181 University Avenue
Suite 300, PO Box 33
Toronto, Ontario
M5H 3M7
416-628-0216

July 30, 2020

Derek Donald
Technical Advisor
Nunavut Water Board
P.O. Box 119
Goja Haven, NU, X0B 1J0

Sent via Email: derek.donald@nwb-oen.ca; licensing@nwb-oen.ca

Re: TMAC Responses to 2019 Nunavut Water Board Annual Report Comments

Dear Mr. Donald

TMAC Resources Inc (TMAC) is pleased to present to the Nunavut Water Board (NWB) responses to comments received on the 2019 NWB Annual Report for the Hope Bay Project.

On July 3, 2020, TMAC received comments from the following interested parties:
1. Kitikmeot Inuit Association (KIA);
2. Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC); and
3. Environment and Climate Change Canada (ECCC).

Responses to comments can be found in Attachment A of this submission.

Should you have any questions please feel free to contact me at oliver.curran@tmacresources.com

Sincerely,

Oliver Curran
Vice-President, Environmental Affairs TMAC Resources Inc.

Cc:
Licencing (NWB)
Bridget Campbell (CIRNAC)
John Roesch (KIA)

Russell Wykes (ECCC)
Kyle Conway / Sarah Warnock (TMAC)
Ashley Mathai (TMAC)
Adam Grzegorczyk (TMAC)

Attachments:
Attachment A – TMAC Responses to 2019 NWB Annual Report Comments

Attachment A

TMAC Response to 2019 NWB Annual Report Comments

TMAC Resources Inc.

HOPE BAY PROJECT

Proponent's Response to Comments Received on the 2019 Nunavut Water Board Annual Report

July 2020

Prepared by:

TMAC Resources Inc.
Toronto, Ontario

Citation:
TMAC. 2020. *Hope Bay Project: Proponent's Response to Comments Received on the 2019 Nunavut Water Board Annual Report*: Toronto, Ontario.

TMAC Resources Inc.
181 University Avenue
Suite 300, PO Box 33
Toronto, Ontario
M5H 3M7
416-628-0216

HOPE BAY PROJECT

Proponent's Response to Comments Received on the 2019 Nunavut Water Board Annual Report

TABLE OF CONTENTS

ATTACHMENTS

1. KIA-NWB-1

1.1 SUBJECT

Flotation tailings levels

1.2 REFERENCE

Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report:

- Section 8.1.2.2.

1.3 SUMMARY

Elevated trace elements content in flotation tailings that were deposited in the Doris TIA.

1.4 DETAILED REVIEW COMMENT

In Section 8.1.2.2, Flotation Tailings (TL-6), TMAC makes the following statement regarding the flotation tailings deposited in the Doris TIA; "Trace element content was elevated compared to the screening criteria for arsenic, sulphur, gold and one high bismuth sample."

Further, "Ten times the average crustal abundance for basalt (Prince 1997)" was used as an indicator of enrichment for the flotation tailings deposited in the Doris TIA.

The reference list for the document does not include the Prince 1997 reference, making review of the element comparison not possible.

1.5 RECOMMENDATION/REQUEST

The KIA requests more clarity surrounding the screening criteria for trace element content, and inclusion of the reference used (Prince 1997).

1.6 TMAC RESPONSE TO KIA-NWB-1

The reference for Price (1997) is documented in SRK (2020) 2019 Geochemical Monitoring of Flotation and Detoxified Tailings, Doris Mill, which is an appendix to Appendix F of the Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report. Data interpretation for trace element content of TL-6 as compared to the screening criteria from Price (1997) are presented in Section 4.2.2 of SRK (2020).

2. KIA-NWB-2

2.1 SUBJECT

Spill report #19-240 Turbid Water Unknown Volume.

2.2 REFERENCES

Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report

- Section 11, table 11-1, spill number 19-240

2.3 SUMMARY

"Surface runoff containing sediment … migrates overland through the active layer of tundra to the shoreline of Patch Lake." Samples of both flows were collected to quantify potential impacts to Patch Lake.

Results and methods used for testing were not present or referenced in the report.

2.4 DETAILED REVIEW COMMENT

Four hours after the initial observation of the runoff event, runoff samples were collected to test for acute lethality. TMAC states that "A review of the analytical results showed both streams entering Patch Lake to be non-acutely lethal with a 100% survival rate for both Rainbow trout (96-hour LC50 test) and Daphnia magna (48-hour LC50 test)".

TMAC does not supply the references for the 96-h and 48-h LC50 tests, which would be helpful. The relevance of LC50-test results on rainbow trout, a temperate fish species, to resident Arctic species such as arctic char must be extrapolated carefully. Although some research has been done that supports the applicability of toxicology research on marine temperate fish species (turbot (Scophthalmus maximus) and European bass (Dicentrarchus labrax)) for Arctic marine fish species (polar cod (Boreogadus saida) and daubed shanny (Leptoclinus maculatus)) (Camus et al., 2015; Olsen et al., 2011), care must be taken when assuming how temperature modifies toxicity within a species, and potential differences in toxicity sensitivity between temperate and Arctic species (Gewurtz et al., 2006). Generally, Arctic organisms differ from temperate species in life span, developmental time, surface-to- volume ratios, metabolic rates, total energy usage, and lipid content for energy storage. Compared to temperate species, the onset and tolerance of toxic effects can be delayed and different in Arctic species due to metabolic differences. Chapman (2016) reviewed the evidence of delayed toxicity in Arctic species, highlighting the need for research to be conducted specifically on Arctic species. Zamora et al. (2015) found that exposure periods of 48-96 hours which is commonly used for temperate species, are too short for responses in polar organisms,

urging the need for longer exposure periods in toxicity tests for polar biota to generate relevant sensitivity data. Chapman (2016) further states that when using current methodologies where exposure period is not accounted for, sensitivity to toxicants may not be adequately estimated in Arctic species, with an underestimation of toxicity and an overestimation of predicted concentrations though to have no effect.

2.5 RECOMMENDATION/REQUEST

Please include LC50 references and/or results. In future instances of spills that require LC50 tests please provide necessary caveats when extrapolating results from temperate species, re-evaluate lab methods for LC50 test to adequately reflect Arctic species.

2.6 TMAC RESPONSE TO KIA-NWB-2

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)	
	Rainbow trout	*Daphnia magna*
L2293385-1 NE-C	>100	>100
L2293385-2 NE-D	>100	>100

LC = Lethal Concentration

See Certificate of Analysis in Attachment#1 for reference. TMAC notes that although conducting an LC50 for this event was not required, but done for additional information, TMAC will take KIA's recommendation under consideration for future events.

3. KIA-NWB-3

3.1 SUBJECT

Water discharge from the Landfarm (ST-4).

3.2 REFERENCES

Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report.

3.3 SUMMARY

"Water quality samples were collected on June 17 from the Land farm (ST-4) prior to discharge of…….second sample was collected on June 24 and exceeded the discharge criteria for Oil & Grease and Visible Sheen."

Water discharge from Landfarm presents visible oil sheen and the second sample collected on June 24 shows exceedance for Oil & Grease criteria.

3.4 DETAILED REVIEW COMMENT

Same as above.

3.5 RECOMMENDATION/REQUEST

The source of Oil & Grease should be identified to prevent future contamination of the water discharged from the Landfarm sump.

3.6 TMAC RESPONSE TO KIA-NWB-3

After review of analytical results and field notes it has been determined that the sample collected on June 24, 2019 was mislabelled. The sample that demonstrated a visible sheen was from the snow pond cell, a lined contaminated water management cell immediately adjacent to the soil cell of the land farm.

4. KIA-NWB-4

4.1 SUBJECT

TL-1 TIA Monitoring Station.

4.2 REFERENCES

Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report.

4.3 SUMMARY

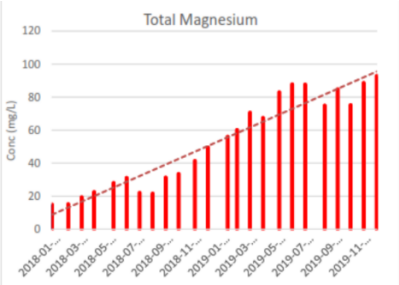
"This section presents the results of monitoring of the Tailings Impoundment Area (TIA) as per the applicable sections of Part F….."

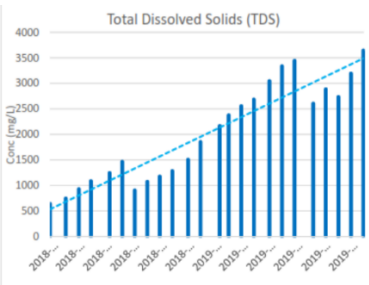
Table D1-24 and D1-25 present a summary of the results of the annual monitoring. Water samples were collected at the TIA Reclaim Pipeline monitoring station TL-1 from a sample port on the reclaim pump.

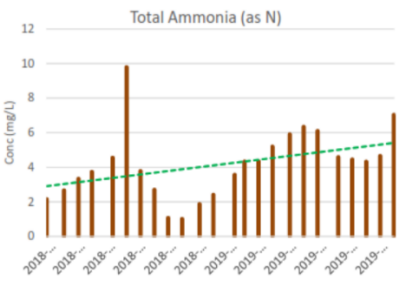
A total of 12 samples had been collected from January 2019 to December 2019 (monthly sampling).

4.4 DETAILED REVIEW COMMENT

Some parameters seem to present upward trends in the concentration at the tailing impoundment area (water quality station TL-1). Three Histograms were prepared for some PCOCs; the upward trend is clear for the parameters Total Magnesium and Total Dissolved Solids. The parameter Total Ammonia, as well, indicates a slightly upward trend.







4.5 RECOMMENDATION/REQUEST

A trend analysis for each contaminant of potential concern should be performed. This includes the identification of significant and sustained upward trends in the concentration of pollutants in the Tailings Impoundment Area (TIA) identified as being at risk of creating potential unconformities with respect to existing licenses.

4.6 TMAC RESPONSE TO KIA-NWB-4

The 2019 Annual Water And Load Balance Assessment (2019 W&LBA, SRK 2020) is a requirement under the Hope Bay Water Licence No: 2AM-DOH1335 Schedule B Item 4. The water and load balance model is a forecasting tool used to evaluate water quality and quantity trending for the Hope Bay Project. Under this specific licence requirement, measured water quality is compared to the model predictions to refine inputs to the model and to evaluate if the project is behaving differently than the conceptual model.

All modelling work to date (SRK 2017a, 2018, 2019, 2020) includes a general trend of increasing concentration for most parameters as contact water sources generally contain higher concentrations compared to natural runoff flowing to the Doris TIA. The Doris TIA was a natural lake (Tail Lake) before the construction of the North Dam. Since then, contact water collected around the Doris Mine Site, Doris mine water and the tailings from the process plant have been deposited in the Doris TIA. These contact water sources all have elevated concentrations for some parameters compared to the baseline concentrations observed in Tail Lake. It is an expectation, that the concentration trend observed for these parameters would be increasing over time. The focus of the 2019 W&LBA was to assess the fit and accuracy of the model predictions when compared to measured values, as required under Schedule B Item 4.

The 2019 W&LBA does not review each parameter with an increasing concentration trend if the measured concentrations in the Doris TIA match or are less than model predictions, as presented in Attachment 2 of the 2019 W&LBA. Parameters higher than model predictions were the focus of the assessment and were evaluated and refined based on measured data to date. For total dissolved solids, total magnesium and dissolved magnesium, measured concentrations in the Doris TIA match the model predictions, see pages 2, 28 and 55 of Attachment 2 of the 2019 W&LBA, respectively. Ammonia concentrations in the Doris TIA are predicted to increase and then stabilize in the Doris TIA, with seasonal decreases over the open water season due to biological degradation (see page 10 of Attachment 2 of the 2019 W&LBA).

Model predictions and measured concentrations for the Doris TIA were then screened against the Metal and Diamond Effluent Mining Regulations (MDMER), see Section 5 of the 2019 W&LBA. Under the Part F, Item 22 and Part I, Item 14 of Water Licence 2AM-DOH1335, effluents from site must be non-acutely lethal under the MDMER. Future concentrations of parameters regulated under MDMER were considered during this assessment and the results are presented in Table 15 of the 2019 W&LBA . TMAC will continue to review water quality data monthly, as required by Schedule B Item 4 of the License, for all parameters but with a focus on the four parameters identified: total suspended solids (TSS), total copper, total cyanide and unionized ammonia, and is in the process of procuring a TSS treatment solution for the Doris TIA.

As outlined within the 2019 W&LBA the increasing predications for total magnesium, total dissolved solids and total ammonia are increasing but within the predictions / expectations. The water quality information for TL-1 will be reviewed again monthly as part of the operation water and load balance tool, and formally documented each year as part of annual reporting.

5. KIA-NWB-5

5.1 SUBJECT

TL12 Monitoring of Underground Dewatering.

5.2 REFERENCES

Hope Bay Belt Project, 2019 Nunavut Water Board Annual Report.

5.3 SUMMARY

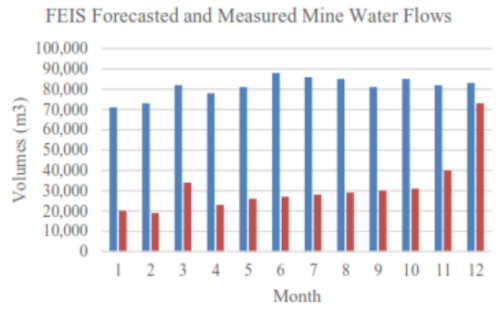
"In December 2019, underground pumping rates periodically exceeded 2000m3/day and TMAC provided notice to the Inspector on January 8, 2020 as outlined in Module A of the Hope Bay Groundwater Management Plan."

The monthly volume of Doris dewatering for December 2019 was 72,904 m3, approximately 2352 m3/day. The average dewatering rate for December is above the 2000m3/day for dewatering activities.

5.4 DETAILED REVIEW COMMENT

The increase of the dewatering rate above the 2000m3/day threshold might require amending Type A Water Licence No. 2AM-DOH1335. During 2019, approximately 430,000 tonnes of waste rock were produced at Doris underground works, approximately 265,000 tonnes were used for immediate backfilling operations and approximately 90,000 tonnes of waste rock from surface stockpiles was placed as backfill in underground stope. A correlation between underground works and increase in the dewatering rate should be investigated.

The 2019 December dewatering flow volume (approximately 72,904 m3) is below the FEIS forecasted value, nevertheless the trend in the measured value indicates the potential to exceed the FEIS values.



5.5 RECOMMENDATION/REQUEST

Monthly dewatering volumes should be analyzed and commented in relation to the ongoing underground works.

5.6 TMAC RESPONSE TO KIA-NWB-5

While conducting initial underground delineation diamond drilling in the Doris Central zone, TMAC encountered groundwater of a high enough pressure and flowrate to warrant additional dewatering, suspension of development in this zone and re-evaluation of the development strategy. Grouting experts prepared a grouting program that has been successful to date and with dewatering volumes substantially reduced. This program has been continued during the temporary reduction of operations during COVID-19. Other areas of the Doris mine are unaffected and continue development and production, with routine water control measures as described by Hope Bay Groundwater Management Plan. Dewatering volumes continue to be reported monthly to the NWB indicating reduced volumes of underground water in 2020.

6. KIA-NWB-6

6.1 SUBJECT

Waste rock used in road construction.

6.2 REFERENCES

Hope Bay 2019 Annual Report, 8. Geochemical Studies, 8.1.1.4 Naartok East CPR.

6.3 SUMMARY

Some of the waste rock used for road construction had potentially higher risk of ML/ARD.

6.4 DETAILED REVIEW COMMENT

TMAC states that mining at Naartok East CPR started in "month 2019 with waste rock production starting in month". The missing month information should be provided.

TMAC states that "all waste rock used for construction was determined to have a low risk of ML/ARD except 7,650 t of waste rock that was strategically placed in areas where waste rock seepage will be managed, specifically in pit of NE CPR (7,300 t) and a lined area adjacent to the Madrid North portal (350 t)" (p. 8-3). Details on how seepage will be managed in these areas (beyond lining storage areas) should be provided to avoid metal leaching and acid rock drainage.

TMAC states that 4 composite samples of waste rock used for construction were analyzed and that results showed that they were non-PAG with arsenic levels below screening criteria. Did these samples include the 7,650 t waste rock mentioned above?

6.5 RECOMMENDATION/REQUEST

Please add missing month information.

Please provide details on how seepage of the 7,650 t waste rock with potentially high risk of ML/ARD will be managed.

Please clarify whether composite samples of waste rock used in construction included samples from the 7,650t waste rock with potentially high risk of ML/ARD.

6.6 TMAC RESPONSE TO KIA-NWB-6

Mining of the Naartok East CPR (NE CPR) was initiated in June 2019 with waste rock production starting in July.

Seepage from the 7,300 t of waste rock placed in the NE CPR will be contained within the excavation of the NE CPR. Excess water accumulation will be sampled to confirm water quality and will be managed through the Madrid Contact Water Pond or transported via truck to the Doris Tailings Impoundment Area.

Water collected in sumps of the lined portal pad area will be transported via truck to the Doris Tailings Impoundment Area.

The composite sample of waste rock used in construction did not include construction material from these two aforementioned areas. As part of the as-built construction geochemical monitoring program, TMAC will conducted a freshet seepage survey in June 2020 (construction of this facility began in September 2019). In August 2020, a geological inspection of infrastructure built in 2019 will be conducted and solids samples collected to geochemically characterize construction rock.

7. KIA-NWB-7

7.1 SUBJECT

Increased concentrations of tailings parameters.

7.2 REFERENCES

Hope Bay 2019 Annual Report, 8. Geochemical Studies, 8.1.2 Tailings, 8.1.2.1 Effluent from Process Plant Tailings (TL-5), Appendix F – 2019 Waste Rock, Quarry and Tailings Monitoring Report.

7.3 SUMMARY

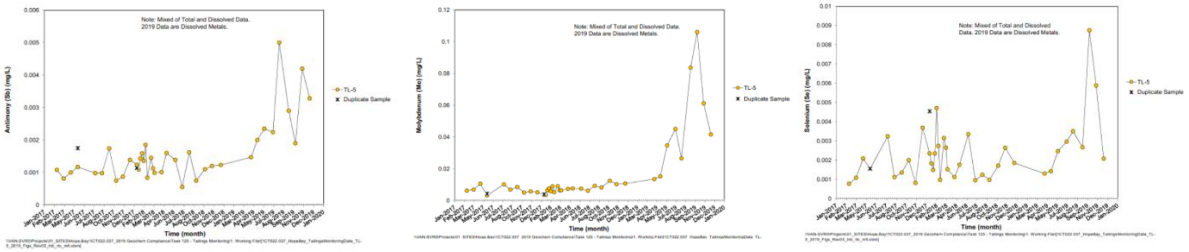
Several parameters showed increasing trends in the process plant tailings water discharge to the TIA in2019, including spikes in concentrations in August or October.

7.4 DETAILED REVIEW COMMENT

TMAC states that, for effluent from process plant tailings, "trends for major ions and trace elements were stable in 2019 with ranges equivalent to 2018. Exceptions included magnesium, molybdenum, antimony and selenium, all of which exhibited increasing trends in 2019" (p. 8-4).

It is unclear why concentrations of magnesium, molybdenum, antimony and selenium increased in 2019.

Appendix F shows the time series of the constituent loads for the process plant tailings water discharge at TL-5 to the TIA. Many parameters show a spike in concentration in August or October 2019 compared to the rest of the year (e.g., for antimony, barium, beryllium, bismuth, cadmium, chromium, copper, lead, lithium, magnesium manganese, mercury, molybdenum, nickel, phosphorus, selenium, thallium, tin, titanium, vanadium, zinc, zirconium). This pattern for these parameters is not discussed in the Annual Report. What was the cause?



7.5 RECOMMENDATION/REQUEST

Please explain why concentrations of magnesium, molybdenum, antimony and selenium increased in the process plant tailings in 2019.

Please explain why many parameters exhibited a spike in concentration in August or October in the process plant tailings. We acknowledge that although the TIA did not discharge to the environment in 2019. However, ongoing increases in tailings process water concentrations may affect the ability to meet TIA discharge limits in future.

7.6 TMAC RESPONSE TO KIA-NWB-7

TL-5 is an input to the TIA water and load balance (WLB) model. TMAC is tracking all parameters in the TIA that are regulated at the Hope Bay project's discharge point. Regulated parameters for the Hope Bay project are those defined as deleterious substances by MDMER. As outlined in Attachment 2 of the 2019 W&LBA (Appendix F of the 2019 NWB Annual Report) the increasing concentrations for magnesium, molybdenum, antimony and selenium are within the predictions / expectations.

TMAC understands that the rationale for KIA's request is based on TMAC's ability to meet TIA discharge limits in the future. Magnesium, molybdenum, antimony and selenium are not regulated discharge parameters therefore the concentrations of these parameters will not affect TMAC's ability to meet TIA discharge limits in the future.

8. KIA-NWB-8

8.1 SUBJECT

Water quality parameter exceedances in tailings.

8.2 REFERENCES

Hope Bay 2019 Annual Report, 8. Geochemical Studies, 8.1.2 Tailings, 8.1.2.2 Flotation Tailings (TL-6) and 8.1.2.3 Detoxified Tailings Solids (TL-7a), Appendix D Table D1-28 to Table D1-31.

8.3 SUMMARY

Parameter exceedances are not summarized in tables in comparison to screening criteria limits, making it difficult to assess their significance.

8.4 DETAILED REVIEW COMMENT

In the Main Report, TMAC indicates that some parameters were elevated above screening criteria in flotation tailings (arsenic, sulphur, gold and bismuth) and detoxified tailings solids (arsenic, bismuth, copper, selenium, gold, silver, sulphur, copper, lead and zinc). Sample results are shown in Tables D1-28 through D1-31 in Appendix D. It would be helpful to include the screening criteria concentrations for all parameters in these tables so that the magnitude of exceedances can be easily evaluated.

8.5 RECOMMENDATION/REQUEST

Please add screening criteria to water quality data tables.

8.6 TMAC RESPONSE TO KIA-NWB-8

Water quality parameter exceedances in tailings did not occur. TMAC's water licences include provisions for monitoring water quality and this data was provided in Appendix D of the NWB Annual Report.

As part of the trace elemental analysis of tailings solids, results were compared to ten times the average crustal abundance data for basalt (Price 1997) as an indicator of enrichment. The purpose of comparing values to the screening criteria is to highlight parameters that are enriched in the samples, however enrichment should not be interpreted to be representative of water quality or an exceedance. These comparisons are done in the corresponding memo that the monitoring results accompany. For Flotation Tailings (TL-6) and Detoxified Tailings (TL-7A) this comparison can be found in Appendix F of the 2019 NWB Annual Report (2019 Waste Rock, Quarry and Tailings

Monitoring Report, Doris and Madrid North Mines, Hope Bay Project), as part of Appendix E (2019 Geochemical Monitoring of Flotation and Detoxified Tailings, Doris Mill) Tables 4-5 and 4-6, respectively.

9. KIA-NWB-9

9.1 SUBJECT

Seepage survey results.

9.2 REFERENCES

Hope Bay 2019 Annual Report, 9. Geochemical Seepage Surveys, 9.1 Doris and Madrid Mines, 9.1.1 Construction (Quarry) Rock and Waste Rock Seepage Survey, 9.2.1 Seepage Monitoring.

9.3 SUMMARY

Seepage surveys were conducted at Doris North and Madrid sites, as well as references sites, but no field data were collected at the reference sites. The results of seepage surveys from Doris North, Madrid and Boston sites are missing from the Annual Report.

9.4 DETAILED REVIEW COMMENT

Seepage surveys were conducted in June 2019 at Doris North and Madrid sites through visual inspection and opportunistic sampling of downstream seepage from areas. Three reference sites were also sampled, but no field data were collected at the reference sites. Why no field data were collected at the reference sites?

Table 9.1-1. Median Values for Field Conductivity and pH Measurements

Mine Area	Material Source	Site Area	No. of Samples	Conductivity (µS/cm)	pH
Reference	-	Reference (Windy Road)	3	-	-
Doris	Waste Rock	WRIA	6	2300	8.1
	Quarry 2	South Dam	1	300	7.9
		Access Road to Doris CPR	2	270	8.0
		MOFB Access Road	13	190	7.7
Madrid	Quarry D	Access Road to Madrid North CWP	11	79	7.5

TMAC reports that no major issues were found relating to metal leaching and acid rock drainage in seepage at Doris North and Madrid associated with infrastructure. However, waste rock seepage showed elevated levels of chloride, nitrate and ammonia and increasing concentration trends for sulphate, copper and cobalt.

TMAC reports that results from seepage monitoring at the Boston Camp were consistent with historical results and no long-term trends were identified. However, the Northeast camp pad had order of magnitude higher concentrations of nitrate, chloride, dissolved arsenic, nickel, selenium and sulphate compared with seepage from the toe of the road (19-BOS-02). Where are the data from the seepage surveys presented? They do not appear in Appendix D.

9.5 RECOMMENDATION/REQUEST

Please explain why no field data were collected at the reference sites.

Please provide the results of the Doris North/Madrid and Boston seepage surveys in tabular and/or graphical form.

9.6 TMAC RESPONSE TO KIA-NWB-9

The absence of field data collected at the reference sites was an oversight by TMAC. Data from reference sites should have been included and will be collected in 2020.

The 2019 seepage survey results are summarized in Section 9.2.1 of the NWB Annual Report. The detailed results of the Doris-Madrid and Boston seepage surveys can be found in the accompanying technical memo. The seep monitoring memo can be found in Appendix F of the 2019 NWB Annual Report (2019 Waste Rock, Quarry and Tailings Monitoring Report, Doris and Madrid North Mines, Hope Bay Project), as part of Appendix D (2019 Hope Bay Waste Rock, Ore and Infrastructure Seep Monitoring).

10. KIA-NWB-10

10.1 SUBJECT

Ephemeral streams monitoring.

10.2 REFERENCES

Hope Bay 2019 Annual Report, 9. Geochemical Seepage Surveys, 9.2.2 Ephemeral Streams Monitoring.

10.3 SUMMARY

Ephemeral stream monitoring is summarized but the monitoring data is not presented.

10.4 DETAILED REVIEW COMMENT

Monitoring of five ephemeral streams in the Boston Camp area is conducted annually to track drainage from the ore stockpiles and camp pad before it enters Aimaokatalok Lake and attenuation by the tundra.

TMAC reports that sulphate and chloride are not attenuated but that "overall, the water quality of the ephemeral streams is stable and results validate the findings of the water and load balance and that there are therefore no projected impacts to the receiving environment" (p. 9-3).

Where is the ephemeral stream monitoring presented?

10.5 RECOMMENDATION/REQUEST

Please provide the results of the ephemeral streams monitoring in tabular and/or graphical form.

10.6 TMAC RESPONSE TO KIA-NWB-10

Ephemeral stream monitoring is presented in Appendix G of the 2019 NWB Annual Report (2019 Waste Rock and Ore Monitoring Report, Boston Camp, Hope Bay Project), as part of Appendix B (2019 Boston Ephemeral Streams Monitoring).

11. KIA-NWB-11

11.1 SUBJECT

Corrective actions for tailings/process water spill at Doris North and sewage spill at Boston Camp.

11.2 REFERENCES

Hope Bay 2019 Annual Report, 11. Spill Reports, Table 11-1 Summary of Reportable Spills in 2019.

11.3 SUMMARY

Information on the implementation and schedules of recommended corrective action is missing.

11.4 DETAILED REVIEW COMMENT

On March 11 2019, tailings/process water spilled onto the tundra from the TIA reclaim pipeline because bolts connecting sections of the pipe loosened. TMAC conducted an internal review and identified two corrective actions:

- Implement routine preventative maintenance program for reclaim water pipeline, including checks of flange bolts and pipe connections; and
- Place delineators at flange locations along reclaim pipeline in summer of 2019 to identify flange locations during winter months and allow effective snow removal at these locations to facilitate inspections.

The Annual Report does not indicate what the schedule will be for the routine preventative maintenance program, nor how often flange bolts and pipe connections will be checked.

On June 23 2019, sewage spilled onto the tundra at Boston Camp. TMAC identified three corrective actions:

- Use Victaulic fittings for pipe connections that are appropriate for the pipe material;
- Conduct assessment of pipe connections along entire length of the grey water pipeline at Boston Camp and replace if necessary; and
- Replace current pipe support with robust materials that are less susceptible to weathering and failure.

The Annual Report does not indicate when these actions will be implemented.

11.5 RECOMMENDATION/REQUEST

Please provide details on the schedule for routine preventative maintenance for the reclaim water pipeline at Doris North, including how often bolts and connections will be checked.

Please explain whether the corrective actions to prevent future sewage spills at the Boston Camp have been implemented, and if not, when they will be.

11.6 TMAC RESPONSE TO KIA-NWB-11

Since March of 2019, as part of the preventative maintenance program at Hope Bay, TMAC conducts an annual bolt and nut re-torque on all flanges to the recommended torque specifications for each assembly. This program is conducted concurrently with NDT (Non-Destructive Testing) on all fuel, glycol, tailings and effluent lines as well as bulk fuel storage tanks and mobile equipment. NDT testing (Ultrasonic thickness) is conduced by the third party and results are used to determine wear rates and potential maintenance and repair programs as required.

With respect to Boston, both the sewage and grey water lines were assessed and all old "Fernco" style couplers were replaced with "Victaulic" style couplers to reduce the likelihood of another sewage spill occurrence. Rotted pipe supports were also replaced as required. TMAC believes that these corrective actions should reduce the likelihood of future spills.

12. KIA-NWB-12

12.1 SUBJECT

Annual inspections.

12.2 REFERENCES

Hope Bay 2019 Annual Report, 15. Annual Inspection Activities, Table 15-1.

12.3 SUMMARY

The KIA identified two problems in their inspections which TMAC states will be monitored. Details on the monitoring strategy are missing.

12.4 DETAILED REVIEW COMMENT

The KIA made two inspections of the Doris Mine in 2019, in June and August. Among the issues identified were the observations that "the berm is cracking at the Tank Farm in main camp, which needs to be repaired" (June 18-20 inspection) and "the Roberts Bay tank farm containment area will be adding another 5 ml tank that is currently being built. The rock face wall behind is not reinforced; this is a big safety concern" (June 18-20 and August 13-15 inspections). TMAC's response on both dates to these issues was "All areas identified will continue to be monitored by TMAC".

No information is provided on how TMAC will monitor the cracking berm and the unreinforced rock face (e.g., what kind of monitoring will be done, its frequency, what changes will trigger action, and what the action will be).

12.5 RECOMMENDATION/REQUEST

Please provide details on monitoring of the cracking berm and unreinforced rock face identified by the KIA in its annual inspections, including what kind of monitoring, when it will be implemented, its frequency, what changes in the structures will trigger action, and what that action will be.

12.6 TMAC RESPONSE TO KIA-NWB-12

The fuel tanks within the Doris camp bulk fuel storage were painted in 2018 and as a result some minor cracking and small ruts were created in the crush layer protecting the liner. The cracking observed during the 2019 KIA inspections at the facility have since been repaired. Minor cracking often occurs in these berms as a result of water accumulation and dewatering during spring melt. The crush often requires regrading and the cracks observed are not indicative of a loss of containment integrity.

Formal inspections of all fuel storage facilities are conducted on a monthly basis. These inspections include visual observations of the berm area for evidence of cracking, erosion, exposed liner, rock fall, spills, water accumulation, etc. Results of these inspections are communicated with the relevant site personnel, and in some cases the Engineer of Record to advise on corrective and preventative measures.

TMAC is also required to undertake a geotechnical inspection of all site infrastructure and earthworks on an annual basis by a Geotechnical Engineer. The outcome of the inspection provides TMAC with a comprehensive summary of inspection components and primary recommendations resulting from the site inspection. This inspection serves as another stratum of monitoring for TMAC to ensure ongoing surveillance and continuous maintenance occurs.

13. KIA-NWB-13

13.1 SUBJECT

Water quality monitoring at ST-1 Doris Sedimentation Pond.

13.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.1 2AM-DOH1335, Table D1-3.

13.3 SUMMARY

Water quality was not monitored at ST-1 throughout the period water was transferred to the Tailings Impoundment Area (TIA).

13.4 DETAILED REVIEW COMMENT

Water was transferred from the ST-1 Doris Sedimentation Pond to the TIA from June through September 2019. However, Table D1-3 shows that water quality monitoring at ST-1 only occurred in June, July and September.

13.5 RECOMMENDATION/REQUEST

Please explain why water quality was not monitored at ST-1 in August 2019.

13.6 TMAC RESPONSE TO KIA-NWB-13

As per Schedule I, Table 3 of Water License 2AM-DOH1335, the sampling frequency for this monitoring location during operations in once annually. This sampling frequency was adhered to by TMAC.

14. KIA-NWB-14

14.1 SUBJECT

Location of runoff monitoring.

14.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.1 2AM-DOH1335, MMS-9 Site Runoff from Sediment Controls, Table D1-44.

14.3 SUMMARY

The location of runoff monitoring sites is not shown on a figure.

14.4 DETAILED REVIEW COMMENT

Water quality monitoring of runoff was conducted at the Madrid site in 2019. Table D1-44 gives the coordinates of sampling locations, but these sites are not indicated on Figures D1-1 to D1-3.

14.5 RECOMMENDATION/REQUEST

Please indicate the location of runoff sampling sites on a figure.

14.6 TMAC RESPONSE TO KIA-NWB-14

Runoff samplings sites are presented on Figure 1 below.

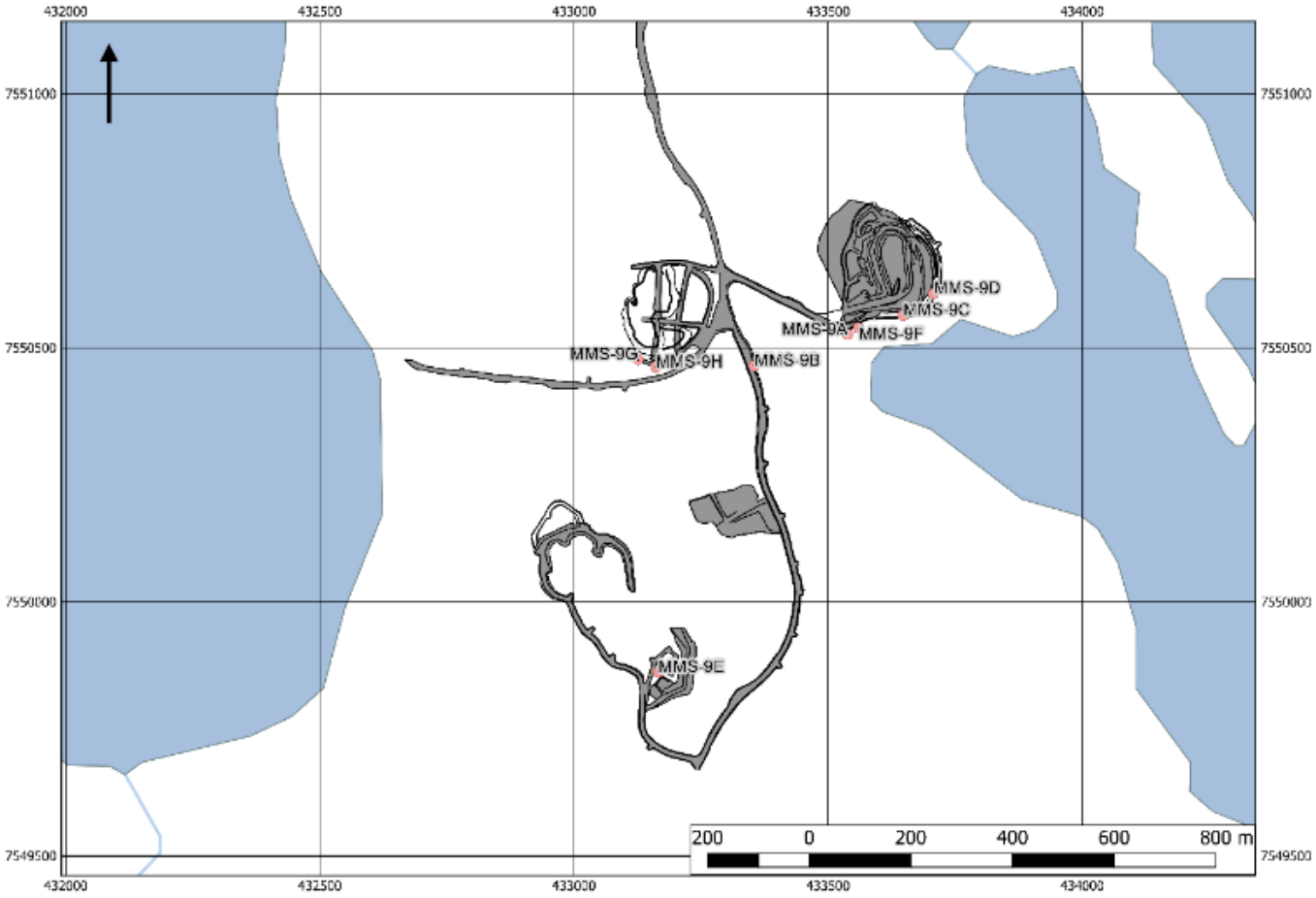


Figure 1. Runoff Monitoring Sites

15. KIA-NWB-15

15.1 SUBJECT

Location of drilling and hydrology monitoring sites.

15.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.2 2BE-HOP1222, Summary of Monitoring Information and Hydrology Monitoring – Windy Lake Water Level.

15.3 SUMMARY

The location of monitoring sites for on-ice exploration drilling on Patch Lake, as well as on-land exploration drilling are not shown on a figure.

15.4 DETAILED REVIEW COMMENT

Sampling was conducted before and after on-ice drilling on Patch Lake, but sampling locations are not shown. In addition, on-land exploration drilling was conducted, but the drill locations are not shown. It is not possible to assess potential impacts of these mine activities on the environment without knowing where they occurred in the project area.

15.5 RECOMMENDATION/REQUEST

Please indicate the location of on-ice and on-land drilling sites on a figure.

15.6 TMAC RESPONSE TO KIA-NWB-15

Patch Lake water sampling locations and on-land exploration drilling figures are provided below.

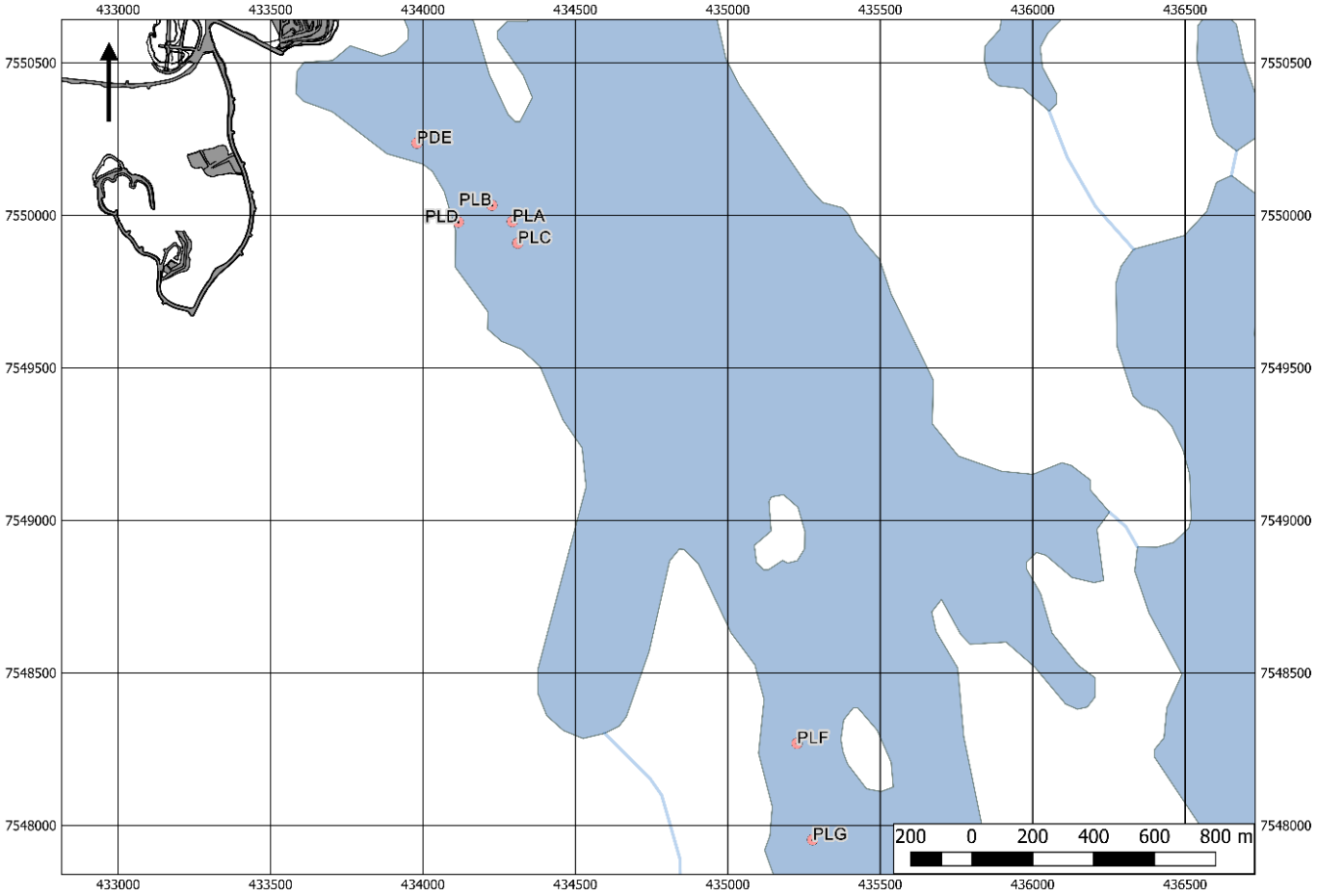


Figure 2. Patch Lake Sampling Locations

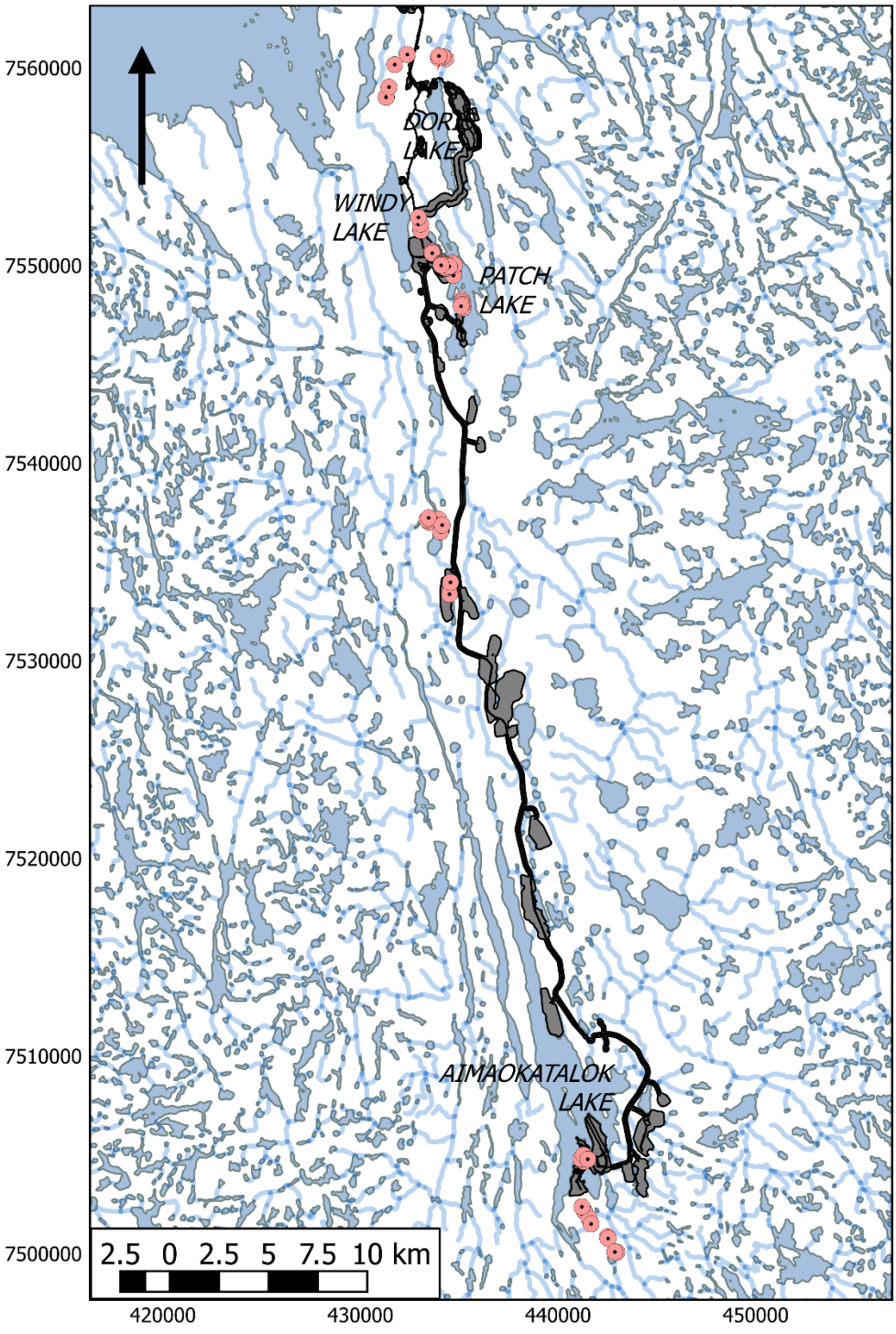


Figure 3. 2019 On-land Exploration Drilling

16. KIA-NWB-16

16.1 SUBJECT

Monitoring parameters for drilling at Windy Lake Camp.

16.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.2 2BE-HOP1222, Tables D2-2, D2-3.

16.3 SUMMARY

Strontium is identified in the water license as a parameter to be measured under ice, but it is not listed in the water quality sampling results and thus appears not to have been sampled as part of the 2019 monitoring program.

16.4 DETAILED REVIEW COMMENT

Part J Item 7 of Water License No. 2BE-HOP1222 indicates that strontium is one of the trace metals to be measured in the under-ice sampling before and after drilling. However, strontium is not listed in the water quality sampling results in Tables D2-2 and D2-3..

16.5 RECOMMENDATION/REQUEST

Please add strontium to the suite of parameters measured under-ice before and after drilling as per the water license requirements.

16.6 TMAC RESPONSE TO KIA-NWB-16

TMAC has added strontium to the suite of parameters measured under-ice before and after drilling as per the water license requirements.

17. KIA-NWB-17

17.1 SUBJECT

Water license conditions for drilling at Windy Lake Camp.

17.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.2 2BE-HOP1222, Tables D2-2, D2-3.

17.3 SUMMARY

Information is missing on drill waste disposal for land and on-ice drilling, as well as use of additives or mud, and release of return water for on-ice drilling.

17.4 DETAILED REVIEW COMMENT

Part F Item 2 of Water License No. 2BE-HOP1222 details the disposal requirements for drill waste from land and on-ice drilling, including the requirement that waste is disposed of at least 31 m from any water body and away from direct flow into any water body. Neither the Main Report nor Appendix D discusses how drill waste was managed in 2019.

Part F Items 5 and 6 of the Water License set out additional conditions for on-ice drilling, relating to the use of additives or mud, and the release of return water:

5. Drilling additives or mud shall not be used in connection with holes drilled through lake ice unless they are re-circulated or contained such that they do not enter the water, or are demonstrated to be non-toxic.

6. For "on-ice" drilling where drill additives are not being used, return water released must be nontoxic, and not result in an increase in total suspended solids in the immediate receiving waters above the Canadian Council of Ministers for the Environment, Guidelines for the Protection of Freshwater Aquatic Life (i.e. 10mg/L for lakes with background levels under 100 mg/L, or 10% for those above 100mg/L).

TMAC does not report whether drilling additives or mud were used for on-ice drilling. If they were used, TMAC should indicate how condition #5 was met. If neither was used, then condition #6 of the Water License applies. The water quality data for pre and post on-ice drilling is presented in Tables D2-2 and D2-3.

Table D2-2. Water Quality Sampling Patch Lake Prior to On-Ice Drilling, January 2019

	Sample ID	PLA	PLB	PLC	PLC *	PLD	PLE
	ALS ID	L2217538-1	L2217538-2	L2217538-3	L2217538-6	L2217538-4	L2217538-5
	Date Sampled	2019-01-06 12:00	2019-01-06 12:45	2019-01-06 13:30	2019-01-06 13:30	2019-01-06 14:20	2019-01-06 14:40
Parameter	Units	Results					
Conductivity	µS/cm	385	383	380	392	375	446
Hardness (as $CaCO_3$)	mg/L	69.4	73.3	73.2	72.5	71.6	83.6
pH	pH	7.74	7.6	7.68	7.7	7.69	7.73
Total Suspended Solids	mg/L	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0

Table D2-3. Water Quality Sampling Patch Lake Post On-Ice Drilling, May 2019

	Sample ID	PLA	PLB	PLC	PLD	PLE	PLF	PLG	PLG *
	ALS ID	L2272441-1	L2272441-2	L2272441-3	L2272441-4	L2272441-5	L2272441-6	L2272441-7	L2272441-8
	Date Sampled	2019-05-12 15:00	2019-05-12 15:30	2019-05-12 15:45	2019-05-12 17:00	2019-05-12 17:15	2019-05-12 16:00	2019-05-12 16:15	2019-05-12 16:15
Parameter	Units	Results							
Conductivity	µS/cm	457	473	452	450	487	405	392	391
Hardness (as $CaCO_3$)	mg/L	91.3	93.1	87.7	87.8	95.6	77.7	76.2	74.8
pH	pH	7.77	7.72	7.74	7.73	7.76	7.72	7.65	7.72
Total Suspended Solids	mg/L	19.6	8.2	17.4	<3.0	<3.0	<3.0	<3.0	<3.0

The results show that TSS increased by >10 mg/L at the PLA and PLC sites post-drilling compared to background levels, which exceeds the CCME guideline and thus does not meet the Water License requirement.

In addition, it is not clear why location PLG was only sampled in the post on-ice drilling monitoring.

17.5 RECOMMENDATION/REQUEST

Please discuss how drill waste for land and on-ice drilling was managed in 2019.

Please clarify whether drilling additives or mud was used for on-ice drilling. If they were used, please explain how Part F Item 5 of the Water License was met. If neither were used, please explain how Part F Item 6 of the Water License was met.

Please explain why sampling at PLG was only conducted post drilling.

17.6 TMAC RESPONSE TO KIA-NWB-17

Surface drilling on the Hope Bay property does not use the traditional sump method. All cuttings are contained within a recirculation system that captures the drill cuttings and mud within a bin. Once the bins have reached capacity they are transported to an approved containment area. When drilling operations are proximal to Doris camp, saline and non-saline cuttings are deposited in the TIA. Drill cuttings produced at Boston camp are deposited into a lined berm area.

Although all drill holes are recirculated such that they do not enter the water, all drilling additives used by TMAC's drilling contractors are biodegradable. Additional details on the 2019 drill program can be found in the 2019 KIA Annual Report, Section 5.0.

Coordinates for drill targets are provided to the Environmental department prior to on-ice drilling activities to establish sampling locations based on the locations of the drill targets and water quality conditions. Additional drill targets were added to the program that were outside of the initial sampling area that were not communicated to the Environmental department until drilling activities were underway. As such, PLG was not sampled prior to drill activities in this area. It should be noted that the six samples collected prior to the on-ice drill program displayed relatively similar water quality conditions that are representative of Patch Lake.

18. KIA-NWB-18

18.1 SUBJECT

Monitoring parameters for effluent, seepage and runoff for the Boston Advance Exploration Project.

18.2 REFERENCES

Appendix D Water Licence(s) Monitoring Data, Appendix D.4 2BB-BOS1727, Tables D4-4, D4-7 and D4-8.

18.3 SUMMARY

Chloride is identified in the water license as a parameter to be measured at BOS-2 and BOS-5, but it is not listed in their respective water quality sampling results. Strontium is identified in the water license as a parameter to be measured at BOS-8 but is not listed in the water quality sampling results. It thus appears that these parameters were not sampled at these sites as part of the 2019 monitoring program.

18.4 DETAILED REVIEW COMMENT

Part J Item 10 of Water License No. 2BB-BOS1727 indicates that sulphate and chloride are to be monitored at BOS-2 (Containment Pond discharge) and BOS-5 (Effluent from the Bulk Fuel Storage Facility) stations. Part J Item 14 of 2BB-BOS1727 indicates that strontium is one of the trace metals to be measured at BOS-8 (the Waste Rock and Ore Storage Pad). However, chloride and strontium are not listed in the respective water quality sampling results for these sampling stations in Tables D4-4, D4-7 and D4-8.

In addition, Part D Item 19 of the water license shows effluent water quality limits for benzene, toluene and ethylbenzene. These limits should be included on Table D4-7.

18.5 RECOMMENDATION/REQUEST

Please add chloride to the suite of parameters measured at BOS-2 and BOS-5, and strontium to the suite of parameters measured at BOS-8 as per the water license requirements.

Please add effluent limits for benzene, toluene and ethylbenzene as per the water license requirements.

18.6 TMAC RESPONSE TO KIA-NWB-18

TMAC has added the above noted to the suite of parameters measured at monitoring station BOS-2, BOS-5 and BOS-8 as per the water license requirements.

TMAC will include effluent limits for benzene, toluene and ethylbenzene to this table in future annual reports.

19. KIA-NWB-19

19.1 SUBJECT

Meteorological data used to update water balance model..

19.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 2.1.1 Hydrology Update.

19.3 SUMMARY

There were several gaps in the Doris meteorological data collected in 2019 and ECCC Cambridge Bay weather station data were used to replace the missing data. It is not clear why there were gaps in the Doris dataset, nor whether ECCC data from the entire year were used to update the water balance model.

19.4 DETAILED REVIEW COMMENT

TMAC used 2019 Doris meteorological data to update the water balance model. However, because there were several gaps in the monitoring data (Oct 15-29 and Nov 15-24 for average daily temperature, and Oct 15-30 and Nov 15-24 for total precipitation and daily rainfall), data from the four ECCC Cambridge Bay weather stations was substituted for the missing data. TMAC states that the ECCC data "were compiled and updated in the model until the end of 2019" (p. 3). TMAC states that "patching in Cambridge Bay data was previously found to be an acceptable method for filling in the gaps" (p. 3). Since the mine is more than 150 km away from Cambridge Bay it would be helpful for TMAC to provide details on validation of patching in these data for mine data. The reason for the gaps in 2019 Doris meteorological data is not given. It is not clear whether the ECCC data from the entire year were added to the model, or just during the October and November missing data periods.

19.5 RECOMMENDATION/REQUEST

Please provide details on the validity of substituting Cambridge Bay meteorological data for local data collected at the mine.

Please explain why meteorological data were not available during the October and November periods. Please clarify whether ECCC weather station data from the entire year was used to supplement mine data in the model.

19.6 TMAC RESPONSE TO KIA-NWB-19

The main meteorological station is located at the Doris Mine Site (7558557 N, 433281 E), which was installed in February 2004 and upgraded in August 2009 (SRK 2017b). Data collected at this station is used as the main input for the Doris Mine Site meteorology including measurements for temperature, total precipitation and rainfall.

During 2019 there were specific periods where data were not measured (Oct 15-29 and Nov 15-24 for average daily temperature, and Oct 15-30 and Nov 15-24 for total precipitation and daily rainfall). Data gaps are common in weather records and the gaps in 2019 represent 7% of the total yearly data collection. The station was down during these periods as the battery powering the station was malfunctioning and needed to be replaced. Once this issue was resolved, the weather station recorded data for the rest of the year without issue.

The available record from the Doris meteorological station was used in the model for 2019 and the Cambridge Bay data was only used to fill in the gaps in the Doris record for the aforementioned dates and parameters. Patching in Cambridge Bay Station (Environment and Climate Change Canada IDs: 2400600, 2400601,2400602 and, 2400603) data was built into the previously assessed model (SRK 2015, 2017a).

Precipitation data between the Doris and Cambridge Bay stations was found to have little orographic effect and no correction factor was required (SRK 2015, 2017a). For temperature, the model uses the following equation to adjust temperature data from the Cambridge Bay Station (SRK 2015, 2017a):

$$T_{Doris\ or\ Madrid,\ \ patched} = T_{Cambridge\ Bay} + 1.6℃$$

The model used the Doris meteorological data for 2019 when available and only supplemented the dataset with Cambridge Bay data when there were data gaps. This method of patching in Cambridge Bay data was assessed under the original Doris Water Licence and the Amended Doris Water Licence (2AM-DOH1335).

20. KIA-NWB-20

20.1 SUBJECT

Modelled vs. Measured Mine Processing Rates.

20.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 2.1.2 Processing Rate, Table 2, Figure 1

20.3 SUMMARY

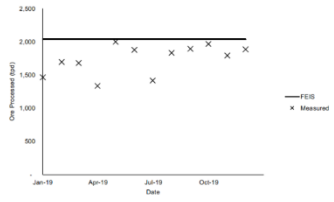
There are discrepancies in the forecasted and measured mine processing rates presented.

20.4 DETAILED REVIEW COMMENT

TMAC updated the monthly processing rates in the water balance model based on measured values in 2019, which are presented in Table 2 for Doris and Madrid mines. The column totals do not match the sums of the monthly rates for each column (i.e., Doris Mine FEIS total = 24,000, Doris Mine Measured total = 19,500, Madrid Mine FEIS = 828, Madrid Mine Measured = 1350, Total Processed FEIS = 24,000, Total Processed Measured = 20,850).

It is not clear why the annual forecasted processed rate for Madrid Mine (828) underestimated the measured processing rate (1350) by about 40%; this value seems outside an acceptable margin of error.

Figure 1 also compares the forecasted and measured processing rates:



Source: \ark.ad\dfs\naw\Projects\01_SITES\Hope Bay\1CT022.066_2020 Site Wide Water Mgmt\1_2019_Annual\WLB\Inputs\HopeBay_2019Inputs_1CT022.040_R00_qjb.xlsx

Figure 1: FEIS Forecasted and Measured Processing Rates

The measured values for May and October should be plotted on the FEIS line, according to the rates listed in Table 2.

Table 2: Summary of FEIS Forecasted and Measured Processing Rates

Date	Ore Processed in the Doris Process Plant (tpd)					
	Doris Mine		Madrid Mine		Total Processed	
	FEIS	Measured	FEIS	Measured	FEIS	Measured
January	2,000	1,500	69	-	2,000	1,500
February	2,000	1,700	69	-	2,000	1,700
March	2,000	1,700	69	-	2,000	1,700
April	2,000	1,300	69	-	2,000	1,300
May	2,000	2,000	69	-	2,000	2,000
June	2,000	1,900	69	-	2,000	1,900
July	2,000	1,400	69	-	2,000	1,400
August	2,000	1,800	69	-	2,000	1,800
September	2,000	1,900	69	-	2,000	1,900
October	2,000	1,800	69	170	2,000	2,000
November	2,000	1,400	69	430	2,000	1,800
December	2,000	1,100	69	750	2,000	1,900
Total	720,000	590,000	25,000	41,000	750,000	630,000

Source: \ark.ad\dfs\naw\Projects\01_SITES\Hope Bay\1CT022.066_2020 Site Wide Water Mgmt\1_2019_Annual\WLB\Inputs\HopeBay_2019Inputs_1CT022.040_R00_qjb.xlsx

20.5 RECOMMENDATION/REQUEST

Please explain what the column totals represent.

Please explain why the measured processing rate for Madrid Mine greatly exceeded the forecasted rate in 2019 (by 163%).

Please correct the May and October rates in Figure 1 to show that they are the same as the predicted rate.

20.6 TMAC RESPONSE TO KIA-NWB-20

The column total represents the total amount (tpd) of ore processed from all sources (Doris and Madrid) at the Doris Process Plant.

The measured processing rates for the Madrid North Mine exceeded the FEIS forecasted rate in 2019 due to the development of the Naartok East Crown Pillar Recovery Trench in 2019, which was the source of all Madrid ore during the period, but was forecasted initially in the FEIS to be developed later in the mine life. The change of mine plan did not impact mine life. The monthly processing rate for Madrid North ore is expected to be more consistent with FEIS forecasts in future years when crown pillar recovery is not occurring.

There is a very minor difference between the values in Table 2 and Figure 1 because the values in Table 2 representing 'Total Processed: Measured' are rounded to the nearest thousand. Figure 1 has plotted the actual measured processing rate (not rounded).

21. KIA-NWB-21

21.1 SUBJECT

Modelled vs. Measured Flow Rates for Site Contact Water.

21.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 2.1.3 Site Contact Water, Table 3.

21.3 SUMMARY

Predicted flow rates from the sediment control pond to the Doris TIA are not presented for comparison with measured flow rates.

21.4 DETAILED REVIEW COMMENT

The monthly measured flows from the sediment control pond to the Doris TIA for 2017 through 2019 were added to the model to update transfer rates. The predicted monthly flow rates were not presented for comparison.

21.5 RECOMMENDATION/REQUEST

Please provide the monthly predicted flow rates from the sediment control pond to the Doris TIA.

21.6 TMAC RESPONSE TO KIA-NWB-21

Modeled flow rates for the sediment control pond are calculated based on catchment size and runoff. Hydrology and catchment definition inputs are presented in the Madrid-Boston Project Water and Load Balance (SRK 2017a). Table presents a comparison of measured and predicted flows from the Sediment Control Pond in 2019. Overall, the modeled values underpredicted surface runoff by 50%. The difference in measured and modeled contact water from the sediment control pond represents less than 1.5% of the total volume stored in the Doris TIA throughout 2019 and only 4% of the total modelled inflows to the Doris TIA in 2019. Therefore, the flows from the sediment control pond are not a key input to Doris TIA.

Since measured flows are 50% greater than the model estimates, the surface runoff input estimates to the sediment control pond will be re-evaluated. However, since flows from the sediment control pond represent less than 4% of the inputs to the Doris TIA in 2019 this refinement will be conducted as part of the 2020 model evaluation.

Table 1: Comparison of Measured and Modeled Flows from the Doris Sediment Control Pond

Month	Volume transferred from the Sediment Control Pond to the TIA (m^3)	
	Measured	Modeled
January	-	-
February	-	-
March	-	-
April	-	-
May	-	-
June	9,800	33,000
July	43,000	7,900
August	39,000	9,200
September	33,000	3,000
October	-	-
November	-	-
December	-	-
Total	120,000	53,000

Source: Y:\01_SITES\Hope.Bay\1CT022.066_2020 Site Wide Water Mgmt\6_NWB_Comments_Analysis\HopeBay_NWB2019ReviewComments_1CT022-066_R00_ajb.xlsx

Note: Values in table rounded to two significant figures, totals may not be reflected of rounded numbers.

22. KIA-NWB-22

22.1 SUBJECT

Modelled vs. Measured Flow Rates for Underground Mine Water.

22.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 2.1.4 Mine Water and Robert's Bay Discharge Line, Table 4

22.3 SUMMARY

There is a discrepancy in the total measured mine water flow reported for 2019.

22.4 DETAILED REVIEW COMMENT

TMAC states that the "measured mine water encountered to date totaled 510,000 m3, representing about 9% of total volume of water held in the Doris TIA…and 40% of the FEIS predicted flow for 2019" (p. 5).

It is not clear where the 510,000 m3 value comes from; since the total measured mine water flow shown in Table 4 is 380,000 m3. Furthermore, 510,000 m3 equals 52% of the FEIS predicted flow for 2019 shown in Table 4 (980,000 m3), while 380,000 m3 equals 40% of the FEIS predicted flow for 2019.

Table 4: Summary of FEIS Forecasted and Measured Mine Water Flows

Month	Mine Water (m^3/month)			
	Doris Mine		Madrid North Mine	
	FEIS	Measured	FEIS	Measured
1	71,000	20,000	-	-
2	73,000	19,000	-	-
3	82,000	34,000	-	-
4	78,000	23,000	-	-
5	81,000	26,000	-	-
6	88,000	27,000	-	-
7	86,000	28,000	-	-
8	85,000	29,000	-	-
9	81,000	30,000	-	-
10	85,000	31,000	-	-
11	82,000	40,000	-	-
12	83,000	73,000	-	-
Total	980,000	380,000	-	-

Source: \\ark.adf\tkinuvan\Projects\01_SITES\Hope Bay\1CT022.066_2020 Site Wide Water Mgmt\1_2019_Annual\WLB\Inputs\HopeBay_2019Inputs_1CT022.045_R00_ajb.xlsx

22.5 RECOMMENDATION/REQUEST

Please clarify whether the 510,000 m3 reported measured mine water flow represents the total for 2019. or for all years of operation, and how it relates to the data provided in Table 4.

22.6 TMAC RESPONSE TO KIA-NWB-22

The volume 510,000 m^3 is the total measured mine water to date directed to the TIA. For 2019, this total is 380,000 m^3. For clarification, the total mine water directed to the TIA to date is summarized below. As stated, the 2019 measured mine inflows are approximately 40% of the FEIS predicted flow for 2019.

Table 2. Summary of Measured Mine Water Flows to Date

Date	Mine Water to TIA (m^3/month)
1-Jan-2018	0
1-Feb-2018	2,700
1-Mar-2018	9,300
1-Apr-2018	7,500
1-May-2018	7,100
1-Jun-2018	9,700
1-Jul-2018	11,000
1-Aug-2018	9,800
1-Sep-2018	6,800
1-Oct-2018	19,000
1-Nov-2018	22,100
1-Dec-2018	20,200
1-Jan-2019	20,000
1-Feb-2019	19,000
1-Mar-2019	34,000
1-Apr-2019	23,000
1-May-2019	26,000
1-Jun-2019	27,000
1-Jul-2019	28,000
1-Aug-2019	29,000
1-Sep-2019	30,000
1-Oct-2019	31,000
1-Nov-2019	40,000
1-Dec-2019	73,000
TOTAL	510,000

23. KIA-NWB-23

23.1 SUBJECT

Elevated total cyanide.

23.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 2.2.1 Total Cyanide and Degradation Products.

23.3 SUMMARY

Total cyanide concentration at TL-5 (effluent from the Doris Process Plant) was elevated in February 2019, but the reason for this spike is not discussed.

23.4 DETAILED REVIEW COMMENT

TMAC states that "the process source term for total cyanide was adjusted to 3.8 mg/L based on the average of the TL-5 data, with omission of the February 3, 2019 sample due to an elevated concentration nine times higher than the 2017 to 2019 observed range" (p. 8).

The increase in total cyanide concentration at TL-5 on February 3, 2019 does not appear to be discussed in the annual report. Why was there a spike in total cyanide at this location in February? What was the previous cyanide source term? What was the elevated concentration?.

23.5 RECOMMENDATION/REQUEST

Please provide the data showing the actual concentration of total cyanide at TL-5 on February 3, 2019 in relation to the historic range and explain why it was nine times higher than the 2017 to 2019 observed range.

23.6 TMAC RESPONSE TO KIA-NWB-23

The concentration of total cyanide in Feb 2019 was 16 mg/L. The increase was a result of an upset in the concentrate treatment plant (CTP) which resulted in cyanide solution being introduced to the tails thickener (upstream of TL-5). TMAC has modified the containment and sump pump routing in this area of CTP to mitigate against such events in the future. Historical concentrations of total cyanide are presented in Attachment D2 (TL-5 Concentration Graphs) as part of Appendix F of the 2019 NWB Annual Report (2019 Waste Rock, Quarry and Tailings Monitoring Report, Doris and Madrid North Mines, Hope

Bay Project), as part of Appendix E (2019 Geochemical Monitoring of Flotation and Detoxified Tailings, Doris Mill).

24. KIA-NWB-24

24.1 SUBJECT

TSS Predictions for the TIA.

24.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 4.2 Predicted TIA Water Quality, 4.2.3 Metals and TSS Evaluation, 5.1. Measured Values

24.3 SUMMARY

The model is unable to accurately predict TSS concentrations in the TIA.

24.4 DETAILED REVIEW COMMENT

TMAC states that "the model is set up as a conservative mass balance and is unable to accurately predict TSS in model reservoirs" (p. 14) but that "the Doris TIA is a large facility that has previously demonstrated capacity to settle TSS from both the tailings slurry and the Doris mine water in 2018" (p. 14). However, TSS was the only parameter that exceeded MDMER limits in 2019 (for the maximum monthly mean concentration) in the TIA (although no discharge from the TIA occurred).

Given that TSS is a parameter of concern in 2019 it should be a functional component of the load balance model..

24.5 RECOMMENDATION/REQUEST

Please calibrate the model to measured results such that it is able to accurately predict TSS concentrations in the TIA.

24.6 TMAC RESPONSE TO KIA-NWB-24

The water balance model is a conservative mass balance following the general equation:

$$\begin{aligned} Load_{Doris\ TIA} = {} & Load_{In,Process\ Plant} + Load_{In,Mine\ Water} + Load_{In,SCP} \\ & + Load_{In,Doris\ TIA\ Catchment\ Runoff} + Load_{In,Precipitation} - Load_{Out,Evaporation} \\ & - Load_{Out,Rob\ Bay\ Discharge} + Load_{Generated,Biological\ Acitivity} \\ & - Load_{\ Removed,Biological\ Activity} \end{aligned}$$

All mass must be accounted for each timestep through any of the inputs above. The model does not include a mechanism for settling total suspended solids (TSS) as this is a

highly variable and complex process depending on process plant conditions, wind convection in the Doris TIA, biological growth, conditions around freshet and mine water TSS. Modelling TSS settling is beyond the capabilities of the model. It is important to observe the key trends in the measured data to understand how future predictions should be evaluated with respect to TSS and if actionable measures are required.

The period of elevated TSS is the result of an algal bloom, responsible for lowering ammonia concentrations in the Doris TIA. TMAC expects there to be an algal bloom each year late in the open water season. During periods of elevated TSS concentrations in the TIA, no discharge from the TIA would be pumped to Roberts Bay (i.e. additional supernatant water would accumulate in the TIA, as planned for as part of the TIA operation).

TMAC is committed to complying with MDMER and will not discharge non-compliant water from the Doris TIA. Based on the future interpretation of TSS trends, TMAC is in the process of evaluating a water treatment plant for the Doris TIA water that would help to reduce TSS concentrations below MDMER limits, to allow for more operational flexibility, prior to discharging to Robert's Bay.

25. KIA-NWB-25

25.1 SUBJECT

Elevated unionized ammonia in the TIA.

25.2 REFERENCES

Appendix E Doris Mine Annual Water and Load Balance Assessment, 5 Comparison to MDMER, 5.1 Measured Values

25.3 SUMMARY

Information on the unionized ammonia exceedance in late summer at TL-1 is missing in the report.

25.4 DETAILED REVIEW COMMENT

TMAC states that "updated water quality projections for the Doris TIA were compared to the MDMER limits…in Attachment 2" (p. 15). Unionized ammonia concentrations were reported to increase to almost three times the future MDMER limit in August and September 2019, coinciding with an algal bloom that increased TSS and pH concentrations in the TIA.

The maximum average monthly concentration for unionized ammonia at TL-1 is presented in Tables 13 and 14, but measured and predicted concentrations are not compared to MDMER limits in these tables nor in Attachment 2.

TMAC states that it "is actively working towards a TSS solution that would allow for a pH adjustment, if required, for any subsequent algae blooms during planned active discharge" (p. 15).

Parameter	Units	MDMER Maximum Authorized Concentration in a Grab Sample	Maximum Concentration Measured in the Doris TIA in 2019 (TL-1)	Date of Maximum Concentration	Percent of MDMER Limit
TSS	mg/L	30	23.8	9/2/2019	79%
Total Arsenic	mg/L	1	0.00157	12/2/2019	0.2%
Total Copper	mg/L	0.6	0.0938	12/2/2019	16%
Cyanide – Total	mg/L	2	0.338	12/9/2019	17%
Total Lead	mg/L	0.4	0.00031	1/28/2019	0.1%
Total Nickel	mg/L	1	0.0137	6/17/2019	1.4%
Total Zinc	mg/L	1	0.017	11/18/2019	1.7%
Unionized Ammonia (as N)	mg/L	-	0.331	9/9/2019	-

Source: \\ark.adds\invarn\Projects\01_SITES\Hope Bay\1CT022.026_2018 General Compliance\Annual_Review_2018\HopeBay_WLBReview_1CT022.026_R05_ajb.xlsm

Table 13: Comparison of Maximum Monthly Mean Measured Concentrations in the Doris TIA to the Proposed MDMER

Parameter	Units	MDMER Maximum Authorized Monthly Mean Concentration	Maximum of 2019 Doris TIA Average Monthly Concentrations (TL-1)	Month of Maximum Concentration	Percent of MDMER Limit
TSS	mg/L	15	21	September	138%
Total Arsenic	mg/L	0.5	0.0014	December	0.3%
Total Copper	mg/L	0.3	0.092	December	31%
Cyanide – Total	mg/L	1	0.33	December	33%
Total Lead	mg/L	0.2	0.00027	January	0.1%
Total Nickel	mg/L	0.5	0.013	June	3%
Total Zinc	mg/L	0.5	0.012	December	2%
Unionized Ammonia (as N)	mg/L	-	0.18	August	-

Source: \\ark.adds\invarn\Projects\01_SITES\Hope Bay\1CT022.026_2018 General Compliance\Annual_Review_2018\HopeBay_WLBReview_1CT022.026_R05_ajb.xlsm

Table 14: Comparison of Maximum Grab Sample Concentration Measured in the Doris TIA Compared to the Proposed MDMER

25.5 RECOMMENDATION/REQUEST

Please provide a graph in Attachment 2 of measured and predicted unionized ammonia concentrations at TL-1 in relation to MDMER limits.

Please explain what mitigation measures are being considered to manage elevated TSS in the TIA during discharge periods.

25.6 TMAC RESPONSE TO KIA-NWB-25

This response was prepared for comments KIA-NWB-25 and KIA-NWB-26. Both comments raised concerns around the lack of unionized ammonia predictions and concerns over elevated TSS in the Doris TIA during algal blooms that could prevent active discharge. Comment KIA-NWB-25 indicated that there was an exceedance of unionized ammonia in 2019 in the Doris TIA. TMAC would like to clarify that there was no discharges from in the TIA in 2019 and that MDMER unionized ammonia criteria for the Roberts Bay discharge will come into effect in June 2021. No exceedance of unionized ammonia in the TIA occurred.

Unionized ammonia does not contribute to increased total suspended solids. Both are different by-products of an algal bloom in the Doris TIA. As the Doris TIA warms up throughout the open water season, algae growth kinetics improve which leads to an algal bloom. As the algae community grows, TSS concentrations in the Doris TIA increase as a result of the increased biomass. Net alkalinity is a by-product of this process and results in an increase to pH. The combination of increased water temperature and pH increase the fraction of total ammonia present as unionized ammonia in the water column.

The water and load balance does not generate unionized ammonia predictions as these are dependent on both water temperature and pH. Future trends in unionized ammonia are expected to be similar to those observed in monitoring data. An algal bloom will cause an increase in pH towards the end of the open water season, at the same time the Doris TIA water temperature is the warmest, roughly 14°C. With both increasing pH and temperature, the fraction of total ammonia shifts to increasing proportions of unionized ammonia, as seen in both 2018 and 2019.

TMAC's plans to mitigate TSS and unionized ammonia are through TIA water management and water treatment. Current operation plans have been set so that discharge from the TIA to Roberts Bay will be stopped prior to periods of observed algal blooms / elevated TSS and increased unionized ammonia, until water treatment is available on site. TMAC is in the process of evaluating a treatment plant that would help to reduce TSS concentrations and pH adjustment to lower unionized ammonia concentrations.

26. KIA-NWB-26

26.1 SUBJECT

Total Suspended Solids (TSS) Management.

26.2 REFERENCES

Appendix E, Section 5.1

26.3 SUMMARY

Further discussion on TSS management.

26.4 DETAILED REVIEW COMMENT

TSS was the only parameter to exceed Metal and Diamond Mining Effluent Regulations (MDMER, 2019), following the revisions to the water and load balance for the Doris TIA and updates to the water quality projections. TSS exceeded the maximum monthly mean concentration in the Doris TIA, but not the maximum authorized, and no discharge from the TIA took place in 2019 during these elevated TSS periods.

BGC understands the higher TSS values were associated with an algae bloom in the TIA coinciding with higher unionized ammonia concentrations. Unionized ammonia is dependent on pH and temperature, both of which increase during the open water season at the Hope Bay Project. Similar algal blooms are expected for the future.

26.5 RECOMMENDATION/REQUEST

BGC understands unionized ammonia is not included in the Doris TIA Water and Load Balance model. However, if unionized ammonia concentrations are the main contributor to TSS exceedances, can TMAC comment as to whether this parameter should be considered as part of future modeling efforts to improve assessment of the fraction of unionized versus ionized ammonia (NH3 vs. NH4+, respectively) and predict the potential for algal blooms and elevated TSS concentrations?

BGC requests that TMAC provides some commentary on the steps being (or to be) taken to actively manage TSS associated with the Doris TIA.

26.6 TMAC RESPONSE TO KIA-NWB-26

See response KIA-NWB-25 for a discussion why unionized ammonia was not modelled and the how TMAC is addressing future unionized ammonia and TSS concentrations in the Doris TIA.

27. KIA-NWB-27

27.1 SUBJECT

Selenium Assessment.

27.2 REFERENCES

Appendix F, Sections 3.1.3., 3.2.5, 3.3.4.

27.3 SUMMARY

Selenium method detection limit (MDL) is equivalent to screening criterion.

27.4 DETAILED REVIEW COMMENT

Trace elemental results are compared to ten times the average crustal (solid phase) abundance for basalt (from Price, 1997) as an indicator of enrichment. The selenium laboratory MDL is 0.5 mg/kg, which is equivalent as the applied selenium screening criterion. Therefore, selenium results are generally not assessed due to measured values below detection or within the range of analytical error.

27.5 RECOMMENDATION/REQUEST

Several laboratories can provide a lower solid-phase selenium analysis (i.e., to 0.003 mg/kg). Can TMAC comment on whether a lower MDL should be considered to improve the assessment of selenium enrichment?

27.6 TMAC RESPONSE TO KIA-NWB-27

TMAC does not see material value in sourcing and financing additional laboratory work for selenium when the assessment can be done with existing data quality and analysis methods.

28. KIA-NWB-28

28.1 SUBJECT

Underground Waste Rock.

28.2 REFERENCES

Appendix F, Section 5.3.2.

28.3 SUMMARY

Underground waste rock used in construction.

28.4 DETAILED REVIEW COMMENT

The Doris CPR cover was primarily constructed of waste rock, with selected areas using ROQ rock from Quarry 2. Waste rock was geochemically characterized prior to use according to the WROMP (TMAC, March 2019); however, elevated chloride and nitrate results from shake flask extraction (SFE) tests suggest waste rock from the underground may be present in the CPR cover material.

The document states "TMAC suspects some underground waste rock may have been mixed with the surface layer when the CPR was being backfilled in stages resulting in waste rock placement in the cover", which is not consistent with the CPR cover design (i.e., underground waste rock to be placed below the active layer).

As a result of this likelihood, the Doris CPR cover will be included in subsequent seepage surveys to assess the potential for contaminant leaching from the Doris CPR. BGC agrees this response is appropriate to monitor and manage the risk of metal leaching and/or acid rock drainage from the Doris CPR cover.

The likelihood that underground waste rock was used in construction in 2019 is not fully consistent with information provided in Table 2-2 (Section 2.1.2) that states underground waste rock was not a source of construction rock in 2019.

28.5 RECOMMENDATION/REQUEST

Table 2-2 should be updated to document the potential placement of underground waste rock in the CPR cover and the response actions. As well, can TMAC comment on how construction practices, including waste rock QA aspects, could be improved to mitigate a similar scenario in future construction activities?

28.6 TMAC RESPONSE TO KIA-NWB-28

Tables 2-1 and 2-2 summarize the monitoring requirements for waste rock from Doris and Madrid North, respectively. The information request discussed Doris waste rock and references Table 2-2. TMAC has responded in reference to Table 2-1, which is relevant to Doris waste rock.

The monitoring requirements in Table 2-1 are from TMAC's waste rock management plan and the water licence. Table 2-1 does not refer to using underground waste rock as construction rock because it was not TMAC's intent to use this rock for this purpose. TMAC does not plan to use Doris underground waste rock as construction rock therefore Table 2-1 will not be updated to state this proposed use.

TMAC segregates surface and underground waste rock on the same waste rock pad. TMAC suspects mixing of rock may have occurred around the pile edges during time of backfill and capping of the Doris CPRT. As a result, TMAC instituted signage on the waste rock pads to clearly identify the different piles to equipment operators. A buffer will also be established between piles to reduce the likelihood of a similar scenario occurring in the future.

29. KIA-NWB-29

29.1 SUBJECT

Tailings Sampling.

29.2 REFERENCES

Appendix F, Section 7.3.

29.3 SUMMARY

Modifications to tailings solid and/or supernatant sampling schedules.

29.4 DETAILED REVIEW COMMENT

Schedule 1 of the Water Licence (NWB 2018) specifies weekly sampling of flotation tailings (TL-6) and (one- time) monthly sampling of the process plant tailings supernatant (TL-5), which are collected from the flotation tailings thickener tank. The weekly TL-6 samples are stored until a composite sample is made each month. In 2019, a substantially lower pH was measured from the August supernatant (TL-5) sample (pH 6.2) relative to the other months (i.e., pH 8.0 – pH 8.4; Figure 4-13 of Appendix E, in Appendix F of the Main Report). This deviation highlights the limitations of sampling the supernatant (TL 5) on a different schedule/method than the tailings solids samples (TL- 6) and suggests increased sampling may help to understand similar anomalies as part of future monitoring efforts. For example, a complementary "point" tailings solid sample (TL-6) could be collected at the same time as the monthly supernatant (TL-5), or sampling frequency could be increased following an anomalous result from either tailings solids or supernatant samples.

A similar comment was made in Appendix E (Section 4.2.1) that indicates the monthly samples associated with the Doris TIA may be too far apart to assess the peak values and estimate the degradation and removal rates of nitrogen species.

29.5 RECOMMENDATION/REQUEST

Can TMAC comment on whether changes to the frequency of tailings sampling should be considered to improve the monitoring of tailings deposited in the Doris TIA, as well as the ability to annually refine the Doris Mine Water and Load Balance (Appendix E).

29.6 TMAC RESPONSE TO KIA-NWB-29

At this time, TMAC dose not anticipate a need for increased sample collection at station TL-5, and TL-6. Increasing sample frequency will not improve model outcomes as the current data collection frequency supports the monthly water quality review and annual

model calibration. Furthermore, data collected at TL-6 is not an input to the water and load balance model and is instead related to the geochemical monitoring program for tailings solids.

Variability in samples from day to day is expected as the process plant is an operational facility that is subject to changing conditions. For the process plant, variability is a result of reagent addition rates and/ or fluctuating processing rates. The August sample with a pH of 6.2 was likely an anomaly and not reflective of normal operations. More frequent data collection was not required to identify this sample as such. Composite collection of the solids sample, TL-6, is more likely to capture average process plant conditions which is more beneficial for the geochemical analysis.

Ammonia degradation rates are initially calculated on a weekly timestep using a simple Excel® water and load balance. Operational models / tools with weekly to monthly time steps are common for tailings facilities like the Doris TIA. Water surface elevations measured in the Doris TIA were converted to volumes using the stage storage curves and a nitrogen balance was set up using the Doris TIA volumes and measured data at TL-12, TL-5, ST-1 and TL-1. Although the peak of ammonia degradation might not be fully captured in the weekly TL-1 samples, average rates can be calculated as degradation occurs over a period of months. The generated rates were then applied in the GoldSim model. The 2019 rates fall within the expected range of the reference facility, which was exposed to both natural and enhanced degradation (SRK 2020).

TMAC feels that increased collection frequency would not improve model forecasting and therefore will not plan to increase sampling frequency at TL-5 and TL-6.

30. KIA-NWB-30

30.1 SUBJECT

Elevated Nitrogen (N)-Species Concentrations.

30.2 REFERENCES

Appendix F, Appendix D (Seepage Survey).

30.3 SUMMARY

Spatially elevated nitrate, nitrite and ammonia values Doris Marine Outfall Berm (MOFB) Access Road.

30.4 DETAILED REVIEW COMMENT

Thirteen seep samples were collected along the Doris MOFB Access Road, which was constructed with Quarry 2 material. Section 3.2.2 (of Appendix D in Appendix F of the Main Report) indicates that nitrite and nitrate values from seepage samples collected from Doris infrastructure and roads were similar and ranged from 0.001 to 0.11 mg/L and 0.005 mg/L to 5.4 mg/L, respectively. These provided ranges vary by several orders of magnitude and review of sample results shown in Table 3-2 (of Appendix D in Appendix F of the Main Report) shows samples collected from 19-MOFB-10 to 19-MOFB-13 had substantially elevated nitrate (0.23 mg/L – 5.4 mg/L), nitrite (0.005 mg/L – 0.11 mg/L) and ammonia (0.15 mg/L - 3.5 mg/L) relative to seeps collected at the other nine locations (19-MOFB-01 to 19-MOFB-09; nitrate: <0.005 mg/L, nitrite: <0.001 mg/L; ammonia: 0.006 mg/L – 0.03 mg/L).

Reference to Figure 2 (of Appendix D in Appendix F of the Main Report) suggests there may be a spatial relationship to elevated N species that is also aligned with a shift to more alkaline pH values. It is acknowledged that there are no historical seepage samples along the MOFB Access Road for comparison, as noted in Section 4 (of Appendix D of the Appendix F of the Main Report).

30.5 RECOMMENDATION/REQUEST

Could TMAC comment on the potential spatial relationship associated with observed nitrogen species concentrations and pH values measured in 2019 from seeps present along the MOFB Access Road? Specifically, are there material or compositional and/or placement timing differences that may promote the observed variability in seepage chemistries between 19-MOFB-01 to 19-MOFB-09 sites versus 19-MOFB-10 to 19-MOFB-13 sites?.

30.6 TMAC RESPONSE TO KIA-NWB-30

As part of the as-built geochemical construction monitoring, the geological inspection of the MOFB access road indicated that the construction rock that was the source of seepage samples 19-MOFB-01 to 19-MOFB-13 was uniformly mafic metavolcanics. The concentrations of nitrogen species from seepage from MOFB access road samples confirm that all construction rock was sourced from Quarry 2. The variability of nitrogen species concentrations does not indicate that the construction material used at the MOFB access road is unsuitable. A review of the field documentation indicated that seepage inspection of sample collection of 19-MOFB-10 to 19-MOFB-13 occurred two days later and that seepage temperatures were several degrees lower the other samples from the MOFB access road.

31. KIA-NWB-31

31.1 SUBJECT

Loading Calculations.

31.2 REFERENCES

Appendix G, Appendix B Section 3.2.

31.3 SUMMARY

Validation of loading conclusions.

31.4 DETAILED REVIEW COMMENT

Sampling of ephemeral streams downgradient of the waste rock pile at the Boston Site is conducted to monitor seepage chemistries and provide an indicate of whether contaminants of potential concern from the ore and waste rock pile are reaching the shoreline at Aimaokatalok Lake. Five ephemeral streams are present, A2, B2, C2, D2 and E2; however, flow was observed in 2019 at stations A2, D2 and E2 only. The first bullet of the summary (in Section 3.2, of Appendix B in Appendix G of the Main Report) indicates that "higher sulphate concentrations were observed during periods of low flow resulting in lower sulphate loading rates (e.g., mg SO4/s) compared to samples collected with higher flow rates and lower sulphate concentrations (e.g., D2 in 2011 and 2016, Table 2), suggesting that concentration is related to dilution from surface waters."

It is not clear how loading rates can be calculated when flow rates are not consistently collected at the same time as sampling. For example, Table 1 indicates two flow rate measurements have been made at D2; however, the chemistry of 8 samples collected at D2 is shown in Table 2.

31.5 RECOMMENDATION/REQUEST

Can TMAC outline the stream sampling methodology and comment on the rationale for fewer flow measurements than samples collected as well as the potential uncertainty introduced with these disparities? Further to this request, can TMAC clarify the statement in Section 3.2 on loading rates and concentrations/trends observed in the sampled ephemeral streams in 2019?

31.6 TMAC RESPONSE TO KIA-NWB-31

The ephemeral streams monitoring program includes water quality sample collection when stream flow is observed. Conversely, a water quality sample is not collected when standing or pooled water is observed because the water is considered to not be

representative of ephemeral stream flow. Flow rate data is collected for all samples, however not all rates are quantitative.

Ephemeral stream flow rates are quantified using a bucket method whereby a stopwatch is used to determine the time for stream water to fill a container of a defined volume. The flow rate is determined multiple times and the average value accepted as the flow rate. A sample flow rate cannot be quantified when stream flow is too shallow to capture flow using the bucket method. In such a case, the flow rate is documented in qualitative terms, such as trickle or trace. Accordingly, there is flow data for all ephemeral samples collected and the "n/a" noted in Table 1 does not indicate the absence of flow or data, but that the flow rate was too low to quantify.

For the purposes of sulphate loading calculations, the flow rate for samples with qualitative flow rates was assumed to 0.007 L/s. A flow rate of 0.007 L/s was selected based on the minimum quantifiable flow rate of 0.008 L/S (measured at stream A2 in June 2019, Table 1) and assumes that the flow rate for streams with trace flow is less than samples that have flow that can be quantified. Figure 4 presents a comparison of observed sulphate concentrations and calculated loading rates for all ephemeral streams samples. Samples with assumed flow rates are denoted by circles in Figure 4. Figure 4 indicates that samples with flow rates too low to measure have lower loading rates, including the sample with maximum observed sulphate concentration (480 mg/L).

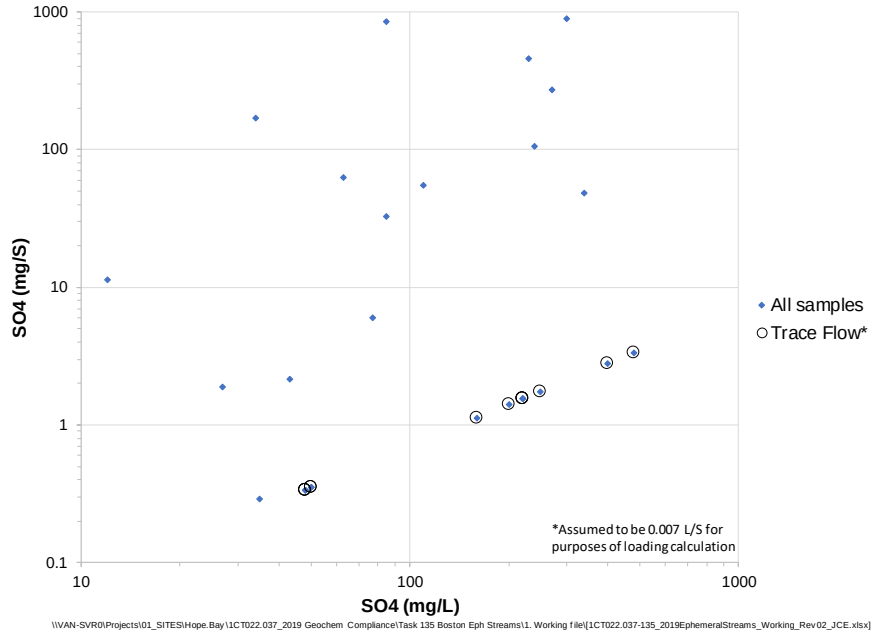


Figure 4: Comparison of Sulphate Concentrations and Loading Rates at Ephemeral Streams, Boston

32. KIA-NWB-32

32.1 SUBJECT

Sulphate from Ephemeral Streams.

32.2 REFERENCES

Appendix G, Section 4.2.

32.3 SUMMARY

Clarification on concluding statements for sulphate trends.

32.4 DETAILED REVIEW COMMENT

Section 4.2 states that sulphate is one of the contaminants of concern, as identified by the 2009 water and load balance (Supporting Document B of SRK, July 2009) and measured sulphate at D2 and E2 ephemeral stream stations exceeded the maximum modelled values. Section 4.2 goes on further to state the following:

"sulphate levels are not attenuated by the tundra and the concentrations measured in 2019 validate the 2009 water and load balance."

And,

"concentrations observed in the ephemeral streams indicate that the tundra continues to effectively attenuate contaminants of concern and the breakthrough of the effectiveness of the attenuation process has not occurred."

The above statements are contradictory to each other.

32.5 RECOMMENDATION/REQUEST

Can TMAC provide clarity on the observed versus predicted sulphate concentrations associated with the ephemeral streams and clarify statements in the document on the potential for attenuation of sulphate by the tundra. As well, if measured sulphate is noted to exceed modelled values, what are the next steps to improve calibration and assessment of potential environmental impacts to downstream receivers?

32.6 TMAC RESPONSE TO KIA-NWB-32

Sulphate and chloride are both geochemically conservative parameters and are not attenuated by the tundra. The statement in the memo can be clarified by the following edit, as denoted by the italicized and bolded text:

"…concentrations observed in the ephemeral streams indicate that the tundra continues to effectively attenuate contaminants of concern ***(specifically nitrate, arsenic, copper, iron, nickel and selenium)*** and the breakthrough of the effectiveness of the attenuation process has not occurred"

As noted in response KIA-NWB-32, high sulphate concentrations do not equate to elevated sulphate loading rates. In subsequent annual reports, TMAC will present figures of parameters in units of loading, which will provide a more fulsome trend analysis and assessment if geochemical source controls from the Boston camp pad require consideration to prevent potential environmental impacts to the downstream environment.

33. KIA-NWB-33

33.1 SUBJECT

Spill Monitoring.

33.2 REFERENCES

Appendix H – Hope Bay Project Spill Contingency Plan, 3.4 Monitoring and Restoration, Appendix 4: Responses to Comments on Previous Plan Versions.

33.3 SUMMARY

Monitoring of spills to the environment that are not fully or partially recoverable is optional.

33.4 DETAILED REVIEW COMMENT

The discretionary language KIA identified in the 2018 Annual Report relating to monitoring of spills remains in the 2019 Annual Report. Under section 3.4 of Appendix H, TMAC states that "monitoring activities may be conducted to assess the impacts of the spill and the effectiveness of associated cleanup/remediation efforts in the event spill material cannot be removed" (p. 20) and "monitoring may be triggered in the event of spills to water of substances that dissolve or sink or where substance recovery is unlikely" (p. 21) and "monitoring may also be triggered in the event of externally reportable spills to land for which recovery of spilled material is unlikely or may be incomplete" (p. 21).

In Appendix 4, in response to our previous comments, TMAC indicates that it is not reasonable or necessary to predetermine "every possible scenario, response, follow up monitoring" because such an approach "would result in an extremely voluminous document with thousands of iterations and combinations that account for every possible factor at Hope Bay" (p. 43).

We are not suggesting that every possible step for monitoring should be detailed in the Spill Contingency Plan, but we are requesting that monitoring be required for (i) every spill that cannot be removed, (ii) spills to water of substances that dissolve or sink or where substance recovery is unlikely, and (iii) externally reportable spills to land for which recovery is unlikely or incomplete. Specific details on what the required monitoring would entail could then be determined on a case by case basis, depending on the nature of the spill. We do not think such an approach would be unduly time-consuming or cumbersome, but rather, would provide an effective and efficient framework for ensuring monitoring of spills that are not fully or partially recoverable is conducted, so that ultimately no adverse effects to the environment occur, and long-term liabilities on IOL are avoided.

33.5 RECOMMENDATION/REQUEST

Please remove the discretionary language in section 3.4 and replace with wording that monitoring is required for all spills detailed in (i) to (iii) above.

33.6 TMAC RESPONSE TO KIA-NWB-33

TMAC acknowledges that any required environmental monitoring would be evaluated on a case by case basis in situations of reportable spills that cannot be removed or fully recovered; or, involve a substance spilled to water that dissolves, sinks or where substance recovery is unlikely. As part of regulated spill reporting and follow up, specific details on the spill and any follow-up monitoring would be detailed in the 30 day spill report submitted to the Government of Nunavut with copy to the KIA. Spill response and monitoring is determined on a case by case basis, depending on the nature of the spill and the KIA has the opportunity to inspect spill locations with their routine site inspections.

34. CIRNAC-1

34.1 SUBJECT

Cyanide Monitoring

34.2 COMMENT

CIRNAC commends TMAC on their aquatic effects monitoring work and reporting; the 2019 Aquatic Effects Monitoring Program (AEMP) Report (ERM Consultants Canada Ltd., March 2020) is thorough and provides clear discussions of the parameters measured. CIRNAC agrees with the parameters which were identified as warranting close monitoring; arsenic in sediment at Patch Lake and under-ice ammonia in Doris Lake.

CIRNAC notes that the AEMP does not include reported values for free cyanide or total cyanide, both included in the list of water quality variables of Table 3.2-2 of the Aquatic Effects Monitoring (AEM) Plan (TMAC Resources Ltd., October 2018).

34.3 RECOMMENDATION/REQUEST

(R-01) CIRNAC recommends that TMAC clarify why cyanide concentrations are not reported or discussed in the AEMP.

34.4 TMAC RESPONSE TO CIRNAC-1

Cyanide will be used as a reagent in the Boston Process Plant which has yet to be constructed. During processing at Boston, it is planned that once the cyanide leach phase is complete, cyanide and will undergo detoxification (cyanide destruction) in the Process Plant. Industrial water, processing water, and contact water at the Boston site will undergo treatment in the Water Treatment Plant prior to discharge to Aimaokatalok Lake (Madrid-Boston FEIS, Volume 3; TMAC 2017). Technical Comment ID#KIA-NIRB-19 received after the submission of the FEIS requested the inclusion of cyanide monitoring in the AEMP Plan because cyanide is a "contaminant of potential concern in the freshwater receiving environment (Aimaokatalok Lake) associated with mining and milling at the Boston site" (TMAC 2018). Cyanide monitoring in effluents and receiving waters is also a requirement of Environmental Effects Monitoring (EEM) Studies under the Metal and Diamond Mining Effluent Regulations (MDMER).

According the AEMP Plan (TMAC 2018), and in agreement with recommendations received following the submission of the FEIS, cyanide is to be monitored in two lakes: Aimaokatalok Lake and Reference Lake B. Cyanide is listed in Table 3.2-2 of the AEMP Plan, with the following relevant table footnotes to describe where cyanide monitoring is to be conducted: "total cyanide […] will be monitored at the MDMER EEM sampling areas (Aim-EEM and Reference Lake B)" and "total and free cyanide will be monitored

at three AEMP sampling areas: Aim-Deep, Aim-West, and Reference Lake B" (TMAC 2018a).

As described in the AEMP Plan, the monitoring schedule for lakes included in the AEMP is based on the Project development and operational sequence, and is tied to periods during which Project effects may occur. Within Aimaokatalok Lake, total and free cyanide monitoring at specific sampling sites will be triggered by either the start of construction activities in the Boston development area or the onset of effluent discharge into Aimaokatalok Lake (TMAC 2018a). No Phase 2 construction has begun at the Boston site and no effluent had been discharged to Aimaokatalok Lake; therefore, the 2019 AEMP did not include water quality sampling (including cyanide monitoring) in Aimaokatalok Lake. Cyanide monitoring in Reference Lake B will be undertaken once monitoring in Aimaokatalok Lake begins. Baseline total and free cyanide data have been collected in both Aimaokatalok Lake and Reference Lake B, and will be incorporated in the analysis of effects once water quality monitoring in Aimaokatalok Lake is triggered by Project activities.

35. CIRNAC-2

35.1 SUBJECT

Management of Cyanide Concentrations

35.2 COMMENT

The 2019 Water and Load Balance Assessment (Appendix E) clearly explains adjustments made to the Water and Load Balance model. Site data were used to update cyanide removal rates and degradation paths.

CIRNAC notes that the final remarks state TMAC is actively taking steps to manage two of the four parameters identified as being of concern: total suspended solids and unionized ammonia. A third parameter, copper, will be monitored throughout 2020. No specific actions are included for the fourth parameter of concern, cyanide.

Table 15 (page 16) states "Measured cyanide concentrations have demonstrated that cyanide readily undergoes degradation in the Doris TIA (tailings impoundment area) during the open water season. TMAC will not discharge water that is above total cyanide limits."

35.3 RECOMMENDATION/REQUEST

(R-02) CIRNAC recommends that TMAC clarify how they plan to manage cyanide concentrations which are predicted to increase above the Metal and Diamond Mining Effluent Regulations (MDMER) limit in 2023. If this plan includes holding water in the Doris TIA until cyanide degrades, TIA capacity should be discussed.

35.4 TMAC RESPONSE TO CIRNAC-2

Cyanide present in the Doris TIA originates from sodium cyanide addition in the gold leaching circuit. Sodium cyanide addition is linked to the amount of ore being processed in the Doris Process Plant. The model assumed that in 2020 the Doris Process Plant would be processing 2,000 tpd and the Madrid Process Plant would be processing 1,000 tpd and sending the flotation concentrate to the Doris Process Plant for cyanide extraction. No work on the Madrid Process Plant has commenced.

In 2019 the process source terms for cyanide were changed and as a result the predicted concentration of cyanide in the Doris TIA increased above the 2018 predictions. TMAC is in the process of evaluating what cyanide concentration management looks like in the future, based on the predictions from the updated mine plan, production rates and reagent use.

Operational water level targets are set annually for the TIA and an allowance is left between the operational target water levels and the design Full Supply Level in the TIA so that upset conditions can be handled through the life of the TIA. Checks on the TIA storage is completed each year as part of the annual geotechnical inspections and updates will be made to operational and Fully Supply Levels as requested by the TIA Engineer-Of-Record. TMAC will continue to evaluate operational processes and treatment options in efforts to maintain MDMER compliance.

36. CIRNAC-3

36.1 SUBJECT

Water Volume Transferred from Sediment Control Pond to TIA

36.2 COMMENT

The reported volume of water transferred from the sediment control pond (ST-1) to the Tailings Impoundment Area (TIA) differs between the Water Licence(s) Monitoring Data (Appendix D) and the Doris Mine Annual Water and Load Balance Assessment (Appendix E). Table D1-2 of Appendix D states a cumulative volume of 205,486 m^3 for 2019. Table 3 of Appendix E states a total of 120,000 m^3 for 2019.

Depending on the pond water chemistry, a 70% increase in volume could potentially change the findings of the Water and Load Balance Assessment.

36.3 RECOMMENDATION/REQUEST

(R-03) CIRNAC recommends that TMAC clarify the volume of water transferred from the sediment control pond to the TIA and if it has been adequately incorporated into the Water and Load Balance Assessment.

36.4 TMAC RESPONSE TO CIRNAC-3

The cumulative volume reported in Appendix D was misreported and should be in agreement with the cumulative volume reported in Appendix E being 120,000 m^3. The correct volume has been incorporated in the Water and Load Balance Assessment.

37. CIRNAC-4

37.1 SUBJECT

Quantities of Tailings Deposited in 2019

37.2 COMMENT

In Section 8 of the Hope Bay 2019 NWB Annual Report main document, Geochemical Studies, it was stated on page 8-4 that: "(F)lotation tailings deposition in the Doris TIA commenced on January 20, 2017. A total of 573,868 t (dry weight) of flotation tailings were deposited in the TIA in 2018."

It is stated on page 8-5 that "(I)n 2018, a total of 18,831 t (dry weight) of detoxified tailings were placed as backfill in Doris Mine underground stopes."

Monitoring occurred during 2019 at monitoring stations TL-6 (flotation tailings) and TL-7a (detoxified tailings solids), and details are provided in appendices D (Water Licence(s) Monitoring Data), F (2019 Waste Rock, Quarry and Tailings Monitoring Report, Doris and Madrid, Hope Bay Project), and G (2019 Waste Rock and Ore Monitoring Report, Boston Camp, Hope Bay Project).

It is not clear if any quantities of flotation tailings were placed in the TIA and if any quantities of detoxified tailings were placed in the underground stopes in 2019.

37.3 RECOMMENDATION/REQUEST

(R-04) CIRNAC recommends that TMAC clarify the quantities of flotation tailings placed in the TIA and quantities of detoxified tailings solids placed in the underground stopes in 2019.

37.4 TMAC RESPONSE TO CIRNAC-4

Thank you for indicating this discrepancy. The statements on pages 8-4 and 8-5 incorrectly refer to 2018. Both statements should refer to 2019 as the volumes of flotation tailings deposited into the TIA and detoxified tailings placed as backfill in the Doris Mine underground stopes. The quantities of tailings on pages 8-4 and 8-5 are correct for 2019.

38. CIRNAC-5

38.1 SUBJECT

Quantity and Management of Detoxified Tailings Filtrate

38.2 COMMENT

Section 8.1.2.4 of the Hope Bay 2019 NWB Annual Report main document summarized the chemistry of the detoxified tailings filtrate (monitoring station TL-7b). The quantity of the detoxified tailings filtrate produced in 2019 was not provided, and it is not clear from the report how the filtrate was managed. [Same as CIRNAC-6]

38.3 RECOMMENDATION/REQUEST

(R-05) CIRNAC recommends that TMAC clarify the quantity of detoxified tailings filtrate that was placed in the TIA in 2019.

38.4 TMAC RESPONSE TO CIRNAC-5

Approximately 8,800 m^3 of detoxified tailings filtrate was sent to the TIA in 2019.

39. CIRNAC-6

39.1 SUBJECT

Quantity and Management of Detoxified Tailings Filtrate

39.2 COMMENT

Section 8.1.2.4 of the Hope Bay 2019 NWB Annual Report main document summarized the chemistry of the detoxified tailings filtrate (monitoring station TL-7b). The quantity of the detoxified tailings filtrate produced in 2019 was not provided, and it is not clear from the report how the filtrate was managed. [Same as CIRNAC-5]

39.3 RECOMMENDATION/REQUEST

(R-06) CIRNAC recommends that TMAC clarify how the detoxified tailings filtrate was managed in 2019.

39.4 TMAC RESPONSE TO CIRNAC-6

Detoxified tailings filtrate is sent to the flotation tailings thickener within the mill complex. The thickener directs a large portion of the filtrate back into the mill process to be recycled to reduce the amount of makeup water. The remaining filtrate is sent to the TIA via the flotation tailings.

40. CIRNAC-7

40.1 SUBJECT

Verification of Closure Design Performance

40.2 COMMENT

Section 13 of the Hope Bay 2019 NWB Annual Report main document describes progressive reclamation and closure of the Doris Crown Pillar Recovery Trench. The section describes backfilling the hole, the placement of geochemically stable rock as a cap, and surficial grading to reduce the flow of contact water into the environment. Design measures were implemented according to recommendations based on thermal modeling conducted by SRK Consulting. These measures were implemented to promote physical, chemical, and thermal stability of the site. CIRNAC encourages TMAC to continue implementing progressive reclamation whenever possible.

One advantage of progressive reclamation during operations is that it provides an opportunity for the licensee to verify that the closure design is performing as intended. It is not clear if, or how, the performance of the cover will be monitored and the performance of the closure design verified.

40.3 RECOMMENDATION/REQUEST

(R-07) CIRNAC recommends that TMAC provide clarification regarding how TMAC plans to verify that the closure design is performing as intended.

40.4 TMAC RESPONSE TO CIRNAC-7

TMAC will confirm the performance of the Doris CPRT cover throughout operations via the regular monitoring of the physical, chemical, and thermal stability of the CPRT site. Monitoring will include regular coverage in internal site inspections, inspection of the site by a Professional Engineer on an annual basis via the Doris-Madrid annual geotechnical inspections, and regular seepage monitoring with results discussed annually via the Doris-Madrid geochemistry compliance reports. Results will be provided annually via annual reporting to NWB, NIRB and KIA, and any recommendations identified during monitoring will be responded to by TMAC.

41. CIRNAC-8

41.1 SUBJECT

Construction Monitoring and Reporting

41.2 COMMENT

Section 3 of the Hope Bay 2019 NWB Annual Report main document outlines construction activities carried out at the Hope Bay Project site during 2019. A Construction Summary Report, titled Hope Bay Project: Doris and Madrid 2019 Construction Summary Report (SRK Consulting, April 1, 2020), was submitted to the NWB in April and provides post-construction information on the following structures:

- Madrid South All-Weather Road (from 0 to 1 km);
- Madrid North Contact Water Pond (CWP);
- Madrid North Waste Rock Pile (WRP);
- Madrid North Portal Pad; and
- Naartok East Overburden Stockpile.

This Construction Summary Report does not include all of the construction items listed in Section 3 of the Hope Bay 2019 NWB Annual Report, nor does it include progressive reclamation work at the Doris Crown Pillar Recovery Trench. A construction summery report would be helpful for CIRNAC inspectors to evaluate the closure work.

Further, CIRNAC commented on the 2018 Annual Report (CIRNAC, August 15, 2019) and recommended that future construction reports mention if compaction tests and sieve analysis are done during construction. Information regarding whether or not compaction tests and sieve analyses were done during construction was not provided in the Construction Summary Report (SRK Consulting, April 1, 2020), nor were these tests mentioned in the Hope Bay 2019 NWB Annual Report main document..

41.3 RECOMMENDATION/REQUEST

(R-08) CIRNAC recommends that a Construction Summary Report and/or Construction Monitoring Report be submitted for the following items which were constructed in 2019 when this information becomes available, and that, where applicable, the reports mention whether compaction tests and sieve analysis are done during construction:

- Roberts Bay Discharge System (RBDS);
- Underground mine dewatering and Tailings Impoundment Area (TIA) discharge pipelines and pumping infrastructure;
- The 5 million litre fuel tank; and
- Reclamation works and cover placement for the Doris Crown Pillar Recovery Trench.

41.4 TMAC RESPONSE TO CIRNAC-8

In compliance with Water Licence 2AM-DOH1335, TMAC acknowledges a Construction Summary Report, including construction monitoring results, will be submitted for a) the Roberts Bay Discharge System (RBDS), including underground mine dewatering and TIA discharge infrastructure; and b) the additional 5ML Fuel Tank at Roberts Bay. These reports were not submitted at the time of the 2019 NWB Annual Report as the facilities were not deemed complete, however reports are expected to be provided in 2020.

TMAC does not anticipate preparing a Construction Summary Report for the reclamation works and cover placement for the Doris Crown Pillar Recovery Trench . As stated in response to CIRNAC-7, TMAC will confirm the performance of the Doris CPRT cover throughout operations via the regular monitoring of the physical, chemical, and thermal stability of the CPRT site. Monitoring will include regular coverage in internal site inspections, inspection of the site by a Professional Engineer on an annual basis via the Doris-Madrid annual geotechnical inspections, and regular seepage monitoring with results discussed annually via the Doris-Madrid geochemistry compliance reports. Results will be provided annually via annual reporting to NWB, NIRB and KIA, and any recommendations identified during monitoring will be responded to by TMAC.

42. CIRNAC-9

42.1 SUBJECT

Management Plans Updated in 2020

42.2 REFERENCES

TMAC Resources Inc., Hope Bay Project Doris-Madrid Water Management Plan, March 2019

42.3 ISSUE/RATIONALE

In Section 12 of the Hope Bay 2019 NWB Annual Report main document, TMAC it is stated that the following management plans have been updated in March 2020:

- Hope Bay Project Emergency Response Plan;
- Hope Bay Project Spill Contingency Plan;
- Hope Bay Project Hazardous Waste Management Plan;
- Hope Bay Project Quality Assurance Quality Control Plan; and
- Hope Bay Project Doris-Madrid Water Management Plan.

CIRNAC reviewed these plans and has no concerns with the content of the updates.

The following recommendations regarding management plans, made by CIRNAC in 2019 pertaining to the 2018 Annual Report (CIRNAC, August 15, 2019), have been implemented by TMAC to the satisfaction of CIRNAC:

- CIRNAC-8 Re: Hope Bay Quality Assurance and Quality Control Plan, March 2019
    - CIRNAC recommends that the photo-maps be updated to include all new sampling points, and that a footnote be written under table B1 that explains the significance of the asterisk, for clarity
- CIRNAC-9 Re: Hope Bay Project Doris-Madrid Water Management Plan, March 2019
    - CIRNAC recommends that TMAC provide justification for the removal of in-line flow meters to quantify discharge in the pumps from the 2019 revision of the Hope Bay Project Doris- Madrid Water Management Plan.
- CIRNAC-10 Re: Hope Bay Project Aircraft De-icing Management Plan, March 2019 and Hope Bay Spill Contingency Plan, March 2019
    - CIRNAC recommends that TMAC provide information regarding the procedure for disposal of glycol contaminated snow and sump water in the Spill Contingency Plan.

Of these updated management plans, only the Spill Contingency Plan was attached to the 2019 Annual Report. Attaching all updated management plans, or a link to where

plans can be found, to the Annual Report in the future would help interveners in their review.

42.4 RECOMMENDATION/REQUEST

(R-09) CIRNAC recommends including links to the updated management plans in the invitation for comments if the updated plans are not stored in the same folder as the annual report on the public registry.

42.5 TMAC RESPONSE TO CIRNAC-9

TMAC suggests this comment is best directed to the Nunavut Water Board. Although submissions happen concurrently, TMAC has been requested by the NWB to submit updated management plans under separate cover from the NWB Annual Report. If needed, a secure link to a complete digital and downloadable copy of the submitted management plans is available at the location listed below.

URL:	https://tmac.exavault.com/share/view/1xjt7-edd96txj

43. ECCC-1

43.1 SUBJECT

TSS Treatment of Underground Water.

43.2 REFERENCE

Section 3 – Summary of Project Activities for 2019

43.3 COMMENT

The report indicates that a water treatment plant was constructed in 2019 to remove Total Suspended Solids (TSS) from underground mine water prior to discharge into Roberts Bay.

43.4 RECOMMENDATION/REQUEST

ECCC recommends:

- An additional Surveillance Network Program (SNP) station be added after treatment through the newly constructed water treatment plant, such that the water quality post treatment can be measured prior to discharge into Roberts Bay.
- The Proponent provide a discussion of overall treatment efficiency from the proposed water treatment plant, including expected water quality after treatment.

43.5 TMAC RESPONSE TO ECCC-1

Water quality post treatment is reported under TMAC's Final Discharge Point (FDP). Effluent discharged from the FDP, is monitored at Monitoring Station RBD-1 representing the Project's federal compliance monitoring station for ocean discharge of effluent from the Project. The water treatment plant is a part of TMAC's discharge strategy to ensure that the FDP effluent is compliant with MDMER Schedule 4 Table 2.

44. ECCC-2

44.1 SUBJECT

Updated Management Plans

44.2 REFERENCE

Section 12 – Management Plans

44.3 COMMENT

The annual report identifies a number of management plans that were updated in March of 2020, including the Emergency Response Plan, Spill Contingency Plan, Hazardous Waste Management Plan, QA/QC Plan, and the Doris-Madrid Water Management Plan. However, these updated plans were not provided with the Annual report for review.

44.4 RECOMMENDATION/REQUEST

ECCC recommends that updated plans be provided with the annual report for review.

44.5 TMAC RESPONSE TO ECCC-2

TMAC suggests this comment is best directed to the NWB. The updated management plans in question were submitted to the NWB and although submissions happen concurrently, TMAC has been requested by the NWB to submit updated management plans under separate cover from the NWB Annual Report. If needed, a secure link to a complete digital and downloadable copy of the submitted management plans is available at the location listed below.

URL:	https://tmac.exavault.com/share/view/1xjt7-edd96txj

45. ECCC-3

45.1 SUBJECT

Water Quality in the TIA

45.2 REFERENCE

Appendix D – Water Licence Monitoring Data; Table D1-24

45.3 COMMENT

TMAC has previously acknowledged that Station TL1 will be used to assess overall Tailings Impoundment Area (TIA) effluent quality prior to the effluent combining with the underground mine water and being discharged into Roberts Bay. However, ECCC notes that as per Table D1-24, the water quality in the TIA is not being compared and contrasted to the relevant discharge criteria. Specifically, to the discharge criteria that are mandated pursuant to the Metal and Diamond Mine Effluent Regulations (MDMER).

45.4 RECOMMENDATION/REQUEST

ECCC recommends that water quality in the TIA at station TL1 be compared to MDMER discharge criteria in order to validate predictions and to inform treatment needs.

45.5 TMAC RESPONSE TO ECCC-3

Water quality data at TL-1 is compared to MDMER discharge criteria and presented with the Doris Mine Annual Water and Load Balance Assessment (Appendix E of the 2019 NWB Annual Report).

46. ECCC-4

46.1 SUBJECT

Underground Dewatering (TL-12) Quality.

46.2 REFERENCE

Appendix D – Water Licence Monitoring Data; Table D1-37

46.3 COMMENT

Table D-37 provides a summary of water quality of water that has been pumped from the underground and that has been deposited into the TIA (until such time that the Roberts Bay pipeline has been commissioned). Based on the data provided, water quality from the underground is very high in metals. Given that there are also high concentrations of TSS, it may be that the majority of the high metals is present in the solid form, and therefore less bioavailable. However, no measurements of dissolved concentrations are provided. Therefore, there is an unclear picture of how available the metals are. In addition, there has been no overall discussion on the quality of the underground water quality in the annual report.

46.4 RECOMMENDATION/REQUEST

ECCC recommends the Proponent provide a discussion of underground water quality, including any relevant available data for dissolved versus solid concentrations. Overall implications for TIA water quality and/or Roberts Bay water quality should be discussed.

46.5 TMAC RESPONSE TO ECCC-4

In 2019, all Doris mine water was directed to the Doris TIA for storage until the discharge line to Roberts Bay was operational. Water quality monitoring of Doris mine water was undertaken at Station TL-12 and presented in Table D1-37 of Appendix D of the 2019 NWB Annual Report. Dissolved metals were not measured at TL-12 during 2019.

The Doris TIA water quality was evaluated in the 2019 Water And Load Balance Assessment, during which mine water was discharged solely to the Doris TIA. The assessment identified four parameters to monitor: unionized ammonia, TSS, total copper and total cyanide. The relationship of these parameters to mine water is discussed below:

- Unionized ammonia: during agal blooms, the fraction of total ammonia as unionized ammonia can increase due to increasing TIA water temperatures and increasing pH as a result of alkalinity production by the agal community (see KIA-NWB-25 for a more complete discussion on this process). In 2019 mine water

contributed 25% of the total ammonia loading to the Doris TIA when compared to the Doris Process Plant and the Sediment Control Pond (see Table 3). Management measures for unionized ammonia are presented in the water and load balance assessment and in KIA-NWB-25.

- Total Cyanide: In 2019 mine water contributed 3% of the total cyanide loading to the Doris TIA when compared to the Doris Process Plant and the Sediment Control Pond (see Table 3).

- TSS and total copper: Mine water contains elevated TSS and total copper concentrations and represent 97% and 56% of the loading into the Doris TIA, respectively. However, the Doris TIA is a large facility that supports settling of solids. Measured water quality predictions for TSS and copper are discussed in the water and load balance assessment. Elevated TSS concentrations at TL-1 have been linked to algal blooms and mine water TSS settles out of the water column prior to Station TL-1. Total copper concentrations are linked to both the process plant and mine water. Management measures are discussed in the water and load balance to lower copper concentrations through treatment in the future.

Table 3: Breakdown of Annual Loading to the Doris TIA by Major Source

Parameter	Percent Loading by Source		
	Sediment Control Pond (ST-1)	Doris process Plant (TL-5)	Doris Mine Water (TL-12)
Total Ammonia	7%	69%	25%
Total Copper	7%	37%	56%
Total Cyanide	5%	92%	3%
TSS	2%	2%	97%

47. ECCC-5

47.1 SUBJECT

Water and Load Balance Assessment.

47.2 REFERENCE

Appendix E

47.3 COMMENT

The Water and Load Balance assessment provides a description of parameters which were under-predicted by the model based on the 2019 data, and therefore the source terms for those parameters were updated in order to increase accuracy of the model. However, although the new source terms have been provided, the report does not indicate what were the source terms previously, therefore it is unclear how much of an adjustment has been made to the model for the parameters that needed additional calibration. Inclusion of the previous values would be useful to assess the level of calibration required.

47.4 RECOMMENDATION/REQUEST

ECCC recommends that the Water and Load Balance Assessment provide the previous values for any parameters that required updating, as well as the new updated values.

47.5 TMAC RESPONSE TO ECCC-5

Updated parameters are provided in the tables below. A complete discussion of the derivation is provided in Section 4 of the Water and Load Balance Assessment. The model is a predictive tool created prior to mine development in order to evaluate future water quality trends and associated mitigative measures. The model inputs (e.g. mine schedules, ore grades, metallurgical test work) are based on available data at the time of model development and some variation during mine operations is expected. For example, in 2019 ore from the Madrid mine was processed at the Doris mill, which is earlier than the mine schedule in the initial model. These model refinements are expected, improve the model's forecasting function, and are considered best practice. Future refinements will likely be required, and the necessity will be evaluated annually, as per the Licence requirements.

Table 4: Updated Table 10 – Summary of Total Cyanide Degradation Changes

Model Input	Units	Updated Parameter	Previous Value	Updated Value
Doris process water source term	mg/L	Total cyanide	1.1	3.8
Madrid North process water source term	mg/L	Total cyanide	1.1	3.8
Madrid South process water source term	mg/L	Total cyanide	1.1	3.8
Boston process water source term	mg/L	Total cyanide	1.1	3.8
Total cyanide degradation rate	mg/m2/day	Total cyanide to free and WAD cyanide (previously to cyanate)	-	50
Free and WAD cyanide degradation rate	mg/m2/day	Free and WAD cyanide to hydrogen cyanide gas, which is volatilized and sent to a model sink	-	35

Table 5: Updated Table 11 – Summary of Cyanate Degradation Changes

Model Input	Units	Updated Parameter	Previous Value	Updated Value
Doris process water source term	mg/L	Cyanate	-	40
Madrid North process water source term	mg/L	Cyanate	5.1	40
Madrid South process water source term	mg/L	Cyanate	25	40
Boston process water source term	mg/L	Cyanate	25	40
Ammonia degradation rate	mg/m2/day	Ammonia degradation rate	249	450

Table 6: Updated Table 12 - Summary of Metals Evaluation Changes

Model Input	Units	Updated Parameter	Previous Value	Updated Value
Doris process water source term	mg/L	Total (and dissolved) manganese	0.16 (0.16)	0.2 (0.16)
Madrid North process water source term	mg/L	Total (and dissolved) manganese	0.06 (0.06)	0.2 (0.16)
Madrid South process water source term	mg/L	Total (and dissolved) manganese	0.08 (0.08)	0.2 (0.16)
Boston process water source term	mg/L	Total (and dissolved) manganese	0.08 (0.08)	0.2 (0.16)
Doris mine water	mg/L	Total (and dissolved) manganese	1.7 (1.7)	7 (7)
Madrid North mine water	mg/L	Total (and dissolved) manganese	0.9 (0.9)	7 (7)
Madrid South mine water	mg/L	Total (and dissolved) manganese	0.2 (0.2)	7 (7)

Attachment 1:

Certificate of Analysis LC-50 Test (Re: KIA-NWB-2)

TMAC Resources Inc
ATTN: Environmental Site Manager
Hope Bay Project
95 Welliington St West
Toronto ON M5J 2N7

Date Received: 18-JUN-19
Report Date: 03-JUL-19 13:19 (MT)
Version: FINAL

Client Phone: 867-988-0569

Certificate of Analysis

Lab Work Order #: L2293385

Project P.O. #: 4500011700
Job Reference: COMPLIANCE SAMPLING PROGRAM
C of C Numbers:
Legal Site Desc:

Amber Springer, B.Sc
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: TMAC Resources Inc
Hope Bay Project 95 Welliington St West
Toronto ON M5J 2N7
Contact: Environmental Site Manager

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

Acute Toxicity Test Results

Samples L2293385-1 NE-C and L2293385-2 NE-D,
collected June 15, 2019

Final Report

July 3, 2019

Submitted to: **ALS Environmental**
Burnaby, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
L2293385-1 NE-C	15-Jun-19 at N/A	19-Jun-19 at 1558h	20-Jun-19 at 1500h	20-Jun-19 at 1245h	10.8°C
L2293385-2 NE-D	15-Jun-19 at N/A	19-Jun-19 at 1558h	20-Jun-19 at 1500h	20-Jun-19 at 1245h	10.3°C

N/A = Not Available

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)	
	Rainbow trout	*Daphnia magna*
L2293385-1 NE-C	>100	>100
L2293385-2 NE-D	>100	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	57.3 (44.1 – 74.4) µg/L Zn[1]	5.2 (4.2 – 6.4) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	105.1 (34.4 – 321.2) µg/L Zn	5.3 (3.7 – 7.7) g/L NaCl
Reference toxicant CV	60%	19%
Organism health history	Acceptable	Acceptable
Protocol deviations	Yes (see below)	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1] Test date: June 20, 2019; [2] Test Date: June 26, 2019, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

The inadequate volume received for sample L2293385-1 NE-C only allowed for the initiation of a 7.5L test volume for the full strength test treatment instead of the standard 10L normally used for the rainbow trout test. The lesser test volume did not appear to affect the results of the toxicity test.

Report By:
Yvonne Lam, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P. Bio
Senior Analyst

APPENDIX A – Summary of test conditions

Table 1. Summary of test conditions: 96-h rainbow trout (*Oncorhynchus mykiss*) LC50 test.

Test species	*Oncorhynchus mykiss*
Organism source	Hatchery
Organism age	Juvenile
Test type	Static
Test duration	96 hours
Test vessel	20-L glass aquarium
Test volume	10 to 20 L (depending on size of fish)
Test solution depth	≥15 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Dechlorinated Metro Vancouver municipal tapwater
Test solution renewal	None
Test temperature	15 ± 1°C
Feeding	None
Light intensity	100 to 500 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	6.5 ± 1 mL/min/L
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/13, with 2007 & 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival (96-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Zinc (added as $ZnSO_4$)

Table 2. Summary of test conditions: 48-h *Daphnia magna* LC50 test.

Test species	*Daphnia magna*
Organism source	In-house culture
Organism age	<24-hour old neonates
Test type	Static
Test duration	48 hours
Test vessel	250-mL glass beaker
Test volume	200 mL
Test solution depth	6 cm
Test concentrations	Five concentrations, plus laboratory control
Test replicates	1 per treatment
Number of organisms	10 per replicate
Control/dilution water	Moderately-hard reconstituted water + 2.5 µg/L Se
Test solution renewal	None
Test temperature	20 ± 2°C
Feeding	None
Light intensity	400 to 800 lux
Photoperiod	16 hours light / 8 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, hardness and alkalinity measured in the undiluted sample at test initiation; conductivity measured at test initiation and termination; survival checked daily
Test protocol	Environment Canada (2000), EPS 1/RM/14, with 2016 amendments
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival (48-hour LC50)
Test acceptability criterion for controls	Survival ≥90%
Reference toxicant	Sodium chloride (NaCl)

APPENDIX B – Toxicity test data

Rainbow Trout Summary Sheet

Client: ALS Environmental

Start Date/Time: June 20, 2019; 1500h

Work Order No.: 191228

Test Species: *Oncorhynchus mykiss*

Test Validity Criteria:
≥ 90% control survival
WQ Ranges:
T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Information:

Sample ID: L2293385-1 NE-C
Sample Date: June 15, 2019
Date Received: June 19, 2019
Sample Volume: 2 x 20L
Other: —

Dilution Water:

Type: Dechlorinated Municipal Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 11

Test Organism Information:

Batch No.: 0604196
Source: Lyndon Fish Hatchery
No. Fish/Volume (L): 10 / 10L
Loading Density (g/L): 0.35
Mean Length ± SD (mm): 36 ± 1 Range: 34 - 37
Mean Weight ± SD (g): 0.35 ± 0.05 Range: 0.28 - 0.41

Zinc Reference Toxicant Results:

Reference Toxicant ID: RTZnL022
Stock Solution ID: 19Zn04
Date Initiated: 20Jun19
96-h LC50 (95% CL): 57.3 (44.1 - 74.4) µg/L Zn

Reference Toxicant Mean and Historical Range: 105.1 (34.4 - 321.2) µg/L Zn
Reference Toxicant CV (%): 60%

Test Results: The 96 hour LC50 is estimated to be >100% (v/v).

Reviewed by: [signature]

Date reviewed: July 2, 2019

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: ALS Environmental
Sample I.D. L2293385-1 NE-C
W.O. # 191228
RBT Batch #: 060419b
Date Collected/Time: Jun 05/19 @ not available
Date Setup/Time: Jun 20/19 @ 1500h
CER #: 2
Sample Setup By: JD

Thermometer: Cer 2
D.O. meter/probe: 2 / D2
Cond./Salinity meter/probe: 2 / C82
pH meter/probe: 2 / P2

Number Fish/Volume: 10/10L
7-d % Mortality: 0.65%
Total Pre-aeration Time (mins): 30
Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	15.0		15.0
D.O. (mg/L)	9.9		10.1
pH	6.9		6.9
Cond. (µS/cm)	91		90
Salinity (ppt)	0		0

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)	
(% v/v)	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
ctrl				10	10	10	10	15.0	14.5	15.0	15.0	15.5	9.9	9.7	9.9	9.7	9.5	7.3	7.1	7.3	7.3	7.2	29	35
6.25				10	10	10	10	15.0	14.5	15.0	15.0	15.0	9.9	9.8	9.9	9.7	9.6	7.2	7.0	7.2	7.3	7.1	31	37
12.5				10	10	10	10	15.0	14.5	15.0	15.0	15.0	10.1	9.8	9.8	9.7	9.7	7.2	7.0	7.1	7.4	7.1	35	40
25				10	10	10	10	15.0	14.6	15.0	15.0	15.0	10.1	9.8	9.8	9.7	9.7	7.1	7.1	7.3	7.4	7.2	45	50
50				10	10	10	10	15.0	14.5	15.0	15.0	15.0	10.1	9.8	9.9	9.6	9.7	7.0	7.1	7.3	7.3	7.2	61	67
@ 100				10	10	10	10	15.0	14.5	15.0	15.0	15.0	10.1	9.7	9.8	9.6	9.7	6.9	7.2	7.4	7.3	7.3	90	102
Initials				RL	RL	MM	RL	JD	RL	RL	MM	RL	JD	RL	RL	MM	RL	JD	RL	RL	MM	RL	JD	RL

Sample Description/Comments: Turbid brown liquid. No particulates. No odour.

Fish Description at 96 h: All fish appear normal — Number of Stressed Fish at 96 h: 0

Other Observations: @ approximately 7.5L due to insufficient sample volume

Reviewed by: [signature] — Date Reviewed: July 2, 2019

Rainbow Trout Summary Sheet

Client: ALS Environmental

Start Date/Time: June 20, 2019; 1500h

Work Order No.: 191228

Test Species: *Oncorhynchus mykiss*

Test Validity Criteria:
≥ 90% control survival
WQ Ranges:
T (°C) = 15 ± 1; DO (mg/L) = 7.0 to 10.3; pH = 5.5 to 8.5

Sample Information:

Sample ID: L2293385-2 NE-D
Sample Date: June 15, 2019
Date Received: June 19, 201
Sample Volume: 2 x 20L
Other: —

Dilution Water:

Type: Dechlorinated Municipal Tap Water
Hardness (mg/L $CaCO_3$): 10
Alkalinity (mg/L $CaCO_3$): 11

Test Organism Information:

Batch No.: 060419b
Source: Lyndon Fish Hatchery
No. Fish/Volume (L): 10/10L
Loading Density (g/L): 0.39
Mean Length ± SD (mm): 37 ± 2 Range: 33 - 40
Mean Weight ± SD (g): 0.39 ± 0.08 Range: 0.27 - 0.50

Zinc Reference Toxicant Results:

Reference Toxicant ID: RTZn1022
Stock Solution ID: 19Zn04
Date Initiated: 20Jun19
96-h LC50 (95% CL): 57.3 (44.1 - 74.4) µg/L Zn

Reference Toxicant Mean and Historical Range: 105.1 (34.4 - 321.2) µg/L Zn
Reference Toxicant CV (%): 60%

Test Results: The 96 hour LC50 is estimated to be > 100% (v/v).

Reviewed by: [signature]

Date reviewed: July 2, 2019

96-Hour Rainbow Trout Toxicity Test Data Sheet

Client/Project#: ACS Environmental
Sample I.D. L2293385-2 NE-D
W.O. # 191228
RBT Batch #: 050419b
Date Collected/Time: Jun 15/19 @ not available
Date Setup/Time: Jun 20/19 @ 1500h
CER #: 2
Sample Setup By: JD

Thermometer: Cer 2
D.O. meter/probe: 2 / D2
Cond./Salinity meter/probe: 2 / C82
pH meter/probe: 2 / P2

Number Fish/Volume: 10/10L
7-d % Mortality: 0.65%
Total Pre-aeration Time (mins): 30
Aeration rate adjusted to 6.5 ± 1 mL/min/L? (Y/N): Y

Undiluted Sample WQ			
Parameters	Initial WQ	Adjustment	30 min WQ
Temp °C	15.0		15.0
D.O. (mg/L)	10.5		10.1
pH	6.9		6.9
Cond. (µS/cm)	76		76
Salinity (ppt)	0		0

Concentration	# Survivors							Temperature (°C)					Dissolved Oxygen (mg/L)					pH					Conductivity (µS/cm)	
(% v/v)	1	2	4	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	24	48	72	96	0	96
Ctrl				10	10	10	10	15.0	14.5	15.5	15.0	15.0	9.9	9.6	9.6	9.8	9.4	7.3	7.0	7.2	7.3	7.2	29	37
6.25				10	10	10	10	15.0	14.5	15.5	15.0	15.0	10.1	9.5	9.7	9.6	9.4	7.3	7.0	7.2	7.3	7.1	31	36
12.5				10	10	10	10	15.0	14.5	15.5	15.0	15.0	10.1	9.5	9.7	9.8	9.4	7.2	7.0	7.1	7.2	7.1	36	41
25				10	10	10	10	15.0	14.5	15.5	15.0	15.0	10.1	9.6	9.6	9.7	9.5	7.1	7.1	7.1	7.2	7.1	40	46
50				10	10	10	10	15.0	14.5	15.5	15.0	15.0	10.1	9.6	9.6	9.7	9.5	7.1	7.1	7.1	7.2	7.1	52	56
100				10	10	10	10	15.0	14.5	15.5	15.0	15.0	10.1	9.7	9.6	9.6	9.6	6.9	7.1	7.2	7.3	7.2	76	82
Initials								JD					JD					JD					JD	

Sample Description/Comments: Turbid brown liquid. No particulates. No odour.

Fish Description at 96 h: All fish appear normal — Number of Stressed Fish at 96 h: 0

Other Observations:

Reviewed by: — Date Reviewed: July 2, 2019

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 191229

Start Date/Time: June 20, 2019 @ 1245h
Test Species: *Daphnia magna*
Set up by: ST

Sample Information:

Sample ID: L2293385-1 NE-C
Sample Date: June 15, 2019
Date Received: June 19, 2019
Sample Volume: ~~1+1~~ 2x20L

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 052919A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 37
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DMDL34
Stock Solution ID: 19NaCl
Date Initiated: June 26, 2019
48-h LC50 (95% CL): 5.2 (4.2-6.4) g/LNaCL

Reference Toxicant Mean and Historical Range: 5.3 (3.7-7.7) g/L NaCL
Reference Toxicant CV (%): 19

Test Results: The 48h LC50 is estimated to be >100% (v/v)

Reviewed by: [signature]

Date reviewed: July 2, 2019

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS ENVIRONMENTAL
Sample ID: L2293355-1 NE-C
Work Order No.: 191229

Start Date/Time: June 20, 2019 @1245 h
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: *D.magna*
Set up by: ST

Thermometer: CER#5 pH meter/probe: 3 / 3 DO meter/probe: 3 / 3 Cond./Salinity meter/probe: 3 / 3

Concentration %(V/V)	Rep	Number of Live Organisms		No. Immobilized	Temperature (°C)			Dissolved oxygen (mg/L)			pH			Conductivity (µS/cm)	
		24	48	48	0	24	48	0	24	48	0	24	48	0	48
CTRL	A	10	10	0	18.5	19.0	20.0	9.1	8.8	8.3	7.7	7.7	7.6	335	338
	B														
	C														
	D														
6.25	A	10	10	0	18.5	19.0	20.0	9.2	8.5	8.3	7.7	7.7	7.6	321	325
	B														
	C														
	D														
12.5	A	10	10	0	18.5	19.0	20.0	9.1	8.7	8.2	7.7	7.6	7.5	305	308
	B														
	C														
	D														
25	A	10	10	0	19.0	19.0	20.0	9.2	8.6	8.2	7.7	7.6	7.4	278	281
	B														
	C														
	D														
50	A	10	10	0	19.0	19.0	20.0	9.0	8.6	8.1	7.6	7.6	7.2	219	223
	B														
	C														
	D														
100	A	10	10	0	19.0	19.0	20.0	9.1	8.6	8.0	7.3	7.2	6.8	92	167
	B														
	C														
	D														
Technician Initials		ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST	ST

	Hardness*	Alkalinity*
Concentration	*(mg/L as CaCo3)	
Control (MHW)	100	76
Highest conc.	64	16
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	19.5	(aerated for 30 mins)	19.0
DO (mg/L)	11.9		9.1
pH	6.9		7.3
Cond (µS/cm)	91		92
Salinity (ppt)	0.0		0.0

Comments: _____ Mortality: Heartbeat checked under microscope not req'd

Sample Description: turbid brown liquid, no particulates, no odor

Batch#: 052919A 7-d previous # young/brood: 37 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: July 2, 2019

Daphnia magna Summary Sheet

Client: ALS Environmental
Work Order No.: 19I229

Start Date/Time: June 20, 2019 @ 1245h
Test Species: *Daphnia magna*
Set up by: ST

Sample Information:

Sample ID: L2293355-2 NE-D
Sample Date: June 15, 2019
Date Received: June 19, 2019
Sample Volume: ~~1x1L~~ 2x20L
4h

Test Validity Criteria:

≥ 90% mean control survival and/or mobility and ≤2 daphnids exibit immobility and/or mortality in any single control replicate.

WQ Ranges:

T (°C) = 20 ± 2; DO (mg/L) = 3.6 to 9.4; pH = 6 to 8.5

Test Organism Information:

Broodstock No.: 052919A
Age of young (Day 0): <24 h
Avg No. young per brood in previous 7 d: 37
Mortality (%) in previous 7 d: 0
Days to first brood: 9

NaCl Reference Toxicant Results:

Reference Toxicant ID: DMDC34
Stock Solution ID: 19NA01
Date Initiated: June 26, 2019
48-h LC50 (95% CL): 5.2 (4.2 - 6.4) g/LNaCL

Reference Toxicant Mean and Historical Range: 5.3 (3.7 - 7.7) g/L NaCL
Reference Toxicant CV (%): 19

Test Results: The 48h LC50 is estimated to be >100% (v/v)

Reviewed by: [signature]
Date reviewed: July 2, 2019

Freshwater Acute
48 Hour Toxicity Test Data Sheet

Client: ALS Environmental
Sample ID: L2293385-2 NE-D
Work Order No.: 191229

Start Date/Time: June 20, 2019 @ 1245
CER #: 5
No. Organisms/volume: 10/200mL
Test Organism: *D.magna*
Set up by: ST

Thermometer: CER#5 pH meter/probe: 3 / 3 DO meter/probe: 3 / 3 Cond./Salinity meter/probe: 3 / 3

Concentration % (v/v)	Rep	Number of Live Organisms 24	Number of Live Organisms 48	No. Immobilized 48	Temperature (°C) 0	Temperature (°C) 24	Temperature (°C) 48	Dissolved oxygen (mg/L) 0	Dissolved oxygen (mg/L) 24	Dissolved oxygen (mg/L) 48	pH 0	pH 24	pH 48	Conductivity (µS/cm) 0	Conductivity (µS/cm) 48
CTRL	A	10	10	0	18.5	19.0	20.0	9.1	8.8	8.3	7.8	7.7	7.6	335	338
	B														
	C														
	D														
6.25	A	10	10	0	18.5	19.0	20.0	9.2	8.8	8.2	7.9	7.7	7.6	319	323
	B														
	C														
	D														
12.5	A	10	10	0	18.5	19.0	20.0	9.2	8.8	8.2	7.8	7.7	7.6	304	308
	B														
	C														
	D														
25	A	10	10	0	18.5	19.0	20.0	9.2	8.8	8.2	7.8	7.7	7.4	272	276
	B														
	C														
	D														
50	A	10	10	0	19.0	19.0	20.0	9.2	8.8	8.2	7.7	7.7	7.3	211	216
	B														
	C														
	D														
100	A	10	10	0	19.0	19.0	20.0	9.2	8.5	8.0	7.7	7.0	6.8	79	80
	B														
	C														
	D														
Technician Initials		ST	RL	RL	ST	ST	RL	ST	ST	RL	ST	ST	RL	ST	RL

Concentration	Hardness*	Alkalinity*
	*(mg/L as CaCo3)	
Control (MHW)	100	76
Highest conc.	50	4
Hardness adjusted	—	—

	Initial WQ	Adjustment	Adjusted WQ
Temp (°C)	19.5	aerated for 30 mins	19.0
DO (mg/L)	11.8		9.2
pH	6.9		7.7
Cond (µS/cm)	77		79
Salinity (ppt)	0.0		0.0

Comments: _____ Mortality: Heartbeat checked under microscope not req'd

Sample Description: turbid brown liquid, no particulates, no odour

Batch#: 052919A 7-d previous # young/brood: 37 Previous 7-d Mortality (%): 0 Day of 1st Brood: 9

Reviewed by: _____ Date reviewed: July 2, 2019

APPENDIX C – Chain-of-custody form

L2293385

VANCOUVER

ALS Environmental

Subcontract Request Form

Subcontract To:

NAUTILUS ENVIRONMENTAL
8664 COMMERCE COURT
BURNABY,BC V5A 4N7

NOTES: Please reference on final report and invoice: PO# *L2293385*
ALS requires QC data to be provided with your final results. Rbt - 191228
D. Magna - 191229

Please see enclosed 2 sample(s) in 2 Container(s)

SAMPLE NUMBER	ANALYTICAL REQUIRED	DATE SAMPLED / DUE DATE	Priority Flag
L2293385-1 NE-C		**6/15/2019**	**P**
	Daphnia Magna LC50 (48 Hour) - Nautilus (DAPHNIA-LC50-48HR-NL 1)	6/26/2019	10.8 °C
	Trout Bioassay LC50 (96 Hour) - Nautilus (TROUT-LC50-96HR-NL 1)	6/27/2019	
L2293385-2 NE-D		**6/15/2019**	**P**
	Daphnia Magna LC50 (48 Hour) - Nautilus (DAPHNIA-LC50-48HR-NL 1)	6/26/2019	10.3°C
	Trout Bioassay LC50 (96 Hour) - Nautilus (TROUT-LC50-96HR-NL 1)	6/27/2019	

Subcontract Info Contact: Walter Lin (604) 253-4188

Analysis and reporting info contact: Amber Springer, B.Sc
8081 LOUGHEED HWY
SUITE 100
BURNABY,BC V5A 1W9
Phone: (604) 253-4188 Email: amber.springer@alsglobal.com

Please email confirmation of receipt to: **amber.springer@alsglobal.com**

Shipped By: PAUL.C. June 19 2019

Received By: Tyrone Hamilton June 19/19 @ 15:58

Verified By:

NEW* Reporting Contacts:
Account Manager Listed Below
ALSEVDataSublet@ALSGlobal.com (PDF / EXCEL)
ALSE.CASDG@ALSGlobal.com (EDD/Database Formats)

Temperature:

Sample Integrity Issues: 2x20L

(TMAC Resources)

Tuesday, June 18, 2019 1:11 PM

END OF REPORT

ALS Environmental

Ch L2293385-COFC

COC # _____

Page 1 of 1

Report To:		Report Format / Distribution				Requested (Rush for routine analysis subject to availability)
Company:	TMAC Resources Ltd (Hope Bay)	☑ Standard	☐ Other			○ Regular (Standard Turnaround Times - Business Days)
Contact:	Environmental Site Manager	☑ PDF	☑ Excel	☑ Digital	☐ Fax	◉ Priority (2-4 Business Days) - 50% Surcharge - Contact ALS to Confirm TAT
Address:	95 Wellington Street West, Suite 1010	Email 1:	enviro@tmacresources.com			○ Emergency (1-2 Bus. Days) - 100% Surcharge - Contact ALS to Confirm TAT
	P.O. Box 44, Toronto, ON, M5J 2N7	Email 2:	enviro.tech@tmacresources.com			○ Same Day or Weekend Emergency - Contact ALS to Confirm TAT
Phone:	1-416-628-0216 Fax:	Email 3:				Analysis Request
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information				Please indicate below Filtered, Preserved or both (F, P, F/P)
Hardcopy of Invoice with Report?	☐ Yes ☑ No	Job #:				
Company:		PO / AFE:	4500011700			
Contact:		LSD:				
Address:		Job Ref:	Compliance Sampling Program			
Phone:	Fax:	Quote #:				
Lab Work Order # (lab use only)	L2293385	ALS Contact:	Amber Springer	Sampler:	KC	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	TMR100-ACULETHAL-VA	Number of Containers
	NE-C	15-Jun-19	21:05	water	X	1
	NE-D	15-Jun-19	21:30	water	X	1

L2293385-COFC

Special Instructions / Regulations with water or land use (CCME-Freshwater Aquatic Life/BC CSR - Commercial/AB Tier 1 - Na... ...ous Details

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.

By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.

Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
Patrick Jolliffe	18-Jun-19	7:30	MA	6/19	12:15	9 °C				

GENF 18.01 Front