria fenestrata (Lyngbye) Kutzing	2,000	1.62
				Fragilaria crotonensis Kitton	1,400	0.45
				Synedra acus Kutzing	1,000	0.10
				Asterionella formosa Hassall	28,400	3.00
				Cyclotella michiganiana Skvortzow	107,760	2.06
				Cyclotella bodanica Eulenst.	1,000	7.72
			Cryptophyceae	*Rhodomonas minuta Skuja*	28,736	3.97
				Cryptomonas erosa Ehrenberg	1,200	1.57
				Katablepharis ovalis Skuja	7,184	0.25
			Dinophyceae	*Gymnodinium* sp.	200	2.06
				Peridinium pusillum (Penard) Lemmermann	4,400	10.54
			Cyanobacteria	*Planktolyngbya limnetica*	400	0.06

Station	Replicate	Sampling Period	Major Taxonomic Group	Taxonomic name	Abundance (cells/L)	Biomass (mg/m^3)
MEL-0204	2	September	Chlorophyceae	*Chlamydomonas* spp.	7,184	0.85
				Sphaerocystis schroeteri Chodat	64,656	1.01
				Oocystis lacustris Chodat	7,184	0.19
				Planctonema lauterbornii Schmidle	21,552	4.88
				Staurodesmus extensus (Andersson) Teiling	400	0.15
				Oocystis gigas Archer	200	0.48
			Chrysophyceae	Small chrysophyceae	86,208	1.22
				Large chrysophyceae	43,104	7.74
				Chrysochromulina parva Lackey	14,368	0.94
				Chrysococcus sp.	416,672	21.25
				Chrysostephanospaera globulifera Scherffel	7,184	2.56
				Kephyrion sp.	43,104	0.74
				Mallomonas crassisquama (Asmund) Fott	400	0.40
				Dinobryon borgei Lemmermann	21,552	0.95
				Dinobryon bavaricum Imhof	50,288	11.38
				Dinobryon bavaricum Imhof	200	0.40
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	600	1.19
				Chrysochromulina laurentiana Kling	21,552	8.50
				Salpingoeca frequentissima (Zach.) Lemmermann	35,920	1.16
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	4,200	6.60
				Cyclotella ocellata Pant.	64,656	6.50
				Fragilaria crotonensis Kitton	2,600	0.83
				Synedra acus Kutzing	1,600	0.16
				Asterionella formosa Hassall	16,200	1.71
				Cyclotella michiganiana Skvortzow	57,472	1.10
				Cyclotella bodanica Eulenst.	200	1.54
			Cryptophyceae	*Rhodomonas minuta Skuja*	28,736	3.97
				Cryptomonas erosa Ehrenberg	1,000	1.31
			Dinophyceae	*Gymnodinium helveticum Penard*	200	4.71
				Gymnodinium sp.	7,184	2.65
				Gymnodinium sp.	200	2.06
				Peridinium pusillum (Penard) Lemmermann	3,400	8.14
MEL-0205	1	September	Chlorophyceae	*Chlamydomonas* spp.	14,368	2.17
				Sphaerocystis schroeteri Chodat	64,656	1.01
				Crucigenia quadrata Morr.	28,736	0.32
				Planctonema lauterbornii Schmidle	43,104	9.75
				Closterium kuetzingii Brebisson	200	0.34
				Cosmarium sp.	600	0.84
				Botryococcus braunii Kutzing	800	0.42
			Chrysophyceae	Small chrysophyceae	122,128	1.72
				Large chrysophyceae	7,184	1.29
				Chrysochromulina parva Lackey	129,312	8.46
				Chrysococcus sp.	431,040	21.98
				Chrysostephanospaera globulifera Scherffel	7,184	2.39
				Kephyrion sp.	28,736	0.49
				*Spiniferomonas sirrata***********	7,184	0.66
				Mallomonas caudata Ivanov	200	1.07
				Mallomonas crassisquama (Asmund) Fott	200	0.20
				Dinobryon bavaricum Imhof	14,368	3.25
				Dinobryon bavaricum Imhof	1,000	1.99
				Dinobryon sertularia Ehrenberg	21,552	4.88
				Dinobryon sertularia Ehrenberg	1,200	2.39
				Chrysolkos skuja (Nauwerck) Willen	7,184	0.19
				Uroglena volvox Ehrenberg	28,736	3.25
				Chrysochromulina laurentiana Kling	86,208	34.02
				Stichogloea spp.	7,184	0.36
				Salpingoeca frequentissima (Zach.) Lemmermann	79,024	2.54
			Bacillariophyceae	*Cyclotella stelligera Cleve and Grunow*	3,800	5.97
				Cyclotella ocellata Pant.	14,368	1.50
				Tabellaria fenestrata (Lyngbye) Kutzing	6,000	4.86
				Fragilaria crotonensis Kitton	1,000	0.32
				Synedra acus Kutzing	2,000	0.20
				Asterionella formosa Hassall	32,800	3.47
				Cyclotella michiganiana Skvortzow	64,656	1.58
				Cyclotella bodanica Eulenst.	800	6.17
			Cryptophyceae	*Rhodomonas minuta Skuja*	64,656	8.94
				Cryptomonas erosa Ehrenberg	1,400	1.83
				Cryptomonas rostratiformis Skuja	200	0.42
			Dinophyceae	*Gymnodinium* sp.	400	4.12
				Peridinium willei Huitfeldt-Kaas	200	4.49
				Peridinium pusillum (Penard) Lemmermann	2,800	6.71

Notes: cells/L=cells per litre; mg/m^3=milligrams per cubic metre

Table 7E-1: Summary Statistics for Zooplankton Abundance, Biomass and Richness

Year	Site	Season	Abundance (org/m^3)						Biomass (mg/m^3)						Richness (no. of taxa)					
			Min	Max	Median	Mean	SE	SD	Min	Max	Median	Mean	SE	SD	Min	Max	Median	Mean	SE	SD
2015	MEL-01	July	23,952	53,338	38,282	38,173	4,658	10,415	230	422	274	299	33	73	12	13	12	12.4	0.2	0.5
		August	55,390	81,599	63,826	66,318	4,558	10,193	594	970	745	761	71	158	11	13	12	12.0	0.3	0.7
		September	35,456	50,778	39,901	41,509	3,552	7,103	235	370	276	289	31	63	9	11	11	10.5	0.5	1.0
	MEL-02	July	23,644	49,118	36,329	38,603	4,751	10,623	309	485	412	411	34	77	12	15	13	13.4	0.5	1.1
		August	31,014	100,456	44,787	51,677	12,467	27,877	474	1370	749	816	161	360	11	14	13	12.8	0.6	1.3
		September	19,464	44,223	23,862	27,744	4,306	9,629	219	479	318	348	50	112	9	13	12	11.6	0.7	1.5
2016	MEL-01	August	37,391	96,650	76,386	72,531	11,361	25,405	68	396	209	235	59	133	12	15	12	13.0	0.6	1.4
		September	13,487	24,306	17,294	18,464	1,859	4,158	50	95	78	74	9	20	9	12	11	10.6	0.5	1.1
	MEL-02	August	32,258	41,387	36,865	37,425	1,693	3,787	184	216	200	201	5	12	12	13	12	12.4	0.2	0.5
		September	14,027	18,094	15,899	15,830	794	1,774	41	84	53	58	8	17	11	13	13	12.4	0.4	0.9
	MEL-03	August	29,593	47,389	46,244	42,467	3,380	7,557	96	210	139	145	22	49	10	12	12	11.4	0.4	0.9
		September	8,648	14,593	13,421	12,587	1,120	2,504	15	53	33	34	6	14	10	14	12	12.2	0.8	1.8
	MEL-04	August	18,381	38,023	22,691	26,205	3,607	8,065	86	252	111	143	30	66	11	12	12	11.6	0.2	0.5
	MEL-05	August	19,578	40,913	38,534	34,032	3,883	8,682	80	184	129	126	18	41	12	13	12	12.4	0.2	0.5
2017	MEL-01	July	30,603	56,224	44,032	42,940	4,823	10,784	77	161	94	106	15	34	13	16	13	13.8	0.6	1.3
		August	10,449	26,305	20,611	18,313	3,299	7,377	23	115	64	70	19	42	11	12	11	11.4	0.2	0.5
		September	8,645	27,893	14,209	16,552	3,532	7,898	27	94	52	55	11	25	9	12	10	10.6	0.6	1.3
	MEL-02	July	18,365	49,351	39,349	35,983	5,280	11,807	62	240	138	154	33	73	11	13	12	12.0	0.3	0.7
		August	22,364	38,369	27,408	28,570	3,047	6,813	47	275	146	159	39	87	10	13	12	11.4	0.6	1.3
		September	7,859	37,778	16,126	18,991	5,123	11,456	30	137	66	68	19	42	10	12	12	11.4	0.4	0.9
	MEL-03	July	32,236	55,025	42,916	43,135	3,845	8,598	137	299	235	229	26	58	10	12	12	11.4	0.4	0.9
		August	16,399	46,580	30,196	31,950	5,541	12,390	89	294	146	174	39	87	10	13	12	11.4	0.6	1.3
		September	9,534	24,864	12,222	15,188	3,052	6,824	24	109	44	52	15	35	12	14	12	12.8	0.5	1.1
	MEL-04	August	18,272	50,830	36,801	34,297	5,440	12,165	80	235	173	160	26	58	11	14	13	12.6	0.5	1.1
	MEL-05	August	15,251	36,660	25,832	27,303	3,748	8,381	71	247	85	143	40	90	11	13	12	12.2	0.4	0.8

Notes: Min=Minimum; Max=Maximum; SD=Standard deviation; SE=Standard error; org/m3=organisms per cubic metre; mg/m^3=milligrams per cubic metre; no. of taxa=number of taxa

Table 7E-2: Relative Abundance of Major Zooplankton Groups

Year	Site	Season	Relative Abundance (%)					Relative Biomass (%)				
			Cladocera	Calanoida	Cyclopoida	Copepod Nauplii	Rotifera	Cladocera	Calanoida	Cyclopoida	Copepod Nauplii	Rotifera
2015	MEL-01	July	3.32	0.59	7.75	12.41	75.92	13.28	0.57	6.92	0.52	78.71
		August	15.18	1.36	8.09	17.91	57.45	39.08	2.78	5.05	0.29	52.80
		September	12.19	0.02	2.41	12.29	73.09	35.55	0.08	1.70	0.30	62.38
	MEL-02	July	7.40	0.66	11.23	14.69	66.02	32.83	0.38	8.48	0.21	58.11
		August	21.35	1.45	6.57	12.32	58.31	59.98	1.75	3.56	0.11	34.59
		September	19.91	0.83	5.03	14.66	59.56	60.17	2.01	3.11	0.21	34.49
2016	MEL-01	August	21.07	0.50	2.26	6.02	70.16	44.55	3.92	3.63	0.14	47.76
		September	2.93	0.13	4.88	15.47	76.58	3.74	0.88	5.45	0.30	89.63
	MEL-02	August	28.84	1.58	8.07	20.94	40.58	71.31	7.66	11.07	0.40	9.56
		September	11.33	0.97	5.57	32.67	49.46	37.80	9.15	12.36	1.13	39.57
	MEL-03	August	20.14	0.70	2.54	37.76	38.86	79.92	6.31	6.71	0.29	6.77
		September	8.01	1.59	3.42	26.37	60.61	40.91	18.39	13.69	1.36	25.65
	MEL-04	August	17.35	6.77	10.11	28.02	37.74	50.54	26.73	20.61	0.08	2.04
	MEL-05	August	22.29	1.19	6.52	44.04	25.96	66.16	8.56	20.70	0.31	4.26
2017	MEL-01	July	6.06	2.01	1.08	10.54	80.32	26.94	9.87	4.78	0.27	58.14
		August	18.49	3.19	1.46	21.07	55.79	59.45	19.72	5.01	0.35	15.47
		September	1.93	0.07	3.03	16.07	78.90	4.15	0.30	6.12	0.55	88.88
	MEL-02	July	24.72	2.04	4.24	17.25	51.75	62.66	6.84	10.48	0.34	19.68
		August	20.06	7.33	5.02	32.33	35.26	47.20	31.44	10.20	0.50	10.67
		September	12.22	4.65	4.69	23.39	55.05	35.52	29.34	12.88	0.48	21.78
	MEL-03	July	29.63	5.53	8.02	21.02	35.80	61.67	11.01	16.69	0.39	10.24
		August	28.24	4.85	2.65	29.35	34.90	61.93	26.12	6.36	0.34	5.25
		September	6.59	2.36	1.63	15.30	74.12	30.06	24.22	6.74	0.36	38.63
	MEL-04	August	36.08	1.00	2.39	5.04	55.49	56.66	4.18	5.02	0.09	34.05
	MEL-05	August	30.54	3.70	4.02	24.77	36.96	63.48	18.42	9.52	0.46	8.11

Notes: %=percent

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-01-01		Mel-01-02		Mel-01-02		Mel-01-03		Mel-01-04	
		Replicate	Rep 1		Rep 1		Rep 2		Rep 1		Rep 1	
		Sampling Period	19/07/2015		19/07/2015		19/07/2015		19/07/2015		18/07/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	95	0.80	17	0.14	50	0.42	320	2.69	123	1.04
	Chydoridae indet.	F	15	0.26	10	0.18	25	0.44	10	0.18	10	0.18
	Daphnia longiremis	F	65	4.20	120	7.76	105	6.79	510	32.99	90	5.82
	Holopedium gibberum	F	260	3.98	140	2.14	265	4.06	210	3.21	143	2.19
	Leptodora kindtii	F										
Calanoida	Calanoida indet.	I-V	165	1.01	67	0.41	95	0.58	40	0.24	87	0.53
	Calanoida indet.	Vlf										
	Calanoida indet.	Vlm										
	Epischura sp.	Vlf										
	Epischura sp.	Vlm										
	Leptodiaptomus minutus	Vlf							20	0.80		
	Leptodiaptomus minutus	Vlm										
Cyclopoida	Cyclopoida indet.	I-V	1,150	5.27	580	2.66	850	3.90	1,830	8.39	550	2.52
	Cyclopoida indet.	Vlf										
	Cyclops scutifer	Vlf					5	0.22				
	Diacyclops thomasi	Vlf	285	7.20	33	0.84	95	2.40	90	2.27	70	1.77
	Diacyclops thomasi	Vlm	215	3.67	20	0.34	40	0.68	80	1.37	40	0.68
Copepoda	Copepoda indet.	nauplius										
	Calanoida indet.	nauplius	2,333	1.01	867	0.38	1,167	0.51	1,933	0.84	967	0.42
	Cyclopoida indet.	nauplius	600	0.01	400	0.00	467	0.01	500	0.01	333	0.00
Rotifera	*Conochilus* sp.	colonial										
	Conochilus sp.	individual	5,567	5.59	1,833	1.84	1,533	1.54	5,133	5.15	4,133	4.15
	Filinia sp.											
	Asplanchna sp.		1,467	67.88	1,133	52.45	1,467	67.88	1,067	49.37	933	43.20
	Kellicottia sp.		3,433	29.60	2,700	23.28	3,267	28.16	7,433	64.09	6,200	53.45
	Keratella sp. 1		1,800	4.44	1,933	4.77	1,633	4.03	2,800	6.91	3,267	8.06
	Keratella sp. 2		67	0.41	33	0.21	100	0.62	33	0.21	67	0.41
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		733	0.36	267	0.13	333	0.17	567	0.28	533	0.26
	Synchaeta sp.								33	0.06	33	0.06
		Total	**18,250**	**135.69**	**10,153**	**97.53**	**11,497**	**122.39**	**22,610**	**179.04**	**17,580**	**124.74**

Notes: #/sample=number of organisms per sample; mg/sample=milligrams per sample (wet weight)

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-01-05		Mel-01-01		Mel-01-02		Mel-01-03		Mel-01-04	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	18/07/2015		14/08/2015		14/08/2015		14/08/2015		14/08/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	125	1.05	3,300	27.71	1,917	16.09	2,100	17.63	1,740	14.61
	Chydoridae indet.	F	5	0.09								
	Daphnia longiremis	F	215	13.91	1,967	127.20	783	50.67	1,360	87.97	1,140	73.74
	Holopedium gibberum	F	335	5.13	967	14.80	517	7.91	780	11.94	980	15.00
	Leptodora kindtii	F			33	8.29						
Calanoida	Calanoida indet.	I-V	125	0.76	267	1.63	117	0.71	280	1.71	180	1.10
	Calanoida indet.	VIf										
	Calanoida indet.	VIm										
	Epischura sp.	VIf					17	0.80				
	Epischura sp.	VIm			33	1.20	17	0.60	20	0.72	40	1.44
	Leptodiaptomus minutus	VIf			300	12.02	67	2.67	140	5.61		
	Leptodiaptomus minutus	VIm			133	4.35	50	1.63	80	2.61	40	1.31
Cyclopoida	Cyclopoida indet.	I-V	1,565	7.17	2,300	10.54	1,533	7.03	2,440	11.18	2,280	10.45
	Cyclopoida indet.	VIf	5	0.22								
	Cyclops scutifer	VIf										
	Diacyclops thomasi	VIf	45	1.14	500	12.62	133	3.37	260	6.56	160	4.04
	Diacyclops thomasi	VIm	20	0.34	200	3.42	50	0.85	220	3.76	100	1.71
Copepoda	Copepoda indet.	nauplius										
	Calanoida indet.	nauplius	1,833	0.79	1,400	0.61	2,400	1.04	2,367	1.03	3,333	1.44
	Cyclopoida indet.	nauplius	767	0.01	5,367	0.06	2,833	0.03	2,500	0.03	3,133	0.04
Rotifera	*Conochilus* sp.	colonial										
	Conochilus sp.	individual	4,467	4.48	11,433	11.47	3,467	3.48	2,900	2.91	4,233	4.25
	Filinia sp.										33	0.01
	Asplanchna sp.		1,333	61.71	3,133	145.02	2,333	107.99	1,267	58.62	2,967	137.30
	Kellicottia sp.		2,600	22.42	10,267	88.52	6,267	54.03	3,700	31.90	9,433	81.33
	Keratella sp. 1		2,300	5.67	3,267	8.06	2,900	7.15	3,000	7.40	3,967	9.78
	Keratella sp. 2						67	0.41				
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		467	0.23	100	0.05	33	0.02	33	0.02	100	0.05
	Synchaeta sp.		67	0.12					33	0.06	67	0.12
Total			**16,273**	**125.24**	**44,967**	**477.56**	**25,500**	**266.48**	**23,480**	**251.66**	**33,927**	**357.71**

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-01-05		Mel-01-05		Mel-01-01		Mel-01-01		Mel-01-02	
		Replicate	Rep 1		Rep 2		Rep 1		Rep 2		Rep 1	
		Sampling Period	15/08/2015		15/08/2015		19/09/2015		19/09/2015		19/09/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	2,080	17.47	2,300	19.31	1,558	13.09	1,930	16.21	1,125	9.45
	Chydoridae indet.	F					8	0.15	10	0.18	5	0.09
	Daphnia longiremis	F	2,860	184.99	2,600	168.17	433	28.03	530	34.28	360	23.28
	Holopedium gibberum	F	1,060	16.22	875	13.39						
	Leptodora kindtii	F										
Calanoida	Calanoida indet.	I-V	120	0.73	100	0.61					5	0.03
	Calanoida indet.	Vlf	20	0.80								
	Calanoida indet.	Vlm										
	Epischura sp.	Vlf										
	Epischura sp.	Vlm										
	Leptodiaptomus minutus	Vlf	140	5.61	25	1.00			10	0.40		
	Leptodiaptomus minutus	Vlm	60	1.96								
Cyclopoida	Cyclopoida indet.	I-V	2,240	10.27	1,725	7.91	217	0.99	310	1.42	330	1.51
	Cyclopoida indet.	Vlf										
	Cyclops scutifer	Vlf										
	Diacyclops thomasi	Vlf	120	3.03	175	4.42			10	0.25	5	0.13
	Diacyclops thomasi	Vlm	40	0.68	100	1.71	8	0.14				
Copepoda	Copepoda indet.	nauplius										
	Calanoida indet.	nauplius	1,900	0.82	3,700	1.60	367	0.16	900	0.39	1,133	0.49
	Cyclopoida indet.	nauplius	2,600	0.03	2,500	0.03	1,600	0.02	700	0.01	967	0.01
Rotifera	*Conochilus* sp.	colonial										
	Conochilus sp.	individual	4,933	4.95	4,100	4.11	4,900	4.92	2,800	2.81	1,567	1.57
	Filinia sp.				33	0.01						
	Asplanchna sp.		2,833	131.13	2,133	98.74	1,267	58.62	433	20.06	567	26.23
	Kellicottia sp.		3,833	33.05	7,233	62.36	4,333	37.36	3,867	33.34	3,367	29.03
	Keratella sp. 1		2,400	5.92	4,467	11.02	4,833	11.92	4,033	9.95	4,333	10.69
	Keratella sp. 2				33	0.21						
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		233	0.12	233	0.12	1,767	0.88	1,633	0.81	1,100	0.55
	Synchaeta sp.		33	0.06	33	0.06	233	0.41	167	0.30	167	0.30
		Total	**27,507**	**417.84**	**32,367**	**394.77**	**21,525**	**156.69**	**17,333**	**120.39**	**15,030**	**103.35**

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-01-04		Mel-01-05		Mel-02-01		Mel-02-02		Mel-02-03	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	19/09/2015		19/09/2015		21/07/2015		21/07/2015		21/07/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,733	14.55	2,110	17.72	200	1.68	250	2.10	310	2.60
	Chydoridae indet.	F	8	0.15			18	0.32	10	0.18	10	0.18
	Daphnia longiremis	F	517	33.42	440	28.46	609	39.40	1,390	89.91	1,240	80.20
	Holopedium gibberum	F					145	2.23	110	1.68	280	4.29
	Leptodora kindtii	F					9	2.26				
Calanoida	Calanoida indet.	I-V					118	0.72	50	0.30	90	0.55
	Calanoida indet.	Vlf										
	Calanoida indet.	Vlm										
	Epischura sp.	Vlf										
	Epischura sp.	Vlm										
	Leptodiaptomus minutus	Vlf										
	Leptodiaptomus minutus	Vlm			10	0.33						
Cyclopoida	Cyclopoida indet.	I-V	442	2.02	620	2.84	1,082	4.96	1,780	8.16	1,980	9.07
	Cyclopoida indet.	Vlf										
	Cyclops scutifer	Vlf					9	0.40			10	0.44
	Diacyclops thomasi	Vlf			10	0.25	218	5.51	200	5.05	490	12.37
	Diacyclops thomasi	Vlm	8	0.14			145	2.48	170	2.90	270	4.61
Copepoda	Copepoda indet.	nauplius										
	Calanoida indet.	nauplius	800	0.35	833	0.36	900	0.39	900	0.39	833	0.36
	Cyclopoida indet.	nauplius	1,233	0.01	1,433	0.02	2,533	0.03	633	0.01	900	0.01
Rotifera	*Conochilus* sp.	colonial									100	0.46
	Conochilus sp.	individual	1,900	1.91	1,467	1.47	2,633	2.64	967	0.97	2,833	2.84
	Filinia sp.											
	Asplanchna sp.		400	18.51	200	9.26	1,767	81.77	200	9.26	700	32.40
	Kellicottia sp.		3,767	32.47	3,300	28.45	6,000	51.73	3,333	28.74	5,800	50.01
	Keratella sp. 1		3,933	9.70	4,033	9.95	2,467	6.08	867	2.14	1,133	2.80
	Keratella sp. 2						333	2.07	100	0.62	67	0.41
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		1,233	0.61	1,000	0.50	1,400	0.70	600	0.30	367	0.18
	Synchaeta sp.		100	0.18			233	0.41	133	0.24	33	0.06
		Total	**16,075**	**114.03**	**15,457**	**99.60**	**20,821**	**205.77**	**11,693**	**152.93**	**17,447**	**203.84**

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-02-04		Mel-02-05		Mel-02-01		Mel-02-02		Mel-02-03	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	21/07/2015		21/07/2015		16/08/2015		16/08/2015		16/08/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	350	2.94	183	1.54	2,167	18.19	1,720	14.44	2,460	20.66
	Chydoridae indet.	F	10	0.18	8	0.15						
	Daphnia longiremis	F	690	44.63	508	32.88	5,200	336.34	5,400	349.27	1,840	119.01
	Holopedium gibberum	F	170	2.60	117	1.79	400	6.12	800	12.24	180	2.76
	Leptodora kindtii	F										
Calanoida	Calanoida indet.	I-V	190	1.16	142	0.86	367	2.24	240	1.46	160	0.98
	Calanoida indet.	Vlf										
	Calanoida indet.	Vlm										
	Epischura sp.	Vlf					33	1.60	40	1.91	20	0.96
	Epischura sp.	Vlm									40	1.44
	Leptodiaptomus minutus	Vlf					167	6.68	100	4.01	40	1.60
	Leptodiaptomus minutus	Vlm					67	2.18	60	1.96		
Cyclopoida	Cyclopoida indet.	I-V	1,730	7.93	1,500	6.87	1,600	7.33	1,380	6.32	1,700	7.79
	Cyclopoida indet.	Vlf										
	Cyclops scutifer	Vlf					33	1.46			20	0.88
	Diacyclops thomasi	Vlf	160	4.04	133	3.37	500	12.62	240	6.06	40	1.01
	Diacyclops thomasi	Vlm	90	1.54	75	1.28	267	4.55	100	1.71	80	1.37
Copepoda	Copepoda indet.	nauplius			33	0.00						
	Calanoida indet.	nauplius	1,433	0.62	233	0.10	833	0.36	1,367	0.59	1,033	0.45
	Cyclopoida indet.	nauplius	2,333	0.03	2,400	0.03	4,533	0.05	2,267	0.03	1,500	0.02
Rotifera	*Conochilus* sp.	colonial	33	0.15	33	0.15						
	Conochilus sp.	individual	2,400	2.41	1,700	1.71	6,133	6.15	2,233	2.24	1,300	1.30
	Filinia sp.											
	Asplanchna sp.		1,867	86.39	1,333	61.71	2,033	94.11	1,833	84.85	1,167	54.00
	Kellicottia sp.		9,067	78.17	4,167	35.92	21,367	184.22	6,467	55.75	9,867	85.07
	Keratella sp. 1		2,267	5.59	1,767	4.36	4,967	12.25	1,367	3.37	3,567	8.80
	Keratella sp. 2		67	0.41			33	0.21			67	0.41
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		1,100	0.55	933	0.46	400	0.20	400	0.20	167	0.08
	Synchaeta sp.		100	0.18	133	0.24					67	0.12
		Total	**24,057**	**239.51**	**15,400**	**153.42**	**51,100**	**696.86**	**26,013**	**546.43**	**25,313**	**308.69**

Table 7E-3: Raw Zooplankton Data, 2015

Major Group	Taxon	Station	Mel-02-04		Mel-02-05		Mel-02-01		Mel-02-02		Mel-02-03	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	16/08/2015		17/08/2015		10/09/2015		10/09/2015		10/09/2015	
		Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,200	10.08	1,386	11.64	1,913	16.06	564	4.73	586	4.92
	Chydoridae indet.	F	20	0.35			13	0.22				
	Daphnia longiremis	F	4,380	283.30	2,086	134.90	1,900	122.89	1,591	102.90	564	36.50
	Holopedium gibberum	F	260	3.98	143	2.19	25	0.38			14	0.22
	Leptodora kindtii	F										
Calanoida	Calanoida indet.	I-V	280	1.71	157	0.96	13	0.08	27	0.17	43	0.26
	Calanoida indet.	VIf										
	Calanoida indet.	VIm										
	Epischura sp.	VIf									7	0.34
	Epischura sp.	VIm	20	0.72							14	0.51
	Leptodiaptomus minutus	VIf	80	3.21	71	2.86	75	3.00	27	1.09	93	3.72
	Leptodiaptomus minutus	VIm	40	1.31	29	0.93	38	1.22	18	0.59	71	2.33
Cyclopoida	Cyclopoida indet.	I-V	1,520	6.97	943	4.32	650	2.98	564	2.58	757	3.47
	Cyclopoida indet.	VIf										
	Cyclops scutifer	VIf	20	0.88	29	1.25						
	Diacyclops thomasi	VIf	240	6.06	143	3.61	125	3.16	64	1.61	121	3.07
	Diacyclops thomasi	VIm	180	3.07	86	1.46	38	0.64	9	0.16	57	0.98
Copepoda	Copepoda indet.	nauplius										
	Calanoida indet.	nauplius	1,200	0.52	1,000	0.43	867	0.38	633	0.27	1,100	0.48
	Cyclopoida indet.	nauplius	1,633	0.02	1,733	0.02	2,400	0.03	1,200	0.01	533	0.01
Rotifera	*Conochilus* sp.	colonial					33	0.15				
	Conochilus sp.	individual	1,467	1.47	1,267	1.27	5,567	5.59	867	0.87	2,633	2.64
	Filinia sp.											
	Asplanchna sp.		1,067	49.37	600	27.77	433	20.06	400	18.51	233	10.80
	Kellicottia sp.		5,167	44.55	4,400	37.94	5,033	43.40	2,767	23.85	3,667	31.61
	Keratella sp. 1		2,200	5.43	1,200	2.96	1,133	2.80	800	1.97	600	1.48
	Keratella sp. 2		33	0.21								
	Notholca sp.											
	Ploesoma sp.											
	Polyarthra sp.		33	0.02	33	0.02	200	0.10	233	0.12	167	0.08
	Synchaeta sp.				33	0.06	167	0.30			33	0.06
		Total	**21,040**	**423.20**	**15,338**	**234.59**	**20,621**	**223.42**	**9,764**	**159.44**	**11,295**	**103.48**

Table 7E-3: Raw Zooplankton Data, 2015

		Station	Mel-02-04		Mel-02-05		Mel-01-04-QA		Mel-02-03-QA	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	10/09/2015		10/09/2015		14/08/2015		16/08/2015	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,780	14.95	1,560	13.10	920	7.73	2,160	18.14
	Chydoridae indet.	F								
	Daphnia longiremis	F	1,000	64.68	2,400	155.23	1,360	87.97	1,520	98.31
	Holopedium gibberum	F	30	0.46	50	0.77	760	11.63	80	1.22
	Leptodora kindtii	F								
Calanoida	Calanoida indet.	I-V	30	0.18	20	0.12	60	0.37		
	Calanoida indet.	Vlf								
	Calanoida indet.	Vlm								
	Epischura sp.	Vlf			20	0.96	20	0.96	20	0.96
	Epischura sp.	Vlm	10	0.36					40	1.44
	Leptodiaptomus minutus	Vlf	40	1.60	20	0.80	20	0.80	40	1.60
	Leptodiaptomus minutus	Vlm	10	0.33	10	0.33	60	1.96		
Cyclopoida	Cyclopoida indet.	I-V	400	1.83	540	2.47	2,040	9.35	960	4.40
	Cyclopoida indet.	Vlf								
	Cyclops scutifer	Vlf							20	0.88
	Diacyclops thomasi	Vlf	70	1.77	90	2.27	100	2.52	20	0.50
	Diacyclops thomasi	Vlm	40	0.68	10	0.17	100	1.71	40	0.68
Copepoda	Copepoda indet.	nauplius					33	0.00		
	Calanoida indet.	nauplius	600	0.26	1,000	0.43	3,600	1.56	1,500	0.65
	Cyclopoida indet.	nauplius	933	0.01	1,033	0.01	3,667	0.04	1,600	0.02
Rotifera	*Conochilus* sp.	colonial					33	0.15		
	Conochilus sp.	individual	2,500	2.51	3,200	3.21	7,633	7.66	2,367	2.37
	Filinia sp.				33	0.01	67	0.02		
	Asplanchna sp.		567	26.23	933	43.20	3,633	168.16	1,367	63.25
	Kellicottia sp.		3,333	28.74	4,200	36.21	10,933	94.26	12,467	107.48
	Keratella sp. 1		833	2.06	533	1.32	5,633	13.89	3,400	8.39
	Keratella sp. 2						67	0.41		
	Notholca sp.									
	Ploesoma sp.									
	Polyarthra sp.		400	0.20	200	0.10	200	0.10	200	0.10
	Synchaeta sp.		33	0.06	100	0.18	167	0.30	267	0.47
		Total	**12,610**	**146.90**	**15,953**	**260.89**	**41,107**	**411.55**	**28,067**	**310.88**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-01-01		Mel-01-02		Mel-01-03		Mel-01-04		Mel-01-05	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	11/08/2016		11/08/2016		11/08/2016		11/08/2016		11/08/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	10,150	72.11	9,700	68.91	4,350	30.90	4,850	34.46	890	6.32
	Chydoridae indet.	F					50	0.21				
	Daphnia longiremis	F	900	3.22	900	3.22	950	3.40	350	1.25	100	0.36
	Holopedium gibberum	F	350	3.11	300	2.67	400	3.56	350	3.11	60	0.53
Calanoida	Calanoida indet.	I-V	30	0.16	40	0.21	40	0.21	80	0.42	20	0.10
	Epischura lacustris	VIf	3	0.16	10	0.55			10	0.55		
	Epischura lacustris	VIm	1	0.04			10	0.39				
	Leptodiaptomus minutus	VIf	50	1.64	40	1.31	80	2.63	80	2.63	80	2.63
	Leptodiaptomus minutus	VIm	30	0.86	60	1.73	40	1.15	80	2.30	40	1.15
	Leptodiaptomus pribilofensis	VIf	1	0.07								
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	780	3.37	760	3.29	710	3.07	750	3.24	430	1.86
	Cyclops scutifer	VIf										
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	40	0.65	30	0.49	70	1.14	20	0.33	20	0.33
	Diacyclops thomasi	VIm	20	0.32	30	0.47	30	0.47	10	0.16	10	0.16
Copepod Nauplii	Copepoda indet.	Nauplius	300	0.01	300	0.01	300	0.01	300	0.01	100	0.00
	Calanoida indet.	Nauplius	600	0.15	700	0.18	300	0.08	600	0.15	300	0.08
	Cyclopoida indet.	Nauplius	1,900	0.02	1,200	0.01	800	0.01	1,200	0.01	1,000	0.01
Rotifera	*Asplanchna* sp.		2,600	62.18	2,900	69.35	800	19.13	1,000	23.91	300	7.17
	Conochilus sp.	Individual	16,700	13.70	13,800	11.32	12,000	9.84	14,900	12.22	7,100	5.82
	Kellicottia sp.		6,900	0.60	5,900	0.51	3,900	0.34	3,900	0.34	3,000	0.26
	Keratella sp. 1		4,900	3.88	4,000	3.17	2,300	1.82	3,600	2.85	1,700	1.35
	Keratella sp. 2											
	Lecane sp.						100	0.00			100	0.00
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		500	0.96			600	1.16	200	0.39	100	0.19
	Synchaeta sp.		200	0.28	200	0.28	300	0.42	100	0.14	500	0.69
	Trichocerca sp.		100	0.05	100	0.05	100	0.05				
		Total	**47,055**	**167.56**	**40,970**	**167.73**	**28,230**	**79.99**	**32,380**	**88.47**	**15,850**	**29.02**

Notes: #/sample=number of organisms per sample; mg/sample=milligrams per sample (wet weight)

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-02-01		Mel-02-02		Mel-02-03		Mel-02-04		Mel-02-05	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	11/08/2016		11/08/2016		11/08/2016		11/08/2016		11/08/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	2,475	36.06	2,200	32.06	2,620	38.18	2,620	38.18	2,940	42.84
	Chydoridae indet.	F										
	Daphnia longiremis	F	885	8.95	2,180	22.05	1,400	14.16	2,040	20.64	1,700	17.20
	Holopedium gibberum	F	90	2.28	360	9.11	260	6.58	100	2.53	160	4.05
Calanoida	Calanoida indet.	I-V	105	0.83	100	0.79	120	0.95	40	0.32	40	0.32
	Epischura lacustris	VIf	3	0.16	7	0.38	1	0.05	7	0.38	11	0.60
	Epischura lacustris	VIm	2	0.08	8	0.33	6	0.25	7	0.29	9	0.37
	Leptodiaptomus minutus	VIf	60	2.18	40	1.45	80	2.90	80	2.90	100	3.63
	Leptodiaptomus minutus	VIm	30	0.93	80	2.47	120	3.70	40	1.23	80	2.47
	Leptodiaptomus pribilofensis	VIf	3	0.20	4	0.27	4	0.27	1	0.07	6	0.40
	Leptodiaptomus pribilofensis	VIm	2	0.11	4	0.21	3	0.16			1	0.05
Cyclopoida	Cyclopoida indet.	I-V	855	4.76	1,320	7.35	1,260	7.01	780	4.34	900	5.01
	Cyclops scutifer	VIf	15	0.26			40	0.70				
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	135	2.20	140	2.28	180	2.94	120	1.96	140	2.28
	Diacyclops thomasi	VIm	60	1.00	80	1.33	80	1.33	20	0.33	40	0.67
Copepod Nauplii	Copepoda indet.	Nauplius									200	0.01
	Calanoida indet.	Nauplius	1,200	0.44	800	0.29	900	0.33	300	0.11	600	0.22
	Cyclopoida indet.	Nauplius	3,400	0.08	2,500	0.06	1,600	0.04	2,400	0.05	2,100	0.05
Rotifera	*Asplanchna* sp.		100	2.66			100	2.66	400	10.65	300	7.99
	Conochilus sp.	Individual	600	0.95	1,300	2.05	1,100	1.74	2,400	3.79	1,400	2.21
	Kellicottia sp.		3,900	0.29	5,500	0.42	2,900	0.22	3,100	0.23	3,800	0.29
	Keratella sp. 1		600	0.71	400	0.48	400	0.48	400	0.48	500	0.59
	Keratella sp. 2				100	0.08						
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		100	0.03	200	0.06	500	0.15	300	0.09	600	0.19
	Synchaeta sp.											
	Trichocerca sp.											
		Total	**14,620**	**65.17**	**17,323**	**83.51**	**13,674**	**84.79**	**15,155**	**88.58**	**15,627**	**91.43**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-03-01		Mel-03-02		Mel-03-03		Mel-03-04		Mel-03-05	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	12/08/2016		12/08/2016		12/08/2016		12/08/2016		12/08/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	2,260	36.33	820	13.18	820	13.18	400	6.43	720	11.57
	Chydoridae indet.	F	60	0.16								
	Daphnia longiremis	F	1,280	15.69	2,540	31.14	2,560	31.38	2,200	26.97	4,500	55.16
	Holopedium gibberum	F	20	0.53	80	2.10	20	0.53			20	0.53
Calanoida	Calanoida indet.	I-V	40	0.30	50	0.37			60	0.44	20	0.15
	Epischura lacustris	VIf			5	0.29	3	0.17	15	0.86	4	0.23
	Epischura lacustris	VIm	20	0.83	3	0.12	13	0.54	28	1.16	52	2.15
	Leptodiaptomus minutus	VIf	20	0.69	60	2.07	60	2.07	50	1.72	20	0.69
	Leptodiaptomus minutus	VIm			10	0.29	10	0.29	50	1.45	10	0.29
	Leptodiaptomus pribilofensis	VIf			20	1.46	10	0.73				
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	380	2.20	440	2.55	320	1.85	290	1.68	240	1.39
	Cyclops scutifer	VIf			40	0.70	30	0.52	70	1.22	20	0.35
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	120	1.96	60	0.98	80	1.31	30	0.49	20	0.33
	Diacyclops thomasi	VIm	40	0.71	80	1.42			10	0.18	40	0.71
Copepod Nauplii	Copepoda indet.	Nauplius	200	0.01			400	0.02				
	Calanoida indet.	Nauplius	100	0.04	100	0.04			200	0.08	200	0.08
	Cyclopoida indet.	Nauplius	5,100	0.09	4,400	0.08	7,000	0.13	9,600	0.18	7,000	0.13
Rotifera	*Asplanchna* sp.		400	12.89								
	Conochilus sp.	Individual	1,400	0.96	1,500	1.02	1,000	0.68	600	0.41	600	0.41
	Kellicottia sp.		4,300	0.30	6,700	0.47	3,800	0.27	5,400	0.38	5,000	0.35
	Keratella sp. 1		200	0.13	400	0.26	400	0.26	400	0.26	1,400	0.90
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		800	0.35	400	0.18	200	0.09	200	0.09	200	0.09
	Synchaeta sp.											
	Trichocerca sp.											
Total			**16,740**	**74.16**	**17,708**	**58.72**	**16,726**	**54.02**	**19,603**	**43.99**	**20,066**	**75.50**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-04-01		Mel-04-02		Mel-04-02		Mel-04-03		Mel-04-04	
		Replicate	Rep 1		Rep 1		Rep 2		Rep 1		Rep 1	
		Sampling Period	14/08/2016		14/08/2016		14/08/2016		14/08/2016		14/08/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,000	17.89	360	6.44	460	8.23	560	10.02	408	7.30
	Chydoridae indet.	F										
	Daphnia longiremis	F	3,040	45.78	1,340	20.18	1,640	24.70	2,120	31.93	925	13.93
	Holopedium gibberum	F	160	2.65	180	2.98	180	2.98	100	1.65	133	2.21
Calanoida	Calanoida indet.	I-V	360	2.22	440	2.72	200	1.23	380	2.35	175	1.08
	Epischura lacustris	VIf	7	0.37	20	1.06	8	0.43	10	0.53	17	0.89
	Epischura lacustris	VIm	11	0.50	20	0.90	15	0.68			8	0.38
	Leptodiaptomus minutus	VIf	180	6.32	220	7.72	300	10.53	240	8.42	100	3.51
	Leptodiaptomus minutus	VIm	80	2.46	60	1.84	60	1.84	120	3.69	33	1.02
	Leptodiaptomus pribilofensis	VIf	10	0.19			10	0.19	5	0.10	8	0.16
	Leptodiaptomus pribilofensis	VIm	10	0.64			5	0.32			8	0.53
Cyclopoida	Cyclopoida indet.	I-V	1,840	18.02	1,080	10.58	620	6.07	135	1.32	275	2.69
	Cyclops scutifer	VIf	240	4.20	280	4.90	100	1.75	35	0.61	17	0.29
	Cyclops scutifer	VIm			20	0.60						
	Diacyclops thomasi	VIf	220	3.59	20	0.33	140	2.28	20	0.33	50	0.82
	Diacyclops thomasi	VIm	60	0.64			40	0.42			33	0.35
Copepod Nauplii	Copepoda indet.	Nauplius							100	0.01		
	Calanoida indet.	Nauplius	200	0.06	100	0.03	100	0.03				
	Cyclopoida indet.	Nauplius	3,800	0.04	3,100	0.03	3,000	0.03	3,900	0.04	2,100	0.02
Rotifera	*Asplanchna* sp.						100	3.93				
	Conochilus sp.	Individual	1,800	0.98	1,000	0.54	2,000	1.08	2,100	1.14	1,600	0.87
	Kellicottia sp.		2,500	0.17	2,800	0.19	2,100	0.14	2,600	0.18	1,100	0.08
	Keratella sp. 1		100	0.04	100	0.04	100	0.04	100	0.04	400	0.15
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		500	0.23	800	0.36	400	0.18	300	0.14	400	0.18
	Synchaeta sp.											
	Trichocerca sp.											
		Total	**16,118**	**106.96**	**11,940**	**61.44**	**11,578**	**67.09**	**12,825**	**62.47**	**7,792**	**36.46**

Table 7E-4: Raw Zooplankton Data, 2016

		Station	Mel-04-05		Mel-05-01		Mel-05-01		Mel-05-02		Mel-05-03	
		Replicate	Rep 1		Rep 1		Rep 2		Rep 1		Rep 1	
		Sampling Period	14/08/2016		16/08/2016		16/08/2016		16/08/2016		16/08/2016	
Major Group	Taxon		Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	86	1.53	580	10.10	386	6.71	514	8.95	320	5.57
	Chydoridae indet.	F										
	Daphnia longiremis	F	300	4.52	3,940	37.77	2,771	26.57	2,186	20.95	2,000	19.17
	Holopedium gibberum	F			160	2.63	29	0.47	29	0.47	400	6.58
Calanoida	Calanoida indet.	I-V	614	3.79	20	0.15	18	0.13	24	0.17		
	Epischura lacustris	VIf	20	1.06	20	0.33	18	0.29	12	0.19	13	0.22
	Epischura lacustris	VIm	60	2.70			35	1.42	29	1.18	20	0.80
	Leptodiaptomus minutus	VIf	657	23.07	40	1.40	29	1.03	65	2.27	60	2.11
	Leptodiaptomus minutus	VIm	286	8.78			6	0.19	24	0.76	20	0.64
	Leptodiaptomus pribilofensis	VIf	20	0.38	47	0.89	29	0.56	29	0.56	33	0.64
	Leptodiaptomus pribilofensis	VIm			7	0.52	6	0.46				
Cyclopoida	Cyclopoida indet.	I-V	1,786	17.49	480	4.84	757	7.64	443	4.47	1,240	12.50
	Cyclops scutifer	VIf	43	0.75	80	1.40	100	1.75	100	1.75	80	1.40
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	86	1.40	140	2.28	171	2.80	86	1.40	200	3.26
	Diacyclops thomasi	VIm			120	2.13	29	0.51	43	0.76	40	0.71
Copepod Nauplii	Copepoda indet.	Nauplius			100	0.01	100	0.01			200	0.01
	Calanoida indet.	Nauplius			200	0.09	200	0.09	250	0.11	350	0.15
	Cyclopoida indet.	Nauplius	4,000	0.04	9,100	0.14	5,400	0.08	3,400	0.05	7,050	0.11
Rotifera	*Asplanchna* sp.				100	3.57			50	1.78		
	Conochilus sp.	Individual	2,200	1.19	1,200	0.76	400	0.25	400	0.25	850	0.54
	Kellicottia sp.		2,500	0.17	3,400	0.21	2,700	0.16	1,700	0.10	3,050	0.19
	Keratella sp. 1		300	0.11	400	0.12	600	0.18	100	0.03	400	0.12
	Keratella sp. 2				100	0.20						
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		100	0.05			200	0.10	200	0.10	100	0.05
	Synchaeta sp.											
	Trichocerca sp.											
		Total	**13,057**	**67.03**	**20,233**	**69.53**	**13,984**	**51.39**	**9,682**	**46.32**	**16,427**	**54.78**

Table 7E-4: Raw Zooplankton Data, 2016

		Station	Mel-05-03		Mel-05-04		Mel-05-05		Mel-01-01		Mel-01-02	
		Replicate	Rep 2		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	16/08/2016		16/08/2016		16/08/2016		10/09/2016		10/09/2016	
Major Group	Taxon		Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	200	3.48	1,400	24.37	320	5.57	148	1.05	77	0.54
	Chydoridae indet.	F							25	0.11		
	Daphnia longiremis	F	3,940	37.77	5,433	52.08	820	7.86	75	0.27	160	0.57
	Holopedium gibberum	F	60	0.99	133	2.19	7	0.11				
Calanoida	Calanoida indet.	I-V	27	0.20	46	0.34	80	0.59	3	0.01	3	0.02
	Epischura lacustris	VIf	20	0.33	31	0.51	7	0.11				
	Epischura lacustris	VIm	27	1.07	31	1.24	7	0.27				
	Leptodiaptomus minutus	VIf	80	2.81	69	2.43	73	2.57	3	0.08	10	0.33
	Leptodiaptomus minutus	VIm	40	1.29	62	1.98	53	1.72	3	0.07	7	0.19
	Leptodiaptomus pribilofensis	VIf	60	1.15	31	0.59	7	0.13				
	Leptodiaptomus pribilofensis	VIm	7	0.52	8	0.60	7	0.52				
Cyclopoida	Cyclopoida indet.	I-V	720	7.26	1,067	10.76	620	6.25	510	2.21	540	2.34
	Cyclops scutifer	VIf	60	1.05	69	1.21	87	1.52				
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	180	2.94	267	4.35	100	1.63	3	0.04		
	Diacyclops thomasi	VIm	20	0.36	33	0.59	40	0.71	3	0.04	7	0.11
Copepod Nauplii	Copepoda indet.	Nauplius	100	0.01					200	0.01	300	0.01
	Calanoida indet.	Nauplius	100	0.04	200	0.09			100	0.03	600	0.15
	Cyclopoida indet.	Nauplius	6,600	0.10	7,800	0.12	7,400	0.11	600	0.01	1,600	0.02
Rotifera	*Asplanchna* sp.						100	3.57	700	16.74	1,300	31.09
	Conochilus sp.	Individual	600	0.38	500	0.32	800	0.51	700	0.57	700	0.57
	Kellicottia sp.		3,000	0.18	3,800	0.23	3,100	0.19	600	0.05	2,800	0.24
	Keratella sp. 1		400	0.12	600	0.18			1,800	1.43	1,900	1.51
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.								200	0.09		
	Polyarthra sp.				200	0.10	100	0.05	900	1.74	300	0.58
	Synchaeta sp.								100	0.14		
	Trichocerca sp.											
		Total	**16,240**	**62.03**	**21,779**	**104.28**	**13,727**	**33.99**	**6,670**	**24.67**	**10,303**	**38.27**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-01-02		Mel-01-03		Mel-01-04		Mel-01-05		Mel-02-01	
		Replicate	Rep 4		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	10/09/2016		10/09/2016		10/09/2016		10/09/2016		11/09/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	67	0.47	93	0.66	123	0.87	52	0.37	184	2.68
	Chydoridae indet.	F	17	0.07	9	0.04	15	0.06	13	0.06	2	0.00
	Daphnia longiremis	F	140	0.50	84	0.30	230	0.82	73	0.26	86	0.87
	Holopedium gibberum	F										
Calanoida	Calanoida indet.	I-V	10	0.05	2	0.01			2	0.01	2	0.02
	Epischura lacustris	VIf										
	Epischura lacustris	VIm										
	Leptodiaptomus minutus	VIf	3	0.11	4	0.15	5	0.16	3	0.10	14	0.51
	Leptodiaptomus minutus	VIm			2	0.06	8	0.22			10	0.31
	Leptodiaptomus pribilofensis	VIf									2	0.13
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	593	2.57	282	1.22	418	1.81	183	0.79	258	1.44
	Cyclops scutifer	VIf										
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf			4	0.07	3	0.04	4	0.07	8	0.13
	Diacyclops thomasi	VIm							1	0.02	12	0.20
Copepod Nauplii	Copepoda indet.	Nauplius	300	0.01	100	0.00	100	0.00	100	0.00	350	0.02
	Calanoida indet.	Nauplius	300	0.08	300	0.08	300	0.08	300	0.08	600	0.22
	Cyclopoida indet.	Nauplius	500	0.01	500	0.01	600	0.01	500	0.01	1,200	0.03
Rotifera	*Asplanchna* sp.		1,900	45.44	1,500	35.87	1,100	26.31	800	19.13	250	6.66
	Conochilus sp.	Individual	1,000	0.82	100	0.08	800	0.66	300	0.25	1,000	1.58
	Kellicottia sp.		4,500	0.39	4,400	0.38	1,400	0.12	3,600	0.31	800	0.06
	Keratella sp. 1		1,700	1.35	1,100	0.87	1,400	1.11	200	0.16	300	0.36
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		900	1.74	200	0.39	500	0.96	1,000	1.93	750	0.23
	Synchaeta sp.				100	0.14			200	0.28	350	0.37
	Trichocerca sp.											
		Total	**11,930**	**53.60**	**8,782**	**40.34**	**7,000**	**33.23**	**7,331**	**23.81**	**6,178**	**15.82**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-02-02		Mel-02-03		Mel-02-04		Mel-02-05		Mel-03-01	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	11/09/2016		11/09/2016		11/09/2016		11/09/2016		12/09/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	313	4.57	647	9.42	313	4.55	827	12.05	220	3.54
	Chydoridae indet.	F	3	0.01							2	0.01
	Daphnia longiremis	F	333	3.37	693	7.01	148	1.49	833	8.43	150	1.84
	Holopedium gibberum	F	7	0.17	20	0.51	8	0.19	7	0.17		
Calanoida	Calanoida indet.	I-V	7	0.05	20	0.16	10	0.08	7	0.05	4	0.03
	Epischura lacustris	VIf			7	0.36	3	0.14			6	0.34
	Epischura lacustris	VIm									7	0.29
	Leptodiaptomus minutus	VIf			113	4.11	25	0.91	40	1.45	24	0.83
	Leptodiaptomus minutus	VIm			33	1.03	8	0.23	33	1.03	30	0.87
	Leptodiaptomus pribilofensis	VIf	33	2.21							1	0.07
	Leptodiaptomus pribilofensis	VIm	10	0.53			3	0.13			1	0.09
Cyclopoida	Cyclopoida indet.	I-V	343	1.91	460	2.56	195	1.09	367	2.04	78	0.45
	Cyclops scutifer	VIf	3	0.06					7	0.12		
	Cyclops scutifer	VIm	3	0.10								
	Diacyclops thomasi	VIf	97	1.58	120	1.96	15	0.24	33	0.54	20	0.33
	Diacyclops thomasi	VIm	100	1.66	113	1.89	18	0.29	20	0.33	22	0.39
Copepod Nauplii	Copepoda indet.	Nauplius	350	0.02	350	0.02	250	0.02	350	0.02	250	0.01
	Calanoida indet.	Nauplius	1,000	0.37	950	0.35	650	0.24	600	0.22	500	0.20
	Cyclopoida indet.	Nauplius	1,500	0.03	1,900	0.04	1,200	0.03	1,500	0.03	900	0.02
Rotifera	*Asplanchna* sp.		150	4.00	550	14.65	400	10.65	300	7.99		
	Conochilus sp.	Individual	750	1.19	1,900	3.00	1,400	2.21	850	1.34	700	0.48
	Kellicottia sp.		900	0.07	1,700	0.13	1,500	0.11	1,150	0.09	1,150	0.08
	Keratella sp. 1		250	0.30	350	0.42	300	0.36	500	0.59	400	0.26
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		950	0.29	300	0.09	100	0.03	500	0.15	650	0.29
	Synchaeta sp.		100	0.11			450	0.48	450	0.48	100	0.11
	Trichocerca sp.								50	0.09		
		Total	**7,203**	**22.58**	**10,227**	**47.71**	**6,993**	**23.47**	**8,423**	**37.22**	**5,215**	**10.51**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-03-01		Mel-03-02		Mel-03-03		Mel-03-04		Mel-03-05	
		Replicate	Rep 5		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	12/09/2016		13/09/2016		13/09/2016		22/09/2016		22/09/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	338	5.43	233	3.74	565	9.08	42	0.68	84	1.35
	Chydoridae indet.	F										
	Daphnia longiremis	F	255	3.13	205	2.51	360	4.41	8	0.10	35	0.43
	Holopedium gibberum	F			3	0.08	25	0.66	1	0.03	1	0.03
Calanoida	Calanoida indet.	I-V	8	0.06	3	0.02	5	0.04	3	0.02	1	0.01
	Epischura lacustris	VIf	10	0.57			1	0.06				
	Epischura lacustris	VIm	3	0.10	1	0.04	2	0.08				
	Leptodiaptomus minutus	VIf	48	1.64	65	2.24	70	2.41	18	0.62	17	0.59
	Leptodiaptomus minutus	VIm	23	0.65	25	0.72	70	2.02	11	0.32	10	0.29
	Leptodiaptomus pribilofensis	VIf					5	0.36				
	Leptodiaptomus pribilofensis	VIm					5	0.43				
Cyclopoida	Cyclopoida indet.	I-V	103	0.59	98	0.57	215	1.25	11	0.06		
	Cyclops scutifer	VIf			3	0.04						
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	15	0.24	38	0.61	135	2.20	14	0.23	9	0.15
	Diacyclops thomasi	VIm	18	0.31	30	0.53	140	2.48	8	0.14	5	0.09
Copepod Nauplii	Copepoda indet.	Nauplius	200	0.01	150	0.01	350	0.02	150	0.01	200	0.01
	Calanoida indet.	Nauplius	250	0.10	250	0.10	800	0.33	200	0.08	267	0.11
	Cyclopoida indet.	Nauplius	1,050	0.02	550	0.01	1,200	0.02	400	0.01	200	0.00
Rotifera	*Asplanchna* sp.				150	4.83	50	1.61	100	3.22	33	1.07
	Conochilus sp.	Individual	650	0.44	1,700	1.16	1,900	1.30	150	0.10		
	Kellicottia sp.		1,100	0.08	950	0.07	1,450	0.10	1,200	0.08	667	0.05
	Keratella sp. 1		300	0.19	150	0.10	150	0.10	550	0.35	33	0.02
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		250	0.11	100	0.04	250	0.11	650	0.29	67	0.03
	Synchaeta sp.		200	0.22	250	0.27	400	0.43	150	0.16	433	0.47
	Trichocerca sp.						100	0.67				
		Total	**4,818**	**13.89**	**4,952**	**17.70**	**8,248**	**30.18**	**3,666**	**6.50**	**2,062**	**4.69**

Table 7E-4: Raw Zooplankton Data, 2016

Major Group	Taxon	Station	Mel-01-01-QA		Mel-02-05-QA		Mel-05-03-QA		Mel-01-01-QA		Mel-03-01-QA	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	11/08/2016		11/08/2016		16/08/2016		10/09/2016		12/09/2016	
			Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	9,000	63.94	3,060	44.59	360	6.27	120	0.85	164	2.64
	Chydoridae indet.	F	50	0.21					18	0.07	4	0.01
	Daphnia longiremis	F	1,100	3.94	1,880	19.02	3,420	32.78	75	0.27	130	1.59
	Holopedium gibberum	F	150	1.33	160	4.05	120	1.97				
Calanoida	Calanoida indet.	I-V	30	0.16	20	0.16	13	0.10	3	0.01	2	0.01
	Epischura lacustris	VIf	3	0.16	10	0.55	20	0.33			3	0.17
	Epischura lacustris	VIm	1	0.04	10	0.41	20	0.80			6	0.25
	Leptodiaptomus minutus	VIf	60	1.97	80	2.90	60	2.11	5	0.16	30	1.03
	Leptodiaptomus minutus	VIm	50	1.44	80	2.47	27	0.86	3	0.07	46	1.33
	Leptodiaptomus pribilofensis	VIf	1	0.07	8	0.53	27	0.51			2	0.15
	Leptodiaptomus pribilofensis	VIm			4	0.21	7	0.52			2	0.17
Cyclopoida	Cyclopoida indet.	I-V	620	2.68	780	4.34	1,260	12.71	335	1.45	18	0.10
	Cyclops scutifer	VIf			20	0.35	1,120	19.59			4	0.07
	Cyclops scutifer	VIm									4	0.12
	Diacyclops thomasi	VIf	60	0.98	140	2.28	60	0.98	5	0.08	10	0.16
	Diacyclops thomasi	VIm	30	0.47	60	1.00	160	2.84	3	0.04	20	0.35
Copepod Nauplii	Copepoda indet.	Nauplius	100	0.00			50	0.00	300	0.01	150	0.01
	Calanoida indet.	Nauplius	800	0.20	700	0.26	300	0.13	300	0.08	350	0.14
	Cyclopoida indet.	Nauplius	2,200	0.02	7,300	0.16	6,650	0.10	900	0.01	950	0.02
Rotifera	*Asplanchna* sp.		1,900	45.44	200	5.33			1,000	23.91		
	Conochilus sp.	Individual	18,200	14.93	3,500	5.53	700	0.45	900	0.74	1,400	0.96
	Kellicottia sp.		7,100	0.62	7,200	0.54	350	0.02	2,600	0.23	1,200	0.08
	Keratella sp. 1		5,600	4.44	1,600	1.90	700	0.21	2,300	1.82	500	0.32
	Keratella sp. 2											
	Lecane sp.											
	Monostyla sp.											
	Ploesoma sp.											
	Polyarthra sp.		400	0.77	1,000	0.31			400	0.77	500	0.22
	Synchaeta sp.		400	0.56			100	1.62	100	0.14	100	0.11
	Trichocerca sp.		200	0.10								
		Total	**48,055**	**144.48**	**27,912**	**96.89**	**15,523**	**84.89**	**9,365**	**30.72**	**5,595**	**10.03**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-01-01		Mel-01-02		Mel-01-03		Mel-01-03		Mel-01-04	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 2		Rep 1	
		Sampling Period	16/07/2017		16/07/2017		16/07/2017		16/07/2017		16/07/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	930	6.83	445	3.27	535	3.93	480	3.53	880	6.46
	Chydoridae indet.	F			5	0.06	25	0.30	5	0.06	10	0.12
	Daphnia longiremis	F	140	0.63	180	0.81	150	0.68			420	1.90
	Daphnia sp.	F					10	0.03	125	0.41		
	Holopedium gibberum	F	700	14.77	335	7.07	175	3.69	165	3.48	460	9.71
Calanoida	Calanoida indet.	I-V	410	3.05	300	2.23	380	2.82	285	2.12	320	2.38
	Calanoida indet.	VIf	10	0.14								
	Epischura lacustris	I-V	2	0.04	10	0.19	5	0.10	25	0.48	40	0.77
	Epischura lacustris	VIf	2	0.09	10	0.43			5	0.22	20	0.86
	Epischura lacustris	VIm	3	0.11	5	0.19	5	0.19	20	0.74	20	0.74
	Leptodiaptomus minutus	VIf			5	0.17			15	0.52	90	3.11
	Leptodiaptomus minutus	VIm							10	0.30	40	1.22
	Leptodiaptomus pribilofensis	VIf			5	0.26			5	0.26	20	1.04
	Leptodiaptomus pribilofensis	VIm									10	0.63
Cyclopoida	Cyclopoida indet.	I-V	170	1.12	130	0.85	155	1.02	140	0.92	210	1.38
	Cyclops scutifer	VIf										
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	20	0.52	20	0.52	15	0.39	25	0.65	90	2.33
	Diacyclops thomasi	VIm	10	0.18	15	0.27	25	0.45	30	0.54	100	1.80
Copepoda	Copepoda indet.	Nauplius	400	0.02	200	0.01	200	0.01	100	0.00		
	Calanoida indet.	Nauplius	100	0.03	500	0.13	200	0.05	400	0.11	700	0.19
	Cyclopoida indet.	Nauplius	1,200	0.02	1,300	0.02	1,100	0.01	800	0.01	1,900	0.02
Rotifera	*Asplanchna* sp.	n/a	500	9.87	1,000	19.73	900	17.76	700	13.81	1,200	23.68
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	3,100	2.36	4,600	3.50	2,500	1.90	5,100	3.88	4,500	3.42
	Filinia sp.	n/a							100	0.03	100	0.03
	Kellicottia sp.	n/a	3,900	0.37	4,400	0.41	5,900	0.55	6,800	0.64	5,500	0.52
	Keratella sp. 1	n/a	4,500	6.43	4,700	6.72	6,300	9.00	5,200	7.43	3,600	5.15
	Keratella sp. 2	n/a					100	0.10	100	0.10		
	Lecane sp.	n/a										
	Monostyla sp.	n/a	200	0.00							100	0.00
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	300	0.13	100	0.04	100	0.04	400	0.17	500	0.21
	Synchaeta sp.	n/a	600	1.18	400	0.78	300	0.59	900	1.76	400	0.78
	Trichocerca sp.	n/a	100	0.10								
		Total	**17,297**	**47.96**	**18,665**	**47.67**	**19,080**	**43.62**	**21,935**	**42.16**	**21,230**	**68.44**

Notes: #/sample=number of organisms per sample; mg/sample=milligrams per sample (wet weight)

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-01-05		Mel-02-01		Mel-02-02		Mel-02-03		Mel-02-04	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	16/07/2017		23/07/2017		23/07/2017		23/07/2017		23/07/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	387	2.84	1,260	13.42	1,700	18.10	867	9.23	1,960	20.87
	Chydoridae indet.	F	13	0.16								
	Daphnia longiremis	F	127	0.57	580	5.53	1,940	18.49	447	4.26	4,000	38.12
	Daphnia sp.	F			10	0.10						
	Holopedium gibberum	F	137	2.88	110	2.28	460	9.54	80	1.66	460	9.54
Calanoida	Calanoida indet.	I-V	240	1.78	310	2.11	500	3.41	227	1.54	260	1.77
	Calanoida indet.	VIf										
	Epischura lacustris	I-V	10	0.19	30	0.72	40	0.97	27	0.64		
	Epischura lacustris	VIf	10	0.43	10	0.41			7	0.28	20	0.83
	Epischura lacustris	VIm	10	0.37	20	0.72	20	0.72	20	0.72		
	Leptodiaptomus minutus	VIf	23	0.81	10	0.38	20	0.75	13	0.50	100	3.77
	Leptodiaptomus minutus	VIm	3	0.10	10	0.31	20	0.63	7	0.21	20	0.63
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	110	0.72	250	1.41	480	2.71	387	2.19	900	5.09
	Cyclops scutifer	VIf					40	1.28	7	0.21	100	3.21
	Cyclops scutifer	VIm			10	0.26	20	0.52	7	0.17	100	2.62
	Diacyclops thomasi	VIf	7	0.17	30	0.73	60	1.46	27	0.65		
	Diacyclops thomasi	VIm	7	0.12	40	0.70	60	1.05	60	1.05		
Copepoda	Copepoda indet.	Nauplius	250	0.01	100	0.01	500	0.05	500	0.05	700	0.07
	Calanoida indet.	Nauplius	500	0.13	500	0.11	1,000	0.21	400	0.09	600	0.13
	Cyclopoida indet.	Nauplius	2,000	0.03	1,100	0.02	2,900	0.06	2,100	0.04	1,300	0.03
Rotifera	*Asplanchna* sp.	n/a	500	9.87	500	12.73			300	7.64	300	7.64
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	4,000	3.04	3,500	4.40	4,700	5.91	1,400	1.76	4,400	5.53
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	5,250	0.49	2,100	0.18	2,900	0.25	1,600	0.14	4,100	0.35
	Keratella sp. 1	n/a	7,750	11.08	2,100	2.63	1,400	1.75	1,500	1.88	1,100	1.38
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a									200	0.00
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	500	0.21	600	0.24	700	0.28	300	0.12	300	0.12
	Synchaeta sp.	n/a	2,000	3.92					100	0.09		
	Trichocerca sp.	n/a										
		Total	**23,833**	**39.94**	**13,180**	**49.39**	**19,460**	**68.12**	**10,380**	**35.10**	**20,920**	**101.67**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-02-05		Mel-02-05		Mel-03-01		Mel-03-01		Mel-03-02	
		Replicate	Rep 1		Rep 2		Rep 1		Rep 2		Rep 1	
		Sampling Period	23/07/2017		23/07/2017		21/07/2017		21/07/2017		21/07/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	2,500	26.62	1,920	20.44	4,840	72.58	4,180	62.69	2,367	35.49
	Chydoridae indet.	F										
	Daphnia longiremis	F	4,600	43.84	3,300	31.45	860	7.30	1,040	8.82	3,867	32.81
	Daphnia sp.	F										
	Holopedium gibberum	F	667	13.82	420	8.71	40	1.18	40	1.18	60	1.77
Calanoida	Calanoida indet.	I-V			380	2.59	800	6.25	640	5.00	400	3.13
	Calanoida indet.	VIf										
	Epischura lacustris	I-V					60	1.23	20	0.41	30	0.61
	Epischura lacustris	VIf	33	1.38	20	0.83					10	0.46
	Epischura lacustris	VIm					20	0.81	20	0.81	30	1.21
	Leptodiaptomus minutus	VIf	33	1.26	40	1.51			20	0.76	20	0.76
	Leptodiaptomus minutus	VIm	33	1.04	20	0.63						
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	800	4.52	620	3.50	400	2.73	420	2.87	720	4.92
	Cyclops scutifer	VIf	133	4.28	20	0.64	40	1.54	40	1.54	100	3.86
	Cyclops scutifer	VIm	200	5.25	20	0.52	80	2.04	120	3.06	40	1.02
	Diacyclops thomasi	VIf			60	1.46			40	0.89		
	Diacyclops thomasi	VIm			120	2.10	20	0.35	80	1.41		
Copepoda	Copepoda indet.	Nauplius	400	0.04	400	0.04	200	0.01	200	0.01	300	0.02
	Calanoida indet.	Nauplius	1,600	0.34	1,000	0.21	600	0.16	1,100	0.29	800	0.21
	Cyclopoida indet.	Nauplius	1,400	0.03	1,400	0.03	1,600	0.03	2,300	0.05	1,900	0.04
Rotifera	*Asplanchna* sp.	n/a	400	10.18	400	10.18	300	6.30	400	8.41	400	8.41
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	5,000	6.28	6,500	8.17	1,000	1.14	1,600	1.82	1,100	1.25
	Filinia sp.	n/a			100	0.02						
	Kellicottia sp.	n/a	3,700	0.32	6,800	0.58	2,600	0.20	2,500	0.19	2,700	0.20
	Keratella sp. 1	n/a	1,500	1.88	1,000	1.25	700	0.74	1,200	1.26	900	0.95
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a										
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	500	0.20	400	0.16	400	0.19	200	0.10	400	0.19
	Synchaeta sp.	n/a	100	0.09			600	0.84	200	0.28	200	0.28
	Trichocerca sp.	n/a										
		Total	**23,600**	**121.36**	**24,940**	**95.02**	**15,160**	**105.63**	**16,360**	**101.84**	**16,343**	**97.59**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-03-03		Mel-03-04		Mel-03-05		Mel-01-01		Mel-01-02	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	21/07/2017		21/07/2017		21/07/2017		09/08/2017		09/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,133	17.00	625	9.37	263	3.94	1,970	14.47	7,033	51.67
	Chydoridae indet.	F										
	Daphnia longiremis	F	7,467	63.35	4,150	35.21	1,538	13.05	770	3.48	2,567	11.61
	Daphnia sp.	F										
	Holopedium gibberum	F	100	2.96	100	2.96	75	2.22	70	1.48	467	9.85
Calanoida	Calanoida indet.	I-V	1,533	11.99	1,150	8.99	488	3.81	30	0.22	33	0.25
	Calanoida indet.	VIf			25	0.35	25	0.35				
	Epischura lacustris	I-V	100	2.04	150	3.06	163	3.32			33	0.64
	Epischura lacustris	VIf			25	1.14	38	1.72	10	0.43		
	Epischura lacustris	VIm			50	2.02	13	0.50				
	Leptodiaptomus minutus	VIf							10	0.35		
	Leptodiaptomus minutus	VIm							30	0.91		
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	1,833	12.52	1,725	11.78	1,363	9.31	150	0.99	400	2.63
	Cyclops scutifer	VIf	100	3.86	175	6.75	150	5.79				
	Cyclops scutifer	VIm	100	2.55	100	2.55	13	0.32				
	Diacyclops thomasi	VIf	133	2.96	75	1.67	50	1.11			67	1.73
	Diacyclops thomasi	VIm	133	2.34	75	1.32	13	0.22	10	0.18	33	0.60
Copepoda	Copepoda indet.	Nauplius	700	0.04	400	0.02	200	0.01				
	Calanoida indet.	Nauplius	1,800	0.47	2,000	0.53	800	0.21	50	0.01	200	0.05
	Cyclopoida indet.	Nauplius	3,100	0.06	3,900	0.08	1,200	0.02	400	0.01	600	0.01
Rotifera	*Asplanchna* sp.	n/a	500	10.51	400	8.41			350	6.91	2,000	39.47
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	2,400	2.73	1,300	1.48	1,300	1.48	900	0.68	3,700	2.81
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	3,700	0.28	5,000	0.38	2,700	0.20	1,600	0.15	8,000	0.75
	Keratella sp. 1	n/a	1,100	1.16	1,000	1.05	400	0.42	600	0.86	1,600	2.29
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a										
	Notholca sp.	n/a										
	Ploima indet.	n/a							50	0.02		
	Polyarthra sp.	n/a	500	0.24	800	0.39	600	0.29	100	0.04	100	0.04
	Synchaeta sp.	n/a	100	0.14	100	0.14					100	0.20
	Trichocerca sp.	n/a										
		Total	**26,533**	**137.21**	**23,325**	**99.64**	**11,388**	**48.28**	**7,100**	**31.19**	**26,933**	**124.58**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-01-03		Mel-01-04		Mel-01-05		Mel-02-01		Mel-02-01	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 2	
		Sampling Period	09/08/2017		09/08/2017		09/08/2017		11/08/2017		11/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	3,520	25.86	5,020	36.88	3,700	27.18	1,730	18.42	1,890	20.12
	Chydoridae indet.	F										
	Daphnia longiremis	F	1,880	8.50	660	2.99	620	2.80	710	6.77	960	9.15
	Daphnia sp.	F										
	Holopedium gibberum	F	360	7.60	180	3.80	180	3.80	50	1.04	60	1.24
Calanoida	Calanoida indet.	I-V	120	0.89	20	0.15	200	1.49	150	1.02	110	0.75
	Calanoida indet.	VIf										
	Epischura lacustris	I-V	20	0.38								
	Epischura lacustris	VIf										
	Epischura lacustris	VIm					20	0.74				
	Leptodiaptomus minutus	VIf	40	1.38			120	4.15	140	5.28	100	3.77
	Leptodiaptomus minutus	VIm	40	1.22	20	0.61	60	1.82	110	3.44	70	2.19
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	420	2.76	200	1.31	380	2.50	320	1.81	280	1.58
	Cyclops scutifer	VIf							20	0.64	20	0.64
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	100	2.59			80	2.07	70	1.70	60	1.46
	Diacyclops thomasi	VIm			40	0.72	40	0.72	20	0.35	30	0.53
Copepoda	Copepoda indet.	Nauplius					200	0.01	250	0.02	350	0.03
	Calanoida indet.	Nauplius	100	0.03	300	0.08	400	0.11	600	0.13	850	0.18
	Cyclopoida indet.	Nauplius	600	0.01	400	0.01	800	0.01	1,900	0.04	1,750	0.03
Rotifera	*Asplanchna* sp.	n/a	700	13.81	1,200	23.68	1,100	21.71	50	1.27	300	7.64
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	2,300	1.75	2,400	1.83	2,500	1.90	950	1.19	1,450	1.82
	Filinia sp.	n/a					100	0.03				
	Kellicottia sp.	n/a	3,100	0.29	2,900	0.27	3,500	0.33	1,150	0.10	1,400	0.12
	Keratella sp. 1	n/a	1,200	1.72	2,200	3.14	1,400	2.00	300	0.38	200	0.25
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a							50	0.00	50	0.00
	Notholca sp.	n/a			200	0.09						
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	100	0.04	200	0.08	200	0.08	50	0.02	150	0.06
	Synchaeta sp.	n/a	100	0.20	100	0.20						
	Trichocerca sp.	n/a										
		Total	**14,700**	**69.02**	**16,040**	**75.83**	**15,600**	**73.45**	**8,620**	**43.62**	**10,080**	**51.57**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-02-02		Mel-02-03		Mel-02-04		Mel-02-05		Mel-03-01	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	11/08/2017		11/08/2017		11/08/2017		11/08/2017		13/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	4,120	43.87	5,240	55.79	2,175	23.16	1,000	10.65	592	8.88
	Chydoridae indet.	F							7	0.10		
	Daphnia longiremis	F	1,960	18.68	620	5.91	638	6.08			292	2.48
	Daphnia sp.	F							567	5.80		
	Holopedium gibberum	F	580	12.02	20	0.41	63	1.30	60	1.24	4	0.12
Calanoida	Calanoida indet.	I-V	200	1.36	260	1.77	125	0.85	40	0.27	52	0.41
	Calanoida indet.	VIf										
	Epischura lacustris	I-V									4	0.08
	Epischura lacustris	VIf	20	0.83					7	0.28	8	0.37
	Epischura lacustris	VIm										
	Leptodiaptomus minutus	VIf	360	13.58	300	11.32	75	2.83	47	1.76	68	2.59
	Leptodiaptomus minutus	VIm	160	5.00	260	8.13	88	2.74	27	0.83	64	2.04
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	460	2.60	340	1.92	225	1.27	180	1.02	36	0.25
	Cyclops scutifer	VIf					13	0.40			8	0.31
	Cyclops scutifer	VIm									4	0.10
	Diacyclops thomasi	VIf	160	3.88	260	6.31	88	2.12	47	1.13	12	0.27
	Diacyclops thomasi	VIm	60	1.05	140	2.45	113	1.97	60	1.05	12	0.21
Copepoda	Copepoda indet.	Nauplius	100	0.01	300	0.03	300	0.03	100	0.01	150	0.01
	Calanoida indet.	Nauplius	1,500	0.32	900	0.19	1,700	0.36	1,100	0.24	50	0.01
	Cyclopoida indet.	Nauplius	2,100	0.04	1,700	0.03	2,000	0.04	1,300	0.03	1,100	0.02
Rotifera	*Asplanchna* sp.	n/a	100	2.55	300	7.64					50	1.05
	Collotheca sp.	n/a	100	1.39								
	Conochilus sp.	n/a	900	1.13	1,600	2.01	3,700	4.65	2,000	2.51	1,850	2.11
	Filinia sp.	n/a							100	0.02		
	Kellicottia sp.	n/a	2,300	0.20	2,700	0.23	3,000	0.26	2,800	0.24	1,300	0.10
	Keratella sp. 1	n/a	200	0.25	400	0.50	100	0.13	100	0.13	100	0.11
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a	100	0.00	200	0.00						
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a					200	0.08	100	0.04	150	0.07
	Synchaeta sp.	n/a							100	0.09		
	Trichocerca sp.	n/a										
		Total	**15,480**	**108.76**	**15,540**	**104.66**	**14,600**	**48.26**	**9,740**	**27.44**	**5,906**	**21.57**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-03-02		Mel-03-03		Mel-03-03		Mel-03-04		Mel-03-05	
		Replicate	Rep 1		Rep 1		Rep 2		Rep 1		Rep 1	
		Sampling Period	13/08/2017		13/08/2017		13/08/2017		13/08/2017		13/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	190	2.85	1,486	22.28	1,571	23.57	1,490	22.34	765	11.47
	Chydoridae indet.	F										
	Daphnia longiremis	F	163	1.38	1,943	16.48	1,286	10.91	660	5.60	520	4.41
	Daphnia sp.	F										
	Holopedium gibberum	F	15	0.44	29	0.84	43	1.27	30	0.89	25	0.74
Calanoida	Calanoida indet.	I-V	45	0.35	171	1.34	300	2.35	220	1.72	110	0.86
	Calanoida indet.	VIf										
	Epischura lacustris	I-V							20	0.41	5	0.10
	Epischura lacustris	VIf							10	0.46		
	Epischura lacustris	VIm					14	0.58				
	Leptodiaptomus minutus	VIf	38	1.43	114	4.35	86	3.26	150	5.71	55	2.09
	Leptodiaptomus minutus	VIm	18	0.56	71	2.28	100	3.19	140	4.47	40	1.28
	Leptodiaptomus pribilofensis	VIf									5	0.37
	Leptodiaptomus pribilofensis	VIm									5	0.30
Cyclopoida	Cyclopoida indet.	I-V	65	0.44	186	1.27	214	1.46	90	0.61	45	0.31
	Cyclops scutifer	VIf	23	0.87			29	1.10	10	0.39	10	0.39
	Cyclops scutifer	VIm	3	0.06								
	Diacyclops thomasi	VIf			57	1.27	57	1.27	30	0.67	15	0.33
	Diacyclops thomasi	VIm					14	0.25	30	0.53	15	0.26
Copepoda	Copepoda indet.	Nauplius	100	0.01	150	0.01	200	0.01	300	0.02	200	0.01
	Calanoida indet.	Nauplius	100	0.03	150	0.04	100	0.03	800	0.21	450	0.12
	Cyclopoida indet.	Nauplius	650	0.01	1,900	0.04	1,950	0.04	1,800	0.04	1,450	0.03
Rotifera	*Asplanchna* sp.	n/a	50	1.05	50	1.05	250	5.25	200	4.20	100	2.10
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	1,350	1.54	2,900	3.30	2,300	2.62	3,700	4.21	3,350	3.81
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	2,200	0.17	2,300	0.17	2,200	0.17	2,100	0.16	1,950	0.15
	Keratella sp. 1	n/a	200	0.21	100	0.11	500	0.53	200	0.21	250	0.26
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a										
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a			50	0.02	100	0.05	100	0.05	100	0.05
	Synchaeta sp.	n/a	50	0.07								
	Trichocerca sp.	n/a										
		Total	**5,258**	**11.46**	**11,657**	**54.86**	**11,314**	**57.89**	**12,080**	**52.89**	**9,465**	**29.46**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-04-01		Mel-04-02		Mel-04-03		Mel-04-04		Mel-04-05	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	15/08/2017		15/08/2017		15/08/2017		15/08/2017		15/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	470	7.43	1,460	23.07	455	7.19	1,060	16.75	1,920	30.34
	Chydoridae indet.	F										
	Daphnia longiremis	F	960	9.37	2,360	23.04	405	3.95	2,300	22.45	590	5.76
	Daphnia sp.	F										
	Holopedium gibberum	F	160	3.47	80	1.74	10	0.22	700	15.19	70	1.52
Calanoida	Calanoida indet.	I-V	400	3.29	660	5.43	55	0.45	580	4.77	60	0.49
	Calanoida indet.	VIf										
	Epischura lacustris	I-V										
	Epischura lacustris	VIf			20	1.18	5	0.29				
	Epischura lacustris	VIm	20	0.82	40	1.65	5	0.21	20	0.82		
	Leptodiaptomus minutus	VIf	310	10.88	400	14.03	40	1.40	480	16.84	70	2.46
	Leptodiaptomus minutus	VIm	260	7.25	460	12.84	20	0.56	580	16.18	130	3.63
	Leptodiaptomus pribilofensis	VIf	10	0.68	20	1.36	5	0.34	20	1.36	10	0.68
	Leptodiaptomus pribilofensis	VIm	10	0.62	60	3.72						
Cyclopoida	Cyclopoida indet.	I-V	650	5.55	700	5.98	125	1.07	1,060	9.06	80	0.68
	Cyclops scutifer	VIf	20	0.72	40	1.44	15	0.54	60	2.17		
	Cyclops scutifer	VIm	10	0.22								
	Diacyclops thomasi	VIf	30	0.66	60	1.33	20	0.44	160	3.54	10	0.22
	Diacyclops thomasi	VIm	40	0.65	60	0.98	10	0.16	100	1.63		
Copepoda	Copepoda indet.	Nauplius	300	0.01	300	0.01			300	0.01	350	0.02
	Calanoida indet.	Nauplius	1,900	0.46	900	0.22	1,700	0.42	800	0.20	1,100	0.27
	Cyclopoida indet.	Nauplius	2,300	0.03	2,900	0.04	3,600	0.05	2,300	0.03	2,200	0.03
Rotifera	*Asplanchna* sp.	n/a	100	2.78	100	2.78	100	2.78	400	11.11	200	5.56
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	1,700	1.83	3,300	3.55	1,100	1.18	3,300	3.55	1,950	2.10
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	900	0.06	2,000	0.13	2,200	0.14	2,800	0.18	1,100	0.07
	Keratella sp. 1	n/a	0		0		200	0.19	300	0.29	200	0.19
	Keratella sp. 2	n/a										
	Lecane sp.	n/a					100	0.00				
	Monostyla sp.	n/a					100	0.00				
	Notholca sp.	n/a									100	0.03
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	100	0.04					300	0.13	150	0.06
	Synchaeta sp.	n/a									50	0.02
	Trichocerca sp.	n/a										
		Total	**10,650**	**56.85**	**15,920**	**104.52**	**10,270**	**21.59**	**17,620**	**126.28**	**10,340**	**54.12**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-05-01		Mel-05-02		Mel-05-03		Mel-05-03		Mel-05-04	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 2		Rep 1	
		Sampling Period	12/08/2017		12/08/2017		12/08/2017		12/08/2017		12/08/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,330	16.82	1,680	21.25	840	10.62	708	8.96	2,120	26.81
	Chydoridae indet.	F										
	Daphnia longiremis	F	790	6.50	810	6.66	1,010	8.31	625	5.14	3,360	27.63
	Daphnia sp.	F										
	Holopedium gibberum	F	260	7.31	110	3.09	100	2.81	158	4.45	400	11.25
Calanoida	Calanoida indet.	I-V	110	0.98	130	1.16	150	1.34	117	1.04	340	3.03
	Calanoida indet.	VIf										
	Epischura lacustris	I-V										
	Epischura lacustris	VIf	10	0.56			10	0.56	8	0.46	20	1.11
	Epischura lacustris	VIm	20	0.81	30	1.22			8	0.34	20	0.81
	Leptodiaptomus minutus	VIf	120	4.76	90	3.57	150	5.95	158	6.28	420	16.66
	Leptodiaptomus minutus	VIm	80	2.61	70	2.28	200	6.52	183	5.98	480	15.66
	Leptodiaptomus pribilofensis	VIf	20	0.79	10	0.40			8	0.33		
	Leptodiaptomus pribilofensis	VIm					10	0.71			20	1.42
Cyclopoida	Cyclopoida indet.	I-V	120	1.22	210	2.14	190	1.93	308	3.14	480	4.88
	Cyclops scutifer	VIf			10	0.37			8	0.31		
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	20	0.47	20	0.47	30	0.70	50	1.17	60	1.41
	Diacyclops thomasi	VIm	20	0.35	20	0.35	20	0.35	42	0.72	80	1.38
Copepoda	Copepoda indet.	Nauplius	150	0.01	200	0.01	200	0.01	100	0.00	500	0.02
	Calanoida indet.	Nauplius	600	0.12	800	0.16	400	0.08	600	0.12	1,200	0.23
	Cyclopoida indet.	Nauplius	2,250	0.04	3,100	0.06	1,550	0.03	1,400	0.03	3,900	0.08
Rotifera	*Asplanchna* sp.	n/a	50	1.28	200	5.12	100	2.56	200	5.12		
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	1,600	1.56	1,100	1.07	1,100	1.07	1,800	1.76	1,600	1.56
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	1,950	0.20	2,300	0.24	1,900	0.20	2,800	0.29	2,600	0.27
	Keratella sp. 1	n/a	100	0.06	300	0.19	100	0.06	400	0.26	100	0.06
	Keratella sp. 2	n/a										
	Lecane sp.	n/a									100	0.00
	Monostyla sp.	n/a										
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a			100	0.05	50	0.02	100	0.05	300	0.14
	Synchaeta sp.	n/a										
	Trichocerca sp.	n/a										
		Total	**9,600**	**46.46**	**11,290**	**49.85**	**8,110**	**43.84**	**9,783**	**45.94**	**18,100**	**114.43**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-05-05		Mel-03-01		Mel-03-02		Mel-03-03		Mel-03-04	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	12/08/2017		01/09/2017		01/09/2017		01/09/2017		01/09/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	3,440	43.51	85	1.27	81	1.21	98	1.46	1,300	19.50
	Chydoridae indet.	F	20	0.90	3	0.06			3	0.06	8	0.19
	Daphnia longiremis	F	1,620	13.32	3	0.02					100	0.85
	Daphnia sp.	F					16	0.15	10	0.10		
	Holopedium gibberum	F	440	12.38	3	0.07	2	0.06	20	0.59	83	2.46
Calanoida	Calanoida indet.	I-V	140	1.25	15	0.12	4	0.03	8	0.06		
	Calanoida indet.	VIf										
	Epischura lacustris	I-V										
	Epischura lacustris	VIf										
	Epischura lacustris	VIm	20	0.81								
	Leptodiaptomus minutus	VIf	240	9.52	98	3.71	39	1.48	115	4.38	117	4.44
	Leptodiaptomus minutus	VIm	220	7.18	93	2.95	40	1.28	43	1.36	75	2.39
	Leptodiaptomus pribilofensis	VIf	20	0.79	3	0.19	1	0.07				
	Leptodiaptomus pribilofensis	VIm			3	0.15	2	0.12				
Cyclopoida	Cyclopoida indet.	I-V	320	3.25	63	0.43	30	0.20	85	0.58	33	0.23
	Cyclops scutifer	VIf	40	1.47			1	0.04				
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	60	1.41	28	0.61	11	0.24	63	1.39	25	0.56
	Diacyclops thomasi	VIm	20	0.35	25	0.44	7	0.12	43	0.75	42	0.73
Copepoda	Copepoda indet.	Nauplius			67	0.00					100	0.01
	Calanoida indet.	Nauplius	1,600	0.31	167	0.04	67	0.02	200	0.05	500	0.13
	Cyclopoida indet.	Nauplius	2,600	0.05	767	0.02	333	0.01	767	0.02	1,000	0.02
Rotifera	*Asplanchna* sp.	n/a			367	7.70	133	2.80	67	1.40	150	3.15
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	2,200	2.15	1,233	1.40	933	1.06	733	0.83	2,250	2.56
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	4,300	0.45	767	0.06	1,400	0.11	1,900	0.14	1,900	0.14
	Keratella sp. 1	n/a	200	0.13	267	0.28	133	0.14	33	0.04	350	0.37
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a			67	0.00	33	0.00				
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	300	0.14	67	0.03	67	0.03	33	0.02	150	0.07
	Synchaeta sp.	n/a			133	0.19	733	1.03	833	1.17	600	0.84
	Trichocerca sp.	n/a										
		Total	**17,800**	**99.37**	**4,318**	**19.75**	**4,067**	**10.22**	**5,052**	**14.38**	**8,783**	**38.65**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-03-05		Mel-01-01		Mel-01-01-Rep1		Mel-01-02		Mel-01-03	
		Replicate	Rep 1		Rep 2		Rep 2		Rep 1		Rep 1	
		Sampling Period	01/09/2017		04/09/2017		04/09/2017		04/09/2017		04/09/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	81	1.21	77	0.56	96	0.71	135	0.99	70	0.51
	Chydoridae indet.	F	1	0.02					4	0.04		
	Daphnia longiremis	F	26	0.22					24	0.11	6	0.03
	Daphnia sp.	F			7	0.02	20	0.07				
	Holopedium gibberum	F	2	0.06								
Calanoida	Calanoida indet.	I-V	4	0.03	3	0.02	2	0.01	4	0.03	6	0.04
	Calanoida indet.	VIf										
	Epischura lacustris	I-V										
	Epischura lacustris	VIf										
	Epischura lacustris	VIm										
	Leptodiaptomus minutus	VIf	12	0.46							1	0.03
	Leptodiaptomus minutus	VIm	19	0.61					2	0.06	2	0.06
	Leptodiaptomus pribilofensis	VIf										
	Leptodiaptomus pribilofensis	VIm										
Cyclopoida	Cyclopoida indet.	I-V	11	0.08	278	1.83	304	2.00	233	1.53	81	0.53
	Cyclops scutifer	VIf									1	0.04
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf	6	0.13							1	0.03
	Diacyclops thomasi	VIm	6	0.11	5	0.09						
Copepoda	Copepoda indet.	Nauplius	100	0.01	67	0.00	250	0.01	167	0.01	150	0.01
	Calanoida indet.	Nauplius	100	0.03	567	0.15	250	0.07	300	0.08	400	0.11
	Cyclopoida indet.	Nauplius	300	0.01	700	0.01	900	0.01	400	0.01	550	0.01
Rotifera	*Asplanchna* sp.	n/a	350	7.35	433	8.55	600	11.84	933	18.42	1,250	24.67
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	2,600	2.96	433	0.33	350	0.27	367	0.28	950	0.72
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	1,700	0.13	767	0.07	1,200	0.11	833	0.08	2,650	0.25
	Keratella sp. 1	n/a	250	0.26	567	0.81	950	1.36	367	0.52	1,750	2.50
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a									50	0.00
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	250	0.12	67	0.03	850	0.36	467	0.20	900	0.38
	Synchaeta sp.	n/a	1,150	1.61							50	0.10
	Trichocerca sp.	n/a										
Total			**6,968**	**15.40**	**3,970**	**12.48**	**5,772**	**16.80**	**4,233**	**22.34**	**8,868**	**30.02**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-01-04		Mel-01-05		Mel-02-01		Mel-02-02		Mel-02-03	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	04/09/2017		04/09/2017		05/09/2017		05/09/2017		05/09/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	128	0.94	128	0.94	319	3.39	173	1.85	292	3.11
	Chydoridae indet.	F	3	0.04	7	0.08	13	0.18				
	Daphnia longiremis	F	17	0.08	15	0.07			107	1.02	275	2.62
	Daphnia sp.	F					306	3.14				
	Holopedium gibberum	F					13	0.26			8	0.17
Calanoida	Calanoida indet.	I-V	2	0.01	2	0.01	6	0.04	7	0.05	675	4.60
	Calanoida indet.	VIf										
	Epischura lacustris	I-V										
	Epischura lacustris	VIf							3	0.14		
	Epischura lacustris	VIm										
	Leptodiaptomus minutus	VIf					75	2.83	37	1.38	100	3.77
	Leptodiaptomus minutus	VIm	2	0.05			56	1.76	137	4.27	258	8.08
	Leptodiaptomus pribilofensis	VIf							10	0.72		
	Leptodiaptomus pribilofensis	VIm					19	1.16	20	1.24		
Cyclopoida	Cyclopoida indet.	I-V	170	1.12	200	1.31	469	2.65	183	1.04		
	Cyclops scutifer	VIf										
	Cyclops scutifer	VIm										
	Diacyclops thomasi	VIf					19	0.46	37	0.89	100	2.43
	Diacyclops thomasi	VIm	2	0.03			31	0.55	40	0.70	133	2.34
Copepoda	Copepoda indet.	Nauplius	150	0.01	100	0.00	250	0.02	33	0.00	50	0.00
	Calanoida indet.	Nauplius	100	0.03	600	0.16	850	0.18	200	0.04	350	0.07
	Cyclopoida indet.	Nauplius	450	0.01	450	0.01	1,900	0.04	700	0.01	1,350	0.03
Rotifera	*Asplanchna* sp.	n/a	850	16.77	700	13.81	50	1.27			150	3.82
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	650	0.49	1,250	0.95	450	0.57	1,033	1.30	1,250	1.57
	Filinia sp.	n/a										
	Kellicottia sp.	n/a	1,450	0.14	3,350	0.32	2,750	0.24	833	0.07	2,900	0.25
	Keratella sp. 1	n/a	1,250	1.79	1,100	1.57	200	0.25	67	0.08	400	0.50
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a	50	0.00								
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	700	0.29	1,050	0.44	200	0.08	267	0.11	900	0.36
	Synchaeta sp.	n/a	50	0.10							150	0.14
	Trichocerca sp.	n/a										
		Total	**6,023**	**21.89**	**8,952**	**19.68**	**7,975**	**19.06**	**3,887**	**14.90**	**9,342**	**33.86**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-02-04		Mel-02-04-Rep2		Mel-02-05		Mel-01-04-QA		Mel-02-03-QA	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	05/09/2017		05/09/2017		05/09/2017		16/07/2017		23/07/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	1,025	10.91	1,167	12.42	630	6.71	940	6.91	793	8.45
	Chydoridae indet.	F			8	0.12			20	0.24		
	Daphnia longiremis	F	625	5.96	450	4.29	230	2.19	320	1.45	387	3.68
	Daphnia sp.	F										
	Holopedium gibberum	F							520	10.97	53	1.11
Calanoida	Calanoida indet.	I-V			8	0.06	5	0.03	360	2.68	160	1.09
	Calanoida indet.	VIf										
	Epischura lacustris	I-V							40	0.77	13	0.32
	Epischura lacustris	VIf	8	0.34					40	1.73	7	0.28
	Epischura lacustris	VIm			17	0.60			30	1.12	7	0.24
	Leptodiaptomus minutus	VIf	33	1.26	25	0.94	25	0.94	90	3.11	13	0.50
	Leptodiaptomus minutus	VIm	33	1.04	33	1.04	20	0.63	40	1.22	33	1.04
	Leptodiaptomus pribilofensis	VIf							20	1.04		
	Leptodiaptomus pribilofensis	VIm							10	0.63		
Cyclopoida	Cyclopoida indet.	I-V	217	1.22	183	1.04	260	1.47	180	1.18	373	2.11
	Cyclops scutifer	VIf	8	0.27			5	0.16			13	0.43
	Cyclops scutifer	VIm	8	0.22			5	0.13			7	0.17
	Diacyclops thomasi	VIf			8	0.20	15	0.36	110	2.85	20	0.49
	Diacyclops thomasi	VIm			17	0.29	10	0.18	60	1.08	73	1.29
Copepoda	Copepoda indet.	Nauplius			33	0.00	50	0.00			300	0.03
	Calanoida indet.	Nauplius	233	0.05	333	0.07	300	0.06	100	0.03	700	0.15
	Cyclopoida indet.	Nauplius	667	0.01	600	0.01	750	0.01	2,100	0.03	2,300	0.04
Rotifera	*Asplanchna* sp.	n/a	300	7.64	333	8.49	150	3.82	900	17.76	300	7.64
	Collotheca sp.	n/a										
	Conochilus sp.	n/a	633	0.80	633	0.80	500	0.63	7,500	5.70	900	1.13
	Filinia sp.	n/a							100	0.03		
	Kellicottia sp.	n/a	1,200	0.10	1,700	0.15	1,650	0.14	4,500	0.42	1,800	0.15
	Keratella sp. 1	n/a	267	0.33	167	0.21	550	0.69	4,400	6.29	1,600	2.00
	Keratella sp. 2	n/a										
	Lecane sp.	n/a										
	Monostyla sp.	n/a	33	0.00					100	0.00		
	Notholca sp.	n/a										
	Ploima indet.	n/a										
	Polyarthra sp.	n/a	500	0.20	267	0.11	350	0.14	500	0.21	500	0.20
	Synchaeta sp.	n/a	100	0.09	200	0.19	200	0.19	500	0.98	100	0.09
	Trichocerca sp.	n/a					50	0.09				
		Total	**5,892**	**30.45**	**6,183**	**31.02**	**5,755**	**18.58**	**23,480**	**68.40**	**10,453**	**32.63**

Table 7E-5: Raw Zooplankton Data, 2017

		Station	Mel-01-04-QA		Mel-04-05-QA		Mel-05-04-QA		Mel-01-01-QA	
		Replicate	Rep 1		Rep 1		Rep 1		Rep 1	
		Sampling Period	09/08/2017		15/08/2017		12/08/2017		04/09/2017	
Major Group	Taxon	Stage	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)	Abundance (#/sample)	Biomass (mg/sample)
Cladocera	Bosminidae indet.	F	5,360	39.37	1,630	25.76	2,360	29.85	88	0.65
	Chydoridae indet.	F								
	Daphnia longiremis	F	600	2.71	420	4.10	3,460	28.46		
	Daphnia sp.	F							24	0.08
	Holopedium gibberum	F	120	2.53	50	1.09	400	11.25		
Calanoida	Calanoida indet.	I-V			100	0.82	380	3.39	4	0.03
	Calanoida indet.	VIf								
	Epischura lacustris	I-V								
	Epischura lacustris	VIf					20	1.11		
	Epischura lacustris	VIm					40	1.62		
	Leptodiaptomus minutus	VIf	40	1.38	50	1.75	200	7.93		
	Leptodiaptomus minutus	VIm	20	0.61	170	4.74	240	7.83		
	Leptodiaptomus pribilofensis	VIf			10	0.68	20	0.79		
	Leptodiaptomus pribilofensis	VIm								
Cyclopoida	Cyclopoida indet.	I-V	260	1.71	80	0.68	420	4.27	326	2.14
	Cyclops scutifer	VIf								
	Cyclops scutifer	VIm								
	Diacyclops thomasi	VIf	40	1.04	10	0.22	100	2.35		
	Diacyclops thomasi	VIm	20	0.36			20	0.35		
Copepoda	Copepoda indet.	Nauplius			150	0.01	300	0.01	150	0.01
	Calanoida indet.	Nauplius	200	0.05	700	0.17	1,100	0.22	450	0.12
	Cyclopoida indet.	Nauplius	500	0.01	2,250	0.03	3,200	0.06	1,000	0.01
Rotifera	*Asplanchna* sp.	n/a	1,500	29.60	50	1.39	100	2.56	650	12.83
	Collotheca sp.	n/a								
	Conochilus sp.	n/a	1,700	1.29	1,700	1.83	2,000	1.95	350	0.27
	Filinia sp.	n/a								
	Kellicottia sp.	n/a	2,700	0.25	1,100	0.07	2,800	0.29	1,800	0.17
	Keratella sp. 1	n/a	2,200	3.14	200	0.19	100	0.06	950	1.36
	Keratella sp. 2	n/a								
	Lecane sp.	n/a								
	Monostyla sp.	n/a								
	Notholca sp.	n/a	100	0.05	100	0.03				
	Ploima indet.	n/a								
	Polyarthra sp.	n/a	200	0.08	100	0.04	600	0.28	550	0.23
	Synchaeta sp.	n/a	100	0.20	50	0.02				
	Trichocerca sp.	n/a								
		Total	**15,660**	**84.39**	**8,920**	**43.63**	**17,860**	**104.64**	**6,342**	**17.88**

Appendix K

Updated Management Plans

AGNICO EAGLE

MELIADINE GOLD PROJECT

Borrow Pits and Quarries Management Plan

MARCH 2018
VERSION 6
6513-MPS-04

ᓇᐃᓈᖅᓯᒪᔪᖅ

ᐊᒡᓃᑯᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒌᓗᒧᑦ ᐅᔾᕿᒃᑕᕆᐊᕐᒥᑦ ᐱᕙᓪᓕᐊᓂᖃᖅᑐᑦ, 25 ᑭᓛᒥᑕᓪᓗᐊᓂᒃ ᐅᐊᖕᓇᖕᒐᓂᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ ᐅᖕᒐᓯᒃᑎᒋᔪᖅ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓪᓗᐊᓂᒃ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐱᖕᖓᖕᓇᖅᐸᓯᐅᓂᑦ ᐃᒡᓗᓕᒑᕐᔪᖕᒥᑦ ᐅᖕᒐᓯᒃᑎᒋᔪᖅ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔾᕿᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᓗᒍ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔾᕿᒃᑕᕆᐊᕐᓂᐅᓂᐊᖅᑐᖅ ᐱᕙᓪᓕᐊᓗᒍ ᑎᑭᒐᓂᐊᖅ ᒌᓗᑕᓕᒃ, ᒪᕐᕉᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔫᓗᑎᒃ (ᑎᑭᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔪᖅ 1 ᐊᒻᒪᓗ ᑎᑭᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔾᕿᒃᑕᕆᐊᕐᓂᖅ.

ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐅᖃᐅᓯᖃᖅᑐᖅ ᐃᓚᖏᓐᓂᑦ, ᐊᐅᓛᖅᑎᑦᑎᓂᕐᓂᑦ, ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᓂᕐᒧᑦ ᖃᓄᖅᑑᕈᑎᓂᒃ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᓕᐅᖅᑕᐅᔪᒪᔪᑦ ᒥᒃᓵᓄᑦ. ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓄᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᓵᓇᔾᔪᓂᖕᖏᓐᓄᑦ ᐊᒻᒪᓗ ᐱᓕᕆᐊᖑᓂᖕᖏᓐᓄᑦ ᐊᕐᑯᑎᐅᔪᖅ ᑲᖏᖅᖠᓂᕐᒥᑦ, ᐃᑎᕙᐊᓂᑦ ᓄᖃᖕᒐᕝᕙᒃ, ᐊᒻᒪᓗ ᐱᕐᑯᑎᓄᑦ ᑐᙱᕙᒃ ᐅᔾᕿᒃᑕᕆᐊᓕᐊᖑᔪᒪᔪᕐᒥᑦ. ᐊᑐᖅᑕᐅᓂᐊᕐᒥᔪᖅ ᐱᓕᕆᐊᖑᖃᑦᑕᕐᓂᖕᒐᓄᑦ ᐅᑭᐅᓗᒃᑖᖅ ᐅᕐᑯᑎ ᐊᑯᓐᓂᖕᒐᓐᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ ᐊᒻᒪᓗ ᑕᓯᕐᔪᐊᕐᒥᑦ ᐅᔾᕿᒃᑕᕆᐊᑉ.

ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᐃᓄᖕᓄᑦ ᓇᖕᒥᓂᕆᔭᐅᔪᓂᑦ ᓄᓈᑦᑐᑦ ᐱᔭᕆᐊᖃᖅᑎᑦᑎᔪᑦ ᐱᓕᕆᕝᕙᖕᔪᐊᑦ ᐊᑐᖅᑐᐊᕐᓂᐊᕐᓗᑎᒃ ᐱᔪᓐᓇᐅᑎᓂᒃ ᑐᓂᔭᐅᔪᑦ ᑭᕙᓪᓕᕐᒥᑦ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᒃᑯᓐᓄᑦ. ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᑎᒋᓂᕐᒧᑦ ᐱᔪᖕᓇᐅᑏᑦ ᕼᐋᒻᒪᒃᑯᑦ ᓄᓇᕐᑯᑎᖕᒐᓂᑦ ᐊᐅᓚᑕᐅᖃᑦᑕᖅᑐᑦ ᓄᓇᕗᒻᒥ ᒪᕙᒪᒃᑯᑦ ᓄᓇᓕᖕᓄᑦ ᐊᒻᒪᓗ ᒪᕙᒪᒃᑯᓐᓄᑦ ᐱᔾᔨᑦᑎᕋᐃᔾᔪᒃᑯᖏᓐᓄᑦ ᐱᔪᑎᐸᓗᒋᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ ᕼᐋᒻᒪᒃᑯᑦ. ᐊᓯᖏᑦ ᑕᒪᒃᑯᓄᙵ ᒪᓕᒐᕿᖑᔪᑦ ᐅᖃᐅᓯᐅᔪᑦ ᐸᕐᓇᐅᑎᒥᑦ.

ᐅᑯᐊ ᐱᐅᓛᒃᑯᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᓂᕈᐊᖅᑕᐅᔪᒥᑦ, ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᑕᐅᕙᓪᓕᐊᓂᖕᖏᓐᓄᑦ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᐱᓕᕆᐊᖑᔪᒪᔪᕐᓄᑦ:

- ᒥᑭᓛᒃᑰᖅᑎᓪᓗᒍ ᓄᓇᐅᑉ ᖄᖓ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓂᑦ, ᐊᔪᕐᓇᙱᒃᑳᖓᑕ;
- ᒥᑭᓛᒃᑰᖅᑎᓪᓗᒍ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓂᑦ ᑭᐱᓯᓃᑦ, ᐊᔪᕐᓇᙱᒃᑳᖓᑕ;
- ᐱᓕᕆᐊᕆᓗᒍ ᓇᑎᖓ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᖁᑎᒃᓯᓯᒪᓂᖅᓴᐅᕌᕐᔪᓪᓗᒋᑦ ᖃᓂᑕᖓᓃᑦᑐᓂᑦ ᑕᐅᓄᖓ ᑰᒃᑎᓐᓂᐊᕐᓗᒍ, ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓂᑦ ᑕᓯᙵᕈᖕᓇᖅᑐᓂᒃ ᑯᕝᕕᔪᖃᑕᐃᓕᑎᓪᓗᒍ, ᐊᒻᒪᓗ ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑐᓂᒃ ᓱᕿᐃᑦᑎᑦᑕᐃᓕᓗᓂ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓂᑦ;
- ᓱᕈᖅᐸᓪᓕᐊᓂᖃᖅᑎᑦᑎᑦᑕᐃᓕᓗᓂ ᐊᒻᒪᓗ ᐃᒪᐅᑉ ᓇᑎᖓᓄᐊᖃᑦᑕᖅᑐᓕᐅᖅᑕᐃᓕᓗᓂ ᐊᑐᕐᓗᓂ ᑕᒪᒃᑯᓄᙵ ᐊᑐᖅᑕᐅᔪᓂᒃ ᐊᐅᓚᑦᑎᓂᐅᔪᓂᒃ;
- ᐱᓕᕆᐊᕆᓗᓂᑦ ARD/ML-ᒥᒃ ᐆᒃᑐᕋᐃᓂᕐᓂᒃ ᐊᒻᒪᓗ ᐃᒪᐅᑉ ᐱᐅᓂᕆᔭᖕᒐᓂᒃ ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓗᓂ ᐊᖏᕐᓗᐊᖏᑎᐊᖅᑎᑦᑎᓂᖃᕐᓂᐊᕐᓗᓂ;
- ᒥᐊᓂᕆᓗᓯᑦ ᐱᕐᑯᓯᑐᖃᖃᕝᕙᐅᔪᑦ;
- ᓇᓗᓇᐃᕐᓗᓯᑦ ᑎᖕᒥᐊᑦ ᓃᕐᓗ ᑭᒡᒐᕝᕙᐊᕐᔪᕋᓗᐃᑦ ᐅᐸᓗᖕᒋᓂᒃ ᐱᑕᖃᙱᓂᖕᒋᓐᓄᑦ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᕐᓂᑦ ᖃᓂᑕᖕᒋᓂᒡᓘᓐᓂᑦ ᐃᓗᑦᑐᖅᑎᑲᕆᐊᕐᓂᐊᕌᕐᓗᒋᑦ (ᑕᑯᓗᒍ ᓄᓇᒥᐅᑕᕐᓂᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᖅ ᐊᒻᒪᓗ ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᑐᓂᐅᑕᐅᔪᖅ ᐃᓚᒋᔭᐅᐸᓗᓂ ᑭᖑᓪᓕᖅᐹᒃᖅ ᐊᕙᑎᒥᒃ ᐊᒃᑐᖅᓯᓂᕐᒧᑦ ᑎᑎᖅᑲᖅ [ᐊᒡᓃᑯᑦ 2014]);
- ᐱᓕᕆᐊᕆᓗᒍ ᐊᓂᖅᓵᖅᑐᖅᑕᑉᑕ ᐱᐅᓂᖓ ᐳᔪᖅᑖᒥᒃ ᐊᐅᓚᑦᑎᓂᒃᑯᑦ/ᐳᔪᖅᑖᖅᑲᓗᐊᖅᑕᐃᓕᑎᑦᑎᓂᒃᑯᑦ; ᐊᒻᒪᓗ
- ᐅᑎᖅᑎᑎᓈᓇᕐᓗᓂ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᓂᐊᕐᓗᒋᑦ ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᖃᕈᖕᓃᕋᖓᑕ.
- ᐊᕙᑎᐅᑉ ᒥᒃᓵᓄᑦ ᖃᐅᔨᓴᐃᓂᖃᕐᓗᑕ

ᓄᓇᒥᑦ ᐃᓗᑦᑐᖅᓯᒪᔪᑦ ᓂᕈᐊᖅᑕᐅᔪᑦ ᐅᑭᐅᓗᒃᑖᖅ ᐊᕐᑯᑎᓕᐅᕐᓂᕐᒧᑦ ᑕᑯᒃᓴᐅᑎᑦᑎᓚᐅᖅᑐᑦ ᐋᓯᑦ-ᓕᐅᖅᑐᓂᒃ ᑯᕝᕕᔪᖃᖕᓂᐊᓂᖕᒐᓄᑦ. ᑕᑯᒃᓴᐅᔪᒃᑯᑦ ᖃᐅᔨᓴᐃᓂᖃᕐᓂᐊᖅᑐᑦ ᐊᑐᖅᑕᐅᔪᓂᒃ ᐊᒻᒪᓗ ᐆᒃᑐᕋᐃᒃᑲᓂᕐᓂᖃᕐᓗᑎᒃ ᓴᓇᔭᐅᑎᓪᓗᒋᑦ ᓇᓗᓇᐃᕐᓂᐊᕐᓗᒋᑦ ᐱᐅᓛᖑᔪᑦ ᒪᓂᒪᔪᑦ ᓴᓇᕙᓪᓕᐊᓂᐊᕐᓗᓂ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᑐᖅᑕᐅᒐᓗᐊᕐᓂᖏᓐᓄᑦ.

ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᑎᑎᓪᓚᑦᑐᑦ ᐊᑐᕐᓂᐊᖅᑐᑦ "ᐃᓱᒋᑦᒥᑦ, ᖃᖅᑎᖓᓚᑎᑦ, ᐅᓯᓂᖅᑐᐃᓚᑎᑦ, ᐊᓴᖅᑐᐃᓚᑎᑦ, ᐅᓯᖏᐅᔪᓂᒃ ᐱᖅᓯᓚᑎᑦ" ᑕᐃᒪᓐᓇᐃᖓᔾᔪᑎᒃ, ᑭᖑᓪᓂᖅᓱᓴᖏᓐᓂᐊᖅᑐᖅ ᐃᓕᐅᖅᑲᖅᑕᐅᓂᕐᓂᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᖅᓂᑦ ᐅᖏᕋᐃᑦ ᐊᑐᕐᓚᑎᑦ ᐳᐊᖓᓂᕐᒥᑦ. ᐃᓕᓴᐅᑦ ᐅᖏᕋᐃᑦ ᓯᖅᑲᓂᓗᖅᑕᐅᔪᓇᖅᑐᑦ ᑲᑎᑎᑦᓂᐅᑦ ᐊᐅᓚᑦᑐᑦ ᐊᖏᔪᓂᑦᑐᑦ ᐊᖏᓂᓱᖁᓪᓚᑎᑦ ᐅᖏᕋᐃᑦ. ᐊᓴᖅᓇᖏᑦᑕᕆᖓᑦ, ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᓂᒃ ᐊᑐᖅᑕᐅᓴᑦ ᐃᖏᖅᑕᐅᖅᑲᑦᑕᕆᓂᐊᖅᑐᑦ ᐳᐊᖓᓂᖅᓗᑦ. ᐃᓱᒋᑕᐃᓂᖅᐹᓇᖅᑐᑦ ᐊᓕᒪᓗ ᖃᖅᑎᖓᓚᑎᑎᑦ ᐃᖏᐃᓂᖅ ᐊᓴᖅᓇᖅᑐᖅᑕᕆᖓᑦ ᐊᓴᖅᑐᐃᓚᑎᑦ.

ᐊᖏᓪᓚᐊᖏᑎᐊᖅᑎᑎᖅᑎᓂᒃᓯᑦ ᐱᖅᓱᓯᑐᖅᖃᖅᖃᕐᓂᓪᓗ ᑕᐃᖏᓪᓗᒍᖅᖃᕐᓂᓪᓗ ᐃᓂᑎᕐᔪᐊᓂᕐᑐᖅᑐᑦ, ᑕᓱᕐᐅᕐᓂᖅᑐᑦ, ᐊᓕᒪᓗ ᐱᖅᓱᓂᖅᖃᐃᕐᓂᖅᑐᑦ ᑭᖑᓪᓕᖅᑐᑦ, ᐊᓕᒪᓗ ᐅᖅᐅᓂᒃᑯᓚᒃ ᐸᖅᓇᐅᑎᑦ. ᐳᓴᖅᑕᓂᒃ, ᓂᐱᖅᓂᖅ, ᐊᓕᒪᓗ ᐃᒪᐅᐸ ᐱᐅᓂᖓᓂᒃ ᖃᐅᔨᑎᐊᖅᑕᑦᓂᖅ ᐱᔨᓴᖅᑐᖅᑕᑦ ᐊᑐᖅᑕᐅᓂᖏᓪᓂᓄᓇᑦ ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᑦ ᐱᓕᕆᓂᐊᖅᑐᖅᑕᑦ ᓴᓇᓯᓂᐊᑎᓪᓚᑦᑐᑦ, ᐊᐅᓪᓚᖅᑎᓪᓚᑦᑐᑦ, ᐊᓕᒪᓗ ᐅᓴᐃᐊᖅᐸᑦᓂᐊᖅᑐᓂᒃ ᐱᓕᕆᐊᖅᑐᑦ.

ᐅᓗᕆᐊᓇᖅᑐᖅᖃᐃᓇᒍ, ᐅᔨᖅᑲᓄᑦ ᐊᓭᓗᓂᓂᒃ ᐃᓕᓴᐅᖅᑐᖅᑐᑦ 10 ᑭᑕᓂᒃ ᐅᖏᓴᓂᑎᒋᔭᒃ ᑭᓱᓕᕐᓂᓂᑦ ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᐃᑦ ᐊᓚᒪᓗ ᖃᐃᓪᓂᑦ ᑕᐃᓴᐱᐅᔪᑦ ᓴᓂᕋᐃᑦ 2 ᑭᑕᐃᑦ ᐅᖏᓪᑕᓄᑦ ᑕᑭᓂᖅᓴᐅᓴᑕ ᕿᐊᓵᑕᖅᑐᓄᑦ ᐅᕐᓭᓗᓵᓂᑦ ᓴᑭᑐᖅᑐᓄᑦ ᐱᓂᕐᓚᑦᑐᖅ ᑭᓱᓕᕐᓂᒃ ᑲᑕᒃᑐᖅᓂᒃ ᑭᓱᓕᕐᓂᒃ.

ᐅᑐᖅᑎᑎᓵᓇᖅᓂᐊᖅᑐᑦ ᐊᓴᖅᓇᓕᕐᑐᐊᕐᓵᖅᑐᑦ. ᐅᔨᔪᖅᑐᑕᑎᐊᖅᓂᓴᖅᑐᑦ ᖃᓄᐃᓕᓴᐅᓵᖅᑐᖅᓴᖅᑐᑦ ᐱᓕᕆᐊᖅᓯᒪᔪᐅᖅᑕᐅᓴᖅᑐᑦ, ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᓕᕆᐊᓴᖅᑐᑦ ᒥᑭᐅᓂᖅᑐᑦ ᐅᑎᖅᑎᑎᓪᓚᑦᑐᑦ. ᐅᑎᖅᑎᑎᓵᓂᖅ ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᓂᒃ ᐊᑐᖅᑕᐅᓂᖅᑐᑦ, ᐊᓕᒪᓗ ᓄᓇᒥᑦ ᐃᓚᓪᑐᖅᓯᒪᔪᓕᒫᑦ ᐃᑎᖅᑲᐃᑎᖅᑐᑦ ᐃᑎᖅᑲᐃᓕᐅᖅᑐᑦᑕᐃᓕᓴᐅᔪᓂᒃ ᐃᓕᓴᐅᓂᒃᑐᑦ ᐅᖏᕋᐃᑦᓂᐊᖅᑐᑦ.

AGNICO EAGLE

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

This Borrow Pits and Quarries Management Plan describes selection, operations, and closure strategies for the borrow pits and quarries at the proposed Project. Borrow pit and quarry materials will be used for the construction and maintenance of the bypass road in Rankin Inlet, the Itivia laydown, and the infrastructure pad at the proposed mine site. It will also be used in the maintenance of the All-weather Access Road (AWAR) between Rankin Inlet and the Meliadine site.

Borrow pits and quarries on Inuit Owned Lands require a commercial lease and quarry permit issued by the Kivalliq Inuit Association. Quarry permits on municipal land are administered by the Government of Nunavut Department of Community and Government Services on behalf of the Hamlet of Rankin Inlet. Other relevant regulations are mentioned in the Plan.

The following best management practices will be used in the selection, operation and closure of borrow pits and quarries for the proposed Project:

- minimize the surface area of quarries and borrow pits, where possible;
- minimize quarry and borrow pit cuts, where possible;
- maintain the floor of the quarries and borrow pits slightly above the elevation of the surrounding area to promote drainage, to avoid creating quarry lakes, and to prevent permafrost degradation in borrow pits;
- prevent erosion and sedimentation through appropriate control measures;
- carry out ARD/ML testing and water quality monitoring in support of mitigation measures;
- protect archeological resources;
- verify that there are no raptor nests in or near quarries and borrow pits before beginning quarrying operations (see the Terrestrial Environment Management and Monitoring Plan submitted as part of the Final Environmental Impact Statement [Agnico Eagle 2014]);
- maintain air quality through dust control/suppression; and
- use progressive reclamation in closing quarries and borrow pits when no longer needed.
- perform environmental inspections

The quarries and borrow pits selected for building the AWAR showed no potential to generate acid drainage. Visual examinations of materials and additional testing will be conducted during construction to confirm that the best available building materials are being used.

Quarry operations will use a “drill, blast, load, haul, dump” sequence, the final step being placement of quarried rock using a dozer. Some rock could be crushed to produce aggregate of various sizes. Wherever possible, borrow pit material will be ripped using a dozer. Standard drill and blast procedures may be used in instances where ripping is not possible.

Mitigation measures pertaining to archaeological resources and adjacent historical sites, attractions, and facilities within boundaries of Iqalugaajuup Nunanga Territorial Park, and wildlife were developed and are described in the Plan. Dust, noise, and water quality monitoring related to the use of the

quarries and borrow pits will be carried out during the construction, operation, and closure phases of the Project.

As a safety measure, rock berms will be placed 10 metres from the edge of a quarry and above any exposed high walls that are more than 2 metres in height where there is a risk of an all-terrain vehicle or snowmobile accidentally going over the edge.

Progressive reclamation will be carried out as much as practicable. With prudent initial design, the proposed quarries/borrow pits should require little reclamation. Reclaimed quarries and borrow pits will have gently sloping walls and positive drainage, wherever possible. Loose wall rock will be pulled to the quarry floor, and quarry entrances will be blocked with large boulders.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	December 2012			First draft of the Borrow Pits and Quarries Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013	1.2.2	3-4	More detail on Discovery access road	John Witteman, Env. Consultant, Agnico Eagle
3	April 2014			FEIS submission	
4	April 2015			Update document for the Class A Water Licence Application	John Witteman, Env. Consultant, Agnico Eagle
5	March 2017			2016 Comprehensive Review following completion of AWAR Construction	Manon Turmel, Agnico Eagle Mines Ltd.
		1.2.1	2	Addition of Table 1	
6	January 2018			Annual reviewe	Alexandre Gauthier, Env. Tech Meliadine Project

ACRONYMS

INAC	Indigenous and Northern Affairs Canada
Agnico Eagle	Agnico Eagle Mines Limited
ARD/ML	Acid Rock Drainage/Metal Leaching
AWAR	All-weather Access Road
CGS	Department of Community and Government Services, GN
CH	Department of Culture and Heritage, GN
CLEY	Department of Culture, Language, Elders and Youth, GN
IOL	Inuit Owned Lands
KIA	Kivalliq Inuit Association
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
Park	Iqaluqaarjuup Nunanga Territorial Park
Project	Meliadine Gold Project

UNITS

km	kilometre
m	metres
m^3	cubic metre

SECTION 1 • INTRODUCTION

1.1 Overview

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

The Borrow Pits and Quarries Management Plan was prepared in accordance with the Guidelines issued by the Nunavut Impact Review Board and was subsequently updated to meet the needs of the Type A Water Licence application to the Nunavut Water Board (NWB).

Borrow pits and quarries are defined by the type of granular material extracted and the method of extraction. Quarries consist of rock material that is typically extracted by digging, cutting, or blasting and yields large stones that may then need to be crushed (INAC 2009). Borrows pits consist of fine grained fill materials, such as sand or clay, that are normally used at a nearby site (INAC 2009).

1.2 Project Components

1.2.1 All-weather Access Road

The construction of the Phase 1 AWAR was completed in 2013.

The borrow pits and quarries selected for the road construction and maintenance, as shown on Figure 1-1 and Table 1.1, are immediately next to the road route thereby minimizing the haul distances for road maintenance. Of the borrow pits and quarries selected, only R19 (closed and rehabilitated), Site D (Municipal Borrow Pit) and the proposed Itivia Quarry (being reviewed by NIRB) are located on municipal land; the remainder are located on IOL administered by the Kivalliq Inuit Association (KIA).

Other considerations in the selection of the borrow pits and quarries include: the volume of material available, proximity to receiving waters, acid rock drainage/metal leaching (ARD/ML) potential, archaeological resources in the immediate vicinity, surface area to be disturbed, and wildlife and territorial park concerns (Golder 2011). The goal in selecting the quarries/borrow pits is to avoid or minimize, wherever possible, potential negative effects to the environment.

Table 1.1. Approved borrow pits and quarries

Issued By	Quarry permit	Quarries/borrow pits approved	Active (Y/N)
KIA	KVCA11Q01	B5	N
		B5A	N
		B6	N
		R2	N
		R5	N
		B10	N
		B11A	N

Issued By	Quarry permit	Quarries/borrow pits approved	Active (Y/N)
		B12	N
		B13	N
		B15	N
		B15A	N
		R19	N
KIA	KVCA07Q08	Tiriganiaq	N
		Westmeg	N
		Meliadine Esker	Y
		Emulsion Esker	Y
GN	01-600-16	Site D	Y
GN	Ongoing with GN	Fuel farm Quarry	N
GN	Ongoing with NIRB	Itivia Quarry	N

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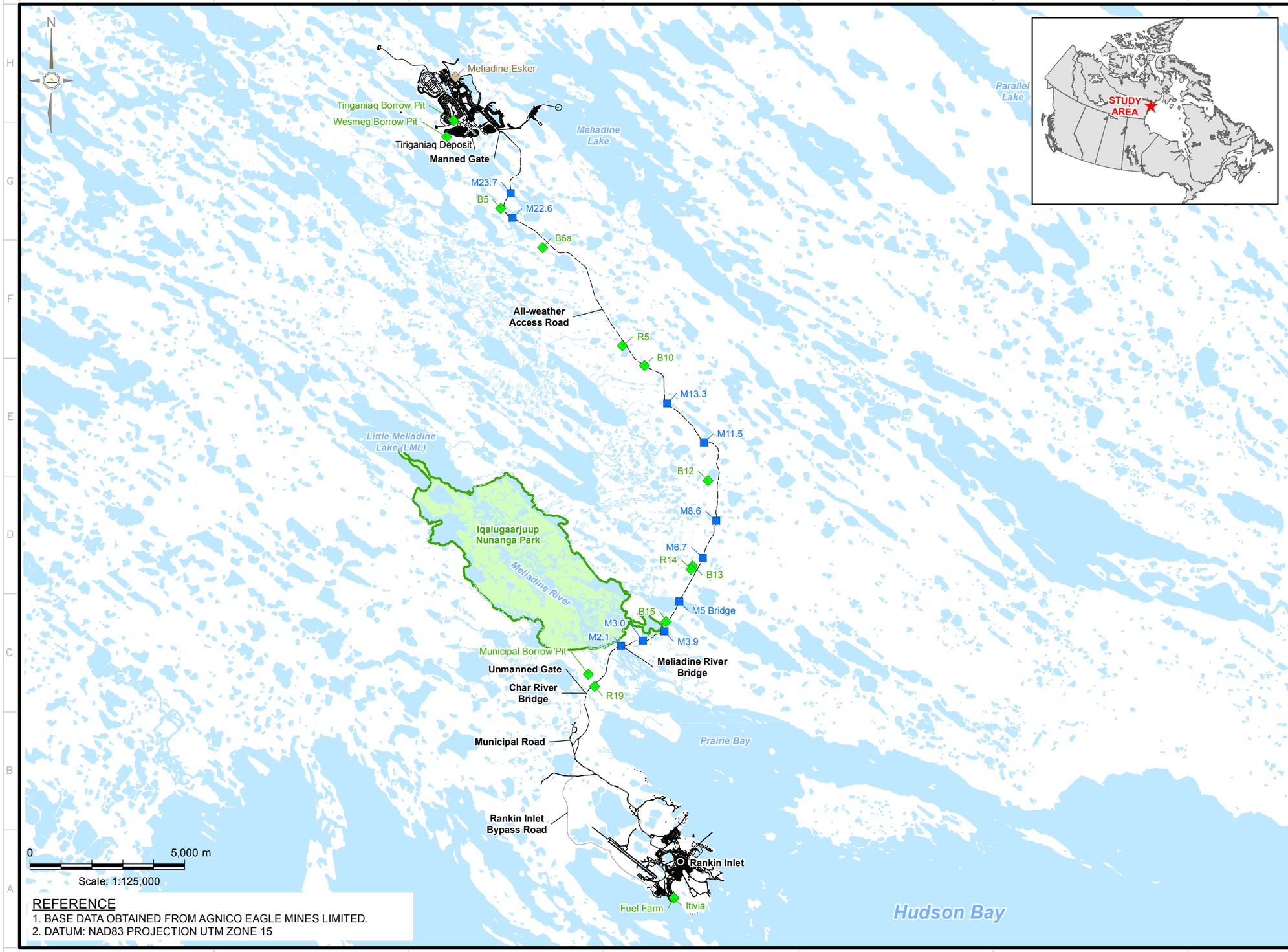

REFERENCE

1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

LEGEND

- PROPOSED MINE SITE
- QUARRY/BORROW PIT LOCATION
- ESKER LOCATION
- WATERCOURSE CROSSING
- ALL-WEATHER ACCESS ROAD (AWAR)
- ROAD - NEW
- ROAD - EXISTING
- Road - New Bypass
- WATERCOURSE
- WATERBODY
- TERRITORIAL PARK

AGNICO EAGLE

Golder Associates

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REVISIONS

DESSINÉ PAR DRAWN BY	VM	DATE	20-10-2016
VÉRIFIÉ PAR CHECKED BY	–		–
APPROUVÉ PAR APPROVED BY	–		–
No. PROJET PROJECT NO.	1656645		
DATE	–		

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION

FIGURE 1-1 LOCATION OF BORROW PITS AND QUARRIES FOR THE MELIADINE GOLD MINE

ÉCHELLE/ SCALE	1:125,000	FICHIER FILE	.DWG
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\\golder.gds\GAL\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1656645_MP_Updates\02_PRODUCTION\3300\MXD\3350\Report\1656645_Figure_1-1_Location_Borrow_Pits_Quarries.mxd

1.2.2 Hamlet Bypass Road and Itivia Laydown

A bypass road is proposed around the airstrip to Itivia harbour, as shown on Figure 1-1. This will allow traffic from Itivia harbour to bypass the hamlet in delivering dry goods and fuel from Itivia to the proposed mine site. It will also be used in moving air freight and mine personnel between the airport and the proposed mine site.

By building the bypass road, use of municipal roads by Agnico Eagle will be kept to a minimum. The proposed bypass road will be approximately 5.9 km long, and 6.5 metres wide. Road building materials will be sourced from Site D (Municipal Borrow Pit), the Itivia fuel farm area, and the Itivia Quarry once required approvals are received from regulatory bodies. The proposed laydown yard at Itivia harbour will cover 14 hectares. Material will be sourced from rock blasted in the fuel farm area and from the Itivia Quarry once required approvals are received from regulatory bodies.

1.2.3 Traditional All-terrain Vehicle and Snowmobile Trails

The proposed building of roads and the mine infrastructure at Itivia will impact some all-terrain vehicle and snowmobile trails. Where these trails cross a road, a ramp will be constructed to ease road crossing, and signage will be installed to alert road users of the crossing. Similarly, there will be a sign alerting all-terrain vehicles and snowmobiles that they are approaching a road. Maintenance of the roads would see no snow placed on these trails.

In accommodating existing trails rather than building new ones, the area impacted will be minimized. The ramps leading up to the road will be small and require little road building material.

The present ski-doo trail at Itivia harbour to the sea ice is located to the east of the fenced laydown yard. Individuals will be able to readily access the sea ice using the re-located snowmobile trail.

1.2.4 On-Site Infrastructure Pad

The proposed major mine infrastructure, as shown on Figure 1-2, will be located on a pad having an area of approximately 70,000 square metres. The site preparation of the pad involved the spreading of waste rock and borrow pit materials to an average thickness of approximately 3 m over the pad area for a total volume of approximately 200,000 m^3. The material to construct the proposed infrastructure pad came from ramp development waste rock and from borrow pits Tiriganiaq Esker, Meliadine Esker, B5, and B6 (see Figure 1-1 for their location).

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FORMAT ANSI B–11x17

INFRASTRUCTURE PAD
FRESH WATER INTAKE CAUSEWAY
CHANNEL2
TEMPORARY OVERBURDEN STOCKPILE
SEWAGE TREATMENT PLANT
WATER TREATMENT PLANT
WTP INTAKE CAUSEWAY
LANDFARM
TREATED SEWAGE DISCHARGE
MELIADINE LAKE
ORE STOCKPILE 3
ORE STOCKPILE 1
ORE STOCKPILE 2
CP2
CP1
CHANNEL1
CULVERT3
BERM2
TAILINGS
TAILINGS STORAGE FACILITY (TSF)
CULVERT1
CP3
WASTE ROCK COVER
CULVERT2
D-CP3
CHANNEL3
LANDFILL
BERM1
CHANNEL8
CHANNEL7
CHANNEL4
WASTE ROCK& OVERBURDEN STORAGE FACILITY 2 (WRSF2)
WASTE ROCK & OVERBURDEN STORAGE FACILITY 1 (WRSF1)
D-CP1
CULVERT4
CULVERT5
CHANNEL6
D-CP6
CP6 JETTY
CP6
WASTE ROCK & OVERBURDEN STORAGE FACILITY 3 (WRSF3)
D-CP4
CP4
CP5 JETTY
CP5
D-CP5
CULVERT6
CHANNEL5
TIRIGANIAQ PIT 1 (TIRI_1000_01)
BERM3
TIRIGANIAQ PIT 2 (TIRI_1000_02)
0 500 m
Scale: 1: 12 500

LEGEND
- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- WATER FLOW DIRECTION
- STREAM

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VÉRIFIÉ PAR CHECKED BY	NG		14–04–2015
APPROUVÉ PAR APPROVED BY			
No. PROJET PROJECT NO.			
DATE			

TITRE / TITLE
AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE 1–2 MINE INFRASTRUCTURE PAD

ISSUED FOR PERMITTING
AGNICO EAGLE DATE : 14–04–2015

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1.3 Quarry and Borrow Pit Extraction Methods

Quarry operations will use explosives. The design, size, and shape of the blasts are planned with safety being the foremost consideration. A predetermined pattern of drill holes are drilled to a depth not exceeding the overall depth of the quarry and filled with explosives. Prior to a blast, all personnel and equipment are moved to a safe distance from the blast area. The blast fragments (i.e., the blasted rock) is then loaded into haul or dump trucks using either a loader or an hydraulic shovel. The truck drives to the end of the road (or other construction area) where the rock is dumped. The rock is then pushed into place using a dozer. This sequence is called a “drill, blast, load, haul, dump” sequence.

Some rock can be moved to a crusher to produce aggregate of various sizes. The crusher is located as far from water as possible and where it is best shielded from the prevailing wind, preferably behind a high wall in a quarry so as to reduce the quantity of wind-blown dust and to have as much dust as possible fall within the boundaries of the quarry.

Wherever possible, borrow pit material will be ripped using a dozer. This loosens the material and allows it to be picked up using a loader or an hydraulic shovel. Standard drill and blast procedures may be used in instances where ripping is not possible. The sequence of steps under this circumstance follows that for rock quarries.

1.4 Related Documents

The following documents provided input to the Borrow Pits and Quarries Management Plan submitted as part of the Water Licence Application:

- Environmental Management and Protection Plan;
- Explosives Management Plan;
- Preliminary Closure and Reclamation Plan;
- Roads Management Plan, including the Dust Management Plan; and
- Water Management Plan.

The Borrow Pits and Quarries Management Plan is part of the Environmental Management and Protection Plan for the Project. The Air Quality Monitoring Plan and the Occupational Health and Safety Plan submitted as part of the Final Environmental Impact Statement also provided input to this plan.

1.5 Regulatory Setting

The proposed Project is located on IOL, with some components located within the municipality of Rankin Inlet. This includes all borrow pits and quarries exclusively used in building and maintaining the AWAR. As well, construction of the proposed bypass road and the fuel farm and laydown at Itivia will require granular material. Although federal requirements do not apply, the *Northern Land Use Guidelines, Pits and Quarries* prepared by Indian Affairs and Northern Development Canada (INAC 2009; which in 2017 split into Services Canada and Crown-Indigenous Relations and Northern Affairs) provides useful guidance in establishing and operating borrow pits and quarries in an Arctic setting.

In building the AWAR, borrow pits and rock quarries on IOL required a commercial lease and quarry permit issued by the KIA. Quarry permits from the KIA include terms and conditions specifying how operations are to be conducted.

Quarry permits on municipal land are administered by the Government of Nunavut Department of Community and Government Services (CGS) on behalf of the hamlet of Rankin Inlet. When the hamlet

council passes a resolution approving the quarry and/or borrow pit, the permit is issued by CGS. If Agnico Eagle purchases materials from existing quarries and borrow pits in the hamlet for the construction of the bypass road and the Itivia laydown, permits would not be required in this instance.

The Department of Culture and Heritage (CH) administers the archaeology permitting process for Nunavut. Archaeological surveys are undertaken in advance of borrow pit and quarry selection to ensure all archaeological sites are identified and avoided if possible. If the sites cannot be avoided, they are mitigated with the approval of CH.

The Nunavut *Wildlife Act and Regulations* will apply as raptors nesting close to the AWAR and quarries/borrow pits may be disturbed, or raptors may nest in the quarries and/or borrow pits upon the completion of their use.

Land animals may also be disturbed by the quarrying activities. The quarries and possibly the borrow pits in some instances will require the use of explosives. The activities will have to comply with the *Explosive Use Act and Regulations*, and the *Mine Health and Safety Act and Regulations.* The latter is administered by the Worker's Safety and Compensation Commission.

Use of rock and granular material from the quarries and borrow pits could introduce waste to water, and will require a water licence from the NWB under the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and associated water regulations. The federal *Fisheries Act* will apply if runoff water containing deleterious substances flow from the quarries/borrow pits into fish bearing waters.

Use of explosives at quarries could lead to fish destruction or to harmful alteration, disruption or destruction of fish habitat. The federal *Fisheries Act* will apply if this was to occur.

SECTION 2 • QUARRIES AND BORROW PITS MITIGATION MEASURES

The ranking of mitigation options is as follows:

- **Avoidance** – using an alternate site or technology to avoid the adverse effect all together. This is the most desirable;
- **Minimization** – taking actions to minimize and/or contain effects to the maximum extent possible during engineering design, pre-development, construction, operations, and closure;
- **Rectification** – taking actions to rehabilitate or restore the affected environment after the fact; and
- **Compensation** – this is used as a last resort to offset adverse environmental effects. This is the least desirable.

Best management practices will employ the following general mitigation measures for the quarries and borrow pits:

- minimize the surface area of quarries and borrow pits where possible;
- minimize rock and borrow pit cuts where possible;
- maintain the floor of the quarries and borrow pits slightly above the elevation of the surrounding area to promote drainage, to avoid creating quarry lakes, and to prevent permafrost degradation in borrow pits;
- prevent erosion and sedimentation through appropriate control measures;
- carry out ARD/ML testing and water quality monitoring in support of mitigation measures;
- protect archeological resources;
- verify that there are no raptor nests in or near quarries and borrow pits before beginning quarrying operations;
- maintain air, water, and sediment quality through dust control/suppression; and
- use progressive reclamation in closing quarries and borrow pits no longer needed.
- perform environmental inspections

2.1 Acid Rock Drainage and Metal Leaching

Initial testing of potential quarry and borrow pit materials was completed in 2010 (Golder 2010) and in 2016 and 2017 for the Itivia Quarry, Rankin Inlet Fuel Farm Quarry, Emulsion Esker and Meliadine Esker quarries. Static methods were used to assess the chemical composition of the potential building material, its potential to generate acid rock drainage (ARD), and its potential to leach metals into the receiving environment upon exposure to ambient conditions.

Sampling and testing prior to use of any quarry or borrow pit significantly reduces the risk of ARD/ML. The quarries and borrow pits selected for road building and maintenance materials showed no potential to generate acid drainage due to the high buffering capacity and low sulphide content in the bedrock and glacial-fluvial deposits. In early testing, some potential quarries/borrow pits were rejected due to potential metal leaching (Golder 2010). Avoiding the use of undesirable or questionable road building materials ranks this mitigation measure as highly beneficial.

Additional measures will be used while the quarries and borrow pits are operational. Visual examinations of the quarry material for sulphur species and additional testing for ARD/ML will be conducted during construction of the roads and pads. As recommended by Price (2009), for every 100,000 tonnes of material removed from a borrow pit or rock quarry, eight samples will be collected for static testing and analysis (ARD/ML). This will include samples of wall rock (Agnico Eagle 2012). If ARD/ML materials are found, these materials will not be used for construction and the area will be covered with a minimum two metre thick layer of non-acid generating borrow material to encapsulate it below the active layer.

The additional testing will confirm that the best available materials are being used in constructing the infrastructure pad, the bypass road, and Itivia fuel farm and laydown.

The same procedures will be used should any new quarry and/or borrow pit be developed.

2.2 Management of Water Originating from Quarries and Borrow Pits

While ARD/ML testing is a measure to avoid using questionable road and pad building materials, water quality monitoring of seeps from quarries and borrow pits provides information on possible impacts on the environment (e.g., water and sediment quality) should the water reach any nearby waterbodies. A buffer of at least 31 m of undisturbed land will be maintained between quarries/borrow pits and waterbodies when practicable. If not possible, Agnico Eagle will seek approval from the Board. Best management practices will prevent direct drainage of the quarry to watercourses. However, any significant seeps originating from the borrow pits or rock quarries likely to reach receiving waters will be sampled and analysed for a full suite of water quality parameters. Any problematic water will be directed away from waterbodies, or held if possible. If necessary, silt curtains and/or straw logs will be used to control suspended sediments in water seeping from the quarries/borrow pits.

Although erosion is not expected to originate from water flow from the quarries/borrow pits, any evidence of erosion will be repaired by placing rip-rap over the affected area, and measures will be taken to reduce the velocity of the water with, for example, silt curtains, straw logs, or small check dams.

2.3 Archaeological Resources

The quarries and borrow pits were selected to avoid archaeological resources. Archaeological surveys were completed along the AWAR alignment, its buffer zone, over the footprint of selected quarries and borrow pits, and the immediate area. The archaeological site identified at borrow pit B11A will be protected. This borrow area is large in extent allowing Agnico Eagle to develop the borrow pit without disturbing this site. There were sites identified at borrow pit B12 and quarry R14 that could not realistically be avoided and these were mitigated under a permit issued by CLEY[1] to Agnico Eagle.

If any potential archaeological site is identified during the operation of any quarry/borrow pit, work will stop, a professional archaeologist will be consulted, and CH will be informed of the discovery.

All equipment will remain within the boundaries of the quarries/borrow pits to ensure any nearby archaeological site is not inadvertently damaged.

[1] In a recent Nunavut government re-organization Culture, Language, Elders & Youth was renamed Culture and Heritage.

Before any new quarry/borrow pit is selected, it will be surveyed for archaeological resources by a professional archaeologist registered in Nunavut. Sites with archaeological resources present will not be selected if there is a similar site devoid of archaeological resources nearby.

2.4 Iqaluqaarjuup Nunanga Territorial Park

Quarries and borrow pits will not be developed in or near the Iqaluqaarjuup Nunanga Territorial Park (the Park). Rock quarry R19 and borrow pit B15 (Figure 1-1) are the closest to the Park. Both are more than 1 km from the Park boundary and quarry R19 is closed and rehabilitated. All personnel working in the quarries/borrow pits and on the AWAR will not enter the Park during work hours. Noise from construction vehicles will be minimized as part of best management practices by ensuring noise control equipment installed on the vehicles are maintained and operating according to specifications.

Noise related to quarry/borrow pit operations will be of short duration and should be restricted primarily to the predevelopment and construction phases of the Project. While noise can be expected to be heard in a 5 km radius, the majority of the noise should be within 1 km of the activities.

The prevailing wind direction at Rankin Inlet is from the north-northwest. This prevailing wind direction is consistent for all months of the year and would tend to blow dust from the road and quarry/borrow pits away from the Park. All wind directions that could carry dust towards the Park occur on average 25 to 35 % of the time.

2.5 Dust Control

Dust will be generated as part of quarry/borrow pit operations and will be restricted primarily to the predevelopment at the proposed mine, and the construction of the proposed bypass road and Itivia laydown. To limit the creation of dust, any crusher will be located where it is best shielded from the prevailing wind, preferably behind a high wall in the quarry. In addition, crushing that occurs during the summer when dry weather is expected will be controlled through wetting. Both of these measures will minimize dust generation and limit dusting to the bounds of the quarry.

Transport of material from the quarries/borrow pits will be subject to speed limit restrictions to help reduce dust.

Dust monitoring is occurring along the AWAR and between the AWAR and the Park.

2.6 Ground Ice and Permafrost Protection

The borrow pits[2] sites selected are from glaciofluvial deposits and weathered bedrock deposits located in well-drained areas. All have positive topography rising above the local setting. These types of granular deposits were selected because they are largely free of ground ice, thereby minimizing possible thaw settlement and melting ground ice, which can result in erosion, slumping of side slopes, and an altered landscape that extends beyond the borrow pit. Should this happen, the area will be monitored and, if necessary, stabilized by covering the affected land with approximately 2 m of rock or other granular material. This reclamation effort would allow the permafrost to move up into the material covering the area and stop any remaining ground ice from melting. Inspections of quarries/borrow pits will continue after their closure at the end of Project predevelopment and construction.

[2] Quarry sites are expected to be free of ground ice and should not release any water should the permafrost melt.

Any significant seeps originating from the borrow pits as a result of ground ice, permafrost melting, or from precipitation events will be monitored if the water is likely to reach receiving waters[3].

[3] Shallow, standing water will not be collected as it poses little risk to the receiving environment.

SECTION 3 • PROGRESSIVE RECLAMATION STRATEGY

The Project's reclamation objective is to avoid or minimize negative environmental effects wherever possible, practice progressive reclamation, and, upon closure, return negatively impacted areas to productive and lasting use by wildlife and humans. Reclaimed areas will be chemically and physically stable, and should ultimately support the same functions as surrounding undisturbed land. Because of the proximity to Rankin Inlet, particular attention will be paid to ensuring that reclaimed areas are safe for future traditional use.

A practical, cost-effective approach will be central to the closure and reclamation of the borrow pits and quarries. The intent is to pursue progressive reclamation to return areas to natural conditions and avoid long-term care and maintenance requirements. Most quarries and borrow pits will no longer be needed following the completion of construction, although several quarries will remain open to support ongoing maintenance and repair of the AWAR[4]. Using best management practices, borrow pits and quarries no longer in use will be reclaimed by stabilizing disturbed land surfaces, which will promote natural re-vegetation.

The reclaimed quarries and borrow pits will have gently sloping walls and positive drainage wherever possible. With prudent initial design, the quarries/borrow pits should require little reclamation. Loose wall rock will be pulled to the floor of the quarry, and the quarry entrance will be blocked with large boulders. For the interim until the quarries and borrow pits are reclaimed, rock berms will be placed 10 m from the edge of the quarry/borrow pits and above any exposed high walls that are more than 2 m in height where there is a risk of an all-terrain vehicle or snowmobile accidentally going over the edge.

Should acid-generating bedrock be exposed in borrow pit/quarry, these areas will be covered with a minimum of a 2 m thick layer of non-acid generating soil or rock. Water will be directed away from the area.

[4] A small number will remain active to store and/or supply crushed rock and/or granular material for ongoing road maintenance.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2011. Borrow Pit and Quarry Management Plan for the Phase 1 All-weather Access Road between Rankin Inlet and the Meliadine site; ftp://nunavutwaterboard.org/1%20PRUC/2%20MINING%20MILLING/2B/2BW%20-%20Watercourse/2BW-MEL1215%20AEM/3%20TECH/9%20MONITORING/111109%202BW-MEL----%20Borrow%20Pit%20and%20Quarry%20Mgmt%20Plan%20November%202011-ILAE.pdf

Agnico Eagle. 2012. Monitoring Plan for the Phase 1 All-weather Access Road between Rankin Inlet and the Meliadine site; ftp://nunavutwaterboard.org/1%20PRUC/2%20MINING%20MILLING/2B/2BW%20-%20Watercourse/2BW-MEL1215%20AEM/3%20TECH/9%20MONITORING/120119%202BW-MEL----%20Monitoring%20Plan-IMLE.pdf

Agnico Eagle. 2014. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

Franke, A. Principal, Arctic Raptors Inc. Adjunct Academic Canadaina Cirumpolar Institute, University of Alberta, Edmonton, AB., pers. comm. October 14, 2014.

Golder (Golder Associates Ltd.). 2010. Geochemical Assessment of Potential Road Construction Material, Meliadine Golder Project, Nunavut. Submitted to Agnico-Eagle Mines Limited. December 2010.

Golder. 2011. Phase 1 – Meliadine All-weather Access Road Project Description and Environmental Assessment.

Hill, J. 2015. Final Report Archaeological Impact Assessment and Mitigation for the Agnico-Eagle Mines Limited Meliadine Gold Project, Rankin Inlet, Nunavut, (NU Permit 2014-016A). Draft manuscript on file, Golder Associates Ltd., Calgary, Alberta (to be submitted).

INAC (Indian and Northern Affairs Canada). 2009. Northern Land Use Guidelines, Pits and Quarries.

Price, W.A. 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geological Materials. MEND Report 1.20.1, Natural Resources Canada.

Ross, J. 2012 . Final Report Archaeological Impact Assessment and Mitigation for the Agnico-Eagle Mines Limited Meliadine Gold Project, Rankin Inlet, Nunavut, (NU Permit 2011-026A). Report on File Department of Culture Language Elders and Youth, Government of Nunavut, Igloolik.

AGNICO EAGLE

MELIADINE GOLD PROJECT

Environmental Management and Protection Plan (EMPP)

MARCH 2018
VERSION 7
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ᓇᐃᓇᖅᓯᒪᔪᖅ

ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐊᐅᓪᓚᑎᓂᖅ ᐊᓚᒪᓗ ᒥᐊᓂᖅᓯᓂᖓᓪᓗᒍ ᐱᓕᕆᐊᖅ (EMPP) ᐅᖃᐅᓯᖃᖅᑐᖅ ᖃᓕᓴᓕᖅᓯᓂ ᓇᐅᔨᒋᐊᖃᖅᓂᖅᓱᓚᓄᓂ ᐊᕕᑎᓕᕆᓂᖅ ᐊᓚᒪᓗ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᐅᓪᓚᑎᓂᖅᓱᓚᓄᑦ, ᐊᐅᓚᐅᖅᑎᓯᓂᖅ ᐱᓕᕆᔨᒪᔪᓂᖅ ᐊᖏᓪᓗᐊᖏᑦᑐᐊᖅᑎᓂᑎᓂᖓᓪᓗᒍ, ᖃᐅᔨᓕᐊᖃᑦᑕᑦᓂᓪᓗᓄᑦ, ᐊᓚᒪᓗ/ᐅᕐᓭᓴᐅᓂᑦ ᐊᐅᓪᓚᑎᓂᖓᓪᓗᒍ ᐸᑦᓀᐃᓂᐅᔨᓂᖅ ᑎᑎᕋᐃᓂ ᐱᓕᕆᐊᐸᑦ ᐊᑐᖅᑕᖏᐅᓂᖅ ᐊᓚᒪᓗ ᐱᔪᕆᐊᖃᖅᑕᖏᐅᓂᖅ ᐃᓕᖏᐅᓂᖅ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐊᓚᒪᓗ ᐃᓂᓪᓚᑎᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ. ᐊᖏᓂᔪᓂᖓᓂ ᐊᕕᑦᓂᐊᖅᑕᖏᑦ ᖃᓄᐃᖓᓂᐅᔨᓂ ᐱᓕᕆᐊᖅᓯᒪᒍ, Type A ᐃᒪᖅᒍ ᓯᐃᓴᔨᓕ (2AM-MEL1631), ᐊᔨᑦᑎᓂ ᐱᔨᖓᓇᖅᑎᑎᔨᓴᑐᓂ, ᐊᓚᒪᓗ ᐱᓴᐊᖃᖅᓯᓂᐅᔨᓂ ᐱᑦᔨᑎᖃᖅᑐᒍ ᑕᒪᐅᔪᓇᖅᓱᒪᓕ ᒪᓕᑐᐅᔨᓄᑦ ᐊᓚᒪᓗ ᒪᓕᑐᕋᓭᓲᔪᓄᑦ. ᐊᖏᓂᔪᓂᖓᓂ ᐃᐦᖃᐸᔨᓕᐅᕐᒥᔨᓂ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᓭᖅᑎᓂᑎᓂᖓᓪᓗᒍ ᐅᕐᓭᓴᐅᓂᑦ ᐱᑦᔨᑎᖃᖅᑕᖏᐅᓂᖅ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐱᓕᕆᔨᒪᔪᓂᖅ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ. ᐊᖏᓂᔪᓂᖓᓂ ᐃᐦᖃᐸᔨᓕᐅᕐᒥᔨᓂ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᓭᖅᑎᓂᑎᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ.

ᐅᑎᖅᑕᖅᑐᒃ ᐅᖃᐅᓯᐅᔨᓕᐅᓂ ᐱᑕᖃᖅᑐᓴᓂᐅᔨᖅ ᐱᓕᕆᐊᖅᓯᓂᐊᖅᑐᖅ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐸᑦᓀᐅᑕᐅᔨᓂ ᐊᓚᒪᓗ ᐊᑐᓕᖅᑎᑕᐅᔨᓂ, ᖃᐅᔨᓕᐊᖃᑦᑕᑦᓂᓪᓗᒍ ᓱᓴᐅᑎᓂ/ᑎᑎᖅᑲᐃᓂ ᑲᑎᕋᐅᔨᓂ ᐊᓚᒪᓗ ᖃᐅᔨᓴᖅᑕᐅᔨᓂ, ᐊᓚᒪᓗ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᒍ ᑎᑦᓯᐅᐊᖅᑕᐅᔨᑐᑎᑎᒍ ᐅᕐᓭᓴᐅᓂᑦ ᐱᑕᖃᖅᑐᓴᓂᐅᔨᓂ ᐱᐅᓪᓛᖅᑐᒍ ᐊᐅᓪᓚᑎᓂᖅᓱᒪᓕ ᐅᖃᐅᓯᐅᔨᓕᐅᓂ ᐱᑕᖃᖅᑐᓴᓂᐅᔨᖅ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᑲᑎᕋᐅᔨᓂ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ.

EMPP ᑐᓂᔨᓂᐊᖃᖅᑐᖅ ᖃᓄᖅᓱᑎᑐᐃᓐᓇᖅ ᑭᐅᔭᕐᓂᑦ ᐊᔨᐊᓵᙱᖃᖅᑐᓄᓂᒍ, ᐅᑦᑐᑎᑎᒪᓕᒍ, ᐅᓴᖃᑎᒌᐊᖏᑦᑐᒍ ᐱᓕᕆᓂᖓᓪᓗᒍ ᐸᑦᓀᐅᑎ, ᒪᓕᑐᓕᕆᓂᖓᑎᑦᑎᓂ, ᐅᒪᓂᖃᖅᑐᓄᓂᒍ ᐊᓚᒪᓗ ᐃᓕᓴᕆᐊᖅᑐᒍ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᓵᖅᑐᓄᓂᒍ, ᑲᑦᐳᔭᓕᖅᑐᓄᓂᒍ, ᖃᐅᔨᓴᐃᓂᖓᓪᓗᒍ ᖃᓄᐃᖓᓂᐅᔨᓕᐅᓂᒍ, ᐊᓚᒪᓗ ᑐᑭᓯᐅᑦᑕᐅᔨᓂᖓᓂᑐᓕᐅᓂᒍ ᐃᓕᓴᕆᐊᖅᑐᒍ ᖃᐅᔨᓴᒪᓕᕐᓗᑐᖅᑎᓂᒍ. ᑎᑭᓴᖅᑐᓂᖓᓂ ᐊᓚᒪᓗ ᓇᓗᓇᐃᖅᑲᓪᓚᑦᓯᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐃᓚᒋᓄ-ᐱᑭᖅᐸᑦᓕᐊᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ.

ᖃᐅᔨᓕᐊᖃᖅᑐᓂᖅ ᐊᓚᒪᓗ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ ᐊᓚᒪᓗ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᒍ ᐃᓕᓴᕆᐊᖃᖅᑐᒍ ᐊᕕᑎᓕᕆᓂᖓᓪᓗᐊᔪᓄᑦ.

ᐊᖏᑭᐅᒪᓂᖅ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᐅᑦ ᐊᒻᒪᓗ ᐊᐅᓪᓕᑎᓂᕐᒧᑦ ᕿᖏᐅᑎᐅᑦ, ᓇᓴᐅᑎᓂᒃ/ᑎᑎᖃᒃᓂᒃ ᖃᐅᔨᓴᐃᓂᑦ, ᐅᓂᒋᒃᓪᓕᐅᔪᓂᖅ, ᐊᒻᒪᓗ ᐃᓪᓕᐅᑎᓂᖏᑦ ᖃᓄᐃᖅᓯᓂᐅᔨᔪᑦ ᐊᐅᓪᓚᖅᑎᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔨᓴᓴᓄᑦ ᐱᓕᕆᐊᖅᓯᐊᖃᖅᑐᑦ ᐊᓱᓂᔨᓄᑦᓴᓄᑦ. ᐅᖃᖅᑎᖃᑦᑕᐅᑎᓂᖅ ᑕᒪᒃᑯᓄᖅᓴᑎ ᐊᓯᐊᖅᓯᑎᑦᑎᑐᐃᓐᓇᕆᐊᓕᒃ ᑎᑭᐅᑎᓂᐊᓕᖅᑐᓂ ᐱᓕᕆᐊᖃᖅᑐᓄᓂᑦ ᐊᒻᒪᓗ ᐃᓱᒪᓕᑕᐅᔨᓄᑦ ᐊᓯᖏᓐᓄᑦ ᑲᑐᔾᔨᖃᑎᒌᓄᑦ. ᐊᓱᓂᔨᓄᑦ ᐃᓕᓴᐅᑎᓂᐊᖃᖅᑕᖏᑦ ᐊᖏᑭᐅᒪᔨᖅᑐᑦ ᓄᓇᕗᑦ:

- ᐱᓕᕆᐊᖅᓯᒪᔨᑦ, ᐊᑐᖅᑐᑦ ᒪᓕᕆᐃᑦ, ᐊᒻᒪᓗ ᒪᓕᕆᕿᓕᑦ;
- ᐃᒃᐱᒋᓂᖃᖅᓯᐅᔨᑦ ᐱᑭᖃᑎᒋᔭᑐᓄᓕᑦ ᐃᓕᓴᕆᐅᔨᑦ (VEC) ᐊᒻᒪᓗ ᐃᒃᐱᒋᓂᖃᖅᓯᐅᔨᑦ ᐃᓄᐃᑦ-ᐱᑭᖅᑕᕐᓕᐊᓂᖅᓴᓄᑦ ᐃᓕᓴᕆᐅᔨᑦ (VSEC) ᖃᐅᔨᒋᐊᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ;
- ᐃᓄᐃᑦ ᖃᐅᔨᒪᓕᑐᖃᖅᓴᓂᑦ ᖃᐅᔨᓴᕆᐅᔨᑦ;
- ᖃᑦᓯᖅᑕᕐᓂᖅ, ᖃᓄᖅ ᐊᑯᓂᐅᑎᑎᔨᖅ, ᐊᒻᒪᓗ ᓄᓇᐅᑦ ᐊᖏᓂᖅᓗ ᖃᐅᔨᒋᐊᖅᓯᐅᖃᑦᑕᖅᑐᑦ;
- ᖃᓄᐃᓕᓴᐅᔪᓂᖅᓯᒪᓂᖅ ᐊᒻᒪᓗ ᖃᓄᐃᖅᓯᐅᓂᖅᓴᓄᑦ ᐊᐅᓪᓕᑎᓂᖅᑎᑦ ᑐᕋᖅᓱᔨᑦ, ᑕᒪᒃᑯᐊᑕᓗᐃᑦ.

ᐱᓴᓇᐊᖃᖅᑐᑦ, ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖅᓴᓄᑦ ᑐᕋᖅᓱᔨᑦ ᐊᑭᑭᑦᑕᐅᓂᐊᖃᖅᑐᑦ ᖃᓄᐃᖅᓱᓂᐅᔨᑦ ᐱᓕᕆᐊᖅᓯᓐᓂᕐᓴᑎᑕ ᑲᔨᔪᐊᒃ ᓄᓇᕗᒻᒥ ᐊᐃᑲᑐᖅᓯᒪᔨᖅᓴᓄᑦ ᐱᓕᕆᐊᓄᑦ ᐅᕝᕙᓚᐅᑦ ᑐᕋᖅᓱᔨᓄᑦ ᑕᒪᒃᑯᓄᖅᓱᒪᓂᖅ ᓴᕿᒪᒃᑯᓄᑦ ᑲᑭᖅᑎᑐᓂᐅᑦ ᐅᕝᕙᓚᐅᑦ ᐱᔨᓴᖅᑎᑐᓂᐅᑦ.

EXECUTIVE SUMMARY

The Environmental Management and Protection Plan (EMPP) describes the overarching direction for environmental and socio-economic management for Agnico Eagle Mines Limited (Agnico Eagle) Meliadine Gold Project (Project). It is supported by a suite of Project-specific mitigation, monitoring, and/or management plans that set out the Project's standards and requirements for particular areas of environmental and socio-economic management. Agnico Eagle will manage the conditions in the Project Certificate, Type A Water Licence (2AM-MEL1631), other authorizations, and the requirements pertaining to the relevant laws and regulations. Agnico Eagle has also developed standard operating procedures that reflect legal requirements pertaining to the Project.

A cyclical feedback loop will be employed where operations are planned and implemented, monitoring data collected and analyzed, and practices adjusted to promptly reduce or eliminate any observed negative impacts throughout the life of the Project. Continual use of this feedback loop will allow adaptive management decisions to be made on an ongoing basis, and shall lead to improvements to the environmental and socio-economic management system as necessary over time.

The EMPP will offer flexibility to respond to changes, for example, in the mining development plan, the regulatory regime, the biophysical and socio-economic environments, technology, research results, and the understanding of Inuit Qaugimajatuqangit (IQ). Threshold and indicators to trigger management actions will be provided, where applicable, in the plans embedded in the EMPP, along with a system of accountability.

Monitoring and adaptive management are essential tools for ensuring that a project is implemented as planned, that mitigation measures are successful, that the procedures and practices are effective, that potential adverse impacts are avoided or minimized, and that enhancement measures are effective. Each individual management plan will assess the effectiveness mitigation measures and associated follow-up mechanisms for adaptive management. These plans will outline how results from monitoring will be used to refine or modify the design and implementation of mitigation measures and management plans, and how monitoring results might wind up in work reorientation and potential improvements in the implementation of the various components of the Project.

The design of monitoring and management plans, data analysis, reporting, and integration of results into operational procedures will be carried out by Agnico Eagle. Consultation on the same may lead to changes to meet the needs and concerns of other organizations. Agnico Eagle has incorporated design elements like:

- objectives, applicable laws, and regulations;
- the Valued Ecosystem Components (VECs) and Valued Socio-economic Components (VSECs) to be monitored;

- IQ findings;
- frequency, duration, and geographic extent of monitoring;
- proposed action plans and reporting procedures; and
- quality assurance and quality control programs, etc.

When applicable, monitoring programs will be designed so that the results can be coordinated with ongoing regional initiatives or programs with the relevant government organisations or regional authorities.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	November 2012			First draft of the Environmental Management and Protection Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013	1.2 3.2 4.5	2-4 11-13 20-21	Add Project phases to Table 1-1 and details on adaptive management Add details on adaptive management in design of plans Independent audits and reviews	John Witteman, Env. Consultant, Agnico Eagle
3	April 2014	1.2 1.3 1.3 2.1 4	5 5 7 8 16 and 18	Monitoring and mitigation plans vs licensing process Revision throughout life-of-mine Added Table 1-3 Updated Sustainable Development Policy Added design, practices and procedures; link with VECs and VSECs	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015	 4.2.2 4.2.3	 24 25	Update of entire document for Water Licence Application New section on Traditional Knowledge (IQ) New section on Inspections	John Witteman, Env. Consultant, Agnico Eagle
5	June 2016	Executive Summary 1 4.2.1 4.2.3 4.4		Revised Section to reflect receipt of Water Licence Revised Introduction Revised Environmental Monitoring to meet Water Licence Revised Inspections Revised Table 4-4 to meet Water Licence	Golder Associates, Ltd.
6	March 2017	Table 4-1 Figure 4-2		Revised Table as per approved new sampling location nomenclature	Manon Turmel, Agnico Eagle Mines Ltd.

7	February 2018	All	Revised to reflect current conditions at Site and reduce repetition	Alex Gauthier and Jennifer Brown, Agnico Eagle Mines Ltd.

ACRONYMS

INAC	Indigenous and Northern Affairs Canada
AEMP	Aquatic Effects Monitoring Program
Agnico Eagle	Agnico Eagle Mines Limited
DFO	Fisheries and Oceans Canada
DOE	Department of Environment
EA	Environmental Assessment
EC	Environment Canada
EMPP	Environmental Management and Protection Plan
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
HTO	Hunting Trapping Organization
IP	Inspection Plan
IQ	Inuit Qaugimajatuqangit
KIA	Kivalliq Inuit Association
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission
NWB	Nunavut Water Board
PDCA	Plan, Do, Check, Adjust
QA/QC	Quality Assurance and Quality Control
RMMS	Responsible Mining Management System
TC	Transport Canada
VEC	Valued Ecosystem Component
VSEC	Valued Socio-Economic Component

SECTION 1 • INTRODUCTION

1.1 Purpose and Scope

The Environmental Management and Protection Plan (EMPP) provides Agnico Eagle with direction to environmental and socio-economic management for the Project throughout the life of mine. It is a site-specific plan that describes the systematic means by which Agnico Eagle will consistently manage and control potentially adverse impacts, and enhance potential project benefits identified through the Environmental Assessment (EA) process and the subsequent licensing and permitting of the Project.

Activities under the EMPP seek to consistently comply with laws, regulations, and authorizations, and enable the achievement of goals set out in Agnico Eagle's Sustainable Development Policy. This plan applies to pre-development, construction, operations, and closure phases for the Project.

The EMPP defines the sequence of policy, planning, implementation, monitoring, and review processes that will ensure that the Project complies with commitments made throughout the EA process, regulated standards and Agnico Eagle's environmental standards, and implements adaptive management activities for ongoing improvement.

The EMPP encompasses a suite of project specific mitigations and monitoring and/or management plans that set out the Project's standards and requirements for different areas of environmental and socio-economic management. Many of the plans are required by law or by conditions attached to the Project Certificate, Type A Water Licence 2AM-MEL1631 (Type A Water Licence) issued to the Project. The plans and measures are specific to various aspects, components, activities and/or the construction, operation, and closure of the Project.

Figure 1-1 General Site Plan

1.2 Environmental Management Documentation

The structure of the Project's environmental management documentation is shown in Table 1-1. Socio-economic plans are included for completeness. They can have a bearing on the EMPP. For complete details, please consult the individual plans.

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System						
			Project Phase			
Plan		Purpose	Construction	Operation	Closure	Post-Closure
6513-MPS-01	Incineration Management Plan	To outline the operation of an incinerator located at the site.	√	√	√	
6513-MPS-03	Roads Management Plan	To manage access, service, and haul roads proposed in the Project areas, covering construction, operations, and final closure (the Plan also covers temporary closure).	√	√	√	
6513-MPS-04	Borrow Pits and Quarries Management Plan	To outline environmental aspects of developing, using, and closing the borrow pits and quarries necessary for the overall Project. May be used throughout the Project's life as necessary (when quarries and borrow pits will be required).	√	√	√	
6513-MPS-05	Spill Contingency Plan	To facilitate the efficient cleanup in case of spill incidents related to the Project, and to promote environmental awareness and safety when dealing with spills.	√	√	√	√
6513-MPS-06	Landfill and Waste Management Plan	To describe how non-combustible, non-hazardous, solid industrial wastes will be managed using a landfill, and how remaining non-hazardous waste will be managed.	√	√	√	
6513-MPS-07	Environmental Management and Protection Plan	To provide overarching direction for environmental and socio-economic management for the Project. It is supported by the following suite of Project-specific mitigation, monitoring, and/or management plans.	√	√	√	√
6513-MPS-08	Ore Storage Management Plan	To address the management of ore mined at the Project.		√		
6513-MPS-09	Mine Waste Management Plan [a]	To address the management of all waste rock and overburden generated through all phases of the Project, and all tailings generated during the operational phase of the Project.	√	√	√	√
6513-MPS-10	Mine Plan	Provide a summary of consolidated information on the design, operation, production and environment management of the mining and milling facilities.	√	√	√	
6513-MPS-11	Water Management [a] Plan	To provide a consolidated source of information on the strategies to be applied to intercept, collect,	√	√	√	√

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System						
			Project Phase			
	Plan	Purpose	Construction	Operation	Closure	Post-Closure
		contain, conserve, and monitor water in the Project's area, thus preventing potential adverse impacts on water.				
6513-MPS-12	Hazardous Materials Management Plan	To describe how solid and liquid hazardous materials, including hazardous waste, will be managed. Includes Fuel Management Plan.	√	√	√	
6513-MPS-14	Explosive Management Plan	To provide information on explosives transport, storage, manufacture, and handling at the Project.	√	√		
6513-MPS-15	Landfarm Management Plan	To outline the storage and remediation of petroleum hydrocarbon contaminated soil, snow, and ice that may be generated at the Project.	√	√	√	
6513-RMM-01	Risk Management and Emergency Response Plan	An assessment of the potential risks from natural hazards, in both aquatic and terrestrial environments, plus a response plan to emergencies. Includes risk assessment and management if incidents and mechanical and procedural malfunctions emergency response plan.	√	√	√	√
6513-CRP-01	Preliminary Closure and Reclamation Plan	To develop a conceptual plan which outlines how the various mine components will be decommissioned, reclaimed and/or closed following temporary closure or final mine closure. Includes care and maintenance.			√	√
6513-QQY-01	Quality Assurance/Quality Control	Provides consolidated information on the quality assurance and quality control measures for the Project.	√	√	√	
6513-REP-03	Aquatic Effects Monitoring Program (AEMP) Design Plan [a]	To provide information on monitoring the aquatic environment and on mitigation measures to protect and minimize potential impacts on the aquatic environment.	√	√	√	√
	Conceptual Fisheries Protection and Offsetting Plan [b]	To discuss measures to be implemented to offset the loss of fish habitat resulting from Project activities and components.	√	√	√	√
	Air Quality Monitoring Plan	To present air quality monitoring and management, and emissions and dust reduction/control strategies.	√	√	√	
	Noise Monitoring Plan [b]	To provide information on monitoring and mitigation of noise.	√	√	√	
	Terrestrial Environment Management and Monitoring Plan (TEMMP) [b]	To include appropriate mitigation and monitoring for selected terrestrial species.	√	√	√	√

Table 1-1 Environmental and Socio-Economic Monitoring, Mitigation, and Management Plans

Environmental Management System						
			Project Phase			
	Plan	Purpose	Construction	Operation	Closure	Post-Closure
	Shipping Management Plan	To present all Project-related shipping of dry cargo and fuel to Rankin Inlet.	√	√	√	
	Oil Pollution Prevention Plan [b]	To present the requirements for emergency procedures, equipment, and resources specific to the Rankin Inlet Oil Handling Facility (tank farm), as well as preventive measures.	√	√	√	
	Socio-Economic Management Plans					
	Cultural and Heritage Resources Protection Plan [b]	To discuss how heritage values will be protected and the management of potential impacts to identified cultural and heritage resources.	√	√		
	Socio-economic Management Plan [b]	To present the approach to socio-economic management and monitoring through the Project development to verify proper mitigation and benefit enhancement measures.	√	√	√	
	Business Development Plan[(a)]	To present strategies for preferential hiring/contracting and for building capacity for local businesses and entrepreneurs.	√	√	√	
	Human Resources Plan [b]	To present recruitment strategies and steps to reduce labour force entry barriers and improve employee retention. This includes information regarding employment/training opportunities, hiring plans, and time schedules.	√	√	√	
	Community Involvement Plan [b]	To provide a clear definition of public and community, and their possible involvement in the Project.	√	√	√	
	Occupational Health and Safety Plan [b]	To present an overview of the occupational health and safety program for the activities and works being proposed.	√	√	√	√

[a] To be updated for submission to the Board for review, within sixty (60) days of issuance of the Water Licence.
[b] Submitted with the Final Environmental Impact Statement, Agnico Eagle (2014a).

The EMPP is not a static document; it will be updated periodically as site and external conditions change and as knowledge is gained. Requirements to refine the EMPP may result from changes in operations, technologies employed, the phase of the Project, the result of research findings commissioned by Agnico Eagle, improvements in safety procedures, and/or greater understanding of traditional knowledge (IQ). Changes to laws and regulations, environmental, and socio-economic conditions, and other external factors can also have a bearing on the EMPP.

SECTION 2 • BACKGROUND

2.1 Sustainable Development Policy

The sustainability policy commits to protecting the environment and forms the basis of the EMPP and defines the framework within which Agnico Eagle and guides actions. The commitments are as follows:

PROTECT THE ENVIRONMENT

We aim to minimize the effects of our operations on the environment and maintain its viability and its diversity. To achieve this we:

- *Minimize the generation of waste and ensure its proper disposal;*
- *Manage tailings, waste rock and overburden to ensure environmental protection;*
- *Implement measures to conserve natural resources such as energy and water;*
- *Implement measures to reduce emissions to air, water and land, and to minimize our footprint;*
- *Implement measures to reduce our greenhouse gas emissions and address climate change;*
- *Integrate biodiversity conservation and land use planning considerations through all stages of business and production activities;*
- *Rehabilitate sites to ensure physical and chemical stability and in consultation with the communities in a timely manner.*

2.2 Regulatory Setting

Appendix A provides a listing of the various territorial and federal laws, regulation, and guidelines applicable to the Project.

The main authorizing agencies participating in the review of the Project's Type A Water Licence are the following:

- Nunavut Impact Review Board (NIRB);
- Indigenous and Northern Affairs Canada (INAC);
- Nunavut Planning Commission (NPC);
- Nunavut Water Board (NWB);
- Kivalliq Inuit Association (KIA);
- Fisheries and Oceans Canada (DFO);
- Environment Canada (EC);
- Hunting Trapping Organization (HTO)
- Transport Canada (TC);
- Nunavut Research Institute;

- Department of Environment (DOE), Government of Nunavut (GN);
- Department of Culture and Heritage, (CH)[1], GN;
- Community and Government Services (CGS), GN; and
- Hamlet of Rankin Inlet.

2.3 Environmental Management and Protection Plan Effectiveness

The effectiveness of the EMPP will be ensured by:

- applying best management practices and using best available information throughout the life of the Project;
- employing adaptive management to address any concerns that may be raised through monitoring;
- seeking continual improvements in environmental and socio-economic management;
- implementing commitments made as part of the Final Environmental Impact Statement (FEIS) (Agnico Eagle 2014a) and Type A Licence;
- consulting with Kivalliq communities and Inuit organizations to obtain their concerns and guidance for environmental and socio-economic management;
- seeking contribution of Inuit Qaujimajatuqangit (IQ) to management decisions;
- complying with laws, regulations, and authorizations, including conditions set out in the Project Certificate and Type A Water Licence;
- managing environmental and socio-economic risks associated with the Project through the use of the Precautionary Principle[2] to prevent risks of serious or irreversible harm to the environment;
- assigning roles and responsibilities in making decisions and responding to environmental and socio-economic impacts; and
- reducing or eliminating potentially adverse impacts while maximizing beneficial effects.

2.4 Flexibility in the Environmental Management and Protection Plan

Adaptive management can improve long run management outcomes. This is possible as the EMPP and decision-making are open to change. Decision-making will simultaneously meet management objectives and accrue information needed to improve future environmental management (Holling 1978). With this in mind, flexibility becomes a necessity as knowledge is gained from operations, IQ, monitoring, and research, and as changes are implemented to the benefit of environmental and social aspects, components, and activities throughout all phases of the Project. Flexibility allows for adjustments to operating procedures and refinement of mitigation measures based on what has been learned through experience, monitoring, and research.

[1] Formerly Department of Culture, Language, Elders and Youth (CLEY)

[2] The *Canadian Environmental Protection Act* (1999) defines the Precautionary Principle as follows: "*…where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*

SECTION 3 • ENVIRONMENTAL MANAGEMENT SYSTEM

3.1 Responsibilities and Resource Allocation

The Responsible Mining Management System (RMMS) is expected to provide information related to two key questions:

1. *Does the RMMS effectively conserve and protect the environment in which the mine operates and allow traditional pursuits to continue unimpeded?*

2. *Does the RMMS achieve the goals found in Agnico Eagle's Sustainable Development Policy?*

The RMMS is designed to provide adequate protection to the environment while leaving the flexibility for continual improvement over time. Asking the above questions verifies that the assignment of environmental management responsibilities is planned before any activities ensue. Asking the questions also confirms that resource allocation to environmental management, monitoring, and mitigation is adequate. By proactively undertaking the task of keeping the EMPP current, continual improvement in environmental performance will be encouraged.

The use of adaptive environmental management allows scenarios to be tested and mitigation measures to be planned and developed beforehand. This allows for a rapid response to adverse effects and reduces the length of time land and water potential impacts could persist. However, in the event inadequacies are detected in the RMMS, the flexibility afforded by adaptive management allows these to be addressed quickly and in a comprehensive manner.

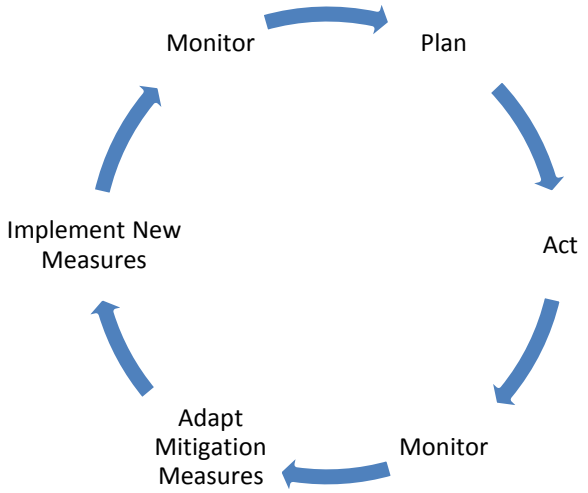
Responsibility for decision-making and providing the resources for the implementation, maintenance, and improvements to the EMPP rests with mine management with input from Agnico Eagle's corporate office. Management responses to potential adverse effects will be based on the analysis of monitoring results and an understanding of the cause and effect, the severity and duration of the adverse effect, and the impact on traditional pursuits. Decisions made using an adaptive management process will improve the EMPP's effectiveness in addressing environmental effects while maintaining the economic viability of the mine. The Environment Superintendent, as a member of the mine management team, will have input to collective decisions.

The response initiated and resources devoted to it would be commensurate with the gravity and duration of the observed effect. The goal is to remove the cause of the adverse effect or reduce the observed effect to an acceptable level. This could include administrative actions, such as adjustments to standard operating procedures, especially if negative effects linger.

3.2 Design of Mitigation and Monitoring Plans

Environmental mitigation and monitoring plans outline specific procedures and actions considered essential in accomplishing defined tasks required by the Project. These plans (e.g., Water Management Plan [Agnico Eagle 2017], Terrestrial Environment Management and Monitoring Plan

[Agnico Eagle 2017], Borrow Pits and Quarries Management Plan [Agnico Eagle 2018], etc.) include various responses (mitigation measures and strategies) designed to be corresponding to the potential adverse effects. The Plans also include monitoring provisions and programs designed with the objective of assessing effectiveness of the planned mitigation measures after such measures have been implemented. These Plans will also assist Agnico Eagle in modifying/reorienting its work activities and in making improvements to its mitigation measures during all phases of the Project. In other words, assist Agnico Eagle to adaptively manage its activities, mitigation measures, and monitoring programs to ensure that its mitigation measures are effective in managing the socio-economic and environmental outcomes. In essence, adaptive management is a cycle that is applicable to all activities under the RMMS.



In this way Agnico Eagle can continue to monitor the effectiveness of its mitigation measures, both against Certificate/Licence/Authorization/Statutory conditions/requirements and against the outcomes predicted through the FEIS process and permitting, and then to adaptively adjust its mitigation measures until the effectiveness of such mitigation measures meet the expected or required outcomes. Agnico Eagle has incorporated initial trigger or threshold levels/points that, when reached or exceeded, would cause Agnico Eagle to initiate further mitigation measures or adaptively adjust its activity/mitigation measure to reverse or arrest unwanted outcomes. These initial threshold points will be the subject of continued assessment and would be reviewed and, where appropriate, revised in subsequent updates to the Monitoring Plans, as appropriate.

In the instance of economic hardship (be it internal project economic hardship or external economic hardship [recession or collapse in the price of gold]), Agnico Eagle will adjust its operational plans to the prevailing economic condition but it will not sacrifice its commitment to operate in accordance with its statutory requirements/obligations nor compromise its internal mandate to operate in a safe, responsible and sustainable manner. It is understood that Agnico Eagle will need to consult the NIRB to determine whether any potential change to the Project would result in a change to the

scope of the Project and potentially require an environmental review. In all such cases, Agnico Eagle will continue to meet its statutory obligations and to meet its internal mandate to operate in a safe, responsible, and sustainable manner.

In the event of a transfer of ownership, Agnico Eagle expects that, as a precedent condition to such a sale or transfer, the new owner would be obligated to continue to meet all of the same obligations under the NIRB Project Certificate/Water Licence/or other authorizations, and to continue to operate in a safe, responsible, sustainable manner under the Project's RMMS/EMPP. Agnico Eagle points out that NIRB, NWB, and other regulatory agencies have the power to require/approve or not allow/approve the transfer of these statutory obligations (Project Certificate/Water Licence, etc.) to any new owner, and that past experience is that such transfer will only occur once the regulatory bodies are confident that the new owner fully understands its responsibility to continue to meet these obligations.

In developing its monitoring and management plans for the Project, Agnico Eagle has included the following elements, where applicable:

- objectives of the monitoring program, applicable laws, and regulations;
- discussion of actions to be taken in case of non-compliance with the law or regulations;
- the Valued Ecosystem Component (VEC) and Valued Socio-Economic Component (VSEC) to be monitored, and applicable criteria/thresholds and regulations, including, if relevant, the obligations imposed on contractors by the environmental provisions of their contracts;
- description of how the efficiency of mitigation measures will be evaluated;
- description of the frequency, duration, and geographic extent of monitoring with justification for each, and identification of personnel who will conduct the collection, analyse and interpretation of data;
- proposed actions in the event that observed results or impacts differ from those predicted;
- proposed reporting scheme for monitoring results, including format, reporting intervals, and responsible territorial and federal authorities;
- identification of organizations to which to communicate results of monitoring efforts: Inuit organizations, institutes of public government, territorial, and federal authorities, etc.;
- plans for integration of monitoring results with other aspects of the Project, including adjustments of procedures and refinement of mitigation measures;
- procedures/mechanisms to assess the effectiveness of monitoring and adaptive management programs; and
- quality assurance and quality control (QA/QC) measures to be applied to monitoring and management programs.

The initial design of monitoring and management plans, data analysis, reporting, and integration of results into operational procedures will be carried out by Agnico Eagle. Consultation on the same may lead to changes to meet the needs and concerns of other organizations.

Monitoring will use a hierarchical sequence of responses when agreed upon threshold or criteria levels and/or compliance limits are exceeded, thereby triggering corrective actions by the appropriate manager. Common triggers are when the mine falls out of compliance with authorizations or when criteria are exceeded. Triggers can lead to increased and focussed monitoring efforts to better understand cause and effect, and to reduce uncertainties, especially if an effect is greater than originally predicted. This will lead to mitigation measures based on the best available information.

Mitigation measures and corrective and preventative actions will be implemented by mine operations and/or contractors with support from the Meliadine Environment Department. This could include the evaluation of mitigation measures in place and updates to operational procedures. Communication will be maintained with Inuit organizations, authorizing agencies, and the general public in describing any adverse effect observed and what corrective action is being used to mitigate it.

3.3 Mitigation of Adverse Environmental Effects

Mitigation is a means of eliminating, reducing, or controlling a potential adverse environmental effect at the Project, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation, or other means (JRP 2010). The ranking of mitigation options is as follows:

- **Avoidance** – using an alternate site or technology to avoid the adverse effect all together. This is the most desirable.
- **Minimization** – taking actions to minimize and/or contain effects to the maximum extent possible during engineering design, construction, operation and closure.
- **Rectification** – taking actions to rehabilitate or restore the affected environment after the fact.
- **Compensation** – this is used as a last resort to offset adverse environmental effects. This is the least desirable.

Agnico Eagle plans to use adaptive management measures to deal with unanticipated adverse environmental effects.

Environmental effects monitoring programs will monitor the effectiveness of mitigation measures. These programs will include a reporting and response system, through adaptive management strategies (see Section 4).

SECTION 4 • FOLLOW-UP AND ADAPTIVE MANAGEMENT PLAN

Each of the management plans developed for the Project include an intrinsic process of continuous improvement that is aimed at evaluating the effectiveness of the design features, mitigation measures, operating practices, and procedures put in place.

Making good use of adaptive management requires the recognition that it is a structured, iterative approach to environmental management decision making (CPR 2011). Many VECs and VSECs applicable to the Project are part of dynamic natural and socio-economic systems where uncertainty can be a significant factor. The goal is to reduce uncertainty over time by incorporating learnings from design, monitoring, mitigation, and changes in operations into environmental management at the proposed mine site. Where applicable, an adaptive management strategy or approach will be used for those VECs and VSECs that will be monitored by Agnico Eagle. The adaptive management process is schematized in Figure 4-1.

Trends will be compiled, followed, and compared to the pre-established goals/thresholds. Any action plan and corrective actions to be taken will also be documented through the RMMS.

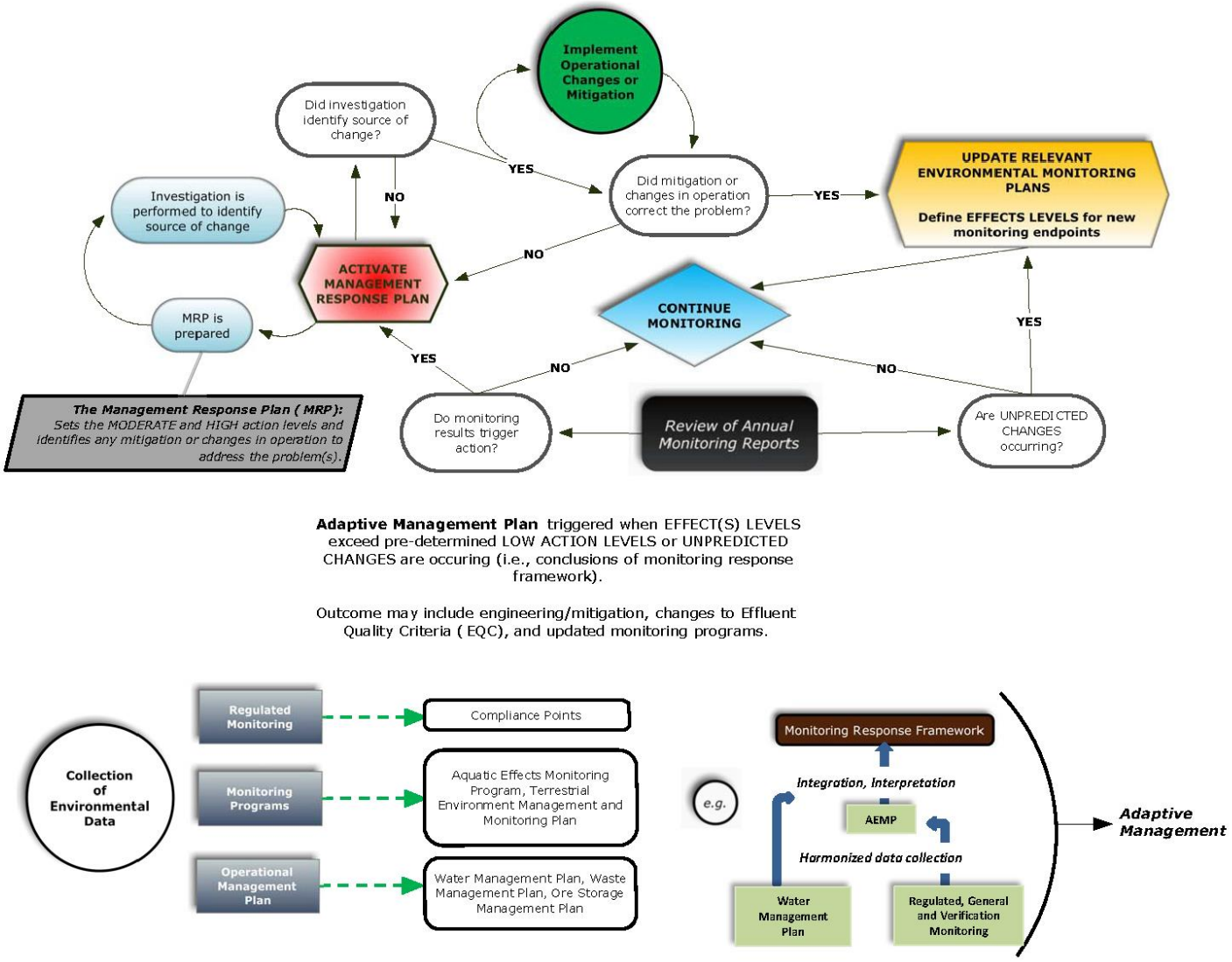


Figure 4-1 Adaptive Management Process

4.1 Adaptive Management and Precautionary Principle

It is through monitoring that any unanticipated adverse environmental impacts can be discovered. Adaptive management is particularly useful in implementing the appropriate remedial measures in these instances. Additionally, the objectives of monitoring and adaptive management are to verify that:

- commitments are fulfilled;
- regulatory and other requirements are met;
- adverse effects are avoided or minimized; and
- benefits are enhanced.

The precautionary principle, in conjunction with adaptive management, will be used in decision-making. In the face of uncertainty, conservative approaches will be used with an aim to reducing uncertainty over time via monitoring and mitigation.

Inspection precedes maintenance. Inspections, combined with monitoring, will signal when adaptive management must be used to mitigate possible negative effects (see Section 4.2.3 Inspections).

4.2 Performance Measurement and Monitoring

To effectively communicate performance, it is important to select the appropriate indicators. As part of the Mining Association of Canada, Agnico Eagle reports its global performance through its annual Corporate Social Responsibility report. This report includes, notably, the indicators of the Global Reporting Initiative and Towards Sustainable Mining Initiative. Those will be incorporated into the Meliadine RMMS. Main indicators to follow will be selected by taking into account:

- the compliance with relevant regulatory requirements and permitting targets;
- activities trends; and
- the progress towards achieving targets.

Regulatory requirements and targets are identified in each of the management plans, as appropriate, or Water Licence. Corrective actions will be triggered when those thresholds are reached. The RMMS will link the thresholds to appropriate corrective actions and establish accountability.

The performance of the management plans will be monitored periodically and the results communicated. Independent researchers or consultants may be engaged to review performance where necessary. The accuracy of the environmental impact predictions and the effectiveness of the mitigation measures will be verified through that process. If unusual or unforeseen adverse environmental impacts are noticed, corrective action will be put in place. Through the adaptive management process, the existing mitigation measures will be adjusted or new mitigation measures implemented if necessary. External reporting will be completed, as required.

A follow-up program will verify the effectiveness of any mitigation measures taken in response to expected and unexpected adverse environmental effects. An environmental effects monitoring program, will monitor the effectiveness of all mitigation measures. This program will include a reporting and response system.

4.2.1 Environmental Monitoring

Environmental monitoring, for the purposes of the EMPP, consists of the following:

- Regulated discharge monitoring occurs at monitoring points specified in the Type A Water Licence, other licences, or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (i.e., water licence) or regulation (i.e., Metal Mining Effluent Regulations). Enforcement action may be taken if discharge limits are exceeded for a parameter.
- Verification monitoring is carried out for operational and management purposes by Agnico Eagle. This type of monitoring provides data for decision making and builds confidence in the success of processes being used. There is no obligation to report verification monitoring results, although some monitoring locations and these results can be mentioned in environmental management plans (i.e., sampling to verify soil remediation in the landfarm).
- General monitoring is commonly included in a water licence specifying what is to be monitored according to a schedule[3]. It covers all types of monitoring (i.e., geotechnical, lake levels, etc.). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included quality assurance/quality control provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring will be used at the Project. A summary of Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure is included in the Aquatic Effects Monitoring Program Design Plan (AEMP) (Golder 2016) and the list of parameters for sample analysis is included in the Type A Water Licence.

[3] Referred to in NWT and old NWB licenses as the Surveillance Network Program.

4.2.2 Use of Inuit Qaugimajatuqangit in Environmental Management and Monitoring

IQ consists of Inuit values, preferences and what they consider significant; it is about the relationships between humans, animals, and the environment. It is location specific and reflects the particular conditions in specific geographic locations. IQ, although normally undocumented, is shared information within the community, and maintains the means and knowledge of living off the land, continues traditional land use activities, and promotes a cultural life style, all of which sustained Inuit for generations.

IQ is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. As such, IQ represents a valid and essential source of information in the design and implementation of environmental management and monitoring programs. Improvements have been incorporated based stakeholder review, and through the inclusion of traditional knowledge from communities and Inuit organizations throughout the Kivalliq region. Agnico Eagle expects to continue active engagement with communities and Inuit organizations, which should lead to further inclusion of traditional knowledge in periodic updates to the design and implementation of environmental programs. Agnico Eagle has and will continue to engage with the KIA to advance the use of IQ. This will ensure that the combination of science and IQ leads to environmental management and monitoring that meets the expectations of government, communities, and Inuit organizations.

4.2.3 Inspections

Agnico Eagle has sole responsibility for inspection and maintenance of all mine components, and the inspection and monitoring of mine activities. A regular inspection program will lead to the early identification of areas where improvements are needed. The early resolution of any deficiencies will result in less ongoing maintenance and repair of mine components, and a reduction in the risk of adverse environmental effects.

Inspections will ensure that Project mine components are constructed, operated, maintained, managed, and closed in an environmentally sound, safe, and efficient manner. Further, inspections will assist in obtaining better environmental outcomes for all activities and more timely maintenance of mine components throughout the mine life.

Mine personnel having knowledge and experience with the mine components and activities will carry out the inspections. Training will be provided by Agnico Eagle to effectively and efficiently complete inspections. Inspections will result in month-end summary reports that will be distributed to mine management. This will allow action to be taken to address any deficiencies in components or activities. Inspection reports will be retained on site by the respective inspecting departments.

4.2.3.1 Scope of the Inspection Plan

The Inspection Plan (IP) is relevant to all phases of the mine life, including pre-development, construction, operation, closure, and any periods of care and maintenance. The geographical area

the IP encompasses is the entire proposed mine site, Agnico Eagle's mine components at Itivia in Rankin Inlet, and all Agnico Eagle mine components in between. This includes, but is not limited to, such mine components such as, open pits, quarries, borrow pits, roads, storage pads, waste rock storage facilities, diversion channels, dikes, sumps, berms, tailings storage facility, landfill, incinerator, landfarm, explosives plant, and pipelines. It includes such activities as the pumping of water and waste, discharge of waste to the receiving environment, spill clean-up, and fuel transport on Agnico Eagle's roads.

4.2.3.2 Inspection Priority and Risk Analysis

Inspection priorities are based on analyzing all mine components / activities and their respective risks. Installations and activities are qualitatively[4] ranked as "high risk", "medium risk" and "low risk" with those posing a "high risk" receiving more frequent inspections[5]. If needed, the inspection schedule will be adjusted to accommodate an increased inspection frequency of mine components and/or activities requiring more attention.

The criteria used in determining risk arising from the use of water or discharging waste to water include the following:

- potential effect on the environment (e.g., due to the location of mine components and sensitivity of the nearby receiving environment);
- potential effect on public health (e.g., potable water treatment or sewage treatment);
- safety risks (e.g., the integrity of roads throughout freshet or following a major rain event);
- potential social impacts (e.g., dust from Agnico Eagle's roads); and,
- potential financial or economic impact resulting from an accident, malfunction, or spill (e.g., tanker truck leaving the all–weather access road, spilling fuel, and requiring significant resources for the cleanup).

4.2.3.3 Routine and Non-routine Inspections

Routine inspections are planned and scheduled on a reoccurring basis and cover the following:

- inspections required under authorizations;
- inspections of mine components where the management of water and waste takes place; and,
- activities that could affect water and waste management.

Non-routine, event, or unplanned inspections cover the following:

[4] If there is a disagreement on the level of risk based on a qualitative determination, a quantitative determination will be undertaken using accepted methods found in the literature (IMPEL 2012).

[5] Agnico Eagle has the capacity to carry out inspection plans. All activities and mine components identified in this inspection plan affecting the use of water or the discharge of waste to water will be inspected, irrespective of the level of risk.

- environmental complaints or concerns raised by the public;
- accidents, malfunctions and spills;
- after major rain events;
- instances when the quality or quantity of water on the mine site is not meeting expectations; and
- instances where discharge criteria to the receiving environment approach, but do not exceed, Water Licence limits or the Metal Mining Effluent Regulations.

Inspections will have a strong seasonal component with some inspections suspended over the winter and others reduced. Agnico Eagle foresees a high frequency of inspections of engineered structures occurring just before and during freshet, followed by less frequent inspections over the remainder of the open water season. For example, inspections of culverts, bridges, ditches, and sumps will be suspended over the winter, and would resume before freshet and continue over the summer until freeze-up. Further, within the open water season, the greatest risk is at freshet, which would necessitate a higher frequency of inspections at that time to ensure mitigation measures employed to manage the higher spring flows prove effective, and that the integrity of bridges and culverts are not compromised.

Year-round inspections at a set frequency will occur for mine components such as the potable water treatment plant, the sewage treatment plant and the landfill. These are not directly influenced by the changing weather experienced at the mine site over the year.

Table 4-1 below provides a summary of proposed inspections of mine components and mine activities; this includes some unrelated to the use or water or the discharge of waste to water. Specific details are included in the respective management plans and/or procedures and indicate inspection methods or procedures, and frequency. It also tentatively identifies the department responsible for the inspection. Ultimately the environmental department at Agnico Eagle will be responsible for ensuring that all monitoring and inspections are completed.

Table 4-1 Summary of Proposed Inspections

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Dikes	Visual inspection for erosion of or seepage through or under the dikes, including movement of crests and slopes. The environment department would collect samples of any seepage.	High. Failure of a dike could have significant adverse effects on the downstream environment	Engineering	Weekly prior to freshet when the dikes are clear of snow, and weekly over the open water season. Monthly during the winter to check for seepage
Open Pits	Visual inspection for seepage and collection of samples, if it safe to do so	Low. Water seeping into open pits will be controlled and directed to CP1	Open Pits Mining Superintendent	Weekly at freshet and monthly thereafter over the open water season
Waste Rock Storage Facilities	Visual Inspection for seepage and collection of samples, if it safe to do so. Thermistor Installation	Low. Ditches will intercept any seepage from the waste rock and direct the water to CP1. Thermistors monitor the rate of freeze back and permafrost development progress	Open Pits Mining Superintendent	Visual inspection, monthly over the open water season and thermistors monitored four times per year.
Ore Stockpiles	Visual Inspection for seepage and collection of samples, if it safe to do so.	Low. Ditches will intercept any seepage from the ore stockpiles and direct the water to CP1.	Engineering	Visual inspection, monthly over the open water season
Tailings Storage Facility	Thermistor Installation	Low. Thermistor cables will be installed in the TSF to monitor the permafrost development progress within the facility during the operations stage	Engineering	Four times per year
Berms	Visual inspection for erosion of or seepage through or under the berms, including movement of crests and slopes.	High. Failure of berms upstream from pits could pose a safety hazard.	Engineering	Weekly inspection just before, during and just after freshet; Monthly after freshet is over in the open water season
Culverts	Visual inspection for snow and/or debris blockage of culverts.	Medium. Snow can be removed from the front and back of the culverts before freshet	Road Superintendent	Just prior to freshet and daily during the first days of freshet; also following major rain events. Weekly during period of flow. Monthly after freshet is over in the open water season

Table 4-1 Summary of Proposed Inspections (continued)

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Roads	Visual inspection for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment	Low. Affected area will be repaired using granular material and/or crushed rock.	Road Superintendent	Weekly over the summer (approximately mid-May , from the start of the freshet period to October, prior to the fall freeze-up)
Water ponding against roads	Visual inspection of roads after freshet and major rain events.	Low. Ponding can be dealt with by pumping the water or by installing a culvert in the road where water is ponding.	Road Superintendent	Weekly over the open water season and following freshet and major rain events
Bridges	Visual inspection for snow dams prior to freshet	High. Snow dams could lead to the bridge being overwhelmed at freshet with resultant damage. Snow dams may also result in flooding upstream from the bridge, potentially impacting existing heritage resources.	Road Superintendent	Prior to freshet to allow time for any snow dams to be removed and weekly during freshet to confirm that snow dams were breeched.
Snow removal from roads	Visual inspections to ensure skidoo trails are not being blocked by snow removed from the roads	Low. Pushing snow onto skidoos trails that cross Agnico Eagle's roads will make it difficult for trail users to cross the roads.	Road Superintendent	Following each major winter storm and clearing of snow off the roads.
Road dust	Visual inspection of the road for excessive dust generation and deposition.	High. Dust can impact on the environment along the roads, and be a safety risk due to limited visibility.	Road Superintendent	Weekly when roads are very dry and/or when road traffic is heavy. Inspections will be suspended during rainy days and over the winter.
Caribou near or on roads	Visual inspection of hunting activities along the road when large numbers of caribou are near-by.	High. Hunters should observe the 1 km no shooting zone along the road	Environment	Weekly, year round, and more frequently when during caribou migration periods.

Table 4-1 Summary of Proposed Inspections (continued)

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Watercourses and watercourse crossings	Visual inspection of infrastructure to identify defects, cracks or any other risks to structural integrity, sediment or other debris accumulation, or bed erosion or scour	Low. Infrastructure will be repaired after deficiencies are noted, when it is safe to do so.	Road Superintendent	Weekly during the open water, during the freshet period, and unscheduled inspections following a major rain event.
Sumps	Visual inspection of sumps and the measurement of freeboard.	Medium. Sumps need to be pumped down prior to freeze-up to accommodate the coming year's freshet.	Engineering	One inspection before freeze-up to ensure the water level in the sumps is low to allow for inflow during freshet. Weekly during freshet, immediately after a major rain event and weekly otherwise over the open water season. Monthly after freshet is over in the open water season
Collection Ponds	Visual inspection and measurement of freeboard in contact ponds	Medium. The storage capacity of the pond needs to be increased before freeze-up to accommodate next year's freshet.	Engineering	One inspection before freeze-up to ensure the water level in the sumps is low to allow for inflow during freshet. Weekly during freshet, immediately after a major rain event and weekly otherwise over the open water season; Monthly after freshet is over in the open water season
Diversion Channels	Visual inspection of the channel for permafrost degradation and excess snow and ice accumulation leading to potential blockages.	Medium. Permafrost degradation may result in bank slumping and channel instability. Diversion channels need to be clear of snow prior to freshet to allow for water flow.	Engineering	(1) Prior to and at freshet; (2) Immediately after a major rain event; and (3) Weekly for the remainder of the ice-free season
Potable Water Treatment Plant	Visual inspection for cleanliness and that the plant is operating as required. Water samples for testing will be collected.	High. Plant provides potable water to the camp and its proper operation is necessary for human health.	Site Services	Ongoing as prescribed by the Dep't of Health or Public Health Authorities. Daily inspections are expected

Table 4-1 Summary of Proposed Inspections (continued)

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Sewage Treatment Plant	Visual inspection for cleanliness and collection of samples for testing	Medium. The sewage treatment plant discharges to CP1, which has a dike to control flow to Meliadine Lake. The water in CP1 is reclaimed for use in processing ore, or receives additional treatment if necessary before release to Meliadine Lake.	Site Services	Weekly
Tank farms at the mine site and at Itivia	Visual inspection of water level within the secondary containment structure, and evidence of any spills or leaks. A geotechnical consultant performs a geotechnical inspection annually (between the months of July and September) of the bulk fuel secondary containment structures.	Low. Due to snow accumulation, melting and precipitation, contact water will unavoidably collect inside the secondary containment area. This water will be sampled and tested before discharge to CP1 Water from the Itivia tank farm will be returned to site, if necessary Spills and leaks will be cleaned up.	Site Services	Weekly by Site Services Supervisor Weekly manual or electronic dip tests are conducted for inventory reconciliation of fuel in the tanks by sites services The geotechnical consultant inspects the tank farms annually.
Diesel Power Generating Plant	Visual inspection. Locate leak(s) and report promptly.	Low. All spills in Generating Plant will be held within the building.	Site Services	Weekly by powerhouse operator
Other Fuelling Stations	Visual Inspection for leaks or spills and keep a written log of inspections to be made available to an Inspector upon request	Low. Fuelling stations will have an impermeable liner to capture spills or leaks	Site Services	Weekly by Site Services Supervisor
Hazardous Material Storage Areas	Visual inspection for proper storage of hazardous wastes	Low. Hazardous waste will be stored in areas having containment or in sea cans	Site Services	Weekly by Site Services Supervisor
Waste Shipments	Inspect shipping forms to ensure they meet regulatory requirements	Low. Employees or contractor preparing waste for transport will be trained in the transportation of dangerous goods.	Warehouse/ Logistics	Waste will be shipped south during the latter part of the shipping season. The shipping forms will be inspected monthly year round for sea cans that are full and have been sealed for shipment.

Table 4-1 Summary of Proposed Inspections (continued)

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Landfarm	Visual inspection for water ponding outside the perimeter berm and water accumulating within the landfarm.	Low. The landfarm will have an impermeable liner and an oil:water separator will be used to remove excess water from the landfarm.	Environment	At freshet and weekly for the remainder of the summer.
Landfill	Visual inspection for orderly use of the landfill, absence of blowing debris, and leachate at the base of the landfill during the summer.	Low. The landfill has a berm to reduce blowing debris, and a ditch will intercept any leachate coming from the landfill.	Site Services	Weekly over the entire year for the orderly use of the landfill and for evidence of blowing debris. Inspections for leachate following freshet and weekly thereafter over the open water season.
Incinerator	Visual inspection for cleanliness and the proper management of all waste delivered to the facility.	Low. All waste delivered to the facility will either be incinerated or managed for future off site recycling or disposal.	Site Services	Weekly to ensure wastes generated at the mine are being properly managed.
Emulsion Plant	Visual inspection for spillage of NH_4NO_3 outside the explosives factory and at storage locations. All Plant components inspected as per regulations	High. If NH_4NO_3 gets into water, it can negatively affect fish.	Emulsion Plant Manager	Weekly, year round, or at a frequency required by regulation.
Quarries / Borrow Pits	Visual inspection for slumping and seepage from the quarries/borrow pits.	Low. Loose rock will be pulled down from the quarry face. Seepage sampled.	Environment	Weekly at freshet and monthly thereafter over the open water period. Also, after major rain events.
Freshwater Jetty	Visual inspection for erosion and settlement of the jetty	Low. If there is settlement of the jetty, additional clean waste rock will be added.	Engineering	Annually following Meliadine Lake becoming ice free
Pipelines	Visual inspection for leakage or damage to the pipeline	Low. If the freshwater pipeline were to fail, the pumps in Meliadine Lake can be remotely turned off. Other pipelines discharge to or from CP1.	Site Services	Weekly, year round

Table 4-1 Summary of Proposed Inspections (continued)

Mine Components / Activities Inspected	Inspection Methods/Procedures/ Department Responsible	Qualitative Risk Level - High, Medium, or Low	Department Responsible	Frequency
Spills	Document the recovery of spilled material and clean-up of any remaining residuals	This could range from low to high risk depending on what was spilled, where it occurred, and success of spill recovery efforts.	All departments; Environment to follow-up	Inspections begin when a spill is reported and continues on a regular basis until the spill is cleaned up. The frequency of inspections will be dependent on what was spilled, where it occurred, and success of spill recovery efforts.
Spill Kits	Inventory of spills response equipment and materials in each spill kit	Low. Spills kits will be restocked after use.	Environment	Quarterly by Environment Technician
Archaeological Sites	Inspect archaeological sites and report annually	Low	Environment	The location of archaeological sites has been identified and Agnico Eagle will take photos of the sites inspected and when new construction is planned in these locations.

4.2.3.7 Periodic Revisions of the Inspection Plan

The effectiveness of the IP will be evaluated annually to determine the extent to which it achieved the desired environmental and maintenance outcomes. Updates to the IP may be prompted by changes in policies or legislation, changes in operations and/or technology at the mine, or as part of corrective action.

4.3 Incident Investigations and Corrective Actions

One of the most important aspects in investigating incidents, accidents, and non-conformities is to analyse situations and try to find root cause(s). Through this process, actions taken to address those incidents, accidents, and non-conformity could result in permanent and positive changes to the RMMS and affirm continuous improvement. It is important that employees with responsibilities with regards to a situation under investigation be part of the process in identifying and assessing causes.

The following standard steps will be followed when conducting an investigation:

- identify the cause(s);
- prepare a report on the findings;
- develop a plan for corrective, mitigation, and preventive action(s)[6];
- implement the plan;
- evaluate the appropriateness and effectiveness of the corrective action(s);
- incorporate changes for continuous improvement; and,
- record and communicate changes arising from the continuous improvement.

Additional detail is provided in the Risk Management and Emergency Response Plan.

4.4 Communication and Reporting

The sharing and communication of information is an important part of the EMPP. Internal communications will be recorded and distributed to managers before being filed for future reference. Agnico Eagle will maintain and preserve internal and external records.

External reporting will detail the activities at the mine site (including accidents and incidents), the monitoring being carried out, how it complies with authorizations and meets environmental goals. Communications will use all available modern means of presenting information on environmental performance to interested parties through community liaison meetings, Agnico Eagle Nunavut website (http://www.aemnunavut.ca/), training initiatives, public notices, compliance reports, annual reports, community presentations, formal correspondence, updates to management and mitigation plans, radio announcements, etc. All efforts will be made to keep Inuit organizations, communities, authorizing agencies, the business community, and the general public informed of environmental performance of the Project. As a member of the Mining Association of Canada,

[6] In the case of spills this would include the verification of its cleanup through inspections and, if necessary, the collection of samples.

Agnico Eagle is committed to "Towards Sustainable Mining" Guiding Principles, one of which is to be "proactively seeking, engaging, and supporting dialogue regarding our operations." The "Towards Sustainable Mining" Guiding Principles are part of Agnico Eagle's RMMS. Agnico Eagle's communication initiatives support this guiding principle.

4.5 Audit, Review, and Update

It is expected that regulatory agencies will inspect the Project over its life for compliance with permits, regulations, and licences. Audits will also be conducted internally; however, independent researchers or consultants may also be engaged to complete the audits. Management reviews will also be conducted to determine the continued suitability, adequacy and effectiveness of the RMMS. Outputs of the audits and management reviews could include:

- recommendations to revise the Environmental, Health, and Safety Policies and Management Plans;
- revision to established objectives and targets; and,
- specifications for corrective actions for individual management plans.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2014a. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

Agnico Eagle. 2017. Meliadine Gold Project, Nunavut. Terrestrial Environment Management and Monitoring Plan. April 2014.

Agnico Eagle. 2016. Meliadine Gold Project, Nunavut. Aquatic Effects Monitoring Program. June 2016.

Agnico Eagle. 2017. Meliadine Gold Project, Nunavut. Water Management Plan. March 2017.

Agnico Eagle. 2018. Meliadine Gold Project, Nunavut. Borrow Pits and Quarries Management Plan. April 2015.

CPR (Center for Progressive Reform). 2011. Making Good Use of Adaptive Management. http://www.progressivereform.org/articles/Adaptive_Management_1104.pdf

Golder. 2016. Meliadine Gold Project, Nunavut - Aquatic Effects Monitoring Program (AEMP) Design Plan. Document: 6513-REP-03 Version 1. June 2016.

IMPEL (European Union Network for the Implementation and Enforcement of Environmental Law). 2012. easyTools - Risk Assessment Guidance Book http://impel.eu/wp-content/uploads/2012/09/easyTools_-Guidance-Book_-2012-06-2.pdf

Holling, C.S. 1978. Adaptive environmental assessment and management. (Editor) London: John Wiley & Sons.

JRP (Joint Review Panel). 2010. Foundation for a Sustainable Northern Future: Report of the Mackenzie Gas Project. Minister of Environment, Government of Canada. March 2010. ISBN En106-87/2009E-PDF.

APPENDIX A • FEDERAL AND TERRITORIES LAWS, REGULATIONS AND GUIDELINES

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) *Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301) *Release and Environmental Emergency Notification Regulations* (SOR/2011-90)	Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil
Canada Wildlife Act (1985 w9)		
Species at Risk Act (2002 c.29)		Species at Risk Policies
Migratory Birds Convention Act (1994 c.22)	*Migratory Birds Regulations* (C.R.C., c. 1035)	
Canada Water Act (1985 c.11)		
Oceans Act (S.C. 1996, c. 31)		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	*Arctic Waters Pollution Prevention Regulations* (C.R.C., c. 354) *Arctic Shipping Pollution Prevention Regulations* (C.R.C., c. 353)	
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	*Transportation Safety Board Regulations* (SOR/92-446)	
Canada Shipping Act, 2001 (S.C. 2001, c. 26)	*Response Organizations and Oil Handling Facilities Regulations* (SOR/95-405) *Pollutant Discharge Reporting Regulations*, 1995 (SOR/95-351) *Environmental Response Arrangements Regulations* (SOR/2008-275) *Ballast Water Control and Management Regulations* (SOR/2006-129) *Vessel Pollution and Dangerous Chemicals Regulations* (SOR/2012-69)	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995

Acts	Regulations	Guidelines
		Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)
Navigation Protection Act		
Marine Liability Act (A.C. 2001, c.6)	*Marine Liability Regulations* (SOR/2002-307)	
Fisheries Act (R.S.C. c. F-14)	*Metal Mining Effluent Regulations* (SOR/ 2002-2222) *Marine Mammal Regulations* (SOR/93-56)	The Policy for the Management of Fish Habitat Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Transport of Dangerous Goods Act (1992, c.34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	
Explosives Act (1985 c.E-17)	*Explosives Regulations* (C.R.C., c. 599) *Ammonium Nitrate and Fuel Oil Order* (C.R.C., c. 598)	
National Fire Code of Canada (2010)		
Nuclear Safety and Control Act (s.c. 1997, c.9)	*General Nuclear Safety and Control Regulations* (SOR/2000-202)	
Canadian Human Rights Act (R.S.C., 1985, c. H-6)	Canadian Charter of Rights and Freedom	
Canada Labour Code (R.S.C., 1985, c. L-2)	*Canada Labour Standards Regulations* (C.R.C., c. 986) *Canada Occupational Health and Safety Regulations* (SOR/86 304)	
Territorial Lands Act (R.S. 1985, c. T-7)	*Northwest Territories and Nunavut Mining Regulations* (C.R.C., c. 1516) *Territorial Land Use Regulations* (C.R.C. 1524) *Territorial Quarrying Regulations* (C.R.C. c. 1527)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act	*Northwest Territories Waters Regulations* (SOR/93/303)	

Acts	Regulations	Guidelines
(2002, c. 10)		
Nunavut Act (1993 c.28)	*Nunavut Archaeological and Paleontological Sites Regulations* (SOR/2001-220)	
Nunavut Land Claims Agreement Act (1993, c. 29)		
Territorial – Nunavut		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) *Used Oil and Waste Fuel Management Regulations* (NWT Reg 064-2003) [The removal of hazardous materials requires the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport. The Meliadine Project and the Meadowbank Mine are registered under a single permit for Agnico Eagle Mines Limited - Waste Generator Number - NUG100031]	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's Land Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Scientists Act (RSNWT (Nu) 1988, c S-4)	*Scientists Act Administration Regulations* (NWT Reg (Nu) 174-96)	
Historical Resources Act (RSNWT (Nu) 1988, c H-3)		
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	*Territorial Parks Regulations* (RRNWT (Nu) 1990 c T-13)	
Wildlife Act (RSNWT (Nu) 1988, c W-4)	*Wildlife General Regulations* (NWT Reg (Nu) 026-92) *Wildlife Licences and Permits Regulations* (NWT Reg (Nu) 027-92) *Wildlife Management Barren-Ground*	

Acts	Regulations	Guidelines
	Caribou Areas Regulations (NWT Reg (Nu) 099-98)	
	Wildlife Management Grizzly Bear Areas Regulations (NWT Reg (Nu) 155-96)	
	Wildlife Management Zones Regulations (RRNWT (Nu) 1990 c W-17)	
	Wildlife Regions Regulations (NWT Reg (Nu) 108-98)	
Commissioner's Land Act (RSNWT 1988, c C-11)	*Commissioner's Airport Lands Regulations* (NWT Reg (Nu) 067-97)	
	Commissioner's Land Regulations (RRNWT 1990, c C-13)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations* (RRNWT (Nu) 1990 c S-1)	
	Work Site Hazardous Materials Information System Regulations (RSNWT 1988, C 81 (Supp))	
Mine Health and Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health and Safety Regulations* (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	*Workers' Compensation General Regulations* (Nu Reg 017-2010)	
Apprenticeship, Trade and Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	*Apprenticeship, Trade and Occupations Certification Regulations* (RRNWT (Nu) 1990 c A-8)	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	*Annual Vacations Regulations* (RRNWT 1990, c.L-1)	
	Educational Work Experience Regulations (RRNWT 1990, c.L-2)	
	Employment of Young Persons Regulations (RRNWT 1990, c.L-3)	
	Labour Standards Meal Regulations (RRNWT 1990, c.L-4)	
	Notice of Termination Exemption Regulations (RRNWT 1990 c.L-5)	
	Pregnancy and Parental Leave Regulations (RRNWT 1990, c.8(Supp.))	
	Reciprocating Jurisdiction Order (RRNWT 1990, c.L-6)	

Acts	Regulations	Guidelines
	Wages Regulations (RRNWT 1990, c.L-7)	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	*Electrical Protection Regulations* (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	*Petroleum Products Tax Regulations* (RRNWT (Nu) 1990 c P-3)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	*Fire Prevention Regulations* (RRNWT (Nu) 1990 c F-12)	
Hospital Insurance and Health and Social Services Administration Act (RSNWT 1988, c T-3)	*Territorial Hospital Insurance Services Regulations* (RRNWT (Nu) 1990 c T-12)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	*Camp Sanitation Regulations* (RRNWT (Nu) 1990 c P-12) *General Sanitation Regulations* (RRNWT (Nu) 1990 c P-16)	
All-terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	*All-terrain Vehicles Regulations* (RRNWT (Nu) 1990 c A-1)	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	*Large Vehicle Control Regulations* (RRNWT (Nu) 1990 c M-30) *Motor Vehicle Registration and Licence Plate Regulations* (NWT Reg (Nu) 054-94)	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	*Highway Designation and Classification Regulations* (NWT Reg (Nu) 047-92)	
Transportation of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c 81 (Supp))	*Transportation of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	

AGNICO EAGLE

MELIADINE GOLD PROJECT

Explosives Management Plan

MARCH 2018
VERSION 5
6513-MPS-14

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ᖃᖅᑕᖅᑐᓄᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ (ᐸᕐᓇᐅᑎ) ᑐᑭᓯᐅᒪᔾᔭᑎᑕᕐᑲᖅᑐᖅ ᖃᖅᑕᖅᑐᓕᐅᖅᑐᓂᒃ, ᐃᖏᕐᕋᔾᔪᑎᓕᕆᔨᓂᒃ, ᑐᖅᑯᖅᓯᒪᕖᓐᓂᑦ, ᐱᓕᕆᐊᖑᓂᖏᓐᓂᒃ, ᐊᒻᒪ ᐊᑐᖅᑕᐅᓂᖏᑦ ᖃᖅᑕᖅᑐᐃᑦ ᐊᓯᓐᓂᑯᒃᑯᓐᓂᑦ. ᑕᒪᑐᒨᖓ ᐱᔾᔭᑎᕐᑲᖅᑐᑦ ᑕᕆᐅᑯᑦ ᐊᐅᓚᖅᑎᑦᑎᕐᑲᑦᑕᕐᓂᕐᒧᑦ ᐊᒻᒪ ᑕᕆᐅᕐᒥᐅᑕᓂᒃ ᐊᓯᓐᓂᑯᒃᑯᑦ ᐊᐅᓚᖅᑎᑦᑎᕐᑲᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᖅ ᐸᕐᓇᐅᑎ-ᖑᓐᓅᑐᖅ (Agnico Eagle 2014a)-ᒥᑦ. ᑲᓇᑕᐅᑉ ᐊᒻᒪ ᓄᓇᕗᑦ ᒪᓕᒐᓗᐊᖑᑦ, ᐅᕐᑲᐅᓯᕐᑲᖅᑐᖅ ᐊᐅᓚᑦᑎᓂᕐᒥᒃ ᐊᒻᒪ ᐊᑐᕐᓂᕐᒥᒃ ᖃᖅᑕᖅᑐᓂᒃ ᐅᑯᐊᖑᔪᑦ: ᑲᓇᑕ – *ᖃᖅᑕᖅᑐᓄᑦ ᐱᕐᑯᔭᖅ* ᐊᒻᒪ *ᒪᓕᒐᐃᑦ; ᐊᓪᔭᖅᑐᐃᓂᖅ ᐅᑐᓇᐊᓇᖅᑐᓂᒃ ᐱᕐᑯᑎᓂᒃ ᐱᕐᑯᔭᖅ ᐊᒻᒪ ᒪᓕᒐᐃᑦ; ᑲᓇᑕᒥᑦ ᐃᑯᐊᓪᓚᒃᑐᓕᕆᓂᕐᒧᑦ ᓇᑐᓇᐃᑯᑕᖅ* ᐊᒻᒪ *ᑲᓇᑕ;* ᓄᓇᕗᑦ – *ᖃᖅᑕᖅᑐᓂᒃ ᐊᑐᕐᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ* ᐊᒻᒪ *ᐊᓪᔭᖅᑐᐃᓂᖅ ᐅᑐᓇᐊᓇᖅᑐᓂᒃ ᐱᕐᑯᑎᓂᒃ ᐱᕐᑯᔭᖅ ᐊᒻᒪ ᒪᓕᒐᐃᑦ; ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒥᑦ ᐋᓐᓂᐊᕐᑲᖅᑕᐃᓕᒪᓂᖅ ᐊᒻᒪ ᐊᑦᑕᓇᖅᑐᒦᑎᑦᑎᑦᑕᐃᓕᒪᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ* ᐊᒻᒪ *ᒪᓕᒐᐃᑦ;* ᐊᒻᒪ *ᐊᑦᑕᓇᖅᑐᒦᑎᑦᑎᑦᑕᐃᓕᒪᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ* ᐊᒻᒪ *ᒪᓕᒐᐃᑦ.*

ᐊᓯᓐᓂᑯᒃᑯᑦ ᐊᑐᕐᓂᐊᖅᑕᖓᑦ ᒥᑭᑦᑐᒥᒃ ᐃᒪᕐᑲᖅᑐᑦ ᖃᖅᑕᖅᑐᐃᑦ, ᐊᒻᒪ Ammonium Nitrate / ᐅᖅᓱᐊᓗᒃ, ᐊᐅᓚᑦᑐᖕᓇᕐᓂᐊᕐᓗᒍ ᖃᖅᑎᓇᓂᕐᒧᑦ ᐅᖓᑕᐅᑦᑎᓯᒪᓗᐊᖅᑐᓄᑦ ᐅᔭᖅᑲᓄᑦ, ᐊᒃᑕᖁᖅᑕᐅᔪᓄᑦ ᐅᔭᖅᑲᓄᑦ, ᐅᔭᕋᖕᓂᐊᖅᑕᐅᔪᓄᑦ, ᓴᓇᔾᔭᑎᕆᔭᐅᔪᑦ ᐅᔭᖅᑲᓄᑦ, ᕐᑯᐊᖅᓯᒪᔪᑦ ᐅᔭᕋᖕᓂᐊᖅᑕᐅᔪᓄᑦ ᑲᑎᓯᒪᔪᑦ, ᐊᒻᒪ ᓯᐅᕋᖖᒍᖅᑎᓯᒪᔪᓄᑦ ᓄᓇᒥᑦ ᐊᒻᒪ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᓴᓇᔭᐅᑎᙵᓗᒍ ᐊᒻᒪ ᐊᐅᓛᖅᑎᙵᓗᒍ ᐱᓕᕆᐊᖅ.

ᑕᒪᐃᓂᓗᒃᑖᖅ ᐱᕐᑯᐃᑦ ᐊᑐᖅᑕᐅᔭᕆᐊᕐᑲᖅᑐᑦ ᖃᖅᑎᕆᓂᕐᒧᑦ ᐊᐅᓚᖅᑎᑕᐅᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᐅᒥᐊᒃᑯᑦ ᕐᑲᑉᐳᓈᓂᑦ ᑲᖏᖅᓴᓂᕐᒧᑦ, ᓯᑲᐅᓄᐊᖅᑕᐅᓗᑎᒃ ᐅᒥᐊᕐᔪᐊᖅ ᑭᓴᖅᓯᒪᕕᖑᓂᑦ, ᐃᑎᕖᐊᓄᐊᕈᔾᔭᐅᓗᑎᒃ. ᓯᑲᐅᑦ ᐅᓯᖏᔭᖅᑕᐅᕐᓂᒃᐸᑕ, ᑐᖅᑯᖅᓯᓯᒪᕖᑦ ᐃᓗᓕᕐᑲᖅᑐᑦ ᑖᐸᑯᓂᙵᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓚᐅᐱᓪᓚᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᕙᓗᓕᖕᒥᑦ ᐃᑎᕖᐊᓂᑦ ᓄᓇᒃᑰᕈᑎᒃᑯᑦ ᐊᐅᓚᖅᑎᑕᐅᓂᐊᖁᕐᓗᑎᒃ ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒧᑦ, ᐱᙱᑦᑐᑑᓗᑎᒃ ᖃᖅᑕᖅᑐᐃᑦ, boosters, ᐊᒻᒪ ᒪᑐᐃᑦ, ᐅᔭᕋᖕᓂᐊᕐᕕᖕᒨᕈᔾᔭᐅᑕᐃᓐᓇᕐᓂᐊᖅᑐᑦ ᐅᓯᖏᔭᖅᑕᐅᕐᓂᒃᐸᑕ ᓯᑲᐅᓂᑦ. ᑕᒪᒃᑯᐊ ᑐᖅᑯᖅᑕᐅᓯᒪᓚᐅᐱᓪᓚᑭᐊᕐᑲᖅᐸᑕ ᖃᖏᖅᓴᓂᕐᒥᑦ, ᑐᖅᑯᖅᑕᐅᓯᒪᓂᐊᖅᑐᑦ ᑐᖅᑯᖅᓯᒪᕖᖑᓐᓂᑦ ᒪᓕᒡᓗᒋᑦ ᑲᓇᑕᒥᑦ *ᖃᖅᑕᖅᑐᓄᑦ ᐱᕐᑯᔭᖅ* ᐊᒻᒪ *ᒪᓕᒐᐃᑦ.* ᑐᖅᑯᖅᑕᐅᓯᒪᓚᐅᐱᓪᓚᒡᕕᒃ ᕐᑲᐅᔨᓴᖅᑎᑕᕐᑲᐃᓐᓇᕐᓂᐊᖅᑐᖅ ᐊᓯᓐᓂᑯᒃᑯᓐᓂᑦ ᐱᓕᕆᔨᖑᓐᓄᑦ.

ᐅᔭᕋᖕᓂᐊᕐᕕᐅᑉ ᐱᕐᑯᑎᖏᑦ ᖃᖅᑕᖅᑐᓄᑦ ᐃᓚᐅᓂᐊᖅᑐᑦ I) ᒥᑭᔪᓂᒃ ᐃᒪᕐᑲᖅᑐᓕᕆᕕᒃ (ᖃᖑ), ii) ᐳᔪᕐᑲᑖᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓗᑎᒃ ᖃᖅᑕᖅᑐᐃᑦ ᓱᕐᓗ boosters, ᖃᖅᓯᔾᔪᑎ, Ammonium Nitrate / ᐅᖅᓱᐊᓗᒃ, ᐊᒻᒪ ᐊᕕᒃᑕᐅᖅᖃᖅᑎᓐᓇᕆᑦ ᖃᖅᑕᖅᑐᐃᑦ (ᖃᖑᓂᑦ ᐊᒻᒪ ᓄᓇᐅᑉ ᐊᑖᓂ), iii) ᒪᑐᐃᑦ (ᖃᖑᓂᑦ ᐊᒻᒪ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ), ᐊᒻᒪ iv) ᑐᖅᑯᖅᓯᒪᓂᖏᑦ ᐱᕐᑯᐃᑦ ᐊᑐᖅᑕᐅᔪᑦ ᒥᑭᔪᓂᒃ ᐃᒪᓕᐅᖅᐸᓪᓕᐊᓂᕐᒧᑦ. A 3T ᓄᓇᒃᑰᕈᑎ ᐊᓪᔭᖅᑐᐃᔾᔪᑎ ᖃᖅᑕᖅᓂᒃ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ ᐃᓂᐅᔪᒥᑦ ᐊᓪᔭᖅᓯᓂᕐᒧᑦ ᒥᑭᔪᓂᒃ ᐃᒪᕐᓂᑦ (ᐆᖅᓯᒪᔪᑦ 1.2 t-ᒥᒃ ᐃᓂᓖᑦ) ᒥᑭᔪᓂᒃ ᐃᒪᓕᕆᕕᖕᒥᑦ ᓄᓇᐅᑉ ᐊᑖᓄᑦ ᐅᔭᕋᖕᓂᐊᕐᕕᐅᔪᒧᑦ. ᐃᓗᓕᕐᑲᕈᖕᓇᖅᑐᖅ 10T-ᓂᒃ ᖃᖅᑕᖅᑐᓂᒃ ᓄᓇᒃᑰᕈᑎ ᑕᐃᔭᐅᔪᖅ

Mobile Manufacturing Unit-ᒥᒃ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ ᐊᒡᔭᖅᓯᓂᕐᒧᑦ ᒥᑭᔪᓂᒃ ᐃᒪᕐᓂᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᒧᑦ ᕿᖅᑕᕐᕕᐅᔪᒧᑦ. ᒥᒃᓵᒋᐊᖅᑎᓐᓂᕐᒧᑦ ᐊᓯᐊᔾᔨᕙᓪᓕᐊᓂᖅ ᐊᒻᒪ ᐱᐅᓯᒋᐊᖅᑎᓐᓂᕐᒧᑦ ᐊᑐᕐᓂᖅ ᕿᖅᑕᖅᑐᓂᒃ, ᒥᑭᔪᑦ ᐃᒪᖅ ᐊᑐᖅᑕᐅᔪᐊᕐᓂᐊᖅᑐᑦ ᐊᔪᙱᒻᒪᑕ ᐃᒪᖅᑕᕐᑲᕋᔪᐊᖅᑎᓪᓗᒍ ᐊᖓᔪᓂᑦ. ᐊᑐᖅᑕᐅᖕᒋᑦᑐᑦ ᕿᖅᑕᖅᑐᐃᑦ ᐊᑐᖅᑕᐅᔫᖕᓇᖅᑑᒐᓗᐊᑦ ᐊᔾᔨᒌᖕᒋᑎᑦᑎᑐᐃᓐᓇᕐᓂᐊᖅᑐᖅ, ᒥᒃᓵᒋᐊᖅᑎᑦᑎᓗᓂ ᓴᖕᒋᓐᓂᖓᓂᒃ ᐱᔭᐅᔪᒥᒃ ᓯᕐᑲᓪᓕᑎᓇᓂᕐᒧᑦ ᓯᕐᑲᓪᓕᑎᓇᕕᖕᒥᑦ ᑕᐃᒪᓐᓇᒧᑦ ᐱᐅᓯᒋᐊᖅᓯᓗᓂ ᐊᑐᖅᑕᐅᓂᖕᒋᑦ ᕿᖅᑕᖅᑐᐃᑦ.

ᐃᑲᔪᐃᓂᕐᒧᑦ ᐊᑦᑕᓇᖅᑐᖅᑕᕐᑲᙱᓪᓗᒍ ᑐᖅᑯᖅᑕᐅᓯᒪᑦᑎᐊᕐᓗᑎᒡᓗ ᐅᖅᓱᐊᓗᐃᑦ, ᐅᓗᓇᐊᓇᖅᑐᑦ, ᐊᒻᒪ ᐅᓗᓇᐊᓇᖅᑐᑦ ᐊᒃᑕᑯᐃᑦ, ᖃᓄᐃᖓᓂᖕᒋᓐᓅᖓᔪᑦ ᐱᕐᑯᑏᑦ ᒪᓕᖕᓂᐊᖅᑐᑦ ᐊᔾᔨᒌᖕᒋᑦᑐᓂᒃ ᒪᓕᒃᑕᐅᔫᒃᓴᓂᒃ ᐋᕐᑭᒃᑕᐅᔪᑦ ᒪᓕᒐᓂᒃ ᑲᒪᔾᔪᔪᓄᑦ. ᒥᑭᔪᓂᒃ ᐃᒪᓕᓇᕕᒃ ᕿᑯᖕᒥᑦ ᓇᑎᕐᑲᕐᓂᐊᖅᑐᖅ ᐊᒻᒪ ᓴᓂᕋᕐᑲᕐᓗᓂ ᑕᒪᐃᓂᒃ ᑯᕕᔪᓗᒃᑖᑦ ᐃᒡᓗᕐᔪᐊᕐᒦᓐᓂᐊᕐᒪᑕ. ᐱᕐᑯᑏᑦ ᕿᖅᑕᖅᑐᓕᖑᐊᖅᑐᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓂᐊᖅᑐᑦ ᒪᓕᒡᓗᒋᑦ ᒪᓕᒐᐃᑦ. ᑯᕕᔪᕐᑲᖅᐸᑦ, ᑯᕕᔪᓂᒃ ᓂᓇᐅᓈᙵᑦᑐᓕᓇᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐊᑐᓕᖅᑎᑕᐅᓂᐊᖅᑐᖅ ᐊᒻᒪ ᐱᕐᑯᑏᑦ ᑖᑉᑯᓄᙵ ᐊᑐᖅᑕᐅᓗᑎᒃ ᐊᑕᐅᓯᕐᒦᑎᑦᑎᓂᕐᒧᑦ ᑯᕕᔪᓕᓇᔾᔪᐃᑦ. ᖃᓄᐃᓕᑦᑕᐃᓕᒪᑎᑦᑎᓂᓗᒃᑖᑦ ᐊᒻᒪ ᓯᕐᑯᒥᑦᑐᓕᓇᓃᑦ ᐱᓕᓇᐊᕈᓂᐊᖅᑐᑦ ᐊᒻᒪ ᑎᑎᕋᐅᓯᐅᓗᑎᒃ ᒪᓕᒡᓗᒋᑦ ᐊᐅᓛᕐᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᕐᑲᑦᑕᖅᑐᑦ. ᓇᓗᓇᐃᔭᖅᓯᒪᔪᑦ ᑐᐊᕕᓇᖅᑐᓕᓇᓂᕐᒧᑦ ᐅᐸᓗᐊᑲᐅᑎᒋᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᑐᓂᔭᐅᓂᐊᖅᑐᖅ ᕿᖅᑕᖅᑐᓂᒃ ᐱᕕᐅᔪᓂᒃ ᐊᒻᒪ ᐃᓚᐅᑎᑕᐅᓂᐊᖅᑐᑦ ᑭᖑᓪᓕᐅᓂᐊᖅᑐᒥᑦ ᑕᒡᕙᓂ ᐸᕐᓇᐅᑎᒥᑦ, ᓴᓇᔭᐅᓂᐊᙵᖅᑎᓪᓗᒋᑦ. ᐱᓕᓇᐊᕐᑲᕐᓂᐊᖅᑐᖅ ᐱᐅᖕᒋᓛᒃᑯᑦ ᐱᓇᔭᖅᑐᒥᑦ, ᓘᕐᓗ ᐱᓂᕐᓗᐊᕐᑭᓂᒃᑯᑦ ᕿᖅᑐᕐᑲᕐᓂᒃᑯᑦ.

ᕿᖅᑎᓇᓂᕐᒧᑦ ᐊᑦᑕᓇᖅᑐᒦᑎᑦᑎᑦᑕᐃᓕᒪᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔪᑦ ᓯᕐᑯᑎᓇᓂᕐᒧᑦ ᐅᔭᖅᑲᓂᒃ ᐅᕐᑲᐅᓯᐅᔪᑦ ᐸᕐᓇᐅᑎᒥᑦ ᓄᓇᐅᑉ ᕿᓐᖓᓄᑦ, ᐊᒻᒪ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ. ᐊᔪᕈᓐᓃᖅᓴᖅᓯᒪᔪᐃᓐᓇᐃᑦ ᐊᒻᒪ ᓇᓗᓇᐃᑯᑖᖅᑖᖅᓯᒪᔪᑦ ᐃᓄᐃᑦ ᐱᓕᓇᐊᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᕿᖅᑕᖅᑐᓂᒃ. ᕿᖅᑕᖅᑐᓕᓈᑦ ᐊᔪᕈᓐᓃᖅᓴᐃᓂᕐᑲᕐᓂᐊᖅᑐᑦ ᐊᒻᒪ ᐱᓕᓇᓗᑎᒃ-ᐊᔪᕈᓐᓃᖅᓴᓗᑎᒃ ᒪᓕᑦᑎᐊᕐᓂᕐᒧᑦ ᒪᓕᒐᓂᒃ. ᐃᓗᐊᓂᑦ ᖃᐅᔨᓴᐃᓐᓂᑦ ᐊᒻᒪ ᕿᒥᕐᕈᓐᓂᑦ ᑕᒪᐃᓂᓗᒃᑖᖅ ᐃᓚᒋᔭᐅᔪᓂᒃ ᕿᖅᑕᖅᑐᓕᓇᓂᕐᒥᑦ ᐱᓕᓇᐊᕈᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᔪᙱᓐᓂᕐᑲᖅᑐᓄᑦ ᐱᓕᓇᔨᓄᑦ, ᐊᒻᒪ ᖃᓄᐃᖓᓂᐅᔪᑦ ᑎᑎᕋᐅᓯᐅᓗᑎᒃ ᒪᓕᒡᓗᒋᑦ ᖃᓄᐃᓐᓂᐅᔪᓄᑦ ᐊᒻᒪ ᐊᑦᑕᓇᖅᑐᒦᑎᑦᑎᑦᑕᐃᓕᒪᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᕐᑲᑦᑕᖅᑐᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔪᓂᑦ. ᑕᒪᐃᓂᒃ ᐃᒪᓐᓈᖅᑑᑎᓗᒃᑖᑦ ᖃᓄᐃᓕᐅᕐᑯᔭᐅᓂᓪᓗ ᒪᓕᒐᓂᒃ ᑲᒪᔨᓄᑦ ᐊᒻᒪ ᕿᒥᕐᕈᔨᓄᑦ ᑭᐅᔾᔪᑕᐅᕐᑲᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᒻᒪ ᐱᓕᓇᐊᓇᓗᒋᑦ.

EXECUTIVE SUMMARY

This Explosives Management Plan (the Plan) provides information on the manufacture, transport, storage, handling, and use of explosives at the Agnico Eagle Mines Limited (Agnico Eagle) Meliadine Gold Project (Project). Aspects related to marine shipping and marine mammals are presented in Agnico Eagle's Shipping Management Plan (Agnico Eagle 2018). The main federal and territorial legislation, which cover the control and use of explosives are: Canada - *Explosives Act* and *Regulations; Transport of Dangerous Goods Act and Regulations; National Fire Code of Canada;* Nunavut - *Explosives Use Act* and *Regulations, Transportation of Dangerous Goods Act* and *Regulations*; *Mine Health and Safety Act* and *Regulations*; *Fire Prevention Act* and *Regulations;* and *Safety Act* and *Regulations*.

Agnico Eagle intends to use emulsion-based explosives, as well as Ammonium Nitrate / Fuel Oil, for controlled blasting of overburden rock, waste rock, ore, construction rock, frozen ore stockpile, and granular material on surface and underground during the construction and operation phases of the Project.

All products required for blasting activities will be shipped by vessel from the south to Rankin Inlet, loaded onto barges at the vessel anchoring location, and transported to Itivia. After the barges are unloaded, sea cans holding the raw products will be temporarily stored in a fenced laydown area at Itivia before being trucked to the mine site, with the only exceptions being explosives, boosters, and caps, which will be transported directly to the mine site after being unloaded from the barge. In the event that these products require temporary storage in Rankin Inlet, they will be stored in appropriate storage magazines meeting federal *Explosives Act* and *Regulations*. The temporary storage magazines will remain under constant surveillance by Agnico Eagle personnel.

Mine infrastructure related to explosives will include an i) Emulsion Plant (surface), ii) Powder Magazines for storage of explosives such as boosters, detonating cord, Ammonium Nitrate / Fuel Oil, and presplitting explosives (surface and underground), iii) Cap Magazines (surface and underground), and iv) storage of raw materials used in the preparation of emulsion. A 3T capacity explosive delivery truck will be used on-site to transport emulsion (in totes of 1.2 t of capacity) from the Emulsion Plant to the underground mining operations. A 10 t capacity explosive truck called Mobile Manufacturing Unit will be used to deliver emulsion in the open pit production blastholes. To minimize loss rate and optimize usage of explosives, emulsion will be mostly used since it is efficient regardless the presence of water in boreholes. Unused explosives that are still usable will be returned to storage. The blasting patterns will favor communition, which will reduce energy consumption related to the crushing at the mill therefore optimizing use of explosives.

To assist in the safe and secure storage of fuels, hazardous materials, and hazardous wastes, design criteria of the infrastructure will follow the various guidelines set by regulatory bodies. The Emulsion Plant is equipped with a concrete floor and walls so that all spills can be wholly contained within the

building. Products entering the composition of explosives will be stored in accordance with regulation. In the event of a spill, the Spill Contingency Plan will be put into operation and appropriate equipment will be used to contain spilled materials. All preventive and breakdown maintenance will be carried out and recorded in accordance with standard operating procedures. An Emergency Response Plan is currently undergoing revision and approval by Dyno Nobel. It addresses worst case scenarios, such as an accidental explosion.

Blasting safety procedures on breaking rock are described in this Plan for surface, as well as underground operations. Only trained and certified persons will work with explosives. The explosives personnel will undertake formal training and on-the-job training to ensure compliance with legislation. Internal audits and inspections of all components related to explosives management will be conducted on a regular basis by qualified personnel, and the results recorded according to quality and safety standard operating procedures. All recommendations and orders made by regulators and inspectors will be responded to and acted upon accordingly.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	October 2012			First draft of the Explosives Management Plan	Blandine Arseneault, Env. Superintendent, Agnico Eagle Ryan Vanengen, Biologist, Agnico Eagle
2	March 2013			DEIS re-submission	No change; rebranding
3	April 2014	3.3-3.4	8-9	Added details on best practices and types of explosives	Josée Noël, Env. Coord. Agnico Eagle
		3.5	10	Reduced instantaneous pressure change from 100 to 50 kPa	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			Update of entire document for submission for Type A Water Licence	François Petrucci, Agnico Eagle
5	March 2018			General revision	Stephen David, Mine Department, Agnico Eagle

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ANFO	Ammonium Nitrate / Fuel Oil
CCME	Canadian Council of Ministers of the Environment
MMU	Mobile Manufacturing Unit
NIRB	Nunavut Impact Review Board
NWT	Northwest Territories
Nu	Nunavut
PHC	Petroleum Hydrocarbons
Plan	Explosives Management Plan
PVS	Peak Vector Sum
WHMIS	Workplace Hazardous Materials Information System

SECTION 1 • INTRODUCTION

1.1 Overview

Agnico Eagle Mines Limited (Agnico Eagle) intends to use explosives for controlled blasting of overburden rock, waste rock, ore, construction rock, frozen ore stockpile, and granular material on surface and underground during the construction and operations phases of the Meliadine Gold Project (Project).

1.2 Purpose and Scope

This Explosives Management Plan (the Plan) provides information on explosives manufacture, transport, storage, handling, and use at the Project and its conformity with Section 9.4.13 of the *NIRB Guidelines for the Preparation of an Environmental Impact Statement for Agnico Eagle Mines Ltd.'s Meliadine Project (NIRB File No. 11MN034),* and with the Nunavut Water Board's *Mining and Milling: Supplemental Information Guideline for Mine Development*.

1.3 Related Documents

Documents containing information related to this Plan include the following:

- Environmental Management and Protection Plan;
- Risk Management and Emergency Response Plan;
- Spill Contingency Plan;
- Landfill and Waste Management Plan;
- Hazardous Materials Management Plan;
- Borrow Pits and Quarries Management Plan;
- Water Management Plan;
- Occupational Health and Safety Plan (Agnico Eagle 2014b); and
- Oil Pollution Emergency Plan (Agnico Eagle 2014c).

1.4 Applicable Legislation

The control and use of explosives within Canada and Nunavut is covered by existing federal and territorial Acts and Regulations. The Project will put in place operational policies and procedures, which meet or exceed applicable legislation. Applicable Acts, Regulations, and Guidelines are listed in Table 1-1.

Table 1-1 Applicable Legislation to Explosives Management

Acts	Regulations	Guidelines
Federal		
Canadian Environmental Protection Act (1999 c.33)	*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197)* *Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301)	*Canadian Council of the Ministers of Environment - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products* Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil
Fisheries Act (R.S.C. c. F-14)	*Metal Mining Effluent Regulations* (SOR/ 2002-2222)	Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters
Explosives Act (1985 c.E-17)	*Explosives Regulations* (C.R.C., c. 599) *Ammonium Nitrate and Fuel Oil Order* (C.R.C., c. 598)	Blasting Explosives and Initiation Systems: Storage, Possession, Transportation, Destruction and Sale
National Fire Code of Canada (2010)		
Transport of Dangerous Goods Act (1992, c.34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	
Territorial – Nunavut		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations* (NWT Reg (Nu) 068-93) *Used Oil and Waste Fuel Management Regulations* (NWT Reg 064-2003)	Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for the Management of Waste
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health And Safety Regulations* (NWT Reg (Nu) 125-95)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	*Fire Prevention Regulations* (RRNWT (Nu) 1990 c F-12)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations* (RRNWT (Nu) 1990 c S-1) *Work Site Hazardous Materials Information System Regulations* (RSNWT 1988, C 81 (Supp))	
Transportation Of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c 81 (Supp))	*Transportation Of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	

SECTION 2 • MANUFACTURE OF EXPLOSIVES

2.1 Infrastructure

The construction and operation of the Project will require the use of ammonium nitrate/fuel oil (ANFO) and emulsion based explosives. ANFO will be used during construction until the Emulsion Plant begins manufacturing emulsion-based explosives, planned for end of Q1 2018. Presplit explosives will also be used to control the final pit walls, where required. General infrastructure for the management of explosives at the mine site includes the following:

- Emulsion Plant;
- Storage of raw materials used in the manufacturing of emulsion;
- Powder Magazines for storage of explosives such as boosters, detonating cord, presplit explosives, and ANFO (surface and underground mining); and
- Cap Magazines (surface and underground).

The Emulsion Plant will operate 7-days a week on a 12-hour per day basis. The explosives truck(s) will be based at the Emulsion Plant. A garage will be included in the building for the maintenance and washing of trucks and equipment used to handle the explosives. The water used for the manufacturing of emulsion will be supplied by truck from the proposed mine site's fresh water tank. Waste water generated inside the Emulsion Plant will be collected and disposed in an appropriate method (remaining solids will be disposed in the same manner as unusable emulsion as described in Section 3.6).

2.2 Location

The Emulsion Plant, raw material storage, and magazines will be safely located away from vulnerable facilities, as stipulated by the federal and territorial *Explosives Use Act* and *Regulations*.

The Emulsion Plant will be located approximately 1.36 kilometres north-west of the mine site as shown on Figure 2-1. The Surface Powder Magazine area and the Cap Magazines will be located along the road providing access to the Emulsion Plant.

Underground facilities will include Powder Magazines and Cap Magazines. These facilities will be constructed as stipulated in the applicable regulations.

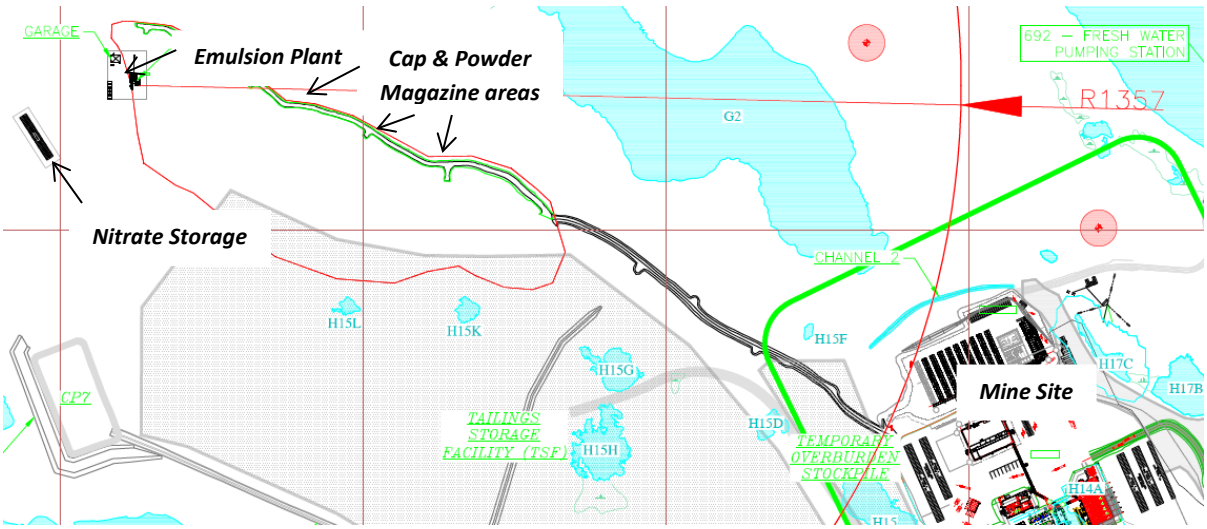

Figure 2-1 Location of Cap Magazine, Powder Magazine, and Emulsion Plant

2.3 Products

The following products will be required for manufacturing emulsion:

- surfactant (highly reacted oil mixture);
- ammonium nitrate;
- sodium nitrate;
- water; and
- microballoons.

The explosive truck (Mobile Manufacturing Unit or MMU) used to deliver emulsion at surface operations (i.e., open pit, quarry, or frozen stockpiles blasting) will use either water or a mixture of water and glycol during freezing conditions to allow for the pumping of the emulsion into the blastholes.

The following products will be required to achieve blasting activities:

- explosives;
- caps;
- boosters;
- detonating cords; and
- glycol (during freezing conditions).

2.4 Emulsion Plant Flow Sheet

The flow sheet of the Emulsion Plant is presented in Appendix B.

2.5 Design Criteria

To assist in the safe and secure storage of fuels, hazardous materials, and hazardous wastes, general design criteria for storage areas and facilities related to explosives will be followed as listed below:

- Design will be in compliance with the *National Fire Code*, where appropriate.
- Compliance with the Canadian Council of Ministers of the Environment (CCME), *Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (2003)* will be followed. This CCME code deals with inventory control, inspections, corrosion protection, records, and monitoring. Environment Canada's *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* outlines registration and documentation requirements for storage tanks.
- Emulsion Plant will be adequately signed indicating that hazardous materials/wastes are stored therein.
- Storage locations will be clearly defined and marked to prevent damage to storage drums and containers in the event they are covered by snow.
- Incompatible materials will be segregated by chemical compatibility within the storage area to prevent contact between materials in the event of a release.
- Emulsion Plant will be located at least 31 metres from surface waters.
- Emulsion Plant will be readily accessible for firefighting and other emergency procedures.
- Emulsion Plant will be adequately ventilated to prevent the build-up of noxious or toxic vapors.
- Secondary containment will be installed to allow for the containment of at least 110 % of the largest container or tank volume of any chemical within the contained area.
- Emulsion Plant will be constructed, or provided with barriers, to protect containers from physical damage.
- Adequate spill and emergency response equipment will be installed in each storage area (i.e., spill control, fire protection, etc.).

SECTION 3 • HANDLING OF EXPLOSIVES

3.1 Transport

All products required for blasting activities will be shipped by vessel from the south to Rankin Inlet, loaded onto barges at the vessel anchoring location, and transported to Itivia. The bypass road and All-weather Access Road will be used to truck explosives and raw materials for manufacturing explosives to designated storage locations at the mine site.

The handling of explosives on-site will be carried out by the supplier and by qualified Agnico Eagle staff (blasters and helper-blasters) under a permit to conduct such work.

A 3T capacity explosive delivery truck will be used on-site to transport emulsion (in 1.2 t of capacity totes) from the Emulsion Plant to the underground mining operations. A 10 t capacity explosive truck called MMU will be used to deliver emulsion in the open pit production blastholes.

3.2 Storage

After the barges are unloaded, sea cans holding the raw products will be temporarily stored in a fenced laydown area at Itivia before being trucked to the mine site, with the exception of explosives, boosters, and caps, which will be transported directly to the mine site after being unloaded from the barges. In the event that these products require temporary storage in Rankin Inlet, they will be stored in appropriate storage magazines meeting federal *Explosives Act* and *Regulations*. The temporary storage magazines with remain under constant surveillance by Agnico Eagle personnel while in use.

On the mine site, raw materials such as sodium nitrate and ammonium nitrate used in the preparation of emulsion will be contained in 1.2 t tote bags, and stored in sea cans (capacity of approximately 20,000 kilograms each). Raw materials of different and incompatible types will be stored in separate sea cans to prevent their mixing. Raw materials will also be stored away from any other products as required by explosive regulations. The explosive caps will be stored in enclosed Cap Magazines (surface and underground). The boosters, detonating cord, and explosives used for pre-shearing and ANFO will be stored in an enclosed Powder Magazine. Surface and underground mining activities will require approximately 10 to 20 magazines in total, which will be managed according to the explosive regulations.

3.3 Blasting Activities

Blast frequency will be between two and four blasts per day, including underground and surface activities. Table 2.1 summarizes the blasting information for both the open pit and underground operations. The quarries, and possibly the borrow pits and stockpiles in some instances, will also require the use of explosives.

Table 2.1 Blasting Details – Meliadine Gold Project

Parameters	Values
Open Pit	
Quantity extracted per blast	120,000 t
Blasting area	120 m^2
Number of blasts per day	2 to 4
Underground	
Quantity extracted per blast (stope)	10,000 t
Quantity extracted per blast (development)	250-350 t
Number of blasts per day	2 to 4

The primary blasthole drills for surface mining will be diesel-powered rigs, whereas electric rigs will be used underground. A number of operating procedures will be implemented to adapt blasting to factors that can affect the operations, notably weather in relation to open pit operations. These may include minimizing the delays between the loading and blasting of holes, ensuring that cuttings are mounded around the holes collar after loading to prevent snow drifting into the holes, and utilizing blasthole covers. Emulsion is efficient (i.e., minimized loss rate) regardless of the presence of water. Unused explosives that remain viable will be returned to storage.

Blasting will likely be by electric initiation and will feature current technology with surface and in-the-hole delays to minimize the energy per delay to single hole loads. This will minimize backbreak, fly rock, vibration levels, and will optimize fragmentation and minimize excavation problems. The blasting patterns will favor communition, which will reduce energy consumption related to the crushing at the mill. Usage of explosives will therefore be optimized.

Blasting will be carried out by certified blasters who will follow blasting regulations and safe practices. The responsibility for blasting will be split between appropriately trained mine personnel and the explosives supplier.

Finally, there is often a relationship between ammonia and nitrate levels in surface water runoff and the quantity of ANFO type explosives that haven't detonated during the blast. Well planned blasts and strict control of spillage are keys to reducing ammonia losses. For safety, environmental, and economic reasons, blast designs will be optimized and will include measures that favor complete detonation of all explosives. Drill patterns, explosive loads, and initiation methods will be designed and performed by experienced professionals, and will be adaptively managed to make necessary adjustments should any problems be observed. Also, having a single explosives supplier and trained certified blasters loading the holes and performing blasting activities will ensure the consistency and

efficiency of the activity. Blasters who are conscientious and aware can prevent most spills by adjusting their loading practices.

3.4 Type of Explosives

The explosive composition can also influence ammonia and nitrate leaching rates, which ultimately can have an influence on loss rates. ANFO is less costly than other explosives, but it readily dissolves in water. Therefore, for economical, operational, and environmental reasons, ANFO will not be used when there is an anticipated presence of water. Emulsion releases ammonia and nitrates much more slowly than ANFO. This is in part why, when planning the operation, emulsion explosives will be favored over ANFO whenever possible. Emulsion is a versatile product that can be used in dry and wet conditions. Moreover, pumped emulsion reduces spillage, and with excellent water resistance, minimizes potential nitrate leaching and the resultant environmental impact (ammonia in water). Blasting with a high energy bulk emulsion explosive is planned with a targeted powder factor of 0.0.37 kg/t in ore, and 0.27 kg/t in waste. Emulsion will be produced on-site within an explosive plant operated and maintained by an explosive supplier. The current plan is to use the same emulsion product for both open pit and underground operations to minimize the complexity of the plant (i.e., only one product)

3.5 Blast Monitoring for the Protection of Fish

3.5.1 Objectives

Monitoring to evaluate blast related peak particle velocity and overpressure to protect nearby fish bearing waters will be conducted to ensure blast operations meet the requirements of specific charge weight/delay/set.

The detonation of explosives in or near water produces compressive shock waves that can cause significant impacts to the swim bladders of fish, rupture other internal organs, and/or damage or kill fish eggs and larvae. In addition, the effects of the shock waves can be intensified in the presence of ice. Fisheries and Oceans Canada guidelines developed in 1998 to protect fish and fish habitat from works or undertakings that involve explosives in or near fisheries waters (Wright and Hopky 1998; see Appendix A) have, in part, been superseded by research carried out by Godard et al. (2008). In particular, the recommended maximum instantaneous pressure change has been reduced from 100 to 50 kPa. As a result, Agnico Eagle will adhere to the following guidelines:

- No explosive is to be detonated in or near fish habitat that can produce an instantaneous pressure change greater than 50 kPa in the swim bladder of a fish.
- No explosive is to be detonated that produces a peak particle velocity greater than 13 millimetres per second in a spawning bed during the period of egg incubation (for lakes near the Project, the fisheries window is from August 15 to June 30 for fall spawning fish [e.g., lake trout]).

Peak particle velocity and overpressure monitoring data will be recorded at a minimum of two locations at the Project. The locations will be selected to confirm that the above guidelines are achieved. The data will be routinely reviewed, evaluated as compared to the guidelines, and compiled at the end of the year during annual reporting.

3.5.2 Methods

Blasts will be monitored using a vibration and overpressure monitoring system that is compliant with the international Society of Explosives and Engineers performance specification for blasting seismographs. The monitoring system has three main parts: a monitor, a standard transducer (geophone), and a microphone. The monitor contains the battery and electronic components of the instrument. It also checks the two sensors to be sure that they work properly.

The transducer measures transverse, vertical, and longitudinal ground vibrations with a mechanism called a geophone. Transverse ground vibrations agitate particles in a side-to-side motion. Vertical ground vibrations agitate particles in an up-and-down motion. Longitudinal ground vibrations agitate particles in a back-and-forth motion progressing outward from the event site. The monitoring system calculates the peak particle velocity for each geophone and calculates the vector sum of the three axes. The final result is the Peak Vector Sum (PVS) and is the resultant particle velocity magnitude of the event:

$$PVS = \sqrt{(T^2 + V^2 + L^2)}$$

Where:
T = particle velocity along the transverse plane
V = particle velocity along the vertical plane
L = particle velocity along the longitudinal plane

The transducer will be installed as per the model specifications.

3.6 Disposal of Wastes

Disposal of regular waste will follow the Landfill and Waste Management Plan for the Project.

Any hazardous material that requires disposal will be handled according to the Project's Hazardous Materials Management Plan, submitted as part of the Type A Water Licence application.

Used water generated at the Emulsion Plant will be re-used within the plant when feasible. Any excess used water will be collected and disposed in an appropriate method. Remaining solids will be disposed in the same manner as unusable emulsion as described below.

Any unusable/unused emulsion waste, as well as other explosive products whose expiry date has passed, will be taken to the open pit blast pattern for disposal down the blastholes.

The empty explosive boxes or bags that cannot be reused will be burned on-site according to the conditions stipulated in the permit.

SECTION 4 • SPILLS

4.1 Spill Prevention

The Emulsion Plant has a concrete floor with channels and sumps so spills are 100 % contained within the building. All facilities related to explosives handling on-site will be secured (locked) and regularly inspected by site security.

More details regarding spill preventive methods are provided in Spill Contingency Plan, submitted as part of the Type A Water Licence Application for the Project. The following is a summary of the main aspects:

- All storage tanks containing products that enter the composition of explosives will be in accordance with the provisions of regulations (e.g., National Fire Code, *Environmental Protection Act*).
- In case of a spill, the Spill Contingency Plan will be put into action and appropriate equipment will be used to contain the liquids or solids spilled.
- All preventive and breakdown maintenance will be carried out and recorded in accordance with standard operating procedures.

4.2 Intervention in Case of a Spill

Table 4-1 summarizes procedures to be applied in case of a leak or a spill of a product used in the manufacture of emulsion. Means of disposal of waste are also included. More details regarding hazardous materials and spill management are provided in the Spill Contingency Plan.

Table 4-1 Procedures in Case of Leaks and Spills of Explosive Products[1]

Product	Description	Spill and Leak Procedures	Waste Disposal
Ammonium Nitrate	Odorless, white to light, tan crystalline solid.	Remove source of heat and ignition. Sweep or shovel spill into a clean, non-combustible container. Wash remaining trace residues with water. Wear rubber gloves and safety glasses to prevent contact with skin and eyes.	Dispose of as-is in approved containers. As much as possible, remove, the spilled material as a solid.
Surfactant	Dyed or pale yellow liquid with petroleum odor.	Eliminate any source of ignition. Prevent spills from entering watercourses or drainage systems. Contain with sand or earth. Recover with pump or inert absorbent material, and place in clean container(s). Wear safety glasses and rubber gloves to prevent contact with eyes and skin.	Dispose as specified in the Hazardous Material Management Plan.
Emulsion	Blasting agent.	Remove all sources of heat and ignition. Prevent spills from entering watercourses or drainage systems. If a large amount of emulsion is involved, contain spill with earth or sand. Recover spilled material with a diaphragm pump. Use of a diaphragm pump also requires an air compressor. Limitation of the pump suction is approximately 2.5 metres, pump discharge is approximately 8 metres. Use a screening device on pump suction hose. Out of area spills will require taking two pumps and extra hose. Transfer the product into a tanker trailer or clean 200 litre drums. If a small amount of emulsion is involved, transfer material into a clean plastic container with a plastic shovel. Label tanker trailer or drums. Wear rubber gloves and rubber boots.	Recycle product, if possible. If not practical, detonate in a blasthole, or if a large amount is involved, demulsify with liquid detergent.
Sodium Nitrate prill	Oxydizing agent, white to light yellow crystals, faint odour.	In the event of a spill or leak, contact the vendor for advice. Wear respirator, protective clothing, and gloves. Vacuuming is the recommended method to clean-up spills. Do not sweep or use compressed air for clean-up. Recover spilled material using non-combustible materials, such as vermiculite. Use non-sparking tools and place in covered containers for disposal. Any recovered material may be used for its intended purpose, depending on contamination.	Waste material will need to be shipped south and disposed at an approved hazardous waste treatment/disposal facility in accordance with the Hazardous Material Management Plan.

[1] *Table will be updated on a regular basis considering the WHMIS sheets.*

SECTION 5 • PERSONNEL TRAINING PROGRAM

Only trained and certified persons will work with explosives. The explosives personnel will undertake formal training and on-the-job training to ensure compliance with legislation. Training requirements will include (but will not be limited to) the following:

- specific fire procedures as per the *Federal Explosives Act*;
- first aid;
- Transportation of Dangerous Goods;
- blasting certificate; and
- Workplace Hazardous Materials Information System (WHMIS).

SECTION 6 • BLASTING SAFETY MEASURES

6.1 Surface

Blasting safety procedures for breaking rock and frozen material are as follows for blasting on the surface (open pit and quarry operations):

- No unauthorized person is allowed inside a posted blast area whether the holes have been loaded or not.
- The blasting supervisor and the blaster are responsible for the safe handling, loading, and connection of a blast.
- The shift supervisor is responsible for the evacuation of all personnel and equipment from the blast area and the guarding of the blast.
- The general supervisor is responsible for notifying the appropriate blast personnel, and other departments and personnel who may be affected by a particular blast.
- Guards will be posted prior to blast time, and must remain guarding until they are told verbally by the shift supervisor that they can leave their position.
- Once guards are posted, the blast area must be inspected by the shift supervisor to ensure that no personnel or equipment remain inside the blast area.
- A blast-warning siren will be sounded for one minute; three minutes after this, the blast will be fired.
- The blaster will only fire the blast when given a direct verbal order to do so by the shift supervisor.
- Before firing a shot, the blaster must ensure the immediate area is clear (i.e., aircraft, etc.).
- The shift supervisor and blaster will inspect the fired shot for indications of any problems, such as misfires or cut-offs.
- Areas in which charged holes are awaiting firing shall be guarded or posted against unauthorized entry.
- Vehicles containing explosives shall not be taken to the repair shop or any other building for any purpose, with the exception of the MMU truck containing unused bulk emulsion. At the end of the shift, the MMU will be parked inside the explosive plant for usage the next day. No open flames or welding are to be used for field repairs unless explosives are first removed.
- All loaded patterns, in addition to being marked with blasting signs, will be clearly delineated to outline the pattern when necessary.
- Redrills shall be marked in an appropriate way and be designated by a member of the blasting crew; the marker shall be firmly implanted in the cuttings of the hole to be redrilled. The marker shall be removed by the driller before drilling and inverted in the hole after drilling for pickup by the blasting crew.

- Where redrills are required on loaded patterns, the drill must be guided by the blasting supervisor or blaster or a responsible person designated by them.
- Service vehicles and fuel trucks are not allowed on a loaded pattern; the drill must pull well clear of the loaded holes before any service or maintenance can be done on it. Where the drill cannot be moved and service is required, it may be done only under the direct supervision of the blast supervisor or designate, and all loaded holes must be covered.

6.2 Underground

Blasting safety procedures for breaking rock are as follows for underground operations:

- Underground blasts will occur at approximately the same time during the day.
- All employees working underground must be back on surface and have removed their badges from the presence board.
- Before blasting, the responsible supervisor makes sure that there are no badges remaining on the presence board.

SECTION 7 • INTERNAL AUDIT AND INSPECTION

Internal audits and inspections of all components related to the Explosives Management Plan will be conducted as required by the regulations. Inspections for physical condition and serviceability will be done on a regular basis by qualified personnel, and the results recorded according to quality and safety standard operating procedures. Qualified personnel will perform regular inspections of the Emulsion Plant and of the Powder and Cap magazines storing the boosters, caps, and explosives to ensure that inventory is documented and confirmed.

All recommendations and orders made by Natural Resources Canada Explosives Branch Inspectors, Fire Marshals, and Insurance Inspectors will be responded to and acted upon accordingly.

SECTION 8 • EMERGENCY RESPONSE PLAN

A detailed Emergency Response Plan is currently being prepared by the explosives supplier, which addresses potential incidents involving the manufacturing, transport, handling, and storage of explosives and related products. The supplier's Emergency Response Plan will be provided as an appendix in the next version of this Plan. It will prescribe the actions that supplier and Agnico Eagle employees must take to ensure employee and public safety in the event of an emergency.

The following situations (worse case scenarios) will be addressed relative to explosives in the Emergency Response Plan:

- fire/explosion;
- storage tank failure;
- spills from product delivery trucks;
- spills from raw material delivery trucks;
- process spills;
- shut-down due to weather, floods, lightning, fires, explosions, and other threats to the security and operation of supplier's facilities, equipment and material;
- bomb threats; and
- quantities of spills that are reportable to the supplier and authorities.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2014a. Shipping Management Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 8, Support Document 8-1.

Agnico Eagle. 2014b. Occupational Health and Safety Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 9, Support Document 9-6.

Agnico Eagle. 2014c. Oil Pollution Emergency Management Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 8, Support Document 8-2.

CCME (Canadian Council of Ministers of the Environment). 2003. Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products. Available on-line: http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=61B26EE8-1

Godard, D.R., L. Peters, R. Evans, K. Wautier, P.A. Cott, B. Hanna, and V. Palace. 2008. Development of histopathology tools to assess instantaneous pressure change-induced effects in rainbow trout (*Oncorhynchus mykiss*) early life stages. Environmental Studies Research Funds Report # 164. Winnipeg.93 p.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. Science Directorate, Central and Arctic Region, and Habitat Management & Environmental Science Directorate, Department of Fisheries and Oceans (DFO).

APPENDIX A • GUIDELINES FOR THE USE OF EXPLOSIVES IN OR NEAR CANADIAN FISHERIES WATER

AGNICO EAGLE

MELIADINE GOLD MINE

Groundwater Management Plan

FEBRUARY 2018
VERSION 1

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (the Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut.

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings (Agnico Eagle 2017). There are four phases to the development of the Mine; just over 4 years of construction (Q4 2015 to 2019), 8 years of Mine operation (2020 to 2027), 3 years of closure (2028 to 2030), and post-closure (2031 forwards).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the Underground Mine will operate below the base of the continuous permafrost. The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the Underground Mine workings once the Mine has advanced below the base of the permafrost.

This document presents the Groundwater Management Plan (GWMP) for the discharge of saline groundwater in compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1525, Part E, Item 14.

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ᐅᓴᖅᑕᕆᐊᖏᓐᓇᑦ ᐸᖏᓇᐅᑎ ᐅᓴᖅᑕᕆᐊᖏᓂᖏᓐᓇᑦ ᐊᑲᖅᑭᐅᒪᔪᑦ ᐱᓕᕐᓂᐊᕐᓂᖅᓯᓇᓂᑦ ᑎᕆᓂᓂᐊᕐᒥᑦ ᔨᓗᑕᓪᓕᒃ, ᒪᑭᑦᓴᓂᒃ 1 ᐊᒻᒪᓗ ᑎᕆᓂᓂᐊᖅ ᓄᓇᒥᑦ ᐅᑦᔪᐃᖏᓐᓇᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒥᑦ ᓄᓇᐅᐸᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖅᑕᕆᐊᖏᓂᖅ. ᒪᓕᓐᓴᔨᑐ ᐃᓐᓇᐅᔪᖅ ᐅᓴᖅᑕᕆᐊᖏᓐᓇᑦ ᐸᖏᓇᐅᑎ, ᐅᓴᖅᑕᕆᐊᖅ 12.1 ᒥᓕᔭᓐ ᑕᓐᓗᐊᓂᒃ ᐅᓴᖅᑕᖏᓂᐊᖅᑐᖅ, 31.8 ᒥᓕᔭᓐ ᑕᓐᓂᒃ ᐊᒃᑕᑯᖅᑕᐅᔪᓂᑦ ᐅᓴᖅᑲᓂᒃ, 7.4 ᒥᓕᔭᓐ ᑕᓐᓂᒃ ᐅᖓᓕᐅᕆᑎᔪᑦ ᐊᒃᑕᑯᖅᑕᐅᔪᓂᑦ, ᐊᒻᒪᓗ 12.1 ᒥᓕᔭᓐ ᑕᓐᓂᒃ ᖃᒪᓂᑕᐅᓂᑦ (ᐊᒃᓗᓂᑦᓂᓪ 2017). ᔪᑕᒪᐅᓕᖅᓯᐊᖅᑐᑦ ᐱᓯᓕᓕᐊᕐᓂᖓᓐᓄ ᐅᓴᖅᑕᕆᐊᖅᓴ; ᐅᑭᐅᑦ ᔪᑕᒪᐃᑦ ᐅᖓᓂᐊᖅᓱᐊᓕᑦ ᓴᓇᔨᐅᓪᓗᒥ (Q4 2015-ᒥᑦ 2019-ᔪᑦ), 8-ᓄᑦ ᐅᑭᐅᓄᑦ ᐅᓴᖅᑕᕆᐊᖅ ᐊᐅᓪᓴᓪᓗᒥ (2020-ᒥᑦ 2027-ᔪᑦ), ᐱᖓᔪᓄᑦ ᐅᑭᐅᓄᑦ ᐅᑦᔪᐊᖅᑐᓪᓗᐊᓪᓗᒥ (2028-ᒥᑦ 2030-ᔪᑦ), ᐊᒻᒪᓗ ᐅᑦᔪᐊᖅᔪᒪᓕᖅᑎᓪᓗᒍ (2013-ᒥᑦ ᔪᐅᒪᔪᑦ).

ᑎᕆᓂᓂᐊᖅ ᓄᓇᒥᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖅᑕᕆᐊᖏᓂᖅ ᑎᑭᐅᑎᓇᓴᖅᑐᖅ 625-ᓗᐊᑦ ᒋᑕᓄᑦ ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᑕᐃᒪᓐᓇᒍᓪᓗ, ᐃᓕᓐᓄ ᓄᓇᒥᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖅᑕᕆᐊᖏᓂᖅ ᐊᐅᓪᓚᖏᓂᐊᕐᓂᖅᑐᖅ ᖏᑦᔪᐊᔪᐃᓐᓇᐅᑉᐳᖅ ᑭᓴᓪᓗᑎᓂᒃ ᐊᒃᑕᓂᑦ. ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᐋᓴᐃᓂᖅ ᓄᓇᒥᖓᓚᖅᑐᑦ ᐃᒪᒥᖅᑐᑕᐅᓂᐊᖅᑐᖅ ᑯᐊᐳᖅᑐᓂᐊᓕᒪᓂᖅ ᐊᐅᓪᓚᖏᓂᒃ, ᐃᓕᖅ ᑯᐊᑎᑕᐅᓪᓗᒍ ᐅᓴᖅᑕᕆᐊᖏᓂᐊᕐᓂᖅᑐᑦ ᐅᓴᖅᑕᕆᐊᖏᓂᖅᑐᑦ ᔪᐅᓂᖅᑐᑦ ᑭᓴᓪᓗᑎᓂᒃ ᑭᓴᓪᓗᑎᓂᒃ ᐊᒃᑕᓂᑦ.

ᑕᐃᓇ ᑎᑎᖅᑲᖅ ᑐᓂᔪᓇᖅ ᓄᓇᒥᑦ ᐃᒪᖏᑦ ᐊᐅᓪᓚᕆᑎᓂᖏᓪᓗᒍ ᐸᖏᓇᐅᑎᒥᑦ ᑯᐊᔪᓂᖏᓪᓗᒍ ᑕᕆᐅᓪᓚᖏᑦ ᓄᓇᒥᑦ ᐃᒪᖏᑦ ᒪᓕᓐᓄᑦ ᐊᒻᒪᓗᑦ Type A ᐃᒪᖏᓪᓗᒍ ᓪᐃᓴᔪᓂᖓᓐᓂᐸ 2AM-MEL1525, ᐊᐃᓐᑐᖅᓯᒪᔪᖅ E, ᑎᑎᖅᑲᖅ 14.

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ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ANFO	Ammonium Nitrate/Fuel Oil
CP	Collection Pond
DDH	Diamond Drillhole(s)
EMPP	Environment Management and Protection Plan
EWTP	Effluent Water Treatment Plant
FEIS	Final Environmental Impact Statement
GWMP	Groundwater Management Plan
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
Mine	Meliadine Gold Mine
QA	Quality Assurance
QC	Quality Control
RO	Reverse Osmosis
SD	Support Document
SSWQO	Site Specific Water Quality Objectives
SWTP	Saltwater Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WMP	Water Management Plan

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
ha	hectare(s)
mg/L	milligram(s) per litre
km	kilometer(s)
km^2	kilo square meter(s)
m	metre(s)
m/day	metre(s) per day
mm	millimetre(s)
m^3	cubic metre(s)
m^3/day	cubic metre(s) per day
m^3/s	cubic metre(s) per second
m^3/hour	cubic metre(s) per hour
m^3/year	cubic metre(s) per year
Mm^3/year	million cubic metre(s) per year
Mm^3	million cubic metre(s)
t	tonne(s)
tpd	tonne(s) per day
Mt	million tonne(s)

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine is subject to the terms and conditions of both the Mine Certificate (No. 006) issued in accordance with the Nunavut Agreement Article 12.5.12 on February 26, 2015 and Nunavut Water Board Type A Water Licence (No. 2AM-MEL1631, 2016) issued by the Nunavut Water Board (NWB) on April 1, 2016.

This document presents the Groundwater Management Plan (GWMP) for the discharge of saline groundwater in compliance with the Type A Water Licence 2AM-MEL1631 (Licence). Overall water management for the life of the Mine and post-closure is described in the Agnico Eagle Meliadine Gold Mine Water Management Plan, dated March 2017 (6513-MPS-11) (WMP). The WMP provides descriptions of the Mine water control structures and associated design criteria. The WMP will be updated in March 2018 to reflect the groundwater management strategy presented in this document.

1.1 Concordance

The Mine is subject to the land and resource management processes established by the Nunavut Agreement and other Federal laws and regulations. Agnico Eagle submitted a Licence Application for a Mining and Milling Undertaking (Application) required to use water and to deposit waste in development of the Mine, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and Nunavut Water Regulations.

The Licence was issued on April 1, 2016 and signed by the Minister on May 19, 2016. The GWMP reflects the commitments made with respect to submissions provided during the technical review of the Application, as well as final submissions and issues raised during the Public Hearing Process, where applicable, to comply with Part B Section 13, and Part E Section 14 of the Licence.

1.2 Objectives

The objective of the GWMP is to provide consolidated information on groundwater management for the Meliadine Gold Mine. The GWMP is divided into the following components:

- Introductory section (Section 1);
- A brief summary of the physical setting at the mine site and the mine development plan (Section 2);
- A description of groundwater management strategies (Section 3); and
- A description of the groundwater monitoring program (Section 4).

The GWMP will be updated as required to reflect any changes in operations or economic feasibility that occurs, and to incorporate new information and latest technology, where appropriate, to comply with Part B Section 15 of the Licence.

SECTION 2 • BACKGROUND

2.1 Site Conditions

The Mine is located in an area of poorly drained lowlands near the northwest coast of Hudson Bay. The dominant terrain in the Mine area consists of glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and many small lakes. The topography is gently rolling with a mean elevation of 65 metres above sea level (masl) and a maximum relief of 20 metres (m).

The local overburden consists of a thin layer of topsoil overlying silty gravelly sand glacial till. Cobbles and boulders are present throughout the region at various depths. Bedrock at the mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite and mafic volcanic flows (Snowden 2008; Golder 2009).

The climate is extreme in the area, with long cold winters and short cool summers, and mean air temperatures of 12 °C in July and -31 °C in January. The mean annual air temperature at the Mine site is approximately -10.4 °C (Golder 2012a). Strong winds blow from the north and north-northwest direction more than 30 percent of the time.

The mean annual precipitation in the area is approximately 412 mm and is typically equally split between rainfall and snowfall.

Late-winter ice thicknesses on freshwater lakes in the mine site area were recorded from 1998 to 2000. The measured data indicated that ice thickness ranges from 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July (Golder 2012b).

2.2 Local Hydrology

The Mine is located within the Meliadine Lake watershed. Meliadine Lake has a surface water area of approximately 107 square kilometres (km^2), a maximum length of 31 km, features a highly convoluted shoreline of 465 km and has over 200 islands. Unlike most lakes, it has 2 outflows that drain into Hudson Bay through two separate river systems. It has a drainage area of 560 km^2 from its' two outflows. Most drainage occurs via the Meliadine River, which originates at the south west end of the lake. The Meliadine River flows for a total stream distance of 39 km. The Meliadine River flows through a series of waterbodies, until it reaches Little Meliadine Lake and then continues into Hudson Bay. A second, smaller outflow from the west basin of Meliadine Lake drains into Peter Lake, which discharges into Hudson Bay through the Diana River system (a stream distance of 70 km). At its mouth, the Diana River has a drainage area of 1,460 km^2.

Watersheds in the Mine area are comprised of an extensive network of waterbodies, and interconnecting streams. The hydrology of these watersheds is dominated by lake storage and evaporation.

2.3 Hydrogeology

The Mine is located in an area of continuous permafrost. Based on thermal studies and measurements of ground temperatures, the depth of permafrost at the mine site is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to about 3 m adjacent to the lakes. The depth of the permafrost and active layer varies depending on proximity to the lakes, overburden thickness, vegetation, climate conditions, and slope direction (Golder 2012b). The typical permafrost ground temperatures at the depths of zero annual amplitude are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder 2012c).

Groundwater characteristics at the Mine are detailed in Final Environmental Impact Statement (FEIS) Volume 7, Section 7.2 Hydrogeology and Groundwater, and in an updated hydrogeological assessment completed for the Mine (Golder 2016). The groundwater characteristics for the Mine are briefly summarized herein.

Two groundwater flow regimes in areas of continuous permafrost are generally present:

- a deep groundwater flow regime beneath the base of the permafrost; and
- a shallow flow regime located in an active (seasonally thawed) layer near the ground surface.

From late spring to early autumn, when temperatures are above 0 ˚C, the active layer thaws. Within the active layer, the water table is expected to be a subdued replica of topography, and is expected to parallel the topographic surface. Mine area groundwater in the active layer flows to local depressions and ponds that drain to larger lakes.

Taliks exist beneath waterbodies that have sufficient depth such that they do not freeze to the bottom over the winter. Beneath small waterbodies that do not freeze to the bottom over the winter, a talik bulb that is not connected to the deep groundwater flow regime will form (a closed talik). Elongated waterbodies with terraces (where the depth is within the range of winter ice thickness), a central pool(s) (where the depth is greater than the range of winter ice thickness), and a width of 340 to 460 m or greater are expected to have open taliks extending to the deep groundwater flow regime at the Mine site. A review of bathymetric data, ice thickness data, and results of thermal modelling suggests that Meliadine Lake and Lake B7 are likely to have open taliks connected to the deep groundwater flow regime (Golder 2012a).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the underground mine will be operated below the base of the frozen

permafrost (top of the cryopeg). The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the underground mine workings once the mine has advanced below the base of the frozen permafrost.

Both Tiriganiaq Pit 1 and Tiriganiaq Pit 2 will be mined within the frozen permafrost, therefore, groundwater inflows to the open pits is expected to be negligible and were not considered in the WMP.

2.4 Mine Development Plan

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings (Agnico Eagle 2017). The following phased approach is proposed for the development of the Tiriganiaq gold deposit:

- Phase 1: 4 years for Mine Construction. Construction began in 2015 and is estimated to be complete in 2019;
- Phase 2: 8 years for Mine Operations, beginning in 2017 and ending in 2027;
- Phase 3: 3 years Mine Closure, from 2028 to 2030; and
- Phase 4: Post-closure (2031 forwards).

Mine facilities on surface include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility, three waste rock storage facilities, a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a final Effluent Water Treatment Plant (EWTP). The general location and site layout of the Mine are shown in Figure 1 of Appendix A.

SECTION 3 • GROUNDWATER MANAGEMENT STRATEGY

3.1 Groundwater Volumes

In the WMP of the water licence application (Agnico Eagle 2015a) it was stated that supplemental hydrogeological investigations were to be undertaken to provide additional information on potential volumes and quality of the saline groundwater to be managed. These investigations were undertaken in 2015 and 2016 and are summarized in Golder (2016). They included the completion of 24 packer tests, two pumping tests, two injection tests, 11 groundwater samples, and seven surface water samples. The work plan for the field work was developed in consultation with two independent technical advisors, Dr. Shaun K. Frape and Dr. Walter A. Illman (both of the University of Waterloo).

The additional hydraulic conductivity measurements, in combination with the updated Mine geologic model, resulted in a refined interpretation on the variability of hydraulic conductivity between geological formations and data on the storage properties of the bedrock. A summary of predicted groundwater inflows between 2017 and 2032, based on this refined interpretation and updated predictions of groundwater inflow using the developed numerical (Golder 2017), are provided in Table 1.

Table 1: Predicted Groundwater Inflow to Underground Mine (2017 to 2032)

Period	Predicted Groundwater Inflow (m^3/day)
2017	230
2018	300
2019	280
2020	300
2021	340
2022	340
2023-2024	420
2025-2026	380
2027-2028	390
2029-2030	380
2031-2032	360

Source: Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine (Golder 2017).

The groundwater inflow predictions presented in Table 1 do not account for grouting currently being conducted as a mitigation to reduce groundwater inflows to the underground development, or potential losses through the ventilation system. Both mechanisms reduce the actual groundwater

inflows to the Underground Mine relative to that which was predicted. As such, these predicted inflows to the underground development represent unmitigated estimates.

3.2 Existing Groundwater Management Control Structures

Contact water in the Underground Mine is contained within underground sumps. A proportion of the underground water will be recirculated as make-up water for underground drilling. The drilling water will report to the underground sumps for recirculation; however, the need for up to 3% treated water make-up has been assumed to compensate for losses of drilling water due to evaporation or capture within the mined waste rock that is transferred to surface. Calcium chloride is currently not added to the underground water but has been used in the past and potentially again in the future to increase salinity and reduce water freezing during drilling.

Groundwater inflows to the Underground Mine since 2015 have not been discharged to the environment and are being stored underground, in the Saline Pond, in the P-Area, Collection Pond 5 (CP5) or actively evaporated during the open water season (Agnico Eagle 2017). Details of the underground dewatering system are provided in the Mine Plan (Agnico Eagle 2015a) and details of the pond are provided in the WMP (Agnico Eagle 2017).

The pond capacities and maximum water elevation for storage of the saline water are presented in Table 2. The locations of the ponds are shown on Figure 1 of Appendix A. The estimated volume of groundwater inputs to surface storage for management are expected to range from approximately a minimum of 0.11 million cubic metre(s) per year (Mm^3/year) to a maximum of 0.18 Mm^3/year, dependent on year of Mine life (Agnico Eagle 2017).

Table 2: Salt Water Storage Capacity at the Mine for Groundwater and Water Primarily Influenced by Underground Workings

Surface Pond	Capacity (m^3)	Maximum Water Elevation (m)
CP5	46,674	66.0
Saline Pond	32,686	62.9
P1	20,781	68.5
P2	6,828	66.5
P3	18,432	67.0

Source: Agnico Eagle (2017).

3.3 Groundwater Quality

Groundwater investigations undertaken indicate that total dissolved solids (TDS) concentrations are relatively consistent below the permafrost at approximately 64,000 mg/L (Golder 2016). Recent groundwater quality data from the Underground Mine collected by Agnico Eagle in 2016 and 2017 from diamond drillholes (DDHs), indicates mostly stable concentrations for several parameters

(Table 3) and suggest that TDS concentrations may be less at approximately 50,000 to 55,000 mg/L, on average, and the assumption of TDS at 64,000 mg/L may represent a more conservative estimate. It should also be noted that mining operations include drill-and-blast excavation for the development of the Underground Mine, which results in certain parameters in groundwater to be influenced by explosives (particularly ammonia and nitrate due to ammonium nitrate, fuel oil [ANFO] and emulsion explosives).

Table 3: Average Underground Saline Water Quality

Representative Months (average per month)		Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017
Parameters (total metal)	**Units**														
pH	pH	7.09	7.09	7.34	7.99	7.17	7.08	6.87	7.11	7.32	7.38	7.27	8.27	7.45	7.33
Alkalinity	mg/L	65	69	56	72.6	64	57	61.7	51	64.5	68	68	75	68.2	64
Conductivity	µmhos/cm	53320	70323	77750	79800	56000	77000	76500	77000	79000	79000	76308	74385	72200	72667
Total Hardness (as $CaCO_3$)	mg/L	14923	14644	13125	13260	13700	13200	18267	12700	18400	12433	12623	12500	12583	11700
Turbidity	NTU	82.85	93.00	56.25	27.56	74.00	123.75	69.00	88.00	90.00	51.00	75.00	61.00	47.02	104.33
Total Dissolved Solids (TDS)	mg/L	39663	50765	58600	60600	55000	54350	66433	54900	57500	57300	55123	57815	57520	54567
Total Suspended Solids (TSS)	mg/L	41	68.5	61	108.6	29	45	75.7	63	248.5	102.7	102.2	156	86	102
Aluminum (Al)	mg/L	0.56	8.72	0.075	0.32	0.06	0.21	0.10	6.02	1.29	0.51	1.45	0.73	0.97	1.75
Ammonia Nitrogen (NH_3-NH_4)	mg/L	4.66	4.20	5.93	5.98	3.50	4.13	105.3	4.50	4.95	5.20	5.51	11.1	4.87	4.43
Arsenic (As)	mg/L	0.0012	0.32	0.005	0.005	0.002	0.003	0.005	0.01	0.008	0.004	0.016	0.016	0.102	0.013
Barium (Ba)	mg/L	0.05	0.19	0.09	0.10	0.05	0.06	0.61	0.10	0.27	0.07	0.09	0.25	0.10	0.07
Beryllium (Be)	mg/L	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.01	0.002	0.002	0.005	0.008	0.01	0.01
Boron (B)	mg/L	1.4	1.7	1.5	1.5	1.8	1.6	4.98	5.0	4.9	1.5	2.7	3.97	5.0	2.5
Total Organic Carbon (TOC)	mg/L	4.95	2.65	3.68	4.28	2.00	2.23	11.67	2.10	2.95	2.63	3.20	5.30	2.57	2.50
Dissolved Organic Carbon	mg/L	2.60	2.35	3.45	3.74	1.90	1.90	10.17	1.70	2.30	2.37	2.70	4.90	2.32	2.10
Calcium (Ca)	mg/L	1899	1955	1965	1816	1800	1710	3777	1650	3737	1593	1608	1771	1610	1565
Cadmium (Cd)	mg/L	0.00002	0.0002	0.0002	0.0013	0.0002	0.0003	0.0002	0.001	0.0003	0.0002	0.0005	0.001	0.001	0.002
Chloride (Cl - dissolved)	mg/L	—	33500	31000	32800	34000	31250	38000	31000	31500	32000	31385	31538	32800	29333
Chromium (Cr)	mg/L	0.01	0.015	0.018	0.014	0.02	0.025	0.017	0.01	0.02	0.017	0.05	0.075	0.1	0.88
Copper (Cu)	mg/L	0.26	0.44	0.009	0.009	0.01	0.01	0.008	0.05	0.01	0.01	0.02	0.04	0.05	0.03
Cyanide (CN)	mg/L	0.005	0.006	0.008	0.017	0.005	0.005	0.19	0.005	0.028	0.005	0.006	0.01	0.005	0.008
Iron (Fe)	mg/L	9.68	40.28	6.48	5.23	4.31	4.76	8.96	3.60	8.78	6.19	9.81	6.33	8.24	4.10
Lead (Pb)	mg/L	0.002	0.002	0.004	0.005	0.004	0.005	0.005	0.02	0.004	0.003	0.009	0.015	0.02	0.018
Magnesium (Mg)	mg/L	2475	2170	2053	2118	2230	2168	2150	2080	2200	2050	2092	1962	2105	1975
Mercury (Hg)	mg/L	0.0002	0.01	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.000001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)	mg/L	0.01	0.015	0.04	0.013	0.02	0.025	0.055	0.01	0.25	0.026	0.047	0.075	0.1	0.17
Nickel (Ni)	mg/L	0.05	0.04	0.02	0.01	0.02	0.025	0.04	0.1	0.07	0.017	0.05	0.08	0.1	0.35
Nitrate (NO_3) as N	mg/L	0.15	0.168	0.88	0.57	0.1	0.5	116.39	0.1	2.58	0.23	0.89	4.35	0.17	0.34
Nitrite (NO_2) as N	mg/L	0.02	0.04	0.089	0.072	0.05	0.05	8.01	0.1	0.125	0.086	0.14	0.391	0.042	0.027
Total Kjeldahl Nitrogen (TKN)	mg/L	4.49	3.65	6.95	7.58	5.90	3.78	112.47	4.60	5.20	7.83	7.40	12.0	72.02	4.50
Phosphorous (P)	mg/L	0.05	0.14	0.05	0.05	0.04	0.07	0.14	0.04	0.13	0.12	0.08	0.09	0.1	—
Potassium (K)	mg/L	512	504.5	460.5	493.6	454	496	595	407	609	433	463	518	488	763
Radium-226 (Ra 226)	mg/L	—	—	—	1.9	1.7	0.49	0.33	0.3	1.2	1.95	1.8	1.9	2.2	0.29
Selenium (Se)	mg/L	0.23	0.006	0.0018	0.0033	0.002	0.003	0.002	0.01	0.002	0.002	0.005	0.0075	0.01	0.007
Silver (Ag)	mg/L	0.002	0.003	0.0004	0.0005	0.0004	0.001	0.0003	0.002	0.0009	0.0004	0.0012	0.0018	0.0002	0.018
Sodium (Na)	mg/L	16379	16000	14100	14600	15100	14625	14700	13400	15400	13900	14369	14654	14417	9433
Strontium (Sr)	mg/L	39.8	39.4	44.7	40.9	40.1	43.1	171	38.4	136	40	39	43.5	36.5	23.6
Sulphate (SO_4 – dissolved)	mg/L	—	3350	3125	3260	3200	3125	2700	3100	3100	3233	3169	2969	3120	3067
Thallium (Tl)	mg/L	0.0009	0.0008	0.0009	0.0006	0.001	0.001	0.001	0.001	0.0002	0.0002	0.0005	0.001	0.001	0.002
Uranium (U)	mg/L	0.002	0.003	0.002	0.002	0.002	0.003	0.002	0.01	0.006	0.002	0.005	0.008	0.01	0.09
Vanadium (V)	mg/L	0.05	0.08	0.09	0.06	0.1	0.13	0.08	0.5	0.1	0.08	0.23	0.38	0.5	0.33
Zinc (Zn)	mg/L	0.06	0.08	0.36	0.1	0.1	0.125	0.1	0.5	0.12	0.08	0.23	0.38	0.5	0.34

Source: Groundwater quality data from DDH sample location (Agnico Eagle, October 2017)

3.4 Groundwater Management Strategy and Associated Control Structures

Based on the Type A Water Licence 2AM-MEL1631 Terms and Conditions, Part E: Conditions Applying to Water Use and Management, No. 14, Agnico Eagle has reviewed the Mine alternatives to apply to the GWMP. Condition No. 14 specifically states:

> *"The Licensee shall submit a Groundwater Management Plan to the Board for approval in writing, at least six (6) months prior to the discharge of any Groundwater. The Plan shall take into consideration all comments raised and commitments made with respect to submissions received during the technical review of the Application as well as final submissions and issues raised during the Public Hearing Process, where applicable."*

Groundwater management alternatives were considered for the Mine based on the potential range of groundwater flows and quality that could be generated (refer to Appendix F of the WMP; Agnico Eagle 2015a). The option selection has been driven by the expected quality and quantity of the water.

Based on the groundwater inflow volume, the following options were considered and form part of the short and long term management of groundwater inflows to the Underground Mine:

- Short-term Strategy: treat saline groundwater and store/use the brine from the treatment process on-site (Section 3.4.1)
- Current Long-term Strategy: treated discharge to receiving environment in Meliadine Lake in combination with treated surface contact water (Section 3.4.2)
- Potential Future Long-term Strategy: ocean disposal (see Section 3.4.3)

The short and long-term groundwater management strategies are described below. At this time, Agnico Eagle is requesting approval from the NWB for the short-term strategy and the current long-term strategy to discharge to Meliadine Lake. The potential future long-term strategy of ocean disposal is still under assessment and provided for information purposes.

3.4.1 Short-Term Management Strategy - Treat and Store/Use Groundwater On-site

This alternative was considered as part of the Type A Water Licence Application and is currently being implemented on-Site as part of the short-term management of groundwater inflow. It involves storing all excess groundwater in underground sumps and in surface water ponds at the Mine. As outlined in the WMP (Agnico Eagle 2017), a total of nine water containment ponds are planned on-site at the Mine surface (CP1, CP3, CP4, CP5 and CP6, the P-Area [P1, P2, and P3], and the Saline Pond), and associated water retention dykes, water diversion berms, channels, and culverts, to manage surface water and underground water (Figure 1).

Evaporators have been in-use on site since mid-2017 at P1 to reduce groundwater volumes stored in surface water ponds. A single evaporator is estimated to remove approximately 500 m^3/day when operated for 24 hours with ideal wind and relative humidity conditions. While evaporators have

been used with some success, the combined volumes of groundwater with anticipated surface water volumes influenced by underground waste rock to be managed is greater than the available long-term storage at the Mine, and therefore, discharge to environment is required.

These short-term storage and treatment options are being implemented at the Mine pending regulatory approvals for the long-term groundwater management option.

3.4.2 Current Long-Term Management Strategy - Treated Groundwater Discharge to Meliadine Lake

Effluent discharge to Meliadine Lake was assessed as part of the FEIS and modelled as part of the Water Licence Application (Agnico Eagle 2014, 2015a) and discharge criteria have been defined in the Licence. Provided the discharge criteria can be met following commissioning of the treatment system, this option represents the immediate long-term management strategy to be implemented at the Site in 2018. Approval of this plan will be required, prior to discharge, as per the Term and Condition Part E, No. 14 of the Licence. Total discharge to Meliadine Lake, including the treated groundwater, will remain within the permitted daily volume and meet the discharge criteria defined in the Licence.

Hatch (2013) investigated groundwater treatment options for the site and concluded that a combination chemical reverse osmosis (RO) and mechanical vapour compression evaporator plant would be the most efficient method of treating excess groundwater for discharge. Agnico Eagle has also undertaken a pilot test of a SaltMaker combined with a Chemical-RO post-treatment system and based on the results of this testing decided to proceed with this technology.

The groundwater will flow through a Saltwater Treatment Plant (SWTP), comprised of a set of SaltMakers, and will be treated to remove excessive total suspended solids (TSS), calcium chloride ($CaCl_2$), sodium chloride (NaCl), metals, phosphorous (P), and nitrogen compounds. The salt generated by the water treatment unit will be stored at the Mine, where it will be re-used for underground operations and/or disposed of at an appropriate disposal location. Given the predicted groundwater volumes, a maximum of three SaltMakers are proposed to be built at the Mine, forming the SWTP, to treat the groundwater for discharge to the environment. Two SaltMaker's have been procured and are anticipated to be in operation between Q3 2018 and Q1 2019. Additional SaltMakers could be built at the Mine to meet the discharge volumes required. This need will be evaluated based on the effectiveness of the short-term management strategies and observed operational capacities of the SaltMakers, which are anticipated to be 120 m^3/day. The saline effluent temperature from the SWTP is expected to be approximately 35 °C, with an approximate pH of 7.5 (Saltworks 2017). The SWTP effluent largely meets the required Water Quality Output requirements defined in Agnico Eagle's Desalination Water Treatment Plan Design Criteria and passes completed toxicity tests (Saltworks 2017). Treated effluent quality (of the groundwater) through the SWTP indicates that TDS concentrations would be approximately 158 mg/L (condensed water after treatment; Saltworks 2017).

Post-treatment options, such as the RO post-treatment system, are being considered if required, to meet applicable effluent quality criteria for Meliadine Lake. The permeate resultant from the Chemical-RO post-treatment system meets all the required Site Specific Water Quality Objectives (SSWQO) and passes completed toxicity tests. Saline effluent quality after secondary treatment through the SWTP indicates that TDS concentration would be considerably reduced, at approximately 55 mg/L after RO post-treatment (Saltworks 2017). Pilot testing of the SaltMaker condensed water and RO permeate quality results are presented in the SaltMaker Pilot Final Report document (Saltworks 2017). The results indicate that values will meet SSWQO for water management, which also comply with MMER.

3.4.3 Potential Future Long-Term Management Strategy - Treated Groundwater Discharge to Melvin Bay at Itivia Harbour

Based on the potential volumes of groundwater, it is anticipated that a second discharge location will be required for long-term groundwater management. Agnico Eagle is proposing to treat groundwater and discharge it as saline effluent to the ocean, either as a direct discharge and/or after temporary on-site storage in one or more of the water containment ponds at the Mine. Ocean discharge is currently not permitted and requires appropriate regulatory licenses and approvals, which are currently being assessed and applications prepared. An updated GWMP will be submitted if appropriate licenses and approvals are obtained prior to discharge.

For the ocean discharge option, the saline effluent would be trucked from the Mine and discharged in Melvin Bay at Itivia Harbour. The discharge facility will include an unheated saline water storage tank at the Itivia Fuel Storage Facility and a pipeline extending to an engineered diffuser located in Melvin Bay during the open water season from 2019 to 2035. The saline effluent will be discharged in a controlled manner through the diffuser in compliance with the required discharge criteria to allow for maximum dilution and minimum environmental impact to the marine environment. Saline effluent quality will be required to meet the Canadian federal end-of-pipe discharge criteria (Metal Mining Effluent Regulations – or MMER), including the amended MMER (GC 2017; anticipated to come into effect in 2018), and Canadian Surface Water Quality Guidelines (Canadian Council of Ministers of the Environment Guidelines for the Protection of Aquatic Life [CCME 2003]) or Site-Specific Water Quality Objectives at the edge of the mixing zone for the diffuser discharge into Melvin Bay. It is recognized that further discussions are required with relevant stakeholders to confirm that this approach meets the amended MMER (GC 2017).

3.5 Discharge Schedule

Table 4 outlines the timeline for key activities on the Mine related to the management of saline groundwater, including tasks and facilities for the current short-term and long-term management strategies for discharge to Meliadine Lake (Section 3.4.1 and 3.4.2). A detailed Mine schedule for the overall Mine Water Management (e.g., building of culverts, berms and containment ponds) are presented in the 2017 WMP, which will be updated in March 2018.

Table 4: High Level Mine Schedule

Activity	Timeline	Notes
On-site water storage	Ongoing	—
Groundwater Management Plan (Current Document)	Six months prior to discharge	Type A Water Licence 2AM-MEL1631 requirement
Commissioning of Salt Water Treatment Plants (SaltMaker #1 and #2)	Q3-2018 to Q1-2019	—
Earliest first Discharge of treated saline groundwater to Meliadine Lake	Q3-2018	
Commissioning of additional SaltMaker unit(s) if required	2019	—
Active Discharge to Meliadine lake	Annually May thru October to 2032	—
Operation of Salt Water Treatment Plant	24 h a day / 7 days a week, May thru Oct	In-service as required
Inactive Discharge	Annually November thru April to 2032	Water will be stored underground and in surface containment ponds during the winter
Final Saline Effluent Discharge to Meliadine Lake	End of Mine life 2032	—

Source: Agnico Eagle (2017).

SECTION 4 • GROUNDWATER MONITORING PROGRAM

4.1 Water Quality and Quantity Monitoring

Water quality monitoring is an important part of the Mine water management to verify the predicted water quality and quantity trends and conduct adaptive management should differing trends be observed. Water quality and quantity monitoring has been initiated and will continue during construction, operations, closure and post-closure. Monitoring will occur at three levels:

- Regulated discharge monitoring that occurs at monitoring points specified in the Licence or regulations.
- Verification monitoring that is carried out for operational and water management purposes by Agnico Eagle. This monitoring data will not be reported to the Regulators in the Annual Water License Report, but can be provided upon request by the Regulators.
- General monitoring that is included in the Licence requirements and is subject to compliance assessment to confirm sampling was carried out using established protocols, including quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring will be used at the Mine. The WMP presents the conceptual water quality monitoring plan during construction, operations and closures and more detailed information on monitoring programs and is described in the Environment Management and Protection Plan (EMPP) (Agnico Eagle 2015b).

The groundwater quality monitoring plan, which will be further defined as the Mine advances and will be conducted in agreement with the WMP for the Mine (Agnico Eagle 2017). Required monitoring and frequency for pre- and post- treatment (i.e., monitoring above ground) is presented in the WMP (Agnico Eagle 2017).

4.2 Water Quantity

The volume of groundwater inflow being collected and transferred to surface water management systems with be measured using a flow meter installed at the Portal Water Sump Stope L75 surface water pond. This data will be supplemented by periodic seepage surveys which will record visually observed groundwater inflows in the Underground Mine.

Measured groundwater inflow rates will be compared to model predictions on an annual basis. If significant variations from model predictions are observed, the assumptions behind the analysis will be reviewed and the analysis updated if required. In addition, updates to the groundwater model may be required based on operational changes as the Underground Mine advances.

If the measured groundwater quantity represents a significant difference from the model predictions, a re-calibration of the model will be considered. If model re-calibration is deemed necessary, future groundwater inflow quantity would be predicted using this re-calibrated model and results considered as part of the adaptive management of the groundwater quantity contribution to the WMP.

4.3 Water Quality

Groundwater quality will be monitored opportunistically from DDHs to assess and verify the quality of groundwater flowing into the Underground Mine. Water samples will be analyzed for the following parameters: conductivity, TDS, pH, temperature, major anions, radium 226, dissolved and total metals and toxicity testing.

To understand and plan for treatment requirements at surface, water accumulating in sumps underground will also be sampled on a monthly basis at the Sump 125, which is the main collection sump prior to recirculation for underground use. Sump water samples will be analyzed for the following parameters: conductivity, TDS, pH, temperature, oil and grease, major anions, radium 226, dissolved and total metals, nitrate and nitrite, volatile organic compounds (i.e., benzene, xylene, ethylene, and toluene).

Water quality results are compared to MMER and SSWQO guidelines and will be compliant prior to discharging to Meliadine Lake.

SECTION 5 • QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality. Specific QA and QC procedures that will be followed during sampling performed for the Groundwater Monitoring Program are described in Section 5.1 and 5.2.

5.1 Quality Assurance

Quality assurance protocols will be diligently followed so data are of known, acceptable, and defensible quality. There are three areas of internal and external management, which are described in the following three sections.

5.1.1 Field Staff Training and Operations

To make certain that field data collected are of known, acceptable, and defensible quality, field staff will be trained to be proficient in standardized field groundwater sampling procedures, data recording, and equipment operations applicable to the Groundwater Monitoring Program. All field work will be completed according to specified instructions and established technical procedures for standard sample collection, preservation, handling, storage, and shipping protocols.

5.1.2 Laboratory

To make sure that high quality data are generated, accredited laboratories that will be selected for sample analysis. Accreditation programs are utilised by the laboratories so that performance evaluation assessments are conducted routinely for laboratory procedures, methods, and internal quality control.

5.1.3 Office Operations

A data management system will be utilized so that an organized consistent system of data control, data analysis, and filing will be applied to the Groundwater Monitoring Program. Relevant elements will include, but are not limited to the following:

- all required samples are collected;
- chain-of-custody and analytical request forms are completed and correct;
- proper labelling and documentation procedures are followed, and samples will be delivered to the appropriate locations in a timely manner;
- laboratory data will be promptly reviewed once they are received to validate data quality;
- sample data entered into a Mine-specific groundwater quality database will be compared to final laboratory reports to confirm data accuracy; and

- appropriate logic checks will be completed to ensure the accuracy of the calculations.

5.2 Quality Control

The QC component will consist of applicable field and sample handling procedures, and the preparation and submission of two types of QC samples to the various laboratories involved in the program. The QC samples include blanks (e.g., travel, field, equipment) and duplicate/split samples.

Sample bottle preparation, field measurement and sampling handling QC procedures include the following:

- Sample bottles will be kept in a clean environment, capped at all times, and stored in clean shipping containers. Samplers will keep their hands clean, wear gloves, and refrain from eating or smoking while sampling.
- Where sampling equipment must be reused at multiple sampling locations, sampling equipment will be cleaned appropriately between locations.
- Temperature, pH, and specific conductivity will be measured in the field using hand held meters.
- Samples will be cooled to between 4 °C and 10˚C as soon as possible after collection. Care will be taken in when packaging samples for transport to the laboratory to maintain the appropriate temperature (between 4°C and 10˚C) and minimize the possibility of rupture. Where appropriate, samples will be treated with preservatives to minimize physical, chemical, biological processes that may alter the chemistry of the sample between sample collection and analysis.
- Samples will be shipped to the laboratory as soon as reasonably possible to minimize sample hold times. If for any reason, samples do not reach the laboratory within the maximum sample hold time for individual parameters, the results of the specific parameters will be qualified, or the samples will not be analysed for the specific parameters.
- Chain of custody sample submission forms will be completed by field sampling staff and will be submitted with the samples to the laboratory.
- Only staff with the appropriate training in the applicable sampling techniques will conduct water sampling.

Quality control procedures implemented will consist of the preparation and submission of QA/QC samples, such as field blanks, trip blanks, and duplicate water samples. These are defined as follows:

- Field Blank: A sample will be prepared in the field using laboratory-provided deionized water to fill a set of sample containers, which will then be submitted to the laboratory for the same analysis as the field water samples. Field blanks will be used to detect potential sample contamination during collection, shipping and analysis.

- Travel Blank: A sample will be prepared and preserved at the analytical laboratory prior to the sampling trip using laboratory-provided deionized water. The sample will remain unopened throughout the duration of the sampling trip. Travel blanks will be used to detect potential sample contamination during transport and storage.
- Duplicate Sample: Two samples will be collected from a sampling location using identical sampling procedures. They will be labelled, preserved individually and submitted for identical analyses. Duplicate samples will be used to assess variability in water quality at the sampling site. Duplicate will be collected and submitted for analyses at approximately, 10% of sampling locations. For smaller batches of samples (less than 10), at least one duplicate will be collected and submitted for analysis.

Additional QA/QC procedures that will be applied to the seepage survey component of the Groundwater Monitoring Program will include:

- Location – Universal Transverse Mercator (UTM) coordinates of seepage will be defined through the use of a hand-held Global Positioning System (GPS) unit.
- Sample Labels – appropriate sample nomenclature will be assigned to the sample labels that will define sample locations, sample type, year, and designation (numerical from 01 sequentially upwards) (e.g., SEEP-13-01 for seepage; 5034PIT-13-02 for pit sump).

REFERENCES

Agnico Eagle. 2014. Final Environmental Impact Statement (FEIS) - Meliadine Gold Project, Nunavut from: ftp://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/11MN034-Agnico Eagle%20MELIADINE/2-REVIEW/09-FINAL%20EIS/FEIS Accessed on November, 2014.

Agnico Eagle. 2015a. Meliadine Gold Project, Type A Water Licence. Water Management Plan. Version 1. Submitted to the Nunavut Water Board. April 2015.

Agnico Eagle. 2015b. Meliadine Gold Project: Environmental Management and Protection Plan (EMPP). Version 4. 6513-MPS-07. April 2015.

Agnico Eagle. 2017. Meliadine Gold Project Water Management Plan. Version 3. 6513-MPS-11. March 2017.

CCME (Canadian Council of Ministers of the Environment). 2003. Canadian Environmental Quality Guidelines – Water Quality Guidelines for the Protection of Aquatic Life.

Golder (Golder Associated Ltd.). 2009. Assess of completeness of geotechnical data for feasibility design Tiriganiaq open pit. Submitted to Comaplex Minerals Corp., 26 May 2009, Doc. 008 Rev. 0

Golder. 2012a. SD 7-2 Aquatic Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 19, 2012.

Golder. 2012b. SD 6-1 Permafrost Thermal Regime Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 25, 2012.

Golder. 2012c. Tailings Storage Facility Preliminary Design – Meliadine Gold Project, Nunavut. A Draft Report Submitted to Agnico Eagle Mines Ltd. by Golder, August 16, 2012.INAC, 1992. Guidelines for ARD Prediction in the North. Department of Indian Affairs and Northern Development, Northern Mine Environment Neutral Drainage Studies No.1, Prepared by Steffen, Robertson and Kirsten (B.C.) Inc.

Golder. 2016. Hydrogeological Assessment in Support of the Underground Mine Development at Tiriganiaq, March 21, 2016.

Golder. 2017. Updated Predictions of groundwater Inflow to Tiriganiaq Underground Mine – V5 Mine Plan, December 18, 2017.

GC (Government of Canada). 2017. Regulations Amending the Metal Mining Effluent Regulations (MMER). Canada Gazette Part I, Vol 151, No. 19. May 2017

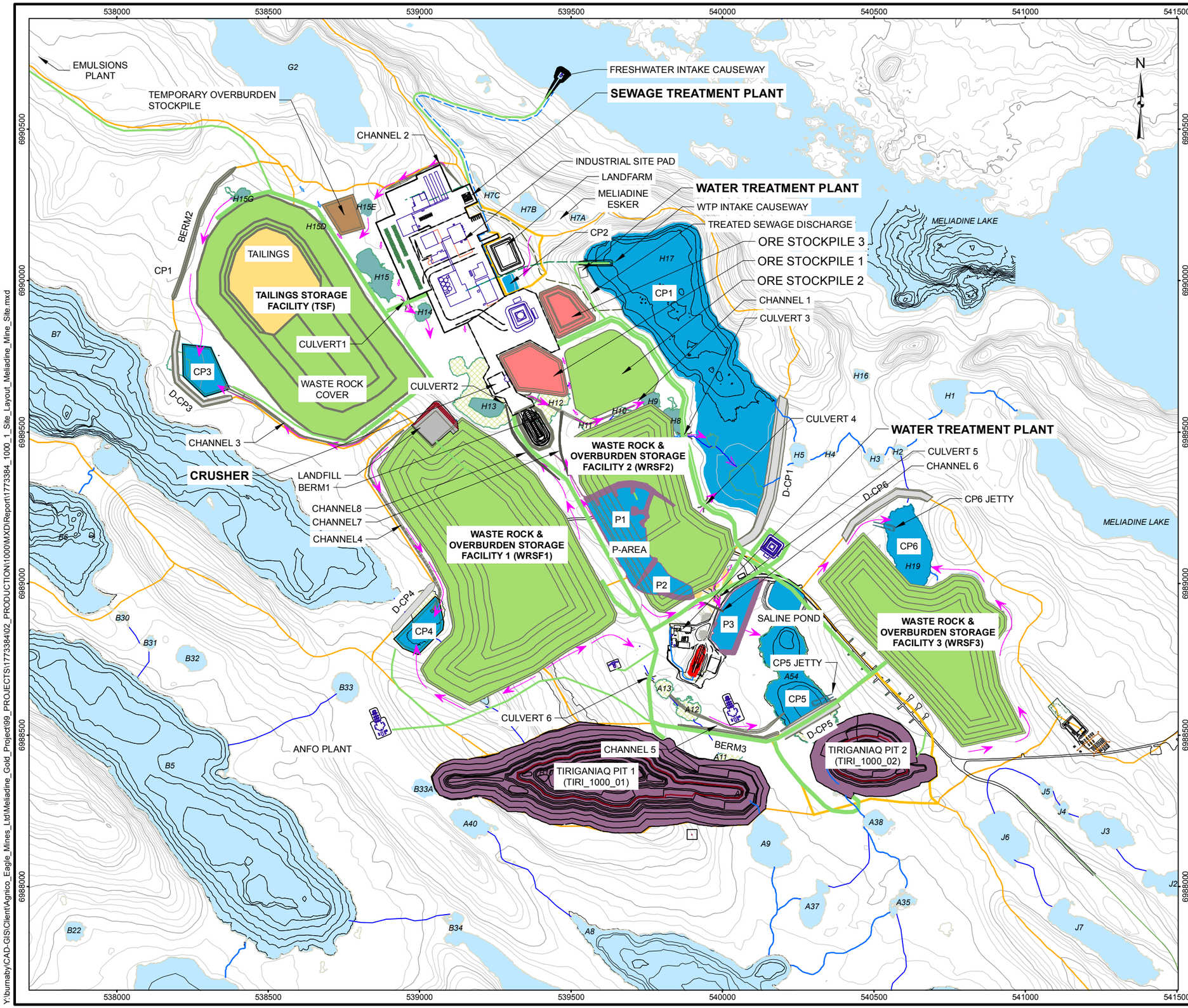
Hatch. 2013. Agnico Eagle Mines Ltd. - Meliadine Desalination Study - Salt Water Treatment Plant Report. Report No. H350003-000-05-124-002/6505-SSR-01_R82, Rev 2. September 30, 2013.

NWB (Nunavut Water Board). 2016. Type A Water Licence No. 2AM-MEL1631.

Snowden. 2008. Tiriganiaq gold deposit, Nunavut – resource update. Submitted to Comaplex Minerals Corp. January 2008.

APPENDIX A • FIGURES

Figure 1 General Mine Site Location Plan



LEGEND

- SERVICE ROAD
- HAUL ROAD
- CATCHMENT BOUNDARY
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

REFERENCE

BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
DATUM: NAD 83 PROJECTION: UTM ZONE 15

250 0 250
METRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
SITE LAYOUT
MELIADINE MINE SITE

Golder Associates

PROJECT NO.		1773384	FILE No.	
DESIGN	CLT	8 Dec. 2017	SCALE AS SHOWN	REV. 0
GIS	CDB	8 Dec. 2017		
CHECK	JR	8 Dec. 2017		
REVIEW	LY	8 Dec. 2017		

FIGURE: 1

Y:\burnaby\CAD-GIS\Client\Agnico_Eagle_Mines_Ltd\Meliadine_Gold_Project\99_PROJECTS\1773384\02_PRODUCTION\1000\MXD\Report\1773384_1000_1_Site_Layout_Meliadine_Mine_Site.mxd

AGNICO EAGLE

MELIADINE GOLD PROJECT

Hazardous Materials Management Plan

MARCH 2018
VERSION 56513-MPS-12

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ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐱᔪᐅᔭᕌᖓᑕ ᐱᓕᕆᕝᕕᐅᔪᒥᑦ, ᒪᓕᒐᕈᖕᖏᓐᓂᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ. ᑲᓇᑕᒥᑦ *ᐱᓕᕆᕝᕕᖕᒥᑦ ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓄᑦ ᑐᑭᓯᐅᒪᔾᔪᑎᓄᑦ ᐋᖅᑭᐅᒪᔪᖅ* ᐊᑎᓕᖅᑐᐃᑎᐊᖃᑦᑕᕐᑯᔨᔪᖅ ᐱᕐᔪᑎᓂᒃ, ᒪᓂᒪᓂᖓᓂᒃ ᐱᕐᔪᑎᒋᔭᐅᔪᖅ ᑕᑕᑎᕆᐊᓕᖕᒥᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐊᑦᑕᕐᓇᖅᑐᖃᕐᓂᖏᓐᓂᕐᒧᑦ ᓈᓴᐅᑎᓄᑦ/ᑎᑎᖅᑲᓄᑦ ᐊᓕᓚᔪᕐᒧᑦ (MSDS)-ᖑᓂᖁᖅᑕᐅᔪᕐᒧᑦ, ᐊᒻᒪᓗ ᐱᓕᕆᔾᔨᐅᔪᑦ ᐊᔪᕈᓐᓂᖅᓴᖅᑕᐅᓯᒪᓂᖏᓐᓄᑦ ᖃᓄᖅ ᐃᓕᑕᖅᓯᓂᕐᒧᑦ ᐊᒻᒪᓗ ᑲᒪᔭᖃᕆᐊᖃᕐᓂᐅᔪᓂᒃ ᐅᓗᕆᐊᓇᖅᑐᓂᒃ. ᐊᓪᓃᑯᒃᑯᑦ ᒪᓕᒃᑕᐅᔭᕆᐊᖃᖅᑐᓕᐅᕐᓂᐊᖅᑐᑦ ᐱᓂᐊᕐᓗᑎᒃ MSDS-ᒥᒃ ᓄᑖᓄᑦ ᐱᕐᔪᑎᓄᑦ ᐊᔾᔨᖅᑐᖅᑕᐅᔪᓄᑦ, ᑲᒪᒋᓗᒍ ᒫᓐᓇᐅᔪᖅ MSDS (ᓰᕐᓗ, ᐱᖓᓱᑦ ᐅᑭᐅᑦ ᐅᖓᑖᓄᑦ ᓄᑕᐅᙱᑎᒋᔪᖅᑕᖅᙱᓪᓗᓂ), ᐊᒻᒪᓗ ᒪᓂᒪᑎᓪᓗᒋᑦ ᐱᓕᕆᔾᔪᑖᓄᑦ. ᐱᐅᖏᑦᑐᑦ ᓇᒧᙵᐅᖃᑦᑕᕐᓂᖏᓐᓄᑦ ᖃᐅᔨᒪᔭᐅᓂᐊᕐᓂᖏᓐᓄᑦ ᐋᖅᑭᐅᒪᔪᕐᒥᑦ ᓴᖅᑭᑎᓂᐊᕐᒥᔪᑦ.

ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓗᒃᑖᑦ ᑐᖅᑯᖅᑕᐅᓯᒪᓂᐊᖅᑐᑦ ᒥᐊᓂᖅᓯᓂᖅᑐᒥᑦ ᐱᓕᕆᐊᖑᖁᓇᒋᑦ, ᐊᒻᒪᓗ ᐱᑎᑕᐅᔾᔭᙱᑦᑐᓄᑦ ᐱᓕᕆᔨᓄᑦ ᐱᔪᖁᓇᒋᑦ. ᐃᑲᔪᕐᓗᒍ ᐳᔪᕐᓗᒃᑕᖅᑕᐃᓕᑎᑦᑎᓂᖅ, ᐊᓪᓃᑯᒃᑯᑦ ᓴᖅᑭᑦᑎᓂᐊᖅᑐᑦ ᒪᓕᒃᑕᐅᔫᓴᓂᒃ ᖃᐅᔨᓴᐃᖃᑦᑕᕐᓂᕐᒧᑦ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᖕᓂᑦ ᐊᒻᒪᓗ ᐃᓗᕐᔪᐊᕆᔭᐅᔪᓂᒃ. ᐋᖅᑭᐅᒪᙱᑦᑐᒥᒃ ᖃᐅᔨᔭᐅᔪᖃᖅᐸᑦ, ᐋᖅᑭᒋᐊᖅᓯᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᑎᑎᕋᐅᓯᐅᓗᑎᒃ.

ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐊᒃᑕᑰᖑᖅᑐᑦ ᑐᖅᑯᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓂᑦ ᐃᒋᑕᐅᓗᑎᒃ ᒪᓕᒡᓗᒋᑦ ᑕᒪᒃᑯᓄᙵ ᓕᕙᒪᒃᑯᑦ ᒪᓕᒐᖏᓐᓂᒃ ᐊᒻᒪᓗ ᒪᓕᒃᑕᐅᔭᕆᐊᖃᖅᑐᓂᑦ. ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᖃᐅᔨᒋᐊᖃᑦᑕᖅᑐᑦ ᐊᐅᓚᓂᖏᓐᓂᒃ ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᒃᑕᑰᖅᑕᐅᔪᑦ, ᔭᓄᐊᕆᒥᙶᖅᓱᑎᒃ ᑭᖑᓪᓕᖅᐸᒃᑯᑦ ᐃᒋᑕᐅᓂᖏᓐᓄᑦ, ᐊᑐᖅᓱᑎᒃ ᓇᒧᙵᐅᓂᖏᓐᓄᑦ ᖃᐅᔨᒪᔭᐅᓂᕐᒧᑦ ᑎᑎᖅᑲᒥᒃ ᑕᐃᔭᐅᔪᖅ ᐊᒃᑕᑰᖅᑕᐅᔪᓕᕆᔾᔪᑎ. ᑕᐃᒪᓐᓇᒧᑦ, ᐊᒃᑕᑰᖅᑕᐅᔪᓕᕆᔾᔪᑎ ᐃᓚᐅᖃᑦᑕᕐᓂᐊᖅᑐᖅ ᓅᓐᓂᕆᔭᖏᑦᑕ ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᒃᑕᑰᖅᑕᐅᔪᑦ ᑖᐸᓯᒧᙵ ᐱᓕᕆᐊᕐᒧᑦ.

ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᒃᑕᑰᖅᑕᐅᔪᑦ ᐃᑎᕙᐊᓂ ᑐᓚᒃᑕᕝᕕᖏᑦ ᑲᖏᖅᖠᓂᖏᑦ ᐊᐅᓚᑕᐅᓂᐊᖅᑐᖅ ᒪᓕᒡᓗᒋᑦ ᒪᓕᒐᕈᓐᓂᑦ ᑕᒪᒃᑯᓄᙵ. ᑐᑭᓯᐅᒪᔾᔪᑎᒃᑲᓐᓃᑦ ᐱᔪᐊᕐᓇᖅᑐᑦ ᐊᐅᓚᖅᑎᑦᑎᖃᑦᑕᕐᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᕐᒥᒃ ᐸᕐᓇᐅᑎᒥᑦ (ᐊᓃᓐᑯ 2018) ᐱᔾᔪᑎᖃᖅᑐᑦ ᐊᒃᑕᑰᑎᖏᓐᓂᒃ ᐅᒥᐊᕐᔪᑦ. ᐅᒃᑯᐊᖅᓯᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐅᑎᖅᑎᑎᕆᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓯᕗᓪᓕᖅᐸᐅᔪᖅ ᑐᓂᓯᔪᖅ ᑐᑭᓯᐅᒪᔾᔪᑎᒃᑲᓂᕐᓂᒃ ᐱᔾᔪᑎᖃᖅᑐᓂᒃ ᐊᑐᖅᑕᐅᓯᒪᙱᑦᑐᓂᒃ ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᑐᖅᑕᐅᔪᓂᒃ ᐱᐊᓂᒃᑎᓪᓗᒍ ᐱᓕᕆᐊᕐᒥᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᑦ.

ᐱᔾᔪᑎᒋᐸᓗᒋᑦ ᐃᖏᕐᕋᔭᖕᓂᕐᒧᑦ ᑭᓪᓕᖅᑲᕐᓂᐅᔪᑦ, ᐅᑭᐅᓗᒃᑖᕐᒧᑦ ᐅᖅᓱᐅᓗᒋᔭᐅᓂᐊᖅᑐᖅ ᐊᓯᖅᑕᐅᓂᐊᖅᑐᖅ ᑐᖅᑯᖅᑕᐅᓗᓂᓗ ᐊᑐᖅᑕᐅᓂᐊᕐᓗᓂ ᐱᓕᕆᐊᖅ ᐊᐅᖀᕐᓂᕈᔾᔭᖓᓄᑦ. ᐊᐅᔭᐅᑎᓪᓗᒍ, ᐅᖅᓯᐊᓗᒃ ᐊᓯᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᖅ ᑲᓇᖕᓇᖓᓂᙶᖅᑐᓂᑦ ᐃᒃᓴᕝᕕᐅᔪᓂᑦ ᑲᖏᖅᖠᓂᕐᒧᑦ, ᑕᐃᑲᓂ ᓃᑕᐅᓂᐊᕐᓗᓂ ᐅᖅᓯᐊᓘᓯᕝᕙᓐᓄᑦ ᐃᑎᕙᐊᓂᑦ. ᐅᖅᓯᐊᓘᓯᕝᕚᑦ ᐊᑕᐅᓯᐅᖓᔪᒥᑦ ᓴᓂᖁᖅᑐᑦ, ᓴᓇᔭᐅᓯᒪᔪᑦ ᓂᐱᐅᓯᖅᑐᖅᑕᐅᓯᒪᐸᓗᒃ ᓴᕝᕚᑦ, ᐊᒻᒪᓗ ᑎᑭᐅᑎᓯᒪᔪᑦ ᑲᓇᑕᒥᑦ ᑲᑎᒪᔨᐅᔪᑦ ᒥᓂᒃᑕᐅᑎᓄᑦ ᐊᕙᑎᓕᕆᔨᒃᑯᓐᓄᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᐃᑦ ᐅᑯᓄᙵ *ᓄᓇᐸ ᖃᖓᓂᑦᑐᓄᑦ ᐅᖅᓯᐊᓘᓯᕝᕙᓐᓄᑦ ᐋᖅᑭᐅᒪᔪᑦ ᐅᖅᓯᐊᓗᒃᑲᖅᑐᑎᒃ ᐅᖅᓯᐊᓗᐃᓚᖕᓂᓪᓗ.* ᐃᓗᐸᖅᑎᓕᖅᑕᐅᓯᒪᔪᖅ ᐅᖅᓯᐊᓘᓯᕝᕚᑦ ᐊᑖᓂᖕᒍᑎᒃ ᐊᒻᒪᓗ ᑭᓪᓕᒋᔭᐅᔫᖕᒍᑎᒃ ᐊᕙᓗᒋᔭᐅᔫᑉ. ᐅᖅᓯᐊᓗᖃᐅᓯᕝᕕᒃ ᐅᖅᓯᐊᓗᖃᕈᓐᓇᖅᑐᖅ 110%-ᖓᓂᑦ ᐊᖏᓛᖑᔫᑉ ᐅᖅᓯᐊᓘᓯᕝᕙᐅᑉ. ᐊᓪᓃᑯᒃᑯᑦ ᐃᑎᕙᐊᓂ ᐅᖅᓯᐊᓗᖃᐅᓯᕝᕙᖓᓂᑦ, ᐅᖅᓯᐊᓗᒃ ᐊᓯᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᖅ ᖃᐅᑕᒫᑦ ᐅᔭᖁᒃᑕᓇᐊᕐᕕᐅᔪᒪᔪᑦ ᐊᐸᕐᑐᑎᒃᑰᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐅᑭᐅᓗᒃᑖᖅ ᐊᐸᕐᑐᑎᕆᔭᐅᔪᒃᑰᕐᓗᑎᒃ.

ᓱᓇᑐᐃᓐᓇᓄᑦ ᒪᓕᒃᑕᐅᔪᖅᓴᐃᑦ ᐱᓕᕆᐊᖑᓂᖓᓐᓄᑦ ᐅᖅᓱᐊᓗᐃᑦ ᓅᑕᐅᑎᓪᓗᒋᑦ ᑎᑭᐅᑎᓂᐊᖅᑐᑦ ᐊᑐᖅᑐᓄᑦ ᒪᓕᒐᙳᐅᔪᓄᑦ ᐃᓚᐅᑉᓗᑎᒃ TDGA. ᒪᓕᒃᑕᐅᔪᖅᓴᓂᑦ ᐃᓚᐅᓂᐊᖅᑐᑦ ᓇᓗᓇᐃᖅᓯᓗᑎᒃ ᐃᒪᓐᓇ:

- ᓅᑦᑎᓂᕐᒧᑦ ᐅᖅᓱᐊᓗᖕᒥᑦ ᓱᑉᓗᓕᓗᒃᑖᑦ ᑲᑎᓐᓂᖃᑦᑎᐊᖅᑐᑦ ᓱᑲᑎᖅᑕᐅᓯᒪᑦᑎᐊᖅᓱᑎᒡᓗ;
- ᓅᑦᑎᓂᕐᒧᑦ ᓱᑉᓗᓖᑦ ᑕᑯᒃᓴᐅᔪᖃᙱᑦᑐᑦ ᓱᕋᒃᓯᒪᓂᖓᓐᓄᑦ;
- ᓅᑦᑎᓂᕐᒧᑦ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐱᓕᕆᔨᐅᔪᑦ ᖃᐅᔨᒪᔪᑦ ᒪᓕᒃᑕᐅᔪᖅᓴᐅᔪᓂᒃ;
- ᐅᖅᓱᐊᓗᓕᕆᔨᐅᔪᑦ ᑕᐃᒪᐅᖃᑦᑕᖅᑐᑦ ᑕᒪᐃᓐᓂᑦ ᐅᖅᓱᖅᑕᐅᑎᓂᒃ/ᐅᒥᐊᕐᔪᐊᕐᒥᑦ ᐊᒻᒪᓗ ᐅᖅᓱᐊᓘᓯᕝᕕᖓᓂᑦ ᓅᑎᔾᔪᑎᓂᑦ ᐊᒻᒪᓗ ᐊᒡᒐᖕᒧᑦ ᓄᖅᑲᖅᑎᑕᐅᔪᙵᖅᓱᓂ ᐅᖅᓱᖅ ᑯᕕᑎᓪᓗᒍ;
- ᐊᖏᔪᒥᒃ ᐃᒪᖃᖅᑐᓄᑦ ᓄᖅᑲᖅᑎᑦᑎᔾᔪᑎᒥᒃ ᐃᓕᓯᒪᔪᖃᖅᐸᑦ ᐊᒃᓯᖅᑐᐃᔪᒥᑦ ᐅᖅᓱᐅᓘᓯᕝᕕᖕᒥᑦ, ᓇᓗᓇᐃᖅᑕᐅᖃᑦᑕᖅᑐᖅ ᓄᖅᑲᖅᑎᑦᑎᔾᔪᑎ ᐊᐅᓵᕈᙵᑦᑎᐊᕋᓗᐊᕐᒪᖖᑦ ᐊᑐᖅᑕᐅᓂᑖᑦ; ᐊᒻᒪᓗ
- ᐅᖅᓱᐊᓗᖕᒥᑦ ᓅᑎᖃᑦᑕᖅᑐᑦ ᐊᑐᖅᓱᒋᑦ ᓅᑦᑎᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔪᖅᓴᖕᒋᑦ ᑳᓐᑐᕌᒃᑲᖅᑑᑉ.

ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᕆᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑎ ᐅᖅᓱᐊᓗᖕᒥᒃ ᑐᖅᑯᖅᓯᓯᒪᓂᕐᒧᑦ ᐃᑎᕕᐊᓂᑦ ᐊᒻᒪᓗ ᐅᔭᕋᒃᑕᕆᐊᕐᕕᐅᔨᒪᔪᕐᒥᑦ ᐃᓚᐅᔪᑦ ᑕᐅᑐᒃᓱᓂ ᐊᒻᒪᓗ ᐊᐅᓚᖅᑎᑦᑎᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓃᑦ, ᐃᒪᐅᑉ ᖄᖑᓂᑦ ᐆᒃᑐᕋᐃᓂᖃᐃᓐᓇᐅᔭᖅᑐᑦ ᐊᐅᓚᓐᓂᐊᕐᓗᒍ ᐊᒻᒪᓗ ᖃᐅᔨᕆᐊᖃᑦᑕᕐᓂᐊᕐᓗᒍ ᐱᐅᓂᕆᔭᖑ ᐃᒪᐅᑉ, ᐊᒻᒪᓗ ᖃᓄᐃᓕᔪᖃᖅᐸᑦ ᖃᐅᔨᕆᐊᖃᑦᑕᕐᓂᖅ (ᑯᕕᔪᖃᖅᐸᑦ ᑐᐊᕕᓐᓂᖅᑐᓕᕆᓂᕐᒧᑦ).

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EXECUTIVE SUMMARY

A hazardous material is one that, as a result of its physical, chemical, or other properties, poses a hazard to human health or the environment when it is improperly handled, used, stored, disposed of, or otherwise managed. In combination with the Risk Management and Emergency Response Plan, and the Spill Contingency Plan, this Hazardous Materials Management Plan (Plan) provides instruction on the prevention, detection, containment, response, and mitigation of accidents that could result from handling hazardous materials.

The Meliadine Gold Project (Project) will require the use of the following types of classified hazardous materials:

- Petroleum Products and Lubricants – diesel fuel, oil, grease, anti-freeze, and solvents used for equipment operation and maintenance;
- Process Plant Consumables – chemicals for mineral extraction;
- Water Treatment Consumable – chemicals;
- Explosives – emulsion, caps, explosives, surfactants, and sodium nitrate used for blasting in the mine;
- Laboratory Wastes – various by-products classified as hazardous waste and chemicals used in the assay laboratory; and
- Other – batteries, paints, compressed gases, materials used and generated at the Health Care Centre, etc.

Agnico Eagle Mines Limited (Agnico Eagle) is committed to the safe and appropriate storage of fuels, hazardous materials, and hazardous wastes. This Plan outlines the guidelines on product supply, transportation, storage, handling, recycling, and waste disposal. Agnico Eagle is committed to ensuring proper life cycle management of all products used at the Project, including hazardous materials.

All hazardous materials will be delivered to site by commercial carriers in accordance with the requirements of the Canadian *Transportation of Dangerous Goods Act* (TDGA). A contract expediting company will arrange all deliveries from the Itivia docking site to the proposed mine site. All required permits, licences, and certificates of compliance will be the responsibility of the carriers. All shipments will be properly identified and labelled. Shipping papers will be accessible and include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers. Each transportation company will be required to develop a spill prevention, control, and countermeasures plan to address the materials they are transporting.

The Environment & Infrastructure Superintendent will have ultimate responsibility for supervising the receipt, inspection, and recording of all material inventories at site. The Department Managers will reconcile total amounts received against amounts ordered. The quantity of hazardous materials received, used, and in possession of personnel will be recorded by appropriate Departments.

Once hazardous materials are received at the workplace, additional regulations will be applied. The federal *Workplace Hazardous Materials Information System* calls for the proper labelling of products, the availability of product information in the form of Material Safety Data Sheets (MSDS), and employee training on how to identify and handle hazardous products. Agnico Eagle will establish procedures for obtaining MSDS with new product deliveries, maintaining current MSDS (i.e., no older than three years), and ensuring that they are readily accessible to all employees. A chemical tracking system will also be established.

All hazardous materials will be stored in secured areas to prevent tampering, as well as access by unauthorized personnel. In support of pollution prevention, Agnico Eagle will establish procedures for the regular inspection of storage containers and facilities. If deficient conditions are identified, appropriate corrective actions will be taken and documented.

Materials that become waste will be stored and/or disposed of in accordance with specific government regulations and guidelines. The Environment Department monitors the movement of hazardous waste, from the generator to final disposal, through use of a tracking document known as a Waste Manifest. Accordingly, a Waste Manifest will accompany movements of hazardous wastes for the Project.

Hazardous wastes at the Itivia docking site in Rankin Inlet will be managed according to the appropriate regulation(s). More information can be found in the Shipping Management Plan (Agnico Eagle 2018) regarding waste generated on-board ships. The Preliminary Closure and Reclamation Plan provides additional information regarding unused hazardous materials upon completion of Project activities.

Due to transportation restrictions, a full year's supply of diesel fuel will be transported and stored to support the Project's operation. During the summer months, diesel will be shipped from eastern ports to Rankin Inlet, where it will be transferred into storage tanks at the Itivia Oil Handling Facility. Diesel tanks are single-walled, constructed of welded steel, and meet the Canadian Council of Ministers of the Environment guidelines for *Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products*. A continuous liner is installed under the tanks and within the perimeter berm. The containment area is be sized to hold 110% of the volume of the largest tank. From the Agnico Eagle's Itivia Oil Handling Facility, fuel will be transported daily to the proposed mine site via the bypass road and All-weather Access Road.

General procedures will ensure that the handling of fuel during bulk transfer meets the applicable legislation that includes the TDGA. The procedures will include verifying that:

- all fuel transfer hoses are connected properly and couplings are tight;
- transfer hoses are not obviously damaged;
- fuel transfer personnel are familiar with procedures;
- personnel are located at both the fuel delivery truck/ship and fuel transfer tank(s) and can manually shutoff the flow of fuel;
- if a high liquid level shutoff device is installed at the delivery tank, verify that the shutoff is operating correctly each time it is used; and
- fuel transfer proceeds per the established procedures of the contract supplier.

An environmental monitoring plan for fuel storage at the Itivia Oil Handling Facility and at the proposed mine site will include visual and operational inspections, routine surface water sampling to control and monitor the quality of the contact water, and event monitoring (in the case of a spill emergency or occurrence).

Any accident or spill will be reported immediately to the Supervisor or Environment Department. Emergency response procedures for spilled materials are provided in the Spill Contingency Plan, the Risk Management and Emergency Response Plan, and the Oil Pollution Emergency Plan (Agnico Eagle 2018) for the Project. These procedures outline the response to accidental spills or releases of hazardous materials to minimize health risks and environmental effects. Included are procedures for evacuating personnel, maintaining safety, clean-up and neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation.

All staff and contractors at the Project will receive appropriate training to deal with hazardous materials.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	November 2012			First draft of the Hazardous Materials Management Plan	Mélanie Roy, Env. Coord., AEM
2	March 2013	3.1	7	Env. and health hazards control	John Witteman, Env. Consultant, AEM
		3.2	7	Shipping containers	
		3.2	7	Air transportation (none to rare)	
		3.4	8	Details; hazardous waste mgmt. at Rankin Inlet and upon closure	
		9	31	Purchasing controls	
3	April 2014	1.2	2	Reference to TDGR	John Witteman, Env. Consultant, AEM
		3.2	7		
		3.3	8		
		3.4	8		
		3.5	9		
		5.3	13		
		6.6	20	Reference to Nunavut's Environmental Guideline for Contaminated Site Remediation	Stéphane Robert, Env. Manager, AEM
4	April 2015			Update entire plan for Class A Water Licence Application	John Witteman, Env. Consultant, Agnico Eagle
5	March 2018			Annual review	Alexandre Gauthier, Env. Tech. Meliadine

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
AWAR	All-weather Access Road
CCME	Canadian Council of Ministers of the Environment
IBC	Intermediate Bulk Container
ICMC	International Cyanide Management Code
MSDS	Material Safety Data Sheet
Plan	Hazardous Materials Management Plan
PPE	Personal Protective Equipment
SCP	Spill Contingency Plan
TDG	Transportation of Dangerous Goods
TDGA	Canadian *Transportation of Dangerous Goods Act*
TDGR	*Transportation of Dangerous Goods Regulations*
WHMIS	Workplace Hazardous Materials Information System

SECTION 1 • INTRODUCTION

1.1 Purpose and Scope of the Plan

The purpose of the Hazardous Materials Management Plan (Plan) is to provide a consolidated source of information on the safe and environmentally sound transportation, storage, and handling of the major hazardous products that may be used at the Meliadine Gold Project (Project). A hazardous material is one that, as a result of its physical, chemical, or other properties, poses a hazard to human health or the environment when it is improperly handled, used, stored, disposed of, or otherwise managed. It can take many forms, for example, hydrocarbon contaminated soil, snow or water; fuel; lubricants; process reagents; chemical reagents; solvents and paint; medical wastes batteries; etc. In combination with the Risk Management and Emergency Response Plan, Spill Contingency Plan (SCP), and Oil Pollution Emergency Plan (Agnico Eagle 2018), this Plan provides instruction on the prevention, detection, containment, response, and mitigation of accidents that could result from handling hazardous materials.

This Plan is based on the following principles of best practice management for hazardous materials:

- identify and prepare materials and waste inventories;
- characterize potential environmental hazards posed by hazardous materials;
- allocate clear responsibility for managing hazardous materials;
- describe methods for transport, storage, handling, and use;
- identify means of long-term storage and disposal;
- prepare contingency and emergency response plans;
- ensure training for management, workers, and contractors whose responsibilities include handling hazardous materials; and,

All hazardous materials to be used at the Project will be manufactured, delivered, stored, and handled in compliance with all applicable federal and territorial laws and regulations. Agnico Eagle is committed to preventing, to the greatest extent possible, both the inadvertent release of these substances to the environment, and accidents resulting from mishandling or mishap.

As with all other aspects of Agnico Eagle's approach to sustainability at the Project, all employees will be expected to comply with all applicable precautions and handling procedures with regard to hazardous materials. Employees will also be expected to report any concerns to their supervisors, the Occupational Health and Safety Committee, the Environment Department, or senior site management. All staff will be encouraged to bring forward suggestions for improvements to hazardous materials management that can be incorporated into procedure revisions, as appropriate.

1.2 Applicable Legislation

Both federal and territorial legislation regulate the management of hazardous materials in Nunavut. Copies of relevant legal documents will be kept on file at the Project site. Agnico Eagle will regularly update this Plan with respect to applicable legislation, and ensure that current legislation documents will be available at the Project site.

Management and the safety department will provide an overview of the applicable regulations to all employees as part of their initiation and ongoing training.

The *Transportation of Dangerous Goods Act* (TDGA) established classes of dangerous goods as per the schedule in the Act. Hazardous materials are classified into the following nine main classes according to an internationally recognized system:

Class 1 – Explosives

Class 2 – Gases

Class 3 – Flammable liquids

Class 4 – Flammable solids

Class 5 – Oxidizing substances and organic products

Class 6 – Poisonous (toxic) and infectious substances

Class 7 – Nuclear substances, within the meaning of the *Nuclear Safety and Control Act*, which are radioactive

Class 8 – Corrosives

Class 9 – Miscellaneous products or substances

The *Transportation of Dangerous Goods Regulations* (TDGR) also applies to the Project and Agnico Eagle will comply with all applicable requirements.

SECTION 2 • OVERVIEW OF HAZARDOUS MATERIALS

2.1 Hazardous Materials and Fuel Storage Locations

Comprehensive lists of all hazardous materials and the estimated quantities that could be stored for the Project are presented in the following sections. Figures 2-1 and 2-2 identify the fuel storage location at Itivia in Rankin Inlet. Figures 2-3 to 2-4 identify the fuel storage location at the Project.

Petroleum products, explosives, sodium cyanide, and miscellaneous hazardous materials will be stored in facilities that contain no open drains, and in concrete bermed areas or within sea cans. Storage tanks on-site will be regularly inspected and maintained.

The permanent storage areas will be clearly marked and only authorized personnel will be allowed access. These areas will be ventilated to prevent the build-up of toxic fumes or dust, which could harm both the personnel present and the environment.

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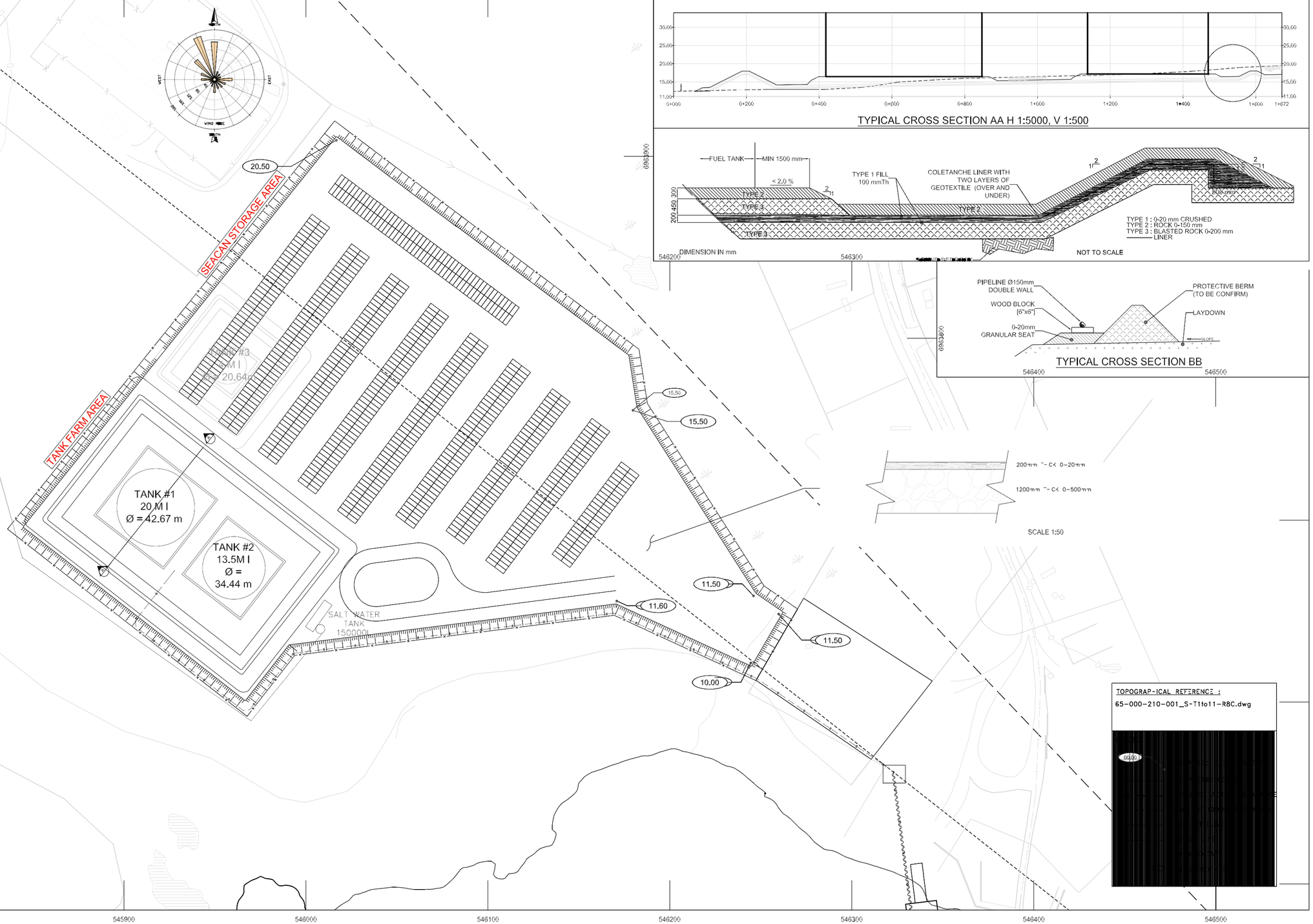

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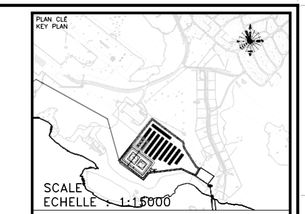

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TITRE / TITLE	# DWG

AGNICO EAGLE

REV.	DATE	DESCRIPTION	PAR/BY	APP.	CLIENT

REVISIONS

ISSUED FOR PERMITTING
DATE : 2015-03-05

TITRE / TITLE
AGNICO EAGLE–MELIADINE DIVISION
130 – FUEL TANK FARM (RANKIN)
GENERAL EARTHWORK
SITE PLAN
ITIVIA OIL HANDLING FACILITY LOCATION
Figure2-1

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VÉRIFIÉ PAR / CHECKED BY	DANY LAFLAMME	2014-10-06
APPROUVÉ PAR / APPROVED BY	DANY LAFLAMME	2014-10-08
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Figure 2-2 Fuel Storage at Itivia Oil Handling Facility

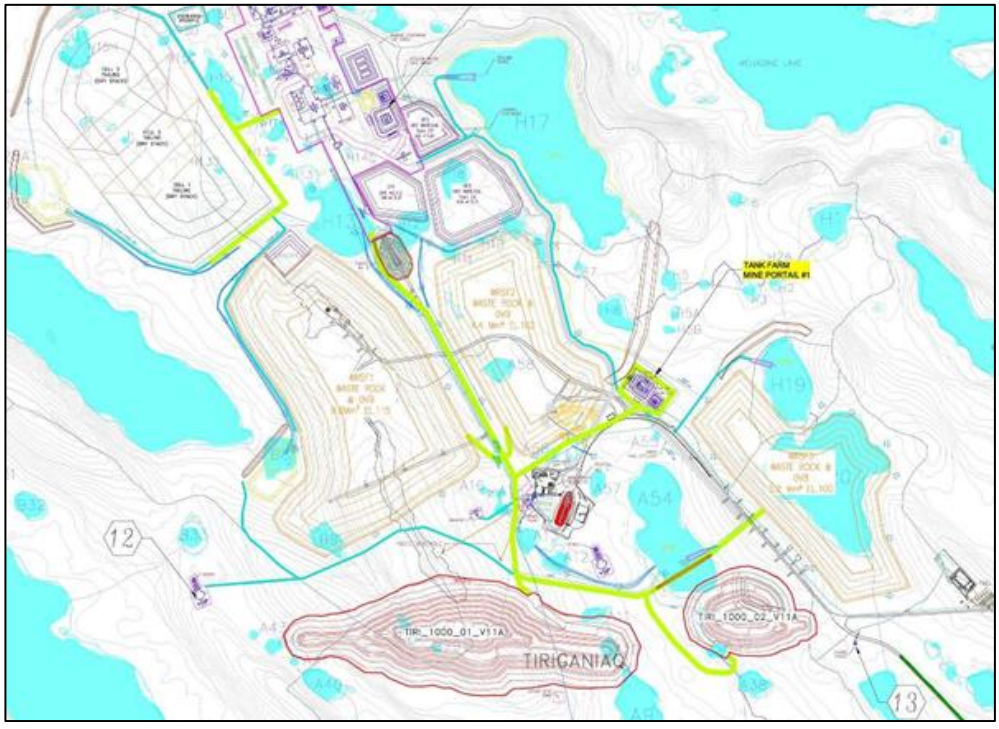

Figure 2-3 Project Fuel Storage Location

Figure 2-4 Fuel Storage at Project

2.2 Types of Hazardous Materials

The Project will require the use of the following types of hazardous materials:

- Petroleum products and lubricants – diesel fuel, oil, grease, anti-freeze, and solvents used for equipment operation and maintenance;
- Process Plant consumables – chemicals for mineral extraction;
- Water treatment consumables – chemicals;
- Explosives – emulsion, caps, explosives, surfactants, and sodium nitrate used for blasting; and
- Laboratory consumable and wastes – various by-products classified as hazardous waste and chemicals used in the assay laboratory.

Sections 5 and 6 contain general information and safe handling procedures regarding petroleum products and chemicals used in the process plant and water treatment. Details concerning explosives are available in the Explosives Management Plan. Laboratory wastes will be very limited in quantity and will only be handled by specialized lab technicians. These wastes will be pumped to the grinding circuit in the process plant for recycle and will eventually become part of the dry stack tailings disposal system. As such, they are not addressed separately in this Plan.

2.3 General Hazardous Materials Storage Guidelines

Agnico Eagle is committed to the safe and appropriate storage of fuels, hazardous materials, and hazardous wastes. The following sections outline Agnico Eagle's general guidelines for storing fuels, hazardous materials, and hazardous wastes. Agnico Eagle will also follow the Government of Nunavut (2010) Environmental Guidelines for the General Management of Hazardous Wastes (Appendix A).

2.3.1 General Guidelines for Storage Drums/Containers

Hazardous materials and wastes shall be stored in quatrex bags, drums, or sea cans according to the following guidelines:

- In the original containers, where possible, or in containers compatible with the material being stored to prevent corrosion or chemical interaction that could lead to leaks or fires.
- Storage containers shall be in good condition, sealable, and not damaged or leaking.
- Drums containing hazardous materials or wastes expected to be in storage for more than six months shall be placed on pallets or other appropriate foundation to prevent corrosion.
- Each container shall be clearly labelled to identify the substance being stored according to the requirements of the Workplace Hazardous Materials Information System (WHMIS) and MSDS (Material Safety Data Sheet).
- Containers shall be kept closed except when adding or removing product.
- Containers with product shall be kept in the upright position. Empty drums can be placed horizontally.

- Containers shall be arranged to prevent damage from falling or dislodging.

2.3.2 General Guidelines for Storage Areas

To assist in the safe and secure storage of fuels, hazardous materials, and hazardous wastes, the following general guidelines for storage areas/facilities will be followed:

- Design of storage areas will be in compliance with the *National Fire Code*, where appropriate.
- Compliance with the Canadian Council of Ministers of the Environment (CCME) publication, *"Environmental Code of Good Practice for Above Ground Storage Tank Systems Containing Petroleum Products"*. This CCME code deals with inventory control, inspections, corrosion protection, records, and monitoring. Environment Canada's *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* outline registration and documentation requirements for storage tanks.
- Storage areas will have controlled access. Only authorized and trained personnel will have access to storage areas.
- Storage areas will be adequately signed indicating that hazardous materials/wastes are stored therein.
- Storage locations will be clearly defined and marked to prevent damage of storage drums and containers in the event they are covered by snow.
- Incompatible materials will be segregated by chemical compatibility within the storage area to prevent contact of incompatible materials in the event of a release.
- Storage areas will be located at least 31 meters from surface waters.
- Storage areas will be readily accessible for firefighting and other emergency procedures.
- Storage areas will be adequately ventilated to prevent the build-up of noxious or toxic vapours.
- Secondary containment will be installed to allow for the containment of at least 110 % of the largest container or tank volume within the contained area.
- Storage areas will be constructed, or provided with barriers, to protect containers from physical damage.
- Adequate spill and emergency response equipment will be installed at each storage area (i.e., spill control, fire protection, etc.). A list of spill control equipment is provided in the SCP.

3.1 Life Cycle Management

"Life cycle management" implies the assessment of a particular product over its entire life, from the time a material need is identified, to the time the product is fully consumed or disposed of as waste. Life cycle management is important to managing and minimizing the potential environmental and health hazards posed by hazardous materials. It covers product supply, transportation, storage, handling, recycling, and waste disposal. Agnico Eagle is committed to ensuring proper life cycle management of all products used at the Project, including hazardous materials. Agnico Eagle and its contractors will deal only with reputable, certified suppliers, transporters, expediters, and hazardous waste recycling and treatment facilities.

3.2 Delivery

All hazardous materials will be delivered to the proposed site by commercial carriers in accordance with the requirements of the Canadian *TDGR, Part 3* and will be properly documented. Air transportation will not be used for the transfer of hazardous materials, with the exception of a rare emergency situation. Carriers will be licensed and inspected as required by Transport Canada. All required permits, licenses, and certificates of compliance will be the responsibility of the carrier.

Purchasing controls will ensure that no excess hazardous materials are purchased beyond that requested by the Project for the upcoming year. The hazardous materials will be shipped in approved containers housed in a sea can. All shipments will be properly identified and labelled. Shipping papers will be accessible and include information describing the substance, immediate health hazards, fire and explosion risks, immediate precautions, fire-fighting information, procedures for handling leaks or spills, first aid measures, and emergency response telephone numbers.

Each transportation company will be required to develop a spill prevention, control, and countermeasures plan to address the materials they are importing. In the event of a release during transport, the commercial transportation company is responsible for first response and clean-up. Agnico Eagle intends to annually verify the qualifications of transport companies, their personnel, and the existence of their spill prevention, control, and countermeasures plan.

Appropriate measures will be in place to minimize impacts to surface water, groundwater, and soil from potential vehicle accidents when transporting hazardous materials to the site. Details on spill response are presented in the SCP. The following general precautions will be taken:

- a maximum speed on the All-weather Access Road (AWAR) for loaded and empty vehicles will be 50 kilometers per hour;
- a maximum speed on the Hamlet Bypass Road will be 30 kilometers per hour;
- all Agnico Eagle and contractor's using the roads are expected to carry spill response equipment;

- trucks will be equipped with a reliable radio; and,
- Agnico Eagle commits to being prepared to respond to spills resulting from vehicle accidents in a timely and efficient manner.

3.3 On-Site Handling

Once hazardous materials are received by Agnico Eagle, additional regulations will be applied: the federal WHMIS calls for the proper labelling of products, the availability of product information in the form of MSDS, and employee education on how to identify and handle hazardous products. Agnico Eagle will establish procedures for obtaining MSDS for new product deliveries, maintaining current MSDS (i.e., no older than three years), and maintaining a system of hardcopy and/or electronic MSDS that is readily accessible by all employees. A chemical tracking system will also be established.

All hazardous materials will be stored in secured areas to prevent access by unauthorized personnel or tampering. All tanks used for the storage of diesel fuel are double walled. There are some exceptions where single walled tanks exist, but all are equipped with secondary containment areas sized to hold at least 110 % of the volume of the largest tank. Tanks and vessels in the process plant will be installed on concrete surfaces sloping to interior sumps that will route spilled solutions to lined collection areas. Additional guidelines for the storage of hazardous materials are provided in Section 2.3.

In support of pollution prevention, Agnico Eagle will establish procedures for the regular inspection of storage containers and facilities. If deficient conditions are identified, appropriate corrective actions will be taken and documented. Additional details for the inspection of storage areas are provided in Section 8.

Emergency response procedures for spilled chemical substances are provided in the SCP, and the Risk Management and Emergency Response Plan. These procedures outline the response to accidental spills or releases of hazardous materials to minimize health risks and environmental effects. Included are procedures for evacuating personnel, maintaining safety, clean-up and neutralization activities, emergency contacts, internal and external notifications to regulatory authorities, and incident documentation.

In the case of accidental release or imminent accidental release, Agnico Eagle will also comply with the reporting requirements listed in Part 8 of the *TDGR*.

3.4 Waste Management

On becoming wastes, materials will be stored and/or disposed of in accordance with specific government regulations and guidelines. This includes hazardous wastes that may be generated at the Rankin Inlet fuel storage, port facility, and laydown area.

Agnico Eagle will store in sea cans most hazardous waste materials at the proposed mine site until they can be transported for recycling or disposal. Likewise, any unused hazardous materials upon completion of Project activities will be inventoried and transported to a licensed waste disposal

facility for recycling or disposal

The Government of Nunavut Department of Environment, Environment Protection Service monitors the movement of hazardous waste, from the generator to final disposal, through use of a tracking document known as a Waste Manifest. Accordingly, a Waste Manifest will accompany movements of hazardous wastes for the Project. Agnico Eagle is registered with the Government of Nunavut Department of Environment, Environment Protection Service as a waste generator, and employs only registered waste carriers to transport waste to registered/approved waste receivers. A copy of the completed manifest will be maintained for a period of two years after the hazardous waste is received by the authorized waste disposal facility.

Process plant tailings will pass through a treatment plant for cyanide destruction using the standard SO_2/air process before being dryed and stacked. The cyanide weak acid dissociable content of the tailings material will be reduced as specified in the International Cyanide Management Code (ICMC). Agnico Eagle will integrate practices to respect the ICMC. The current regulatory requirement for cyanide content in liquids released to the environment is 1 milligrams per litre (mg/L) for a single grab sample as specified in the Metal Mining Effluent Regulations (2012), or no greater than a 0.5 mg/L average for the grab samples in any month.

3.5 Empty Product Containers

Many empty chemical containers are not safe for direct disposal and require handling precautions identical to those for full containers and may be subject to TDGR. Chemical users must be familiar with the safe waste handling and storage procedures described in the MSDS. When prescribed, the containers will be backhauled to the Rankin Inlet laydown area for transport to an approved facility for disposal. These containers will be stored and hauled south via sealift.

SECTION 4 • SODIUM CYANIDE

The Project operation will use sodium cyanide. Due to transportation restrictions, about a full year's supply of sodium cyanide will be transported and stored on-site during the shipping season. This product will be transported, stored, handled, transferred, and used in compliance with appropriate legislation and applying principles and standards of practice as specified in the ICMC.

4.1 Physical Properties

Cyanide is one of only a few chemical reagents that dissolve in water. Gold mining operations use very dilute solutions of sodium cyanide, typically in the range between 0.01 and 0.05 % cyanide (100 ppm and 500 ppm). Unlike many synthetic chemicals, cyanide oxidizes and decomposes when exposed to air or other oxidants, and does not persist in the environment. As such, it does not give rise to chronic health or environmental problems when present in low concentrations.

4.2 Cyanide Production

Cyanide production and handling is highly regulated, and its risk management is well documented. Both the manufacturer and Agnico Eagle will employ stringent risk management systems to prevent injury or environmental damage from the use of cyanide.

4.3 Cyanide Transport

Sodium cyanide for the Project will be shipped in briquette form, and packaged in water-resistant super sac 4 millimeter bags inside an Intermediate Bulk Container (IBC). The IBC will hold 1,000 kilograms of cyanide, and will have the following approximate dimensions: 1.1 m x 1.1 m x 1.1 m. For shipment, there are normally 20 IBCs in a sea can. This method of cyanide transport provides three levels of containment. The cyanide is contained within plastic bags. In the event one of the bags ruptures, the cyanide is contained within the IBC. In the event the IBC container breaks, the cyanide is contained within the sea can, which provides a tertiary precautionary containment measure for minimizing the impact of a potential spill.

Cyanide producers audit purchasers and transportation systems. They design special packaging for the transport of cyanide and inventory all shipments against delivery records to ensure proper surveillance at all times. All shipments will be accompanied by MSDS that provide the chemistry and toxicity of sodium cyanide, instructions in case of accidents, and emergency telephone numbers for assistance.

Truck, rail, and ship transporters screen their employees, carefully inventory packages, and establish and maintain systems for loading and unloading cyanide products. Product handling and transportation will be in accordance with protocols set by the industries and in compliance with national and international regulations.

For the Project, IBCs will be properly stacked in sea cans and transported by ship from eastern ports to Rankin Inlet. At Rankin Inlet, the containers will be transferred from ship to truck for transport to the proposed mine site. At no point during transport will the sea can or IBCs be opened. From the point of cyanide packaging onwards, the bags will only be opened on-site, when use of cyanide is required.

4.4 On-Site Storage and Handling

The cyanide will be stored on-site in a dark, cool, dry, location. It will be stored within sealed sea cans until cyanide is needed for ore processing. The cyanide storage area will be located close to the process plant. Only authorized personnel will have access to the cyanide storage area.

Only the quantity of cyanide required for immediate use will be removed from storage. The cyanide bag will be lifted by its straps (the straps will be provided by the manufacturer as part of packaging) using a forklift. An overhead crane will be used to lower the bag onto a specially designed knife slitter that will cut the bag. The contents of the bag will drop into a mixing tank. At no time will the cyanide have to be physically handled by Project personnel.

The IBCs will be properly decontaminated and disposed of according to all applicable regulations to prevent environmental impact. Before disposal, the bags will be visually inspected to ensure they are empty, and then flushed, triple rinsed, and drained to dissolve any residual cyanide left in the bag. Rinse water from the flushing process will be pumped into the cyanide mixing tank and used in the gold recovery plant.

All personnel potentially exposed to cyanide, including contractors and visitors, will receive appropriate training (refer to Section 9).

4.5 Spills

In the event a spill occurs, the cyanide will be promptly cleaned-up to minimize exposure to humans and the environment. A dry spill will be swept-up and disposed of in a drum or other suitable container. In the event of a wet spill, spill procedures will be carried out to prevent environmental contamination and the appropriate authorities will be contacted. For more information on spills handling and containment, see the SCP and Risk Management and Emergency Response Plan.

After cleaning-up as much cyanide as possible, the area will be decontaminated using a small amount of caustic solution (i.e., 1 ounce per 5 gallon hypochlorite solution). This will help keep the pH in the 10 to 11 range and suppress the formation of potentially lethal hydrogen cyanide gas.

4.6 International Cyanide Management Code

Agnico Eagle is a signatory to the ICMC for the manufacture, transport, and use of cyanide in the production of gold. The ICMC is administered by a non-profit institute consisting of participants from

the gold mining industry, governments, non-governmental organizations, labour, cyanide producers, and other interested parties.

The ICMC represents a voluntary commitment on the part of all signatories to identify and follow basic principles and guidelines for safe cyanide use at gold mining operations. This is the first such generic international code in the history of the mining industry. Under the ICMC, gold mines are required to manage their cyanide from source to site, thus assuming “full life cycle” responsibility for all cyanide used at their operation.

SECTION 5 • PETROLEUM PRODUCTS

5.1 Product Description

During operations, the Project will use the fuel and lubricants (petroleum products) listed in Table 5-1. These products will be transported, stored, handled, transferred, and used in compliance with appropriate legislation.

Table 5-1 Project Fuel Products, Hazard Classes, and Potential Impacts

Material	TDGA Class	Potential Environmental Impact
Diesel	3	Water and soil contamination
Motor oil	Not regulated	Water and soil contamination
Aviation fuel	3	Water and soil contamination
Hydraulic fluid	Not regulated	Low risk to water and soil with proper handling
Solvent	3	Water and soil contamination
Automotive grease	Not regulated	Low risk to water and soil with proper handling
Ethylene glycol	Not regulated	Toxic by ingestion; could potentially be consumed by wildlife

5.2 Diesel Fuel Storage in Rankin Inlet and at the Project Site

Agnico Eagle's Itivia Oil Handling Facility consist of one 20 million L tank, one 13.5 million L tank, and one 4 million L tank, for a total capacity of up to 37.5 million L's of diesel fuel. Tanker trucks transfer the fuel from Agnico Eagle's Itivia Oil Handling Facility in Rankin Inlet to the tanks located at the proposed mine site. The main storage tanks at the proposed mine site include one 6 and one 3 million L tank. There also will be a number of storage tanks with capacities varying between 1,000 and 250,000 L (Table 5-2). The total diesel fuel storage capacity at the mine site will be in the range of 9.7 million L's.

The large diesel tanks at the mine and at Itivia are single-walled, constructed of welded steel, and designed, constructed, and located to meet the CCME guidelines for *Aboveground Storage Tank Systems Containing Petroleum and Allied Petroleum Products*. A continuous 60 millimeter high-density, polyethylene liner sheet is installed under the diesel tanks and within the sides of the perimeter berm. The containment area is sized to hold 110 % of the volume of the largest tank.

Table 5-2 Fuel Products – Storage Location

Product	Use/Location	Maximum Amount Anticipated	Maximum Amount by Unit
Diesel	**Itivia**		
	1- Itivia Oil Handling Facility	20 ML	20 ML tank
	2- Itivia Oil Handling Facility	13.5 ML	13.5 ML tank
	3- Itivia Oil Handling Facility (Sustaining)	4 ML	4 ML tank
	Industrial site Tank Farm		
	4- Site Main Fuel Tank	6 ML	6 ML tank
	5- Site Fuel Tank summer	250,000 L	250 000 L
	6- Powerhouse	50,000 L	25,000 L/tank
	7- Process Plant	10,000 L	10 000 L/tank
	8- Mechanical shop (Oil)	10,000 L	1,000 L/tank
	Portal #1 Mine Site Tank Farm		
	9- Site Main Fuel Tank	3 ML	3 ML
	10- Site Fuel Tank summer	250,000 L	250,000 L/tank
	11- Site Fuel Tank Measure for UG	2,000 L	2,000 L/tank
	12- Site Fuel Tank UG heating Intake West	25,000 L	25,000 L/tank
	13- Site Fuel Tank UG heating Intake East	25,000 L	25,000 L/tank
	Underground		
	14- UG Fuel Tank UG level 325	50,000 L	10,000 L/tank
	15- UG Fuel Tank (Sustaining)	10,000 L	10,000 L/tank
Motor Oil	Mechanical shop	800,000 L	20,800 L/sea can
	Powerhouse		
Hydraulic Fluid	Mechanical shop		Cubes or Barrels
	Powerhouse		Cubes or Barrels
	Process Plant		Cubes or Barrels
Ethylene glycol	Mechanical shop	60,000 L	10,000 L/sea can

5.3 Fuel Management Plan

The transportation of fuel from Itivia to the mine site and around the mine site will be subject to TDGR, Part 5.

5.3.1 Storage, Delivery to Site, and Safe Handling

With the exception of diesel fuel, most petroleum fuel and lubricant products will be delivered to site and stored in the original packing container from the manufacturer. These types of containers include a variety of sealed drums, pails, 1-ton super sac, bulk cubs, cans, and tubes.

Due to transportation restrictions, a full year's supply of petroleum fuel and lubricants products will be transported and stored at the mine during the shipping season. During the summer months, diesel will be shipped from eastern ports to Rankin Inlet, where it will be transferred into storage tanks at the Itivia Oil Handling Facility. From the Itivia storage tanks, fuel will be transported daily to the proposed mine site via the bypass road and All-weather Access Road. Table 5-2 provides the varieties and volumes of petroleum products that will be stored on-site, and the corresponding storage locations.

Safe handling procedures and personal protective equipment (PPE) regarding fuel products are presented in Table 5-3 and Table 5-4, respectively.

Table 5-3 Fuel Products – Safe Handling Procedures

Product	Handling Procedures
Diesel	Avoid contact with eyes, skin, or clothing. Avoid breathing vapours, mist, fume, or dust. Do not swallow. May be aspirated into lungs. Wear PPE and/or garments if exposure conditions warrant. Wash thoroughly after handling. Launder contaminated clothing before reuse. Use with adequate ventilation. Keep away from heat, sparks, and flames. Store in a well-ventilated area. Store in a closed container. Bond and ground during transfer.
Motor oil	Wear protective clothing and impervious gloves when working with used motor oils. To be handled generally consistent with other petroleum hydrocarbons.
Hydraulic fluid	Keep container closed until ready for use.
Ethylene glycol	Ensure adequate ventilation. Wear protective gloves and chemical safety goggles. Keep in tightly closed container, stored in a cool, dry, ventilated area. Separate from acids and oxidizing materials. Empty containers of this product, retain product residues; may be hazardous.

Table 5-4 Fuel Products – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	Skin	Respiration
Diesel	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Motor oil	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required
Hydraulic fluid	Chemical goggles	None usually required	None usually required

Ethylene glycol	Chemical goggles	Neoprene or nitrile gloves; protective garments	None usually required; ensure adequate ventilation

5.3.2 Fuel Truck Transfer Procedures

A contract supplier will fill the storage tanks in the Itivia Oil Handling Facility as outlined in the Oil Pollution Emergency Plan (Agnico Eagle 2018). General procedures will ensure that the handling of fuel will meet the applicable legislation that includes the *TDGA.* The general procedures to be followed are listed below. Similar procedures would be followed for fueling remote station tanks.

Before fuel transfer, verify that:

- all fuel transfer hoses are connected properly and couplings are tight;
- transfer hoses are not obviously damaged;
- fuel transfer personnel are familiar with procedures;
- personnel are located at both the fuel delivery truck/ship and fuel transfer tank(s), and can communicate with each other and manually shutoff the flow of fuel;
- if a high liquid level shutoff device is installed at the transfer tank, verify that the shutoff is operating correctly each time it is used; and
- fuel transfer proceeds per the established procedures of the contract supplier.

Any accident or spill must be reported immediately to the Supervisor or Environment Department. Notification and response procedures are detailed in the SCP and the Oil Pollution Emergency Plan (Agnico Eagle 2014b).

5.3.3 Fuel Tank Performance Monitoring

The following section outlines the monitoring plan to be prepared and implemented, prior to construction, to evaluate the environmental performance of the bulk fuel storage facilities. The environmental performance monitoring plan is a tiered approach with an emphasis on visual and operational inspections, routine surface water sampling to control and monitor the quality of the contact water, and event monitoring (in the case of a spill emergency or occurrence).

Visual and Operational Inspections

Visual and operational inspections are a central component of performance monitoring.

Visual inspections will be conducted once per week by operations staff. Staff will inspect the facilities for:

- tank and piping condition;
- secondary containment berm structure and integrity;
- indicators of liner damage;
- precipitation and snow accumulation;
- evidence of tampering or misuse;
- any structural abnormalities; and
- visible sheens on contact water pools and crush material inside the secondary containment.

Visual inspections of the secondary containment structure are important because if the integrity of the berm walls or liner is compromised, this presents the greatest risk of leaks or seepage to the environment.

Environmental staff will follow-up with operations staff and conduct periodic visual inspections during routine-mine environmental conformity inspections. As licensed, a weekly written log will be completed and held on file at the Project site to be provided to appropriate authorities upon request.

Routine Contact Water Monitoring

Due to melting snow that accumulates over the winter and precipitation, contact water will unavoidably collect inside the secondary containment berm. During visual inspections, the quantity of contact water collected inside the secondary containment berm will be evaluated. If there is a visible sheen on the contact water or if water withdrawal is deemed necessary, water samples will be collected and analyzed. Accumulated water will only be released to the receiving environment if it meets discharge criteria.

Event Monitoring

The SCP will be followed in the event of a spill occurrence at a bulk fuel storage tank. If deemed necessary, the environmental staff will conduct an environmental assessment as a follow-up to a spill response to evaluate the extent of impacts to the nearby environment. This may include the identification of potential environmental pathways of concern that may result in impacts to surface water, soil, or groundwater.

5.4 Contaminated Material

Contaminated material, for example spill pads, resulting from the storage and handling of fuels and lubricants will be salvaged, put into appropriate containers, and labelled for temporary storage. Depending on the nature of the contamination, material will be either: treated on-site in the landfarm, incinerated, disposed of on-site if appropriate, or shipped off-site to an approved disposal facility.

5.5 Used Petroleum Products

Used oil that is no longer suitable for its intended use is classified as a hazardous waste. The discharge of used oil into the environment, including but not limited to landfills, sewers, and waterbodies, is prohibited.

Agnico Eagle intends to apply for a permit to incinerate used oil in the camp incinerator as per Schedule B of the *Used Oil and Waste Fuel Management Regulations.* Otherwise, all used oil products will be collected in tanks or drums marked “Waste Oil” and sent south annually for recycling and/or disposal at an approved disposal facility. Empty petroleum containers will be stored on-site in a designated area and returned to the supplier on backhauls. Oil filters will be punctured and/or crushed, and drained of their contents for 24 hours prior to disposal.

SECTION 6 • PROCESS PLANT AND WATER TREATMENT REAGENTS AND CONSUMABLES

6.1 Product Description

The process plant will use a number of chemicals and reagents to treat the ore and recover entrained gold. The Water Treatment Plant will also use a number of chemicals and reagents to treat water. Water treatment chemicals would be used over a three to four month period during frost-free months only.

The following tables present specific descriptions for each reagent at the time that the document was drafted, however current MSDS should be referred to prior to use of any reagent:

- Table 6-1 and Table 6-2 present the average annual consumption of reagents during the operation and in which format they will be delivered;
- Table 6-3 presents hazard classes and potential environmental impacts for each reagent;
- Table 6-4 presents handling procedures for each reagent; and
- Table 6-5 presents the Personal Protective Equipment for each reagent.

Table 6-1 Process Plant Reagents – Use and Consumption for Processing

Product	Use/Location	Maximum Amount Anticipated On-Site	Maximum Amount by Unit
Activated carbon	Carbon-In-Leach	76 t	500 kg/bag (10 t/sea can)
Anti-scaling agent	Mill	5.5 t	
Borax	Refinery	17 t	3,375 kg/sea can
Hydrochloric acid	Elution-Regeneration	652 t	
Copper sulfate	Cyanide Destruction	345 t	2,500 kg/bag (20 t/sea can)
Sodium cyanide	Carbon-In-Leach	1,414 t	1,000 kg/bag (19 t/sea can)
Flocculent	Grinding	46 t	750 kg/bag (15 t/sea can)
Lead nitrate	Carbon-In-Leach	-	
Lime	Carbon-In-Leach	1734 t	1,743 kg/bag
Silica	Refinery	17 t	
Sodium hydroxide	Elution-Regeneration	133 t	1,000 kg/bag
Sodium metabisulfite	Cyanide Destruction	1,758 t	1,000 kg/bag
Sodium nitrate	Refinery	17 t	5.1 t/sea can
Sulfur prills	Cyanide Destruction	0 t	1,000 kg/bag (20 t/sea can)

Table 6-2 Water Treatment Reagents and Others – Use and Consumption

Product	Use/Location	Maximum Amount Anticipated on-site	Maximum Amount by Unit
Ferric sulfate	Water Treatment Plant	260 t	1t/bag
Lime	Water Treatment Plant	320 t	1,743 kg/bag
Flocculent	Water Treatment Plant	5 bags	750 kg/bag (15 t/sea can)
Acetylene	Welding	830 bottles	11 m^3 / bottle
Paints	Maintenance	180 gal.	1 gal./pail
Solvents	Maintenance	56 gal.	1 gal./pail
Lead acid batteries (12V)	Maintenance	386	

Table 6-3 Process Plant, Water Treatment Reagents, and Others – Hazard Classes and Potential Environmental Impacts

Material	Class	Potential Impact
Acetylene	2.1	Generally not hazardous for water
Activated carbon	4.2	No information available
Anti-scaling agent	Not classified	Negligible with proper handling
Borax	Not classified	Presents no health hazards
Copper sulfate	9	Harmful to aquatic life
Sodium cyanide	6.1	Expected to be very toxic to aquatic life and to terrestrial life
Flocculent	Not classified	Acute fish, invertebrate, algae and bacteria toxicity
Ferric sulfate	8	Ecological impact has not been determined
Hydrochloric acid	8	Extremely toxic to aquatic life by lowering the pH below 5.5. When released into the soil, this material may leach into permafrost
Lead nitrate	5.1	Very toxic to aquatic organisms, may cause long-term effects in the aquatic environment
Lead acid batteries	8	Limited information available. Negligible with proper handling
Lime	8	This material is alkaline and if released into water or moist soil will cause an increase in pH
Paints	Not classified	Limited information available. Negligible with proper handling
Solvents	Not classified	Harmful to aquatic life with long lasting effect
Silica	Not classified	Generally not hazardous for water
Sodium hydroxide	8	Ecological impact has not been determined
Sodium metabisulfite	Not classified	Ecological impact has been determined
Sodium nitrate	5.1	Possibly hazardous; short-term degradation products are not likely. However, long-term degradation products may arise. The products of degradation are less toxic than the product itself
Sulfur prills	9	No information available (insoluble in water)

Table 6-4 Process Plant and Water Treatment Reagents – Safe Handling Procedures

Product	Handling Procedures
Acetylene	Do not mix with air or oxygen above atmospheric pressure. Store away from oxidizing agents. Open and handle cylinder with care. Keep ignition sources away - Do not smoke. Protect from heat. Protect against electrostatic charges. Pressurized container: protect from sunlight, store in a cool location and do not expose to temperatures exceeding 50°C. Do not pierce or burn, even after use. Prevent impact and friction. Store in accordance with local fire code and/or building code or any pertaining regulations.
Activated carbon	Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Activated carbon, especially when wet, can deplete oxygen from air in enclosed spaces, and dangerously low levels of oxygen may result. Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.
Anti-scaling agent	Used in extremely small quantities. Can cause mild to moderate irritation of eyes, skin, and upper respiratory tract. Wash thoroughly after handling. Use sensible industrial hygiene and housekeeping products. Not flammable. Keep containers tightly closed
Borax	No special steps required.
Copper sulfate	Avoid contact with skin and eyes. DO NOT breathe dust. Always wash hands thoroughly after contact. Store and use only in dry, well-ventilated areas. Keep container tightly closed.
Flocculent	Dust generated in handling of this product can be explosive if sufficient quantities are mixed in air, in which case ignition sources should be avoided. Employ grounding, venting and explosion relief provisions in accordance with accepted engineering practices in process operations capable of generating dust/or static electricity. Handle in accordance with good industrial practice, handle with care and avoid unnecessary personal contact. Avoid contact with eyes and prolonged or repeated skin contact. Avoid continuous or repetitive breathing of dust. Use only with adequate ventilation. Remove contaminated clothing; launder or dry-clean before reuse. Wash thoroughly with soap and water after using. For industrial use only. Material is slippery when wet. Store in the original container, securely closed, in a cool and dry location. Avoid extremes of temperature and ignition sources.
Ferric sulfate	Store and handle in corrosion-proof materials (and area). Use FRP or PVC pipes. Be cautious of substance residue in empty containers. Act according to precautions and warnings set forth.
Lead nitrate	Keep away from heat. Keep away from sources of ignition. Keep away from combustible material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as combustible materials and organic materials.

Table 6-4 Process Plant and Water Treatment Reagents – Safe Handling Procedures (continued)

Product	Handling Procedures
Lead acid (batteries)	Keep containers tightly closed when not in use. If battery case is broken, avoid contact with internal components. Do not handle near heat, sparks, or open flames. Protect containers from physical damage to avoid leaks and spills. Place cardboard between layers of stacked batteries to avoid damage and short circuits. Do not allow conductive material to touch the battery terminals. A dangerous short-circuit may occur and cause battery failure and fire. Keep away from combustible materials, organic chemicals, reducing substances, metals, strong oxidizers and water.
Lime	Avoid contact with skin and eyes. Do not breathe dust. Wear suitable protective clothing, gloves and eye/face protection. In case of insufficient ventilation, wear suitable respiratory equipment. Hydrated lime should be stored in a cool protected place away from moisture, strong oxidants or acids and to minimize dust emissions. Storage in steel or concrete bins and silos, or plastic lined bags, is appropriate. An alkaline material that reacts vigorously with acids, generating some heat. May absorb carbon dioxide from the atmosphere, forming calcium carbonate. Soluble in glycerol, aqueous solution of sucrose, and ammonium chloride. Incompatible with maleic anhydride, nitroparaffins, and phosphorus.
Hydrochloric acid	Do not get in eyes, on skin, or on clothing. Wear protective clothing. Avoid breathing vapours or fumes. Store in cool, dry, ventilated area with acid-resistant floors. Keep container closed, out of direct sunlight, and away from heat, water, and incompatible materials. When diluting, add acid slowly to water and in small amounts. Never use hot water and never add water to acid. When opening metal drum, use non-sparking tools because hydrogen gas may be present. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Paints	No special steps required.
Solvents	Use only with adequate ventilation. Wash thoroughly after handling. Observe good industrial hygiene practices. Keep container tightly closed and in a well-ventilated place. Store in closed original container at room temperature. Store away from incompatible materials.
Silica	Prevent formation of dust. This product is not flammable. When pouring into a container of flammable liquid, ground both containers electrically to prevent static electric spark. Keep containers tightly sealed.
Sodium cyanide	Highly toxic, corrosive to eyes, skin, and respiratory tract. Can be fatal if swallowed, inhaled, or absorbed through skin. Keep cyanide antidote kit available in any cyanide work area. Wear personal protective clothing at all times. Keep in tightly closed container in cool, dry, ventilated area. Protect against physical damage to containers. Do not store under sprinkler systems. Do not wash out container and use for other purposes. Empty containers retain product residues and may be hazardous.
Sodium hydroxide (caustic soda)	Can cause severe injury to eyes, skin, and respiratory tract. Use PPE at all times and DO NOT contact product directly. Wash thoroughly after handling. Store in dry, well-ventilated area. Keep in original container, tightly closed. Empty containers retain product residues and may be hazardous.

Table 6-4 Process Plant and Water Treatment Reagents – Safe Handling Procedures (continued)

Product	Handling Procedures
Sodium metabisulfite	May cause irritation to eyes, skin, and respiratory tract with prolonged exposure. Sulfite-sensitive individuals may experience severe allergic reaction to dust. Releases sulfur dioxide gas when mixed with water. Wear PPE and wash thoroughly after handling. Store in dry, well-ventilated area away from heat, acids, and oxidizers. Keep container tightly closed. Use vacuum to clean up dust.
Sodium nitrate	Keep away from heat. Keep away from sources of ignition. Keep away from combustible materials. Empty containers pose a fire risk; evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as reducing agents, combustible materials, and acids. Keep container dry. Keep in a cool place. Keep container tightly closed. Keep in a cool and well-ventilated area. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.
Sulfur prills	Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. May form flammable dust-air mixtures. Avoid contact with skin, eyes and clothing. Empty containers contain product residue (liquid and/or vapour), and can be dangerous. Keep containers tightly closed. Avoid contact with heat, sparks, and flame. Use with adequate ventilation. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat spark, or open flames. Store away from heat, sparks, and flame. Keep away from sources of ignition. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances (oxidizing agents).

Table 6-5 Process Plant, Water Treatment Reagents, and Others – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	Skin	Respiration
Acetylene	Tightly sealed goggles	Protective gloves	Use atmosphere-supplying respirators (e.g. supplied-air: demand, pressure-demand, or continuous-flow or self-contained breathing apparatus: demand or pressure-demand or combination supplied-air with auxiliary self-contained air supply atmosphere-supplying respirator in case of insufficient ventilation)
Activated carbon	None required	None required	None required
Anti-scaling agent	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Not normally needed
Borax	Avoid eye contact	None required	None required
Copper sulfate	Chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Dust mask; NIOSH/MSHA approved respirator, if required
Flocculent	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	Dust mask
Ferric sulfate	Splash goggles	Lab coat; gloves	Dust respirator. Be sure to use an approved/certified respirator or equivalent
Lead nitrate	Splash goggles	Lab coat; gloves	Dust respirator. Be sure to use an approved/certified respirator or equivalent
Lead acid (batteries)	Wear protective glasses with side shields or goggles.	Wear chemical resistant gloves as a standard procedure to prevent skin contact	Not required for normal conditions of use.
Lime	Safety goggles	Wear impervious gloves, shoes and protective clothing to prevent skin contact	NIOSH/MSHA approved respirator, if required

Table 6-5 Process Plant, Water Treatment Reagents, and Others – Personal Protective Equipment

Product	Personal Protective Equipment		
	Eyes	**Skin**	**Respiration**
Hydrochloric acid	For splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Paints	None required	None required	None required
Solvents	Use approved safety goggles or face shield	Wear appropriate chemical resistant clothing to prevent any possibility of skin contact	In case of inadequate ventilation, use respiratory protection
Silica	Safety goggles	Wear impervious gloves, shoes and protective clothing to prevent skin contact	NIOSH/MSHA approved respirator, if required
Sodium cyanide	For dust and splash protection use chemical goggles or full face shield	Rubber or neoprene gloves; impervious lab coat, apron, or coveralls and boots	NIOSH/MSHA approved respirator, if required
Sodium hydroxide (caustic soda)	Tight-fitting goggles if dust is generated. For splash protection use chemical goggles or full face shield	Gauntlet type rubber or neoprene gloves; impervious apron or coveralls and boots	NIOSH/MSHA approved respirator
Sodium metabisulfite	Chemical safety goggles	Cotton gloves adequate for handling dry product. For solutions, use rubber or neoprene gloves; impervious apron or overalls and boots	NIOSH/MSHA approved respirator
Sodium nitrate	Contact lenses should not be worn; they may contribute to severe eye injury	Impervious gloves of chemically resistant material (rubber or PVC), body suits, aprons, and/or coveralls of chemical resistant material and impervious boots of chemically resistant material should be worn at all times	For dusty or misty conditions, wear NIOSH-approved dust or mist respirator. In case of spill or leak resulting in unknown concentration, use NIOSH approved supplied air respirator
Sulfur prills	Chemical safety goggles	Wear impervious gloves, shoes and protective clothing to prevent skin contact	NIOSH/MSHA approved respirator, if required

SECTION 7 • MISCELLANEOUS HAZARDOUS/TOXIC MATERIALS

7.1 Product Description

Acids such as nitric acid, as well as emulsifiers and ammonium nitrate, will be used at the proposed mine site. Gases such as propane, oxygen, and acetylene, solvents, water/effluent treatment chemicals, and various additives will also be utilized.

The release or spillage of any of these substances would possibly result in environmental impacts and pose a potentially hazardous situation for those personnel exposed to these materials. It is essential that materials deemed to be potentially hazardous be dealt with in a cautious manner and in strict adherence to recommended regulations outlined in the legislation, whether the substance is provided in large or small quantities. This will prevent serious repercussions should an accidental release of material happen.

7.2 Storage Facilities of Hazardous/Toxic Chemicals

All explosive related chemicals will be stored as discussed in the Explosives Management Plan. All other chemicals and gases will be stored in appropriate locations.

These storage facilities ensure that chemicals that could interact and cause a serious incident will be kept segregated.

SECTION 8 • INVENTORY, INSPECTION, AND RECORDS

A contract expediting company will arrange all deliveries from the Itivia docking site to the proposed mine site. This will include the hazardous materials discussed in this Plan. The Environment & Infrastructure Superintendent will have ultimate responsibility for supervising the receipt, inspection, and recording of all material inventories at site. The Division Managers will reconcile total amounts received against amounts ordered. Purchasing controls will ensure that no excess hazardous materials are purchased beyond that requested by the Project for the coming year.

8.1 Petroleum Products

8.1.1 Inventory Management

Diesel fuel use will be automatically metered when it is pumped from the bulk tanks. The metered volumes will be summarized weekly and reconciled against tank levels determined manually with a dipstick from the top of the tanks. Diesel fuel consumption for the power generators will be recorded weekly.

8.1.2 Inspection

The Environment Department will perform regularly scheduled inspections of all fuel and lubricant storage areas. The inspection schedule and procedure to be followed are summarized in Table 8-1. All inspections will be logged with the date and time of inspection, facility inspected, and name of the person completing the inspection.

Table 8-1 Inspection of Petroleum Storage Sites

Site	Inspection
Fuel Tanks	*Schedule* – Weekly by Site Services Fuel Operator; weekly by Environment Technician; quarterly by Environment Coordinator. *Procedure* – Locate leak(s) and report promptly. Inspections will be reported annually and filed with the General Mine Manager or Site Services Superintendent and Environment Superintendent.
Diesel Power Generating Plant	*Schedule* – Daily by powerhouse operator; weekly by Environment Technician as part of regular internal environmental inspections. *Procedure* – Inspections will be reported annually and filed as above.
Other Fueling Stations	*Schedule* – Daily by Site Services Supervisor; weekly by Environment Technician as part of regular internal environmental inspections. *Procedure* – Inspections will be reported annually and filed as above.
Spill Kits	*Schedule* – Monthly by Environment Technician; quarterly by Environment Coordinator. *Procedure* – Inspections will be reported annually and filed as above.
Other Hazardous Material Storage Areas	*Schedule* – Weekly by Environment Technician when materials are on-site. *Procedure* – Inspections will be reported annually and filed as above.

The condition of hazardous materials storage areas, containers, tanks, connectors, and associated plumbing will be checked on a regular basis. Observations on their condition will be logged, dated, and kept near the corresponding storage area. Drums/containers will be inspected for the following:

- the presence and legibility of symbols, words, or other marks identifying the contents;
- signs of deterioration or damage such as corrosion, rust, leaks at seams; or,
- signs that the drum/container is under pressure such as bulging and swelling, spillage, or discoloration on the top or sides.

If a leak or deterioration is encountered, it will be noted and addressed in a timely manner.

The hazardous materials area's secondary containment will be inspected and the condition of the secondary containment will be noted. Arrangements will be made for repairs if necessary.

Any accidental damage to containment structures will be inspected immediately and appropriate repairs undertaken. The extent of damage will be reported in writing to the General Mine Manager and Environment Superintendent. The report will note any remedial repairs that have/may be made, the date of any repairs, and the need for any follow-up inspection.

8.1.3 Records

Records pertaining to storage, use, and loss of fuels and lubricants are required by CCME and the Fire Marshal (under the *National Fire Code).* The following records will be prepared by the Procurement and Logistics and Environment & Infrastructure Departments:

- reconciliation of bulk inventory from resupply logs;
- weekly use summaries;
- weekly reconciliation for each storage tank;
- overfill alarm tests;
- pressure tests (if applicable);
- inspections and maintenance checks of the storage tank, piping, and delivery systems;
- any alteration to the systems;
- reports of leaks or losses;
- reports of spill responses; and
- records of training.

8.2 Miscellaneous Hazardous/Toxic Materials

8.2.1 Inventory Management

Quantities of all hazardous chemicals will be reconciled against orders on receipt. The appropriate department responsible for the miscellaneous chemicals will be responsible for reconciling the resupply inventory.

8.2.2 Inspection

During operations, the appropriate department responsible for storage and handling of the miscellaneous chemicals will regularly inspect all areas where such hazardous materials are used and stored. Any problems will be noted and reported to the Department Manager. The Department Manager will be responsible for weekly or monthly inspections of miscellaneous hazardous materials and storage areas.

8.2.3 Records

The quantity of hazardous materials received, used, and in possession of personnel will be recorded by appropriate departments. The departments will comply with the environmental regulations.

SECTION 9 • TRAINING

9.1 General

All staff and contractors at the Project will receive the following training:

- WHMIS;
- emergency and spill response (see also the SCP and Risk Management and Emergency Response Plan);
- operations overview; and
- Mine Standard Operating Procedures.

Mine employees will receive additional training in mine safety as specified by the *Mine Health and Safety Act* and regulations. Agnico Eagle will ensure compliance with the training requirements specified in the Act and regulations.

Plant employees will receive additional training specific to their area of work and duties, including safe operating practices, safe handling and storage of chemicals, and use of PPE. Other training will include cyanide and chemical awareness, specific chemical training for specific tasks, and mill induction training. This training will be the responsibility of Agnico Eagle.

A record of training received will be maintained for each employee and contractors.

9.2 Petroleum Products Handlers

Personnel who handle petroleum products will be expected to be conversant with relevant MSDS information. As well, these personnel will be given training in the following:

- Transportation of Dangerous Goods (TDG);
- Agnico Eagle's fuel handling procedures (outlined in Section 5);
- spill response and clean-up procedures for petroleum (see the SCP); and
- emergency response, especially firefighting procedures (see the Risk Management and Emergency Response Plan).

9.3 Plant Employees

Plant operators may receive TDG training, if appropriate. All plant employees will be trained in spill and emergency response procedures. Emergency response procedures for spilled chemical substances are provided in the SCP.

9.4 Third Party Contractors

It is expected that third party contractors receive adequate and comprehensive training to conduct their work tasks from their employer. Agnico Eagle intends to review the general qualifications of third party contractors prior to having them work at the site. In addition, the contractor companies

may also be requested to confirm the qualifications of specific individuals they have working at the site.

Third party contractors working on-site will be required to participate in, and complete, a site specific health and safety training session. The training session will be valid for a period of three years, after which time the contractor will be required to complete the training again, or attend a refresher session. The training session will outline site specific hazardous and response procedures of which they need to be aware in the course of conducting work on-site. The training session will cover hazardous materials management.

SECTION 10 • PLAN EVALUATION, AUDIT AND IMPROVEMENT

As part of Agnico Eagle's commitment to attain certification under the ICMC, every three years Agnico Eagle will sponsor audits by Institute-approved, third-party professionals to verify its compliance with the Code's principles and standards of practice with regard to cyanide handling.

The Plan will be reviewed annually and updated if there are changes in operations and/or technology.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2014a. Shipping Management Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 8, Supporting Document 8-1. Submitted to the Nunavut Impact Review Board. April 2014.

Agnico Eagle. 2018. Oil Pollution Emergency Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 8, Supporting Document 8-2. Submitted to the Nunavut Impact Review Board. April 2014.

Government of Nunavut. 2010. Environmental Guideline for the General Management of Hazardous Waste. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/Guideline%20-%20General%20Management%20of%20Hazardous%20Waste%20(revised%20Oct%202010).pdf

Minister of Justice. 2012. Metal Mining Effluent Regulations, SOR/2002-222. Last amended on March 2, 2012.

APPENDIX A • ENVIRONMENTAL GUIDELINE FOR THE GENERAL MANAGEMENT OF HAZARDOUS WASTE

Environmental Guideline for the

General Management of Hazardous Waste

Department of Environment
Government of Nunavut

GUIDELINE: GENERAL MANAGEMENT OF HAZARDOUS WASTE

Original: April 1999
Revised: January 2002
April 2010
October 2010

This Guideline has been prepared by the Department of Environment's Environmental Protection Division and approved by the Minister of Environment under the authority of Section 2.2 of the *Environmental Protection Act.*

This Guideline is not an official statement of the law and is provided for guidance only. Its intent is to increase the awareness and understanding of the risks and hazards associated with hazardous waste and to assist in its proper management. This Guideline does not replace the need for the owner or person in charge, management or control of a hazardous waste to comply with all applicable legislation and to consult with Nunavut's Department of Environment, other regulatory authorities and qualified persons with expertise in the management of hazardous waste.

Copies of this Guideline are available upon request from:

Department of Environment
Government of Nunavut
P.O. Box 1000, Station 1360, Iqaluit, NU, X0A 0H0
Electronic version of the Guideline is available at http://env.gov.nu.ca/programareas/environmentprotection

Cover Photos: E. Paquin

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Introduction

'Waste' is a term used to describe materials that are no longer wanted or are unusable for their original intended purpose. Many different types of waste are generated each day in Nunavut by industry and small business, hospitals and health centers, schools and individuals during the normal course of carrying out daily activities. Some types of waste pose greater risks than others because of their chemical, physical and biological properties. These wastes are generally referred to as being a 'hazardous waste'. Examples of hazardous waste include discarded paint, used solvents, motor and lubricating oil, cleaning compounds, certain building construction and demolition waste and products with an expired shelf life. They will generally exhibit one or more of the following characteristics - ignitable (i.e. flammable), reactive, corrosive or toxic. Hazardous waste often requires that specific management measures be taken to ensure the health and safety of the environment, workers and the general public.

The purpose of the Environmental Guideline for the General Management of Hazardous Waste (the Guideline) is to ensure the safe, effective and efficient management of hazardous waste in Nunavut. It provides information to generators, carriers and receivers of hazardous waste on its hazards, how best to reduce or eliminate the effects it can have on the environment, worker and public safety and guidance on its storage, registration and transportation.

The *Environmental Protection Act* enables the Government of Nunavut to implement measures that preserve, protect and enhance the quality of the environment. Section 2.2 of the *Act* provides the Minister with authority to develop, coordinate, and administer the Guideline.

The Guideline is not an official statement of the law. For further information and guidance, the owner or person in charge, management or control of a hazardous waste is encouraged to review all applicable legislation and consult the Department of Environment, other regulatory agencies or qualified persons with expertise in hazardous waste management.

1.1 Definitions

Carrier	A person who accepts hazardous waste for transportation or transports hazardous waste, whether or not for hire or reward. A carrier is also referred to as a transporter of hazardous waste.
Commercial	Actions undertaken for hire or reward.
Commissioner's Land	Lands that have been transferred by Order-in-Council to the Government of Nunavut. This includes roadways and land subject to block land transfers. Most Commissioner's Land is located within municipalities.
Consignee	A person to whom hazardous waste is being or is intended to be transported. A consignee is also referred to as a receiver of hazardous waste.

Consignor	A person who has possession of hazardous waste immediately before it is transported. A consignor may also be a generator of hazardous waste.
Contaminant	Any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment, (a) endangers the health, safety or welfare of persons, (b) interferes or is likely to interfere with normal enjoyment of life or property, (c) endangers the health of animal life, or (d) causes or is likely to cause damage to plant life or to property.
Dangerous Good	Any product, substance or organism included by its nature or by the *Transportation of Dangerous Goods Regulations* in any of the classes listed in the Schedule provided in the *Transportation of Dangerous Goods Act* (Canada).
Empty Container	A container that previously held a hazardous waste and has been emptied to the greatest extent practical or triple rinsed with an appropriate cleaning agent. This does not include containers that previously contained mercury or Class 2.3, 5.1 or 6.1 materials.
Environment	Means the components of the Earth and includes (a) air, land and water, (b) all layers of the atmosphere, (c) all organic and inorganic matter and living organisms, and (d) the interacting natural systems that include components referred to in paragraphs (a) to (c) above.
Generator	The owner or person in charge, management or control of a hazardous waste at the time it is generated or a facility that generates a hazardous waste. A generator may also be a consignor of hazardous waste.
Hazardous Waste	A contaminant that is a dangerous good and is no longer wanted or is unusable for its original intended purpose and is intended for storage, recycling, treatment or disposal. A hazardous waste does not include a contaminant that is (a) household in origin; (b) exempted as a small quantity; (c) returned directly to a manufacturer or supplier of the product, substance or organism for reprocessing, repackaging or resale for any reason; (d) an empty container; or (e) intended for disposal in a landfill or a sewage treatment facility and meets the applicable standards set out in the Environmental Guideline for Industrial Waste Discharges.

Hazardous Waste Management Facility	A commercial facility used for the collection, storage, transfer, treatment, recycling or disposal of a hazardous waste. For clarity, a hazardous waste management facility does not include a municipal landfill or sewage lagoon.
Incompatible Hazardous Waste	A hazardous waste that, when in contact with another substance or hazardous waste under normal circumstances, reacts to produce heat, gas, fire, explosion or a corrosive or toxic substance.
Landfilling	The intentional depositing or placement of waste in or on land for the purposes of disposal.
Long-term Storage	The storage of hazardous waste for a period of 180 days or more.
Manifest	The manifest as set out in Schedule IX to the *Export and Import of Hazardous Waste and Hazardous Recyclables Regulations* under the *Canadian Environmental Protection Act* (Canada).
Minister	The Minister of Environment of the Government of Nunavut.
Qualified Person	A person who has an appropriate level of knowledge and experience in all relevant aspects of hazardous waste management.
Receiver	A person to whom hazardous waste is being or is intended to be transported. A receiver is also referred to as a consignee of hazardous waste.
Responsible Party	The owner or person in charge, management or control of the hazardous waste.
Small Quantity	Hazardous waste that is generated in an amount that is less than five kilograms per month if a solid or less than five litres per month if a liquid, and where the total quantity accumulated at any one time does not exceed five kilograms or five litres. This does not include hazardous waste that is mercury or Class 2.3, 5.1 or 6.1 materials. These wastes must be generated in an amount that is less than one kilogram per month if a solid or less than one litre per month if a liquid, and where the total quantity accumulated at any one time does not exceed one kilogram or one litre.
Transport Authority	The statute and regulations controlling the management of hazardous waste under that mode of transport. These include (a) Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations; Interprovincial Movement of Hazardous Waste Regulations* (CEPA) and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* (CEPA). (b) Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and

(c) Marine – *International Maritime Dangerous Goods Code* (IMDG).

Transfer	The temporary storage of hazardous waste for a period of 179 days or less for the purpose of changing from one vehicle or means of transportation to another.
Transporter	A person who accepts hazardous waste for transportation or transports hazardous waste, whether or not for hire or reward. A transporter is also referred to as a carrier of hazardous waste.
Waste Audit	An inventory or study of the amount and type of waste that is produced at a location.

1.2 Roles and Responsibilities

1.2.1 Environmental Protection Division

The Environmental Protection Division of the Department of Environment is the key environmental agency responsible for ensuring the proper management of hazardous waste and other contaminants on Commissioner's Land. Authority is derived from the *Environmental Protection Act*, which prohibits the discharge of contaminants to the environment and enables the Minister to undertake actions to ensure appropriate management measures are in place. Although programs and services are applied primarily to activities taking place on Commissioner's and municipal lands and to Government of Nunavut undertakings, the *Environmental Protection Act* may be applied to the whole of the territory where other controlling legislation, standards and guidelines do not exist. A complete listing of relevant legislation and guidelines can be obtained by contacting the Department of Environment or by visiting the web site at http://env.gov.nu.ca/programareas/environmentprotection.

The Department of Environment will provide advice and guidance on the proper management of hazardous waste. However, it remains the responsibility of the owner or person in charge, management or control of the hazardous waste to ensure compliance with all applicable statutes, regulations, standards, guidelines and local by-laws.

1.2.2 Generators of Hazardous Waste

The generator is the owner or person in charge, management or control of the hazardous waste at the time it is produced or of the facility that produces the hazardous waste. The generator is responsible for any and all hazardous waste produced and must ensure the hazardous waste is properly and safely managed from the time it is generated to its final disposal. This is referred to as managing the waste from cradle-to-grave.

Contractors may manage hazardous waste on behalf of the generator. However, the generator remains responsible for determining whether the waste is hazardous and ensuring the method of management complies with all applicable statutes, regulations, standards, guidelines and local by-laws. If the contractor does not comply with the requirements of the *Environmental Protection Act* and is charged with a violation while managing the waste, the generator may also be held liable.

The basic responsibilities of a hazardous waste generator in Nunavut are:

- Registering with the Department of Environment as a generator of hazardous waste. Registering
- the facility with the Department of Environment as a hazardous waste management facility where the facility is used for commercial purposes and is intended for the storage of hazardous waste for a period of 180 days or more, where stored quantities exceed the criteria set out in Appendix 8 or where hazardous waste is recycled, treated or disposed of in quantities in any single month that exceed a 'small quantity'.
- Classifying and labeling hazardous waste in accordance with the Transport Authority.
- Managing the hazardous waste in accordance with the Guideline, *Environmental Protection Act, Fire Prevention Act*, *Safety Act, Public Health Act* and all other applicable statutes, regulations, standards, guidelines and local by-laws.
- Reusing, recycling, treating or disposing of the hazardous waste in a proper and safe manner.
- Where the hazardous waste is transported off-site, completing Part A of the waste manifest form and retaining a copy for two years, using a registered hazardous waste carrier to transport the waste and sending the waste to a registered receiver or hazardous waste management facility.
- Ensuring staff are trained and qualified to safely handle the hazardous waste.
- Filing a spill contingency plan with the Minister where stored quantities of hazardous waste exceed the criteria set out in Schedule A of the *Spill Contingency Planning and Reporting Regulations*.
- Reporting any spill immediately to the NWT/Nunavut Spill Report Line at (867) 920-8130.

Further information and application forms for registering as a generator or a hazardous waste management facility are available from the Department of Environment. Refer to sections 3.2.1 and 3.2.2 and Appendices 4 and 7 for further information.

1.2.3 Carriers of Hazardous Waste

Hazardous waste must be transported in accordance with the appropriate Transport Authority: Road and Rail - *Transportation of Dangerous Goods Act* (Canada) and *Regulations, Interprovincial Movement of Hazardous Waste Regulations* (CEPA) and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations* (CEPA)*;* Air – *International Air Transport Association (IATA) Dangerous Goods Regulations* and *International Civil Aviation Organization* (ICAO) *Technical Instructions;* and Marine – *International Maritime Dangerous Goods Code* (IMDG).

Carriers operating in Nunavut must be registered with the Department of Environment before transporting hazardous waste. Other basic responsibilities of hazardous waste carriers are:

- Placarding and labeling all transport vehicles and containers in accordance with the appropriate Transport Authority.
- Completing Part B of the waste manifest form and retaining a copy for two years.
- Accepting hazardous waste only from registered generators and safely transporting hazardous waste only to a registered receiver or hazardous waste management facility.
- Ensuring staff are trained and qualified to safely transport hazardous waste.
- Reporting any spill immediately to the NWT/Nunavut Spill Report Line at (867) 920-8130.

Further information and application forms for registering as a hazardous waste carrier are available from the Department of Environment. Refer to section 3.2.1 and Appendix 5 for further information.

1.2.4 Receivers of Hazardous Waste

Any person receiving or accepting hazardous waste in Nunavut for the purpose of storage, transfer, reuse, recycling, treatment or disposal must be registered with the Department of Environment as a hazardous waste receiver. The facility must also be registered as a hazardous waste management facility where it is used for commercial purposes and is used to store hazardous waste for a period of 180 days or more, store quantities that exceed the criteria set out in Appendix 8 or hazardous waste is recycled, treated or disposed of in quantities in any single month that exceed a 'small quantity'. Other basic responsibilities of hazardous waste receivers in Nunavut are:

- Handling and storing the hazardous waste in accordance with the Guideline, *Environmental Protection Act, Fire Prevention Act*, *Safety Act, Public Health Act* and all other applicable statutes, regulations, standards, guidelines and local by-laws.
- Reusing, recycling, treating or disposing of the hazardous waste in a proper and safe manner.
- Completing Part C of the waste manifest form and retaining a copy for two years.
- Accepting hazardous waste only from registered generators and carriers.
- Ensuring staff are trained and qualified to safely handle hazardous waste.
- Filing a spill contingency plan with the Minister where stored quantities of hazardous waste exceed the criteria set out in Schedule A of the *Spill Contingency Planning and Reporting Regulations*.
- Reporting any spill immediately to the NWT/Nunavut Spill Report Line at (867) 920-8130.

Further information and application forms for registering as a receiver or hazardous waste management facility are available from the Department of Environment. Refer to sections 3.2.1 and 3.2.2 and Appendices 6 and 7 for further information.

1.2.5 Other Regulatory Agencies

Other regulatory agencies may have to be consulted regarding the management of hazardous waste as there may be other environmental or public and worker health and safety issues to consider. Some of the other agencies include:

Department of Economic Development and Transportation

The Motor Vehicles Division is responsible for ensuring the safe transport of hazardous waste and other dangerous goods by road through administration of the *Transportation of Dangerous Goods Act*. The Department is also responsible under the *Motor Vehicles Act* for driver licensing and various other vehicle and load safety matters.

Workers' Safety and Compensation Commission

The Workers' Safety and Compensation Commission is responsible for promoting and regulating worker and workplace health and safety in Nunavut. The Commission derives its authority from the *Workers' Compensation Act* and *Safety Act* which require an employer to maintain a safe workplace and ensure the safety and well being of workers. The Workplace Hazardous Materials Information System, or WHMIS, requires information be provided to workers on the safe use of any hazardous material used in the workplace. All hazardous waste generators, carriers and receivers should consult the Prevention Services Division for further information and guidance.

Department of Community and Government Services

The Department of Community and Government Services is responsible under the *Commissioners' Lands Act* for the issuance of land leases, reserves, licenses and permits on Commissioner's Lands. The Department, in cooperation with communities, is also responsible for the planning and funding of municipal solid waste and sewage disposal facilities in most Nunavut communities. Emergency planning responsibilities under the *Emergency Measures Act* include developing territorial emergency response plans, coordinating emergency operations at the territorial and regional levels and supporting community emergency response operations.

The Office of the Fire Marshal is responsible for ensuring the safe storage, handling and use of flammable and combustible liquids and materials. The Office of the Fire Marshal derives its authority from the *Fire Prevention Act*, National Fire Code and National Building Code.

Department of Health and Social Services

Activities related to the generation, storage, transportation, treatment and disposal of hazardous waste may have an impact on public health. The Office of the Chief Medical Officer of Health and Regional Environmental Health Officers should be consulted regarding legislated requirements under the *Public Health Act.*

Environment Canada

Environment Canada is responsible under the *Canadian Environmental Protection Act* for ensuring the safe management of designated hazardous waste at federal facilities and on federal lands. The management, disposal and export of polychlorinated biphenyl (PCB) waste is controlled under the *PCB Regulations*, the *Federal Mobile PCB Treatment and Destruction Regulations* and the *PCB Waste Export Regulations*. The interprovincial and international transport of waste is controlled under the *Interprovincial Movement of Hazardous Waste Regulations* and the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*. Environment Canada is also responsible for administering the pollution prevention provisions of the federal *Fisheries Act*.

Indian and Northern Affairs Canada

Indian and Northern Affairs Canada is responsible under the *Territorial Lands Act* and *Nunavut Waters and Nunavut Surface Rights Tribunal Act* for the management of federal lands and waters in Nunavut, including the impact hazardous waste may have on the quality of these lands and waters.

Natural Resources Canada

The *Explosives Act* provides Natural Resources Canada with authority to manage explosives in Canada, including waste explosives. The Canadian Nuclear Safety Commission, which reports to Parliament through the Minister of Natural Resources, administers the safe handling and disposal of radioactive materials and licenses institutions and companies to possess and use radioactive materials under the *Nuclear Safety and Control Act* and *Nuclear Liability Act.*

Local Municipal Governments

The role of municipal governments is important in the proper local management of hazardous waste. Under the Nunavut Land Claim Agreement, municipalities are entitled to control their own municipal disposal sites. Hazardous waste may be deposited into municipal landfill sites and sewage treatment facilities only with the consent of the local government. Local environmental and safety standards are determined, in part, by how the property is designated under municipal government development plans (i.e. land use zoning). The local fire department may also be called upon if a fire or other public safety issue is identified.

Co-management Boards and Agencies

Co-management boards and agencies established under the Nunavut Land Claim Agreement have broad authority for land use planning, impact assessment and the administration of land and water. Activities involving hazardous waste may be controlled through the setting of terms and conditions in plans, licenses and permits issued by the Nunavut Water Board and other co-management boards and agencies.

Appendix 3 provides further assistance in determining the primary regulatory agency contact for managing hazardous waste in Nunavut.

Appendix 11 provides mailing addresses, phone and fax numbers for each of the regulatory agencies.

Management of Hazardous Waste

2.1 What is Hazardous Waste?

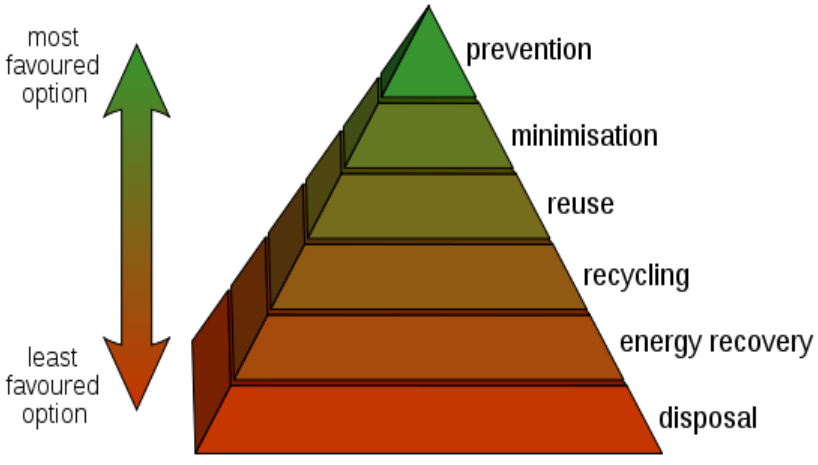
Hazardous waste is unwanted material or products that can cause illness or death to people, plants and animals. It may be a liquid, solid, sludge or gas and contain chemicals, heavy metals, radioactives, infectious organisms or other toxic substances. It may be a single product or a combination of many hazardous and non-hazardous materials (i.e. mixed waste). Its harmful effects may exist for a relatively short period of time (i.e. oil-based paint before hardening) or continue for hundreds of years. It can persist in soil, water and sediment (i.e. radioactive materials) or bioaccumulate in plants and animals (i.e. mercury, PCBs).

Hazardous waste is generated by everybody. Households commonly generate unwanted gasoline, brake and windshield wiper fluid, cleaning supplies, paints and paint thinners, lead acid batteries, used computer equipment and construction materials (i.e. asbestos), pesticides and others. Hospitals and nursing stations generate unwanted needles and waste human tissue, body fluids and biotic cultures. Business and industry generate many different types of hazardous waste including used motor and lubricating oil, cleaning solvent, drilling fluid and cuttings and mine tailings.

2.2 Waste Management

Proper waste management simply makes good sense. Minimizing or eliminating the generation of hazardous and other waste helps to reduce the hazards and costs associated with its handling, storage, transport, recycling, treatment and disposal. It also reduces the impacts waste could have on the environment, human and worker health and safety and reduces the global emission of greenhouse gases by minimizing the use of raw materials. Another term commonly used to describe activities that reduce the amount of material entering a waste stream or being released to the environment is ‘pollution prevention’.

Once a waste is created, the generator is responsible for its safe management from cradle-to-grave. Waste generators can prevent pollution and reduce costs by implementing various waste reduction, reuse and recycling programs through changes to operational procedures, maintenance practices and raw material use. Treating and disposing of waste either locally or outside of Nunavut should be considered only if reuse and recycling options are not available or practical.



2.2.1 Reduce and Minimize – the first option

Using raw materials efficiently and reducing the amount of waste generated is the first and most important step in effective waste management. Both environmentally and economically, consuming less is the most fundamental and effective step to reducing waste.

A waste audit should be undertaken to inventory and study the waste produced at a location or business. The audit should identify the type and amount of waste being generated, the costs of current management methods including handling, storage, treatment, transport and disposal, and examine opportunities and set targets for reducing or reusing waste. These opportunities include awareness and education, the substitution or reduction of purchased raw materials, production redesign, process changes and improved maintenance activities. Other opportunities include purchasing products that are durable or are manufactured from environmentally-friendly materials (i.e. biodegradable or post-consumer materials), avoiding products that are designed for single or short life usage and buying only the quantity that is needed. Effective communications is critical to the success of any waste reduction program.

2.2.2 Reuse and Recycle

Even with effective waste reduction measures in place there will be waste generated. Reusing the waste product for a different but related purpose (reuse) or producing a new product from the original material (recycle) is an effective way to reduce the volume of waste. The waste audit should identify whether opportunities are available for reusing or recycling waste within the generating facility. Alternatively, other local or distant users may be found to reuse or recycle the waste that would otherwise require treatment or disposal.

The Department of Environment encourages the reuse and recycling of hazardous and other waste in the following ways:

- Local reuse and recycle programs are available in various communities for some types of hazardous waste including used oil and waste fuel. Generators should contact the Department of Environment or local municipal government for the names of registered waste receivers or other opportunities to reuse or recycle wastes locally.
- Waste exchanges and associations offer opportunities for waste generators to transfer unwanted, overstocked, obsolete, damaged, contaminated and post-dated material to another person or company that can use it. In some cases, the receiving company will purchase the waste from the generator. Appendix 10 provides a listing of several waste exchanges and associations in Canada.

2.2.3 Treatment and Disposal in Nunavut

Treatment and disposal of a hazardous waste is the last step in effective waste management and should be undertaken only after all other practical reuse and recycle options have been examined.

Treatment covers a broad spectrum of activities. It includes any method, technique or process that will change the physical, chemical or biological character or composition of a hazardous waste so as to reduce its volume, neutralize or make the waste less hazardous and make it safer to transport or store

prior to its disposal. In some cases, more than one process may be required to treat the waste. Facilities in Nunavut at which hazardous waste is stored, treated, recycled or disposed of for commercial purposes must be registered as a hazardous waste management facility. The owner or operator of a facility should refer to section 3.2.2 and Appendix 7 for further information.

It is a contravention of the *Environmental Protection Act* for hazardous waste to be abandoned or disposed of on land or into water in Nunavut. Although a detailed discussion on specific hazardous waste disposal methods is beyond the scope of the Guideline, the following are general points for consideration:

- Hazardous waste must not be mixed or diluted with another substance, or divided into smaller quantities, simply to avoid meeting the definition of a hazardous waste.
- The generator is responsible for determining how hazardous waste can be safely disposed of and to comply with all applicable statutes, regulations, standards, guidelines and local by-laws. The Department of Environment will provide advice and guidance on the management of hazardous waste. Other sources of information and assistance include:
    - Manufacturer or distributor of the new product;
    - Manufacturer's Material Safety Data Sheets (MSDS); and
    - Waste exchanges and associations, other regulatory authorities, waste management consultants and other qualified persons with expertise in the management of hazardous waste.
- Hazardous waste that meets standards set out in the Environmental Guideline for Industrial Waste Discharges may be directed to municipal landfills and sewage treatment systems for disposal. The local municipal government must be consulted and consent to the use of their facility prior to the waste being disposed. Waste that does not meet the standards set out in the Environmental Guideline for Industrial Waste Discharges must be treated prior to disposal or transported to a facility that is registered to accept the waste.
- The open burning of hazardous waste is not an acceptable practice as toxic substances may be released into the atmosphere.
- Incompatible hazardous waste should not be mixed, combined or stored together in the same container as new hazards may be created. Combining or mixing one waste with another waste may also prevent its reuse or recycling and increase disposal costs.
- Containers that previously held a hazardous waste must be emptied to the greatest extent practical or triple rinsed with an appropriate cleaning agent prior to disposal. The rinsings must then also be managed according to their waste characteristics. Cleaned containers should be rendered unusable by puncturing or crushing prior to disposal to prevent their reuse. This is especially important for containers that could be reused for water or food storage.

The Department of Environment will consider alternate hazardous waste management and disposal measures that provide an equivalent level of environmental protection to those identified in this Guideline.

2.2.4 Treatment and Disposal Outside Nunavut

Hazardous waste can be sent to a receiver or hazardous waste management facility located outside of Nunavut only where the receiver or facility has been registered in the receiving province or territory to

accept that waste. The generator must comply with all applicable statutes, regulations, standards, guidelines and local by-laws of the receiving jurisdiction.

Within Canada, Environment Canada monitors and controls the interprovincial movement of hazardous waste under the *Interprovincial Movement of Hazardous Waste Regulations*. Waste manifests must accompany each shipment of waste in accordance with the Transport Authorities' requirements. Generators and carriers should refer to section 3.3 of the Guideline for additional information on transport and waste manifest requirements.

The international movement of hazardous waste is controlled under the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. Known simply as the Basel Convention, it is an international treaty to control and reduce the transfer of hazardous waste from developed to less developed countries. Environment Canada monitors and controls the international movement of hazardous waste under the *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*.

A listing of Canadian waste management facilities may be obtained by contacting the waste exchanges and other organizations listed in Appendix 10.

General Requirements

Hazardous waste is classified using the system developed under the *Transportation of Dangerous Goods Act (Canada)*. Wastes are categorized into one of nine classes according to their chemical, physical or biological properties. Each waste, or group of similar wastes, is then identified using a specific 'UN' number assigned under the *Transportation of Dangerous Goods Regulations*. Refer to Appendix 2 for additional information on dangerous goods classifications.

3.1 Storage

Storage refers to containment of a hazardous waste for transport, or while awaiting treatment and disposal. Except under extraordinary circumstances (i.e. radioactive materials), storage should always be considered as a temporary measure and is not acceptable for the long-term management of hazardous waste.

Recognition of the incompatibility of different wastes during storage is important in order to avoid the possibility of violent, explosive reactions and toxic fumes. Various systems have been developed to ensure compatible storage including the 'Hazardous Waste Compatibility Chart' adopted by the United States' Environmental Protection Agency[1].

3.1.1 Containers

Hazardous waste storage containers are designed to hold, store and transport small quantities of waste. Many different types of containers are available (i.e. barrels, bottles, bags and boxes) and are made from a variety of materials (i.e. aluminum, plastic, steel, and stainless steel). Selecting the proper container requires an understanding of the properties of the waste to be stored. If transport is to be undertaken, the generator should consult the Transport Authority to confirm the container meets all legislated requirements.

The following are additional general points for consideration:

- Hazardous waste should be stored in their original containers where possible or in containers specially manufactured for the purpose of storing hazardous waste. The containers must be sound, sealable and not damaged or leaking.
- Containers should be clearly labeled to identify their contents according to requirements of the Workplace Hazardous Materials Information System (WHMIS) and the relevant Transport Authority, if transport is planned.
- Small quantities of compatible hazardous waste should be bulked into 16 gauge or equivalent metal or plastic 205 litre (45 gallon) drums for the purpose of secondary containment.
- Containers should be closed and sealed at all times, except while waste is being added or removed.

[1] EPA-600/2-80-076 April 1980. A Method for Determining the Compatibility of Chemical Mixtures.

3.1.2 Facilities

A hazardous waste storage facility is a specially designed building or area that helps to ensure the safe and secure storage of hazardous waste. Detailed storage facility building designs are beyond the scope of the Guideline. The Department of Environment or other qualified person should be consulted prior to designing and constructing a storage facility.

The following are general points to consider when establishing a storage facility:

- The facility should meet all local and territorial siting and construction requirements and be readily accessible for fire fighting and other emergency responses. The local Fire Chief should be advised of the storage facility and its contents for emergency planning and response purposes.
- The facility should be secure. Access should be limited where practical to employees who have been trained in safety and emergency procedures. These procedures should be documented and a copy made available to those employees who have access to the facility.
- Inspections of the facility and stored wastes should be performed and recorded at least once every week.
- Containers should be placed so that each can readily and easily be inspected for signs of leakage, corrosion or deterioration. Leaking, corroded or deteriorated containers should immediately be removed and their contents transferred to a sound container.
- Records should be maintained indicating the type and quantity of waste being stored along with the date, type and quantity of hazardous waste brought into or removed from the facility.
- Drainage into and from the storage facility site should be controlled to prevent spills or leaks from leaving the site and to prevent run-off from entering the site.
- All waste should be stored on a firm working surface that is impervious to leaks.
- Incompatible waste must be stored in a manner that contact in the event of a spill or accidental release is not possible.
- Emergency response plans should be developed in cooperation with local emergency response personnel and emergency response equipment should be locally available in the event of a spill, fire or other emergency situation.

Where the facility is used for commercial purposes and is used to store hazardous waste for periods of 180 days or more or the quantity of waste stored on-site exceeds the criteria set out in Appendix 8, the facility must be registered with the Department of Environment as a hazardous waste management facility.

3.2 Registration

3.2.1 Hazardous Waste Generators, Carriers and Receivers

Generators, carriers and receivers of hazardous waste must be registered before undertaking activities involving these wastes. Completion of the approved form and submission of accurate information enables the Department of Environment to quickly complete the registration process. Registration enables the government to track the generation, transport and disposal of hazardous waste in Nunavut. It also provides assurance that the company has the necessary emergency response and spill

contingency plans in place should an accident or other incident occur involving a hazardous waste. Upon registration, the applicant will be assigned a unique identification number. This number is required in order to complete the waste manifest form.

Appendices 4, 5 and 6 provide samples of registration forms required for generators, carriers and receivers to apply for registration in Nunavut. Original forms and users' guides are available from Nunavut's Department of Environment or by downloading through the department's web site. Incomplete applications will result in delays in completing the registration process.

Generators and receivers of hazardous waste located in Nunavut must be registered with the Department of Environment. Carriers may be registered either in Nunavut or in the province or territory in which the company is based.

3.2.2 Hazardous Waste Management Facilities

A hazardous waste management facility is a facility or specially-designated area that is used for the collection, storage, transfer, treatment, recycling or disposal of hazardous waste for commercial purposes. Where the facility is used solely for the collection, storage or transfer of hazardous waste, the facility must be registered where waste is stored for a period of 180 days or more or the quantities exceed those set out in Appendix 8 of the Guideline. Where the facility is to be used for the treatment, recycling or disposal of hazardous waste, the facility must be registered where the quantity treated, recycled or disposed of in any single month exceeds a 'small quantity'.

The collection, storage, transfer, treatment, recycling or disposal of hazardous waste on behalf of a third-party does not remove the obligation of the owner or operator of a hazardous waste management facility to register the facility.

Appendix 7 includes a sample of the registration form required for the owner or operator of a hazardous waste management facility to apply for registration of the facility. The owner or operator may obtain an original form and users' guide by contacting Nunavut's Department of Environment or by downloading through the department's web site. Incomplete applications will result in delays in completing the registration process.

Registration of a hazardous waste management facility does not remove the obligation to comply with all other applicable municipal, territorial and federal statutes, regulations, standards, guidelines and by-laws. Guidance on planning for and achieving territorial environmental requirements for new industrial projects may be found in the *Environmental Guideline for Industrial Projects on Commissioner's Lands.*

3.3 Transportation

Carriers must ensure hazardous waste is packaged, documented, labeled and placarded in compliance with the method of transport used - road, rail, air or marine. A completed waste manifest must accompany each shipment of hazardous waste. Completion of the manifest together with proper marking and placarding of containers and vehicles enables police, ambulance, fire and other first responders to react effectively and safely in the event of a spill or other accident involving hazardous waste while in transit.

The transport of hazardous waste by road in Canada is controlled under the territorial and federal *Transportation of Dangerous Goods Acts* and the federal *Interprovincial Movement of Hazardous Waste Regulations* and *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.* These Acts and Regulations require that personnel are trained, containers and transport vehicles are labeled and placarded and a completed waste manifest accompanies each shipment. The generator, carrier and receiver must each complete their portion of the manifest form and provide copies to the Department of Environment at various stages in the transport process. Refer to Appendix 9 for a copy of the manifest. Original manifest forms are available from Nunavut's Department of Environment and completion instructions are included on the reverse side of each manifest. Further assistance in completing a waste manifest may be obtained by referring to the *User's Guide for the Hazardous Waste Manifest* produced by Environment Canada or by contacting the Motor Vehicles Division of the Department of Economic Development and Transportation.

The International Air Transport Association (IATA) requires that all shipments of hazardous wastes tendered to air carriers be accompanied by the IATA Shipper's Declaration of Dangerous Goods. The consignor is responsible for completion of the form in accordance with IATA requirements and to ensure all packaging, placarding and labeling is consistent with the product being transported.

The International Marine Dangerous Goods Code requires use of the International Marine Organization's Multimodal Dangerous Goods Form when transporting dangerous goods or hazardous waste by ship or barge.

Further information on transporting hazardous waste by air or marine can be obtained by contacting Transport Canada. Information and instructions on manifesting, placarding and labeling hazardous waste commonly generated in Nunavut can be obtained by referring to waste-specific guidelines produced by the Department of Environment. A complete listing of guidelines is available at http://env.gov.nu.ca/programareas/environmentprotection.

Conclusion

This is a general introduction to the risks associated with hazardous waste and is intended to inform the reader about the proper handling, storage and transportation of hazardous waste in Nunavut. Detailed guidance on the management of specific waste types can be obtained by referring to other guidelines developed by the Department of Environment.

For additional information on the management of hazardous waste, or to obtain a complete listing of available guidelines, contact the Department of Environment at:

Environmental Protection Division
Department of Environment
Government of Nunavut
Inuksugait Plaza, Box 1000, Station 1360
Iqaluit, Nunavut, X0A 0H0

Phone: (867) 975-7729
Fax: (867) 975-7739
Email: EnvironmentalProtection@gov.nu.ca
Website: http://env.gov.nu.ca/programareas/environmentprotection

References

Government of Alberta, Department of Environment. Alberta Users Guide for Waste Managers, (Catalogue # ENV-266-O/P).

Government of Alberta, Department of Environment. Hazardous Waste Storage Guidelines, (1988).

Government of the Northwest Territories, Department of Environment and Natural Resources. User's Guide for Hazardous Waste Movement Documents in the NWT, (2009).

Government of the Northwest Territories, Department of Municipal and Community Affairs. Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories, (2003).

Government of Nunavut, Department of Environment. Environmental Guideline for General Management of Hazardous Waste, (2002).

Government of Nunavut, Department of Environment. Environmental Guideline for Industrial Projects on Commissioner's Lands, (2002).

Government of Nunavut, Department of Environment. Environmental Guideline for Industrial Waste Discharges, (2002).

APPENDICES

APPENDIX 1 - *ENVIRONMENTAL PROTECTION ACT*

The following are excerpts from the *Environmental Protection Act*

1. "Contaminant" means any noise, heat, vibration or substance and includes such other substance as the Minister may prescribe that, where discharged into the environment,
   (a) endangers the health, safety or welfare of persons,
   (b) interferes or is likely to interfere with normal enjoyment of life or property,
   (c) endangers the health of animal life, or
   (d) causes or is likely to cause damage to plant life or to property;

   "Discharge" includes, but not so as to limit the meaning, any pumping, pouring, throwing, dumping, emitting, burning, spraying, spreading, leaking, spilling, or escaping;

   "Environment" means the components of the Earth and includes
   (a) air, land and water,
   (b) all layers of the atmosphere,
   (c) all organic and inorganic matter and living organisms, and
   (d) the interacting natural systems that include components referred to in paragraphs (a) to (c).

   "Inspector" means a person appointed under subsection 3(2) and includes the Chief Environmental Protection Officer.

2.2 The Minister may
   (a) establish, operate and maintain stations to monitor the quality of the environment in the Territories;
   (b) conduct research studies, conferences and training programs relating to contaminants and to the preservation, protection or enhancement of the environment;
   (c) develop, co-ordinate and administer policies, standards, guidelines and codes of practice relating to the preservation, protection or enhancement of the environment;
   (d) collect, publish and distribute information relating to contaminants and to the preservation, protection or enhancement of the environment:

3. (1) The Minister shall appoint a Chief Environmental Protection Officer who shall administer and enforce this Act and the regulations.

   (2) The Chief Environmental Protection Officer may appoint inspectors and shall specify in the appointment the powers that may be exercised and the duties that may be performed by the inspector under this Act and regulations.

5. (1) Subject to subsection (3), no person shall discharge or permit the discharge of a contaminant into the environment.

   (3) Subsection (1) does not apply where the person who discharged the contaminant or permitted the discharge of the contaminant establishes that
   (a) the discharge is authorized by this Act or the regulations or by an order issued under this Act or the regulations;
   (b) the contaminant has been used solely for domestic purposes and was discharged from within a dwelling house;
   (c) the contaminant was discharged from the exhaust system of a vehicle;
   (d) the discharge of the contaminant resulted from the burning of leaves, foliage, wood, crops or stubble for domestic or agricultural purposes;

(e) the discharge of the contaminant resulted from burning for land clearing or land grading;
(f) the discharge of the contaminant resulted from a fire set by a public official for habitat management of silviculture purposes;
(g) the contaminant was discharged for the purposes of combating a forest fire;
(h) the contaminant is a soil particle or grit discharged in the course of agriculture or horticulture; or
(i) the contaminant is a pesticide classified and labelled as "domestic" under the *Pest Control Products Regulations* (Canada).

(4) The exceptions set out in subsection (3) do not apply where a person discharges a contaminant that the inspector has reasonable grounds to believe is not usually associated with a discharge from the excepted activity.

5.1. Where a discharge of a contaminant into the environment in contravention of this Act or the regulations or the provisions of a permit or license issued under this Act or the regulations occurs or a reasonable likelihood of such a discharge exists, every person causing or contributing to the discharge or increasing the likelihood of such a discharge, and the owner or the person in charge, management or control of the contaminant before its discharge or likely discharge, shall immediately:
(a) subject to any regulations, report the discharge or likely discharge to the person or office designated by the regulations;
(b) take all reasonable measures consistent with public safety to stop the discharge, repair any damage caused by the discharge and prevent or eliminate any danger to life, health, property or the environment that results or may be reasonably expected to result from the discharge or likely discharge; and
(c) make a reasonable effort to notify every member of the public who may be adversely affected by the discharge or likely discharge.

6. **(**1) Where an inspector believes on reasonable grounds that a discharge of a contaminant in contravention of this Act or the regulations or a provision of a permit or license issued under this Act or the regulations has occurred or is occurring, the inspector may issue an order requiring any person causing or contributing to the discharge or the owner or the person in charge, management or control of the contaminant to stop the discharge by the date named in the order.

7. (1) Notwithstanding section 6, where a person discharges or permits the discharge of a contaminant into the environment, an inspector may order that person to repair or remedy any injury or damage to the environment that results from the discharge.

(2) Where a person fails or neglects to repair or remedy any injury or damage to the environment in accordance with an order made under subsection (1) or where immediate remedial measures are required to protect the environment, the Chief Environmental Protection Officer may cause to be carried out the measures that he or she considers necessary to repair or remedy an injury or damage to the environment that results from any discharge.

APPENDIX 2 - DANGEROUS GOODS CLASSIFICATIONS

Class 1 – Explosives[1]

Class 2 – Compressed Gases
Division 2.1 – Flammable Gases
Division 2.2 – Non-flammable and Non-toxic Gases
Division 2.3 – Poison Gases

Class 3 - Flammable Liquids

Class 4 – Flammable Solids
Division 4.1 – Flammable Solids
Division 4.2 – Spontaneously Combustible
Division 4.3 – Water Reactive

Class 5 - Oxidizing Substances and Organic Peroxides
Division 5.1 – Oxidizing Substances
Division 5.2 – Organic Peroxides

Class 6 - Toxic and Infectious Substances
Division 6.1 – Toxic Substances
Division 6.2 – Infectious Substances

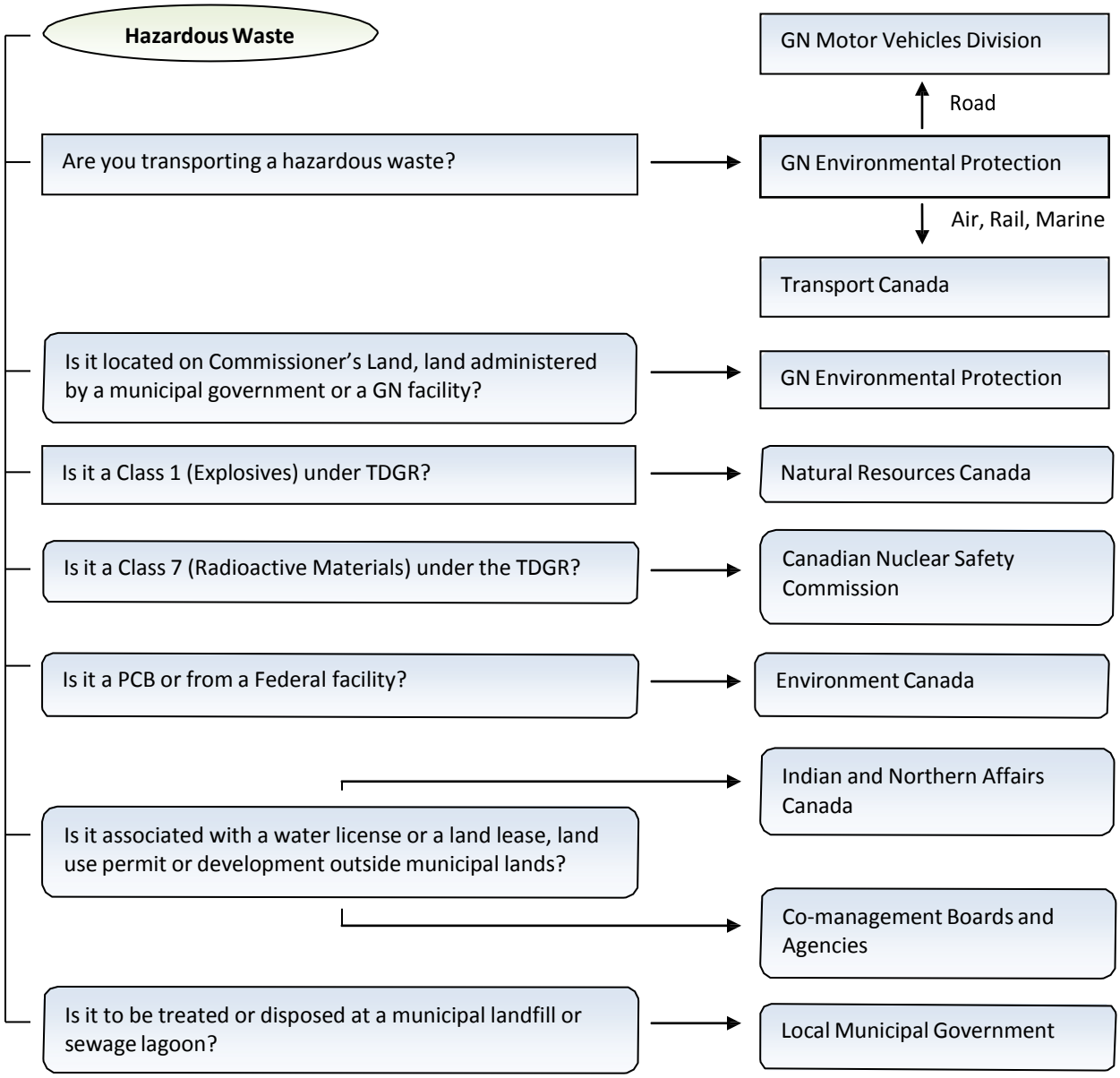
Class 7 - Radioactive Materials[2]

Class 8 - Corrosives

Class 9 - Miscellaneous

1. Class 1 substances (Explosives) are regulated by Natural Resources Canada under the *Explosives Act*.
2. Class 7 substances (Radioactive Materials) are regulated by the Canadian Nuclear Safety Commission under the *Nuclear Safety and Control Act* and *Nuclear Liability Act*.

APPENDIX 3 - DETERMINING REGULATORY AGENCY CONTACTS



APPENDIX 4 – REGISTRATION FORM – HAZARDOUS WASTE GENERATOR

A copy of the generator registration form and users' guide is available by contacting the Department of Environment or by downloading at http://env.gov.nu.ca/programareas/environmentprotection.

Instructions

1. The following information must be provided in order to register as a hazardous waste generator in Nunavut and to obtain a generator number. Incomplete applications will be returned to the applicant.
2. Completed registration forms are to be forwarded to the Manager of Pollution Control, Department of Environment, Government of Nunavut, Box 1000, Station 1360, Iqaluit, Nunavut, X0A 0H0. Electronic registration forms are preferred and may be forwarded to EnvironmentalProtection@gov.nu.ca.
3. Use additional pages to provide information as required.
4. Applicants should refer to the accompanying users' guide for further assistance on completing the generator registration form.

Section 1 - Identification

Generator (Legal Name) _____

Mailing Address _____ Postal Code _____

Principle Contact Person _____ Title _____

Phone _____ Email _____

Alternate Contact Person _____ Title _____

Phone _____ Email _____

Section 2 - Description of Waste Generated (provide a separate table if required)

Site Location(s) where Waste is Generated _____

Shipping Name (Description)	TDG Number	TDG Class	Quantity Generated each Month (L or Kg)	Frequency of Generation

Section 3 - Waste Management Information

General Type of Business _____

Source of Waste _____

Hazardous Waste Carrier(s) Used _____

Hazardous Waste Receiver(s) Used _____

Do you have an approved Emergency Response and Spill Contingency Plan? Yes_____(attach copy) No _____

Section 4 - Certification

I certify that the information provided on this form is correct, accurate and complete.

Signature of Contact Person _____ Date (dd/mm/yy) _____

Print Name of Contact Person _____ Title _____

Phone _____ Email _____

For Department Use Only
Generator Number NUG#_____ Approved by_____ Date _____

SAMPLE

APPENDIX 5 – REGISTRATION FORM – HAZARDOUS WASTE CARRIER

A copy of the carrier registration form and users' guide is available by contacting the Department of Environment or by downloading at http://env.gov.nu.ca/programareas/environmentprotection.

Instructions

1. The following information must be provided in order to register as a hazardous waste carrier in Nunavut and to obtain a carrier number. Incomplete applications will be returned to the applicant.
2. Completed registration forms are to be forwarded to the Manager of Pollution Control, Department of Environment, Government of Nunavut, Box 1000, Station 1360, Iqaluit, Nunavut, X0A 0H0. Electronic registration forms are preferred and may be forwarded to EnvironmentalProtection@gov.nu.ca.
3. Use additional pages to provide information as required.
4. Applicants should refer to the accompanying users' guide for further assistance on completing the carrier registration form.

Section 1 - Identification

Carrier (Legal Name) _____

Corporate Address _____

Site (Dispatch) Address _____

Principle Contact Person _____ Title _____

Phone _____ Email _____

Alternate Contact Person _____ Title _____

Phone _____ Email _____

Section 2 - Description of Waste Transported (provide a separate table if required)

Shipping Name (Description)	TDG Number	TDG Class	Quantity Transported each Month (L or Kg)	Frequency of Transport

Section 3 - Waste Management Information

Mode of Transport (check all that apply) Road _____ Rail _____ Marine _____ Air _____

Hazardous Waste Generator(s) Used _____

Hazardous Waste Receiver(s) Used _____

Do you have an approved Emergency Response and Spill Contingency Plan? Yes _____ (attach copy) No _____

Section 4 - Certification

I certify that the information provided on this form is correct, accurate and complete.

Signature of Contact Person _____ Date (dd/mm/yy) _____

Print Name of Contact Person _____ Title _____

Phone _____ Email _____

For Department Use Only

Carrier Number NUC# _____ Approved by _____ Date _____

SAMPLE

APPENDIX 6 – REGISTRATION FORM – HAZARDOUS WASTE RECEIVER

A copy of the receiver registration form and users' guide is available by contacting the Department of Environment or by downloading at http://env.gov.nu.ca/programareas/environmentprotection.

Instructions

1. The following information must be provided in order to register as a hazardous waste receiver in Nunavut and to obtain a receiver number. Incomplete applications will be returned to the applicant.
2. A receiver who operates a commercial business for the purpose of collecting, storing, transferring, treating, recycling or disposing of hazardous waste may be required to register the facility as a hazardous waste management facility. Refer to section 3.2.2 of the *Environmental Guideline for the General Management of Hazardous Waste* for further information.
3. Completed registration forms are to be forwarded to the Manager of Pollution Control, Department of Environment, Government of Nunavut, Box 1000, Station 1360, Iqaluit, Nunavut, X0A 0H0. Electronic registration forms are preferred and may be forwarded to EnvironmentalProtection@gov.nu.ca.
4. Use additional pages to provide information as required.
5. Applicants should refer to the accompanying users' guide for further assistance on completing the receiver registration form.

Section 1 - Identification

Receiver (Legal Name) _____

Mailing Address _____ Postal Code _____

Principle Contact Person _____ Title _____

Phone _____ Email _____

Alternate Contact Person _____ Title _____

Phone _____ Email _____

[redacted]

_____

Site Location(s) where Waste is Received

Shipping Name (Description)	TDG Number	TDG Class	Quantity Received each Month (L or Kg)	Frequency of Acceptance

[redacted]

General Type of Business _____

General Type of Activity _____

Hazardous Waste Generator(s) Used _____

Hazardous Waste Carriers(s) Used _____

Hazardous Waste Management Facilities Used

[redacted]

I certify that the information provided on this form is correct, accurate and complete.

Signature of Contact Person _____ Date (dd/mm/yy) _____

Print Name of Contact Person _____ Title _____

Phone _____ Email _____

SAMPLE

For Department Use Only
Receiver Number NUR#_____Approved by_____Date _____

APPENDIX 7
REGISTRATION FORM – HAZARDOUS WASTE MANAGEMENT FACILITY

A copy of the management facility registration form and users' guide is available by contacting the Department of Environment or by downloading at http://env.gov.nu.ca/programareas/environmentprotection.

1. The following information must be provided in order to register as a hazardous waste management facility in Nunavut and obtain a management facility number. Incomplete applications will be returned to the applicant.
2. Completed registration forms are to be forwarded to the Manager of Pollution Control, Department of Environment, Government of Nunavut, Box 1000, Station 1360, Iqaluit, Nunavut, X0A 0H0. Electronic registration forms are preferred and may be forwarded to EnvironmentalProtection@gov.nu.ca.
3. Use additional pages to provide information as required.
4. Applicants should refer to the accompanying users' guide for further assistance on completing the management facility registration form.

Applicant (Legal Name) _____

Corporate Address _____

Facility Address _____

Principle Contact Person _____ Title _____

Phone _____ Email _____

Alternate Contact Person _____ Title _____

Phone _____ Email _____

Site Location(s) where Waste is Managed _____

Shipping Name (Description)	TDG Number	TDG Class	Quantity Managed each Month (L or Kg)	Frequency of Acceptance

Attach a complete description of the proposed facility, safety measures, equipment and management processes to be used. Include engineered drawing where applicable.

General Type of Business (check all that apply) Receiver of Waste _____ Manage Self-generated Waste _____

Type of Activity (check all that apply) Collect and Store _____ Transfer _____

Treat _____ Recycle _____ Dispose _____

Hazardous Waste Generator(s) Used _____

Hazardous Waste Carriers(s) Used _____

Do you have an approved Emergency Response and Spill Contingency Plan? Yes _____ (attach copy) No _____

I certify that the information provided on this form is correct, accurate and complete.

Signature of Contact Person _____ Date (dd/mm/yy) _____

Print Name of Contact Person _____ Title _____

Phone _____ Email _____

For Department Use Only
Management Facility Number NUF# _____ Approved by _____ Date _____

SAMPLE

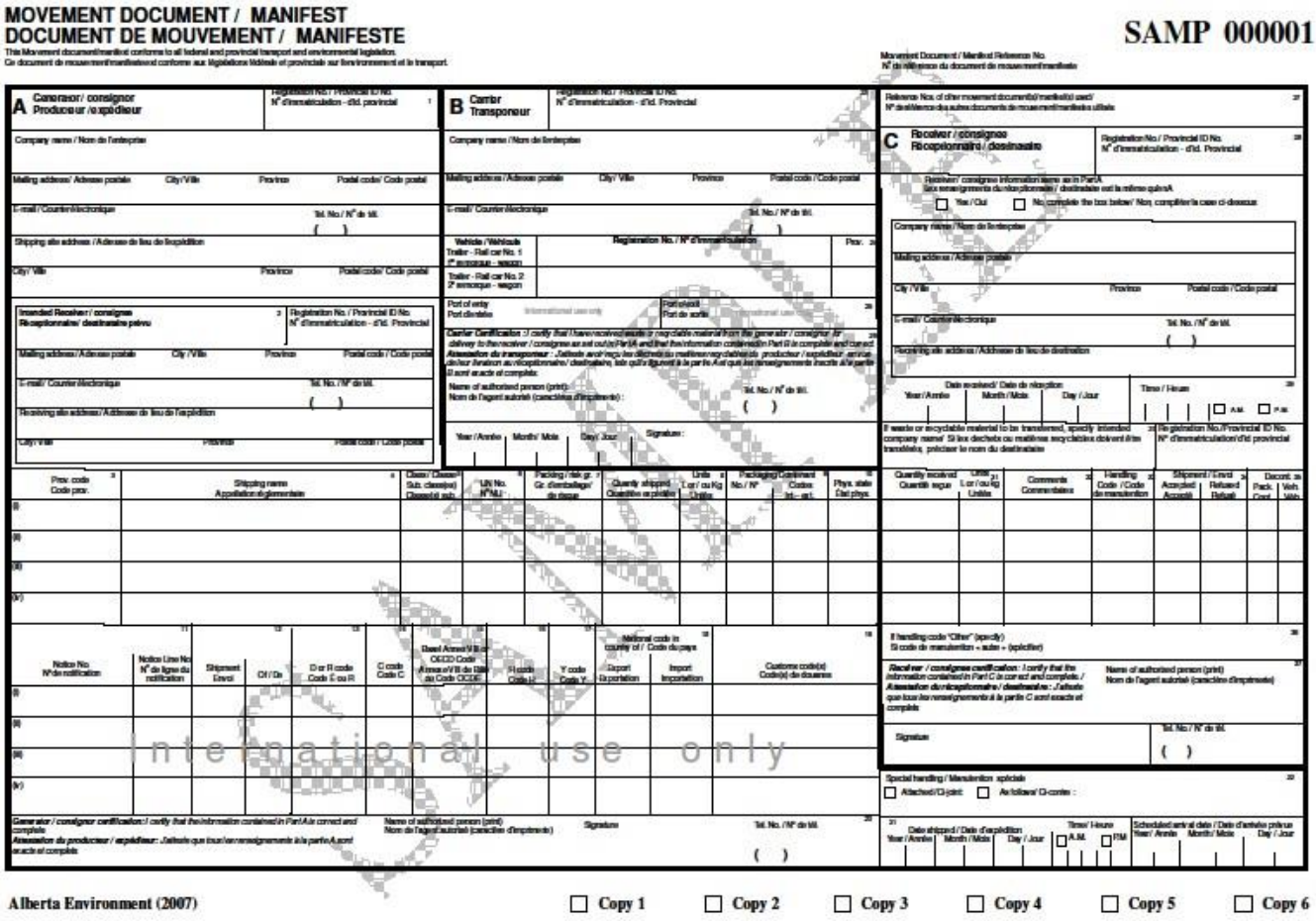
APPENDIX 8 - CRITERIA FOR REGISTERING A HAZARDOUS WASTE MANAGEMENT FACILITY

A facility must be registered with the Department of Environment as a hazardous waste management facility where it is used for commercial purposes to store hazardous waste for a period of 180 days or more or the quantity of hazardous waste[1] stored on-site at any one time exceeds the criteria established in the following table. Where the facility is to be used for the treatment, recycling or disposal of hazardous waste, the facility must be registered as a hazardous waste management facility where the quantity treated, recycled or disposed of each month exceeds a 'small quantity'[2].

	Description	**Quantity[3] (Kg or L)**
Class 1	Explosives	50
Class 2	Division 2.1 – Flammable Gases	500[4]
	Division 2.2 – Non-flammable and Non-toxic Gases	5000[4]
	Division 2.3 – Poison Gases	200[4]
Class 3	Flammable Liquids	4000
Class 4	Division 4.1 – Flammable Solids	5000
	Division 4.2 – Spontaneously Combustible	1000
	Division 4.3 – Water Reactive	500
Class 5	Division 5.1 – Oxidizing Substances	1000
	Division 5.2 – Organic Peroxides	50
Class 6	Division 6.1 – Toxic Substances	1000
	Division 6.2 – Infectious Substances	500[4]
Class 7	Radioactive Materials	Any amount
Class 8	Corrosives	1000
Class 9	Miscellaneous	1000
	PCB Materials	50
	Environmentally Hazardous Substance Solid – UN3077	5000
All Classes	Total Aggregate Quantity	5000

1. Applies to hazardous waste only and not to dangerous goods.
2. Small quantity means hazardous waste that is generated in an amount that is less than five kilograms per month if a solid or less than five litres per month if a liquid, and where the total quantity accumulated at any one time does not exceed five kilograms or five litres. This does not include hazardous waste that is mercury or Class 2.3, 5.1 or 6.1 materials. These wastes must be generated in an amount that is less than one kilogram per month if a solid or less than one litre per month if a liquid, and where the total quantity accumulated at any one time does not exceed one kilogram or one litre.
3. Quantity applies to solids when expressed in kilograms (kg) and liquids when expressed in litres (L).
4. Total liquid capacity of the container.

APPENDIX 9 – HAZARDOUS WASTE MANIFEST



MOVEMENT DOCUMENT / MANIFEST
DOCUMENT DE MOUVEMENT / MANIFESTE

SAMP 000001

This Movement document/manifest conforms to all federal and provincial transport and environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement et le transport.

Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste

A Generator / consignor
Producteur / expéditeur

Registration No.* / Provincial ID No.
N° d'immatriculation - d'id. provincial

Company name / Nom de l'entreprise

Mailing address / Adresse postale | City / Ville | Province | Postal code / Code postal

E-mail / Courriel électronique | Tel. No. / N° de tél.

Shipping site address / Adresse de lieu de l'expédition

City / Ville | Province | Postal code / Code postal

B Carrier
Transporteur

Registration No.* / Provincial ID No.
N° d'immatriculation - d'id. Provincial

Company name / Nom de l'entreprise

Mailing address / Adresse postale | City / Ville | Province | Postal code / Code postal

E-mail / Courriel électronique | Tel. No. / N° de tél.

Vehicle / Véhicule
Trailer - Rail car No. 1
1er remorque - wagon
Trailer - Rail car No. 2
2e remorque - wagon

Registration No. / N° d'immatriculation | Prov.

Port of entry
Port d'entrée

Port of exit
Port de sortie

Carrier Certification: I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part IV and that the information contained in Part III is complete and correct.
Attestation du transporteur : J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur, aux fins de leur livraison au récipiendaire / destinataire, tels qu'ils figurent à la partie IV et que les renseignements inscrits à la partie III sont exacts et complets.

Name of authorized person (print)
Nom de l'agent autorisé (caractères d'imprimerie)

Tel. No. / N° de tél.

Signature

Year / Année | Month / Mois | Day / Jour

C Receiver / consignee
Récipiendaire / destinataire

Registration No.* / Provincial ID No.
N° d'immatriculation - d'id. Provincial

Reference Nos. of other movement document(s) / manifest(s) used
N° de référence des autres documents de mouvement/manifestes utilisés

Receiver / consignee information same as in Part A
Les renseignements du récipiendaire / destinataire sont la même que ceux A
☐ Yes / Oui ☐ No, complete the box below / Non, compléter la case ci-dessous

Company name / Nom de l'entreprise

Mailing address / Adresse postale

City / Ville | Province | Postal code / Code postal

E-mail / Courriel électronique | Tel. No. / N° de tél.

Receiving site address / Adresse de lieu de destination

Date received / Date de réception
Year / Année | Month / Mois | Day / Jour

Time / Heure ☐ A.M. ☐ P.M.

If waste or recyclable material to be transferred, specify intended company name / Si les déchets ou matières recyclables doivent être transférés, préciser le nom du destinataire

Registration No.* / Provincial ID No.
N° d'immatriculation* / d'id provincial

Prov. code Code prov.	Shipping name Appellation d'expédition	Class / Classe Sub. class(es) Classe(s) sub.	UN No. N°s ONU	Packing / Risk gr. Gr. d'emballage / de risque	Quantity shipped Quantité expédiée	Units L or / ou Kg L ou/ou Kg	Packaging / Containment No. / N°	Packaging / Containment Codes Int. - ext.	Phys. state Etat phys.
(i)									
(ii)									
(iii)									
(iv)									

Quantity received Quantité reçue	Units L or / ou Kg Unités	Comments Commentaires	Handling Code / Code de manutention	Shipment / Envoi Accepted Accepté	Shipment / Envoi Refused Refusé	Decont. Pack. Cont.	Decont. Veh. Véh.

Notice No. N° de notification	Notice Line No. N° de ligne de notification	Shipment Envoi	OI / Or	D or R code Code E ou R	CI code Code C	Basel Annex VIII or OECD Code Annexe VIII de Bâle ou Code OCDE	H code Code H	Y code Code Y	National code in country of / Code du pays Export Exportation	National code in country of / Code du pays Import Importation	Customs code(s) Code(s) de douanes
(i)											
(ii)											
(iii)											
(iv)											

International use only

If handling code "Other" (specify)
Si code de manutention « autre » (spécifier)

Receiver / consignee certification: I certify that the information contained in Part C is correct and complete. / Attestation du récipiendaire / destinataire : J'atteste que tous les renseignements à la partie C sont exacts et complets

Name of authorized person (print)
Nom de l'agent autorisé (caractères d'imprimerie)

Signature | Tel. No. / N° de tél.

Special handling / Manutention spéciale
☐ Attached / Ci-joint ☐ As follows / Ci-contre :

Generator / consignor certification: I certify that the information contained in Part A is correct and complete.
Attestation du producteur / expéditeur : J'atteste que tous les renseignements à la partie A sont exacts et complets

Name of authorized person (print)
Nom de l'agent autorisé (caractères d'imprimerie)

Signature | Tel. No. / N° de tél.

Date shipped / Date d'expédition
Year / Année | Month / Mois | Day / Jour
Time / Heure ☐ A.M. ☐ P.M.

Scheduled arrival date / Date d'arrivée prévue
Year / Année | Month / Mois | Day / Jour

Alberta Environment (2007)

☐ Copy 1 ☐ Copy 2 ☐ Copy 3 ☐ Copy 4 ☐ Copy 5 ☐ Copy 6

APPENDIX 10 - WASTE EXCHANGES AND ASSOCIATIONS

The concept of exchanging waste began in Canada in the 1980s. It involves the transfer of unwanted, overstocked, obsolete, damaged, contaminated or post-dated material and waste to another company or person who would reuse it. Various waste exchanges and associations have been established in Canada to facilitate these transfers. Several, but not all, waste exchanges and associations are listed below.

Northern Territories Water and Waste Association
201, 4817- 49 Street
Yellowknife, Northwest Territories X1A 3S7
(867) 873-4325
http://www.ntwwa.com

Recycling Council of British Columbia
Unit #10, 119 West Pender Street
Vancouver, British Columbia V6B 1S5
(604) 683-6009
http://www.rcbc.bc.ca

Alberta Waste Materials Exchange
Building #350, 6815 Eighth Street NE
Calgary, Alberta T2E 7H7
(403) 297-7505

Calgary Materials Exchange
809 Fourth Avenue NE
Calgary, Alberta T2P 0K5
(403) 230-1443
http://www.cmex.ca

Saskatchewan Waste Materials Exchange
515 Henderson Drive.
Regina, Saskatchewan S4N 5X1
(306) 787-9800

Manitoba Waste Exchange
1329 Niakwa Road
Winnipeg, Manitoba R2J 3T4
(204) 257-3891

Ontario Waste Exchange
OCETA 63 Polson Street, 2nd floor
Toronto, Ontario M5A 1A4
(416) 778-4199
http://www.owe.org

Canadian Waste Materials Exchange
2395 Spearman Drive
Mississauga, Ontario L5K 1B3
(416) 822-4111

Canadian Chemical Exchange
900 Blondin
Ste-Adele, Quebec J0R 1L0
(450) 229-6511
http://www.stobec.com

Quebec Waste Materials Exchange
14 Place du Commerce, Bureau 350
Le-des-Squeurs, Quebec H3E 1T5
(514) 762-9012

APPENDIX 11 – GOVERNMENT CONTACTS

Government of Nunavut

Environmental Protection Division
Department of Environment
Inuksugait Plaza
P.O. Box 1000, Station 1360
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-7729 Fax: (867) 975-7739

Workers' Safety and Compensation Commission
P.O. Box 669
Baron Building/1091
Iqaluit, Nunavut X0A 0H0
Telephone: 1-877-404-4407 (toll free) Fax: 1-866-979-8501

Office of Chief Medical Health Officer of Health
Department of Health and Social Services
P.O. Box 1000, Station 1000
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5774 Fax: (867) 975-5755

Motor Vehicles Division
Department of Economic Development and Transportation
P.O. Box 10
Gjoa Haven, Nunavut X0B 1J0
Telephone: (867) 360-4615 Fax: (867) 360-4619

Department of Community and Government Services (all Divisions)
P.O. Box 1000, Station 700
4th Floor, W.G. Brown Building
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-5400 Fax: (867) 975-5305

Government of Canada

Indian and Northern Affairs – Nunavut Region
P.O. Box 2200
Iqaluit, Nunavut X0A 0H0
Telephone: (867) 975-4500 Fax: (867) 975-4560

Environment Canada (NWT and Nunavut)
5019 52nd Street
Yellowknife, Northwest Territories X1A 1T5
Telephone: (867) 669-4730 Fax: (867) 873-8185

Department of Transport – Road, Rail, Marine, Air
P.O. Box 8550
344 Edmonton Street
Winnipeg, Manitoba R3C 1P6
Telephone: 1-888-463-0521 (toll free)
Fax: (204) 983-8992 Road, Rail and Marine only
Fax: (204) 983-1734 Air only

AGNICO EAGLE

MELIADINE GOLD PROJECT

Incineration Management Plan

MARCH 2018
VERSION 5
6513-MPS-01

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ᐊᒃᓅᑯᒃᑯᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒨᓗᒧᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᐱᕙᓪᓕᐊᓂᖅᖢᑦ, 25 ᑭᕌᒥᑕᓪᓗᐊᓂᒃ ᐅᐊᙵᙳᓂᑦ ᑲᖏᖅᖠᓂᕐᒥᑦ ᐅᖓᓯᒃᑎᓯᔪᖅ, ᐊᒻᒪᓗ 80 ᑭᕌᒥᑕᓪᓗᐊᓂᒃ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐱᙳᙵᖅᐸᓯᐅᓂᑦ ᐃᒡᓗᓕᒡᓚᕐᔪᖕᒥᑦ ᐅᖓᓯᒃᑎᓯᔪᖅ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓗᒍ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᐅᓂᐊᖅᑐᖅ ᐱᕙᓪᓕᐊᓗᒍ ᑎᕆᒐᓂᐊᖅ ᒨᓗᑕᓕᒃ, ᒪᕐᕿᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔫᓗᑎᒃ (ᑎᕆᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᖅ 1 ᐊᒻᒪᓗ ᑎᕆᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᖅ.

ᑖᓐᓇ ᑎᑎᖅᑲᖅ ᑕᑯᒃᓴᐅᑎᑦᑎᔪᖅ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᐱᓕᕆᐊᕐᒧᑦ ᐊᒻᒪᓗ ᐋᖅᑭᒃᓯᐸᓗᓂ ᐃᓚᒋᔭᐅᔪᖅ ᑎᑎᖅᑲᓕᕆᓂᕐᒧᑦ ᐱᔭᐅᔪᖅ Type “A” ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᒥᒃ ᑐᒃᓯᕋᐅᑎᒧᑦ. ᑖᓐᓇ ᐸᕐᓇᐅᑎ ᐱᓕᕆᐊᖑᓚᐅᖅᑐᖅ ᒪᓕᒃᓱᒋᑦ ᐱᐅᓛᒃᑯᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓂᒃ, *ᑲᓇᑕᒥᑦ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᐱᓕᕆᐊᕐᒧᑦ ᑎᑎᖅᑲᐅᑎᙵᑦ ᑲᑎᑕᐅᔪᓂᒃ ᐊᒃᑕᑯᓂᒃ ᐃᑯᐊᓪᓚᐃᓂᕐᒧᑦ*, ᐊᒻᒪᓗ ᒪᓕᒃᑕᐅᔾᔪᒃᓴᐃᑦ ᐱᓕᕆᐊᕐᒧᑦ ᓴᖅᑭᑕᐅᔪᑦ ᐊᕙᑎᓕᕆᔨᒃᑯᓐᓄᑦ.

ᓯᑎᔪᓂᒃ ᐊᒃᑕᑯᓂᒃ ᐃᑯᐊᓪᓚᒃᑎᕈᑏᑦ ᐊᒻᒪᓗ ᐊᒃᑕᑰᖅᑕᐅᔪᓂᒃ ᐅᖅᓱᐊᓗᙵᓂᒃ ᐃᑯᐊᓪᓚᒃᑎᑦᑎᔾᔪᑏᑦ ᐊᐅᓚᑕᐅᔪᑦ ᓄᓇᕗᒻᒥᑦ ᒪᓕᒃᓱᒋᑦ *ᓄᓇᕗᒻᒥ ᐃᓄᒃᑖᓂᒃ ᐋᓐᓂᐊᖃᖅᑕᐃᓕᒪᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ, ᓄᓇᕗᒻᒥ ᐊᕙᑎᒥᒃ ᒥᐊᓂᖅᓯᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ*, ᐊᒻᒪᓗ *ᑲᓇᑕᒥᑦ ᐊᕙᑎᒥᒃ ᒥᐊᓂᖅᓯᓂᕐᒧᑦ ᐱᕐᑯᔭᖅ*. ᖃᓄᐃᓕᐅᕐᓂᕐᒧᑦ ᑭᓪᓕᐅᔪᑦ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ ᒪᓕᖓᓂᐊᖅᑐᖅ ᐊᓂᐊᔪᓄᑦ ᒪᓕᒃᑕᐅᔾᔭᓂᒃ ᑎᑎᕋᖅᓯᒪᔪᑦ ᑲᓇᑕᒥᑦ ᐊᕙᑎᐅᑉ ᒥᒃᓵᓄᑦ ᑲᑎᒪᔩᑦ ᒥᓂᔅᑕᐅᑎᐅᑉᓗᑎᒃ. ᐊᕐᔭᐃᑦ ᐱᔪᑦ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᑦ ᐃᒋᑕᐅᓂᐊᖅᑐᑦ ᒪᓕᒡᓗᒋᑦ *ᓄᓇᕗᒻᒥ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔾᔭᐃᑦ ᐱᓕᕆᕝᕕᒃᔪᐊᕐᓄᑦ ᐊᒃᑕᑰᓇᖅᑲᑦᑕᖅᑐᑦᓄ.*

ᐱᓕᕆᐊᖅ ᓂᕈᐊᕐᓂᐊᖅᑐᖅ ᐊᒻᒪᓗ ᐊᐅᕌᖅᑎᓪᓗᒍ ᐃᑯᐊᓪᓚᒃᑎᕈᑎ ᒪᓕᒡᓗᒋᑦ *ᑲᓇᑕᒥᑦ ᐊᕙᑎᓕᕆᔨᒃᑯᑦ ᐱᓕᕆᐊᕐᒧᑦ ᑎᑎᖅᑲᐅᑎᙵᑦ ᑲᑎᑕᐅᔪᓂᒃ ᐊᒃᑕᑯᓂᒃ ᐃᑯᐊᓪᓚᐃᓂᕐᒧᑦ*. ᐊᒻᒪᓗ ᐃᓚᒋᔭᐅᔪᖅ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᓕᕆᓂᕐᒧᑦ, ᐊᑐᓕᖅᑎᑕᐅᓂᖓ ᐊᒃᑕᑯᐃᑦ ᐊᑉᑎᖅᑕᐅᓂᖏᓐᓄᑦ ᑐᕌᖓᔪᖅ ᑭᓪᓕᖅᑲᖅᑎᑦᑎᓂᐊᖅᑐᖅ ᐊᓂᐊᔪᓂᑦ (ᓱᕐᓗ, dioxins ᐊᒻᒪᓗ furans, ᓄᖑᓯᐃᑦᑐᖅ) ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᑦ.

ᐅᑉᓗᒥ ᒨᖓᔪᒥᒃ ᐊᐅᓚᑕᐅᑉᓗᓂ-ᐊᓂᖅᓵᖅᑐᖅᑕᑉᑎᖕᓄᑦ, ᑲᑎᑦᑎᓲᕐᒥᑦ, ᒪᕐᕿᐃᓕᖓᔪᒥᒃ ᑐᖅᓱᐊᓕᖕᒥᑦ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᒃ ᐃᓕᓯᓂᐊᖅᑐᑦ. ᐱᒪᕆᐅᓂᖅᖢᖅ ᐱᕙᓪᓕᐊᓂᖅ ᑭᓪᓕᐅᔪᑦ, ᓲᕐᓗ ᐆᓇᕐᓂᖏᑦ, ᐃᑯᐊᓪᓚᒃᐸᓪᓕᐊᓂᕐᒥᑦ ᐊᓂᐊᓂᖓ, ᐊᒻᒪᓗ ᐃᑯᐊᓪᓚᒃᑎᑦᑎᔾᔪᑎᐅᑉ ᐊᓂᓂᖓ ᖃᕆᑕᐅᔭᒃᑯᑦ-ᐊᐅᓚᑕᐅᓂᐊᖅᑐᖅ ᑲᒪᔭᐅᓗᓂᓗ ᓈᒻᒪᒃᓯᓯᒪᔪᓂᒃ ᐃᑯᐊᓪᓚᒃᑎᑦᑎᓂᕐᒨᖓᔪᓄᑦ. ᐃᑯᐊᓪᓚᒃᑎᓇᖅᑦᑕᕐᓂᐊᖅᑐᖅ 1,500 ᑭᕌᒥᑕᓂᒃ ᐅᕐᑯᒪᐃᓐᓂᖅᖢᓂᒃ ᐅᑉᓗᑕᒫᖅ ᐊᑐᕐᓂᐊᕐᓗᒋᑦ

ᓇᓚᐅᑦᑖᖅᑕᐅᔪᑦ ᐊᖏᑎᒋᓂᖏᑦ ᐅᔭᕆᒃᑕᕆᐊᕐᒥᑦ ᐊᒃᑕᑰᖅᑕᐅᔪᑦ. ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐃᓪᓗᕐᔪᐊᖅ[1] -ᒦᓐᓂᐊᖅᑐᖅ ᐊᐅᓚᑕᐅᓗᓂᓗ ᐊᔪᕈᓐᓃᖅᓴᖅᑕᐅᓯᒪᔪᓂᒃ ᐱᓕᕆᔾᔪᑦ.

ᖃᐅᔾᒋᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐆᒃᑐᕋᐃᓂᕐᒧᑦ ᐸᕐᓇᐅᑕᐅᔪᑦ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᐅᑉ ᑐᖅᓱᐊᖓᓂᑦ ᐊᓂᐊᔪᓄᑦ, ᐅᖅᓯᖅᑎᕈᑏᑦ ᐊᒃᑕᑰᖅᑕᐅᔪᑦ/ᐅᖅᓱᐊᓗᒃ ᐃᑯᐊᓪᓚᒃᑎᑕᐅᔭᕆᐊᓕᒃ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒧᑦ, ᐊᒻᒪᓗ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᓐᓛᖅᑐᑦ ᐊᕐᔭᐃᑦ.

ᑕᑯᒃᓴᐅᑎᓐᓂᐊᕐᓗᒋᑦ ᒪᓕᖕᓂᐅᔪᖅ ᖃᓄᐃᓕᐅᕐᓂᖕᒐᓄᑦ ᑭᓪᓕᐅᔪᓂᒃ, ᐊᕐᕌᒍᑕᒫᖅ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐅᓂᒃᑳᓕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᑐᓂᐅᑕᐅᓗᓂᓗ ᐃᓚᒋᔭᐅᓗᓂ ᐊᕐᕌᒍᑕᒫᖅ ᐅᓂᒃᑳᓕᐅᕆᓂᕐᒧᑦ ᐱᔪᖕᓇᖅᑎᑦᑎᔾᐅᔪᓄᑦ. ᖃᑉᓯᐅᓂᖓ ᐊᒻᒪᓗ ᖃᓄᐃᑦᑑᓂᖏᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐃᑯᐊᓪᓚᒃᑎᕈᑎᒥᑦ ᐅᔭᕆᒃᑕᕆᐊᕐᒥᑦ ᐊᐅᓖᕐᓂᖃᖅᑎᓪᓗᒋᑦ, ᐊᑕᐅᑦᑎᒃᑯᑦ ᐃᓚᐅᓗᑎᒃ ᖃᓄᐃᖏᓂᐅᔪᑦ ᖃᑯᑎᒃᑯᑦ ᑐᖅᓱᐊᒃᑯᑦ ᐊᓂᐅᔪᓂᑦ ᐊᒻᒪᓗ ᐊᕐᔭᓂᒃ ᖃᐅᔾᒋᐊᖃᑦᑕᕐᓂᐅᔪᑦ ᐃᓚᐅᓂᐊᖅᑐᑦ ᐊᕐᕌᒍᑕᒫᖅ ᐅᓂᒃᑳᒥᑦ. ᐅᓂᒃᑳᖅᑕᖃᕐᓂᐊᕐᒥᔪᖅ, ᐱᔭᕆᐊᖃᖅᐸᑦ, ᑲᓇᑕᒥᑦ ᐱᐅᖏᑦᑐᓂᒃ ᐊᓂᐊᑎᑦᑎᓂᕐᒧᑦ ᓈᓴᐃᔾᔪᑦ. ᑭᖕᒍᓕᖅᐹᖅ, ᐊᓪᓃᑯᒃᑯᑦ ᐅᓂᒃᑲᓕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᐱᐅᖏᑦᑐᓂᒃ ᐅᖅᓯᓂᒃ ᐊᓂᐊᔪᑦ ᒥᒃᓵᓄᑦ ᐃᑲᔪᕐᓗᒋᑦ ᑲᓇᑕᒥᑦ ᐃᓯᒪᖅᓯᕐᓂᒃᑯᑦ ᐱᒋᐊᖃᑕᐅᓂᕐᒧᑦ ᑎᑎᕋᐃᔾᒃᑯᑦ.

[1] ᖃᐅᔨᒪᔭᐅᔪᖅᑕᐅᖅ ᐃᑯᐊᓪᓚᕝᕕᒃ

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

This document presents the Incineration Management Plan for the Project and forms a component of the documentation series produced for the Type "A" Water Licence Application. This Plan was prepared in accordance with best management practices, Environment Canada's *Technical Document for Batch Waste Incineration,* and guidelines issued by the Nunavut Impact Review Board for the Project.

Solid waste incinerators and waste oil burners are regulated in Nunavut under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act,* and the federal *Environmental Protection Act*. Performance limits for the incinerator at the Project will be in accordance with the emission guidelines set out by the Canadian Council of Ministers of the Environment. Ash produced from the incineration process will be disposed of in accordance with the *Nunavut Environmental Guideline for Industrial Waste Discharges*.

The Project will select and operate its incinerator based on Environment Canada's *Technical Document for Batch Waste Incineration*. In addition to incinerator technology, the implementation of a waste segregation program will limit emissions (e.g., dioxins and furans, mercury) from the incinerator.

A typical modern controlled-air, batch, dual chamber incinerator will be installed. Critical process parameters, such as temperature, combustion air flow, and burner output will be computer-controlled to maintain optimal combustion conditions. The incinerator will have an incineration capacity of approximately 1,500 kilograms per day to accommodate predicted volumes of waste to be generated at the site. It will be located in the waste management building[2] and operated by appropriately trained personnel.

Monitoring and testing is planned for incinerator stack emissions, waste oil/fuel to be burned in the incinerator, as well as incinerator ash.

To demonstrate conformity with performance limits, an annual incineration management report will be prepared and submitted as part of annual reporting to authorizing agencies. The quantity and type of materials incinerated on-site during operation, together with results from periodic stack

[2] Also known as the incinerator building.

emission and ash monitoring, will be included in the annual report. A report will also be provided, if necessary, to the National Pollutant Release Inventory. Finally, Agnico Eagle is committed to reporting greenhouse gas emissions in support of Canada's Voluntary Challenge Registry.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	October 2012			First draft of the Incineration Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			DEIS re-submission; rebranding	
3	April 2014	7.4.2	15	Revision made to address review comments and commitments	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			First version of Supporting Documents for Type A Water Licence Application, submitted to Nunavut Water Board for review	John Witteman, Env. Consultant, Agnico Eagle
5	February 2018			Reviewed internally	Agnico Eagle Environment Dept.

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
CCME	Canadian Council of Ministers of the Environment
CEPA	*Canadian Environmental Protection Act*
CWS	Canada-Wide Standards
EC	Environment Canada
GN	Government of Nunavut
IMP	Incinerator Management Plan

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Mining facilities include a plant site and accommodation buildings; three ore stockpiles; a temporary overburden stockpile; a tailings storage facility (TSF); three waste rock storage facilities (WRSFs); a water management system that includes collection ponds, water diversion channels, and retention dikes/berms; and a Water Treatment Plant (WTP).

This document presents the Incineration Management Plan (Plan) to support the Type A Water Licence application for the Project.

The purpose of the Plan is to provide consolidated information on the specifications, operations, management, monitoring, and reporting of the incinerator process proposed for the Project. This Plan will be reviewed and updated on a regular basis to reflect changes to the Project.

1.1 Concordance with Project Guidelines

This document was developed under the Guidelines for the Preparation of an Environmental Impact Statement for Agnico Eagle Mines Limited's Meliadine Project (the Guidelines) issued by the Nunavut Impact Review Board for the Project (NIRB 2012), and specifically those relating to the presentation of the Plan in Section 9.4.9 of the Guidelines. In addition this Plan has been developed to be consistent with the guidance provided in the Environment Canada's (EC) Technical Document for Batch Waste Incineration (EC 2010). It is one in a series of environmental management plans that have been prepared for the Project. All are included under the umbrella Environmental Management and Protection Plan.

1.2 Linkages to Other Management Plans

Documents included in the application package of this Type A Water Licence, which support this Plan include the:

- Environmental Management and Protection Plan;
- Landfill and Waste Management Plan;
- Hazardous Materials Management Plan; and
- Preliminary Closure and Reclamation Plan.

The Occupational Health and Safety Plan, submitted with the FEIS also supports this Plan (Agnico Eagle 2014).

SECTION 2.0 • BACKGROUND INFORMATION

At the Project site, all wastes will be safely managed from the time they are produced to their final disposal. All waste will be segregated at the proposed mine site and will predominately be landfilled, incinerated, or recycled. Used oil burning will be maximised as much as possible using the second chamber of the incinerator. Remaining wastes, including hazardous waste[3], will be packaged for shipment to a certified waste management facility for treatment, recycling, and/or disposal.

Incineration is an essential part of waste management at the proposed mine site. The incineration of acceptable solid waste from the accommodation complex, kitchen, lunch rooms, shops, warehouses, and offices will divert waste from directly reporting to the on-site landfill. It will have the advantage of eliminating putrescible waste that could potentially attract wildlife to the landfill, thereby reducing possible dangerous interactions between humans and wildlife.

The objectives of this Plan are summarized as follows:

1) To understand the quantity and composition of the waste to be generated at the proposed mine site, and separate waste acceptable for incineration from waste that is not;
2) To select the proper batch waste incinerator based on the characteristics and quantity of waste, and to locate it in an appropriate building away from other site infrastructure;
3) To properly equip and install the incinerator;
4) To operate the incinerator for optimal combustion, and avoid the formation of dioxins and furans in the combustion process;
5) To safely handle and dispose of incinerator residues; and
6) To establish a record keeping system for managing the facility and for future reporting.

As a component of the Project Environmental Management System, the Plan will be updated prior to mine operation and periodically thereafter to ensure that site experience is reflected in the Plan and subsequently communicated to all parties. The Project Environment Superintendent will be responsible for managing and implementing the IMP.

2.1 Incinerator Location

The incinerator will be located in its own building on the south end of the industrial pad, down-wind of other mine infrastructure. The incinerator building will have sufficient floor space to manage all Project wastes in one convenient location.

[3] Please refer to the Hazardous Materials Management Plan for further information on the handling and management of hazardous waste.

SECTION 3 • REGULATORY SETTING

Solid waste incinerators and waste oil burners are regulated in Nunavut under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act,* and the federal *Environmental Protection Act*. Various regulations and guidelines under these Acts, as well as guidelines developed by the Canada Council of Ministers of the Environment (CCME), were reviewed in preparing the Plan. They are as follows:

- *Canadian Environmental Protection Act* (CEPA)
    - Schedule 1: List of Toxic Substances
    - *Interprovincial Movement of Hazardous Waste Regulations*
    - *Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations*
- EC Technical Document for Batch Waste Incineration (EC 2010)
- Canada-Wide Standard for Dioxins and Furans (CCME 2001a)
- Canada-Wide Standard for Mercury (CCME 2000)
- Northwest Territories *Environmental Protection Act*
    - *Used Oil and Waste Fuel Management Regulations*
- Nunavut *Environmental Protection Act*
    - Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities (GN 2011b)
    - Environmental Guideline for the Burning and Incineration of Solid Waste (GN 2012)
    - Environmental Guideline for Ambient Air Quality (GN 2011)
    - Environmental Guideline for Mercury-Containing Products and Waste Mercury (GN 2010)
- Nunavut *Public Health Act*

Provincial and/or territorial regulations that pertain to emissions from incinerators were not found for Nunavut or the Northwest Territories. Therefore, performance limits for the incinerator at the Project will be in accordance with the emission guidelines set out by the CCME: Canada-Wide Standard for Dioxins and Furans (CCME 2001a), and Canada-Wide Standards for Mercury Emissions (CCME 2000).

The management of used oil is regulated in the Northwest Territories through the *Used Oil and Waste Fuel Management Regulations* (NWT 2012; Reg. 064-2003). In the absence of Nunavut guidelines/regulations pertaining to used oil and waste fuel, the Northwest Territories regulations will be followed for the Project.

Ash produced from the incineration process will be disposed of in accordance with the Nunavut Environmental Guideline for Industrial Waste Discharges (GN 2014).

SECTION 4 • BACKGROUND INFORMATION

4.1 Dioxins and Furans

Polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, commonly known as dioxins and furans, are toxic, persistent, and bioaccumulative chemicals. Their presence in the environment results predominantly from human activity. The biggest source of dioxins and furans in Canada is the large-scale burning of municipal and medical waste. Other major sources include:

- the production of iron and steel;
- backyard burning of household waste, especially plastics;
- fuel burning, including diesel fuel and fuel for agricultural purposes and home heating;
- wood burning, especially if the wood has been chemically treated;
- electrical power generation; and
- tobacco smoke.

Due to their environmental persistence and ability to accumulate in biological tissues, dioxins and furans are slated for virtual elimination under the CEPA, the Environment Canada Toxic Substances Management Policy (EC 2004) and the CCME *Policy Statement for the Management of Toxic Substances* (CCME 1998).

4.2 Mercury

Mercury is a naturally occurring substance, which can be transformed through biological processes to methyl mercury, a persistent substance which bioaccumulates in the food chain and is particularly toxic to humans and wildlife. Mercury contamination originates from natural and antropogenic sources, the latter including combustion of waste. Under a variety of regional, national, bi-national, and internal programs, treaties and agreements, mercury is being targeted for emissions reductions consistent with the CCME *Policy Statement for the Management of Toxic Substances* (CCME 1998), which identifies that mercury shall be managed through its lifecycle to minimize release.

4.3 Used Oil and Waste Fuel

The following definitions are provided in the *Used Oil and Waste Fuel Management Regulations*.

Used oil: Any oil, including lubrication oil, hydraulic fluids, metal working fluid, and insulating fluid, that is unsuitable for its intended purpose due to the presence of impurities or the loss of original properties, but does not include waste oil derived from animal or vegetable fat, a petroleum product spilled on land or water, or waste from a petroleum refining operation.

Waste fuel: A flammable or combustible petroleum hydrocarbon, with or without additives, that is unsuitable for its intended purpose due to the presence of contaminants or the loss of original properties, and includes gasoline, diesel fuel, aviation fuel, kerosene, naphtha, and fuel oil, but does not include paint, solvent, or propane.

SECTION 5 • PERFORMANCE LIMITS

5.1 Incinerator Selection

The Project selected its incinerator based on Environment Canada's *Technical Document for Batch Waste Incineration*. The incinerator for the Project is a camp waste incinerator (model no. ECO 1.75TN 1PVC100L 16-1MS) from Eco-Waste Solutions. The incinerator complies with the guidelines listed in Table 5-1, where the maximum emissions are expressed as a concentration in the exhaust gas exiting the facility's stack. The specifications of the incinerator are available in Appendix A. In addition to incinerator technology, the implementation of a waste segregation program will limit emissions of dioxins and furans, and mercury from the incinerator.

Table 5-1 Emission Regulations for Solid Waste Incinerators

Emissions	Sector	Guideline (max)[a]	Units	Reference
Dioxins and Furans	Municipal Solid Waste[b]	80	pg I-TEQ/Rm^3	CCME 2001a
Dioxins and Furans	Sewage Sludge Incineration	80	pg I-TEQ/Rm^3	CCME 2001a
Mercury	Municipal Waste	20	µg/Rm^3	CCME 2000
Mercury	Sewage Sludge Incineration	70	µg/Rm^3	CCME 2000

[a] Stack concentrations are corrected for 11% oxygen.

[b] According to the Canada-Wide Standards (CWS), "municipal solid waste" includes any waste that might be disposed of in a non-secure landfill site if not incinerated (i.e., non-hazardous wastes regardless of origin), but does not include "clean" wood waste.

Compliance to these performance limits will be confirmed by periodic stack testing, normally on an annual basis.

5.2 Used Oil and Waste Fuel

Agnico Eagle will manage used oil and waste fuel according to the *Used Oil and Waste Fuel Management Regulations* (NWT 2012) as presented in Table 5-2.

Table 5-2 Summary of Used Oil and Waste Fuel Regulations

Activity	Summary of Regulations
Registration	• Waste oil burner shall be registered with the Chief Environmental Protection Officer.
Disposal	• Used oil/waste fuel will not be disposed of directly into the environment.
Storage	• Used oil/waste fuel will be stored in specifically designed container for hydrocarbons to minimize the risk of spills; • Used oil/waste fuel containers will be periodically inspected for leaks or potential leaks; and • Used oil/waste fuel will be stored as per the Hazardous Materials Management Plan.

Sampling and Analysis	• A sample of one month's feedstock of used oil/waste fuel is required to be tested at least once a year;
	• Used oil/waste fuel will be tested for:
	  • Flash point; and
	  • Existence and amount of each impurity Listed in Table 5-3.

Burning	• Used oil/waste fuel will not be openly burned; • Used oil will not be burned in accommodation areas; • Used oil with a flash point of less than 37.7°C will not be burned or blended with another used oil/waste fuel; • Used oil that exceeds guidelines will not be burned; and • A 14-day notice will be given for the burning of waste fuel.

Records	• The following will be recorded in association with the incineration of used oil/waste fuel:
	  • Volume of used oil/waste fuel generated;
	  • Volume of used oil/waste fuel incinerated/consumed;
	  • Name and address of person in charge, management or control of the used oil;
	  • Location of production of used oil/waste fuel;
	  • A summary of maintenance performed on used oil/waste fuel burners or processing equipment; and
	  • Volume and nature of the products produced from the used oil.

Table 5-3 summarizes the maximum level of contaminants in used oil that can be incinerated as stipulated in the *Used Oil and Waste Fuel Management Regulations* (NWT 2012). Under the regulations blending of used oil that exceeds one of more of the criteria listed in Table 5-3 is not allowed.

Table 5-3 Used Oil Impurity Limit

Impurity	Maximum Level Allowed in Used Oil (ppm)
Cadmium	2
Chromium	10
Lead	100
Total Organic Halogens (as Chlorine)	1,000
Polychlorinated Biphenyls	2

5.3 Incinerator Ash

Provided the materials that go into the incinerator are controlled to exclude all hazardous materials, the incinerator ash should be non-hazardous. Even small quantities of hazardous waste, such as batteries, should not be mixed with waste to be incinerated. An ash testing protocol is implemented to ensure that the incinerator ash is suitable for disposal in the landfill. Ash not meeting the guidelines will be packaged in drums to be sent to a certified waste management facility for appropriate treatment, recycling, and/or disposal, or will be buried within the dry stacked tailings.

SECTION 6 • INCINERATOR SPECIFICATIONS AND OPERATION

The Project has selected a dual chamber, high-temperature incinerator as the primary incinerator. The technical specifications are included in Appendix A. The incinerator will be housed inside a separate building that will have sufficient floor space to manage all Project wastes in one convenient location.

6.1 Incinerator Specifications

Typical modern, controlled-air, batch, dual chamber incinerators are design using the principles of pyrolysis (starved-air burning condition) in the primary chamber and complete oxidation (high temperature, excess oxygen, and sufficient combustion time) in the secondary chamber. The incineration system will be a two-stage process. In the first stage, waste will be converted to gas in the primary chamber at approximately 650 to 850 degrees Celsius (°C). This process will be self fueling until the volume is reduced by 90 %. Gasses from the primary chamber will enter the secondary chamber of oxygen-rich and turbulent conditions, which is typically at a higher temperature – around 1,000°C. Combustion will be complete after a retention time of about two seconds. The temperature of combustion gases exiting the stack is anticipated to exceed 700°C and to flash cool in the ambient air, thereby leaving little opportunity for the *de novo* synthesis of dioxins/furans. Heat capture will not be used on the exhaust gases.

Critical process parameters, such as temperature, air flow, and burner output will be computer-controlled to maintain optimal combustion conditions.

For an incinerator capacity suitable for the predicted volumes of waste to be generated at the Project, the total particulate matter generated is expected to be extremely low. Therefore, dust collection technologies, such as baghouse filters, will not be necessary, as very minor amount of fly ash will be generated. Ash residues generated in the primary chamber are manually removed on a daily basis using a shovel emptied into a metal bin.

6.1.1 Operation Procedures

General operating procedures for the incinerator include:

1. Sort the waste on the basis of origin and heating value. Food waste and waste that has been in contact with food will have priority for incineration.
2. Mix the waste to ensure a calorific value within the incinerator's specification and to achieve good combustion inside the primary chamber.
3. Observe the start of the burn cycle to ensure the incinerator is operating correctly.
4. The door to the incinerator is only opened after the burn cycle is complete and the unit cooled.
5. The ash is removed from the incinerator before it is charged with the next load of waste to be incinerated.

6. The ash is placed in drums or bags before disposal.
7. The ash is disposed of in the on-site landfill. If the concentration of trace metals exceeds the Government of Nunavut's *Environmental Guideline for Industrial Waste Discharges* (GN 2014), ash will be either packaged and sent to an approved disposal facility or buried in the dry stack tailings.

The system has a sizable front door for easy access to manually load/feed waste into the unit with a front-end loader. The proposed waste streams are layered wherever possible during loading to ensure proper combustion.

6.1.2 Emissions

The incinerator is designed to meet performance limits described in Section 5.1. Good engineering practices will be used to ensure required incineration temperatures and dispersion of gases meet applicable air quality standards/guidelines.

The incinerator stack design incorporates appropriate sampling ports, with caps where necessary, at appropriate locations to allow for stack testing to be undertaken during incinerator operation.

6.1.3 Dust/Odour Control Measures

Modern incinerators are commonly designed such that the non-turbulent atmosphere in the primary burn chamber reduces the formation of particulate matter. Therefore, the need for additional dust and/or odour control measures is not anticipated. Organic/putrescible wastes will be given incineration priority to limit odours.

6.1.4 Staffing and Equipment

The computerized incinerator typically requires one operator to interact with the equipment for approximately 1 to 1.5 hour per day, largely for ash removal, loading, and start-up. Operators are not typically required to be in attendance during the rest of the operation, as it is normally a fully automated process. The incinerator is designed, installed and operated so that the operators are not exposed to high temperatures during loading or ash removal due to complete cool down after the burn cycle. Also, the waste will not be allowed to combust until the chamber is sealed thus isolating the worker from smoke and high temperatures.

6.1.5 Inspections

Weekly inspections will be undertaken of the incinerator building for cleanliness and the proper management of wastes delivered to the facility. The Environment Department will carry out the inspections.

6.2 Used Oil and Waste Fuel

The incinerator is able to efficiently burn used oil and waste fuel. A quantity of about 365,000 litres of used oil and waste fuel should be incinerated per year. The quantity of waste fuel is expected to

be small and will be dependent on the adherence to standard operating procedures. The goal is to avoid practices that could result in waste fuel. The principal sources of the used oil will be from oil changes on the mining equipment and light vehicles, as well as oil changes to mechanical gearboxes within the mill. Typical used oil and waste fuel furnaces include a storage tank and a filter to recover sludge prior to burning. Sludge collected in the filters will be drummed and shipped, as needed, to a certified waste management facility for treatment, recycling, and/or disposal.

6.3 Shipboard Incinerator

See Section 8 of the Shipping Management Plan (Agnico Eagle 2018).

6.4 Closure Plan

In accordance with the Preliminary Closure and Reclamation Plan, salvageable buildings and surface structures, including the incinerator and waste management building, will be dismantled and demobilized from the site.

SECTION 7 • WASTE MANAGEMENT

Waste reduction is being worked towards by implementing purchasing policies that focus on reduced packaging. Reduce, reuse, and recycle initiatives as well as the waste segregation program at the Project as per the Landfill and Waste Management Plan minimizes the quantity of waste incinerated or directed to the landfill.

7.1 Approach

A waste segregation program is implemented at the site. This allows materials that are unsuitable for incineration to be either landfilled on-site or shipped off-site to a certified waste management facility for treatment, recycling, and/or disposal.

7.2 Acceptable Waste for Incineration

Acceptable wastes for incineration will include the following:

- organic matter including food;
- food containers and wrappings, including plastics that are contaminated by food;
- medical waste from the Health Care Station;
- paper, cardboard, and the like;
- hydrocarbon spill absorbents;
- plastic and Styrofoam except plastic containing chlorine;
- dead animals; and
- used oils and waste fuel.

7.3 Unacceptable Waste for Incineration

Materials that are not listed above would be unacceptable for incineration. These materials include, but are not limited to:

- chlorinated plastics;
- inert materials, such as concrete, bricks, ceramics, ash, asbestos, drywall;
- bulky materials such as machinery parts or large metal goods such as appliances;
- radioactive materials, such as smoke detectors and laboratory wastes;
- potentially explosive materials, such as propane tanks, other pressurized vessels, unused or ineffective explosives;
- hazardous materials such as organic chemicals (pesticides), other toxic substances (arsenic, cyanide);
- electronics;
- batteries;
- vehicles and machinery;
- fluorescent light bulbs;

- whole tires;
- paint and solvents;
- any materials containing mercury, lead, and cadmium;
- used oil or waste fuel that exceeds the maximum impurity limits for parameters listed in Table 5-3;
- waste oil and waste fuel with a flash point of less than 37.7°C; and
- propane.

7.4 Waste Volumes

7.4.1 Solid Waste and Incinerator Ash

The number of people working on-site and the activities occurring at the time have a direct bearing on the volume of waste destined for the landfill, the incinerator, and the amount removed from waste streams for reuse and recycling.

It has been assumed that each person will produce 1 tonne of refuse per year[4]. Mean camp populations of approximately 200 during construction, 680 during operation, and 50 during closure have been estimated. Fifty percent of the refuse by weight can be incinerated, approximately 30% of incinerated material by mass is converted into ash, thereby reducing the mass of waste by approximately 70 %. Thus for 680 workers, the annual quantity of ash during 8 years of operations would be about 105 tonnes. Table 7-1 estimates the annual tonnes of ash resulting from incineration for each project phase, based on the number of people on site, and cumulatively over the life of mine.

Table 7-1 Estimation of Ash over the Life of the Project

Project Phase	Workers On-Site	Annual Tonnes of Waste Incinerated	Annual Tonnes of Ash	Numbers of Years	Cumulative Tonnes of Ash
Construction	200	100	30	4	120
Operation	680	340	102	8	816
Closure	50	25	7.5	3	22.5
Total					**958.5**

Incinerator ash will be packaged in drums or sacks before being preferentially disposed of in the on-site landfill, thus eliminating any wind-blown effects.

[4] Environment Canada's "State of the Environment InfoBase", Environmental Indicator Series 2003 (http://www.ec.gc.ca), indicates that the per capita non-hazardous solid waste generation in 2000 for Canada was almost 1 tonne per person per year.

7.4.2 Used Oil and Waste Fuel

The quantity of used oil anticipated to be generated from the servicing of machinery at the Project was estimated to be approximately 365,000 litres per year (based incineration's maximum capacity of 1,000 litres per day).

The quantity of waste fuel is expected to be small but may vary between years.

7.5 Waste Incineration Rate

Due to the predicted volumes of waste to be generated at the site, the incinerator will have an approximate incineration capacity of 1,750 kilogram per day. If this cannot be achieved due to a lower volume of waste, the primary chamber could be used as storage of wastes until the desired volume is reached. This will primarily be wastes associated with food and small amount of medical waste. The batch cycle will be 6 to 10 hours for the burn cycle, followed by a cool-down of 6 to 8 hours.

SECTION 8 • MONITORING AND TESTING

The following presents the monitoring and testing plan for the incinerator.

8.1 Incinerator Emissions Testing

The incinerator stack design incorporates appropriate sampling ports at appropriate locations, in right angle configuration, to allow for stack testing to be undertaken during incinerator operation. Table 8-1 summarizes the frequency of testing that will be completed as per relevant guidelines (see also CCME 2001b).

Table 8-1 Summary of Incinerator Emissions Testing

	Frequency	Number of Test Required	Reference
Dioxins and Furans	Annual	3	CCME 2001a
Mercury	Annual	3	CCME 2000

8.2 Used Oil/Waste Fuel Testing

A sample of feedstock of used oil/waste fuel will be collected each month with one of the monthly samples being tested each year. Used oil/waste fuel not meeting impurity limits or having a flash point less than 37.7°C will be drummed and shipped to a certified management facility for re-refining, treatment, recycling, and/or disposal.

8.3 Ash Testing

An ash testing protocol is implemented on site to ensure that the incinerator ash is suitable for disposal in the landfill. Ash is disposed of and then covered immediately to prevent mobilization.

Three ash samples will be collected during the first year of operation and the leachate tested for metals content. The samples will be compared to the *Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities* (GN 2011b) presented in Table 8-2. Following the initial testing, ash samples will be collected and tested quarterly.

If monitoring indicates the ash is above the guidelines and not suitable for landfilling, an investigation will be undertaken to identify the cause and eliminate the source for the exceedance. If deemed necessary, the ash will be packaged in drums and sent to a certified waste management facility for treatment, recycling, and/or disposal.

Table 8-2 Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities

Parameter	Maximum Concentration (mg/L)
Arsenic	2.5
Barium	100
Cadmium	0.5
Chromium	5
Lead	5
Mercury	0.1
Selenium	1
Silver	5
Zinc	5

SECTION 9 • REPORTING

As part of the annual reporting, results from periodic stack emissions and ash monitoring, will be provided.

9.1 National Pollutant Release Inventory

The National Pollutant Release Inventory is a Canadian database containing information on the annual on-site release of specific substances to the air, water, and land from industrial and institutional sources (EC 2012). The National Pollutant Release Inventory provides a list of tracked substances and requirements for reporting incinerator emissions. Table 9-1 lists the substances under the National Pollutant Release Inventory that the Project expects to report annually. In addition, there are certain substances, as indicated in Table 9-1 that may require reporting depending on the quantity of incinerator emissions. Whether or not reporting is necessary will depend on results of periodic stack emission testing data and the quantity of annual emission calculated with emissions factors.

Table 9-1 National Pollutant Release Inventory Incineration Reportable Substance List

Substance	Note
Hexachlorobenzene	Required to report
Dioxins and Furans	
Carbon Monoxide	Required to report if released to air from facility in a quantity of 20 tonnes or more per annum
Oxides of Nitrogen	
Sulphur Dioxide	
Total Particulate Matter with diameter <100 microns	
Particulate matter with diameter less than or equal to 10 microns (PM_{10})	Required to report if released to air from facility in a quantity of 0.5 tonne or more per annum
Particulate matter with diameter less than or equal to 2.5 microns ($PM_{2.5}$)	Required to report if released to air from facility in a quantity of 0.3 tonne or more per annum

9.2 Greenhouse Gas Emissions and Global Warming

Agnico Eagle is committed to reporting greenhouse gas emissions in support of Canada's Greenhouse Gas Reporting Program.

SECTION 10 • PLAN REVIEW AND ADAPTIVE MANAGEMENT

The Plan will be updated regularly to reflect the operating conditions at the Project during construction, operation, and closure. The Plan will be reviewed annually and an updated version will be produced every two years of operation at a minimum.

The up-to-date Plan will be made available by Agnico Eagle at all times for review by the Government of Nunavut, Kivalliq Inuit Association, Nunavut Water Board, and Aboriginal Affairs and Northern Development Canada (formerly Indigenous and Norther Affairs Canada).

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2014. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

CCME (Canadian Council of Ministers of the Environment). 1998. Policy Statement for the Management of Toxic Substances. Available on-line: http://www.ccme.ca/assets/pdf/toxics_policy_e.pdf

CCME 2000. Canada-Wide Standards for Mercury.

CCME 2001a. Canada-Wide Standards for Dioxins and Furans.

CCME 2001b. Canada-Wide Standard for Waste Incineration – Stack Testing Requirements.

EC (Environment Canada). 2004. Toxic Substances Management Policy (TSMP).

EC. 2010. Technical Document for Batch Waste Incineration.

EC. 2012. National Pollutant Release Inventory (NPRI).

GN (Government of Nunavut). 2010. Environmental Guideline for Mercury-Containing Products and Waste Mercury. Government of Nunavut, Department of Environment, Environmental Protection Service.

GN 2011. Environmental Guideline for Ambient Air Quality.

GN 2011b. Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities.

GN 2012. . Environmental Guideline for the Burning and Incineration of Solid Waste. Government of Nunavut, Department of Environment, Environmental Protection Service

GN 2014. Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities. Government of Nunavut, Department of Environment, Environmental Protection Service.

Minister of Justice 1999. CEPA (Canadian Environment Protection Act). Available on-line: http://laws-lois.justice.gc.ca/PDF/C-15.31.pdf

NIRB (Nunavut Impact Review Board). 2012. Guidelines for the Preparation of an Environmental Impact Statement for Agnico-Eagle Mines Ltd. Meliadine Project (NIRB File No. 11MN034)

NWT. 2012. Used Oil and Waste Fuel Management Regulations, Department of Environment, Government of Nunavut.

APPENDIX A • TECHNICAL SPECIFICATIONS OF THE INCINERATOR

AGNICO EAGLE

Vendor Document Status

1 ☐ **Proceed to next submission and status.**

2 ☐ **Proceed with exceptions as noted to next submission and status.**

3 ☐ **Do not proceed.**
Revise as noted and resubmit next submission and status.

4 ☑ **Complete, no further submission required.**

By: Dominique Richard — Signature numérique de Dominique Richard, Date : 2017.09.25 11:37:18 -04'00' **Date:**

Review and authorization to fabricate are only for general conformance with the design concept of the Project as expressed in the Contract Documents. Sole responsibility for the accuracy and completeness of this document, including but not limited to dimensions and quantities, remains with the Supplier/Contractor. Agnico Eagle does not warrant the accuracy or completeness of any of the information contained herein, nor does Agnico Eagle authorize or approve any construction means, methods, techniques, sequences or any safety precautions or procedures.

Agnico Eagle No. 6515-S-265-008-154-MNL-0002 **R:** Sub002

DOCUMENT FOR INFORMATION

Bolts and torques for breech and stack installation pg.33 & pg.35
Capacity typo corrected pg.47
Table of content added
Parts list added pg.123-128
Stack erection revised pg.35&36

ECO WASTE SOLUTIONS

Meliadine Incinerator
ECO 1.75TN 1PVC100L
16-1MS

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ECO WASTE SOLUTIONS

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SECTION 1

HEALTH & SAFETY PRECAUTIONS

Health and Safety Precautions

This machine has a number of energy sources:

e.g. Electricity
Heavy mechanical parts which may move due to gravity
High Temperature
Explosive Gases
Flammable Liquids

- **THE INCINERATOR HAS THE POWER TO CAUSE SERIOUS INJURY OR DEATH**
- **KEEP CLEAR OF ANY MOVING PARTS AT ALL TIMES**
- **BEFORE STARTING THE CYCLE ENSURE THAT ALL PERSONNEL ARE CLEAR OF THE INCINERATOR**
- **DO NOT ATTEMPT TO START OR OPERATE THIS EQUIPMENT UNTIL THIS MANUAL IS READ THOROUGHLY AND IS UNDERSTOOD**.
- **RESPONSIBILITY FOR THE SAFE OPERATION AND MAINTENANCE OF THE EQUIPMENT SUPPLIED RESTS SOLELY ON THOSE OPERATING IT.**

OBEY THE FOLLOWING SAFETY INSTRUCTIONS:

A qualified person is a person whom the owner of the equipment deems as having the required experience, training and skills to perform the required work.

1. Keep the electrical panel doors closed at all times except when doing electrical trouble-shooting.
2. Allow only qualified people to perform maintenance and troubleshooting on the machine.
3. Open and lockout the Main Disconnect Switch on the electrical control panel while working on the machine.
4. Do not bypass or tie down any of the door safety switches.
5. Do not open any of the doors while the Primary or Secondary Chambers are above 90^0C
6. Do not enter the chamber unless the Emergency Stop Button is pushed in
7. When opening or closing the chamber door keep clear of the door and ensure that the path for the door is clear.
8. Secure the chamber door when it is open so it cannot move accidentally.
9. Immediately correct any fuel leaks.
10. Do not fill the Primary Chamber more than ¾ full. Overfilling can result in poor burning and damage to the oxidizer.
11. Use proper tools, wear goggles, dust mask and gloves while loading and cleaning the oxidizer.
12. This unit is a confined space. Follow the safety rules for working in a confined space.
13. Ensure that all personnel who are going to operate or work on the machine read and understand the above points and are trained in the operation and maintenance of the machine.

SECTION 2

GENERAL DESCRIPTION

General Description - Thermal Oxidation Concept

The **ECO 1.75 TN 1PVC100L Incinerator system** consists of a **Primary Chamber** and a **Secondary Chamber** (also known as the Afterburner). Both chambers are vessels constructed of steel with a special insulating liner known as refractory.

The **Primary Chamber** has **Hydraulic Roof Lifters** installed for loading of the waste material from the top of the **Primary Chamber** and the front door is used for the removal of residual ash.

The waste material is loaded into the **Primary Chamber** until it is ¾ full. Once ¾ full the **Primary Chamber** is sealed and the combustion cycle begins. This type of system is known as *batch-fed* processing.

Primary Chamber

In the first stage, a burner is used to elevate the temperature of the **Primary Chamber** to ignite the waste. Once the **Primary Chamber** reaches a temperature of approximately 650-850°C, the burn process becomes self-fuelling and the burner will shut off. To save fuel and control temperatures, only when the energy contained within the waste is depleted, will the burner periodically turn on. At these operating temperatures, waste is allowed to fully combust and is rendered sterile.

The **Primary Chamber** operates under *controlled temperature* conditions. The amount of heat released, from the burning of the waste, is controlled by limiting the air into the **Primary Chamber** to less than what is required to complete combustion. This is described as *starved air* conditions. With controlled air and temperature the waste is dried, heated and burned thereby releasing moisture and volatile components. The non-volatile, combustible portion of the waste is burned in the **Primary Chamber** to provide heat while the non-combustible portion accumulates as ash.

In the end, the waste volume is reduced by over 90%. Independent tests have shown that the residual ash is non-hazardous, non-leaching and essentially inert. After enduring the combustion process, metals and glass remain intact. Preservation of metals and glass not only protects the refractory lining from damage caused by melted and fused metals and glass, but also allows for post-combustion recycling where possible.

Remaining in the **Primary Chamber** are non-combustibles, such as metal and glass, and carbonaceous residue. The incoming air, subjecting the non-combustibles to high temperatures, further burns the carbonaceous residue. The result is an oxidized ash product.

Controlling the gas velocity through the system is an important factor in limiting pollution. The gases flowing from the **Primary Chamber** are a result of the interaction of the air with the waste during the controlled burning process. Both the quantity and velocity of the gas product vary according to chamber temperature conditions and the type of waste being burned. The integrated controls for the **Primary** and **Secondary Chamber** act to minimize peaking activity thus controlling pollution automatically.

The combustion gases released in the **Primary Chamber** then pass into the **Secondary Chamber** through a turbulent mixing zone where ignition takes place and additional combustion air is provided to complete the burning process.

Secondary Chamber

As waste burns in the **Primary Chamber**, gases containing the products of combustion enter the high temperature zone of the **Secondary Chamber** for cleansing. The **Secondary Chamber** is sized to retain the incoming gases for a minimum of 2 seconds at 1000°C. This chamber utilizes a high output, fully modulating dual fuel (diesel & waste oil) burner to maintain the required temperature (even in the absence of energy input from the first stage which is important when processing wet or low energy waste). This stage employs a large blower, tightly controlled by the control system using a variable frequency drive on the motor. The blower creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour.

The **Secondary Chamber Blower** air is introduced into the **Secondary Chamber** by an air ring manifold that surrounds the **Secondary Chamber**. The manifold has small air jets called tweers that open into the **Secondary Chamber** at the side walls and create a powerful vortex of excess air to mix the incoming gases and ensure complete combustion. The flow of air is tightly managed by the control system using a Variable Frequency Drive (VFD) by controlling the speed of the fan and modulating motors on the blower inlet dampers.

The **Secondary Chamber Blower** is extremely important as it creates the turbulence required to mix the gases and oxygenate them. This fosters the high efficiency combustion required to break hydrocarbon chains into carbon dioxide and water vapour. It also acts to cool the **Primary Chamber** and prevent temperature overruns.

The **Secondary Chamber** burner is a high output burner and its output is self modulated over a broad range for very precise temperature control.

The **Secondary Chamber** is sized to allow two seconds of retention time. This is the time that the gases from the **Primary Chamber** are retained in the **Secondary Chamber** before they exit to the next stage. Two seconds of retention is considered to be ideal to destroy any harmful organic hydrocarbons produced from the **Primary Chamber**.

Main Control Panel

There is one **Main Control Panel** that controls all of the interconnecting modules. The Operator has one simple **Human Machine Interface (HMI)** to start the equipment, view system status and change control settings if required. The system utilizes a PLC (programmable logic controller) to automate its functions. All critical process parameters such as temperature, combustion airflow and burner output are operated using EWS' patented system control program to maintain optimal combustion and air pollution abatement.

Protecting the Environment

Why Incinerate?

As society becomes more environmentally conscious, environmental regulations on the proper disposal of solid waste have become more stringent. As a result, incineration has become an environmentally responsible and socially acceptable alternative for handling waste at the point of need. However, incineration does not eliminate the need to landfill waste but it does reduce the amount of waste that must be placed in landfills.

Primary advantages of incineration are:

- It greatly reduces the weight and volume of waste material that must be disposed of in landfills
- It destroys organic materials that may be harmful or that may be degradable to harmful materials in landfills
- The incinerator sterilizes the waste; that is, the high temperatures in incinerators can destroy any pathogens that may be in infectious waste materials
- The incinerator destroys animal or human pathological wastes that the general public finds objectionable to handle or see.

Environmental Concerns

The general public will not accept incineration as an option for treating waste of any kind, if they do not believe that it is safe environmentally. The primary concerns are about air pollutants produced by the incinerator and the toxicity of the residual ash. This section will present some of the terminology that is important to understanding these concerns. The remainder of the manual will describe how an incineration system can be operated and maintained in a way that keeps environmental releases at an acceptable level.

Air Pollutants of Concern

Particulate matter may be defined as fine liquid or solid matter such as dust, smoke, mist, or fumes found in the gaseous emissions from the incinerator. Particulate matter emissions may have a dark or light color. Particulate matter emissions can be described in terms of opacity. Opacity is the degree to which light is obscured by a polluted gas (a clear window has 0 percent opacity while black paper has 100 percent opacity). Opacity may be measured with the naked eye or using an opacity monitor. Particulate matter is a problem because it can cause or aggravate respiratory problems in humans. It also creates aesthetic problems since it is readily noticed and is a nuisance because of soiling of exposed surfaces on houses and cars.

Hydrochloric (HCl) acid is generated when polyvinyl chloride (PVC) plastic (usually clear plastic) material is burned in the incinerator. The appearance of a white plume or cloud a short distance above the stack indicates that HCl is condensing. The major concerns about HCl are that it causes respiratory problems in humans, contributes to acid rain problems, and causes material damage to metals and concrete.

Toxic metals include cadmium, arsenic, beryllium, chromium, nickel, lead, and mercury. These metals may be found in municipal wastes. These metals are known to be hazardous to human health.

Organic compounds are compounds that contain primarily carbon and hydrogen and may also contain other elements such as oxygen, nitrogen, and chlorine in smaller amounts. Some organic compounds are known to cause or are suspected of causing cancer and are considered hazardous air pollutants. The public's primary concern is related to dioxin and furan emissions, but other organic compounds such as benzene and vinyl chloride may be emitted.

Carbon Monoxide (CO) also is generated during combustion if the combustor is not operated properly. (Your automobile generates some amount of CO.) CO is toxic to humans if concentrations are high enough, and it also is an indicator of combustion quality.

Solid Waste Ash Quality

One of the major objectives of incineration is to generate a high quality ash for land disposal. All pathogens should be destroyed, and almost all organic material should be completely burned. Ideally, no large chunks of unburned waste material (other than metals or glass) should remain in the waste. A measure of ash quality is "burnout," which is the percentage of organic material remaining in the waste. For example, a burnout of 95 percent means that the ash can contain only 5 percent organics. Adequately burned and quenched ash may be disposed of in a sanitary (municipal) landfill. The ash should be stored in covered containers or kept wet prior to transport to the landfill to prevent 'fugitive \ emissions.' Individual landfills may have requirements that must be followed in order for your waste to be accepted. You should familiarize yourself with these requirements to prevent refusal of the waste.

The Operator – Your Role

It is the operator's role and responsibility to protect the environment by:

1 Complying with all emission limits and operating practices specified in the permit to operate.
2 Minimizing emissions of particulate matter, HCl, toxic metals, carbon monoxide, and organic compounds through proper incineration;
3 Operating the incinerator to generate high quality ash that is sterile and can be disposed of in landfills;
4 Minimizing particulate matter emissions from ash handling;
5 Disposing of ash properly by sending it to appropriate disposal sites; and
6 Performing the regular maintenance inspections to catch any operational problems early.

Basic Combustion Principles

The Combustion Process

Combustion of Municipal Solid Waste (MSW) is a chemical reaction. In the incinerator, organic materials and oxygen react rapidly and violently to produce combustion gases and energy in the form of heat and light.

Organic Solid Material + Oxygen $\xrightarrow[\text{Heat}]{}$ Combustion Gas + Solid Residue + Energy(Heat)

For the reaction to begin and to keep going, all three elements - organic material, oxygen, and heat-must be present. The organic material used in the reaction comes from two sources, waste and auxiliary fuel. Some organic material is contained in most solid waste types. Depending on the fraction of organics and the specific organic composition, the waste may be adequate to sustain combustion. Auxiliary fuel may be used to maintain combustion if the waste material does not contain enough organic material to maintain high temperatures. The combustion reaction between the organic material and oxygen that causes the organics to burn will occur only after the temperature of the organic material is raised to the point that combustion can begin.

Energy in the form of heat is required to raise the temperatures of the incinerator chamber and organic material and O_2. This energy usually is supplied by the auxiliary fuel burners.

Rate of Combustion Air

The oxygen needed for the combustion reaction is supplied by the ambient combustion air. Combustion air is supplied to the combustion chambers through air ports by natural draft. In general, this air contains about 21 percent oxygen (O_2) and 79 percent nitrogen (N_2), so about 21 percent of the total combustion air fed to the incinerator is oxygen that is available to react with the organic material in the waste and fuel. The nitrogen passes through the chamber mostly unreacted; some nitrogen oxides are formed.

Oxygen Reaction

Solid waste contains two types of organic materials

1. Volatile Matter
2. Fixed Carbon

These two types of materials are involved in distinct types of combustion reactions, and the operating variables that control the two types of reaction are different.

Volatile matter is that portion of the waste that is vaporized (or evaporated) when the waste is heated. Combustion occurs after the material becomes a gas. The combustion variables that influence this reaction are gas temperature, residence time, and mixing.

- A minimum temperature is needed to start and sustain the chemical reaction.
- Residence time is the length of time, generally measured in seconds that the combustion gas spends in the high temperature combustion chamber. The residence time must be long enough for the reaction to be completed before it leaves the high temperature zone.
- Turbulent mixing of the volatile matter and combustion air is required to ensure that the organic material and oxygen are well mixed.

Fixed carbon is the nonvolatile organic portion of the waste. The combustion reaction is a solid-phase reaction that occurs primarily in the waste bed (although some materials may burn in suspension). Key operating parameters are bed temperature, solids retention time, and mechanical turbulence in the bed.

- The solids retention time is the length of time that the waste bed remains in the Primary Chamber.
- Mechanical turbulence of the bed is needed to expose all the solid waste to oxygen for complete burnout. Without mechanical turbulence, the ash formed during combustion can cover the unburned waste and prevent the oxygen necessary for combustion from contacting the waste.

Products of complete combustion are:

- Carbon dioxide
- Water

One example of volatile waste is backyard charcoal grill with starting fluid. The starting fluid is highly volatile. When put on the charcoal and ignited with a match, it rapidly volatilizes and burns. The charcoal contains less volatile matter and primarily burns slowly as a fixed carbon bed.

Operating Factors Related to Combustion

The three operating factors that have the greatest effects on the combustion reaction are:

- Combustion airflow rate and distribution,
- Operating temperatures, and
- Waste feed rate and characteristics.

These three factors are all related. Controlling them controls the combustion reaction.

Stoichiometric Air

In the chemical reaction between organic materials and oxygen, the amount of oxygen required under ideal or "perfect" conditions to burn all of the organic materials with no oxygen left over is called the stoichiometric (or theoretical) oxygen level. The amount of combustion air associated with that oxygen level is called the stoichiometric air level. At stoichiometric air level the combustion gas would contain no oxygen because it would all be used in the combustion reaction.

Substoichiometric Air

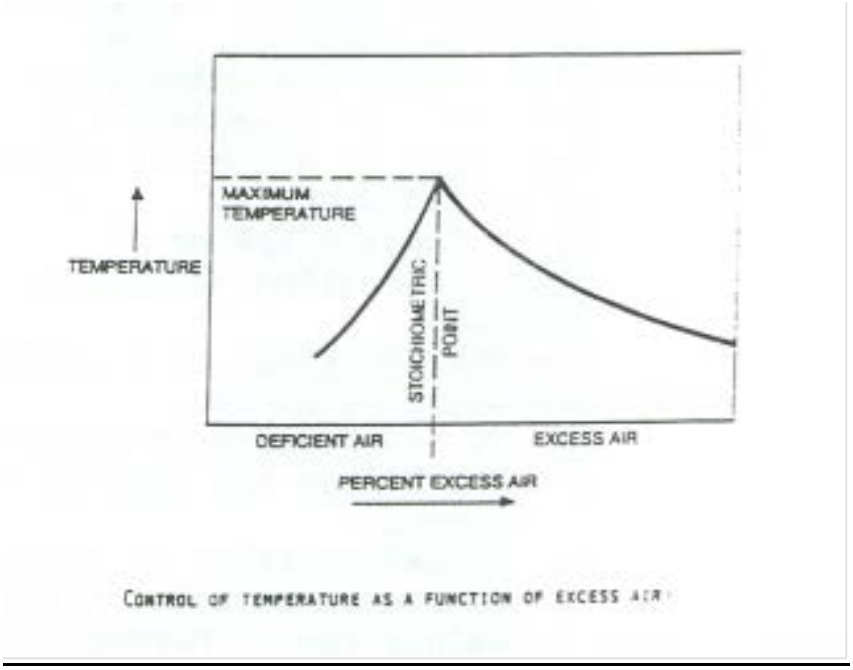
Airflows less than those required at stoichiometric levels are called deficient air or substoichiometric starved-air levels. Under starved-air conditions, the combustion gas would again contain no oxygen, but organics also would remain because combustion is not complete.

Excess Air

Air flows greater than those required at stoichiometric levels are called excess-air levels. Typically an incinerator operates with an overall 140 to 200 percent excess air level. That is, the incinerator operates with one and one-half to two times more air than required at stoichiometric levels. Excess air is used to assure that enough oxygen is available for complete combustion.

Control of Temperature as a Function of Air Level

Maximum combustion temperatures are always attained at stoichiometric conditions. As the amount of excess air is increased above the stoichiometric point, the temperature in the incinerator drops because energy is used to heat the combustion air. If the amount of combustion air is too great, the temperature drops below “good combustion temperature," and undesirable combustion products are generated as a result of incomplete combustion. As the amount of excess air is decreased, the combustion temperature increases until it becomes maximum at the stoichiometric point. Below the stoichiometric point, the temperature decreases because complete combustion has not occurred.



CONTROL OF TEMPERATURE AS A FUNCTION OF EXCESS AIR

The relationship of how combustion air level can affect temperature has just been shown. Temperature also plays an important role in the combustion of waste. Temperatures need to be maintained at levels high enough to ensure pathogen destruction and to sustain the combustion reaction. However, temperatures that are too high also cause problems. Continuous exposure of the combustor refractory to high temperatures is generally not desirable because it can cause the ash to fuse and can cause damage to the refractory.

Waste Characteristics

The primary characteristics of the waste that affect the combustion reaction are:

- The heating value
- The moisture content
- The chlorine content

Different wastes have different heating values and moisture contents. They will affect the combustion process.

The HEATING VALUE of a waste is a measure of the energy released when the waste is burned. It is measured in units of Btu/lb (J/kg). A heating value of about 5,000 Btu/lb (11.6×10^{-6} J/kg) or greater is needed to sustain combustion. Wastes with lower heating values can be burned but they will not maintain adequate temperature without the addition of auxiliary fuel. The heating value of the waste can be used to calculate total heat input to the incinerator where:

Heat Input (Btu/h) = Feed Rate (lb/h) x Heating Value (Btu/lb)

Heat input to the incinerator will affect temperature. More heat input yields higher temperature. Heat input also will affect air requirements; more air is required (1 SCF/100 Btu).

MOISTURE is evaporated from the waste as the temperature of the waste is raised in the combustion chamber. It passes through the incinerator, unchanged, as water vapor. Evaporation of moisture uses energy and reduces the temperature in the combustion chamber.

CHLORINE in plastics or solvents in the waste feed will react to form hydrochloric acid (HCl). This HCl can be an emission problem. It can create corrosion problems of the equipment downstream from the incinerator.

The heating value (Btu value) and moisture varies widely. Compare plastics (high Btu, no moisture) to beddings, shavings, etc. to anatomical.

Summary of Key Operation Factors Affecting Combustion

1 Key factors are interrelated.
2 Air quality/distribution
3 Sufficient air for complete reaction
4 Distributed to promote mixing
5 Mixing
6 Assure contact of oxygen and organics
7 Temperature
8 High enough to sustain combustion
9 High enough to have complete reaction
10 Residence/retention time
11 Sufficient time to allow reaction to complete

Waste Characteristics are also important

12 Heating value
13 Measure of energy released

14 Heat input determines air required
15 Moisture content
16 Requires energy to vaporize water
17 Chlorine content
18 Affects HCl emissions

This summarizes the key parameters affecting combustion.

Products of Combustion Reaction

Complete Combustion

The primary products of waste incineration are:

- Combustion gases
- Solid residue (ash)
- Energy

The primary objectives of the combustion process are to generate an ash residue that is sterile (free of pathogens) and does not contain unburned, recognizable wastes; and to minimize air pollutants in the combustion gas stream.

The organic materials that enter the incinerator with the waste and fuel are primarily made up of carbon, hydrogen, and oxygen. Ideally, these organic materials react with oxygen in the combustion gas to form carbon dioxide and water vapor. The chemical reaction for this ideal situation is

$$\underset{(C,\ H,\ 0)}{\text{Organics}} + O_2 + \text{Heat} \longrightarrow CO_2 + H_2O + \text{Heat}$$

This ideal reaction represents complete combustion.

Incomplete Combustion

However, this ideal reaction does not occur in operating waste combustion systems. Factors that lead to a less than ideal reaction are poor mixing, too little combustion air, and low temperatures. Under those conditions products of incomplete combustion are emitted with the stack gases. The most common product of incomplete combustion is CO. Another product of incomplete combustion that often is emitted under poor mixing conditions or high temperature, low excess air conditions, is elemental carbon (or soot). The soot particles are very fine and generally result in high opacity at the combustion stack. Other products of incomplete combustion that cause concern because of their health impacts are hazardous organic compounds such as benzene, dioxins, and furans. Although these compounds are not found in the waste, under incomplete combustion conditions they can be formed as intermediate combustion products.

The waste feed also includes inorganic materials; generally, they are not involved in the combustion reaction. The inorganic materials in the waste feed (ash) are either retained in the ash or are emitted as particulate matter in the combustion gas. Air velocities in the combustion bed are controlled to reduce the amount of inorganic material entrained (picked up by) the combustion gas and emitted with the combustion gas. If combustion is not complete, organics

will remain in ash; this is typical…it is atypical to have 100 percent combustion of ash bed. Under poor conditions (low temperature, low turbulence in ash bed) may have pathogens remaining in ash; i.e., may not sterilize ash.

Combustion Indicators

The information presented in the above section suggests that the following indicators can be used to monitor combustion quality.

Opacity

The opacity of the combustion gas stream is a measure of the degree to which the stack gas plume blocks light.

- High opacities indicate high emissions.
- Opacity is primarily caused by noncombustible ash or uncombusted carbon (soot) in the flue gas.
- High opacities can indicate poor mixing or low levels of combustion air.
- High opacities also may be generated by high levels of HCl emissions or poor burner operation in the secondary chamber.

If a large amount of water vapor is present in the combustion gas, the water can condense when it cools as it leaves the stack forming a dense white "steam plume." This is not an indicator of poor combustion and should not be confused with a black or white smoke plume caused by soot or acid gases. Opacity can be visually determined by a person or measured by an instrument.

Other indicators which provide information about combustion conditions are measurements of the combustion gas oxygen and CO levels. However, these measurements require instruments and most facilities do not have those instruments.

Ash Quality

Visual appearance of ash can be an indicator of combustion problems. If an incinerator is operating properly, little organic material will remain in the ash. Whitish gray ash indicates better burnout and less carbon than black. The extent of organics combustion can be measured by the quantity of combustible materials remaining in the ash. Noted increases in combustibles in the ash indicate a combustion problem which may include bed temperatures that are too low, improper distribution of combustion air in the bed, or insufficient waste retention times.

SECTION 3

PHOTOS OF THE INCINERATOR

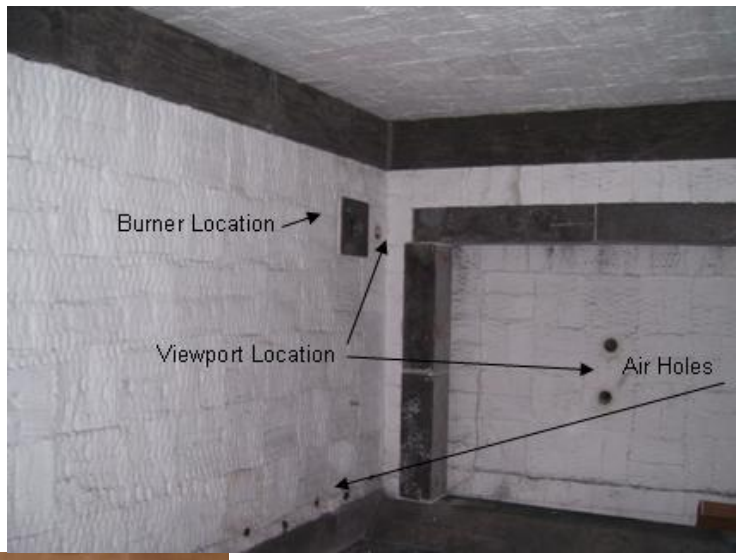
NOTE some of these are sample photos and may not depict the actual Incinerator components

Primary (right) & Secondary (left) Chambers

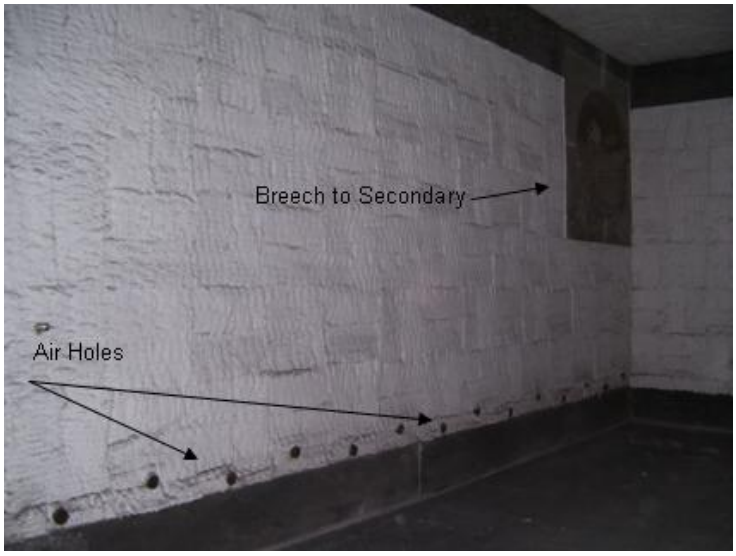
NOTE **Stack sections and breech have not been installed.**

Primary Chamber Access Door View

Primary Chamber Interior View (sample picture)



Floor and grate detail



Secondary Chamber Door View

Secondary Chamber / T-section View

Primary Chamber Blower

Secondary Chamber Blower

Adjustable Damper and Modutrol Motor

Primary Chamber Burner

NOTE **Burner is shown without cover installed.**

Diesel Tank (4,500lt)

Secondary Chamber Burner

Waste Oil Tank (5,000lt)

Main Control Panel

Thermocouple, Viewport and Limit Switch

T-Stack and Stack Sections

Spark Arrestor

SECTION 4

ASSEMBLY & INSTALLATION INSTRUCTIONS

General Assembly and Installation Overview

The incinerator is factory pre-assembled to ensure proper fit then shipped disassembled. On-site assembly by certified trade's people is required. Trades people (Riggers, Mechanical Contractors, Millwrights, Electricians, Gas Fitters, etc) are to be arranged by Purchaser and/or Contractor.

This is a **general overview**, therefore, project specific details must still be considered. Please refer to relevant data and drawings supplied by EWS.

Purchaser/Contractor Responsibilities

These responsibilities include, but are not limited to, the following:

1. Ensure all concrete and structural steelwork, as may be required, is adequate to support the incinerator and associated equipment. The Purchaser/Contractor is responsible for all concrete design such as slab thickness, footing depths and dimensions and any placement reinforcement so as to be consistent with all applicable building codes.

2. Supply of any anchor bolts when applicable.

3. Provide all utility services to the equipment including fuel, electrical, water, air, etc, as may be required.

4. Provide adequate air makeup to the incinerator room through forced air circulation blowers, air intakes and/or opened louvers to avoid the creation of negative pressures within the building.

5. Observe caution in the selection of materials and coating of building walls or other structural components to the incinerator area giving due consideration to high-localized temperatures of the incinerator.

6. Provide all external thermal insulation when required on steam piping, water piping, etc.

   NOTE External thermal insulation should never be applied to any surface of the incinerator or refractory lined stacks and breeching. If applied to these surfaces, structural damage may result.

7. Provide proper roof thimbles, clearances, flashing and counter flashing around all roof penetrations, including the incinerator stack.

8. Guying of all stacks (if required) is to be done by the Purchaser/Contractor. Guying should be at three points at 120° apart or four points at 90° apart. The Purchaser/Contractor provides design of guying and guying connection points to the stacks. Torque draw band bolts to 35 lbs. during stack assembly.

9. Provide proper protection of all equipment from damage, vandalism and weather, while on-site and/or when installation is in progress.

10. Provide all touch up painting and cleanup of equipment after erection.

11. Inspect and field weld miscellaneous flanges, when applicable.

12. Supply all main fuel line regulators at connection points to the Incinerator. Fuel lines should be sized for maximum pressures and instantaneous fuel flow at cold starting. Pressures should be based under flow conditions, not static. Static pressure should never exceed the design pressure of the pressure regulator. Gas volume includes burner pilot requirements.

13. General Arrangement drawings are normally provided by EWS. As soon as possible after acknowledgement of a Purchaser/Contractor's order, it is the responsibility of the Purchaser/Contractor to provide EWS with all applicable sketches, layouts, building drawings, roof and floor elevations and other pertinent information to allow preparation of the General Arrangement drawings. With this information, the Purchaser/Contractor's will provide desired orientation of the chambers.

14. The Purchaser/Contractor must recognize the importance of proper waste material descriptions concerning physical and chemical properties. Changes in waste composition to be incinerated should be made known to EWS, as soon as possible.

15. It is the Purchaser/Contractor's responsibility to obtain all construction, operating and environmental/air emissions permits as may be required in the area of jurisdiction for the incinerator equipment. EWS will assist in supplying all technical information required for these permits to the Purchaser/Contractor.

16. The Purchaser/Contractor must be aware that certain components will be broken down for shipment purposes and reassembly will be required in the field by the Purchaser/Contractor.

17. Locating and mounting the incinerator in a confined area should be avoided. The Purchaser/Contractor should maintain ample space around all equipment for maintenance, cleaning and safety considerations. A rule of thumb would be to provide a minimum of six feet from all major equipment surfaces and edges. Always allow proper space for the swing radius of loading doors, cleanout doors and electrical panel doors. If space limitations exist, it is the Purchaser/Contractor's responsibility to make EWS aware of these dimensional restraints so that modifications may be considered.

18. Do not scale drawings: If certain dimensions are required which are not shown on drawings, the Purchaser/Contractor should contact EWS Project Manager. EWS will not be responsible for any dimensional conflicts resulting from dimensions not shown on a certified drawing. Do not use general sales literature or other general equipment submittals for construction unless so indicated. EWS reserves the right to change equipment dimensions as required for design purposes.

19. All drawing dimensions are typically subject to ¼"tolerances.

20. If the refractory is shipped in the green condition, the refractory has not been heat cured. This curing process must be accomplished in the field after final erection and assembly. It is understood that the Purchaser/Contractor will provide all required utilities for this curing process and initial equipment operation for adjustments at no expense to EWS including but not limited to fuel, electrical, water, etc.

21. Due to the physical size of the incinerator, the unit is shipped partially dismantled and will, therefore, require reassembly in the field. Consult EWS for maximum component weights so that properly sized cranes are available at the site for unloading and erecting. Purchaser/Contractor may, also therefore, have to reinstall electrical components and control connections, burners, blowers, lifters, etc. These connections are normally of the flexible type with leads marked.

22. Lifting lugs are provided on chambers, stacks, and major accessories. These lugs should be used in setting the pieces into position. Do not attach lifting chains or cables to piping, control panel or mounting flanges as they may be damaged. Avoid dragging lifting gear across painted surfaces as this will cause damage to the high temperature paint. When placing the incinerator into position be extremely careful not to subject the refractory to mechanical shock as this may result in refractory damage.

Step by Step Assembly and Installation Instructions

The following **sequence** applies specifically to the Meliadine Waste Incinerator.

Trades-people required for the following steps:

Forklift Operator, Crane Operator, Riggers, Electrician and Mechanical Contractors (pipe and gas fitter)

Please refer to the supplied drawings and data.

Foundation Drawing: Anchor Bolt and Loading Diagram ECO1.75TN1PVC100L-00D rev.0

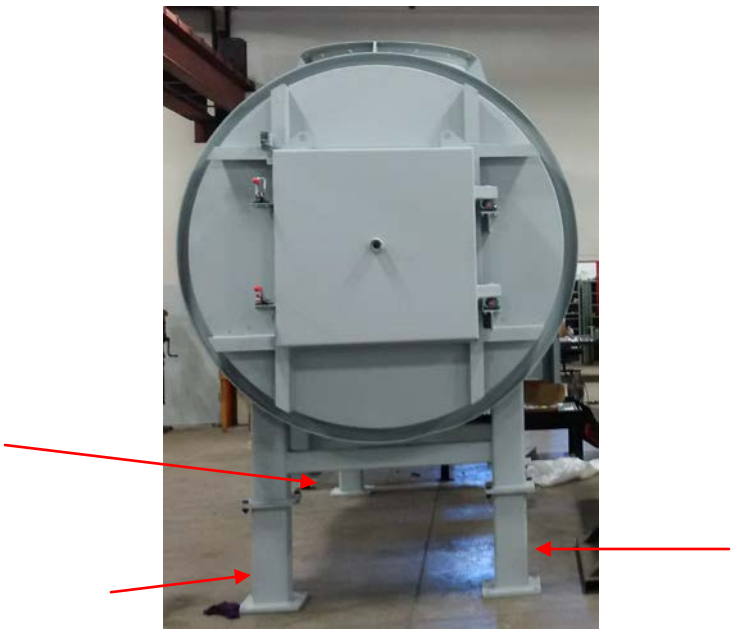
1. The incinerator and related components must be installed on a level concrete pad. It is recommended that appropriate consultation with civil engineers and/or architects is taken before designing an appropriate foundation for the equipment.

2. Please refer to General Arrangement Drawing ECO1.75TN1PVC100L-00A rev.1 and its Bill of Materials.

Place the Primary Chamber and Secondary Chamber on the Foundation

3. Locate leg extension for the Secondary Chamber and put into position.

4. Once the leg extensions have been put into place, using a crane, lift the **Secondary Chamber** into position and connect the leg extensions.



Leg extensions

5. Position the Secondary Chamber (item 2) beside the Primary Chamber (Item 1) on the level concrete pad. Ensure that the breech openings on each Chamber are facing each other.

6. Shim with steel shim plates to ensure the Secondary Chamber is level. This is required to prevent rocking, or any movement of the **Secondary Chamber.**

Connecting the Breech to the Secondary Chamber

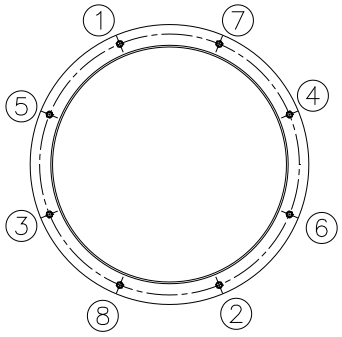
1. Install the **Secondary Breech Gasket,** by spraying the gasket adhesive on the Breech connecting flange and on the gasket material. Line up holes of the **Secondary Breech Gasket** to line up with the flange bolt holes. Press **Secondary Breech Gasket** onto flange securely.

Gasket adhesive spray being applied

Correctly Installed Gasket

2. Raise the **Breech** (Item 7) with forklift and slings, once the **Breech** is 8 to 13 cm from the flange, use alignment bars to help with the final alignment of the two (2) breech flanges, as shown below.

3. Once breech flanges are aligned and together bolt flanges together using the numerical order described in the pattern below using hardware provided.



Correctly installed Breech on Secondary Chamber

Position the Primary Chamber

1. Install the **Primary Breech Gasket,** by spraying the gasket adhesive on the Breech connecting flange and on the gasket material. Line up holes of the **Primary Breech Gasket** to line up with the flange bolt holes. Press **Primary Breech Gasket** onto flange securely.

Gasket NOT installed

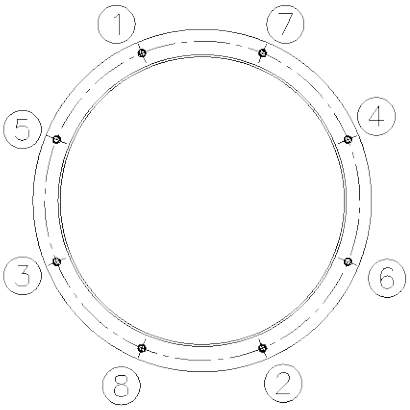
Correctly Installed Gasket

2. While constantly checking alignment of the **Breech** move **Primary Chamber** along the floor using the forklift and skates until the flanges are aligned.

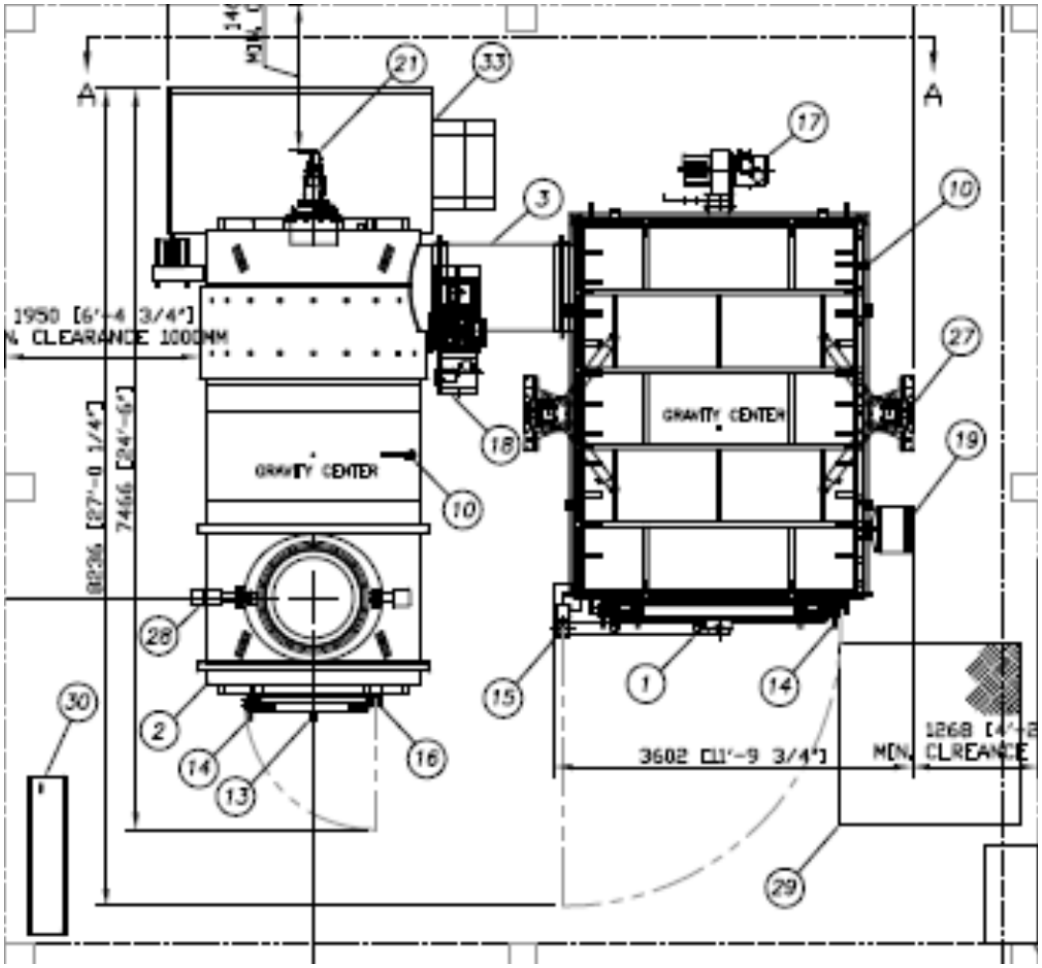
NOTE Do NOT pull the Primary Chamber closer to the Secondary Chamber with the flange bolts. Doing so will bow the steep plate, in turn damaging the breech refractory.

3. Once breech flanges are aligned bolt flanges together, shim and level the Primary Chamber with steel shim plates. Support pads should be shimmed as required to prevent rocking, or any movement of the Primary Chamber.

4. Using the numerical order described in the pattern below using hardware provided.



Correctly Installed Breech on Primary Chamber



NOTE The diagram above shows the burners and blowers already attached to the Primary and Secondary Chambers. When positioning the Primary Chamber, Breech and Secondary Chamber, these items will not be attached.

Installing the Stack

Install stack gaskets between stack sections.

Install refractory-lined *T-Stack Section* on top of the *Secondary Chamber* using the hardware provided. Then install the next four *Stack Sections and the spark arrestor* as per the drawing using hardware provided.

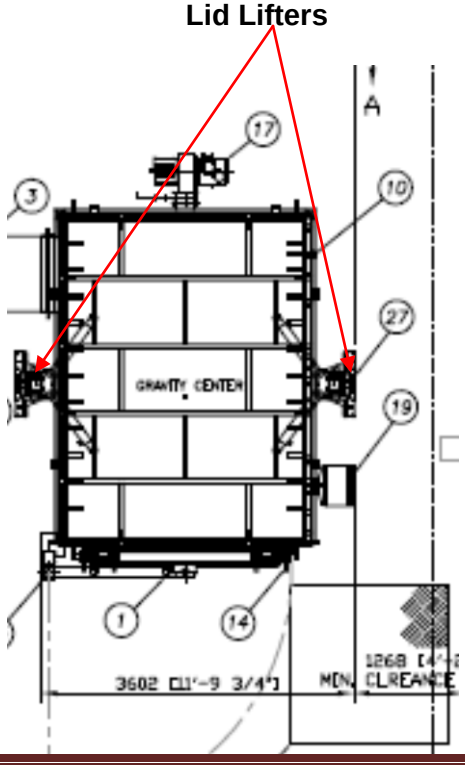
T-Stack and Stack Sections

This is a Sample Photo only of Erection of the Stack Sections

Installing the Lid Lifters

1. Place the lid lifters (item 27) on either end of the Primary Chamber. The slave column, the one without the hydraulic power pack, is to be located in between the chambers.

Lid Lifters



2. Once lifters are in place, shim and level, do not exceed 2.54 cm under the column. Anchor the columns to the floor.

3. Install the pre-assembled hydraulic pump on the master column reinforcement and connect the hydraulic hose and piping.

4. Install the limit switches, proximity switches and solenoid valves with the hardware provided.

5. Install the control stations for the lid lifters (attached to junction box at the master column). Location determined by customer.

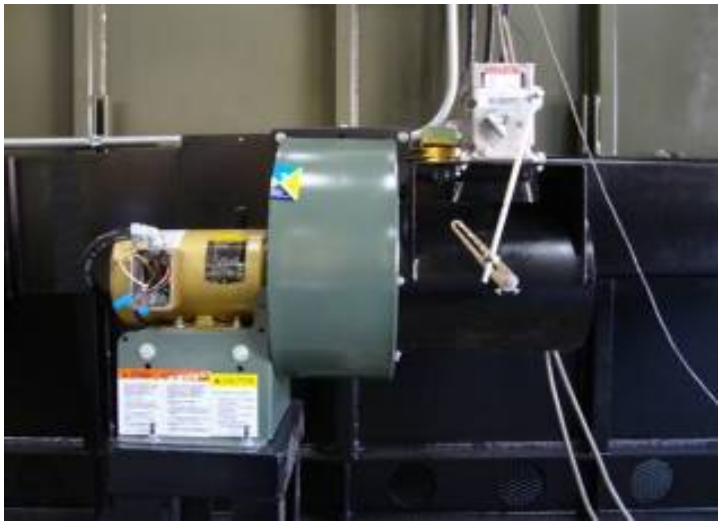
For further detail consult the OEM manual of this lifter in 6515-S-265-008-280-EDS-0015_Sub002.pages175to190

Assembling and Installing the Primary Chamber Blower

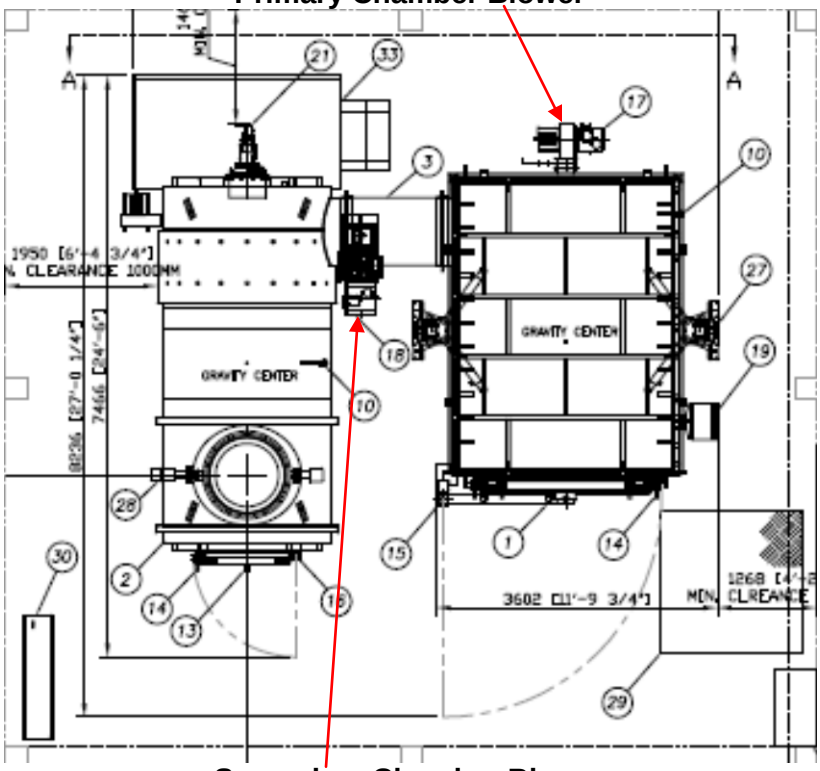
1. Place the **Primary Blower** mounting frame where the **Primary Blower** is to be installed.

2. Install **Primary Blower**, shim and level as required with steel shim plates until the flanges are align. Support pads should be shimmed as required to prevent rocking.

3. Bolt together using bolts provided after alignment of all bolt holes



Primary Chamber Blower



Secondary Chamber Blower

Assembling and Installing the Secondary Chamber Blower

1. Place the **Secondary Blower** mounting frame where the **Secondary Blower** is to be installed.

2. Install **Secondary Blower**, shim and level as required with steel shim plates until the connecting flanges are level.

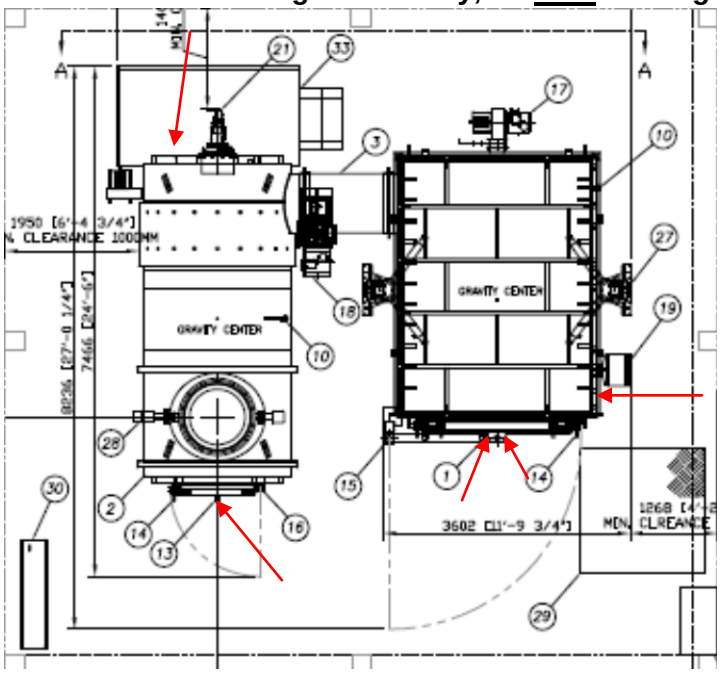
3. Bolt together using bolts provided after alignment of all bolt holes.

Secondary Chamber Blower

Installing the View Ports

1. Install four (5) 2" threaded **Viewports** at positions indicated in red below on **Primary Chamber** door, the left hand side of the **Primary Chamber Burner,** the **Secondary Chamber** door and the right hand side of the **Secondary Chamber Burner.**

NOTE **The viewports should be hand tightened only, do NOT over tighten.**

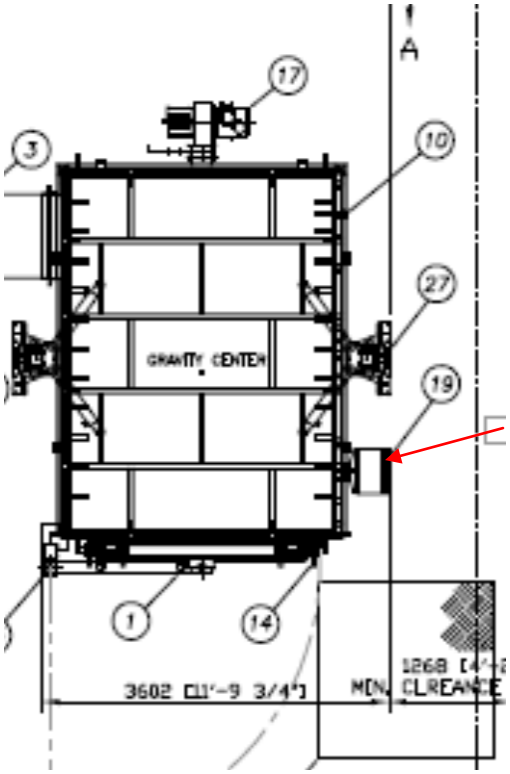


Installing the Primary Chamber Burner

1. Install the **Primary Burner** and burner gasket in the burner port located on the right side of the **Primary Chamber**.

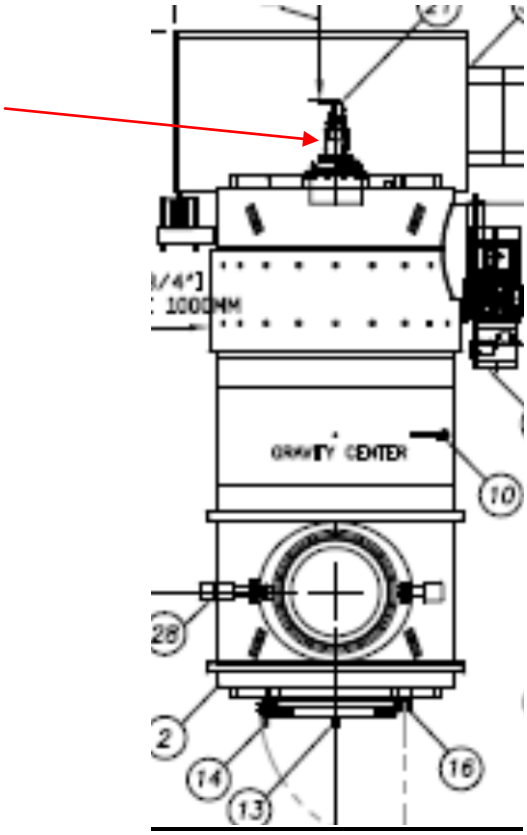
2. Bolt together using provided hardware after alignment of all bolt holes.

Primary Burner shown without red cover installed.



Installing the Secondary Chamber Dual Burner

1. Install the **Secondary Chamber Burner** and gasket in secondary burner ports using the hardware provided. The fuel train is pre-assembled and the final installation to follow the P&ID drawing



It is the customer's responsibility to conform to any local codes when installing the Waste Oil System.

Positioning and Installing the Diesel Tank

The Fuel Tanks are to be installed at ground level as per the site layout. Locations are to be determined by the customer to satisfy all local codes. Interconnecting piping and filters for each burner have been shipped with the equipment

Fuel Connections

Reference: General Arrangement ECO1.75TN1PVC100L-00A rev.1 and P&ID ECO1.75TN1PVC100L-00B rev.1 drawings

NOTE All fuel connections to be done by a certified technician and should satisfy all local codes (all lines to be pressure tested), including the distance between the incinerator system and the fuel tanks. If not properly installed and maintained, the waste oil tank (see image) can become a serious threat to the environment. Ensure the installation follows all local regulations and environmental protection measures.

Even though the tank is double walled, it is highly recommended that the installation site of the storage tank be equipped with a secondary containment system consisting of the following: dikes, berms, or retaining walls and a floor. The floor should cover the entire area within the dike, berm or retaining wall.

WASTE OIL PIPING TRAIN
The Waste Oil piping train consists of:
1. Pump skid.
2. Interconnecting piping.
3. Fuel train to dual burner.

When installing the waste oil piping train check to ensure that:
- Piping is clean.
- That the pipe has been reamed and free of burrs
- The work is done to trade standards

To perform the installation a (½" and 1") pipe threader is needed.

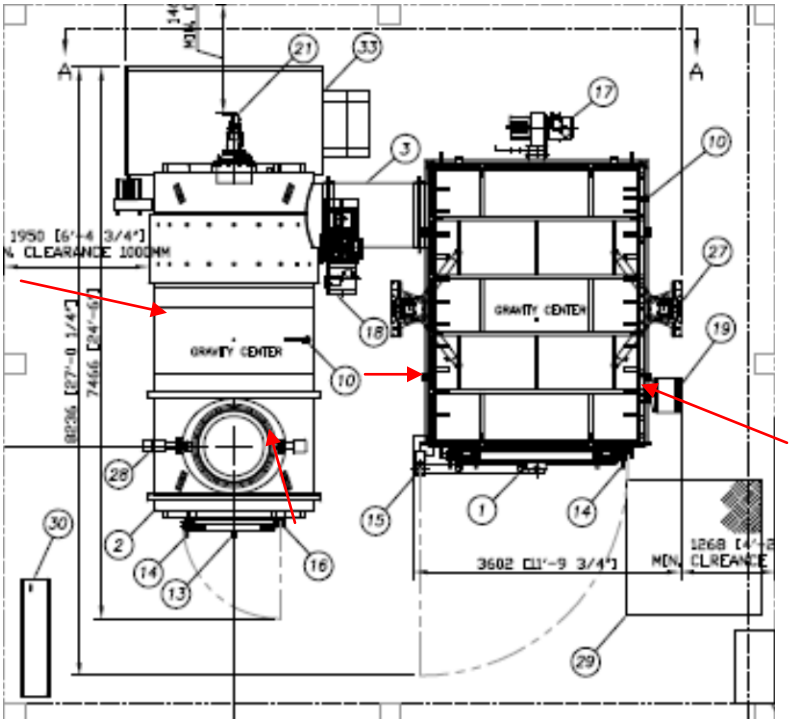
Note: When the pipe installation is complete flush out the line to remove any sediment and dirt that may have contaminated the pipes.

This incinerator system includes two (2) waste oil totes and their correspondent containment, as well as spill kits according to the volume, these items are to be deployed by the customer according with their waste management plan.

Also, two (2) ash bins are included for the storage of the ash removed from the incinerator.

Installing the Thermocouples

1. Install the four (4) ¾" threaded **Thermocouples** at the positions indicated in red below: two (2) in the **Primary Chamber,** one (1) on **Secondary Chamber** and one (1) on **T-Stack**



Installing the Weigh Scale

The weigh scale is to be installed closer to the loading point (to be determined by customer) and anchor it (note: the loading of this incinerator is intended to be through the roof when the lid is in the open position.

Electrical Connections

Reference: Electrical Drawings ECO1.75TN1PVC100L-10A / B/ C/ D rev.0 (17drawings)

NOTE All electrical connections, terminations and conduit installation to be done by a certified electrician and should satisfy all local codes.

1. The **Main Control Panel** should be installed at a minimum of 8' from the Incinerator system.

2. Wiring is necessary (customer's scope) from the power source to the **Main Control Panel** and between the **Main Control Panel** and the **Junction Boxes** on the incinerator and all Teck Cable from the junction boxes to the components.

3. The **Thermocouples** must be wired directly to the thermocouple input card on the **PLC** with the thermocouple wire provided, without splicing the wire. Interconnecting cable has been shipped with the equipment

4. Connect terminal wires. Connect main electrical feed through conduit connection in the bottom of the panel enclosure to the line terminals on the disconnect switch.

5. Run cables to scale and tank

Start Up and Commissioning EWS Field Services

Do not attempt to place the equipment into operation until an EWS Service Technician has inspected all equipment and interlocks.

1. Upon completion of mechanical erection, interconnection of equipment and provisions of utilities as described above, arrangements should be made with the EWS field service department for scheduling of a service technician for initial start-up.

2. An EWS representative must perform start-up of all incinerator systems unless specifically arranged otherwise in writing by EWS.

3. Attempts to start-up incinerator systems by the buyer without prior written approval may result in revocation of all expressed or implied warranties.

SECTION 5

OPERATING INSTRUCTIONS

Important Information

Proper operating and maintenance procedures must be followed in order for the ECO Model Incinerator system to perform at maximum efficiency.

Do not attempt to start or operate this equipment until this Operator Manual is read thoroughly and is understood.

The equipment has been designed with many safety features, however, like all thermal processes; this equipment is not free from the inherent hazards of high temperature processes.

Safety procedures and precautions must be followed at ALL times during operation.

There are safety procedures outlined in this Manual, however, no amount of written instruction can replace good judgment and safe operating practices.

Responsibility for the safe operation and maintenance of the equipment supplied rests solely on those operating it.

There are many engineered features incorporated into the ECO Model Incinerator system to free the operator of repetitive chores. They do not, however, relieve the operator of maintenance responsibilities. In order to maximize the operating life of the equipment, it is strongly recommended that the maintenance procedures, outlined in Section 6, be followed diligently. It is advisable to keep an equipment log for recording maintenance activities along with unusual operation.

NOTE

In the event that the equipment is not operating in the normal manner, contact Eco Waste Solutions immediately at (905) 634-7022 and ask for Customer Service Manager. It is important to report problems as soon as they are noticed to minimize damage that faulty operation could cause.

Design Specification Criteria

The **ECO 1.75 TN 1PVC100L incinerator systems** was designed specifically for the **Meliadine Mine.** Based on information provided, the EWS team designed an incinerator with the following criteria in mind.

Waste Description and Assumptions

Solid waste:

- Food waste (food, food packaging and containers, plastic and paper waste from food preparation) - 50%
- Domestic waste (paper, plastics, bottles, newsprint, cans, cardboard) - 40% Packaging (cardboard boxes, paper, plastic containers, plastic film, Styrofoam, poly-weave bags) - 10%
- Absorbents (Rags, wipes, spill cleanup materials) - negligible
- Medical waste (bandages, dressings, gloves, swabs, syringes, sharps) - Negligible

Waste Oil:

- Used Oils (hydraulic, transmission, motor, crankcase, gear box, synthetic and brake fluids)

The waste is expected to be bagged or stored in skips/bins around the mine operation and then brought to the incinerator building by truck. The waste oils will be brought to the incinerator by totes (handling by forklift or pallet jack).

Waste Quantity

The incinerator is designed to process and treat the waste generated on site, up to 1,750 kg per day. Therefore the ECO 1.75TN 1PVC100L incinerator system was selected, as it will process up to 1,750 kg of camp waste per day in a single batch.

Incinerator Design Parameters

Incinerator Design Parameters	Unit	Details
Secondary Chamber Operating Temperature	°C	1000
Secondary Chamber Retention Time	s	2 (minimum)
Incineration capacity	Kg/day	~~1700~~ 1750
Charge per cycle	Kg	1700
Burn Cycle Duration for entire load	h	less than 10
Cool Down Cycle Duration	h	8 to 12

NOTE

This incinerator was only designed for the type of waste and amount of waste mentioned above. It is important that the waste quantities and characteristics described above are processed in the incinerator. Otherwise, the incinerator system will not operate properly.

It is also important to note that some waste-streams are unacceptable and SHOULD NOT be processed in the incinerator.

Unacceptable Waste-streams

The following is a list of some of the waste streams that should not be processed in this system.

Waste Materials Not Suitable for Processing in Eco Waste Solutions Technology

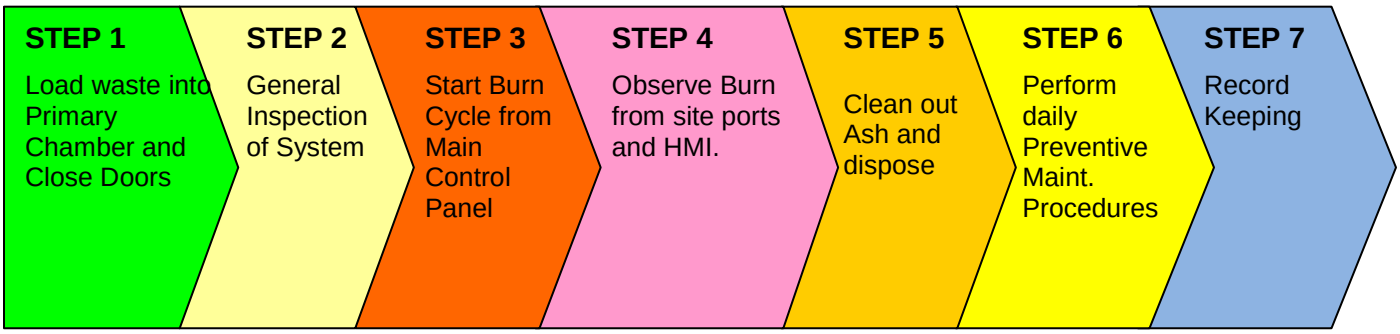
Solid Waste	Description	Origin
Bulky Materials	Automotive or heavy equipment parts such as engine blocks and transmissions	From vehicles and equipment maintenance shop
Non-Combustible Materials	Drywall, asbestos, bricks, concrete, soils	Construction activity
Radioactive Materials	Smoke detectors, laboratory wastes	From Buildings, laboratories
Potentially Explosive Materials	Large propane tanks, other pressurized vessels. Actual explosives	From warehouse, plant and production facilities
Heavy Metals	Items containing lead, mercury, cadmium, for example: batteries, electronic devices, fittings, old pipe work, fluorescent light bulbs, electrical switches, thermometers, PVC plastics, aluminum solder, photovoltaic cells	From maintenance activities, operations and construction activities
Liquid Waste	**Description**	**Origin**
High Alkaline or High Acid Materials	By-products of industrial processes, unrefined fuels	From warehouse, plant and production facilities
Solvents	Solvents such as acetone, xylene, methanol	From vehicles and equipment maintenance shop

Important Notes:

1. These lists are guides and should not be assumed to be an exhaustive list of materials
2. A waste and procurement audit is highly recommended and encouraged to ensure that all sources of heavy metals (especially mercury) are identified and diverted from the incinerator

General Operating Overview

The operation of the **ECO 1.75TN 1PVC100L Incinerator** package follows 7 general steps that take place over a 24-hour period.



Although all 7 steps are critical in the general operation of the incinerator system, this section of the manual focuses on **Step 1, Step 3** and **Step 4** and how to start the system and monitor it during operation.

It is assumed, at this point, that the waste material is properly loaded with the weight, density and type the incinerator is designed for, as outlined on page 5 of this section.

It is also assumed that the waste is loaded after the ash has been removed from the previous burn cycle and any daily maintenance routines have been completed.

This section will also cover **Step 7** on how to use the historical charts, store incinerator data, and access incinerator historical information for record keeping purposes.

Monitoring and Data Acquisition System

Overview

The **Human Machine Interface (HMI)** system automatically monitors the entire process and all system inputs are recorded and logged for record-keeping purposes and also allows for historical trending of key operating conditions.

The integrated **Human Machine Interface (HMI)** in the Main Control Panel monitors and records the following:

1. Temperature sensors
2. Differential pressure sensor with transmitter (draft)
3. Monitoring of burner functions
4. Auxiliary burner operation and fan amperage monitoring via current transducer
5. Door position interlock monitoring
6. High temperature limit and interlock
7. Low Fuel level limit and interlock
8. Air proving switch interlocks
9. Waste loading records

All data can be transferred to storage by using USB port (to transfer to PC to print)

HMI Operator Interface

Main Control Panel Components

Number	Name	Purpose
1	**Main Disconnect Switch**	Isolates the incinerator from its source of electric power.
2	**Human Machine (Operator) Interface**	Displays various screens reflecting system performance.
3	**Control Power ON**	1. Green light indicates the control power in the panel is on. 2. Pushing it if the **Emergency-Stop** is out will turn on the control power.
4	**Emergency Stop Pushbutton**	When pushed, shuts down the system and disables any possibility of starting it.
5	**Communications Port**	Allows for communication to/from the PLC
6	**Start Switch**	Activates the system

The Human Machine Interface (HMI)

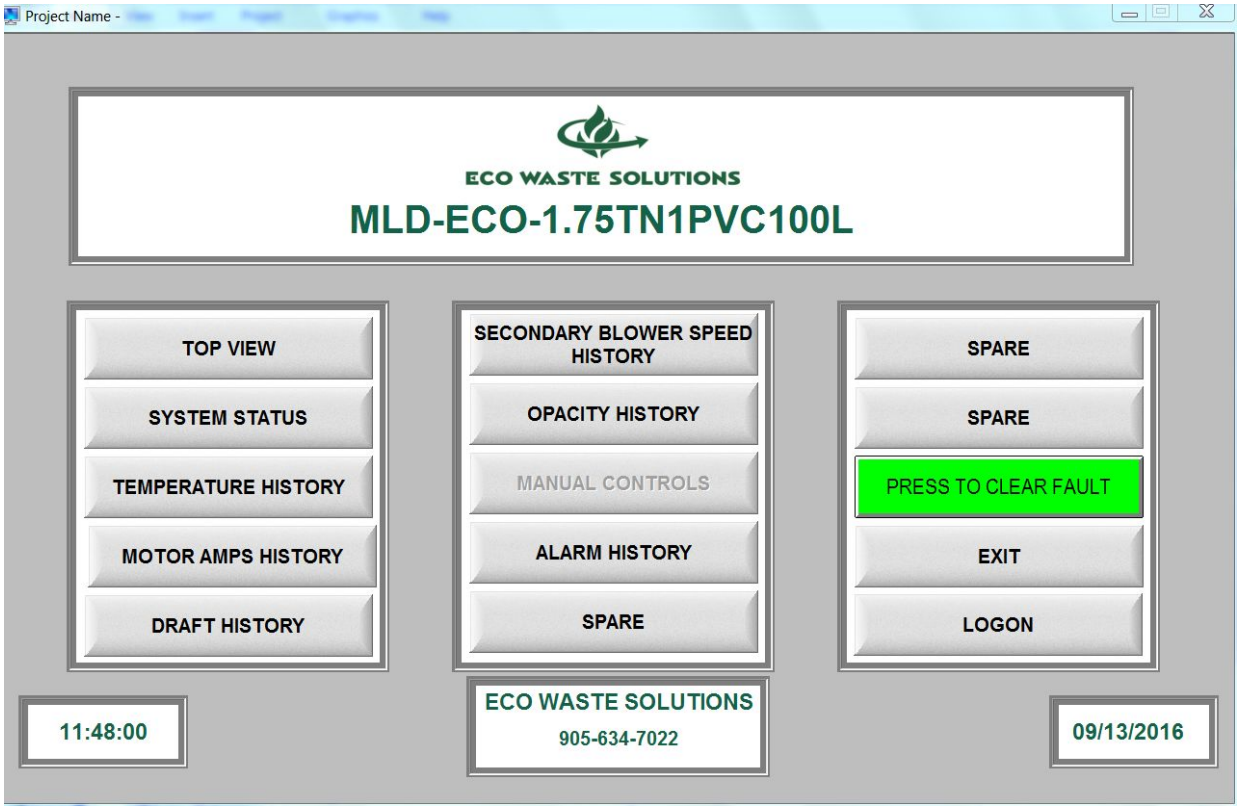
The **Human Machine Interface (HMI)** controls the operation of the incinerator directly from the **Main Control Panel.**

The **Main Menu** screen displays all the available options for viewing the system in operation.

The **Human Machine Interface (HMI)** has a touch-screen and items can be selected by touching them on the screen.

Main Menu

The first screen the operator will view is the **Main Menu** (see below).



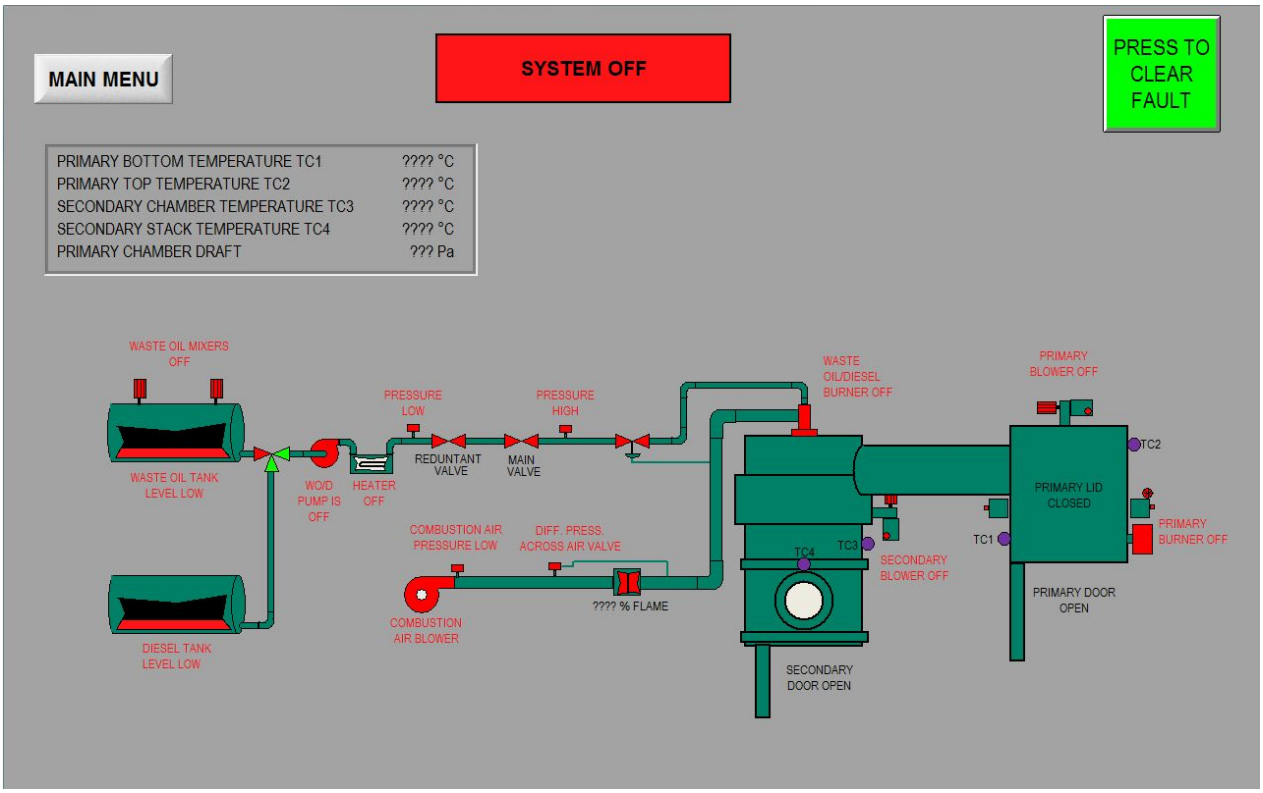
Top View

When the ***Top View*** button is selected, an overview of the incinerator and related components is displayed. This shows key temperatures, flows, and other indicators of what is happening in the process in a real-time basis.

NOTE

The system will not start if there are alarms or faults present. Clear and/or acknowledge faults.

At any time, touch **Main Menu** to go back to the main screen.

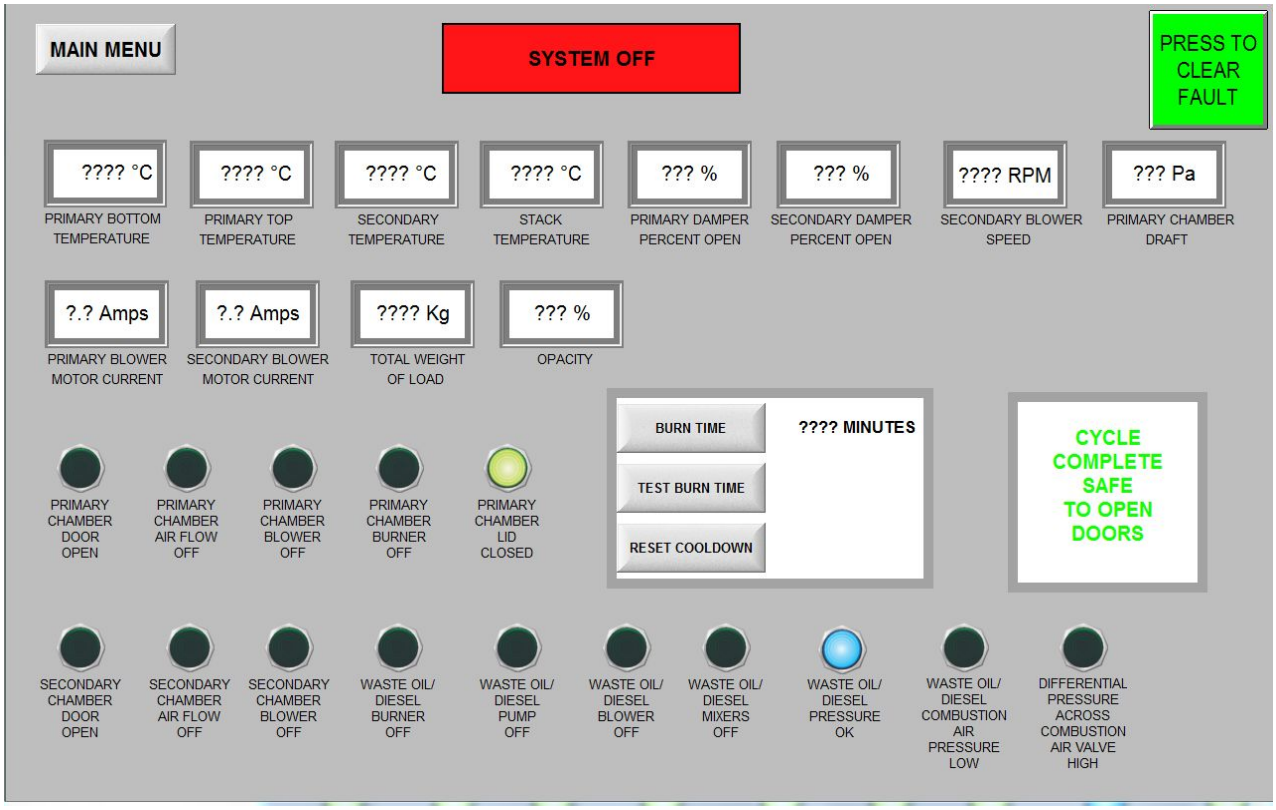


System Status

When the ***System Status*** button is selected from the **Main Menu,** a screen will display the status of all the operating parameters of the incinerator, such as the temperatures and the time remaining in the cycle, as well as displaying other informational items such as status of the door, lid lifter, blowers, etc.

The operator can change the burn time of the cycle by selecting “BURN TIME” and entering a time (in minutes). The operator may do this over time to either prolong the burn time, or decrease the burn time depending on the waste mixture; for example a very wet batch of garbage will take more time to burn than a dryer batch of waste.

At any time, touch **Main Menu** to go back to the main screen.



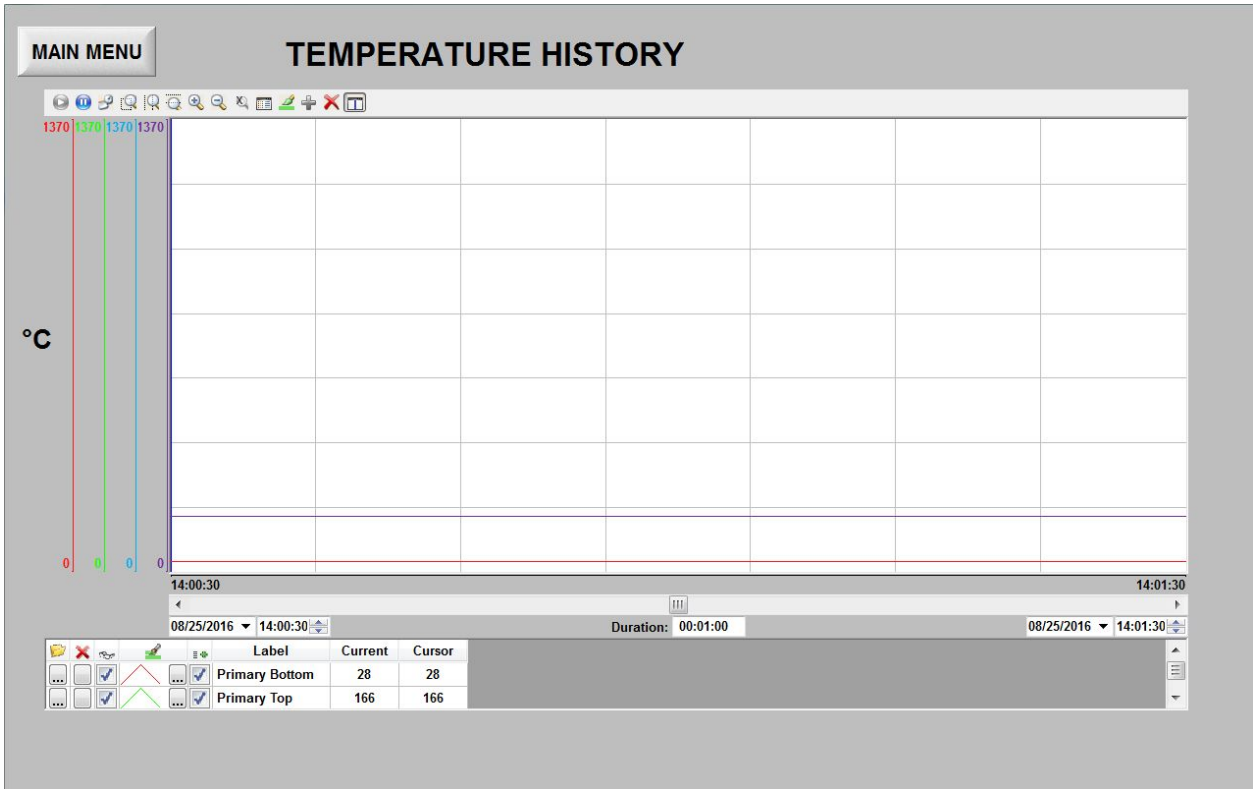
Overview of Historical Charts

The **Human Machine Interface (HMI)** monitors and records (every minute) critical operating parameters of the incinerator system like the temperature, motors, draft, load weights and alarms. Each operating parameter has its own graphic display for the operator to view, at any given time. Each display can easily be selected from the **Main Menu** of the **Human Machine Interface (HMI)**. The display will show the specific data collected from previous burn cycles.

This **Incinerator Data** is important for regulatory purposes and for general operating purposes. Also, the incinerator data is to be downloaded on a weekly basis to USB key for record-keeping purposes.

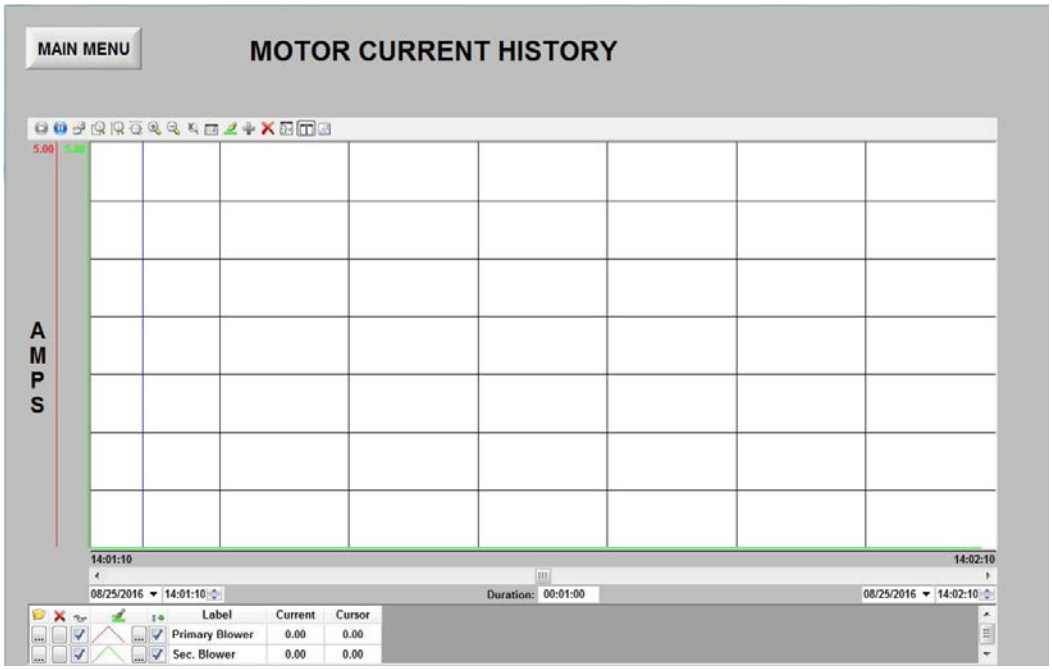
Temperature History

For example, when the ***Temperature History*** button is selected, the screen will display the trend in temperature during the operation of the system, include date & time of occurrence of that specific temperature.



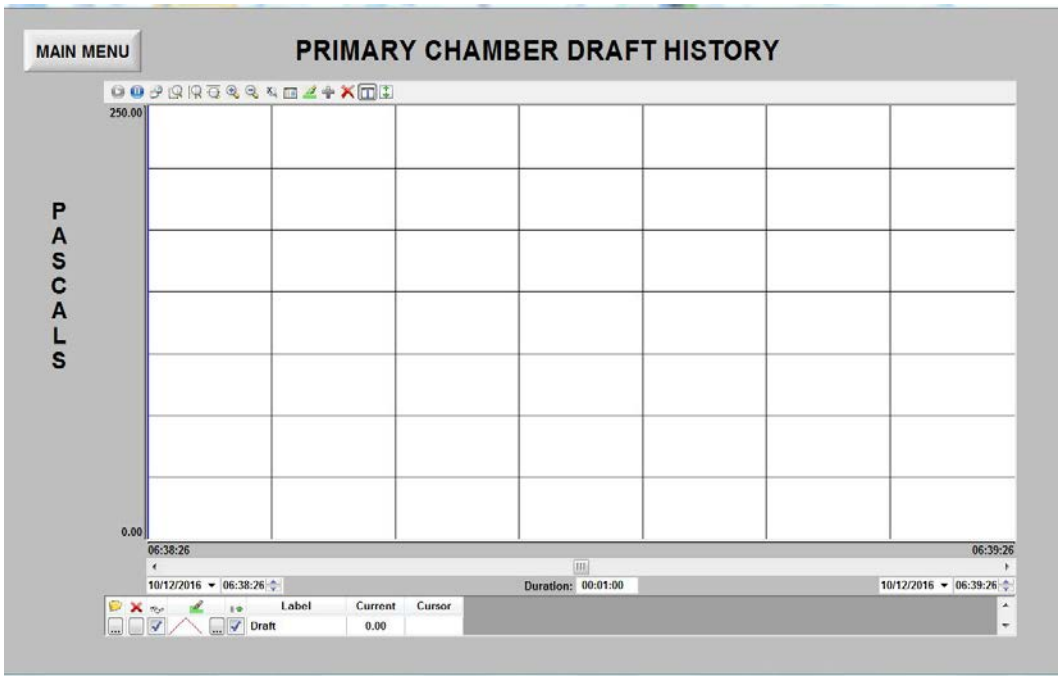
Motor Currents History

When the ***Motor Currents History*** is selected a screen will display the motor currents from the Primary Burner and the Secondary Burner, in AMPS, during the operation of the system, including date & time of occurrence of that specific motor current.



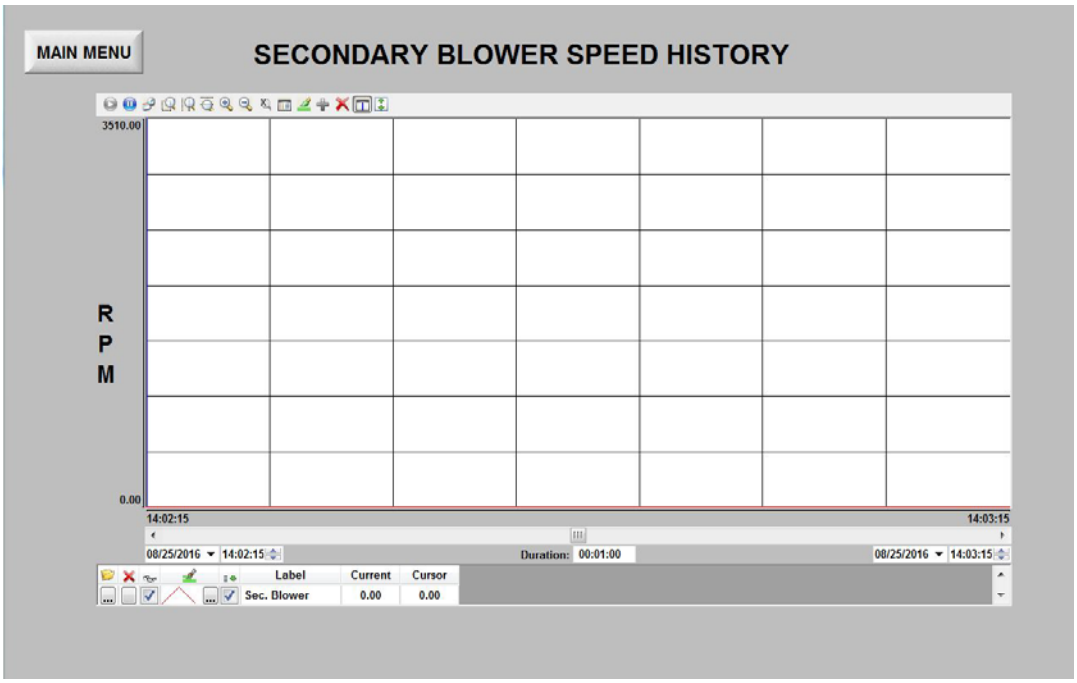
Draft History

When the ***Draft History*** button is selected a screen will display the draft during the operation of the system, include date & time of occurrence of that specific draft trend.



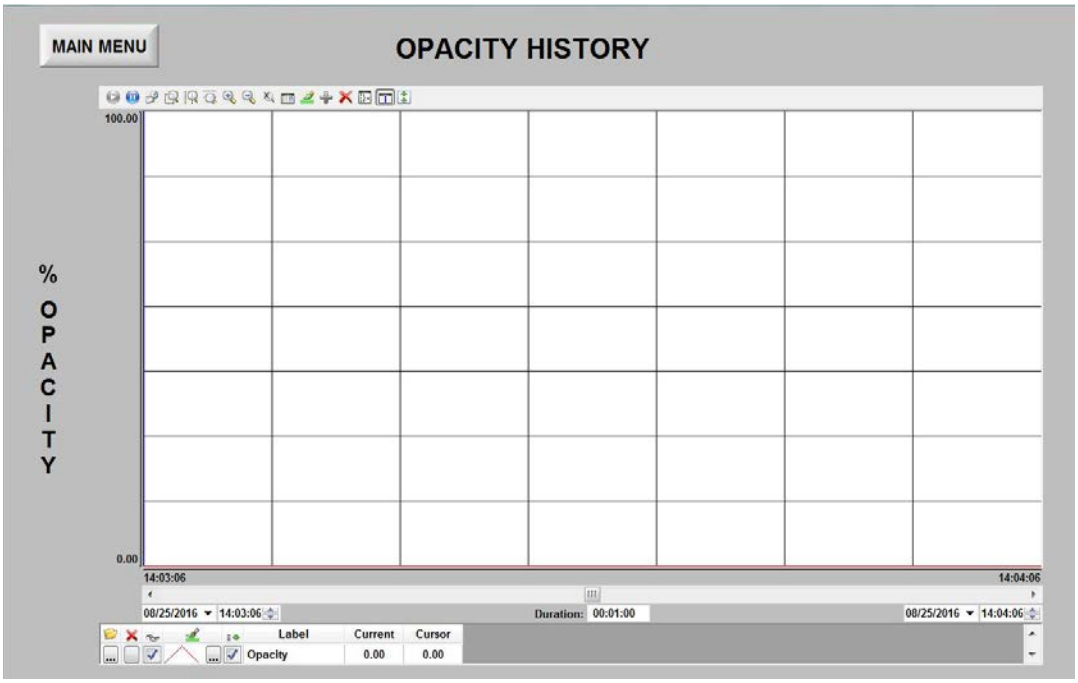
Secondary Blower Speed History

When the ***Secondary Blower Speed History*** button is selected a screen will display the RPM during the operation of the system, include date & time of occurrence of that specific speed.



Opacity History

When the ***Opacity History*** button is selected a screen will display the Opacity during the operation of the system, include date & time of occurrence of that specific reading.

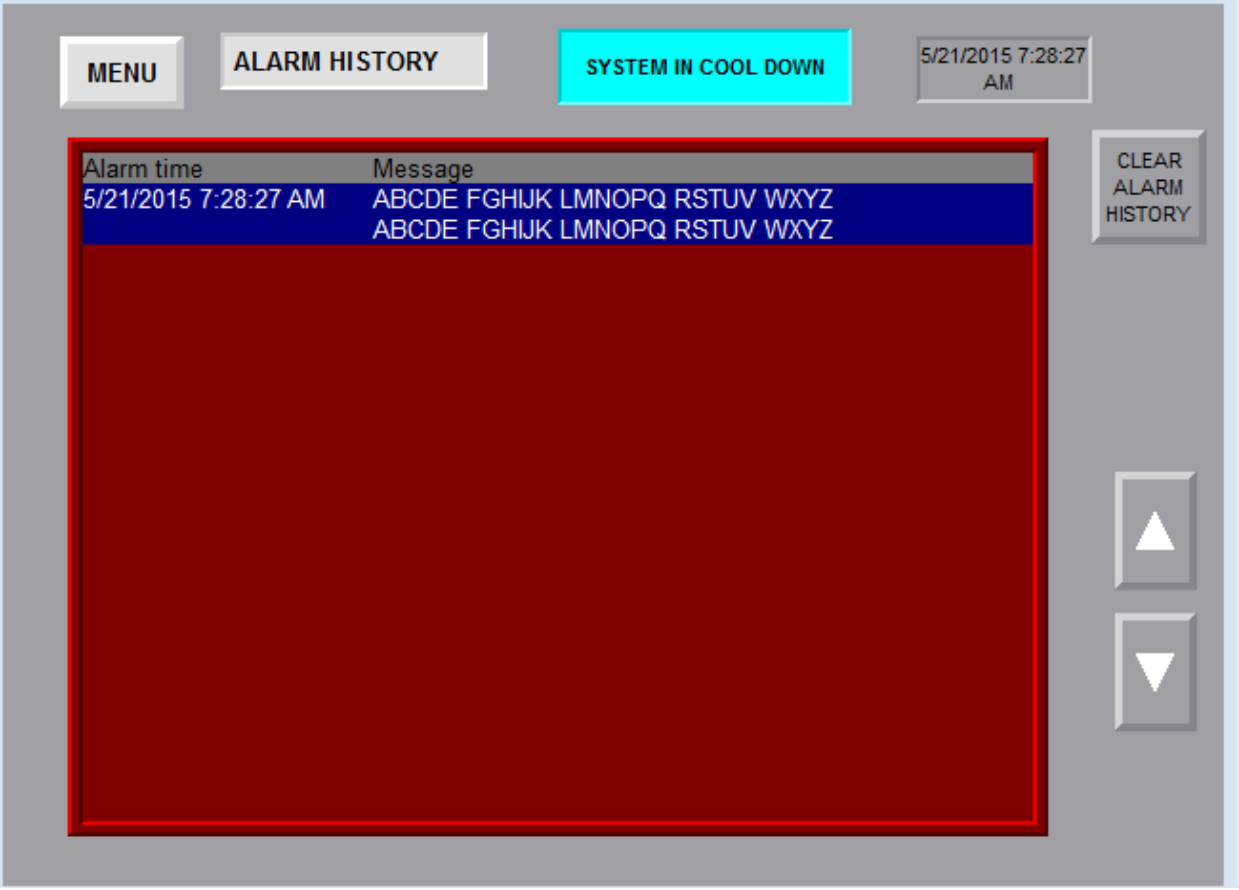


Alarm History

When the ***Alarm History*** button is selected a screen will display the last 128 faults with the date & time of occurrence.

The operator can press the *CLEAR ALARM HISTORY* to clear all of the faults, if they wish to. This does not affect the record-keeping feature of the system.

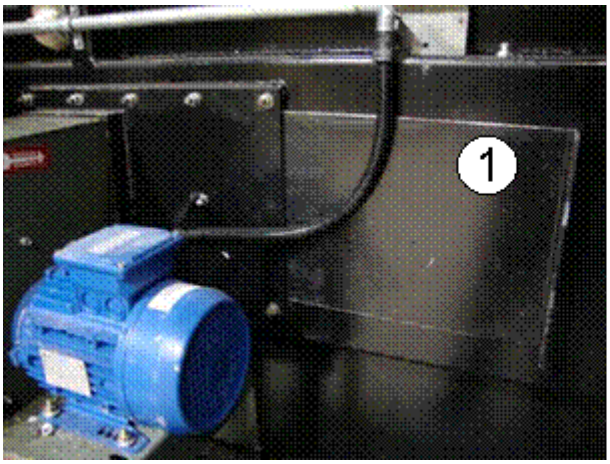
At any time, touch **Main Menu** to go back to the main screen.



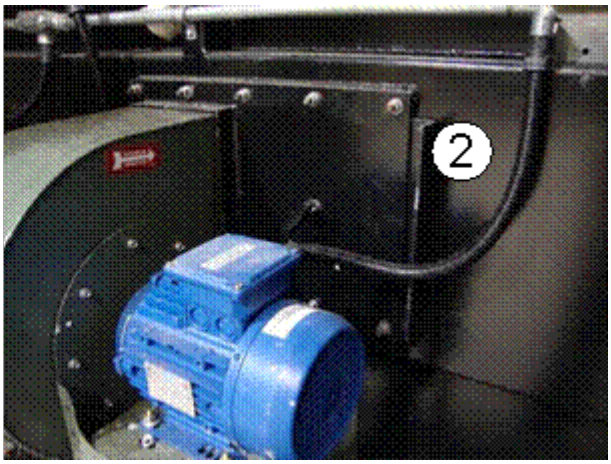
Standard Daily Operating Procedures

Incinerator Daily Start up

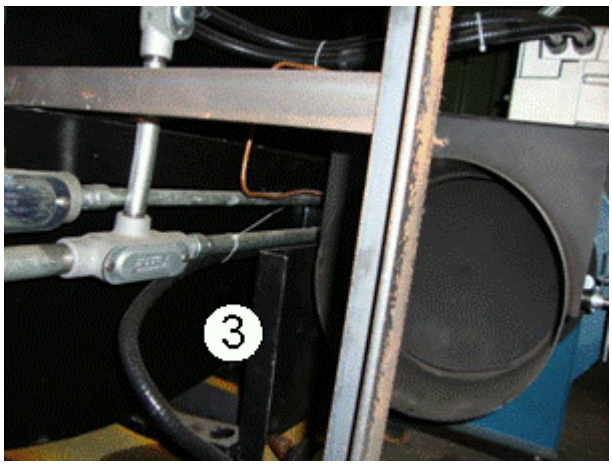
1. Ensure that manual slide gates for each blower are in the open position for free airflow into the **Primary and Secondary Chambers**.



1. **Primary Chamber Blower** Manual Slide Gate Open



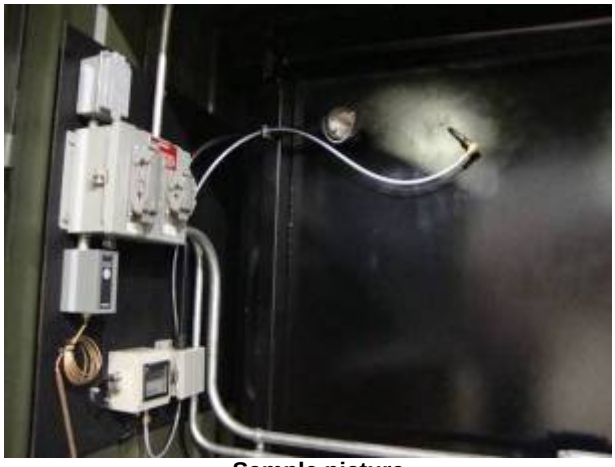
2. **Primary Chamber Blower** Manual Slide Gate Closed



3. **Secondary Chamber Blower** Manual Slide Gate Open

2. Visually inspect the burner hoses to ensure that there are no fuel leaks. Check to see if lines are brittle or cracked, check for any oil spills near the burner, which would indicate a leak.

3. Ensure the draft gauge hose connection is tight and sealed. This is a clear flexible tubing located in the **Primary Chamber** (see photo below).



Sample picture

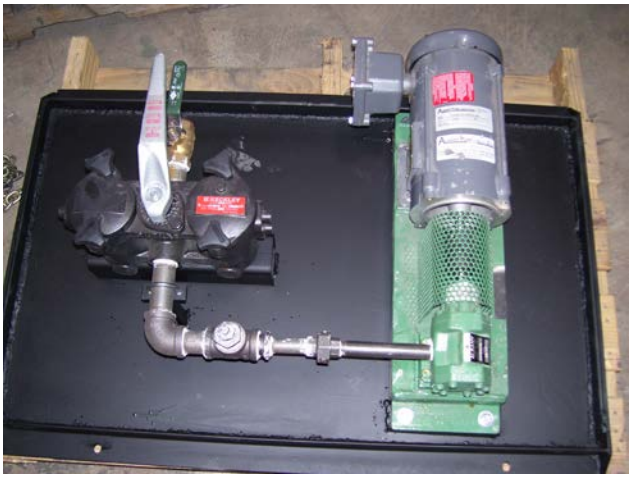
4. Unlatch all clamps on the **Primary Chamber** door, open and secure in the open position

5. Ensure the Primary Chamber floor is cool (less than 90°C). Remove all the ash from the previous burn and store ash is ash bins.
6. Lock the **Primary Chamber** Front Loading Door and ensure all latches are properly engaged.

If the floor is too hot the waste may spontaneously catch on fire during loading.

High Output dual Burner Secondary Chamber Start-up

SYSTEM CHECK



Filter & Pump.(sample image)

Do a walk around the Waste Oil System, ensuring that there are no leaks, all ball valves are in the proper and fully open position for either Diesel or Waste Oil according to the fuel to be used for this specific cycle

Ensure that the correspondent storage tank has enough fuel for the entire cycle.

Using Waste Oil: 800 L minimum of Waste Oil and 300 L minimum of Diesel (the Primary Chamber operated with Diesel only)

Using Diesel Only: 1100 L of Diesel minimum

Both the Waste Oil and Diesel Tanks require at least 150L stored at all time to keep the level sensor closed.

Clean the filter if necessary.

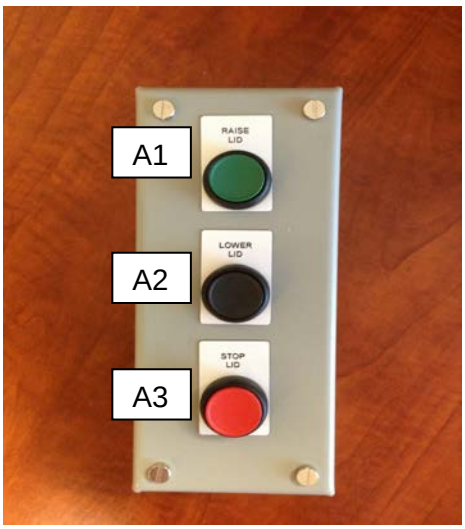
Check that all of the ball valves on the burner fuel oil train are fully open

Check that the Incinerator is not in cool down and the Primary temperature is 90°C or less.

Loading Procedure

Operator Stations for Lid Lifter

The Primary Chamber of the ECO 1.75TN 1PVC100L Waste Incinerator has a lid lifter to allow the roof of the chamber to be opened for quick loading of the waste.



Number	Name	Purpose
A1	**Raise Lid**	Raises the Lid on the Primary Chamber
A2	**Lower Lid**	Lowers the Lid on the Primary Chamber
A3	**Stop Lid**	Stops the lid during raising or lowering.

Once the roof is opened, the chamber can be loaded by the operator with the waste going to the incinerator.

Operating the Integrated Weigh Scale

1. The Operator has two options for managing the waste quantity prior to loading the selected Primary Chamber:

    i. Option 1: The operator will use the hoppers (previously tarred) to load waste onto the weigh scale.

    ii. Option 2: The operator may load waste/garbage (in bags/boxes) on the weigh scale directly.

2. Regardless of the option selected above, once the waste is on the weigh scale the Operator has to push the RECORD WEIGHT (black button) on the Weigh Scale Push-Button Station. By pressing this button, the weight value of that particular load of waste is sent to the PLC and the weight is recorded. At this time, the MAXIMUM WEIGHT (green button) will flash green once to show that the weight has been logged.

3. Then, the operator must take the waste and load it into the Primary Chamber. The hopper is to be raised just past the top edge of the Primary Chamber (using proper lifting equipment by others).

4. Once the hopper clears the edge of the Primary Chamber, the hopper's content can be dumped inside the chamber.

5. The empty hopper can now be pulled from the edge of the chamber and then lowered.

6. The operator returns to the weigh scale with some more waste and repeats Steps 2 to 6. This entire procedure is repeated until the maximum load weight for the Primary Chamber is reached. The PLC will indicate this to the operator when the MAXIMUM WEIGHT (green light) comes on and remains on. This indicates that the maximum weight permitted, in this case, the incinerator is designed for a maximum of 1,750Kg of waste material.

NOTE

No more waste should be loaded into the Primary Chamber after the load has reached the maximum weight.

7. The Primary Chamber is loaded, and the incinerator is ready to start.

Tips for loading: To decrease burn time and allow for more uniform burn.

a. Load the less dense waste first

b. Load dry waste first. Placing wet waste near the top of the Primary Chamber allows moisture to evaporate early in the cycle.

NOTE

Do not load waste greater than 90 Kg using the top loading system. This waste is to be loaded from the front of the unit. Loading waste over 90 Kg from the top will cause refractory floor to fracture.

NOTE

Do not throw the waste towards the sides of the Primary Chamber. Doing so will damage the ceramic blanket refractory.

NOTE

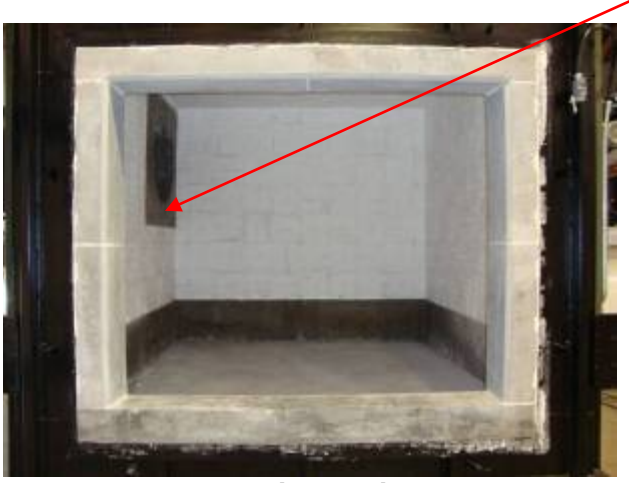
Load only the waste stream that the system has been designed for. DO NOT load a lot of high BTU rated waste for one burn (e.g. do not load more than three (3) gallons of bacon grease, kitchen grease or cooking oil). Doing so will result in excessive temperatures in the system reducing the life of the refractory.

NOTE

Do not load the Primary Chamber above its rated capacity by weight.

NOTE

Do not load the Primary Chamber such that the Breech and Burner section is blocked in any way.



Breech Opening

Burner port

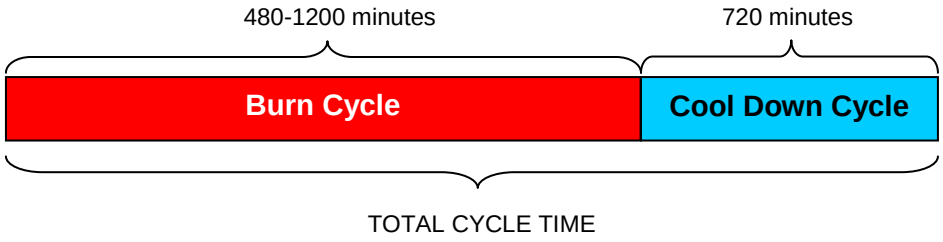
8. Inspect the lid ledge of the Primary Chamber and remove any debris that will prevent a tight seal with the lid.
9. Close the **Primary Chamber** lid by pressing the close button on the Lid Lifter Station. The lid will initially raise, after 0.5 seconds the safety pawls will pull out. Two seconds after sensing that the safety pawls are out the lid will lower.
10. The lid will keep lowering until either the down limit switch is activated or the stop button is pressed.
11. If the stop button was pushed just press the close button to resume lowering. The lid will raise then lower again. When the lid is stopped by either the lower limit switch or the stop button the safety pawls will be released back in.
12. Proceed to the **Main Control Panel.**

NOTE

The burn time will be set to the previous burn, if you wish to change the set time, proceed to the Primary Status screen and click on the BURN TIME button. The minimum number of minutes you can enter is 480 (8 hours). When you have finished, the time will be displayed in minutes beside the BURN TIME button

NOTE

The burn time value (in minutes) determines the length of the burn cycle before cool down cycle starts.



13. Check that the PRIMARY DOOR AND LID are closed on the **Human Machine Interface (HMI)** screens.
14. Check that no alarms are displayed on the **Human Machine Interface (HMI)**
15. Check that the EMERGENCY STOP BUTTON is out.
16. Check the GREEN CONTROL POWER BUTTON is lit up. Press this button to power on the control panel
17. On the **Main Control Panel turn the SELECTOR SWITCH** to the right to start the cycle. The following steps will automatically take place, controlled by the **Main Control Panel**:
    I. The **Primary Blower and Secondary Blower** will purge the system for 2 minutes.
    II. The **Secondary Burner** will purge for safety, and upon completion will ignite.
    III. Once the **Secondary Chamber** temperature reaches 1000°C, the **Primary Burner** on both Primary Chambers will purge for safety and upon completion will ignite.

IV. The burn time will start counting down when the temperature in the **Primary Chamber** reaches 427°C.

NOTE

The Main Control Panel System will maintain proper operating conditions and will provide continuous monitoring capability

After the burn cycle is completed the system will enter the cool-down cycle when the following things will occur:

- Primary Chamber & Secondary Chamber burners OFF
- Secondary Chamber Blower OFF
- Primary Modutrol 100% open
- Primary Blower ON

Once fully cooled and the temperature is below 90°C, proceed to the **Primary Chamber Clean Out Procedures**.

Primary Chamber Clean Out Procedures

Operators responsible for loading and cleaning out incinerators should wear appropriate protective equipment, including eye protection, dust masks, heavy gloves and safety shoes with puncture-proof toes and soles to avoid injury.

Although the ash from the system is considered sterile and will not contain microorganisms, it may contain a quantity of sharp objects, such as broken glass and other sharps which may not be fully destroyed in the burning process, and may thus still pose a hazard to persons who clean out the ash and residues. Also removing the ash does create dust particles in the air. Dust should not be inhaled. The operator must wear dust protection safety gear.

Please follow these steps when the cycle is complete:

1. When the internal temperature of the **Primary Chamber** has cooled to less than 40°C, lock out the power to the system on the **Main Control Panel** by moving the main disconnect to the “OFF” position.
2. Unlock all door latches on the access door to the **Primary Chamber.**
3. While standing in front of the **Primary Chamber** door, slowly open the door to allow clear entry. Secure **Primary Chamber** Door in the OPEN position.
4. With the **Primary Chamber** Door secured in the open position, raise the lid to fully opened
5. Clean the **Primary Chamber** by using ash handling tool(s) and proper safety equipment (not provided).
6. Inspect the interior of the **Primary Chamber** for wear and inspect around the door seals to ensure the door will maintain a tight seal upon closure.
7. Check the air inlet holes and remove any obstructions if necessary.

8. Inspect the door seals to ensure there are no gaps between the door gasket and the door jamb.
9. Close the **Primary Chamber** access door by clamping each latch until it is tight.
10. Clean the inspection **View Port** (glass) with a mild soap and water. To clean the view port, unscrew it by hand and re-tighten by hand.

In Case of Emergency

1. Go to manual Slide Gates on the **Primary Chamber**, located just after the blower and close them all the way. This will help to put the fire in the **Primary Chamber** out.
2. Check alarms to see what the problem is.
3. Do not open the door of the **Primary Chamber** unless the temperature inside the chamber is below 90°C.
4. Call a certified technician to fix the problem and/or consult with **Eco Waste Solutions Customer Service Department at 905.634.7022, toll free 1-866-326-2876.**

Start Up After Power Failure

1. Once the power is restored turn breaker (main disconnect) back on.
2. The **Human Machine Interface (HMI)** and PLC will begin a boot up procedure.
3. Wait until the **Human Machine Interface (HMI)** on the **Main Control Panel** has booted up before turning the control power to the panel back on by pressing the Control Power ON button.
4. When the power is restored to the **Main Control Panel**, the button should illuminate.
5. If the system was interrupted during a burn cycle, restart the system by turning the selector switch on the main panel to the right to start the cycle . If the system was interrupted during cool-down cycle, it will resume the cycle where it left off.

Dealing with Warning and Faults

Troubleshooting

The burn cycle will not start if one of the following conditions exists:

1. The system is in the “cool-down” part of the cycle. Wait until the “cool down” cycle is complete.

2. There is a fault in the system as indicated on the **HMI**

3. Loss of power due to any one or more of the following:

    - The main disconnect (see image) is off or there is no electrical power. Turn on the disconnect switch or check why there is no power.

Power is OFF in this position

Power is ON in this position

- An open breaker. Check the breakers and replace any that are defective.

- The EMERGENCY STOP is pushed in. Twist the EMERGENCY STOP button to unlock, and then push the CONTROL POWER ON button. The CONTROL POWER BUTTON should now be illuminated.

4. If on the Main Control Panel HMI the **Primary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

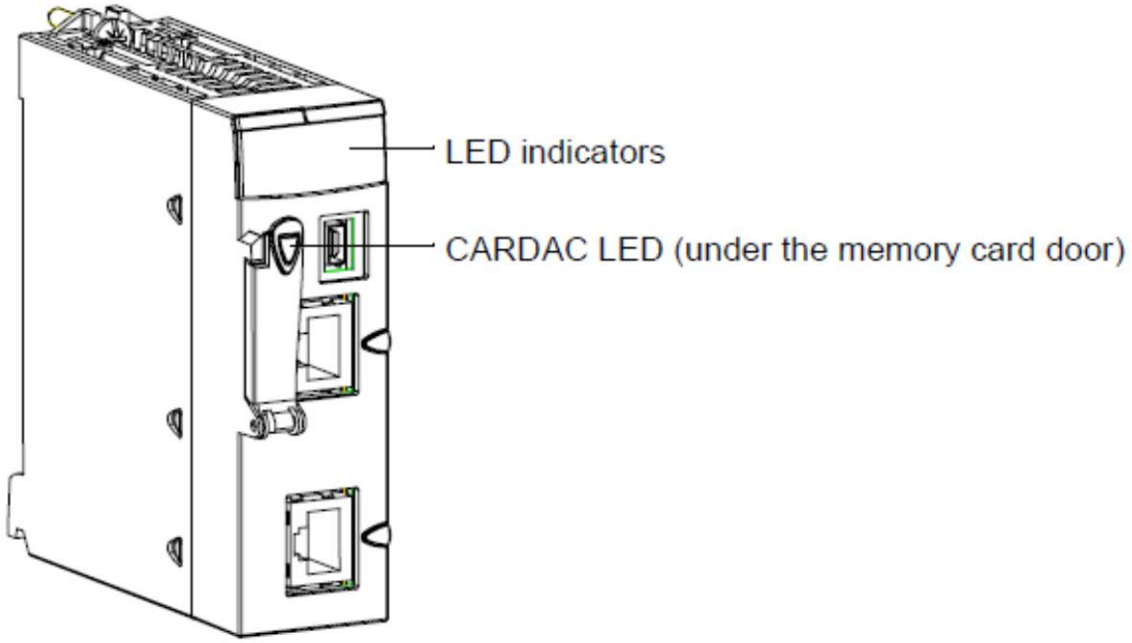
5. If on the Main Control Panel HMI the **Primary Chamber** roof lid is not closed, the lid has not been shut properly. Adjust the limit switch lever arm if necessary. Check the limit switch and that the wiring is in working order.

6. If on the Main Control Panel HMI the **Secondary Chamber** door is not closed, the door has not been shut properly. Adjust the limit switch lever arm, if necessary. Check the limit switch and that the wiring is in working order.

7. If fuel tank is low, system will not start. Tank on the **HMI** will be red, indicating the level is low and needs to be filled.

PLC Processor Problem

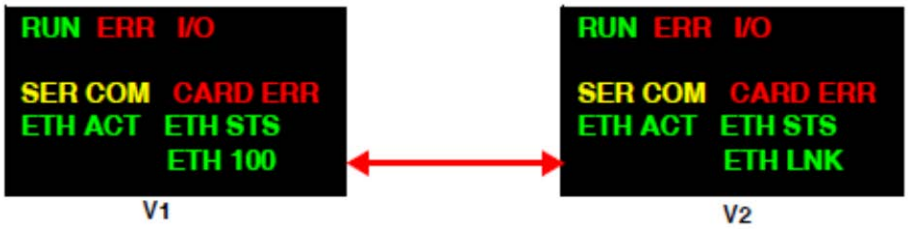
There are several LEDs available on the front panel of each Modicon M340 module or processor, enabling rapid diagnosis of the PLC status:



These LEDs provide information on:
- PLC functioning
- the memory card
- communication with the modules
- serial communication
- communication on the CANopen network
- communication on the Ethernet network

The following diagram shows the diagnostic LEDs on the BMX P34 2020 processor. Note that two displays exist, depending on whether you are using firmware V1 or V2

(or greater) of the processor.



The colors and blink patterns of the LEDs indicate the status and operating conditions of Ethernet communications on the module:

Label	Pattern	Indication
RUN (green): operational state	on	• PLC hardware and PLC program operations are normal. • Module is in RUN state.
	flashing	• PLC is in STOP mode or a blocking error in the application has been detected. • Processor is configured but not in RUN state.
	off	PLC is not configured (application is absent, invalid, or incompatible).
ERR (red): detected error	on	Processor, system, or configuration detected error
	flashing	• PLC is not configured (application is absent, invalid, or incompatible). • PLC is in STOP mode or a blocking error in the application has been detected.
	off	Normal (no detected errors)
ETH STS (green): Ethernet communication status	on	Communication OK
	2 flashes	Invalid MAC address
	3 flashes	Link not connected
	4 flashes	Duplicate IP address
	5 flashes	Waiting for a server IP address
	6 flashes	Secure and safe mode (with default IP address)
	7 flashes	Configuration conflict between rotary switches and internal configuration
CARDERR (red): memory card detected error	on	• Memory card is missing. • Memory card not usable (bad format, unrecognized type). • Memory card content is inconsistent with internal RAM application.
	off	• Memory card is valid and recognized. • Application on card is consistent with the internal RAM application.
I/O (red): input/output status	on	• Error detected on a configured module or CPU channel • Configuration mismatch with the application (module missing...)
	off	Normal (no detected errors)

SER COM (yellow): serial data status	flashing	Data exchange (send/receive) on the serial connection in progress
	off	No data exchange on the serial connection
CAN RUN (green): CANopen operations	on	CANopen network operational
	rapid flashing (note 1)	Automatic detection of data flow or LSS services in progress (alternates with CAN ERR).
	slow flashing (note 2)	CANopen network is pre-operational.
	1 flash	CANopen network is stopped.
	3 flashes	Downloading CANopen firmware.
CAN ERR (red): CANopen detected error	on	CANopen bus is stopped.
	rapid flashing (note 1)	Automatic detection of data flow or LSS services in progress (alternates with CAN RUN).
	slow flashing (note 2)	CANopen configuration is not valid.
	1 flash	At least one error counter has reached or exceeded alert level.
	2 flashes	A guard event (NMT slave or NMT master) or a heartbeat event has occurred.
	3 flashes	The SYNC message was not received before the end of the communication cycle period.
	off	No error detected on CANopen.
CARDAC (green): memory card access **Note:** This LED is located under the memory card door (see *The Module, p. 20*).	on	Access to the card is enabled.
	flashing	Activity on the card: during each access, the card LED is set to OFF, then back to ON.
	off	Access to the card is disabled. You can remove the card after you disable card access by setting system bit %S65 to 0.
Note 1: Rapid flashing is defined as ON for 50 ms and OFF for 50 ms.		

Note 2: Slow flashing is defined as ON for 200 ms and OFF for 200 ms.

The following table describes the meaning of the ETH ACT and ETH 100 LEDs on the front panel for firmware V1 NOE and CPU modules.

Label	**Pattern**	**Indication**
ETH ACT (green): Ethernet communication (transmission/ reception activity)	on	Ethernet link detected: no communications activity.
	off	No Ethernet link detected.
	flashing	Ethernet link detected: receiving or sending packets.
ETH 100 (green): Ethernet transmission speed	on	Ethernet transmission at 100 Mbit/s (Fast Ethernet).
	off	Ethernet transmission at 10 Mbit/s (Ethernet) or no link detected.

The following table describes the meaning of the ETH ACT and ETH LNK LEDs on the front panel for firmware V2 NOE and CPU modules.

Label	Pattern	Indication
ETH ACT (green): Ethernet communication (transmission/ reception) activity	on	Communications activity detected.
	off	No communications activity detected.
ETH LNK (green): Ethernet link status	on	Ethernet link detected.
	off	No Ethernet link detected.

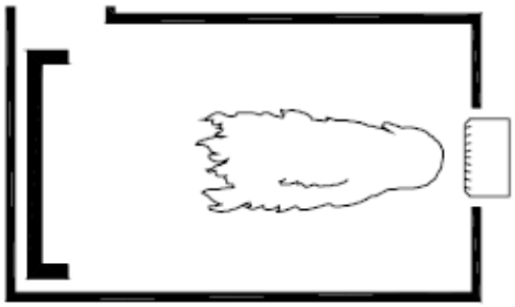
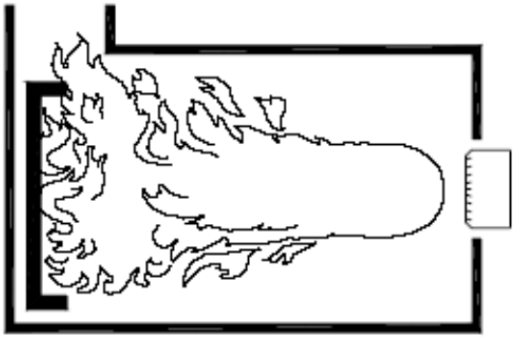
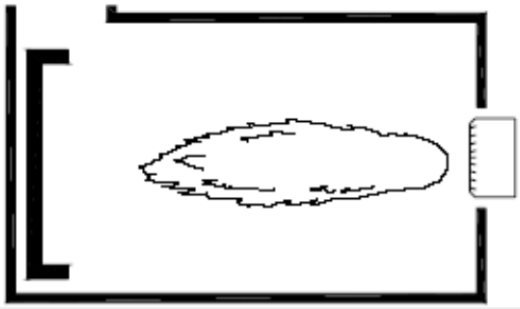
Note:

- Rapid flashing is defined as ON for 50 ms and OFF for 50 ms.
- Slow flashing is defined as ON for 200 ms and OFF for 200 ms.

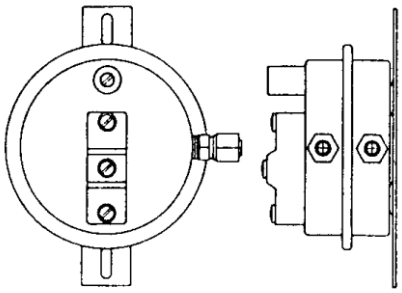
Possible Problems, Causes and Solutions

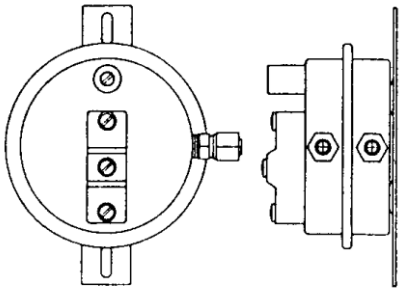
Problem	Causes	Solutions
Blower Fails to start	Over load tripped, blown fuse	Turn power off. Open Panel and reset overload. Check fuse and replace.
	Motor starters or contactor coil is burnt out	Locate contactor for Blower and visually observe if the contactor is pulled in. Use a volt meter to check for voltage across the coil If there is voltage across the coil and the contactor is not pulled in, replace the contactor.
Secondary Burner won't ignite	Bad Electrodes	Refer to Section 6 of this manual.
	Low Oil Pressure	Adjust pressure setting on burner pump. Refer to Riello Manual in Section 10.
	Fuel Line Leak	Visually inspect the lines for the leak. Tighten any fittings that are near the leak.
	Door Switch not making contact Burner alarm has been tripped	Make sure main door is closed and latched shut. Make sure limit switch is hitting striker plate.
	Bad Thermocouple	Replace thermocouple .
Primary Burner won't ignite	Bad Electrode	Refer to Section 6 of this manual.
	Low Oil Pressure	Adjust pressure setting on burner pump. Refer to Riello Manual in Section 8.
	Fuel Line Leak	Visually inspect the lines for the leak. Tighten any fittings that are near the leak.
	Door Switch not making contact or broken	Make sure main door is closed and latched shut. Make sure limit switch is hitting striker plate.
	Secondary temperature not at 1000°C	Wait until Secondary temperature is at 1000°C and try again.
	Burner main switch is turned off	Turn switch on.
	Burner alarm has been tripped	Acknowledge burn alarm and then hit the reset button on control panel.

Problem	Causes	Solutions
Persistent Black Smoke	Insufficient air supply to Secondary Chamber to completely consume emissions	Check to ensure combustion air blower/damper assembly is operating properly.
	Secondary Chamber is not hot enough.	Check that the Secondary temperature is operating at required temperature set point.
	Secondary Chamber is not hot enough.	Too much draft, open barometric damper.
	Overloading or loading highly volatile material	Decrease load size on next batch (confirm by weighing), ensure the waste mix is correct.
	Burner failure	Check burner operation – if no flame or a poor flame is visible through the flame view port adjust air/fuel ratio.
	Operating at a too high Primary Chamber temperature	Check/decrease primary chamber combustion air.
Smoke coming out of Primary	Too much air	Check dampers on primary blower.
	Too much volatile material loaded	Decrease load size on next batch to ensure the waste mix is correct.
	Primary Chamber temperature too high	Waste loaded may not be a good mix of heat value.
	Low draft	Close barometric damper on stack's T-section
Too much fuel usage	Too much secondary combustion air	Check/reduce secondary combustion air.
	Too much air infiltration	Reduce air flow by adjusting the damper.
	Fuel leakage	Check fuel trains and burners for fuel leakage.
	Wet waste	Spread wet waste with other waste through several loads – do not charge all of the wet waste at one time.
	Excessive draft	Check/reduce draft – check door seals and other seals for leakage adjust damper.
	Burner setting too high	Check air/fuel mix.

Problem	Causes	Solutions
		Correct Maximum Flame Adjustment (Proper Oil and Air Pressure with correct supply of combustion air)
		Incorrect Flame Adjustment (Not enough Combustion Air)
		Incorrect Flame Adjustment (Air Pressure too high; too much air)
Incomplete burnout/poor ash quality	Build-up around air holes – clogged with ash from previous burn	Check around air holes and clean.
	Poor draft	Draft should be -0.2-0.06 KPa (or 0.8-0.25“ W.C).
	Too much wet waste – overloading system	Spread wet waste with other waste through several loads – do not charge all of the wet waste at one time.
	Insufficient burn time	Allow longer burn time period.

Possible Alarms (Faults)

#	ALARM (System Fault)	SOLUTION
1	The Primary Chamber top/bottom thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
2	The Secondary Chamber thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
3	The Secondary Stack Thermocouple is faulted	Refer to Section 6 of this manual for corrective maintenance procedures.
4	The primary burner is faulted	The primary burner has failed to light when it received a signal to start. To reset the burner, press the reset button located on the Burner. If this does not start the burner, refer to Supplier Catalogue (Riello Burner) in Section 8
5	The secondary burner is faulted	The secondary burner has failed to light when it received a signal to start. To reset the burner,
6	The system has shut down due to primary blower low air flow. 	Visually examine the primary blower for any obstructions that may be causing low air flow. Check slide gate located between Primary chamber and blower, ensure it is open. Check damper assembly, ensuring modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air proving switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.
7	The primary blower motor overload is tripped.	Turn power off on Control panel by turning the Main Disconnect to the OFF position. Reset overload.

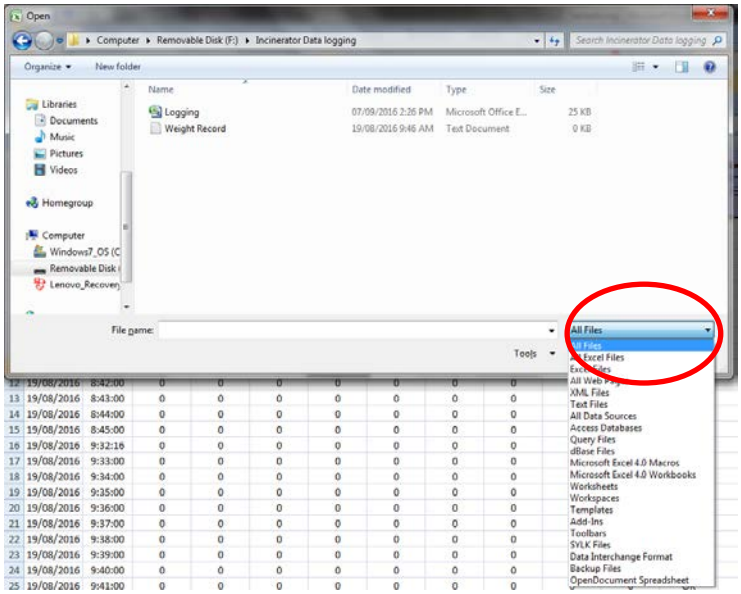
#	ALARM (System Fault)	SOLUTION
8	The system has shut down due to secondary blower low air flow 	Visually examine the Secondary Blower for any obstructions that may be causing low air flow. . Check slide gate located between Secondary chamber and blower, ensure it is open. Check damper assembly, ensuring Modutrol crank arm is still connected and that butterfly damper is open, allowing air flow. Air flow switch may be defective. Refer to Section 6 of this manual. There are two ports on the air flow switch marked V and P. Ensure the inlet tube is attached to the port marked “P” for pressure. V stands for vacuum. Ensure the “V” port is open to atmosphere and is not blocked. If no air restriction is observed (i.e. blockage in the tube) change the air proving switch. Refer to Section 6 of this manual.
9	The Secondary blower variable frequency drive is faulted	Push fault reset button on the HMI If fault persist check the error code on the variable frequency drive and check manual for troubleshooting alarm.
10	The burner fuel level is low.	Add fuel to the fuel tank and the alarm should reset itself. If alarm persists, replace the low level switch.
11	Primary Chamber – lid lifter hydraulic pump overload.	Turn power off on Control panel by turning the Main Disconnect to the OFF position. Reset overload.
12	Primary Chamber – lid lifter stuck while rising.	Check to see if anything is blocking the lifts or roof from raising Check the power pack fluid level to ensure enough hydraulic oil is available Check the limit switch is working

#	ALARM (System Fault)	SOLUTION
13	Primary Chamber - lid lifter stuck while lowering.	Check to see if anything is blocking the lifts or roof from lowering Check the power pack fluid level to ensure enough hydraulic oil is available Check the limit switch is working This can be caused by a burnt out solenoid valve. Check that the control valve is open.
14	Primary Chamber - lid lifter left or right safety pawl failed to retract.	Check the proximity switch that senses that the safety catch is out Check the solenoid valves (located on each column)

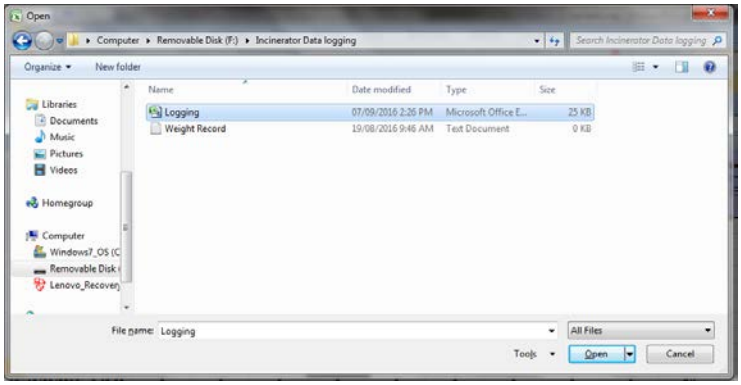
Record Keeping

Accessing Historical Information

1. It is recommended that a dedicated folder be set on the destination computer that is used for storing data from the Incinerator Package (e.g. “Incinerator Data”)
2. Turn power off to the Main Control panel by turning the Main Disconnect to the OFF position.
3. Open the Main Control Panel door and remove the USB from the back of the HMI panel and insert the USB into the destination computer.
4. Open an Excel File, once opened go to File/Open locate the USB on your computer, in the bottom right corner choose “All Files”.

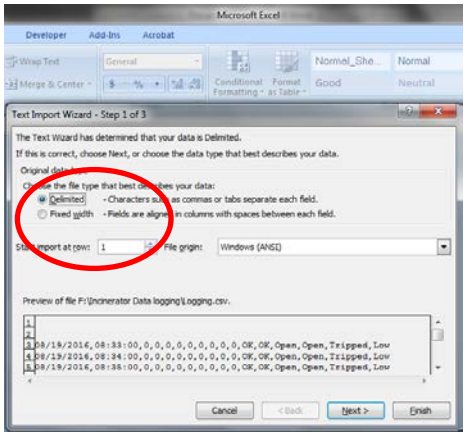


5. Click on the “logging” file and press open.

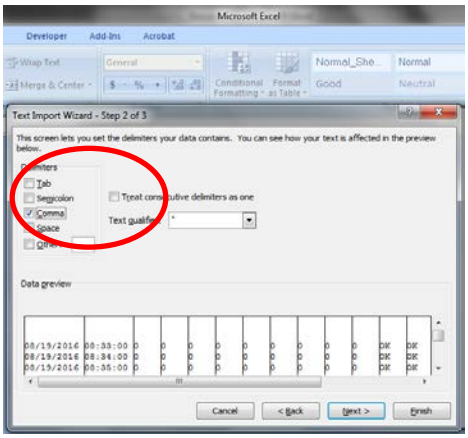


6. Excel will prompt you with a text import wizard, follow the next 3 steps to ensure the log files is displayed properly:

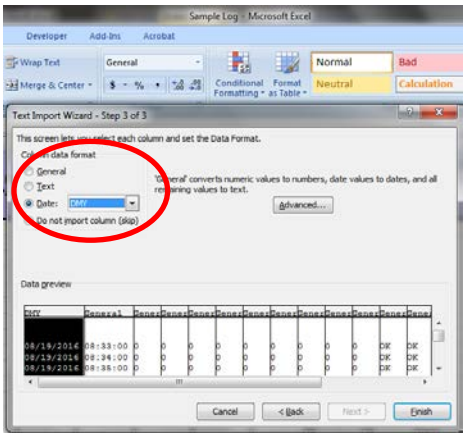
7. Steps 1 of 3 choose delimited – character such as commas or tabs separate each field, and choose Next:



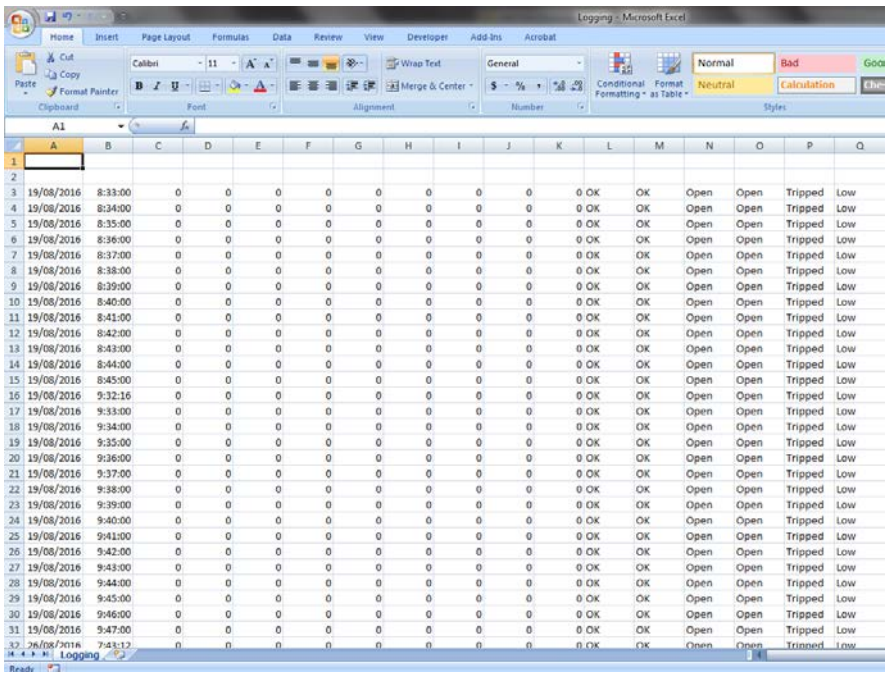
8. Steps 2 of 3 choose Comma as the delimiting item, and choose Next:



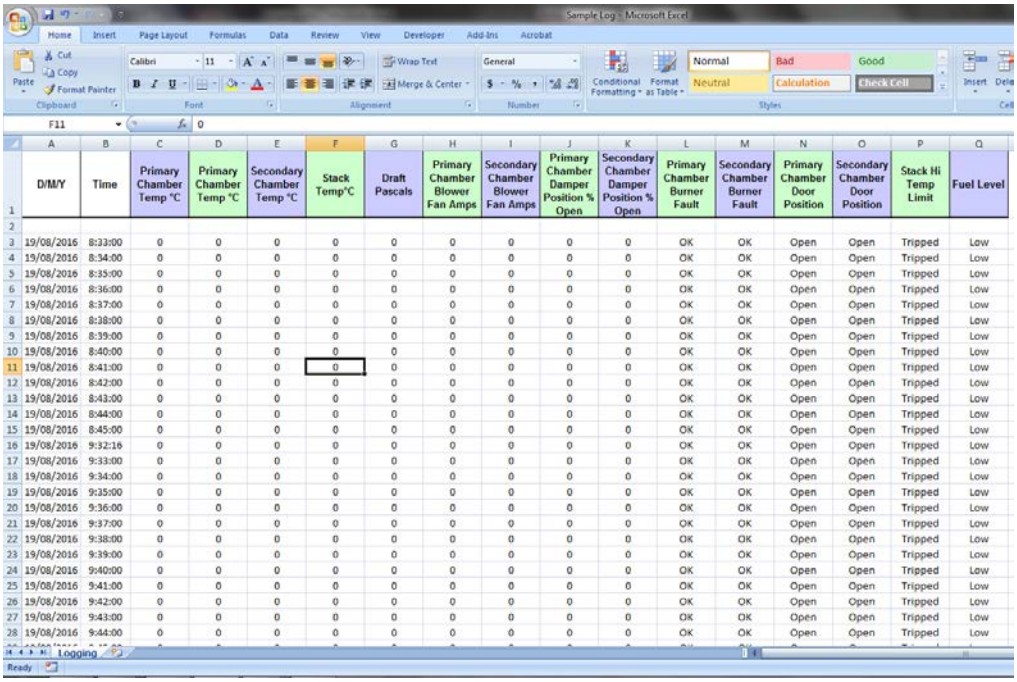
9. Steps 3 of 3 Column data format should be Date with DMY – character such as commas or tabs separate each field, choose Finish.



10. Once the data is open, it will look similar to the following:



11. From the electronic template file located on the USB for the manual copy the first row and paste into your log file:



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	D/M/Y	Time	Primary Chamber Temp °C	Primary Chamber Temp °C	Secondary Chamber Temp °C	Stack Temp°C	Draft Pascals	Primary Chamber Blower Fan Amps	Secondary Chamber Blower Fan Amps	Primary Chamber Damper Position % Open	Secondary Chamber Damper Position % Open	Primary Chamber Burner Fault	Secondary Chamber Burner Fault	Primary Chamber Door Position	Secondary Chamber Door Position	Stack Hi Temp Limit	Fuel Level
2																	
3	19/08/2016	8:33:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
4	19/08/2016	8:34:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
5	19/08/2016	8:35:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
6	19/08/2016	8:36:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
7	19/08/2016	8:37:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
8	19/08/2016	8:38:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
9	19/08/2016	8:39:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
10	19/08/2016	8:40:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
11	19/08/2016	8:41:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
12	19/08/2016	8:42:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
13	19/08/2016	8:43:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
14	19/08/2016	8:44:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
15	19/08/2016	8:45:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
16	19/08/2016	9:32:16	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
17	19/08/2016	9:33:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
18	19/08/2016	9:34:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
19	19/08/2016	9:35:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
20	19/08/2016	9:36:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
21	19/08/2016	9:37:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
22	19/08/2016	9:38:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
23	19/08/2016	9:39:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
24	19/08/2016	9:40:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
25	19/08/2016	9:41:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
26	19/08/2016	9:42:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
27	19/08/2016	9:43:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low
28	19/08/2016	9:44:00	0	0	0	0	0	0	0	0	0	OK	OK	Open	Open	Tripped	Low

12. Save your excel file with the date in the designated folder.

13. Reinstall the USB to the back of the HMI, close the Main Control Panel door and turn power back on to the system.

SECTION 6

MAINTENANCE INSTRUCTIONS

Zero Mechanical State & Lock Out Procedures

Proper maintenance of the equipment is essential to ensure long term, reliable operation of the EWS Incinerator.

NOTE The warranty will become void if proper maintenance is not performed as instructed.

Safety

During maintenance of the EWS mobile incinerator, it is very important to be aware of special hazards. Two safety programs are described in the following sections:

1. Zero Mechanical State
2. Power Lock Out Procedures

Failure to comply with these instructions during maintenance could result in injury or death. The responsibility for implementation of a comprehensive safety program rests with the operating staff and supervision. The safety procedures in this *Manual* should be considered only as a starting point for the safety program at site.

ACCIDENTS CAN BE PREVENTED A CAREFUL WORKER IS THE BEST SAFETY DEVICE

Zero Mechanical State

Zero Mechanical State (ZMS) exists when the possibility of an unexpected mechanical movement has been eliminated. During maintenance, it is absolutely mandatory to totally deactivate the incinerator so that there is no possibility of an unexpected machine movement. Power lock-out, described in the next section, is commonly used for this purpose. Most machines are powered by electrical, hydraulic or pneumatic drives. Energy may be stored in a shutdown machine in various ways: Air pressure in a cylinder, hydraulic pressure fluid stored in pressurized hoses, or machine members whose weight can generate fluid pressure. Therefore, just cutting off the electrical power may not be enough to neutralize all power sources. Certain maintenance procedures at site should require ZMS condition as a matter of course.

Zero Mechanical State (ZMS) Checklist:

1. Every electrical power source to the incinerator must be cut off and locked out (to prevent others who may not be aware of maintenance work from turning the power back on inadvertently).

2. Ensure that the mechanical potential energy of the incinerator is at its lowest practical value so that opening of pipe, tubing, hose or actuation of any valve will not produce an unexpected movement that could cause injury.

3. Check that there is no pressurized fluid (air, oil, gas or other) trapped in the incinerator lines, cylinders or other components. This will ensure that there will be no incinerator motion when a valve is actuated.

4. Secure loose or freely moving parts so that there is no possibility of accidental movement.

Power Lock Out Procedures

Unexpected operation of electrical equipment started by automatic or manual remote control may cause injuries to persons who happen to be nearby. For this reason, when repair work is to be done on motors or other electrical equipment the circuit should be opened at the switch box and the switch pad locked in the OFF position. Tag the switch with a lock out tag indicating who must be contacted before the power is turned back on again.

BECAUSE OF THE SEVERE CONSEQUENCES, INCLUDING DEATH, OF NOT PROPERLY LOCKING OUT ELECTRICITY SUPPLIES DURING MAINTENANCE, THE SUPERVISOR SHOULD ENSURE THAT THERE IS ONLY 1 KEY FOR THE LOCK USED TO LOCK OUT THE POWER SUPPLY.

For identification, locks may be color coded to indicate different crews or shifts.

The Supervisor should maintain the master key and list of key numbers, and should keep an extra key to each lock for his department. The master key should not be loaned out under any circumstances.

No matter what method is used to lock out power to electricity, strict discipline and constant supervision should be employed during any equipment maintenance work.

Power Lock Out Checklist

1. Alert the operator of the equipment.

2. Before starting the work on an engine or motor, line shaft or other power transmission equipment or power-driven machine, make sure it can not be set in motion without your knowledge.

3. Place your own padlock on the control switch, lever, or valve, even if someone has locked the control panel before you. You will not be protected unless you put your own padlock on it. (Another maintenance person could remove their lock and then someone else could start the equipment if they were not aware of maintenance work being done.)

When finished working at the end of your shift remove your own padlock. Never permit someone else to remove it for you. Be sure you are not exposing someone else to danger by removing your padlock

Instruction Classification

Each component is associated with an identification number, see table below:

System Component	Identification number
Primary Blower	01-001
Secondary Blower	02-001
Primary Burner	01-002
Secondary Burner	02-002
Refractory	05-001
Air Compressor	03-001
Thermocouple	05-002
Main Control Panel	03-010
Paint	05-003
Electrical	05-004
Limit Switch	05-005
Lid Lifters	06-001

To differentiate if the instruction is weekly, monthly, quarterly or yearly, the above identification number will be followed by a letter:

Daily: D
Weekly: W
Monthly: M
Quarterly: Q
Yearly: Y

For example**, 01-001.Q.01** Primary blower assembly quarterly instruction number 1.

i. Daily Instructions

Primary Chamber Burner: (01-002.D)

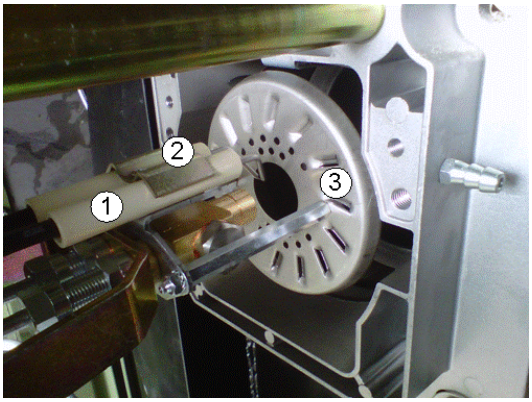
Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

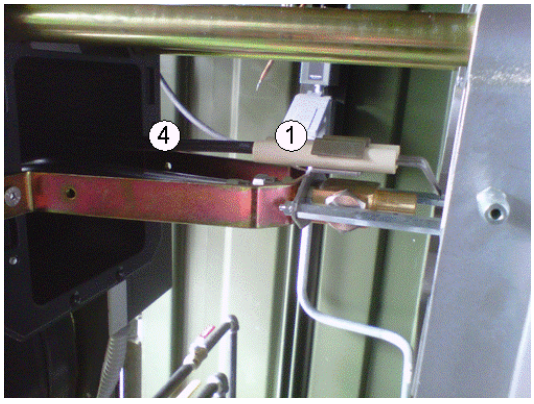
Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 01-002.D.01: INSPECTING AND CLEANING ELECTRODES

1. Remove the cover from the Burners as described in 01-002.W.01
2. Inspect the electrodes (PN: 3003796) for any soot build-up.



1. Electrode
2. U-bolt
3. Diffuser Disc

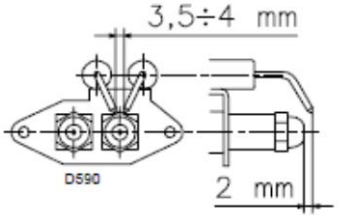


4. HT Leads

3. Clean/wipe down the ignition electrode with a cloth should there be a build-up of soot.

NOTE Do not use sand paper as this will increase the deposit of future soot.

4. If electrodes are damaged remove the screws and u-bolt (see above photo) and install new electrodes. When reinstalling the electrodes make sure that they are positioned as shown below.



Primary Burner

Check the High Temperature (HT) Leads (PN: 3012995) for any heat damage. If HT Leads are severely damaged (ie, you can see the wire beneath the sheathing) then replace. (See *CMI 6.3.3/01-002A)*

INSTRUCTION 01/02-002.D.02: INSPECTING THE FUEL LINES

1. Visually inspect all fuel lines to the Primary and Secondary Burner for any leaks.
2. The Primary Burner have two oil lines, one feed and one return. the Secondary Burner has only a feed line
3. If any leaks are observed tighten or replace the fitting where the leak is occurring

INSTRUCTION 01-002.D.03: INSPECT AND CLEAN BURNER NOZZLES

Primary Burner:

1. Remove the burner cover as outlined in 01/02-002.W.01 REMOVAL OF BURNER COVERS
2. Remove the centre retaining bolt.
3. Slide burner out.
4. Check nozzle. If there is carbon, remove the nozzle and clean.
5. Reinstall or replace if necessary (PN: C5222433)

Refractory: (05-001.D)

When working with the refractory make sure you use the proper tools; wear goggles, approved dust mask and gloves

INSTRUCTION 05-001.D.01: INSPECTING THE REFRACTORY

Ensure power is locked out.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

1. Open Primary Chamber door by unlatching all four clamps.

2. Tie-off door to open position to ensure that it will not close unintentionally.

3. Enter Primary Chamber and check the refractory for shrinkage, any gap between the modules greater than 2.5 cm should be patched with the blanket refractory

4. Check for any exposed metal between the modules, if metal is exposed make sure to patch area with blanket material (PN: 1" x 24" 8# 2600) or new module (PN: 6" Mod ZR) (*CMI 6.3.2/05-001A & 6.3.2/05-001B)*

ii. Weekly Instructions

Primary & Secondary Chamber Blowers: (01-001.W & 02-001.W)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

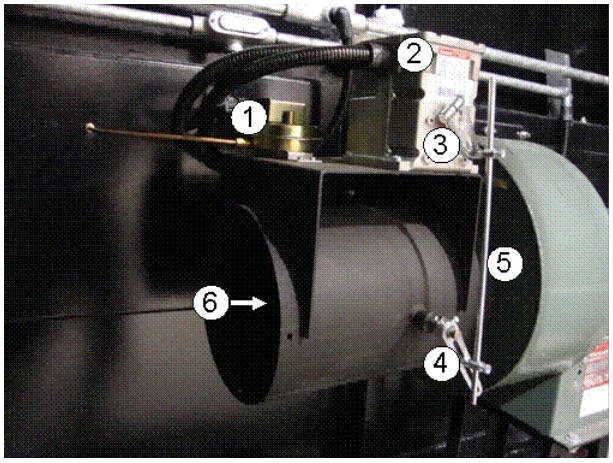
A fan can windmill despite removal of all electrical power therefore, take extra care when working with fans in the system.

The rotating assembly should be blocked securely before attempting maintenance of any kind.

INSTRUCTION 01/02-001.W.01: DAMPER CRANK ARM

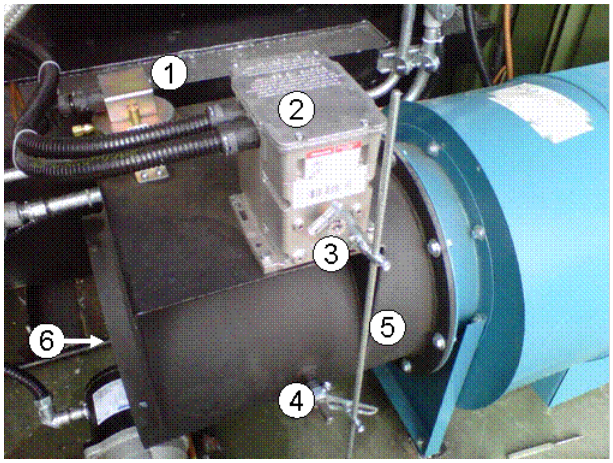
Check to see that the damper crank arm is connected to the damper and the rod.

Ensure mechanical linkage on damper is tight, if loose tighten with wrench.



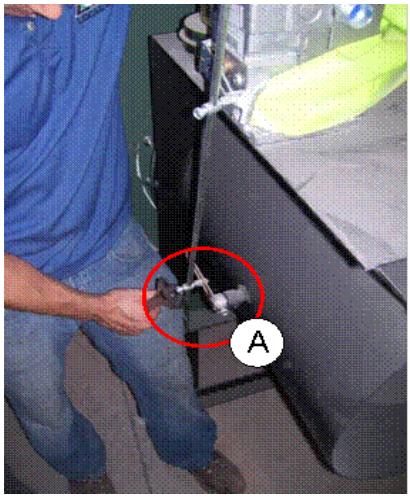
PRIMARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



SECONDARY BLOWER

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper



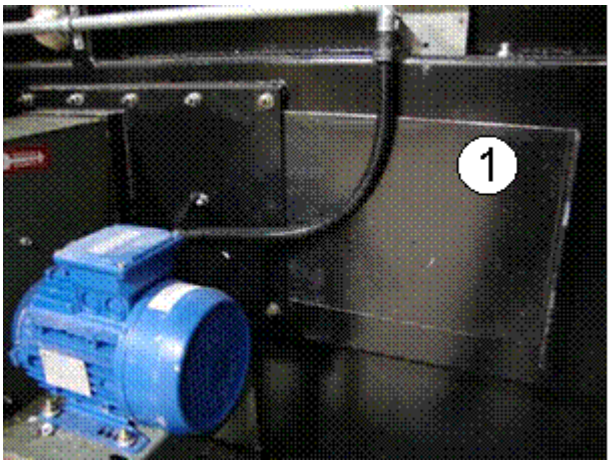
A. Damper Crank arm and connection to Damper and Rod

INSTRUCTION 01/02-001.W.02: SLIDE GATES

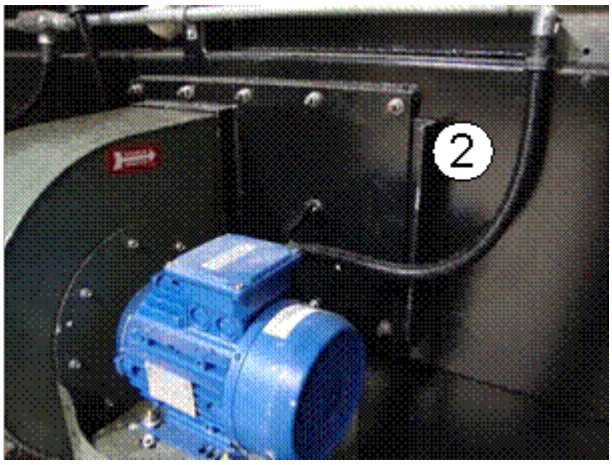
Check to see if slide gates move freely.

1. Move slide gate in and out to ensure free movement. If sticking, use lubricant to loosen. Lubricant should be rated for a high temperature (>150°F) application.

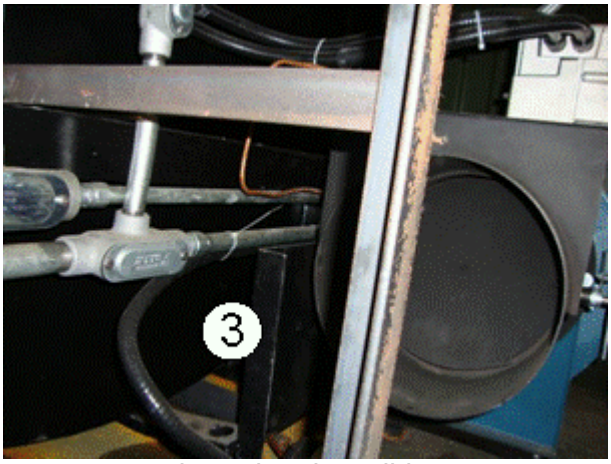
2. Gates must be opened to allow under fire air to enter the chamber. They should only be closed to reduce air in abnormal operating conditions.



1. Primary Chamber Slide Gate Open



2. Primary Chamber Slide Gate Closed



3. Secondary Chamber Slide gate Open

Primary Chamber Burner: (01-002.W)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 01/-002.W.01: REMOVAL OF BURNER COVER

Switch off the electrical power. Please follow all instructions in *Section 6.1 Zero Mechanical State & Lock Out Instructions.* Cover must be removed to perform maintenance on the burner.

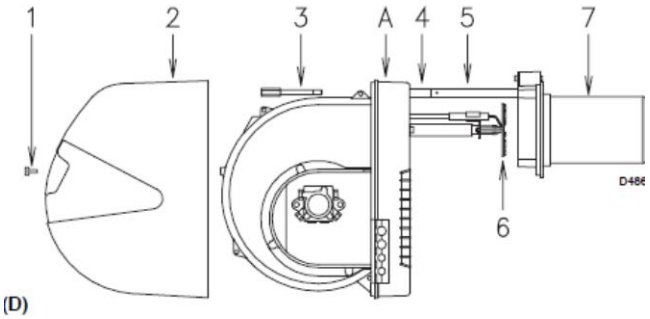
To remove the cover and to pull out the Primary or Secondary Burner, follow instructions below:

1. Loosen screw (Item #1, in the following diagrams) and withdraw the cover (Item #2, in the following diagrams)

2. Primary Burner has one screw to remove the cover. The Secondary Burner has four screws to remove the cover.

3. Remove bolt (Item #3) for the Primary Burner, or screws (Item #3) for the Secondary Burner.

4. Pull (Part A) backwards keeping it slightly raised to avoid damaging the diffuser disk (Item #6).



Primary Burner has 1 screw

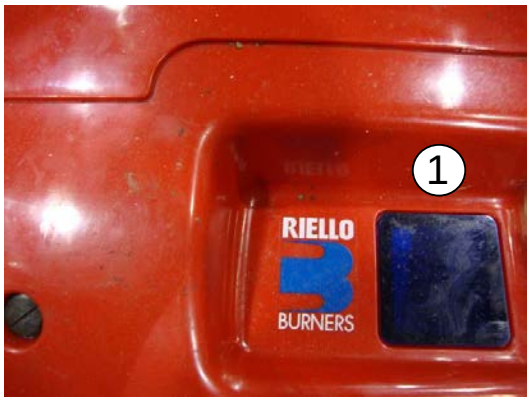
INSTRUCTION 01/02-002.W.02: CLEANING THE PHOTO ELECTRIC CELL

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.
2. Clean Photo Electric (P.E) cell with a wet cloth (Primary Burner PN: 3006216)
3. P.E. cell (Item #1) can be removed by pulling it outward forcefully. Ensure you take note of the position of the eye while removing, this will help when reinstalling.
4. Once cleaned insert P.E. cell back into position ensuring the eye is not facing directly into the chamber (where the flame will be) but on the same angle as before it was removed.
5. Replace burner cover.

Primary Burner PE Cell

INSTRUCTION 01-002.W.03: CLEANING THE INSPECTION WINDOWS

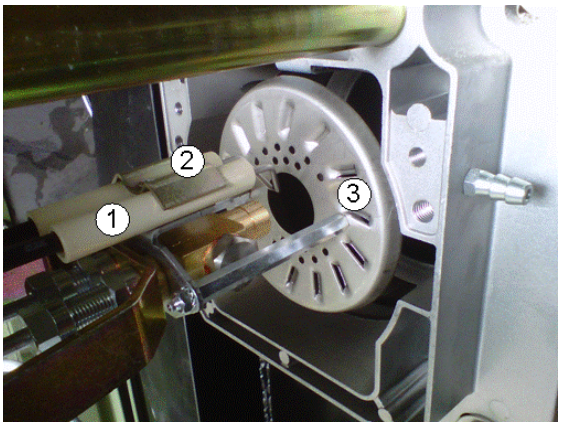
Clean the inspection windows with a wet cloth.



1. Primary Burner Inspection Window

INSTRUCTION 01-002.W.04: INSPECTING THE DIFFUSER DISC ASSEMBLY

1. Remove the cover from the Burners as described in 01-002.W.01.
2. Check the diffuser disc assembly (Primary Burner PN: 3003791) for any heat damage
3. If any heat damage, deformation or excess rust is noted, replace. (*CMI 6.3.8/03-009K)*



1. Electrode
2. U-bolt
3. Diffuser Disc

Secondary Chamber High Output Dual Burner: (02-002.W)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death.

Burner shall be installed and maintained in accordance with manufacturer's requirements as outlined in the Burner manual, local codes and authorities having jurisdiction.

INSTRUCTION 02-002.W.01: SECONDARY BURNER WEEEKLY ROUTINE

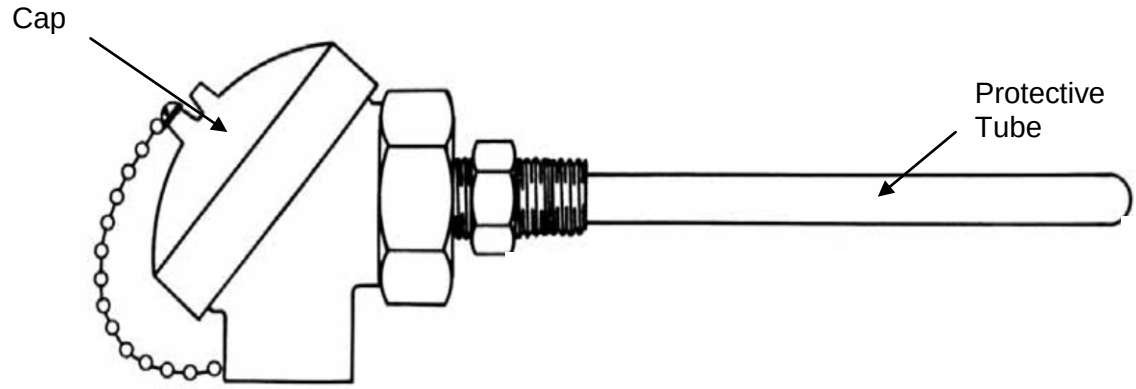
1. Clean flame sensors.
2. Clean the glass on the flame inspection window.
3. Clean spark ignitors.
4. Clean pilot assemblies.
5. Check spark ignitor lead connections.
6. Check turbulator ring.
7. Clean all filters and filter screens.
8. Lubricate all moving parts (i.e. bearings on doors, door latches & hinges, air and fuel valves, proportioning fuel valves, particularly the shafts on both air modulation valves

9. Check all motors for bearing noise, loose fans, etc.

10. Inspect fuel lines for leaks

Thermocouple: (05-002.W)

When working with electrical components ensure lock out instructions are being followed.

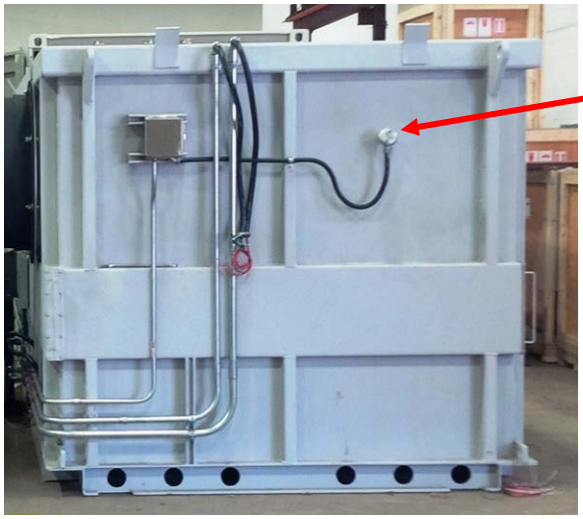


Thermocouple Assembly

Thermocouple Element

INSTRUCTION 05-002.W.01: INSPECT THERMOCOUPLE FOR DAMAGE

Turn main power to the system off - Remove thermocouple and visually inspect for damage. If damaged, see *CMI 6.3.1/05-002A*



1. Primary Chamber #1 Thermocouple

2. Two Secondary Thermocouples on Secondary Chamber body and beside the burner

3. Stack Thermocouple on Stack

i. Monthly Instructions

Primary & Secondary Chamber Blowers: (01-001.M & 02-001.M)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 01/02-001.M.01: CHECK FAN WHEEL

1. Check the fan wheel for any wear or corrosion, as either can cause catastrophic failures, if left in operation.

2. The wheel can be accessed one of two ways.
   a. Remove the blower assembly from the unit and look down the outlet of the blower.
   b. Remove the damper assembly from the inlet of the blower and inspect by looking through the inlet of the blower.

3. Check also for the build-up of material which can cause unbalance resulting in vibration, bearing wear and serious safety hazards.

4. Clean the wheel as required.

5. If replacement is necessary follow these steps:

   a. Remove damper assembly from the unit
   b. Remove the blower assembly
   c. Remove the blower housing around the wheel
   d. Loosen all set screws that are located on the wheel.
   e. A puller may be required if the wheel hasn't been removed for some time.
   f. Ensure the shaft "key" is installed on the shaft before installing the new wheel.
   g. When installing a new wheel, the wheel should be positioned in the housing with the correct spacing between the edge of the inlet cone and the wheel. The wheel to cone clearance on the Primary Blower is 0.3175 cm.
   h. Ensure that the wheel is installed securely before reassembling the blower assembly.
   i. Install the blower assembly
   j. Install the damper assembly

Primary Chamber Burner: (01-002.M)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 01-002.M.01: CHECK FLEXIBLE OIL LINE

1. Check flexible oil lines to make sure that they are still in good condition. This includes frayed, leaking, or worn swivel joints.

2. If any type of damage is observed replace the flexible oil lines see *CMI 6.3.3/01-002F & 6.3.3/02-0002F*

Primary Chamber Burner Flexible lines

INSTRUCTION 01-002.M.02: INSPECT BURNER PUMP DELIVERY PRESSURE

1. Remove the cover from the Burner as described in Instruction 01/02-002.W.01.

2. The pump delivery pressure must be between 180-210 psi, and can be viewed on the gauge shown below.

3. If the pressure is found to be unstable or if the pump is running noisily try the following:
    a. Detach the flexible hose from the line filter (Shown below as #1).
    b. At the tank pour fuel into the supply line.
    c. If there is fuel coming in through the filter it means the filter is not clogged. If no fuel is coming through the filter remove and replace.

Primary Chamber Burner Flexible lines

4. If the pump is found to be responsible:
    a. Loosen the bleed screw.
    b. Turn on the burner
    c. Once all the air has been bled out. Close the bleed screw.

    If the pump is still not working after these steps replace the pump.

5. If the problem lies in the suction line, check to make sure that the filter is clean and that air is not entering the piping from a loose fitting or damaged line.

INSTRUCTION 01-002.M.03: CLEAN BURNER OF DUST

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.

2. Check that no dust has accumulated inside the burner fan or on fan blades.

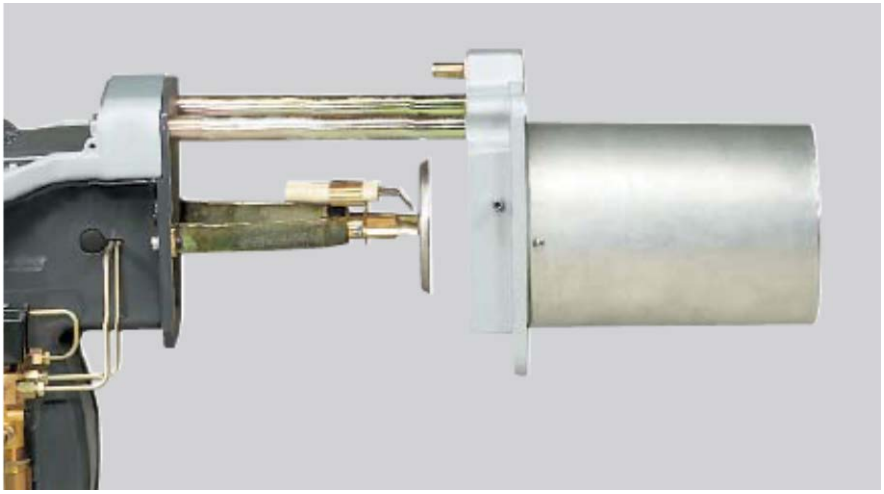
3. If any dust is visible take a clean soft cloth to the fan or the blades and wipe clean.

INSTRUCTION 01-002.M.04: CHECK BURNER COMBUSTION HEAD

1. Remove the cover from the Burners as described in Instruction 01-002.W.01.

2. Check that all parts of the combustion head are in good condition, free of all impurities, and that no deformation has been caused by operation at high temperatures.

(Below is an example of burner in good condition)



If damage is found, please refer to *CMI 6.3.3/01-002D & 6.3.3/02-002D*

Secondary Chamber High Output Dual Burner: (02-002.M)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

INSTRUCTION 02-002.M.01: SECONDARY BURNER IN-LINE HEATER

1. Check all electrical connections.
2. Remove heater element from casing and inspect for build-up. Clean any deposits. When reinstalling always ensure the bundle will be restarted immersed. **NEVER** use the inline oil heater dry.

INSTRUCTION 02-002.M.02: SECONDARY BURNER SOLENOID VALVES

1. Examine solenoid valves for any deposits. Remove if necessary
2. Check electrical connections.

Refractory: (05-001.M)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 05-001.M.01: INSPECT REFRACTORY

1. Ensure power is locked out.
2. Open Secondary Chamber door.
3. Fasten door open, ensuring it will not close by its own weight.
4. Enter Secondary Chamber and check the refractory for shrinkage, any gaps between the modules greater than 2.5 cm should be patched.
5. Fix gaps with supplied blanket by stuffing material into opening. (See *CMI 6.3.2/05-001A)*
6. Check for any exposed metal, if metal is exposed make sure to patch area with blanket material or new module. (See *CMI 6.3.2/05-001A & 6.3.2/05-001B)*
7. Pay special attention to areas where the junction boxes are located, as any excessive heat may melt the wires within the box.
8. From Secondary Chamber interior look up the stack while the cap is in closed position.
9. View the surface of the bottom of the stack cap flap with a flash light
10. Some cracking is normal, however if pieces are missing or have fallen out, (See *CMI 6.3.2/05-001E)*

Lid Lifters: (06-001.M)

Controls are normally closed. Do not modify to by-pass or leave the controls open.

Always remain vigilant and avoid injury.

INSTRUCTION 06-001.M.01: CHECK HYDRAULIC FLUID

Check the level of the hydraulic fluid. Fill if necessary.

1. Always use High temperature hydraulic oil Grade 32 to fill the tank.

ii. Quarterly Instructions

Primary & Secondary Chamber Blowers: (01-001.Q & 02-001.Q)

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

INSTRUCTION 01/02-001.Q.01: LUBRICATE BEARINGS

1. Lubricate the bearings, but do not over lubricate.

2. Bearings are completely filled with grease at the factory; they may run at an elevated temperature during initial operation. Surface temperatures may reach 180°F and grease may bleed from the bearing seals. This is normal and no attempt should be made to replace lost grease. Bearing surface temperatures will decrease when the internal grease quantity reaches a normal operating level.

3. Bearings should be lubricated with premium quality lithium-based grease conforming to NLGI Grade 2. Examples are:

   Mobil - Mobilgrease XHP
   Texaco - Premium RB
   Chevron - Amolith #2
   Shell - Alvania #2

4. Add grease to the bearing via the grease nipple while running the fan or rotating the shaft by hand. Be sure all guards are in place if lubrication is performed while the fan is operating. Add just enough grease to cause a slight purging at the seals. Do not over lubricate.

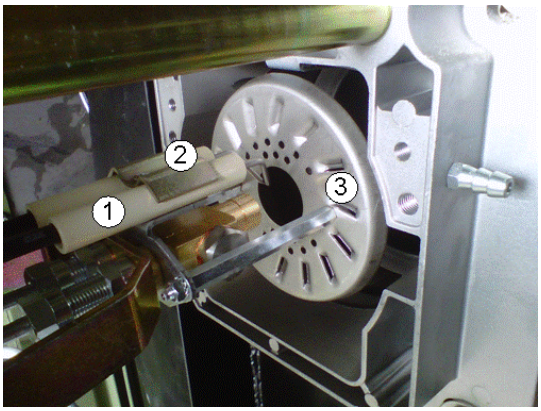
Primary Chamber Burner: (01-002.Q)

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances. Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or death. Refer to the Burner manual for instructional or additional information.

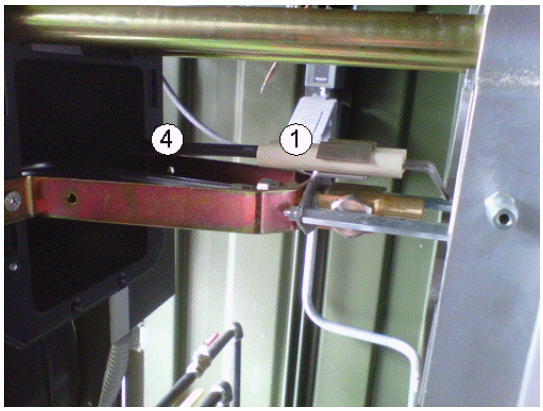
INSTRUCTION 01-002.Q.01: INSPECT COMPONENTS FOR HEAT DAMAGE

1. Check all components for heat damage.
2. Look for excessive rust, deformation of all the parts including but not limited to the end cone and the diffuser disc.
3. Check to see that the High Temperature Leads (HT leads) are still intact and have not melted from any excessive heat coming back into the burner. If they are damaged replace with new HT Leads (PN: 3012995 Primary). *See CMI 6.3.3/01.002A.*

    a. The HT leads are attached to the control box and the electrode via a squeeze fitting. Remove the leads from the electrode and control box by simply pulling them out.



1. Electrode
2. U-Bolt
3. Diffuser Disc



4. HT Leads

End cone

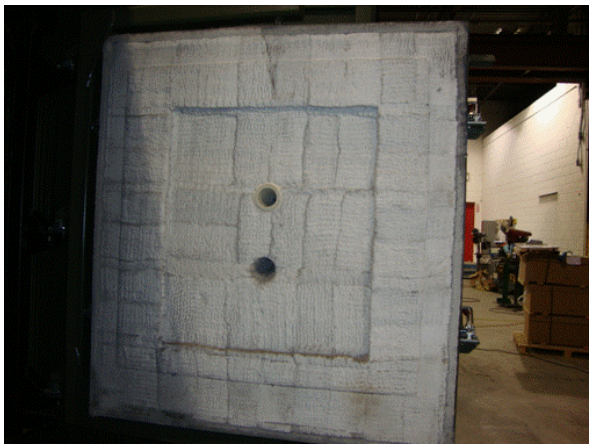
Refractory: (05-001.Q)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

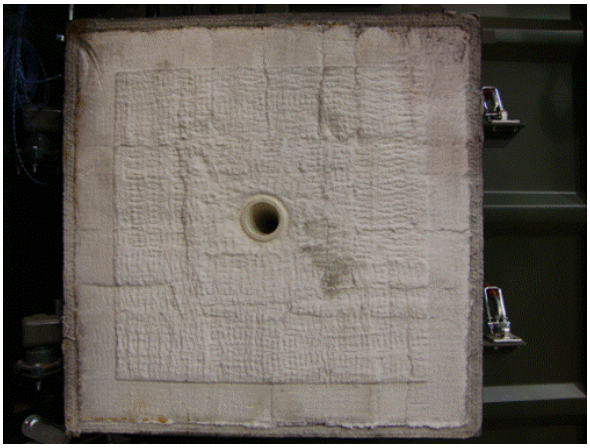
INSTRUCTION 05-001.Q.01: INSPECT DOOR GASKETS

1. Open Primary and Secondary Chamber doors.
2. Fasten doors open, ensuring the door will not close on its own.
3. Inspect door gasket for damage.
4. Replace any damaged segments of door gasket (PN: GSB 1.5") if necessary. Cut out the damaged section and replace with new door gasket. See *CMI 6.3.2/05-001C*.
5. Doors must close tightly and securely, ensuring a good seal.



Primary Door (refractory lined)

1. Primary Door Gasket



Secondary Door (refractory lined)

1. Secondary Door Gasket

INSTRUCTION 05-001.Q.02: INSPECT REFRACTORY FOR SHRINKAGE

1. Ensure power is locked out.
2. Open Primary and Secondary Chamber doors.
3. Fasten doors open, ensuring they will not close on their own.
4. Enter Primary and Secondary Chamber and check the refractory for shrinkage, anything greater than 2.54 cm should be patched.
5. Check to make sure the anchoring of the modules is still strong and intact, if any modules seem loose replace complete module with new module.

A. **REMOVAL:** Remove existing Module (physically pull away existing refractory from underlying Module Anchor).

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell).

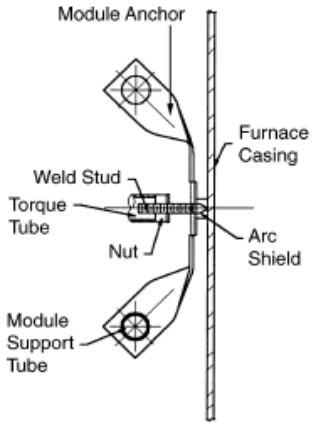


Figure 1: Side view of the Weld Loc Module

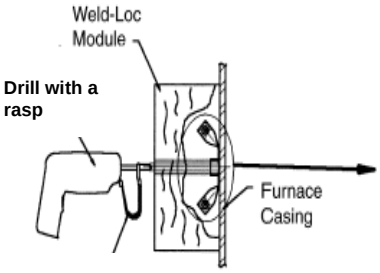


Figure 2: Stud Gun with rasp and Torque Tube.

A. **INSTALLATION**: Once the new module (PN: 433026) is in place take the stud gun (PN: ECO-STUD) with rasp to the Torque Tube and drill into place.

B. Once it has tightened the Torque Tube should come off with the drill.

Paint: (05-003.Q)

Ensure proper ventilation and proper equipment is being used when using any paint product.

INSTRUCTION 05-003.Q.01: INSPECT AND MAINTAIN EXTERIOR PAINT

1. Maintain paint exterior to protect metal from heat and corrosion damage. This includes all components in the system including containers and incinerator components.

2. If discoloration is noted and painting needs to be performed, on areas where paint will be applied, you must do a light sanding before application.

3. Follow paint manufacturer's application instructions which will include surface preparation, priming and painting.

4. If components within the container need to be painted, for example the Primary Chamber or the Secondary Chamber, proceed as above. Use a type of paint that meets the following specifications:

Paint Specifications:

Incinerator Paint: This is the paint coated directly on the incinerator shell. This includes the following components:

1. Primary Chamber
2. Secondary Chamber
3. Breech Section
4. Hot Stack Section (Black)

Finish needs to be able to withstand temperatures in the 650-750°F (340-400°C) range.

Parts: There are no paint specifications for each individual component. This is left up to the discretion of the customer.

iii. Yearly Instructions

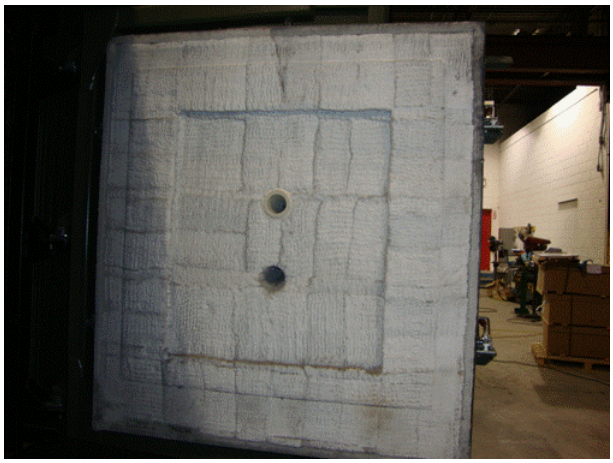
Refractory: (05-001.Y)

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

INSTRUCTION 05-001.Y.01:
CHECK DOOR GASKET ALONG PRIMARY & SECONDARY CHAMBER DOORS

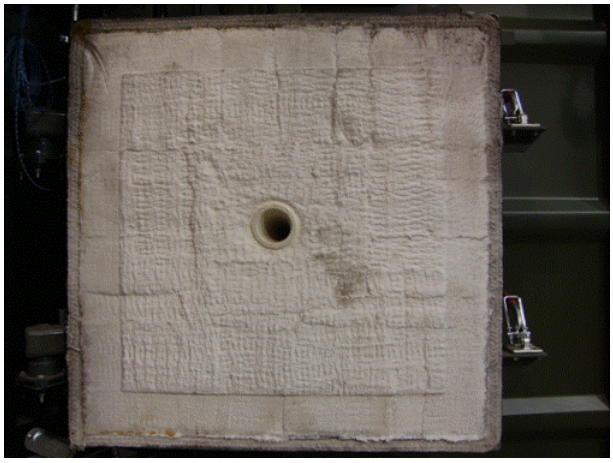
1. If required replace the door gasket. The gasket can last over 2 years but will depend on the careful use by the operator when loading and unloading.

2. Remove the damaged section of door gasket from door and reinstall new gasket (PN: GSB 1.5")



Primary Door (refractory lined)

Primary Door Gasket



Secondary Door (refractory lined)

Secondary Door Gasket

Electrical: (05-004.Y)

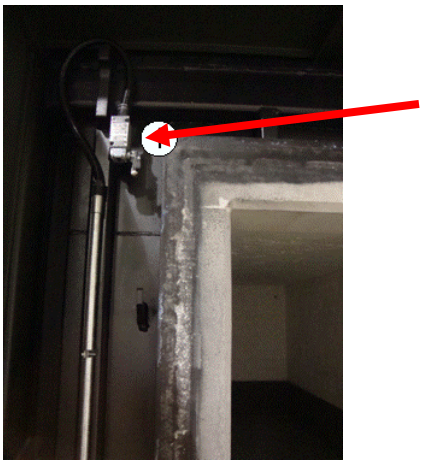
When working with electrical components ensure lock out instructions are being followed

Please follow all instructions outlined in *Section 6.1 Zero Mechanical State & Lock Out Instructions.*

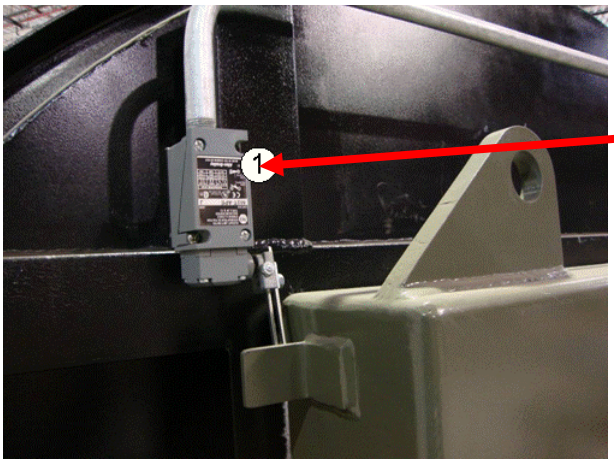
INSTRUCTION 05-004.Y.01: CHECK LIMIT SWITCHES

NOTA System must not be running or in cool down to perform this inspection.

1. Open Primary and Secondary Chamber doors and check top view screen on the HMI to ensure that it indicates door is open.
2. Close Primary and Secondary Chamber doors and check top view screen on the HMI to ensure that it indicates door is open.
3. All limit switches located on the unit are checked this way.
4. Replace limit switches (PN: 802T-APE) if necessary.



Primary Chamber Limit Switch



Secondary Chamber Limit Switch

1. See *CMI 6.3.1/05-005A)*.

2. Check all other limit switches in the system.

    a. Limit Switch located at upper limit of lid lifter Primary Chamber
    b. Limit Switch located at lower limit of lid lifter Primary Chamber

CORRECTIVE MAINTENANCE INSTRUCTIONS (CMI)

The following instructions relate to the replacement or correction (fixing) of components of the EWS Incinerator Package.

These Corrective Instructions are grouped in this section by the following:

6.3.1 General Corrective Maintenance Instructions
6.3.2 Refractory Corrective Maintenance Instructions
6.3.3 Primary & Secondary Burner Corrective Maintenance Instructions
6.3.4 Primary & Secondary Blower Corrective Maintenance Instructions
6.3.5 Waste Oil Burner Corrective Maintenance Instructions
6.3.6 Main Control Panel Corrective Maintenance Instructions

the following table is utilized to identify the components of the system that require corrective maintenance.

System Component		**Identification number**	
Primary Blower		**01-001**	
	Air Proving Switch Replacement		6.3.4/01-001A
	Damper Calibration		6.3.4/01-001B
	Modutrol Resistor Replacement		6.3.4/01-001C
	Damper Crank Arm Replacement		6.3.4/01-001D
	Motor Replacement		6.3.4/01-001E
	Modutrol Motor & Transformer Replacement		6.3.4/01-001F
Secondary Blower		**02-001**	
	Air Proving Switch Replacement		6.3.4/02-001A
	Damper Calibration		6.3.4/02-001B
	Modutrol Resistor Replacement		6.3.4/02-001C
	Damper Crank Arm Replacement		6.3.4/02-001D
	Motor Replacement		6.3.4/02-001E
	Modutrol Motor & Transformer Replacement		6.3.4/02-001F
Primary Burner		**01-002**	
	Replacing Fuel Filter		6.3.1/01-002A
	HT Lead & Electrode Replacement		6.3.3/01-002A
	Diffuser Disc Replacement		6.3.3/01-002B
	Nozzle Replacement		6.3.3/01-002C
	End Cone Replacement		6.3.3/01-002D
	Nozzle Assembly Repair or Replacement		6.3.3/01-002E
	Burner Flexible Oil Line Replacement		6.3.3/01-002F
	Low Level Switch Replacement		6.3.3/01-002G
	Inspection Window Replacement		6.3.3/01-002H
	Fuel Pump Replacement		6.3.3/01-002I
	Control Box Replacement		6.3.3/01-002J
	Oil Tube Replacement		6.3.3/01-002K
	Burner PE Cell & UV Detector Replacement		6.3.3/01-002L
	Burner Fan Motor Replacement		6.3.3/01-002M

Refractory		**05-001**	
	Wall Refractory: Gaps between the Modules		6.3.2/05-001A
	Wall Refractory: Replacement of the Modules		6.3.2/05-001B
	Door Gasket		6.3.2/05-001C
	Castable Refractory		6.3.2/05-001D
	Temporary Repair of Castable		6.3.2/05-001E
Main Control Panel		**03-010**	
	Main Control Panel		6.3.6/03-010A
	Reboot PLC		6.3.6/03-010B
Limit Switch		**05-005**	
	Limit Switch Replacement		6.3.1/05-005A

iv. General Corrective Maintenance Instructions

LIMIT SWITCH REPLACEMENT (6.3.1/05-005A)

1. Loosen the 2 screws holding the limit switch in place.
2. Remove limit switch, replace with a new one (PN: 802T-APE).
3. Take arm off of old body and mount to new.
4. Tighten the 2 screws holding the limit switch body.

REPLACING THERMOCOUPLE (6.3.1/05-002A)

The thermocouple will require routine replacement. The environment inside the incinerator will erode the protection tube to the point of failure. If the element is exposed to this environment it will be destroyed and will need to be replaced.

1. Unscrew thermocouple lid and remove wires.
2. Remove protection tube. To aid with this a vise and a pipe wrench will be needed.
3. Remove element and replace with new element (PN: TK-K08B-0100-S) and protection tube (PN: TA-A427A-K08B-010).

4. Reinstall on incinerator.

5. After installation turn power back on. Observe the temperature reading of the thermocouple you were just working on. If the wires were installed incorrectly the temperature will read the opposite temperature. (ie 20°C would read as -20°C). If this is the case open the thermocouple housing and switch the wires.

REPLACING FUEL FILTER (6.3.1/01-002A AND 02-002A)

The fuel filter will require routine replacement to ensure clean fuel delivery to the Primary and Secondary Chamber burners.

1. Close the ball valve on the supply line.

2. Unscrew the used filter. Use a bucket to catch the surplus fuel when you unscrew the filter.

3. Before installing the filter lubricate the seal on the new filter.

4. Install the new filter, and open the supply line ball valve.

v. Refractory Corrective Maintenance Instructions

When working with the refractory make sure you use the proper tools; wear goggles, dust mask and gloves

WALL REFRACTORY: GAPS BETWEEN THE MODULES (6.3.2/05-001A)

The ceramic block refractory will shrink over time exposing the exterior metal shell. These gaps need to be filled in with ceramic refractory blanket.

1. Identify gaps in the chamber that are larger than 1” in width between the modules or if you can see exterior shell.

2. With a Utility knife cut a length of ceramic blanket (PN: 1" x 24" 8# 2600) that will fit in the gap between the modules.

3. Stuff the blanket into the space with a straight edge or ruler.

WALL REFRACTORY: REPLACEMENT OF MODULES (6.3.2/05-001B)

Excessive damage to a section of refractory may necessitate the replacement of modules in the incinerator. Such damage is largely due to mechanical wear. The following diagram walks through the removal and installation of new modules.

A. REMOVAL: Remove existing Module (physically pull away existing refractory from underlying Module Anchor)

B. Remove welded stud from steel casing (cut with hack saw or other device between Module Anchor and Furnace Casing/Shell)

Figure 1: Side view of the Weld Loc Module

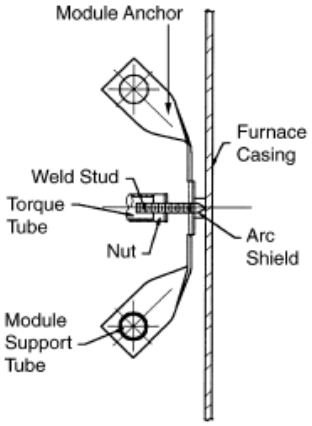
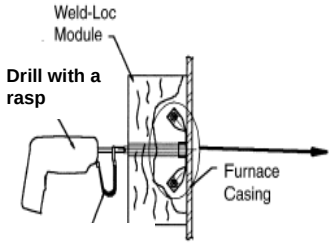


Figure 2: Stud Gun with rasp and Torque Tube (part of module assembly).



C. INSTALLATION: Once the new module is in place take the stud gun (PN: Eco-Stud) with rasp to the Torque Tube and drill into place.

D. Once it has tightened the Torque Tube should come off with the drill.

DOOR GASKET REFRACTORY (6.3.2/05-001C)

The door gasket will degrade over time and will need to be replaced over time. The bottom of the door will see more degradation due to the waste burning in that vicinity.

1. Identify the damaged section of gasket that will need to be removed
2. With a utility knife cut out the section that needs to be replaced.
3. A new piece of gasket (PN: GSB 1.5") will need to be cut the same length as the removed piece.
4. With contact cement coat the gasket on one side and the door section and install.

CASTABLE REFRACTORY (6.3.2/05-001D)

Operators will notice that the castable refractory will show signs of minor cracking. The minor cracking is normal. Large sections of castable should not separate from the rest of the monolithic cast. Such occurrences are largely due to a sudden impact from machinery or dropping of the units themselves. Mortar (PN: SM3000) is supplied to help with a temporary repair while a permanent repair is resolved. Such permanent repairs are a third level repair and have to be considered on a case by case basis.

TEMPORARY REPAIR OF CASTABLE (6.3.2/05-001E)

1. Find the pieces of castable refractory that have separated.

2. Clean both the pieces of refractory and the area where the separation occurred.

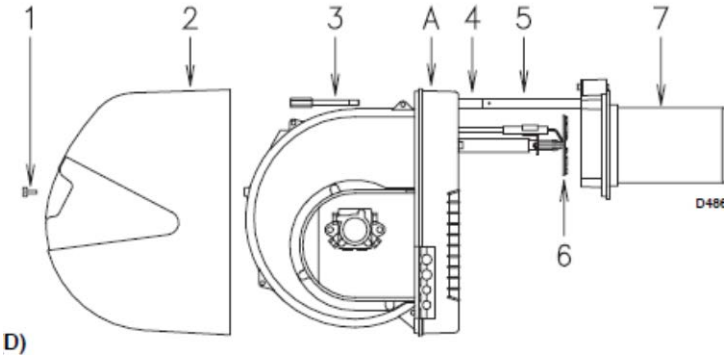
3. Spread an even amount of high temperature mortar on the pieces and the area of separation.

4. Put the pieces back where they originated and support as necessary for a minimum of an hour while the mortar cures.

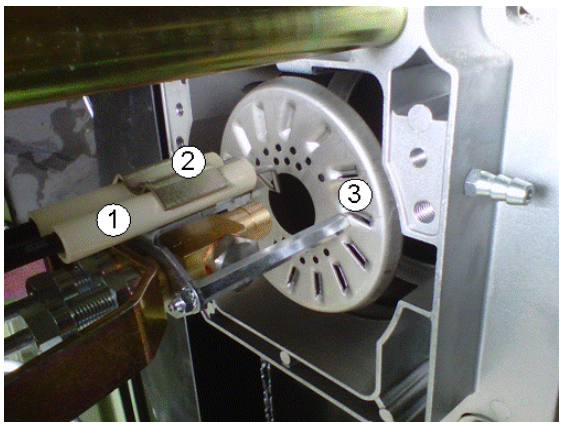
vi. Burner Corrective Maintenance Instructions

Do not store flammable or hazardous materials in the vicinity of fuel burning appliances.

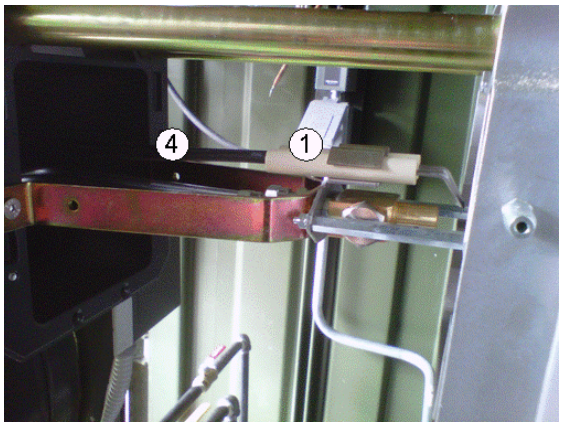
The Burners are pieces of equipment that will require routine corrective and preventive maintenance. Parts within this assembly will need to be repaired or replaced. The most common parts to be repaired or replaced are located at the front end of the burner where the parts are exposed to high temperatures.



Front End Primary Burner



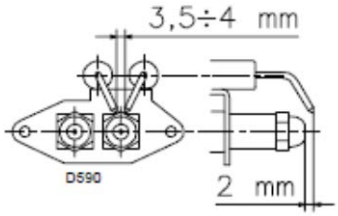
1. Electrode
2. U-bolt
3. Diffuser Disc



4. HT Leads

HT LEAD & ELECTRODE REPLACEMENT (6.3.3/01-002A)

1. In order to change out the HT leads (PN: 3012995) Primary Burner or Electrode (PN: 3003796) the U-Bolt will have to be removed
2. Remove the electrode by pulling the lead out of the white ceramic tube, replace and re-install.
3. To change the Leads the wire will need to be removed from the burner.
4. Pull the wire out of the burner housing through the rubber grommet.
5. The other end is connected to the back of the control box. Pull the wire straight out and the spring fitting will disengage.
6. Replace the lead with a new one reversing the above directions.
7. When reinstalling the electrodes make sure that they are positioned as shown below:



Primary Burner

DIFFUSER DISC REPLACEMENT (6.3.3/01-002B)

1. Identify the diffuser disc in the above pictures.
2. The disc assembly is secured to the nozzle housing by 2 hex nuts.
3. Remove these nuts and remove the assembly from the burner.
4. The disc is attached to the assembly with 2 screws.
5. Remove the screws and replace the disc.
    - Primary Chamber Burner diffuser disc PN: 3003791
6. Reassemble.

NOZZLE REPLACEMENT (6.3.3/01-002C)

1. Identify the nozzle at the very front end of the burner just behind the diffuser disc.

2. Remove the nozzle with a wrench.

3. Install the new nozzle.
    - Primary Chamber Burner nozzle PN: C5222433

END CONE REPLACEMENT (6.3.3/01-002D)

The end cone will need replacement when the flame becomes unstable from too much heat damage.

1. Loosen and remove the 4 hex bolts that hold the burner on the flange.

2. Remove the burner completely from the incinerator. This will require more than one operator because the burner is heavy.

3. There are two screws that hold the end cone on. Remove and save the screws for the new end cone.

4. Install the new End Cone with the old screws.
    - Primary Chamber burner end cone PN: 3003807

5. Reinstall the burner.

NOZZLE ASSEMBLY REPAIR OR REPLACEMENT (6.3.3/01-002E)

The nozzle assembly is subjected to high heat cycling. The heat cycling will eventually cause the seals and assembly to leak. The assembly will have to be replaced when this occurs. First identify the location of the nozzle assembly.

The parts (seals, nozzle assembly) needed for these replacements are all included under one part number.

- Primary Chamber Burner nozzle assembly: PN: 3003814

Remove all connections to the nozzle assembly and replace with the above parts.

BURNER FLEXIBLE OIL LINE REPLACEMENT (6.3.3/01-002F)

1. Turn the inline ball valve to the closed position to isolate the fuel supply from the burner. This valve is located down line from the burner.

2. Remove flexible lines.

3. Replace with new lines.

    - Primary Chamber Burner flexible oil line: PN: C5281160

4. Open ball valve.

Primary Chamber Burner Flexible lines
(Item # 1 Above)

LEVEL SWITCH REPLACEMENT (6.3.3/01-002G & 02-002G)

The level switch is located in the Fuel Tank.

NOTA
Tanks do not have to be emptied to replace.

1. Unplug the level switch.
2. Disconnect the cord and remove the level switch.
3. Replace level switch (PN: FS301-01) and reconnect the cord.
4. Plug in the level switch.

INSPECTION WINDOW REPLACEMENT (6.3.3/01-002H & 02-002H)

To replace the inspection window simply remove the old inspection window and replace with a new one:

- Primary Burner inspection window PN: 3003763

FUEL PUMP REPLACEMENT (6.3.3/01-002I)

Identify the pump on the burner you wish to replace.

Remove all fuel connections to the pump with the appropriate wrench. Unbolt the pump from the main body of the burner and pull the pump away from the burner to remove.

Reinstall the new pump, and reattach all fuel connections.

- Primary Burner: PN: 3013027

CONTROL BOX REPLACEMENT (6.3.3/01-002J & 02-002J)

Identify the control box on the burner you wish to replace:

Ensuring the power is off unscrew the old control box and install the new one.

- Primary Burner: PN: 3012933

OIL TUBE REPLACEMENT (6.3.3/01-002K)

Oil tubes leak due to heat cycling which causes the fittings to fail or a loose fitting.

1. Identify the oil tubes on the Primary Burner and on the Secondary burner.
2. First try tightening the fittings to see if the leak stops. If the leak does not stop:
3. Remove the old oil tubes with a wrench and install the new ones:

- Primary Burner Tubes: PN: 3003821
  PN: 3003822

BURNER PE CELL REPLACEMENT (6.3.3/01-002L)

Primary Burner: If the PE cell has been damaged, then it will need to be replaced. The PE cell while removed needs to be unplugged from the control box. This is accomplished by pulling the connection towards you. With the new PE cell install the control box end first by pushing the connection hard. Reinstall the PE cell in the burner.

BURNER FAN MOTOR REPLACEMET (6.3.3/01-002M)

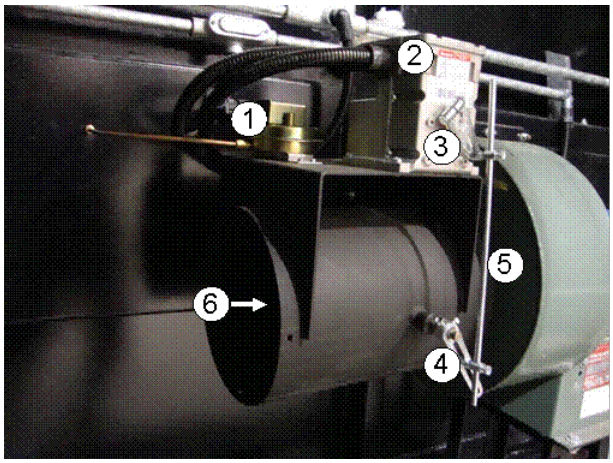
Identify the malfunctioning motor in the affected burner:

Unbolt and remove the malfunctioning motor from the housing. Disconnect all electrical connections. Reinstall the new motor exactly how the old motor was installed.

vii. Primary & Secondary Blower Corrective Maintenance Instructions

Do not attempt any maintenance on a fan unless the electrical supply has been completely disconnected and locked. In many cases, a fan can windmill despite removal of all electrical power. The rotating assembly should be blocked securely before attempting maintenance of any kind.

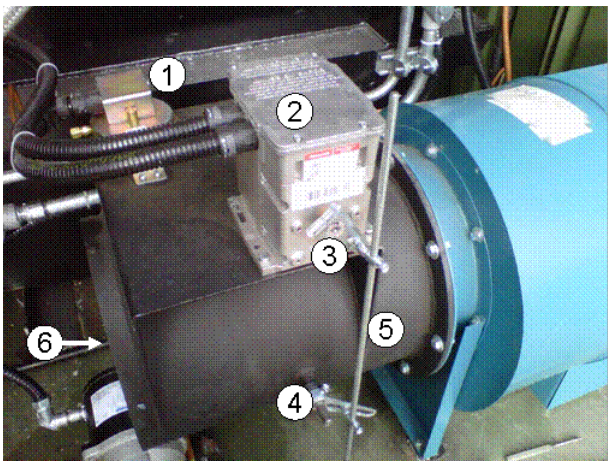
Primary Blower assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



Primary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

Secondary Blower assemblies are not a commonly repaired part on the incinerator. Parts within this assembly will need to be repaired or replaced. They are outlined below.



*Sample picture of a Secondary Blower and its assembly

Secondary Blower

1. Air Proving Switch
2. Modutrol Motor
3. Motor Crank Arm
4. Damper Crank Arm
5. Rod
6. Damper

AIR PROVING SWITCH REPLACEMENT (6.3.4/01-001A & 02-001A)

1. Ensure all power is locked out.
2. Remove wiring from switch.
3. Remove tubing from switch.
4. Unscrew screws at the two locations and remove switch.
5. Reinstall new switch (PN: SML8221210034) complete with tubing and wiring and then retighten.
6. Turn power back on.

DAMPER CALIBRATION (6.3.4/01-001B & 02-001B)

Sometimes the damper linkage will slip when the connections become loose (Items 3,4,5 in the Secondary Blower photo) In order to ensure that the linkage is correctly calibrated the operator will need to look at the display screen on the control panel while the unit is in operation

1. Read the % Open value on the control panel operator interface (PanelView) for the Primary Blower.
2. During operation the damper is factory preset to be 0% open, or fully closed.
3. Look inside the damper (Item 6) and ensure that the linkage is completely closed.
4. If it is then this maintenance is complete.
5. Should the damper be open even a small percentage the linkages are to be loosened and the damper adjusted to be completely closed, and then retighten.

MODUTROL RESISTOR REPLACEMENT (6.3.4/01-001C & 02-001C)

The Modutrol resistors are located inside the top lid of the Modutrol motor. Remove the lid to the Modutrol motor by unscrewing the top four (4) screws. The connection between the control panel and the Modutrol is made with a small white connector with 3 terminals. Jumpered between these terminals is the resistors.

Remove and replace the resistors one at a time to ensure the correct resistors are replaced. You identify the correct resistor by examining the color band on the center node of the resistor. Replace like resistors.

DAMPER CRANK ARM REPLACEMENT (6.3.4/01-001D & 02-001D)

The crank arm will only need to be replaced if the arm is damaged due to misuse. Identify the damper crank arm (Item #4 in the picture on the previous page).

Identify the location of the linkage on the rod and the damper arm with a marker, so the new crank arm will be in the same spot when reinstalled. Remove the connections to the crank arm and replace with the new one (PN: 26026G) and ensure it is in the same spot as the old one.

MODUTROL MOTOR & TRANSFORMER REPLACEMENT (6.3.4/01-001F & 02-001F)

To replace the Modutrol motor all power needs to be off to the system as you will need to expose electrical connections. Firstly get the new motor and orientate the motor in the same direction as the old motor. Identify where the conduit is connected on the old motor and punch the connector holes for the new motor.

Removal

1. Remove all electrical terminations and remove the transformer.
2. Install the transformer in the new Modutrol motor.
3. Remove all conduit connections on the motor.
4. Remove the damper arm and linkage from the motor.
5. Unbolt the motor from the damper, and ensure all nuts and bolts are kept for the new motor install

Install

1. Bolt the new motor in the same orientation as the old motor.
2. Install the damper arm and linkage to the motor
3. Install all conduit connections

Terminate all electrical connections the same as the old motor.

REPLACE THE BLOWER CONTACTOR 6.3.4/01-001G

1. Turn the Main Disconnect Switch off.
2. Open Panel.
3. Remove the wires from M1.
4. Pull the retaining clip up.
5. Tilt contactor forward and remove.
6. To reinstall tilt new contactor (PN: 100-C09D10) until it clicks back in.
7. Pull the retaining clip back down to lock.
8. Reinstall wires to M1.
9. Close panel.
10. Turn power back on.

viii. Main Control Panel Corrective Maintenance Instructions

MAIN CONTROL PANEL (6.3.6/03-010A)

All control panel diagnostics are to be completed by certified or trained technicians. Electrical drawings / diagrams are provided to aid electricians with any diagnostics.

REBOOT PLC (6.3.6/03-010B)

Turn Main Disconnect to the off position on the front of the Control Panel. Turn the main disconnect back on.

SECTION 7

PARTS LIST

ECO WASTE SOLUTIONS

ECO 1.75TN 1PV100L Parts List

General Incinerator Components	Quantity		Part #	Supplier
Primary Door Bearings			F4B-E-200R DGE	Canadian Bearings Ltd.
Secondary Door Bearings	5		F4B-E-104R DGE	Canadian Bearings Ltd.
Stack Bearings	2		P2B-SC-100	Canadian Bearings Ltd.
Toggle Clamps US$	6		51335A66	McMaster-Carr
View Ports	5		P1030/8	Pegasus
Thermocouple	4		TA-A427A-K08B-010.0	Thermo-Kinetics Company Ltd.
Metal ash bins 2.5 yds with lid	2		JT-2.5-60-188	JT Fabrication Ltd..
Blower Assemblies	Quantity		Part #	Supplier
Primary Chamber Blower	1		BI10	Canarm
Secondary Chamber Blower w/flanges	1		BI13	Canarm
Modutrol	2		M9184D4009	Yorkland Controls Limited
Air Proving Switch	3		SML 8221210034	Yorkland Controls Limited
Primary Chamber Burner	Quantity		Part #	Supplier
Primary Burner RL 28/2	1		C9511200	Riello
Fuel Tank 4500l	1		6011000	Hassco Industries Inc.
Ktech 37.5" low level switch stainless steel	1		FS301SF-1 28"NC	Ktech Industrial Products Inc.
Diesel filter	1		VF1210	National Energy Equipment Inc.
5 micron pleated paper filter	2	KPP21005B		National Energy Equipment Inc.
High Output Used Oil Burner	Quantity		Part #	Supplier
Special 6514-8-A fireall dual fuel burner complete with refractory tile, standard capacity iron nose	1		6514-8-A/LX/1.0A-X13546	Fives North American Combustion
3/4" Pilot Set	1		4015-0-T	Fives North American Combustion
1/2" std regulator	1		7218-01	Fives North American Combustion
3/8" sensitrol oil valve	1		1813-02-D	Fives North American Combustion
1/2"dia. x 18" AOL; 1/2" mnpt connectors e/e; braided CGA approved and tagged	1		C8777-01/18-CGA	Fives North American Combustion
2" butterfly valve	1		1122-4	Fives North American Combustion
Gauge, 0 - 60" wc and 0 - 35 osi	2		8735-HI	Fives North American Combustion
8" wafer valve	1		1156-9	Fives North American Combustion
Control motor, 310 IN/LBS, 37 second timing,4-20 ma, no feedback signal, 1000 ohm potentiometer, 135 degree travel, 110-120VAC	1		1615-F	Fives North American Combustion
Bracket and Linkage for 1615-A through N, for 1136, 1146, and 1156-9 through -22	1		2-9004-205	Fives North American Combustion
Pressure switch, 12 - 60" wc	1		8757-GAO-A4/4/6	Fives North American Combustion
DIF. PRES. SW 1-20"W.C.AUTO.RST	1		C8757-DG50T-DIF	Fives North American Combustion
1/2" ball valve	4		C1821-01	Fives North American Combustion
1/4" ball valve	5		C1821-03	Fives North American Combustion
Pressure gauge, 2-1/2"; 0-60 psi/400 kPa, dual scale; liquid filled 1/4" bottom; SS case;	2		C8735-M-LF	Fives North American Combustion
1/2" pressure regulator	1		7142-01-25	Fives North American Combustion
1/2" relief valve	1		7177-01-75	Fives North American Combustion

Pressure switch #B424B range=0-100 psi	2	C8757-B424B-100	Fives North American Combustion
1/2" oil solenoid valve, NEMA 3R	1	1483-01	Fives North American Combustion
1/2" automatic reset oil shutoff valve 120/1/60	1	1517-01	Fives North American Combustion
1/4" Oil flow meter nickel-plated brass housing Buna o-ring 0.2-0.9 GPM SS orifice and spring vertical flow up	1	8598B-03-0.9-VU	Fives North American Combustion
1/2" ratiotrol with gauges	1	7052-01-WG	Fives North American Combustion
1/2" expansion chamber	1	C7000-0-HSR	Fives North American Combustion
3/4" regulator	2	C1485-01	Fives North American Combustion
Combution Blower -Chicago Blower	1	D53 E4	Canada Blower
Burner control	1	RM7895C1012	Yorkland Controls Limited
1" three way valve	1	4093T25	McMaster-Carr
1/2" three way valve	1	4093T23	McMaster-Carr
Used Oil Pump	1	03HB1131 code10/13	Albany Pump Company Ltd.
Basket suction strainer with 60 mesh	1	SBS-100	Albany Pump Company Ltd.
Ball Valve, 1” NPT, cUL Listed	1	BAVA-100	Albany Pump Company Ltd.
Relief Valve c/w WS spring (30-100 PSI)	1	FVJ-3R-SS	Albany Pump Company Ltd.
Pressure gauge, 4” Dial; liquid filled, 100 PSI	1	PG100LF-100	Albany Pump Company Ltd.
Compound Gauge;4" Dial; liquid filled; 30-0-30 PSI	1	CG100LF-30/30	Albany Pump Company Ltd.
Watson McDaniel size 3/4” Series ‘B’ pressure reducing valve	1	with Viton disc and diaphragm. 1-50 psig	Albany Pump Company Ltd.
Waste Oil ciculation heater with controller 600v. 3ph, 4687watts	1	CBLS747E13S	Hassco Industries Inc.
Transfer Pump	1	FR450B	National Energy Equipment Inc.
Oil Filter	1	VF1210	National Energy Equipment Inc.
5 micron pleated paper filter	2	KPP21005B	National Energy Equipment Inc.
Waste oil Tank 5000L	1	CUSTOMTANK	Hassco Industries Inc.
Level Switch	1	FS301SF-1 45”NC for 60 dia. tank	Ktech Industrial Products Inc.
Mixer	2	NP HGL-3.3	Metex Corporations
Waste oil totes IBC containment	2	H4435	ULINE CANADA CORPORATION
Waste oil totes IBC	2	H-3886	ULINE CANADA CORPORATION
Salt and/or sand box spillage kit	2	S18304	ULINE CANADA CORPORATION
Top Loading Package	Quantity	Part #	Supplier
Lid lifter HT 3500 Stoke 72"	1	9-LL-3500-72-BE-575	Canada Hydraulique Equipment Inc.
Lid Lifting Link Assembly	4	ECO5TN2PV-06-XX	P.D.S. WELDING LTD
Jaw Only 3/4" - 10 Right Hand Thread 12" max adj	4	3001T23	McMaster-Carr
18-8 Stainless Steel Clevis Pin, 3/4" Dia 2" L	4	92390A521	McMaster-Carr
Opacity Monitor	Quantity	Part #	Supplier
Compliance Opacity Monitoring System (EPA PS-1)	1	PN 80-0290	Akrulogic
Includes:			
Transceiver / Reflector			
Stack Mounting Flanges			
Local Control Panel			
1hp Air Purge Assembly			

-60C Air Purge Hose (2 pcs @ 20')	1	PN 80-3411 (Upgrade)	Akrulogic
Opacity Optic Head Extension Control Cable	1	PN 80-0297	Akrulogic
Scale	Quantity	Part #	Supplier
4 x 4 Scale w/ digital indicator, analog output and weather gland	1		Matrix Scale Service Inc.
Electrical	Quantity	Part #	Supplier
IEC 60 amp 600 volt rotary disconnect	1	GS2GU3N	Graybar
Disconnect operating handle	1	GS2AH420	Graybar
Operating shaft	1	GS2AE81	Graybar
175 amp power distribution block	1	PDB220-3	Graybar
175 amp power distribution block cover	1	CPB162-1	Graybar
Ground lug	1	LAMA2/0-14-QY	Graybar
600 volt 30 amp 3 pole class J fuse block	11	JT60030	Graybar
250 volt 30 amp 1 pole class RK1 fuse block	11	H25030-1CR	Graybar
600 volt 60 amp class J fuse	3	LPJ-60SP	Graybar
600 volt 17 amp class J fuse	3	LPJ-17SP	Graybar
600 volt 10 amp class J fuse	3	LPJ-10SP	Graybar
600 volt 7 amp class J fuse	8	LPJ-7SP	Graybar
600 volt 4 amp class J fuse	9	LPJ-4SP	Graybar
250 volt 30 amp class RK1 fuse	1	LPNRK-30SP	Graybar
250 volt 10 amp class RK1 fuse	1	LPNRK-10SP	Graybar
250 volt 6 amp class RK1 fuse	1	LPNRK-6SP	Graybar
250 volt 5 amp class RK1 fuse	2	LPNRK-5SP	Graybar
250 volt 2 amp class RK1 fuse	2	LPNRK-2SP	Graybar
250 volt 1 amp class RK1 fuse	4	LPNRK-1SP	Graybar
12 amp IEC contactor 120 VAC coil	1	LC1D12G7	Graybar
9 amp IEC contactor 120 VAC coil	6	LC1D9F7	Graybar
4 N.O. top mount auxilary contact	1	LADN40	Graybar
IEC solid state overload relay range 6.4- 32 a	1	LR9D32	Graybar
IEC solid state overload relay range 1.6-8 a	2	LR9D08	Graybar
IEC solid state overload relay range 0.2- 2 a	2	LR9D02	Graybar
16 amp SPDT slim line relay 120 VAC coil	10	RXG15F7	Graybar
Base slim line relay	10	RGZE1S35M	Graybar
8 PIN tube based relay 120VAC coil	10	RUMC23F7	Graybar
DPDT 8 PIN tube based relay base	10	RUZC2M	Graybar
600 to 120 VAC 3000 VA transformer	1	CE3000JA	Graybar
24 VDC 1.3 amp switching power supply	1	PS5R-SC24	SnS
5 port unmanaged ethernet switch US$99	1	SE-SW5U	Automation Direct
Current transducer US$75.5	1	ACT050-42L-F	Automation Direct
10.4" TFT touch panel with Intouch run time	1	TCND1U-10AC-CM2	Wonderware Canada East
600 volt 3 H.P. V.F.D.	1	ACS25-03U-04A1-6	Gerrie
480 volt 8 amp line reactor	1	3PR-004C5H	Graybar
0-1" H2O draft transmitter	1	616KD-00	Furneco
Ethernet PLC programing port	1	P-R2-F3R0	Gerrie

ECO WASTE SOLUTIONS

ECO 1.75TN 1PV100L Parts List

22mm Green illuminated push button operator	2	ZB5AW333	Graybar
22mm Emergency stop push button operator	1	ZB5AS844	Graybar
22mm 3 position return to center selector switch	1	ZB5AD5	Graybar
22mm Green flush push button operator	2	ZB5AA34	Graybar
22mm Black flush push button operator	2	ZB5AA24	Graybar
22mm Red extended push button operator	2	ZB5AL4	Graybar
Green integrated led module	2	ZBVG3	Graybar
N.O. contact block	5	ZBE101	Graybar
N.C. contact block	3	ZBE102	Graybar
Limit switch	4	802T-AP	Gerrie
Limit switch lever	4	802T-W2B	Gerrie
18 mm AC inductive proximity switch US$31	2	VK1-AO-1B	Automation Direct
Pt100 RTD for cold junction compensation	1	TFD	Omega
Unity CPU cw 1 Enet port and 1 serial port	1	BMXP342020	Graybar Canada Inc.
8 Slot Backplane	1	BMXXBP0800	Graybar Canada Inc.
110Vac Power supply	1	BMXCPS2000	Graybar Canada Inc.
16 point 120 vac input module	2	BMXDAI1604	Graybar Canada Inc.
8 channel analog input module	1	BMXAMI0810	Graybar Canada Inc.
4 channel thermocouple input module	1	BMXART0414	Graybar Canada Inc.
16 point relay output module	1	BMXDRA1605	Graybar Canada Inc.
4 Channel analog output module	1	BMXAMO0410	Graybar Canada Inc.
Connectors for all modules except AMI0810 and ART0814	4	BMXFTB2000	Graybar Canada Inc.
Connector for AMI080	1	BMXFTB2800	Graybar Canada Inc.
Connector	1	BMXFCW301S	Graybar Canada Inc.
IEC solid state overload relay range 0.2- 2 a	1	LR9D02	Graybar
1hp VFD ABB	1	ACS250-03U-02A1-6	Gerrie
1hp line reactor	1	REX3PR0002C5H	Graybar Canada Inc.
Type K Thermocouple 20AWG	300	K-20S-TT	Thermo-Kinetics Company Ltd.

AGNICO EAGLE

MELIADINE GOLD PROJECT

Landfarm Management Plan

March 2018
Version 3
6513-MPS-15

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ᐊᒡᓃᑯᒃᑯᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒨᓗᒧᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᐱᕙᓪᓕᐊᓂᖃᖅᑐᑦ, 25 ᑭᓵᒥᑕᓪᓗᐊᓂᒃ ᐅᐊᖕᓇᖕᒐᓂᑦ ᑲᖏᖅᖢᓂᕐᒥᑦ ᐅᖕᒐᓯᒃᑎᕆᔪᖅ, ᐊᒻᒪᓗ 80 ᑭᓵᒥᑕᓪᓗᐊᓂᒃ ᓂᕆᖅᐸᓯᐊᓂᑦ ᐱᖕᒐᖕᓇᖅᐸᓯᐅᓂᑦ ᐃᒡᓗᓕᒑᕐᔪᖕᒥᑦ ᐅᖕᒐᓯᒃᑎᕆᔪᖅ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᓗᒍ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᐅᓂᐊᖅᑐᖅ ᐱᕙᓪᓕᐊᓗᒍ ᑎᕆᒐᓂᐊᖅ ᒨᓗᑕᓕᒃ, ᒪᕐᕉᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔫᓗᑎᒃ (ᑎᕆᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔪᖅ 1 ᐊᒻᒪᓗ ᑎᕆᒐᓂᐊᖅ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖕᒐᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᖅ.

ᑖᓐᓇ ᑎᑎᖅᑲᖅ ᑕᒃᑯᔅᓴᐅᑎᑦᑎᔪᖅ ᐊᒃᑕᑯᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᒃ ᐱᓕᕆᐊᕐᒧᑦ ᐊᒻᒪᓗ ᐋᖅᑭᒃᓯᐸᓗᓂ ᐃᓚᒋᔭᐅᔪᖅ ᑎᑎᖅᑲᓕᕆᓂᕐᒧᑦ ᐱᔭᐅᔪᖅ Type “A” ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᒥᒃ ᑐᒃᓯᕋᐅᑎᒧᑦ. ᑖᓐᓇ ᐸᕐᓇᐅᑎ ᐅᖃᐅᓯᖃᖅᑐᖅ ᐋᖅᑭᐅᒪᓂᕆᔭᖕᒋᓐᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓂᒃ ᐊᒃᑰᖅᑕᐅᔪᑦ ᐃᓂᒋᓂᐊᖅᑕᖕᒐᓄᑦ ᓴᓇᔭᐅᓂᐊᖅᑐᖅ ᐱᓕᕆᐊᕐᒥᑦ ᑕᐃᑯᙵᖅᑕᐅᓂᐊᕐᓗᑎᒃ ᐱᓕᕆᐊᖑᓗᑎᒡᓗ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐱᔪᓂᒃ ᐱᐅᖏᑦᑐᖅᑕᖅᑐᑦ.

ᐃᓂᐅᔪᒥᑦ ᑐᖅᑯᖅᓯᓂᖅ ᐊᒻᒪᓗ ᓄᑖᙳᖅᑎᑦᓃᑦ ᐊᑐᖅᑕᐅᖕᒌᕈᒪᔪᖅ ᐱᓕᕆᐊᕆᓂᐊᕐᓗᒋᑦ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐱᐅᖏᑦᑐᖅᑕᖅᑐᑦ ᐱᔭᐅᔪᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᕕᐅᔪᒪᔪᒥᑦ. ᐊᒃᑕᑰᖅᑕᐅᔪᓄᑦ ᐃᓂᐅᔪᖅ ᐋᖅᑭᒃᓯᒪᔪᖅ ᐃᐸᔪᓂᒃ, ᐅᔭᖅᑲᓂᒃ, ᐊᐳᑎᒥᒃ, ᐊᒻᒪᓗ ᓯᑯᒥᒃ ᐱᐅᖏᑦᑐᖅᑕᖃᖅᑐᓂᒃ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐱᖃᑦᑕᕐᓂᐊᕐᓗᓂ. ᐃᓚᐅᓂᐊᖅᑐᑦ ᐱᐅᖏᑦᑐᖅᑕᖄᕐᔪᒃᑐᑦ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐊᒻᒪᓗ ᐅᖅᓯᕐᒥᑦ ᐱᓕᕆᐊᖑᔪᑦ ᐊᒃᑕᑯᖃᕐᕕᖕᒥᑦ.

ᐊᒃᑕᑰᕐᕕᒃ ᐃᓂᒌᑦᑐᖅ ᐱᕐᑯᑎᖅᑲᕐᕕᐅᑉ ᓯᓚᑎᐊᕐᔪᐊᓂᑦ, 200 ᒦᑕᓪᓗᐊᓂᒃ ᐅᖕᒐᓯᒃᑎᕆᔪᖅ ᑲᑎᖅᓯᐃᕝᕕᐅᔪᖅ ᑕᓯᕋᔭᒃ 1-ᒥᑦ (CP1). ᐊᒃᑕᑰᕐᕕᒃ ᓂᕈᐊᖅᑕᐅᓚᐅᖅᑐᖅ ᒥᑭᓵᒃᑯᖕᒐᑎᑦᑐᒪᓪᓗᒍ ᐃᓂᐅᔪᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐊᒻᒪᓗ ᐊᒡᔭᖅᑐᖅᑕᐅᔪᓂᒃ ᐅᖕᒐᓯᒃᑎᕆᓂᖕᒐᓄᑦ ᐱᐅᖏᑦᑐᖅᑕᓕᖕᓂᑦ ᑯᕕᔪᖃᕋᔭᖅᐸᑦ. ᐊᒃᑕᑰᕐᕕᒃ ᓂᕆᐅᒋᔭᐅᔪᖅ ᐱᓕᕆᐊᖃᖃᑦᑕᕐᓂᐊᕐᓂᖕᒐᓄᑦ 5,000-ᓗᐊᓂᒃ ᑭᐅᐱᒃ ᒦᑕᓂᒃ ᐱᐅᖏᑦᑐᖅᑕᓕᖕᓂᑦ ᓴᓇᔭᐅᑎᓪᓗᒍ, ᐊᐅᓵᖅᑎᑦᑎᓂᕐᒥᑦ, ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᑎᓪᓗᒍ ᐱᓕᕆᐊᖅ, ᐊᒻᒪᓗ 500 ᑭᐅᐱᒃ ᒦᑕᓂᒃ ᐊᐳᑎᒥᒃ ᓯᑯᒥᓪᓗ ᐊᕐᕋᒍᑕᒫᖅ. ᐃᒻᒥᖅᐸᓪᓕᐊᓂᖅ ᐊᒃᑕᑰᕐᕕᖕᒥᑦ ᑯᕕᑎᑕᐅᔾᔮᙱᑦᑐᖅ ᓯᓚᒧᑐᐃᓐᓇᖅ. ᑲᑎᑕᐅᓂᐊᖅᑐᖅ CP1-ᒧᓪᓗ ᑯᕕᑎᑕᐅᓗᓂ ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ. ᐊᒃᑕᑰᕐᕕᒃ ᐃᓗᐹᕈᑕᖅᑲᕐᓂᐊᖅᑐᖅ ᐊᒻᒪᓗ ᐊᒃᑐᖅᓯᓂᖅᑲᕐᓂᐊᕐᓂᖕᒐᓄᑦ ᓂᕆᐅᒋᔭᐅᙱᖅᓱᓂ ᓄᓇᒥᑦ ᐃᒪᕐᒥᑦ.

ᐅᓂᑉᑳᓕᐅᖅᑕᖅᑲᕐᓂᐊᖅᑐᑦ ᐊᒃᑐᑰᕐᕕᖕᒥᑦ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᑦ ᐊᕐᕌᒍᑕᒫᒃᑯᑦ ᐊᕙᑎᓕᕆᔨᒃᑯᓐᓄᑦ, ᓇᓗᓇᐃᕐᓗᑎᒃ ᖃᓄᑎᒋᐅᓂᖕᒥᑦ ᐃᓚᔭᐅᔪᑦ ᐊᒃᑕᑰᓇᕝᕕᖕᒧᑦ, ᖃᓄᑎᒋᐅᓂᖕᒥᑦ ᐊᑐᖅᑕᐅᔪᑦ ᐲᖅᑕᐅᓂᖕᒥᑦ ᐊᒻᒪᓗ ᐊᒃᑕᑰᖅᑕᐅᓂᖕᒥᑦ ᐅᕙᓘᓐᓃᑦ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕐᓂᖕᒐᓄᑦ ᐃᓂᐅᔪᖅ, ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᖕᒐᓂᐅᔪᓗᒃᑖᑦ, ᖃᓄᑎᒋᐅᓂᖕᒥᑦ ᐊᒻᒪᓗ ᖃᓄᐃᑦᑑᓂᖕᒥᑦ ᐃᓚᔭᐅᔪᑦ, ᑕᒃᑯᔅᓴᐅᔪᒃᑯᑦ ᖃᐅᔨᓴᐃᓂᕐᒧᑦ ᖃᓄᐃᖕᒐᓂᐅᔪᑦ, ᐊᒻᒪᓗ ᖃᓄᑎᒋᐅᓂᖕᒥᑦ ᑯᕕᔭᐅᔪᑦ ᐃᒪᖅ ᐊᑐᖅᑕᐅᓯᒪᔪᑦ.

ᐱᐅᖏᑦᑐᖅᑕᖅᑐᑦ ᐅᖅᓱᐊᓗᖕᒥᑦ ᐱᔪᓂᒃ ᓇᓚᐅᑦᑖᕐᓂᖅᑲᐊᖅᑲᕐᓂᐊᖅᑐᑦ ᐱᖕᒐᓯᓂᑦ ᐊᐅᔭᓗᒃᑖᕐᒧᑦ ᓄᑖᙳᖅᑎᑦᑎᐊᕐᓂᐊᕐᓗᒍ. ᓄᑖᙳᖅᑎᖅᑕᐅᒃᐸᑦ, ᐃᐸᔪᐃᑦ ᐲᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᒃᑕᑰᕐᕕᖕᒥᑦ ᐊᒻᒪᓗ ᐊᑐᖅᑕᐅᔪᖕᓇᕐᓂᐊᕐᓗᑎᒃ ᓴᓇᕙᓪᓕᐊᓂᕐᒧᑦ ᓱᕐᓗ ᐃᓚᒋᔭᐅᓗᑎᒃ ᖄᓂᔭᐅᓂᐊᕐᓗᓂ ᕿᒪᒃᑎᑦᑐᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᖕᒧᑦ ᐅᕙᓘᓐᓃᑦ ᑲᑎᑕᐅᓗᑎᒃ ᐊᒃᑕᑰᖅᑕᐅᔪᓄᑦ ᐅᔭᖅᑲᓂᒃ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᖕᒧᑦ.

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

This document presents the Landfarm Management Plan for the Project and forms a component of the documentation series produced for the Type A Water Licence Application. The Plan describes the design features and operational procedures for the landfarm to be constructed at the Project for the storage and treatment of petroleum hydrocarbon contaminated soils.

On-site storage and remediation has been established as the preferred method for treatment of light petroleum hydrocarbon contaminated soil that may be generated on the proposed mine site. The landfarm is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline being treated in the landfarm.

The landfarm is located just off the infrastructure pad, approximately 200 metres from Collection Pond 1 (CP1). The central location of the landfarm was chosen to minimize the footprint of the site and the transport distance of contaminated material from potential spill locations. The landfarm is expected to effectively treat up to 5,000 cubic metres of contaminated soil over the construction, operations, and closure of the Project, and 500 cubic metres of snow and ice annually. Water accumulating in the landfarm will not be discharged directly to the receiving environment. It will be collected and directed to CP1 for treatment. The landfarm will have an impervious liner and no impacts on shallow groundwater are anticipated.

A report of landfarm activities will be prepared annually by Environment Department, indicating the volume of material added to the facility, amount of material removed and disposal or re-use location, all analysis results, volume and type of nutrient addition, visual inspection results, and volume of contact water pumped.

Soils contaminated with light end petroleum hydrocarbons will require an estimated three full summer seasons for complete remediation. When remediated, the soils will be removed from the facility and can be used for construction purpose such as part of the cover of the Tailings Storage Facility or stacked in the Waste Rock Storage Facility.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	April 2015			First version of the Landfarm Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	February 2018	Figure 2-1	5	- "Main Infrastructure for the Meliadine Project, including the Landfarm" - figure added to figure reference	Meliadine Environment Department
		3.1	9	- Antifreeze removed from list of acceptable contaminates for landfarm disposal	
		2.1	3	-Approximate volume of material adjusted to 700 m3	
		1.3	2	- Updated Oil Pollution Emergency Plan revision date and version	
		All	All	-General review and revision	

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
BTEX	benzene, toluene, ethylbenzene, and xylene
CP1	Collection Pond 1
GN	Government of Nunavut
NWB	Nunavut Water Board
PHC	Petroleum hydrocarbons
Project	Meliadine Gold Project
RMMS	Responsible Mining Management System
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility

SECTION 1 • INTRODUCTION

1.1 Project History

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the proposed Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

The Landfarm Management Plan (Plan) focuses on minimizing the waste footprint on-site, and maximizing remediation potential through implementation of bioremediation experience and research carried out at the Agnico Eagle's Meadowbank Gold Mine.

During the advanced exploration phase of the Project, the Nunavut Water Board (NWB) approved amendment #6 to Water Licence 2BB-MEL1424, which allowed the operation of light PHC soil stockpile. This approval supported using a landfarm developed inside a bermed and lined area previously used to store fuel bladders. Soil contaminated with light PHC is being deposited in this bermed and lined area for treatment. To date, there is approximately 420 cubic metres (m^3) of contaminated soil being treated. This quantity resulted from inadvertent spills that occurred during the advanced exploration phase of the Project. Some or all of this material will be transferred to the landfarm for the proposed mine upon its completion and commissioning.

When possible, materials contaminated with heavy hydrocarbons (e.g., hydraulic fluid or grease), are to be segregated, packaged, and shipped south for treatment and/or disposal.

1.2 Objectives

On-site storage and remediation has been established as the preferred method for treatment of light PHC contaminated soil that may be generated at the proposed mine. Specifically, remediation through landfarming has been identified as the primary treatment option and, as such, is the focus of this contaminated soil management plan. A pilot project to enhance rates of bioremediation through addition of a nutrient source is being carried out at Meadowbank and will be employed at the Project

should it prove successful. Alternate contingency options in the event that landfarming is not successful or as efficient as planned are also discussed.

This Plan is a component of the Responsible Mining Management System (RMMS)[1]. The objectives of this Plan are to:

- provide an overview of contaminated soil management at the Project;
- describe the physical setting, location, and design criteria of the landfarm;
- define acceptable types of contaminated soils to be placed in the landfarm and conditions for removal of treated soil;
- define operating procedures and monitoring requirements for the landfarm; and
- describe contingency options for alternate treatment/storage of PHC contaminated soil.

1.3 Related Documents

Spill prevention is the first stage in contaminated soil management at the Project. Documents containing information related to this Plan and submitted as part of the Type A Water Licence Application include:

- Spill Contingency Plan;
- Environmental Management and Protection Plan; and
- Risk Management and Emergency Response Plan.

There is also a related Oil Pollution Emergency Plan (Agnico Eagle 2018), which is specific to spills at Agnico Eagle's Itivia Oil Handling Facility located in Rankin Inlet. The Oil Handling Facility is located on the shore of Melvin Bay, which is part of Hudson Bay. The Oil Pollution Emergency Plan was prepared as a requirement of *Canadian Shipping Act* and associated regulations. It will be submitted to Transport Canada for approval prior to any shipping related to the development of the proposed mine.

1.4 Spill Prevention

Similar to the waste management philosophy, plans are to actively work towards minimizing spills through suitable work procedures. Plans developed from the environmental impact study address the management of spills on land, ice, water, and into the marine environment. When spills do occur, the goal is to limit the spread of the spill, and then manage contaminated material resulting from the spill. The Spill Contingency Plan describes spill prevention measures.

[1] The RMMS is described in the Environmental Management and Protection Plan.

SECTION 2 • LANDFARM DESIGN

2.1 Background

In the event of a spill, on-site storage and remediation is the most practical and efficient method in handling contaminated soil, particularly in an isolated location such as the Project. Any PHC contaminated soils generated during the construction, operation, and closure phases will be adequately managed. Soils contaminated with light PHCs, such as diesel, will be treated on-site in a landfarm. This method involves spreading, mechanical mixing, and placing the contaminated soil in windrows within a containment area and promoting conditions favorable for the volatilization and aerobic microbial degradation of hydrocarbons.

When possible, materials contaminated with heavy hydrocarbons (e.g., hydraulic fluid or grease), are to be segregated, packaged, and shipped south for treatment and/or disposal.

There are currently PHC contaminated soils, totalling approximately 2900 m³, stored on-site in two landfarms resulting from spills that occurred during the exploration and construction phases. This volume has been accounted for in the design of the facilities.

A landfarm options analysis prepared for Agnico Eagle by Golder (2007) identified factors relevant to landfarming in the north. This include environmental factors and physical properties of the soil that affect microbial growth and rates of biodegradation, including temperature, pH, soil moisture, nutrient content, salinity, and soil particle size.

Although rates of biodegradation decline with temperature, landfarming is still a feasible technique in Arctic climates as demonstrated by the Meadowbank landfarm. Degradation in the north is typically restricted because microbial activity stops between 0 to -5 degrees Celsius (°C) restricting biodegradation to the months of June to September[2]. Nevertheless, degradation was reported at 90% over two summers on Resolution Island (Paudyn et al. 2008).

The landfarm design was based on the design and operation of the Meadowbank landfarm (Tetra Tech EBA 2014). At the Meadowbank mining operation, it was estimated during the design phase of the landfarm that the volume of PHC soils would be between 300 and 350 m³ per year (Agnico Eagle 2008). Therefore, the landfarm at the proposed mine has been designed assuming that 350 m³ per year of PHC soils will need to be managed for the construction, operations, and closure of the Project. Similar to the Meadowbank landfarm, it was assumed that a yearly volume of 500 m³ of contaminated ice and snow would require management and the landfarm has been designed to account for this volume.

It is estimated that soils contaminated with light end PHCs would require three full summer seasons for complete remediation. When remediated, the soils will be removed from the facility and can be

[2] Even though bioremediation ceases below -5°C, volatilization of the PHCs does continue but at a much slower rate.

used for construction purpose such as part of the cover of the Tailings Storage Facility (TSF) or stacked in the Waste Rock Storage Facility (WRSF). Based on a remediation period of three seasons, it would be possible to close the landfarm facility on three years after the end of the process plant operation.

2.2 Location

The overall site plan showing the main infrastructure for the Project, including the landfarm, is shown in Figure 2-1. The area has no exposed bedrock and up to 20 metres (m) of glacial-fluvial till that has little ground ice and shows no permafrost degradation. The central location of the landfarm was chosen to minimize the footprint of the site and the transport distance of contaminated material from potential spill locations. The management of all waste generated at the Project in the form of dry stack tailings, waste rock, incinerator, and landfill waste are located in close proximity to the main infrastructure.

2.2.1 Proximity of Surface Water

The landfarm is located just off the infrastructure pad, approximately 200 m from Collection Pond 1 (CP1). The landfarm is to be located on land that slopes towards the southwest corner, which results in any rainwater or snowmelt draining to temporary water storage having the capacity to store a 1:100 wet year spring freshet plus 500 m^3 of water from melting of the contaminated snow/ice. Drainage from the landfarm may be used as water in the turning of the windrows during the remediation process. Excess water is collected within a sump inside the landfarm and will be pumped to an oil pre-treatment plant to remove any oil. The pre-treated water will then be discharged into the CP1. Discharge from CP1, is controlled by a dike, which stops direct flow to Meliadine Lake. Meliadine Lake is the source of freshwater for the site and is used by Inuit for traditional pursuits. If water is to be discharged from CP1 to Meliadine Lake, it is treated to meet discharge criteria. Except for a short duration during the spring freshet or a heavy rainfall, water ponding will be eliminated in the landfarm by the end of the summer such that a sufficient storage capacity is available for the upcoming spring freshet.

Figure 2-1 Landfarm Site Location Plan

2.2.2 Proximity of Groundwater

In the Project area, the groundwater within the active layer is estimated to reach 1.5 m in October. The active layer begins to form in July when temperatures largely remain above 0°C, and deepens to a maximum in October. Shallow groundwater flow in the area of the landfarm is towards the industrial site.

To prevent movement of contaminants from the landfarm facility into groundwater and the surrounding environment, Environment Canada (SAIC 2006) recommends implementation of a barrier with 10^{-7} centimetres per second hydraulic conductivity at a thickness of 0.6 m. The Meliadine landfarm will have an impervious liner and no impacts on shallow groundwater are anticipated.

2.3 Design

The landfarm is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline. The design volume of the landfarm is based on allowances for the materials being treated at Meadowbank.

The average floor slope is 3.1% going in the designed direction of northwest to southeast, matching the natural ground slope. This slope is still adequate allowing leachate/drainage from the PHC soils and internal runoff to gradually seep through the filter berm into the sump area. The water collected in the sump will be pumped to the oil separator for oil removal before being discharge into CP1. The sump area was built as per design capacity.

The geomembrane liner crest elevation was installed at an elevation of 74.80 m, it does allow for 0.45 m of freeboard before reaching the geomembrane liner crest elevation.

2.3.1 Soil Volume Requirements

The landfarm is expected to effectively treat up to 5,000 m^3 of contaminated soil over the construction, operations, and closure of the Project, and 500 m^3 of snow and ice annually. Based on the experience at Meadowbank, the volume of PHC would be approximately 350 m^3 per year during construction, operation, and closure phases. Table 2-1 outlines the estimated volumes of contaminated soils and rock, and contaminated snow and ice expected during each phase of the mine.

Table 2-1 Estimated Volume of Petroleum Hydrocarbon Contaminated Soil and Ice/Snow to be Managed

Project Phase	Volume of PHC Soil/Rock (m^3)	Annual PHC Snow/Ice (m^3)
Advanced exploration	2,209 (volume in exploration landfarm to date)[(a)]	500 per year
Predevelopment (2 years)	350 (175 per year)	
Construction (3 years)	1,050 (350 per year)	
Operations (7 years)	2,450 (350 per year)	
Closure & Reclamation (2 years)	700 (350 per year)	
Total	**4,970**	

[(a)] The contaminated soil in the advanced exploration landfarm will be transferred to the mine landfarm upon its completion and commissioning.

As described in (Agnico Eagle 2008), it is estimated that soils contaminated with light end PHCs would require three full summer seasons for complete remediation. When remediated, the soils will be removed from the landfarm and used on-site, placed in a WRSF or used as cover at the TSF.

2.3.2 Design Specifications

The design criteria for the landfarm are outlined in Table 2-2. Its footprint will be approximately 11,000 square metres (m^2), with a perimeter berm that is approximately 2.0 m high over the landfarm surface. The geometry of the characteristics of the landfarm are shown in Table 2.2.

Table 2.2 Geometry and Characteristics of the Landfarm

Item	Actual
Dimensions of Perimeter Berm Crest Exterior (avg.)	86.8 m x 68.4 m
Dimensions of Perimeter Berm Crest Interior (avg.)	74.4 m x 53.3 m
Side Slopes of Perimeter Berm (avg.)	1V:2.5H (40%)
Perimeter Berm Crest Width (avg.)	3.5 m
Perimeter Berm Height (Min. to Max.)	1.4 m to 5.2 m
Perimeter Berm Crest Elevation (avg.)	75.25 m
Dimensions of Filter Berm Crest Interior (avg.)	19.0 m x 12.0 m
Side Slopes of Filter Berm (avg.)	1V:1.5H (67%)
Filter Berm Crest Width (avg.)	1.0 m
Geomembrane Liner Crest Elevaton	74.80 m
Interior Floor Slope (avg.)	-3.1% (NW to SE)
Fill Thickness Above Original Ground for Inside Base/ Sump Area (Min.)	1.52 / 1.48 m
Fill Thickness Above Liner	0.5 m
Inside Base Surface area Including Sump Area	3,794 m²
Sump Surface Area	10,040 m²

Table 2-3 shows the growth and stabilization of the volume of PHC considering remediation over three years and the maximum volume of contaminated material that is anticipated to be stored over a period of 13 years.

The size of the landfarm was based on the design criteria (Table 2-2), the estimated volume of material (Table 2-3), and the requirement to turn over the surface of the piles during the summer months. The designed footprint of the landfarm is 11,000 m² with a useful landfarm surface of 3,650 m². Contaminated material will be piled 1.5 m so that the material is below the crest height of the perimeter berm. At the maximum estimated capacity of the facility, three windrows having each 890 m³ of PHC will cover 1,800 m² allowing 1,850 m² for turnover and water management.

Table 2-3 Volume of Petroleum Hydrocarbon Contaminated Material in the Landfarm

Mine Year	Estimated PHC Produced (m^3)	Accumulated PHC in Landfarm for Remediation (m^3)	Treated PHC Removed from Landfarm (m^3)	Hydrocarbon Contaminated Snow or Ice to Landfarm (m^3)	Maximum Accumulated PHC in Landfarm (m^3)
Before -6	420			0	0
-6 and -5	350			0	0
-4	350			0	0
-3	350	1,470		500	1,970
-2	350	1,820		500	2,320
-1	350	2,170		500	2,670
1	350	1,400	1,120	500	1,900
2	350	1,400	350	500	1,900
3	350	1,400	350	500	1,900
4	350	1,400	350	500	1,900
5	350	1,400	350	500	1,900
6	350	1,400	350	500	1,900
7	350	1,400	350	500	1,900
8	350	1,400	350	500	1,900
9	0	1,050	350	0	1,050
10	0	525	525	0	525
11	0	0	525	0	0

SECTION 3 • LANDFARM OPERATION AND MANAGEMENT

Agnico Eagle will be responsible for managing and implementing the landfarm operation plan. Operation and monitoring of the landfarm as well as designation of training requirements will be the responsibility of the Environment General Supervisor and Coordinators.

3.1 Acceptable Landfarm Material

3.1.1 Contaminants

The landfarm facility will only treat and/or store light PHC contaminated soils that have been generated through mine related activities at the Project and that transferred from the Project's advanced exploration camp landfarm upon closure. Material from the Hamlet of Rankin Inlet or other sites will not be accepted without approval from the NWB, Aboriginal Affairs and Northern Development Canada, Water Resources Inspectors, and the Kivalliq Inuit Association.

The following products are acceptable for treatment in the landfarm if used on-site and spilled on soil:

- diesel fuel;
- gasoline;
- aviation fuel (Jet A);
- hydraulic oil;
- other light oil (e.g., engine oil, lubricating oil);

In the event that the contaminant source is unknown, soil samples will be analyzed for PHCs and possibly additional contaminants prior to placement in the landfarm. These additional parameters could include total metals, oil and grease, and volatile organic compounds. Analysis for additional compounds will be determined by the Environment Department on a case-by-case basis. Concentrations of contaminants will be compared to the site background values (for metals) and/or criteria in the Government of Nunavut (GN) *Guidelines for Contaminated Site Remediation* (GN 2009). If this analysis indicates soil contamination above background or GN guidelines for any substance not approved for landfarming (i.e., non-PHC contaminants), the spill material will not be placed in the landfarm. This is to ensure that PHC contaminated soils are not contaminated with other products.

Spills of non-PHC material (e.g., solvents) will be placed in drums and stored on-site for shipment south to approved facilities during shipping season.

3.1.2 Grain Size

Bioremediation of very coarse-grained larger soil material is inhibited as it does not readily retain moisture. However, volatilization will occur more rapidly (SAIC 2006). It has been noted that this material likely contains lower concentrations of contaminants due to a lower volume: surface area ratio, and can typically be screened out prior to landfarming (SAIC 2006). As a result, soils and rock

material with grain size less than 2.5 centimetres (cm) will be separated from larger-grained material, where possible. This will occur at the spill location or in the landfarm using a screen sieve, should it prove necessary. The two soil fractions will be treated separately in the landfarm.

3.2 Contaminated Soil Additions

3.2.1 Spill Excavation

Soil contaminated with the above-described petroleum hydrocarbon materials will be excavated and transported to the landfarm facility in dump trucks Care will be exercised to ensure that the entire spill is excavated (verified by olfactory and visual assessment, or sampling if necessary) and that none of the contaminated material is lost during transport.

3.2.2 Placement in the Landfarm

As above, larger coarse material (rocks) will be separated from the finer material (sand and gravel) in the landfarm and assessed visually for PHC staining and product. If the material is saturated it will be spread to allow volatilization in the designated area of the landfarm.

Materials identified as acceptable in the landfarm will be placed in windrows with dimensions about 18 m wide at base x 1.5 m high x 34 m long. Windrows may be piled wider, higher, or longer as space permits. A record will be kept by the on-site Environmental Coordinator of the amount of contaminated soil placed in the landfarm and the location of each load within it.

3.2.3 Decontamination of Soil Movement Equipment

The decontamination of soil movement equipment is outlined in the separate procedure, included as the Appendix A to this Management Plan.

3.3 Contaminated Snow

Petroleum hydrocarbon contaminated snow and ice will be placed in a designated area of the landfarm and treated as contact water after snowmelt. After snowmelt, the contaminated water will accumulate in the landfarm sump and be pumped through the site's oil-water separator to remove PHC residue. The treated water will be discharged to the CP1.

3.4 Remediation

Remediation of fine grained PHC contaminated soil in landfarms occurs naturally through volatilization and aerobic microbial degradation. Soil aeration and nutrient amendment are recognized as methods of improving rates of remediation. Agnico Eagle commissioned the National Research Council Canada to undertake the bioremediation research study to optimize the biodegradation process. Agnico Eagle will look at increasing biodegradation rates through potential opportunities such as nutrient amendment.

3.4.1 Absorbent Materials

Coarse-grained soils are not readily bio-remediated, but concentrations of PHC contaminants may still be reduced through volatilization. Oil absorbent pads will be used to help remove visible product from coarse-grained material.

3.4.2 Aeration

To promote aerobic conditions throughout the windrows, soil will be mixed mechanically with earth-moving equipment. This turnover of soil piles will occur two to four times per year, during the summer months.

3.4.3 Soil Moisture

Prior to turning, site personnel will ensure that soil is not so dry as to generate significant dust, nor overly saturated. If soil is too dry, non-contaminated water from within the landfarm containment area will be used as a moisture source and sprayed on the piles. If no accumulated water is available, water from CP1 or freshwater will be used. If the windrows are saturated, aeration will be delayed until the moisture content is reduced.

3.4.4 Nutrient Amendment

The use of sewage sludge as a nutrient amendment has precedent in the north. Sewage sludge as a nutrient source has also been proposed for the Milne Inlet Mary River Project (EBA 2010). This material not only provides the benefit of nutrients, but also adds organic matter to help retain moisture and microorganisms. Furthermore, the use of sewage sludge produced on-site helps to reduce the waste footprint of the mine by re-directing this material from disposal facilities and avoids needing to import a chemical fertilizer. The use of sewage sludge or another recommended nutrient amendment will be considered for optimization of biodegradation.

3.5 Removal of Soil From the Landfarm

3.5.1 Government of Nunavut Remediation Guidelines

The following parameters will be measured and compared with the GN industrial remediation criteria to determine whether PHC contaminated soil has been adequately remediated:

- benzene, toluene, ethylbenzene and xylene (BTEX); and
- petroleum hydrocarbon fractions 1 - 4.

The GN remediation criteria are characterized for agricultural/wildlife, residential/parkland, commercial, and industrial land uses. At the Project, remediation to agricultural/wildlife criteria is targeted; however, if these criteria cannot be met, industrial criteria will be followed.

The GN remediation criteria for coarse-grained soils will be applied. Table 3-1 presents the applicable Tier 1 criteria for coarse-grained soil, assuming agricultural/wildlife or industrial land uses.

Table 3-1 Summary of Relevant GN Tier 1 Soil Remediation Criteria for Surface Soil (mg/kg)

	Land Use Criteria (mg/kg)	
	Agricultural/Wildlife	**Industrial**
Benzene	0.03	0.03
Toluene	0.37	0.37
Ethylbenzene	0.082	0.082
Xylene	11	11
PHC Fraction 1	30	320
PHC Fraction 2	150	260
PHC Fraction 3	300	1,700
PHC Fraction 4	2,800	3,300

mg/kg = milligram per kilogram

3.5.2 Sampling and Analysis

Landfarm windrows will be sampled annually at the end of the summer season to determine if remediation objectives have been met. Representative composite samples will be taken of each windrow to estimate remaining PHC concentrations. For each 10 m of windrow length, one composite sample will be collected, each consisting of three surface sub-samples and three sub-samples at 1 m depth. Sub-samples will be taken approximately 3.3 m apart, and will be taken from both sides of the windrow. Sampling QA/QC measures will include collection of 1 duplicate per 10 samples.

After two seasons of treatment in the landfarm, degradation rates will be assessed to estimate the total remediation time required for PHC contaminated soil under these conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above. If rates of degradation are not sufficient through this method, alternate options will be further investigated as described in Section 4.2.

3.5.3 Soil Removal

Coarse-grained soils will be assessed near the end of the summer season by Environment Department technicians for PHC product and odour. Based on the experience learned at Meadowbank, Agnico Eagle is confident that confirmatory sampling and laboratory analysis is not required prior to removing coarse-grained soil from the Landfarm. Observations show that volatilization of PHCs from coarse-grained soil occurs more rapidly than biodegradation. It has been noted that this material likely contains lower concentrations of contaminations due to a lower volume: surface area ratio, and can typically be screened out prior to landfarming. Thus, the use of a photoionization detector (PID) is sufficient to confirm material is in a suitable state to be removed from the landfarm When PHC odours are no longer detected, the material will be removed to waste rock storage facility or at the TSF to be used as cover material.

When sample analysis of fine-grained material at the end of a season indicates that concentrations of contaminants are below GN guidelines, a soil pile or the appropriate section of a pile will be deemed acceptable for removal from the facility. Interim monitoring may be conducted through measurements of headspace with a portable instrument (e.g., flame ionization detector), but samples will be confirmed by an accredited laboratory prior to soil removal.

When remediated, the soils will be removed from the facility and can be used for construction purpose such as normal overburden (i.e., part of the cover of the TSF) or stacked in the WRSF. Based on a remediation period of three seasons, it would be possible to close the landfarm facility three years after the end of the process plant operation.

3.6 Water Management

Since the landfarm facility is uncovered to facilitate natural weathering, water accumulating inside the bermed area may come into contact with contaminated material.

While the landfarm will have an impermeable liner, visual inspections by the Environment Department will be conducted for seepage of contact water coming through the perimeter berm, or the accumulation of water within the containment berm. This will be conducted on a weekly basis starting after freshet and continuing until October when water is likely to be present. In the event of water accumulation or seepage, the ponded water will be pumped through the site's oil-water separator to remove PHC residue and will be analyzed for BTEX, lead, and oil and grease prior to discharge to CP1 or used on the windrows to increase moisture content, as required. Water accumulating in the landfarm will not be discharged directly to the receiving environment.

3.7 Winter landfarm management

Uncontaminated snow will be removed as much as possible during winter to minimize the quantity of spring melt water inside the berm. Care will be taken to ensure contaminated snow/soil is not disturbed by leaving a base layer of snow of no less than 10 cm in place. Following snowmelt, any contaminated product left from winter spill clean-up operations will be padded up. The base soil in these areas will be excavated and added to existing remediation windrows as soon as possible after snowmelt to minimize migration into the facility substrate.

3.8 Landfarm Closure and Reclamation

After removal of all remediated soil and prior to closure and reclamation of the landfarm, the berm and base will be sampled on a 10 m grid, to determine if these soils are free from PHC contamination. Results of this analysis will be compared to GN criteria set out in Table 3-1. No excavation will be necessary if agricultural/wildlife are met. If industrial criteria are used, the landfarm will be covered with 2 m of waste rock or other material used for reclamation. The surrounding berm will be breached to avoid water accumulation on the landfarm.

3.9 Summary of Activities

A summary of landfarm activities including monitoring of the physical condition and potential environmental impacts of the landfarm is provided in Table 3-2. An annual report will be prepared indicating the volume of material added to the facility, amount of material removed, disposal or reuse location, all analysis results, volume and type of nutrient addition, visual inspection results, and volume of contact water pumped. This information will be appended to Agnico Eagle's NWB Annual Report.

Table 3-2 Summary of Landfarm Activities, Analyses, and Records

Activity	Analysis	Frequency of Analysis	Record
Excavation of spill and transport of contaminated material to landfarm.	If unsure of full excavation - F1-F4, BTEX If contaminant source unknown, F1-F4, BTEX, metals, oil and grease, VOCs	As needed	Date, time and location of spill and excavation; estimated volume of spill; estimated quantity of excavated soil; storage/disposal location of excavated soil, if applicable. Any evidence of remaining product
Soil aeration	NA	Two to four times over the summer	Date and time of the aeration; location; soil condition (moisture, odour, granulometrie, etc.)
Soil treatment with sewage sludge as nutrient supplement.	Visual inspection to ensure proper incorporation	At least once during summer on selected windrows	Date and time; type of treatment (aeration or nutrient amendment); location in landfarm; any odour noticed during aeration
Sampling for progress of remediation	Hydrocarbon vapour in headspace (by PID); F1-F4, BTEX (laboratory)	Vapour – as needed; Laboratory - annually	Date and time; location; odour; laboratory report
Soil removal from landfarm	Removal subject to meeting GN criteria	Once GN criteria are met	Date and time; location; quantity of soil removed; final location
Ponded contact water	BTEX, oil and grease, lead – as specified in Water Licence	Prior to any dewatering; if re-used in landfarm, no sampling necessary	Date and time, location, laboratory report, in Annual Report
Seepage	Visual inspection; BTEX, oil and grease, lead – as specified in Water License	Weekly during summer	Location, extent, approximate depth, evidence of sheen
Identification of maintenance requirements	Visual inspection of landfarm	Twice over the summer	Inspected areas; condition of berm and base; previously unidentified safety concerns

SECTION 4 • CONTINGENCY OPTIONS

This section describes the contaminated soil management plan, should a large spill event occur, and if landfarm treatment proves not successful.

4.1 Large Spill Event

A large spill event producing a quantity of soil that cannot be contained in the landfarm is unlikely because the landfarm is designed to hold nearly two times as much contaminated soil as is expected to be produced. Nevertheless, in this event, soils will be placed in a temporary storage area. A temporary stockpile area would be set up on an emergency basis, such as in the Waste Rock Storage Facility (WRSF) or the Tailings Storage Facility (TSF). As space becomes available, the soil would be added to the landfarm. Through spill prevention measures discussed earlier in this Plan, Agnico Eagle is minimizing the probability of this scenario occurring.

4.2 Alternate Treatment Options

Should landfarm treatment not perform as anticipated and it is evident that rates of degradation are not sufficient to meet GN Tier 1 criteria within the life-of-mine and the anticipated closure, the following alternative treatment options will be considered. Implementation will be after development of a more detailed protocol and approval of a revised plan by the NWB.

4.2.1 Soil Amendment

Since pH, salinity, moisture content, and microbial population density all affect rates of biodegradation by microbes, these factors may be monitored and adjusted through soil amendments if they are not found to be optimal (SAIC 2006). In addition, the height of soil windrows could be reduced to maximize air exposure if space in the landfarm allows.

4.2.2 Tier 2 – Modified-Criteria Approach

According to the GN *Environmental Guideline for Contaminated Site Remediation* (GN 2009), in cases where site conditions, land uses, receptors, or exposure pathways are different from those assumed in the development of the Tier 1 criteria, modified criteria may be permitted. This process requires the collection of site-specific information on exposure and risk estimates, and is subject to GN approval. For this Project, landfarmed soils are to be encapsulated in a WRSF rather than used in surface applications, as assumed in Tier 1, reducing the likelihood of exposure to any remaining contamination. Therefore, the Tier 2 approach could be warranted if Tier 1 criteria cannot be met. Any consideration for this approach would be based on soil sampling results and science based information.

4.2.3 Direct Placement in Waste Rock Storage Facility or on Tailings Storage Facility

Another option for management of contaminated soil if bioremediation proves not effective would be the direct placement of this material in a WRSF or on the TSF. Although the use of PHC contaminated soils in these storage areas is not optimal, the quantity generated on-site is small in comparison to the quantity of waste rock and cover on the TSF. While this method would not result in the treatment of soil, it is a viable contingency option because it would allow for the safe disposal of the contaminated material. Encapsulation and freeze-back would occur, eliminating any movement of contaminants. Over time, this material would undergo natural degradation. Consideration of this option would also include a suitable monitoring program for PHCs, which would be incorporated into the Closure and Reclamation Plan.

SECTION 5 • ASSESSMENT AND REPORTING

5.1 Feasibility

After two seasons of treatment in the landfarm, degradation rates of PHC contaminants will be assessed to estimate the total remediation time required under these conditions. If remediation to GN guidelines is feasible within the life-of-mine timeframe, landfarm operations will continue, with aeration and possible nutrient amendments as described above. If rates of degradation are not sufficient through this method, alternate options will be further investigated (Section 4).

5.2 Reporting

Reporting of landfarm activities will be submitted annually by Environment Department, indicating the volume of material added to the facility, amount of material removed and disposal or re-use location, and confirmatory analysis results. This information will be appended to Agnico Eagle's NWB Annual Report.

5.3 Plan Review and Continual Improvement

The Landfarm Management Plan will be reviewed annually by the Meliadine Environmental Department, and, if necessary, updated at least every two years of operation.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2008. Landfarm Design and Management Plan In Accordance with Water License 2AM-MEA0815, Meadowbank Gold Project, 20 p. + Figures and Appendix. October 2008.

Agnico Eagle. 2017. Version 1.1, Supporting Document 8-2 Oil Pollution Emergency Plan, Final Environmental Impact Statement, Meliadine Gold Project, Nunavut. Submitted to the Nunavut Impact Review Board. September 2017.

EBA. 2010. Hydrocarbon Impacted Soils Storage and Landfarm Facility Operations, Maintenance and Monitoring Plan, Milne Inlet, Mary River Project, Nunavut. Prepared for: Baffinland Iron Mines Corporation. Issued for Review. December 2010.

Golder (Golder Associates Ltd). 2007. Technical Memorandum: Landfarm Option Analysis, Meadowbank Gold Project, Nunavut. Prepared for: Agnico-Eagle Mines Ltd. August 23, 2007.

Government of Nunavut, March 2009. Environmental Guideline for Contaminated Site Remediation http://env.gov.nu.ca/sites/default/files/Guideline%20Contaminated%20Site%20Remediation.pdf

Paudyn, K. et al, 2008. Remediation of hydrocarbon contaminated soils in the Canadian Arctic by landfarming. Cold Regions Science and Technology, v53, p 102-114, n 1 June 2008

SAIC (Science Applications International Corporation), 2006. Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. Final report presented to: Contaminated Sites Division and Emergencies Engineering Technologies Office (EETO), Environmental Technology Centre, Environment Canada. SAIC Canada Project #: 11953.B.S08. CM #: 001659. March 31, 2006.

TetraTech EBA. 2014. Tailings, Waste And Water Management For Feasibility Level Study Meliadine Project, Nunavut, FILE: E14103188-01, AEM Report Number: 6509-REP-05, 145 p. + Appendix.

APPENDIX A

	DOCUMENT ID: NU-E&I-PRO – Land farm soil movement
People concerned: Site services HEO, environmental department	**Effective Date: 2018-03-13**
This procedure corresponds to the required minimum standard. Each and everyone also have to comply with the rules and regulations of the Nunavut Government in terms of health and safety at work.	

Rev #	Date	Description	Initiator
0	2018-03-13	Draft	Guillaume Gemme

Objective:

- Safe operation of equipment during land farm soil movement

Definitions (If applicable):

This procedure is in place to ensure proper usage of heavy equipment on the land farm during the soil movement process.

Tool/Equipment Required	PPE Required
• Heavy equipment (Backhoe/excavator/ Dozer/ Etc.) equipped with flat lip bucket to avoid membrane damage • Measuring device (Ex: Measuring tape) • Shovel and broom	• Standard PPE

Specific Training Requirements
• Appropriate Heavy equipment operator training. (Class 2 Operator or equivalent)

1. Access to the Land farm a. Before entering the land farm, the operator need to have the approval of the Site Services field Supervisor and be accompanied by an environmental representative. 2. Soil movement a. Following the environmental department direction, proceed with the requested soil movement work. (Drawing of the work to be done including exact location, dimension of the area and maximum deepness to reach need to be done by Environment department before proceeding with the work) b. Sampling will be completed by environment department following procedure : MEL-ENV-Permanent Land farm & Soil Sampling

3. Equipment decontamination

   a. Before exiting the area, make sure to remove all contaminated soil from the heavy equipment.

   b. Using a hand shovel remove all contaminated soil on the equipment. If required use a broom to reach all potential contaminated parts of equipment

   c. Call the field supervisor to assess the equipment cleanness before exiting the land farm.

Related Documentation (If applicable):
• N/A

References (If applicable):
• Meliadine Water license type A (Land farm Management plan)

Appendix (If applicable):
• Pictures • Plans

Authorization (Print Name)	
Approved: _____ Name JOHSC Worker Rep.	Date: _____
Approved: _____ Name Department Superintendent / Delegate	Date: _____
Approved: _____ Name Health & Safety Superintendent / Delegate	Date: _____

AGNICO EAGLE

MELIADINE GOLD PROJECT

Landfill and Waste Management Plan

MARCH 2018
VERSION 6
6513-MPS-06

ᓇᐃᓇᖅᓯᒪᔪᖅ

ᐊᑐᓂᒃᑯᑦ ᑕᓯᔨᐊᕐᒥᑦ ᔪᑕᓗᑦ ᐅᓴᖏᖅᓂᐊᕐᓇᐃᓐᓇᑕᓂᐊᔨᑦ (ᐱᑕᓇᐊᖅ), 25 ᑭᓪᒥᑕᒥᒃ ᐅᐊᖅᓇᖅᑐᓂᑦ ᐅᖅᓱᓂᒃᑐᕐᓂᖅ ᑲᖏᖅᑕᓂᖅᒥᑦ, ᐊᒪᓗ 80 ᑭᓪᓕᒥᑕᒥᒃ ᓂᒋᖅᑮᓯᐊᓂᑦ ᐱᖅᖏᖅᑮᓯᐊᓂᑦ ᐅᖅᓱᓂᒃᑐᕐᓂᖅ ᐃᓗᓕᓴᕐᖏᒥᑦ ᑭᐅᓐᓂᒥᑦ. ᐅᓴᖏᖅᓂᐊᖏᖅᓯᒪᔪᑦ ᐸᖏᓇᐅᑕᐅᔨᖅ ᐅᒃᑯᐃᖅᑲᒪᒃ ᐊᒪᓗ ᓄᓇᕗᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖏᖅᓂᐊᖏᖅᑲᓐᓂᖅᑐᖅ ᐱᖅᓯᓂᐊᓂᖅᓱᑦ ᑎᓪᓗᓂᐊᖅ-ᒥᑦ ᔪᓕᓂᒃ ᐱᓂᖅᓱᑦ, ᒪᖁᔭᖅᓂᒃ ᐅᒃᑯᐃᖅᑲᓐᓂᖅᓂᒃ ᓄᓇᕗᑦ (ᑎᓪᓗᓂᐊᖅ Pit 1 ᐊᒪᓗ ᑎᓪᓗᓂᐊᖅ Pit 2) ᐊᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᕗᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖏᖅᓂᐊᖏᓂᖅ.

ᑕᐅᓇ ᑎᑎᖅᑲᖅ ᐅᖏᖅᐅᓯᖅᑲᖅᑐᖅ ᐊᒃᑕᑯᔨᕐᖓᓐᓂᑦ ᐊᒪᓗ ᐊᒃᑕᑯᓕᓪᓂᖏᓪᓕᑦ ᐊᐅᓕᕆᓂᖏᓪᓕᑦ ᐸᖏᓇᐅᑎᑎᒃ ᐱᓕᓪᐊᓕᑦ ᐊᒪᓗ ᐃᓕᓕᐅᑎᓂᔪᓐᓃᓂ ᑎᑎᖅᑲᖅᑐᖅ Type A ᐃᒪᖏᑦ ᓕᐃᓴᓯᔨᒃ ᑐᓴᔾᕋᐅᑎᒃ. ᑕᐅᓇ ᐸᖏᓇᐅᑎ ᐅᖏᖅᐅᓯᖅᑲᖅᑐᖅ ᐊᑲᓂᑯᔨᑕᑎᖕᓂᓐᓂᖅᑐᖅ ᐊᒃᑕᑯᔨᓂᖅ ᐊᐅᓕᕆᓂᖏᓪᓕᑦ ᑕᓯᔨᐊᕐᓇᐃᓐᓇᑕᓂᐊᔨᑦ ᔪᑕᓗᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖏᖅᓂᐊᖏᓂᖅᑲᓐᓂᑦ (ᐱᑕᓇᐊᖅ).

ᒥᓀᕐᓂᐊᖏᓪᓕᒋᑦ, ᐊᑐᖅᑲᓂᖏᓪᓕᒋᓕᑦ ᑐᖃᓚᔨᓂᖅ ᓴᖅᑭᑕᐅᓂᐊᖏᖅᑐᑦ ᐱᑕᓇᐊᒥᑦ ᒥᓀᕐᓂᐊᖏᖅᑎᓪᓂᖏᓪᓕᑦ ᖃᖅᔨᓯᐅᓂᖅᓱᒋᑦ ᐊᒃᑕᑯᔨᐃᑦ ᑕᓚᓀᖓᓱᒋᑦ. ᐊᒃᑕᑯᔨᐃᑦ ᐊᔨᑎᖅᑕᐅᔨᔪᑦ ᐊᑐᖅᑕᐅᓂᐊᖏᖅᑐᑦ ᐊᑐᖅᑕᐅᑲᖅᓂᐊᖏᖅᑐᑦ, ᑕᐃᒪᓐᓇᐃᑕᐅᖅᑎᑦᓗᒋᑕᓗᓗ ᐅᓗᓇᐊᓇᖅᑐᑦ ᐊᒃᑕᑯᔨᐃᑦ ᐊᐅᓕᑕᐅᑎᐊᖏᑯᔨᓗᒋᑕᓂᑦ.

ᐊᒃᑕᑯᔨᓂᐊᓕ ᐊᑐᖅᑕᐅᔭᓇᐊᖏᖅᓂᐊᖏᖅᑐᖅ ᐃᖅᖢᑕᐃᓂᖅᒥᑦ ᐅᑎᖅᑎᑦᑕᕐᖑᐅᑎᓂᑐᓂ, ᐅᓗᓇᐊᓇᖅᑐᖅᑲᖅᓯᑎᓂᑐᓂ, ᐱᑕᓇᐊᒥᑦ ᓯᑭᖅᑮᓪᓂᐊᓂᖏᖅᑲᐅᓇᖅᑎᓂᑐᓂᓄᑦ ᔭᓇᔭᐅᑎᓪᓗᒋᑲᖅᓱᒃᑲᖅᑐᓂ, ᐊᐅᓪᓚᖅᑎᓪᓗᒋ, ᐊᒪᓗ ᐅᖅᑯᐊᖅᑮᓪᓂᐊᑎᓪᓗᒋᑲᖅᓱᒃᑲᖅᑐᓂ. ᐱᑕᓇᐊᖅ ᐃᖃᓗᑯᓱᓂᐊᖏᖅᑐᖅ, ᐊᒪᓗ ᐊᑐᖅᑕᐅᓚᐅᖅᑎᑦ ᐊᑐᖅᑕᐅᓂᐊᖏᖅᑐᖅ ᐊᐅᓕᑕᐅᑎᐊᖏᑯᔨᓗᒋᑕᓂᑦ ᐊᒃᑕᑯᔨᐃᑦ ᐊᐅᓕᕆᓂᖏᓪᓕᑦ.

ᐊᒃᑕᑯᔨᓂᐊᓕᒃ ᐊᑐᖅᑕᐅᔭᓇᐊᖏᖅᓂᐊᖏᖅᑐᖅ ᐃᖅᖢᑕᐃᐅᓪᓕᑦ ᐅᑎᖅᑎᑦᓚᖅᐅᖕᒥᑕᑐᓂᑐᓂᖅ, ᐅᓗᓇᐊᓇᖅᑐᖅᑲᖅᓯᑎᓂᑐᓂᖅ, ᐱᑕᓇᐊᒥᑦ ᓯᕐᓴᖅᑮᓪᓂᐊᓂᖏᖅᑲᕐᖓᓐᓂᖅᑐᓂᑲᓂ ᓴᓇᔭᐅᑎᓪᓂᑕᒧᖕᒪᖅᑲᖅᑐᓂᓄᑦ, ᐊᐅᓪᓚᖅᑎᓪᓗᒋ, ᐊᒪᓗ ᐅᖅᑯᐊᖅᑮᓪᓂᐊᑎᓪᓗᒋᑲᖅᓱᒃᑲᖅᑐᓂ. ᐱᑕᓇᐊᖅ ᐃᖃᓗᐃᑦᓱᒃᑲᖅᑐᖅ ᐊᒃᑕᑯᔨᐃᑦ ᐊᐅᓕᑕᐅᑎᐊᖏᑯᔨᓗᒋᑕᓂᑦ.

ᐊᒃᑕᑯᔨᓂᐊᓕᐅᓂᐊᖏᖅᑐᖅ ᐅᔭᖅᑲᓂᑦ ᐊᒃᑕᑯᔨᖁᔨᓂᐊᖏᖅᑐᖅ 1 (WRSF 1) ᓂᒋᖅᑮᓯᐊᓂᑦ ᐱᖅᖢᓇᖅᑮᓯᐊᓂᕐᓂᖅ ᐅᔭᖅᓂᐊᖏᖅᑲᐅᔨᑦ. ᐊᒃᑕᑯᔨᓂᐊᓕᒃ ᐃᓗᓪᓕᓂᖅᑐᖅᑕᐅᓂᖅᑐᓴᖅᑕᕐᓂᐊᖏᖅᑐᖅ ᐋᔪᕐᕕᒃᓴᓕᑦ. “ᐃᓂᐅᔨᒥᒃ ᐊᑐᓪᓗᑎᒃ” ᐃᖅᖢᑕᐃᓂᖅᑎᑦ ᐊᑐᖅᑕᐅᓂᐊᖏᖅᑐᖅ ᐊᒃᑕᑯᔨᖁᔨᓂᐊᖏᑯᔨᓗᒋᑕᓂᑦ ᑐᐱᓪᓚᓪᓗᓗᑎᒃ ᐊᒪᓗ ᖃᖅᓪᓕᓂᖅᑕᐅᓗᓗᑎᒃ ᐱᓕᕆᐊᖏᖅᓂᖅ ᒪᓕᓪᓗᓗᒍ. ᐊᒃᑕᑯᔨᐃᑦ ᐃᑎᑕᐅᖅᑕᕐᓂᐊᖏᖅᑐᖅ ᐊᒃᑕᑯᔨᓂᐊᓕᐅᓂᐊᖏᖅᑲᐅᔨᑦ ᓇᑎᑲᐊᓗᓂᑦ ᐊᒪᓗ ᒥᓀᕐᓂᐊᖏᖅᑐᖅᑕᐅᓂᖅᑐᓴᖅᑕᕐᓂᐊᖏᖅᑐᖅ ᓇᓂᕐᓗᓗᒍ ᐃᓗᐊᓂᑦ ᐊᒃᑕᑯᔨᖁᔨᓂᐊᖏᑯᔨᓗᒋᑕᓂᑦ ᐅᑎᖅᑎᑦᑕᕐᓂᐊᖏᖅᑐᖅᑕᐅᓂᖅᑐᓴᖅᑕᕐᓂᐊᖏᖅᑐᖅ ᐊᐅᓕᓪᓗᓂᑦ ᐊᒃᑕᑯᔨᖁᔨᓂᐊᖏᑯᔨᓗᒋᑕᓂᑦ ᐊᒃᑕᑯᔨᓂᐊᓕᐅᓂᐊᖏᖅᑲᐅᔨᑦ. ᐊᒃᑕᑯᔨᓂᐊᓕᒃ ᐊᐅᓕᕆᓂᖏᓪᓕᑦ ᐊᑐᖅᑕᐅᓂᐊᖏᖅᑐᖅ ᐃᓗᐊᓂᑦ ᐊᑐᖅᑕᐅᓂᐊᖏᖅᑐᖅᑕᐅᓂᖅᑐᓴᖅᑕᕐᓂᐊᖏᖅᑐᖅ ᐊᓚᓂᑦ ᐊᒃᑕᑯᔨᖁᔨᓂᐊᖏᑯᔨᓗᒋᑕᓂᑦ ᐊᒃᑕᑯᔨᓂᐊᓕᐅᓂᐊᖏᖅᑲᐅᔨᑦ.

ᑯᓘᔪᖅ ᐊᒃᑕᑯᔨᓂᐊᓕᒃ ᓂᓗᐅᒋᐊᖅᑐᔪᖅ ᓴᙱᑭᑐᐅᓂᐊᖏᓂᖅᓱᓚᓂᑦ ᐊᐅᓕᕆᓂᖏᓪᓕᑦ ᐊᒃᑕᑯᔨᓚᓂᐊᖏᖅᑐᖅ ᐊᒃᑕᑯᔨᓚᓂᐊᖏᖅᑲᖅᑎᓪᓗᒋᑦ. ᐊᒪᓚᔭᒃᓂᖏᓪᓕᖅ, ᑯᓘᔪᖅ ᐊᒃᑕᑯᔨᓂᐊᖏᖅᑐᖅ ᓂᓗᐅᒋᐊᖅᑐᔪᖅᑲᐅᔨᑦ ᖁᑯᖁᓂᐊᖏᖅᓂᖏᖅᑎᓪᓗᒋᑦ ᐅᓂᒃᑳᖅᑐᖅ WRSF-ᒥᑦ ᒥᑭᔪᑦ ᐱᑕᖅᓴᕐᓂᔪᓐᓃᑦ ᐅᓂᒃᑲᐅᔨᓴᓕᓂᖏᖅᑎᓪᓂᖏᖅᑎᓪᓗᒋᑦ ᐃᓕᓴᕐᒥᒃ ᑲᖏᖅᑐᓂᖅᓱᑦ ᐅᓂᒃᑲᐅᔨᓴᓕᓂᖏᖅᑎᓪᓗᒋᑦ

ᐋᕐᑭᒃᓯᒪᔪᒧᑦ WRSF-ᒧᑦ. ᐊᕐᕌᒍᑕᒫᑦ ᐊᒃᑕᑰᓯᕙᕕᖕᒥᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᖅ ᐊᐳᑕᐃᔭᐃᓂᖅᑲᕐᓂᐊᕐᒪᑦ ᐅᐱᕐᖓᖅᑳᖅᑎᓐᓇᒍ ᐊᐅᒃᐸᓪᓕᐊᓂᕐᒥᑦ. ᑭᓯᐊᓂ, ᑯᕕᔪᖅᑲᖅᐸᑦ ᐊᒃᑕᑰᓯᕙᕕᖕᒥᑦ ᒪᕐᑯᒐᔪᖕᓂᖅ ᐱᔾᔪᑎᐱᖕᓗᒍ ᐅᕙᓘᓃᑦ ᐅᐱᕐᖓᒃᑯᑦ ᐊᐅᒃᐸᓪᓕᐊᔪᒥᑦ, ᑯᕕᔪᖅ ᑲᑎᑕᐅᓂᐊᖅᑐᖅ, ᐊᐅᓚᑕᐅᓗᓂ ᐊᒪᓗ ᐱᓕᕆᐊᖑᓗᓂ, ᐱᔭᕆᐊᖅᑲᕌᖓᑦ.

ᐊᒃᑕᑰᓯᕙᕕᒃ ᖃᓪᓕᖅᑕᐅᓂᐊᖅᑐᖅ ᒥᑭᓛᒃᑯᑦ 3.7 m-ᒥᒃ ᐊᒃᑕᑰᖅᑕᐅᔪᓂᒃ ᐅᔭᖅᑲᓂᒃ ᐃᖕᒥᒃᑰᖓᑎᓪᓗᒍ ᐊᕙᑎᒥᑦ ᐊᒪᓗ ᓄᖅᑲᖓᑎᓪᓗᒍ.

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

This document presents the Landfill and Waste Management Plan (Plan) for the Project and forms a component of the documentation series produced for the Type A Water Licence Application. The Plan describes Agnico Eagle Mines Limited's (Agnico Eagle) strategies regarding waste management for the proposed Meliadine Gold Project (Project).

Reduce, reuse, and recycle initiatives will be developed at the Project to minimize the quantity of waste generated. Waste segregation will be used to capture wastes suitable for reuse or recycling, while at the same time ensuring that hazardous waste is managed appropriately.

A landfill will be required for the disposal of non-salvageable, non-hazardous, non-putrescible solid wastes from the construction, operation, and closure of the Project. The Project will be totally independent of, and will not use, municipal facilities or services for waste management.

The proposed landfill will be located within the Waste Rock Storage Facility 1 (WRSF 1) located to the southwest of the main mine infrastructure. The landfill will be filled progressively and in an orderly manner. An "area method" of dumping will be used such that materials will be dumped in rows and covered as required. Wastes will be disposed directly on the landfill floor and compacted with heavy equipment against the berm or an existing row of debris that was compacted earlier. Controlling the materials that can be placed in the landfill is a strategy aimed to reduce the concentration of constituents in potential leachate and to minimize the attraction of wildlife to the landfill. Landfill operation will also conform to best management practices to reduce the potential for windblown debris.

Leachate from the landfill is anticipated to be weak due to the controls placed on materials acceptable for landfilling. Moreover, drainage from the landfill is largely expected to freeze within the WRSF with little to none migrating to the water collection infrastructure placed around the WRSF. Annual landfill operation will also involve clearing of snow prior to spring melt. However, in the event there is leachate from the landfill due to periods of heavy rainfall or spring freshet, the runoff will be collected, controlled and treated, if necessary.

The landfill will be covered with a minimum 3.7 m of waste rock to isolate it from the environment and physically stabilize it.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	November 2012			First draft of the Landfill and Waste Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			Draft Environment Impact Statement re-submission; rebranding	
3	April 2014	1.3 1.4 4.3.1 4.5 5 6 7	2-3 3 11 13-14 16-17 18 19	Addressed commitments made during review of Draft Environmental Impact Statement: - Leachate management - Landfill schedule - Asbestos management - Records and reports - More details on Standard Operation Procedures - More details on best practices and training	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			Complete update to correspond with the Mine Plan	John Witteman, Env. Consultant, Agnico Eagle
5	February 2017	- 1.1 4.1 4.4.1 - - -	All Pages 1 9 12 Title Page 3 4	- Changed effective date from April 2015 to March 2017 - Added statement “Plan will have to be updated and submitted 90 days prior to landfill construction” - Removed statement “paper lunch bags will be replaced by sturdy metal or plastic lunch boxes” - Added ultraviolet lamp tubes to the section on fluorescent lamp tube disposal, as both contain mercury and will be disposed of in the same way - Changed April 2015 to March 2017 - Landfill Site Location diagram added - Typical Sections for Landfill Closure diagrams added	Justin MacMillan, Environmental Technician, Agnico Eagle

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ARD/ML	Acid-Rock Drainage/Metal Leaching
CP1	Collection Pond 1
GN	Government of Nunavut
INAC	Indian and Northern Affairs Canada
NIRB	Nunavut Impact Review Board
Project	Meliadine Gold Project
WHMIS	Workplace Hazardous Materials Information System
WRSF	Waste Rock Storage Facility

UNITS

km	kilometre
m	metre
t	metric tonnes

SECTION 1 • INTRODUCTION

1.1 Purpose and Scope of the Plan

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the proposed Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

The Landfill and Waste Management Plan (Plan) outlines the design, operation, and closure of a solid waste landfill as part of Agnico Eagle's proposed Project. It also highlights the waste segregation strategies that will be implemented to minimize the quantity of waste to be placed in the proposed landfill or incinerated. The Plan will have to be updated and submitted 90 days prior to permanent landfill construction.

The objectives of this Plan are summarized as follows:

1. To define the location, design, and operating procedures to be used in the landfill disposal of non-salvageable, non-hazardous, non-putrescible solid waste generated at the proposed mine.
2. To define acceptable/non-acceptable types of solid waste to be placed in the proposed landfill.
3. To describe plans to reduce/reuse/recycle Project wastes.
4. To define monitoring requirements for the proposed landfill.

A landfill is required for the disposal of non-salvageable, non-hazardous, non-putrescible solid industrial wastes that cannot be incinerated and that result from construction, operations, and closure of the Project. The proposed Project will be operated totally independent of, and will not use, any municipal facilities or services for waste management.

Hazardous wastes will not be placed in the proposed landfill. All hazardous materials will be packaged for shipment to a certified waste management company for treatment, recycling, and/or

disposal. The proposed Project also includes a landfarm to treat soils and rocks contaminated with hydrocarbons. The landfarm is described in the Landfarm Management Plan.

1.2 Location of the Landfill

The proposed landfill will be situated within the Waste Rock Storage Facility 1 (WRSF 1), which is located close to, and northeast of, the main mine infrastructure. The following criteria were considered in determining its location:

- Drainage – sites that will drain into areas where water will be collected and monitored as part of the overall site plan were preferred;
- Disturbed areas – sites within or near areas that will be disturbed as part of the future overall mine plan were preferred to minimise the environmental footprint of the Project;
- Access – sites located close to existing service or haul roads were preferred; and
- The landfill site had to be large enough to accommodate non-salvageable, non-hazardous, non-putrescible solid industrial wastes for the life of the Project, including the development of the other pits.

The first three criteria are recommendations from the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007).

1.3 Landfill Design

The proposed landfill will not be a conventional landfill; it will be a controlled landfill where:

- Wastes will be segregated with liquids, hazardous and putrescible waste all being diverted away from the landfill (Section 4.3 and 4.4). The segregation of waste involves a major commitment by Agnico Eagle to educating all its employees and contractors in directing wastes to the proper waste collection bins.
- Waste management will include an incinerator where all organic, office waste, and any waste coming in contact with food is incinerated. Ash from the incineration process will be disposed of in the landfill (Section 4.6).
- Waste in the proposed landfill will not be scattered all over the floor of the landfill, but will be placed daily at the active working face where the waste can be leveled, compacted, and covered (Section 5).

The proposed landfill is planned to be located within the WRSF 1 as shown on Figure 1-1. The active WRSF 1 will set the bounds of the proposed landfill on its south and west sides, while berms will be constructed on the north and east sides of the landfill (see Figure 1-2). The purpose of the berms will be to confine the area for waste disposal and to act as a wind shield to reduce windblown debris. The landfill will be a rectangular shape with the length perpendicular to the prevailing wind direction so that much of the waste will be protected from wind by the berm.

Figure 1-1 Landfill Location for Meliadine Gold Project

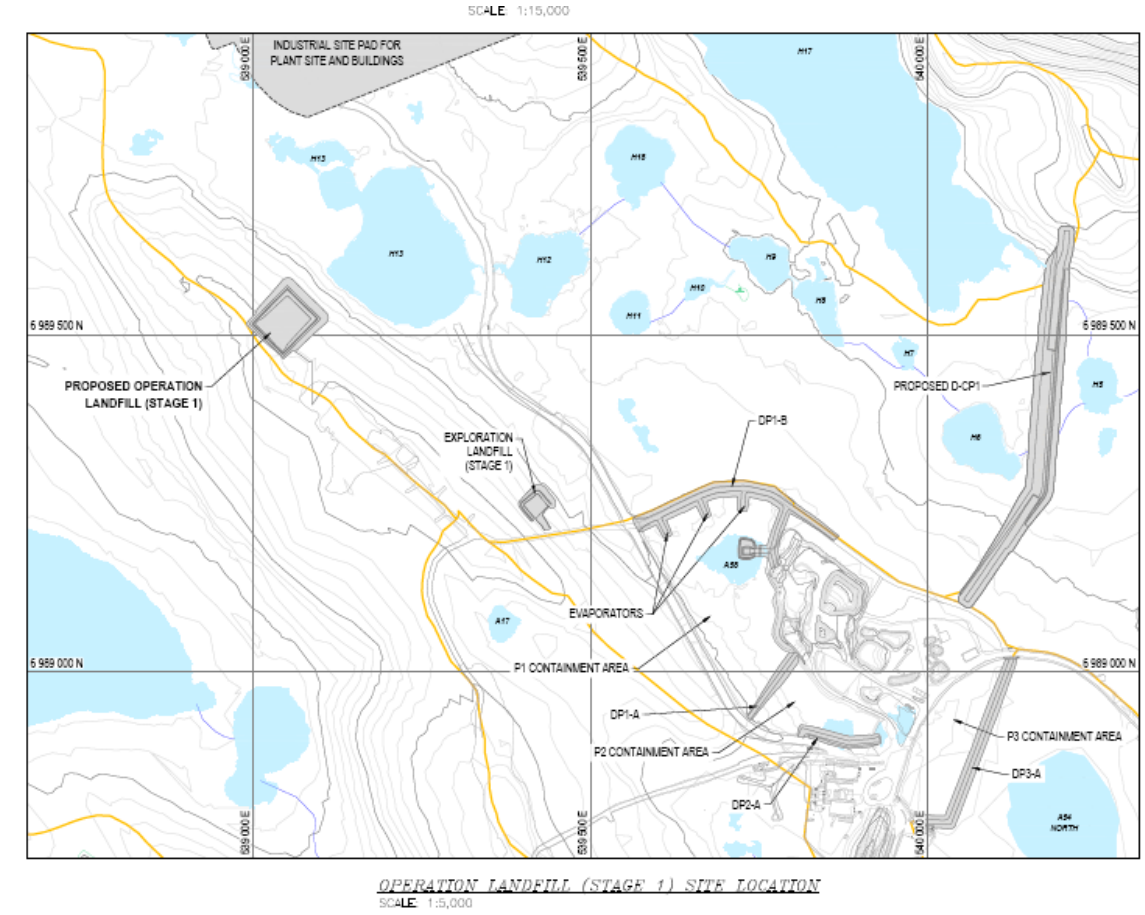
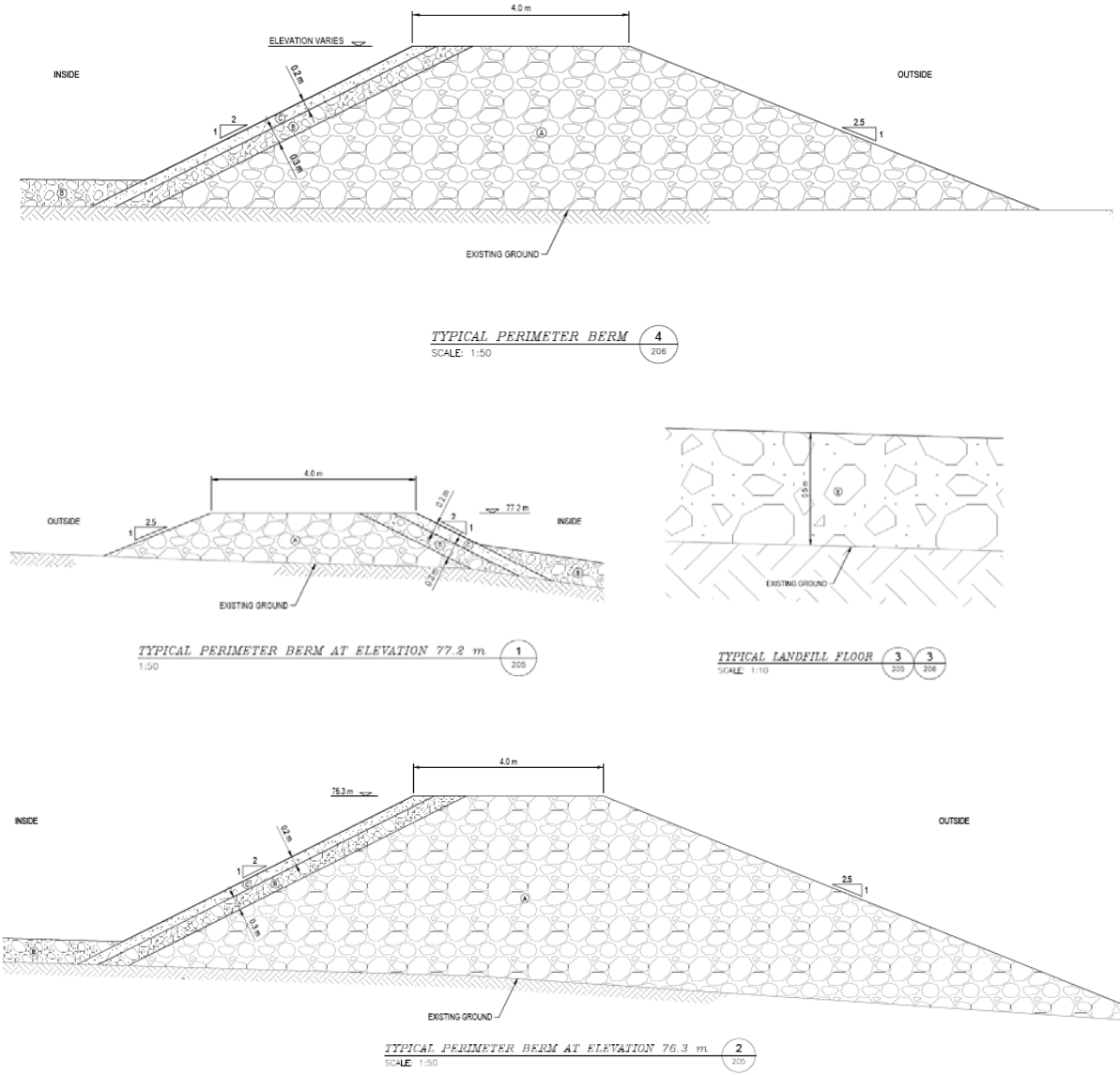


Figure 1-2 Typical Sections for Landfill Closure



Both the floor and the berm of the proposed landfill will be constructed with material (rockfill and/or waste rock) sourced from open pit stripping of Tiriganiaq Pit 1 or 2. The landfill floor will be approximately 1.2 m thick. The design of the berms will not assume that they will be in a frozen state or permanently impermeable to leakage. The final design will take into account berm and subgrade stability.

Due to the restriction on wastes that can be landfilled (see Section 4.3), and since the proposed landfill will be located within the WRSF 1, the quantity of leachate is expected to be minimal (if any), and of low ionic strength. The proposed landfill will nonetheless receive precipitation during the summer period, which could infiltrate the landfill before it can evaporate. In the event that leachate migrates from the landfill, it will be collected, monitored, and, if necessary, treated before being released to the receiving environment.

Closure design for the proposed landfill is described in Section 7 and illustrated in Figure 1-2. Based on the design strategy for the proposed landfill, and the management and operating procedures listed above, a liner is not considered necessary for the landfill.

1.4 Landfill Schedule

The proposed landfill will be used for the construction, operations, and closure phases. It will not be required for post-closure. The exploration landfill approved under water licence 2BB-MEL0914[1] will be used during the pre-development phase; this is until the proposed landfill for the mine has been constructed and becomes operational.

The schedule for the proposed landfill is as follows:

- Years -3 to -1: Construction of the landfill will occur directly after the placement of minimum 1.2 m of waste rock or rockfill to serve as a base or foundation. This will occur during the first year of construction, with commissioning of the landfill directly thereafter. This will allow non-salvageable, non-hazardous, non-putrescible solid construction waste to be placed in the landfill;
- Years 1 to 8: The landfill will be used continuously during operations;
- Years 9 to 11: The landfill will be one of the last parts of mine infrastructure to close. It is expected to be extensively used during closure for demolition waste and will remain operational until it is no longer needed.[2]

[1] Although approved by the Nunavut Water Board, this landfill has not been built as of March 2015.
[2] The incinerator will close before the landfill.

SECTION 2 • RELATED DOCUMENTS

Related documents include the following:

- Risk Management and Emergency Response Plan;
- Hazardous Materials Management Plan;
- Incineration Management Plan;
- Environmental Management and Protection Plan;
- Preliminary Closure and Reclamation Plan; and
- Occupational Health and Safety Plan (Agnico Eagle 2014).

The Landfill and Waste Management Plan is part of the Environmental Management and Protection Plan, which provides overarching environmental direction for the Project.

SECTION 3 • REGULATORY SETTING

Waste management in Nunavut is regulated under the *Nunavut Public Health Act*, the *Nunavut Environmental Protection Act*, the federal *Environmental Protection Act,* and the federal *Transport of Dangerous Goods Act*. Agnico Eagle will also be bound by the forthcoming terms and conditions of its commercial lease with the Kivalliq Inuit Association and its water licence from the Nunavut Water Board.

In addition to mandatory requirements, a number of waste management guidelines are commonly used in the Northwest Territories and Nunavut. The most recent of these was developed for municipal solid waste and is titled: "*Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT*" (Ferguson Simek Clark 2003). *Environmental Guideline for Industrial Waste Discharge into Municipal Solid Waste and Sewage Treatment Facilities* (GN 2011c) were also used (Appendix D). While not all of the recommendations provided in these guidelines are appropriate for the management of industrial waste expected at the proposed Project, principles considered applicable have been adopted in this Plan.

In addition, the *Mine Site Reclamation Guidelines for the Northwest Territories* (INAC 2007) were followed regarding specific landfill design and mitigation for potential impacts pertaining to waste.

SECTION 4 • WASTE MANAGEMENT APPROACH

Waste[3] at the proposed Project is divided into the following categories:

1. Domestic waste: general waste materials coming from the kitchen, cafeteria, lunch rooms, dormitories, and offices. Bins will be located in high traffic areas for segregating wastes destined for incineration, landfilling, or recycling.

2. Medical waste: medical waste generated in the first aid/health room will require special handling and will be placed in easily identifiable single use medical waste containers. Both the containers and its contents will be incinerated.

3. Industrial waste: waste arising from operations in the truck shops, process plant, emulsion plant, paste plant, and warehouses. Each work area will have specially marked bins for segregating waste for incineration, recycling, or disposal. Special bins or areas will be set aside for hazardous waste. Large bulky items that cannot be incinerated will be prepared for shipment south for recycling, or be cleaned of any hydrocarbon contamination and have the electronics removed before disposal in the landfill.

4. Sewage: wastewater from the accommodation complex will be treated in the Sewage Treatment Plant before being directed to Collection Pond 1 (CP1). Sewage sludge removed from the Sewage Treatment Plant will be added to the landfarm as nutrient amendment on an as needed basis. Excess sludge will be disposed of in the tailings storage facility.

5. Used oil and waste fuels: used engine oil, hydraulic fluids, and fuels that do not meet specifications for designated use. This does not include solvents or paints. The used oil and waste fuels will be used in waste oil burners if it is found acceptable. For more details on the used oil and waste fuels, refer to the Incineration Management Plan.

6. Incinerator ash: ash testing protocol developed by the Government of Nunavut in accordance with the *Nunavut Environmental Guideline for Industrial Waste Discharges* will be implemented to ensure that the incinerator ash is suitable for disposal in the landfill (GN 2012). Ash not meeting the guidelines will be packaged in drums to be sent to a certified waste management facility for appropriate treatment, recycling, and/or disposal, or will be buried within the dry stacked tailings.

7. Hazardous waste: refer to the Hazardous Materials Management Plan for details on how hazardous waste will be managed.

[3] Tailings, waste rock, and overburden are also considered waste materials. The Mine Waste Management Plan provides details on these wastes.

4.1 Reduce/Recycle/Reuse Initiatives

Waste management begins by keeping all materials that can be economically recycled out of the waste stream destined for the landfill or incineration. The three R's of waste management - reduce, reuse, and recycle - will be encouraged within the waste management program.

Reduce, reuse, and recycle initiatives will be developed at the Project to minimize the quantity of waste incinerated or directed to the landfill. To support this initiative, operating procedures will be developed to maximize the volume of materials that are recycled and/or reused. This will include eliminating the use of disposable materials where possible, and segregating waste destined for reuse, and recycle alternatives.

Minimizing or avoiding the creation of pollutants and wastes can be more effective in protecting the environment than treating or cleaning them up after they have been created (Environment Canada 2003). Waste management for the proposed Project will include efforts directed at eliminating, where practicable, the use of disposable materials in everyday use, such as disposable cups, plates, and table ware. Workers will be encouraged to use ceramic mugs and stainless steel cutlery in the cafeteria or lunch rooms, and to carry personal drink containers or thermoses. Water will be recycled from CP1 for use in the mill with fresh water from Meliadine Lake only being used as makeup water. A tailings pond will not be constructed; instead, Dry Stack Tailings technology will be employed whereby tailings water will be reclaimed within the mill before the tailings are trucked for disposal. This will increase the volume of water available for recycling to the process. Low flush toilets and water saving showers heads will also be used throughout the facility to conserve water.

Recycle bins will be located in high traffic areas for small waste items such as alkaline and rechargeable batteries, obsolete computer equipment and supplies, and fluorescent light bulbs. Scrap metal will be collected on-site. These wastes will be packed for shipment off-site to licensed recycling depots.

All hazardous materials collected on-site will also be sent off-site to a licensed hazardous waste management company. Many of these materials end up being compatible with recycling after treatment. Examples include lead recovered from lead-acid batteries and oil filters becoming scrap metal after cleaning.

4.2 Collection and Handling of Waste

The strategy for the management of solid waste at the proposed Project will be to first identify and segregate acceptable disposal items from non-acceptable items. Within the acceptable disposal items, the second step will be to segregate those items that can be economically recycled from those that cannot. This segregation will be done at source by locating bins throughout the facilities for the collection of items suitable for recycling.

Waste will be generated and segregated in all buildings and will need to be collected and transported to the incinerator (waste management) building for final disposal or incineration. The Site Services Department will be responsible for the collection and transport of waste to the incinerator building.

All solid wastes that may contain medical waste from the Health Centre, food waste, food packaging waste, or other organic waste that could attract wildlife will be incinerated in the on-site incinerator. This will include all garbage from the accommodation complex, kitchen, lunchrooms, and offices. These will receive priority in being incinerated. Food wastes and wastes associated with food will be collected daily, at a minimum, and immediately transported to the incinerator building. This waste will not be allowed to remain unattended in vehicles at any time. The ash from the incinerator will be disposed of in the landfill.

The development of the proposed landfill will minimize the area required for waste storage and re-handling of waste. Acceptable items that will be disposed of in the landfill will be those that are solid, non-salvageable, non-hazardous, non-putrescible, with a low leachate and low heat generation potential. Controlling the materials that can be placed in the landfill is a strategy aiming at reducing the concentration of constituents in potential leachate. The proposed landfill will conform to best management practices allowing for orderly landfill development, which will reduce the potential for windblown debris.

Hazardous waste and materials that can be recycled will be appropriately packaged (as per regulations under the *Transport of Dangerous Goods Act)* to be sent off-site to a licensed hazardous waste management facility or recycling facility, respectively. Management of hazardous materials is covered in detail in the Hazardous Materials Management Plan.

4.3 Waste Acceptable for Placement in Landfill

The following materials will be acceptable for disposal in the proposed landfill:

- Plastic (except expanded polystyrene);
- Steel, copper, aluminum, iron;
- White goods;
- Wire;
- Wood;
- Fiberglass insulation;
- Fiberglass;
- Roofing;
- Asphalt;
- Concrete;
- Carpet;
- Bricks;

- Ceramics;
- Rubber;
- Empty caulking tubes;
- Hardened caulk;
- Clothing;
- Glass, including light bulbs (fluorescent bulbs will require special handling, see below for more details);
- Waste Asbestos (see below for more details);
- Small appliances (with batteries removed);
- Gyproc;
- Ash, provided it has cooled to 60 degrees Celsius or less;
- Vehicles and machinery provided all liquids, grease, batteries, and electronics have been removed; and
- Treated soils from landfarm.

4.3.1 Waste Asbestos[4]

Waste asbestos includes any type of material with greater than 1 % asbestos by weight (GN 2011a). Asbestos that has been immersed or fixed in a natural or artificial binder or included in a manufactured product is not considered waste asbestos; it is considered a hazardous waste and will be disposed of accordingly. Waste asbestos can either be backhauled off-site for disposal in an approved facility or it can be landfilled. The following are guidelines for landfilling waste asbestos:

- Immediate burial and cover with 0.5 m of cover material;
- Burial where it will not be disturbed; and
- Maintenance of the location on a map or diagram for future reference.

In addition to following the *Environmental Guideline for the General Management of Hazardous Waste* (GN 2010a), Agnico Eagle will adhere to the Government of Nunavut's (GN) *Environmental Guideline for Waste Asbestos* (GN 2011a). Before landfilling waste asbestos, Agnico Eagle will review the steps in this guideline with the GN.

The complete *Environmental Guideline for Waste Asbestos* (GN 2011a) and *Environmental Guideline for the General Management of Hazardous Waste* (GN 2010a) can be found in Appendix A and the Hazardous Materials Management Plan, respectively. All Government of Nunavut environmental guidelines can be accessed online at http://env.gov.nu.ca/programareas/environmentprotection/legislation.

[4] It is unlikely that asbestos waste will result from mine operations. Agnico Eagle will avoid using asbestos wherever possible.

4.4 Waste Unacceptable for Placement in Landfill

Materials not listed in the previous section will be unacceptable for placement in the landfill, unless approved in writing by the Meliadine Environment Department. These materials include the following:

- Organic matter, including food, sludge from the Sewage Treatment Plant, dead animals, paper, cardboard;
- Food containers and wrappings, unless cleaned;
- Hazardous wastes including mercury, batteries, solvents, glues, ethylene glycol antifreeze, adhesives (except empty caulking tubes);
- Electronics;
- Materials that can be recycled economically;
- Petroleum products, including materials contaminated with petroleum products; and
- Expanded polystyrene.

In particular, organic matter will not be accepted in the landfill, thus eliminating the attraction of small mammals, carnivores, and/or raptors. This will be accomplished by requiring all personnel to dispose of domestic waste in designated receptacles and by sending all collected domestic waste (e.g., from kitchen, offices, and living quarters) to the on-site incinerator.

4.4.1 Fluorescent Lamp Tubes

Fluorescent tubes contain mercury phosphorus powder and traces of lead and cadmium, which are considered environmental contaminants under the Nunavut *Environmental Protection Act* (GN 2010b). The only disposal method for fluorescent tubes is through an approved hazardous waste recycling or disposal facility (GN 2003). Government of Nunavut guidelines on *Mercury-Containing Products and Waste Mercury* (GN 2010b) and E*nvironmental Guideline for the General Management of Hazardous Waste* (GN 2010a) are included in Appendix B and the Hazardous Materials Management Plan, respectively. These guidelines will be followed and wastes having mercury will be sent to a certified waste management company for treatment, recycling, and/or disposal.

Ultraviolet (UV) lamp tubes used in the wastewater and potable water treatment systems shall be disposed of in the same way as fluorescent lamp tubes, as they also contain mercury (vapour).

4.4.2 Ozone Depleting Substances

Ozone depleting substances include chlorofluorocarbons or halons. Common sources include refrigeration equipment, air conditioning equipment, motor vehicle air conditioners, and fire extinguishing equipment (GN 2011b). These materials are hazardous in nature; consequently, all disposal of ozone depleting substances will take place at an approved facility.

Any non-salvageable equipment containing ozone depleting substances will have the ozone depleting substances removed by a certified technician prior to disposal in the proposed landfill. The *Environmental Guideline for Ozone Depleting Substances* is included in Appendix C.

4.5 Total Volume of Waste

The number of people working on-site, and the activities occurring at the time, will have a direct bearing on the volume of waste destined for the proposed landfill, the incinerator, and the amount of materials removed from the waste stream for reuse and recycling. Also, purchasing policies that focus on reduced packaging will have a bearing on the volume of waste.

An estimate of waste volume is required to determine the appropriate size of the landfill. However, an exact waste volume is not a critical parameter in the design because of the flexibility of design to accommodate extensions (larger to accept more waste) or contractions (smaller to accept less waste) within WRSF 1.

Table 4-1 tabulates the estimated mass of waste destined for the landfill each year and cumulatively for the life of the Project. As mentioned earlier, the flexibility in the landfill design allows for greater flexibility in the landfill design and allows for increased volume in case more waste than estimated is generated. This ensures there will be enough room for all landfill waste for the life of the Project.

Table 4-1 Estimated Waste in Landfill

Project Phase	Waste Not Incinerated (t/year)	Ash From Incinerator (t/year)	Estimated Volume of Non-Hazardous Waste and Ash Produced (m^3/year)	Approximate Treated Soil From Landfarm (m^3/year)	Maximum Accumulated Waste Material in Landfill (m^3)
Construction	100	30	260	0	1,040
Operations	340	102	884	446	37,043
Closure	25	7.5	65	525	25,226
Total					**63,309**

As part of the larger waste management system, records will be kept of quantity of waste landfilled, the quantity of waste incinerated, type and quantity of materials recycled, and any analytical results. All this information will be submitted to regulators in an annual report.

4.6 Incinerator Ash Testing Protocol

Provided the materials that go into the incinerator are controlled to exclude all hazardous materials, then ash from the incineration process should be non-hazardous. An ash testing protocol, as described in Section 8.3 of the Incineration Management Plan, will be implemented to ensure that the incinerator ash is suitable for disposal in the proposed landfill.

SECTION 5 • LANDFILL MANAGEMENT

5.1 Site Development and Landfilling Method

The site for the proposed landfill will be prepared by first placing a foundation (or base) of 1.2 m of waste rock or and/or rockfill material directly on top of the natural ground to form a floor. A service road, accessible only to mine staff and Agnico Eagle's contractors, will connect the landfill to other mine infrastructure. Berms surrounding the facility on three sides will be built of waste rock and/or rockfill material. The design of the berms does not assume that they will be in a frozen state, or permanently impermeable to leakage. The berms will serve to confine the area for waste disposal and act as a wind shield to reduce windblown debris (Figure 5.1).

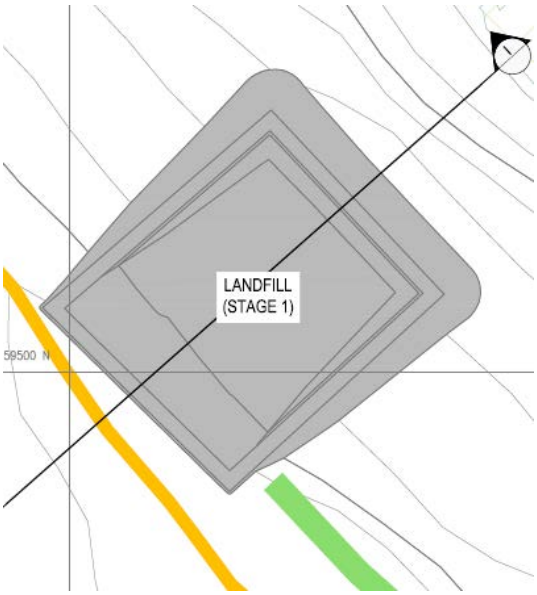


Figure 5-1 Landfill Stage 1

The Project's Site Services Department will be responsible for the operation and maintenance of the proposed landfill and will develop standard operating procedures for the same. The landfill will progressively be filled in an orderly manner. Specifically, waste will be placed to full height at one end of the proposed landfill and then the active waste area will progressively advance. An "area method" of dumping will be used such that materials will be dumped in rows and covered as required. Wastes will be deposited directly onto the landfill floor and compacted with heavy equipment against the berm or an existing row of debris that was compacted earlier.

Areas where the waste has been placed to full height, compacted and levelled will be progressively covered by placement of a minimum of 0.3 m thick of rock fill on top of the waste to reduce windblown debris.

Owing to its placement within the WRSF 1, the proposed landfill will become encapsulated within waste rock. Agnico Eagle plans to use waste rock to surround and cover the landfill. Upon closure, the entire landfill will be covered with 3.7 m of waste rock.

5.2 Staffing and Equipment

The Project's Site Services Department will collect all waste throughout the proposed mine site using trucks. Waste will be segregated at source with different waste streams following different paths. Trucks will haul waste destined for the proposed landfill and dump it at the working face where a dozer will be used to spread, level, and compact the waste.

Landfill operation will not require a full-time attendant as waste will only be delivered to the landfill for short periods each day.

5.3 Leachate Management

The leachate from the proposed landfill is anticipated to be of very low ionic strength (dilute) due to controls on materials to be placed in the landfill, and, as a result, site-specific landfill leachate management is not considered necessary.

In the event there is leachate from the landfill during periods of heavy rainfall or spring freshet, the runoff will be collected and directed to CP1[5], where it will be controlled and, if necessary, treated before release to the receiving environment. During operations, wastewater in CP1 could also be recycled and sent to the mill for use in the process.

In the event that greater volumes of leachate, or leachate with high ionic strength, is found coming from the proposed landfill, an investigation would immediately be undertaken to determine the cause. This could lead to changes in the configuration and/or management of the landfill to further limit water coming in contact with landfill materials and/or modify the water management strategy in this area.

The toe of WRSF 1 will be visually inspected monthly during the open water season and, if required, samples of water found ponding on the natural ground below the proposed landfill will be collected and analysed. The collection of samples, their analysis and reporting of results are anticipated to be part of the Water Licence for the mine.

Because the proposed landfill will be located in an area with underlying permafrost (see Permafrost Thermal Regime Baseline Studies in Agnico Eagle 2014), deep groundwater contamination from potential landfill leachate is not anticipated.

[5] Collection Pond 1 collects contact water runoff from a number of mine areas. For more details on CP1, refer to Water Management Plan.

5.4 Surface Water and Erosion Control

The slopes of the proposed landfill will be constructed of waste rock and should not be subject to erosion.

5.5 Operational Inspections

The Project's Environment Department will undertake periodic inspections of the landfill operations to verify compliance with applicable plans, including the condition of landfill works, evidence of erosion, excessive ponding or unusual landfill settlement, and adequacy of safety measures. The Environment Department will also visually inspect the toe of the WRSF 1 monthly during the open water season for leachate from the proposed landfill and, if present, collect samples for analysis.

SECTION 6 • TRAINING

All Agnico Eagle personnel and contractors working at the proposed Project site will be trained in waste management. This will be included in the site orientation upon arrival, which will include the identification of waste bins and dumpsters for the different categories of waste, where these are located, and the signage associated with each. Stewardship of the environment will be emphasized in that it is everybody's responsibility to properly dispose of waste, including wastes that can be recycled. This extends to ensuring wildlife does not have access to food or food wastes.

The success of the waste management system at the proposed mine site will be dependent on the proper disposal of all waste by all employees and contractors. Waste management training beyond the initial orientation will occur in each department. Environment department staff will reinforce proper waste segregation and disposal at various departmental meetings.

The Project's Site Services Department will have enhanced on-the-job waste management training as they will be collecting and processing all mine site waste. They will be trained in identifying misdirected waste, identifying where to dispose of it and in recommending where further waste management training is required on-site.

All maintenance staff must successfully complete equipment training before they can operate machinery and vehicles related to waste management on-site. Additionally, crews handling waste will be fully trained in safe work procedures. Training programs will include Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goods (TDG). Training completion and retraining will be documented and tracked by the Project's Human Resources Department.

SECTION 7 • CLOSURE PLAN

The proposed landfill is designed to be located within the WRSF 1. This location serves to minimize the area of surface disturbance, stabilize disturbed land surfaces against erosion, and return the land to a post-mining use that is chemically and physically stable, and consistent with past traditional pursuits and wildlife habitat. While waste rock will be disposed on land and in a manner that encourages total freezing. The design, operation, and/or closure of the WRSFs and landfill do not rely on total freezing. Any unacceptable leachate that is generated following closure of these facilities will be contained, collected, and/or treated, if necessary.

The following is a plan for closing the proposed landfill; more information is available in the Mine Preliminary Closure and Reclamation Plan:

a) Estimate of Total Waste Volume at Closure

Upon closure, it is estimated that the landfill will have a volume of approximately 63,000 m^3 of waste.

b) Final Cover Design

The proposed landfill will be covered with a minimum of 3.7 m of waste rock, and should thereafter be stable. When finalizing the design for the cover, the need for thermistors to be installed will be evaluated. The cover surface will be left irregular so as to capture snow, windblown sediment, and plant seeds.

c) Water Management

Contact water from the proposed landfill at its closure will continue to be managed using best management practices in accordance with the Project's closure and reclamation plan.

SECTION 8 • PLAN REVIEW AND UPDATE

The Landfill and Waste Management Plan will be reviewed annually by the Meliadine Environment Department. This plan will be reviewed and updated on an annual basis, as required, to reflect changes in operations and/or technology. Improvements suggested through these reviews would be implemented in consultation with the Nunavut Water Board and Kivalliq Inuit Association.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2014. Meliadine Gold Project, Nunavut. Final Environmental Impact Statement. Submitted to the Nunavut Impact Review Board. April 2014.

Environment Canada. 2003. State of the Environment InfoBase, Environmental Indicator Series 2003. Available online: http://www.ec.gc.ca.

Ferguson Simek Clark (Ferguson Simek Clark Engineers and Architects). 2003. Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT. Report prepared for the Department of Municipal and Community Affairs, Government of Northwest Territories, April 2003.

GN (Government of Nunavut). 2003. Disposal Guidelines for Fluorescent Lamp Tubes. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/Fluorescent%20Lamp%20Tubes.pdf

GN. 2010a. Environmental Guideline for the General Management of Hazardous Waste. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/Guideline%20-%20General%20Management%20of%20Hazardous%20Waste%20(revised%20Oct%202010).pdf

GN. 2010b. Mercury-Containing Products and Waste Mercury. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/mercury-containing_products_and_waste_mercury_2010.pdf

GN. 2011a. Environmental Guideline for Waste Asbestos. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/waste_asbestos_2011.pdf

GN. 2011b. Environmental Guideline for Ozone Depleting Substances. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/ozone_depleting_substances_2011.pdf

GN. 2011c. Environmental Guideline for Industrial Waste Discharges into Municipal Solid Waste and Sewage Treatment Facilities. Nunavut Department of Environment, Environmental Protection Service. Available online: http://env.gov.nu.ca/sites/default/files/industrial_waste_discharges_2011.pdf

GN 2012. . Environmental Guideline for the Burning and Incineration of Solid Waste. Government of Nunavut, Department of Environment, Environmental Protection Service

INAC (Indian and Northern Affairs Canada). 2007. Mine Site Reclamation Guidelines for the Northwest Territories. Available online: http://www.nwtwb.com/Downloads/MIne_Site_Reclamation_2007.pdf

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APPENDIX B • ENVIRONMENTAL GUIDELINE FOR MERCURY-CONTAINING PRODUCTS AND WASTE MERCURY

APPENDIX C • ENVIRONMENTAL GUIDELINE FOR OZONE DEPLETING SUBSTANCES

APPENDIX D • ENVIRONMENTAL GUIDELINE FOR INDUSTRIAL WASTE DISCHARGES INTO MUNICIPAL SOLID WASTE AND SEWAGE TREATMENT FACILITIES

AGNICO EAGLE

MELIADINE GOLD PROJECT

Mine Waste Management Plan

MARCH 2018
VERSION 3
6513-MPS-09

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ᐊᓂᔨᑦᑎᐊᕐᒥᑦ ᑕᓯᔾᔪᐊᖏᑦ ᔨᓗᓕᒧᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓇᐅᑉᓂᓕᕆᔨᑦ (ᐱᓕᓇᐊᖅ), 25 ᑭᓪᒥᑕᒥᒃ ᐅᐊᖅᓇᖅᓯᓂᓕ ᐅᖅᓯᓄᑎᕐᔪᖅ ᑲᖏᑦᓂᓂᑦᑎᒥᑦ, ᐊᒪᓗ 80 ᑭᓪᒥᑕᒥᒃ ᓂᑎᖅᑦᓯᐊᓂᓕ ᐱᖅᓯᓄᑎᕐᔪᖅ ᐅᖅᓯᓄᑎᕐᔪᖅ ᐃᓚᓕᑎᔾᔪᖅᒥᑦ ᑭᐅᓕᓕᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᓴᖃᖅᓂᐊᖏᓐᓄᓪᓗᑦ ᐸᖅᑲᓇᐅᑕᐅᔪᖅ ᐅᑦᑯᐃᖅᑲᓪᓚᒃ ᐊᒪᓗ ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓄᕆᖏᖅᑐᖅ ᐱᓕᓕᓂᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓄᕆᖏᖅᑐᖅ ᐱᖓᓱᓂᑦ ᑎᓪᓗᓯᓂᐊᑦᑎᓂᑦ ᑭᓕᓕᓂᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᓴᖃᖅᓂᐊᖏᓐᓄᓪᓗᑦ ᐸᖅᑲᓇᐅᑕᐅᔪᖅ ᐅᑦᑯᐃᖅᑲᓪᓚᒃ ᐊᒪᓗ ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓄᕆᖏᖅᑐᖅ ᐱᓕᓕᓂᑦ ᑎᓪᓗᓯᓂᐊᑦᑎᓂᑦ ᔨᓗᓕᒧᑦ, ᒪᑦᑭᒃᑐᖅ ᐅᑦᑯᐃᖅᑲᓪᓚᒃ Pit 1 ᐊᒪᓗ ᑎᓪᓗᓯᓂᐊᖅ Pit 2) ᐊᒪᓗ ᐊᑕᐅᓂᖅ ᓄᓇᐅᑦ ᐃᓗᐊᓂᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓄᖅ.

ᓂᑕᒪᐅᓕᕆᔨᖅ ᐱᓕᓕᓕᐊᓂᖓᓗ ᑎᓪᓗᓯᓂᐊᕐ: ᓂᑕᒪᐃᑦ ᐅᑭᐅᑦ ᐅᖅᓱᑎᐊᖏᓐᓇᐊᓄᑦ ᓴᓇᔨᐅᓂᖓᓗ (Q4 ᐅᑭᐅᖅ -5-ᒥᑦ ᐅᑭᐅᖅ -1-ᒧᑦ), 8-ᓄᑦ ᐅᑭᐅᓄᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓇᖅᑲ ᐊᐅᓪᓛᖏᓪᓂ (ᐅᑭᐅᖅ 1-ᒥᑦ ᐅᑭᐅᖅ 8-ᒧᑦ), ᐱᖅᓱᓂᑦ ᐅᑭᐅᓂᖅ ᐅᖅᑯᐊᖅᑐᑦᓕᐊᔪᐃ (ᐅᑭᐅᖅ 9-ᒥᑦ ᐅᑭᐅᖅ 11-ᒧᑦ), ᐊᒪᓗ ᐅᖅᑯᐊᖅᓂᒪᓕᖅᑎᑦᓗᐃ (ᐅᑭᐅᖅ 11-ᒥᑦ ᐅᖅᑭᒧᓄᑦ). 12.1 ᒥᓕᔭᐅ ᑕᐅᓂᖅ ᐅᓴᖅᑲᓂᖅ ᐱᓂᐊᖅᑐᖅ. ᐅᓴᖅᑲᐅᑦ ᐱᓴᐅᔪᑦ ᓂᐲᑦᓕᓕᖅᑎᖅᑕᐅᓂᐊᖅᑐᖅ 8-ᓄᑦ ᐅᑭᐅᑦᓗᐊᓄᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓄᕐᓂᐅᑦ ᐊᐅᓪᓛᖏᓪᓂᓕᓚᐅᖅᑎᑦᓗᓂᑦ 3,000 ᑕᐅᓂᖅ ᐅᑦᓗᑕᒧᑦ (tpd) ᐅᑭᐅᖅ 1-ᒥᑦ ᐅᑭᐅᖅ 3-ᒧᑦ ᐊᒪᓗ 5,000 tpd-ᓂᖅ ᐅᑭᐅᖅ 4-ᒥᑦ ᐅᑭᐅᖅ 8-ᒧᑦ.

ᐊᖏᑕᐃᖅᑕᐅᔪᑦ ᐅᓴᖅᑲᐅᑦ ᐅᖅᓯᑕᐅᑎᔪᓪᓗ ᓄᓇᖅᐃᕐᑎᓂᖅ ᐊᖅᓴᖅᑕᐅᓂᐊᖏᓐᓇᖅᑐᑦ ᐅᓴᖅᑲᓄᑦ ᐊᖏᑕᐃᓂᕐᒪᑦ (WRSFs) ᑕᐃᑲᖅᓂᓗᑎᒃ ᑭᓂᔨᑦ ᐅᓴᖃᖅᓂᐊᖏᓐᓂᖅ ᓄᖅᑲᖅᐸᑦ, ᐊᖅᓴᖅᑐᖅᑲᕐᑕᔪᓕᑦ ᒪᑕᖅᓗᓕᑦ ᐊᐅᓚᒪᓕᖅᓂᖓᓕᑦ ᐊᑐᖅᑕᐅᓂᖅᑲᕐᑕᖅᑐᖅ. ᖃᓄᐃᓕᖅᓯᓂᐅᔪᑦ ᓄᓇᕗᑦ ᖃᓄᐃᓕᖅᓯᖅᓯᓄᓄᑦ ᐅᑐᖅᑐᓕᖅᓯᓂᐅᔪᑦ ᐊᑭᓐᓄᑦᑎᓂᖅ (NPAG); ᑕᒪᖏᒃ ᐅᖅᓯᖅᑲᐃᑦ ᐊᖏᑕᐃᓂᕐᒪᑦ ᐅᖅᓯᑕᐅᑎᔪᓪᓗ ᓴᓇᔨᖅᓯᒪᔪᖅᑐᓂᖅ. ᐱᖅᓯᓂᐊᑦ ᐃᓂᐅᔪᑦ ᐃᓕᑕᕆᔨᐅᓂᐊᓕᑦ WRSFs-ᖏᓂᖅᑐᓄᑦ. ᐅᑦᑯᐃᖅᑕᐅᑎᐊᖏᓂᐊᖅᑐᖅᑐᑦ WRSFs ᐱᔪᖅᓇᖅᓂᐊᑎᒃ ᐃᓕᑎᕆᐅᔪᑦ ᐅᑎᖅᑎᕐᑎᓇᖅᓯᒪᓕᖅᑎᑦᓗᓂᑦ. WRSFs ᖃᐅᓕᖅᑕᐅᔨᕐᖏᖅᑐᑦ ᐊᒪᓗ ᐱᕐᖅᑐᓕᖅᑐᖅᑐᖅᑕᐅᖅᖏᓕᓚᐅᖅᑎᒃ ᐊᒪᓗ ᖃᐅᓄᐃᑐᓂᖅᖏᑦ ᓇᓂᖅᓂᖅᖏᓂᓄᑦ ᐱᑎᐊᖅᑲᔨᕐᖏᖅᑐᑦ ᐱᒪᖅᑐᑦ ᓄᓇᕗᑦ ᐊᖏᑕᐃᓂᕐᒪᑦ ᐅᖅᓯᖅᑲᐃᑦ ᐊᑐᖅᑕᐅᓂᖅᑲᕐᑕᖅᑐᖅ TSF ᐅᑦᑯᐃᖅᑕᐅᓂᖅᑲᓄᑦ. ᒪᓂᒪᓂᓕ ᐅᖅᑐᑦᓗᓂᑦ

ᖃᓄᐃᔨᓂᐅᕐᕕᒃ ᐊᒪᓗ ᒪᓕᖅᓯᑎᑦ ᐸᓂᖅᑐᑦ ᖃᑭᒃᑎᑦ ᖃᓄᐃᔨᓂᖅᓱᑎ, ᑎᓪᓚᓂᓕᕆᖅᑎᑦ ᖃᑭᒃᑎᑦ ᐃᓱᒋᓕᐅᖅᑐᙱᖅᑎᑦ, ᓴᐃᖅᓂᓪᓗᓐᓂᒃ ᐊᑯᓂᐅᖅᑐᓴᖅᑎᑦ ᑕᑭᓂᖅᑎᑦ.

WRSFs ᐊᒪᓗ TSF ᐃᖃᑭᒃᑕᐅᓕᐅᖅᑐᑦ ᐊᒪᓗ ᐊᑐᖅᑕᐅᓗᑎᒃ ᒥᑭᓴᑯᖅᑎᓐᓂᖓᓕᒫᑦ ᐊᒃᑐᖅᓱᓂᐅᕙᖅ ᐊᕐᕌᑎᒍᑦ ᐊᒪᓗ ᐃᓱᒪᒋᔭᓗᒍ ᓄᓇᒥᒃ ᖃᐅᔨᓴᐃᓐᓂᑦ ᐊᒪᓗ ᓄᓇᐅᔨ ᖃᓄᐃᑕᐅᖅᓂᕆᓗᓐᓄᑕ ᐊᔪᖏᑎᓐᓂᖓᓄᑦ. ᑯᓘᑐᔨ ᖃᓗᖓ ᐊᒪᓗ ᐊᓂᐊᔪᖅ ᐃᒪᖅ ᑐᖅᑯᔪᖅᓱᒪᕐᒪᖓᓂᑦ ᓱᔨᓗᑯᑦ ᐊᓱᐊᔫᖅᑎᑕᐅᓂᐊᖅᑐᑦ ᐊᒪᓗ ᑲᑎᑕᐅᓗᑎᒃ ᐃᒪᖅᓄᑦ ᑲᑎᖅᓱᐃᐹᖓᓂᑦ (Cps). ᐃᒪᐅᔨ ᖃᓄᐃᐅᓂᖓ ᑎᑭᐅᑎᖏᑐᔨᑦ ᑯᐹᔪᓄᑦ ᐃᖃᑭᐅᒪᔪᒥᒃ ᒪᑕᒃᓴᐃᒍ ᐃᒪᖅᒍᑦ ᓪᐃᓴᐊᖅᑎᓂᒃᓴᖅ, ᑲᑎᑕᐅᔪᖅ ᐃᒪᖅ ᐱᑕᕆᐊᖓᓂᐊᖅᑐᖅ ᐃᒪᑕᕆᖏᓐᓂᑦ (WTP)-ᒥᑦ ᑯᐹᑎᑕᐅᓂᐊᓴᖅᓗᓂ ᓱᓪᒪᒍᑦ.

AGNICO EAGLE

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Project), located approximately 25 km north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine.

There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards). Approximately 12.1 million tonnes (Mt) of ore will be produced. The produced ore will be milled over approximately 8 years of mine life at a rate of 3,000 tonnes per day (tpd) in Year 1 to Year 3 and 5,000 tpd in Year 4 to Year 8.

Waste rock and overburden will be trucked to the waste rock storage facilities (WRSFs) until the end of mine operation, with distribution according to an operation schedule. Results of geochemical testing indicate that the produced waste rock and overburden is non-potentially acid generating (NPAG); both the waste rock and overburden are considered non-metal leaching. Three areas have been identified as the WRSFs. Closure of the WRSFs will begin when practical as part of the progressive reclamation program. The WRSFs will not be covered and vegetated and no additional re-grading activity will be required under the closure plan. Thermistors will be installed within the WRSFs to monitor permafrost development.

Of the total 12.1 Mt of tailings produced, about 9.7 Mt of tailings will be placed in the tailings storage facility (TSF) as dry stack tailings, while the remaining 2.4 Mt will be backfilled to the underground mine as cemented paste backfill. The produced tailings are considered to be non-acid generating (NAG). The TSF consists of three cells, which will be operated one by one to facilitate progressive closure during mine operation. A layer of overburden and waste rock will be used for the TSF closure. From the available testing results and based on the dry stack tailings design, the Tiriganiaq tailings will not pose an acid generation problem, nor a metal leaching problem in the long-term.

The WRSFs and TSF were designed and to be operated to minimize the impact on the environment and to consider geotechnical and geochemical stability. The surface runoff and seepage water from the storage facilities will be diverted via channels and collected in the water collection ponds (CPs). If the water quality does not meet the discharge criteria as per the Water Licence requirement, the collected water will be treated by the Water Treatment Plant (WTP) prior to being discharged to the outside environment.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	April 2015			First draft version of Mine Waste Management Plan as Supporting Document for Type A Water Licence Application, submitted to Nunavut Water Board for review and approval	Tetra Tech EBA Inc.
2	June 2016	1.1, 1.2,	1-2	Update to reflect issuance of the Type A Water Licence.	Golder Associates Ltd.
		1.3	12-15	Removal of original Section 1.3 as was specifically linked to the application.	
		3.3	22-24	Update to reflect receipt of Type A Water Licence	
		5.5, 6.1, 9.1, 9.2	34-35; 37-38	The Plan updated to comply with Part B Section 13, and Part F Sections 12, and20 of the Type A Water Licence 2AM-MEL1631 and commitments made during the licensing process.	
3	March 2017			General update of the plan	Environment, Engineering and Mine Departments
4	March 2018			Minor revisions	Environment, Engineering Departments

ACRONYMS

ABA	Acid Base Accounting
Agnico Eagle	Agnico Eagle Mines Limited
ARD	Acid Rock Drainage
ML	Metal Leaching
CP	Collection Pond
CRA	Commercial, Recreational, and Aboriginal
DFO	Department of Fisheries and Oceans Canada
FEIS	Final Environmental Impact Statement
HCT	Humidity Cell Test
INAC	Indigenous and Northern Affairs Canada
MEND	Mining Environment Neutral Drainage
MMER	Metal Mining Effluent Regulations
NAG	Non-Acid Generating
NLCA	Nunavut Land Claims Agreement
NPAG	Non-Potential Acid Generating
NPR	Net Potential Ratio
NWB	Nunavut Water Board
NWR	Nunavut Water Regulations
NWNSRTA	Nunavut Waters and Nunavut Surface Rights Tribunal Act
PAG	Potential Acid Generating
PGA	Peak Ground Acceleration
Project	Meliadine Gold Project
SFE	Shake Flask Extraction
TSF	Tailings Storage Facility
WRSF	Waste Rock Storage Facility
WTP	Water Treatment Plant
WRTP	Waste Rock Transfer Pad

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per meter
cm/s	centimetre per second
ha	hectare
kPa	kilopascal
km	kilometre(s)
L	liter(s)
m	metre
mg	milligram
m/s	metre per second
mm	millimetre
mm/h	millimetre per hour
m^2/year	square metre(s) per year
m^3	cubic metre(s)
Mm^3	million cubic metre(s)
t	tonne
t/m^3	tonne per cubic metre
Mt	million tonne(s)
µm	micrometre

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.4 Mt of waste rock, 7.1 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Mining facilities include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), and a water management system that includes collection ponds (CPs), water diversion channels, and retention dikes/berms, and a Water Treatment Plant (WTP). The general mine site location for the Project and the site layout plan are shown in Figures 1.1 and 1.2, respectively, as attached in Appendix A.

1.1 Concordance

The Project is subject to land and resource management processes established by the Nunavut Land Claims Agreement (NLCA) and other Federal laws and regulations. Agnico Eagle submitted a Type A Water Licence Application for a Mining and Milling Undertaking (Application) required to use water and to deposit waste in development of the Project, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* (NWNSRTA) and Nunavut Water Regulations (NWR) to submit to the Nunavut Water Board (NWB).

The Type A Water Licence 2AM-MEL1631 was issued on April 15, 2016 and signed by the minister on May 19, 2016. The Mine Waste Management Plan reflects the commitments made with respect to submissions provided during the technical review of the Application, as well as final submissions and issues raised during the Public Hearing Process, where applicable, to comply with Part B Section 13, and Part E Section 10 of the Type A Water Licence 2AM-MEL1631.

1.2 Mine Waste Management Plan Summary

This document presents the Mine Waste Management Plan (the Plan) in compliance with the Type A Water Licence 2AM-MEL1631. The purpose of the Plan is to provide consolidated information on

waste rock, overburden, and tailings management, including strategies for runoff and dust control and monitoring programs for the storage facilities. The Plan is divided into the following components:

- Introductory section (Section 1);
- A brief summary of the physical setting at the mine site (Section 2),
- A brief summary of the mine plan (Section 3);
- A description of the waste rock and overburden management plan (Section 4);
- A description of the tailings management plan (Section 5);
- A description of water management associated with mine waste management (Section 6);
- A description of dust management associated with mine waste management (Section 7);
- A description of reclamation and closure related to mine waste management (Section 8); and
- Monitoring program (Section 9).

The Plan will be updated, as required, to reflect changes in operation or economic feasibility occurs, and incorporate new information and latest technology, where appropriate, to comply with Part B Section 15 of the Type A Water Licence 2AM-MEL1631.

1.3 Overall Schedule and General Activities

The construction phase is anticipated to start in last quarter of Year -5 and take approximately just over 4 years (Q4 Year-5 to Year -1). The mine construction period will primarily focus on site preparation and the construction of infrastructure, with some mining activities (advancement of the mine ramp) occurring at the Tiriganiaq underground mine. The first year of operation (Year 1) will commence after commissioning is completed in the last quarter of construction (Year -1). The operation phase will span approximately 8 years (Year 1 to Year 8). Mining activities are expected to end in Year 7 and ore processing is expected to end in Year 8. Closure will occur within three years (Year 9 to Year 11) after the completion of mining and will include the removal of non-essential site infrastructure. Flooding of the mined-out open pits with water pumped from Meliadine Lake and flooding of the underground mine with natural groundwater seepage will start in Year 8 as progressive reclamation. Post-closure phase will commence as closure is completed in Year 11 and will continue until it is shown that the site and water quality meets all the regulatory closure objectives. Table 1.1 summarizes the overview of the timeline and general activities.

Table 1.1: Key Mine Development and Water Management Activities and Sequence

Mine Year	Mine Development Activities	Water Management Activities
Q4 of Yr-5 2015	• Start to construct the industrial pad • Develop the ramp to Tiriganiaq underground mine • Construct portion of rock pad for OP1 and OP2 stockpiles to store the ore from Tiriganiaq underground ramp development • Install Culvert2 • Construct Channel2	• Start to re-use the underground water • Dewatering top 0.5 to 1.0 m of fresh water in Pond H17
Yr -4 PC: 2016	• Continue construction of the industrial pad • Start Construction of D-CP1 to impound CP1 • Start Construction of D-CP5 to impound CP5 • Construct and operate the temporary landfill • Start to place waste rock in the WRSF2 • Construct and operate P-Area Containment Ponds • Construct Saline Pond for additional underground saline water storage	• Dewatering of H17 into Meliadine Lake. • Dewater Pond A54 in Q3 of Year -4 and pump the water to CP1. • Start to store the excess groundwater from the underground mine at surface. • Implement and test evaporators at P-Area to reduce water volumes stored at surface. • Construct trenches down gradient from DP1-B and DP3-A to be able to pump collected water seep and pump back to the associated containment pond.

Table 1.1: Key Mine Development and Water Management Activities and Sequence

Mine Year	Mine Development Activities	Water Management Activities
Yr -3 PC: 2017	• Complete the industrial pad • Construct and operate the land farm • Construct and operate the operation landfill • Complete Construction D-CP1, jetty and Pumping station CP1 • Complete Construction D-CP5 jetty and Pumping station CP5 • Erect and close all main buildings except, Crusher, Paste Plant and Crushed Ore Storage • Erect Incinerator • Erect and operate Effluent Water Treatment plant • Fuel tanks at portal 1 • Construct channel 1, 7 & 8 and berm 1 and 3 • Install all Culverts • Construct freshwater intake causeway in Meliadine Lake & Install Pumping station • Construct Lv75 Water stope for additional underground saline water storage	• Start to pump the water from CP1 to WTP for treatment prior to discharge to the outside environment via the diffuser in Meliadine Lake. • Pump the underflow sludge water from the WTP to CP1. To limit recirculation of the sludge within CP1, the discharge will be located away from the WTP intake. • Start to treat sewage water and pump the treated sewage water from sewage treatment plant to CP1. • Start to pump the contact water from CP5 to CP1 for treatment/dilution • Start to pump water seepage collected in trenches, down gradient from D-CP1, D-CP5, DP1 and DP3 to the associated containment pond. • Start to pump the water from the Landfarm to CP1 after pre-treatment for oil. • Start to pump water from washbay to underground for storage until treatment for oil plant arrives at the site • De-ice or divert water from Lakes H17A, H17B, and H17 C • Start to pump the water from CP1 to WTP for treatment prior to discharge to the outside environment via the diffuser in Meliadine Lake
Yr -2 PC: 2018	• Expand the pad footprint of OP1 and OP2 to increase the storage capacity • Start to place waste rock in the WRSF1 • Erect and close crusher, paste plant and Crushed ore storage • Channels 3, 4, berm 2, • Construct D-CP3 to form CP3, jetty and start to collect contact water • Construct D-CP4 to form CP4, jetty and start to collect contact water • Fuel tank 20ML in Rankin, • Fuel Tank 6ML and 250KL at site • Install all Culverts	• Start to divert the contact water from industrial pad to CP1 via Channel1 • Construct and operate saline water treatment to be discharged to CP1

Table 1.1: Key Mine Development and Water Management Activities and Sequence

Mine Year	Mine Development Activities	Water Management Activities
Yr -1 PC: 2019	• Start process commissioning in Q2 of Year -1 • Start to place dry stack tailings in Cell 1 of TSF in Q2 of Year -1 • Start full capacity of ore processing end Q3	• Start to pump the treated water from WTP to mill as make-up water • Start to pump the underflow sludge water from WTP to the mill during the open water season, the mill will be supplemented as much as possible with water from the WTP. For the balance of the year, fresh water will be used for ore processing • Start to pump excess truck wash water from the wash bay to the saline treatment plan to and then to CP1
Yr 1 PC: 2020		• Start to pump the contact water in CP3 to the partially drained Pond H13 where the water will flow through Channel1 into CP1 • Start to pump the contact water in CP4 to the partially drained Pond H13 where the water will flow though Channel1 into CP1
Yr 2	• Start to mine Tiriganiaq Pit 1 • Start to place overburden and waste rock from Tiriganiaq Pit 1 in WRSF1	• Start to pump contact water collected in Tiriganiaq Pit 1 to CP5
Yr 3	• Expand process plant to reach the process capacity of 6,000 tpd • Construct temporary overburden stockpile to store the selected ice-poor overburden that will be used for progressive reclamation of TSF	• Dewater Ponds H19 and H20 in Q3 of Year 3 and pump the water to CP1
Yr 4	• Increased mill production to 5,500 tpd for 2023 and 6,000 tpd beyond • Start to mine Tiriganiaq Pit 2 • Start to place waste rock and overburden from Tiriganiaq Pit 2 in WRSF3 • Construct D-CP6 to CP6 and start to collect contact water • Start to place dry stack tailings in Cell 2 of TSF • Start to place low grade ore from the open pits in the OP1 stockpile • Construct rock pad for OP3 to store marginal grade ore from the open pits	• Start to pump contact water collected in Tiriganiaq Pit 2 to CP5 • Start to pump contact water in CP6 to CP1

Table 1.1: Key Mine Development and Water Management Activities and Sequence

Mine Year	Mine Development Activities	Water Management Activities
	• Stop placing rock and overburden in WRSF1 when WRSF1 reaches design capacity	
Yr 5	• Start to place waste rock from Tiriganiaq Pit 1 in WRSF2 • Place final closure cover on top of tailings surface in Cell 1 of TSF (waste rock cover over final Cell 1 perimeter slope to be placed as progressive reclamation -as soon as slope reaches final grade)	• Water management plan similar to Year 4
Yr 6	• Start to place dry stack tailings in Cell 3 of TSF • Stop placing overburden waste in WRSF3	• Water management plan similar to Year 4
Yr 7	• Place final closure cover on top of tailings surface in Cell 2 of TSF (waste rock cover over final Cell 2 perimeter slope to be placed as for progressive reclamation as soon as slope reaches final grade) • Stop mining of Tiriganiaq Pit 1 and Tiriganiaq Pit 2 when the open pits reach design elevation • Stop Tiriganiaq underground operation when underground mine reaches design elevation • Stop placing waste rock and overburden in WRSF2 when WRSF2 reaches design capacity • Stop placing waste rock in WRSF3 when WRSF3 reaches design capacity	• Water management plan similar to Year 4 • Stop pumping water from the open pits when the pits are mined-out at end of year • Stop pumping excess water from underground when underground mine is completed
Yr 8	• Process the ore from the OP1, OP2, and OP3 until all stored ore are processed • Decommission of underground mine surface openings as needed	• Start to fill the mined-out Tiriganiaq Pits 1 and 2 with active pumping water from Meliadine Lake • Start natural flooding of Tiriganiaq Underground mine with groundwater seepage • Stop pumping water to process plant when the processing is completed

Table 1.1: Key Mine Development and Water Management Activities and Sequence

Mine Year	Mine Development Activities	Water Management Activities
Closure (Yr 9 to 11)	• Place final closure cover on top of tailing surface in Cell 3 of TSF in Year 9 (waste rock cover over final Cell 3 perimeter slope to be placed as progressive reclamation - as soon as slope reaches final grade) • Decommission non-essential mine infrastructure and support buildings in Years 9 and 10 • Continue to fill the mined-out open pits with active pumping water from Meliadine Lake until Year 10 • Start monitoring and maintenance in Year 9 (start in Year 8 if possible)	• Finish flooding Tiriganiaq Pit 1 and Tiriganiaq Pit 2 by Q4 of Year 10 • Continue to collect and manage the contact water in CP1 to CP6 • Continue to pump the contact water in CP1 to WTP, if required, for treatment before being discharged to the outside environment • Remove non-essential site infrastructure • Pump the underflow sludge water from WTP to CP1 • Continue natural flooding of Tiriganiaq Underground mine with groundwater seepage • Remove Meliadine Lake pumping system
Post-Closure	• Continue monitoring and maintenance until Year 18	• Treat the contact water until water quality meet direct discharge criteria and then decommission the water management system • Continue natural flooding of Tiriganiaq Underground (progressive reclamation since Year 8) • Breach water retention dikes D-CP1, D-CP3, D-CP4, D-CP5 and D- CP6 once water quality monitoring results meet discharge criteria to allow water to naturally flow to outside environment • Remove culverts and breach remaining water retention dikes/berms in Year 18

SECTION 2 • PHYSICAL SETTING

2.1 Site Conditions

The mine site is located in lowlands near the northwest coast of Hudson Bay. The dominant terrain at the mine site area comprises glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and small lakes. The topography is gently rolling with a mean elevation of 65 m above sea level and a maximum relief of 20 m.

The local overburden typically consists of sand and gravel deposits of various thicknesses overlying till with cobbles and boulders. Some of the surfaces are covered by a thin layer of organics. Bedrock at the mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite, and mafic volcanic flows (Snowden 2008; Golder 2009a).

Low-lying areas are poorly drained as a result of a low slope in the landscape and intermittent streams connect numerous shallow ponds and lakes. The following subsections summarize the physical setting at the mine site.

2.2 Climate

The mine site is located in the Kivalliq Region of Nunavut, near the northern border of the southern Arctic terrestrial ecozone, and within the Arctic tundra climate region. Within this region daylight reaches a minimum of 4 hours per day during the winter to a maximum of 20 hours per day during the summer. The climate is extreme with long cold winters and short cool summers. Temperatures are cool, with a mean temperature of 12°C in July and -31 °C in January. The mean annual air temperature at the Project site is approximately -10.4 °C (Golder 2012a).

The recorded prevailing winds are from north and north-northwest. The wind blows from the north and north-northwest direction more than 30% of the time, and the least frequent wind direction is west-southwest, with a frequency of 2.1%. The calm frequency is 2.8% of the time. The mean values for wind speed show that the north-northwest together with north and northwest winds have the highest speeds and tend to be the strongest.

Mean annual precipitation at the mine site, based on the hydrological year from 1 October to 30 September, is estimated to be 411.7 mm after accounting for rainfall and snowfall undercatch. Approximately 51% of precipitation occurs as rain (207.1 mm) and 49% occurs as snow (199.1 mm).

2.3 Permafrost

The mine site is located in an area of continuous permafrost, as shown on Figure 2.1 as attached in Appendix A.

Late-winter ice thicknesses on freshwater lakes in the mine site area were recorded from 1998 to 2000. The measured data indicated that ice thickness ranges from 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July (Golder 2012 b).

Published data regarding permafrost were used to recreate the permafrost map of Canada shown in Figure 2.1. Based on thermal studies and measurements of ground temperatures, the depth of permafrost at the mine site is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to about 3 m adjacent to the lakes. The depth of the permafrost and active layer will vary based on proximity to the lakes, overburden thickness, vegetation, climate conditions, and slope direction (Golder 2012b). The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 15 m) are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder, 2012c).

2.4 Taliks

Taliks (areas of unfrozen ground) are to be expected where lake depths are greater than about 1.0 to 2.3 m. Formation of an open-talik, which penetrates through the permafrost, would be expected for lakes that exceed a critical depth and size. It is anticipated that an open-talik exists below Lake B7 based on the depth and geometry of this lake (Golder, 2012b). The salinity of groundwater also influences the temperature at which the groundwater will freeze. The test results on two deep groundwater samples collected below the base of the permafrost for baseline study indicated salinity level leads to a freezing point depression of about 3.2 °C (FEIS Volume 7, Appendix 7.2-A).

2.5 Subsurface Condition

A series of geotechnical site investigation programs had been carried out at the mine site (Golder 1999, 2009b, 2010a, 2010b, 2012d, 2012e, SRK 2007, Tetra Tech EBA 2013a, 2014a, 2016a), and LVM (2015). A total of 175 geotechnical boreholes were drilled and 37 thermistor cables were installed during the site investigation programs.

Fourteen boreholes were drilled within the footprints of the WRSFs during the previous site investigations. In general, a veneer of organic material ranging from 0.02 to 0.70 m was encountered in most of boreholes. The underlying overburden material encountered in most of boreholes consisted of a sand and silt matrix, gravelly, and some gravel with cobbles and boulders. The overburden thickness ranges between 1.5 to 13.6 m and is underlain by greywacke bedrock. Overburden soils with excess ice were observed in most of the boreholes. Massive icy beds up to 1.5 m thick were also encountered.

In 2014, a total of seven boreholes were drilled within the footprint of the TSF. The subsurface soil profile is similar to the soil encountered within the footprint of the WRSFs. Generally, the soil profile consists of a veneer of organic material ranging from 0.1 to 0.75 m, layers of a sand and silt matrix, and overlaid by bedrock. The overburden thickness ranges from 1.3 to 7.3 m. An ice layer up to 1.75 m thick was encountered in one borehole. Soil porewater salinity tests (Tetra Tech EBA, 2013a) indicated that the overburden soils at the mine site may have a porewater salinity of 4 to 12 parts per thousand.

2.6 Seismic Zone

The mine site is situated in an area of low seismic risk. The peak ground acceleration (PGA) for the area was estimated using seismic hazard calculator from the 2010 National Building Code of Canada website (http://www.earthquakescanada.nrcan.gc.ca/hazard-alea/interpolat/index_2010-eng.php). The estimated PGA is 0.019 g for a 5% in 50-year probability of exceedance (0.001 per annum or 1 in 1,000 year return) and 0.036 g for a 2% in 50-year probability of exceedance (0.000404 per annum or 1 in 2,475 year return) for the area.

SECTION 3 • MINING PLAN

3.1 Mine Development Plan

Tiriganiaq gold deposit will be developed using traditional open-pit and underground mining methods. Two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and an underground mine (Tiriganiaq Underground) will be developed as shown in Figure 1.2. Approximately 31.4 Mt of waste rock, 7.1 Mt of overburden material, and 12.1 Mt of tailings will be produced.

The following mining development sequence is planned:

- Tiriganiaq underground mine will be developed and operated from Year -5 to Year 7;
- Tiriganiaq Pit 1 will be mined from Year 2 to Year 7; and
- Tiriganiaq Pit 2 will be mined from Year 4 to Year 7.

3.2 Mine Waste Development Plan

Three mine waste streams will be produced: waste rock, tailings, and overburden material.

The term “waste rock” designates all fragmented rock mass that has no economic value and needs to be stored separately. Waste rock is also commonly referred to as “mine rock” in the mining industry. Typically, waste rock is produced during the initial stripping and the subsequent development of open pits and underground workings.

The term “overburden” designates all soils above the bedrock that needs to be stripped at surface prior to developing the open pits. Generally, the overburden at the site consists of a thin layer of organic material overlying a layer of non-cohesive soil with variable amounts of silt, sand, and gravel.

Tailings are the processed material by-product of the gold recovery process and generally comprise water with gravel, sand, silt, and clay sized particles.

Table 3.1 summarizes the schedule and quantities to be mined from the open pit and underground mining operations. The usage or destination of the three mine waste materials is presented in Table 3.2. Figure 3.1 presents a graphical representation of the mine waste management flow sheet.

Further details on the management of the mine waste materials are presented in Sections 4 and 5 of this plan.

Table 3.1: Summary of Mine Waste Production Schedule

Year	Mine Waste and Ore from Underground (t)		Mine Waste and Ore from Tiriganiaq Pit 1 (t)			Mine Waste and Ore from Tiriganiaq Pit 2 (t)		
	Waste Rock	Ore	Overburden	Waste Rock	Ore	Overburden	Waste Rock	Ore
Yr-5	290,705*	36,911**	0	0	0	0	0	0
Yr-4	355,200	7,646	0	0	0	0	0	0
Yr-3	583,679	5,725	0	0	0	0	0	0
Yr-2	691,529	120,865	0	0	0	0	0	0
Yr-1	764,683	602,440	0	0	0	0	0	0
Yr1	959,950	1,185,403	0	0	0	0	0	0
Yr2	789,614	1,051,472	2,038,237	68,930	0	0	0	0
Yr3	608,626	1,254,293	4,328,239	4,205,799	0	0	0	0
Yr4	336,059	1,237,507	236,246	5,774,071	905,004	391,137	287,727	6,509
Yr5	31,567	1,154,294	0	5,004,160	742,892	97,830	1,667,353	70,586
Yr6	0	967,430	0	3,703,548	781,391	0	2,468,635	123,008
Yr7	0	888,008	0	1,830,060	710,953	0	973,358	254,040
Total (t)	**5,411,612**	**8,511,994**	**6,602,722**	**20,586,568**	**3,140,240**	**488,967**	**5,397,073**	**454,143**

*The amount include approximately 112,775 tonnes of waste rock produced during development of ramp to underground mine before construction phase starting in Year-5

**Volume from 2008-2015 of ore produced during development of ramp to underground mine before construction phase starting in Year-5

Table 3.2: Summary of Mine Waste Tonnage and Destination

Mine Waste Stream	Estimated Quantities		Waste Destination
Overburden	7.1 Mt		Temporary storage in the Overburden Stockpile ~ 0.1 Mt for reclamation of TSF
			Closure and site reclamation for the TSF
			Co-disposed with waste rock within WRSFs
Waste Rock	31.4 Mt		Dike and road construction
			WRSFs
			Closure and site reclamation for the TSF
Tailings	12.1 Mt	9.7 Mt	As dry stack tailings placed in the TSF
		2.4 Mt	Backfilled to underground mine as cemented paste backfill

3.2 Mine Waste Storage

The overall objective of the site selection for the WRSFs and TSF was to minimize the footprint of the areas occupied by the waste rock, overburden, and tailings, and where possible, avoid environmentally and socially sensitive areas.

3.2.1 Waste Rock and Overburden Storage Area

Three areas were identified for the combined storage of waste rock and overburden material as shown in Figure 1.2 of Appendix A. These areas can be described as follows:

- The WRSF1: located north of Tiriganiaq Pit 1 with an approximate footprint of 41.4 ha.
- The WRSF2: located south of Pond H17 (CP1) with an approximate footprint of 20.2 ha.
- The WRSF3: located north of Tiriganiaq Pit 2, covered H20 pond basin with an approximate footprint of 22.7 ha.

Originally, four main areas were proposed as the waste rock storage areas in the baseline study for the project during the FEIS to store the waste rock and overburden generated from mining the five deposits. Comparatively, the WRSFs for Tiriganiaq have less impact on existing waterbodies, smaller footprints, shorter haul distances, and it will be easier to manage the surface runoff and seepage from the facilities as shown in Figure 3.2.

3.2.2 Tailings Storage Area

Tailings will be placed and stored the as a dry stacked tailings within the TSF that is located on an area of high ground located between the mill and east of Lake B7 as shown on Figure 1.2. It will be constructed on land and will not cover any major waterbodies. A total 12.1 Mt of tailings will be produced over a mine life of approximately 8 years. About 9.7 Mt tailings (80% of total tailings) will be placed in the TSF as dry stack tailings. The remaining 2.4 Mt (20% of total tailings) will be used as underground cemented paste backfill for the primary stopes and longitudinal stopes.

3.3 Use of Traditional Knowledge in the Planning for Mine Waste Management

Inuit Qaujimajatuqangit (IQ) is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. Information collected can contribute to mine design and monitoring.

Agnico Eagle is committed to including IQ and public concerns stemming from IQ, where practical, in the design of management and monitoring plans for the Project. Agnico Eagle will continue active engagement with communities and Inuit organizations as the Project proceeds through permitting, and if approved, construction, operations and closure. This consultation and engagement should lead to further inclusion of IQ, as it becomes available, in updates to the design and implementation of environmental programs. Section 1.5 of the Main Application Document developed for the Type A

Water Licence Application (Agnico Eagle 2015a) summarizes IQ and public concerns. A list of public concerns can be found in the Public Engagement and Consultation Baseline Report, in compliance with the Type A Water Licence 2AM-MEL-1631.

This Mine Waste Management Plan considers IQ, including traditional ecological knowledge (TEK), traditional land use (TLU) and public concerns regarding Project effects on traditional resources and traditional land use sites, through the following Project design and mitigation measures:

- Based on IQ and community consultation, it is clear that clean water and the health of fish, wildlife, birds, and caribou is important to Elders and other people in the communities. Therefore, the WRSFs and TSF for the Project are designed and will be operated to minimize the impact on the environment. For example, the surface runoff and seepage water from the storage facilities will be diverted via channels, collected in water collection ponds, and treated as needed prior to discharge to the outside environment. In addition, contact water quality will be monitored and assessed throughout the construction, operations, closure, and post-closure phases such that any required changes to how the water is managed on site can be identified and implemented in a timely fashion.
- Inuit Qaujimajatuqangit indicates that caribou move through the Project area on a regular basis. Therefore, progressive reclamation of Project waste management infrastructure includes closure activities that take place prior to the end of mining (final closure). These closure activities consider minimizing the risk of erosion and sediment loss as a result of on-site runoff, minimizing dust generation and soil drifting, stabilizing slopes, and the creation of a final landscape that allows caribou to continue to move through the area in the future as they have done in the past. They also provide for clean water, as well as healthy fish, wildlife, birds, and caribou.
- Through IQ and community consultation, it is known that people have fished and continue to fish in the Meliadine area. The use of dry stack tailings avoids potentially impacting and/or using significant bodies of water, such as Lake B7, and further limits the amount of seepage potentially reporting from the TSF, both during operations and into closure and post-closure of the proposed mine. The dry stack tailings process also minimizes the traditional “tailings pond” surface area thereby reducing the potential for contact between migratory birds and the tailings “pond”.
- Inuit Qaujimajatuqangit states that berry picking and caribou hunting are important parts of the Inuit culture in the past and today. Community members have expressed concern over dust that could impact the health of the caribou and berries. Therefore, dust suppression measures will be considered though the design, operation, and closure phases of all waste management infrastructures at the Project. Monitoring programs have been included to monitor the impact of dust on vegetation near the mine site and to specifically measure uptake of metals by such vegetation.

SECTION 4 • WASTE ROCK AND OVERBURDEN MANAGEMENT

4.1 General Description of Waste Rock and Overburden Management

Approximately 31.4 Mt of waste rock will be mined from the open pits and underground mine operations. The majority of the waste rock produced (about 25.3 Mt) will be placed and stored within the designated WRSFs. The remaining 6.1 Mt of waste rock will be used for other purposes, including: about 2.0 Mt will be backfilled to the underground mine, 1.65 Mt of waste rock will be used for construction activities, and 2.45 Mt of waste rock will be used as TSF closure cover material.

Approximately 7.1 Mt of overburden will be produced. About 7.0 Mt of overburden will be co-disposed within the WRSFs. The remaining, approximately 0.1 Mt, will be stored in a temporary overburden stockpile that will be used as cover material for progressive closure and reclamation of the TSF area.

Seepage and runoff water from the WRSFs and the temporary overburden stockpile will be managed by a series of water diversion channels, water retention dikes/berms, and water collection ponds. If the water quality does not meet the discharge criteria the collected contact water will be treated by the WTP prior to discharge to the outside environment. The contact water quality and the water management structures for the WRSFs will be monitored and assessed according to an approved environmental protocol during each stage of the mine life, including construction, operations, closure, and post-closure. The geochemical characterization of the waste rock, ore, tailings and overburden was submitted as SD 6-3 Geochemical Characterization of Waste Rock, Ore, Tailings and Overburden Meliadine Gold Project, Nunavut (Agnico Eagle 2014).

The waste rock will be managed as one mixed pile; the management plan for waste rock considers the overall leachability of the mixed pile, and aims to limit arsenic leaching during operation and post-closure. Predictive water quality modelling also considered the overall leachability of waste rock and results show that the mine effluent will meet MMER during operation, and MMER, Canadian Council of Ministers of the Environment water quality guidelines, or site specific water quality objectives post-closure. No arsenic treatment is anticipated to be needed.

4.2 Waste Rock Storage Facilities

The design location of the WRSFs took into consideration the environmental, social, economic, and technical aspects of waste rock management which included the following:

- maintain a minimum distance of 100 m between the toe of the WRSFs and the open pits;
- maintain a minimum distance of 20 m from the toe of the WRSFs to haul and access roads; and
- maintain a distance between the toe of the WRSFs and adjacent lakes that will ensure stability of the facilities and ensure no effects to lakes not disturbed by mine activities.

Table 4.1 summarizes some of the key physical parameters used for the design of the WRSFs:

Table 4.1: Design Parameters for Waste Rock Storage Facilities

Design Parameters	WRSF1	WRSF2	WRSF3
Height of the first lift above original ground surface (m)	5		
Sideslope of each lift of waste rock	1.3(H):1(V)		
Width of the horizontal offset between the first and second lift (m)	15		
Width of the horizontal offset between two adjacent lifts above the second lift (m)	30	20	20
Maximum crest elevation above the sea level (m)	115	102	100
Average overall sideslopes of each WRSFs (from bottom toe of first lift to top crest of final lift)	2.5(H):1(V) to 3.4(H):1(V)	2.2(H):1(V) to 2.4(H):1(V)	2.3(H):1(V) to 2.5(H):1(V)
Sideslope for each lift of overburden	1.6(H):1(V)		
Internal Overburden setback distance from toe of WRSF for the first lift (m)	120	80	88
Assumed waste rock in place bulk density (t/m^3)	1.88		
Assumed overburden in place bulk density (t/m^3)	1.62		

Based on the above design criteria, the WRSFs will provide a 9.4 Mm^3, 3.6 Mm^3, and 5.0 Mm^3 of design capacity for WRSF1, WRSF2, and WRSF3, respectively.

4.2.1 Waste Rock Storage Facility 1

The proposed WRSF1 will occupy an area of approximately 41.4 ha and will be located to the north of Tiriganiaq Pit 1. Two small shallow ponds (Ponds A17 and B9) are located within the footprint of WRSF1 and will be covered by the facility as shown in Figure 4.1. The ponds are less than 2 m deep and freeze to the bottom annually during the winter season. These ponds do not provide habitat for fish designated as commercial, recreational, or aboriginal (CRA) fish species (Golder 2015).

The proposed WRSF1 was designed in consideration of both frozen and unfrozen foundation conditions. Thus, the stability of the facility does not rely on the presence of permafrost foundations even though permafrost foundation conditions are expected to be present over long term based on the geothermal analyses that consider long-term climate change, waste rock placement schedule, and annual thaw of the active layer. The WRSF1 will accommodate waste rock produced from Tiriganiaq underground mining and Tiriganiaq Pit 1 and the overburden produced from Tiriganiaq Pit 1. It is anticipated that approximately 10.2 Mt (5.42 Mm^3) of waste rock and 6.5 Mt (4.02 Mm^3) of overburden will be placed in WRSF1.

From Year -2 to Year 4, the majority of the waste rock produced will be placed at WRSF1, with a portion of waste rock being used for underground backfill and TSF progressive closure cover. All overburden material produced from pre-stripping of Tiriganiaq Pit 1 will be placed at WRSF1. To

manage the slope stability of the placed overburden, the overburden will be placed within areas that will be surrounded by waste rock. The WRSF1 is expected to reach its design capacity at the end of Year 4.

4.2.2 Waste Rock Storage Facility 2

The proposed WRSF2 is located to the south of Pond H17 (CP1) with an approximate footprint of 20.2 ha. Five small ponds (Ponds A58, H8, H9, H10, and H11) are located within the footprint of WRSF2 as shown in Figure 4.1. Pond A58 will be fully covered and the other four ponds will be partially covered by waste rock. All five ponds are less than 2.0 m deep and freeze to bottom during the winter (about 8 months of the year). Of the five ponds impacted by WRSF2, only nine spine stickleback were caught in Ponds A58 and H10. These ponds do not provide habitat for fish designated as CRA fish species and the ninespine stickleback is not considered to be a species supporting the CRA fisheries (Golder 2015).

The WRSF2 will accommodate the majority of waste rock produced from Tiriganiaq Pit 1 from Year 5 to Year 7. The WRSF2 is expected to reach its design capacity by the end of Year 7.

4.2.3 Waste Rock Storage Facility 3

The proposed WRSF3 is located to the north of Tiriganiaq Pit 2, covered basin of Pond H20 with an approximate footprint of 22.7 ha as shown in Figure 4.1. The runoff water from WRSF3 will be collected within Pond H19. Maximum water depths for Ponds H19 and H20 are 1.4 m and 1.6 m, respectively. No fish species were found in these two ponds.

The proposed WRSF3 was designed in consideration of both frozen and unfrozen foundation conditions. Thus, the stability of the facility does not reply on the presence of permafrost foundations even though permafrost foundation conditions are expected to be present over long term based on the geothermal analyses that consider long-term climate change, waste rock placement schedule, and annual thaw of the active layer. The WRSF3 will accommodate overburden from pre-stripping of Tiriganiaq Pit 2 and all waste rock produced from Tiriganiaq Pit 2 with some portions of waste rock from Tiriganiaq Pit 1 in Year 4 and Year 5. The WRSF3 is expected to reach its design capacity by end of Year 7.

4.3 Waste Rock Distribution

An estimate for the production schedule, quantities, and distribution of waste rock by year is presented in Table 4.2. The development plan for the waste rock placement is shown in Figures 1.2.

Table 4.2: Schedule, Quantities, and Distribution of Waste Rock by Year

Mine Year	Total Waste Rock from Mine Operation (t)	Utilization of Waste Rock (t)			Waste Rock to be Placed in WRSFs(t)		
		Construction	Rockfill for Underground Backfill	TSF Closure Cover	WRSF1	WRSF2	WRSF3
Yr -5	290,705*	290,705	0	0	0	0	0
Yr -4	355,200	355,200	0	0	0	0	0
Yr -3	583,679	583,679	0	0	0	0	0
Yr -2	691,529	0	0	0	691,529	0	0
Yr -1	764,683	0	31,910	0	732,773	0	0
Yr 1	959,950	0	190,180	160,929	608,842	0	0
Yr 2	858,544	0	235,839	164,214	458,491	0	0
Yr 3	4,814,425	19,268	188,991	128,402	4,477,764	0	0
Yr 4	6,397,857	0	349,005	236,634	3,221,661	0	2,590,557
Yr 5	6,703,080	0	364,965	411,296	0	3,059,326	2,867,493
Yr 6	6,172,183	0	370,885	239,114	0	3,093,548	2,468,635
Yr 7	2,803,418	0	319,338	533,194	0	977,528	973,358
Yr 8	0	0	0	313,774	0	-313,774	0
Yr 9	0	0	0	269,094	0	-269,094	0
Total (t)	**31,395,253**	**1,248,852**	**2,051,112**	**2,456,651**	**10,191,060**	**6,547,534**	**8,900,043**
Volume (m^3)	**16,999,603**	**664,283**	**1,091,017**	**1,306,729**	**5,420,777**	**3,482,731**	**4,734,065**

*The amount include approximately 112,775 tonnes of waste rock produced during development of ramp to underground mine before construction phase starting in Year-5

4.4 Overburden Storage and Management

Approximately 7.1 Mt of overburden material will be removed from the surface footprint of the two pits over the mine life. The approximate quantities and proposed placement location of the overburden is presented in Table 4.3.

The overburden material will be mainly stored within the WRSFs. A small volume of overburden (approximately 0.5% of total overburden produced) will be used for site infrastructure construction. The amount of overburden used for site infrastructure construction is included within the quantities of overburden placed into the WRSFs, as presented in Table 4.3. About 0.1 Mt of selected ice-poor overburden will be stored in a temporary overburden stockpile as TSF closure cover material. This temporary overburden stockpile is located at the east side of the TSF and has a footprint of approximately 1.12 ha and is shown in Figure 1.2. The temporary overburden stockpile is approximately 5.0 m high with sideslopes of 3(H):1(V).

The design of the main overburden WRSF was revisited to determine if a portion of the 7.1 M tonnes of overburden removed prior to mining of the Tiriganiaq open pits could be placed in a manner within the same overburden/WRSF footprint that would permit later recovery of this overburden for use in mine site reclamation purposes for use in mine site reclamation purposes. Two options were considered (Tetra Tech EBA 2016b), including the placement, storage, and recovery of the overburden material in a zone at the outer edge of the facility; and the recovery of the overburden material from the top of the facility. However, given the small footprint and compactness of the mine layout, there is no available real estate to reconfigure the WRSF's to accommodate the late recovery of overburden materials. There is the potential to recover some of the overburden materials from the top of WRSF1, which would require careful management and would yield approximately 0.15 M tonnes.

Table 4.3: Schedule, Quantities, and Distribution of Overburden by Year

Mine Year	Total Overburden from Mine Operation (t)	Utilization of Overburden (t)		Overburden to be Placed in WRSFs (t)		
		Overburden Stockpile for TSF Closure Cover	Withdraw from Stockpile for TSF Closure Cover	WRSF1	WRSF2	WRSF3
Yr -5	0	0	0	0	0	0
Yr -4	0	0	0	0	0	0
Yr -3	0	0	0	0	0	0
Yr -2	0	0	0	0	0	0
Yr -1	0	0	0	0	0	0
Yr 1	0	0	0	0	0	0
Yr 2	2,038,237	0	0	2,038,237	0	0
Yr 3	4,328,239	94,816	0	4,233,423	0	0
Yr 4	627,383	0	0	236,246	0	391,137
Yr 5	97,830	0	20,844	0	0	97,830
Yr 6	0	0	0	0	0	0
Yr 7	0	0	26,737	0	0	0
Yr 8	0	0	0	0	0	0
Yr 9	0	0	47,235	0	0	0
Total (t)	**7,091,689**	**94,816**	**94,816**	**6,507,906**	**0**	**488,967**
Volume (m^3)	**4,377,585**	**58,528**	**58,528**	**4,017,226**	**164,806**	**301,831**

4.5 Anticipated Design Performance of WRSFs

The WRSFs were designed to minimize the impact on the environment and consider both the physical and geochemical stability of the stored waste rock and overburden.

Slope stability analyses for the WRSFs were carried out during the feasibility study. Using the geometric parameters presented in Section 4.2, the results of the stability analysis indicates that the calculated minimum factors of safety for the WRSFs meet or exceed the acceptable factors of safety. Thermal analyses were conducted to estimate the thermal regime of the WRSFs and foundations during mine operations and after closure. The results indicate that material placed in the winter period will probably stay in a frozen condition while the material placed in the summer period will take 2 to 10 years to freeze back. Information on the stability and thermal studies for the WRSFs is described in the report of Tailings, Waste and Water Management for Feasibility Level Study, Meliadine Project, Nunavut (Tetra Tech EBA, 2014b).

It should be noted that the design and performance of the WRSFs are not dependent on freeze-back of waste rock and permafrost conditions continuing to exist at the site (i.e., the design has included for thaw of the WRSFs and its foundations). The permafrost development within the WRSFs will provide additional benefits (i.e., more physical stable and less seepage water) during operation and closure of WRSFs.

SECTION 5 • TAILINGS MANAGEMENT

5.1 General Description of Tailings Management

Dry stack tailings produced in the mill at Meliadine will be dewatered to a solids content of 85%. The dewatered tailings will be trucked to the TSF with haul trucks and spread and compacted into thin lifts using a dozer and compactor.

Site contact water from the TSF will be collected by the perimeter water management system located to the northwest and south of the TSF. The contact water quality and the water management structures for the TSF will be monitored and assessed according to an approved environmental protocol during each stage of the mine life. The geochemical characterization is provided in the document *Meliadine Project Trade-Off Dry-Stack vs. Slurry* (Agnico Eagle 2013).

5.2 Tailings Storage Facility

The TSF is located on high ground west of the proposed mill and east of Lake B7, as shown in Figure 1.2. The direct distance from the mill to the tailings stack ranges from 300 to 900 m. The minimum setback distance from the edge of Lake B7 is approximately 200 m.

The TSF is designed to accommodate approximately 9.7 Mt of tailings. As shown in Figure 5.1, the tailings will be managed using a three cell system (Cell 1, Cell 2, and Cell 3) to limit dust generation, control tailings surface erosion, and to facilitate the progressive reclamation and closure of the TSF. As the tailings reach final elevation, it is proposed that the tailings are progressively encapsulated with either waste rock or a layered combination of waste rock and overburden. The closure plan for TSF is described in Section 8 and the Preliminary Closure and Reclamation Plan.

The properties of the tailings and TSF operation parameters relevant to the design of the TSF are presented in Table 5.1.

Table 5.1: Design Parameters for the Tailings Storage Facility Operations

Parameters	Value
Mine design life	8 years
Mill production	3,000 tpd in Years -1 to 3 5,000 tpd per day in Years 4 to 8
Ore processed	12.1 Mt
Tailings to TSF as dry stack	9.7 Mt (or 80% or total tailings)
Tailings backfilled to underground mine	2.4 Mt (or 20% or total tailings)
Average specific gravity of tailings	2.83
Tailings solid content to TSF	85%

Table 5.1: Design Parameters for the Tailings Storage Facility Operations

Parameters	Value
Average tailings dry density	1.71 t/m^3
Maximum height of TSF over original ground surface	30 m
Side slope for the bottom 15 m thick (or below elevation of 84 m)	4H:1V
Side slope for the top 15 m thick (or above elevation of 84 m)	3H:1V
Slope of the final tailings surface at crest	4%
TSF storage capacity	9.7 Mt (5.65 Mm^3)

5.3 Tailings Physical and Geotechnical Properties

A laboratory test program on the tailings was conducted for the slurry tailings option with solids contents of 65% and 72%. The test program included physical index tests, a gradation analysis test, settling tests, thermal conductivity tests, a consolidated-undrained triaxial test, a consolidation test, a hydraulic conductivity test, and a direct shear test. The index and gradation analysis tests indicated that the tailings are inorganic silt with low plasticity and low compressibility and consist of 17% sand, 81% silt, and 2% clay size particles. Tailings have the gradation curve of 98% passing 150 µm, 83% passing 75 µm, 40% passing 20 µm, and 5% passing 3 µm (Tetra Tech EBA 2013b).

Additional tailings laboratory geotechnical tests were carried out in 2014 for the dry stack tailings option with a tailings solid content of 85% at disposal (Tetra Tech EBA 2014c). The test included moisture-density relationship (Standard Proctor), consolidation test, soil water characteristic curve, direct shear test, and hydraulic conductivity test. The key finding from the test results were briefly summarized below:

- The moisture-density relationship (Standard Proctor, ASTM D698) test indicated that the maximum dry density of the tailings was 1.8 t/m^3 at an optimum moisture content of 14.9%.
- The coefficient of consolidation (cv) of the tailings ranged from 24.6 to 29.8 (m^2/year) under various pressures ranging between 10 and 1,600 kPa.
- The tailings had a soil water characteristic curve with an air entry value of 20 kPa and a residual suction of 900 kPa.
- The shear strength parameters were determined to be an inferred internal angle of friction of 33.5° and an apparent cohesion of 9.9 kPa for the tailings samples with a dry density of 1.7 t/m^3.
- The saturated hydraulic conductivity of the tailings sample was 2.91E-07 m/sec for the tailings sample with a dry density of 1.7t/m^3.

5.4 Schedule, Quantities, and Distribution of Tailings

Commissioning of the process plant is planned to start in the second quarter of Year-1. Approximately 12.1 Mt of tailings will be produced over an eight year period. Approximately 9.7 Mt or 80% of the tailings will be deposited within the TSF and the remaining 2.4 Mt or 20% will be used as underground cemented paste backfill. Based on a tailings dry density of 1.71 t/m^3, the TSF will have a storage volume of 5.65 Mm^3.

The production schedule, quantities, and distribution of tailings by year are presented in Table 5.2.

Table 5.2: Schedule, Quantities, and Distribution of Tailings by Year

Mine Year	Tailings Solids from Mill (t)	Tailings Solids to be Used as Underground Backfill (t)	Tailings Solids to be Placed in Dry Stacked TSF (t)		
			Cell 1	Cell 2	Cell 3
Yr -1	202,350*	164,196	38,154	0	0
Yr 1	1,095,000	362,047	732,953	0	0
Yr 2	1,095,000	256,607	838,393	0	0
Yr 3	1,095,000	381,440	713,560	0	0
Yr 4	1,808,880	334,949	1,018,350	455,581	0
Yr 5	1,825,000	358,645	469,171	997,184	0
Yr 6	1,825,000	375,746	0	838,819	610,435
Yr 7	1,825,000	200,371	0	265,328	1,359,301
Yr 8	1,320,602	0	0	0	1,320,602
Total	**12,091,832**	**2,434,001**	**3,810,581**	**2,556,912**	**3,290,338**

*Tailings produced during commissioning in the last quarter of Year -1 (construction phase)

5.5 Tailings Placement Plan

The dry stacked tailings will be dewatered to a solid content of 85% by mass in the mill. Thereafter the tailings will be hauled from the mill to the TSF by truck; end dumped, spread, and compacted. The following tailings placement and management strategy will be used:

- Prior to tailings placement, remove all surface water and snow within the footprint of placement.
- Tailings placement will start from Cell 1 in the last quarter of Year -1. The dewatered tailings will be hauled to the TSF Cell 1 with haul trucks, end dumped, and bladed into thin lifts using a dozer. Thereafter, the tailings' lifts will be compacted using a vibratory drum roller. This compaction is designed to promote runoff, reduce the potential for oxygen ingress and water infiltration, and maintain geotechnical stability. The thickness of each lift will be approximately 0.3m.
- Based on the tailings production schedule, Cell 1 will reach its design capacity by Year 5 at a height of 30 m above the original ground. Cell 2 will start operation from Year 4 and will reach design capacity in Year 7 and Cell 3 will start operation from Year 6 and will reach design capacity in Year 8.
- When possible and practical, as the tailings stack increases in height, a waste rock layer will be placed along the side slopes as erosion and thermal protection.
- At the final elevation, the top of the tailings stack will be progressively capped with a layered combination of overburden and waste rock. This will comprise 0.5 m of overburden followed by 2.5 m of waste rock.

Table 5.3 presents the tailings placement schedule for the TSF. The annually tailings placement plan is shown in Figure 5.2 to 5.14 and Figure 6.2 shows the typical cross-section of the TSF. The external perimeter slopes of the TSF will be covered with waste rock but no perimeter berm is planned.

Table 5.3: Tailings Placement Schedule and Estimated Tailings Heights

Mine Year	Estimated Average Height of Tailings Placed in Each Cell (m)			Planned Tailings Placement Period		
	Cell 1	Cell 2	Cell 3	Cell 1	Cell 2	Cell 3
Yr -1	2.0*			Oct to Dec		
Yr 1	4.0			Jan to Dec		
Yr 2	8.5			Jan to Dec		
Yr 3	13.0			Jan to Dec		
Yr 4	23.0	4.5		May to Dec	Jan to Apr	
Yr 5	30.0	15.0		Jan to Apr	May to Dec	
Yr 6		26.0	4.5		Jun to Dec	Jan to May
Yr 7		30.0	15.0		Jan to Feb	Mar to Dec
Yr 8			28.0			Jan to Sep
*Tailings produced during commissioning in the last quarter of Year -1 (construction phase)						

5.6 Tailings Freeze-back

Based on ground temperatures and climate data for the Project site, it is anticipated that the TSF will freeze back in the long term. In order to promote freeze-back of the TSF, the following tailings placement strategies will be adopted during mine operation, when feasible and practical:

- During the initial year of placing tailings in a cell, limit the maximum yearly thickness of the tailings placed to 4.5 m;
- In the subsequent years, limit the total yearly thickness of the tailings placed in a cell to be no greater than 13 m.
- When feasible, place the initial tailings over the original ground during the winter period; and
- When feasible, use up to two operating cells in a given year to alternate tailings placement to promote the in situ freezing of the stacked tailings.

Preliminary thermal analyses were conducted to estimate the thermal conditions of the tailings and foundations during the TSF operation and after closure. The detailed information of the thermal analysis is described in the report of Tetra Tech EBA (2014b).

5.7 Anticipated Design Performance of TSF

The TSF is designed to minimize the impact to the environment and the design does not rely on freeze-back of the tailings to meet the design intent of the structure. However, the freeze-back of the TSF

and the foundations will provide additional benefits such as increasing stability and minimizing seepage from the TSF during operation and closure of TSF.

The stability analysis of the TSF indicates that the calculated minimum factors of safety meet or exceed the acceptable factors of safety. The information of the stability analysis is described in the Tetra Tech EBA (2014b) report.

SECTION 6 • WATER MANAGEMENT ASSOCIATED WITH MINE WASTE MANAGEMENT

6.1 Water Management

The water management objectives for the Project are to minimize potential impacts to the quantity and quality of surface water at the site. This is further detailed in the Water Management Plan provided with the Annual Report 2017. Seepage and runoff water from the WRSFs, TSF, and temporary overburden stockpile will be managed by water diversion channels, water retention dikes/berms, and water collection ponds. If the water quality does not meet the discharge criteria, the contact water in the water collection ponds will be treated by the WTP prior to being discharged to the outside environment. No water will be discharged without authorization.

6.1.1 Water Management Associated with WRSFs

As shown in Figure 5.1, WRSF1 will straddle three catchment areas (catchment of Pond H17, catchment of Pond A54, and catchment of Lake B7), WRSF2 will straddle two catchment areas (catchment of Pond H17 and catchment of Pond A54), and WRSF3 will be located within the basin of Pond H20.

Seepage and runoff from the WRSFs during construction and operation phases will be managed using the water management system described below:

- Seepage and runoff from WRSF1 within the catchment of Pond H17 will be diverted to CP1 via Channels 1, 7 and 8;
- Seepage and runoff from WRSF1 within the catchment of Pond A54 will be diverted to CP5 via Channels 5 and 6;
- Seepage and runoff from WRSF1 within the catchment of Lake B7 will be diverted and collected in CP4 via Channel 4;
- Seepage water and runoff from WRSF2 within the catchment of Pond H17 will be diverted to CP1 via Channel1 and Channel7 or directly flow into CP1;
- Seepage water and runoff from WRSF2 within the catchment of Pond A54 will be diverted to CP5 via Channel 6;
- Seepage and runoff from WRSF3 will directly report to CP6; and
- The water collected in CP4, CP5, and CP6 will be pumped to CP1, where the contact water will be treated by the WTP prior to discharging to outside environment.

The WRSFs water management infrastructure will remain in place until mine closure activities are completed and monitoring results demonstrate that the contact water quality from the WRSFs meets discharge criteria. Once the water quality from the WRSFs meets the discharge criteria, the water retention dikes/berms will be breached to allow the water from the WRSFs to directly flow to the

outside environment. Further details on water management for the WRSFs are described in the Water Management Plan.

6.1.2 P Area Containment Ponds

Late in the winter/early spring of 2016, Agnico Eagle initiated a series of corrective actions as a result of the water quality issues associated with the Portal No.1 area. The result was additional water management controls, such as monitoring, improved explosives management, the design/construction of a more robust series of containment ponds around the area of Portal No.1, and a review of chloride management practices.

The immediate focus was to increase the storage capacity at original Containment Pond P1 to accommodate the 2016 spring freshet and minimize seepage towards CP5 (former A54).

To obtain the required minimum temporary storage capacity for management of underground mine inflows and WRTP runoff, the original Containment Pond P1 basin was divided in two ponds [a "new" P1-Containment Pond (P1) and P2-Containment Pond (P2); a third [P3-Containment Pond (P3)] was also added to the area.

The three newly constructed containment ponds are collectively known as the P-Area Containment Ponds (P-Area). The total storage capacity of the P-Area ponds is 46,041 m^3. P1 is located at the northern area of the existing containment. P2 is located at the southern area of the original containment area footprint. P3 was constructed east of the existing south access road, with the primary purpose of collecting seepage originating from the P2 confining berm and its abutments. A pumping station was installed to collect and pump any collected water from P3 to P1.

To accommodate these modifications, four (4) emergency water containment berms DP1-A, DP1-B, DP2-A, and DP3-A, with three evaporators (on DP1-B) were constructed during the spring of 2016 to provide the required containment and mitigate the water quality issues in the nearby lakes.

Increased water monitoring protocols for the P-Area, over and above that required by the water license, were also implemented. More details on the P Area are available in the Water Management Plan.

6.1.3 Water Management Associated with TSF

The TSF is located within the catchment of Lake B7 with a small portion straddling the water catchment of Pond H17 as shown in Figure 4.1. Water sources from the TSF during construction and operation will be managed as follows:

- Seepage and runoff from the TSF within the catchment of Pond H17 will be diverted to the CP1 using Channel 1;
- The seepage and runoff from the TSF within the catchment of Lake B7 will be diverted and collected and monitored for water quality in CP3 via Channel 3; and
- The water collected in CP3 will be pumped to CP1, where the contact water will be treated by the WTP prior to discharging to outside environment.

The TSF water management infrastructure will remain in place until mine closure activities are completed and monitoring results demonstrate that the contact water quality from the TSF meets discharge criteria. Once the water quality from the TSF meets the discharge criteria, the water retention dikes/berms will be breached to allow the water from the TSF to directly flow to the outside environment. Further details on water management for the TSF are described in the Water Management Plan.

SECTION 7 • DUST MANAGEMENT ASSOCIATED WITH MINE WASTE MANAGEMENT

The possible sources of dust related to the waste rock, overburden, and dry stacked tailings management during construction, operation, and closure include:

- Site preparation prior to placement of waste rock, overburden or dry stacked tailings i.e., stripping, excavation and/or placement of foundation pad;
- Wind erosion of fine particles from the WRSFs and TSF surface;
- Vehicle traffic dislodging fine particles from the surface of WRSFs and TSF, and associated service and haul roads to WRSFs and TSF;
- Waste rock, overburden, and dry stack tailings handling and transfer - loading, hauling, unloading, placement and compaction; and
- Placement of closure and capping layers.

Dust suppression measures, which are considered to be typical of the current mine practices (i.e. Meadowbank Mine) and consistent with best management practices, will be considered through design, operation and closure phases to control the dust.

Minimal site preparation is required for the WRSFs and the TSF during the construction phase. Therefore, dust is not expected to be problematic.

Dust is expected to be a minor issue during the operation of the WRSFs as the waste rock produced at the Project site will generally comprise large pieces of rock that will not be susceptible to wind erosion. The overburden contains material that is fine-grained and thus more susceptible to wind erosion. The plan is to store the majority of the overburden materials within the core of the WRSFs. Therefore, dust from the overburden materials is not expected to be an issue. However, should dusting become an issue, dust control measures such as spraying water and/or other approved chemical dust suppressants will be used as necessary.

Dry stacked tailings will be placed in lifts and spread with a dozer and then compacted. The surface compaction of the lifts will significantly reduce the potential for wind erosion of the tailings surface. Dust related to TSF operation during the winter season will be further managed by limiting the exposed surface area of the tailings. In the summer period, dust from the TSF will be controlled by spraying water and/or other approved chemical dust suppressants if problematic. Other control measures considered in the design of TSF to minimize dust generation include:

- Place the waste rock cover over the final perimeter tailings slope surface as soon as possible;
- TSF will be operated by cells to limit the tailings surface area exposed to wind and facilitate progressive closure;
- Tailings surface will be covered progressively once it reaches the design elevation; and
- Flat sideslope of 4(H):1(V) for the TSF was adopted to minimize the erosion potential and maintain overall stability of the tailings stack.

Dust generated from vehicles travelling on the surface of the WRSFs, TSF, and associated access roads will be controlled principally by spraying water on the traffic area, which will be carried out regularly by mine services during dry periods in the summer. Watering the haul and access roads is only possible when temperatures are above freezing. When the temperature is below freezing, dust suppression using water or chemical will pose a safety hazard for travel; therefore, reducing the speed limit will be the principal way of controlling dust during these periods. More details on the dust management for traffic are described in the Roads Management Plan.

Other control measures considered in design and operation related to dust generation by vehicles travelling include:

- Road will be designed as narrow and short as possible while maintaining safe construction and operation practices;
- Coarse size rock will be used as much as possible for road construction;
- Roads will be regularly graded to mix the fines found on the road surface with coarser material located deeper in the roadbed; and
- As required, roads and travel areas will be topped with additional aggregate.

Dust from material handling is not expected to be problematic on site. Long end dumps which can generate significant amounts of dust will not occur at site, since waste rock, overburden and dry stack tailings will be dumped in lifts and spread with a dozer. Where possible, multiple handlings of materials that have the potential to generate dust will be avoided. However, should dust related to material handling occur on site, specific control measures will be evaluated and applied, as required.

At closure, the TSF will be fully covered to prevent further wind erosion of the tailings. The proposed closure cover includes a layer of 0.5 m thick of overburden followed by a layer of 2.5 m thick waste rock on the top of the facility. The TSF slopes closure cover includes a 3.7 m to 4.2 m thick waste rock layer only. The overburden will be surrounded by waste rock in the WRSFs; therefore, dusting is not expected to be an issue. The need for dust control at closure will be further evaluated during closure activities.

SECTION 8 • RECLAMATION AND CLOSURE OF THE WRSFs AND TSF

Progressive reclamation includes closure activities that take place prior to permanent closure in areas or at facilities that are no longer actively required for current or future mining operations. Reclamation activities can be done during operations with the available equipment and resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving reclamation objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure. The WRSFs and TSF will be operated to facilitate progressive reclamation as discussed in the above sections. Detailed mine closure and reclamation activities are provided in the Preliminary Closure and Reclamation Plan.

Monitoring will be carried out during all stages of the mine life to demonstrate geotechnical stability and the safe environmental performance of the facilities (Section 9). If any non-compliant conditions are identified, then maintenance and planning for corrective measures will be completed in a timely manner to ensure successful completion of the Mine Closure and Reclamation Plan.

8.1 Closure and Reclamation of WRSFs

Mine closure and the reclamation of the WRSFs will use currently accepted management practices and appropriate mine closure techniques that will comply with accepted protocols and standards.

Geochemical testing indicates that the waste rock and overburden from the Project is non-potentially acid generating (NPAG) and non- ML. Kinetic tests completed on all waste rock types and at various scales show that drainage water quality is expected to meet MMER monthly mean effluent limits, including results for arsenic. Therefore, a closure cover system is not proposed for the WRSFs. The Water Management Plan provides the water quality site predictions.

The WRSFs were designed for long-term stability and no additional re-grading will be required at closure. It is anticipated that the native lichen community will naturally re-vegetate the surface of the WRSFs over time.

The contact water management system for the WRSFs and TSF will remain in place until mine closure activities are completed and monitoring results demonstrate that water quality conditions from the WRSFs are acceptable for the discharge of all contact water to the environment with no further treatment required. Once water quality meets the discharge criteria established through the water licensing process, diversion channels/berms/dikes will be decommissioned to allow the surface runoff and seepage water from the WRSFs to naturally flow to the outside environment.

8.2 Closure and Reclamation of the TSF

Mine closure and reclamation of the TSF will utilize currently accepted management practices and appropriate mine closure techniques that will comply with accepted protocols and standards.

Results of geochemical characterization indicates that the tailings produced at the Project are NPAG and ML is not predicted to be an issue as there will be limited seepage from the tailings porewater at closure. The closure plan for the TSF is to progressively place an engineered cover over the tailings surface. The proposed closure cover includes a 0.5 m thick layer of overburden followed by a 2.5 m thick layer of waste rock on the top of the facility. The TSF slopes closure cover includes a 3.7 m to 4.2 m thick waste rock layer only. The overburden material is intended to limit runoff water infiltration into the tailings. This closure cover concept will be further evaluated during the final detailed design stage. It is anticipated that the native lichen community will naturally re-vegetate the TSF cover over time.

The contact water management system for the TSF will remain in place until mine closure activities are completed and monitoring results demonstrate that water quality conditions from the TSF are acceptable for the discharge of all contact water to the environment with no further treatment required. Once the water quality meets the discharge criteria established through the water licensing process, the TSF water management infrastructure will be decommissioned to allow the water to naturally flow to the outside environment.

SECTION 9 • MONITORING PROGRAM

This section presents a summary of the monitoring programs that will be carried out during construction and operation related to mine waste storage management. The monitoring program presented here includes; stability and deformation, ground temperature, and annual inspections. The detailed information on monitoring of runoff and seepage from the WRSFs and the TSF is described in the Water Management Plan. There are two types of monitoring related to mine waste management. Verification monitoring is carried out for operational and management purposes by Agnico Eagle. This type of monitoring provides data for decision making and builds confidence in the success of processes being used, with no obligation to report. General monitoring is commonly included in a water licence specifying what is to be monitored according to a schedule. It covers all types of monitoring (e.g., geotechnical). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included quality assurance/quality control provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

9.1 Monitoring Activities for WRSFs

Table 9.1 summarizes the monitoring activities for each WRSF. Each monitoring activity will be further defined, including location and type of instrumentation, prior to construction of each WRSF, according to the approved environmental protocols.

Table 9.1: Waste Rock Storage Facilities Monitoring Activities

Monitoring Component		Monitoring Frequency	Reporting
Verification Monitoring	Quantities of waste rock produced	Monthly	Monitoring data will be used by Agnico Eagle internally.
	Routine visual inspections of WRSFs	Daily during active rock placement, Monthly to semi-annually after placement	
	Elevation and geometry survey	Annually	
	Waste rock and overburden sampling	To be determined	
	Seepage collection and monitoring	Monthly over the open water season	
General Monitoring	Quantities of waste rock placed into facilities	Monthly	Monitoring data will be reported to the Regulators in the annual water licence report or annual inspection report
	Geochemical monitoring	Eight samples per 100,000 tonnes of mined material	
	Thermal and freeze-back monitoring	Quarterly	
	Dust monitoring related to WRSFs	Governed by Air Quality Monitoring Plan	
	Geotechnical inspection by qualified Geotechnical Engineer	Annually or more frequent at the request of an Inspector	

9.1.1 Verification Monitoring Program for WRSF

Verification monitoring data will be used by Agnico Eagle for the management of waste rock and overburden. The following verification monitoring data will be collected, compiled, and managed internally:

- The WRSFs were designed to store approximately 25.3 Mt of waste rock and 7.1 Mt of overburden material during mine operation. Monthly quantities of the waste rock and overburden produced during mine operation will be recorded.
- During the active development of each WRSF, site staff will carry out daily visual inspections in relation to the performance and condition of each structure. When placement activity ceases on an interim or seasonal basis, the inspection frequency will shift to monthly. Following the completion of a WRSF, inspections will continue on a semi-annual basis until closure. The purpose of these inspections is to identify and document any potential hazards or risks to the facility, such as deformations, unusual seepage, slumping, local failure, etc.
- The heights of the WRSFs are estimated to be approximately 35 to 40 m. During operation an annual elevation survey of the WRSFs will be performed to estimate the overall volume placed, determine the reclamation progress, and provide input information to the operation plan.
- Surface runoff and seepage from the WRSFs will be monitored during the construction and operation phases by visual inspection during the ice free season. Additional inspections will be carried out after the extreme rainfall event (1 in 100 wet year 24 hours rainfall event). The detailed information on the monitoring of surface runoff and seepage from the WRSFs is described in the Water Management Plan.

9.1.2 General Monitoring Program for WRSF

The following general monitoring data will be reported to the NWB through either the Water Licence Annual Report or an Annual Inspection Report:

- Monthly quantities of the waste rock and overburden placed into the WRSFs during mine operation.
- Waste rock samples will be taken from the production blast holes and analyzed the percentage of sulphur and carbon. The results from these analyses will be used to differentiate NPAG and PAG based on the derived NPR. To validate the classification method of NPAG/PAG based on NPR, additional samples will be taken evenly at a rate of one sample per 100,000 tonnes of mined material. The collected samples will be sent to an accredited commercial laboratory for ARD and ML using the ABA (the modified Sobek method) and SFE analyses.
- The placed waste rock and overburden are expected to freeze back and permafrost is likely to develop within the WRSFs with time. Thermistors will be installed in each WRSF to monitor the rate of freeze-back and permafrost development progress in the facilities during closure.

Temperature readings will be taken quarterly to track permafrost development within the WRSFs.

- Dust related to waste rock and overburden management is not expected to be an issue by employing the dust suppression measures presented in Section 7.0 through design, operation, and closure phases. Air quality at the mine site will be monitored during construction, operation, and closure through air quality monitoring stations and reported annually.
- The performance of the WRSFs will be inspected and assessed during the annual geotechnical site inspection by a geotechnical or civil engineer registered in Nunavut. The visual assessment and recommended actions to be taken related to the WRSFs will be summarized in the Annual Inspection Report. Inspections may occur more frequently at the request of the Inspector. Records of all inspections will be maintained for the review of the Inspector upon request.

The results from the general monitoring program related to waste rock and overburden management will be reported to the Regulators in the annual water license report or in the annual geotechnical inspection report.

9.2 Monitoring Activities for the TSF

Table 9.2 summarizes the monitoring activities for the TSF. Each monitoring activity will be further defined, including location and type of instrumentation prior to construction, according to the approved environmental protocols.

Table 9.2: Tailings Storage Facility Monitoring Activities

Proposed Monitoring	Monitoring Component	Monitoring Frequency	Reporting
Verification Monitoring	Tailings production rate and solid content	Continuous	Monitoring data will be used by Agnico Eagle internally, and will be reported to the Regulators upon request
	In situ density testing and moisture content determination of recently placed tailings	Weekly	
	Routine visual inspections of TSF	Daily to weekly when water is being actively managed	
	Elevation and geometry survey	Annually	
	Runoff and seepage collection and monitoring	Monthly over the open water season or when water is present	
General Monitoring	Quantities of tailings placed into facilities	Monthly	Monitoring data will be reported to the Regulators in annual water licence report or annual inspection report
	Thermal and freeze-back monitoring	Quarterly	
	Dust monitoring related to TSF	Governed by Air Quality Monitoring Plan	
	Geotechnical inspection by qualified Geotechnical Engineer	Annually or more frequent at the request of an Inspector	

9.2.1 Verification Monitoring Program for TSF

A summary of the verification monitoring program for the TSF is presented below.

- The tailings production rate at the mill and solid content will be continuously monitored during mine operation.
- In situ density testing and moisture content of placed tailings will be carried out weekly to ensure that dry density of placed tailings meets the design criteria.
- During the active development of the TSF, the procedures and protocols for routine and annual inspections of the WRSFs will also apply, consistent with the inspection of the TSF.
- The heights of the TSF are estimated to be approximately 28 to 30 m. An annual elevation survey of the TSF will be performed to estimate the overall volume placed, determine the reclamation progress, and provide input information to the operation plan.
- The runoff and seepage monitoring procedures and protocols for the WRSFs during mine operation will also apply to the TSF.

9.2.2 General Monitoring Program for TSF

A summary of the general monitoring program for the TSF is presented below.

- The monthly quantities of tailings placed into the TSF will be recorded.
- Thermistor cables will be installed in the TSF to monitor the permafrost development within the facility during closure. The temperature readings will be taken quarterly (i.e. 4 times per year) to monitor permafrost development. The monitoring schedule will be reviewed and modified as necessary. The measured temperatures within the TSF will provide the background information for the study of permafrost development.
- Dust related to tailings management is not expected to be an issue by employing the dust suppression measures presented in Section 7 through design, operation, and closure phases. Air quality at the mine site will be monitored during construction, operation, and closure through air quality monitoring stations.
- The performance of the TSF will be inspected and assessed during the annual geotechnical site inspection by a geotechnical or civil engineer registered in Nunavut. The visual assessment and recommended actions to be taken related to the TSF will be summarized in the annual inspection report. Inspections may occur more frequently at the request of the Inspector. Records of all inspections will be maintained for the review of the Inspector upon request.

The results from general monitoring program related to tailings management will be reported to the Regulators in the Annual Water License Report or in the Annual Geotechnical Inspection Report.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited), 2013. *Meliadine Project Trade-Off Dry-Stack vs. Slurry, Agnico Eagle Mines Ltd (6508-TOR-02)*, 16 p. + Appendix.

DFO (Fisheries and Oceans Canada), 2006. Regulations amending the metal mining effluent regulations (MMER). June 2002. Amended March 2012.

Golder (Golder Associates Ltd.), 1999. Review of Overburden Drilling-Proposed Open Cut- Meliadine West Gold Project. Submitted to WMC International Ltd., December 9, 1999.

Golder, 2009a. Assess of completeness of geotechnical data for feasibility design Tiriganiaq open pit. Submitted to Comaplex Minerals Corp., 26 May 2009, Doc. 008 Rev. 0

Golder, 2009b. F-Zone Dyke Geotechnical Investigation 2009 - Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Comaplex Minerals Corp. by Golder Associates, September 10, 2009.

Golder, 2010a. Discovery Deposit 2009 Geotechnical Field Investigation - Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Comaplex Minerals Corp. by Golder Associates, February 8, 2010.

Golder, 2010b. Tiriganiaq Deposit and F-zone Deposit Summer 2009 Geotechnical Field Investigation - Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Comaplex Minerals Corp. by Golder Associates, March 10, 2010.

Golder, 2012a. SD 7-2 Aquatic Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 19, 2012.

Golder, 2012b. SD 6-1 Permafrost Thermal Regime Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 25, 2012.

Golder, 2012c. Tailings Storage Facility Preliminary Design – Meliadine Gold Project, Nunavut. A Draft Report Submitted to Agnico Eagle Mines Ltd. by Golder, August 16, 2012.INAC, 1992. Guidelines for ARD Prediction in the North. Department of Indian Affairs and Northern Development, Northern Mine Environment Neutral Drainage Studies No.1, Prepared by Steffen, Robertson and Kirsten (B.C.) Inc.

Golder, 2012d. SD 2-4A Factual Report on 2011 Geotechnical Drilling Program- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, June 7, 2012.

Golder, 2012e. Factual Report on 2012 Geotechnical Drilling Program- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, November 29, 2012.

Golder, 2012f. SD 6-3 Geochemical Characterization of Waste Rock, Ore, Tailings and Overburden, Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, October 10, 2012.

Golder, 2015. Fisheries Screening Assessment and Offsetting Plan- Meliadine Gold Project, Nunavut. Submitted to Agnico Eagle Mines Limited. June 2015.

Government of Nunavut, 2012. Engineering Challenges for Tailings Management Facilities and Associated Infrastructure with regard to Climate Change in Nunavut. Report No. L-11-1472, March 21, 2012.

LVM, 2015. Projet Meliadine. Campagne de forages 2015. Rapport préliminaire. Submitted to Agnico Eagle Mines Limited. June 2015.

NIRB (Nunavut Impact Review Board), 2012. Guideline for the Preparation of an Environmental Impact Statement for Agnico Eagle Mine Ltd.'s Meliadine Project (NIRB File No. 11MN034).

INAC, 1992. Guidelines for Acid Rock Drainage Prediction in the North. Department of Indian Affairs and Northern Development, Northern Mine Environment Neutral Drainage Studies No.1, Prepared by Steffen, Robertson and Kirsten (B.C.) Inc.

MEND, 2009. Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials. MEND Report 1.20.1. Mining Environment Neutral Drainage Program, Natural Resources Canada. December 2009.

Snowden. 2008. Tiriganiaq gold deposit, Nunavut – resource update. Submitted to Comaplex Minerals Corp. January 2008.

SRK Consulting Engineers and Scientists (SRK), 2007. Winter 2007 Geotechnical Field Investigation at Meliadine West, Nunavut, Canada. A Technical Report Submitted to Comaplex Minerals Corp. by SRK Consulting Engineers and Scientists, October 2007.

Tetra Tech EBA (Tetra Tech EBA Inc.), 2013a. Meliadine Gold Project 2013 March Geotechnical Site Investigation Data Report. Submitted to Agnico Eagle Mines Limited by Tetra Tech EBA Inc., Tetra Tech EBA File: E14103023-01.003, May 2013.

Tetra Tech EBA, 2013b. Summary of Tailings Laboratory Test Results, Meliadine Project, NU. Technical memo submitted to Agnico Eagle Mines Limited by Tetra Tech EBA Inc., AEM Document Number: 6505-REP-102-R80, Tetra Tech EBA FILE: E14103047-01.002, August 20, 2013.

Tetra Tech EBA, 2014a. Meliadine Project 2014 Geotechnical Site Investigation Data Report. Submitted to Agnico Eagle Mines Limited by Tetra Tech EBA Inc., Tetra Tech EBA File: E14103181-01, May 2014.

Tetra Tech EBA, 2014b. Tailings, Waste and Water Management for Feasibility Level Study, Meliadine Project, Nunavut. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Tetra Tech EBA, December 2014.

Tetra Tech EBA, 2014c. Summary of Additional Tailings Laboratory Geotechnical Test Results (AEM PO: OC-45443-L), Meliadine Project, Nunavut. A Technical Memo submitted to Agnico Eagle Mines Ltd. by Tetra Tech EBA, EBA File: E14103047-01-008, February 26, 2014.

Tetra Tech EBA, 2016a. Geotechnical specifications for construction of saline water storage/transfer pond and berm, Meliadine Gold Project, Nunavut. Presented to Agnico Eagle Mines Ltd. EBA File: E14103230-01, June 10, 2016.

Tetra Tech EBA, 2016b. Response to Information Request KIA-WL-01: Type A Water Licence Application: Meliadine Gold Project, NU. Technical Memorandum Subitted to Agnico Eagle Mines Ltd. By Tetra Tech EBA, January 2016.

APPENDIX A • FIGURES

Figure 1.1 General Mine Site Location Plan

Figure 1.2 General Site Layout Plan (Year 7 Operation)

Figure 2.1 Permafrost Map of Canada

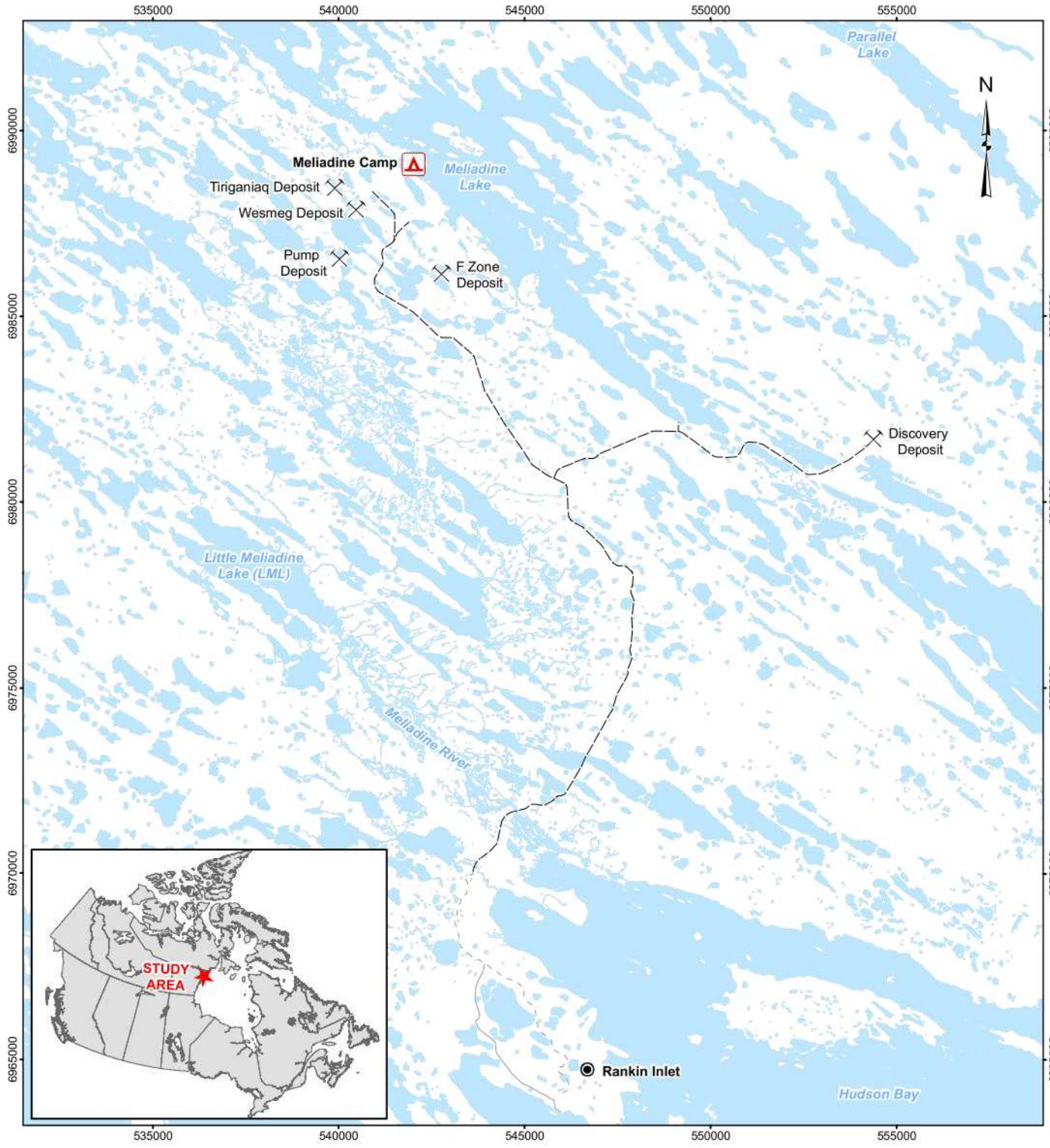
Figure 3.1 Mine Waste Management Flow Diagram

Figure 3.2 Locations and Footprints of Waste Rock Storage Facilities and TSF

Figure 4.1 Watershed and Waterbodies Affected By Site Infrastructure

Figure 5.1 Tailings Placement Plan in Cells

Figure 5.2 Typical Design Cross-Section for TSF



LEGEND

- Camp
- Proposed Mine Site
- All-weather Access Road (AWAR)
- Road - New
- Road - Existing
- Watercourse
- Waterbody

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AGNICO EAGLE – MELIADINE GOLD PROJECT

FIGURE 1.1 GENERAL PROJECT LOCATION PLAN

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EMULSION PLANT
TEMPORARY OVERBURDEN STOCKPILE
SEWAGE TREATMENT PLANT
CHANNEL2
FRESH WATER INTAKE CAUSEWAY
MELIADINE ESKER
WATER TREATMENT PLANT
WTP INTAKE CAUSEWAY
TREATED SEWAGE DISCHARGE
INDUSTRIAL SITE PAD
LANDFARM
ORE STOCKPILE 3
ORE STOCKPILE 1
ORE STOCKPILE 2
CHANNEL1
CULVERT3
CULVERT1
CULVERT2
CHANNEL3
LANDFILL
BERM1
CHANNEL8
CHANNEL7
CHANNEL4
EVAPORATORS
WASTE ROCK & OVERBURDEN STORAGE FACILITY 2 (WRSF2)
WASTE ROCK & OVERBURDEN STORAGE FACILITY 1 (WRSF1)
CULVERT4
CULVERT5
CHANNEL6
CP6 JETTY
CULVERT6
CHANNEL5
TIRIGANIAQ PIT 1 (TIRI_1000_01)
BERM3
TIRIGANIAQ PIT 2 (TIRI_1000_02)
SALINE POND
CP5 JETTY
WASTE ROCK & OVERBURDEN STORAGE FACILITY 3 (WRSF3)
ANFO PLANT
AWAR
BERM2
TAILINGS
TAILINGS STORAGE FACILITY (TSF)
WASTE ROCK COVER
MELIADINE LAKE
CP1
CP3
CP4
CP5
CP6
P1
P2
P3
P-AREA
D-CP3
D-CP1
D-CP4
D-CP5
D-CP6
G2
B0
B5
B6
B7
B30
B31
B32
B33
B33A
A9
A12
A13
A35
A36
A37
A38
A40
A54
H1
H2
H3
H4
H5
H7A
H7B
H7C
H8
H9
H10
H11
H12
H13
H14
H15
H15E
H15G
H16
H17
H19
J2
J3
J4
J5
J6
J7
0
500 m
Scale: 1: 12 500

LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

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AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE 1.2 GENERAL MINE SITE PLAN LAYOUT

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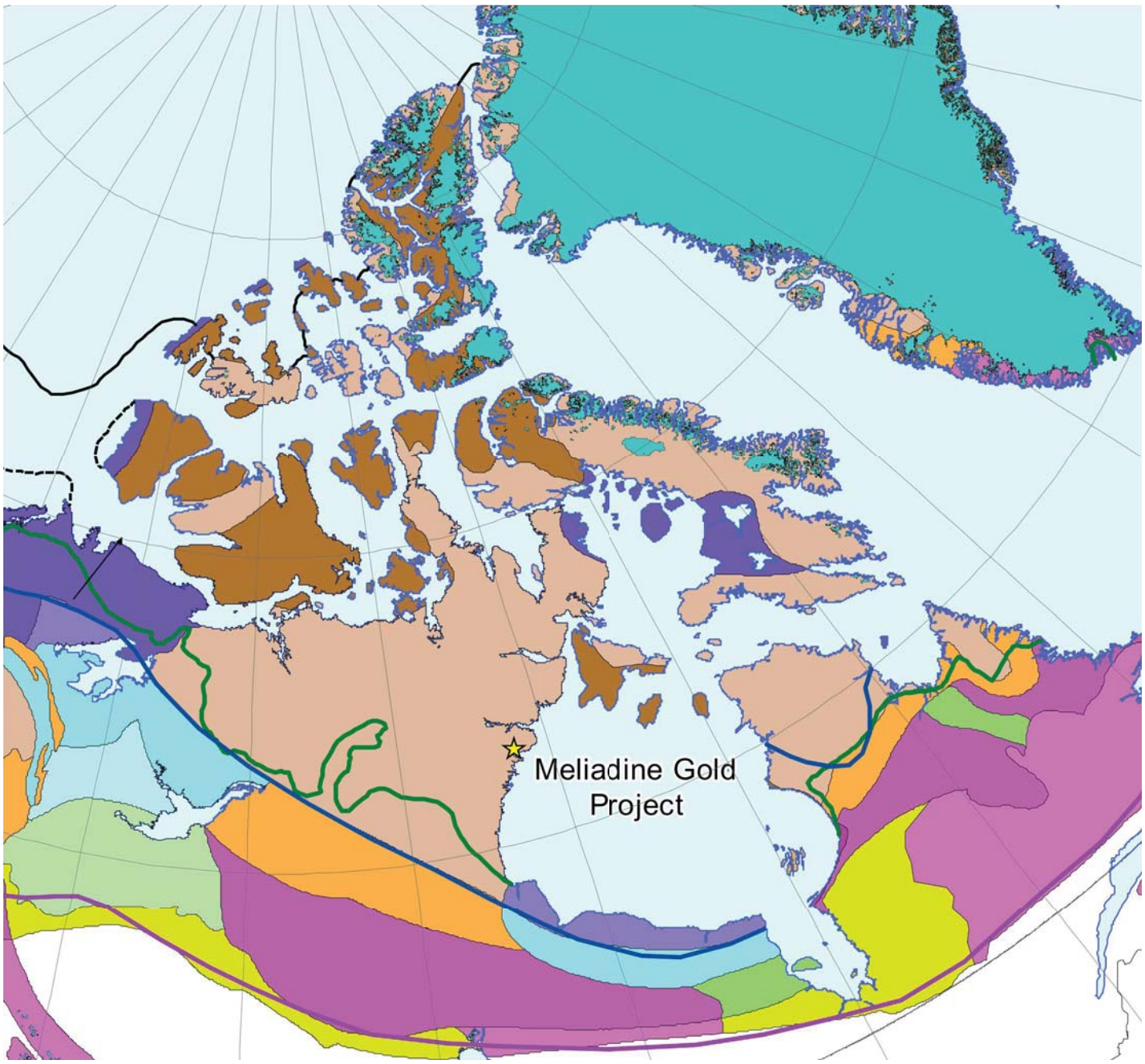
I:\OPERATIONS\Water Management\WMP Figures\For Jen\Draft2\FIGURE 1.2R2.dwg



Legend for EASE-Grid Permafrost and Ground Ice Map

Permafrost Extent (percent of area)	Ground Ice Content (visible ice in the upper 10-20 m of the ground; percent by volume)				
	Lowlands, highlands, and intra- and intermontane depressions characterized by thick overburden cover (>5-10m)			Mountains, highlands, ridges, and plateaus characterized by thin overburden cover (<5-10 m) and exposed bedrock)	
	High (> 20%)	Medium (10-20%)	Low (0-10%)	High to medium (>10%)	Low (0-10%)
Continuous (90-100%)	Ch	Cm	Cl	Ch	Cl
Discontinuous (50-90%)	Dh	Dm	Dl	Dh	Dl
Sporadic (10-50%)	Sh	Sm	Sl	Sh	Sl
Isolated Patches (0-10%)	Ih	Im	Il	Ih	Il

Variations in the extent of permafrost are shown by the different colors; variations in the amount of ground ice are shown by the different intensities of color. Letter codes assist in determining to which basic permafrost and ground ice class any particular unit belongs. Letter codes are defined in the documentation that accompanies the data files.

Ice caps and glaciers

LEGEND

- MELIADINE GOLD PROJECT
- SOUTHERN BOUNDARY OF CONTINUOUS PERMAFROST - PRESENT
- SOUTHERN BOUNDARY OF DISCONTINUOUS PERMAFROST - PRESENT
- TREELINE
- SEA-ICE EDGE LIMIT
- SUBSEA PERMAFROST LIMIT

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FIGURE 2.1 PERMAFROST MAP OF CANADA

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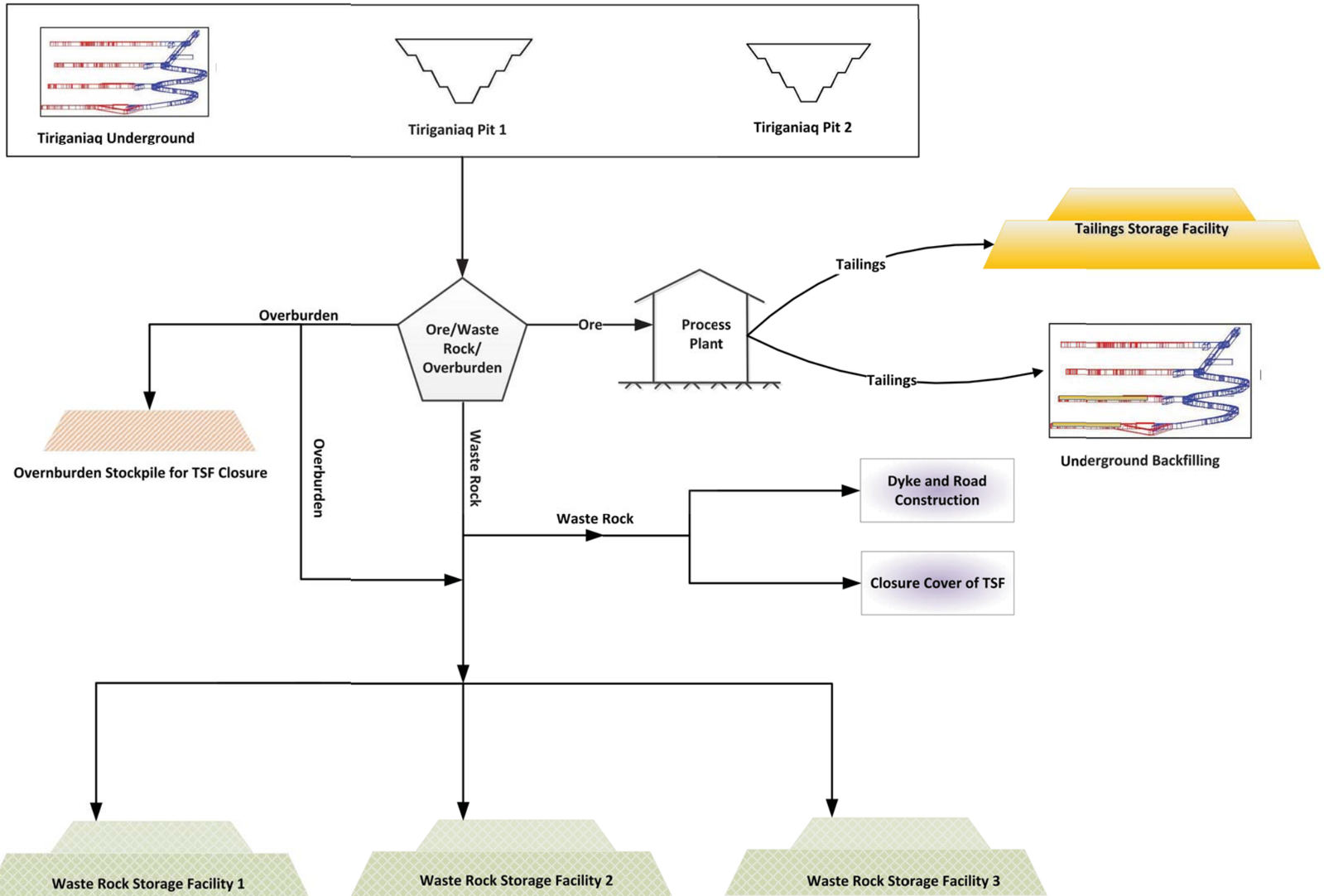

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AGNICO EAGLE – MELIADINE GOLD PROJECT

FIGURE 3.1 MINE WASTE MANAGEMENT FLOW DIAGRAM

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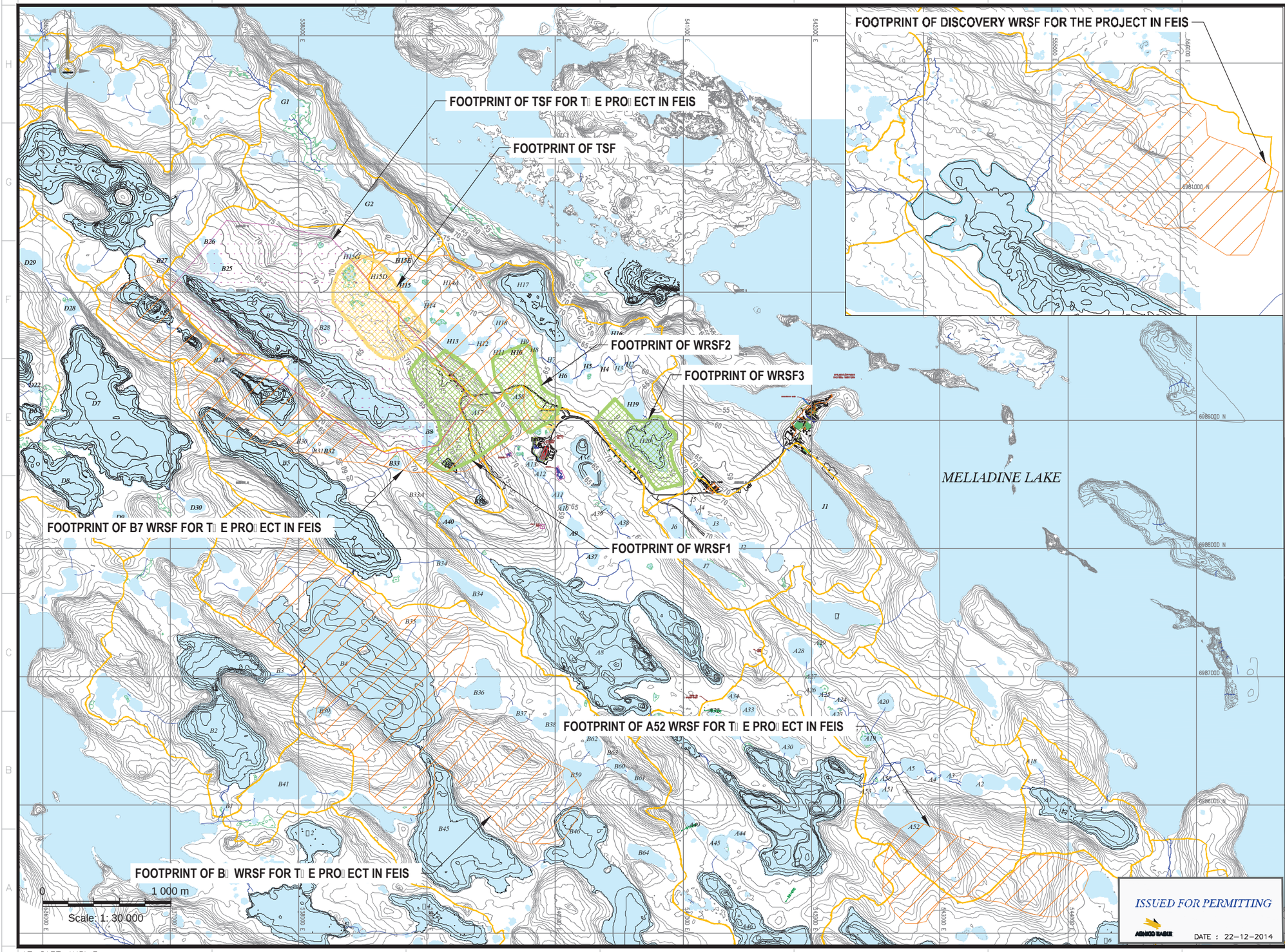

LEGEND

CATCHMENT BOUNDARY
WATERBODY

AGNICO EAGLE

TETRA TECH EBA

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AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE 3.2 LOCATIONS AND FOOTPRINTS OF WASTE ROCK STORAGE FACILITES AND TAILINGS STORAGE FACILITY

ISSUED FOR PERMITTING
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DATE : 22-12-2014

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Q:\Edmonton\Engineering\E141\Projects\E14103209_Meladine_Mgmt_Plans\EBA Drawings\Mine Waste MP\CAD_Feb_2015\FIGURE 3.2.dwg–September 5, 2014

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FOOTPRINT OF OVERBURDEN STOCKPILE

FOOTPRINT OF INDUSTRIAL PAD

FOOTPRINT OF LANDFARM

FOOTPRINT OF OP3

FOOTPRINT OF OP1

FOOTPRINT OF OP2

MELIADINE LAKE

WATERSHED H

FOOTPRINT OF WRSF2

FOOTPRINT OF WRSF3

WATERSHED B

FOOTPRINT OF TSF

FOOTPRINT OF LANDFILL

WATERSHED A

FOOTPRINT OF WRSF1

FOOTPRINT OF TIRIGANIAQ PIT1

FOOTPRINT OF TIRIGANIAQ PIT2

0 500 m

Scale: 1: 12 500

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CATCHMENT BOUNDARY

NON CONTACT WATERBODY

AGNICO EAGLE

TETRA TECH EBA

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TITRE / TITLE

AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE **4.1** WATERSHED AND WATERBODIES AFFECTED BY SITE INFRASTRUCTURE

ISSUED FOR PERMITTING
AGNICO EAGLE
DATE : 22–12–2014

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Q:\Edmonton\Engineering\E141\Projects\E14103209_Meladine_Mgmt_Plans\EBA Drawings\Mine Waste MP\CAD_Feb_2015\FIGURE 5.1.dwg–September 5, 2014

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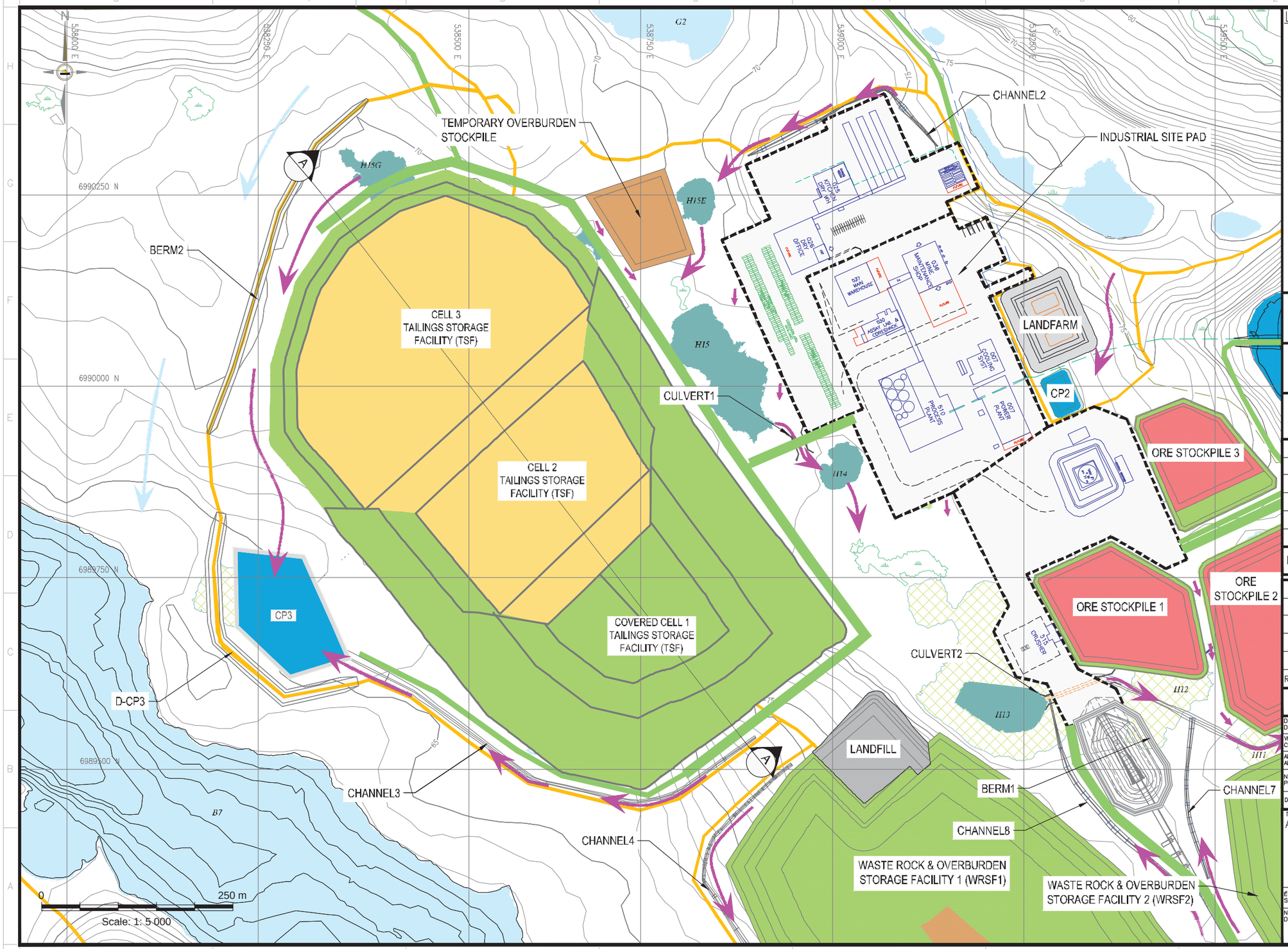

LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- WATER FLOW DIRECTION
- STREAM

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AGNICO EAGLE – MELIADINE GOLD PROJECT

FIGURE **5.1** TAILINGS PLACEMENT PLAN IN CELLS

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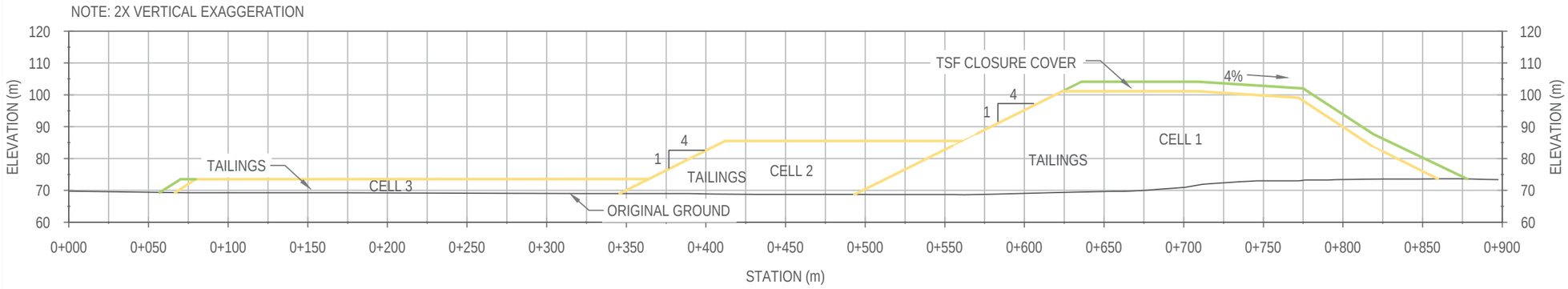
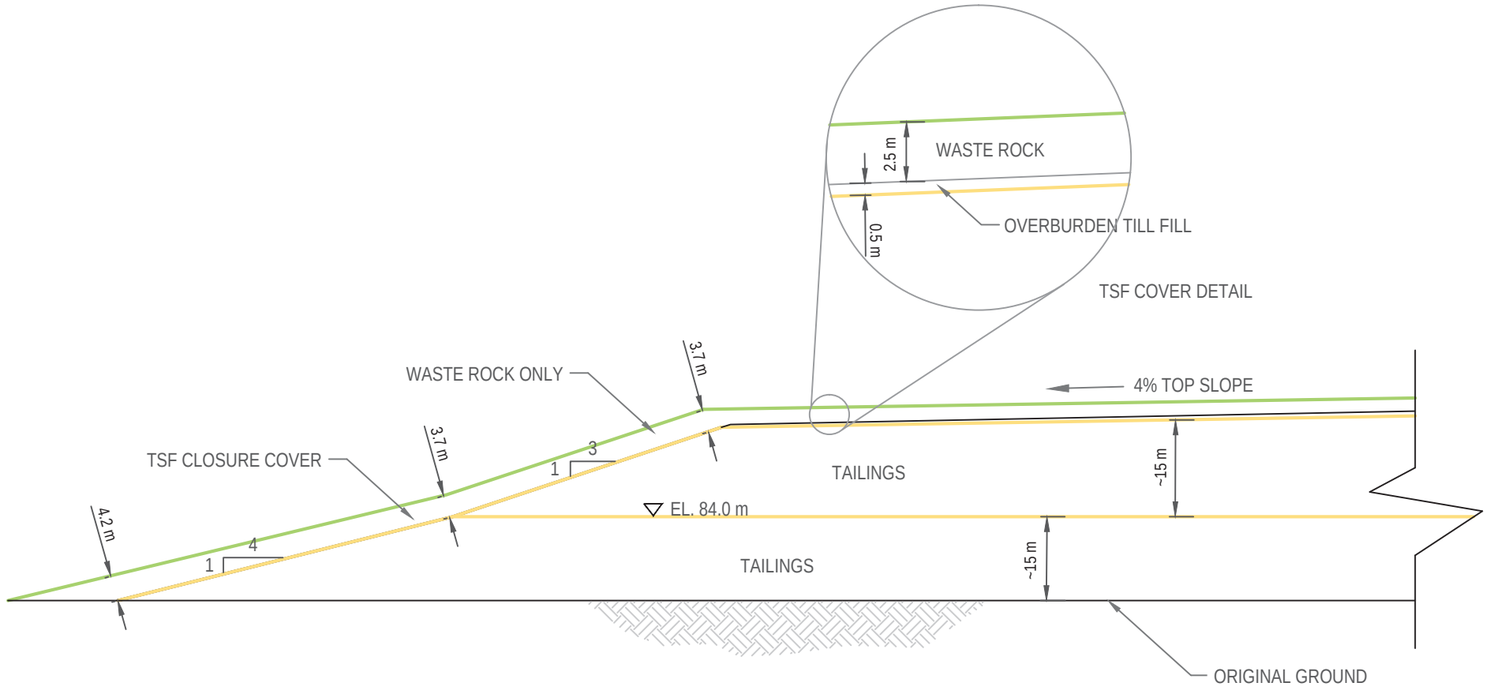


SECTION A–A TSF DURING OPERATION (YEAR 6 SHOWN)



TYPICAL DESIGN SECTION FOR TSF

NOTES:

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AGNICO EAGLE – MELIADINE GOLD PROJECT
FIGURE **5.2** TYPICAL DESIGN CROSS SECTION FOR TSF

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AGNICO EAGLE

MELIADINE GOLD PROJECT

Quality Assurance/Quality Control Plan

MARCH 2018
VERSION 2
6513-QQY-01

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AGNICO EAGLE

EXECUTIVE SUMMARY

This document presents the Meliadine Mine Quality Assurance / Quality Control (QA/QC) Plan. It summarizes the field sampling equipment, and methods, as well as laboratory and data requirements.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	April 2015			This is the first version of this Plan, developed for the Type A Water Licence Application	Golder Associates Ltd.
2	March 2018	All	All	-Updated revision date	Meliadine Environment Department
		2.1	3	-Changed Hanna multi-meter to Eureka Manta II	
		2.2.4	6	-Laboratory name change: MultiLab to H2Lab	
		Table A-2	Appendix 12	-Updated table of analytical parameters (removed Group listing)	
		Figure A-2		-Removed figure heading for site sampling location – no figure was included with the heading	
		Figure A-1	Appendix 16	-Added General Site Plan figure to existing heading	

ACRONYMS

AANDC	Aboriginal Affairs and Northern Development Canada
Agnico Eagle	Agnico Eagle Mines Limited
AEMP	Aquatic Effects Monitoring Program
Mine	Proposed Meliadine Gold Mine
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
Project	Meliadine Gold Project
QA/QC	Quality Assurance and Quality Control
SNP	Surveillance Network Program

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres north from Rankin Inlet, and 80 kilometres southwest from Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson's Bay, the proposed Project site is located on a peninsula (the Peninsula) between the east, south, and west basins of Meliadine Lake (63°01'23.8"N, 92°13'6.42"W), on Inuit Owned Land.

This report presents the Quality Assurance/Quality Control (QA/QC) Plan for the Project. The Plan was prepared in accordance with the requirements of Type A Water Licence Application and the Supplementary Information Guidelines for Mining and Water Works, issued by Nunavut Water Board (NWB 2010a, b, c). It has been developed in accordance with the Aboriginal Affairs and Northern Development Canada (AANDC) 1996 '*Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan*', which includes the following definitions:

- Quality Assurance: the system of activities designed to better ensure that quality control is done effectively; and
- Quality Control: the use of established procedures to achieve standards of measurement for the three principal components of quality – precision, accuracy and reliability.

The mine plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

A general location plan of the proposed Mine is shown in Figure A-1.

This Plan, which is part of the Environmental Management System for the proposed Mine, is divided into the following components:

- procedures for field sample collection (Section 2);
- external and internal laboratory requirements (Section 3); and
- data verification procedures and regulatory reporting requirements (Section 4).

The objective of the QA/QC program is to assure that the chemical data collected are representative of the material being sampled, are of known quality, are properly documented, and are scientifically defensible. Data quality is assured throughout the collection and analysis of samples using specified standardized procedures, by the employment of accredited laboratories, and by staffing the program with experienced technicians.

This QA/QC Plan sets out standard procedures for sample and data collection with respect to surface water and groundwater sampling in support of monitoring programs outlined in the Water Management Plan and the Aquatic Effects Monitoring Program (AEMP) Design Plan.

SECTION 2 • FIELD SAMPLING

Water quality monitoring will be initiated at the pre-development stage and will continue during construction, operations, and closure. Proposed sampling stations, frequency, and parameters are listed Appendix A, Table A-1. Table A-2 provides supporting definitions. The stations and their requirements may be adjusted based on the requirements of the Type A Water Licence and/or any updates to the Mine management plans over the life of the Mine. Proposed sampling stations are shown in Appendix A, Figure A-2.

There are three categories of aquatic monitoring at Meliadine:

- **Regulated discharge monitoring** occurs at monitoring points specified in licences or regulations. It includes discharge limits that must be achieved to maintain compliance with an authorization (i.e., water licence) or regulation (i.e., Metal Mining Effluent Regulations). Enforcement action may be taken if discharge limits are exceeded for a parameter.
- **Verification monitoring** is carried out for operational and management purposes by Agnico Eagle. This type of monitoring provides data for decision making and builds confidence in the success of processes being used. There is no obligation to report verification monitoring results, although some monitoring locations and these results can be mentioned in environmental management plans (i.e., sampling to verify soil remediation in the landfarm).
- **General monitoring** is commonly included in a water licence specifying what is to be monitored according to a schedule. It covers all types of monitoring (i.e., geotechnical, lake levels, etc.). This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included QA/QC provisions, and addresses identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the Water Board.

All sampling stations will be clearly identified; their GPS coordinates collected and stored. All sampling will be conducted by qualified personnel, at the same location, using the same techniques to reduce operational error. The following sections outline the standard procedures for collection and handling of all surface water and groundwater samples.

2.1 Sampling Equipment

New laboratory supplied containers will be used for sample collection. The bottles will be either polyethylene plastic or glass, dependent on the specific parameter being analyzed.

Equipment, such as the Analite NEP 160 Meter (turbidity), Oakton PCS35 Meter (pH and conductivity), and Eureka Manta II (pH, dissolved oxygen and conductivity) are handheld instruments that can be used to collect, as required, field parameters. The YSI 6-series MPS (multiprobe system) can also be used to measure parameters in field like pH, temperature, conductivity, dissolved oxygen, and

oxidation reduction potential data as required. The instruments are to be calibrated before each sample event to ensure optimal performance and record of the calibration will be kept in a log Calibration and maintenance procedures will be followed as set out by the supplier's operation manual. Equipment and bottles will be selected so that they do not contaminate or alter the concentrations of parameters of interest according to laboratory standards.

For groundwater sampling, and to collect water samples at depth from the surrounding lake receiving environments, a pump with tubing will be used. Low Density Polyethylene tubing, filter apparatus, manual or electric pump, and ashless filter paper will be used to filter water for specific analyses (e.g., dissolved metals, chlorophyll *a*) and/or for depth integrated sampling (e.g., chlorophyll *a*, phytoplankton, or biological oxygen demand).

2.2 Sampling Methods and Handling

2.2.1 Sampling Identification

All samples have a unique sample identification name based on a station identifier, date, and time of collection. For duplicates and field blanks, the sample identification will follow the naming convention *year* and *sampling number* by following the Environment QAQC table (e.g. 2018-0001)

All sample bottles will be identified with the sample identification and date of collection. This information will be marked on a label with a water resistant pen or using a label printer and affixed to the sample bottle. Additional information (time of sampling and parameters to analyze) will be included in the analysis request that will be sent to the accredited laboratory.

2.2.2 Surface Water Sampling

The bottles will be pre-labelled with the required sample identification before going to the field. Surface grab samples will be collected by submerging the sample bottle to half depth of the stream. For sumps, diversion ditches and piped discharge points, sample will be collected below the surface of the water.

Samples bottles will be provided by the accredited laboratory. They will be received pre-rinsed and pre-preserved or pre-rinsed with vials of preservative to be added in the field by qualified technicians in the case that bottles are not pre-preserved, bottles will be rinsed three times with sample water before filling. When the sampling bottle contains preservative, the bottle will be filled by using another clean bottle to avoid any release of preservative. Sometimes, a preservative is added after filling as directed by the laboratory; see Section 2.2.4 for more details on preservation. The bottles will be filled properly to allow mixing, preservative addition, and thermal expansion.

Samples analyzed for dissolved metals and chlorophyll *a* are filtered through ashless filter paper at the time of collection when the delay before analyses is long. However, when the delay before analyses is short, the accredited laboratory filters the sample before analyses. In some cases, when the analysis delay is long, the sample will be frozen to prevent parameter degradation.

2.2.3 Groundwater Sampling

Well Preparation for Sampling

At the time of purging and sampling, if necessary, any heat trace cables will be activated to warm the well pipe. The well is only purged once the well is thawed.

Well Purging

Purging is performed by inserting a ¾'' Low Density Polyethylene Waterra tube to approximately 20 metres below the water surface and using a compressor to completely dry the well. The wells are purged to remove standing water inside the well and to induce the flow of fresh groundwater from the rock formation. The quality of the purged water is monitored for pH, conductivity, temperature, water clarity, and colour (visual observation) during this activity. Sampling occurs after three well volumes of water (between the in-well packer and bottom of screened interval) have been removed or once the monitored parameters stabilize (values remaining within 10% for three consecutive readings).

Groundwater Sampling

Groundwater is sampled immediately after purging by lowering the intake of the Double Valve Pumping tubing to 3 to 5 metres above the screened interval.

A groundwater sample is collected in clean, laboratory-supplied containers as per the instructions in the previous section. Samples analyzed for dissolved metals are filtered through a 45 micrometer inline filter.

Samples are collected in duplicate (see Section 2.2.5) and submitted to an accredited analytical laboratory. Duplicate samples are collected.

Measurements of groundwater temperature, pH, electrical conductivity, and salinity are obtained in the field during the purging and sampling. Measurements are recorded for future reference and to check against laboratory data.

The following procedures are followed to provide data quality control on the samples:

- measuring field parameters at selected intervals until stable readings (within 10% of each other);
- minimizing the exposure of the sampled water to the atmosphere;
- using compressed, inert gas (nitrogen) to evacuate water for sample collection;
- measuring, in-situ, sensitive chemical parameters (pH, conductivity, where applicable); and
- abiding by sample preservation methods (refrigeration and use of preservatives where needed); and specified holding times.

Bottles are labelled with required information.

2.2.4 Preservation

Preservatives, if required, are added to sample bottles by the laboratory or added by the technician after filling, as directed by the analytical laboratory. Table A-3 summarizes the minimum sample volumes, preservation, and holding times for select parameters. This information was provided by the accredited laboratory H2Lab (formerly MultiLab) for the Meadowbank Mine; however, they are also applicable to the Project.

2.2.5 Field Duplicates and Blanks

One field duplicate, one filter blank, one field blank and one trip blank will be collected for a) every 10 samples (i.e., duplicate samples are taken for 10% of the samples); b) each sampling event; or c) once per year (Table A-4).

Field duplicates and filter blanks will be collected and handled in the same manner as the other samples in the field.

Field blanks are samples of distilled water handled concurrently and in the same manner as the other samples in the field.

Trip blanks are used to determine whether contamination (particularly VOC) has been introduced to aqueous samples through cross-contamination during shipment and storage of sample containers. Trip blanks are typically prepared by the lab and travel with the sample to the site and back to the lab without being opened.

The duplicate samples will be given sample identification numbers and included in the sample stream. The indication of the sample as a duplicate is maintained in the data records at site.

2.2.6 Sample Transport

All water samples will be stored upright in coolers with ice packs and preserved as specified by the laboratory. Samples are to be shipped to the external laboratory as soon as possible via Nolinor Charter flight and dedicated ground transportation to ensure arrival in a safe and timely manner. If the sample cannot be shipped the same day, they are to be stored in a refrigerator at 4°C until shipping.

A Chain of Custody form with the following information is completed for every shipment of samples:

- company name and sampler's name;
- sample identification name;
- time and date of sampling;
- presence and type of preservative and whether the sample was filtered or not;
- requested analytical parameters for each bottle;
- time and date of shipping; and

- analytical laboratory address and contact person.

One electronic or PDF copy will be sent by email to the laboratory; an electronic copy will be kept at the Mine site for reference.

Section 3 • LABORATORY ANALYSIS

3.1 External Laboratory

All analytical chemistry analyses are performed by an accredited laboratory.

In most cases, these analyses will be performed by Maxxam, an accredited facility (see Appendix B) located in Ottawa, Ontario. All data from Maxxam undergoes a rigorous internal QA/QC process, including the use of spiked samples and duplicate samples. Toxicity tests will be performed by Aquatox in Nova Scotia. Testing will be conducted as stipulated by Environment Canada's Biological Test Methods.

Agnico Eagle may also require the services of laboratory, such as Maxxam in Edmonton, AB, SGS in Lakefield, ON and H2Lab in Val d'Or, QC. Agnico Eagle may also use the services of ALS Global for some of the AEMP water quality analysis.

3.2 Internal Laboratory

The assay lab at the Mine site is not an accredited laboratory but will be used periodically for "real-time" results for some parameters like pH, total suspended solids, and Weak Acid Dissociable Cyanide. These results are for observational purposes and do not meet the standards of an accredited laboratory.

SECTION 4 • DATA REQUIREMENTS

4.1 Data Collection

A database of all water sampling data is to be maintained at the Mine site. The database should be designed based on the various discharge limits designated in the Water Licence. The database functionality will include event scheduling, trend analysis, and flagging out-of-compliance samples, all to enhance the effectiveness of the QA/QC program. The database information will be presented to regulators in the annual report.

The following data is collected for each sample in the field and will be entered into the database by the sampler for the corresponding sampling station:

- sample identification name;
- name of sampler;
- date and time of sampling or measurement; and
- physical characteristics (pH, temperature, etc.), if required.

Upon receipt of sample results from the laboratory, the data will be input to the database and matched to the sample identification name. The analysis certificate for each sample from the accredited laboratory will include but is not limited to:

- analytical methods or techniques used;
- date of analysis;
- name of the person(s) / laboratory that approved the certificate; and
- results of any analysis.

4.2 Data Verification

Upon receipt of analytical results, the field blank and duplicate analyses will be verified for potential contamination and accuracy, respectively. Results will be interpreted and recommended actions will be taken if necessary.

4.3 Exceedance Reporting

Any measured concentration at a sample station exceeding a regulated discharge criterion stipulated in the Water Licence or the Metal Mining Effluent Regulations will be reported to the Nunavut Water Board, Environment Canada, and AANDC water inspector within 30 days of the receipt of the analysis. In addition, results of the action plan, where required, will be reported and, where necessary, mitigation options identified within 90 days after receipt of the analyses.

SECTION 5 • REFERENCES

AANDC (Aboriginal Affairs and Northern Development Canada). 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "A" Licensees in Meeting SNP Requirements and for Submission of a QA/QC Plan.

NWB (Nunavut Water Board). 2010a. Guide 4: Completing and Submitting a Water Licence Application for a New Licence. April 2010.

NWB. 2010b. Supplemental Information Guideline (SIG) for General Water Works (M1). Issued February 2010.

NWB. 2010c. Supplemental Information Guideline (SIG) for Mine Development (MM3). Issued February 2010.

APPENDIX A • TABLES AND FIGURES

Table A-1: Proposed Water Quality Regulated, General Aquatic, and Verification Monitoring for the Project during Construction, Operations, and Closure

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	UTM Zone 11		Sampling Depth	Sample Type	Number of Samples per Station
					Easting	Northing			
Regulated	Construction	MEL-D-1 to TBD	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes	Quality of intake water	TBD	TBD	Shoreline	Grab	1
Regulated	Construction, and Operations	MEL-SR-1-TBD	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries	Confirm no adverse effects from leakage/runoff	546244	963636	Surface water runoff (if present)	Grab	1
Aquatic	Construction, and Operations	MEL-11	Water intake from Meliadine Lake	Test quality of final effluent before release	TBD	TBD	From pipe	Grab	1
Verification	Construction (prior to release), Operations, and Closure	MEL-12	Water treatment plant (pre-treatment) coming from CP1, off the pipe and not in the pond	Test quality of water before treatment (required to evaluate treatment efficiency)	TBD	TBD	From pipe	Grab	1
Aquatic	Construction (prior to release), Operations, and Closure	MEL-13	Mixing zone in Meliadine Lake, Station 1; and MMER exposure stations for final discharge point	Test mixing of effluent in the receiving environment; sample at varied distances and directions from pipe; MMER exposure for final discharge point	TBD	TBD	Depends on presence of a vertical conductivity gradient	Discrete	1 (depth of maximum conductivity, or mid-depth if no conductivity gradient is present)
Regulated	Construction (upon effluent release), Operations, and Closure	MEL-14	Water treatment plant from CP-1 (post-treatment), end of pipe (before offsite release) in the plant before release.	Quality of intake water	539724	6989988	Depth Integrated or from Intake Pipe	Grab	1
Verification	Construction, and Operations	MEL-15	Local Lake E-3	Confirm no leakage/runoff from Emulsion Plant	536753	6990492	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-16	Local Lake G2	Possible seepage or dust loadings from site infrastructure	538840	6990498	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-17	Local Pond H1		540685	6989588	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-18	Local Lake B5		537306	6988841	Shoreline	Grab	1
Verification	Construction, Operations, and Closure	MEL-19	CP-2 Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	Collection of natural catchment drainage from the outer berm slopes of the Landfarm and industrial pad	TBD	TBD	TBD	Grab	1
Verification	Construction, and Operations	MEL-20	CP-3 Collection of drainage from dry stacked tailings	Collection of drainage from dry stacked tailings	TBD	TBD	TBD	Grab	1
Verification	Construction, and Operations	MEL-21	CP-4 Collection of drainage from WRSF1	Collection of drainage from WRSF1	TBD	TBD	TBD	Grab	1
Verification	Construction, Operations, and Closure	MEL-22	CP-5 Collection of drainage from WRSF1 and WRSF2	Collection of drainage from WRSF1 and WRSF2	540120	6988825	TBD	Grab	1

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	UTM Zone 11		Sampling Depth	Sample Type	Number of Samples per Station
					Easting	Northing			
Verification	Construction, Operations, and Closure	MEL-23	CP-6 Collection of drainage from WRSF3	Collection of drainage from WRSF3	TBD	TBD	TBD	Grab	1
Verification	Construction, Operations, and Closure	MEL-24	Seepage from the Landfill between the landfill and Pond H3	Located between the landfill and Pond H3 to monitor seepage from the landfill	NA	NA	Pooling Water (if present)	Grab	1
Regulated	Construction, Operations, and Closure	MEL-25	Secondary containment area at the Itivia Site Fuel Storage and Containment Facility	Located in the secondary containment area of the tankfarm at Itivia to monitor water quality prior to discharge to land	NA	NA	Pooling Water (if present)	Grab	1

Notes: as per Metal Mining Effluent Regulations (MMER), samples for effluent characterization and receiving environment must be collected quarterly, or at least one month apart while effluent is being deposited.

Grey shading indicates that verification monitoring parameters and locations are internal for Agnico Eagle. A systematic approach will be used in communicating inspections results, likely on an annual basis. This will allow Agnico Eagle to inform government, Inuit associations, and the public of inspection outcomes.

CP = collection pond; WRSF = waste rock storage facility; TBD = to be determined

Table A-2: List of Analytical Parameters

	Parameters
Total/Dissolved Metals	Aluminum, antimony, arsenic, barium, beryllium, boron cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc and mercury
Nutrients	Ammonia-nitrogen, total Kjeldahl nitrogen, nitrate-nitrogen, nitrite-nitrogen, ortho-phosphate, total phosphorus, total organic carbon, dissolved organic carbon
MMER	Total cyanide, arsenic, copper, lead, nickel, zinc, radium-226, TSS, pH, sulphate, turbidity, and aluminum. Effluent volumes and flow rate of discharge, acute toxicity (Rainbow Trout and *Daphnia magna*) and environmental effects monitoring (EEM).
Conventional Parameters	Bicarbonate alkalinity, carbonate alkalinity, turbidity, conductivity, hardness, pH, total alkalinity, TDS, TSS, turbidity
Cyanide	Free and total cyanide
Major Ions	Calcium, magnesium, potassium, sodium, chloride and sulphate
Petroleum Hydrocarbons	F1, F2-F4 and BTEX
Other	Reactive silica, radium-226, oil & grease
Flow	Flow datalogger/meter
Field measurements	Field pH, specific conductivity, dissolved oxygen, and temperature.

MMER = Metal Mining Effluent Regulations.

Table A-3: Holding times for sampling parameters

Parameters	Matrix				Type of Bottle	Preservative	Volume
	Drinking Water	Waste Water	Surface Water	Ground Water (1)			
Microbiology							
Escherichia coli, total coliforms, A.A.H.B	48[h]	48[h]	48[h]	48[h]	PPS	TS, E	250[ml]
Enterococcus	48[h]	48[h]	48[h]	48[h]	PPS	TS, E	250[ml]
Thermo tolerant coliforms (fecal)	48[h]	48[h]	48[h]	48[h]	PPS	TS, E	250[ml]
Inorganic Chemistry							
Absorbance UV, Transmittance UV	24[h]			24[h]	P. T. V	N	125[ml]
Alkalinity, Acidity, Bicarbonates, Carbonates	14[d]	14[d]	14[d]	14[d]	P, T, V	N	250[ml]
Ammonia nitrogen (NH3-NH4)	28[d]	28[d]	28[d]	28[d]	P, T, V	AS	125[ml]
Kjeldahl ammonia (NTK)		28[d]	28[d]	28[d]	P, T, V	AS	125[ml]
Anions (Cl, F,SO4)	28[d]	28[d]	28[d]	28[d]	P, T, V	N	250[ml]
Color, Free & total Chlorine	48[h]	48[h]	48[h]	48[h]	P, T, V	N	125[ml]
Conductivity	28[d]	28[d]	28[d]	28[d]	P, T, V	N	250[ml]
Cyanides total/available, Cyanides	14[d]	14[d]	14[d]	14[d]	P, T, V	NaOH	250[ml]
BOD5/Carbonated BOD5 (2)		48[h]/4°	48[h]/4°		P, T, V	N	250[ml]
COD (chemical oxygen demand)		28[d]	28[d]		P, T, V	AS	125[ml]
Mercury (Hg)	28[d]	28[d]	28[d]	28[d]	P, T, V	AN	250[ml]
Total/dissolved metals (filtered on field)	180[d]	180[d]	180[d]	180[d]	P, T, V	AN	250[ml]
Dissolved metals (filtered in the laboratory)	24[h]	24[h]	24[h]	24[h]	P, T, V	N	250[ml]
Total suspended solids & volatile TSS		7[d]	7[d]	7[d]	P. T. V	N	500[ml]
NH3 or NH4		24[h]	24[h]	24[h]	P.T.V	N+AS	2/125[ml]
Nitrites (NO2), Nitrates (NO3), Turbidity	48[h]	48[h]	48[h]	48[h]	P, T, V	N	250[ml]
Nitrites-Nitrates (NO2-NO3)	28[d]	28[d]	28[d]	28[d]	P, T, V	AS	250[ml]
O-Phosphates (O-PO4)	48[h]	48[h]	48[h]	48[h]	P, T, V	N	500[ml]
pH	24[h]	24[h]	24[h]	24[h]	P, T, V	N	125[ml]
Total Phosphorus (P-tot)	28[d]	28[d]	28[d]	28[d]	P, T, V	AS	125[ml]
Dissolved solids (TDS)		7[d]	7[d]	7[d]	P. T. V	N	250[ml]

Parameters	Matrix				Type of Bottle	Preservative	Volume
	Drinking Water	Waste Water	Surface Water	Ground Water (1)			
Total solids		7[d]	7[d]	7[d]	P. T. V	N	250[ml]
Sulphides (H2S) (3)	28[d]	28[d]	28[d]	28[d]	P. T. V	E.D.T.A	125[ml]
Thiosulfates	48[h]	48[h]	48[h]	48[h]	P. T. V	N	125[ml]
Radioactive & Organic Chemistry							
Fatty resin acids (S-T)	-	28[d]	28[d]	-	VA, VT	AS	1[L]
Congeners PCB (S-T)	28[d]	28[d]	28[d]	28[d]	VA, VT	N	1[L]
Chlorobenzene	28[d]	28[d]	28[d]	28[d]	2 Vial+1 blank	TSS	2/40[ml]
Total organic carbon (TOC)	28[d]	28[d]	28[d]	28[d]	P, T, V (B)	AC	100[ml]
Dissolved organic carbon (DOC)	48[h]	48[h]	48[h]	48[h]	P, T, V (B)	N	100[ml]
Total inorganic carbon (TIC)	48[h]	48[h]	48[h]	48[h]	P, T, V (B)	N	100[ml]
Phenolic compound (GC-MS)	28[d]	28[d]	28[d]	28[d]	VA, VT	AS	1[L]
Glyphosate (S-T)	14[d]	14[d]	14[d]	14[d]	P.T	N	500[ml]
PAH	28[d]	28[d]	28[d]	28[d]	VB	AS	1[L]
Oil & greases (total and non-polar)	28[d]	28[d]	28[d]	28[d]	VA, VT	AS	1[L]
C10-C50 HP and/or Petroleum product identification	28[d]	28[d]	28[d]	28[d]	VA, VT	AS	1[L]
Phenol index	28[d]	28[d]	28[d]	28[d]	VA, VT	AS	500[ml]
Radium-226	180[d]	180[d]	180[d]	180[d]	P, T. V	AN	1[L]
VOC (MAH, CAH, THM, BTEX) (3)	28[d]	28[d]	28[d]	28[d]	2 Vial+1 blank	TSS	2/40[ml]

Notes:

Type of Bottle:

- = non-applicable; P.S.V.T. = plastic bottle, bag or glass bottle with Teflon cap; P, T = Plastic bottle or plastic bottle with Teflon cap; P.T.V. = Plastic bottle or glass bottle with plastic or Teflon cap; PPS = Sterile propyl ethylene bottle; VA = Clear or amber glass with aluminium or Teflon seal; VB = Amber glass (or clear glass covered with aluminium paper) aluminium seal of Teflon; *VT = Clear or amber glass bottle with Teflon seal*

Preservative:

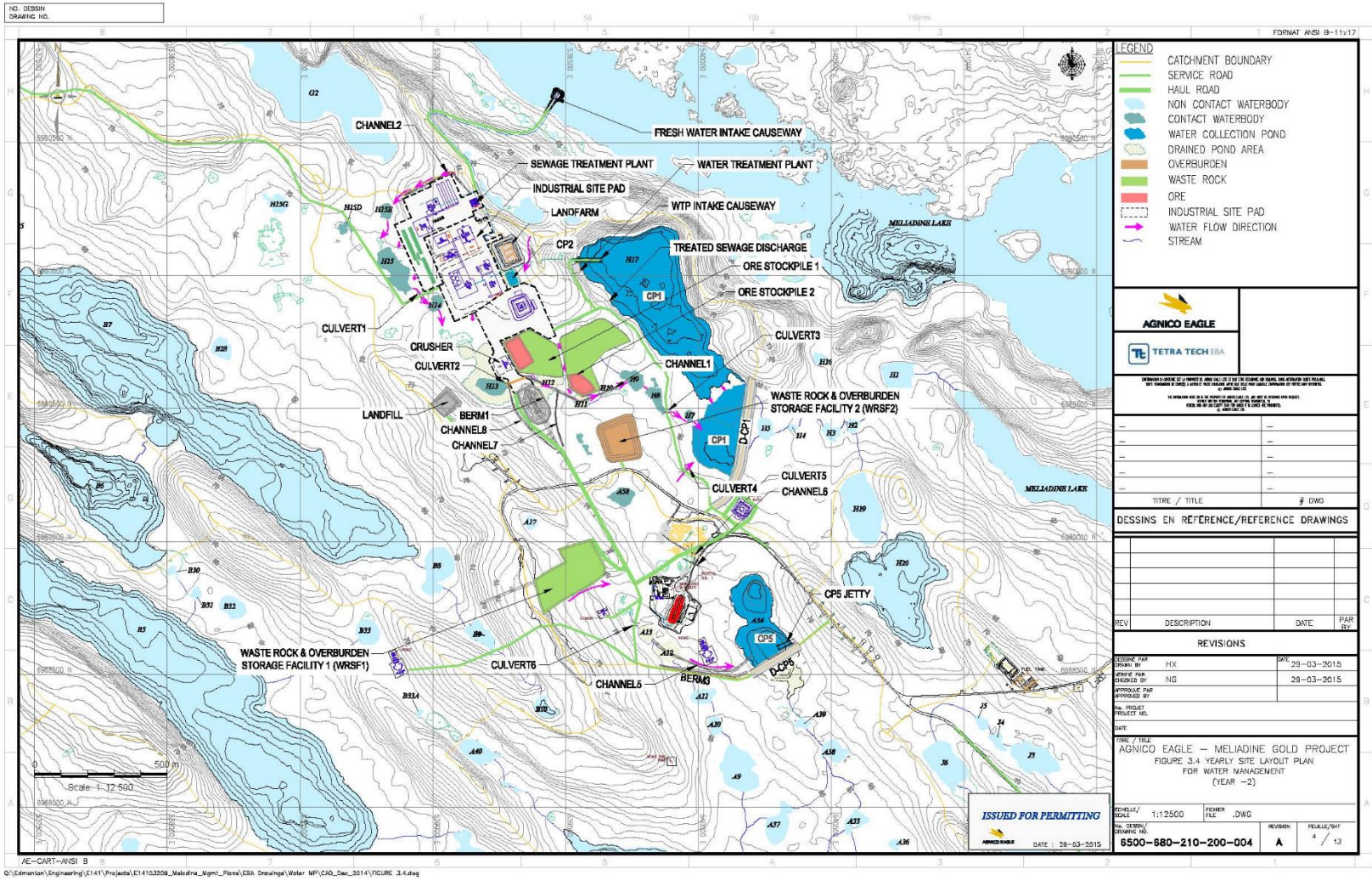
AC = 0.1ml (100 µl) of HCl per 100 ml of sample; AcZn = 0.2 ml zinc acetate 2 N per 100 ml of sample and NaOH 10 N to pH >9; AN = HNO3 to pH <2; AS = H2SO4 to pH <2; E = 2.5 ml EDTA 1.5% (p/v) per 100 ml of sample if heavy metals are suspected; ED = 0.1 ml diamine ethylene 45 mg/l per 100 ml of sample; EDTA = 1 ml EDTA 0.25 M per 100 ml of sample; N = No preservative; NaOH = NaOH 10 N to >12; TS = Sodium thiosulfate final concentration in the sample of 0.1% (p/v); TSS = about 40 mg of thiosulfate sodium

Table A-4: Quality Control Sample Frequency

Sampling Site	QA/QC Sampling Frequency
Regulated and General Aquatic Monitoring	
Collection Pond 1 [a]	1 field duplicate and 1 field blank per year
Mine facilities - operations	1 field duplicate per year
Mine facilities - closure	1 field duplicate per year
Mine facilities - post-closure	1 field duplicate per year
Receiving water chemistry	Blind field duplicates, laboratory and field blanks, sediment cleaning swipes, laboratory matrix spike duplicates per 10 samples
Event Monitoring Program	
Each event	One field duplicate per 10 samples

[a] Collection Pond 1 is the Water Management Pond for the Project

Figure A-1: General Site Plan



AGNICO EAGLE

MELIADINE GOLD PROJECT

ROAD MANAGEMENT PLAN

MARCH 2018
VERSION 5
6513-MPS-03

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ᐊᒡᓃᑯ ᐅᔾᕿᒃᑕᕆᐊᑦ ᓚᒥᑎᑦ (ᐊᒡᓃᑯᒃᑯᑦ) ᐱᕙᓪᓕᐊᓂᖃᖅᑐᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒨᓗᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐱᓕᕆᐊᖅ), ᐃᓂᐅᔪᒥᑦ 25 ᑮᓛᒥᑕᓪᓗᐊᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᙵᙳᓂᑦ ᑲᖏᖅᖠᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑮᓛᒥᑕᓪᓗᐊᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐱᖓᙳᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᒫᕐᔫᑉ ᑭᕙᓪᓕᖅ ᓄᓇᕗᒻᒥᑦ. ᐱᓕᕆᐊᖅ ᑕᓯᕐᔪᐊᑉ ᐃᒪᖅᑲᕐᓂᕆᔭᖓᓃᑦᑐᖅ ᐅᐃᓪᓴᓐ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᐅᔪᕐᒥᑦ (ᓄᓇᕗᒻᒥᑦ ᐃᒪᓕᕆᓂᕐᒧᑦ ᒪᓕᒐᕿᓪ ᐅᖃᓚᒫᒐᖅ 4).

ᐅᔾᕿᒃᑕᕆᐊᓕᐊᕐᕚᔪᒪᔪᖅ ᐃᓄᐃᑦ ᓄᓇᖁᑎᖓᓐᓃᑦᑐᖅ, ᑕᐃᒪᓐᓇᒎᓪᓗ, ᓄᓇᒥᒃ ᐊᒻᒪᓗ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᐊᐅᓚᑦᑎᓂᐅᔪᖅ ᐊᐅᓚᑕᐅᖃᑦᑕᖅᑐᑦ ᒪᓕᒐᖏᓐᓄᑦ ᓄᓇᕗᒻᒥᑦ ᓄᓇᑖᕐᓂᕐᒧᑦ ᐊᖏᖃᑎᒌᒍᑎᒥᑦ. ᑖᒻᓇ ᑎᑎᖅᑲᖅ ᑕᒃᓴᐅᑎᑦᑎᔪᖅ ᐊᑉᑯᑎᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒥᑦ (ᐸᕐᓇᐅᑎ) ᐅᔾᕿᒃᑕᕆᐊᓕᐊᕐᕚᔪᕐᒧᑦ ᐊᒻᒪᓗ ᐃᓚᓕᐅᖅᑐᖅ ᑎᑎᖅᑲᐅᑎᒧᑦ ᖃᑉᓯᐊᕐᔪᖕᓂᑦ Type A ᐃᒪᕐᒧᑦ ᓚᐃᓴᓐᓯᒧᑦ ᑐᒃᓯᕋᐅᑎᒥᒃ. ᑎᑎᕋᖅᑲᐅᑏᑦᑦ ᓂᕆᐅᒋᔭᐅᔪᑦ ᐳᒥᑦ-ᖑᔪᑦ, ᐊᖏᖅᑲᑎᒌᒍᑏᑦ, ᐱᔪᙳᖅᑎᑕᐅᓃᑦ, ᐊᒻᒪᓗ ᓈᒻᒪᒋᔭᐅᔪᑦ ᐊᑐᖅᑐᑦ ᑖᑉᓯᒧᙵ ᐸᕐᓇᐅᑎᒧᑦ ᑕᐃᒪᐅᖃᑕᐅᔪᑦ.

ᐊᒡᓃᑯᒃᑯᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᒥᑦ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐅᔾᕿᒃᑕᕈᒪᔪᑦ ᐱᕙᓪᓕᐊᔭᐅᔪᒥᑦ ᑎᕆᕋᓂᐊᖅ-ᒥᑦ ᒨᓗᑕᓕᒃ, ᒪᕿᙵᓂᒃ ᐅᒃᑯᐃᖓᔫᖕᓂᒃ (ᑎᕆᕋᓂᐊᖅ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 1 ᐊᒻᒪᓗ ᑎᕆᕋᓂᐊᖅ ᐃᓗᑦᑐᖅᓯᒪᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᓄᓇᒥᑦ ᐃᓗᐊᓂᑦ ᐅᔾᕿᒃᑕᕐᓂᖅ. ᐅᔾᕿᒃᑕᕆᐊᓕᐊᕐᕚᔪᖅ 12.1 ᒥᓕᔭᓐ ᑕᓐ-ᓗᐊᓂᒃ (Mt) ᐅᔾᕿᒃᑕᕐᓂᐊᖅᑐᖅ, 31.8 Mt-ᓂᒃ ᐊᒃᑖᖅᑕᐅᔪᓂᑦ ᐅᔾᖅᑲᓂᒃ, 7.5 Mt-ᓂᒃ ᐅᖓᑕᐅᑦᑎᔪᓂᒃ ᐊᒃᑯᓂᒃ, ᐊᒻᒪᓗ 12.1 Mt-ᓂᒃ ᕿᒪᒃᑎᑦᑐᓂᑦ. ᓯᑕᒪᐅᓚᖓᔪᖅ ᐱᕙᓪᓕᐊᔭᐅᓂᖓ ᑎᕆᕋᓂᐊᖅ: ᓯᑕᒪᑦ ᐅᑭᐅᑦ ᐅᖓᑎᐊᕐᔪᐊᓄᑦ ᓴᓇᔭᐅᓗᓂ (Q4 ᐅᑭᐅᖅ -5-ᒥᑦ ᐅᑭᐅᖅ -1-ᒧᑦ), 8-ᓄᑦ ᐅᑭᐅᓄᑦ ᐅᔾᕿᒃᑕᕆᐊᖅ ᐊᐅᓛᕐᓗᓂ (ᐅᑭᐅᖅ 1-ᒥᑦ ᐅᑭᐅᖅ 8-ᒧᑦ), ᐱᖓᓱᑦ ᐅᑭᐅᓄᑦ ᐅᒃᑯᐊᖅᐸᓪᓕᐊᓗᒍ (ᐅᑭᐅᖅ 9-ᒥᑦ ᐅᑭᐅᖅ 11-ᒧᑦ), ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ (ᐅᑭᐅᖅ 11-ᒥᑦ ᓯᕗᒧᑦ).

ᐊᑉᑯᑎᓂᒃ ᐊᐅᓚᑦᑎᓂᖅ

ᐸᕐᓇᐅᑎᒥᑦ ᐃᓚᐅᔪᑦ ᐊᑉᑯᑎ, ᐱᔾᑎᕋᐃᓂᖅ, ᐊᒻᒪᓗ ᐅᓯᒃᑦᑕᕐᓂᕐᒧᑦ ᐊᑉᑯᑎᓕᐊᕐᕚᔪᑦ ᐱᓕᕆᐊᑉ ᐃᓂᖓᓂᑦ, ᐊᒻᒪᓗ ᐃᓚᐅᑉᓗᑎᒃ ᓴᓇᔭᐅᑎᓪᓗᒍ, ᐊᐅᓛᖅᑎᓪᓗᒍ, ᐅᒃᑯᐊᖅᐸᓪᓕᐊᑎᓪᓗᒍ ᐊᒻᒪᓗ ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ ᐱᓕᕆᐊᖅ. ᑖᒻᓇ ᐸᕐᓇᐅᑎ ᐊᒃᑐᐊᓂᖃᖅᑐᖅ ᓂᕆᐅᓐᖏᑦᑐᓂᒃ ᑯᕕᔪᖃᖅᐸᑦ ᐸᕐᓇᐅᑎᒧᑦ ᐊᒻᒪᓗ ᓄᓇᒥᑦ ᐆᒪᔪᐃᑦ ᐊᕙᑎᖓᓂᑦ ᐊᐅᓚᑦᑎᓂᖅ ᐊᒻᒪᓗ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᕐᒧᑦ ᐸᕐᓇᐅᑎᒧᑦ (ᐊᒡᓃᑯᒃᑯᑦ 2014a). ᐊᑉᑯᑏᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᒡᓃᑯᒃᑯᓐᓄᑦ ᑭᓯᐊᓂᑦᑕᐅᖅ ᐊᑐᖅᑕᐅᑎᖃᑦᑕᕐᓂᐊᖅᑕᖓᑦ ᑭᒡᓕᖃᖅᓂᖅᖢᒋᓪᓗᒍ ᐃᓄᖕᓄᑦ, ᐅᓗᕆᐊᓇᙱᑉᐸᑦ ᑕᐃᒪᓐᓇᐃᑦᑐᙵᕐᓂᕐᒧᑦ. ᐊᑉᑯᑏᑦ ᐅᔾᕿᒃᑕᕆᐊᑉ ᖃᓂᑕᖓᓃᑦᑐᑦ ᐃᓚᐅᔪᑦ:

1. 30 ᑮᓛᒥᑕᒥᒃ ᑕᑭᑎᒋᔪᖅ ᐅᑭᐅᓗᒃᑖᖅ ᐊᑉᑯᑎ (AWAR) ᑲᖏᖅᖠᓂᕐᒥᑦ ᐅᔾᕿᒃᑕᕆᐊᓕᐊᕐᕚᔪᕐᒧᑦ. AWAR ᐊᑐᖅᑕᐅᖃᑦᑕᕐᓂᐊᖅᑐᑦ ᐊᒃᔭᖅᑐᐃᓗᑎᒃ ᐃᒡᓗᕐᔪᐊᒃᓴᓄᑦ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᓂᒃ/ᐅᔾᕿᒃᑕᕆᐊᑉ ᐱᕐᑯᑎᖏᓐᓂᒃ, ᐅᖅᓯᐊᓗᕐᓂᒃ, ᐊᑯᑉᓚᖅᑎᕈᑎᓂᒃ, ᐱᕐᑯᑎᓂᒃ, ᐱᓕᕆᔨᓂᒃ, ᐊᒻᒪᓗ ᑳᓐᑐᕌᖅᑐᖅᑐᓂᒃ ᐅᔾᕿᒃᑕᕆᐊᓕᐊᕐᕚᔪᕐᒧᑦ. ᐊᑉᑯᑎ ᑭᒡᓕᖅᑲᔾᔫᖕᒋᑦᑐᖅ ᐃᓄᖕᓄᑦ ᐊᑐᕈᒪᔪᓄᑦ ᒪᓕᒃᐅᔪᑦ ᐊᑉᑯᑎᒥᒃ ᐊᑐᕐᓂᐊᕐᓗᑎᒃ ᖃᐅᔨᒪᔭᐅᒃᐸᑕ.
2. 5.9 ᑮᓛᒥᑕᒥᒃ ᑕᑭᑎᒋᔪᖅ ᑲᖏᖅᖠᓂᒃᑰᖅᑐᖅ ᐃᑎᕖᐊᓂᑦ ᐱᕐᑯᑎᖃᕐᕕᖕᒥᑦ ᐅᑭᐅᓗᒃᑖᖅ ᐊᑉᑯᑎᒧᑦ. ᑖᒻᓇ ᐊᑉᑯᑎ ᐅᒃᑯᐊᖅᓯᒪᓂᐊᖅᑐᖅ ᐃᓄᖕᓄᑦ ᐊᑐᖅᑕᐅᔪᙳᕐᓂᖓᓄᑦ.

AGNICO EAGLE

ᐃᓄᒃᒧᑦ ᖃᐅᔨᓴᐃᔨᖃᖅᑐᒥᒃ ᐃᓕᓯᓂᐊᖅᑐᑦ ᐅᑭᐅᓗᒃᑖᖅ ᐊᑉᖁᑎᒥᑦ ᐅᔭᖃᑦᑕᓇᐊᓕᐊᖑᔪᒪᔫᑉ ᖃᓂᒪᖓᓂᑦ ᐃᓄᒃᓄᑦ ᐃᑎᖅᑕᐅᑕᐃᓕᑎᓪᓗᒍ. ᐃᓄᖃᖖᒋᑦᑐᒥᒃᑕᐅᖅ ᐱᑕᖃᕐᓂᐊᖅᑐᖅ ᑭᓛᒥᑕ 7-ᒥᑦ ᓂᒋᐅᑉ ᐃᓱᐊᓂᑦ AWAR ᐊᑉᖁᑎᐅᑉ. ᐊᑉᖁᑎ ᐅᒃᑯᐊᖅᓯᒪᖃᑦᑕᕐᓂᐊᖅᑐᖅ ᓯᓚᕐᓗᒃᑎᓪᓗᒍ, ᐊᑉᖁᑎᒥᑦ ᐱᓂᕐᓗᐊᕿᓂᖅᑕᖃᖅᐸᑦ, ᐊᑉᖁᓯᕆᓂᐅᓗᐊᖅᑎᓪᓗᒍ, ᐊᒻᒪᓗ ᑐᒃᑐᐃᑦ ᓈᓕᖄᖓᑕ.

ᓇᒍᓇᐃᒃᑯᑕᕐᒥᒃ ᐃᓕᓯᓂᐊᖅᑐᑦ ᑲᖏᖅᓵᓂᐅᑉ ᖃᓂᒪᖓᓂᑦ ᖃᐅᑕᒫᑦ ᖃᓄᐃᖓᓂᖓᓂᒃ ᐊᑉᖁᑎᐅᑉ ᒥᒃᓵᓄᑦ, ᐅᖃᖅᓯᒪᓗᓂ ᐅᒃᑯᐃᖕᒪᖕᒫᑦ ᐅᒃᑯᐊᖅᓯᒪᖕᒪᖕᒫᑦᓘᓐᓃᑦ ᐃᓄᖕᓄᑦ ᑕᐃᑲᓂ ᐅᑉᔫᔪᒥᑦ. ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᕐᒥᑦ ᖃᐅᑕᒫᑦ ᐃᖏᕐᕋᔭᖕᓂᐅᔪᑦ ᐊᑉᖁᑎᒥᑦ ᐃᓚᐅᓂᐊᖅᑐᑦ ᖃᓄᐃᑦᑐᑦ ᐊᒻᒪᓗ ᖃᑉᓯᐅᓂᖏᑦ ᓄᓇᒃᑰᕈᐲᑦ ᐅᑭᐅ ᐃᓚᖓ ᒪᓕᒃᓗᒍ, ᐃᓚᐅᔪᖅ ᐸᕐᓇᐅᑎᒥᑦ.

ᑖᓐᓇ ᐸᕐᓇᐅᑎ ᑕᑯᒃᓴᐅᑎᑦᑎᔪᖅ ᐊᖏᓗᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᔫᖕᖓᔪᓂᒃ ᐊᒻᒪᓗ ᒪᓕᒐᐅᔪᒥᒃ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᓴᓇᕙᓪᓕᐊᑎᓪᓗᒋᑦ ᐊᒻᒪᓗ ᐊᐅᓛᖅᑎᑦᑎᓂᖃᖅᑎᓪᓗᒋᑦ ᐊᓯᐅᔨᑦᑕᐃᓕᓂᕐᒧᑦ ᓂᕐᔪᑎᓂᒃ, ᖁᐊᖑᐃᓐᓇᐅᔭᖅᑐᓂᒃ ᓄᖑᑉᐸᓪᓕᐊᑎᑦᑎᑦᑕᐃᓕᓗᒋᑦ, ᐊᐅᓚᓐᓂᐊᕐᓗᒋᑦ ᓄᓇᐅᑉ ᖄᖓᓂᑦ ᑰᒃᑐᑦ ᐊᒻᒪᓗ ᐊᓗᐊᓄᐊᖅᑐᑦ, ᐊᒻᒪᓗ ᐊᖏᓗᐊᖏᒋᐊᖅᑎᓪᓗᒍ ᐳᔪᖅᑖᒃ. ᐊᒡᓃᑯᒃᑯᑦ ᐋᖅᑭᒃᓯᓚᐅᖅᑐᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒧᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᓂᒃ ᖃᐅᑕᒫᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᑉᖁᓯᕆᓂᕐᓄᑦ ᐃᓚᐅᑉᓗᑎᒃ ᐳᔪᖅᑖᖅᑲᓗᐊᖅᑕᐃᓕᑎᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᐅᔪᑦ, ᐊᐳᑕᐃᔭᐃᓂᖅ, ᓯᑯᑎᑦᑎᑦᑕᐃᓕᓂᖅ ᐊᒻᒪᓗ ᐊᐱᔪᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ, ᐊᒻᒪᓗ ᐊᐳᓯᓇᓂᐅᔪᑦ ᐃᑳᕈᑎᓂᑦ ᐊᒻᒪᓗ ᓱᑉᓗᓂᒃ ᐃᒪᕐᓄᑦ ᐊᑉᖁᑎᕆᔭᐅᔪᓂᑦ.

ᒪᓕᒐᐅᔪᑦ ᐱᓂᕐᓗᐊᕿᓂᐅᔪᓄᑦ ᐊᒻᒪᓗ ᓂᕆᐅᒋᔭᐅᔪᑦ ᐊᑐᖅᑕᐅᓂᐊᕐᓂᖏᑦ ᐳᑭᖅᑕᓖᑦ ᑕᐃᒪᐅᔪᑦ ᐊᕙᒃᑐᖅᓯᒪᔪᓂᑦ ᐊᑖᓂᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᐋᖅᑭᒃᓯᓂᐊᖅᑐᑦ ᒪᓕᒃᑕᐅᔪᒃᓴᓂᒃ ᐊᒻᒪᓗ ᐱᕝᕙᐅᖅᑦᑕᖅᑐᑦ ᒪᓂᒪᑎᓐᓂᐊᖅᑕᖏᑦ ᐅᐸᓗᑲᐅᑎᒋᓂᐊᕐᓗᑎᒃ ᑐᐊᕙᓇᖅᑐᖅᑕᖃᖅᐸᑦ ᐊᑉᖁᑎᓂᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᐅᖃᐅᓯᓇᖅᑦᑕᕐᓂᐊᕐᒥᔭᖏᑦ ᐅᖃᐅᓯᓇᕝᕙᐅᔭᓇᐊᖅᑐᓄᑦ ᒐᕙᒪᒃᑯᓐᓄᑦ ᖃᓄᐃᓕᓂᐅᔪᓗᒃᑖᑦ ᐱᔪᓐᓇᖅᑎᑦᑎᔨᐅᔪᓄᑦ.

ᐅᑎᖅᑎᕆᓂᖅ ᐊᑉᖁᑎᒥᑦ, ᐱᔾᔨᑦᑎᕋᐃᓂᖅ ᐊᒻᒪᓗ ᐅᓯᑲᑦᑕᖕᓂᕐᒧᑦ ᐊᑉᖁᑏᑦ ᒪᓕᖕᓂᐊᖅᑐᑦ ᐱᐊᓂᒃᐸᑦ ᐅᔭᖃᑦᑕᓇᐊᕐᓂᐅᔪᓗᒃᑖᑦ. ᐊᓯᖏᓐᓂᑦ ᐱᓕᕆᐊᖃᖅᑎᑦᑎᓂᖅ ᐊᑉᖁᑎᒥᑦ(ᓂᑦ), ᐊᓯᖏᑦ ᓇᖕᒥᓂᖅ ᐋᖅᑭᒃᓯᖃᑎᖃᕆᐊᖃᖅᑐᑦ ᓄᓇᖃᖅᑐᓂᒃ (ᑭᕙᓪᓕᕐᒥᑦ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᒃᑯᑦ ᐊᒻᒪᓗ/ᐅᕝᕙᓃᖕᓂᑦ Hᐋᓪᓚᒃᑯᑦ) ᐊᒻᒪᓗ ᓇᖕᒥᓂᖅ ᐱᐊᓂᓕᕐᓗᓂᔾᔪᒃ ᐊᕙᑎᓕᕆᓂᕐᒧᑦ ᖃᐅᔨᓴᐃᓂᖅ ᐊᒻᒪᓗ ᐳᒥᑦ-ᓕᕆᓂᐅᔪᑦ ᐱᔾᔪᑎᖃᖅᑐᑦ ᓱᕗᓂᒃᓴᕐᒥᑦ ᐊᑐᕐᓂᐊᕐᓗᒍ.

ᐳᔪᖅᑖᖕᒥᑦ ᐊᐅᓚᑦᑎᓂᖅ

ᐊᒡᓃᑯᒃᑯᑦ ᐊᑐᕐᓂᐊᖅᑐᑦ ᐱᐅᓛᓂᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓂᒃ ᒥᑭᓛᒃᑰᖅᑎᓐᓂᐊᕐᓗᒍ ᐳᔪᖅᑖᓕᐅᕆᓂᖅ ᑕᖅᑲᐅᖓᖅᑐᑦ ᐅᔭᖃᑦᑕᓇᐊᓕᐊᖑᔪᒪᔪᒥᑦ, ᐃᑎᕝᕕᐊᓂᑦ, ᐊᒻᒪᓗ AWAR-ᒥᑦ, ᐱᔾᔨᑦᑎᕋᐃᓂᖅ, ᐊᒻᒪᓗ ᐅᓯᑲᑦᑕᖕᓂᕐᒧᑦ ᐊᑉᖁᑎᓂᑦ. ᖃᐅᔨᓂᐊᖅᑐᒍᑦ ᓇᓂ ᐳᔪᖅᑖᓕᐅᑐᐊᕐᓂᐅᖕᒪᖕᒫᑦ, ᐊᑐᖅᑕᐅᑎᓪᓗᒋᑦ ᐳᔪᖅᑖᖕᒥᑦ ᐊᖏᓗᐊᖏᒋᐊᖅᑎᑦᑎᓂᕐᔫᖕᖓᔪᑦ, ᖃᐅᔨᓴᖃᑦᑕᖅᑐᓂ ᓈᒻᒪᖏᑦᑐᒥᒃ ᐳᔪᖅᑖᑦ ᓇᓃᓐᓂᓴᖏᓐᓄᑦ, ᑎᑎᕋᐅᓯᓗᑎᑦ ᐳᔪᖅᑖᖕᒥᑦ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᖏᑦ ᓈᓴᐅᑏᑦ/ᑎᑎᖅᑲᐃᑦ ᐊᒡᓃᑯᒃᑯᑦ ᐱᐊᓂᑦᑎᐊᖅᓯᒪᓂᖏᓐᓄᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᒥᒃᓵᓂᐊᖅᑎᑦᑎᓂᕐᒧᑦ ᐳᔪᖅᑖᖅ ᐱᓕᕆᐊᕐᒥᑦ.

ᐳᔪᖅᑖᓕᐅᕐᓂᖅᑲᕐᓇᖅᑐᖅ ᖃᓄᐃᓕᐅᕐᓂᐅᔪᓂᑦ ᓲᕐᓗ ᐊᑉᖁᑎ ᐊᑐᖅᑕᐅᑎᓪᓗᒍ, ᐃᑰᑕᐃᑎᓪᓗᒋᑦ, ᖄᖅᑎᕆᑎᓪᓗᒋᑦ, ᓯᖃᓪᓕᑎᕆᑎᓪᓗᒋᑦ, ᓅᑎᕆᑎᓪᓗᒋᑦ, ᐅᓯᓕᖅᑐᐃᑎᓪᓗᒋᑦ, ᐊᔾᔭᖅᑐᐃᑎᓪᓗᒋᑦ, ᐅᓯᖏᔭᐃᑎᓪᓗᒋᑦ, ᖃᓕᓈᓕᖅᑐᐃᑎᓪᓗᒋᑦ ᑲᑎᓯᒪᔪᓂᒃ, ᐊᒻᒪᓗ ᐊᓄᓇᒧᑦ ᐱᕚᓪᓕᐊᔪᓂᒃ ᐸᓂᖅᑐᓂᒃ,

ᑕძᖏᐅᔪᓂᑦ ᐅᔭᕃᑕᕆᐊᑦ ᖃᐅᓂᖅᓯᑦ. ᐊᔪᖃᑦᑕᒃ ᑕᐃᒪᐅᕃᖃᑦᑕᓂᕐᐊᕃᑐᖅ ᐊᐅᔭᕃᒃᓯᓗᒥᑦ ᐊᓚᓗ ᐊᐅᔭᕋᒥᑦ, ᒥᒃᓯᑎᐊᕃᖃᑦᓯᓗᓂᑕ ᐅᑭᐊᕃᓴᕃᑦ ᐊᓚᓗ ᐅᑭᐅᕃᑦ.

ᐊᖏᑕᓗᐊᖏᑎᐊᖅᑎᕐᓂᕐᒧᖏᓪᓗᑦ ᐊᐅᓪᓚᕐᓂᐅᔪᑦ ᐊᔪᖃᑦᑕᒃᒥᑦ ᐃᓪᒪᐅᔪᑦ ᐅᔭᕃᑕᕆᐊᑦ ᖃᓄᐃᙱᖏᓂᖏᓪ ᐊᓚᓗ ᐊᐅᓴᖅᑎᕐᓂᕐᒧᑦ ᒪᓪᒥᑕᐅᔪᖅᓱᐃᑦ. ᐊᐅᓴᖅᑎᕐᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔭᕃᖃᑦᑕᖅᑐᑦ, ᓄᓇᓗ ᓇᑭᕃᖅᓴᓂᕐᒧᑦ ᑭᖑᓪᓕᕆᔨᐅᔪᑦ ᐊᓚᓗ ᐊᑦᕋᔪᑎᓪᓕᓂᑦ, ᐃᑲᔪᓂᐊᓂᕐᓂᖅᑎᑦ ᐅᔪᓂᒃᑯᑦ. ᐃᒪᖅ ᐊᓚᓗ ᐅᔪᖃᑦᖃᓗᖃᖅᑕᐃᓕᒪᔪᓐᑦ Calcium Chloride ($CaCl_2$) ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᐅᓕᵒᓂᐊᕋᓗᒍ ᐊᓚᓗ ᒥᒃᓯᑎᐊᖅᑎᑦᓗᒍ ᐅᔪᖃᑦᑕᒃ ᐊᑦᕋᔪᑎᓂᑦ ᐊᓱᖏᑎᵒᓂᑦ ᐅᔭᕃᑕᕆᐊᑦ ᖃᓂᓕᖏᓪᓗᑦ ᐅᓗᓕᖃᖅᑐᑦ ᐃᓕᓴᐅᓂᖃᖅᑐᑦ ᐃᓕᑐᓂᖃᖅᑐᑦ ᐊᓕᐅᓂᐊᖅᑐᑦ ᓄᓇᑦ ᐃᓂᖏᵒᓂᑦ.

ᐅᔪᖃᑦᑕᖃᓗᐊᖅᑕᐃᓕᓕᑎᓪᓗᑦ ᑕᐃᒪᐅᓂᐊᖅᑐᑦ ᓴᓇᔭᐅᓕᓪᓕᐊᑎᓪᓗᒍ, ᐊᓚᓗ ᐅᓄᑯᓕᓪᓕᐊᑎᓪᓗᒍ.

AGNICO EAGLE

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

The proposed mine is located on Inuit Owned Lands and, as such, land and environmental management are generally governed by the provisions of the Nunavut Land Claims Agreement. This document presents the Roads Management Plan (the Plan) for the proposed mine and forms a component of the documentation series produced for the Type A Water Licence Application. A list of anticipated permits, licenses, agreements, authorizations, and approvals applicable to this Plan are provided.

Agnico Eagle proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Roads Management

The Plan includes access, service, and haul roads proposed within the Project area, and covers construction, operations, closure and post-closure phases of the Project. This Plan is linked to the Spill Contingency Plan and the Terrestrial Environment Management and Monitoring Plan (Agnico Eagle 2014a). Access roads will be used by Agnico Eagle but will also provide unrestricted access to the public, if it is safe to do so. Roads outside the mine area include:

3. A 30 km All-weather Access Road (AWAR) from Rankin Inlet to the proposed mine site. The AWAR will be used to transport the building materials, construction/mining equipment, fuel, reagents, supplies, workers, and contractors to the proposed mine site. This road will have unrestricted public access providing rules of the road are observed.
4. A 5.9 km bypass road around the Hamlet of Rankin Inlet from the Rankin Inlet Itivia land-based facilities (Itivia) to the AWAR. This road will be closed to public use.

A manned gate is installed on the AWAR near the proposed mine site to prevent public entry. There will also be an unmanned gate at km 7 at the south end of the AWAR. The road will be closed during periods of bad weather, in the event of a road accident, during periods of major road maintenance, and, during caribou migration.

A sign will be installed near Rankin Inlet giving the daily status of the AWAR, stating whether it is open or closed to the public that day. Monitoring the average daily traffic on the AWAR including the type and numbers of vehicles depending on the season, is included in the Plan.

This Plan presents mitigation measures and protocols to be implemented during construction and operations to preserve wildlife, to prevent permafrost degradation, to control surface runoff and sedimentation, and to mitigate dust. Agnico Eagle has put in place operational procedures for daily operation and maintenance of the roads including dust suppression methods, snow removal, de-icing and snow drifts/banks management, and snow management at bridges and culverts.

Protocols for accidents and anticipated use of police services are presented in the sections below. Agnico Eagle will put the procedures in place and will keep resources close-at-hand to respond to emergencies on the roads in a timely manner. Agnico Eagle will also report all reportable incidents to the appropriate Government authority.

Reclamation of the access, service and haul roads will follow the completion of all mining. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowner (the Kivalliq Inuit Association and/or the Hamlet) and then complete its own environmental assessment and permitting process covering future use.

Dust Management

Agnico Eagle will use best management practices to minimize dust generation from becoming airborne at the proposed mine site, Itivia, and AWAR, service, and haul roads. This includes identification of major sources of dust, implementation of dust mitigation measures, inspections for unacceptable levels of dust, and recording dust monitoring data to document Agnico Eagle's success in controlling and reducing dust at the Project. The Dust Management Plan (Appendix C) focuses primarily on dust generated from roads, with some reference to other mining activities. Dust generated from other mining activities, such as the tailings storage facility, are addressed in other plans, including the Mine Waste Management Plan.

Dust could potentially be generated by such activities as road use, drilling, blasting, crushing, conveying, loading, hauling, unloading, stockpiling, and by wind erosion of dry, exposed mine areas. Dust emissions will be prevalent during late spring and summer, while being much reduced in fall and winter.

Mitigation measures to control dust include mine design and operational procedures. Operational practices, such as speed limits and road maintenance, will assist in reducing dust. Water and the addition of Calcium Chloride ($CaCl_2$) will be used to control and reduce dust on roads and other mine areas when airborne dust becomes a safety hazard or impacts sensitive natural areas.

Dust suppression measures will be in place during construction, operations, and closure.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	September 2012			First draft of the Roads Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			Additions made throughout the Plan	John Witteman, Env. Consultant, Agnico Eagle
		6.4	17	Addition of Section 6.4	
3	April 2014	1.2.1	4	Added IQ box	Larry Connell, Corp. Dir. Reg. Affairs, Agnico Eagle
		1.2.5	6-7	Details on snowmobile trails	
			8	Added new Figure 1-2 (Itivia)	
		2.2	12-14	Update including *Navigation Protection Act*	
		4	17	Added details on consultation wrt road mgmt. and use	
		6.1	20	Details on emergency reporting	
		6.5	23	Territorial Park	
		6.6	24	Periodic survey of road use	
		7.1	25-26	Section on sedimentation control	
		7.2.1	28	Protection of archaeological sites	
		7.3	29	Meadowbank experience wrt winter maintenance	
		8.2	34	Role of the Royal Canadian Mounted Police (RCMP)	
		App. C		New Appendix: Dust Management Plan	John Witteman, Env. Consultant, Agnico Eagle
4	April 2015			Complete plan update based on Feasibility Study and NIRB Conditions for the Water Licence Application	John Witteman, Env. Consultant, Agnico Eagle
5	March 2017			General review of the plan	Environment Department, Agnico Eagle Mines
6	March 2018			Update plan based on NIRB requests	Environment and E&I Departments, Agnico Eagle Mines

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ARD/ML	Acid Rock Drainage/Metal Leaching
ATV	All-Terrain Vehicle
AWAR	All-weather Access Road
CGS	Department of Community and Government Services, Government of Nunavut
DFO	Department of Fisheries and Oceans Canada
ERT	Emergency Response Team
GN	Government of Nunavut
HTO	Hunters and Trappers' Organization
INAC	Indigenous and Northern Affairs Canada
IOL	Inuit Owned Lands
IQ	Inuit Qaujimajatuqangit
KIA	Kivalliq Inuit Association
MDAG	Multidisciplinary Advisory Group
NIRB	Nunavut Impact Review Board
NLCA	Nunavut Land Claims Agreement
NTI	Nunavut Tunngavik Incorporated
NU	Nunavut
NWB	Nunavut Water Board
RCMP	Royal Canadian Mounted Police

UNITS

km	kilometre
m	metre

SECTION 1 • INTRODUCTION

1.1 Project Description

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (Project), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. Situated on the western shore of Hudson Bay, the proposed Project site is located on a peninsula between the east, south, and west basins of Meliadine Lake (63°1'23.8'' N, 92°13'6.42"W), on Inuit Owned Lands (IOL). The Project is located within the Meliadine Lake watershed of the Wilson Water Management Area (Nunavut Water Regulations Schedule 4).

Agnico Eagle proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one underground mine. The proposed mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. There are four phases to the development of Tiriganiaq: just over 4 years construction (Q4 Year -5 to Year -1), 8 years mine operation (Year 1 to Year 8), 3 years closure (Year 9 to Year 11), and post-closure (Year 11 forwards).

Figure 1-1 provides an overview of the Project access road network. There is presently a controlled access, Phase 1 All-weather Access Road (AWAR) between the proposed mine site and Rankin Inlet[1] (constructed in 2013/2014). A bypass road remains partially built. The remote location of the Project necessitates that access, service, and haul roads be built to support the development.

The following structures and facilities located near the Tiriganiaq gold deposit include:

- Two open pits for the Tiriganiaq gold deposit and ancillary facilities;
- Underground and ancillary facilities;
- Tailings storage facility consisting of dry stack tailings;
- Overburden/waste rock/ore storage facilities;
- Plant site and ancillary facilities;
- Storage areas;
- Fuel tanks holding up to 9 million litres;
- Quarries and granular borrow pits;
- Water management facilities;
- All-weather access, bypass, service and haul roads;
- Incinerator building;

[1] The Meliadine Phase 1 AWAR was authorized under a separate process (Golder Associates 2010, 2011a, 2011b) and subject to separate monitoring and management plans (Agnico Eagle 2011, 2012). The concepts and monitoring and management plans are being merged with the current Project.

- Landfarm for petroleum hydrocarbon contaminated soils and snow/ice; and
- Industrial waste landfill.

The following structures and facilities located in Rankin Inlet include:

- Spud barge located at Itivia and serving as a dock;
- Oil Handling Facility at Itivia holding up to 38 million litres;
- Laydown yard at Itivia;
- 5.9 km bypass road around the community;
- Two kilometres of the AWAR located on municipal land;
- Bridges over the Char and Meliadine Rivers on municipal land; and
- Reclaimed rock quarry (R19) on municipal land.

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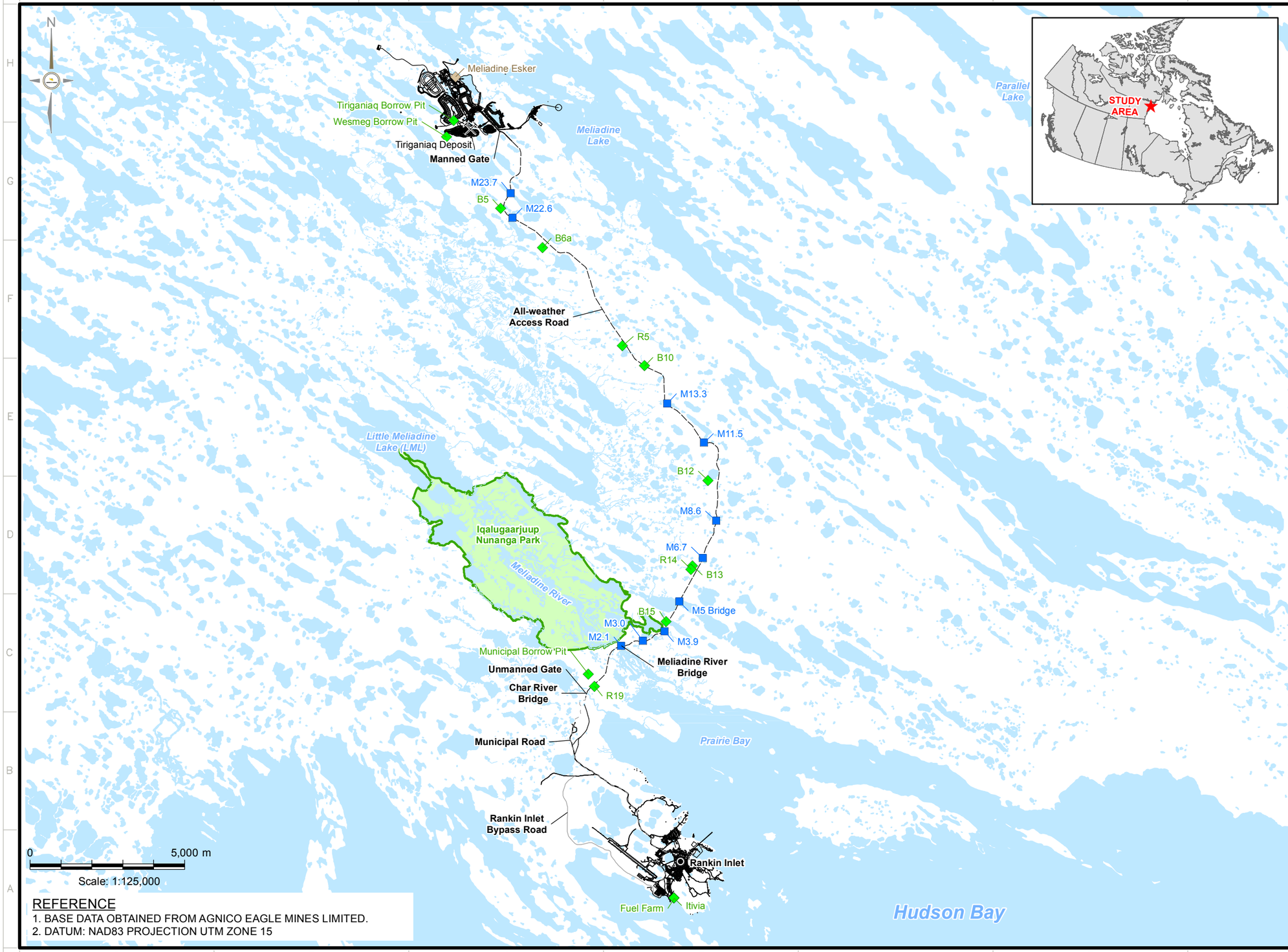

REFERENCE

1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

LEGEND

- PROPOSED MINE SITE
- QUARRY/BORROW PIT LOCATION
- ESKER LOCATION
- WATERCOURSE CROSSING
- ALL-WEATHER ACCESS ROAD (AWAR)
- ROAD - NEW
- ROAD - EXISTING
- Road - New Bypass
- WATERCOURSE
- WATERBODY
- TERRITORIAL PARK

AGNICO EAGLE

Golder Associates

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REVISIONS

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VÉRIFIÉ PAR CHECKED BY	–		–
APPROUVÉ PAR APPROVED BY	–		–
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DATE	–		

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION

FIGURE 1-1 LOCATION OF BORROW PITS AND QUARRIES FOR THE MELIADINE GOLD MINE

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1.2 Access Roads, Service Roads, and Haul Roads

What is the difference between access roads, service roads and haul roads?

Access Roads will have public access. The public can use small vehicles such as All-Terrain Vehicle (ATVs), skidoos, and pick-up trucks on these roads, providing use is in a safe manner. Small mine and contractor vehicles will frequently use access roads. Large vehicles such as fuel tankers, buses, transport trucks, graders, and snow plows can also be expected. If oversized vehicles were to use an access road, they will be accompanied by escort vehicles. Access roads will have two-way traffic, be 6.5 metres (m) wide with pull offs approximately every 400 ± 50 m.

Service Roads will not have public access. These roads will be restricted to mine and Agnico Eagle contractor vehicles. All mine and contractor drivers using service roads will be trained to do so. Large equipment will on occasion use service roads but will normally use haul roads. Service roads will have two-way traffic and be 6.5 m wide.

Haul Roads will not have public access. All mine and contractor drivers using haul roads will be trained to do so. Haul roads will essentially be reserved for haul trucks transporting waste rock and ore from open pits. Haul roads will be approximatively 17 m, and will have safety berms where required.

Access, service, and haul roads are needed in the operation of the Project. Access roads will be used by Agnico Eagle but will also have unrestricted access by the public, if it is safe to do so. The only access road will be a 30 km AWAR between Rankin Inlet and the proposed mine site as shown on Figure 1-1. The bypass road around Rankin Inlet, which remains to be completed, will be closed to public use. It will be used by Agnico Eagle and its contractors to transport fuel, supplies, and reagents from Itivia to the AWAR.

A gate is installed on the AWAR near the proposed mine site to prevent public entry. There is an unmanned gate at km 7 at the south end of the AWAR. The road is closed during periods of bad weather, in the event of a serious road accident, during periods of major road maintenance, and during migration. A chronological record of consultation on the AWAR to date is provided in Appendix A.

Service roads will be exclusively for Agnico Eagle and its contractors use; the public will not have right of entry to these roads. These will service mine areas. They will be found in and around open pits, leading to waste rock storage facilities, around the mill site, to the landfill and Emulsion Plant to mention a few. Service vehicles, trucks carrying explosives, and small trucks with mine personnel will use the service roads. All Agnico Eagle workers and its contractors using service roads will receive training before doing so.

Haul roads will primarily be restricted to haul trucks, loaders, and other heavy machinery. Small vehicles operated by Agnico Eagle and its contractors can also use haul roads, but only after driver training and when it is safe to do so.

The Plan applies equally to access, service, and haul roads. Operations and maintenance of all types of roads will largely be the same. While public safety is emphasized in the use of the access roads, the safety of its workers and contractors will be of no less importance to Agnico Eagle in their use of all roads.

1.2.1 Road Routes

The routing of the AWAR and service roads were selected to minimize possible effects of construction and operation on the environment, and to facilitate maintenance of the road, particularly during winter. Prior to future road construction, Agnico Eagle will conduct a survey along proposed road routes to verify that dens of foxes, bears or wolverines are not destroyed or damaged. Other considerations include the overall length of the road, the route's proximity to satellite ore bodies, the number of stream crossings, the availability of quarries along the route, acid rock drainage/metal leaching (ARD/ML) potential of borrow materials, geomorphology, avoidance of archaeological resources, avoidance of the Iqalugaarjuup Nunanga Territorial Park, Inuit Qaujimajatuqangit (IQ), and avoidance of raptor nesting sites. An additional design consideration for roads was to remain on the height of land as much as possible to allow for drainage in the summer and for wind to assist in clearing snow in the winter.

> The location of the Meliadine Bridge was in part determined by IQ. Inuit Elders spoke of graves on an esker downstream of the present bridge location, which ruled out crossing at this location.
>
> The elevation of the bridge above the Meliadine River was based on IQ as Elders spoke of significant overflow at the selected location, which could impinge on the bridge. This caused Agnico Eagle to raise the elevation of the bridge more than first described in the engineering design.

Wildlife concerns also factor into road routes. Their design will take into account measures that roads do not prevent or unduly limit the movement of wildlife. This includes limiting the height of the road above the surrounding topography and limiting safety berms on haul roads where possible. Ore from the underground mine will be transported by conveyor underground to the primary crusher. This design feature eliminates the surface transport of underground ore and mitigates possible interactions with wildlife.

Haul roads will be proximal to open pits and used year round; they connect open pits to Waste Rock Storage Facilities, ore storage pads and the primary crusher. Haul roads will be kept as short as possible and, where feasible, follow routes that limit the need for safety berms, which can block the movement of wildlife.

The routing of the bypass road, as shown on Figure 1-1, avoids the built-up part of the Hamlet thereby ensuring homes, businesses, recreation centres, schools, and healing centre are not disturbed by mine traffic. It does not interfere with the operation of the airport, potential runway expansion, community's water intake source (i.e. Nipissar Lake) or the new Hamlet landfill, and joins the municipal road leading to the AWAR, Iqalugaarjuup Nunanga Territorial Park, and a community borrow pit.

1.2.2 All-weather Access Road

The AWAR, as shown on Figure 1-1, connects Rankin Inlet to the proposed mine site. The route was selected following consultation with Inuit. The AWAR is a 30 km private road built with a 6.5 m running surface between the Char River bridge turn-off and the proposed mine site, and has passing turnouts approximately every 400 ± 50 m (9.5 m total road width at passing turnouts[2]).

There will be controlled access to the proposed mine area by a manned gate located on the AWAR just south of the mine area. There will also be an unmanned gate at km 7 at the south end of the AWAR. The road will be closed during periods of bad weather, in the event of a road accident, during periods of major road maintenance and, during caribou migration. Finally, a sign will be installed near Rankin Inlet giving the daily status of the AWAR stating whether it is open or closed to the public today.

1.2.3 Hamlet Bypass Road

A bypass road is planned for completion prior to barge season 2018 and will be built around the south of the airstrip to Itivia as shown on Figure 1-1. Its design and width will be identical to the AWAR (6.5 m). The bypass road will be approximately 5.9 km long and will allow traffic from Itivia to bypass the Hamlet in delivering materials and fuel to the proposed mine site. By building the bypass road, use of municipal roads by Agnico Eagle will be kept to a minimum. The bypass road will be closed to the public.

Why a bypass road is preferable to using existing roads in the Hamlet?

Thirty million litres of fuel are required annually for mine operations and it will be stored in the Itivia tank farm. All this fuel needs to be transported to the proposed mine site where two tank farms, each having 2 tanks will be constructed. The total fuel that can be stored on site is approximately 9 million litres. If each fuel tanker carries 45,000 litres, it will result in a total of 667 trips annually or, on average, 1.8 trips per day. Added to this would be moving 20,000 to 40,000 tonnes of dry cargo from Itivia to the site annually, and up to 350 workers to and from the airport for each two-week work rotation.

[2] Passing turnouts allow vehicles to pass each other when travelling in opposite directions.

A small amount of material will also be transported from the proposed mine site to Itivia for transport south by sea, including hazardous materials and other wastes that require shipment to the south.

1.2.4 Traditional ATV and Snowmobile Trails

The building of roads and the infrastructure at Itivia will impact existing ATV and snowmobile trails. Where these trails cross a road, a ramp has been constructed to ease road crossing, and signage is in place to alert road users of the crossing. Similarly, there are signs alerting ATVs and snowmobiles when approaching a road. Maintenance of the roads would ensure the snowmobile crossings are kept clear of snow.

Rankin Inlet residents, the Rankin Inlet and Kangiqliniq Hunters' and Trappers' Organization (HTO) have identified that there is an existing snowmobile trail in the area of the proposed Itivia laydown yard that local residents use in winter months to access the sea ice at Melvin Bay. Agnico Eagle is aware of this trail and has accommodated the trail to allow continued unfettered snowmobile access along the east side of the proposed laydown yard to the sea ice at Melvin Bay. The location of this trail in relation to the proposed laydown yard is shown in Figure 1-2.

While the laydown area will be fenced, this snowmobile trail will not be hampered or blocked by any fencing.

1.2.5 Haul Roads

The building of haul roads will be governed by the sequence of the two open pits to be mined, Tiriganiaq 1 and 2, and their width determined by the size of the haul trucks and other equipment using the roads. Haul roads will be kept separate from access and service roads to ensure road safety. The proposed layout of haul roads in the vicinity of the proposed mine site is presented in Figure 1-3.

Haul roads outside the open pits will be 26 m wide to allow for two way traffic, or 17 m for single lane traffic with passing zones spaced accordingly. A two-lane 17 m wide haul road designed for 70-t trucks in dual lanes is required for access to the TSF and Paste Plant. Safety berms will be installed where necessary along the haul roads.

The ramps and haul roads were designed for the largest equipment (70 payload tonne class haul trucks), with an operational width not exceeding 5.7 m, in accordance with Nunavut mine regulations. For double lane traffic, the ramp width will be 21.5 m decreasing to 15.8 m for single lane traffic at the pit bottom (last three benches) to reduce waste stripping. The ramp's width includes a protection berm and a drainage ditch. The safety berm on the outside edge will be constructed of crushed rock to a height equal to 3/4 of the rolling radius of the largest tire using the

ramp. To facilitate drainage, ramp gradients have been established at 10% and will increase to 12% for the last three benches at the bottom of the open pit.

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Airstrip

Roadways

Approximate location of skidoo trail to sea ice

Rankin Inlet Bypass Road

Sea-can Storage

Tank Farm

Sea-can Holding Area

Spud Barge

Reef

Melvin Bay
(Hudson Bay)

0 250 m

Scale: 1:5,000

REFERENCE
1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

LEGEND
- ROCK QUARRY
- RANKIN INLET BYPASS ROAD
- FENCE
- TANK FARM AREA
- TOPOGRAPHIC CONTOUR (1 m INTERVAL)
- SEA-CAN HOLDING AREA
- INTERTIDAL AREA
- WATERBODY

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VÉRIFIÉ PAR CHECKED BY	LY	24–03–2015
APPROUVÉ PAR APPROVED BY	DRW	24–03–2015
No. PROJET PROJECT NO.	1405283	
DATE	–	

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION
FIGURE 1–2 ITIVIA GENERAL ARRANGEMENT AND ACCESS

ECHELLE/ SCALE	1:5,000	FICHIER FILE	.DWG
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DRAWING NO.

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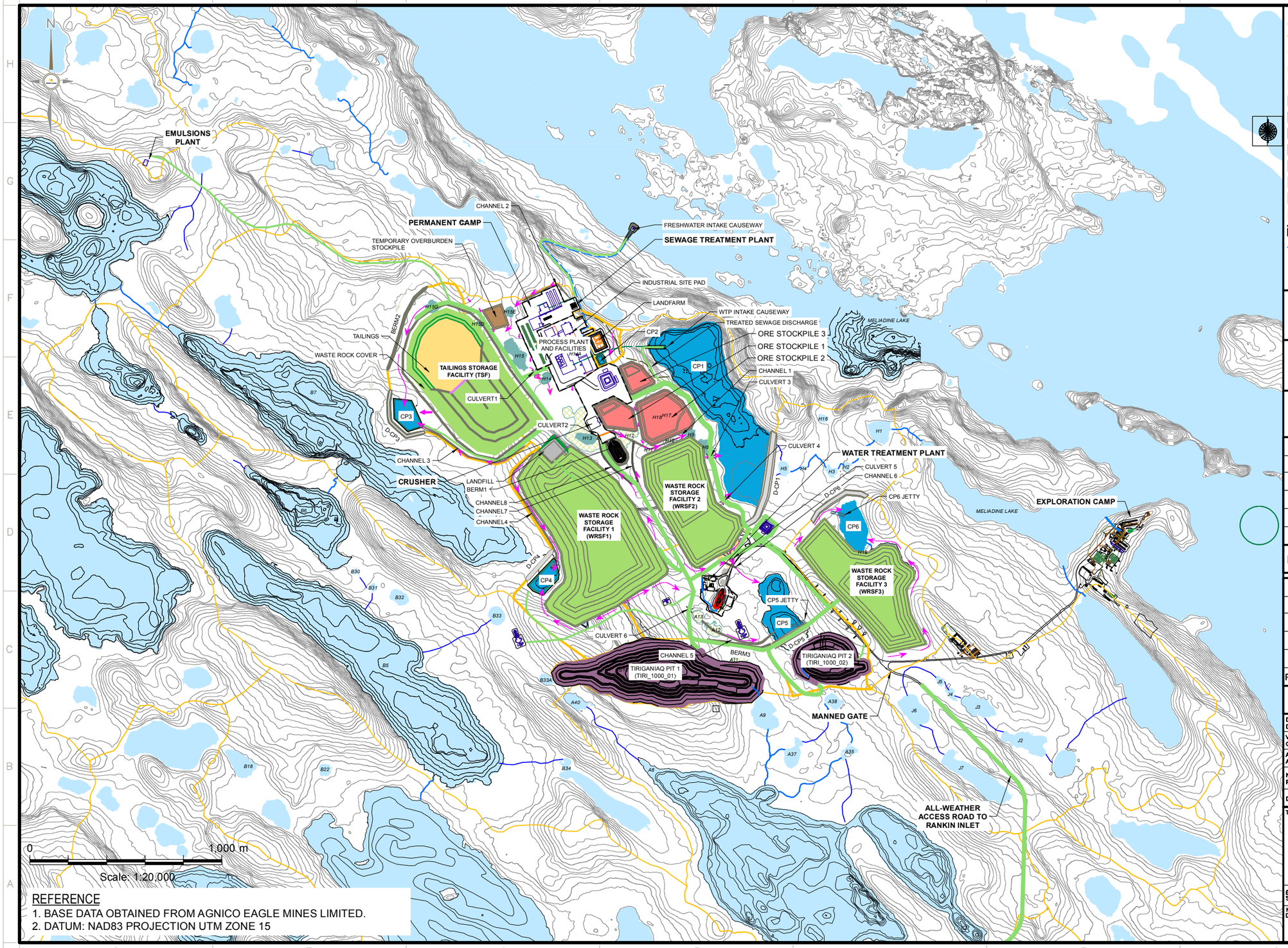

LEGEND

- CATCHMENT BOUNDARY
- SERVICE ROAD
- HAUL ROAD
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- STREAM

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REV	DESCRIPTION	DATE	PAR BY

REVISIONS

DESSINÉ PAR DRAWN BY	CDB	DATE	05-12-2014
VÉRIFIÉ PAR CHECKED BY	LY		24-03-2015
APPROUVÉ PAR APPROVED BY	DRW		24-03-2015
No. PROJET PROJECT NO.	1405283		
DATE	–		

TITRE / TITLE

AGNICO EAGLE – MELIADINE DIVISION
FIGURE 1-3 MELIADINE HAUL ROADS NETWORK

ÉCHELLE/ SCALE	1:12500	FICHIER FILE	.DWG

No. DESSIN/ DRAWING NO.	REVISION	FEUILLE/SHT
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REFERENCE
1. BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
2. DATUM: NAD83 PROJECTION UTM ZONE 15

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SECTION 2 • REGULATORY SETTING

2.1 Land Tenure

The large part of all proposed access, service and haul roads are to be located on IOL administered by the Kivalliq Inuit Association (KIA). The surface ownership of the land encompassing the roads right-of-ways was transferred to the KIA when the Nunavut Land Claims Agreement came into effect. Land and environmental management in this area are generally governed by the provisions of the Nunavut Land Claims Agreement.

Closer to Rankin Inlet, 2.3 km of the AWAR and the complete bypass road are on Commissioner's land held by the Department of Community and Government Services (CGS) for the benefit of the Hamlet of Rankin Inlet.

The Phase 1 AWAR was constructed under land use permits issued by CGS on municipal land, and the KIA on IOL. Leases followed the completion of construction and a legal survey of the road right-of-way. The width of the land leases is 20 m for the length of the roads, wide enough to accommodate their 6.5 m width.

Service and haul roads will exclusively be constructed on IOL under the mine lease(s) issued by the KIA.

2.2 Permitting Regime

Federal, territorial, and municipal laws and regulations that apply to the construction, operation and closure of all access, service, and haul roads are itemized in Appendix B. No land use permit, operating permit, authorization, or license can be issued by any regulatory agency that would allow Agnico Eagle to undertake construction of the bypass road or start construction on any other road until the Nunavut Impact Review Board (NIRB) has completed its environmental assessment and issued a Project Certificate No. 006.

Table 2-1 outlines the current licences and permits held by Agnico Eagle in relation to the Phase 1 AWAR and for advanced exploration. Most winter roads right-of-way permits are being allowed to expire because the AWAR is complete, but are included for sake of completeness. After receiving a Project Certificate and all necessary authorizations, land use permits will be issued by CGS on behalf of the Hamlet for the construction of the bypass road. This permit will subsequently be taken to lease following completion of the bypass road.

A list of anticipated permits, licenses, agreements, authorizations, and approvals for all roads is presented in Table 2-2.

Table 2-1 Licenses and Permits held by Agnico Eagle – Roads

License Number	Explanation	Issued By	NIRB File	Remarks
KVL100B195	Meliadine Prospecting – Land Use	KIA		general land use permit applying to exploration and drilling
KVL302C268	NTI RI-01 Parcel Drilling	KIA		drilling on RI-01 Inuit Owned Lands
KVL308C07	Mel E Exploration RI-01	KIA		drilling on RI-01 Inuit Owned Lands
N2010C0002	PB1, Drilling Permit	INAC	10EN006	
N2013-C002	Exploration, drilling claims CWM	AANDC		
KVCL102J168	Commercial Lease	KIA	07EN044	commercial lease for exploration and underground activities
KVRW98F149	Meliadine Right-of-Way	KIA		amended to allow access to old Discovery camp (renewed annually)
KVRW07F02	Overland Right-of-Way	KIA	07AN063	winter road along proposed all-weather road route(will be allowed to expire)
KVRW11F02	Permanent Road Right-of-Way	KIA	11RN017	
KVCA07Q08	Mainland Esker Quarry Permit	KIA		Tiriganiaq Esker quarry
KVCA11Q01	Permanent Road Quarries	KIA	11RN017	
	WCB Program Authorization	WCB		annual renewal
2BB-MEL1424	Bulk Sampling - Water License	NWB	07EN044, 11RN017	
2BE-MEP1318	Exploration – Water License	NWB	08EN043	
2AM-MEL1631	Meliadine Mine	NWB	11MN034	

Table 2-2 Approvals and Authorizations for All Roads

Authorization	Authority	Basis
Conformity determination with Keewatin Regional Land Use Plan	Nunavut Planning Commission	allows Project to proceed to screening
Article 12, Part 5 Environmental Assessment	Nunavut Impact Review Board	allows Project to proceed to authorizations to build and operate roads
Type A Water License	Nunavut Water Board	allows for construction of the proposed mine and related roads
Navigation Protection Act evaluation	Transport Canada	Agnico Eagle provided a list of water crossings for the Phase 1 AWAR and requested a navigability determination for each from Transport Canada. Subsequently, a navigation evaluation was prepared for small streams, lakes, and ponds impacted by the Project
Inuit Impact and Benefits Agreement	Kivalliq Inuit Association	impacts are compensated and benefits provided to Inuit
Water Compensation Agreement	Kivalliq Inuit Association	compensation for Inuit Water Rights under NLCA Section 20
Right-of-way Lease	Kivalliq Inuit Association	allows right-of-way for AWAR across Inuit lands
Land Use Permit	Rankin Inlet and Community and Government Services	allows construction of the bypass road on municipal land
Right-of-way Lease	Rankin Inlet and Community and Government Services	allows right-of-way for AWAR and bypass road located on municipal lands
Quarry License	Kivalliq Inuit Association	various quarry and borrow pit sites on Inuit Owned Land along the right-of-way for building the road to the proposed mine site and infrastructure pad.
Explosive Magazine Permit Renewal	Workers' Safety and Compensation Commission	permits an explosive magazine on-site and at other approved locations
Class 2 Permit for Heritage Sites (obtained by qualified professional archaeologist)	Department of Culture, Language, Elders and Youth	unavoidable impacts of roads on heritage sites have been mitigated

Amendments to the *Navigable Waters Protection Act* came into force in April 2014 as part of the Federal Government's 2012 Bill C-45. In part, these amendments:

- Changes the name of the *Navigable Waters Protection Act* to the *Navigation Protection Act*;
- Includes a schedule, which clearly lists the major waterways for which regulatory approval is required prior to the placement or construction of a work;
- Allows proponents of works in non-scheduled waters to opt-in and seek approval of their proposed work to give them additional legal certainty; and
- Expands the list of low risk works (e.g., minor repairs on bridges) that can be pre-approved because they pose very little impact on safe navigation.

Schedules listing major waterbodies requiring regulatory approval include Schedule 2 Part 1 – Oceans and Lakes, and Schedule 2 Part 2 – Rivers and Riverines. Schedule 2, Parts 1 and 2 do not include any waterbodies found within the Project's footprint. As such, all are non-scheduled waterbodies and Agnico Eagle undertook an assessment to determine navigability.

Using the *Navigation Protection Act*, Agnico Eagle assessed the navigability of the small lakes, ponds and streams within the Project's footprint through the following questions[3]:

- Are the waterbodies within the Project's footprint capable of being navigated by floating vessels for the purpose of transportation/recreational use?
    - If the answer is "no" to this question, the waterbodies are not navigable.
    - If the answer is "yes", then additional questions were asked.

- Is there a public right to travel?
- Is there any historical use of the waterbodies for navigation?
- Is there any proposed future use of the waterbodies for navigation?
- Is the waterbody part of a navigational network or transit route to other waterbodies?
- Is the waterbody a self-contained route for fishing or recreation?
- Will Agnico Eagle's roads offer access to waterbodies with the Project's footprint?

Based on these questions, Agnico Eagle determined that:

- Navigation of streams found within the Project's footprint is not feasible;
- Navigation to and between waterbodies is not feasible;
- The waterbodies within the Project's footprint do not form part of a navigational network or transit route;
- There is no evidence of historical use of the waterbodies for navigation or recreation; and

[3] The questions being asked are in part based on the *Draft Working Framework for determining a Navigable Water under the Navigation Protection Act* prepared by Transport Canada.

- There is no anticipated future use of the waterbodies for navigation.

At this time, Agnico Eagle does not believe that the small lakes, ponds, and streams within the Project's footprint are navigable waterbodies. Agnico Eagle does recognize that Meliadine Lake, Meliadine River, and Melvin Bay[4] as navigable waterbodies.

[4] The port of Itivia is located in Rankin Inlet at Melvin Bay, which is part of Hudson Bay.

SECTION 3 • RELATED DOCUMENTS

Final Environmental Impact Statement documents and documents submitted in support of the Water Licence Application that provided input to the Roads Management Plan include the following:

- Terrestrial Environment Management and Monitoring Plan (Agnico Eagle 2014a);
- Spill Contingency Plan;
- Occupational Health and Safety Plan (Agnico Eagle 2014b);
- Preliminary Closure and Reclamation Plan;
- Borrow Pits and Quarries Management Plan; and
- Dust Management Plan (Appendix C).

The Plan is part of the Environmental Management and Protection Plan for the Project and will be in effect during the construction, operation, and closure of the Project. The Dust Management Plan is presented in Appendix C of this Plan.

SECTION 4 • CONSULTATION

Consultations on the road route with the community of Rankin Inlet, Inuit Elders, Kangiqliniq HTO and KIA were ongoing from as early as 2004. A chronological record of consultation on the AWAR is provided in Appendix A. Extensive details on all consultation for the Project can be found in the Public Engagement and Consultation Baseline Report. In Agnico Eagle's June and August 2014 Kivalliq community consultations, concerns with the AWAR or the bypass road were not raised.

On several occasions in 2013, Agnico Eagle met with the KIA and with the Rankin Inlet HTO to discuss how the Phase 1 AWAR should be managed and to develop a plan on how limited public access would be provided. The HTO told Agnico Eagle that they believe the AWAR should be open to unlimited public access but acknowledged that for Phase 1, the AWAR must be operated with controlled, limited public access until NIRB has the time and opportunity to assess the impact of such open public access. In the interim closure, Agnico Eagle and the HTO discussed how to control and manage limited public access on the Phase 1 AWAR beginning in the summer of 2014. It was agreed that access be limited to ATVs only unless otherwise permitted and be via a pass system where the HTO has involvement over who is granted a pass. Agnico Eagle and the HTO have also been discussing a program that would see the HTO provide wildlife monitoring services for Agnico Eagle along the Phase 1 AWAR. In 2016, 3 meetings were attended by Agnico Eagle personnel at the KHTO meetings. Agnico provided the KHTO with offers and opportunities to assist in the AWAR road surveys. Agreement on this program still remains to be concluded with KTHO. In 2017, Agnico will continue communicating with KTHO to engage the organization in assisting in these programs.

Agnico Eagle presented its proposed management procedures for the AWAR, along with options for the proposed further development of the Rankin Inlet by-pass road at public meetings held in Rankin Inlet in 2012 (mid-October) and 2013 (mid-February).

There were some elders who would have preferred the AWAR be built using a different alignment that ran west of the Iqalugaarjuup Nunanga Territorial Park and then cut north towards the Project. This would have given them better access to the Diana River and traditional hunting and fishing area to the northwest. Agnico Eagle explained that this was a much longer route as it moved away from the site (i.e. was not a straight line to the Project site) and involved more water crossings and was thus not an acceptable route from Agnico Eagle's needs and perspectives. The community spoke to its preference to the Rankin Inlet by-pass route going along the southwest side of the Rankin Inlet airport and not along the northeast side as proposed in one option by Agnico Eagle. This option placed the by-pass road in conflict with the entry to the airport terminal and future housing development areas.

At the NIRB's technical meeting and pre-hearing conference in early December 2013, road issues were raised by various Kivalliq communities. Unrestricted road accessibility to Inuit, road interactions with

caribou, peregrine nests, dust control, what happens to the roads upon closure, and fuel transport were all raised as concerns.

4.1 Upcoming Consultations Prior to Opening the All-weather Access Road to Public Use

Agnico Eagle wants to meet the expectation of Rankin Inlet residents in opening the AWAR to public use. However, Agnico Eagle shares the concerns of others that all AWAR users need to abide by 'rules of the road' to protect their own safety and that of others. While Agnico Eagle will maintain the AWAR in good operating condition and close it when poor driving conditions prevail, it will be incumbent on all organizations and the public to share in the responsibility in educating AWAR users in safe and responsible road use. This could be as simple as leading by example to participating in developing and endorsing the rules of the road.

Prior to the opening of the All-weather Access Road to public use, Agnico Eagle will:

- Undertake extension consultation with the KIA, HTO, residents of Rankin Inlet, and the Hamlets of Rankin Inlet and Chesterfield Inlet with the purpose of developing rules of the road and safety requirements for public use of the AWAR;
- Update this Plan, with particular emphasis on public safety, and submit it to the Nunavut Impact Review Board, KIA, HTO, the Government of Nunavut (GN), Nunavut Water Board (NWB), Hamlet of Rankin Inlet and authorizing agencies;
- Prior to opening the AWAR to the public, hold community meetings to go over the rules of the road and impress on all potential AWAR users their responsibility for their own safety and that of others in using the AWAR safely; and
- Place signs emphasising safe use of the AWAR at strategic locations along the AWAR.

The rules of the road will be posted on community bulletin boards; and on a quarterly basis, read over the community radio and placed on the local television station. Agnico Eagle will also post them on its Nunavut web site.

4.2 Road Use by Nunavummiut and Other Developers

The AWAR partly covers existing ATV and snowmobile trails, which were used as access to traditional areas for hunting, fishing, and recreation in the Meliadine Lake, Machum Lake, and Twin Lakes areas. Agnico Eagle is unaware of any possible future developments near the Project that could make use of the access and/or service roads.

It is Agnico Eagle's responsibility to decommission and reclaim the roads once its activities in the area are complete. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowners (the KIA and the Hamlet) and then complete its own environmental assessment and permitting process covering future use. Agnico Eagle does not own the land on which the roads are constructed and, thus, cannot transfer future ownership or use privileges to any third party. Agnico Eagle must complete its obligation to decommission and reclaim

all roads unless directed otherwise by a combination of the landowners and other regulatory agencies who issued permits/authorizations for the roads.

4.3 Use of Inuit Qaujimajatuqangit in the Planning of the Roads Management Plan

Inuit Qaujimajatuqangit (IQ) is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. Information collected through IQ can contribute to mine design and planning, as well as monitoring activities. Agnico Eagle is committed to including IQ and public concerns raised through IQ, where practical, in the design of management and monitoring plans for the Project. Agnico Eagle will continue active engagement with communities and Inuit organizations as the Project proceeds through permitting, and if approved, construction, operations, and closure. Additional IQ collected through consultation and engagement will be included in updates to the design and implementation of environmental programs.

The Road Management Plan considered IQ (including TEK, TLU) and concerns regarding Project effects on traditional resources and traditional land use sites through the following Project design and mitigation measures:

- In allowing public access on the AWAR, Agnico Eagle took into consideration that the area in the vicinity of the Project will continue to be used for traditional purposes during the construction, operation, and closure phases of the Project.
- Access to traditional use sites are being mitigated by constructing ramps and installing signage along Project roads to facilitate road crossings for existing ATV and snowmobile trails. Snow clearing takes into consideration the location of snowmobile trails such that they are not blocked, and snowmobile crossings are identified with signs identifying the location of the trail prior to snow removal.
- The proposed Itivia laydown yard was designed to avoid impacting the existing snowmobile trail so that local residents can continue to access the sea ice at Melvin Bay.
- Elders expressed the greatest concern regarding potential effects of the Project on caribou including road construction and motorized vehicles potentially limiting or altering their movement patterns, and the potential for overhunting to occur as a result of increased access to caribou migration routes and calving grounds. Agnico Eagle will consult the Government of Nunavut, the KIA, the Kivalliq Wildlife Board, local HTOs, and the public in developing appropriate monitoring and mitigation measures related to the ease in harvesting of caribou afforded by the AWAR. The result of these consultations will be a Road Access Management Agreement (see Section 10.2).
- IQ indicated that land mammals including Arctic fox, wolverine, and wolf are important traditional resources for harvesting, and community concerns were raised regarding the potential effects of snowmobiles, and the potential of road construction creating barriers to

wildlife movement. The routing and design of the AWAR and service roads were selected to minimize potential Project effects on the environment, including to wildlife movement. Potential adverse effects to wildlife abundance or movement were considered in setting the rules of the road, including setting maximum speed limits and ensuring wildlife has right-of-way on the roads, wildlife will not be harassed and hunting is prohibited within 1 km of the AWAR. Furthermore, locations of large aggregations of animals will be reported and all incidents between vehicles and wildlife will be reported and investigated. Finally, a wildlife monitoring program will be implemented with input from the local stakeholders to record the species, numbers and location of wildlife observed along the roads, with particular focus on caribou, muskoxen, bears, wolves, migratory birds and raptors.

- Community concerns were also raised regarding the potential for the Project to change the land and water, subsequently impacting the diet of land animals. There was also concern that road construction could affect environmental stability and contaminate water. IQ also indicated that berry harvesting is an important activity in the area, and community members expressed concerns over dust that could impact the health of both water and vegetation. These concerns were considered in proposing the following mitigation measures and protocols to be implemented during construction and operations to preserve wildlife, prevent permafrost degradation, control surface runoff and sedimentation, and mitigate dust:
    - Sedimentation and erosion control measures will be implemented prior to the start of work and maintained until after all disturbed areas have been stabilized; and
    - Regular inspection of the roads will be conducted to identify areas of ponding, erosion or sedimentation.

- IQ indicated that the rivers and Meliadine Lake are considered important fish harvesting sites, and community concerns were raised regarding potential contamination of waterbodies in the entire Meliadine watershed, and for potential adverse effects to fish and other traditional resources. Accordingly, to protect fish spawning and nursery periods of local fish populations, no in-water work will take place from May 1st to July 15th. In addition, areas where dust deposition could impact fish habitat and/or water quality, mitigation measures will be implemented, including grading of the road surface, placement of new coarser topping, and/or watering/addition of $CaCl_2$ on the road surface.

- IQ has indicated that the entire Meliadine valley, including Iqalugaarjuup Nunanga Territorial Park, has a long history of traditional use and many important cultural sites. To mitigate the potential for disturbance to cultural sites, all employees or contractors are not allowed to construct any side roads/trails off the west side of the AWAR between Km 1 and Km 8, and regular road inspections will occur to ensure that no unauthorized trails or access routes leading from the AWAR into the Park are being created. In addition, Agnico Eagle and GN-DoE Park staff will work together to discuss what other measures can be taken to prevent

unauthorized access into the park, including potential signage, public education and the placement of barriers.

- To prevent potential ice buildup at the lower Meliadine River crossing bridge resulting in flooding of important cultural sites upstream from the bridge, regular inspections and monitoring will occur so that potential risks to cultural sites can be mitigated.

SECTION 5 • MEASURES TO PREVENT PERMAFROST DEGRADATION

Roads have been designed with a minimum fill thickness to maintain permafrost conditions within the subgrade soils. The thermal modelling indicated a minimum road fill thickness of 1 m is required above ice poor subgrade soils to maintain the soil in a frozen condition year round. Similarly, a minimum road fill thickness of at least 1.3 m is required above ice rich subgrade soils.

To the greatest extent possible, roads will be constructed in the winter when the subgrade soils are frozen to prevent insulation of thawed subgrade soils. A rough base would be advanced at the full road width so that the base of the roads is laid down in winter frozen ground conditions. The stream crossing culverts would also be installed in the winter. Once the rough base and stream culverts are installed, the remainder of the construction will be completed by building up the rough base primarily under winter conditions, and placing the final topping materials during the spring and early summer.

Mitigation and environmental design features to reduce the potential for permafrost degradation are as follows:

- Road alignments avoid, where possible, fine-grained, poorly drained, ice-rich, frost susceptible soil conditions as noted by geomorphologic mapping, due to their susceptibility to thaw related settlement;
- Regions of high ground relief (higher elevations) are sought to provide better drainage conditions, to minimize the potential for snow drifting on the road and to avoid organic depressions and/or other poor ground conditions, which are more abundant in the low lying areas;
- Road fill material will be placed directly over the existing soil layer without cutting, stripping, or grubbing to avoid disturbing the subgrade soils;
- Thick drifted snow will be removed before road fills are placed;
- The road fill thickness should be a minimum of 1 m in thaw-stable soils, and 1.3 m in thaw-sensitive soils; and
- Construct access, service, and haul roads in the winter when the subgrade soils are frozen to prevent insulation of thawed subgrade soils, to the greatest extent possible.

The road and its shoulders will be inspected weekly (at a minimum) during the summer period (June to August) for evidence of seasonal freeze and thaw adjacent to the toe of the road embankment. Such movements are expected and may lead to longitudinal cracking and thaw settlement especially for portions of the road founded on thaw susceptible (ice rich) soils. When such areas are discovered, the affected area will be repaired using granular material and/or crushed rock. Agnico Eagle will maintain stockpiles of such material in select borrow/quarry areas along the road.

SECTION 6 • TRAFFIC MANAGEMENT ON ACCESS ROADS

6.1 Management of Agnico Eagle Traffic on the Access Roads

All of the required fuel, supplies, equipment, and workers for the mine will be transported to the proposed mine via the bypass road and AWAR. All drivers transporting these materials and personnel will either be Agnico Eagle employees or employees of contractors directly hired by Agnico Eagle. They must possess a valid driver's license from a Canadian province or territory, for the appropriate class of vehicle, for them to be allowed to operate vehicles on access roads. Agnico Eagle educates all of its employees and all of its contractor's employees on road safety rules during the safety introduction training that occurs when first starting work at the mine site.

All Agnico Eagle vehicles that routinely travel on the access roads are equipped with a radio set to the requisite road frequency. Similarly, contractor's vehicles that routinely travel on the access roads are also equipped with a radio set to the requisite road frequency. Consequently, Agnico Eagle and contractor traffic on the road will always have radio contact with the northern gatehouse, security, and other Agnico Eagle and contractor traffic. This system is used to report any unusual conditions along the roads such as: location of other vehicles, presence of wildlife on or near the roadway, presence of non-Agnico Eagle traffic such as ATVs, snowmobiles or other vehicles on the access roads, special road conditions, and special weather conditions. All Agnico Eagle drivers using the road are required to monitor and report to the northern gatehouse by radio any observed unauthorized or unsafe use of the road.

Once the AWAR is open to unrestricted public access, Agnico Eagle will implement a process to inform the public using the AWAR on how they can communicate with Agnico Eagle in the event of an emergency on the road. Agnico Eagle is hoping that it will be able to establish full cell phone service along the full length of the AWAR at some point in time during the construction phase of the Project and continuing into the operational phase. Thus, the prime mechanism for contacting Agnico Eagle in the event of an emergency will be by cell phone. Once such service capability is in place, Agnico Eagle will take the following action to communicate how the public can contact Agnico Eagle to report an emergency on the AWAR:

- Signage at the Rankin Inlet end of the road and at the mid-point Emergency Spill Response station(at a minimum) will provide the public with the Agnico Eagle phone contact number (probably site security) to which the public can report an emergency along the AWAR.
- Signage near Rankin Inlet will provide the current status of the AWAR, stating whether it is open or closed to public use that day.
- Include this information on periodic public information sessions on the rules of the road and road safety procedures delivered in Rankin Inlet.
- Include this information in periodic community radio and TV announcements.

6.2 Management of Non-Agnico Eagle Traffic on the All-weather Access Road

Agnico Eagle will work with the KIA, HTO, the Government of Nunavut, and the Hamlet of Rankin Inlet to devise a system for unrestricted public access to the AWAR at a future date. Until this system is in place, traffic on the AWAR will be controlled by Agnico Eagle through an unmanned gate at its southern end and a manned gatehouse at its northern end.

The rules of the road[5] developed for the roads will apply to all users of the road, including Agnico Eagle employees, Agnico Eagle contractor employees, and the public. Agnico Eagle will hold public information sessions in Rankin Inlet for AWAR users prior to its opening to unrestricted access, and on a regular basis thereafter (minimum of twice per year). The Government of Nunavut will also be consulted prior to opening the AWAR to unrestricted traffic. A copy of the rules of the road, which will have a strong emphasis on road safety, will be presented at these sessions.

Agnico Eagle will also hold public information sessions in Chesterfield Inlet for AWAR users prior to its opening and on a regular basis thereafter (minimum of once per year). A copy of the rules of the road will be presented at these sessions. This is required because Chesterfield Inlet has now built approximately 17 km of trail/road south from their community towards Rankin Inlet and occasionally drive their ATVs/snowmobiles to Rankin Inlet.

Agnico Eagle will also use other communication tools to get the road access procedures and road safety rules out to the public in Rankin Inlet. These will include community radio, community TV[6], and postings around town, signage near Rankin Inlet, through the Project office in Rankin Inlet, and via an Agnico Eagle Project website. The communication will be in both English and Inuktitut. All non-Agnico Eagle road users will also be encouraged to monitor and report any observed unsafe use of the roads to Agnico Eagle.

6.3 Other Access Control Procedures

There will be occasions when access to the AWAR will be restricted for short time periods for special reasons. This includes bad weather, unsafe road conditions, maintenance activity on the roads, heavy project related truck traffic, movement of oversized loads, and/or presence of large numbers of caribou on or adjacent to the road. The AWAR could also be temporarily closed in the event of an incident, accident or other event requiring mitigation or response. These short-term closures will be required to ensure safety.

In communicating such short-term closures, Agnico Eagle will take the following actions:

[5] See Section 8 for complete details on rules of the road measures proposed for the AWAR.

[6] Notices on rules of the road will be placed on community radio and television a minimum of 4 times a year.

- Agnico Eagle will issue a daily road condition bulletin by means of email to a subscriber list, through an Agnico Eagle website, and through community radio. The bulletin will provide information on current road and weather conditions and on special activity planned for that day on the AWAR.
- Agnico Eagle (with the consent of the Hamlet of Rankin Inlet) will set up and maintain a sign in English and in Inuktitut to be located close to Rankin Inlet on the existing municipal road out to the Char River and the Territorial Park that indicates whether the AWAR is "open" or "closed" at that specific point in time. This will be in place by Q4 2018.
- Agnico Eagle will limit access and, in certain conditions, close the roads to all traffic during bad winter weather (blizzard or white out conditions). In the worst weather, the southern gate on the AWAR near the Char River will be closed and signed accordingly;
- Agnico Eagle will limit access to the AWAR when it is not safe as a result of an accident or a road maintenance problem.
- Agnico Eagle will limit access to the AWAR when large numbers of caribou are near to or crossing the road. This will occur in consultation with the Kangiqliniq HTO.
- Agnico Eagle will work with the GN, KIA, and HTO to establish a one kilometre no shooting zone on both sides of the AWAR to ensure that project workers and all other road users are not inadvertently exposed to the risk of accidental shooting.
- Agnico Eagle reserves the right to refuse access to individuals who do not respect the rules of the road on safety, speed and the no shooting zone when using the AWAR.

The GN Department of Environment (GN-DoE) has expressed a valid concern that there is potential for unauthorized trails/access routes to be created from the AWAR into a designated preservation zone within the Iqalugaarjuup Nunanga Territorial Park at an area to the northeast of the Meliadine River just north of the new Meliadine River Bridge. The AWAR is in close proximity to the park boundary in this location. The GN-DoE have pointed out that such an unauthorized use of this designated preservation zone could cause irreparable damage to the natural and cultural features meant to be protected within this territorial park. Agnico Eagle acknowledges this concern and commits to work with the GN-DoE to reduce/prevent this potential unauthorized access from the AWAR to this part of the Iqalugaarjuup Nunanga Territorial Park.

In this respect, Agnico Eagle will take the following actions:

- Agnico Eagle commits that it will not allow any of its employees or contractors to construct any side roads/trails off the west side of the AWAR between Km 1 and Km 7. Agnico Eagle has no intention of constructing any side roads and/or trails off the designated AWAR corridor at any point along its length, and if so, additional regulatory approval would be needed under the Terms of the Road Use Lease with the KIA and/or Community & Government Services before any side road/trail could be constructed;

- Agnico Eagle will task its Road Supervisor with keeping an eye on this critical section of the AWAR as part of its regular road inspections (as outlined in Section 7 of this Roads Management Plan) with the objective of identifying any signs of unauthorized trails/access routes leading from the AWAR into this area of the Park. If any evidence of unauthorized access trails is discovered, the Road Supervisor will contact GN-DoE Park Staff in Rankin Inlet to inform the GN-DoE Park staff of the discovery and to jointly work on a plan to prevent any further use of such access points. Agnico Eagle would then take the agreed upon measures to implement the plan provided that such measures are reasonable; and

- Agnico Eagle will meet with GN-DoE Park staff to jointly discuss what other measures can be taken to dissuade/prevent such potential unauthorized access into this area of the Park (e.g. possibly signage, public educational measures, placement of barriers, etc.). Agnico Eagle will then implement the agreed upon measures. Agnico Eagle will continue to periodically meet with GN-DoE park staff (at least annually, but more frequently if required) to discuss protection of this designated preservation zone within the Park.

6.4 Projected All-weather Access Road Traffic between Itivia and the Proposed Mine

Agnico Eagle and contractor traffic on the AWAR between Itivia and the mine site is not expected to vary as much as public traffic between summer and winter. Table 6-1 provides the projected traffic for the bypass road and AWAR.

Agnico Eagle and contractor vehicles expected to use the road will include, but not be limited to: pick-up trucks, cube vans, buses, fuel trucks, tractor-trailers, snowplows and graders. However, the amount of traffic will be highly dependent on the level of activity on site and the time of year, such as when supplies and materials arrive by sea, as well as on the weather. Also, should flights not be able to get into Rankin Inlet, passenger vans/buses would only transport local employees to the mine site, which would reduce the number of vans/buses by half.

Summer traffic is expected to be moderately higher than winter traffic as more contractual work can be expected over the summer. Fuel deliveries and passenger van/bus traffic are not expected to vary a great deal between winter and summer.

Table 6-1 Estimated Average Daily Traffic on the All-weather Access Road

Type of vehicle	Winter		Summer	
# of vehicles	Week Days	Weekends	Week Days	Weekends
Mine-Related Traffic				
Pick-up trucks	10-12	4-8	12-14	6-10
Cube vans	4	1	4	1
Passenger vans/buses	2	1	2	1
Fuel trucks[(a)]	2	2	2	2
Transport trucks[(b)]	1	1	6-14	6-14
Public Road Use				
Pick-up trucks	4-6	2-4	6-8	12-16
ATVs/snowmobiles	4-8	4-10	10-16	10-20

[(a)] Transport of fuel will be continuous, year round. A fuel truck will carry on average 45,000 litres.

[(b)] Transport of dry goods from Itivia will largely take place over a 4-month period, from August to November.

Projected public traffic on the access roads has greater uncertainty as it will be weather dependent. Agnico Eagle estimates that 25-50% of the anticipated trips will be incremental to current access, which is by ATVs and snowmobiles. During periods of mild weather, more traffic can be expected as those living in Rankin Inlet may travel up the AWAR for a day of fishing, hunting, berry picking, or other leisure activities. During poor weather conditions, public traffic on the road can be expected to drop significantly and it is likely that no public access will occur during such conditions.

During the Phase 1 operation of the AWAR, Agnico Eagle will collect information on traffic volume on the road on a daily basis. The survey information will record the number and types of mine vehicles, and the number and types of public vehicles using the AWAR over a 12-hour period, typically from 8:00 AM to 8:00 PM. The surveys will gauge the accuracy of the predictions contained within Table 6-1. The survey results will form part of Agnico Eagle's annual report.

SECTION 7 • INSPECTION AND MAINTENANCE OF ACCESS, SERVICE, AND HAUL ROADS

Agnico Eagle recognizes that inspection precedes maintenance, and believes that a thorough inspection program will lead to the early identification of areas of the roads where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the driving surface and water crossings.

Agnico Eagle has the sole responsibility for the ongoing inspection and maintenance of all of the components of the access, service, and haul roads, including road beds, bridges, culverts, and borrow/quarry sites used in the construction and maintenance of the roads. Agnico Eagle will apply the experience that it has gained from the ongoing operation of the Meadowbank All-Weather Road, which has now been in operation for eight years. This experience will be applied in the planning of day-to-day operation, inspection, and maintenance of the Project roads. Agnico Eagle has a road supervisor who is responsible for the ongoing road inspection and maintenance of the access, service and haul roads. The operation and maintenance of all roads will apply the same principles.

The road supervisor conducts periodic inspections (minimally on a weekly basis) of the roads to ensure that the roads are maintained for safe travel of personnel, equipment, and supplies. These inspections are recorded, including deficiencies which are followed up by a corrective plan. These periodic inspections include an inspection of the bridge abutments and a visual observation of the road surfaces to assess the status of road foundation.

During the summer period (June to August), the road surface is maintained with fresh gravel being spread as required and regular grading of the road. By September, the road starts to freeze; therefore, gravel is added for safety reasons. Snow clearing and road sanding along the road are done to operate vehicles on roads safely. The manner in which the snow is cleared will also take into account the road configuration to avoid snow accumulation that could cause problems during the freshet or block snowmobile trails.

All roads are inspected for signs of accumulation of ponded water either on the road surface or along the sides of the road. Where noticed, the Agnico Eagle road supervisor will evaluate and monitor the accumulation to determine why water is accumulating in these areas. Based on these evaluations, the road supervisor will take remedial action where and when necessary to correct the cause of such ponding, such as grading of the road surface to remove areas of ponding or installation of additional culverts if the road is causing excessive water ponding.

7.1 Sedimentation Control

7.1.1 Construction

Various mitigations and best practices that will be followed during the bypass road construction to control sedimentation are as follows:

- No in-water work will take place from May 1st to July 15th, to protect fish spawning and nursery periods of local fish populations; this would apply to all stream crossings;
- Sediment and erosion control measures will be implemented prior to the start of work and maintained during the work phase to prevent entry of sediment into water or the movement of re-suspended sediment into the stream crossings;
- Sediment and erosion control measures will be left in place until all disturbed areas have been stabilized;
- All disturbed areas will be physically stabilized as soon as possible following construction using rock and/or vegetation;
- Machinery used near stream crossings or working within the drainage of Nipissar Lake will arrive on-site in a clean condition and be maintained free of fluid leaks to keep contaminants out of the drainage basin;
- The equipment will be re-fuelled, serviced, and washed away from the stream crossings to prevent deleterious substances from entering the water. Fuel, lubricants, hydraulic fluids, etc., will not be stored within 31 m of the high water mark of any waterbody, and will be kept in an area where spillage can be contained, and in a manner inaccessible to all wildlife; and
- An emergency spill kit will be kept at the work site in case of fluid leaks or spills from machinery.

In addition to those listed above, the following mitigation measures will be used to minimize potential effects on water resources should road construction activities occur in non-winter months:

- Regular inspection of the road to identify areas of ponding, erosion, or sedimentation, will be conducted;
- Construction runoff will be captured and managed to minimize suspended solids in the watercourses, where applicable; and
- In-stream construction work will be avoided, or limited, to the minimum extent possible.

7.1.2 Operation

During the operational phase, routine periodic inspections of the AWAR and bypass road will continue to be conducted as discussed previously in this Section. These inspections will include looking to identify areas of ponding, erosion, or sedimentation. If identified, any such areas will be addressed using the same mitigation measures described in this section for the construction phase.

7.2 Watercourse Crossings Inspections and Maintenance

The watercourse crossing inspection and maintenance program has three main components:

- A regular inspection program to identify issues relating to watercourse crossings, such as structural integrity and hydraulic function;

- An event inspection program to track the impacts of large storm events on watercourse crossings, such as structural integrity and hydraulic function; and
- A culvert location inspection program to ensure that culverts have been installed in the right locations with respect to the watercourse and that culvert capacity is adequate to ensure that the culvert(s) pass the water under all hydraulic conditions. In most cases there will be multiple culverts installed at different elevations at each stream crossing to ensure that these culverts can adequately pass normal summer flows as well as spring freshet and heavy rainfall flows.

7.2.1 Regular Crossing Inspection and Maintenance

Just prior to spring freshet, all culverts and stream crossings (including the bridge crossings at the Char River, lower Meliadine River and at the M5 Bridge (see Figure 1-1) will be inspected to confirm that they are in a state that will allow them to accommodate the rapid spring thaw that is seen in the north. During the freshet period, crossings inspections will be performed twice a week (mid-May through June) and weekly during the remainder of the ice-free period prior to fall freeze-up (July through October).

These inspection activities for each watercourse crossing will consist of:

- Visual inspection of its infrastructure to identify defects, cracks or any other risks to structural integrity. Particular attention will be paid to the inlet and outlet structures of culverts, and to bridge abutments and their foundations, as required.
- Visual inspection to identify sediment or other debris accumulation impeding the free flow of water through the crossings. Maintenance operations will consist of hand removal of accumulated debris and repairing damages as soon as possible.
- Visual inspection of upstream and downstream channel to identify bed erosion or scour around the watercourse crossing structure. Particular attention will be paid to bridge abutments and abutment foundations as they will be vulnerable to scouring and erosion during flood events. Particular attention will also be paid to potential sources of sediment transport at the crossing.

Inspection results will be recorded by Agnico Eagle to help track changes in conditions over time. Maintenance operations will consist of undertaking remediation of any detected problems and repairing damage as soon as possible.

7.2.2 Archaeological Sites and Ice Buildup

Agnico Eagle acknowledges that the GN Territorial Archaeologist has concerns that potential ice buildup at the site of the lower Meliadine River crossing bridge can cause water to back up and flood important archaeological sites upstream from the bridge in the Iqalugaarjuup Nunanga Territorial Park. Agnico Eagle has committed to work with the GN to inspect and mitigate where possible such

risks. To this effect, Agnico Eagle has committed to provide copies of its twice weekly inspections at the lower Meliadine River Bridge to the GN Territorial Archaeologist in the spring/early summer freshet period via email or fax. The intention is to allow both Agnico Eagle and the GN Territorial archaeologist to monitor for this potential risk, specifically for the purpose of taking appropriate action in a timely manner should ice buildup reach the point where these sites are at risk of flooding. The intent is for action to be taken prior to harm being done. The action plan would be developed and implemented by Agnico Eagle in consultation with the GN.

Agnico Eagle has agreed to work with the GN to develop other protective measures to protect important archaeological sites upstream of the Meliadine River Bridge within the Iqalugaarjuup Nunanga Territorial Park if it is shown that these sites continue to be damaged by flooding caused by ice and snow accumulation at the bridge.

7.2.3 Event Crossing Inspection and Maintenance

Inspection frequency will increase just after heavy or prolonged rainfall storm events. Visual inspection of each watercourse crossing will be completed to identify potential risks to the crossing's structural integrity, debris accumulation, and whether erosion and scouring have occurred. Water accumulation along the road will also be monitored. Results will be recorded by Agnico Eagle to help track changes in condition over time. The remediation of any detected problem and any necessary damage repairs will be undertaken as soon as possible, under the direction of Agnico Eagle's road supervisor.

7.2.4 Culvert Location Inspection

Following their installation, the culvert crossings will be visually inspected to confirm they have been properly executed and installed. These culverts will initially be installed during winter conditions and thus it is possible that a culvert will not be sited correctly to pass all ponding of water through the road. The intent is to check for such conditions during the first snow melt and after rain events so that adjustments can be made accordingly. Additional culverts will be installed, if necessary, should the inspection indicate that the culverts were installed in a location that does not optimally route water flows.

7.3 Snow Removal and Snow Management – Winter Maintenance

Sections of the Meliadine roads are expected to experience snow drifts because of strong winds over the winter period[7]. As much as possible, this snow will be cleared to the downwind side of the road to limit the wind re-depositing the same snow on the cleared road. Routine spring snow management

[7] This has been the experience along the AWAR where significant snow accumulation occurs at one location on municipal land known as Apache Pass.

will include the removal of any snow that accumulates at bridges and culverts so that water at freshet can move freely through the culverts and under bridges. In the case of culverts, snow will be removed from both ends but not from the inside.

Where snowmobile trails cross the road, snow clearing will be mindful of not placing snow on the trails thereby making crossing the roads easy.

The report, "Preliminary Snow Drift Assessment of the Meliadine All-Weather Road from Rankin Inlet to the proposed mine site, Nunavut" (Golder Associates 2011c) provides an assessment where snow drifts can be expected. It states:

> *"Observations seem to indicate that snow drifts can be expected on the lee of short, steep slopes and along lake shores."* and
>
> *"Maintenance will be required during operations to manage snow accumulation along the road alignment; however, most of the alignment appears to be located along the windward slopes and ridge crests where there should be a limited tendency for snow to build up."*

The design of the AWAR between the proposed mine site and Rankin Inlet factored in snow accumulation and this is one of the reasons the road is located along the height of land as much as possible and has a northerly alignment.

Dangerous ice formation on road surfaces, including the AWAR, is expected to occur periodically leading to their temporary closure until they can be graded and/or sanded. These procedures are employed at Meadowbank and were adopted for the Project. Road sanding and grading equipment is available at Meliadine to address icy road conditions.

7.4 Dust Suppression

The Dust Management Plan in Appendix C addresses in detail the actions that Agnico Eagle will take to suppress dust generated by road traffic during the non-winter months when dust becomes an issue. Particular attention will be paid to the dryness of the bypass road surface, the number of vehicles, weight and speed, and maintenance road near Nipissar Lake where dust suppression will be a priority.

In general, the amount of dust generated along a road is dependent on the driving surface. Regular grading of the roads combined with the addition of granular material to the driving surface will be needed. This will improve road safety and reduce the amount of dust. Dust will also be mitigated by maintaining posted speed limits.

In areas or times identified by the Agnico Eagle road supervisor as being prone to high dust levels, where safe road visibility is impaired, or in areas where dust deposition could impact fish habitat and/or water quality, the road supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, placement of new coarser topping, and/or

watering of the road surface. Use of chemical dust suppressants will be only used as a last resort and only in accordance with the Guideline for Dust Suppression on Unpaved Roads published by the Government of Nunavut Department of Environment (GN 2014).

Dust control measures along the AWAR, service and haul roads, and travel surfaces such as yards at the mine site have been identified by the community of Rankin Inlet as an important health concern[8].

[8] Following the technical review and community roundtable sessions held by the NIRB on the Draft EIS, NIRB directed Agnico Eagle to prepare a Dust Management Plan for inclusion with the Final EIS. This plan was prepared and attached as an appendix to the Roads Management Plan and can be found in Appendix C. It was updated following receipt of Final Hearing Report.

SECTION 8 • ROAD SAFETY

Agnico Eagle security personnel along with Agnico Eagle's road supervisor monitor activity on all roads through radio contact with both staff at the gatehouse and drivers on the roads, and through periodic patrols of the roads. All Agnico Eagle and contractor vehicles that routinely travel on the roads are equipped with a radio set to the requisite road frequency (Section 6). This radio system will be used to report any unusual conditions along the roads such as:

- Location of other Agnico Eagle vehicles;
- Presence of wildlife on the roadway;
- Presence of non-Agnico Eagle traffic such as ATVs, snowmobiles, or other vehicles;
- Non-Agnico Eagle vehicles broken down on the roads;
- Any unsafe practices noticed;
- Any special road conditions; and
- Any special weather conditions; etc.

Agnico Eagle will work to develop partnerships with the residents of Rankin Inlet, community organizations, and government departments in developing rules of the road, and educating the non-Project related users on road safety, on good driving practices, and on influencing people's behaviour on the roads. Emphasis will be directed to the use of helmets, seat belts, observing the posted speed limits, improving one's visibility by wearing reflective clothing when on a snowmobile or ATV, not drinking and driving, dealing with driver inexperience, etc.

These are the same safety rules that will apply to all users of the roads, including Agnico Eagle employees, Agnico Eagle contractor employees, and public users of the roads. The rules of the road include but not limited to the following:

- Maximum speed limits:
    - on AWAR: 50 km/h;
    - on the bypass road: 30 km/h;
- Use of seat belts by all drivers and passengers is mandatory;
- Driving under the influence of alcohol or intoxicating drugs is prohibited;
- Wildlife has right-of-way on the roads, and no harassment of wildlife is allowed;
- All hunting activity must avoid shooting across the road and should respect a safe shooting distance from the road (suggested at 1 km);
- Hunting is prohibited within 1 km of the AWAR and the Project;
- Vehicles are not to park on the travelling surface of the roads but pull off the road at a safe location such as passing turnouts to prevent accidents (passing turnouts are spaced approximately every 400 ± 50 m along AWAR length); and

- No public traffic is allowed within mining areas; these are industrial work sites and, thus, non-Project related vehicles will be stopped at the gate. Signs will be posted warning of an upcoming gate[9].

Agnico Eagle will hold public information sessions in Rankin Inlet for users of the roads prior to the roads opening and on a regular basis thereafter (minimum of twice per year). The rules of the road and safety considerations will be presented at these sessions, and modified if necessary based on broad and frequent consultation.

Agnico Eagle will also use other communication tools to get the road access procedures and rules of the road and safety considerations out to the public in Rankin Inlet. These will include community radio, community TV, and postings around town, signage near Rankin Inlet indicating whether the AWAR is open, through the Project office in Rankin Inlet and via the Agnico Eagle Project website. The communication will be in English, Inuktitut, and French.

Agnico Eagle has placed an emergency spill response trailer at km 7 and km 18 along the AWAR. The station will have the necessary spill response supplies to address any spills that occur along the road in an emergency situation.

8.1 Road Signage

Agnico Eagle has posted appropriate road signs along the roads in both English and Inuktitut. Typically, signs will advise drivers of the posted speed limit, of approaching bridges, of approaching curves, and/or areas of lower visibility (blind hills or obstructed curves).

English and Inuktitut signs are posted at the southern and northern ends of the AWAR, and at an appropriate mid-point to advise any public travelling by snowmobile or ATV that they are entering an area that may be potentially hazardous due to the presence of heavy vehicle traffic. This recognizes that snowmobiles and ATVs can enter and leave the road from any point along the roads. Signs will also be posted to advise the public that they are approaching the gate at the northern end of the AWAR where public access is not allowed. This will be just before entering the proposed mine site, where heavy industrial activity and large vehicles can be expected. Both ends of the bypass road will have an automatic gate with signs indicating it is not open to public access.

Speed limit signs are posted at intervals of approximately every 5 km along the roads. Reflective flags are installed along one side of the roads to help drivers identify the road shoulder during blizzard, white-out conditions or dense fog. Typically, these flags will be black in colour to help them stand out

[9] A manned gate will be installed on the AWAR near the proposed mine site.

in white-out conditions, and are nominally set at intervals of 100 m to 200 m apart. Kilometre markers are posted at intervals of at least 1 km along the roads.

A list of road signage on roads is presented in Table 8-1.

Table 8-1 Road Signage

Element	Location
Safety precautions and users advice	at the southern and northern ends of the AWAR, and at an appropriate mid-point
Stop signs	where required at road junctions
Give way	at haul and service road junctions
Blind hill	200 m ahead of the beginning of a blind hill
Speed limit	nominally at 5 km intervals
Curve	200 m ahead of a curve
Bridge announcement	200 m ahead of a bridge
Bridge side sign	On each side of the bridge
Flexible delineators (flags)	nominally at 100 to 200 m intervals
Kilometres markers	nominally at 1 km intervals

8.2 Policing of Rules of the Road

As privately operated roads, responsibility for "policing" will not fall to the RCMP. Responsibility for all operating and maintenance activity on roads will rest solely with Agnico Eagle. For the access roads, Agnico Eagle will concentrate on raising public awareness and commitment to road safety, and improving communication, cooperation and collaboration among all stakeholders on the safe use of the roads. For all roads, all Agnico Eagle employees and its contractors who will use the roads will be required to take road safety training before being allowed to access the roads.

Agnico Eagle uses its road supervisor and site security to monitor what is occurring on the roads. They monitor activity on the roads through radio contact with the staff at the gatehouse, through periodic patrols of the roads, and in conversation with drivers on the roads at the time. Agnico Eagle monitors speed limit infractions by direct observation of drivers seen driving too fast and by recording the time taken to drive between the Project and the Hamlet. Agnico Eaglealso relies on radio contact with all Agnico Eagle and Agnico Eagle contractor vehicles on the roads to monitor unsafe conditions or activity. Agnico Eagle records unsafe practices, warns the person causing the infraction, and in severe or repeated cases of violation, removes all privileges for future access to the roads by an offending driver. In the case when Agnico Eagle is aware of unsafe or illegal activity on the road, the RCMP will be informed.

Regulatory inspectors can inspect the roads and any associated infrastructure at will. Agnico Eagle abides with the recommendations and directives provided by the inspectors.

However, the *Criminal Code* of Canada applies to private roads. For example, if an accident were to occur on a road and alcohol was involved, that person could be charged by the RCMP. Under their current mandate, while the RCMP is not responsible for policing of the AWAR as it is a privately operated road, the RCMP will have the right to access the AWAR at any time to investigate any accident or incident where they believe there is a need.

8.3 Public Use of Private Roads in Other Jurisdictions

The AWAR is a private road constructed, operated, and maintained by Agnico Eagle. The AWAR covers traditional trails that were openly and continuously used by Inuit for many years. As well, most of the AWAR is on Inuit Owned Land. Agnico Eagle had to obtain land use permits from the KIA. After completion of the AWAR, these land use permits were taken to lease. Agnico Eagle is subject to the terms and conditions of the leases.

Before the construction of the bypass road is complete, Agnico Eagle will meet with all regulatory agencies and the public as it finalizes the rules of the road and this Plan.

SECTION 9 • ACCIDENTS, SPILLS, MALFUNCTIONS, AND EMERGENCY RESPONSE

Emergency response is reactive whereas prevention lowers the frequency of incidents occurring requiring emergency response. Agnico Eagle's emphasis will be on the latter, while at the same time keeping resources nearby to respond to emergencies on the roads in a timely manner.

Three possible causes of road emergencies are the road, vehicle, and people. It is the interplay of these three elements that lead to either safe use of the roads or emergency response. Agnico Eagle is fully responsible for the design, construction, and maintenance of the roads for Project related use, and public use of the access roads. This includes regular inspection and maintenance of transportation infrastructure, including access roads, service roads, haul roads, road crossings, water crossings, signage and the two emergency spill response stations.

Agnico Eagle verify its vehicles are in good working order prior to use. Agnico Eagle, however, has little influence on the condition of the non-Agnico Eagle owned vehicles that will use the AWAR. Vehicles could be poorly maintained and individuals could also make poor decisions such as using an ATV in winter when a snowmobile would be more appropriate. Nonetheless, Agnico Eagle will provide emergency assistance where the health or safety of people is at risk when travelling on the AWAR or on the land near Project facilities. Additionally, Agnico Eagle trains its employees and contractors on road safety and emergency response (first aid, firefighting, spill response, etc.). By educating and protecting its workers, they lead by example in road safety.

While Agnico Eagle feels it can successfully manage the condition of the AWAR and influence what vehicles use it, shaping an individual's responsible driving habits and attitudes to safety could prove more difficult. As a result, Agnico Eagle, in cooperation with Inuit organizations, authorizing agencies and others, will, to the best of its ability, implement all such measures necessary to protect public and mine traffic on all roads open to unrestricted public use. Responsibility and risk comes with driving on the AWAR and Agnico Eagle will:

- Impress on AWAR users that they should always remain aware of what is happening around them as they drive and make responsible decisions about hazards and problems;
- Highlight the environmental and human costs of irresponsible driving habits, and a driver's accountability for his/her decisions; and
- Repeatedly inform AWAR users of the rules of the road.

In 2018, Agnico Eagle will educate the public on road safety, shaping good driving practices and influencing people's behaviour on the roads. Emphasis will be directed to the use of helmets, seat belts, observing the posted speed limits, improving one's visibility by wearing reflective clothing when on a snowmobile or ATV, not drinking and driving, dealing with driver inexperience, etc. This will also include encouraging all drivers to abide by the rules of the road to control speeds and advance

considerate driving. Vests and buggy whips will be available for borrow at the gatehouse (km 7) when accessing the AWAR.

An Agnico Eagle trained site-based emergency response and spill clean-up team[10] are available on site with appropriate equipment to respond to all spills and road accidents. The Emergency Response Team (ERT) are trained in emergency response (firefighting, first aid, mine rescue, spill response, vehicle accidents, etc.). In addition, emergency response equipment and spill kits are carried in all Agnico Eagle vehicles using the roads to improve response in the event of an incident or accident. This equipment includes emergency first aid equipment, and initial spill response equipment. Spill response will be implemented by environmental staff who will advise, document, and report on initial response and clean-up actions. The Spill Contingency Plan will be activated in responding to a spill. Minor spills will be handled safely without the assistance of the ERT using initial spill response equipment carried in the vehicle. Major spills[11] will require the ERT, who will use spill response equipment and supplies maintained by Agnico Eagle at the mine site, from the two emergency spill response stations on the AWAR and/or at Itivia.

In urgent circumstances, where appropriate, Agnico Eagle may request assistance from other parties in Rankin Inlet. However, based on Agnico Eagle's experience with the Meadowbank access, service, and haul roads, Agnico Eagle does not believe that its Project roads will result in any increased demand on local public service providers (i.e., fire, police, ambulance, medical, and maintenance) in Rankin Inlet.

9.1 Accidents and Malfunctions

Agnico Eagle understands that accidents can occur, but the prevention and proposed mitigation measures along the roads, emergency response planning, training, and preparation will substantially reduce the risk, frequency, and severity of such incidents. Agnico Eagle emergency response personnel are tasked with responding to any vehicle accident resulting in personal injury or spillage of harmful material. Agnico Eagle will initiate response and transport to medical assistance at the mine's health centre or Rankin Inlet's medical center. Agnico Eagle staff will follow the procedures in place in Risk Management and Emergency Response Plan. The types of accidents and malfunctions that may occur are as follows:

- Vehicle collisions that may result in personal injury and spillage of potential harmful materials such as fuel, lubricating fluids, and antifreeze;

[10] For more details on emergency and spill response, please refer to the Risk Management and Emergency Response Plan and the Spill Contingency Plan, respectively.

[11] A major spill is defined as an event that cannot be handled safely without the assistance of Emergency Response Team, including all events where a person is injured or contaminated.

- Contact between vehicles and wildlife that may result in harm to wildlife, personal injury and spillage of potentially harmful materials;
- Single vehicle accidents that may result in personal injury and spillage of potentially harmful materials;
- Risk of people getting stuck on the roads in bad weather such as in blizzard, white out or dense fog conditions, or due to mechanical breakdown;
- Risk of accident due to an intoxicated or impaired driver on the roads; and
- Spills of harmful materials onto the land or into water through a vehicle rollover or tipping over.

Agnico Eagle will report all reportable incidents to the appropriate Government authority (e.g., Mines Inspector, RCMP, NWB, NU Spill Line, Environment Canada, GN Department of Environment, Fisheries and Oceans Canada (DFO), KIA, and Hamlet of Rankin Inlet).

The following actions are to be taken in the event of an accident on the roads involving other vehicles (including ATVs), or in the event of an accident involving contact with wildlife such as caribou, muskox, bear, and wolf, the ERT will:

- Check the condition of people involved in the accident and provide immediate first aid if appropriate;
- Call the Meliadine road dispatch by radio and report the location and nature of the accident and indicate the type of assistance required (medical help, environmental cleanup, fire and/or mechanical help);
- Secure the accident site so that the vehicles do not continue to present a hazard to others. This may involve moving the vehicles to the nearest pull off in the event of a minor accident, or blocking off the road in both directions in the event of a more serious accident; and
- If safe to do so, secure the site to prevent continued spill or leakage of contaminants into the surrounding environment.

Upon receiving the accident call, the road dispatch will initiate the emergency response procedure passing along the information to the emergency response coordinator. The emergency response coordinator will then call out the required emergency response personnel to assist at the accident site.

Once the accident site is secured and all people requiring assistance have been removed to medical care, the emergency coordinator will turn the scene over to the mine's safety personnel so that an appropriate accident investigation can be initiated.

In the event of an incident involving contact with wildlife, the road dispatch will notify the site security personnel and the environmental representatives. Security and the site environmental team will then initiate an appropriate accident investigation. The Environmental Department will ensure that

appropriate reporting of such incidents is done in a timely manner to the KIA, the Rankin Inlet HTO, and the GN Conservation Officer in Rankin Inlet.

In the event of a serious accident, the RCMP will be contacted and advised of the incident. The RCMP will then decide on whether they will become involved or take the lead on any subsequent accident investigation.

SECTION 10 • WILDLIFE MANAGEMENT

Wildlife is occasionally expected to be observed on or near the AWAR, service, and haul roads. Caribou and other wildlife will have the right-of-way at all times. In case of problems (e.g., aggregations of caribou), the environmental personnel on-site will be in charge of managing the situation and, with the collaboration of the security department, will advise road users by patrolling the roads. The Project personnel will be notified by dispatch radio if any wildlife is observed on the roads.

The following protocol is implemented on the roads for the protection of wildlife:

- Vehicle traffic speeds on the access, service and haul roads will be limited to 50 km/h;
- Where small to moderate aggregations of caribou (i.e., 1 to 50 animals) are observed within 100 m of a road, travel speeds are reduced to 30 km/h;
- Where large aggregations of caribou (i.e., 50 or more) are observed within 100 m of a road, the protocol outlined in section 10.2 is followed;
- Caribou and all wildlife are given right-of-way on the road: vehicles must stop until the animal is off the road;
- Locations of large aggregations of animals are reported to the road supervisor who will inform all potentially affected employees and the environmental representative, and put the protocol in Section 10.2 into effect. Agnico Eagle's environmental coordinator will then inform the KIA, the Hamlet, HTO, and the GN Conservation Officer in Rankin Inlet;
- All incidents between vehicles and wildlife are reported to the Agnico Eagle road supervisor and the environmental representative whether they are:
    - Near-miss;
    - Collision with injury to the wildlife; or
    - Accidental death.
- Each incident is investigated by the road supervisor and the Environment Department, and measures taken to avoid re-occurrence are put in place. Disciplinary measures will be taken against any employee if the investigation concludes that the accident is the result of negligence; and
- In the case of accidental death of an animal, the Environmental Coordinator will contact the GN Conservation Officer in Rankin Inlet. The carcass will be removed from the road and incinerated to avoid attracting scavengers such as Arctic foxes, wolves, grizzly bears, and/or wolverines.

10.1 Wildlife Monitoring Program

Agnico Eagle has implemented a monitoring program to record on a systematic basis the prevalence of wildlife seen along the roads. This program will be developed further with the input of the local HTO and the KIA. The program will focus on caribou, muskoxen, bears, wolves, migratory birds, and

raptors. Agnico Eagle and the HTO have also been discussing a program that would see the HTO provide wildlife monitoring services.

The current program consists of weekly ground surveys of wildlife observed along the roads. The survey is logged and includes type of wildlife observed, estimate of numbers, and nearest kilometre marking along the roads. The data is aggregated and presented in the annual report for the mine. Complete details on wildlife monitoring can be found in the Terrestrial Environment Management and Monitoring Plan (Agnico Eagle 2014a).

10.2 Road Management Agreement

Agnico Eagle plans to consult the Government of Nunavut, the KIA, the Kivalliq Wildlife Board, local HTOs, and the public in developing appropriate monitoring and mitigation measures related to the ease in harvesting of caribou afforded by the AWAR. The result of these consultations will be known as the Road Access Management Agreement that endorses the following measures:

- During periods when large aggregations of caribou (greater than 50 individuals) are detected within 1 km of the AWAR, the southern gate is closed to public cars and trucks. Public access using ATVs will still be allowed.
- In consultation with the Kivalliq Wildlife Board (KWB), as required under the Nunavut Wildlife Act, Agnico Eagle will seek the establishment of a no-shooting zone (1 km wide) on either side of the road. If the KWB, other agencies and the public are in agreement, AWAR use by hunters will be conditional on observing the 1 km no-shooting zone[12].
- Dedicated 'road monitors' patrol the road to ensure compliance relating to public safety and wildlife. Monitoring is increased during periods of road closure when large aggregations of caribou are present;
- All incidents of hunting involving shooting along or across the AWAR are reported by the Agnico Eagle to the GN.
- During periods when large aggregations of caribou are detected near the Project, harvest monitoring intensity is increased to properly document harvesting levels of caribou.

The roads supervisor, in consultation with the environment coordinator is responsible for ordering the southern gate shut and preventing the use of bridges by ATVs while large numbers of caribou remain on or near the AWAR. Similarly, the roads supervisor, in consultation with the environment coordinator, would open the southern gate and bridges to all traffic once the caribou have moved on.

SECTION 11 • RECLAMATION

Reclamation of the access, service, and haul roads will follow the completion of all mining. Progressive reclamation will, in some instances, lead to roads being reclaimed after they are no longer needed. As described in the Preliminary Closure and Reclamation Plan, the access roads should be one of the last mining components to be reclaimed.

In most circumstances, the AWAR will continue to be open to public access during any temporary closure of the mine. The status of the road during such periods would be assessed by Agnico Eagle on a case-by-case basis. For short duration temporary shutdowns (short-term temporary closure), the AWAR would remain open and be maintained in the same manner as proposed during the operational phase. While each case would be assessed separately, temporary shutdowns of less than 6 months duration would not change the way the access road is operated or maintained. For temporary shutdowns of greater than six months and less than 12 months in duration, and/or for indefinite shutdowns (period of time greater than one year: long-term temporary closure), Agnico Eagle would have to change the way it operates and maintains the road. In such an instance, Agnico Eagle would evaluate what level of activity was expected to continue at the site during the shutdown period and adjust its care and maintenance of the access road accordingly. For example, here are two possible scenarios:

Case 1: Long-term Temporary Closure of the Proposed Mine due to a low Gold Price

Under an indefinite shutdown of the mine due to a low gold price, in this case the duration of the event would be unknown and beyond the control of Agnico Eagle. Agnico Eagle would likely shutdown all mining and milling operations in a progressive manner and put the facilities into a care and maintenance mode with a minimal site presence to protect the integrity of the facilities at the site. In this event, Agnico Eagle would likely suspend winter snow clearing along the AWAR and would significantly reduce summer maintenance. Winter use of the AWAR by public would stop; summer access would still be open but likely limited to ATVs as the road would no longer be maintained to its normal standard.

Case 2: Short-term Temporary Closure of the Proposed Mine

Short-term Temporary Closure is defined as the shutdown of the proposed mine with a defined timeline, less than 1 year mill shutdown. The duration of the event would be known and would be within the control of Agnico Eagle. Agnico Eagle would reduce activity at the site while the mill is rebuilt and/or repaired. In this case, there would be a continued presence on site and thus regular road access would still be required. In this event, Agnico Eagle would likely maintain the road in the same manner as during normal operations with potential extended shut downs during the worst winter conditions. In this event, continued public access to the road would continue as normal except for periods when the road is closed due to severe winter conditions or some other eventuality.

There are a number of scenarios that could fall between those presented above and each would be considered on a case-by-case basis. In general, if during the short-term or long-term shutdown period there is ongoing activity planned at the site, the AWAR would for the most part remain open to public access. However, if during the shutdown period there is no ongoing activity planned at the site, the road would not be maintained, thereby limiting public access to snowmobiles or tracked vehicles during winter and to ATVs during summer months.

The question as to how public use of the AWAR will be monitored and how road use rules and procedures will continue to be enforced during any short-term or long-term temporary closure of the mine has been raised as a valid concern.

- For short-term temporary closures (up to 12 months in duration), the AWAR would continue to be monitored, maintained and operated (enforcement of rules and procedures) in the same manner as those laid out in Sections 6 through 10 of this Plan for normal operations; and

- For long-term temporary closures or for indefinite shutdowns (greater than 12 months in duration) where further site activity is being curtailed and the intention is that the mine will resume operations as soon as possible after the cause for the indefinite shutdown has been addressed, then AWAR monitoring, maintenance and enforcement activities would be significantly reduced. A decision on the estimated length of the indefinite shutdown would be made after the initial one year period. Decisions on possible extensions to the indefinite shutdown would be made every 6 months thereafter and would be based on the conditions at that time. At present, the maximum length of time or number of extensions for interim shutdown before moving to final closure has not been defined.

When further site activity is curtailed, a physical barrier would be established on the AWAR before the Meliadine River Bridge that prevents open public access by cars, trucks or other motorized vehicles larger than an ATV. This would likely be a rockfill barrier with appropriate signage. During winter months, the road would not be kept open thus curtailing travel other than by snowmobile or tracked snow vehicle. In summer months, Agnico Eagle would continue to carry out environmental monitoring both along the AWAR and at the mine site but at a reduced frequency in accordance with its license/permit requirements. During these inspections, Agnico Eagle personnel would continue to monitor for inappropriate use of the AWAR and for conditions along the AWAR that could result in risk to public safety or to the environment (e.g., wash outs, erosion, plugged culverts, etc.). This would include monitoring and addressing any unauthorized trails/access into the designated preservation zone of the Iqalugaarjuup Nunanga Territorial Park as discussed in Section 6.3 of this Plan.

For the permanent closure scenario and as outlined in the Preliminary Closure and Reclamation Plan, the AWAR will remain available for use during closure as access to the mining areas is required until post-closure and reclamation activities have been completed. The road surface will at this point

be rehabilitated to promote natural re-vegetation, water crossings removed, and natural drainages re-established.

Agnico Eagle would like to emphasis that it has the responsibility of decommissioning and reclaiming all roads once construction, operations, closure, and post-closure activities are complete. For a third party to take over the road(s), that third party would have to complete its own arrangements with the landowners (the KIA and the Hamlet) and then complete its own environmental assessment and permitting process covering future use. Agnico Eagle does not own the land on which the roads are constructed and, thus, cannot transfer future ownership or use privileges to any third party. Agnico Eagle must complete its obligation to decommission and reclaim all roads unless directed otherwise by a combination of the landowners and other regulatory agencies who issued permits/authorizations for the roads.

Decommissioning of the roads will be accomplished by loosening compacted surfaces, flattening side slopes, and removing all culverts, bridges (not including the Char River bridge as this would become the property of the Hamlet of Rankin Inlet), and other potential obstructions to drainage paths. The objective will be to make the road surface impassable by vehicle traffic by ripping the entire road bed and removing all bridges and culverts along the route.

The loosening of compacted surfaces will be accomplished by ripping of the road bed using a dozer with a “ripper” attachment on the back. Successive passes with the dozer longitudinally along the road bed will eliminate the level road surface and make travel difficult (Figure 11-1). It is anticipated that, in this way, the abandoned roads will not be useable by wheeled vehicles (i.e., cars, trucks, and pick-up trucks). The road bed would still be useable by ATV or snowmobile and, thus, even after final reclamation, the reclaimed roadbed would offer similar passage to the existing set of trails that currently exist and are used by the residents of Rankin Inlet for traditional use purposes.

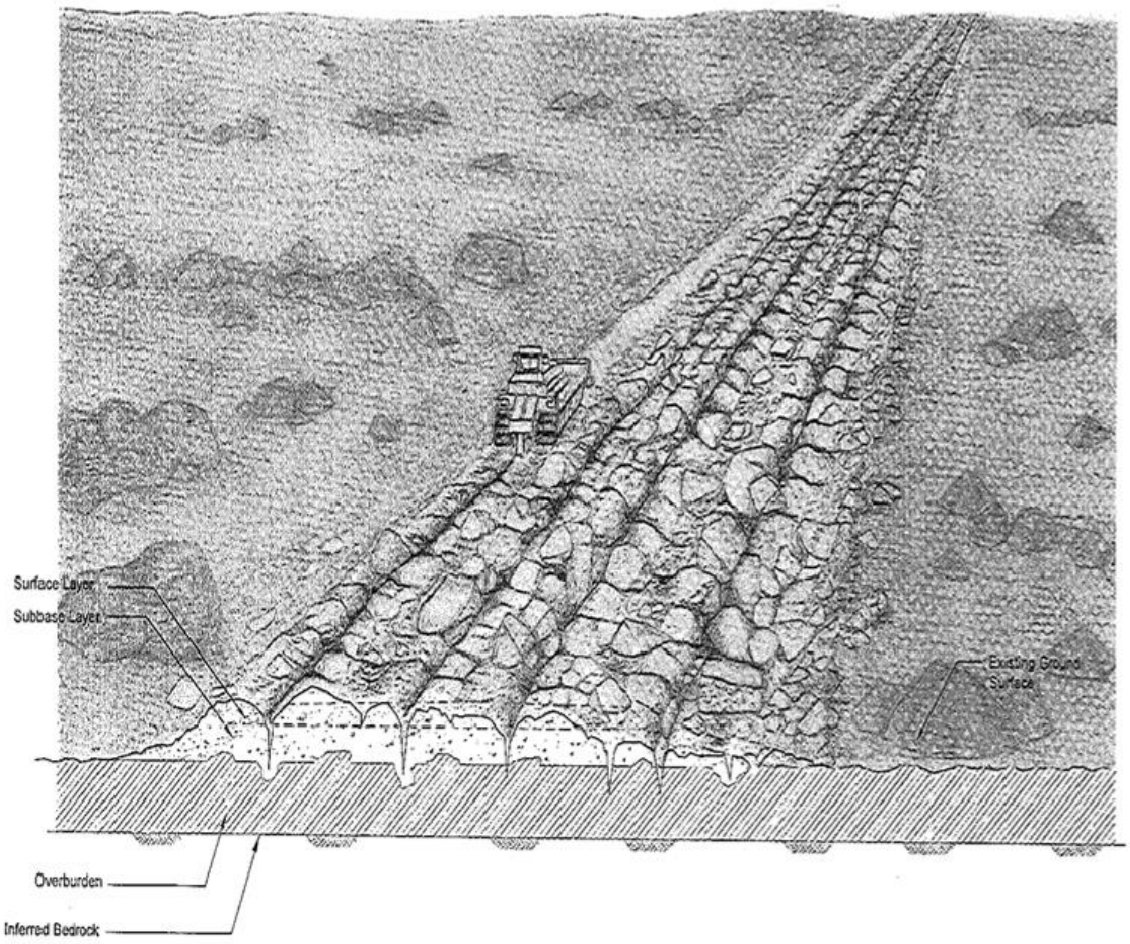

Figure 11-1 Schematic Showing the Ripping of the Road upon Closure

The road deactivation works will be carried out as necessary to stabilize any slopes where potential for slope erosion may exist. Stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened out slopes using non-acid generating material.

These measures would also be applicable to borrow pits/quarries that remained open following construction and are located adjacent to the roadway. As much as practical, deactivated surfaces will be graded to blend with the existing topography.

To the extent practical, the reclamation would also restore the natural pre-road hydrology. Natural drainage courses would be restored primarily through the removal of all culverts and bridges (excluding the Char River bridge, which will belong to the Hamlet of Rankin Inlet), and through rehabilitation of channels and banks at the crossing sites. Cross-drain structures (cross-ditches) will also be installed where necessary between culvert sites. Where armouring rock (rip-rap) is required, this rock will be non ARD/ML for the protection of aquatic life. Where affected watercourses are fish

bearing, the timing of work will have to be restricted to within the designated DFO fisheries work window (July 16th to April 30th). For these sites, appropriate fish exclusion measures will be undertaken prior to the in-stream works. All in-stream works will be carried out using best management practices for erosion and sediment control.

Decommissioning of the roads will start from the Project site and progress south towards Rankin Inlet and will include reclamation of the bypass road. Stream crossings will be rehabilitated as they are encountered during the progression of the work. The culverts and bridges, as previously mentioned, will be removed from the crossings using a backhoe and crane, and then removed materials (i.e., culvert steel, bridge decks, abutment steel, etc.) will be transported to Rankin Inlet using a semi-tractor and a low-boy trailer, for disposal and salvage.

11.1 Reclamation of Quarries and Borrow Pits Sites

All quarry sites and borrow sources developed during the construction of the roads have been selected to generate only non-acid generating/low metal leaching materials (see Borrow Pits and Quarries Management Plan). Water quality monitoring and testing will be undertaken periodically during the construction and operational period of the roads to measure the quality of water draining from the open quarry/borrow sites and from the road base materials.

The quarries and borrow pits will have gently sloping walls and be designed for positive drainage wherever possible. Reclamation and closure of quarries and borrow pits will depend on the individual site conditions. With a conservative initial design, the quarries should require little reclamation following completion of the roads. Loose rock will be pulled to the floor of the quarry and the entrance blocked with large boulders. Reclamation should lead to natural re-vegetation establishing on disturbed areas.

During reclamation of the roads, should acid-generating bedrock be exposed along the roadway or in borrow pit/quarries, these areas will be covered with a minimum 2m thick layer of non-acid generating soil or rock to direct water away from the surface.

REFERENCES

Agnico Eagle (Agnico Eagle Mines Limited). 2011. Borrow Pit and Quarry Management Plan for the Phase 1 All-weather Access Road between Rankin Inlet and the Meliadine site; ftp://nunavutwaterboard.org/1%20PRUC/2%20MINING%20MILLING/2B/2BW%20-%20Watercourse/2BW-MEL1215%20AEM/3%20TECH/9%20MONITORING/111109%202BW-MEL----%20Borrow%20Pit%20and%20Quarry%20Mgmt%20Plan%20November%202011-ILAE.pdf

Agnico Eagle 2012. Monitoring Plan for the Phase 1 All-weather Access Road between Rankin Inlet and the Meliadine site; ftp://nunavutwaterboard.org/1%20PRUC/2%20MINING%20MILLING/2B/2BW%20-%20Watercourse/2BW-MEL1215%20AEM/3%20TECH/9%20MONITORING/120119%202BW-MEL----%20Monitoring%20Plan-IMLE.pdf

Agnico Eagle. 2014a. Terrestrial Environment Management and Monitoring Plan, Meliadine Gold Project, Nunavut, Volume 6, Support Document 6-4.

Agnico Eagle. 2014b. Occupational Health and Safety Plan, Meliadine Gold Project, Nunavut. Volume 9, Supporting Document 9-6.

Golder Associates 2010. Geochemical Assessment of Potential Road Construction Material, Meliadine Golder Project, Nunavut. Submitted to Agnico-Eagle Mines Limited. December 2010.

Golder Associates 2011a. Phase 1 – Meliadine All-weather Access Road Project Description and Environmental Assessment.

Golder Associates 2011b. All-weather Access Road, Meliadine Gold Project, Feasibility Level Design. Prepared for Agnico-Eagle Mines Ltd. January 2011. Report number 09-1426-0015/4700-085, Rev.1.

Golder Associates 2011c. Technical memorandum preliminary snow drift assessment of Meliadine all-weather road from Rankin Inlet to Meliadine Site, Nunavut. Prepared for Agnico-Eagle Mines Ltd. 30 August 2011. Report number 11-1428-0011/9999-152 Ver. 0 Rev.1.

GN (Government of Nunavut) 2014. Guideline: Dust Suppression on Unpaved Roads Published by the Government of Nunavut Department of Environment.

APPENDIX A • AGNICO EAGLE CONSULTATION ON THE ALL-WEATHER ACCESS ROAD

A chronological record is provided of the consultation undertaken on the routing of the AWAR between Rankin Inlet and the proposed mine site.

Date	Place	Parties Present and Subject(s) of Meeting
21/10/2004	Rankin Inlet	Presentation on Project status to KIA Board of Directors with a request for a proposal of motion to support a future road from Rankin Inlet to the site.
26/03/2007	Chesterfield Inlet	Presentation to the KIA Board of Directors on the proposed underground program and 2007 Meliadine West exploration plans. Verbal Motion of Support from the Board.
27/03/2007	Rankin Inlet	Presentation of the proposed 2007 Meliadine West exploration program to the Rankin Inlet Community Lands and Resources Committee.
28/03/2007	Rankin Inlet	Presentation of the proposed 2007 Meliadine West exploration program to the Kivalliq Chamber of Commerce.
28/03/2007	Rankin Inlet	Town hall meeting - presentation of the proposed 2007 Meliadine West exploration program.
04/07/2007	Rankin Inlet	Briefing on Project status to Hamlet Council with specific discussions on road alignment and overwinter fuel storage in barge.
4/07/2007	Rankin Inlet	Elders Luncheon at Nunavut Arctic College. Project overview and immediate project plans for underground exploration was presented by Mark Balog with a slide show. Issues that were raised: - employment opportunities for young people, - all-season road location and utility for other projects, - soapstone from Newfoundland. Attendees: Hamlet Elders including Mr/Mrs Tatty, Mr/Mrs. Itinuar, Mr/Mrs Kabvitok, Mrs. Pissuk, others: Comaplex Minerals: Mark Balog, Ben Hubert. Arranged by John Hickes.
6-8/05/2009	Rankin Inlet	Multidisciplinary Advisory Group (MDAG), chaired by Bernie MacIssac, INAC: all regulatory groups in attendance. Presented the Project and All-weather Road to regulators. Met regulators who will work on Project, including Jackson Lindell and Stephen Hartman, KIA, and Keith Morrison and Jorgan Aitaok, NTI.
17/06/2009	Rankin Inlet	Meeting with Manager CED (Robert Connelly) and Nunavut Transport (Alan Johnson) regarding proposal to access federal infrastructure money for the Meliadine River bridge and Comaplex fund the road. Visit to the bridge site.
18/06/2009	Rankin Inlet	Discussion with Rankin Inlet Mayor John Hickes, the SAO, and several council members. Project update and proposed application for road and bridge funding.

Date	Place	Parties Present and Subject(s) of Meeting
01/06/2010	Chesterfield Inlet	Mark Balog and John Witteman, Comaplex sponsored a town hall meeting providing an update on the Project and the building of an All-weather Road. The road would link to the planned road to Chesterfield Inlet.
02/06/2010	Rankin Inlet	Mark Balog and John Witteman, Comaplex sponsored a town hall meeting providing an update on the Project and the building of an All-weather Road. The meeting was particularly well attended and there were no objections to the routing to the All-weather Road. There were no objections to the proposed road alignment.
01/09/2010	Meliadine site	John Witteman and Jacek Patalas (Golder Associates) met with Gary Cooper and Nicola Johnson of DFO to discuss fisheries habitat and compensation issues relating to the development of the Meliadine Gold Project. Discussions regarding compensation for road crossings were also discussed.
06/01/2011	Cambridge Bay	Eric Lamontange, Denis Gourde and John Witteman met with Ryan Barry, Kelli Gillard and one more staff member, NIRB, to describe the status of the Project and in particular the AWAR. Agnico Eagle described what had been done in regards to gathering baseline information for the road, regulatory permits required and use of the road (having it open access).
07-09/02/2011	Rankin Inlet	Larry Connell and John Witteman met with the Lands Division of KIA to discuss the road and other matters. A meeting with the HTO was cancelled due to a blizzard.
01/03/2011	Rankin Inlet	John Witteman, Bertho Caron and Selma Eccles of Agnico Eagle attended a meeting with the HTO, Rankin Inlet. The HTO raised a number of concerns with the route of the road, bridge location over the Meliadine River, wildlife monitoring along the road, plans for the Itivia port area, fish concerns with the bridge. Agnico Eagle talked to each of the concerns raised and were subsequently informed that the HTO Board was satisfied with the responses received.
23/03/2011	Rankin Inlet	Denis Gourde, Eric Lamontagne, Larry Connell, Selma Eccles, John Witteman met with the Hamlet Council to describe the AWAR and ongoing activities at the Meliadine site. The Hamlet Council supports the All- weather Access Road and a letter of support can be expected. The underground program was explained and what is hoped to be gained from carrying out this work - getting needed information on the deep ore. The question of dust control was raised and lands available in town for development. The underground development was discussed.
23/03/2011	Rankin Inlet	Denis Gourde, Eric Lamontagne, Larry Connell, Selma Eccles, John Witteman hosted a town hall meeting with the community to discuss the All-weather Access Road and the proposed mine. A PowerPoint presentation in English and Inuktitut was presented. The meeting was well attended with over 100 persons present. The road is widely supported by the community as it offers access to Meliadine Lake

Date	Place	Parties Present and Subject(s) of Meeting
		and also is expected to lead to more economic activity. The question of jobs and careers was frequently raised and what must be done to get jobs such as supervisors and managers. Education was emphasized by Agnico Eagle as well as on-the-job training. Support was voiced for the road and the proposed mine.
7/04/2011	Iqaluit	Meeting with NIRB and NWB in Iqaluit during the Nunavut Mining Symposium. PowerPoint presentation was made on the proposed Meliadine AWAR and our application to amend our Type B water license to allow for construction of this road. Good exchange with NIRB an NWB pointing out omissions in what was presented.
6/05/2011	Geovector, consultant to KIA	AWAR – quarry locations and need to check for ground ice, geochemistry of the waste rock and potential quarries, snow drifting along road, design of culverts, lessons learned from Meadowbank.
6/06/2011	Cambridge Bay Gjoa Haven Iqaluit	Presentation to NIRB, NWB, Regulatory Agencies in Iqaluit. Discussions on next steps in EA process, possible predevelopment activities, class A water licence, Agnico Eagle's use of municipal infrastructure, need to submit a land use permit for crown land to be crossed by the AWAR, quarries along road.
14/06/2011	KIA, Mayor of Rankin Inlet	Possible predevelopment, Hamlet motion to approve AWAR, build only 1 lane at this time.
31/10/2011	Rankin Inlet	Larry Connell and John Witteman met with the HTO. A PowerPoint presentation was made on the All-weather Access Road and developments at the Meliadine site. The HTO wanted to discuss the alignment of the AWAR to the Meliadine site and the arrangement of Agnico Eagle facilities at Itivia. A more southerly route was proposed by the HTO but Agnico Eagle indicated it was too long and had too many water crossings. The HTO want a role and contract in monitoring wildlife along the AWAR. The arrangement at Itivia was raised but Agnico Eagle did not have maps of the area. Discussion was deferred to the next meeting when Agnico Eagle would bring maps of Itivia and surrounding area. Agreement was reached on a ski-doo trail along the east side of the laydown area.
29/02/2012	Rankin Inlet	A public meeting with the community. The meeting covered the status of the Meliadine Project with emphasis on the planned construction of the Phase 1 AWAR between Rankin Inlet and the Meliadine Project site. Options for a bypass road around the Hamlet were presented with support for keeping Agnico Eagle traffic outside the community. Other topics touched on the fate of the existing Char River bridge, the formation of a Liaison Committee for Rankin Inlet, plans for the Itivia area and employment opportunities in the building of the road.
18/04/2012	Iqaluit	Presentation made to the NIRB and the NWB on the proposed Meliadine All-weather Access Road and update on the exploration project.
16/08/2012	Rankin Inlet	Site visit of the Phase 1 AWAR by two representatives of the Hunters and Trappers' Organization. Progress on the bridges and road was viewed.

Date	Place	Parties Present and Subject(s) of Meeting
11/09/2012	Rankin Inlet	Site visit of the Phase 1 AWAR by KIA and CLARC representatives. Progress on the bridges and road was viewed.
21/06/2013	Rankin Inlet	Meeting was held with the hamlet and Government Services (GN) concerning the removal of the Char River Bridge, the Apache Pass, and the airport by-pass road.
27/06/2013	Rankin Inlet	Presentation on Agnico Eagle exploration activities, Phase 1 AWAR and road access made to town council, community, Land and Resources, Hunters and Trappers' Organization, Kivalliq Inuit Association, NTI.
10/07/2013	Rankin Inlet	Discussions were held with the Airport Manager and Government Services (GN) concerning the airport by-pass road.
8/08/2013	Rankin Inlet	Meeting with town council, community, Land and Resources, Hunters and Trappers' Organization, Kivalliq Inuit Association, NTI on the Phase 1 AWAR and Road Access Policy – minutes are available.
6/11/2013	Rankin Inlet	Meeting with HTO Board explaining the status of the Project, Phase 1 All-weather Access Road, caribou migration, sewage treatment – minutes available.
29/05/2014	Rankin Inlet	Rankin Inlet Public consultation on the road access by ATV.
5/05/2016	Rankin Inlet	Meeting with the KHTO to discuss the proposed joint Wildlife Monitoring Program to be conducted along the AWAR.
9/06/2016	Rankin Inlet	Meeting with Nunavut Airports, Government Services (GN) and the Hamlet to present the updated road route for the bypass road. The permitting process was also discussed.
7/07/2016	Rankin Inlet	Meeting with the KHTO to discuss the proposed joint Wildlife Monitoring Program to be conducted along the AWAR.
25/08/2016	Rankin Inlet	Meeting with Nunavut Airports, Government Services (GN) and the Hamlet to provide an update on the bypass road design process and hear concerns. The permitting process was also discussed.
20/09/2016	Rankin Inlet	Meeting with KHTO to discuss signage erected on AWAR.
28/11/2016	Rankin Inlet	Pre-Hamlet Council meeting with Nunavut Airports, Government Services (GN) and the Hamlet to discuss the bypass road project. Pre-Council concerns were also shared by all parties.
28/11/2016	Rankin Inlet	Hamlet Council Meeting. Bypass road project presented to request support for the project by the Hamlet.
13/12/2016	Rankin Inlet	Hamlet Council Meeting. Bypass road project receives support from the Hamlet.
27/02/2017	Rankin Inlet	Hamlet Council Meeting. Bypass road project application for lease presented for approval by Council. Outstanding concerns discussed. Vote postponed.
13/03/2017	Rankin Inlet	Hamlet Council Meeting. Bypass road project application for lease discussed. Agnico Eagle is requested to provide design for road extention.

APPENDIX B • APPLICABLE ACTS, REGULATIONS, AND GUIDELINES FOR THE ACCESS, SERVICE AND HAUL ROADS

Applicable Acts, Regulations, and Guidelines for the Access, Service and Haul Roads

Act	Regulation	Guideline
Federal		
Canadian Environmental Protection Act (1999 c.33)	Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations (SOR/2008-197) Environmental Emergency Regulations (SOR/2003-307) Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations (SOR/2002-301) Release and Environmental Emergency Notification Regulations (SOR/2011-90)	CCME - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory (threshold for hydrochloric acid 6.8 tonnes) Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Canada Wildlife Act (1985 w9)		
Species at Risk Act (2002 c.29)		Species at Risk Policies
Migratory Birds Convention Act (1994 c.22)	Migratory Birds Regulations (C.R.C., c. 1035)	
Canada Water Act (1985 c.11)		
Oceans Act (S.C. 1996, c. 31)		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)	Arctic Waters Pollution Prevention Regulations (C.R.C., c. 354) Arctic Shipping Pollution Prevention Regulations (C.R.C., c. 353)	
Canadian Transportation Accident Investigation and Safety Board Act (S.C. 1989, c. 3)	Transportation Safety Board Regulations (SOR/92-446)	
Canada Shipping Act, 2001 (S.C. 2001, c. 26)	Response Organizations and Oil Handling Facilities Regulations (SOR/95-405) Pollutant Discharge Reporting Regulations, 1995 (SOR/95-351) Environmental Response Arrangements Regulations (SOR/2008-275) Ballast Water Control and Management Regulations (SOR/2006-129) Vessel Pollution and Dangerous Chemicals Regulations (SOR/2012-69)	Oil Handling Facilities Standards – TP12402 Environmental Prevention and Response National Preparedness Plan 2008 – TP13585 Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants – TP9834E 2009 Arctic Waters Oil Transfer Guidelines, 1997 - TP10783E Response Organizations Standards – TP 12401E 1995 Guidelines for the Control of Ballast Water Discharge from Ships in Waters under Canadian Jurisdiction (TP 13617)
Navigation Protection Act		

Act	Regulation	Guideline
Marine Liability Act (A.C. 2001, c.6)	Marine Liability Regulations (SOR/2002-307)	
Fisheries Act (1985, c. F-14)	Metal Mining Effluent Regulations (SOR/2002-2222) Marine Mammal Regulations (SOR/93-56)	The Policy for the Management of Fish Habitat Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Safe Containers Convention Act (R.C.C. 1985, c. S-1)		
Transport of Dangerous Goods Act (1992, c. 34)	Transportation of Dangerous Goods Regulations (SOR/2001-286)	
Explosives Act (1985 c.E-17)	Explosives Regulations (C.R.C., c. 599) Ammonium Nitrate and Fuel Oil Order (C.R.C., c. 598)	
National Fire Code of Canada (2010)		
Nuclear Safety and Control Act (s.c. 1997, c.9)	General Nuclear Safety and Control Regulations (SOR/2000-202)	
Canadian Human Rights Act (R.S.C., 1985, c. H-6)	Canadian Charter of Rights and Freedom	
Canada Labour Code (R.S.C., 1985, c. L-2)	Canada Labour Standards Regulations (C.R.C., c. 986) Canada Occupational Health and Safety Regulations (SOR/86 304)	
Territorial Lands Act (R.S. 1985, c. T-7)	Northwest Territories and Nunavut Mining Regulations (C.R.C., c. 1516) Territorial Land Use Regulations (C.R.C. 1524) Territorial Quarrying Regulations (C.R.C. c. 1527)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c.10)	Northwest Territories Waters Regulations (SOR/93/303)	
Nunavut Act (1993 c.28)	Nunavut Archaeological and Paleontological Sites Regulations (SOR/2001-220)	
*Nunavut Land Claims Agreement Ac*t (1993, c.29)		

Act	Regulation	Guideline
Territorial - Nunavut		
Environmental Protection Act (RSNWT (nu) 1988, c E-7)	Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93) Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003) [The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport.]	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guidelines on Mercury-Containing Products and Waste Mercury Environmental Guideline for Waste Asbestos Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries Guideline for the Management of Waste Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's land Environmental Guideline for Ozone Depleting Substances
Scientists Act (RSNWT (Nu) 1988, c S-4)	Scientists Act Administration Regulations (NWT Reg (Nu) 174-96)	
Historical Resources Act (RSNWT (Nu) 1988, c. H-3)		
Territorial Parks Act (RSNWT (Nu) 1988, c T-4)	Territorial Parks Regulations (RRNWT (Nu) 1990 c T-13)	
Wildlife Act (RSNWT (Nu) 1988, c W-4)	Wildlife General Regulations (NWT Reg (Nu) 026-92) Wildlife Licences And Permits Regulations (NWT Reg (Nu) 027-92) Wildlife Management Barren-Ground Caribou Areas Regulations (NWT Reg (Nu) 099-98) Wildlife Management Grizzly Bear Areas Regulations (NWT Reg (Nu) 155-96) Wildlife Management Zones Regulations (RRNWT (Nu) 1990 c W-17) Wildlife Regions Regulations (NWT Reg (Nu) 108-98)	

Act	Regulation	Guideline
Commissioner's Land Act (RSNWT 1988, c C-11)	Commissioner's Airport Lands Regulations (NWT Reg (Nu) 067-97)	
	Commissioner's Land Regulations (RRNWT 1990, c C-13)	
Safety Act (RSNWT 1988, c.S-1)	General Safety Regulations (RRNWT (Nu) 1990 c S-1)	
	Work Site Hazardous Materials Information System Regulations (RSNWT 1988, C 81 (Supp))	
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	Mine Health And Safety Regulations (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	Workers' Compensation General Regulations (Nu Reg 017-2010)	
Apprenticeship, Trade And Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	Apprenticeship, Trade And Occupations Certification Regulations (RRNWT (Nu) 1990 c A-8)	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	Annual Vacations Regulations (RRNWT 1990, c.L-1)	
	Educational Work Experience Regulations (RRNWT 1990, c.L-2)	
	Employment of Young Persons Regulations (RRNWT 1990, c.L-3)	
	Labour Standards Meal Regulations (RRNWT 1990, c.L-4)	
	Notice of Termination Exemption Regulations (RRNWT 1990 c.L-5)	
	Pregnancy and Parental Leave Regulations (RRNWT 1990, c.8(Supp.))	
	Reciprocating Jurisdiction Order (RRNWT 1990, c.L-6)	
	Wages Regulations (RRNWT 1990, c.L-7)	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	Electrical Protection Regulations (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	Explosives Regulations (RRNWT (Nu) 1990 c E-27)	
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	Petroleum Products Tax Regulations (RRNWT (Nu) 1990 c P-3)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	Fire Prevention Regulations (RRNWT (Nu) 1990 c F-12)	

Act	Regulation	Guideline
Hospital Insurance And Health And Social Services Administration Act (RSNWT 1988, c T-3)	Territorial Hospital Insurance Services Regulations (RRNWT (Nu) 1990 c T-12)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	Camp Sanitation Regulations (RRNWT (Nu) 1990 c P-12) General Sanitation Regulations (RRNWT (Nu) 1990 c P-16)	
All-Terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	All-Terrain Vehicles Regulations (RRNWT (Nu) 1990 c A-1)	
Motor Vehicles Act (RSNWT (Nu) 1988, c M-16)	Large Vehicle Control Regulations (RRNWT (Nu) 1990 c M-30) Motor Vehicle Registration And Licence Plate Regulations (RWT Reg (Nu) 054-94)	
Public Highways Act (RSNWT (Nu) 1988, c P-13)	Highway Designation And Classification Regulations (NWT Reg (Nu) 047-92)	
Transportation of Dangerous Goods Act (1990. RSNWT (Nu) 1988, c 81 (Supp))	Transportation Of Dangerous Goods Regulations (1991, NWT Reg (Nu) 095-91)	

Appendix C • Dust Management Plan

AGNICO EAGLE

MELIADINE GOLD PROJECT

Dust Management Plan

MARCH 2017

VERSION 3

Executive Summary

Agnico Eagle Mines Limited (Agnico Eagle) will use best management practices to minimise dust generation from becoming airborne at the mine site, Itivia, and all access, service, and haul roads. This includes identification of major sources of dust, implementation of dust mitigation measures, inspections for unacceptable levels of dust, and recording dust monitoring data to document Agnico Eagle's success in controlling and reducing dust at the Meliadine Project. The Dust Management Plan focuses primarily on dust generated from roads, with some reference to other mining activities. Dust generated from other mining activities, such as the tailings storage facility, are addressed in other plans, including the Mine Waste Management Plan.

Dust could potentially be generated by such activities as road use, drilling, blasting, crushing, conveying, loading, hauling, unloading, stockpiling, and by wind erosion of dry, exposed mine areas. Dust emissions will be prevalent during late spring and summer, while being much reduced in fall and winter.

Mitigation measures to control dust include mine design and operational procedures. Operational practices, such as speed limits and road maintenance, will assist in reducing dust. Water and, if necessary, chemical dust suppressants will be used to control and reduce dust on roads and other mine areas when airborne dust becomes a safety hazard or impacts on sensitive natural areas. The Itivia bypass road will not have any chemical dust suppressants applied. Only water will be applied on this portion of the road for dust suppression.

Dust suppression measures will be in place during construction, operations, and closure.

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Document Control

Version	Date	Section	Page	Revision	Author
1	April 2014			Version 1 of the Dust Management Plan	John Witteman, Env. Consultant, Agnico Eagle
2	April 2015	7.2	8	Update plan for Water Licence application - Added EK-35 and DUST-STOP to chemical dust suppressants approved for use in Nunavut	John Witteman, Env. Consultant, Agnico Eagle
3	April 2017			General review of the plan	Environment Department, Agnico Eagle Mines
4	March 2018			Minor modifications	Environment Department, Agnico Eagle Mines

1. Introduction

The Dust Management Plan (the Plan) is a framework for the management and control of dust[13] (airborne particulate matter) arising from traffic related to mine activities. Best management practices are identified to minimize and reduce the impact of dust on the natural and human environment.

The Plan identifies the sources of dust along with measures for their control during mine construction, operation, and closure.

2. Climate

The Meliadine Gold Project (Project) is located in the low Arctic eco-climate characterized by long cold winters and short cool summers. The frost-free period can be as short as 90 days and have prolonged periods with no precipitation. The 30-year climate normals for Rankin Inlet (1971 to 2000) indicate that wind speeds are relatively high, averaging more than 19 km/h every month.

Dust can be a problem at certain times of the year. During the winter and early spring, dust does not pose a significant problem as snow and ice cover most surfaces. However, surfaces that are exposed to the wind can result in dust, especially if ice resulting from fall rains is not present to bond fine particles together. However, in the late spring and summer, and under the right conditions, dust generation could present an issue at the mine site and along its roads. In late spring when temperatures remain below freezing, sublimation tends to cause mine surfaces, including roads, to be dry leading to a potential for dust generation. In summer, when evaporation is high and with little rain, mine surfaces and roads can again be dry. The combination of low precipitation and drying winds promote dust generation from developed areas where work is underway and where vehicle traffic is present, especially if mitigation measures are not employed. High winds by themselves can also erode dust from exposed mine surfaces.

3. Related Documents

3.1 Environment Management and Protection Plan

The Environmental Management and Protection Plan (EMPP) provides Agnico Eagle with overarching direction to environmental and socio-economic management for the Project throughout its life (i.e., across all Project phases). It is a site-specific plan that describes the systematic means by which Agnico Eagle will consistently manage and control potentially adverse impacts, and enhance potential project benefits identified through the Environmental Assessment process and the subsequent licensing and permitting of the Project.

The EMPP offers enough flexibility to respond to changes, for example, in the mining development plan, the regulatory regime, the biophysical and socio-economic environments, technology, research results, best management practices, and the understanding of traditional knowledge. Thresholds and indicators to trigger management actions are provided in the sub plans embedded in the EMPP, along with a system of accountability.

3.2 Air Quality Monitoring Plan

In the Air Quality Monitoring Plan (Agnico Eagle 2015), dust monitoring is expected throughout all phases of the mine, during all seasons, at various locations on the mine site, along the All-weather Access Road (AWAR), and at the Rankin Inlet Itivia land-based facilities area (Itivia). The principle monitoring means are anticipated to be particulate fallout measurements.

The Air Quality Monitoring Plan outlines how dust monitoring data will help in verifying if the actual effects from air emissions are less than those predicted in the FEIS. The data collected will provide feedback for continuous improvement in dust mitigation measures. If the dust monitored indicates more dust than expected, adaptive management will be used to understand the reason for the elevated levels and recommend mitigation measures to reduce it.

4. Environmental, Safety and Operational Effects of Dust

The Project is anticipated to generate dust representative of local overburden and rock type. There should not be enrichment of any metal in the dust. Agnico Eagle will use all reasonable and practicable measures to minimise dust generated from the Project.

4.1 Environmental Concern

Physical and chemical stresses on the tundra environment are commonly associated with unpaved roads. Dust generated by vehicle traffic along the roads is carried by the prevailing wind onto the surrounding tundra where it is deposited onto the vegetation and waterbodies.

Chemically inert dust can have negative effects on sensitive receptors such as vegetation. It can accumulate on leaf surfaces and negatively affect leaf physiology. Dust has a shading effect, which reduces the amount of photosynthesis and increases the leaf temperature through incident solar radiation being absorbed by the dust, thus increasing the transpiration rate (Agnico Eagle 2008). Adverse impacts might occur on the wildlife that depend upon the vegetation as a food source. Dust carried off the roads can eventually wash into the local waterbodies adding suspended solids to the water, which can adversely affect water quality and possibly the health of aquatic species.

4.2 Safety Concern

Dust generated by vehicle traffic along roads and other mine surfaces is typically fine, inorganic particulate matter. It reduces visibility along roads, thereby increasing the risk of vehicle accidents. Inhalation of fine particulate matter can potentially cause adverse health effects, especially in persons with pre-existing respiratory problems.

4.3 Operational Cost Concern

Excessive dust when drawn into a vehicle's engine can result in rapid clogging of vehicle air filters, diminishing engine performance and increasing maintenance costs. While the engines are equipped with air filters, the finer sized particulate matter can pass through these filters, getting into the engine where it can cause premature scouring and wear on the pistons and other moving components, thereby leading to a need for more frequent maintenance and shortening the life of the engine.

5. Sources of Dust

The greatest source of dust at mine sites is vehicle traffic on unpaved roads (Thompson and Visser 2001). Dust emissions will vary by the time of week, as well as the time of year. Dust will be more prevalent during the late spring and summer than during winter. Dust emissions are anticipated to be greatest during the operation of the AWAR, when traffic along the road will be at its peak (e.g., on days when additional road traffic is required due to barge unloading and transport to the mine site).

The most significant sources of dust during construction, operations, and closure include the following:

- Preparation of ground surface for construction through stripping, excavating, covering, and/or stockpiling;
- Wind erosion of exposed mine surfaces – e.g., roads, ore stockpiles, waste rock storage facilities, and dry stack tailings;
- Vehicle traffic on unpaved roads and other mine surfaces – haul, service and access roads, pit ramps, other vehicle travel areas (e.g. waste rock storage facilities, storage pads, laydown pads, parking lots);
- Material handling and transfer – loading, hauling, unloading, crushing, conveying;
- Open pit mining activities – drilling, blasting; and
- Closure activities such as covering the tailings, decommissioning of other mine areas, and scarification of roads.

Dust from buildings where people are working such as the mill, maintenance shop and warehouse is expected to be minimal due to the use of bag houses or equivalent means to control dust.

6. Dust Suppression

Dust suppression measures, which are considered to be typical of current mine practices and consistent with best management practices, are expected to achieve desired results through design, operations, and closure.

6.1 Design-Based Dust Suppression Measures

In assessing dust emissions associated with the Project, consideration was given to those mitigation measures that were considered integral in the mine design. Design-based means of dust suppression include:

- The mine site will be compact thereby reducing the area where dust generation can occur;
- Dry stack tailings were selected as the preferred form of tailings. These will be trucked from the mill to a tailings storage area northwest of the mill[14];
- Roads were designed as narrow and short as possible while maintaining safe construction and operation practices. This reduces the surface area of roads and the potential to generate dust;
- To minimize dust during construction and operations, coarse sized rock will be used as much as possible in building roads, pads, and laydown areas;
- If possible, road construction will largely occur during the winter when the generation of dust is at its lowest;

[14] Details on the use of dry stack tailings and how dust arising from them will be mitigated can be found in Mine Waste Management Plan

- Sheds, enclosures, covers, and/or bag houses will be used on most crushing and processing equipment to limit dust emissions; and
- Most outside conveyer belts will have covers.

6.2 Operation-Based Dust Suppression Measures

Best management practices will be used to control and suppress dust emissions from the Project. Dust suppression during operations include:

- Overburden stripped in opening the open pits is anticipated to be prone to wind erosion, and will be stored with the core of the waste rock storage facilities;
- Roads will be regularly graded to mix excessive silt found on the road surface with the coarser materials located deeper in the roadbed. This will reduce the percentage of silt in the road surface with the benefit of reducing related dust;
- As needed, roads and travel areas will be topped with aggregate and stabilized, which will minimize erosion and dust emissions;
- Where appropriate, larger sized aggregate will be used on the road surface to replace material lost due to wind and water erosion;
- Water and/or approved chemical dust suppressants recognized by the Government of Nunavut will be applied as needed to reduce airborne dust and improve visibility on access, service, haul roads, pit ramps and other travel areas. This will remove a safety hazard;
- The Itivia bypass road will not have any chemical dust suppressants applied. Only water will be applied on this portion of the road for dust suppression.
- Dust aprons will be used on open pit, production drills, where practical during all open pit drilling to control dust emissions;
- Should further rock crushing occur in the quarries along the access roads, the crushers location will be best shielded from the prevailing wind, preferably behind a high wall in the quarry so as to reduce the quantity of wind-blown dust, and to have as much dust as possible fall within the bounds of the quarry;
- The maximum speed limit on the AWAR will be 50 km/hr but will be lower where required for safety reasons (e.g., approaches to bridges, intersections, etc.);
- The number of mine vehicles on the AWAR will be kept to a minimum (e.g., vans and buses are to be used to transport employees to and from the Rankin Inlet airport);
- Maximize the transport of materials from Itivia to the mine site in late summer when rain events are more common, and in the fall when the road surface is frozen and less susceptible to dust generation;
- Regularly inspect the road and undertake timely repairs to minimize the silt loading on the road surface;
- Avoid multiple handling of materials that have the potential to generate dust, where possible;
- Conveyor loads will be kept within designated load limits, and conveyor covers used, where practical;
- Stockpiles will be of a suitable height, width and slope to minimise wind effects;

- Employees and contractors will be encouraged to report excessive dust to their supervisor; and
- Contractors for activities that have the highest potential for dust generation are required to submit detailed work plans that indicate dust mitigating practices and procedures. This may include the modification of activities to reduce the dust created by their activities.

6.3 Closure-Based Dust Suppression Measures

Closure will include the following dust suppression measures:

- The tailings storage facility will be covered progressively, with an engineered cover, thereby isolating it from the environment and preventing dust generation;
- Other exposed mine areas subject to wind erosion will also be covered with waste rock;
- Open pits will be flooded;
- All roads will be scarified and bridges and culverts removed thereby making the roads impassable to large vehicles and associated dust generation. Scarification will also allow plants to establish on the former roads and, in doing so, prevent wind and water erosion; and
- During operations, obsolete roads will be closed and scarified.

7. Access, Service and Haul Roads

For the Phase 1 AWAR, Agnico Eagle committed to apply active controls on the road surfaces to reduce dust. These controls could include actions such as using water or applying chemical dust suppressants. Although literature does not provide a control efficiency for regular maintenance of the road surfaces, the commitment by Agnico Eagle to maintain the road surface is expected to have benefits with respect to the amount of dust generated (Agnico Eagle 2011b).

The nature of the road surface and the size distribution of the material, in particular the percentage content of silt and fine sand (2 µm to 75 µm), directly influences the potential to generate dust (Thompson and Visser 2001). The greatest sources of dust on a mine site are the disturbance of granular surfaces, and this normally occurs when materials are handled or when vehicles pass over an unpaved surface[15]. Of the two, by far the largest source of dust is vehicle traffic on unpaved roads; this has been estimated to reach 70 percent in some instances (*Cecala 2012*). The mechanical grinding of surface materials on the road and their breakdown under the weight of vehicle wheels creates dust, while the air turbulence created by the vehicle causes dust to become airborne. The amount of dust generated along a road is dependent on the dryness of the road surface, the percentage of silt on the

[15] Volume 5 of the Final Environmental Impact Statement Atmospheric, Environment and Impact Assessment, section 1.4 Emissions Estimation provides details on how dust emissions can be calculated for various mine sources (*Golder Associate 2013*).

road surface, the number of vehicles, weight and vehicle speed, weather conditions[16], and maintenance of the driving surface.

The composition of the road surface will be analysed to determine what dust suppression measures will work best. Different types of road surfaces dictate different approaches to dust control. Kissel (*2003*) makes the following recommendations based on the particle size distribution of material on the road surface:

- *Gravel with few fines.* In gravel road surfaces with not enough fines, only watering will be effective. Chemical dust suppressants can neither compact the surface (because of the poor size gradation) nor form a new surface, and water soluble suppressants will thus leach.
- *Sand.* In compact sandy soils, bitumens, which are not water-soluble, are the most effective dust suppressant. Water-soluble suppressants such as salts, lignons, and acrylics will leach from the upper road surface. However, in loose, medium, and fine sands, bearing capacity will not be adequate for the bitumen to maintain a new surface.
- *Good size gradation.* In road surfaces with a good surface particle gradation, all chemical suppressant types offer potential for equally effective control.
- *Silt.* In road surfaces with too much silt (greater than about 20 to 25%), no dust suppression program is effective, and the road should be rebuilt. In high-silt locations, chemical suppressants can make the road slippery, and there is an inability to compact the surface or maintain a new road surface because of poor bearing capacity. Further, rutting under wet conditions requires that the road be graded, which destroys chemical dust suppressant effectiveness. If the road cannot be rebuilt, watering is the best option.

Optimally designed and maintained roads offer the best means of controlling dust but it does not remove the potential for dust generation completely. The potential for dust generation decreases significantly when road design and maintenance are combined with the application of water and/or chemical dust suppressants.

7.1 Dust Suppression Using Water

Water remains the most readily available means of controlling dust in Nunavut. It is common at mine sites worldwide to apply water through fantail sprayers or spray bars attached to a haul truck or equivalent fitted with a large tank. Agnico Eagle recognises that water is only a temporary measure, and reapplications could be necessary to achieve the desired dust control efficiency[17]. The control

[16]Humidity, frequency of days with rain, mean daily evaporation rates, and the prevailing wind speed and direction. Wind erosion contributes to road dust emissions, especially when strong winds combined with vehicle traffic moves the dust generated far afield.

[17] Regular light watering is more effective than infrequent heavy watering (Thompson and Visser 2007).

efficiency of water applications is dependent on the amount of water applied, the time between re-applications, penetration depth of the water into the road surface, the traffic volume, prevailing weather conditions, and the state of the road surface (e.g., excessive fines over coarse material). All these variables need to be considered before selecting water to control dust from roads and other mine areas. If water is selected to suppress dust, Agnico Eagle will use it with a greater frequency near critical areas along the roads.

Watering the roads is only possible during frost-free days. In late spring significant sublimation can be expected when the temperatures remain below freezing, which can lead to dry roads and significant dust potential. If water is applied while the temperature is below freezing, it will turn to ice on the road and pose a safety hazard for travel. Dust suppression using water or chemicals will not be possible at this time of the year.

7.2 Chemical Dust Suppression

Chemical dust suppressants offer advantages over water under the right conditions. They tend to have the benefit of a reduced treatment frequency over water. However, use of chemical suppressants under all conditions does not necessarily lead to improved dust suppression over that of water. Presently, only fresh water, seawater, DL10, calcium chloride, EK-35 and DUST-STOP are approved for use in Nunavut. Other chemical dust suppressants can be approved for use in Nunavut following their assessment by the Government of Nunavut's Environmental Protection Service.

Numerous types of chemical suppressants are available; broad categories that encompass those approved for use in Nunavut are as follows:

- Wetting agents are designed to increase the ability of water to adhere to and spread over the dust particle. This increases the bulk density of the particle and leads to agglomeration. Calcium chloride ($CaCl_2$) is one such wetting agent.
- Binders hold particulates together and can provide long-term dust suppression on roads. DL10, EK-35, and DUST-STOP are examples of binders approved for use in Nunavut (*GN 2014*).
- Crusting agents work best on inactive storage piles. They are reasonably long lasting, rain resistant, and wind proof. None are approved for use in Nunavut.

Table C.1 provides a comparison of the advantages and disadvantages of using water, wetting agents, and binders for dust suppression.

Analysis of the road surface will be considered when the decision on whether to use chemical dust suppressants or not is made. The chemical dust suppressant most likely to be used by Agnico Eagle is calcium chloride; however, its use will be kept to a minimum to prevent damage to vegetation adjacent to the road and to mitigate the risk of creating an attractant to wildlife (salt lick effect). It will be used selectively where it will be more effective than water alone, and where it will not adversely

affect the environment immediately next to the road. As calcium chloride is susceptible to leaching, Agnico Eagle will not use it within 30 metres of waterbodies or sensitive plant communities.

Table C.1. Comparison of Dust Suppressants

Dust Suppressant	Advantages	Disadvantages
Water	- no environmental impacts - readily available	- short term dust suppression, requires frequent re-application - works better than chemical dust suppressants on roads having greater than 20 – 25 % silt on the driving service or having a majority of sand - can cause water erosion if too much is applied
Calcium chloride	-effective in climatic areas when relative humidity greater than 30% -less frequent applications required than water	- possible impact on water and aquatic species when washed from the road and into the environment - soil salinization and impact on plant life; attractant for wildlife - not effective when road surface has greater than 20 – 25 % silt or has a majority of sand on the driving surface
Oil based binders (DL10)	- effective and long lasting	- may have adverse impacts on vegetation, soil, water and aquatic life
Organic binders (EK-35, DUST-STOP)	- effective and applied directly to road surfaces- Less frequent applications than water	- significantly more expensive to use than water - limited effectiveness if road has greater than 20 to 25 % site on the driving surface, it is better to use water under this condition

Adapted from Alberta Environment 2012

As part of its Meliadine Update Technical Study Phase 2, 2015 Agnico Eagle plans to use saline groundwater as the primary dust suppressant (Agnico Eagle 2015). If this proves not to be sufficiently efficient, Agnico Eagle will evaluate other dust suppression techniques and chemical dust suppressants with the results to be used in selecting the chemical dust suppressant(s) that will work best at the Project. If the selected dust suppressant is not calcium chloride, DL10, or some other approved product, Agnico Eagle will request that the Department of Environment carry out an assessment.

7.3 Planned Dust Suppression

During the peak season where dust suppression is required, Agnico Eagle will complete daily inspections of the road and, on an as-needed basis, will apply water and/or a mix of $CaCl_2$ and water along the length of the AWAR, as well as the Bypass Road (when completed).

Other chemical suppressants will be tested to evaluate the performance in terms of dust suppression. It is Agnico Eagle's intention to use best management practices with regards to dust suppression along all of its roads.

7.4 Maintenance of the Road Surface for Dust Suppression

Agnico Eagle recognizes that inspection precedes maintenance and a good inspection program will lead to the early identification of areas of the roads where improvements are necessary. The early resolution of any deficiencies will result in less ongoing maintenance and repair of the driving surface (Agnico Eagle 2011a). It will also lead to less dust generation.

The amount of dust generated is a function of the composition of the road surface. If there is a significant percentage of silt size particles on the road surface, one can expect greater dust generation. Likewise, any reduction in the percentage of silt on the road surface leads to an equivalent reduction in dust. Grading roads provides relief from excessive dust by mixing silt sized material on the road surface with coarser road materials found deeper in the roadbed.

On an ongoing basis, unpaved roads and travel areas are topped with new aggregate and graded, with goals of improving safety, minimizing erosion, and reducing dust emissions. This is required as unpaved road constantly lose surface material through wind and water erosion, and from vehicles throwing material off the road.

8. Thresholds for Initiating Dust Suppression

Table C.2 outlines the thresholds Agnico Eagle will use at the Project to initiate mitigation measures.

Dustfall measurements are regularly be collected along the roads and other parts of the mine site using passive sampling methods to record the quantity of dust collected over time, and to allow the success of mitigation measures to be quantified. The monitoring data will be used to adjust mitigation measures to improve dust management strategies.

Table C.2. Thresholds and Mitigation Measures

Location	Frequency	Indicator	Threshold	Mitigation Measure
Itivia laydown and Oil Handling Facility	routine inspection by Itivia supervisor during summer period.	- measured dustfall. - deterioration of visibility along road.	- deterioration of visibility. - safety concern. - dust reaching Hamlet.	- use water and/or dust suppressant to control the dust.
AWAR and bypass road	regular weekly or more frequent inspection by road supervisor during the late spring and summer periods.	- measured dustfall. - deterioration of visibility along road.	- deterioration of visibility. - safety concern. - high dust levels evident near significant waterbodies.	- use water and/or dust suppressant in areas requiring attention. - grade the road surface. - add new granular material to the road surface. - temporarily lower the speed limit on the road.
Mine site, including travel areas, haul and service roads	regular weekly or more frequent inspection by site services supervisor during the late spring and summer periods.	- measured dustfall.	- deterioration of visibility. - safety concern. - dust reaching Meliadine Lake.	- use water and/or dust suppressant on exposed surfaces such as parking areas, pads, haul, access and service roads, dry stack tailings. - review mitigation measures in place. - add new granular material to surface, - if applicable, grade the surface. - temporarily lower speed limit on site.
Ramps in the open pits	regular inspection by pit supervisor during summer period.	- deterioration of visibility.	- deterioration of visibility. - safety concern.	- use water as a dust suppressant.

Table adapted from Baffinlands 2010

8.1 The Role of the Road Supervisor

The road supervisor[18] will conduct periodic inspections (minimum weekly) of roads to ensure that they are maintained for safe travel of personnel, equipment, and supplies. These inspections will be recorded and any deficiency recorded and followed up by a corrective plan.

In areas or times identified by the Agnico Eagle road supervisor as being prone to high dust levels, where safe road visibility is impaired, or in areas where dust deposition could impact waterbodies or the Hamlet, the road supervisor will arrange mitigation measures as appropriate. This could involve actions such as grading of the road surface, addition of aggregate to the road surface, watering of the road surface and/or using an approved chemical dust suppressant.

The bypass road will receive special attention and extra dust suppression measures may be taken to avoid dust impinging on Nipissar Lake.

Adaptive management will be used when inspections or monitoring shows the generation of dust to be greater than anticipated and that additional mitigation measures are required. As well, if dust is unexpectedly generated where it was not anticipated, adaptive management will be used to understand the source and find ways to reduce or eliminate the same.

9. Dust Management Plan Update

The Plan will be reviewed annually and updated if there are changes in operations and/or technology.

[18] The open pit supervisor will do the same for the open pit ramps.

10. References

Agnico Eagle (Agnico Eagle Mines Limited). 2008. Dust Suppression Protocol for the Meadowbank Gold Mine Site Roads and for the All Weather Access Road to Baker Lake. (NIRB Project Certificate Condition #74

Agnico Eagle. 2011a. Meliadine Exploration Project, Operations & Maintenance Manual for the Phase 1 All-Weather Access Road.

Agnico Eagle. 2011b. Phase 1 – Meliadine All-weather Access Road Project Description and Environmental Assessment.

Agnico Eagle 2015. Meliadine Update Technical Study Phase 2,2015. Internal company report by Agnico Technical Services group. *Petrucci F., Proulx M.,Larouche J.,Caron D. and all*,January 2015.

Alberta Environment. 2012. Used oil as a Dust Suppressant, Acceptable Industry Practices.

Baffinlands 2010. Environmental Impact Statement**,** Volume 10 – Environmental Management.

Cecala, A.B. 2012. Dust Control Handbook for Industrial Minerals Mining and Processing. Report of Investigations 9689.

GN (Government of Nunavut) 2014. Environmental Guideline for Dust Suppression on Unpaved Roads Department of Environment.

Golder Associates. 2013. m Final Environmental Impact Statement, Volume 5 Atmospheric Environment.

Kissel, F.N. 2003. Handbook for Dust Control in Mining. U.S. Department of Health and Human Services.

Thompson, R.J. and Visser, A.T. 2001. Mine Haul Road Dust Emission and Exposure Characterisation. Department of Engineering, University of Pretoria.

Thompson, R.J. and Visser, A.T. 2007. Selection, performance and economic evaluation of dust palliatives on surface mine haul roads. Volume 107**,** Journal of the Southern African Institute of Mining and Metallurgy.

AGNICO EAGLE

MELIADINE GOLD PROJECT

Spill Contingency Plan

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VERSION 7
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ᓂᕆᐅᓇᖕᒋᑦᑐᓂᒃ ᑯᕕᔪᖅᑲᖅᐸᒧᑦ ᐸᕐᓇᐅᑎ (ᐸᕐᓇᐅᑎ) ᐊᒡᓃᑯ ᐅᔭᕋᒃᑕᕆᐊᑦ ᓕᒥᑎᑦ (ᐊᒡᓃᑯᒃᑯᑦ)-ᑯᑦ ᐱᕙᓪᓕᐊᓂᖅᑲᖅᑐᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒌᓗᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐱᓕᕆᐊᖅ) ᐅᑯᓂᖕᒐᑦ ᐱᓕᕆᐊᖅᑲᖅᑐᑦ: ᑕᓯᕐᔪᐊᕐᒥᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᐊᕚᔪᒪᔪᖅ, ᑳᖏᖅᓱᓂᕐᒥᑦ ᐃᑎᕝᕙᐊᓂᑦ ᐱᕐᑯᑎᒋᔭᐅᔪᑦ ᐊᒻᒪᓗ ᐅᑭᐅᓗᒃᑖᖅ ᐊᑉᕐᑯᑎ (AWAR) ᐊᒻᒪᓗ ᐃᓚᒋᔭᐅᔪᑦ ᐊᑉᕐᑯᑏᑦ ᐃᓂᐅᔪᒥᑦ ᐊᒻᒪᓗ ᐊᑯᓐᓂᖓᓐᓂᑦ, ᐃᓚᐅᑉᓗᓂ ᑳᖏᖅᓱᓂᕐᒥᑦ ᐊᑉᕐᑯᑎᐅᔪᖅ.

ᑖᒪ ᐸᕐᓇᐅᑎ ᐊᒡᓃᑯᒃᑯᓐᓂᑦ ᐃᒃᐱᒍᓱᖕᓂᖅᑲᖅᑎᑦᑎᔪᖅ ᐊᑐᖅᑐᒃᑖᓂᒃ ᑲᓇᑕᒥᑦ ᐊᒻᒪᓗ ᐊᕕᒃᑐᖅᓯᒪᔪᓂᑦ ᒪᓕᒐᕐᓂᑦ, ᒪᓕᒐᕋᓖᓂᑦ, ᐊᒻᒪᓗ ᒪᓕᒃᑕᐅᔪᒃᓴᓂᑦ ᑯᕕᔪᓄᑦ ᓄᓇᒧᑦ, ᐃᒪᕐᒧᑦ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓃᑦ ᓯᑯᒧᑦ. ᑯᕕᔪᐃᑦ ᐃᓱᒪᒋᔭᐅᔪᑦ "ᐅᖅᑲᐅᓯᕆᔭᕆᐊᓖᑦ ᑯᕕᔪᑦ" ᒪᓕᒃᓱᒋᑦ ᐊᑐᖅᑐᑦ ᒪᓕᒐᐃᑦ ᐊᒻᒪᓗ ᒪᓕᒐᕋᓚᑦ ᐊᒡᓃᑯᒃᑯᑦ ᐅᖅᑲᐅᓯᕆᓂᐊᖅᑕᖓᑦ NT-NU-ᑯᓐᓄᑦ 24-ᐃᑲᕐᕋᓄᑦ ᐅᒃᑯᐃᖕᒐᔪᖅ ᑯᕕᔪᖅᑲᖅᐸᑦ ᐅᖅᑲᐅᓯᕆᕝᕕᖕᒧᑦ ᐅᖅᑲᓘᑎ, ᑲᓇᑕᒥᑦ ᓄᓇᖅᑳᖅᑐᓕᕆᔩᑦ ᐊᒻᒪᓗ ᐅᑭᐅᖅᑕᖅᑐᒥᑦ ᐱᕙᓪᓕᐊᔪᓕᕆᔩᒃᑯᑦ, ᑲᓇᑕᒥᑦ ᐊᕙᑎᓕᕆᔩᒃᑯᑦ, ᐃᖅᑲᓗᓕᕆᔩᒃᑯᑦ, ᑭᕙᓪᓕᕐᒥᑦ ᐃᓄᐃᑦ ᑲᑐᔾᔨᖃᑎᒌᒃᑯᑦ, ᐊᒻᒪᓗ ᓄᓇᕗᒻᒥ ᐃᒪᓕᕆᔩᒃᑯᑦ.

ᑐᕌᒐᖓ ᐸᕐᓇᐅᑎᐅᑉ ᒥᒃᓵᓂᐊᕐᓗᒋᑦ ᐊᒃᑐᖅᓯᓂᐅᔪᑦ ᑯᕕᔪᓂᑦ ᓴᖅᑭᑦᑎᓗᓂ ᖃᐅᔨᓴᐅᕙᕇᖅᓯᒪᔪᑦ ᐅᐸᓗᐊᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐸᕐᓇᐅᑏᑦ ᖃᓄᐃᓕᐅᕆᐊᖃᕐᓂᕐᒧᑦ, ᐊᒻᒪᓗ ᒥᐊᓂᕆᓗᒋᑦ ᐅᓗᕆᐊᓇᖅᑑᑎᙱᓪᓗᒋᑦ ᐱᓕᕆᓃᑦ ᐊᒻᒪᓗ ᑳᓐᑐᕌᒃᖅᑲᖅᑐᑦ ᑯᕕᔪᖅᑲᕋᔭᖅᐸᑦ. ᑖᒪ ᑐᕌᒐᐅᔪᖅ ᑎᑭᐅᑎᓂᐊᖅᑐᖅ ᐊᑐᕐᓗᒋᑦ ᐱᐅᓖᑦ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ, ᐊᕙᑎᓕᕆᓂᕐᒥᒃ ᐅᔾᔨᕈᓱᒃᑎᑦᑎᓗᓂ ᐊᒻᒪᓗ ᐊᑦᑕᕐᓇᖅᑐᖅᑲᙱᑎᑦᑎᓗᓂ, ᐃᑲᔪᖅᑐᕐᓗᒍ ᐱᑕᖅᑲᖅᑕᐃᓕᑎᑦᑎᓂᖅ ᐊᒻᒪᓗ ᐱᓕᕆᐊᖅᑲᑦᑕᕐᓂᖅ, ᐊᒻᒪᓗ ᓴᓗᒪᖅᓴᐃᑎᑦᑎᑦᑎᐊᖅᑲᑦᑕᕐᓗᓂ ᑯᕕᔪᓂᑦ ᓄᓇᒧᑦ, ᐃᒪᕐᒧᑦ, ᓯᑯᒧᑦ ᐊᒻᒪᓗ ᐊᐳᑎᒧᑦ.

ᐊᑯᑉᓕᖅᑎᑭᐲᑦ ᐱᓕᕆᐊᖑᔪᖅ ᐸᕐᓇᐅᑎᒧᑦ ᐃᓚᐅᔪᑦ ᐱᐅᖕᒋᑦᑐᖅᑕᓖᑦ, ᑭᓂᖅᑐᑦ ᐊᒻᒪᓗ ᓯᑎᔪᑦ ᐅᓗᕆᐊᓇᖅᑐᑦ ᐊᑯᑉᓕᖅᑎᑭᐲᑦ, ᐊᒻᒪᓗ ᐳᑉᓚᐃᑦ ᐅᖅᓯᐃᑦ. ᐊᓯᖏᑦ ᖃᓄᐃᑦᑑᓂᖏᑦ ᑯᕕᔪᑦ ᓲᕐᓗ ᐃᒪᖅᐅᓯᕝᕙᖕᓂᑦ ᑯᕕᔪᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐊᒃᑕᑯᓂᖖᒌᖅᑐᑦ ᐃᓂᐅᔫᖖᒋᑦᑐᓂᒃ ᐊᒃᑐᖅᓯᓂᖅᑭᖕᓇᖅᑐᑦ ᐃᓱᒪᒋᔭᐅᖕᒥᔪᑦ.

ᑯᕕᔪᖅᑲᖅᐸᑦ ᑐᐊᕕᓇᖅᑐᓄᑦ, ᓯᕗᓪᓕᖅᐸᐅᑎᔭᕆᐊᓖᑦ ᖃᓄᐃᓕᐅᕈᑎᒋᓂᐊᕐᓗᒋᑦ ᐅᑯᐊᖑᔪᑦ: (1) ᐊᑦᑕᕐᓇᖅᑐᖅᑲᙱᒃᑲᓗᐊᕐᓂᖕᒐᓄᑦ, (2) ᐅᐸᓗᑲᐅᑎᒋᓗᓂ, ᐊᒻᒪᓗ (3) ᐅᖅᑲᐅᓯᕆᓗᒍ ᑯᕕᔪᖅ. ᐸᕐᓇᐅᑎ ᑕᑯᒃᓴᐅᑎᑦᑎᔪᖅ ᐅᐸᓗᐊᓂᕐᒧᑦ ᐋᖅᑭᒃᓯᒪᔪᑦ ᐊᒻᒪᓗ ᑐᓴᐅᒪᑎᑦᑎᓂᕐᒧᑦ, ᐊᒻᒪᓗ ᑎᑎᕋᖅᓯᒪᑉᓗᑎᒃ ᑐᐊᕕᓇᖅᑐᖅᑕᖅᐸᑦ ᐅᐸᓗᐊᓂᐊᕐᓗᑎᒃ ᖃᐅᔨᒋᐊᕐᕕᐅᔭᕆᐊᓖᑦ. ᐃᓄᒃ, ᐃᓚᐅᓂᖅᑲᓗᐊᖅᑐᖅ ᑯᕕᔪᒥᑦ, ᐅᕝᕙᓘᓐᓃᑦ ᓯᕗᓪᓕᖅᐸᐅᑉᓗᓂ ᖃᐅᔨᔪᖅ, ᓯᕗᓪᓕᖅᐸᐅᔪᖅ ᐅᐸᓗᐊᓂᕐᒧᑦ. ᓯᕗᓪᓕᖅᐸᐅᔫᑉ ᖃᐅᔨᑎᓐᓂᐊᖅᐸᖓ ᐃᓱᒪᑕᕆᔭᖓ ᐅᕝᕙᓘᓐᓃᑦ ᖃᓄᐃᓕᔪᖅᑲᖅᐸᑦ ᑲᒪᔨᒧᑦ, ᑖᒪ ᐱᔭᒃᓴᐅᑎᖅᑲᓂᐊᖅᑐᖅ ᑯᕕᔪᖅᑲᖅᐸᑦ ᐅᐸᓗᐊᓂᕐᒧᑦ. ᐊᒡᓃᑯᒃᑯᑦ ᑐᐊᕕᓇᖅᑐᓄᑦ ᐅᐸᓗᐊᓂᖅᑲᖅᓂᐊᖅᑐᑦ (ERT) ᐊᔪᕈᓐᓃᖅᓴᖅᑕᐅᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᐃᑲᔪᕐᓗᑎᒃ ᐅᐸᓗᐊᓂᕐᒧᑦ ᑯᕕᓂᖅᑲᔪᐊᖅᑐᓄᑦ, ᐱᔭᕆᐊᖅᓂᖅ ᐊᑐᕐᓗᒍ. ᐃᓚᒋᔭᐅᔪᓗᒃᑖᑦ ERT-ᑯᓐᓄᑦ ᐊᔪᕈᓐᓃᖅᓴᖅᑕᐅᓯᒪᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᖃᐅᔨᒪᓗᑎᒃ ᑐᐊᕕᓇᖅᑐᓕᕆᓂᕐᒥᒃ ᐊᒻᒪᓗ ᐅᐸᓗᐊᓂᕐᒧᑦ ᐱᕝᕙᐅᖅᑲᑦᑕᖅᑕᑐᓂᒃ, ᐸᕐᓇᐅᑎᒥᒃ, ᐊᒻᒪᓗ ᑐᐅᕙᓇᖅᑐᒥᒃ ᑯᕕᔪᖅᑲᖅᐸᑦ ᐅᐸᓗᐊᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᓂᒃ. ERT-ᖑᔪᑦ ᐊᔪᕈᓐᓃᖅᓴᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐱᓕᕆᐊᖅᑲᕐᓂᕐᒧᑦ ᐅᓗᕆᐊᓇᖅᑐᓂᒃ ᐊᑐᖅᑕᐅᔪᓂᑦ (ᐊᑐᖅᑕᐅᔪᓂᒃ ᐊᑦᑕᕐᓇᖅᑐᖅᑲᖕᒋᓐᓂᕐᒧᑦ ᓈᓴᐅᑏᑦ/ᑎᑎᖅᑲᐅᑏᑦ ᐊᓕᓚᔪᖅ) ᐊᒻᒪᓗ ᐅᐸᓗᐊᔪᖕᓇᖅᓱᑎᒃ ᐅᓗᕆᐊᓇᖅᑐᖅᑲᙱᑦᑐᒃᑯᑦ ᐊᑐᖅᓱᑎᒃ ᓇᖕᒥᓂᖅ ᒥᐊᓂᖅᓯᔾᔪᑎᓂᒃ. ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᓱᓇᑐᐃᓐᓇᓄᑦ ᐊᐅᓚᑦᑎᔨ, ᐊᕙᑎᓕᕆᔨᒃᑯᓐᓄᑦ ᐊᖏᔪᖅᑳᖅ, ᐋᓂᐊᖅᑕᐃᓕᒪᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᑦᑕᕐᓇᖅᑐᖅᑲᖕᒋᓐᓂᕐᒧᑦ ᐊᖏᔪᖅᑳᖅ ᐊᒻᒪᓗ ᐋᓂᐊᖅᑐᓂᒃ ᑲᒪᔨᐅᔪᑦ ᖃᐅᔨᒪᔭᐅᔪᑦ ᐃᓚᒋᔭᐅᑎᐊᕐᓂᖕᒋᓐᓄᑦ ᑯᕕᔪᖅᑲᖅᐸᑦ ᑐᐊᕕᓇᖅᑐᓄᑦ ᐅᐸᓗᐊᓂᕐᒧᑦ.

ᑯᕕᔪᖅᑲᖅᐸᑦ ᐅᐸᓗᐊᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᖃᑦᑕᖅᑐᑦ ᐃᓕᔭᐅᓯᒪᓂᐊᖅᑐᑦ ᐱᔭᐅᔭᕆᐊᖅᑲᖅᑐᓂᑦ ᐃᓂᐅᔪᒥᑦ. ᑕᒪᕐᒥᓗᒃᑖᑦ ᐃᖕᒋᕐᖃᔭᒍᑏᑦ (ᓄᓇᐅᑉ ᖃᖕᒐᓂᑦ ᓄᓇᒃᑰᕈᑎᕐᔪᐊᑦ) ᐱᖃᕐᓂᐊᕐᒥᔪᑦ ᑯᕕᔪᓄᑦ ᑐᐊᕕᓇᖅᑐᖅᑲᖅᐸᑦ ᐊᑐᖅᑕᐅᔪᒃᓴᓂᑦ. ᐃᖕᒋᕐᖃᔭᒃᑐᖅ ᐊᕙᑎᒥᒃ ᑐᐊᕕᓇᖅᑐᓄᑦ ᐅᓯᔭᐅᖃᑦᑕᖅᑐᖅ ᐃᓂᐅᔪᓕᕆᓂᐊᖅᑐᖅ. ᐅᒥᐊᕐᔪᐊᒃᑯᑦ ᐅᓯᔭᐅᖃᑦᑕᖅᑐᑦ ᑐᖅᑯᖅᓯᓯᒪᕝᕚᑦ

Δ⊃⌐ᖁᖏᑐᑦ ძᕕᐸᖏᐸᑦ ᑐᐊᕕᓇᖏᑐᓄᑦ ᐊᑐᖏᑕᐅᖁᑦᑕᖏᑐᓂᒃ ᐊᓪᒪ⊃ ᐱᕋᐢᑎᑕᖁᕋᓂᐸᖏᖅ ᑭᓭᒥᑕ 18-ᒥᑦ Δᖁ⊃ᔪᕋᖅᒥᑦ ᐊᓪᒪ⊃ Δᑎᕕᐊᓂᑦ (ᓯᖅᐅᖁᕋᓇᐅᑎᓵ⊃ᔪ).

ᖁᓄΔ⌐ᐅᑏᓂᕋᒧᑦ <ᕋᓇᐅᑦᑦ ᓯᓂᓵ⌐ᔨᒥᑦ Δᓭᐅᓂᐊᖏᑐᑦ ᐊᑐᖏᑕᐅᖁᑦᑕᖏᑐᑦ ᐊᓪᒪ⊃ ძᕕᐸᖏᐸᑦ ᐊᐅᓭᑎᓂᕋᒧᑦ ᐊᓪᒪ⊃ ᓄᖏᖅᓚᑎᑦᑎᓂᕋᒧᑦ ᐊᑐᖏᑕᐅᖁᑦᑕᖏᑐᑦ (ᓯᕋ⊃ Δᒪᕋᒧᑦ ᐊᑐᖏᑕᐅᖁᑦᑕᖏᑐᑦ ᑕᒪᐅძᐊᖅᓗΔᑦ). ᐊᑐᖏᑕᐅᐳᐅᑐᓂᒃ ᐊᑐᑭᓱᓇᕋᓂᒪᔪᓄᑦ ᐊᑐᖁᑦᑕᕋᓂᐸᖏᑐᑦ ᐊᑐᕋ⊃ᓪᑦ ᒥ⊃ᖅᐅᓵᑦ, ძᕕᖏᑕΔᐟᔪᓵᑦ, ᑕᒪᐅძᐊᖅᓗΔᑦ ᐊᓪᒪ⊃ ᑐᖏძᕐᓯᓯᒪᕐᓇᐳᕋᓂᑦ. ᒥ⊃ᐅᐟᔪᓵᑦ ᐊᑐᖏᑕᐅᓂᐊᖏᑐᑦ ᒥ⊃ᓱᓂᐊᕋ⊃ᓪᑦ ძᕕᓱᓂძΔᑦ. ᐱᐅᖅᓪᑐᑐᖏᑕᖁᖏᑐᑦ ᐊᑐᖏᑕᐅᔪᓂᑦ ᐱᕆᐅ⊃ᓪᑦ, ᑐᖏძᖏᓯᓯᒪᕐᓇᐳᕋᑕᐅ⊃ᓪᑎᑦ ᐊᓪᒪ⊃ ᓇ⊃ᓇΔᐟძᑎᖏᑕᐅ⊃ᓪᑎᑦ ᑐᖏძᖏᑕᐅᓯᒪᓭᐅᐱᓪᓚᐅᓂᒃ. ᖁᓄΔᑦᑐᓂᖅᓚ ᐱᐅᖅᑭᑐᓪᑐᓵᑦ ᐊᑐᕋ⊃ᓪᑐᑕ, ᓯᑎᓂᐅᔪᑦ ᐱᓪᓕᐊᖅᔨᐊᖏᑐᑦ Δᓂᐅᔪᒥᑦ (ᐊᐟᑕძᕋᖅᐟ) ᐅᐸᓇᓵᓂᓂᑦ ᐊᐅᓭᖅᑎᑕᐅᕐᓕᓪᓚᑎᐟ ᐱᓪᓕᐊᖁᑭᖅᓇᕋᓂᑦ ᐊᓪᒪ⊃ ᐊᐟᑕძᑭᖅᓇᓂᓄᑦ.

EXECUTIVE SUMMARY

The Spill Contingency Plan (Plan) for the Agnico Eagle Mines Limited (Agnico Eagle) Meliadine Gold Project (Project) covers: the proposed Meliadine site, Rankin Inlet Itivia land-based facilities and All-weather Access Road (AWAR) and associated roads on-site and in between, including the Rankin Inlet bypass road.

This PLAN ensures that Agnico Eagle respects all applicable federal and territorial laws, regulations, and guidelines for spills to land, water and/or ice. Spills that are deemed "reportable spills" pursuant to applicable laws and regulations will be reported by Agnico Eagle to the NT-NU 24-Hour Spill Report Line, Aboriginal Affairs and Northern Development Canada, Environment Canada, Department of Fisheries and Oceans, Kivalliq Inuit Association, and Nunavut Water Board.

The goal of the Plan is to minimize the impacts of spills by the establishment of predetermined lines of response and plans of action, and to protect the safety of workers and contractors in the event of a spill. This goal will be achieved by applying best management practices, by promoting environmental awareness and safety, by encouraging prevention and maintenance, and by facilitating efficient cleanup of spills, releases, or discharges to land, water, ice and snow.

Substances covered by the Plan include hydrocarbon products, liquid and solid hazardous substances, and compressed gas. Other types of spills such as seepage from water containment structures or waste sources that could affect off site receptors are also considered.

For all spill emergencies, priority actions are: (1) ensure safety, (2) respond quickly, and (3) report the spill. The Plan outlines response organization and communication lines, and lists emergency response contacts. The person, who is the primary person involved in a spill, or the first to observe a spill, is the first responder. The first responder shall contact a Supervisor or the Incident Commander, which will be responsible for initiating appropriate spill emergency response. Agnico Eagle will have an Emergency Response Team (ERT) that will be trained and will support in the response of major spills, as needed. All members of the ERT will be trained and familiar with emergency and spill response resources, the Plan, and appropriate emergency spill response methodologies. The ERT members receive basic training on hazardous materials handling (Material Safety Data Sheets) and are equipped to respond safely while wearing Personal Protective Equipment. The General Mine Manager, Environment Superintendent, Health and Safety Superintendent and Health care personnel are all identified as key elements to spill emergency response.

Spill response kits will be strategically located where required on-site. All mobile equipment on-site (surface heavy equipment) will also be equipped with an emergency spill kit. A mobile environmental emergency trailer will be located on-site. Sea cans with spill response equipment and supplies will also be located near the Meliadine River at Km 18 and at Itivia (during barge season).

Action plans will first involve standard and appropriate spill control and containment techniques (e.g., dikes and trenches, floating booms, etc.). Free-product will be recovered as much as possible using vacuums, pumps, etc. and placed in appropriate containers. Absorbent materials will be used to soak up residual products. Contaminated materials will be salvaged, put into appropriate containers, and labelled for temporary storage. Depending on the nature of the contamination, solid materials will be either treated on-site (landfarm), or eventually shipped off-site to an approved treatment and disposal facility.

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Version	Date	Section	Page	Revision	Author
1	October 2012			First draft of the Spill Contingency Plan	John Witteman, Env. Consultant, Agnico Eagle
2	March 2013			DEIS re-submission	Rebranding
3	April 2014	7	23-24	Included Tables 7-2 and 7-3 as per Information Request answer (TC_149)	John Witteman, Env. Consultant, Agnico Eagle
		6.5	21	Included commitment from technical review wrt TDGR.	
		App. H	A-32 A-36	Completed regulations table (ref. information requests)	Josée Noël, Env. Coord., Agnico Eagle
4	April 2015			Update for Type A Water License Application	John Witteman, Env. Consultant, Agnico Eagle
5	December 2015			Comprehensive revision and updates. Adapted to licenses B (MEL1424, 2BW-MEL1525 and 8BC-MEL1516) and future Type A Water License	Environment dept., Agnico Eagle
6	March 2017			Spill kit list and spill kit location updated	Alexandre Gauthier, Environment dept., Agnico Eagle
7	March 2018			Annual review	Jessica Huza Alexandre Gauthier, Environment dept., Agnico Eagle

Approved By:

Jessica Huza
General Supervisor Environment

DISTRIBUTION LIST

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Agnico Eagle – Engineering Superintendent
Agnico Eagle – Health and Safety Superintendent AEM – Geology Superintendent
Agnico Eagle – Mill Superintendent
Agnico Eagle – Maintenance Superintendent AEM – Mine Superintendent
Agnico Eagle – Energy & Infrastructure Superintendent
Agnico Eagle – General Services Superintendent

IMPLEMENTATION SCHEDULE

The implementation schedule for this Plan is effective immediately (December 2015) subject to any modification proposed by the NIRB and/or NWB as a result of the review and approval process.

ACRONYMS

INAC	Indigenous and Northern Affairs Canada
Agnico Eagle	Agnico Eagle Mines Limited
ANFO	Ammonium Nitrate – Fuel Oil, a type of explosive
AWAR	All-Weather Access Road
DFO	Department of Fisheries and Oceans Canada
ERT	Emergency Response Team
IQ	Inuit Qaujimajatuqangit
KIA	Kivalliq Inuit Association
MSDS	Material Safety Data Sheet
NIRB	Nunavut Impact Review Board
NT	Northwest Territories
NU	Nunavut
NWB	Nunavut Water Board
PLAN	Spill Contingency Plan
PPE	Personal Protective Equipment
Project	Meliadine Gold Project
RMMS	Responsible Mining Management System
TSF	Tailing Storage Facility
WHMIS	Workplace Hazardous Materials Information Sheet
Water Licence	Type A Water Licence No. 2AM-MEL1631
WRSF	Waste Rock Storage Facility

1.1 Purpose and Scope

The goal of the Spill Contingency Plan (Plan) is to minimize the impacts of spills by the establishment of predetermined lines of response and plans of action, and to protect the safety of workers and contractors in the event of a spill.

This goal will be achieved by applying best management practices, by promoting environmental awareness and safety, by encouraging prevention and maintenance, and by facilitating efficient cleanup of spills, releases, or discharges to land, water, ice, and snow related to Agnico Eagle Mines Limited Meliadine Project (Project).

This Plan has been designed to facilitate effective communication and efficient cleanup of spills of potentially hazardous materials. Hazardous materials include and are not limited to:

- hydrocarbon products such as diesel fuel, gasoline, hydraulic oil;
- soluble solids, such as ammonium nitrate pill;
- liquids, such as glycols and paints;
- corrosive liquids, such as sulphuric acid and sodium cyanide;
- compressed (inert and flammable) gas; and,
- Seepage from waste related structures that could affect off site receptors.

Furthermore, the objectives of this Plan are to:

- comply with federal and territorial laws, regulations, and guidelines;
- identify roles, responsibilities, and reporting procedures;
- detail plans of action to be followed in the event of a spill at the Project;
- provide readily accessible emergency information to the cleanup crews, management, and government agencies;
- promote the safe and effective recovery of spilled materials; and,
- minimize the environmental impacts of spills to land, water and/or ice and snow.

This Plan applies to all Agnico Eagle employees and any contractors associated with:

- the proposed Project site including Itivia fuel storage facility; and,
- the All-weather Access Road (AWAR) and associated roads on-site and in between including by-pass road in Rankin Inlet.

1.2 Related Documents

Documents containing information related to this Plan, submitted as part of the Type A Water Licence No. 2AM-MEL1631 (Water Licence) include the following management plans:

- Environmental Management and Protection Plan;
- Risk Management and Emergency Response Plan;
- Explosives Management Plan;
- Borrow Pits and Quarries Management Plan;
- Roads Management Plan;
- Landfill and Waste Management Plan;
- Hazardous Materials Management Plan;
- Water Management Plan; and,
- Waste Management Plan.

1.3 Use of Inuit Qaujimajatuqangit in Spill Management

Inuit Qaujimajatuqangit (IQ) is the most successful and oldest monitoring practice in Nunavut, where the resource users do the observing or monitoring. Information collected through IQ can contribute to mine design and planning, as well as monitoring activities. Agnico Eagle is committed to including IQ and public concerns stemming from IQ, where practical, in the design of management and monitoring plans for the Project.

This Plan considers IQ, including traditional ecological knowledge, traditional land use, and concerns regarding Project effects on traditional resources and traditional land use sites. The IQ indicates that the Project area is important for the traditional harvesting of caribou, other land mammals, waterfowl and geese, fish and vegetation, and maintaining the health of these resources so that traditional land use activities can continue. This Plan is designed to minimize the potential impacts of spills to land, water, and/or ice and snow and focuses on promoting environmental awareness, encouraging prevention and maintenance, and facilitating efficient cleanup of spills, releases, or discharges to land, water, ice, and snow as follows:

- Predetermined lines of response and plans of action will be established.
- Spill prevention will occur though regular inspections of storage areas for leaks and hazardous materials, and the training of workers in the use of safe work and spill clean-up procedures.
- Spill response kits are strategically located where required on-site and all mobile equipment on-site (surface heavy equipment) are required to be equipped with an emergency spill kit. A mobile environmental emergency trailer and a designated and trained emergency response team will also be located on-site, and sea cans with spill response equipment and supplies will also be located at km 7 and 18 along the AWAR.
- Spill and emergency response equipment will be installed at hazardous material storage areas.
- To minimize potential impacts to surface water, groundwater, and soil from potential vehicle accidents, a maximum speed of 50 km/hr on the AWAR is applied to all vehicles (empty and transporting hazardous materials). All employees and contractors using the roads will carry spill response equipment.

2.1 Classification of Spills

For the purposes of this Plan, a major spill is defined as an accidental release of a large or small quantity of material into the environment that has the potential for adverse impact, and cannot be handled safely without the assistance of the Emergency Response Team (ERT), including all events where a person is injured or contaminated. The ERT must be notified immediately of a major spill or emergency and will respond accordingly. As an example, for the purpose of this Plan, a tanker truck overturned on the AWAR is considered a major spill. Major spills will be reported to the NU/NT Spill Report Line @ 867 920 8130, fax 867 873 6924, spills@gov.nt.ca.

A minor spill is defined as any spill of material that does not involve highly toxic, highly reactive, or explosive chemicals, in a situation that is not life threatening to humans, fish or wildlife. Furthermore, this type of spill presents a manageable physical or health hazard to personnel who, when wearing proper personal protective equipment (PPE), will not be exposed to any chemical at a level that exceeds any recognized action levels or permissible exposure limits. Minor spills will be reported to the Environment Department but are not expected to involve emergency responders.

2.2 Materials and Reportable Spills on-site

To ensure compliance with Section 36 (3) of the *Fisheries Act*, all spills of fuel or hazardous materials, regardless of quantity, into a waterbody or onto ice will be reported immediately to the NT-NU 24-Hour Spill Report Line[1].

As a precaution, if there is any doubt as to whether the quantity spilled meets the minimum reportable thresholds listed in Table 2-1 (AANDC 2010), the spill incident will be reported to the Spill Report Line. Furthermore, Agnico Eagle will maintain a detailed log of all spills of hazardous materials, including non-reportable spills. As part of Agnico Eagle's overall Responsible Mining Management System (RMMS), and for continuous improvement of environmental performance, procedures will be implemented to ensure that employees communicate non-reportable spill incidents and clean them up as required.

[1] Nunavut Environmental Protection Act. *Consolidation of Spill Contingency Planning and Reporting Regulations* R-068-93.

Table 2-1 Spill Quantities to be Reported to the Spill Report Line[(a)]

Transportation Class	Type of Substance	Compulsory Reporting Amount
1	Explosives	Any amount
2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity exceeding 100 L
2.2	Compressed gas (non-corrosive, non-flammable)	Any amount from containers with a capacity exceeding 100 L
2.3	Compressed gas	Any amount
2.4	Compressed gas (corrosive)	Any amount
3.1, 3.2, 3.3	Flammable liquid	100 L
4.1	Flammable solid	25 kg
4.2	Spontaneously combustible solid	25 kg
4.3	Water reactant solids	25 kg
5.1	Oxidizing substances	50 L or 50 kg
5.2	Organic peroxides	1 L or 1 kg
6.1	Poisonous substances	5 L or 5 kg
7	Radioactive substances	Any amount
8	Corrosive substances	5 L or 5 kg
9.1 (in part)	Miscellaneous substances	50 L or 50 kg
9.2	Environmentally hazardous	1 L or 1 kg
9.3	Dangerous wastes	5 L or 5 kg
9.1 (in part)	PCB mixtures of 5 ppm or more	0.5 L or 0.5 kg
None	Other contaminants	100 L or 100 kg

[(a)] *Nunavut Environmental Protection Act*. *Consolidation of Spill Contingency Planning and Reporting Regulations* R-068-93.
Note: PCB = polychlorinated biphenyls; ppm = parts per million.

A variety of petroleum products and other hazardous materials are used as part of the mining operations. Explosives will also be stored on-site; details are available in the Explosives Management Plan. Other hazardous materials will be used but in smaller quantities and are presented in Table 3-1. Nonetheless, all these products are considered as potential environmental and safety hazards.

Material Safety Data Sheets (MSDS) of all materials transported, stored and used on-site will be made available at strategic locations near to where hazardous materials or toxic substances are stored or utilized. As a reference; the up-to-date MSDS's can be found on the Agnico Eagle SDS portal called ***3E-Online***. Appendices B to G also provide general response procedures for specific spilled chemical substances.

Table 3-1 Main Hazardous Materials Stored and Used On-Site

Product	Use/Location	Maximum Amount Anticipated On-Site	Maximum Amount by Unit
Process Plant Reagents			
Activated Carbon	Carbon-In-Leach	76 t	500 kg/bag (10 t/sea can)
Anti-scaling agent	Mill	5.5 t	
Borax	Refinery	17 t	3,375 kg/sea can
Hydrochloric acid	Elution-Regeneration	652 t	
Copper Sulfate	Cyanide Destruction	345 t	2,500 kg/bag (20 t/sea can)
Sodium cyanide	Carbon-In-Leach	1,414 t	1,000 kg/bag (19 t/sea can)
Flocculant	Grinding	46 t	750 kg/bag (15 t/sea can)
Lead Nitrate	Carbon-In-Leach	-	
Lime	Carbon-In-Leach	1734 t	1,743 kg/bag
Silica	Refinery	17 t	
Sodium Hydroxide	Elution-Regeneration	133 t	1,000 kg/bag
Sodium Metabisulfite	Cyanide Destruction	1,758 t	1,000 kg/bag
Sodium Nitrate	Refinery	17 t	5.1 t/sea can
Sulfur Prills	Cyanide Destruction	0 t	1,000 kg/bag (20 t/sea can)
Water Treatment Reagents			
Ferric Sulfate	Water Treatment Plant	260 t	1 t/bag
Lime	Water Treatment Plant	320 t	1,743 kg/bag
Flocculant	Water Treatment Plant	5 bags	750 kg/bag (15 t/sea can)
Caustic Soda	Sewage Treatment Plant	1 t	22.5 kg/pail
Soda Ash	Sewage Treatment Plant	365 kg	25 kg/bag

Citric Acid	Sewage Treatment Plant	50 kg	25 kg/bag
Chlorine (NaOCl)	Sewage Treatment Plant	962 L	20 L/bucket
Acetylene	Welding	830 bottles	11 m^3 / bottle
Paints	Maintenance	180 gal.	1 gal./pail
Solvents	Maintenance	56 gal.	1 gal./pail
Lead acid batteries (12V)	Maintenance	386	
Fuel Products			
Diesel	**Itivia**		
	1- Itivia Oil Handling Facility	20 ML	20 ML tank
	2- Itivia Oil Handling Facility	13.5 ML	13.5 ML tank
	3- Itivia Oil Handling Facility (Sustaining)	4 ML	4 ML tank
	Industrial site Tank Farm		
	4- Site Main Fuel Tank	6 ML	6 ML tank
	5- Site Fuel Tank summer	250,000 L	250,000 L
	6- Powerhouse	50,000 L	25,000 L/tank
	7- Process Plant	10,000 L	10,000 L/tank
	8- Mechanical shop (Oil)	10,000 L	1,000 L/tank
	Portal #1 Mine Site Tank Farm		
	9- Site Main Fuel Tank	3 ML	3 ML
	10- Site Fuel Tank summer	250,000 L	250,000 L/tank
	11- Site Fuel Tank Measure for UG	2,000 L	2,000 L/tank
	12- Site Fuel Tank UG heating Intake West	25,000 L	25,000 L/tank 25,000 L/tank
	13- Site Fuel Tank UG heating Intake East	25,000 L	10,000 L/tank
	Underground		
	14- UG Fuel Tank UG level 325	50,000 L	10,000 L/tank
	15- UG Fuel Tank (Sustaining)	10,000 L	10,000 L/tank
Motor Oil	Mechanical shop	800,000 L	20,800 L/sea can
	Powerhouse		
Hydraulic Fluid	Mechanical shop		Cubes or Barrels
	Powerhouse		Cubes or Barrels
	Process Plant		Cubes or Barrels
Ethylene glycol	Mechanical shop	60,000 L	10,000 L/sea can

SECTION 4 • PREVENTION AND INSPECTIONS

Spill response is reactive while spill prevention is proactive. Spill prevention, response, and reporting will be part of the online induction which is mandatory for anyone coming to work at the Meliadine site. As well, all staff will be trained to call the Environment Department in the event of a major spill and to notify their supervisor in the event of a minor spill. Spill kits will be made available to assist with retaining the spill or starting cleanup, if safe to do so. Upon arriving and inspection of the spill site, if potential hazards are present, call ERT or initiate a Code 1.

Regular worksite inspections are conducted to identify measures to minimize or prevent the risk of spills. As part of online orientation sessions, all staff is to understand the steps to be undertaken in the event of a spill. This includes that all spills are to be reported, and that containment and clean-up is necessary for all minor and/ or major spills. Following the clean-up of a spill, the Environmental Department will inspect the spill site and, if necessary, collect samples to verify that the clean-up is complete.

All personnel are trained to be aware of the potential hazards associated with the fuel/chemicals with which they will be assigned to work. In addition to work site inspections conducted by area specific employees, the Environmental Department conducts weekly inspections to audit facilities where hazardous materials are handled and stored.

Agnico Eagle will implement the following general principles for spill prevention:

- provide up-to-date and accessible MSDS for all hazardous materials to designated emergency response personnel and mine health staff, and to the Rankin Inlet health center staff;
- regular inspection of fuel/chemical storage areas for leaks (including flex connectors and plumbing) and platform shifting;
- regular inspection of hazardous materials storage areas;
- train workers in the use of safe work procedures for hazardous materials, and procedures to clean up spills;
- encourage workers to take reasonable measures to prevent spills;
- keep drums/containers sealed or closed;
- place drums/containers within a suitable form of secondary or spill containment.
- segregate incompatible materials;
- ensure chemical storage areas are adequately protected from weather and physical damage; and,
- provide adequate spill response materials at storage areas (details of spill prevention and response equipment are outlined in Section 7 • Response Equipment).

During site orientation, inductions are scheduled to ensure employees have an understanding of the steps to be undertaken in the event of a spill. All employees and contractors will be shown where spill kits are stored, will be aware of their contents, and will be familiar with using spill equipment and responding to spills.

Figure 5-1 illustrates Agnico Eagle's spill/incident reporting procedure and the following sub-sections list the major responsibilities of site staff that will be participating in the emergency response.

5.1 First Responder

The person who is the primary person involved in a spill, or the first to observe a spill, is the first responder. The responsibilities of the First Responder are as follows:

- If considered safe to do so after initial assessment, STOP the spill using equipment contained in spill response kits, if required.
- in case of a tanker truck overturn or other type of major spill where human life is threatened or the spill is uncontrollable, initiate Code 1. Remain on radio to provide guidance to the ERT;
- in case of spill to land, ice or water, contact the Supervisor and/or the Environment Department to report the incident;
- identify spilled product and contain the spill, IF SAFE TO DO SO; and,
- participate in spill response as a member of the cleanup crew.

5.2 Supervisor

The responsibilities of the Supervisor are as follows:

- initially assess the severity of the incident;
- contact the ERT Incident Commander and/or the Environment Department;
- gather facts about the spill; and,
- participate in spill response as a member of the cleanup crew.

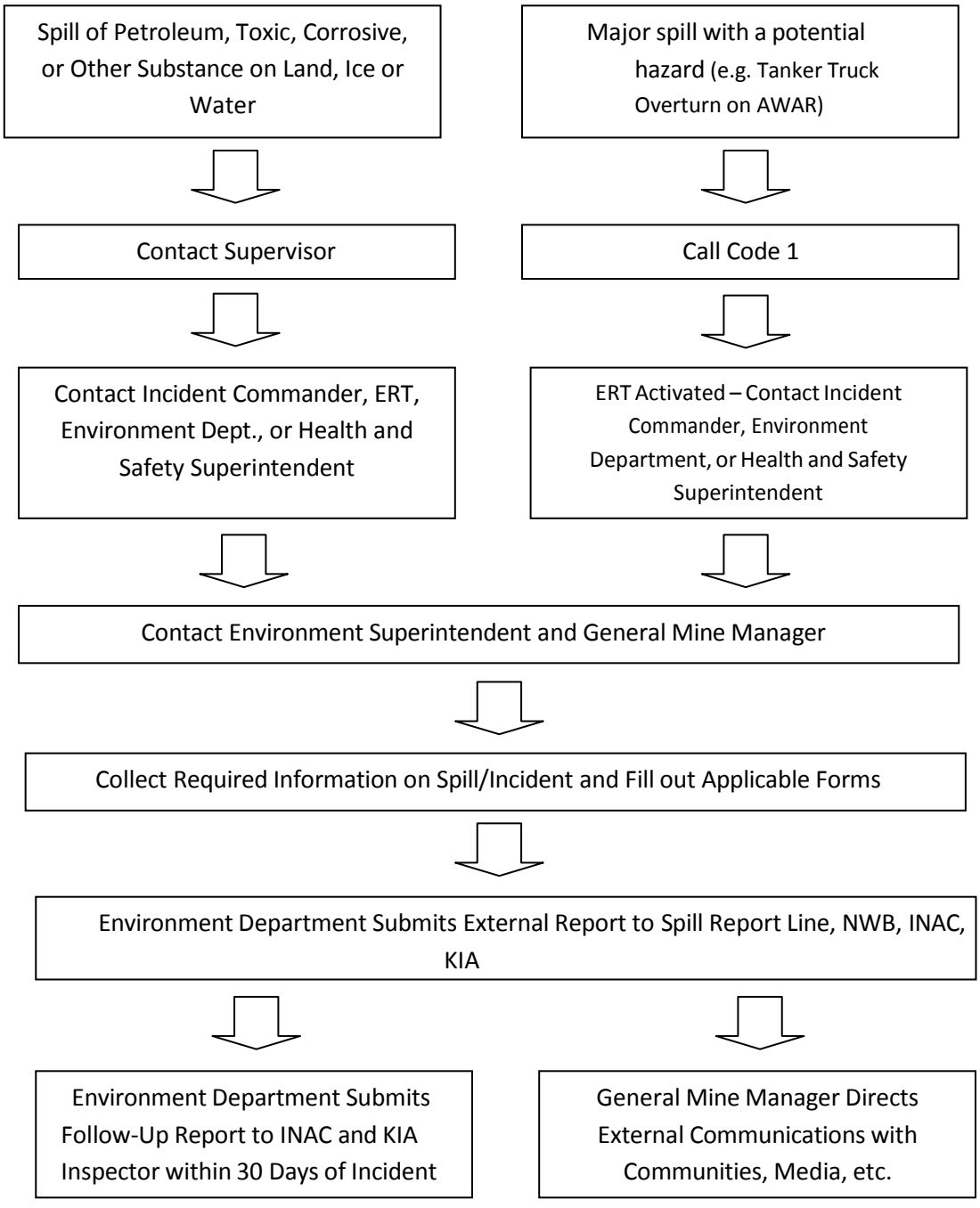

Figure 5-1 Spill/Incident Reporting Procedure

5.3 Environment Incident Coordinator

Responsibilities of the Environment Incident Commander are as follows:

- assume complete authority over cleanup personnel and the spill scene;
- assume responsibility for all mitigation efforts;
- evaluate the initial situation and assess the magnitude of the problem;
- activate the initial response plan;
- alert and assemble key personnel in the ERT, as deemed appropriate, to handle the situation;
- in consultation with the Environment Superintendent or designate, develop the overall plan of action for containment and cleanup, and direct and implement the plan;
- ensure assigned responsibilities are carried out and the activities of team members are coordinated;
- assess the requirements for people, equipment, materials, and tools to contain the spill in light of what resources are immediately available - urgency will depend on the nature of the spill; and
- in consultation with the Environment Superintendent or designate, mobilize any additional resources that may be required and arrange for the transportation of necessary personnel and/or materials to the spill site.

5.4 Emergency Response Team

Prior to the commencement of construction, Agnico Eagle will have an ERT that is trained and assist for controlling major spills. For example, they will be called upon to respond to spills from potential tanker truck rollovers along the AWAR. These team members will attend regular training sessions in spill response.

5.5 Emergency Response Team Incident Commander

The responsibilities of the Emergency Response Team Incident Commander are as follows:

- assume complete authority over securing the scene prior to cleanup;
- mobilize all ERT personnel, equipment, PPE, and supplies as required to the site of the spill;
- assist the Environment Incident Coordinator in obtaining any additional resources not available on-site;
- ensure that appropriate PPE is worn and used properly;
- assist in developing and implementing emergency response training programs and exercises; and
- ensure that all spill response personnel receive adequate training to fulfil their responsibilities as part of the ERT.

5.6 Environment Superintendent

The Environment Superintendent or designate will be responsible for implementing and maintaining

the Plan. In addition, the responsibilities of the Environment Superintendent or designate are as follows:

- liaise with the Environment Incident Coordinator;
- provide technical advice on the anticipated environmental impacts of the spill;
- advise on the effectiveness of various containment, recoveries, and disposal options, and suggest the most appropriate approach;
- prepare and submit any formal report (see Appendix A for the Spill Report Form) to regulators and Agnico Eagle management detailing the occurrence of a spill;
- contact the Senior Vice President - Environment and Sustainable Development immediately in case of a major spill;
- contact the Corporate Director of Communication & Public Affairs immediately in case of a major spill;
- act as the spokesperson with regulatory and government agencies;
- if authorized by the General Mine Manager or delegate, act as a spokesperson with the public and media, as required;
- implement a sampling protocol for the collection and analysis of samples to identify and monitor possible contaminant levels resulting from the spill;
- ensure on-site resources for spill response and cleanup are available;
- monitor the effectiveness of the cleanup operation and recommend further work, if necessary
- review incident occurrences and recommend preventative measures; and,
- assist in implementing training and simulation requirements for spill response personnel.

5.7 General Mine Manager

The General Mine Manager or designate will be required to inform ERT members of the detailed nature of the operations to be performed in the event of a facility malfunction causing a spill during the operations phase. The responsibilities of the General Mine Manager or designate are as follows:

- liaise with appropriate Agnico Eagle personnel and keep them informed of cleanup activities; and,
- assist the Incident Commander and ERT as needed, particularly in obtaining any additional personnel and resources not available on-site for spill response and cleanup.

5.8 Health and Safety Superintendent

The following will be the responsibilities of the Health and Safety Superintendent or designate in conjunction with the Training Department:

- maintain emergency and health and safety records;
- assist in conducting emergency spill response exercises;
- track all emergency and health and safety training that on-site staff, including contractors, have received, and when retraining is required;

- notify the Incident Commander (related to ERT) when retraining is required;
- ensure that employees are retrained in appropriate emergency response skills prior to expiry of existing training certification (e.g., Workplace Hazardous Materials Information System (WHMIS), Hazard Communication, Occupational Health and Safety Administration, first aid, respirator fit-testing; and
- consult with appropriate organizations regarding retraining requirements and schedule.

5.9 On-Site Health Care Providers

On-site nurses are responsible to:

- provide on-site first aid and other medical support; and,
- provide additional training for ERT members.

In addition to the health care providers on-site, the Rankin Inlet health professionals will be called for assistance, if required. For example, they may be the first to respond to incidences that could occur at Itivia.

5.10 Emergency Response Team Contact Information

Table 5-1 provides contact information for select Agnico Eagle contractors present at the Project. Internal contact information is presented in Table 5-2 for all Agnico Eagle personnel involved in spill recovery and subsequent reporting. Important external contacts relating to spill response, such as regulatory agencies and health organizations, are listed in Table 5-3. Table 5-4 provides contact information for external spill response contractors should incident warrant assistance from outside sources. These tables will be updated on a minimum annual basis and updated, as required.

Table 5-1 Contractor Contacts

Title	Telephone No.	Contact in Emergency for:
Nolinor Aviation Services	Protocol Agent 867.759.3700 ext. 8008	Flight services for additional crew, or additional supplies
First Air	(867) 669-6605	Flight services for additional crew, or additional supplies
Calm Air	(867) 793-2873	Flight services for additional crew, or additional supplies
Dyno Nobel Explosives Ltd.	(867) 793-4610 ext. 6804	Heavy Equipment, Man power, Emergency Blasting
Woodward Group of Companies (Shipping)	(709) 896-2421	Fuel Hauler
M&T Enterprises, Rankin Inlet	867 645-2778	

Table 5-1 Internal Contacts

Title	Name	Telephone No.
Sr. Vice President, Environment and Sustainable Development	Louise Grondin	416.847.8656 Cell: 819.724.2020
Vice President of Environment	Michel Julien	416-947-1212 ext. 3738 Cell: 514.244.5876
Corporate director, Communications & Public Affairs	Dale Coffin	416.847.8669 Cell: 647.274.4154
Manager of Nunavut Services Group	Jason Allaire	819.759.3555 ext. 8004 Cell: 819.355.2608
Meliadine General Mine Manager	Martin Plante	819-759-3555 Cell: 819.856.1873
H&S Superintendent	Normand Ladouceur	819.759.3555 ext.6720 MBK Cell: 819.860.6258
Sr H&S Coordinators	Nathalie Ledoux Jean Ladouceur	819.759.3555 Ext 3968
Emergency Measure Counsellor	Dave Loder Darren Wilcox	819.759.3555 ext.3906
Environmental Superintendent	Nancy Duquet Harvey	819.759.3555 ext.6980 Cell: 819.856.4385
Environmental General Supervisor	Jessica Huza	819.759.3555 ext.3928 Cell: 819.856.5097
SR. Environmental Coordinator	Jennifer Brown Daniel Gorton	819.759.3555 ext.3996
Environmental Department	Environmental Technicians	819.759.3555 ext.3903 & 3925
On-site Nurses		819.759.3555 ext.3011

Table 5-3 External Contacts

Organization/Authority	Telephone Number	Fax Number
NT-NU 24-Hour Spill spills@gov.nt.ca	(867) 920-8130	(867) 873-6924
Workers Safety and Commission	(867) 979-8500	(867) 979-8501
Kivalliq Inuit Association	(867) 645-5725	(867) 645-2348
Nunavut Water Board	(867) 360-6338	(867) 360-6369
INAC Inspector	(867) 645-2830	(867) 979-6445
Department of Fisheries and Ocean (DFO) – Nunavut Regional Office	(867) 979-8000	(867) 979-8039
Manager, Environmental Protection, Government of Nunavut	(867) 975-7748	(867) 975-5981
Kivalliq Health Services – Rankin Inlet After Hours	867 645-8300 867 645-6700	
Rankin Hamlet Office	867 645-2895	
Rankin Fire Emergency	867 645-2525	
RCMP 24 Hour Emergency Number	(867) 645-1111	
Canadian Coast Guard (in the event of a spill to the marine environment) Superintendent Environmental Response	(800) 265-0237 (519) 383-1954 (519) 381-6186 (cell)	(519) 337-2498
Transport Canada – Marine Safety Jaideep Johar Ian Salisbury	 (204) 880-0754 or (204) 984-8618 (780) 495-8360	 (780) 495-8607

The primary form of ensuring safety is by using preventative measures. All personnel who will have to deal with chemicals will have training in first aid and safe materials handling, including WHMIS. In addition, regular training updates and site-specific exercises/drills will be integral to preventing incidents.

Procedures will vary depending on the season and hazardous materials spilled, as well as on location of the spill (on land, water, ice, or snow). The MSDS will be consulted to ensure that safety procedures are followed. Response procedures specific to spills on land, water, snow, and ice are presented in the following sub-sections as general guidelines.

6.1 Initial Action

For all spill emergencies, it is required that the following priority actions be undertaken:

- Ensure personal safety;
- respond quickly; and,
- report the spill.

6.1.1 Respond Safely

Responding safely involves the following:

- consult the MSDS and Product Guides for further information on the substance;
- control the spill area to prevent unauthorized access by other workers;
- Ensure adequate ventilation;
- assess whether the spill, leak, or system failure can be readily stopped or brought under control;
- stop product flow or leak if possible and IF SAFE TO DO SO;
- approach spill from upwind IF SAFE TO DO SO;
- do not contain compounds (e.g., gasoline, aviation fuel) if vapours might ignite – allow them to evaporate;
- depending on the type of compound spilled and IF SAFE TO DO SO, contain product using booms, berms, absorbent pads, earthen dike, trenches or improvise with materials at hand; and,
- wear appropriate PPE, such as impervious clothing, goggles, and gloves when containing the spill.

6.1.2 Respond Quickly

Responding quickly involves the following:

- identify the spilled material;
- stop the spill if safe to do so;
- be alert – ensure safety of yourself and others by notifying them of the incident;
- contact the Incident Commander if it is a major spill (Code 1), identify the location, and request assistance as required. The Incident Commander will mobilize the ERT if necessary
- shut off ignition sources such as vehicles and unplug electrical equipment – NO SMOKING nearby;
- attend to the injured if applicable; and,
- assess the severity of the spill.

6.1.3 Report Spill

Reporting the spill includes the following:

- obtain all necessary information to complete the external spill report and forward to Environment Department (see Appendix A). External reportable spills must be reported by Agnico Eagle Environment Staff to the NT-NU 24-Hour Spill Report Line, Aboriginal Affairs and Northern Development Canada (INAC), Kivalliq Inuit Association (KIA), NWB and NIRB.
- Submit a detailed spill follow up report to the same external stakeholders no later than 30 days after the spill. This is to be done by Agnico Eagle Environment Staff. The report shall contain the amount and type of spilled product, the GPS location of the spill, and the measures taken to contain, cleanup, and restore the spill site.

6.2 Spills on Land

Response to spills on land will include the general procedures detailed in the following section. The main spill control techniques involve the use of two types of barriers: dikes and trenches. Barriers should be placed down-gradient (down-slope) from the source of the spill, and as close as possible to the source of the spill. Barriers will slow the progression of the spilled material and will also serve as containment to allow recovery of the spilled material.

Depending on the spill volume, the site of the spill and available material, a dike may be constructed with soil, booms, lumber, snow, etc. A plastic liner should be placed at the foot of and over the dikes to protect the underlying soil or other material and to facilitate recovery of the spill material.

Dikes should be constructed to accumulate a thick layer of free product in a single area (V- shaped or U-shaped).

Trenches are useful in the presence of permeable soil and when the spilled material is migrating below the ground surface. If deemed necessary, a material specific liner should be placed on the down-gradient edge of the trench to protect the underlying soil. Liners should not be placed on the bottom of the trench to allow water to continue flowing underneath the layer floating material (such as fuel).

The use of large quantities of absorbent materials to recover significant volumes of spilled material should be avoided. Large volumes of free-product should be recovered, as much as possible, by using vacuums and pumps, and containerized. Mixtures of water and fuel may be processed through an oil-water separator. Absorbent sheets should be used to soak up residual fuel on water, on the ground (soil and rock), and on vegetation. Peat moss may also be sprinkled on vegetation to absorb films of petroleum products. Excavations will be planned for contaminated areas using heavy equipment and contaminated soil will be disposed at the Landfarm.

6.3 Spills on Water

Response to spills on water will include the general procedures provided in the following section. Various containment, diversion and recovery techniques are discussed. The following elements must be taken into consideration when conducting response operations:

- type of waterbody or watercourse (lake, stream, river);
- type of spilled material;
- water depth and surface area;
- wind speed and direction;
- water flow and direction;
- type of shoreline;
- seasonal considerations (open-water, freeze-up, break-up, frozen).
- Equipment and personnel available for first response

Containment of an oil slick in water will require the deployment of mobile floating booms, maritime barrier to intercept, control, contain and concentrate (i.e., increase thickness) the floating oil.

Measures will be taken to protect sensitive and accessible shoreline. The spill will be monitored to determine the direction of migration. In the absence of strong winds, the material will likely follow water flow direction. Measures will be taken to block and concentrate the spilled material at the discharge of a waterbody using booms where it will subsequently be recovered.

In the case of spills in larger rivers, with fast moving currents, diversion booming will be used to direct the spilled material ashore for recovery. Single or multiple booms (i.e., cascading) may be used for diversion. Typically, the booms are anchored across the river at an angle. The angle depends on the current velocity. Choosing a section of a river that is both wider (i.e., less current) and shallower makes boom deployment easier. Diversion booming may also be used to direct the spilled material away from a sensitive area to be protected.

6.4 Spills on Snow and Ice

In general, snow and ice will slow the movement of hydrocarbons or other spilled material. Snow is generally a good natural sorbent. Hydrocarbons have a tendency to be soaked up by snow through capillary action. However, the use of snow as a sorbent material will be limited as much as possible. Snow and frozen ground will also prevent spilled material from migrating down into soil or at least slow the migration process. Ice will prevent seepage of spilled material into the water. On the other hand, the presence of snow may hide the spilled material (especially oil slicks) and make it more difficult to follow its progression.

Most response procedures for spills on land can be used for spills on snow and ice. The use of dikes (i.e., compacted snow berms lined with plastic sheeting) or trenches (dug in ice) will slow the progression of the spilled material and will also serve as containment to allow recovery of the material. Free-product will be recovered by using a vacuum, a pump, or sorbent materials. Contaminated snow and ice will be scraped up manually or using heavy equipment depending on volumes. The contaminated snow and ice will be disposed at the Landfarm and treated in spring with the oil and water separator.

6.5 Disposal of Spilled Material

Contaminated materials will be salvaged, put into appropriate containers (e.g., Quatrex bags/drums), and labelled for temporary storage. Water contaminated with oil or fuel will be sent to the oil separator. Water contaminated with other products will be placed in drums for shipment. Depending on the nature of the contamination, solid materials will be either treated on-site (landfarm), or eventually shipped off-site to an approved disposal facility.

Soils contaminated with light hydrocarbons (such as gasoline or aviation fuel) will be treated on-site in a landfarm. Details on the design and operation of the landfarm are provided in the Landfarm Management Plan.

Soils contaminated with other spilled products will be segregated, packaged and shipped to an external approved facility for proper treatment and disposal. In this, Agnico Eagle will adhere to the requirements under the *Transportation of Dangerous Goods Regulations*, particularly Part 5. All contaminated materials (dangerous goods) will be shipped in a means of containment required or permitted by Part 5 of the Regulations.

6.6 Seepage management

Seepage from the tailings storage facility (TSF) and waste rock storage facilities (WRSF) will be treated as actionable and reportable spills. In the event that seepage would be observed, an action plan would be elaborated to address the problem. The action plan would include: cause identification, mitigation measures put in place to stop and/or control the seepage, clean-up actions and disposal of contaminated material if applicable and follow-up and monitoring actions.

6.7 Event Monitoring

The Event Monitoring (EM) program addresses the site specific monitoring that is required following any accidental release. A “release” may be caused by a spill or an emergency. The EM program is designed to verify whether contamination of the surface soil, nearby receiving environment and active zone has occurred as a result of an accidental release of a hazardous material or contaminated water, through monitoring of surface runoff and nearby receiving environment following remediation of any release. It is anticipated that owing to the presence of permafrost beneath most of the mine footprint, there will be minimum impact to groundwater.

The EM plan is developed on a site specific basis subsequent to a spill or accidental release, and considers the location and extent of the spill, the type of product spilled, the potential receptors and the potential for any remaining contamination after clean up. The plan is done in coordination with the Environmental Superintendent, or designate. In the event of an accidental release, the water quality of the downstream receptor and possibly upstream of the receiving point, if any, is to be sampled (during the ice-free season) and analyzed. Should the spill have happened over snow cover, water and possibly soil sampling is to take place at the earliest feasible time after thaw to verify if there has been any impact to the receiving water or soil quality. The specific parameters monitored as part of the EM program will depend on the nature of the spill, and will be determined for the specific hazardous material released.

This section addresses the emergency response machinery, equipment, tools and other resources that will be made available on-site for spill recovery measures (see Tables 7-1, 7-2, and 7-3).

Table 7-1 Equipment for Spill Emergency Response

Mobile Equipment	
Excavators	Pickup trucks
Snowmobiles	Generator
ATV	Fire truck *
Vacuum truck	Boats
Loaders	Fuel trucks
Backhoe	Haul truck
Bulldozer	Spill response trailer
Zoomboom	Bobcat
Water trucks	
Temporary Containment Systems	
Booms	Spill absorbent material
Drums Tanks	Packages/pads
Flexible bladder	Silt fencing
Temporary secondary Containment	Maritime barrier
Emergency Transportation	
Helicopter if available	Snow mobile
ATV	Boats
Sno Cat	
Communication Equipment	
Radio	Email
Phone	Wireless communication system

* Not yet available on site

If required, additional on-site equipment will be made available to assist with spill recovery. Temporary containment systems will be also available on-site and at Itivia. If required, external resources available in Rankin Inlet are listed in Table 5-2 and Table 5-4.

Communication equipment on-site will include radios, telephones, and other wireless communication systems that will be available in the event of an emergency situation.

Spill response kits will be strategically located where required on-site. Each department and work area will be responsible for providing sufficient spill response kits in their respective work areas. The kits will be kept in marked and accessible locations. The locations will notably include all fuel storage areas and chemical storage areas.

All mobile equipment on-site (surface heavy equipment) will also be equipped with an emergency spill kit and quarterly audit is performed by the Environment Department.

A mobile environmental emergency trailer, which will be easily accessible and transportable, will be located on-site and will contain the items listed in Table 7-2.

Table 7-2 Contents of Mobile Environmental Emergency Trailer

Emergency Response Equipment	
Pump centrifugal (summer only)	White oil spill pads and roll
Pump accessories, Vacuum ends	Universal booms
Tubing or pipes for vacuum or pumping	Quatrex bags
Tyvek suit and glove	Wedge wood, Plug pattie
Diesel fuel jerry can (placed on a miniberm)	Hand shovel
Leak control Kit	Sledge hammer, Re- bars
Drum opener	Pipe patch kit
Wescot (to open empty drum screw)	Absorbent pellet bag
Drums	Crow bar
Absorbent booms	Secondary containment
Tarps	
Ropes	
Evac treatment system	
Yellow liner roll (Bags)	

Environmental emergency sea cans are located near the Meliadine River at km 7 and 18 along the AWAR as well as at Itivia. Each environmental emergency sea can contains material listed in Table 7-3.

Table 7-3 Environmental emergency sea can content

Quantity	Equipment/tool name
3	Empty drum (sealed)
2	Mini berm 36”x 36”
2	4 drums berm 4’x 8’
4	Tarp 20’x 30’
4	Tarp 30’x 50’
10	Oil spill absorbent pad
5	Universal absorbent boom 5”x 10’ (for hydro-soluble chemical)
5	Universal absorbent boom 8”x 10’ (for hydro-soluble chemical)
5	Petroleum base absorbent boom 5”x 10’ (for petroleum product)
3	Maritime barrier (baffle)
2	Cell-U-Sorb (absorbent)
2	Amerisorb peat moss (absorbent)
2	Oil gator absorbent
1	Plug pattie
4	Quatrex bag and liners
2	Fork lift wood pallet
4	Hand shovel
1	Crowbar chisel
1	Ice breaker chisel
1	Sledge hammer
15	Re- bar 4’
1	½ drum containment
1	Yellow liner roll
1	Toolbox
2	Silt fence
2	Silt bag
2	EVAC System
1	45 gallon Spill Kit
1	Yellow Nylon rope roll

TABLE 7-4 Spill kit Location

Area	Location	
	Easting	Northing
Fountain tire ome, Fuel Tank	541904	6989004
Jet-A Tank	541941	6988939
Orbit Dome	541861	6988932
Gaz Station	541837	6988946
Fuel Farm	541222	6988453
DCP5	540468	6988747
DCP1	540144	6989255
Nuna Yard (beside Nuna Dome)	540048	6989058
Nuna Dome (2 SK available)	540019	6989058
Warehouse Dome	539900	6988854
Dome 1 (Brine shop)	539892	6988800
Fuel Tank Portal (Dome1)	539892	6988791
Mine Compressor Room	539838	6988848
Mine Gen Set	539834	6988853
Waste Rock Area	539806	6989147
Batch Plan Yard 1	539594	6989084
Batch Plan Yard 2	539577	6989067
Batch Plan Yard 3	539541	6989077
Batch Plan Yard 4	539539	6989060
A & K Dome	539198	6990190
A & K Industrial Pad	539138	6990034
BLAIS Industrial Pad	539027	6990361
TANGMAARVIK Industrial Pad	538917	6990253
Camp Gen Set Tank	542034	6989099
Camp Gen Set Building	542038	6989093
ANFO Plant Shop	539567	6988322
Crusher (Meliadine esker, 3 SK available)	539447	6990118
Emulsion Plant Shop	537626	6990745

8.1 Training

8.1.1 On-Site Personnel

A designated ERT consisting of on-site personnel is established. Agnico Eagle will ensure that the ERT is trained and present at all times. All members of the team will be trained and familiar with emergency and spill response resources, including their location and access, the Spill Contingency Plan, and appropriate emergency spill response methodologies. The ERT will receive 4 hours of training per quarter.

The training will include the following:

- a review of the spill response plan and responsibilities of the ERT members;
- the nature, status, and location of fuel and chemical storage facilities;
- the on-site and off-site spill response equipment and how to use it;
- distribution of MSDS sheets;
- emergency contact lists;
- worker health and safety during emergency interventions;
- communication methods and signals;
- desktop exercises of “worst case” scenarios;
- emergency evacuation;
- fires or explosions;
- emergency equipment and use;
- personal protective equipment and clothing;
- marine shoreline recovery operations; and,
- likely causes and possible effects of spills.

Every employee and contractor at the Meliadine site will receive basic spill and waste management training during their online induction, so that they are able to respond to small spills and raise the alarm if a larger response is required. The ERT members will receive more spill response training and learn how to respond while wearing PPE.

The Environment Department will regularly attend tool-box sessions to provide information on spill response and reporting procedures. The Health and Safety Department, including the Health Center staff, will be familiar with and have up-to-date MSDS available.

To prepare for emergency spill response, potential spill analysis will be conducted for a variety of potential worst case scenarios. The exercise will serve in identifying potential risk areas, as well as in determining the fate of spilled products and their environmental effects. The following example is used to demonstrate the application of the spill response as part of the spill analysis. The example is of tanker truck spill along the AWAR.

Description of incident: Roll-over of fuel tanker due to poor road conditions. The roll-over has resulted in approximately 1,000 L of fuel to the ground along the road side.

Potential causes: Vehicle accident, human error.

Hazardous product(s) spilled: Diesel fuel.

Maximum potential volume spilled: 45,000 litres.

Immediate receiving medium: Land.

Distance and direction to nearest receiving body of water: 500 metres.

Resources to protect: land and any nearby stream, river or waterbody.

Estimated emergency response time: Maximum time is 90 minutes depending on location of spill (assuming truck driver is injured and cannot commence spill response procedures). Minimum time to respond to a spill on the AWAR is 15 minutes, depending on the distance from the proposed Meliadine site.

Spill response procedures: Under this scenario, the truck driver is not injured, and therefore he acted as the first responder and immediately activated the Plan as defined in Section 6. The driver attempted to seal the leak. He tried to use the spill kit carried in the fuel truck and made all attempts to contain and recover the fuel on the ground using dikes, sumps or trenches as described in Section 6.2. A sorbent boom[2] will be used to block the flow of the fuel towards the Lake. The first responder notified the Incident Commander, ERT and Environment Department by calling a Code 1 on radio. The mobile emergency response trailer was brought to the spill site by the ERT, who assisted in digging trenches to contain and collect free-product for temporary storage. Spilled material was recovered using pumps. The Environment Superintendent immediately transmitted the information to the General Mine Manager. The fuel remaining in the tanker was pumped into a temporary storage tank using appropriate equipment. The leak stopped as the tank volume was

[2] Tanker trucks will be required to carry sorbent booms as part their spill kit.

reduced below the leaking safety valve. Pumping continued until all of the fuel was removed. The empty tanker was righted and brought back to the site. All soil was cleaned up thereafter and disposed of in the landfarm. The spill was reported to the NT/NU spill report line, KIA, and INAC. After the cleanup had been completed, the Environment Department collected soil samples to verify that no residual fuel remained at the spill site. A follow-up of the spill causes results in the development of mitigation measures including:

- Fuel deliveries from Itivia to the mine site will be suspended during poor weather or poor road conditions.
- Agnico Eagle will sand the roads when road ice poses a safety risk to travel.
- All Agnico Eagle vehicles will carry basic spill response equipment and the drivers will be trained in its use. This will allow the truck driver to act as the first responder if it is safe to do so, and attempt to contain the spill and recover any spilled product.

These mitigation measures, combined with the procedures outlined in this Plan above, will provide protection to Nipissar Lake.

INAC (Aboriginal Affairs and Northern Development Canada). 2010. Guidelines for Spill Contingency Planning. Last modified- 2010/09/15 http://www.aadnc-INAC.gc.ca/eng/1100100024236/1100100024253#sub1A_6

Agnico Eagle (Agnico Eagle Mines Limited). 2014. Oil Pollution Emergency Plan (OPEP), Final Environmental Impact Statement, Meliadine Gold Project, Nunavut, Volume 8, Support Document 8-2.

NWB (Nunavut Water Board). 2010. Guide 4 – Completing and Submitting a Water Licence Application for a New Licence and the Supplemental Information Guide for Mining and Milling (SIG-MM3 Guide).

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

Northwest Territories · Nunavut · Canada

NT-NU 24-HOUR SPILL REPORT LINE
TEL: (867) 920-8130
FAX: (867) 873-6924
EMAIL: spills@gov.nt.ca

REPORT LINE USE ONLY

A	REPORT DATE: MONTH – DAY – YEAR	REPORT TIME	☐ ORIGINAL SPILL REPORT, OR	REPORT NUMBER
B	OCCURRENCE DATE: MONTH – DAY – YEAR	OCCURRENCE TIME	☐ UPDATE # _____ TO THE ORIGINAL SPILL REPORT	
C	LAND USE PERMIT NUMBER (IF APPLICABLE)	WATER LICENCE NUMBER (IF APPLICABLE)		
D	GEOGRAPHIC PLACE NAME OR DISTANCE AND DIRECTION FROM NAMED LOCATION	REGION ☐ NWT ☐ NUNAVUT ☐ ADJACENT JURISDICTION OR OCEAN		
E	LATITUDE DEGREES MINUTES SECONDS	LONGITUDE DEGREES MINUTES SECONDS		
F	RESPONSIBLE PARTY OR VESSEL NAME	RESPONSIBLE PARTY ADDRESS OR OFFICE LOCATION		
G	ANY CONTRACTOR INVOLVED	CONTRACTOR ADDRESS OR OFFICE LOCATION		
H	PRODUCT SPILLED	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
	SECOND PRODUCT SPILLED (IF APPLICABLE)	QUANTITY IN LITRES, KILOGRAMS OR CUBIC METRES	U.N. NUMBER	
I	SPILL SOURCE	SPILL CAUSE	AREA OF CONTAMINATION IN SQUARE METRES	
J	FACTORS AFFECTING SPILL OR RECOVERY	DESCRIBE ANY ASSISTANCE REQUIRED	HAZARDS TO PERSONS, PROPERTY OR EQUIPMENT	
K	ADDITIONAL INFORMATION, COMMENTS, ACTIONS PROPOSED OR TAKEN TO CONTAIN, RECOVER OR DISPOSE OF SPILLED PRODUCT AND CONTAMINATED MATERIALS			

L	REPORTED TO SPILL LINE BY	POSITION	EMPLOYER	LOCATION CALLING FROM	TELEPHONE
M	ANY ALTERNATE CONTACT	POSITION	EMPLOYER	ALTERNATE CONTACT LOCATION	ALTERNATE TELEPHONE

REPORT LINE USE ONLY

N	RECEIVED AT SPILL LINE BY	POSITION STATION OPERATOR	EMPLOYER	LOCATION CALLED YELLOWKNIFE, NT	REPORT LINE NUMBER (867) 920-8130

LEAD AGENCY ☐ EC ☐ CCG ☐ GNWT ☐ GN ☐ ILA ☐ NAC ☐ NEB ☐ TC | SIGNIFICANCE ☐ MINOR ☐ MAJOR ☐ UNKNOWN | FILE STATUS ☐ OPEN ☐ CLOSED

AGENCY	CONTACT NAME	CONTACT TIME	REMARKS
LEAD AGENCY			
FIRST SUPPORT AGENCY			
SECOND SUPPORT AGENCY			
THIRD SUPPORT AGENCY			

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B.1 Ammonium Nitrate

The first step to prevent potential spills and associated hazards is the application of proper storage procedures for bulk ammonium nitrate, including the following:

- ensure good housekeeping of the storage facility to prevent spilling and/or cross-contamination of materials;
- store ammonium nitrate away from combustible materials, fuels, and other blasting accessories (i.e., boosters, delays, detonating cords, and detonators);
- post proper signage restricting the use/exposure of ammonium nitrate to ignition sources (e.g., no hot work, smoking or vehicle maintenance);
- ensure the storage facility is well ventilated; and
- ensure the storage facility is locked at all times with only authorized personnel allowed access.

The following is a general spill response procedure for ammonium nitrate. Consult the MSDS to determine whether deviations from the general guidance are required.

For an **ammonium nitrate spill** (solid):

1) Isolate and evacuate the spill area.

2) Contact your Supervisor who will then contact the Incident Commander and coordinate appropriate spill response (assemble ERT members and the appropriate spill response materials). **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

3) Put on appropriate personal protective equipment. For an ammonium nitrate spill, this includes:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Protective eyeglasses or chemical safety goggles or face shield as recommended by the MSDS;

    c. Lab coat, coveralls or TyvekTM coveralls as recommended by the MSDS; and

    d. Half mask air-purifying respirator with cartridges and/filters as recommended by the MSDS or respirator manufacturer.

4) Ventilate (open windows/doors to outdoor) closed spaces before entering.

5) Remove all sources of heat and ignition (no smoking, flares, sparks, or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area.

6) For spills on land, protect the spill area from water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier.

7) Vacuum or sweep the spill residue using non-metal, non-sparking tools and place the residue in a labelled plastic container (plastic pail with lid or double heavy duty plastic bags) for re-use or off-site disposal at a licensed disposal facility.

   Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid and clearly label the container per WHMIS Guidelines.

   Note: Minimize dust generation during the operation.

8) Remove and bag PPE for cleaning or disposal at a licensed facility. Thoroughly wash potential skin contact locations after handling.

B.2 Ammonium Nitrate Fuel Oil

Proper storage, handling and disposal of ammonium nitrate fuel oil (ANFO) are an important first step in preventing spills and associated hazards.

The proper storage procedures are as follows:

- use ANFO under the supervision of authorized trained personnel;
- keep ANFO away from heat, sparks, and flames, as well as initiating explosives, oxidizing agents, combustibles, and other sources of heat; and
- protect containers from physical damage and store them in dry, well ventilated conditions.

Explosives that have been identified as deteriorated or damaged will need to be disposed of or destroyed. The appropriate method of disposal or destruction and subsequent course of action will be determined by authorized personnel or the explosive supplier.

Transportation of explosives-related compounds and materials will be in accordance with Section 14 of the *Mine Health and Safety Act* and associated regulations, and the *Transportation of Dangerous Goods Act*. Transport vehicles will be in sound mechanical condition and equipped with proper safety equipment. Loaded vehicles will not be left unattended, and only authorized personnel will be responsible for the security of the explosives under their control.

The following is a general spill response procedure for ammonium nitrate fuel oil – ANFO. The following procedure does not apply to emulsions or other explosives. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For an **ANFO spill** (solid):

1) Isolate and evacuate the spill area.

2) **IF SAFE TO DO SO,** immediately extinguishe any open flames and remove ignition sources (no smoking, flares, sparks in immediate area). **Fires involving large quantities of ANFO should not be fought.**

3) Contact the Incident Commander who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

4) Put on appropriate personal protective equipment. For an ANFO spill this includes:

    a. Gloves as recommended by the MSDS or glove manufacturer;

b. Protective eyeglasses or chemical safety goggles or face shield as recommended by the MSDS;

c. Lab coat, coveralls or TyvekTM coveralls as recommended by the MSDS;

d. Shoe covers or rubber boots; and

e. Half mask air-purifying respirator with cartridges and/filters as recommended by the MSDS or respirator manufacturer.

5) If the spill occurred outdoors, stay upwind and avoid low lying areas. Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion proof ventilation for cleanup.

6) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area.

7) Do not operate radio transmitters within 100 m of electric detonators.

8) For a spill on land, protect the spill area from water runoff by constructing a ditch or dike using suitable absorbent materials, soil or other appropriate barrier. For a spill to water, utilize damming, and/or water diversion to minimize the spread of contamination.

9) Collect, sweep or shovel spilled material and the other contaminated material/soil using non-metallic, spark-proof tools and place residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility.

   Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and clearly label the container per WHMIS Guidelines.

   Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual off-site disposal at a licensed disposal facility.

10) Remove and bag PPE for cleaning or disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles including shoes that cannot be decontaminated.

The following is a general spill response procedure for compressed gases. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **compressed (inert and flammable) gas** leak:

1) **IF SAFE TO DO SO** and if it will stop the gas leak, turn off cylinder valve.

2) If the leak cannot be stopped by closing the cylinder valve and it is **an inert atmospheric gas** (e.g., nitrogen, carbon dioxide, etc.), isolate and evacuate the affected area. If the leak is a **flammable gas** and the leak is outside of a ventilated building enclosure that will contain the gas, immediately activate the fire alarm system and evacuate the area/building.

3) Contact the Incident Commander who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

4) If possible and if safety permits, adjust leaking cylinder so that gas escapes rather than liquid.

5) If possible and if safety permits, eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area) and turn off electrical equipment.

6) If a spill has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, it may also be necessary to have it shut-down. Allow vapours to ventilate outdoors by opening windows and doors to the exterior.

7) Isolate area until gas has dispersed. Incident Commander to verify safe conditions.

APPENDIX D • GENERAL RESPONSE PROCEDURES FOR SPILLED FLAMMABLE OR COMBUSTABLE LIQUIDS

The following is a general spill response procedure for flammable or combustible liquids, particularly petroleum hydrocarbon products. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a spill of **flammable or combustible petroleum hydrocarbon product (liquid):**

1) Isolate and evacuate the spill area.

2) **IF SAFE TO DO SO**, immediately extinguishes any open flames and remove ignition sources (no smoking, flares, sparks in immediate area).

3) **IF SAFE TO DO SO**, stop leak and contain spill (**see Step 9**).

4) Contact the Incident Commander who will assemble ERT members if required and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

5) Put on appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Splash goggles or face shield;

    c. Shoe covers or rubber boots;

    d. Lab coat or TyvekTM coveralls; and

    e. Half mask air-purifying respirator with **organic vapour or combination cartridges**, or as otherwise recommended by the MSDS or respirator manufacturer.

6) If the spill has occurred outdoors, stay upwind and avoid low lying areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, it may also be necessary to have it shut-down.

7) Ventilate (open windows/doors to outdoors) closed spaces before entering. Ensure adequate explosion-proof ventilation for cleanup. A vapour suppressing foam or water spray may be used to reduce vapours.

8) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.) from within the spill area.

9) Contain spill by using spill absorbent, spill pads or pillows, soil or snow by constructing a dike that will limit flow and prevent entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. If possible, compact soil or snow dikes, and place plastic tarps over the dike and at its foot to allow the product to pool on the plastic for easy recovery.

   Note: Do not use paper towels to absorb spill as this increases the rate of evaporation and vapour concentration in the air.

   Note: Do not flush with water into drainage areas or ditches as this will spread spill.

   Note: Snow works well as a natural absorbent to collect and contain spilled petroleum hydrocarbons. However, its use in containing a spill will result in a water-contaminant mixture that may be more difficult to manage. It is important to scrape up the contaminated snow and ice as soon as possible.

10) Carefully cover the spill area with spill absorbent, spill pads, soil or snow, starting at the outside and working inward. Do not touch or walk through spilled material.

11) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags). For larger spills to land, excavate impacted absorbent material and soil, place in lined and bermed temporary storage area or directly into sealed drums/containers.

   Note: The drums/containers/residues are to be stored in ventilated areas away from incompatible materials for eventual treatment at on-site landfarm facility or off-site disposal at a licensed disposal facility. Electrically ground all containers and transporting equipment.

   Note: Larger pools of product may be pumped into empty storage tanks or drums.

12) If a spill is indoors, mop the affected area using detergent and water. Dispose of this water to drums for eventual off-site disposal at a licensed disposal facility. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The Incident Commander and/or Environment Superintendent will assess this requirement.

13) For spills to water, immediately limit the area of the spill on water using absorbent pads and booms and similar materials to capture small spills on water. Deploy and slowly draw in absorbent booms to encircle and absorb the spilled product. Recover larger spills on water with floating skimmers and pumps, as required, and discharge recovered product to drums or tanks.

   Note: Petroleum hydrocarbons are generally hydrophobic, and as such, do not readily dissolves in water. They typically tend to float on the water's surface. Absorbent booms are often relied on to recover hydrocarbons that escape land containment and enter water.

   Note: Antifreeze sinks and mixes with water. If released to water, attempt to isolate/confine the spill by damming or diverting the spill. Pump contaminated water to tanks or drums.

14) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated leather articles (including boots and shoes) that cannot be decontaminated.

E.1 Liquids

The following is a general spill response procedure for liquid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **liquid oxidizer** spill:

1) Isolate and evacuate the spill area.

2) **IF SAFE TO DO SO**, stop leak and contain spill (**see Step 8**).

3) Contact the Incident Commander who will assemble, if required, ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

4) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Splash goggles or face shield;

    c. Shoe covers or rubber boots;

    d. Lab coat, coveralls or TyvekTM coveralls as recommended by the MSDS; and

    e. Half mask air-purifying respirator with cartridges and/or filters as recommended by the MSDS or respirator manufacturer.

5) Ventilate closed spaces before entering. Ensure adequate explosion-proof ventilation for cleanup.

6) Remove and/or moisten with water any combustible material (wood, paper, oil, etc.) affected by the spill.

7) Use water spray to reduce vapours or divert vapour cloud drift, if required.

8) Contain spill by using non-combustible spill absorbent, soil or snow to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate.

    Note: Flushing area with flooding quantities of water may also be appropriate assuming this does not make cleanup and waste management more difficult – refer to the MSDS.

9) Carefully cover the spill area with spill absorbent, soil or snow, starting at the outside and working inward. Use non-combustible absorbent. Do not touch or walk through spilled material.

10) Sweep up or shovel the spill residue using non-metal, non-sparking tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility.

11) For indoor spills, mop the affected area using detergent and water. Flushing area with flooding quantities of water may also be appropriate – refer to the MSDS. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate. Spills to land may require further excavation or remediation of contaminated soil until acceptable soil quality is achieved. The Incident Commander and/or Environment Superintendent will assess this requirement.

12) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

E.2 Solids

The following is a general spill response procedure for solid oxidizer compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **solid oxidizer** spill:

1) Isolate and evacuate the spill area.

2) Contact the Incident Commander who will assemble, if required, ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

3) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Safety glasses or goggles;

    c. Lab coat; and

    d. Half mask air-purifying respirator with **N95 or greater protection** particulate filter or as recommended by the MSDS or respirator manufacturer.

4) Remove all sources of heat and ignition (no smoking, flares, sparks or flames in immediate area) and remove uncontaminated combustible materials and organic compounds (wood, paper, oil, etc.) from spill area.

5) For spills to land, protect the spill area from water runoff by constructing a ditch or dike using suitable non-combustible absorbent materials, soil or other appropriate barrier. For spills to water, utilize damming and/or water diversion to minimize the spread of contamination.

6) Vacuum, sweep, or shovel the spill residue using non-metal, non-sparking tools, and place the residue into a labelled plastic container (plastic pail with lid or double heavy duty plastic bags) for re-use or off-site disposal at a licensed disposal facility.

    Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid, and clearly label the container per WHMIS Guidelines.

    Note: Minimize dust generation.

7) If there is still oxidizer residue left in the spill area, neutralize with appropriate agent as recommended by the MSDS, or for spills to land, continue to excavate until no visible spilled solid remains. Use non-combustible spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal at a licensed facility.

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate.

9) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

APPENDIX F • GENERAL RESPONSE PROCEDURES FOR SPILLED POISONOUS AND TOXIC SUBSTANCES

F.1 Sodium Cyanide

The following is a general spill response procedure for solid Sodium Cyanide.

For a **Sodium Cyanide (solid)** spill:

1) Isolate and evacuate the spill area.

2) Contact the Incident Commander who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

3) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Safety glasses or goggles;

    c. Lab coat; and

    d. Half mask air-purifying respirator as recommended by the MSDS or respirator manufacturer.

    Note: For worker safety, maintain readily accessible supply of cyanide antidote kits on-site.

4) Ventilate area of spill or leak.

5) Avoid exposure to acids, water or weak alkalis, which can react to form toxic Hydrogen Cyanide gas.

6) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from water runoff by constructing a ditch or dike using absorbent materials, soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent subsequent runoff. For spill to water, utilize damming, and/or water diversion to minimize the spread of contamination.

7) Shovel the spilled material into labelled drums, containers or plastic bags for re-use or off-site disposal at a licensed disposal facility.

    Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid and clearly label the container per WHMIS Guidelines.

    Note: Minimize dust generation.

8) If there residue from the Sodium Cyanide spill remaining in the spill area, neutralize with appropriate agent **as recommended by the MSDS** (Sodium or Calcium Hypochlorite solution), or for spills to land, continue to excavate until no visible spilled solid remains. Use suitable spill absorbent or soil to absorb the neutralized residue. Place in suitable drums/containers for disposal to a licensed facility. Collect material and place in a closed container for recovery or disposal.

9) For indoor spills, mop the affected area using detergent and water. Dispose of this water to waste drums/containers for disposal to a licensed facility.

10) Remove and bag PPE for disposal at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

G.1 Acids, Liquids

The following is a general spill response procedure for liquid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **liquid acid** spill:

1) Isolate and evacuate the spill area.

2) **IF SAFE TO DO SO**, stop leak and contain spill (**see Step 8**).

3) Contact the Incident Commander who will assemble, if required, ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

4) Put on appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Splash goggles or face shield;

    c. Shoe covers or rubber boots;

    d. Lab coat or TyvekTM coveralls; and

    e. Half mask air-purifying respirator with **acid gas or combination** cartridges, or as otherwise recommended by the MSDS or respirator manufacturer.

5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, it may also be necessary to have it shut-down.

6) Ventilate (open windows/doors to outdoors) closed spaces before entering.

7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area).

8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent as recommended by the MSDS.

Note: Many acids, particularly concentrated acids, react violently in the presence of water. Do not flush spill area with water unless the MSDS indicates acceptable.

Note: Nitric Acid reacts violently and explosively with organic chemicals and organic material such as wood, cotton and paper; therefore, do not use organic absorbent material on Nitric Acid.

Note: Hydrofluoric Acid will fume during neutralization. Provide adequate ventilation and approach from upwind. Neutralize carefully with Sodium Bicarbonate, soda ash or lime. Use water spray to disperse the gas/vapour if required. Remove all sources of ignition.

9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using MSDS-recommended or commercially available neutralizers. Use pH indicator paper to determine if spill is neutralized (pH 7).

   Note: Use caution as neutralization reactions generate heat.

10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility.

11) Check the pH of the spill area. If it is less than pH 6, then further neutralize with a dilute solution of a suitable reagent as identified on the MSDS, or for spills to land, continue to excavate contaminated soil.

12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate.

13) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area, re-clean the area as per Steps 11 and 12 or wait at least 1 hour before re-entering or until considered safe by the Incident Commander or Environment Superintendent.

G.2 Acids, Solids

The following is a general spill response procedure for solid acid compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **solid acid** spill:

1) Isolate and evacuate the spill area.

2) Contact the Incident Commander who will assemble, if required, ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

3) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Safety glasses or goggles;

    c. Lab coat; and

    d. Half mask air-purifying respirator with **N95 or greater protection** particulate filter, or as otherwise recommended by the MSDS or respirator manufacturer.

4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spills to water, utilize damming, and/or water diversion to minimize the spread of contamination.

5) If necessary to minimize dust production, slightly moisten the solid. Use water, or if the material is water reactive, another inert liquid as recommended by the MSDS.

6) Sweep up or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for reuse or off-site disposal at a licensed disposal facility.

    Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid and clearly label the container per WHMIS Guidelines.

7) Remaining solid acid residue may be neutralized using a dilute solution of appropriate agent as recommended by the MSDS (e.g., Sodium Bicarbonate - baking soda) or, for spills to land,

continue to excavate until no visible spilled solid remains. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue.

Note: Use caution as neutralization reactions generate heat.

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate.

9) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

G.3 Bases/Alkali, Liquids

The following is a general spill response procedure for liquid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **liquid alkali or base** spill:

1) Isolate and evacuate the spill area.

2) **IF SAFE TO DO SO**, stop leak and contain spill (**see Step 8**).

3) Contact the Incident Commander who will assemble ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

4) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Splash goggles or face shield;

    c. Shoe covers or rubber boots;

    d. Lab coat or TyvekTM coveralls; and

    e. Half mask air-purifying respirator with cartridges/filters as recommended by the MSDS or respirator manufacturer.

5) If the spill has occurred outdoors, stay upwind and stay out of low areas. If the spill has occurred inside a building, prevent spread of vapour throughout the building by closing doors to other rooms and hallways. If the room's air exchange system distributes air throughout the building, it may also be necessary to have it shut-down.

6) Ventilate (open doors/windows to outdoors) closed spaces before entering.

7) Remove all sources of ignition (no smoking, flares, sparks or flames in immediate area) and combustible materials (wood, paper, oil, etc.).

8) Contain spill by using spill absorbent, spill pads or pillows, or dry soil to construct a dike that limits flow and prevents entry to sewer, waterways or onto ice. For spills to land, excavation of trenches/pits to capture spill flow may also be appropriate. Ideally, use spill absorbent that contains a mild neutralizing agent as recommended by MSDS.

Note: Use caution as neutralization reactions generate heat.

9) Carefully cover the spill area with spill absorbent, spill pads or dry soil, starting at the outside and working inward. If practical, neutralize spill using MSDS-recommended or commercially available neutralizers. Use pH indicator paper to determine if spill is neutralized (pH 7).

   Note: Use caution as neutralization reactions generate heat.

10) Sweep or shovel the neutralized spill residue using non-metal, non-sparking tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility.

11) Check the pH of the spill area. If it is greater than pH 10, then further neutralize with a dilute solution of a suitable reagent as identified on the MSDS, or for spills to land, continue to excavate contaminated soil.

12) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate.

13) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

14) After the spill has been cleaned up, the area should be free of vapours. However, if personnel note odours or irritation, isolate the spill area, re-clean as per Steps 11 and 12 or wait at least 1 hour before re-entering or until it is considered to be safe by the Incident Commander or Environment Superintendent.

G.4 Bases/Alkali, Solids

The following is a general spill response procedure for solid alkali or base compounds. Consult the MSDS for the specific spilled compound to determine whether deviations from the general guidance are required.

For a **solid alkali or base** spill:

1) Isolate and evacuate the spill area.

2) Contact the Incident Commander who will assemble, if required, ERT members and the appropriate spill response materials outside the spill area. **Obtain and read the MSDS** for the substance to determine the chemical-specific hazards and to identify any special precautions that must be taken.

3) Put on the appropriate PPE. Depending on the scale of the spill and properties of the spilled substance, this can include:

    a. Gloves as recommended by the MSDS or glove manufacturer;

    b. Safety glasses or goggles;

    c. Lab coat; and

    d. Half mask air-purifying respirator with **N95 or greater protection** particulate filter or as recommended by the MSDS or respirator manufacturer.

4) Contain spill to prevent release to sewer, waterway or onto ice. For spills to land, protect the spill area from water runoff by constructing a ditch or dike using absorbent materials, dry soil or other appropriate barrier. If raining, cover spill area with tarp or plastic to minimize contact with water and prevent reaction and/or subsequent runoff. For spills to water, utilize damming, and/or water diversion to minimize the spread of contamination.

5) If necessary to minimize dust production, slightly moisten the solid. Use water or, if the material is water reactive, another inert liquid as recommended by the MSDS.

    Note: Do not use water to flush bases in powdered form, such as Calcium Oxide (lime), as this material is not very soluble.

6) Sweep or shovel the residue using non-metallic, spark-proof tools and place the residue into a labelled plastic waste container (plastic pail with lid or double heavy duty plastic bags) for off-site disposal at a licensed disposal facility.

    Note: Recovered solid, if generally free from impurities, may be suitable for its intended use. In this case, place solid in suitable container with lid and clearly label the container per WHMIS Guidelines.

7) Remaining solid alkali or base residue may be neutralized using a dilute solution of appropriate acid. Check the pH of the spill area; the final pH should be between pH 6 and 10. Use spill absorbent, spill pads or dry soil to absorb the neutralized residue.

8) For indoor spills, mop the affected area using detergent and water. Dispose of this water to the sanitary sewer, process stream or waste drums as appropriate.

9) Remove and bag PPE for cleaning, inform laundry personnel of contaminant hazards, or dispose at a licensed disposal facility. Thoroughly wash with soap potential skin contact locations after handling. Properly dispose of contaminated clothing that cannot be decontaminated.

Act	Regulation	Guideline
Federal		
Canadian Environmental Protection Act (1999 c.33)	*Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations* (SOR/2008-197) *Environmental Emergency Regulations* (SOR/2003-307) *Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations* (SOR/2002-301)	CCME - Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products Notice with respect to substances in the National Pollutant Release Inventory Canada-Wide Standards for Particulate Matter (PM) and Ozone Canada-wide Standards for Petroleum Hydrocarbons (PHC) in Soil
Canada Wildlife Act (1985 w9)		
Species at Risk Act (2002 c.29)		
Migratory Birds Convention Act (1994 c.22)	*Migratory Birds Regulations* (C.R.C., c. 1035)	
Canada Water Act (1985 c.11)		
Arctic Waters Pollution Prevention Act (R.S.C., 1985, c. A-12)		
Canada Shipping Act, 2001 (S.C. 2001, c. 26)	*Response Organizations and Oil Handling Facilities Regulations* (SOR/95-405)	
Navigable Waters Protection Act (R.S. 1985 c. N-22)	*Navigable Waters Works Regulations* (C.R.C., c. 1232) *Navigable Waters Bridges Regulations* (C.R.C., c. 1231)	
Marine Liability Act (A.C. 2001, c.6)	*Marine Liability Regulations* (SOR/2002-307)	
Fisheries Act (1985, c. F-14)	*Metal Mining Effluent Regulations* SOR/2002-2222)	The Policy for the Management of Fish Habitat Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters Freshwater Intake End-of-Pipe Fish Screen Guideline Standard Operating Procedure – Clear Span Bridges
Transport of Dangerous Goods Act (1992, c. 34)	*Transportation of Dangerous Goods Regulations* (SOR/2001-286)	

Act	Regulation	Guideline
Explosives Act (1985 c.E-17)	*Ammonium Nitrate and Fuel Oil Order* (C.R.C., c. 598)	
----------	*Explosives Regulations* (C.R.C., c. 599)	
National Fire Code of Canada (2010)		
Nuclear Safety and Control Act (s.c. 1997, c.9)	*General Nuclear Safety and Control Regulations* (SOR/2000-202)	
Canadian Human Rights Act (R.S.C., 1985, c. H-6)		
Canada Labour Code (R.S.C., 1985, c. L-2)	*Canada Labour Standards Regulations* (C.R.C., c. 986) *Canada Occupational Health and Safety Regulations* (SOR/86 304)	
Territorial Lands Act (R.S. 1985, c. T-7)	*Northwest Territories and Nunavut Mining Regulations* (C.R.C., c. 1516) *Territorial Land Use Regulations* (C.R.C., c. 1524) *Territorial Quarrying Regulations* (C.R.C. c. 1527)	
Nunavut Waters and Nunavut Surface Rights Tribunal Act (2002, c. 10)	*Northwest Territories Waters Regulations* (SOR/93/303)	
Nunavut Act (1993 c.28)	*Nunavut Archaeological and Paleontological Sites Regulations* (SOR/2001-220)	
Nu*navut Land Claims Agreement Act* (1993, c. 29)		
Territorial		
Environmental Protection Act (RSNWT (Nu) 1988, c E-7)	*Spill Contingency Planning and Reporting Regulations (NWT Reg (Nu) 068-93)* *Used Oil and Waste Fuel Management Regulations (NWT Reg 064-2003)* [The removal of hazardous materials will require the registration with the Government of Nunavut, Department of Environment as a waste generator as well as carrier (if applicable) prior to transport.]	Guideline on Dust Suppression Guideline for the General Management of Hazardous Waste in Nunavut Guideline for Industrial Waste Discharges in Nunavut Guideline for Air Quality – Sulphur Dioxide and Suspended Particulates Guideline for the Management of Waste Antifreeze Guideline for the Management of Waste Batteries

Act	Regulation	Guideline
		Paint Guideline for the Management of Waste Solvents Guideline for Industrial Projects on Commissioner's Land
Scientists Act (RSNWT (Nu) 1988, c S-4)	*Scientists Act Administration Regulations* (NWT Reg (Nu) 174-96)	
Historical Resources Act (RSNWT (Nu) 1988, c H-3)		
Territorial Parks Act (RSNTW (Nu) 1988, c T-4)	*Territorial Parks Regulations* (RRNWT (Nu) 1990 c T-13)	
Wildlife Act (RSNWT (Nu) 1988, c W-4)	*Wildlife General Regulations* (NWT Reg (Nu) 026-92) *Wildlife Licences and Permits Regulations* (NWT Reg (Nu) 027-92) *Wildlife Management Barren-Ground Caribou Areas Regulations* (NWT Reg (Nu) 099-98) *Wildlife Management Grizzly Bear Areas Regulations* (NWT Reg (Nu) 155-96) *Wildlife Management Zones Regulations* (RRNWT (Nu) 1990 c W-17) *Wildlife Regions Regulations* (NWT Reg (Nu) 108-98)	
Commissioner's Land Act (RSNWT 1988, c C-11)	*Commissioner's Airport Lands Regulations* (NWT Reg (Nu) 067-97) *Commissioner's Land Regulations* (RRNWT 1990, c C-13)	
Safety Act (RSNWT 1988, c.S-1)	*General Safety Regulations* (RRNWT (Nu) 1990 c S-1) *Work Site Hazardous Materials Information System Regulations* (RSNWT 1988, C 81 (Supp))	
Mine Health And Safety Act (SNWT (Nu) 1994, c 25)	*Mine Health And Safety Regulations* (NWT Reg (Nu) 125-95)	
Workers' Compensation Act (RSNWT, 1988, c. W-6)	*Workers' Compensation General Regulations* (Nu Reg 017-2010)	

Act	Regulation	Guideline
Apprenticeship, Trade and Occupations Certification Act (RSNWT (Nu) 1988, c A-4)	*Apprenticeship, Trade and Occupations Certification Regulations* (RRNWT (Nu) 1990 c A-8)	
Labour Standards Act (RSNWT (Nu) 1988, c L-1)	*Annual Vacations Regulations* (RRNWT 1990, c.L-1) *Educational Work Experience Regulations* (RRNWT 1990, c.L-2) *Employment of Young Persons Regulations* (RRNWT 1990, c.L-3) *Labour Standards Meal Regulations* (RRNWT 1990, c.L-4) *Notice of Termination Exemption Regulations* (RRNWT 1990 c.L-5) *Pregnancy and Parental Leave Regulations* (RRNWT 1990, c.8(Supp.)) *Reciprocating Jurisdiction Order* (RRNWT 1990, c.L-6) *Wages Regulations* (RRNWT 1990, c.L-7)	
Electrical Protection Act (RSNWT (Nu) 1988, c E-3)	*Electrical Protection Regulations* (RRNWT 1990 c. E-21)	
Explosives Use Act (RSNWT (Nu) 1988, c E-10)	*Explosives Regulations* (RRNWT (Nu) 1990 c E-27)	
Petroleum Products Tax Act (RSNWT (Nu) 1988, c P-5)	*Petroleum Products Tax Regulations* (RRNWT (Nu) 1990 c P-3)	
Fire Prevention Act (RSNWT (Nu) 1988, c F-6)	*Fire Prevention Regulations* (RRNWT (Nu) 1990 c F-12)	
Hospital Insurance and Health and Social Services Administration Act (RSNWT 1988, c T-3)	*Territorial Hospital Insurance Services Regulations* (RRNWT (Nu) 1990 c T-12)	
Public Health Act (RSNWT (Nu) 1988, c P-12)	*Camp Sanitation Regulations* (RRNWT (Nu) 1990 c P-12) *General Sanitation Regulations* (RRNWT (Nu) 1990 c P-16)	
All-terrain Vehicles Act (RSNWT (Nu) 1988, c A-3)	*All-terrain Vehicles Regulations* (RRNWT (Nu) 1990 c A-1)	
Motor Vehicles Act (RSNWT (Nu) 1988 c M-16)	*Large Vehicle Control Regulations* (RRNWT (Nu) 1990 c M-30)	

Act	Regulation	Guideline
Public Highways Act (RSNWT (Nu) 1988, c P-13)	*Highway Designation and Classification Regulations* (NWT Reg (Nu) 047-92)	
Transportation Of Dangerous Goods Act (1990, RSNWT (Nu) 1988, c 81 (Supp))	*Transportation Of Dangerous Goods Regulations* (1991, NWT Reg (Nu) 095-91)	

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MELIADINE GOLD PROJECT

Water Management Plan

MARCH 2018
VERSION 2
6513-MPS-11

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ᐊᒡᓃᑯᒃᑯᑦ ᐱᕙᓪᓕᐊᓂᖃᖅᑐᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒪᓘᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐅᔭᕋᒃᑕᕆᐊᖅ), 25 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᖕᓇᖕᖓᓂᑦ ᑲᖏᖅᖢᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓂᒃ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐱᖓᖕᓇᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᒑᕐᔪᖕᒥᑦ ᐅᖓᓯᒃᑎᒋᔪᖅ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓖᔪᖅ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᕐᒧᑦ ᐋᖅᑭᐅᒪᔪᓂᒃ ᐱᕙᓪᓕᐊᓂᕐᒧᑦ ᑎᕆᒐᓂᐊᖅ ᒫᓗᑕᓕᖕᒥᑦ, ᒪᕐᕿᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓗᐄᖕᓂᑦ (ᑎᕆᒐᓂᐊᖅ ᐅᒃᑯᐃᖓᓗᔪᖅ 1 ᐊᒻᒪᓗ ᑎᕆᒐᓂᐊᖅ ᐅᒃᑯᐃᖓᓗᔪᖅ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒥᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᔭᕋᒃᑕᕆᐊᖅ.

ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᒪᔪᑦ ᒥᑭᓛᒃᑰᖅᑎᓪᓗᕆᑦ ᐊᒃᑐᖅᓯᓂᐅᔪᖕᓇᖅᑐᑦ ᐃᒪᐅᑉ ᐊᖏᑎᒋᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐱᐅᓂᕆᔭᖓᓄᑦ ᖃᖓᓃᑦᑐᓄᑦ ᐃᒪᕐᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ. ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐋᖅᑭᐅᒪᔪᑦ (ᖃᖓᓂᑦ ᐃᒪᖅᓱᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑦᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᐃᒪᕐᒥᒃ ᓴᖑᑎᑦᑎᓂᕐᒧᑦ ᓱᐸᓗᐃᑦ ᐊᒻᒪᓗ ᓱᐸᓗᓛᑦ) ᓴᓇᔭᐅᓂᐊᖅᑐᑦ ᐃᒪᖅᑕᖃᖅᑎᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᖅᑕᐅᔪᒥᑦ ᐃᒪᕐᒥᒃ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᓂᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐅᔭᕋᒃᑕᕆᐊᓕᓂᐅᔪᓄᓪᓘᓐᓃᑦ. ᐊᖏᔪᖅ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᑎᐅᔪᓂᑦ ᐃᓚᐅᔪᑦ: ᐃᒪᖃᖅᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᕋᔭᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᓱᐸᓗᐃᑦ, ᐃᒪᓕᕆᕝᕕᒃ, ᕐᑯᕐᕕᖕᒥᓖᖅᑐᓕᕆᔾᔪᑎ, ᐃᒪᕐᒥᑦ ᑕᕆᐅᖃᖅᑐᓕᕆᔾᔪᑎ ᐊᒻᒪᓗ ᑯᕕᔭᐅᔪᓂᖕᓖᖅᑐᓂᒃ ᐃᒪᓕᕆᔾᔪᑎ.

ᐅᔭᕋᒃᑕᕆᐊᖅ ᓴᓇᔭᐅᑎᓪᓗᒍ ᐊᐅᓛᖅᑎᓪᓗᒍᓗ, ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᐱᔭᐅᔪᖅ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᓂᑦ ᓄᓇᐅᑉ ᖃᖓᓂᑦ ᑲᒪᒋᔭᐅᓂᐊᖅᑐᖅ, ᓴᖑᑎᑕᐅᓗᓂ ᐊᒻᒪᓗ ᑲᑎᑕᐅᓗᓂ ᐊᔾᔩᓐᖏᑦᑐᓄᑦ ᐃᒪᖃᖅᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᕋᔭᖕᓂᑦ. ᑲᑎᑕᐅᔪᖅ ᐃᒪᖅ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑯᕕᑎᑕᐅᕋᑕᓕᕐᓂᐊᖅᑐᖅ ᑐᖅᑯᖅᑕᐅᓗᓂᓗ ᐃᒪᖃᕐᕕᒃ ᑕᓯᕋᒃ 1-ᒧᑦ, ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ ᑯᕕᔭᐅᔪᓂᖕᓖᖅᑐᓂᒃ ᐃᒪᓕᕆᔾᔪᑎᒧᑦ ᐲᖅᑕᐅᓂᐊᕐᓗᑎᒃ ᑲᑎᕝᕙᓯᑦ ᓯᑎᓂᐅᔪᑦ ᑯᕕᑎᑕᐅᓂᐊᖅᑎᓪᓗᒍ ᓯᓚᒧᑦ ᐅᕙᓘᓐᓃᑦ ᐃᒥᖅᑖᕐᓂᕐᒧᑦ ᐱᓕᐅᕆᕙᓪᓕᐊᕝᕕᖕᒧᑦ. ᐊᑐᖅᑕᐅᔪᖅ ᐃᒪᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑲᑎᑕᐅᓂᐊᖅᑐᖅ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᑐᖅᑯᖅᓯᓯᒪᕝᕕᖕᓄᑦ. ᐃᓚᖏᑦ ᐃᒪᐃᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐱᔪᑦ ᐊᑐᖅᑕᐅᒃᑲᓐᓂᕐᓂᐊᖅᑐᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᐅᓛᖅᑎᑦᑎᓂᐅᔪᓂᑦ.

ᐊᑯᓂᐅᔪᒥᑦ, ᐅᒃᑯᐊᖅᓯᒪᓕᖅᑎᓪᓗᒍ ᐃᒪᐅᑉ ᐱᐅᓂᖓ ᐃᒪᖃᖅᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᕋᔭᖓᓂᑦ ᐊᒻᒪᓗ ᐃᒻᒥᖅᑐᖅᑕᐅᓯᒪᔪᓂᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓗᔪᐃᑦ ᑕᓰᑦ ᑎᑭᐅᑎᓯᒪᓂᐊᖅᑐᑦ ᓴᕖᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒥᑦ ᑯᕕᔭᐅᔪᓂᑦ ᒪᓕᒐᕋᓛᓄᑦ, ᑲᓇᑕᒥᑦ ᑲᑎᒪᔩᑦ ᒥᓂᔅᑕᐅᑏᑦ ᐊᕙᑎᒥᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖓᓄᑦ ᒪᓕᒃᑕᐅᔪᖅᓴᐃᑦ ᒥᐊᓂᖅᓯᓂᕐᒧᑦ ᐃᒪᕐᒥᐅᑕᓂᒃ ᐊᒻᒪᓗ/ᐅᕙᓘᓐᓃᑦ ᐃᓂᐅᔪᒥᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖓᓄᑦ ᐱᓕᕆᐊᖑᔪᑦ ᓴᖅᑭᑕᐅᓯᒪᔪᑦ ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ.

ᐅᔭᕋᒃᑕᕆᐊᖅ ᐅᒃᑯᐊᖅᑕᐅᑎᓪᓗᒍ, ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᑎᐅᔪᑦ ᑕᐃᑲᓃᖏᓐᓇᕐᓂᐊᖅᑐᑦ ᑭᓯᐊᓂ ᐅᔭᕋᒃᑕᕆᐊᖅ ᐅᒃᑯᐊᖅᑕᐅᕙᓪᓕᐊᓂᕐᒧᑦ ᖃᓄᓕᐅᕐᓂᐅᔪᑦ ᐱᐊᓂᒃᐸᑕ ᐊᒻᒪᓗ ᖃᐅᔨᓯᐊᖃᑦᑕᕐᓂᖅ ᑕᑯᒃᓴᐅᑎᑦᑎᓕᖅᐸᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖓ ᐱᓕᕆᐊᖑᙱᓕᓗᓂ ᓈᒻᒪᒃᓯᒃᐸᑦ ᐊᕙᑎᒧᑦ ᑯᕕᓯᓂᕐᒥᒃ.ᐊᒡᓃᑯᒃᑯᑦ ᐱᕙᓪᓕᐊᓂᖃᖅᑐᑦ ᑕᓯᕐᔪᐊᕐᒥᑦ ᒪᓘᒧᑦ ᐱᓕᕆᐊᕐᒥᑦ (ᐅᔭᕋᒃᑕᕆᐊᖅ), 25 ᑭᓛᒥᑕᓂᒃ ᐅᖓᓯᒃᑎᒋᔪᖅ ᐅᐊᖕᓇᖕᖓᓂᑦ ᑲᖏᖅᖢᓂᐅᑉ, ᐊᒻᒪᓗ 80 ᑭᓛᒥᑕᓂᒃ ᓂᒋᖅᐸᓯᐊᓂᑦ ᐱᖓᖕᓇᖅᐸᓯᐊᓂᑦ ᐃᒡᓗᓕᒑᕐᔪᖕᒥᑦ ᐅᖓᓯᒃᑎᒋᔪᖅ ᑭᕙᓪᓕᕐᒥᑦ ᓄᓇᕗᒻᒥᑦ. ᐅᔭᕋᒃᑕᕆᐊᕐᒧᑦ ᐸᕐᓇᐅᑎ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓖᔪᖅ ᐊᒻᒪᓗ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᐅᔭᕋᒃᑕᕆᐊᕐᓂᕐᒧᑦ ᐋᖅᑭᐅᒪᔪᓂᒃ ᐱᕙᓪᓕᐊᓂᕐᒧᑦ ᑎᕆᒐᓂᐊᖅ ᒫᓗᑕᓕᖕᒥᑦ, ᒪᕐᕿᖕᓂᒃ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᓗᐄᖕᓂᑦ

(ᑎᕆᒐᓂᐊᕐᒃ ᐅᒃᑯᐃᖓᔪᕐᒃ 1 ᐊᒻᒪᓗ ᑎᕆᒐᓂᐊᕐᒃ ᐅᒃᑯᐃᖓᔪᕐᒃ 2) ᐊᒻᒪᓗ ᐊᑕᐅᓯᕐᒥᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᔾᔪᖅᑕᕆᐊᕐᒃ.

ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᓕᕆᐊᖑᔪᒪᔪᑦ ᒥᑭᓪᒃᑰᕐᑎᓪᓗᒋᑦ ᐋᒃᑐᕐᓯᓂᐅᔪᓐᓇᕐᑐᑦ ᐃᒪᐅᑉ ᐊᖏᑎᒋᓂᖓᓄᑦ ᐊᒻᒪᓗ ᐱᐅᓂᕆᔾᔪᖓᓄᑦ ᖄᖓᓅᑦᑐᓄᑦ ᐃᒪᕐᓂᑦ ᐅᔾᔪᖅᑕᕆᐊᕐᒥᑦ. ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐋᕐᑭᐅᒪᔪᑦ (ᖄᖓᓂᑦ ᐃᒪᕐᓯᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑦᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᐃᒪᕐᒥᒃ ᓴᖑᑎᑦᑎᓂᕐᒧᑦ ᓱᑉᓗᐃᑦ ᐊᒻᒪᓗ ᓱᑉᓘᓐᑦ) ᓴᓇᔭᐅᓂᐊᕐᑐᑦ ᐃᒪᕐᑕᖃᕐᑎᑦᑎᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐊᑐᕐᑕᐅᔪᒥᑦ ᐃᒪᕐᒥᒃ ᐋᒃᑐᕐᑕᐅᓯᒪᔪᓂᑦ ᐅᔾᔪᖅᑕᕆᐊᕐᒧᑦ ᐅᔾᔪᖅᑕᕆᐊᓕᓂᐅᔪᓄᓪᓘᓐᓃᑦ. ᐊᖏᔪᕐᒃ ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᑎᐅᔪᓂᑦ ᐃᓚᐅᔪᑦ: ᐃᒪᖃᕐᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᖅᔮᐃᑦ, ᐃᒪᕐᒥᒃ ᐸᐸᑎᓂᕐᒧᑦ ᐊᕙᓗᐃᑦ, ᓱᑉᓗᐃᑦ, ᐃᒪᓕᕆᕝᕕᒃ, ᕐᑯᕐᕕᖕᒥᙱᕐᑐᓕᕆᔾᔪᑎ, ᐃᒪᕐᒥᑦ ᑕᕆᐅᖃᕐᑐᓕᕆᔾᔪᑎ ᐊᒻᒪᓗ ᑯᕕᔭᐅᔪᓂᙱᕐᑐᓂᒃ ᐃᒪᓕᕆᔾᔪᑎ.

ᐅᔾᔪᖅᑕᕆᐊᕐᒃ ᓴᓇᔭᐅᑎᓪᓗᒍ ᐊᐅᓛᕐᑎᓪᓗᒍᓗ, ᐊᑐᕐᑕᐅᔪᕐᒃ ᐃᒪᕐᒃ ᐱᔭᐅᔪᕐᒃ ᐋᒃᑐᕐᑕᐅᓯᒪᔪᓂᑦ ᓄᓇᐅᑉ ᖄᖓᓂᑦ ᑲᒪᒋᔭᐅᓂᐊᕐᑐᕐᒃ, ᓴᖑᑎᑕᐅᓗᓂ ᐊᒻᒪᓗ ᑲᑎᑕᐅᓗᓂ ᐊᔾᔨᒋᙱᑦᑐᓄᑦ ᐃᒪᖃᕐᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᖅᔮᖓᓂᑦ. ᑲᑎᑕᐅᔪᕐᒃ ᐃᒪᕐᒃ ᐅᔾᔪᖅᑕᕆᐊᕐᒥᑦ ᑯᕕᑎᑕᐅᖃᑕᕐᓂᐊᕐᑐᕐᒃ ᑐᕐᑯᕐᑕᐅᓗᓂᓗ ᐃᒪᖃᕐᕕᒃ ᑕᓯᖅᔮᒃ 1-ᒧᑦ, ᐊᑐᕐᑕᐅᔪᕐᒃ ᐃᒪᕐᒃ ᐱᓕᕆᐊᖑᓂᐊᕐᓗᓂ ᑯᕕᔭᐅᔪᓂᙱᕐᑐᓂᒃ ᐃᒪᓕᕆᔾᔪᑎᒧᑦ ᐲᕐᑕᐅᓂᐊᕐᓗᑎᒃ ᑲᑎᓪᓗᒋᑦ ᓯᑎᓂᐅᔪᑦ ᑯᕕᑎᑕᐅᓂᐊᓃᕐᑎᓪᓗᒍ ᓯᓚᒧᑦ ᐅᕝᕙᓘᓐᓃᑦ ᐃᒥᕐᑖᕐᓂᕐᒧᑦ ᐱᓕᐅᕆᕙᓪᓕᐊᕝᕕᖓᒧᑦ. ᐊᑐᕐᑕᐅᔪᕐᒃ ᐃᒪᕐᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂ ᐅᔾᔪᖅᑕᕆᐊᕐᒥᑦ ᑲᑎᑕᐅᓂᐊᕐᑐᕐᒃ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᑐᕐᑯᕐᓯᓯᒪᕝᕕᖓᓄᑦ. ᐃᓚᖏᑦ ᐃᒪᐃᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐱᔪᑦ ᐊᑐᕐᑕᐅᒃᑲᓂᕐᓂᐊᕐᑐᑦ ᓄᓇᐅᑉ ᐃᓗᐊᓂᑦ ᐊᐅᓛᕐᑎᑦᑎᓂᐅᔪᓂᑦ.

ᐊᑯᓂᐅᔪᒥᑦ, ᐅᒃᑯᐊᕐᓯᒪᓕᕐᑎᓪᓗᒍ ᐃᒪᐅᑉ ᐱᐅᓂᖓ ᐃᒪᕐᑕᖃᕐᑎᑦᑎᓂᕐᒧᑦ ᑕᓯᖅᔮᖓᓂᑦ ᐊᒻᒪᓗ ᐃᒻᒥᕐᑐᕐᑕᐅᓯᒪᔪᓂᑦ ᓄᓇᒥᑦ ᐅᒃᑯᐃᖓᔪᐃᑦ ᑕᓲᑦ ᑎᑭᐅᑎᓯᒪᓂᐊᕐᑐᑦ ᓴᕝᕖᑦ ᐅᔾᔪᖅᑕᕆᐊᕐᒥᑦ ᑯᕕᔭᐅᔪᓂᑦ ᒪᓕᒐᖃᕐᓂᑦ, ᑲᓇᑕᒥᑦ ᑲᑎᒪᔩᑦ ᒥᓂᔅᑕᐅᐲᑦ ᐊᕙᑎᒥᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖏᓐᓄᑦ ᒪᓕᒃᑕᐅᔾᔭᐃᑦ ᒥᐊᓂᕐᓯᓂᕐᒧᑦ ᐃᒪᕐᒥᐅᑕᓂᒃ ᐊᒻᒪᓗ/ᐅᕝᕙᓘᓐᓃᑦ ᐃᓂᐅᔪᒥᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖓᓄᑦ ᐱᓕᕆᐊᖑᔪᑦ ᓴᕐᑭᑕᐅᓯᒪᔪᑦ ᐅᔾᔪᖅᑕᕆᐊᕐᒧᑦ.

ᐅᔾᔪᖅᑕᕆᐊᕐᒃ ᐅᒃᑯᐊᕐᑕᐅᑎᓪᓗᒍ, ᐃᒪᕐᒥᒃ ᐊᐅᓚᑦᑎᓂᕐᒧᑦ ᐱᕐᑯᑎᐅᔪᑦ ᑕᐃᑲᓃᖏᓐᓇᕐᓂᐊᕐᑐᑦ ᑭᓯᐊᓂ ᐅᔾᔪᖅᑕᕆᐊᕐᒃ ᐅᒃᑯᐊᕐᑕᐅᕙᓪᓕᐊᓂᕐᒧᑦ ᖃᓄᓕᐅᕐᓂᐅᔪᑦ ᐱᐊᓂᒃᐸᑕ ᐊᒻᒪᓗ ᖃᐅᔨᒋᐊᖃᑦᑕᕐᓂᕐᒃ ᑕᑯᒃᓴᐅᑎᑦᑎᓕᕐᐸᑦ ᐃᒪᐅᑉ ᐱᐅᓂᖓ ᐱᓕᕆᐊᖑᖕᒋᓪᓗᓂ ᓈᒻᒪᒃᓯᒃᐸᑦ ᐊᕙᑎᒧᑦ ᑯᕕᓯᓂᕐᒥᒃ.

EXECUTIVE SUMMARY (ENGLISH)

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Project (the Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine Plan proposes open pit and underground mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine.

The water management objectives are to minimize potential impacts to the quantity and quality of surface water at the Mine. Water management structures (surface ponds, water retention dikes/berms, water diversion channels and culverts) will be constructed as needed to contain and manage the contact water from the areas affected by the Mine or mining activities. The major water management infrastructure include: water containment ponds, water retention dikes, berms, channels, a potable Water Treatment Plant (WTP), a Sewage Treatment Plant (STP), a Saline Water Treatment Plant (SWTP) and an Effluent Water Treatment Plant (EWTP).

During mine Construction and Operations, contact water originating from affected areas on surface will be intercepted, diverted and collected within the various containment ponds. The collected water at the Mine will be eventually pumped and stored in Containment Pond 1 (CP1), where the contact water will be treated by the EWTP for removal of Total Suspended Solids (TSS) prior to discharge to the outside environment or as make-up water by the Process Plant. Contact water from the Underground Mine will be collected in underground storage stopes and sumps. Some water from Underground will be reused for underground operations.

The long-term, post-closure water quality in the containment ponds and in the flooded open pit lakes will meet Metal Mining Effluent Regulations (MMER) , Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME-WQG) for the protection of aquatic life and/or the Site Specific Water Quality Objectives (SSWQO) developed for the Mine.

During mine closure, the water management infrastructure on site will remain in place until mine closure activities are completed and monitoring demonstrates that the water quality is acceptable for environmental discharge without treatment.

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ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
AWAR	All Weather Access Road
CCME-WQG	Canadian Council of Ministers of the Environment Water Quality Guidelines
CP	Containment Pond
EMPP	Environmental Management and Protection Plan
EWTP	Effluent Water Treatment Plant
GWMP	Groundwater Management Plan
IDF	Inflow Design Flood
Licence	Type A Water Licence 2AM-MEL1631
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
Mine	Meliadine Gold Project
SD	Support Document
SSWQO	Site Specific Water Quality Objectives
STP	Sewage Treatment Plant
SWTP	Saline Water Treatment Plant
TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSS	Total Suspended Solids
WMP	Water Management Plan
WRSF	Waste Rock Storage Facility
WTP	Water Treatment plant

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
mg/L	milligram per litre
km	kilometer(s)
km^2	kilo square meter(s)
m	metre
mm	millimetre
m^3	cubic metre(s)
m^3/day	cubic metre per day
m^3/s	cubic metre per second
m^3/hour	cubic metre per hour
m^3/year	cubic metre per year
Mm^3/year	million cubic metre (s) per year
Mm^3	million cubic metre(s)
masl	metres above sea level
Mt	million tonne(s)

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Ltd. (Agnico Eagle) is developing the Meliadine Gold Project (the Mine) located approximately 25 kilometres (km) north of Rankin Inlet (Figure 1.1), Nunavut, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine is subject to the terms and conditions of both the Project Certificate issued in accordance with the Nunavut Land Claims Agreement Article 12.5.12 on February 26, 2015 and Type A Water Licence No. 2AM-MEL1631 (the Licence), issued by the Nunavut Water Board (NWB) on April 1, 2016 (NWB, 2016).

This report presents an updated version of the Water Management Plan (WMP).

1.1 Water Management Objectives

The water management objectives are to minimize potential impacts to the quantity and quality of surface water at the Mine and surrounding waterbodies. The groundwater management plan (GWMP) developed in 2018 is included as Appendix A. The purpose of the WMP is to provide information for water management practices, proposed infrastructure, the water balance model, water quality predictions, and water quality monitoring plan for the Mine.

Water management structures (culverts, sumps, pipelines, water diversion channels and water retention dikes/berms) will be utilized to contain and manage contact water from areas affected by mining activities. Measures will be implemented for both the Mine Construction and Mine Operation phases.

1.2 Management and Execution of the Water Management Plan

Revisions of the WMP can be initiated by changes in the Mine Development Plan (Mine Plan), operational performance, personnel or organizational structure, regulatory or social considerations, and/ or design philosophy. The WMP will be reviewed annually by Agnico Eagle and updated as necessary.

SECTION 2 • BACKGROUND

2.1 Site Conditions

The Mine is located in an area of poorly drained lowlands near the northwest coast of Hudson Bay. The dominant terrain in the area consist of glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and many small lakes. The topography is gently rolling with a mean elevation of 65 metres above sea level (masl) and a maximum relief of 20 meters.

The local overburden consists of a thin layer of topsoil overlying silty gravelly sandy glacial till. Cobbles and boulders are present throughout the region at various depths. Bedrock at the Mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite, and mafic volcanic flows (Snowden, 2008; Golder, 2009).

The climate is extreme in the area, with long cold winters and short cool summers, and mean air temperatures of 12°C in July and -31°C in January. The mean annual air temperature at the Mine site is approximately -10.4 °C (Golder, 2012a). Strong winds blow from the north and north-northwest direction more than 30 percent of the time.

The mean annual precipitation in the area is approximately 412 mm and is typically equally split between rainfall and snowfall.

2.1.1 Local Hydrology

The Mine is located within the Meliadine Lake watershed. Meliadine Lake has a water surface area of approximately 107 square kilometres (km^2), a maximum length of 31 km, features a highly convoluted shoreline of 465 km, and has over 200 islands. Unlike most lakes, it has 2 outflows that drain into Hudson Bay through two separate river systems. It has a drainage area of 560 km^2 upstream of its two outflows. Most drainage occurs via the Meliadine River, which originates at the south west end of the lake. The Meliadine River flows for a total stream distance of 39 km. The Meliadine River flows through a series of waterbodies, until it reaches Little Meliadine Lake and then continues into Hudson Bay. A second, smaller outflow from the west basin of Meliadine Lake drains into Peter Lake, which discharges into Hudson Bay through the Diana River system (a stream distance of 70 km). At its mouth, the Diana River has a drainage area of 1,460 km^2.

Watersheds in the Mine area are comprised of an extensive network of waterbodies, and interconnecting streams. The hydrology of these watersheds is dominated by lake storage and evaporation.

2.1.2 Ice and Winter Flows

Late-winter ice thicknesses on freshwater lakes in the Mine area range between 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely

formed in early November. The spring ice melt (freshet) typically begins in mid-June and is complete by early July (Golder, 2012b).

2.1.3 Spring Melt (freshet) and Freeze-up Conditions

With the exception of the main outlet of Meliadine Lake, which has been observed to flow continuously throughout the year, outlets of waterbodies near the Mine typically start flowing late May or early June, followed by freshet flows in mid-to-late-June. Flows steadily decrease in July and low flows are ongoing from August to the end of October, prior to winter freeze.

2.1.4 Permafrost

The Mine is located in an area of continuous permafrost. The depth of permafrost is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to 3 m adjacent to the lakes. The typical permafrost ground temperatures at the depths of zero annual amplitude (typically at the depth of below 15 m) are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder, 2012b).

2.1.5 Local Hydrogeology

Groundwater characteristics at areas of continuous permafrost that are generally present in the Mine area include the following flow regimes:

- A shallow flow regime located in an active layer (seasonally thawed) near the ground surface and above permafrost; and,
- A deep groundwater flow regime beneath the base of the permafrost.

From late spring to early autumn, when temperatures are above 0 ˚C, the shallow active layer thaws. Within the active layer, the water table is projected to be a subdued replica of topography. Groundwater in the active layer flows to local depressions and ponds that drain to larger waterbodies. The talik beneath large waterbodies will be open. The open talik will connect to the deep groundwater flow regime beneath the permafrost.

Elongated waterbodies with terraces and a width of 340 to 460 m or greater are expected to have open taliks extending to the deep groundwater flow regime at the Mine. Meliadine Lake and Lake B7 are likely to have open taliks connected to the deep groundwater flow regime (Golder, 2012a). No impact is expected to Lake B7 by mine activities.

2.2 Mine Development Plan

The Mine Plan and key mine development activities, including mine waste management are currently used concurrently with the WMP.

The Mine Plan proposes one underground mine (Tiriganiaq Underground Mine) and two open pits (Tiriganiaq Open Pit 1 and Tiriganiaq Open Pit 2) for the development of the Tiriganiaq gold deposit.

The Mine is estimated to produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings. The following phased approach is proposed for the development of the Tiriganiaq gold deposit;

- Phase 1: 4 years for Mine Construction. Construction began in 2015 and is estimated to be completed in 2019 (Q4 Year -5 to Year 1);
- Phase 2: 8 years for Mine Operations, beginning in 2018 (Year 1 to Year 8);
- Phase 3: 3 years Mine Closure (Year 9 to Year 11); and;
- Phase 4: Post-Closure (Year 11 forward).

Mining facilities on surface will include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility (TSF), three waste rock storage facilities (WRSFs), a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a series of water treatment plants. The general mine site layout plan is shown on Figure 1.2.

SECTION 3 • WATER MANAGEMENT CONTROLS AND STRUCTURES

A network of berms, dikes, containment ponds, channels, culverts and sumps will be constructed and maintained to facilitate water management. The following sections describe the water management design criteria for the infrastructure required at the Mine.

3.1 Water Management Systems

The water management systems, as shown in Figure 1.2, include the following components:

- Five water containment ponds (CP1, CP3, CP4, CP5, and CP6) and their associated dikes or thermal berms (D-CP1, D-CP3, D-CP4, D-CP5, and D-CP6)
- Three P-Area containment ponds (P1, P2, and P3) and four dikes (DP1-A, DP1-B, DP2-A, and DP3-A)
- A surface Saline Pond
- Three diversion berms (Berm 1, Berm 2, and Berm 3)
- Eight water diversion channels (Channel 1 to Channel 8)
- Fourteen water passage culverts to convey water (Culverts 1 to 4, 78, 8, 10 to 14, 16, 18 & 19)
- Three evaporators
- A reverse osmosis (RO) treatment plant
- An effluent water treatment plant (EWTP)
- A saline water treatment plant (SWTP)
- A sewage treatment plant (STP)
- A freshwater treatment plant (FWTP)
- A network of surface pumps and pipelines
- A freshwater intake causeway
- Two jetties and pumping infrastructure (CP1 and CP5)
- An effluent diffuser located in Meliadine Lake

During the Mine Construction and Mine Operation phases, surface contact water will be intercepted, diverted and contained within various containment ponds prior to evaporation or treatment. Water contained in CP5 will be treated by the RO treatment plant prior to discharging to CP1. The saline water collected in the Saline Pond and P-area will be temporarily stored and then actively evaporated or pumped to the SWTP prior to being pumped to CP1. At CP1, the water will be treated for total suspended solids (TSS) at the EWTP and either transferred to the process plant for use as make-up water or discharged through the diffuser located in Meliadine Lake.

Contact water from the Underground Mine will be collected in underground sumps and recirculated for use in various underground operations. Underground contact water that is not used for operations will be stored underground and any excess water that cannot be stored underground will

be pumped to the Saline Pond temporarily and then eventually transferred to P1 for active evaporation or for treatment at the SWTP and then to CP1.

During the mine closure, the water management infrastructure will remain in place until closure activities are completed and monitoring demonstrates that water quality is acceptable for discharge to the environment without treatment.

A list of the water management control structures are presented in Table 1 with the approximate Mine phase. Figure 1.2 shows the location of the respective structures at the different development stages (Year – 5 to Year 8) of the mine life. Final design details of these structures have been or will be provided to the Regulators for approval at least 30 days prior to construction, as per the Licence.

Table 1: Water Management Control Structures

Mine Phase	Infrastructure Name
Pre-Production Construction (Y-5 to Y 1)	Culvert 2
	Channel 2
	D-CP1
	CP1 Jetty
	D-CP5
	CP5 Jetty
	Permanent Freshwater Intake Causeway and Pumping Station
	Channel 1
	Berm 3
	Channel 5
	Berm 1
	Channel 6
	Channel 7
	Channel 8
	Culvert 3
	Culvert 4
	Submerged Diffuser
	WTP Intake Causeway
	Culvert 1
	CP3
	CP4
	Berm 2
	D-CP3
	D-CP4

	Channel 3
	Channel 4
Sustaining Construction during Mine Operation (Y1 to Y8)	D-CP6

3.2 Water Management Structures Design Criteria

The following sections describe various water management systems that will be designed to meet the criteria:

- Water quality guidelines that meet regulatory criteria (described in Section 8).
- Design capacity of the EWTP, D-CP1 and CP1 will be able to manage the surface contact water from the entire site for a 1:100 wet year spring freshet or a 1:2 mean year spring freshet, plus a 1:1000 return 24-hour extreme rainfall.
- With the design capacity of pumping from CP5 to CP1, D-CP5 and CP5 will be able to manage the water from its catchment area for 3/7 of a 1:100 wet year spring freshet or a 1:1000 return 24-hour extreme rainfall.
- Each of the other water management dikes (D-CP3, D-CP4, and D-CP6) and associated ponds (CP3, CP4, and CP6, respectively), with the design pumping capacity, will be able to manage the water from their respective catchment area for 3/7 of a 1:100 wet year spring freshet or a 1:1000 return 24-hour extreme rainfall.
- The daily pumping rate for each of the ponds (CP3 to CP6), Tiriganiaq Pit 1 sump, and Tiriganiaq Pit 2 sump will be designed to have sufficient pumping capacity to handle the runoff water, which would result from one day (24.4 mm) of a 1:100 return wet spring freshet plus a 1:2 return one-hour rainfall (9.8 mm).

Channel 2 to Channel 4 are designed to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 9.2 mm. Channel 1 and Channel 5 to Channel 8 are internal channels where any water overflowing the channels will remain within the catchment areas of various containment ponds. Hydraulic analyses indicated that very wide channels are required to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 9.2 mm. As a result, these channels were designed to have a reasonable bottom width to pass a flow with lesser intensity, but the water overflowing the channels can be safely managed by berms or temporarily stored in a lower basin nearby. For example, water overflowing Channel 5 can be contained by Berm 3. Water overflowing Channel 7 and Channel 8 can be stored in the lower basin in the drained Pond H13, and Berm 1 will protect Portal No.2 from flooding. Water overflowing Channel 1 will flow through the flat ground between Ore Pad 1 (OP1)/Ore Pad 2 (OP2) and WRSF2 into CP1.

Hydraulic analyses indicated that many more culverts or larger culverts would be required to pass an extreme intensity flow under a 5-minute 1:100 return rainfall of 9.2 mm for Culvert 1. As a result, Culvert 1 was designed to pass a flow with lesser intensity, but the excess water can be safely managed by berms or temporarily stored in a lower basin nearby. The excess water that cannot pass through Culvert 1 can be temporarily stored in the lower basin in the drained Pond H13, and Berm1 will protect Portal No.2 from flooding. Other culverts are less critical and the excess water that cannot pass through the culverts can be temporarily stored in a lower basin nearby, within the water containment pond catchment area.

Table 2 presents the design parameters for CP1, CP5 and CP6.

Table 2: Design Parameters for CP1, CP5 and CP6

Pond	CP1	CP5	CP6
Pond Volume for Water Elevation at Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years (m^3)	742,075	46,674	19,154
Estimated Maximum Operating **Water Elevation (m)**	66.2	66.0	63.9
Dike for Pond	D-CP1	D-CP5	D-CP6
Design Crest Elevation of Dike Containment Element (liner system) (m)	66.50	66.30	64.30
Pond Volume for Water Elevation at Design Crest Elevation of Dike Containment Element (m^3)	778,502	66,231	49,627

CP3 and CP4 will be established through sub excavation of the original ground to increase the water storage capacity and eliminate or limit the requirement for berm construction. The key design parameters for CP3 and CP4 are provided in Table 3.

Table 3: Design Parameters for CP3 and CP4

Pond	CP3	CP4
Elevated Pond Bottom Elevation (m)	62.20	61.00
Excavated Pond Outlet Elevation (m)	64.15	63.46
Pond Volume for Water Elevation at Pond Outlet Elevation (m^3)	25,454	30,911
Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years (m)	63.49	62.55
Pond Volume for Water Elevation at Projected Maximum Pond Operating Water Elevation under Normal Operating Conditions and Mean Precipitation Years (m^3)	16,899	19,458
Estimated Maximum Water Elevation during IDF (m)	64.32	63.55

Pond	CP3	CP4
Pond Volume for Water Elevation at Estimated Maximum Water Elevation during IDF (m^3)	28,056	32,304
Dike for Pond	D-CP3	D-CP4
Design Crest Elevation of Dike containment Element (liner system) (m)	65.10	64.40
Pond Volume for Water Elevation at Design Crest Elevation of Dike Containment Element (m^3)	42,456	51,337

3.3 Water Containment ponds

Five water containment ponds (CP1, CP3, CP4, CP5, and CP6) will be constructed as part of the water management infrastructure. Table 4 presents the locations and the required operational period of the containment ponds. The locations of the five water containment ponds are shown on Figure 1.2. CP1, CP5, and CP6 have been or will be established within existing shallow ponds.

Table 4: Location of Containment Pond and Required Operation Periods

Containment Pond	Relative Location	Required Operation Period
CP1	Pond H17	Year 2017 to Mine closure
CP3	North of Lake B7 and southwest of TSF	Year 2019 to Mine closure
CP4	Southeast of Lake B7 and south of WRSF1	Year 2019 to Mine closure
CP5	North of Tiriganiaq Pit 2	Year 2017 to Mine closure
CP6	Pond H19 and north of WRSF3	Year 2023 to Mine closure

3.4 P-Area Containment Ponds

The P-area consists of three storage ponds, four water containment berms and three evaporators. This area contains surface runoff and is part of the surface water management system dedicated to saline water. The total storage capacity of the P-Area ponds is 46,041 m^3. P1 is divided by a berm and P1-A (6,131.8 m^3) is the southern section of P1 and P1-B (14,649 m^3) is the northern section. P2 is adjacent and located south of P1-A. P3 was constructed east of the existing south access road, with the primary purpose of collecting seepage originating from the P2 confining berm and its abutments. A pumping station was installed to collect and pump any collected water from P3 to P1.

P1, P2 and P3 are contained by water containment berms DP1-A, DP1-B, DP2-A, and DP3-A, with three evaporators (on DP1-B). Table 5 summarizes the as-built capacities for the P-Area ponds and Figure 3.1 illustrates the P-Area plan view.

Table 5: As-Built Capacity for P-Area Ponds

Pond	P1	P2	P3
As-built Capacity (m^3)	20,781	6,828	18,432
Maximum Design Water Elevation (m)	68.5	67.5	67.0
Total P-Area Capacity (m^3)	46,041		

Increased water monitoring protocols for the P-Area, over and above that required by the Licence, were also implemented. The additional monitoring includes water quality and transfer data, such as locations and flow volumes for water pumped to and from the containment ponds are discussed further in Section 8.

3.5 Saline Pond

The Saline Pond was constructed in Q3-2016 to accommodate excess saline water from the Underground. The Saline Pond is located east of P3 and north of CP5 (Figure 1.2). Table 6 summarizes the Saline Pond capacity for storage and maximum designed operating water levels. The maximum saline water capacity, is the volume that can be stored in the Saline Pond prior to winter freeze. Approximately 9,000 m^3 capacity should be available to accommodate precipitation that may accumulate throughout winter and at freshet.

Table 6: As-Built Storage Capacity for the Saline Pond

Item	Water Balance Under Mean Precipitation Conditions
Maximum Design Water Elevation (m)	62.9
Maximum Saline Water Capacity (m^3)	23,686
Estimated Maximum Storage Capacity at Maximum Water Elevation (m^3)	32,686 *

* Includes the capacity for saline water to be pumped into the Saline Pond from Underground, a combined capacity for net precipitation, and potential seepage water into the pond.

3.6 Water Diversion Channels, Dikes and Berms

3.6.1 Water Diversion Channels

Eight water diversion channels (Channel 1 to Channel 8) will be constructed as part of the water management infrastructure. The key information and design parameters for each channel are presented in Table 7.

Table 7: Design Parameters for Channels

Item	**Channel**

	1	2	3	4	5	6	7	8
Approximate Total Length (m)	493	270	619	710	429	69	214	315
Bottom Width (m)	3	1	1 or 2*	1 or 2*	3	1	1	1
Side Slopes	3(H):1(V)	1.82(H):1(V)	3(H):1(V)	3(H):1(V)	3(H):1(V)	3(H):1(V)	3(H):1(V)	3(H):1(V)
Rip-rap Thickness (m)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Bottom Slope Gradient (%)	0.28	0.30	0.17	0.13	0.17	0.44	0.42	0.38

* 1 m bottom width for first 100 m upstream section, and 2 m bottom wide for the remaining channel section

3.6.2 Water Retention Dikes and Berms

In general terms, “dikes” will retain continuous water during normal operations and “berms” may retain short-term water during high level water events. At the end of Mine closure, when the water quality in the corresponding pond meets direct discharge criteria, each of the other dikes and berms on site (except for Berm 2) will be breached to restore the original natural drainage paths. Berm 2 will remain in place to prevent non-contact water from flowing into the TSF.

Permafrost is expected to exist beneath the footprint of each dike and berm at the Mine. Each of the water retention dikes (D-CP1, D-CP3, D-CP4, D-CP5, and D-CP6) has been designed as a zoned earth fill dam with a geomembrane liner keyed into the expected permafrost foundation to limit the seepage through the dike and its foundation. The characteristics of the dikes and berms required for the WMP are summarized in Table 8.

3.7 Evaporators

Three evaporators were installed on jetties constructed at DP1-B. The evaporator system is designed for vaporizing water contained at the P-Area. The evaporators were installed to accommodate the quantity of excess saline water before saline water treatment options and disposal plans have been implemented at the Mine. Based on data collected during 2016, the efficiency of one evaporator was estimated to be 22 m^3/hr.

3.8 Freshwater Intake

Freshwater usage at the Mine includes potable uses, fire suppression, make-up water for the mill, and other operational requirements, such as drilling water, batch plant use and use at the washbay. The main freshwater intake is housed within a rockfill causeway located north east of the industrial pad in Meliadine Lake, as shown on Figure 1.2 and an additional freshwater intake pump is located at Lake A8. The intakes consist of vertical filtration wells fitted with vertical turbine pumps that supply water on demand. Both intake pipes will be fitted with a screen of an appropriate mesh size

to ensure that fish are not entrained and shall withdraw water at a rate such that fish do not become impinged on the screen (NWB, 2016).

The Meliadine Lake freshwater intake is connected to the pump house with piping buried under the rockfill causeway.

3.9 Water Treatment

Contact water will be treated (if necessary) to meet Licence requirements prior to be discharged to the environment. TSS mitigation techniques (i.e., attenuation ponds, silt screens, etc), oil separation treatment, STP, SWTP, and an EWTP will be used at various locations at the Mine prior to water being transferred to containment ponds and/or as effluent discharge to Meliadine Lake. Water quality criteria are discussed in Section 8.

Table 8: Design Parameters for Water Retention Dike/Berm

Item	D-CP1	D-CP3	D-CP4	D-CP5	D-CP6	DP1-A	DP1-B	DP2-A	DP3-A	Berm1	Berm2	Berm3
Approximate Maximum Height (m)	5.6	2.0	2.0	3.3	1.8	3.7	3.4	4.0	3.4	1.6	2.5	2.76
Maximum Elevation (m)	67.5	66.1	65.4	67.3	65.3	70.5	70.7	69.5	69.0	68.5	varies	67.37
Maximum Head of Water Retained (m)	3.5	0.2	0.1	1.4	0.5	68.5	68.7	67.5	67.0	0	0	0

3.9.1 Freshwater Treatment Plant (WTP)

Freshwater from Meliadine Lake will be treated in the WTP before being directed to the camp areas for potable (domestic) water uses. The design flow rate for freshwater for the main camp and accommodations is 216 m^3/day. In the WTP, freshwater will be pumped through cartridge filters, then pumped through ultraviolet units, and finally treated with sodium hypochloride (chlorine). The treated water will be stored within a potable water tank. Potable water will be monitored according to the Nunavut Health Regulations for total and residual chlorine and microbiological parameters. Operation and maintenance details for the WTP can be reviewed in the Process and Control Narrative (H2O Innovation, 2016).

3.9.2 Sewage Treatment Plant (STP)

Waste water from the accommodation complex and from satellite sewage tanks will be treated in the STP before being directed to CP1. Operation and maintenance details for the STP can be reviewed in the Operational & Maintenance Manual – Sewage Treatment Plant (Agnico Eagle, 2017c).

3.9.3 Saline Water Treatment Plant (SWTP)

Saline water generated from the Underground Mine is currently being stored underground and on surface at the P-Area and the Saline Pond. A SWTP will be installed at the Mine in 2018. The location for the SWTP will be near Portal 1.

3.9.4 Effluent Water Treatment Plant (EWTP)

The Effluent Water Treatment Plant (EWTP) will be required to treat and discharge 470,000 m³ of contact water at Year -4. The volume of water requiring treatment for TSS and discharge will increase to a maximum of 798,000 m³ at Year 3 and then decrease to 673,000 m³ during the final year of the life of mine (Year 8).

Based on the anticipated water quality (Section 8) and water quantity, the EWTP will be used to treat TSS at CP1. Based on the maximum flow rate required each year, it was determined that the EWTP (Actiflo® system model ACP-600R) will have a maximum capacity of 520 m³/h (nominal flow) at Year -4 and will be increased with a second ACP-600R to reach a maximum capacity of 1,040 m³/h at Year 3.

TSS mitigation is ongoing with runoff water and is described further in the Freshet Action Plan (Agnico Eagle, 2018b). Additional TSS removal options are being considered for underground water, prior to pumping to surface.

3.9.6 Oil Separator

In 2018, an oil separator will be installed at the Maintenance Shop to collect and separate oil from water used for washing mining equipment.

3.10 Discharge Diffuser

The discharge diffuser will be the final effluent discharge location for the Mine. The overall purpose of the diffuser is to discharge water from CP1 (at sampling station Mel_14) to Meliadine Lake while providing minimal environmental impacts to the Lake. The effluent mixing will be dependent on ambient currents in Meliadine Lake, driven by wind during the open water period. The diffuser modelling was initially conducted by Golder (Golder, 2015) and updated design progress was reported by Tetra Tech EBA (Tetra Tech, EBA 2016).

SECTION 4 • WATER MANAGEMENT STRATEGY

There are four major sources of inflow water considered in the Mine water management system; freshwater pumped from Meliadine Lake and Lake A8, natural run off from precipitation, natural groundwater inflow to the Underground Mine and open pits, and water produced during freshet.

A brief summary of the water management strategy for the Mine is presented as follows:

- Contact water from key mine infrastructure will be diverted and/or collected in the containment ponds (CP1, CP3, CP4, CP5, CP6, the Saline Pond and the P-Area).
- The collected water in CP3 to CP6 will be pumped to CP1. Water collected in CP1 will be reused by the process plant and the excess water will be treated by the EWTP prior to discharge to the outside environment via the diffuser into Meliadine Lake.
- Contact water from the Underground Mine will be contained in underground sumps and the water storage stope and reused for mining operations. Excess water volumes will be pumped to the Saline Pond or P-Area Ponds to be stored on surface, actively evaporated to reduce water quantities or treated before transferring to CP1.
- Runoff water in the open pits will be collected in sumps and then pumped to the designated water containment ponds.
- Natural flooding to the open pits at end of mining will be supplemented by using freshwater from Meliadine Lake.
- Upon the completion of underground mining, the Underground Mine workings will be allowed to naturally flood by groundwater seepage.

Appendix B presents the Freshet Action Plan and the Snow Management Plan for the Mine. Table 9 summarizes the overall contact water management plan for the key infrastructure and presents the initial water collection locations and final water destinations. The plans for water management at key areas are described in following sections.

Table 9: Overall Site Surface Contact Water Management Plan

Contact Water Source	Initial Contact Water Collection Location	Final Contact Water Collection Location
Industrial Site Pad Area (camp/process plant area)	CP1	CP1
WRSF1 Area	CP1, CP4 and CP5	
WRSF2 Area	CP1 and CP5	
WRSF3 Area	CP6	
Dry Stack TSF Area	CP1 and CP3	
Ore Stockpiles OP1 to OP3	CP1	
Landfill	CP1	
Landfarm (biopile)	Sump within Landfarm	To CP1 after oil separation
Tiriganiaq Pit 1 Tiriganiaq Pit 2	Open pit sumps	First to CP5 and then to CP1
Tiriganiaq underground	Sump in underground mine	Mainly within the Underground Mine with excess surface water to be pumped to the ground surface and stored at the P-Area or Saline Pond.

Various containment ponds will be dewatered and treated (as necessary), prior to freshet (open water season) or prior to discharging through the diffuser to Meliadine Lake. The following sections describe the strategy for water management at different areas for the Mine.

4.1 Key Water Management Activities

The activities required for the WMP are summarized in Table 10. Water management activities during closure are described in Section 6.

Table 10: Key Water Management Activities

Mine Year	Major Water Management Activities and Sequence
Q4 of Yr -5 (2015)	• Start to re-use the underground water.
Yr -4 (2016)	• Dewatering of H17 into Meliadine Lake. • Dewater Pond A54 in Q3 of Year -4 and pump the water to CP1. • Start to store the excess groundwater from the underground mine at surface. • Implement and test evaporators at P-Area to reduce water volumes stored at

Mine Year	Major Water Management Activities and Sequence
	surface. • Construct trenches down gradient from DP1-B and DP3-A to be able to pump collected water seep and pump back to the associated containment pond.
Yr -3 (2017)	• Start to treat sewage water and pump the treated sewage water from the STP to CP1. • Start to pump the contact water from CP5 to CP1 for treatment/dilution • Start to pump water seepage collected in trenches, down gradient from D-CP1, D-CP5, DP1 and DP3 to the associated containment pond. • Start to pump water from washbay to underground for storage until treatment for oil plant arrives at the site • De-ice or divert water from Lakes H17A, H17B, and H17 C
Yr -2 (2018)	• Start to pump the water from CP1 to EWTP for treatment prior to discharge to the outside environment via the diffuser in Meliadine Lake. • Pump the underflow sludge water from the EWTP to CP1. To limit recirculation of the sludge within CP1, the discharge will be located away from the EWTP intake. • Start to divert the contact water from industrial pad to CP1 via Channel 1. • Start to pump the water from the Landfarm to CP1 after pre-treatment for oil. • Start to treat CP5 water by RO for removal of TDS. Permeate will blend with CP1 water prior to environmental discharge.
Yr -1 (2019)	• Start to pump the treated water from EWTP to the Process Plant as make-up water • Start to pump the underflow sludge water from WTP to the mill • During the open water season, the Process Plant will be supplemented as much as possible with water from the EWTP. For the balance of the year, freshwater will be used for ore processing
Yr 1 (2020)	• Start to pump the contact water in CP3 to the partially drained Pond H13 where the water will flow through Channel 1 into CP1 • Start to pump the contact water in CP4 to the partially drained Pond H13 where the water will flow though Channel 1 into CP1
Yr 2 (2021)	• Start to pump the contact water collected in Tiriganiaq Pit 1 to CP5
Yr 3 (2022)	• Dewater Ponds H19 and H20 in Q3 of Year 3 and pump the water to CP1
Yr 4 (2023)	• Start to pump the contact water collected in Tiriganiaq Pit 2 to CP5 • Start to pump the contact water in CP6 to CP1
Yr 5 (2024)	• WMP similar to Year 4
Yr 6 (2025)	• WMP similar to Year 4
Yr 7 (2026)	• WMP similar to Year 4 • Stop pumping water from open pits when the pits are mined-out at the end of year • Stop pumping excess water from underground when underground mining is completed

Mine Year	Major Water Management Activities and Sequence
Yr 8 (2027)	• Start to fill the mined-out Tiriganiaq Pit 1 and Tiriganiaq Pit 2 with active pumping water from Meliadine Lake • Start natural flooding of Tiriganiaq Underground Mine with groundwater seepage • Stop pumping water to process plant when the processing is completed

4.1.1 Pond Dewatering and Displacement

The initial dewatering at Lake H17 and Lake A54 was conducted in 2016 prior to constructing CP1 and CP5, respectively. The water from these ponds was pumped to Meliadine Lake through a temporarily installed diffuser. Dewatering of Ponds H19, and H20, is assumed that approximately half the volume of water in these ponds will be pumped to Meliadine Lake if it meets discharge criteria, and the remaining volume of water will be pumped to CP1 to be stored for treatment or dilution. Table 11 summarizes the dewatering plan and estimated volume of water to be dewatered for construction or prior to freshet.

Table 11: Pond Dewatering Plan

Pond	A54 (CP5)	H17 (CP1)	H20	H19
Maximum Pond Water Depth (m)	1.3	1.7	1.6	1.4
Existing Pond Surface Area (ha)	5.99	15.4	9.58	2.91
Dewatering Schedule	Sept. to Oct. of 2016	August to September of 2016	Sept. to Oct. of Year 3	Sept. to Oct. of Year 3
Estimated Total Volume of Water to be Dewatered (m^3)	34,545	82,400	90,307	16,431

The Meliadine Esker is located adjacent and north of CP1 and contains three shallow ponds (H17a, H17b, and H17c) (Figure 1.2). The three ponds will have ice removed or the water will be diverted directly to CP1 during the open water season. During the freshet, excess water at Ponds H15 and H15E will be diverted and pumped directly to CP1.

Ponds may also be displaced by the placement of fills. The water displaced by fill material will be diverted and collected in the adjacent water containment ponds. During winter season, the ice within the ponds will be removed and deposited at CP1 before site infrastructure construction.
Channel 1 will drain Ponds H8, H9, H10, H11, H12, and H13. The water in these ponds will be contained and treated prior to discharge to CP1. If water quality meets requirements, these ponds will flow naturally to CP1 via Channel 1 without prior treatment.

Channel 5 will drain Ponds A12 and A13. The water in these ponds will flow into CP5 via Channel 5.

4.1.2 Underground Water Management

The Underground Mine will extend approximately 650 m below the ground surface and part of the underground workings will be operated below the base of continuous permafrost. The underground excavations will act as a sink for groundwater flow during mining, with water induced to flow through the bedrock to the Underground Mine workings once the Mine has advanced below the base of the permafrost. Table 12 presents the predicted groundwater inflow rates for passive groundwater inflow to the Underground Mine.

Table 12: Predicted Groundwater Inflow to the Underground Mine (2017 to 2032)

Period	Predicted Groundwater Inflow (m^3/day)
2017	230
2018	300
2019	280
2020	300
2021	340
2022	340
2023-2024	420
2025-2026	380
2027-2028	390
2029-2030	380
2031-2032	360

Source: Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine (Golder 2016).

Underground contact water will be contained within underground sumps and the Water Stope. A proportion of the underground water will be recirculated as make-up water for underground drilling. The drilling water will report to the underground sumps for recirculation; however, the need for up to 3% treated water make-up has been assumed to compensate for losses of drilling water due to evaporation or capture within the mined waste rock that is transferred to surface.

Excess underground water will be pumped to surface to be managed. The estimated volume of water to be managed is expected to range from a minimum of about 0.11 Mm^3/year to a maximum of 0.18 Mm^3/year depending on the production. Details of the underground dewatering system are provided in the Mine Plan (Agnico Eagle, 2017a).

Calcium chloride is added to the underground water to increase salinity and reduce water freezing during drilling. A heating system was installed in Q4-2017 and calcium chloride usage will be decreased underground. Excess water that is pumped to surface will be treated to meet regulatory criteria prior to any discharge to environment. Additional details are described in the GWMP in Appendix A.

4.1.3 Water Management for Haul Road

A network of haul roads will be used to provide access to infrastructure at the Mine. The majority of the roadways servicing the mining area will be located so that drainage will be directed towards the contact water management infrastructure. Detailed information about water management on roads is described in the Roads Management Plan (Agnico Eagle, 2014).

4.1.4 Water Management for Landfarm and Landfill

Water management for water collected at the Landfarm will be treated for oil and then pumped to CP1. Additional details for Landfarm water management is described in the Landfarm Management Plan (Agnico Eagle, 2015b).

Leachate from the Landfill is anticipated to be diluted due to the controls placed on materials acceptable for the landfill. Drainage from the Landfill is expected to freeze within the WRSF with minimal amounts of leachate reporting to the water collection infrastructure placed around the WRSF. Annual Landfill operations will involve clearing of snow prior to spring melt. However, in the event there is leachate from the Landfill due to periods of heavy rainfall or spring freshet, the runoff will be collected, controlled and treated, if necessary (Agnico Eagle, 2015a), and sent to CP1.

4.1.5 Water Management for Emulsion Plant Area

Freshwater will be trucked to the emulsion plant and used for manufacturing emulsion as well as for washing the explosive trucks. Water within the emulsion plant will be re-used when feasible, and excess water will be collected and disposed of with an appropriate method that is currently being evaluated by Agnico Eagle.

4.1.6 Water Management for the Batch Plant

Freshwater is pumped from Lake A8 to the Batch Plant and used for concrete production. Water used in the Batch Plant will be re-used when feasible and excess used water will be collected and disposed of in P1.

4.1.7 Water Management for the Wash Bay

Freshwater is pumped from Lake A8 to the Wash Bay and used to wash equipment at the Mine. Water used in the Wash Bay will be re-used when feasible and excess used water will be collected and disposed of appropriately. Water treatment will be commissioned in 2018 for excess Wash Bay water at the Maintenance Shop.

4.2 Freshwater and Sewage Water Management

Additional freshwater usage and sewage water management is described in the following sections.

4.2.1 Freshwater Management

Major freshwater usages on site include potable use, fire suppression, a portion of make-up water for the mill, and other operational needs, such as drilling. Freshwater will be sourced from Meliadine Lake through a freshwater intake and pump system. For dust suppression, water will be sourced from ponded water against the All Weather Access Road (AWAR), small ponds proximal to the road and/or from the Meliadine River.

Freshwater will be pumped through an overland pipeline to an insulated main storage tank located at the plant site. Approximately 62,000 m^3/year of freshwater will be required during construction phase, and approximately 318,000 m^3/year of freshwater will be required during operation phase. Additionally, approximately 4,000,000 m^3 of freshwater will be required per year to fill the mined-out open pits during the mine closure. These quantities are inclusive of water needs for dust suppression.

The design flow rate for the potable water for the main camp and accommodations (kitchen, laundry) is 136 m^3 per day (based on a 680-people camp capacity and a nominal consumption of 200 L/day/person). Treated potable water will be treated at the freshwater treatment plant (FWTP) and then piped to areas in the process plant, service complex, and other facilities requiring potable water.

4.2.2 Sewage Water Management

Sewage will be collected from the camp and change-room (dry) facilities and pumped to the STP. The objective of the STP is to treat sewage to an acceptable level for discharge to CP1 via a sewage water discharge pipeline. The STP is housed in a prefabricated (modular) structure, located at south-east of the service complex at the Industrial Pad, as shown in Figure 1.2. The sewage treatment system will be designed based on a flow rate of 200 L per day per worker for a peak load of 680 people, for an average daily flow rate of 136 m^3 (5.67 m^3/h).

The STP for the camp facilities will be designed to meet appropriate guidelines for wastewater discharge (Agnico Eagle, 2017).

4.2.3 Process Water Management

Process water will be required in the mill for ore processing. Both contact water from CP1 and sludge water from the EWTP will be used as process water. When possible, water from CP1 will be the main source of water for the ore process. Additional water needs will be supplied by freshwater from Meliadine Lake. Approximately 460 m^3/day of process water will be required in Year 1 to Year 3 operations and approximately 770 m^3/day of process water will be required in Year 4 to Year 8.

4.3 Discharge Diffuser Effluent Flow Rates

The effluent discharge pump responsible for sending effluent into Meliadine Lake via a diffuser has a design rate of 11,688 m^3/day (a water treatment rate of 12,000 m^3/day minus 312 m^3/day of sludge returned back to CP1). The pump does not operate continuously. It was assumed that once the pump is activated, it would stay active, i.e., pumping, for at least three consecutive days. The amount of effluent flow released over each month and over each year was based on the overall water balance for the feasibility study (Tetra Tech EBA, 2016).

Table 13 shows the estimated total volume of effluent released per month per year.

Table 13: Estimated Effluent Flow Rates over Mine Operating Life

Year	Effluent Released Over the Course of the Month (m^3)				
	June	July	August	September	October
Year -3: 2017	175,320	233,760	70,128	70,128	23,376
Year -2: 2018	175,320	163,632	81,816	70,128	23,376
Year -1: 2019	175,320	151,944	93,504	58,440	23,376
Year 1: 2020	175,320	268,824	116,880	93,504	35,064
Year 2: 2021	175,320	303,888	105,192	93,504	35,064
Year 3: 2022	175,320	292,200	105,192	163,632	70,128
Year 4: 2023	175,320	350,640	128,568	105,192	35,064
Year 5: 2024	175,320	350,640	128,568	93,504	35,064
Year 6: 2025	175,320	350,640	128,568	93,504	35,064
Year 7: 2026	175,320	350,640	128,568	93,504	35,064
Year 8: 2027	175,320	280,512	105,192	81,816	35,064
Year 9: 2028	175,320	292,200	116,880	93,504	35,064
Year 10: 2029	175,320	292,200	116,880	93,504	35,064
Year 11: 2030	175,320	280,512	116,880	93,504	35,064

SECTION 5 • WATER BALANCE

5.1 Global Water Balance

A water balance model was developed to assist in the evaluation of the water management infrastructure and estimation of the pumping requirements over the life of the Mine and under closure conditions. The model includes a water balance conducted on both a monthly and yearly basis. The model focuses specifically on contact water management infrastructure and areas that have been affected by mining activities.

A monthly site-wide water balance was conducted for CP1, CP3, CP4, CP5 to CP6, Tiriganiaq Pit 1, Tiriganiaq Pit 2, water in the underground mine operation, make-up water for the mill, water for the WTPs, and freshwater during mine construction period to mine closure under mean precipitation years. The water balance will be updated in further iterations of the WMP, as stated in the Licence, prior to operations. The following sections present the parameters and assumptions adopted in the water balance model along with a summary of the water balance results.

5.2 Water Balance Framework

The water balance framework developed for the site-wide water balance model was presented in Version 1 of the WMP (Agnico Eagle, 2015a). To simulate a range of conditions, the model was run for the proposed mine life and closure conditions.

5.3 Water Balance Assumptions

The water balance was based on the following:

- snow accumulates throughout the months of November to May, and thaws in June during the annual spring freshet period;
- average precipitation year climate conditions;
- the open pits and water containment ponds (CP3 to CP6) are not to be used for long-term storage of water during operations;
- the water collection sumps and ponds are empty in the autumn prior to the spring freshet each year; and,
- other water management assumptions described in Section 4 of this WMP.

A general water management flow sheet illustration is presented in Appendix C.

5.4 Water Balance Results

The estimated maximum annual water input/output from each of the various water management facilities under mean precipitation conditions are summarized in Table 14. Results were also

provided for 1:100 year wet and dry conditions, with corresponding basis and assumptions, in a separate technical memorandum (Tetra Tech EBA, 2015).

Table 14: Estimated Maximum Annual Volumes from Mine Site Water Balance

Item	Maximum Annual Water Volume (Mm^3)
Contact Water from CP1	0.800
Contact Water from CP3	0.088
Contact Water from CP4	0.087
Contact Water from CP5	0.240
Contact Water from CP6	0.076
Water Pumped from CP1 to WTP for Treatment	0.798
Fresh Water Pumped from Meliadine Lake during Construction	0.062
Fresh Water Pumped from Meliadine Lake during Operation	0.318
Treated Water from WTP to be Discharged to Outside Environment	0.730
Underground Water Pumped to Underground TSS Removal Plant	0.696
Excess Water from Underground Mine to be Stored on Surface	0.155
Fresh Water Pumped from Meliadine Lake to Fill Mined-out Tiriganiaq Pit 1	3.068
Fresh Water Pumped from Meliadine Lake to Fill Mined-out Tiriganiaq Pit 2	0.749

5.5 Waterbody Inventory

Three watersheds (Watershed A, Watershed B and Watershed H) will be impacted by the Mine activities. Table 15 presents the waterbodies that are impacted by mining activities. Watersheds and waterbodies in proximity to the Mine location and waterbodies affected by Mine infrastructure are shown on Figure 5.1.

Table 15: Inventory of Waterbodies Impacted by Mining Activities

Watershed	Waterbody	Maximum Lake Water Depth, m	Total Area (ha)	Water Volume (m^3)	Notes
A	A9	N/A	0.18	-	Flow regimes impacted by the development of Tiriganiaq Pit 1
	A10	0.67	0.26	-	Ponds removed by development of Tiriganiaq Pit 1
	A11	0.45	0.40	-	
	A12	0.87	0.47	-	Pond drained due to construction of Channel 5
	A13	0.30	0.26	-	
	A17	0.30	0.16	-	Covered by WRSF 1
	A38	N/A	0.05	-	Flow regimes impacted by the development of Tiriganiaq Pit 2
	A39	0.48	0.12	-	Ponds removed by development of Tiriganiaq Pit 2
	A54	1.3	5.99	34,545	Dewatered for CP5
	A58	0.50	0.43	-	Covered by WRSF 2
B	B8	0.8	1.43	-	As part of CP4/D-CP4
	B9	1.40	0.64	-	Covered by WRSF1
	B10	0.8	0.33	-	Ponds removed by development of Tiriganiaq Pit 1
	B28	N/A	0.45	-	As part of CP3/D-CP3
H	H6	0.58	0.75	-	As part of CP1
	H7	0.67	0.11	-	
	H8	0.59	0.38	-	Partially covered by WRSF2 and haul road
	H9	0.40	0.42	-	Partially covered by WRSF2 and OP2
	H10	0.11	0.10	-	Partially covered by WRSF2 and OP2, drained due to construction of Channel1
	H11	0.27	0.28	-	
	H12	0.81	0.97	-	Drained due to construction of Channel1 and partially covered by OP1
	H13	1.04	3.49	-	Drained due to construction of Channel1 and partially covered by industrial pad
	H14A	0.37	0.15	-	Covered by industrial pad
	H15D	0.30	0.15	-	Partially covered by TSF
	H15G	0.40	0.38	-	
	H17	1.70	15.8	195,700	Dewatered for CP1
	H17A	1.50	0.13	1,365	Dewatered for Meliadine esker
	H17B	1.50	0.69	10,350	Dewatered for Meliadine esker
	H17C	1.50	0.23	3,450	Dewatered for Meliadine esker
	H18	0.67	0.74	-	Covered by OP2
	H19	1.40	2.91	16,431	Dewatered for CP6
	H20	1.60	9.58	90,307	Covered by WRSF3

"-" indicates that data not available or not applicable Ponds to be drained Ponds to be dewatered

SECTION 6 • WATER MANAGEMENT DURING CLOSURE

The detailed Mine closure and reclamation activities are provided in the Preliminary Closure and Reclamation Plan (Agnico Eagle, 2015d).

Water management during closure and reclamation will involve flooding the open pits using precipitation and freshwater from Meliadine Lake, flooding the Underground Mine workings with groundwater inflows (groundwater seepage), and maintaining contact water management systems on site until monitoring results demonstrate that water quality are acceptable for discharge of all contact water to the environment without further treatment. Once water quality meets the discharge criteria, the water management systems will be decommissioned to allow the water to naturally flow to the environment.

The key water management activities during Mine closure are summarized in Table 16. Figures 6.1 and 6.2 illustrate the WMP during and after Mine closure, respectively. Additional details for the activities are described in the following sections.

Table 16: Key Water Management Activities during Mine Closure

Mine Year	Figure	Key Water Management Activities and Sequence
Yr 9 to 11	6.1	• Finish flooding the mined-out Tiriganiaq Pit 1 and Tiriganiaq Pit 2 by Q4 of Year 10 • Continue to collect and manage the contact water in CP1, CP3, CP4, CP5 and CP6 • Continue to pump the contact water in CP1 to EWTP, if required, for treatment before being discharged to the outside environment • Remove non-essential site infrastructure • Pump the underflow sludge water from EWTP to CP1 • Continue natural flooding of Tiriganiaq Underground Mine with groundwater seepage • Remove Meliadine Lake pumping system
Post-Closure	6.2	• Treat the contact water until water quality meet direct discharge criteria and then decommission the water management system • Continue natural flooding of Tiriganiaq Underground (progressive reclamation since Year 8) • Breach water retention dikes D-CP1, D-CP3, D-CP4, D-CP5, and D- CP6 once water quality monitoring results meet discharge criteria to allow water to naturally flow to outside environment • Remove culverts and breach remaining water retention dikes/berms in Year 18

6.1 Open Pits Flooding

When flooding the open pits for closure, the maximum pumping rate from Meliadine Lake shall not exceed 4,000,000 m^3/year during closure of the Mine, as stated in Part E of the Licence. The planned pumping period will occur during the open water season from mid-June to end of September for each year. Table 17 summarizes the pit volume and expected water elevations at the completion of flooding activities. It will take approximately three years to fill the pits with an assumed pumping rate of 0.44 m^3/s (38,300 m^3/day). The assumed pumping rate of 0.44 m^3/s from Meliadine Lake during closure will have negligible effect to Meliadine Lake when compared to the average outflow rate at the outlet of Meliadine Lake. The pumping rate will be evaluated further to validate that any possible negative effects to Meliadine Lake do not occur.

Table 17: Pit and Underground Flooding

Pit	Volume (Mm^3)	Final Water Elevation (masl)	Water Source
Tiriganiaq Pit 1	9.20	64.14	Freshwater from Meliadine Lake
Tiriganiaq Pit 2	2.25	64.38	Freshwater from Meliadine Lake
Tiriganiaq Underground	1.4	Groundwater level	Groundwater seepage

The water quality model results indicated that water quality in the flooded pits will meet the discharge criteria and post closure treatment will not be required. The water quality within the pits will be monitored during flooding to verify the prediction of the water quality model. The information will be used to develop a strategy to minimize contamination of the regional surface water system.

6.2 Underground Mine Flooding

Passive flooding of the Tiriganiaq Underground Mine will occur following the completion of mining. The estimated total flooding volume of the underground workings is 1,372,000 m^3. Seepage water into the Underground Mine will be the main water source for flooding. At the predicted seepage rate it is estimated to take 6 years to flood the Underground Mine.

6.3 Containment Ponds, Dikes and Berms

The containment ponds, dikes and berms will remain in place to collect the surface runoff water and seepage from the Mine until the water quality meets discharge criteria. Once the water quality meets discharge criteria, dikes/berms will be breached to allow the water to naturally flow to the environment. Dikes/berms breaching will involve the removal of a portion of the dikes to a minimum depth of 1 m below average water level or back to original ground levels. Consideration

will be given to breach staging, with the above water portions of the dike/berm in the breach area removed during winter periods, when there will be little surface water flow, thereby minimizing the potential release of sediments to the neighbouring waterbodies. The remainder of the breach would be conducted during the open water season following freshet so as to allow for the deployment of turbidity controls to minimize potential sediment release to the environment.

6.3 Channels and Sumps

Once monitoring results have indicated that contact water conveyed in channels and sumps meets acceptable water quality, the infrastructure will be graded and/or surface treated according to site-specific conditions to minimize wind-blown dust and erosion from surface runoff, if required. This closure activity is intended to enhance site area development for re-colonization by native plants and wildlife habitat.

SECTION 7 • WATER QUALITY

Water quality predictions for the Mine were generated using the GoldSim database management and simulations code (Version 11.1.2) where Mine contact water flows derived from the Meliadine water balance are combined with chemistry data from materials exposed in mine infrastructure (tailings storage facility, waste rock piles, etc.), and site baseline information. Where site specific information is not available, data collected at other mine sites in the north are used to supplement the input data.

Water quality estimates were generated for the operational and post-closure periods, for each contact water containment ponds, for sumps in the two open pits and for the two fully flooded open pit lakes post-closure.

The sensitivity of water quality to an added TSS load was evaluated outside of the GoldSim mass balance model. Total parameter concentrations were evaluated at ponds that discharge to the receiving environment (i.e., CP1 during operations, and CP1, CP3, CP4, and CP6 post-closure) based on an addition of 15 milligrams per litre TSS, the maximum monthly mean of the Metal Mining Effluent Regulations (MMER) criteria. Given the uncertainties associated with the modelling exercise (i.e., the development stage of the Mine, laboratory-based input values, assumptions where data do not exist and consideration of an average climate year), the predicted concentrations are considered to be order-of-magnitude estimates. The estimates are sensitive to the assumptions and design elements considered. The water quality modelling predictions will be updated as stated in the Licence in future iterations of the WMP, prior to operations. A water balance and water quality model will be updated at a minimum of every two (2) years following commencement of Operations, as required by the License.

Table 18 shows the various constituent concentrations corresponding to the Licence and the predicted values. These concentrations correspond to end-of-pipe concentrations discharge from the diffuser to Meliadine Lake (Tetra Tech EBA, 2016).

7.1 Summary of Regulatory Guidelines

Water quality results are compared to MMER and Site Specific Water Quality Objectives (SSWQO) guidelines and will be compliant prior to discharging to Meliadine Lake or the environment. Post-closure discharge water quality will be compared to Canadian Council of Ministers of the Environment Water Quality Guidelines (CCME-WQG) guidelines or the Meliadine SSWQO developed for aluminum, fluoride, and iron (Golder 2013a, 2013b, 2014).

Table 18: Effluent Characteristics

	Water Licence "A"		Meliadine Lake Median Background Concentration [mg/L]	End-of-Pipe Prediction based on Tiriganiaq Monthly Average Concentrations	
	Maximum end-of-pipe Average Concentration [mg/L]	Maximum end-of-pipe Concentration of Any Grab Sample [mg/L]		Dissolved Contaminant Concentration [mg/L]	Total Used in the Model (Dissolved + 15 mg/L TSS) [mg/L]
Conventional Constituents					
Total Dissolved Solids	1400	1400	35.0	204	204
Total Suspended Solids	15	30	1.5		15
pH	6 to 9.5	6 to 9.5	7.4		
Major Ions					
Chloride			6.4	20	20
Fluoride			0.03	0.0002	0.0002
Sodium			3.2	5.3	5.6
Sulphate			2.9	35.9	35.9
Nutrients					
Total Ammonia as Nitrogen	14	18	0.025	4.6	4.6
Nitrate Ion	-	-	0.11	5.8	5.8
Phosphorus (total)	2	4	0.0055	0.4	0.4
Cyanides					
Total cyanide	0.5	1.0	0.00100	0.005	0.005
Free cyanide	-	-			
Metals					
Aluminum	2	3	0.0025	0.09	1.20
Antimony			0.0001	0.0029	0.0029
Arsenic	0.3	0.6	0.0003	0.101	0.191
Barium			0.0071	0.012	0.021
Cadmium			0.00003	0.000005	0.000012
Chromium			0.0002	0.00001	0.0030
Copper	0.2	0.4	0.00111	0.0011	0.0037
Iron			0.0235	0.01	1.70
Lead	0.2	0.4	0.00003	0.0011	0.0049
Manganese			0.00283	0.12	0.13

7.2 Operations

During operations, the water quality at the Mine (including CP1 water) is anticipated to meet regulatory monthly mean discharge criteria, with the possible exception of TSS at all ponds and arsenic, on occasion, at CP3 which receives water from the TSF. Although TSS content was not specifically modelled, experience at other northern mine sites suggests that TSS in site contact water is likely to require attenuation during operations to meet the MMER effluent criteria of 15 mg/L monthly average (Government of Canada, 2012). An EWTP that removes TSS is planned to be operational in Year -4 of the Mine.

CP3 arsenic concentration may exceed MMER on occasion if precipitation events generate drainage from the TSF (Golder, 2012c). The main source of arsenic in CP3 is predicted to be from residual process water that is assumed to be present in the filtered tailings. Arsenic transfer from process water to CP3 water will be minimized by effective dewatering of the tailings prior to placement into the TSF, and from freezing of the tailings in the TSF which will act to limit infiltration and seepage. Water from CP3 will be pumped to CP1 where it will mix with other site waters before discharge. Dissolved arsenic concentration in CP1 is predicted to meet the MMER monthly average maximum concentration. All other chemical parameters in CP3 and all chemical parameters in CP4, CP5, and CP6 are predicted to meet MMER limits for chemical constituents.

7.3 Post-Closure

The long-term, post-closure water quality in the containment ponds and in the flooded open pit lakes are anticipated to meet MMER limits and CCME-WQG for the protection of aquatic life or the SSWQO developed for the Mine for aluminum, fluoride, and iron. Arsenic concentrations in CP3 could slightly exceed the SSWQO post-closure, a criteria that is conservatively protective of the receiving aquatic environment (Golder, 2013a). Concentrations that exceed predictions are minor, much less than the mixing capacity in the receiving environment. These arsenic concentrations (Golder, 2013a) are within the tolerance levels that have been deemed non- deleterious by Environment Canada for the Mine (Environment Canada, 2014).

SECTION 8 • WATER QUALITY MONITORING PROGRAM

Water quality monitoring is an important part of the Mine WMP to verify the predicted water quality trends and conduct adaptive management should differing trends be observed. This section outlines the water quality monitoring plan, which will be further defined as the Mine advances.

Water quality monitoring has been initiated at the pre-development stage and will continue during construction, operations, closure, and post-closure. Monitoring will occur at three levels:

1. Regulated discharge monitoring that occurs at monitoring points specified in the Licence or regulations.
2. Verification monitoring that is undertaken for operational and water management purposes by Agnico Eagle. This monitoring data will not be reported to the Regulators in the Annual Water Licence Report, but can be provided upon request by the Regulators
3. General monitoring that is commonly included in the Licence, specifying what is to be monitored according to a schedule. This monitoring is subject to compliance assessment to confirm sampling was carried out using established protocols, included quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring will be used at the Mine. The following section presents the conceptual water quality monitoring plan during construction, operations and closure. More detailed information on monitoring programs is described in the Environmental Management and Protection Plan (EMPP) (Agnico Eagle, 2018a) and is based on the Licence.

8.1 Water Quality Monitoring

Table 19 presents the water quality monitoring stations during construction, operation, closure and post-closure phases. Figure 8.1 presents the water quality monitoring locations for all three Mine phases.

Table 19: Water Quality Regulated, General Aquatic and Verification Monitoring for the Meliadine Gold Mine during Construction, Operations, and Closure

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	Frequency
Regulated	Construction	MEL-D-1 to TBD	Dewatering: Water transferred from lakes to Meliadine Lake during dewatering of lakes		Prior to discharge and weekly during discharge Daily during periods of discharge
Regulated	Construction and Operations	MEL-SR-1-TBD	Surface Runoff – runoff downstream of Construction areas at Meliadine Site and Itivia Site, Seeps in contact with the roads, earthworks and any Runoff and/or discharge from borrow pits and quarries		Prior to construction, weekly during construction Monthly during open water or when water is present upon completion
General Aquatic	Construction, Operation, and Closure	MEL_11 (MEL-04 suggested by Agnico Eagle in the Application)	Water intake from Meliadine Lake	Quality of intake water	Monthly during period of intake (Full Suite); Daily during periods of intake (Volume m^3)
Verification	Construction (prior to release), Operation, and Closure	MEL_12	Water treatment plant (pre-treatment) coming from H17 station will be off the pipe and not in the pond	Test quality of water before treatment (required to evaluate treatment efficiency	Monthly during periods of discharge

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	Frequency
General Aquatic	Construction (prior to release), Operations, and Closure	MEL_13	Mixing zone in Meliadine Lake, station 1; and MMER exposure stations for final discharge point within mixing zone	Test mixing of effluent in the receiving environment; sample at varied distances and directions from pipe; MMER exposure for final discharge point	Monthly during periods of discharge
Regulated	Construction (upon effluent release), Operation, and Closure	MEL_14[a] (MEL-01 suggested by Agnico Eagle in the Application)	Water treatment plant (post-treatment), end of pipe (before offsite release) in the plant before release.	Test quality of final effluent before release	Prior to discharge and weekly during discharge (Full Suite, Group 3); Daily during periods of discharge (Volume m^3); Once prior to discharge and monthly thereafter (Acute Lethality)
Verification	Operations, Closure	MEL_15	Local Lake, E3	Confirm no leakage/runoff from Emulsion Plant	Bi-annually during open water
Verification	Construction, Operations, Closure	MEL_16	Local Lake, G2	Possible seepage or dust loadings from site infrastructure	Bi-annually during open water
Verification	Construction, Operations, Closure	MEL_17	Pond, H1	Possible seepage or dust loadings from site infrastructure	Bi-annually during open water
Verification	Construction, Operations, Closure	MEL_18	Local Lake, B5	Possible seepage or dust loadings from site infrastructure	Bi-annually during open water

Monitoring Type	Mine Development Phase	Monitoring Station Number	Station Description	Purpose of Station	Frequency
Verification	Operations, Closure	MEL_20	CP3	Collection of drainage from dry stacked tailings	Monthly during open water or when water is present
Verification	Operations, Closure	MEL_21	CP4	Collection of drainage from WRSF1	Monthly during open water or when water is present
Verification	Construction, Operations, Closure	MEL_22	CP5	Collection of drainage from WRSF1 and WRSF2	Monthly during open water or when water is present
Verification	Operations, Closure	MEL_23	CP6	Collection of drainage from WRSF3	Monthly during open water or when water is present
Verification	Construction, Operations, Closure	MEL_24	Seepage from Landfill between the Landfill and H13	Located between the landfill and Pond H3 to monitor seepage from the landfill	Monthly during open water or when water is present
Regulated	Construction, Operations, Closure	Mel-25	Secondary containment area of the tankfarm at Itivia	Test quality before discharge to land	Prior to discharge or transfer of effluent

[a] *Sampling may not occur during break-up (June)*

CP = contact pond; WRSF = waste rock storage facility;

During the closure period, parameters included in the CCME-WQG for freshwater aquatic life may also be included in the verification monitoring program.

8.2 Licence Water Monitoring

Regulatory guidelines are applied at the last point of control prior to discharge to the receiving environment as part of the Licence.

REFERENCES

Agnico Eagle. 2014. Meliadine Gold Project: Roads Management Plan. Version 3. April 2014.

Agnico Eagle. 2015a. Meliadine Gold Project: Mine Plan. Version 1. 6513-MPS-10. April 2015.

Agnico Eagle. 2015b. Meliadine Gold Project: Landfill and Waste Management Plan. Version 4. 6513-MPS-06 April 2015.

Agnico Eagle. 2015c. Meliadine God Project: Landfarm Management Plan. Version 1. 6513-MPS-15. April 2015.

Agnico Eagle. 2015d. Meliadine Gold Project: Preliminary Closure and Reclamation Plan. Version 1.0. 6513-CRP-01. April2015.

Agnico Eagle. 2017a. Meliadine Gold Project: Mine Plan. Version 1. 6513-MPS-10. April 2017.

Agnico Eagle. 2017b. Meliadine Gold Project. Water Management Plan. Version 3. 6513 MPS-11. March 2015.

Agnico Eagle.2017c. Meliadine Gold Project. Operational & Maintenance Manual – Sewage Treatment Plant – Version 2, February 2017.

Agnico Eagle. 2018a. Meliadine Gold Project: Environmental Management and Protection Plan (EMPP). Version 4. 6513-MPS-07. April 2015.

Agnico Eagle. 2018b. Meliadine Gold Project. 2018 Freshet Action Plan.

BEKO Technologies GMBH. Unknown. Bekosplit 12, 13, 14 Instructions for Installation and Operation.

Environment Canada. 2014. Electronic mail communication from Environment Canada to Agnico Eagle. Subject: Assessment of Meliadine Waste Rock. May 6, 2014.

Golder (Golder Associated Ltd.). 2009. Assess of completeness of geotechnical data for feasibility design Tiriganiaq open pit. Submitted to Comaplex Minerals Corp., 26 May 2009, Doc. 008 Rev. 0

Golder. 2012a. SD 7-2 Aquatic Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 19, 2012.

Golder. 2012b. SD 6-1 Permafrost Thermal Regime Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 25, 2012.

Golder. 2012c. Tailings Storage Facility Preliminary Design – Meliadine Gold Project, Nunavut. A Draft Report Submitted to Agnico Eagle Mines Ltd. by Golder, August 16, 2012.INAC, 1992. Guidelines for ARD Prediction in the North. Department of Indian Affairs and Northern Development, Northern Mine Environment Neutral Drainage Studies No.1, Prepared by Steffen, Robertson and Kirsten (B.C.) Inc.

Golder. 2013a. Site specific Water Quality Objectives (SSWQO) Assessment – Meliadine Gold Project, Nunavut. Document 371. Report to Agnico-Eagle Mines Ltd. February 22, 2013. 57 p.

Golder. 2013b. Appendix 7.2-B, Hydrogeological Modelling, Meliadine Gold Project, Nunavut. Technical Report Submitted to Agnico Eagle Mines Ltd. Reference No. Doc 335-101370076, Jan. 16, 2013.

Golder. 2014. Assessment of Site Specific Exposure and Toxicity Modifying Factors on Aluminum Toxicity and Validation of Non-Deleterious Nature of All Parameters of Potential Concern in Waste Rock Leachate – Meliadine Gold Project, Nunavut. Document 440. 2014. Report to Agnico-Eagle Mines Ltd. March 14, 2014. 7 p.

Golder. 2015. Meliadine Gold Project. Appendix E: Near-Field Modelling and Diffuser Design. Report Number: Doc 493-1405283 Ver. 0. March 2015.

Golder. 2016. Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine – V5 Mine Plan. Reference No. 1656287-002-TM-Rev0-1000. Memo to Agnico Eagle Mines Ltd. December 18, 2016.

Government of Canada. 2012. Metal Mining Effluent Regulations. SOR/2002-222; current to November 18, 2012.

H2O Innovation. 2016. Process and Control Narrative: Meliadine WTP. P65873-I13-0001, 01. July 25, 2016.

Nunavut Water Board (NWB). 2016. Type A Water Licence: No: 2AM-MEL1631. April 1, 2016.

Snowden. 2008. Tiriganiaq gold deposit, Nunavut – resource update. Submitted to Comaplex Minerals Corp. January 2008.

Tetra Tech EBA. 2015. Summary of Water Balance Key Assumptions and Results, Meliadine Gold Project. Technical Memorandum Submitted to Agnico Eagle Mines Ltd. by Tetra Tech EBA, October 2015.

Tetra Tech EBA. 2016. Meliadine Lake Diffuser Design Progress Report for Discussion. September 20, 2016. File: E14103230-01 Task 007.

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APPENDIX A • MELIADINE GROUNDWATER MANAGEMENT PLAN

AGNICO EAGLE

MELIADINE GOLD MINE

Groundwater Management Plan

FEBRUARY 2018
VERSION 1

EXECUTIVE SUMMARY

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (the Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut.

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings (Agnico Eagle 2017). There are four phases to the development of the Mine; just over 4 years of construction (Q4 2015 to 2019), 8 years of Mine operation (2020 to 2027), 3 years of closure (2028 to 2030), and post-closure (2031 forwards).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the Underground Mine will operate below the base of the continuous permafrost. The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the Underground Mine workings once the Mine has advanced below the base of the permafrost.

This document presents the Groundwater Management Plan (GWMP) for the discharge of saline groundwater in compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1525, Part E, Item 14.

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DOCUMENT CONTROL

Version	Date	Section	Page	Revision	Author
1	February 2018	All		In compliance with Agnico Eagle's Type A Water Licence 2AM-MEL1525, Part E, Item 14	Golder Associates Ltd. on behalf of Agnico Eagle Mines Limited

ACRONYMS

Agnico Eagle	Agnico Eagle Mines Limited
ANFO	Ammonium Nitrate/Fuel Oil
CP	Collection Pond
DDH	Diamond Drillhole(s)
EMPP	Environment Management and Protection Plan
EWTP	Effluent Water Treatment Plant
FEIS	Final Environmental Impact Statement
GWMP	Groundwater Management Plan
MMER	Metal Mining Effluent Regulations
NWB	Nunavut Water Board
Mine	Meliadine Gold Mine
QA	Quality Assurance
QC	Quality Control
RO	Reverse Osmosis
SD	Support Document
SSWQO	Site Specific Water Quality Objectives
SWTP	Saltwater Treatment Plant
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
WMP	Water Management Plan

UNITS

%	percent
°C	degrees Celsius
°C/m	degrees Celsius per metre
ha	hectare(s)
mg/L	milligram(s) per litre
km	kilometer(s)
km^2	kilo square meter(s)
m	metre(s)
m/day	metre(s) per day
mm	millimetre(s)
m^3	cubic metre(s)
m^3/day	cubic metre(s) per day
m^3/s	cubic metre(s) per second
m^3/hour	cubic metre(s) per hour
m^3/year	cubic metre(s) per year
Mm^3/year	million cubic metre(s) per year
Mm^3	million cubic metre(s)
t	tonne(s)
tpd	tonne(s) per day
Mt	million tonne(s)

SECTION 1 • INTRODUCTION

Agnico Eagle Mines Limited (Agnico Eagle) is developing the Meliadine Gold Mine (Mine), located approximately 25 kilometres (km) north of Rankin Inlet, and 80 km southwest of Chesterfield Inlet in the Kivalliq Region of Nunavut. The Mine is subject to the terms and conditions of both the Mine Certificate (No. 006) issued in accordance with the Nunavut Agreement Article 12.5.12 on February 26, 2015 and Nunavut Water Board Type A Water Licence (No. 2AM-MEL1631, 2016) issued by the Nunavut Water Board (NWB) on April 1, 2016.

This document presents the Groundwater Management Plan (GWMP) for the discharge of saline groundwater in compliance with the Type A Water Licence 2AM-MEL1631 (Licence). Overall water management for the life of the Mine and post-closure is described in the Agnico Eagle Meliadine Gold Mine Water Management Plan, dated March 2017 (6513-MPS-11) (WMP). The WMP provides descriptions of the Mine water control structures and associated design criteria. The WMP will be updated in March 2018 to reflect the groundwater management strategy presented in this document.

1.1 Concordance

The Mine is subject to the land and resource management processes established by the Nunavut Agreement and other Federal laws and regulations. Agnico Eagle submitted a Licence Application for a Mining and Milling Undertaking (Application) required to use water and to deposit waste in development of the Mine, in accordance with the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and Nunavut Water Regulations.

The Licence was issued on April 1, 2016 and signed by the Minister on May 19, 2016. The GWMP reflects the commitments made with respect to submissions provided during the technical review of the Application, as well as final submissions and issues raised during the Public Hearing Process, where applicable, to comply with Part B Section 13, and Part E Section 14 of the Licence.

1.2 Objectives

The objective of the GWMP is to provide consolidated information on groundwater management for the Meliadine Gold Mine. The GWMP is divided into the following components:

- Introductory section (Section 1);
- A brief summary of the physical setting at the mine site and the mine development plan (Section 2);
- A description of groundwater management strategies (Section 3); and
- A description of the groundwater monitoring program (Section 4).

The GWMP will be updated as required to reflect any changes in operations or economic feasibility that occurs, and to incorporate new information and latest technology, where appropriate, to comply with Part B Section 15 of the Licence.

SECTION 2 • BACKGROUND

2.1 Site Conditions

The Mine is located in an area of poorly drained lowlands near the northwest coast of Hudson Bay. The dominant terrain in the Mine area consists of glacial landforms such as drumlins (glacial till), eskers (gravel and sand), and many small lakes. The topography is gently rolling with a mean elevation of 65 metres above sea level (masl) and a maximum relief of 20 metres (m).

The local overburden consists of a thin layer of topsoil overlying silty gravelly sand glacial till. Cobbles and boulders are present throughout the region at various depths. Bedrock at the mine site area consists of a stratigraphic sequence of clastic sediments, oxide iron formation, siltstones, graphitic argillite and mafic volcanic flows (Snowden 2008; Golder 2009).

The climate is extreme in the area, with long cold winters and short cool summers, and mean air temperatures of 12 °C in July and -31 °C in January. The mean annual air temperature at the Mine site is approximately -10.4 °C (Golder 2012a). Strong winds blow from the north and north-northwest direction more than 30 percent of the time.

The mean annual precipitation in the area is approximately 412 mm and is typically equally split between rainfall and snowfall.

Late-winter ice thicknesses on freshwater lakes in the mine site area were recorded from 1998 to 2000. The measured data indicated that ice thickness ranges from 1.0 to 2.3 m with an average thickness of 1.7 m. Ice covers usually appear by the end of October and are completely formed in early November. The spring ice melt typically begins in mid-June and is complete by early July (Golder 2012b).

2.2 Local Hydrology

The Mine is located within the Meliadine Lake watershed. Meliadine Lake has a surface water area of approximately 107 square kilometres (km^2), a maximum length of 31 km, features a highly convoluted shoreline of 465 km and has over 200 islands. Unlike most lakes, it has 2 outflows that drain into Hudson Bay through two separate river systems. It has a drainage area of 560 km^2 from its' two outflows. Most drainage occurs via the Meliadine River, which originates at the south west end of the lake. The Meliadine River flows for a total stream distance of 39 km. The Meliadine River flows through a series of waterbodies, until it reaches Little Meliadine Lake and then continues into Hudson Bay. A second, smaller outflow from the west basin of Meliadine Lake drains into Peter Lake, which discharges into Hudson Bay through the Diana River system (a stream distance of 70 km). At its mouth, the Diana River has a drainage area of 1,460 km^2.

Watersheds in the Mine area are comprised of an extensive network of waterbodies, and interconnecting streams. The hydrology of these watersheds is dominated by lake storage and evaporation.

2.3 Hydrogeology

The Mine is located in an area of continuous permafrost. Based on thermal studies and measurements of ground temperatures, the depth of permafrost at the mine site is estimated to be in the order of 360 to 495 m. The depth of the active layer ranges from about 1 m in areas with shallow overburden, up to about 3 m adjacent to the lakes. The depth of the permafrost and active layer varies depending on proximity to the lakes, overburden thickness, vegetation, climate conditions, and slope direction (Golder 2012b). The typical permafrost ground temperatures at the depths of zero annual amplitude are in the range of -5.0 to -7.5 °C in the areas away from lakes and streams. The geothermal gradient ranges from 0.012 to 0.02 °C/m (Golder 2012c).

Groundwater characteristics at the Mine are detailed in Final Environmental Impact Statement (FEIS) Volume 7, Section 7.2 Hydrogeology and Groundwater, and in an updated hydrogeological assessment completed for the Mine (Golder 2016). The groundwater characteristics for the Mine are briefly summarized herein.

Two groundwater flow regimes in areas of continuous permafrost are generally present:

- a deep groundwater flow regime beneath the base of the permafrost; and
- a shallow flow regime located in an active (seasonally thawed) layer near the ground surface.

From late spring to early autumn, when temperatures are above 0 ˚C, the active layer thaws. Within the active layer, the water table is expected to be a subdued replica of topography, and is expected to parallel the topographic surface. Mine area groundwater in the active layer flows to local depressions and ponds that drain to larger lakes.

Taliks exist beneath waterbodies that have sufficient depth such that they do not freeze to the bottom over the winter. Beneath small waterbodies that do not freeze to the bottom over the winter, a talik bulb that is not connected to the deep groundwater flow regime will form (a closed talik). Elongated waterbodies with terraces (where the depth is within the range of winter ice thickness), a central pool(s) (where the depth is greater than the range of winter ice thickness), and a width of 340 to 460 m or greater are expected to have open taliks extending to the deep groundwater flow regime at the Mine site. A review of bathymetric data, ice thickness data, and results of thermal modelling suggests that Meliadine Lake and Lake B7 are likely to have open taliks connected to the deep groundwater flow regime (Golder 2012a).

Tiriganiaq Underground Mine is planned to extend to approximately 625 m below the ground surface; therefore, part of the underground mine will be operated below the base of the frozen

permafrost (top of the cryopeg). The underground excavations will act as a sink for groundwater flow during operation, with water induced to flow through the bedrock to the underground mine workings once the mine has advanced below the base of the frozen permafrost.

Both Tiriganiaq Pit 1 and Tiriganiaq Pit 2 will be mined within the frozen permafrost, therefore, groundwater inflows to the open pits is expected to be negligible and were not considered in the WMP.

2.4 Mine Development Plan

The Mine Plan proposes mining methods for the development of the Tiriganiaq gold deposit, with two open pits (Tiriganiaq Pit 1 and Tiriganiaq Pit 2) and one Underground Mine. Based on the current Mine Plan, the Mine will produce approximately 12.1 million tonnes (Mt) of ore, 31.8 Mt of waste rock, 7.4 Mt of overburden waste, and 12.1 Mt of tailings (Agnico Eagle 2017). The following phased approach is proposed for the development of the Tiriganiaq gold deposit:

- Phase 1: 4 years for Mine Construction. Construction began in 2015 and is estimated to be complete in 2019;
- Phase 2: 8 years for Mine Operations, beginning in 2017 and ending in 2027;
- Phase 3: 3 years Mine Closure, from 2028 to 2030; and
- Phase 4: Post-closure (2031 forwards).

Mine facilities on surface include a plant site and accommodation buildings, three ore stockpiles, a temporary overburden stockpile, a tailings storage facility, three waste rock storage facilities, a water management system that includes containment ponds, water diversion channels, retention dikes/berms, and a final Effluent Water Treatment Plant (EWTP). The general location and site layout of the Mine are shown in Figure 1 of Appendix A.

SECTION 3 • GROUNDWATER MANAGEMENT STRATEGY

3.1 Groundwater Volumes

In the WMP of the water licence application (Agnico Eagle 2015a) it was stated that supplemental hydrogeological investigations were to be undertaken to provide additional information on potential volumes and quality of the saline groundwater to be managed. These investigations were undertaken in 2015 and 2016 and are summarized in Golder (2016). They included the completion of 24 packer tests, two pumping tests, two injection tests, 11 groundwater samples, and seven surface water samples. The work plan for the field work was developed in consultation with two independent technical advisors, Dr. Shaun K. Frape and Dr. Walter A. Illman (both of the University of Waterloo).

The additional hydraulic conductivity measurements, in combination with the updated Mine geologic model, resulted in a refined interpretation on the variability of hydraulic conductivity between geological formations and data on the storage properties of the bedrock. A summary of predicted groundwater inflows between 2017 and 2032, based on this refined interpretation and updated predictions of groundwater inflow using the developed numerical (Golder 2017), are provided in Table 1.

Table 1: Predicted Groundwater Inflow to Underground Mine (2017 to 2032)

Period	Predicted Groundwater Inflow (m^3/day)
2017	230
2018	300
2019	280
2020	300
2021	340
2022	340
2023-2024	420
2025-2026	380
2027-2028	390
2029-2030	380
2031-2032	360

Source: Updated Predictions of Groundwater Inflow to Tiriganiaq Underground Mine (Golder 2017).

The groundwater inflow predictions presented in Table 1 do not account for grouting currently being conducted as a mitigation to reduce groundwater inflows to the underground development, or potential losses through the ventilation system. Both mechanisms reduce the actual groundwater

inflows to the Underground Mine relative to that which was predicted. As such, these predicted inflows to the underground development represent unmitigated estimates.

3.2 Existing Groundwater Management Control Structures

Contact water in the Underground Mine is contained within underground sumps. A proportion of the underground water will be recirculated as make-up water for underground drilling. The drilling water will report to the underground sumps for recirculation; however, the need for up to 3% treated water make-up has been assumed to compensate for losses of drilling water due to evaporation or capture within the mined waste rock that is transferred to surface. Calcium chloride is currently not added to the underground water but has been used in the past and potentially again in the future to increase salinity and reduce water freezing during drilling.

Groundwater inflows to the Underground Mine since 2015 have not been discharged to the environment and are being stored underground, in the Saline Pond, in the P-Area, Collection Pond 5 (CP5) or actively evaporated during the open water season (Agnico Eagle 2017). Details of the underground dewatering system are provided in the Mine Plan (Agnico Eagle 2015a) and details of the pond are provided in the WMP (Agnico Eagle 2017).

The pond capacities and maximum water elevation for storage of the saline water are presented in Table 2. The locations of the ponds are shown on Figure 1 of Appendix A. The estimated volume of groundwater inputs to surface storage for management are expected to range from approximately a minimum of 0.11 million cubic metre(s) per year (Mm^3/year) to a maximum of 0.18 Mm^3/year, dependent on year of Mine life (Agnico Eagle 2017).

Table 2: Salt Water Storage Capacity at the Mine for Groundwater and Water Primarily Influenced by Underground Workings

Surface Pond	Capacity (m^3)	Maximum Water Elevation (m)
CP5	46,674	66.0
Saline Pond	32,686	62.9
P1	20,781	68.5
P2	6,828	66.5
P3	18,432	67.0

Source: Agnico Eagle (2017).

3.3 Groundwater Quality

Groundwater investigations undertaken indicate that total dissolved solids (TDS) concentrations are relatively consistent below the permafrost at approximately 64,000 mg/L (Golder 2016). Recent groundwater quality data from the Underground Mine collected by Agnico Eagle in 2016 and 2017 from diamond drillholes (DDHs), indicates mostly stable concentrations for several parameters

(Table 3) and suggest that TDS concentrations may be less at approximately 50,000 to 55,000 mg/L, on average, and the assumption of TDS at 64,000 mg/L may represent a more conservative estimate. It should also be noted that mining operations include drill-and-blast excavation for the development of the Underground Mine, which results in certain parameters in groundwater to be influenced by explosives (particularly ammonia and nitrate due to ammonium nitrate, fuel oil [ANFO] and emulsion explosives).

Table 3: Average Underground Saline Water Quality

Representative Months (average per month)		Aug 2016	Sep 2016	Oct 2016	Nov 2016	Dec 2016	Jan 2017	Feb 2017	Mar 2017	Apr 2017	May 2017	Jun 2017	Jul 2017	Aug 2017	Sep 2017
Parameters (total metal)	**Units**														
pH	pH	7.09	7.09	7.34	7.99	7.17	7.08	6.87	7.11	7.32	7.38	7.27	8.27	7.45	7.33
Alkalinity	mg/L	65	69	56	72.6	64	57	61.7	51	64.5	68	68	75	68.2	64
Conductivity	µmhos/cm	53320	70323	77750	79800	56000	77000	76500	77000	79000	79000	76308	74385	72200	72667
Total Hardness (as $CaCO_3$)	mg/L	14923	14644	13125	13260	13700	13200	18267	12700	18400	12433	12623	12500	12583	11700
Turbidity	NTU	82.85	93.00	56.25	27.56	74.00	123.75	69.00	88.00	90.00	51.00	75.00	61.00	47.02	104.33
Total Dissolved Solids (TDS)	mg/L	39663	50765	58600	60600	55000	54350	66433	54900	57500	57300	55123	57815	57520	54567
Total Suspended Solids (TSS)	mg/L	41	68.5	61	108.6	29	45	75.7	63	248.5	102.7	102.2	156	86	102
Aluminum (Al)	mg/L	0.56	8.72	0.075	0.32	0.06	0.21	0.10	6.02	1.29	0.51	1.45	0.73	0.97	1.75
Ammonia Nitrogen (NH_3-NH_4)	mg/L	4.66	4.20	5.93	5.98	3.50	4.13	105.3	4.50	4.95	5.20	5.51	11.1	4.87	4.43
Arsenic (As)	mg/L	0.0012	0.32	0.005	0.005	0.002	0.003	0.005	0.01	0.008	0.004	0.016	0.016	0.102	0.013
Barium (Ba)	mg/L	0.05	0.19	0.09	0.10	0.05	0.06	0.61	0.10	0.27	0.07	0.09	0.25	0.10	0.07
Beryllium (Be)	mg/L	0.002	0.002	0.002	0.002	0.002	0.003	0.002	0.01	0.002	0.002	0.005	0.008	0.01	0.01
Boron (B)	mg/L	1.4	1.7	1.5	1.5	1.8	1.6	4.98	5.0	4.9	1.5	2.7	3.97	5.0	2.5
Total Organic Carbon (TOC)	mg/L	4.95	2.65	3.68	4.28	2.00	2.23	11.67	2.10	2.95	2.63	3.20	5.30	2.57	2.50
Dissolved Organic Carbon	mg/L	2.60	2.35	3.45	3.74	1.90	1.90	10.17	1.70	2.30	2.37	2.70	4.90	2.32	2.10
Calcium (Ca)	mg/L	1899	1955	1965	1816	1800	1710	3777	1650	3737	1593	1608	1771	1610	1565
Cadmium (Cd)	mg/L	0.00002	0.0002	0.0002	0.0013	0.0002	0.0003	0.0002	0.001	0.0003	0.0002	0.0005	0.001	0.001	0.002
Chloride (Cl - dissolved)	mg/L	—	33500	31000	32800	34000	31250	38000	31000	31500	32000	31385	31538	32800	29333
Chromium (Cr)	mg/L	0.01	0.015	0.018	0.014	0.02	0.025	0.017	0.01	0.02	0.017	0.05	0.075	0.1	0.88
Copper (Cu)	mg/L	0.26	0.44	0.009	0.009	0.01	0.01	0.008	0.05	0.01	0.01	0.02	0.04	0.05	0.03
Cyanide (CN)	mg/L	0.005	0.006	0.008	0.017	0.005	0.005	0.19	0.005	0.028	0.005	0.006	0.01	0.005	0.008
Iron (Fe)	mg/L	9.68	40.28	6.48	5.23	4.31	4.76	8.96	3.60	8.78	6.19	9.81	6.33	8.24	4.10
Lead (Pb)	mg/L	0.002	0.002	0.004	0.005	0.004	0.005	0.005	0.02	0.004	0.003	0.009	0.015	0.02	0.018
Magnesium (Mg)	mg/L	2475	2170	2053	2118	2230	2168	2150	2080	2200	2050	2092	1962	2105	1975
Mercury (Hg)	mg/L	0.0002	0.01	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001	0.000001	0.00001	0.00001	0.00001	0.00001	0.00001
Molybdenum (Mo)	mg/L	0.01	0.015	0.04	0.013	0.02	0.025	0.055	0.01	0.25	0.026	0.047	0.075	0.1	0.17
Nickel (Ni)	mg/L	0.05	0.04	0.02	0.01	0.02	0.025	0.04	0.1	0.07	0.017	0.05	0.08	0.1	0.35
Nitrate (NO_3) as N	mg/L	0.15	0.168	0.88	0.57	0.1	0.5	116.39	0.1	2.58	0.23	0.89	4.35	0.17	0.34
Nitrite (NO_2) as N	mg/L	0.02	0.04	0.089	0.072	0.05	0.05	8.01	0.1	0.125	0.086	0.14	0.391	0.042	0.027
Total Kjeldahl Nitrogen (TKN)	mg/L	4.49	3.65	6.95	7.58	5.90	3.78	112.47	4.60	5.20	7.83	7.40	12.0	72.02	4.50
Phosphorous (P)	mg/L	0.05	0.14	0.05	0.05	0.04	0.07	0.14	0.04	0.13	0.12	0.08	0.09	0.1	—
Potassium (K)	mg/L	512	504.5	460.5	493.6	454	496	595	407	609	433	463	518	488	763
Radium-226 (Ra 226)	mg/L	—	—	—	1.9	1.7	0.49	0.33	0.3	1.2	1.95	1.8	1.9	2.2	0.29
Selenium (Se)	mg/L	0.23	0.006	0.0018	0.0033	0.002	0.003	0.002	0.01	0.002	0.002	0.005	0.0075	0.01	0.007
Silver (Ag)	mg/L	0.002	0.003	0.0004	0.0005	0.0004	0.001	0.0003	0.002	0.0009	0.0004	0.0012	0.0018	0.0002	0.018
Sodium (Na)	mg/L	16379	16000	14100	14600	15100	14625	14700	13400	15400	13900	14369	14654	14417	9433
Strontium (Sr)	mg/L	39.8	39.4	44.7	40.9	40.1	43.1	171	38.4	136	40	39	43.5	36.5	23.6
Sulphate (SO_4 – dissolved)	mg/L	—	3350	3125	3260	3200	3125	2700	3100	3100	3233	3169	2969	3120	3067
Thallium (Tl)	mg/L	0.0009	0.0008	0.0009	0.0006	0.001	0.001	0.001	0.001	0.0002	0.0002	0.0005	0.001	0.001	0.002
Uranium (U)	mg/L	0.002	0.003	0.002	0.002	0.002	0.003	0.002	0.01	0.006	0.002	0.005	0.008	0.01	0.09
Vanadium (V)	mg/L	0.05	0.08	0.09	0.06	0.1	0.13	0.08	0.5	0.1	0.08	0.23	0.38	0.5	0.33
Zinc (Zn)	mg/L	0.06	0.08	0.36	0.1	0.1	0.125	0.1	0.5	0.12	0.08	0.23	0.38	0.5	0.34

Source: Groundwater quality data from DDH sample location (Agnico Eagle, October 2017)

3.4 Groundwater Management Strategy and Associated Control Structures

Based on the Type A Water Licence 2AM-MEL1631 Terms and Conditions, Part E: Conditions Applying to Water Use and Management, No. 14, Agnico Eagle has reviewed the Mine alternatives to apply to the GWMP. Condition No. 14 specifically states:

> *"The Licensee shall submit a Groundwater Management Plan to the Board for approval in writing, at least six (6) months prior to the discharge of any Groundwater. The Plan shall take into consideration all comments raised and commitments made with respect to submissions received during the technical review of the Application as well as final submissions and issues raised during the Public Hearing Process, where applicable."*

Groundwater management alternatives were considered for the Mine based on the potential range of groundwater flows and quality that could be generated (refer to Appendix F of the WMP; Agnico Eagle 2015a). The option selection has been driven by the expected quality and quantity of the water.

Based on the groundwater inflow volume, the following options were considered and form part of the short and long term management of groundwater inflows to the Underground Mine:

- Short-term Strategy: treat saline groundwater and store/use the brine from the treatment process on-site (Section 3.4.1)
- Current Long-term Strategy: treated discharge to receiving environment in Meliadine Lake in combination with treated surface contact water (Section 3.4.2)
- Potential Future Long-term Strategy: ocean disposal (see Section 3.4.3)

The short and long-term groundwater management strategies are described below. At this time, Agnico Eagle is requesting approval from the NWB for the short-term strategy and the current long-term strategy to discharge to Meliadine Lake. The potential future long-term strategy of ocean disposal is still under assessment and provided for information purposes.

3.4.1 Short-Term Management Strategy - Treat and Store/Use Groundwater On-site

This alternative was considered as part of the Type A Water Licence Application and is currently being implemented on-Site as part of the short-term management of groundwater inflow. It involves storing all excess groundwater in underground sumps and in surface water ponds at the Mine. As outlined in the WMP (Agnico Eagle 2017), a total of nine water containment ponds are planned on-site at the Mine surface (CP1, CP3, CP4, CP5 and CP6, the P-Area [P1, P2, and P3], and the Saline Pond), and associated water retention dykes, water diversion berms, channels, and culverts, to manage surface water and underground water (Figure 1).

Evaporators have been in-use on site since mid-2017 at P1 to reduce groundwater volumes stored in surface water ponds. A single evaporator is estimated to remove approximately 500 m^3/day when operated for 24 hours with ideal wind and relative humidity conditions. While evaporators have

been used with some success, the combined volumes of groundwater with anticipated surface water volumes influenced by underground waste rock to be managed is greater than the available long-term storage at the Mine, and therefore, discharge to environment is required.

These short-term storage and treatment options are being implemented at the Mine pending regulatory approvals for the long-term groundwater management option.

3.4.2 Current Long-Term Management Strategy - Treated Groundwater Discharge to Meliadine Lake

Effluent discharge to Meliadine Lake was assessed as part of the FEIS and modelled as part of the Water Licence Application (Agnico Eagle 2014, 2015a) and discharge criteria have been defined in the Licence. Provided the discharge criteria can be met following commissioning of the treatment system, this option represents the immediate long-term management strategy to be implemented at the Site in 2018. Approval of this plan will be required, prior to discharge, as per the Term and Condition Part E, No. 14 of the Licence. Total discharge to Meliadine Lake, including the treated groundwater, will remain within the permitted daily volume and meet the discharge criteria defined in the Licence.

Hatch (2013) investigated groundwater treatment options for the site and concluded that a combination chemical reverse osmosis (RO) and mechanical vapour compression evaporator plant would be the most efficient method of treating excess groundwater for discharge. Agnico Eagle has also undertaken a pilot test of a SaltMaker combined with a Chemical-RO post-treatment system and based on the results of this testing decided to proceed with this technology.

The groundwater will flow through a Saltwater Treatment Plant (SWTP), comprised of a set of SaltMakers, and will be treated to remove excessive total suspended solids (TSS), calcium chloride ($CaCl_2$), sodium chloride (NaCl), metals, phosphorous (P), and nitrogen compounds. The salt generated by the water treatment unit will be stored at the Mine, where it will be re-used for underground operations and/or disposed of at an appropriate disposal location. Given the predicted groundwater volumes, a maximum of three SaltMakers are proposed to be built at the Mine, forming the SWTP, to treat the groundwater for discharge to the environment. Two SaltMaker's have been procured and are anticipated to be in operation between Q3 2018 and Q1 2019. Additional SaltMakers could be built at the Mine to meet the discharge volumes required. This need will be evaluated based on the effectiveness of the short-term management strategies and observed operational capacities of the SaltMakers, which are anticipated to be 120 m^3/day. The saline effluent temperature from the SWTP is expected to be approximately 35 °C, with an approximate pH of 7.5 (Saltworks 2017). The SWTP effluent largely meets the required Water Quality Output requirements defined in Agnico Eagle's Desalination Water Treatment Plan Design Criteria and passes completed toxicity tests (Saltworks 2017). Treated effluent quality (of the groundwater) through the SWTP indicates that TDS concentrations would be approximately 158 mg/L (condensed water after treatment; Saltworks 2017).

Post-treatment options, such as the RO post-treatment system, are being considered if required, to meet applicable effluent quality criteria for Meliadine Lake. The permeate resultant from the Chemical-RO post-treatment system meets all the required Site Specific Water Quality Objectives (SSWQO) and passes completed toxicity tests. Saline effluent quality after secondary treatment through the SWTP indicates that TDS concentration would be considerably reduced, at approximately 55 mg/L after RO post-treatment (Saltworks 2017). Pilot testing of the SaltMaker condensed water and RO permeate quality results are presented in the SaltMaker Pilot Final Report document (Saltworks 2017). The results indicate that values will meet SSWQO for water management, which also comply with MMER.

3.4.3 Potential Future Long-Term Management Strategy - Treated Groundwater Discharge to Melvin Bay at Itivia Harbour

Based on the potential volumes of groundwater, it is anticipated that a second discharge location will be required for long-term groundwater management. Agnico Eagle is proposing to treat groundwater and discharge it as saline effluent to the ocean, either as a direct discharge and/or after temporary on-site storage in one or more of the water containment ponds at the Mine. Ocean discharge is currently not permitted and requires appropriate regulatory licenses and approvals, which are currently being assessed and applications prepared. An updated GWMP will be submitted if appropriate licenses and approvals are obtained prior to discharge.

For the ocean discharge option, the saline effluent would be trucked from the Mine and discharged in Melvin Bay at Itivia Harbour. The discharge facility will include an unheated saline water storage tank at the Itivia Fuel Storage Facility and a pipeline extending to an engineered diffuser located in Melvin Bay during the open water season from 2019 to 2035. The saline effluent will be discharged in a controlled manner through the diffuser in compliance with the required discharge criteria to allow for maximum dilution and minimum environmental impact to the marine environment. Saline effluent quality will be required to meet the Canadian federal end-of-pipe discharge criteria (Metal Mining Effluent Regulations – or MMER), including the amended MMER (GC 2017; anticipated to come into effect in 2018), and Canadian Surface Water Quality Guidelines (Canadian Council of Ministers of the Environment Guidelines for the Protection of Aquatic Life [CCME 2003]) or Site-Specific Water Quality Objectives at the edge of the mixing zone for the diffuser discharge into Melvin Bay. It is recognized that further discussions are required with relevant stakeholders to confirm that this approach meets the amended MMER (GC 2017).

3.5 Discharge Schedule

Table 4 outlines the timeline for key activities on the Mine related to the management of saline groundwater, including tasks and facilities for the current short-term and long-term management strategies for discharge to Meliadine Lake (Section 3.4.1 and 3.4.2). A detailed Mine schedule for the overall Mine Water Management (e.g., building of culverts, berms and containment ponds) are presented in the 2017 WMP, which will be updated in March 2018.

Table 4: High Level Mine Schedule

Activity	Timeline	Notes
On-site water storage	Ongoing	—
Groundwater Management Plan (Current Document)	Six months prior to discharge	Type A Water Licence 2AM-MEL1631 requirement
Commissioning of Salt Water Treatment Plants (SaltMaker #1 and #2)	Q3-2018 to Q1-2019	—
Earliest first Discharge of treated saline groundwater to Meliadine Lake	Q3-2018	
Commissioning of additional SaltMaker unit(s) if required	2019	—
Active Discharge to Meliadine lake	Annually May thru October to 2032	—
Operation of Salt Water Treatment Plant	24 h a day / 7 days a week, May thru Oct	In-service as required
Inactive Discharge	Annually November thru April to 2032	Water will be stored underground and in surface containment ponds during the winter
Final Saline Effluent Discharge to Meliadine Lake	End of Mine life 2032	—

Source: Agnico Eagle (2017).

SECTION 4 • GROUNDWATER MONITORING PROGRAM

4.1 Water Quality and Quantity Monitoring

Water quality monitoring is an important part of the Mine water management to verify the predicted water quality and quantity trends and conduct adaptive management should differing trends be observed. Water quality and quantity monitoring has been initiated and will continue during construction, operations, closure and post-closure. Monitoring will occur at three levels:

- Regulated discharge monitoring that occurs at monitoring points specified in the Licence or regulations.
- Verification monitoring that is carried out for operational and water management purposes by Agnico Eagle. This monitoring data will not be reported to the Regulators in the Annual Water License Report, but can be provided upon request by the Regulators.
- General monitoring that is included in the Licence requirements and is subject to compliance assessment to confirm sampling was carried out using established protocols, including quality assurance/quality control provisions, and addressing identified issues. General monitoring is subject to change as directed by an Inspector, or by the Licensee, subject to approval by the NWB.

All three types of monitoring will be used at the Mine. The WMP presents the conceptual water quality monitoring plan during construction, operations and closures and more detailed information on monitoring programs and is described in the Environment Management and Protection Plan (EMPP) (Agnico Eagle 2015b).

The groundwater quality monitoring plan, which will be further defined as the Mine advances and will be conducted in agreement with the WMP for the Mine (Agnico Eagle 2017). Required monitoring and frequency for pre- and post- treatment (i.e., monitoring above ground) is presented in the WMP (Agnico Eagle 2017).

4.2 Water Quantity

The volume of groundwater inflow being collected and transferred to surface water management systems with be measured using a flow meter installed at the Portal Water Sump Stope L75 surface water pond. This data will be supplemented by periodic seepage surveys which will record visually observed groundwater inflows in the Underground Mine.

Measured groundwater inflow rates will be compared to model predictions on an annual basis. If significant variations from model predictions are observed, the assumptions behind the analysis will be reviewed and the analysis updated if required. In addition, updates to the groundwater model may be required based on operational changes as the Underground Mine advances.

If the measured groundwater quantity represents a significant difference from the model predictions, a re-calibration of the model will be considered. If model re-calibration is deemed necessary, future groundwater inflow quantity would be predicted using this re-calibrated model and results considered as part of the adaptive management of the groundwater quantity contribution to the WMP.

4.3 Water Quality

Groundwater quality will be monitored opportunistically from DDHs to assess and verify the quality of groundwater flowing into the Underground Mine. Water samples will be analyzed for the following parameters: conductivity, TDS, pH, temperature, major anions, radium 226, dissolved and total metals and toxicity testing.

To understand and plan for treatment requirements at surface, water accumulating in sumps underground will also be sampled on a monthly basis at the Sump 125, which is the main collection sump prior to recirculation for underground use. Sump water samples will be analyzed for the following parameters: conductivity, TDS, pH, temperature, oil and grease, major anions, radium 226, dissolved and total metals, nitrate and nitrite, volatile organic compounds (i.e., benzene, xylene, ethylene, and toluene).

Water quality results are compared to MMER and SSWQO guidelines and will be compliant prior to discharging to Meliadine Lake.

SECTION 5 • QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

Quality Assurance (QA) refers to plans or programs that encompass a wide range of internal and external management and technical practices designed to ensure the collection of data of known quality that matches the intended use of the data. Quality Control (QC) is a specific aspect of QA that refers to the internal techniques used to measure and assess data quality. Specific QA and QC procedures that will be followed during sampling performed for the Groundwater Monitoring Program are described in Section 5.1 and 5.2.

5.1 Quality Assurance

Quality assurance protocols will be diligently followed so data are of known, acceptable, and defensible quality. There are three areas of internal and external management, which are described in the following three sections.

5.1.1 Field Staff Training and Operations

To make certain that field data collected are of known, acceptable, and defensible quality, field staff will be trained to be proficient in standardized field groundwater sampling procedures, data recording, and equipment operations applicable to the Groundwater Monitoring Program. All field work will be completed according to specified instructions and established technical procedures for standard sample collection, preservation, handling, storage, and shipping protocols.

5.1.2 Laboratory

To make sure that high quality data are generated, accredited laboratories that will be selected for sample analysis. Accreditation programs are utilised by the laboratories so that performance evaluation assessments are conducted routinely for laboratory procedures, methods, and internal quality control.

5.1.3 Office Operations

A data management system will be utilized so that an organized consistent system of data control, data analysis, and filing will be applied to the Groundwater Monitoring Program. Relevant elements will include, but are not limited to the following:

- all required samples are collected;
- chain-of-custody and analytical request forms are completed and correct;
- proper labelling and documentation procedures are followed, and samples will be delivered to the appropriate locations in a timely manner;
- laboratory data will be promptly reviewed once they are received to validate data quality;
- sample data entered into a Mine-specific groundwater quality database will be compared to final laboratory reports to confirm data accuracy; and

- appropriate logic checks will be completed to ensure the accuracy of the calculations.

5.2 Quality Control

The QC component will consist of applicable field and sample handling procedures, and the preparation and submission of two types of QC samples to the various laboratories involved in the program. The QC samples include blanks (e.g., travel, field, equipment) and duplicate/split samples.

Sample bottle preparation, field measurement and sampling handling QC procedures include the following:

- Sample bottles will be kept in a clean environment, capped at all times, and stored in clean shipping containers. Samplers will keep their hands clean, wear gloves, and refrain from eating or smoking while sampling.
- Where sampling equipment must be reused at multiple sampling locations, sampling equipment will be cleaned appropriately between locations.
- Temperature, pH, and specific conductivity will be measured in the field using hand held meters.
- Samples will be cooled to between 4 °C and 10˚C as soon as possible after collection. Care will be taken in when packaging samples for transport to the laboratory to maintain the appropriate temperature (between 4°C and 10˚C) and minimize the possibility of rupture. Where appropriate, samples will be treated with preservatives to minimize physical, chemical, biological processes that may alter the chemistry of the sample between sample collection and analysis.
- Samples will be shipped to the laboratory as soon as reasonably possible to minimize sample hold times. If for any reason, samples do not reach the laboratory within the maximum sample hold time for individual parameters, the results of the specific parameters will be qualified, or the samples will not be analysed for the specific parameters.
- Chain of custody sample submission forms will be completed by field sampling staff and will be submitted with the samples to the laboratory.
- Only staff with the appropriate training in the applicable sampling techniques will conduct water sampling.

Quality control procedures implemented will consist of the preparation and submission of QA/QC samples, such as field blanks, trip blanks, and duplicate water samples. These are defined as follows:

- Field Blank: A sample will be prepared in the field using laboratory-provided deionized water to fill a set of sample containers, which will then be submitted to the laboratory for the same analysis as the field water samples. Field blanks will be used to detect potential sample contamination during collection, shipping and analysis.

- Travel Blank: A sample will be prepared and preserved at the analytical laboratory prior to the sampling trip using laboratory-provided deionized water. The sample will remain unopened throughout the duration of the sampling trip. Travel blanks will be used to detect potential sample contamination during transport and storage.
- Duplicate Sample: Two samples will be collected from a sampling location using identical sampling procedures. They will be labelled, preserved individually and submitted for identical analyses. Duplicate samples will be used to assess variability in water quality at the sampling site. Duplicate will be collected and submitted for analyses at approximately, 10% of sampling locations. For smaller batches of samples (less than 10), at least one duplicate will be collected and submitted for analysis.

Additional QA/QC procedures that will be applied to the seepage survey component of the Groundwater Monitoring Program will include:

- Location – Universal Transverse Mercator (UTM) coordinates of seepage will be defined through the use of a hand-held Global Positioning System (GPS) unit.
- Sample Labels – appropriate sample nomenclature will be assigned to the sample labels that will define sample locations, sample type, year, and designation (numerical from 01 sequentially upwards) (e.g., SEEP-13-01 for seepage; 5034PIT-13-02 for pit sump).

REFERENCES

Agnico Eagle. 2014. Final Environmental Impact Statement (FEIS) - Meliadine Gold Project, Nunavut from: ftp://ftp.nirb.ca/02-REVIEWS/ACTIVE%20REVIEWS/11MN034-Agnico Eagle%20MELIADINE/2-REVIEW/09-FINAL%20EIS/FEIS Accessed on November, 2014.

Agnico Eagle. 2015a. Meliadine Gold Project, Type A Water Licence. Water Management Plan. Version 1. Submitted to the Nunavut Water Board. April 2015.

Agnico Eagle. 2015b. Meliadine Gold Project: Environmental Management and Protection Plan (EMPP). Version 4. 6513-MPS-07. April 2015.

Agnico Eagle. 2017. Meliadine Gold Project Water Management Plan. Version 3. 6513-MPS-11. March 2017.

CCME (Canadian Council of Ministers of the Environment). 2003. Canadian Environmental Quality Guidelines – Water Quality Guidelines for the Protection of Aquatic Life.

Golder (Golder Associated Ltd.). 2009. Assess of completeness of geotechnical data for feasibility design Tiriganiaq open pit. Submitted to Comaplex Minerals Corp., 26 May 2009, Doc. 008 Rev. 0

Golder. 2012a. SD 7-2 Aquatic Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 19, 2012.

Golder. 2012b. SD 6-1 Permafrost Thermal Regime Baseline Studies- Meliadine Gold Project, Nunavut, Canada. A Technical Report Submitted to Agnico Eagle Mines Ltd. by Golder Associates, September 25, 2012.

Golder. 2012c. Tailings Storage Facility Preliminary Design – Meliadine Gold Project, Nunavut. A Draft Report Submitted to Agnico Eagle Mines Ltd. by Golder, August 16, 2012.INAC, 1992. Guidelines for ARD Prediction in the North. Department of Indian Affairs and Northern Development, Northern Mine Environment Neutral Drainage Studies No.1, Prepared by Steffen, Robertson and Kirsten (B.C.) Inc.

Golder. 2016. Hydrogeological Assessment in Support of the Underground Mine Development at Tiriganiaq, March 21, 2016.

Golder. 2017. Updated Predictions of groundwater Inflow to Tiriganiaq Underground Mine – V5 Mine Plan, December 18, 2017.

GC (Government of Canada). 2017. Regulations Amending the Metal Mining Effluent Regulations (MMER). Canada Gazette Part I, Vol 151, No. 19. May 2017

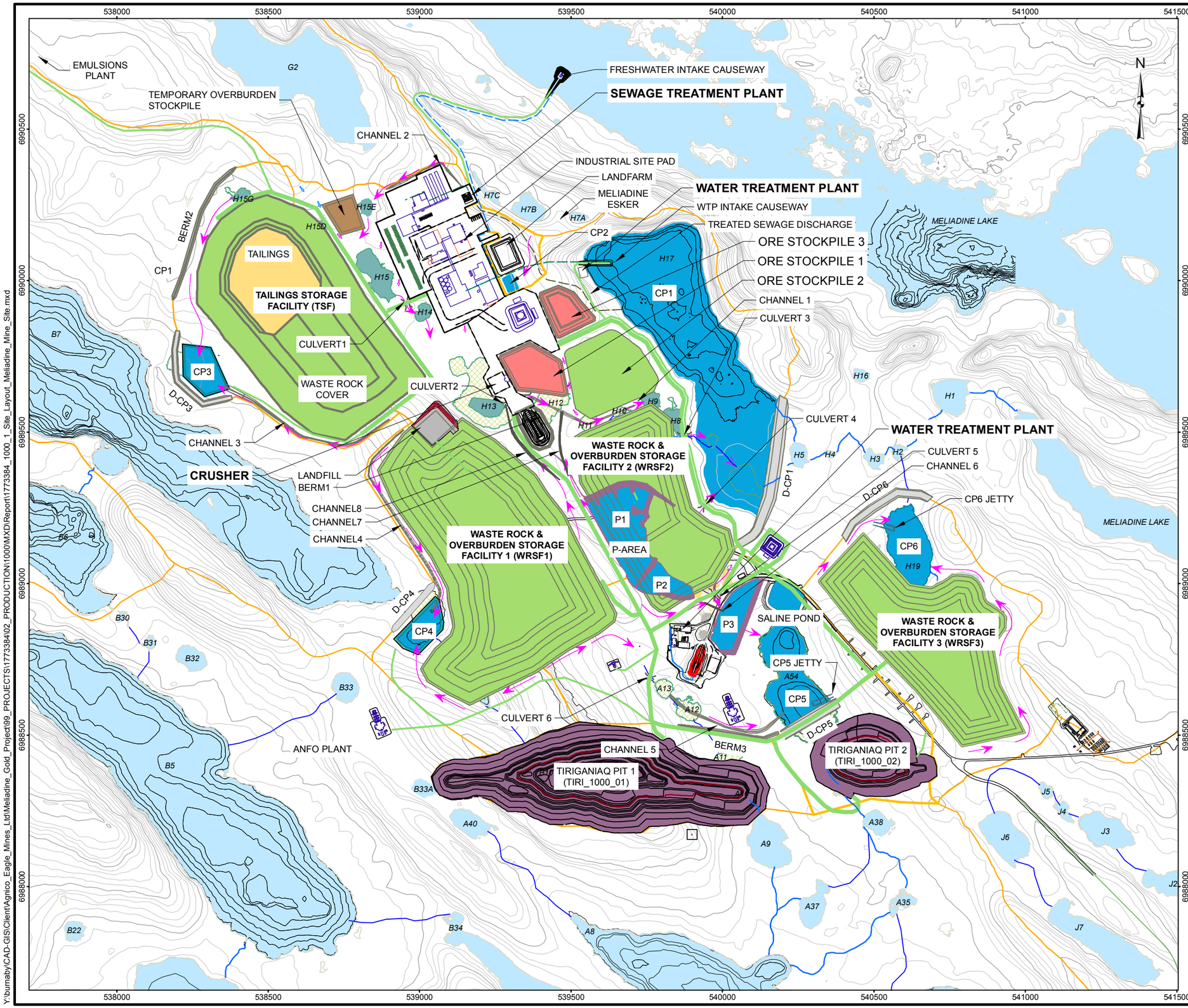
Hatch. 2013. Agnico Eagle Mines Ltd. - Meliadine Desalination Study - Salt Water Treatment Plant Report. Report No. H350003-000-05-124-002/6505-SSR-01_R82, Rev 2. September 30, 2013.

NWB (Nunavut Water Board). 2016. Type A Water Licence No. 2AM-MEL1631.

Snowden. 2008. Tiriganiaq gold deposit, Nunavut – resource update. Submitted to Comaplex Minerals Corp. January 2008.

APPENDIX A • FIGURES

Figure 1 General Mine Site Location Plan



LEGEND

- SERVICE ROAD
- HAUL ROAD
- CATCHMENT BOUNDARY
- NON CONTACT WATERBODY
- CONTACT WATERBODY
- WATER COLLECTION POND
- DRAINED POND AREA
- OPEN PIT
- OVERBURDEN
- WASTE ROCK
- ORE
- TAILINGS
- INDUSTRIAL SITE PAD
- CONTACT WATER FLOW DIRECTION

REFERENCE

BASE DATA OBTAINED FROM AGNICO EAGLE MINES LIMITED.
DATUM: NAD 83 PROJECTION: UTM ZONE 15

250 0 250
METRES

PROJECT
AGNICO EAGLE MINES LIMITED
MELIADINE GOLD PROJECT
NUNAVUT

TITLE
SITE LAYOUT
MELIADINE MINE SITE

Golder Associates

PROJECT NO.		1773384	FILE No.	
DESIGN	CLT	8 Dec. 2017	SCALE AS SHOWN	REV. 0
GIS	CDB	8 Dec. 2017		
CHECK	JR	8 Dec. 2017		
REVIEW	LY	8 Dec. 2017		

FIGURE: 1

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APPENDIX B • FRESHET ACTION PLAN AND SNOW MANAGEMENT PLAN

AGNICO EAGLE

MELIADINE GOLD PROJECT

FRESHET ACTION PLAN

MARCH 2018
VERSION 3

DOCUMENT CONTROL

Revision				Pages Revised	Remarks
#	Prepared by	Revised	Date		
01	AGNICO EAGLE	Internally	March 2016	All	
02	AGNICO EAGLE	Internally	March 2017	All	
03	AGNICO EAGLE	Internally	March 2018	All	

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Approved by:

Jessica Huza
Environment General Supervisor

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1 INTRODUCTION

The purpose of this Freshet Action Plan (Plan) is to provide Agnico Eagle with specific management and mitigation measures to address and manage water associated with the freshet season (Freshet), a response plan and procedures to prevent and to minimize potential negative impacts to the surrounding environment at the Meliadine Site (Site).

The term freshet refers to spring thaw, which can result in inundation of floodplains. Freshet at Meliadine typically takes place between May 15 and July 30. In some years, Freshet can also happen in early fall, when freezing re-occurs (mid-October) and then thaws. There are areas at the Site that are vulnerable to excess water produced during Freshet; the objective of this document is to identify those areas, and to develop a plan with defined roles and responsibilities to manage excess water produced on site.

The following guiding principles are applicable to the Plan:

- To ensure that mine contact water from runoff or seepage is managed to prevent adverse environmental impacts;
- To ensure the health and safety of Agnico Eagle employees and contractors; and
- To ensure the Site is in compliance with the Nunavut Water Board (NWB) Type A Water Licence No.: 2AM-MEL1631 (Type A Licence).

The Plan identifies areas of risk during Freshet, risk management and the procedures necessary to address potential concerns.

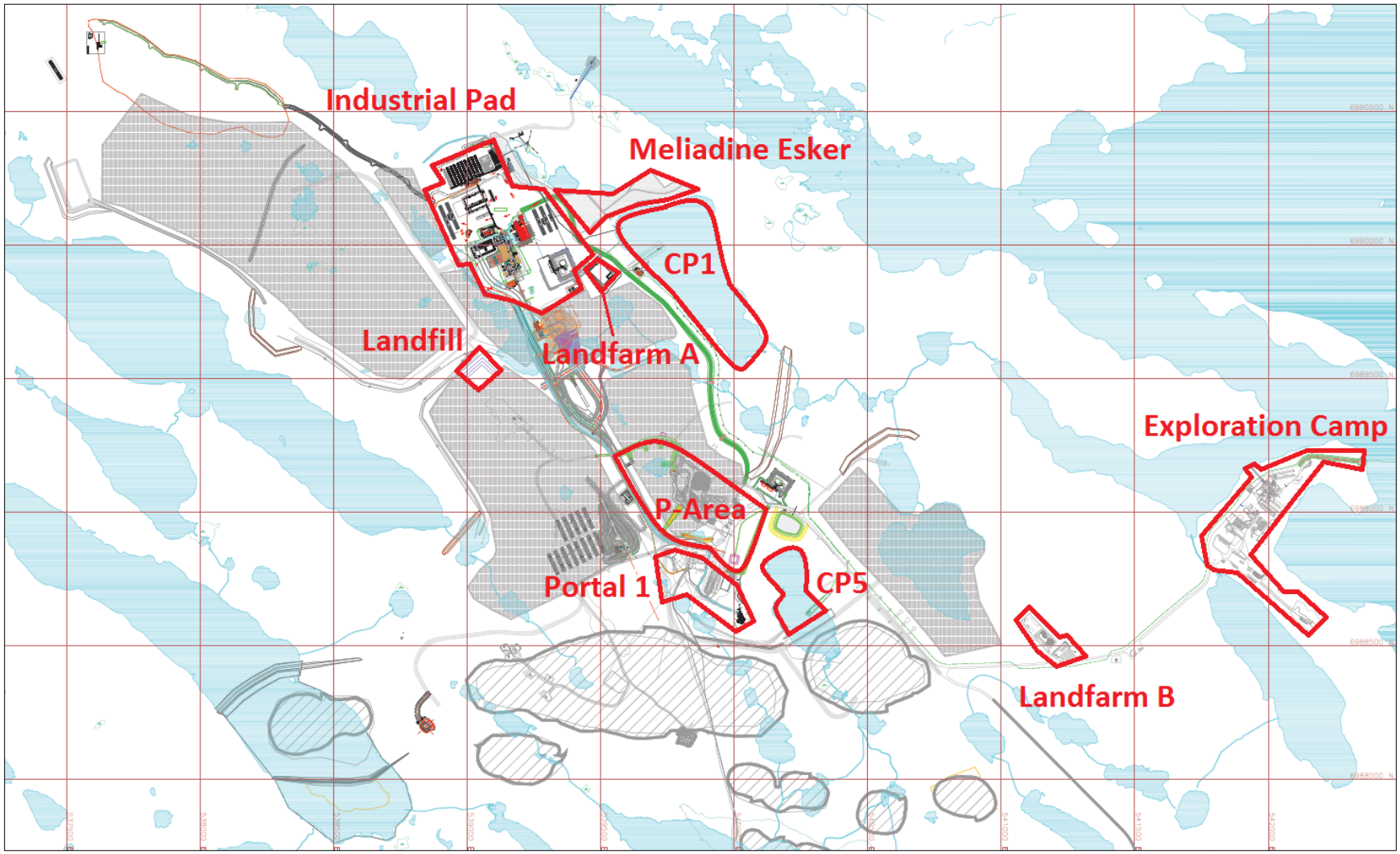
2 AREAS OF RISK DURING FRESHET

The key areas of risk during Freshet at the Site include the following:

- P-Area
- Sump 1 (Sump LV50)
- New (Type A) and old (Type B) Landfarms
- Landfill
- All Weather Access Road (AWAR) and Quarries along the road
- Infrastructure Areas; including the Exploration Camp area, Portal 1 and the Industrial Pad Areas
- Containment Pond 1 (CP1), Containment Pond 5 (CP5)
- Meliadine Esker Quarry
- Itivia laydown and fuel handling facility (Itivia)

Identified areas of risk at Site are shown in Figure 1, and are described in the following section.

Figure 1: Site Plan View with Areas of Risk at Site during Freshet



2.1 P-AREA

The P-Area is the initial containment area identified for precipitation events; snow melt or Freshet water that has come in contact with mine waste rock or surface works in the area of the Underground Portals (contact water).

The P-Area includes three containment areas (Figure 2); P1 Containment Area (P1), P2 Containment Area (P2), and P3 Containment Area (P3) and has a cumulative capacity of 46,041 m^3. Periodic pumping to P1, from P2 and P3, is planned to manage water levels and to assist with active evaporation at P1.

2.1.2 P1

P1 is the largest containment of the three ponds that make up the P-Area (20,781 m^3). Snow removed from the selected areas at the Site throughout winter months, will be directed to P1. Precipitation, water drainage from the adjacent waste rock pile, and any water pumped from P2 or P3 will also be contained within P1. Surface water that flows to Portal 2 is pumped to P1. Three evaporators are installed at P1 to assist with active evaporation of water contained at P1 during the open water season at Site.

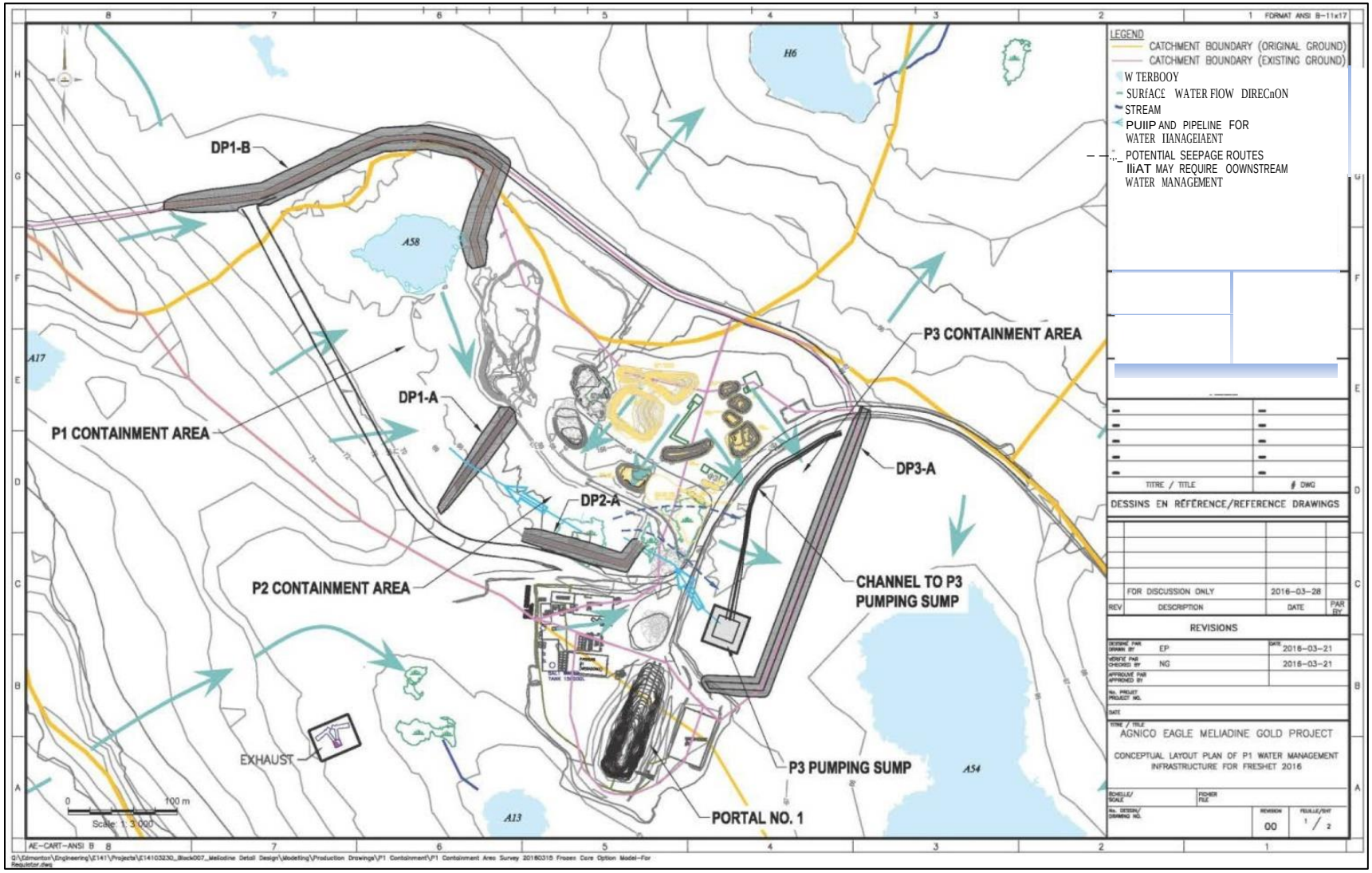
2.1.3 P2

P2 is directly adjacent and down-gradient to P1. P2 allows for additional contact water, precipitation and waste rock drainage water management with a capacity of 6,828 m^3. Additionally, P2 is the main containment area for water pumped to surface from underground Sump 1 (LV50). LV50 is the receptor of surface water that flows from the surface to Portal 1. Water from P2 is pumped to P1 to be actively evaporated.

2.1.3 P3

P3 is down-gradient to P1 and P2. P3 contains surface runoff from the surrounding portal entrance surface area, precipitation, and inflow water from waste rock and ore piles to the north-northwest of P3. Water from P3 is pumped to P1 to be actively evaporated.

Figure 2: P-Area Plan View



2.3 SUMP 1 (LV50 SUMP)

LV50 is located 50 meters below grade (mbg) and is the first sump, closest to the entrance of Portal 1. Snow melt and surface run-off that flows to the portal entrance (the lowest elevation at the Site), down the underground haulage ramp to sump LV50, is pumped from LV50 to the P-Area. The overall capacity for LV50 is 29 m^3. Water pumped from LV50 to P2 is measured with a volumetric flow meter and recorded daily.

2.4 LANDFARM

The Type A Licence Landfarm will be located adjacent and east of the Industrial Site Pad and is designed to receive soils, rock, snow, and ice contaminated with petroleum hydrocarbons. This will include light hydrocarbons such as diesel and gasoline (Agnico Eagle 2016). It was assumed that an annual volume of 500 m^3 of contaminated ice and snow would require management and the landfarm has been designed to account for this volume.

The Landfarm has geotextile liners and are filled with soil. Water that pools, collects or flows from the Landfarm needs to be collected for monitoring (as per the Licence requirements) and treated before it is discharged to CP1, nearby.

2.5 ALL WEATHER ACCESS ROAD (AWAR)

The All-Weather Access Road (AWAR) was built in 2013 to connect the Site to the hamlet of Rankin Inlet. The road is approximately 23.8 km long with twenty-two water crossings; three bridge crossings and nineteen culverts installed (Figure 3).

2.6 INFRASTRUCTURE AREAS

Infrastructure Areas represent buildings, pads and towers installed at the Site and include the Industrial Pad, Exploration Camp, ANFO Plant and Emmulsion Plant (Figure 1).

2.7 CP1 AND CP5

Engineered water containment dikes constructed in 2017 at lakes A54 and H17 were developed as CP5 and CP1, respectively. The dikes are designed to contain contact water within the footprint of the Site and prevent pollution provisions of the *Fisheries Act*. Both CP1 and CP5 will be used for Site contact water and snow and ice collection prior to Freshet. CP1 and CP5 are illustrated in Figure 1 and discussed in Section 4 of this report.

2.8 ITIVIA

Itivia is located in Rankin Inlet and is accessed by Site from the AWAR. Itivia is intended to support the Site with a bypass road to divert site-related traffic around the community of Rankin Inlet, for fuel storage and containment facility, and as a laydown area for barge shipments. The location of Itivia is shown on Figure 3 and the plan view of the Itivia Site is presented as Figure 4. A culvert is installed to allow runoff at the Itivia laydown area.

Figure 3: AWAR Map Showing Water Crossing Location

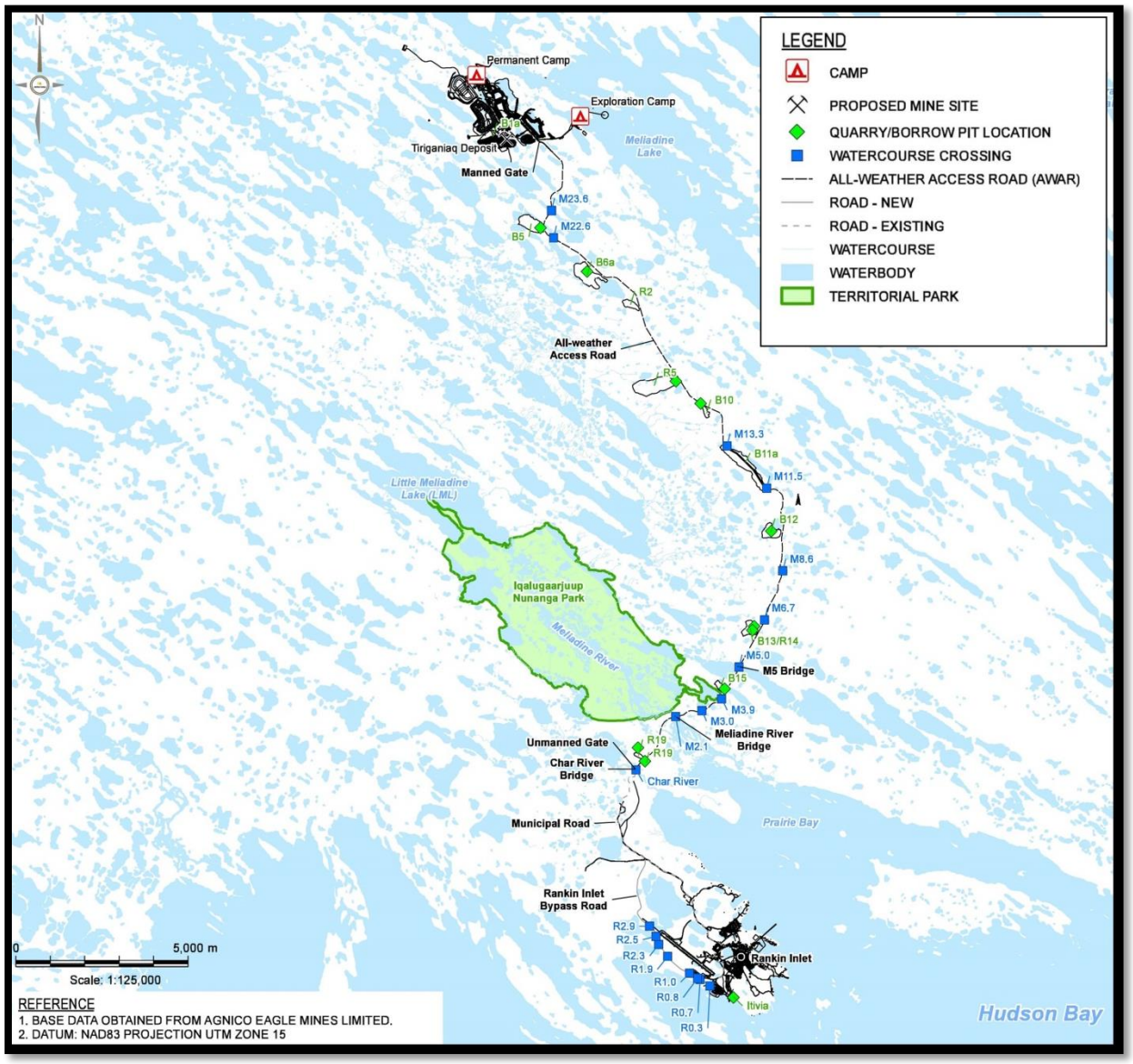
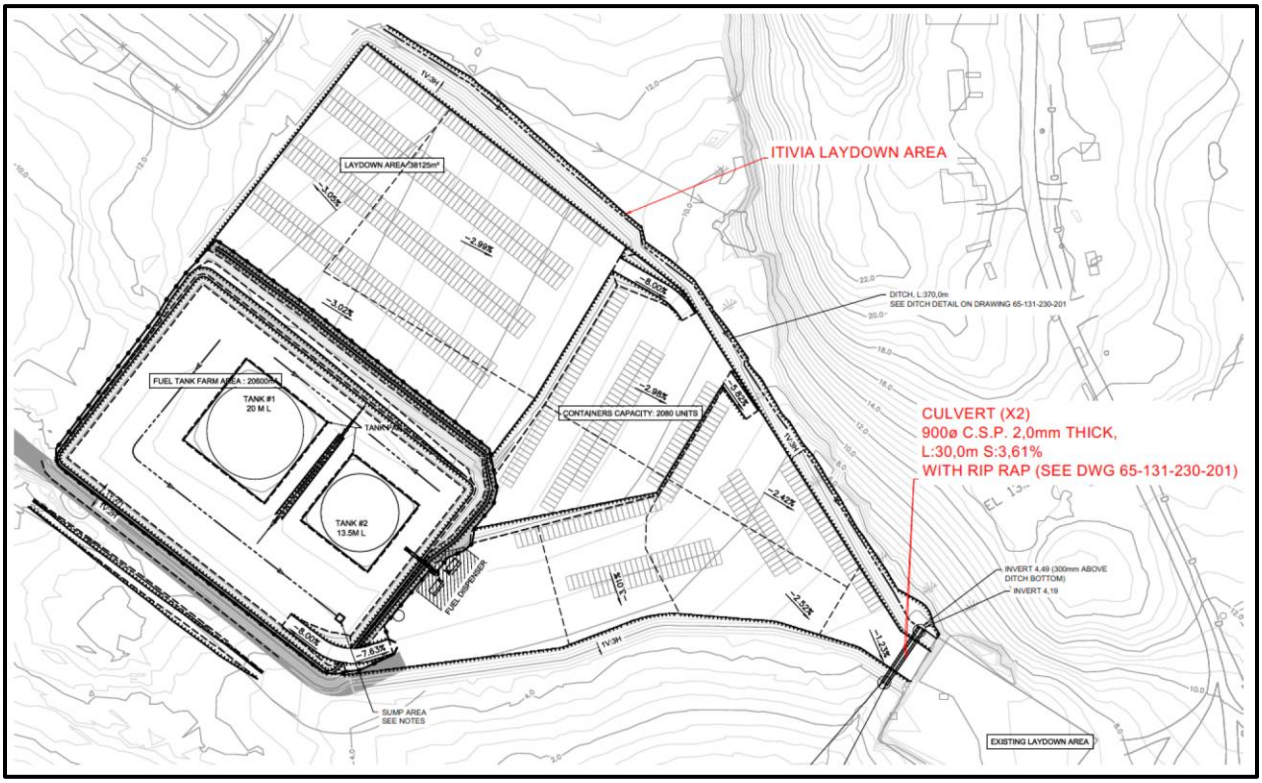


Figure 4: Itivia Laydown Area and Culvert Location



3 FRESHET RISK MANAGEMENT

Managing the risks prior to Freshet is a primary objective at Site. Planning and preparing before Freshet alleviates some of the risk from excess water that may suddenly occur, and ensures compliance with applicable regulations. This is managed by removing water (pumping) at containment pond areas prior to winter freeze (fall) to allow for increased capacity from precipitation, snow and ice removal on roads, road water crossings, culverts, ditches, and select containment ponds after winter freeze and before Freshet (winter and spring).

Water treatment options (equipment and technology) are currently being planned by Agnico Eagle. A saltwater treatment system is estimated to be operational on the Site before the end of 2018. Water contained at the P-Area, CP1, CP5, the Saline Pond, the underground sumps and water stope will be contained and then treated to meet the Mining Metal Effluent Regulations (MMER) and/or Type A Licence requirements prior to effluent discharge to the environment.

Risk management for the Site areas during Freshet are described below and Appendix A presents the Freshet Action Plan Procedure for preparation prior to, during and after Freshet. Section 4 describes snow management at Site and Appendix B presents the Snow Management procedure.

3.1 P-Area Risk Management

The following management practices are maintained at the P-Area during Freshet and are described in more detail in Appendix A:

- Water levels will be monitored. The water level will not exceed the maximum design elevation in any of the three containment ponds (P1, P2 or P3).
- Environment will conduct visual inspections of the P-Area. This will include visually monitoring the base of the downstream side of dikes DP1-B and DP3-A (see Figure 2) for seepage, sedimentation deposition, and erosion. If seepage or water with increased total suspended solids (TSS) is noted during inspections, water will be sampled, contained, and pumped back to the P-Area.
- Engineering will undertake structural inspections of the dikes and note observed seepage.
- Active evaporation from use of the evaporators will contribute to managing the quantity of water contained at P-Area.

If an emergency occurs, such as the dikes indicating compromised integrity, Agnico Eagle will discharge the water to CP5. The definition and associated design criteria for managing the integrity of the dikes is defined by Golder and Associates during an annual geotechnical inspection.

If CP5 does not have the capacity for water from the P-Area, water will be diverted to the Saline Pond or to the Underground Water Stope for storage until a system for suitable water treatment to meet the Type A Licence and/or MMER discharge criteria.

3.2 LV50 Risk Management

If the P-Area becomes filled to capacity and LV50 sump needs to be pumped, the water from LV50 will flow down gradient to the Underground Water Stope.

3.3 Landfarm Risk Management

During Freshet, if there is any excess water collected at the Landfarm, the Environmental Department will request that the Energy & Infrastructure (E&I) Department pump the excess water. Water samples will be collected in accordance with the Type A Water Licence to ensure compliance prior to its release to the environment. Based on the Landfarm Management Plan and the Type A Water Licence requirements; notice will be provided to the Inspector 10 days prior to this pumping activity. Once sample results have been obtained, the Environmental Department will advise the E&I Department if pumping can begin. If sample results permit, the pumping may begin; to direct water to CP1 or the tundra / ground (water will be discharged in a manner that will eliminate soil erosion or transport of TSS).

In the event that the water sample results do not meet discharge criteria, the water will be stored until suitable treatment system can be put in place to remove contaminants. Suitable treatment methods potentially used are as follows:

- Oil/water Separator
- CI Agent E-VAC Waste Water Filter System
- Carbon Filter System

If a suitable treatment system cannot be obtained the water will be pumped to bladders or totes and will be shipped south for disposal in a certified disposal facility.

3.4 AWAR RISK MANAGEMENT

The following management practices are maintained to ensure the integrity of the AWAR before and during the Freshet and are described in further detail in Appendix A:

- Snow and ice will be removed from ditches and culverts (water crossings). Proper technique will be used to ensure that no ground disturbance occurs during snow and ice removal.
- Large culverts will be heated / steamed to allow the free flow of Freshet.
- Prior to Freshet, water crossings will have snow removed from ice surface on the up and downstream side of the crossing to allow free flow of water.
- Daily visual inspections will be undertaken as to the structural integrity of the abutments and road integrity by the E&I Supervisor.
- Weekly throughout freshet and daily during peak flows a written inspection will be completed by the Environment Department in conjunction with the E&I Department.
- As per the Type A Water Licence, monthly water samples are collected at the following locations (Figure 3) and possibly during Freshet:
    - Mel-River (M2.1)
    - M3.0
    - M5.0
    - M11.5
    - M23.6
    - Any significant water seeps or ponding on the road will be sampled

If soil erosion or ground surface scouring are observed, the E&I Department will be notified for repairs. Turbidity barriers, silt fences, straw logs or other sediment control methods will be implemented as required.

3.5 INFRASTRUCTURE AREAS

Risk management practices for the main Infrastructure Areas at the Site during Freshet are described in the following sections.

3.5.2 CAMP PADS AND SURROUNDINGS

Risk management practices are maintained at the Exploration Camp, Main Camp and surrounding camp areas by monitoring observed water pooling. If water pooling is observed, a water sample will be collected and monitored for turbidity. Turbidity will also be monitored at the culvert beside the garage that flows straight to Meliadine Lake. This area will be monitored for TSS and preventative measures (install straw wattles and/or booms) will be installed to prevent deleterious substances from entering Meliadine Lake.

3.5.3 INDUSTRIAL PAD AND ACCESS ROAD

The following management practices are maintained to ensure the integrity of the industrial pad and access road:

- The culvert between Lake H12 and H13 will be heated/steamed prior to freshet and will be monitored closely for turbidity.
- This area will be monitored for turbidly and preventative measures (install straw wattles and/or booms) will be implemented to prevent deleterious substances from entering Meliadine Lake.

3.6 CP1, CP5 AND QUARRIES

Risk management practices for CP1, CP5, the Meliadine Esker and Quarries include discharging/pumping the water prior to winter freeze to be treated and/or discharged as per the Type A Water Licence and Water Management Plan for the Site. If water is observed to be flowing or ponding, it will be sampled to ensure deleterious substances and TSS is not released to surrounding water bodies (Part I, Item 11 of the Type A Water Licence).

3.7 ITIVIA

The following management practices are maintained to ensure the integrity of Itivia and the Itivia access road:

- The culvert installed between the Itivia laydown and the existing laydown areas (Figure 4) will be cleared of snow and ice prior to freshet and will be monitored closely for turbidity.
- Rip rap installed around the culvert to control erosion.
- The upstream and downstream of the culvert area will be monitored for turbidly and preventative measures (install straw wattles and/or booms) will be implemented to prevent deleterious substances from entering Hudson's Bay.

4 SNOW MANAGEMENT

Proper snow management during the winter contributes to risk mitigation from excess water during Freshet and prevents possible environmental impacts. *The Snow Management Procedure* (Procedure Number MEL-ENV-0017) (Appendix B) presents the plan to efficiently manage snow at the Site.

Snow that is collected and moved from the fuel farm, landfarm, ANFO plant, the area surrounding the portal entrance, waste rock pile and surrounding P-Area will be moved and collected at P1. Snow and ice from the other areas at the Site are removed from roadways with a snow blower or plow and /or collected and transported to the CP1 or CP5. Figure 5 illustrates the locations for snow collection during the winter and prior to Freshet. Figure 6 illustrates the snow management and storage areas for Itivia.

Figure 5: Snow Management Plan

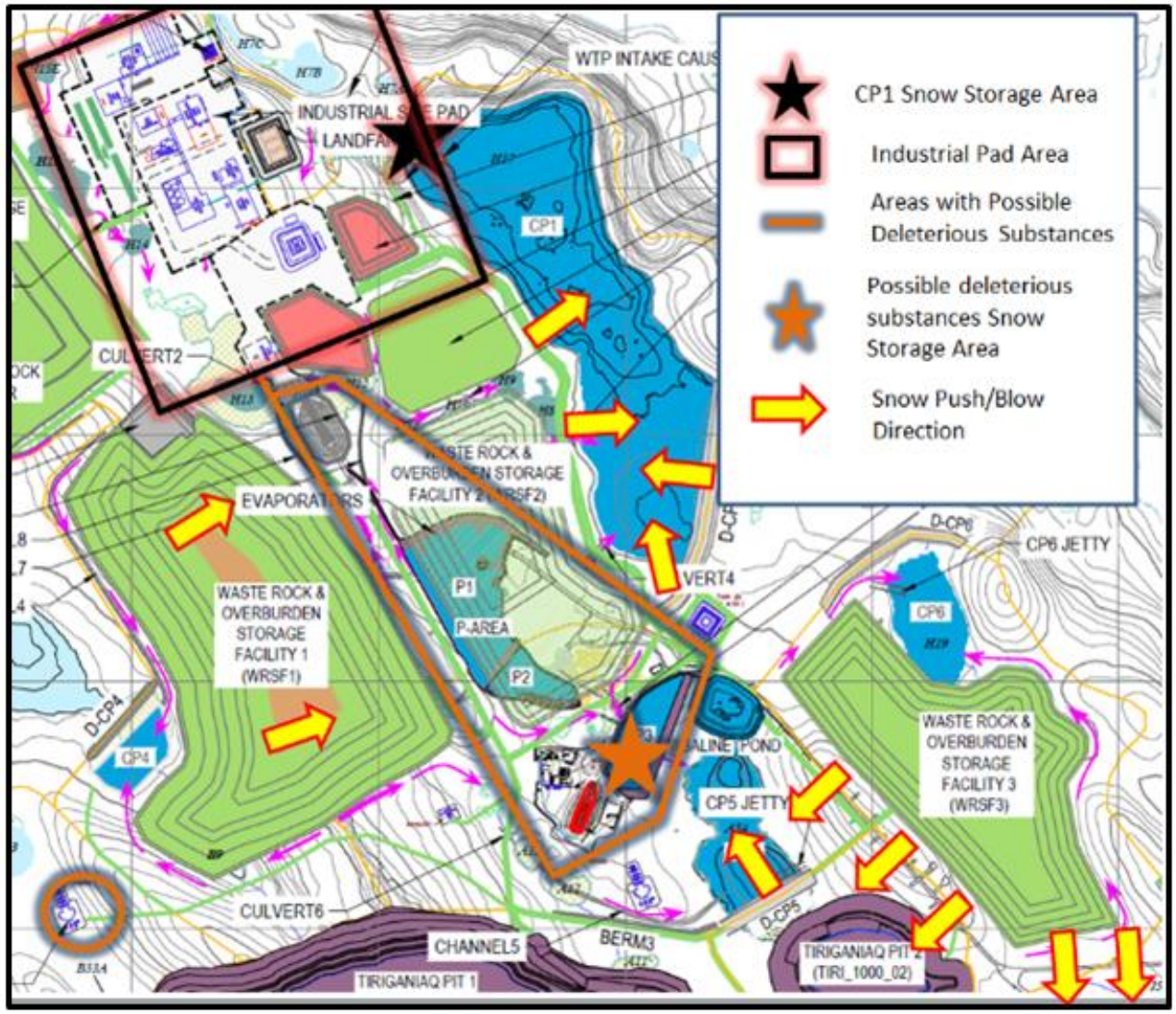
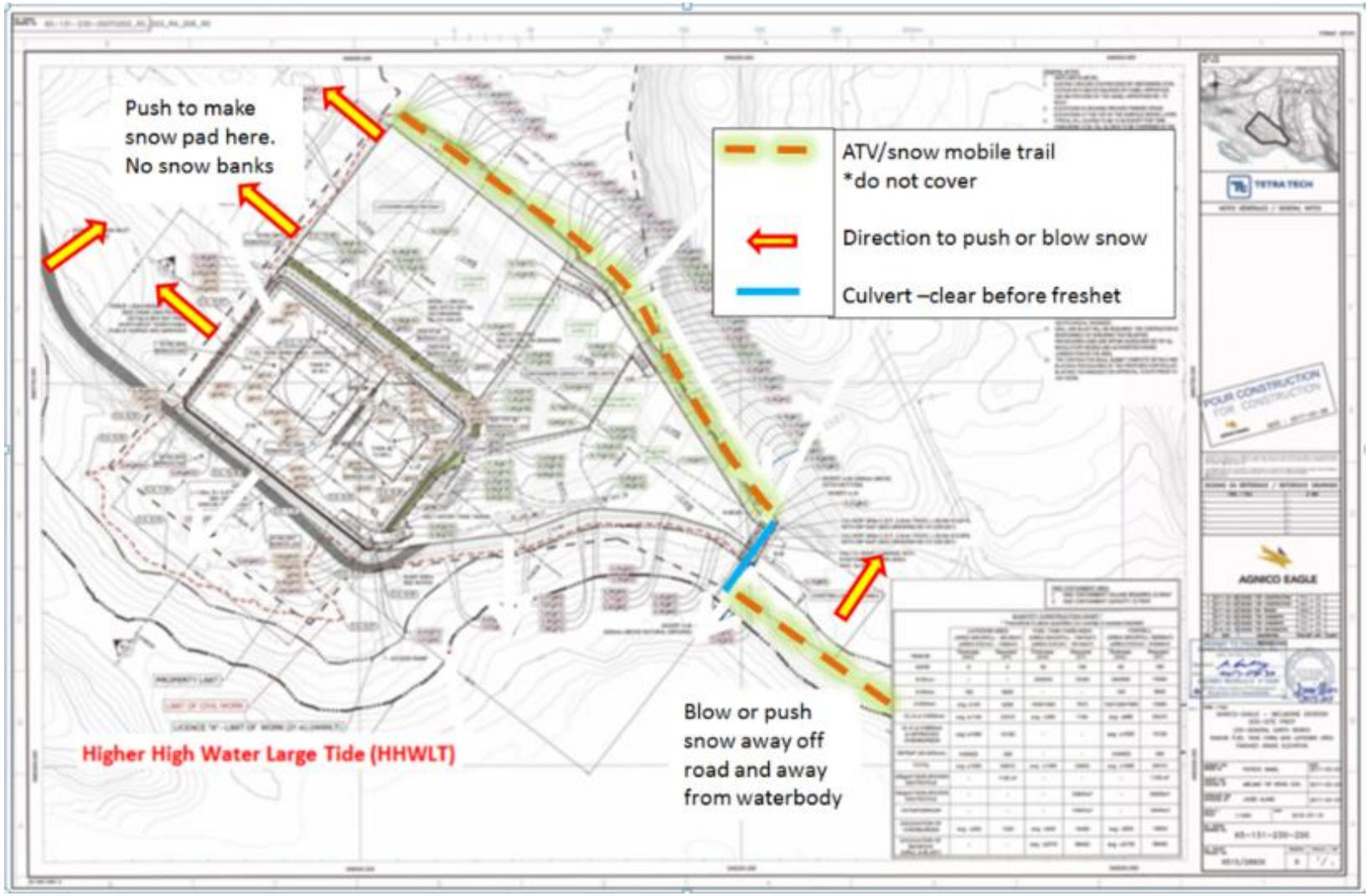


Figure 6: Itivia Snow Management Areas



5 REFERENCES

Agnico Eagle. 2015. Meliadine Gold Project: Landfarm Management Plan. Version 1. April 2015. 6513-MPS-15.

Agnico Eagle. 2016. Meliadine Gold Project: Water Management Plan. Version 2. March 2017.

Nunavut Water Board (NWB). 2015. Type A Water Licence No: 2AM-MEL1631.

APPENDIX A: FRESHET ACTION PLAN PROCEDURE

Freshet Management Procedure

		PROCEDURE NUMBER:	**MEL-ENV-024**
People concerned	All Departments	**Prepared by**	Jennifer Brown, Water Engineer
		Reviewed by	Jeff Pratt, Sr. Environmental Coordinator Guillaume Gemme, Energy & Infrastructure General Foreman Jack Dutil, Construction Manager
Effective Date: **Revision Date:**	January 26, 2017	*"Safety First, Safety Last … Safety Always!"* *"No Repeats" – Our Stepping Stone to ZERO HARM*	
This procedure corresponds to the required minimum safety and environmental standards. All employees must comply with the rules and regulations of the Nunavut Government in terms of health, safety, and environment at work.			

Objective:

To provide a plan to prevent potential environmental incidents at the Meliadine Site (Site) caused by the freshet season (Freshet) by recognizing specific areas for risk at the Site, possible actions to be undertaken and the departmental responsibilities to address the required actions.

Concerned Departments:

Environment, Energy & Infrastructure, Construction, Engineering and Departmental Supervisors

Note: It is the responsibility of all Meliadine Site employees to report any observed environmental concerns or incidents to their supervisor and/or the Environmental Department to ensure that any required mitigation or corrective procedures will be implemented in a timely manner.

Risks/ Impacts Legend

Health & Safety | Process/quality | Costs | Environment

Freshet Management Procedure

Procedure					
Winter and Spring – Preparation Prior to Freshet[1]					***Risks/ Impacts***
Area for Risk		**Action**	**Responsible Department**	**Approximate Dates**	
P-Area	P1, P2 & P3	• Snow must not be stockpiled to be greater than the containment capacity	Environment to coordinate with Energy & Infrastructure, Engineering and Construction	March - May	
AWAR	Culverts	• Weekly Inspections	Environment	March - May	
	Major Crossings	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs (mark culvert locations, add armouring at downstream around culverts and bridges, replace pipe as needed, and document maintenance and repairs • Monitor signs of erosion (especially downstream at culverts 14.9 and 16 Km) • Notify the Environmental Department about any areas for concern[2, 3]	Energy & Infrastructure	Winter Freeze to May (start of thaw)	
	Overall Road				
Industrial Pad	Culverts	• Weekly Inspections	Environment		
	Channels and ditches	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs • Notify the Environmental Department about any areas for concern[2, 3]	Construction		
	Access Road				
Quarries		• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Re-grade disturbed areas to provide appropriate drainage	Construction Environment (for Sampling)	Winter Freeze to May (start of thaw)	

Note:

[1] See the *Snow Management Procedure* (Procedure No.: MEL-ENV-0017) for additional information for snow removal at the Site.

[2] The Environmental Department will assess the area of concern and action will be undertaken to comply with the Nunavut Water Board (NWB) Water Licence No.: 2AM-MEL1631 (Licence)(i.e. collect field parameters or water samples for analysis of total suspended solids, turbidity, or any deleterious substance).

[3] Areas of concern are defined as high water areas on roads, near the up gradient opening of a culvert, flowing water with sediment, spills, wildlife, etc.

Freshet Management Procedure

Spring and Summer – During Freshet or During Heavy Rainfall				*Risks/ Impacts*
Area for Risk	**Action**	**Responsible Department**	**Approximate Dates**	
P-Area				
P1, P2, and P3	• Daily visual inspection • Daily monitor and record water levels • Weekly written inspection • Water sampling	Environment	May - October	
	• If water levels or structural integrity of berms are observed to be compromised, immediate action is required. Notify Supervisor	Engineering		
	• P2 and P3 water volume should be kept as minimal as possible. Pumping of this water should occur regularly (daily) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
Evaporators	• Commission after sub-zero temperatures no longer occur • Operate as efficient as possible	Energy & Infrastructure		
DP1 and DP3 Trenches /Seep	• Install pump and flow meter at trench to collect seep • Pump water to respective containment area (P1 or P3) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
All Weather Access Road (AWAR)				
AWAR Culverts	• Inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments (2x per Week or after heavy rainfall between May and October and daily during peak flow)	Environment	May - October	
AWAR Major Crossings	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Energy & Infrastructure Environment (for Sampling)		
AWAR (Overall)				
Quarries	• Repairs and erosion/sediment control implementation • Re-grade disturbed areas to provide appropriate drainange • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)		

Spring and Summer – During Freshet or During Heavy Rainfall			
New Camp Pad/Industrial Pad			
Culverts	• Daily inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments	Construction Environment (for Sampling)	May - October
Channels and Ditches Access Road	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)	May - October
Infrastructure Pads			
Exploration Camp	• Daily visual inspections • Water sampling as required	Environment	May - June
Landfarm Structure	• Daily inspection of the landfarm retaining wall • Daily visual inspection for seepage • Collect a seepage water sample for hydrocarbon analysis. If seepage is present it should be immediately sampled and the seep be controlled. Whether by creating a sump and pumping back the water or by other methods.	Environment	
Landfarm	• Visually monitor excess water in containment area • Monitor seep (weekly) and collect water sample • Sample water according to the Licence	Environment	Mid-June and September
	• Provide notice of pumping (include estimated volume) to be pumped to NWB		10 days prior to pumping
	• Once approval has been received, and if water meets the Licence criteria, water can be pumped to tundra at a low flow to avoid erosion • Measure and record pumped volume	Energy & Infrastructure	Mid-June and September
Garage (Agnico Eagle)	• Install sump to contain excess water • Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
Core Box Cemetery and Culvert	• Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
ANFO Pad	• Weekly Inspections • Water sampling as required for ammonia, nitrates, turbidity and TSS	Environment	May - June
	• Daily visual inspection for pooling water and water run off form ANFO pad, if noticed immediately contact environment department	Dyno Nobel	

Note:

[1] See the *Snow Management Procedure* (Procedure No.: MEL-ENV-0017) for additional information for snow removal at the Site.

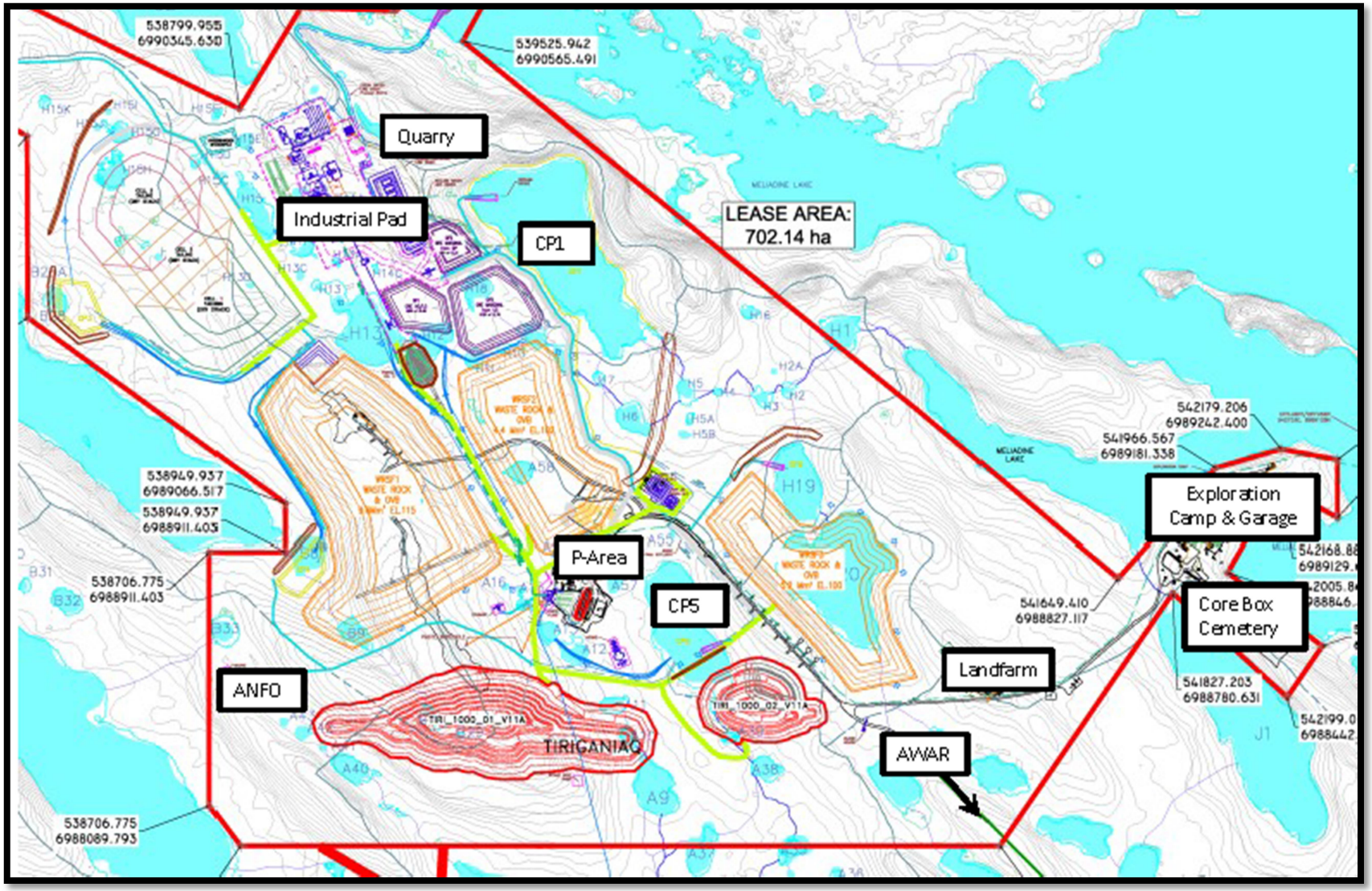
[2] The Environmental Department will assess the area of concern and action will be undertaken to comply with the Nunavut Water Board (NWB) Water Licence No.: 2AM-MEL1631 (Licence)(i.e. collect field parameters or water samples for analysis of total suspended solids, turbidity, or any deleterious substance).

[3] Areas of concern are defined as high water areas on roads, near the up gradient opening of a culvert, flowing water with sediment, spills, wildlife, etc.

Freshet Management Procedure

Fall – Preparation Prior to Winter Freeze					Risks/ Impacts
Area for Risk		**Action**	**Responsible Department**	**Approximate Dates**	
LV50		• Survey water level and calculate water volume and provide to Environment, and/or • Measure and record flow meter volume prior to pumping and after pumping and provide to Environment • Remove pumps and prepare equipment for maintenance and winter storage	Mining	Prior to pumping to P2 (Late September)	
		• Pump to P2		Late September/Early October	
Lv75/Water Stope		• Pump to Saline Pond		June - September	
P-Area	P2 and P3	• Pump water to P1 for active evaporation	Energy & Infrastructure	June - September	
	P1, P2 & P3	• Remove pumps and prepare equipment for maintenance and winter storage		At beginning of winter freeze	
	Evaporators	• Decommission for winter and prepare equipment for maintenance and winter storage		Prior to any sub-zero temperatures	
A8		• Move pump house/pump closer to Site		Late September	
CP1		• Written inspection • Water sampling • Discharge approval	Environment	June - September	
		• Pump water to discharge at Meliadine Lake	Process Plant		
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Downstream D-CP1		• Pump water to CP1	Energy & Infrastructure	June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
CP5		• Pump water to CP1/Saline Water Treatment Plant		Late September	
Downstream D-CP		• Pump water to CP5		June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Saline Pond		• Remove pumps and prepare equipment for maintenance and winter storage		First week of October	

Figure 1: Areas for Risk



APPENDIX B: SNOW MANAGEMENT PROCEDURE

Freshet Management Procedure

		PROCEDURE NUMBER:	**MEL-ENV-024**
People concerned	All Departments	**Prepared by**	Jennifer Brown, Water Engineer
		Reviewed by	Jeff Pratt, Sr. Environmental Coordinator Guillaume Gemme, Energy & Infrastructure General Foreman Jack Dutil, Construction Manager
Effective Date: **Revision Date:**	January 26, 2017	*"Safety First, Safety Last … Safety Always!"* *"No Repeats" – Our Stepping Stone to ZERO HARM*	
This procedure corresponds to the required minimum safety and environmental standards. All employees must comply with the rules and regulations of the Nunavut Government in terms of health, safety, and environment at work.			

Objective:

To provide a plan to prevent potential environmental incidents at the Meliadine Site (Site) caused by the freshet season (Freshet) by recognizing specific areas for risk at the Site, possible actions to be undertaken and the departmental responsibilities to address the required actions.

Concerned Departments:

Environment, Energy & Infrastructure, Construction, Engineering and Departmental Supervisors

Note: It is the responsibility of all Meliadine Site employees to report any observed environmental concerns or incidents to their supervisor and/or the Environmental Department to ensure that any required mitigation or corrective procedures will be implemented in a timely manner.

Risks/ Impacts Legend

Health & Safety | Process/quality | Costs | Environment

Freshet Management Procedure

Procedure					
Winter and Spring – Preparation Prior to Freshet[1]					***Risks/ Impacts***
Area for Risk		**Action**	**Responsible Department**	**Approximate Dates**	
P-Area	P1, P2 & P3	• Snow must not be stockpiled to be greater than the containment capacity	Environment to coordinate with Energy & Infrastructure, Engineering and Construction	March - May	
AWAR	Culverts	• Weekly Inspections	Environment	March - May	
	Major Crossings	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs (mark culvert locations, add armouring at downstream around culverts and bridges, replace pipe as needed, and document maintenance and repairs • Monitor signs of erosion (especially downstream at culverts 14.9 and 16 Km) • Notify the Environmental Department about any areas for concern[2, 3]	Energy & Infrastructure	Winter Freeze to May (start of thaw)	
	Overall Road				
Industrial Pad	Culverts	• Weekly Inspections	Environment		
	Channels and ditches	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs • Notify the Environmental Department about any areas for concern[2, 3]	Construction		
	Access Road				
Quarries		• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Re-grade disturbed areas to provide appropriate drainage	Construction Environment (for Sampling)	Winter Freeze to May (start of thaw)	

Note:

[1] See the *Snow Management Procedure* (Procedure No.: MEL-ENV-0017) for additional information for snow removal at the Site.

[2] The Environmental Department will assess the area of concern and action will be undertaken to comply with the Nunavut Water Board (NWB) Water Licence No.: 2AM-MEL1631 (Licence)(i.e. collect field parameters or water samples for analysis of total suspended solids, turbidity, or any deleterious substance).

[3] Areas of concern are defined as high water areas on roads, near the up gradient opening of a culvert, flowing water with sediment, spills, wildlife, etc.

Freshet Management Procedure

Spring and Summer – During Freshet or During Heavy Rainfall				*Risks/ Impacts*
Area for Risk	**Action**	**Responsible Department**	**Approximate Dates**	
P-Area				
P1, P2, and P3	• Daily visual inspection • Daily monitor and record water levels • Weekly written inspection • Water sampling	Environment	May - October	
	• If water levels or structural integrity of berms are observed to be compromised, immediate action is required. Notify Supervisor	Engineering		
	• P2 and P3 water volume should be kept as minimal as possible. Pumping of this water should occur regularly (daily) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
Evaporators	• Commission after sub-zero temperatures no longer occur • Operate as efficient as possible	Energy & Infrastructure		
DP1 and DP3 Trenches /Seep	• Install pump and flow meter at trench to collect seep • Pump water to respective containment area (P1 or P3) • Measure and record pumping volumes daily and report to Environment weekly	Energy & Infrastructure		
All Weather Access Road (AWAR)				
AWAR Culverts	• Inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments (2x per Week or after heavy rainfall between May and October and daily during peak flow)	Environment	May - October	
AWAR Major Crossings	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Energy & Infrastructure Environment (for Sampling)		
AWAR (Overall)				
Quarries	• Repairs and erosion/sediment control implementation • Re-grade disturbed areas to provide appropriate drainange • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)		

Spring and Summer – During Freshet or During Heavy Rainfall			
New Camp Pad/Industrial Pad			
Culverts	• Daily inspections for free flow water through culverts and major crossings, pooling water on road, and integrity of road and abutments	Construction Environment (for Sampling)	May - October
Channels and Ditches Access Road	• Snow and ice clearing[1], including ice and snow that may impede free water flow through culverts and at major water crossings • Repairs and erosion/sediment control implementation • Notify the Environmental Department about any areas for concern [2, 3]	Construction Environment (for Sampling)	May - October
Infrastructure Pads			
Exploration Camp	• Daily visual inspections • Water sampling as required	Environment	May - June
Landfarm Structure	• Daily inspection of the landfarm retaining wall • Daily visual inspection for seepage • Collect a seepage water sample for hydrocarbon analysis. If seepage is present it should be immediately sampled and the seep be controlled. Whether by creating a sump and pumping back the water or by other methods.	Environment	
Landfarm	• Visually monitor excess water in containment area • Monitor seep (weekly) and collect water sample • Sample water according to the Licence	Environment	Mid-June and September
	• Provide notice of pumping (include estimated volume) to be pumped to NWB		10 days prior to pumping
	• Once approval has been received, and if water meets the Licence criteria, water can be pumped to tundra at a low flow to avoid erosion • Measure and record pumped volume	Energy & Infrastructure	Mid-June and September
Garage (Agnico Eagle)	• Install sump to contain excess water • Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
Core Box Cemetery and Culvert	• Install straw wattles for sediment control on the other side of the road	Energy & Infrastructure	May
	• Daily monitoring of TSS and turbidity and possible contaminant runoff	Environment	May - June
ANFO Pad	• Weekly Inspections • Water sampling as required for ammonia, nitrates, turbidity and TSS	Environment	May - June
	• Daily visual inspection for pooling water and water run off form ANFO pad, if noticed immediately contact environment department	Dyno Nobel	

Note:

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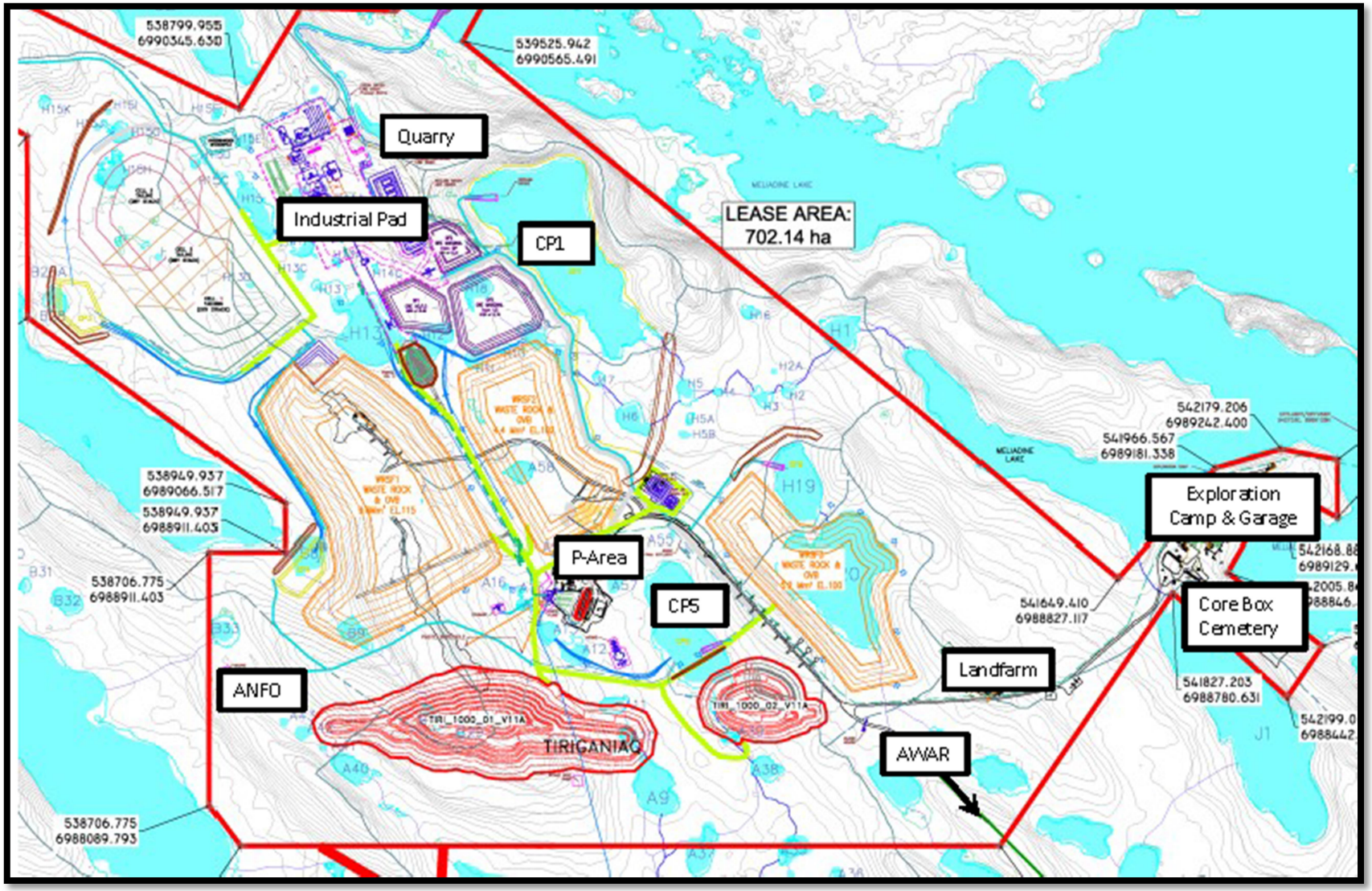
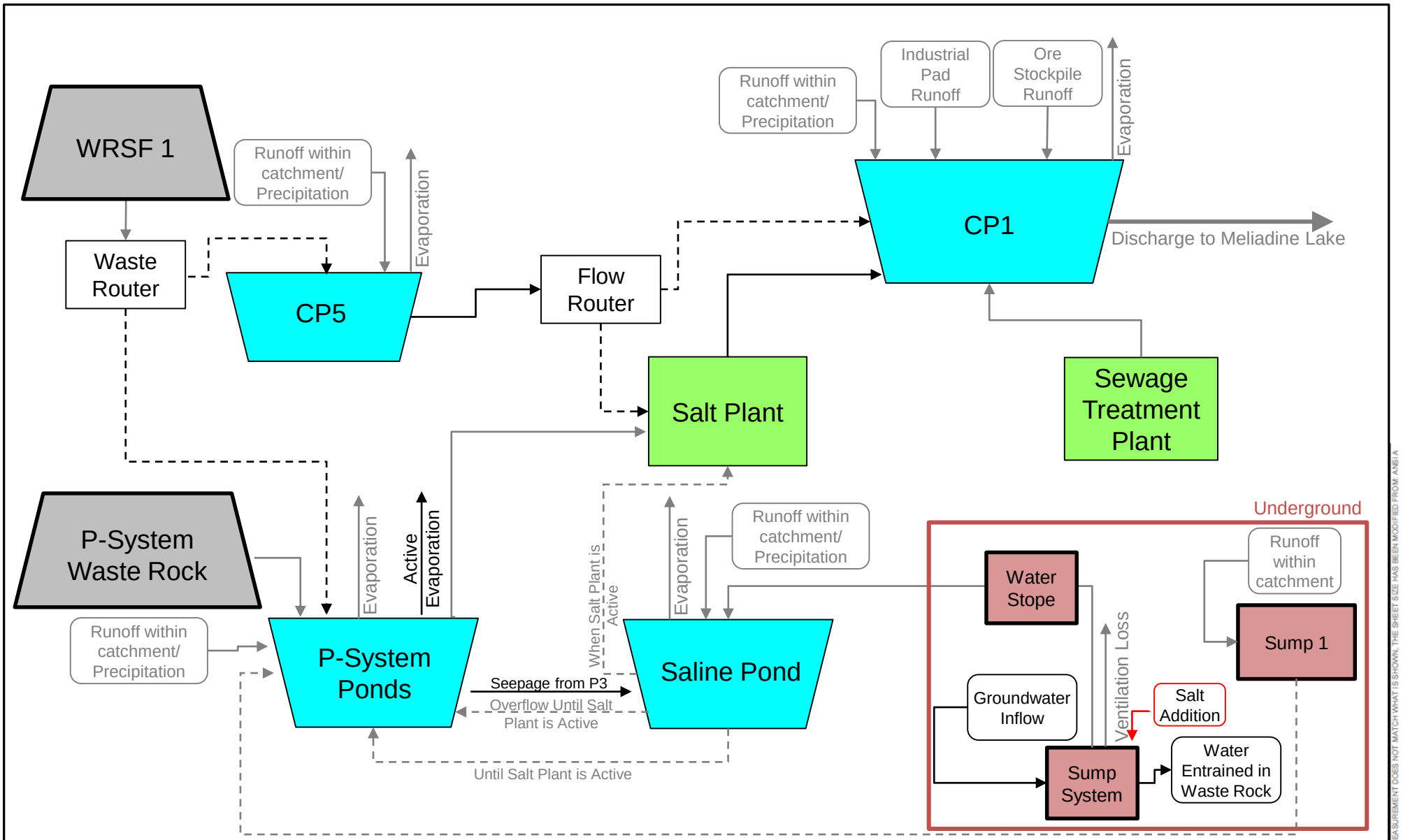
Freshet Management Procedure

Fall – Preparation Prior to Winter Freeze					Risks/ Impacts
Area for Risk		**Action**	**Responsible Department**	**Approximate Dates**	
LV50		• Survey water level and calculate water volume and provide to Environment, and/or • Measure and record flow meter volume prior to pumping and after pumping and provide to Environment • Remove pumps and prepare equipment for maintenance and winter storage	Mining	Prior to pumping to P2 (Late September)	
		• Pump to P2		Late September/Early October	
Lv75/Water Stope		• Pump to Saline Pond		June - September	
P-Area	P2 and P3	• Pump water to P1 for active evaporation	Energy & Infrastructure	June - September	
	P1, P2 & P3	• Remove pumps and prepare equipment for maintenance and winter storage		At beginning of winter freeze	
	Evaporators	• Decommission for winter and prepare equipment for maintenance and winter storage		Prior to any sub-zero temperatures	
A8		• Move pump house/pump closer to Site		Late September	
CP1		• Written inspection • Water sampling • Discharge approval	Environment	June - September	
		• Pump water to discharge at Meliadine Lake	Process Plant		
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Downstream D-CP1		• Pump water to CP1	Energy & Infrastructure	June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
CP5		• Pump water to CP1/Saline Water Treatment Plant		Late September	
Downstream D-CP		• Pump water to CP5		June - September	
		• Remove pumps and prepare equipment for maintenance and winter storage		Late September/Early October	
Saline Pond		• Remove pumps and prepare equipment for maintenance and winter storage		First week of October	

Figure 1: Areas for Risk



APPENDIX C • WATER MANAGEMENT SCHEMATIC FLOW SHEET



Notes:
P-System Ponds have been grouped for illustrative purposes. Active evaporation from P1 Pond only.

Components shown in black can be controlled via the dashboard. Grey Components are fixed flows.

Dashed lines represent flow/mass routing that changes with time or by scenario.

CLIENT
AGNICO EAGLE MINES LIMITED

PROJECT
MELIADINE GOLD PROJECT
CONSTRUCTION PHASE WATER QUALITY MODEL

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-03-17
PREPARED	MIB
DESIGN	MIB
REVIEW	VJB
APPROVED	VJB

TITLE
WATER BALANCE SCHEMATIC

PROJECT No.	Doc.	Rev.	FIGURE
1668371	**611**	**0**	**1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
1 in
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