LANDFILL MONITORING REPORT – BAF-5 RESOLUTION ISLAND

Resolution Island, Nunavut

Final Version
(Y/Ref.: SOA 01-09-6039-4) (O/Ref.: DI9653)

INDIAN AND NORTHERN AFFAIRS CANADA

March 2011

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March 2011

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LICENSEE
10 03, 2011
NWT/NU

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EXECUTIVE SUMMARY

Biogenie, a division of EnGlobe Corp., was awarded a contract by Indian and Northern Affairs Canada to carry out the monitoring of all the landfills at BAF-5 Former Dew Line Site in Resolution Island, NU.

The objective of the Landfill Monitoring Program is to collect sufficient information to assess the landfills' performance from a geotechnical and environmental perspective.

Biogenie personnel visited the site from August 5 to 11, 2010 and participated in fieldwork with the Analytical Services Unit of Queen's University personnel.

Data and information were collected during the visual inspection of the BAF-5 landfills for the following: Tier II Landfill, Airstrip Landfill and Maintenance Area Dump. According to the preliminary stability assessment, the overall performance of these 3 landfills has been rated acceptable.

Eleven soil-sampling stations were visited during the 2010 monitoring event. One surface sample (0-15 cm below ground surface) was collected from each sampling station, with the exception of MW-4, which was omitted.

During the 2010 field program, it was possible to collect groundwater from 12 out of the 15 monitoring wells. The water in MW21 was frozen and two monitoring wells (MW1B and MW3B) were dry; therefore groundwater from these 3 wells could not be sampled.

The soil and groundwater chemical analysis results for the 2010 Tier II Landfill samples are presented and commented on in this report.

Thermistors, only present at the Tier II Landfill, were inspected and found to be in good condition with no significant concerns identified. All analogues/thermocouples were found to be working properly. Data from all thermistors were successfully retrieved.

1 INTRODUCTION

1.1 LOCATION AND SITE FEATURES

Resolution Island is situated at the south-eastern tip of Baffin Island, just outside Frobisher Bay, at a longitude of 60°40'W and latitude of 61°35'N (see figure 1 in Appendix A) approximately 310 km southeast of Iqaluit. It is currently the site of an automated North Warning System radar. Previously, it was used as a Pole Vault communications station in operation from 1953 until 1972, when it was vacated by the U.S. Air Force and then owned by the Canadian Coast Guard, which in turn used it as a Long Range Navigation (LORAN) station until 1974. The site was transferred on to Indian and Northern Affairs Canada (hereinafter called INAC) in 1976. Cleanup and site remediation began in 1997 and were completed in 2006.

The current station, which consists of a new short-range radar station and some old buildings, is located at the top of a 360 m hill, and occupies approximately 3 km^2 (see figure 2 in Appendix A).

The site features include an airstrip and beaching area joined by a 6 km road, a Tier II Disposal Facility, a Landfarm, a Non-Hazardous Waste Landfill (NHWL), Polychlorinated biphenyls (PCBs) barriers, dumps, etc. The buildings remaining on site include:

- Garage
- Warehouse
- Former Cold Storage
- Airstrip Building
- Monitoring Camp
- Radome building
- Officer's quarters and mess
- Beach warehouse building
- Radio Hill building

Fuel storage tanks owned by the department of National Defence (DND) are also located on site.

The inspections taking place at Resolution Island are carried out according to the long-term monitoring plan (see *Resolution Island Monitoring Program*, NWB App. #NWB5RES0308, December 31, 2003 (hereinafter called "RIMP" (Appendix B)). The monitoring schedule for the 2010 BAF-5 Resolution Island site is provided in Table I in Appendix C.

1.2 OBJECTIVES AND SCOPE OF WORK

The objective of the INAC Landfill Monitoring Program is to collect sufficient information to assess the landfills' performance from a geotechnical and environmental perspective. INAC has specified the requirements for the Landfill Monitoring Program in Call-Up Number 04, part of the *Standing Offer Agreement Number 01-09-6039.*

The objective of the landfill monitoring is to ensure that the landfills are operating as intended. The accepted proposal dated August 3, 2010 submitted by Biogenie, a division of EnGlobe Corp. (hereinafter called "Biogenie") presents the scope of work, which generally includes the following activities:

- Visual inspection;
- Soil sampling done by the Analytical Services Unit (ASU) of Queen's University personnel (hereinafter called "Queen's");
- Groundwater sampling (done by Queen's);
- Thermal monitoring (Tier II Landfill);
- Creation of a photographic record;
- Production of Draft and Final reports.

1.3 REPORT FORMAT

This report describes the work carried out in August 2010 at three landfill sites at BAF-5 Resolution Island. The soil and groundwater sampling results, thermal monitoring, and visual inspection of the sites are also presented in the formats described in Call-Up Number 04. An electronic version of the report and its components (tables, figures and data files) is included in a CD-ROM enclosed to this report.

The report is organized with a separate chapter for each landfill containing all relevant information for each site such as:

- Visual inspection checklist;
- A selection of visual inspection photos;
- Thermal monitoring summary (where applicable);
- Plots of ground temperatures with depth at each thermistor installation (where applicable);
- Summary of 2010 soil analytical data;
- Evaluation of 2010 soil analytical data;
- Summary of 2010 groundwater analytical data
- Evaluation of 2010 groundwater analytical data.

The printed copy of the report only includes an index and thumbnail image of photos for each of the landfill areas. The photographic record is included in electronic format in the CD-ROM. Certificates of Analysis as well as Quality Assurance and Quality Control analytical results are attached in appendices.

1.4 REFERENCES

The following references are specifically relevant to the 2010 Landfill Monitoring activities:

A. Indian and Northern Affairs Canada, 2003. *Resolution Island Monitoring Program*, Nunavut Water Board App. #NWB5RES0308, December 31, 2003.
B. Indian and Northern Affairs Canada, 2010. *Call Up Number 04*, August 3, 2010.
C. Indian and Northern Affairs Canada, 2008. *Standing Offer Agreement – Expert Engineering and Advice, Environmental Investigations and Remediations for Various Locations*, April 18 2008.
D. Analytical Services Unit, Queen's University. *Resolution Island 2009, Monitoring and Research*, Prepared for Indian and Northern Affairs Canada, March 2010.

The range of the report, limitation of responsibilities as well as the detailed procedures for the use of this report are presented in Appendix D.

2 OUTLINE AND METHODOLOGY

2.1 FIELD PROGRAM STAFF

The on-site 2010 field program at BAF-5 Resolution Island took place from August 5 to 13, 2010. Biogenie assisted Queen's University personnel to perform the field work.

The field team, listed in Table II (Appendix C), consisted of engineers, students and local support personnel.

2.2 WEATHER CONDITIONS

Inclement weather hindered the work during the first few days on-site. Extended daylight hours provided the team with the opportunity of working longer hours and completing the work earlier than anticipated. The following conditions were encountered during the August 2010 data collection event:

- August 5 2010: approximately 7 ºC, partly cloudy sky and very light wind
- August 6 2010: approximately 6 ºC, very foggy, light wind
- August 7 2010: approximately 7 ºC, very foggy, very strong wind
- August 8 2010: approximately 6 ºC, very foggy, clear sky at times, moderate wind
- August 9 2010: approximately 4 ºC, foggy, moderate wind
- August 10 2010: approximately 3 ºC, foggy, light wind
- August 11 2010: approximately 8 ºC, clear sky, very light wind
- August 12 2010: approximately 8 ºC, clear sky, light wind
- August 13 2010: approximately 12 ºC, clear sky, very light wind

2.3 VISUAL INSPECTION

Data and information collected during the visual inspection of the BAF-5 landfills are included in the Visual Inspection Sheets. These sheets include such information as the location of settlement, erosion, frost action, sloughing and cracking, animal burrows, vegetation cover and stress, staining, seepage points, exposed debris, and any other features of relevance. The visual inspections were conducted with Queen's staff, which provided some context for observations.

Each feature was identified with an alpha-numeric symbol to be used consistently each year in an effort to track changes in condition for each specific feature. New features are added to the checklist and are noted as new observations. This symbol is shown on the figures for each landfill along with the symbol for the particular feature.

Digital photos with a measure of scale (when possible) were taken to show the actual general state of the landfills as well as features of interest.

The photos were taken with a Panasonic DMC-ZS7 12.1 megapixel (MP) and an Olympus Stylus Tough 3000 digital cameras. Full resolution digital JPEG copies are provided on a CD-ROM appended with the final report. The photo log for each landfill report includes the coordinates of the places where the photos were taken, the orientation (relative to geographic north), feature of note and picture number.

2.4 SOIL SAMPLING

Soil sampling was performed by Queen's. Refer to Queen's 2010 Monitoring Report for details on the sampling methodology.

Eleven (11) soil-sampling stations were visited during the 2010 monitoring event. One surface sample (0-15 cm depth below surface) was collected from each sampling station, with the exception of MW-4 due to its omission. The Certificates of Analysis for the 2010 monitoring campaign are enclosed in Appendix E of this report. No frozen ground or frost was encountered at the soil sampling stations during the August 2010 sampling event.

The soil sampling procedures included:

- Soil sample collections from locations adjacent of the monitoring wells;
- Duplicate samples (10 %) collection for QA/QC purposes.

The soil samples were analyzed for requested parameters (Total Petroleum Hydrocarbons (TPHs), metals (As, Cd, Cr, Co, Cu, Pb, Ni, and Zn) and PCBs) as specified in the RIMP. Table III in Appendix C summarizes the soil sampling locations at BAF-5 during the August 2010 field program.

2.5 GROUNDWATER SAMPLING

The groundwater sampling was performed by Queen's personnel. Refer to Queen's 2010 Monitoring Report for the methodology.

There are 15 monitoring wells at BAF-5. During the 2010 field program, it was possible to collect groundwater from 12 out of the 15 monitoring wells. Water in MW21 was frozen and two monitoring wells (MW1B and MW3B) were dry; therefore groundwater could not be sampled. Table IV in Appendix C summarizes the groundwater sampling locations at BAF-5 during the August 2010 field program.

2.6 THERMAL MONITORING

Thermistors are only present at the Tier II Landfill. They were inspected and observed to be in good condition with no significant concerns identified. All analogues/thermocouples were observed to be functioning properly. Data from all thermistors were successfully retrieved.

Specific detailed information regarding temperature data is contained in the Tier II Landfill section.

2.7 FIELD NOTES AND DATA

The locations of all observations and features for the visual inspection were recorded using the Panasonic GPS camera, as well as a hand-held Garmin GPS device (accuracy ±2 m.), courtesy of Stephen Hooey from INAC. Data packages collected from the individual vertical thermistors was downloaded directly into a field laptop computer.

2.8 QUALITY CONTROL

Sample collection was performed following the relevant standards to decrease the likelihood of compromising samples. The methods used for sample collection are summarized in Queen's Report.

Chain of custody (COC) forms were completed by the Queen's Team Leader after sample collection. The samples were refrigerated prior to shipment to the ASU at Queen's University in Kingston, Ontario, via Iqaluit and Ottawa. All analyses were completed as specified in the COC forms.

2.9 QA/QC PROCEDURES

Standard QA/QC procedures as specified in the RIMP and CCME Guidance Documents were used for this project.

ASU has QA/QC measures for the analysis of the samples. Please refer to Queen's Report for ASU's QA/QC reports.

3 TIER II LANDFILL

3.1 BACKGROUND AND MONITORING PROGRAM

The Tier II Landfill was constructed between 2003 and 2005. The design of the Tier II Landfill included the construction of compacted perimeter berms, and the placement of a cover of compacted granular fill over the landfilled material. Four monitoring wells and associated soil monitoring stations were established in 2003 and 5 additional monitoring wells were added in 2004. All the groundwater monitoring wells are installed on the landfill perimeter. Four thermistor strings were also placed in the landfill during construction. Groundwater monitoring well locations, as well as soil sample and thermistor installation locations are identified on Figure 3, Appendix A.

The long term monitoring plan consists of visual monitoring, and the collection of soil and groundwater samples. Those were sampled up to seven times during the 2004 and 2005 seasons in order to establish baseline data.

As requested in the RIMP, the 2010 monitoring of this landfill includes visual inspection to verify for evidence of settlement or erosion, collection of soil and groundwater samples to monitor the presence of leachate and monitoring of subsurface ground temperatures of the landfill.

The Tier II Landfill monitoring system is normally comprised of 9 groundwater monitoring wells and 8 associated soil monitoring stations: soil monitoring station 5 is adjacent to MW5A and MW5B. In 2010, as no water could be obtained from 2 of the wells (MW1B and MW3B), 7 wells were sampled. Besides, 5 soil stations were sampled due to the omission of MW4 and the collection of only 1 sample for the MW3A and MW3B sites. In the sampled wells, no signs of free-phase hydrocarbon were detected.

The visual inspection reports and the analytical results for the water and soil samples collected in 2010 are presented in the next sections.

3.2 VISUAL INSPECTION REPORT

The visual inspection of the Tier II Landfill was conducted on August 6 and 7, 2010. The Landfill Visual Inspection Checklist / Report is presented in Table V Appendix C and is supported by thumbnails photos, which are included in Appendix F.

Settlement

A subtle depression was observed on the northwest area near the bedrock wall (SM1). Other small isolated depressions were also observed on the northeast area (SM3) and on the south west berm (SM2). These depressions were consistent with the one observed during Queen's 2009 inspection with no apparent changes.

Erosion

The minor erosion channels previously observed at the Tier II Landfill on the southeast toe (next to the road) (E3), on the east toe (3 m from it) (E2), at the northeast corner (E1) and along the west berm (E9) were consistent with the ones observed during the 2009 inspection with no apparent changes. A new erosion gully has been identified along the south berm (E10).

Ponded Water

Heavy rains prior and during the visual inspection resulted in the channeling of surface runoff on the Tier II Landfill. Multiple ponds evenly distributed over the landfill were also created by these rain events. A new pond has been identified at the middle of the east berm, approximately 2 m from it (P11).

Frost Action

No evidence of frost action was observed.

Evidence of Burrowing Animals

No signs of burrowing animals were observed.

Reestablishment of Vegetation

No signs of the reestablishment of vegetation were observed.

Staining

Areas of surface staining were observed during the inspection in the vicinity of MW4 (ST1, ST2 and ST3).

Seepage Points

No seepage points were observed at this landfill.

Debris

No surface or exposed debris was observed at this landfill.

Presence/Condition of Monitoring Instruments

All monitoring wells and thermistor locations were in good condition with no evidence of frost action observed.

Other Features

As observed in previous years, the upstream position of the culvert near the service road at the east corner of the landfill was crushed (OF1).

Discussion

It was observed that surface runoff has resulted in the development of small rills across the surface with more pronounced channeling on the west face of the Tier II Disposal Facility. Although these features are currently deemed acceptable, it is anticipated that erosion of these areas will continue and should be closely monitored.

3.3 PRELIMINARY STABILITY ASSESSMENT

The Preliminary Stability Assessment for Tier II Landfill is included as Table VI in Appendix C of this report. The Tier II Landfill performance with respect to containment of debris and soil within the landfill is rated acceptable.

3.4 LOCATION PLAN

The Location Plan for the Tier II Landfill has been completed as per Call-Up Number 04 and is included in Appendix A as Figure 3.

3.5 PHOTOGRAPHIC RECORDS

The Photographic Record for Tier II Landfill has been completed as per Call-Up Number 04 and is included in Appendix F. It only contains an index and “thumbnail” photographs; full sized photographs are provided in the enclosed CD-ROM.

3.6 THERMAL MONITORING DATA

All thermistors at the Tier II Landfill were inspected and observed to be in good condition with no significant concerns identified. All analogues/thermocouples were observed to be functioning properly at the time of the inspection.

Data from all thermistors were successfully retrieved. Graphs 1 to 4 (Appendix G) summarize temperature data obtained from the dataloggers. These data are a representative example of monthly data points downloaded from thermistor dataloggers for the 2009-2010 period.

Raw data are provided in the enclosed CD-ROM.

3.7 SOIL SAMPLE ANALYTICAL DATA

The soil chemical analysis results for the 2010 Tier II Landfill samples are presented in Table VII and commented in Table VIII (Appendix C). The Certificates of Analysis are presented in Appendix E.

3.8 GROUNDWATER SAMPLE ANALYTICAL DATA

The groundwater chemical analysis results for the 2010 Tier II Landfill samples are presented in Table IX and commented in Table X in Appendix C. As noted above, MW1B and MW3B were dry during the inspection and consequently, no samples were collected at these locations.

4 AIRSTRIP LANDFILL

4.1 BACKGROUND AND MONITORING PROGRAM

The remediation of the airstrip landfill was completed in 2003. Four monitoring wells were installed around this landfill, one upgradient and three downgradient from it (Figure 4, Appendix A).

The 2010 monitoring of this landfill includes visual inspection to verify for evidence of settlement or erosion and the collection of soil and groundwater samples to monitor the presence of leachate. Water and soil sampling were conducted at all four wells locations. In the sampled wells, no signs of free-phase hydrocarbon were detected.

4.2 VISUAL INSPECTION REPORT

The visual inspection of the Airstrip Landfill was conducted on August 6 and 7, 2010. The Landfill Visual Inspection Checklist / Report is presented in Table XI Appendix C and is supported by thumbnails photos, which are included in Appendix F.

Settlement

No indications of consolidation or differential settlement were observed.

Erosion

The surface of the airstrip landfill is in good condition with marginal erosion. On the northwest berm, there is evidence of minor erosion (E1). The gravel berm was built with large boulders on the top surface. Some boulders and even some gravel from the actual berm have migrated down the slope. Several large shallow gullies have formed from the erosion.

The extent of the erosion is noted as marginal and should be reinvestigated next year. Local erosion was noticed on the west berm between MW12 and MW13 (E2), near the vegetation and visible debris. There are several deep gullies in sand/gravel.

Frost Action

No evidence of frost action was observed.

Burrowing Animals

No indications of burrowing animals were observed.

Reestablishment of Vegetation

No signs of the reestablishment of vegetation were observed.

Staining

No areas of staining were observed during the inspection.

Seepage Points

No seepage points were observed at this landfill.

Debris

Several areas of surface and partially exposed debris such as crushed metal parts and steel drums were observed mostly to the southwest, including the landfill and the perimeter areas (D1, D2 and D3).

Presence/Condition of Monitoring Instruments

All monitoring wells were in good condition with no evidence of frost action.

Discussion

It was observed that surface runoff has continued to erode sandy soil from the drainage channels situated along the northwest side of the landfill. It is anticipated that more debris will be exposed with ongoing erosion of the peripheral drainage areas.

4.3 PRELIMINARY STABILITY ASSESSMENT

The Preliminary Stability Assessment for the Airstrip Landfill has been completed and is included in Table XII (Appendix C). The Airstrip Landfill performance with respect to containment of the debris within the landfill is rated as acceptable.

4.4 LOCATION PLAN

The Location Plan for the Airstrip Landfill has been completed and is included in Figure 4, Appendix A.

4.5 PHOTOGRAPHIC RECORDS

The Photographic Record for the Airstrip Landfill has been completed and is included in Appendix F. The Photographic Record only contains an index and “thumbnail” photographs. Full sized photographs are provided in the CD-ROM.

4.6 THERMAL MONITORING DATA

Not applicable to this landfill.

4.7 SOIL SAMPLE ANALYTICAL DATA

The soil chemical analysis results for the 2010 Airstrip Landfill samples are presented in Table XIII and commented in Table XIV (Appendix C). The Certificates of Analysis are presented in Appendix E.

4.8 GROUNDWATER ANALYSIS RESULTS

The groundwater chemical analysis results for the 2010 Airstrip Landfill samples are presented in Table XV and commented in Table XVI (Appendix C).

5 MAINTENANCE AREA DUMP

5.1 BACKGROUND AND MONITORING PROGRAM

The remediation of the maintenance area dump was completed in 2005 and two monitoring wells and two soil monitoring stations were established (Figure 5, Appendix A).

The visual inspection reports as well as analytical results for the water and soil samples collected in 2010 are presented in the next sections.

5.2 VISUAL INSPECTION REPORT

The visual inspection of the Maintenance Area Dump was conducted on August 8, 2010. The Landfill Visual Inspection Checklist / Report is presented in Table XVII (Appendix C) and is supported by thumbnails photos, which are included in Appendix F.

Settlement

No indications of consolidation or differential settlement were observed.

Erosion

No erosion of the capping material was observed.

Frost Action

No evidence of frost action was observed.

Burrowing Animals

No signs of burrowing animals were observed.

Reestablishment of Vegetation

The area has more vegetation than last year, according to Queen's.

Staining

No areas of staining were observed during the inspection.

Seepage Points

There were no seepage points at this landfill.

Debris

No surface or exposed debris was observed at this landfill.

Discussion

No leaching of contaminants was found and the preliminary stability assessment showed no evidence of erosion and instability.

5.3 PRELIMINARY STABILITY ASSESSMENT

The Preliminary Stability Assessment for the Maintenance Area Dump has been completed and is included in Table XVIII (Appendix C) of this report. The Maintenance Area Dump performance is rated as acceptable.

5.4 LOCATION PLAN

The Location Plan has been completed and is included in Figure 5, Appendix A.

5.5 PHOTOGRAPHIC RECORDS

The Photographic Record for the Maintenance Area Dump has been completed and is included in Appendix F. The Photographic Record only contains of an index and "thumbnail" photographs; full sized photographs are provided in the enclosed CD-ROM.

5.6 THERMAL MONITORING DATA

Not applicable to this landfill.

5.7 SOIL SAMPLE ANALYTICAL DATA

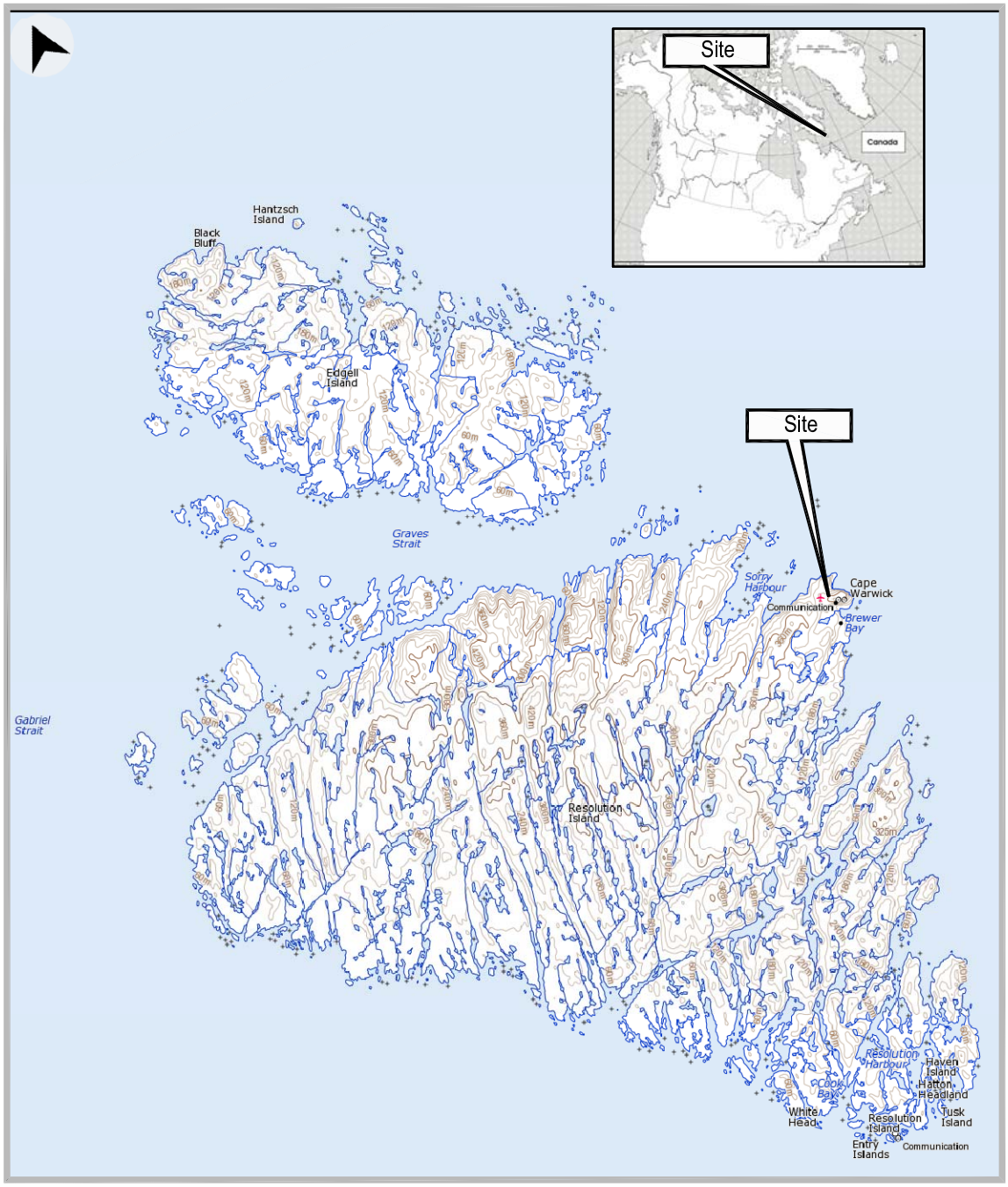
The soil chemical analysis results for the 2010 Maintenance Dump Area samples are presented in Table XIX and commented in Table XX (Appendix C). The Certificates of Analysis are presented in Appendix E.

5.8 GROUNDWATER ANALYTICAL RESULTS

The groundwater chemical analysis results for the 2010 Maintenance Dump Area samples are presented in Table XXI and commented in Table XXII (Appendix C). As mentioned above, water in MW21 was frozen; therefore groundwater could only be sampled in MW22.

APPENDIX A

Figures



Biogénie / Indian and Northern Affairs Canada	COLLECTION OF LANDFILL MONITORING DATA AT BAF-5 POLE VAULT MILITARY RADAR STATION RESOLUTION ISLAND NUNAVUT	SITE LOCATION SCALE = 1 : 1,000,000 **FIGURE 1**

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LEGEND

0 150m 300m 450m 600m 750m

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Indian and Northern Affairs Canada

COLLECTION OF LANDFILL MONITORING DATA AT BAF-5 POLE VAULT MILITARY RADAR STATION

RESOLUTION ISLAND, NUNAVUT

GENERAL LAYOUT

SITE REMEDIATION SOLUTIONS

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Metre	1 : 15,000	MARCH 2011
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PROJECT NO:	DRAWING NO:	PAGE
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FIGURE 2

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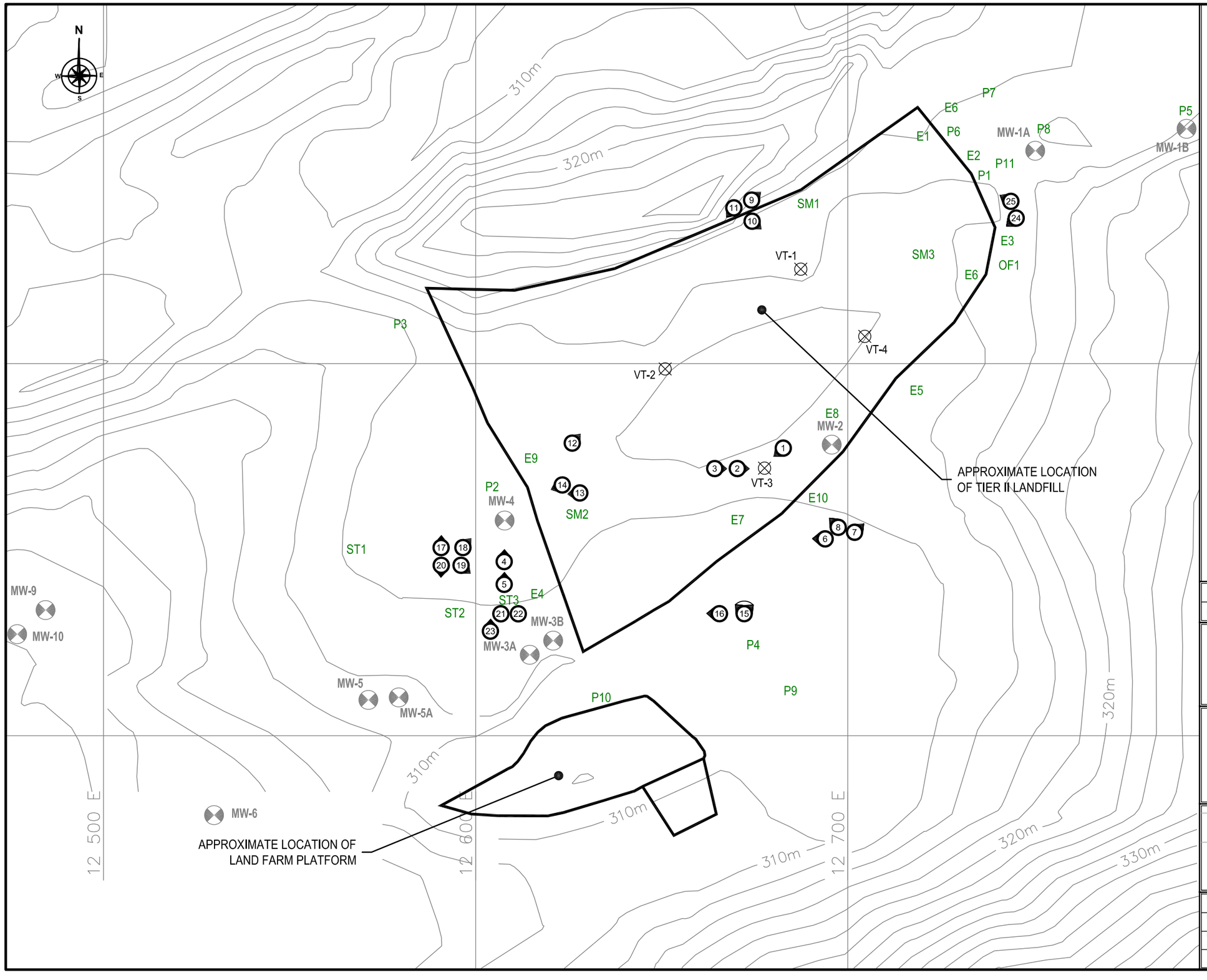

LEGEND

- Monitoring Well
- Thermistor (Approximate Location)
- Photo Viewpoint (Approximate Location)
- Soil Sampling Location
- P7 Features

0 10m 20m 30m 40m 50m

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Indian and Northern Affairs Canada

COLLECTION OF LANDFILL MONITORING DATA AT BAF-5 POLE VAULT MILITARY RADAR STATION

RESOLUTION ISLAND, NUNAVUT

TIER II LANDFILL SITE

SITE REMEDIATION SOLUTIONS

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PROJECT NO: DI9653_005_101	DRAWING NO: DI9653_005_101-PL_LANDFILL	PAGE PL

FIGURE 3

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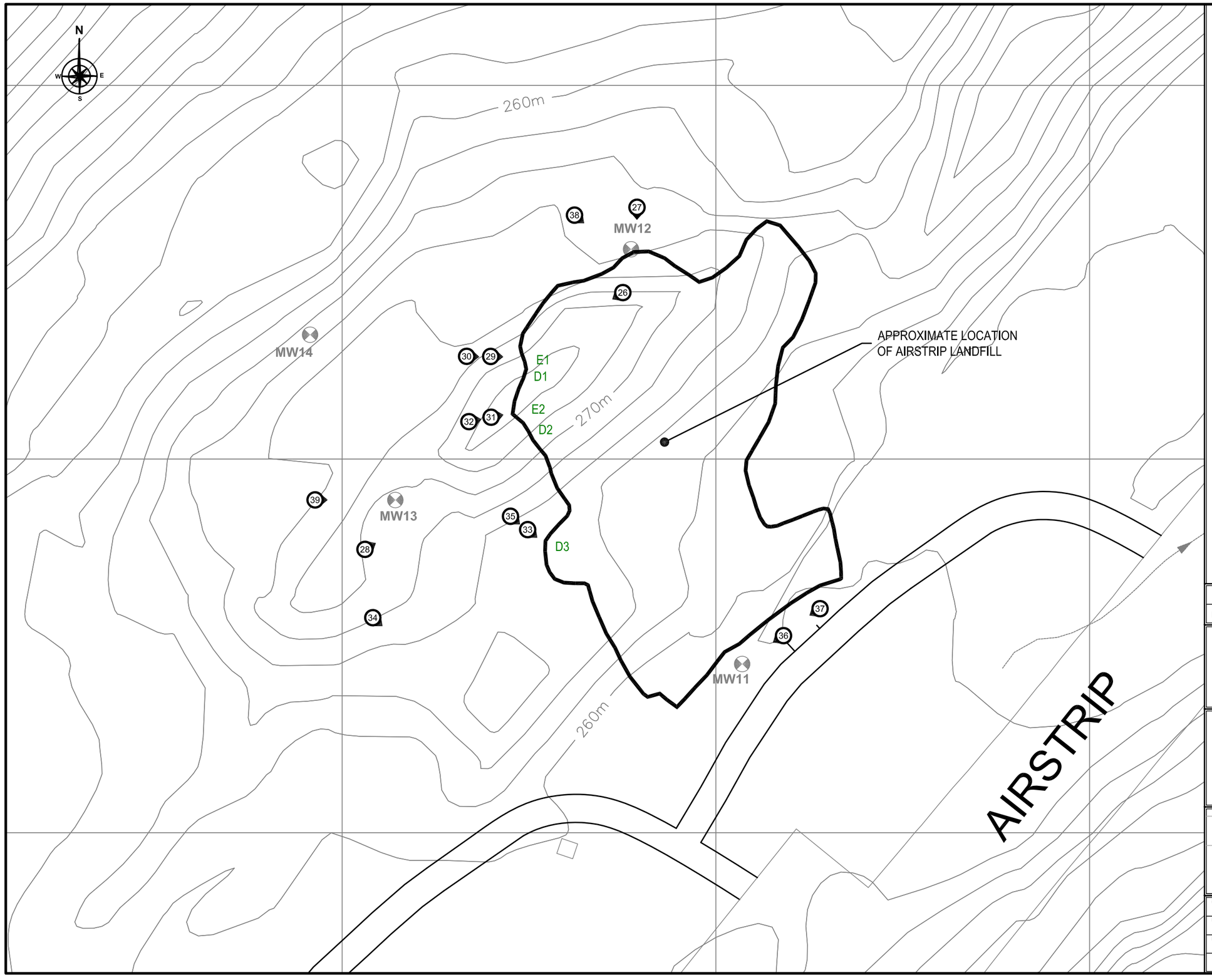

LEGEND

- Monitoring Well
- Photo Viewpoint (Approximate Location)
- Soil Sampling Location
- D3 Features

0 10m 20m 30m 40m 50m

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COLLECTION OF LANDFILL MONITORING DATA AT BAF-5 POLE VAULT MILITARY RADAR STATION

RESOLUTION ISLAND, NUNAVUT

AIRSTRIP LANDFILL

SITE REMEDIATION SOLUTIONS

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FIGURE 4

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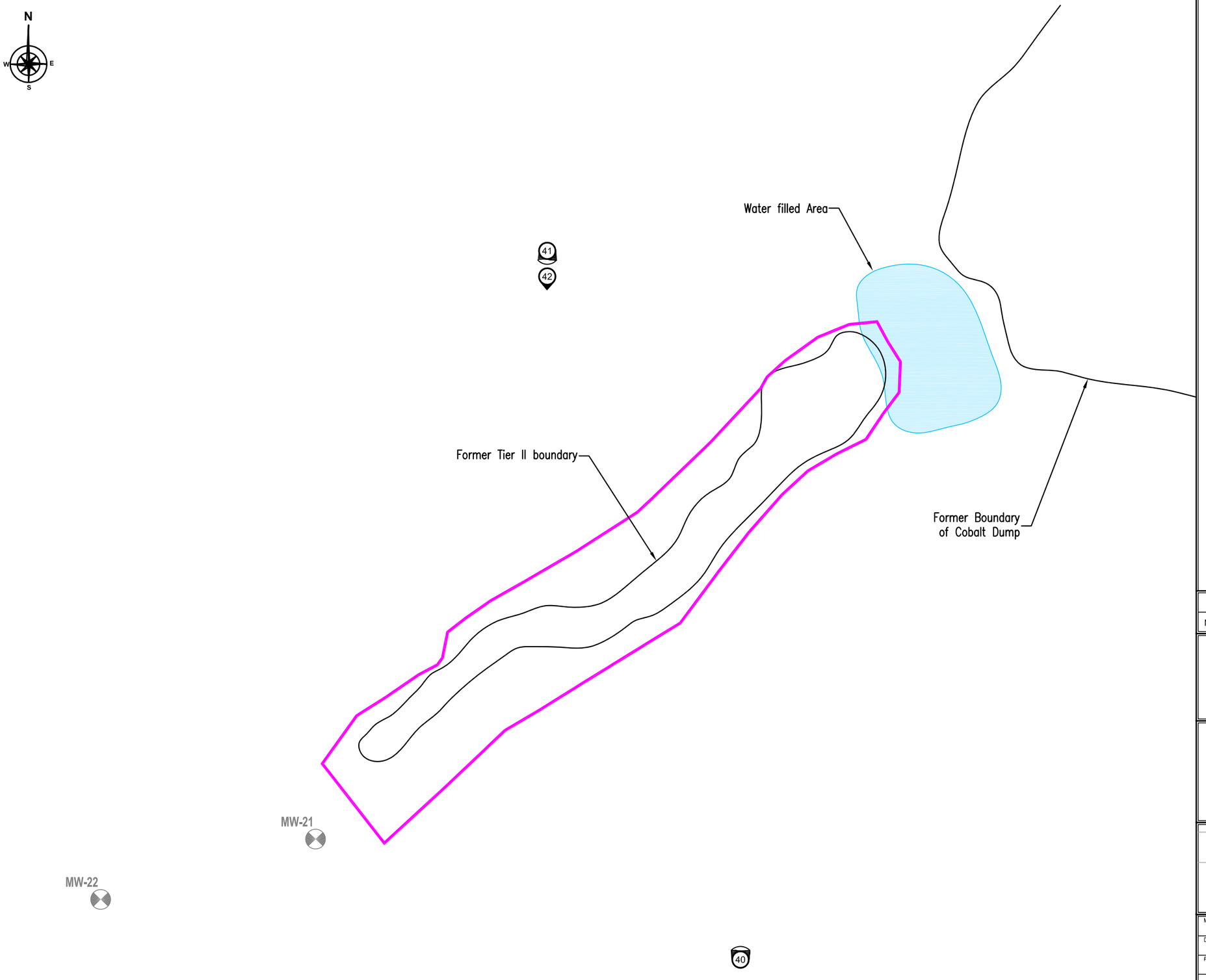

LEGEND

- Monitoring Well
- Extend of Excavation
- Photo Viewpoint (Approximate Location)
- Soil Sampling Location

0 2.5m 5m 7.5m 10m 12.5m

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COLLECTION OF LANDFILL MONITORING DATA AT BAF-5 POLE VAULT MILITARY RADAR STATION

RESOLUTION ISLAND, NUNAVUT

MAINTENANCE DUMP AREA

SITE REMEDIATION SOLUTIONS

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Metre	1 : 250	MARCH 2011
DRAWN BY: P. LÉGARÉ	VERIFIED BY: J.-P. PELLETIER	APPROVED BY: R. GAUTHIER
PROJECT NO: DI9653_005_101	DRAWING NO: DI9653_005_101-PL_DUMP	PAGE PL

FIGURE 5

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APPENDIX B

Resolution Island Monitoring Plan

Department of Indian Affairs and Northern Development
Northern Affairs Program

Resolution Island Monitoring Program

NWB App. #NWB5RES0308

(December 31, 2003)

Table of Contents

EXECUTIVE SUMMARY

Resolution Island BAF-5 is located at the southeastern tip of Baffin Island, approximately 310km southeast of Iqaluit and just outside Frobisher Bay. It was part of the Pole Vault Line, used to transmit intercepted northern signals to southern military stations. This site was operated from 1953 to 1972 when the site was vacated by the U.S. Air Force. The site occupies an area of approximately 3 square km, and while in operation, over 200 people were stationed there. Over 20 buildings, eight dump sites, over 4000 barrels, and large amounts of visible debris were left on site. A series of environmental assessments conducted from 1985-1997 identified and delineated contamination on the site. The site is highly contaminated with PCBs from electrical equipment in the communications complex buildings, many buildings contain asbestos, and soils contaminated with hydrocarbons, lead, cobalt, mercury, and copper were also found.

Since 1997 the site has been under active remediation which is scheduled to continue for two more years. Following the clean up and remediation of the BAF-5 Resolution Island former military site a long-term monitoring program will be implemented. The 2003 field season witnessed the largest effort and volume of remediation work completed to-date with over 2000 m^3 of contaminated soil containerized, shipped offsite and thermally treated. Identified below are the estimated masses and progress to date for all PCB contaminated material on Resolution Island.

Area	Estimated mass of PCB (kg)	Status
PCB oil from transformers and barrels	4000	Completed
PCB contaminated building material	100	Stored on site for shipment in 2004
S1/S4 Valley	3498	3396 kg remediated
S1/S4 Beach	1285	To begin in 2004
Furniture Dump	181	Completed
Airstrip Dump	23	Completed
PCL Dump	6	50% Complete
DND Helipad	3	33% Complete
Total	**9096**	**84.6% Complete**

Table 1: Estimated PCB mass on Resolution Island

1.0 MONITORING AREAS

The monitoring plan will be concerned with the landfills, dumps and the permanent interceptor barriers. The remediation plan proposed below is based largely on the agreement between Nunavut Tunngavik Incorporated (NTI) and the Department of National Defence (DND) for the clean-up and restoration of DEW line sites within the Nunavut settlement area (environmental provisions 1998).

1.1 New Landfills

Non Hazardous Landfills

Three (3) new landfills for non-hazardous (NH) wastes will be present at the end of the project:
1) the East Camp NH Landfill,
2) the West Camp NH Landfill, and
3) the Beach NH Landfill.

These landfills will be inspected visually for stability only. This visibility inspection will look for any settling, ponding, erosion or frost action that may have occurred. If there are signs of instability at these landfills such that buried material becomes exposed, then remedial action will be required. Table 2 summarizes the monitoring requirements for the three (3) non-hazardous landfills.

Tier II Landfill

For the Tier II landfill, visual inspection, water and soil monitoring as well as the recording of thermal measurements are proposed. The location of the Tier II landfill is presented in Figure 1.

The landfill will be inspected visually for stability. If there are any signs of instability (*i.e.,* settling, ponding, erosion or frost action) such that the geomembrane liners or buried material become exposed, then remedial action will be required.

Three (3) monitoring wells (MW) will be installed down-gradient form the landfill and one (1) up-gradient. The three (3) down-gradient wells were installed in 2003, the remaining well (up-gradient) will be installed in 2004. The location of the installed and proposed MW is presented in Figure 3. Monitoring of these locations will begin in 2004. Water from the wells will be tested for As, Cd, Cr, Co, Cu, Pb, Ni, and Zn, PCBs, and TPH. Furthermore, the following parameters will be measured on site: pH, conductivity, and temperature.

Soil collected from four (4) locations adjacent to the monitoring wells will be analysed for the same set of parameters. Remediation steps will be required if the analytical results show a significant increase in contamination over a period of three (3) or more years.

Three (3) thermister strings will be placed within the landfill so as to record temperature at 0.5 m intervals. Temperatures will be recorded during the annual site visit. This landfill is designed to ensure that all the buried Tier II material should remain frozen. This steady state should be reached within 3 to 4 years. Remedial action could be required if all the buried material is not frozen permanently. The location of the proposed thermisters is presented in Figure 3. Table 2 summarizes the monitoring requirements for the Tier II Landfill and Table 3 summarizes the specific location and monitoring criteria of each monitoring well.

1.2 Old Dumps

The Airstrip and Maintenance dumps will be visually monitored for stability and have a water and soil sampling program. The location of these dumps is presented in Figure 1. Water and soil monitoring points will be established down-gradient from each dump with one reference location up-gradient. Table 2 sumarizes the general monitoring requirements for these dumps while Table 3 shows the specific monitoring criteria.

In the case of the Maintenance dump three (3) points will be established at 10m and 30m down-gradient and one up-gradient from the dump and monitored for cobalt (Co) only. The location of the monitoring wells is presented in Figure 3.

For the Airstrip dump, four (4) monitoring wells will be established at 5 m, 25 m and 50 m down-gradient and one up-gradient from the dump. The up-gradient well and one down-gradient (25 m) well were installed in 2003. Figure 2 shows the location of the monitoring wells with respect to the dump.

1.3 Interceptor Barriers

The two (2) permanent interceptor barriers (*i.e.,* S1/S4 Valley barrier and S1/S4 Beach barrier) will be inspected and repaired, if necessary at each monitoring visit. The location of these barriers is presented in Figure 3.

Any silt collected by the barriers will be excavated and/or any used filters that need to be replaced will be removed and placed into plastic drums and sub-samples collected for PCB analysis. These drums will be temporarily stored in building B2 at the beach area. The drum contents will be managed according to the PCB level in the soil. In addition soil samples will be collected from the clean cells which will be established beyond the barriers. Table 2 summarizes the monitoring requirements for the interceptor barriers and Table 3 summarizes the specific monitoring criteria for the soil samples.

1.4 GPS Locations

The GPS coordinates of all sampling points will be measured during the 2004 season and subsequent seasons and will be reported starting in 2004.

Location	Visual	Water	Soil	Thermal
East Camp NH Landfill	X			
West Camp NH Landfill	X			
Beach NH Landfill	X			
Tier II Landfill	X	X	X	X
Maintenance Dump	X	X	X	
Airstrip Dump	X	X	X	
S1/S4 Valley Barrier	X		X	
S1/S4 Beach Barrier	X		X	

Table 2: General Monitoring Requirements

	Water & Soil				Thermal		
Location	ID	Notes	Distance	Install Date	ID	Depth	Install Date
Tier II Landfill	MW-1	Up-gradient	n/a	2004	TH-1	Various*	2005
	MW-2	Down-gradient	5 m (E)	2003	TH-2	Various*	2005
	MW-3	Down-gradient	5 m (S)	2003	TH-3	Various*	2005
	MW-4	Down-gradient	5 m (W)	2003			
Maintenance Dump	MW-11	Down-gradient	10 m	2004	* dependent on soil depth		
	MW-12	Down-gradient	30 m	2004			
Airstrip Dump	MW-20	Up-gradient	n/a	2003			
	MW-21	Down-gradient	5 m	2004			
	MW-22	Down-gradient	25 m	2003			
	MW-23	Down-gradient	50 m	2004			
S1/S4 Valley barrier	STV	Up-gradient	n/a	2003			
	CCV	Clean cell soil	n/a	2003			
	BWV	Down-gradient	n/a	2003			
S1/S4 Beach Barrier	STB	Up-gradient	n/a	2005			
	CCB	Clean cell soil	n/a	2005			
	BVB	Down-gradient	n/a	2005			

Table 3: Specific Monitoring Requirements

1.5 Monitoring Schedule

Initially, a baseline study will be conducted in 2006 during demobilization of equipment and infrastructure. Monitoring will then be conducted, according to the requirements on Table 2, once a year in approximately mid-August. Based on the agreement between NTI and DND, the frequency of the program will be on a yearly basis for the first 5 years, then year 7, 10, 15 and 25 if no problems are encountered. A full review of all data will be undertaken in the fifth year. The proposed monitoring schedule is presented in Table 4.

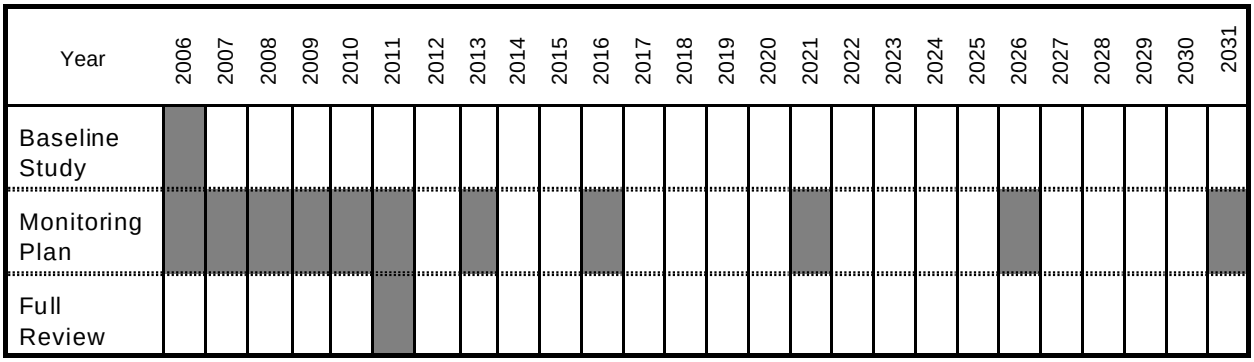


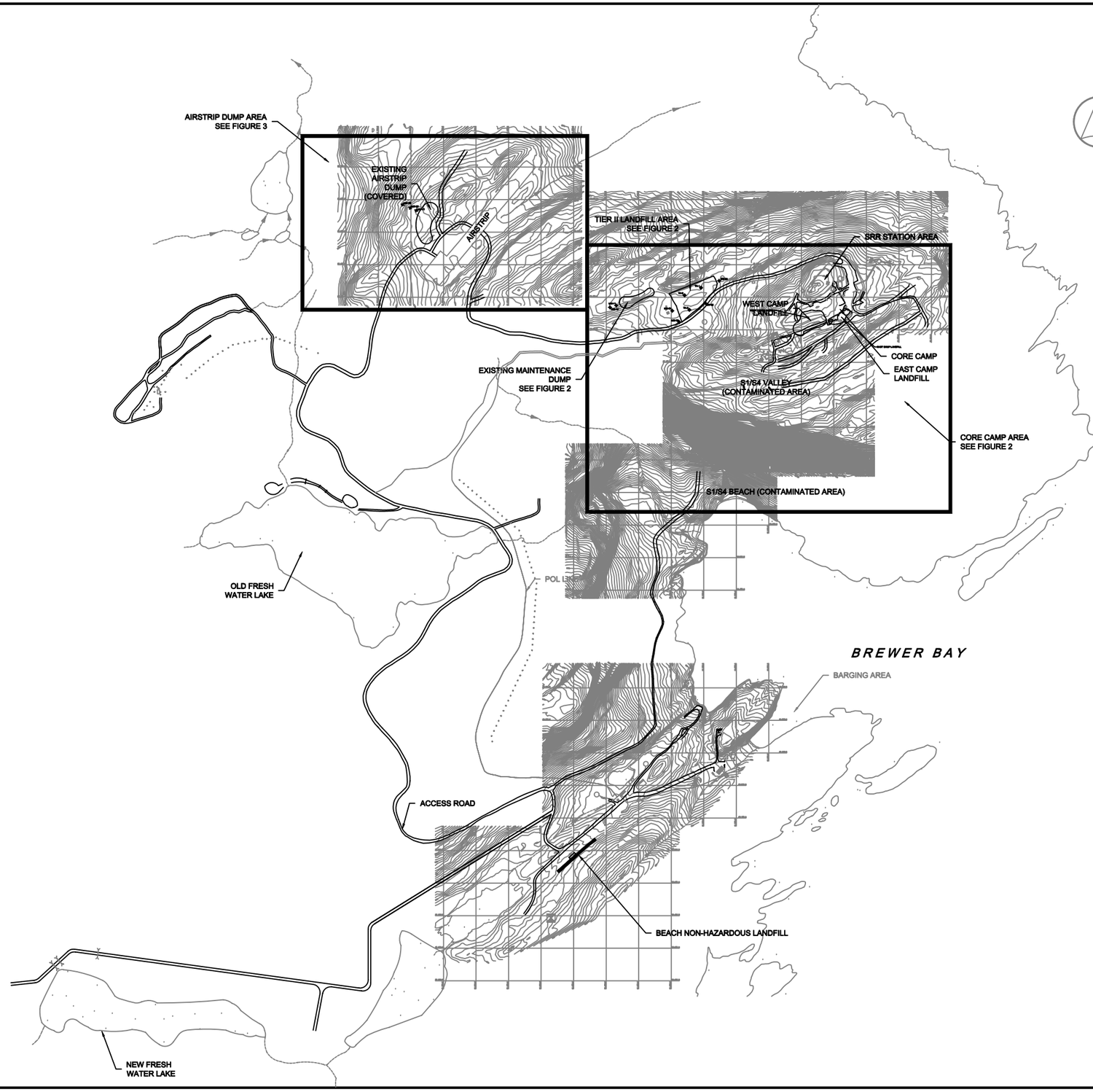
Table 4: Proposed Monitoring Schedule

1.6 Sampling and Analysis

All sampling, sample preservation and analyses will be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater". All analysis will be performed in a Canadian Association of Environmental Analytical Laboratories (CAEAL) Accredited Laboratory.

1.7 Quality Assurance/Quality Control (QA/QC) Plan

Quality Assurance/Quality Control (QA/QC) will be consistent with CAEAL regulations and guidelines. At least 20% of samples will be taken and analysed in duplicate and all appropriate laboratory QA/QC data will be generated and reported.



INDIAN AND NORTHERN AFFAIRS CANADA

NUNAVUT REGIONAL OFFICE

General Notes:

1. LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.

Legend:

No.	DATE	REVISION	REVISION	APPR.

QIKIQTAALUK CORPORATION

Sinanni inc.

SCALE - ÉCHELLE 100 50 0 100 200 300 m

PROJECT - PROJET

BAF-5 RESOLUTION ISLAND

TRADE - MÉTIER	DATE
SITING	2003-12-11

SUBJECT - SUJET

FIGURE 1
GENERAL SITE LAYOUT AND DRAWING INDEX

PRODUCTION	CONCURRENCE - ASSENTIMENT
DESIGNED ÉTUDIE	P.S.
DRAWN DESSINE	G.J.
CHECKED VÉRIFIE	K.C.
COORDINATION	REVIEWED - REVU

DWG. NO. - DESSIN NO.
MP-2003-102-01

Canada

INDIAN AND NORTHERN AFFAIRS CANADA

NUNAVUT REGIONAL OFFICE

General Notes:

1. LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.

Legend:

No.	DATE	REVISION	REVISION	APPR.

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Sinanni inc.

SCALE - ÉCHELLE 20 10 0 20 40 60 m

PROJECT - PROJET: BAF-5 RESOLUTION ISLAND

TRADE - MÉTIER: SITING

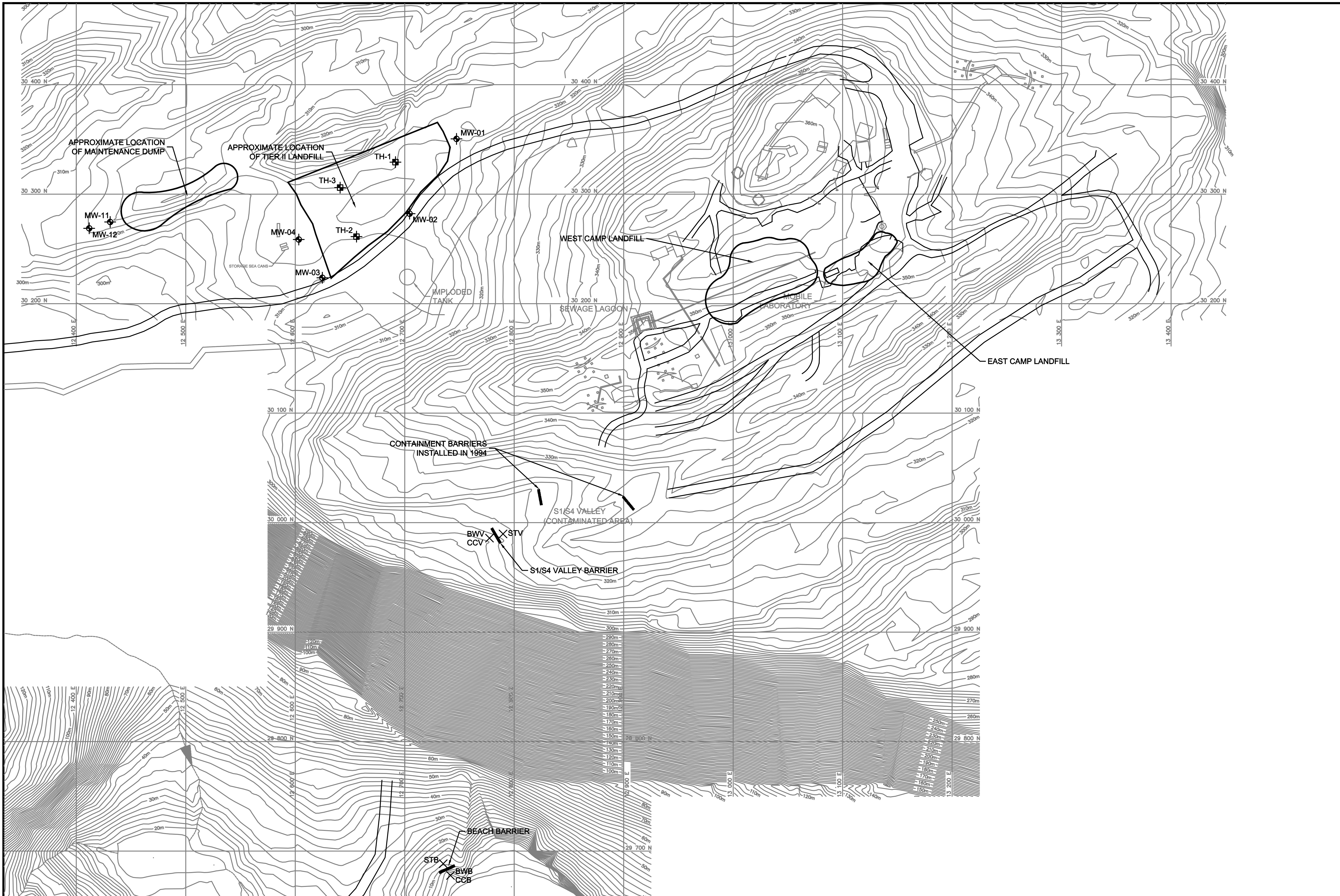
DATE: 2003-12-11

SUBJECT - SUJET: FIGURE 3 AIRSTRIP DUMP

PRODUCTION	CONCURRENCE - ASSENTIMENT
DESIGNED ÉTUDIE	P.S.
DRAWN DESSINE	G.J.
CHECKED VÉRIFIE	K.C.
COORDINATION	REVIEWED - REVU

DWG. NO. - DESSIN NO. MP-2003-102-03

Canadä



INDIAN AND NORTHERN AFFAIRS CANADA

NUNAVUT REGIONAL OFFICE

GENERAL NOTES:

1. LOCATIONS ARE APPROXIMATE AND NOT SURVEYED.

LEGEND:

No.	DATE	REVISION	REVISION	APPR.

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Sinanni inc.

SCALE - ÉCHELLE 50 25 0 50 100 m

PROJECT - PROJET
BAF-5 RESOLUTION ISLAND

TRADE - MÉTIER: SITING
DATE: 2003-12-11

SUBJECT - SUJET
FIGURE 2
LOCATION OF EAST AND WEST CAMP NON-HAZARDOUS LANDFILLS, THE S1/S4 VALLEY AND BEACH BARRIERS, TIER II LANDFILL, AND MAINTENANCE DUMP

PRODUCTION	CONCURRENCE - ASSENTIMENT
DESIGNED ÉTUDIE	P.S.
DRAWN DESSINÉ	G.J.
CHECKED VÉRIFIÉ	K.C.
COORDINATION	REVIEWED - REVU

DWG. NO. - DESSIN NO.
MP-2003-102-02

Canada

APPENDIX C

Tables

Table I : 2010 Monitoring Requirements for BAF-5 Landfills

Landfill	Visual Inspection	Soil Sampling	Groundwater Sampling	Thermal Monitoring
Tier II Landfill	✓	✓	✓	✓
Airstrip Landfill	✓	✓	✓	
Maintenance Area Dump	✓	✓	✓	

Table II : Field Team

Personnel	Role	Company	Period
Stephen Hooey	Senior Project Manager	INAC	August 5 to 11
Nicolas Audet	Project Engineer	Biogenie	August 5 to 11
Rebecca McWatters	Team Leader	Queen's	August 5 to 13
Sonja Koster	Assistant	Queen's	August 5 to 13
Daniel Jones	Assistant	Queen's	August 5 to 13
Alex Gerber	Assistant	Queen's	August 5 to 13
Ellen Woolfenden	Assistant	Queen's	August 5 to 13
Johnny Qammaniq	Wildlife Monitor	Local	August 5 to 13
Siut Peter	Wildlife Monitor	Queen's	August 11 to 13
Lazarus Arreak	Cook	Local	August 5 to 11
Pierre Pernod	Cook	SILA	August 11 to 13

Table III : Summary of Soil Sampling at BAF-5, August 2010

Landfill Site	Soil Sample Locations				
Tier II Landfill	MW1	MW2	MW3	MW5	MW6
Airstrip Landfill	MW11	MW12	MW13	MW14	
Maintenance Area Dump	MW21	MW22			

Table IV : Summary of Groundwater Sampling at BAF-5, August 2010

Landfill Site	Groundwater Sample Locations						
Tier II Landfill	MW1A	MW2	MW3A	MW4	MW5A	MW5B	MW6
Airstrip Landfill	MW11	MW12	MW13	MW14			
Maintenance Area Dump	MW22						

Notes: All monitoring wells were inspected and observed to be in good condition with no significant concerns identified.

Table V : Landfill Visual Inspection Checklist / Report – Tier II Landfill

LANDFILL VISUAL INSPECTION

Site Name: BAF-5, Resolution Island
Landfill Designation: Tier II Landfill
Date of Inspection: August 6-7, 2010
Date of Previous Inspection: August 18, 2009
Inspected by: Nicolas Audet, P.Eng., M.Sc.

The inspector/reporter represents to the bestof their knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge and that no material facts have been suppressed or misstated.

TIER II LANDFILL

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Record	Severity Rating	Additional Comments
Settlement	Yes	SM1 - north west area near bedrock wall	~ 0.5 m	~ 0.2 m	20 cm	Isolated	Pockets.	N/A	Acceptable	Not significant.
		SM2 - south west berm	0,3 m	0.2 m	10 cm	Occasional	---	13	Acceptable	Not significant.
		SM3 - north east area	0.5 m	0.5 m	10 cm	Isolated	Gradual sinking.	N/A	Acceptable	Maybe present from construction.
Erosion	Yes	E1 - NE corner	-	-	-	Isolated	From surface water runoff on road.	N/A	Acceptable	No additional erosion.
		E2 - 3 m from east toe	-	-	-	Isolated	---	N/A	Acceptable	No additional erosion.
		E3 - SE toe next to road	-	-	-	Isolated	---	24	Acceptable	No additional erosion.
		E4 - toe of SW corner	30 m	1 to 2 m	20 cm	Isolated	Several erosion channels from runoff.	N/A	Acceptable	Appear stable.
		E5 - south side adjacent to road	50 m	1 m	50 cm	Isolated	Small channel from surface water runoff.	N/A	Acceptable	Not significant.
		E6 - largest drainage gully near NE corner	-	-	-	Isolated	Small amount of erosion on steep slope.	N/A	Acceptable	Not significant.
		E7- south berm area, near thermister VT-3	3 m	1 m	10 cm	Isolated	Surface water runoff extends down landfill slope.	N/A	Acceptable	Smaller than previous year.
		E8 - middle east berm	10 m	15 m	10 to 50 cm	Isolated	Surface water runoff.	N/A	Acceptable	Similar to previous year.
		E9 - along west berm	8 to 10 m	1 to 2 m	10 to 20 cm	Isolated	Water runoff from west middle of landfill to west berm. Small finger gullies.	N/A	Acceptable	Same as previous year.
		E10 - S berm NEW OBS.	2 m	1 m	10 to 20 cm	Isolated	Erosion channel from surface water runoff.	8	Acceptable	Not significant.

Table V : Landfill Visual Inspection Checklist / Report – Tier II Landfill (cont.)

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Record	Severity Rating	Additional Comments
Ponded water	Yes	P1 - middle of east berm, 1-3 m from berm	6 m	2 m	6 cm	Isolated	3 m east of berm, ponded water observed.	N/A	Acceptable	
		P2 - west toe of berm (near MW4)	2 m	0.5 m	4 cm	Isolated	Water observed.	17-18	Acceptable	
		P3 - NW corner	1 m	1.5 m	9 cm	Isolated	No water observed, dry ponds.	N/A	Acceptable	
		P4 - south of landfill adjacent to landfarm	3 m	1 m	5 cm	Isolated	Small water pond.	N/A	Acceptable	
		P5 - 30 m east of landfill surrounding MW1A	27 m	10 m	30 cm	Isolated	From rain, not landfill area.	N/A	Acceptable	Larger pond than last year.
		P6 - north east berm, 4 m from berm	15 m	5 m	15 cm	Isolated	Small pond.	N/A	Acceptable	Evidence of larger pond.
		P7 - north east berm, 10 m from berm	8 m	12 m	15 cm	Isolated	Ponded water from rain.	N/A	Acceptable	
		P8 - surrounding MW1B	12 m	12 m	10 cm	Isolated	Ponded water.	N/A	Acceptable	Low area where MW1B exists.
		P9 - 40 m south of landfill	25 m	15 m	10 to 30 cm	Isolated	Large pond from rain, not landfill area	N/A	Acceptable	
		P10 - parallel to P4 on opposite side of the road.	2 m	30 m	4 cm	Isolated	Ponded water in ditch adjacent to road	N/A	Acceptable	
		P11 - middle of east berm, 2 m from berm NEW OBS.	2 m	1 m	5 cm	Isolated	Ponded water observed	N/A	Acceptable	
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A

Table V : Landfill Visual Inspection Checklist / Report – Tier II Landfill (cont.)

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Record	Severity Rating	Additional Comments
Staining	Yes	ST1 - west toe, adjacent to landfill berm	5 m	30 m	10 cm	Isolated	Old rust stain, stable.	N/A	Acceptable	Same size as previous year.
	Yes	ST2 - west toe, from MW4 to MW5A NEW OBS.	2 m	20 m	10 cm	Isolated	Hydrocarbon sheen.	N/A	Marginal	
	Yes	ST3 - west toe, from MW4 to MW3B NEW OBS.	1 m	15 m	10 cm	Isolated	Hydrocarbon sheen.	4-5-21-22-23	Marginal	
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Debris Exposed	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Presence/Condition of Monitoring Instruments	Yes	VT-1 to VT-4	N/A	N/A	N/A	N/A	Inclined protective surface casings	1-2-3	Marginal	Protective surface casings at VT-1 to VT4 are inclined between 10º and 20º from vertical. Observations are consistent with previous year. Successfully downloaded ground temperature data from loggers.
Other Feature	Yes	OF1 - east corner of the landfill	N/A	N/A	N/A	Isolated	Crushed Culvert	24	Acceptable	
Overall Landfill Performance:	**Acceptable**									

Table VI : Preliminary Stability Assessment –Tier II Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Isolated
Erosion	Acceptable	Isolated
Frost Action	Not observed	None
Staining	Marginal	Occasional
Vegetation Stress	Not observed	None
Seepage/Ponded Water	Acceptable	None
Debris exposure	Not observed	None
Overall Landfill Performance	**Acceptable**	

Performance/ Severity Rating	Description
Acceptable	Observed features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion and settlement.
Marginal	The physical/environmental performance appears to be deteriorating with time. An increase in size or number of features of note, such as differential settlement, erosion or cracking may be observed. No significant impact on landfill stability to date, but the potential of failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability in such aspects as slope geometry, erosion or settlement; scarp development. The potential of failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include:
	• Debris exposed in erosion channels or areas of differential settlement.
	• Liner exposed.
	• Slope failure.

Extent	Description
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting more than 50% of the surface area of the landfill

Table VII : Soil Chemical Analysis Results –Tier II Landfill

Sample #	Location	Depth (cm)	As [mg/kg]	Cd [mg/kg]	Cr [mg/kg]	Co [mg/kg]	Cu [mg/kg]	Pb [mg/kg]	Ni [mg/kg]	Zn [mg/kg]	PCBs [mg/kg]	TPH Lube Oil and Grease [mg/kg]	TPH Fuel [mg/kg]
RI10-005	MW1	0-15	1.2	<1.0	33	8.2	44.7	<10	47.8	44	0.0060	<40	<40
RI10-001	MW2	0-15	2.4	<1.0	47	8.2	51.2	10	28.9	40	0.0244	<40	<40
RI10-001 DUP	MW2	0-15	1.4	<1.0	48	10.7	64.1	<10	37.9	49	0.0426	<40	<40
RI10-002	MW3	0-15	2.0	<1.0	40	13.5	48.4	30	51.4	77	0.231	682	422
-	MW4	0-15	-	-	-	-	-	-	-	-	-	-	-
RI10-003 [(1)]	MW5	0-15	2.0	<1.0	62	29.5	115.1	21	118.4	109	0.144	<40	<40
RI10-004	MW6	0-15	1.4	<1.0	34	6.7	49.7	<10	25.7	35	0.0082	<40	<40

[(1)] Average result of duplicate for the metals

Table VIII : Evaluation of 2010 Soil Analytical Results – Tier II Landfill

Parameter	Minimum (mg/kg)	Maximum (mg/kg)	Comments
Arsenic	1.2	2.4	The lowest concentration was observed at MW1, upgradient of the landfill. The highest concentration was observed at MW2, along the south berm of the landfill.
Cadmium	<1.0	<1.0	All concentrations are below the detection limit of 1.0 mg/kg.
Chromium	33	62	The lowest concentration was observed at MW1, upgradient of the landfill. The highest concentration was at MW5, downgradient of the landfill.
Cobalt	6.7	29.5	The lowest and highest concentrations were observed at MW6 and MW5, respectively, both downgradient of the landfill.
Copper	44.7	115.1	The lowest concentration was observed at MW1, upgradient of the landfill. The highest concentration was observed at MW5, downgradient of the landfill.
Lead	<10	30	The lowest detected concentration of 10 mg/kg was observed at MW2, along the south berm of the landfill. The highest concentration was observed at MW3, downgradient of the landfill.
Nickel	25.7	118.4	The lowest and highest concentrations were observed at MW6 and MW5, respectively, both downgradient of the landfill.
Zinc	35	109	The lowest and highest concentrations were observed at MW6 and MW5, respectively, both downgradient of the landfill.
PCBs	0.0060	0.231	The lowest concentration was observed at MW1, upgradient of the landfill. The highest concentration was observed at MW3, downgradient of the landfill.
TPH	<40	682	Detected concentration of 682 mg/kg (lube oil and grease) and 422 mg/kg (fuel) were observed in the sample collected at MW2, downgradient of the landfill.

Table IX : Groundwater Chemical Analysis Results – Tier II Landfill

Sample #	Location	As [µg/L]	Cd [µg/L]	Cr [µg/L]	Co [µg/L]	Cu [µg/L]	Pb [µg/L]	Ni [µg/L]	Zn [µg/L]	PCBs [µg/L]	TPH Lube Oil and Grease [µg/L]	TPH Fuel [µg/L]
RI-10-MW 1A	MW1	<3	<1	<5	10	<5	<10	20	19	0.032	<1000	<1000
RI-10-MW 2	MW2	<3	1	<5	68	8	<10	277	170	<0.020	<1000	<1000
RI-10-MW 3A	MW3A	<3	<1	<5	25	<5	<10	72	34	<0.020	<1000	<1000
RI-10-MW 3A Dup	MW3A	<3	<1	<5	24	<5	<10	69	48	<0.020	<1000	<1000
RI-10-MW 4	MW4	<3	<1	<5	39	<5	<10	51	<10	<0.020	<1000	<1000
RI-10-MW 5A	MW5A	<3	<1	<5	24	23	<10	47	51	<0.020	<1000	<1000
RI-10-MW 5B	MW5B	<3	<1	<5	15	5	<10	49	138	<0.020	2000	<1000
RI-10-MW 5B_Dup	MW5B	<3	<1	<5	16	6	<10	138	161	<0.020	<1000	<1000
RI-10-MW 6	MW6	<3	<1	<5	29	<5	<10	98	126	<0.020	<1000	<1000

Table X : Evaluation of 2010 Groundwater Analytical Data – Tier II Landfill

Parameter	Minimum (µg/L)	Maximum (µg/L)	Comments
Arsenic	<3	<3	All concentrations were below the method detection limit of 3 µg/L.
Cadmium	<1	1	Trace concentration was observed at MW2, downgradient of the landfill.
Chromium	<5	<5	All concentrations were below the method detection limit of 5 µg/L.
Cobalt	10	68	The lowest concentration was observed at MW1, upgradient of the landfill, whereas the highest result was observed at MW2, downgradient of the landfill.
Copper	<5	23	The lowest detected concentration of 5 µg/L was observed at MW5B, whereas the highest result was observed at MW5A, both downgradient of the landfill.
Lead	<10	<10	All concentrations were below the method detection limit of 10 µg/L.
Nickel	20	277	The lowest concentration was observed at MW1, upgradient of the landfill, whereas the highest result was observed at MW2, downgradient of the landfill.
Zinc	<0.010	0.170	Non-detect level was observed at MW4 (downgradient), whereas the highest result was observed at MW2, downgradient of the landfill.
PCBs	<0.020	0.032	Concentration of 0.032 µg/L was observed at one sample location (MW1), upgradient of the landfill. All other results were below the method detection limit of 0.020 µg/L.
TPH	<1000	2000	Concentration of 2000 µg/L was observed at one sample location (MW5B), downgradient of the landfill. All other results were below the method detection limit of 1000 µg/L.

Table XI : Landfill Visual Inspection Checklist / Report – Airstrip Landfill

LANDFILL VISUAL INSPECTION

Site Name: BAF-5, Resolution Island
Landfill Designation: Airstrip Landfill
Date of Inspection: August 6-7, 2010
Date of Previous Inspection: August 18, 2009
Inspected by: Nicolas Audet, P.Eng., M.Sc.

The inspector/reporter represents to the bestof their knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge and that no material facts have been suppressed or misstated.

AIRSTRIP LANDFILL

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Record	Severity Rating	Additional Comments
Settlement	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Erosion	Yes	E1 - northwest berm	4 m	1 m	50 cm	Isolated	Erosion channel from surface water runoff.	29-30	Acceptable	Not significant.
	Yes	E2 - west berm	6 m	1 m	40 cm	Isolated	Erosion channel from surface water runoff.	31-32	Acceptable	Not significant.
Ponded Water	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Staining	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Debris Exposed	Yes	D1 - northwest berm	N/A	N/A	N/A	Occasional	Exposed and surface metal debris.	29-30	Acceptable	Not significant.
	Yes	D2 - west berm	N/A	N/A	N/A	Occasional	Exposed and surface metal debris.	31-32	Acceptable	Not significant.
	Yes	D3 - southwest berm	N/A	N/A	N/A	Occasional	Exposed metal debris and steel drum.	33-35	Acceptable	Not significant.
Presence/Condition of Monitoring Instruments	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other Features of Note:	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Overall Landfill Performance:	**Acceptable**									

Table XII : Preliminary Stability Assessment – Airstrip Landfill

Feature	Severity Rating	Extent
Settlement	Not observed	None
Erosion	Acceptable	Occasional
Frost Action	Not observed	None
Staining	Not observed	None
Vegetation Stress	Not observed	None
Seepage/Ponded Water	Not observed	None
Debris exposure	Acceptable	Occasional
Overall Landfill Performance	**Acceptable**	

Performance/ Severity Rating	Description
Acceptable	Observed features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion and settlement.
Marginal	The physical/environmental performance appears to be deteriorating with time. An increase in size or number of features of note, such as differential settlement, erosion or cracking may be observed. No significant impact on landfill stability to date, but the potential of failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability in such aspects as slope geometry, erosion or settlement; scarp development. The potential of failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include:
	• Debris exposed in erosion channels or areas of differential settlement.
	• Liner exposed.
	• Slope failure.

Extent	Description
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting more than 50% of the surface area of the landfill

Table XIII : Soil Chemical Analysis Results – Airstrip Landfill

Sample #	Location	Depth (cm)	As [mg/kg]	Cd [mg/kg]	Cr [mg/kg]	Co [mg/kg]	Cu [mg/kg]	Pb [mg/kg]	Ni [mg/kg]	Zn [mg/kg]	PCBs [mg/kg]	TPH Lube Oil and Grease [mg/kg]	TPH Fuel [mg/kg]
RI10-008	MW11	0-15	1.2	<1.0	45	15.1	65.4	31	58.9	93	0.108	<40	<40
RI10-009 (1)	MW12	0-15	1.1	<1.0	37	15.5	60.1	14	77.3	97	0.0608	1970	<40
RI10-043 (2)	MW13	0-15	2.0	<1.0	42	13.5	77.9	35	63.3	233	0.106	100	<40
RI10-010	MW14	0-15	1.7	<1.0	45	15.7	66.0	10	75.1	135	0.0105	<40	<40

(1) Average result of duplicate for the metals

(2) Average result of duplicate for the PCBs and the TPHs

Table XIV : Evaluation of Soil Chemical Analysis Results – Airstrip Landfill

Parameter	Minimum (mg/kg)	Maximum (mg/kg)	Comments
Arsenic	1.1	2.0	The lowest and highest concentrations were observed at MW12 and MW13, respectively, both downgradient of the landfill.
Cadmium	<1.0	<1.0	All concentrations are below the detection limit of 1.0 mg/kg.
Chromium	37	45	The lowest concentration was observed at MW12, downgradient of the landfill. The highest concentration was observed at MW11 and MW14, upgradient and downgradient of the landfill, respectively.
Cobalt	13.5	15.7	The lowest and highest concentrations were observed at MW13 and MW14, respectively, both downgradient of the landfill.
Copper	60.1	77.9	The lowest and highest concentrations were observed at MW12 and MW13, respectively, both downgradient of the landfill.
Lead	10	35	The lowest and highest concentrations were observed at MW14 and MW13, respectively, both downgradient of the landfill.
Nickel	58.9	77.3	The lowest concentration was observed at MW11, upgradient of the landfill, whereas the highest concentration was observed at MW12, downgradient of the landfill.
Zinc	93	233	The lowest concentration was observed at MW11, upgradient of the landfill, whereas the highest concentration was observed at MW13, downgradient of the landfill.
PCBs	0.0105	0.108	The lowest and highest concentrations were observed at MW14 and MW13, respectively, both downgradient of the landfill.
TPH	<40	1 970	Detected concentration of 1 970 and 100 mg/kg (lube oil and grease) were observed at MW12 and MW13, respectively.

Table XV : Groundwater Chemical Analysis Results – Airstrip Landfill

Sample #	Location	As [µg/L]	Cd [µg/L]	Cr [µg/L]	Co [µg/L]	Cu [µg/L]	Pb [µg/L]	Ni [µg/L]	Zn [µg/L]	PCBs [µg/L]	TPH Lube Oil and Grease [µg/L]	TPH Fuel [µg/L]
RI-10-MW 11	MW11	<3	<1	<5	<3	<5	<10	10	10	0.062	<1000	<1000
RI-10-MW 12	MW12	<3	<1	<5	<3	<5	<10	5	<10	0.054	<1000	<1000
RI-10-MW 13	MW13	<3	<1	<5	<3	<5	<10	12	<10	<0.020	<1000	<1000
RI-10-MW 14	MW14	<3	<1	<5	<3	<5	<10	7	<10	0.020	<1000	<1000

Table XVI : Evaluation of 2010 Groundwater Analytical Data – Airstrip Landfill

Parameter	Minimum (µg/L)	Maximum (µg/L)	Comments
Arsenic	<3	<3	All concentrations were below the method detection limit of 3 µg/L.
Cadmium	<1	<1	All concentrations were below the method detection limit of 1 µg/L.
Chromium	<5	<5	All concentrations were below the method detection limit of 5 µg/L.
Cobalt	<3	<03	All concentrations were below the method detection limit of 3 µg/L.
Copper	<5	<5	All concentrations were below the method detection limit of 5 µg/L.
Lead	<10	<10	All concentrations were below the method detection limit of 10 µg/L.
Nickel	5	12	The lowest and highest concentrations were observed at MW12 and MW13, respectively, both downgradient of the landfill.
Zinc	<10	10	Detectable concentration of 10 µg/L was observed at MW11, upgradient of the landfill.
PCBs	<0.020	0.062	The highest concentration of 0.062 µg/L was observed at MW11, upgradient of the landfill.
TPH	<1000	<1000	All concentrations were below the method detection limit of 1000 µg/L.

Table XVII : Landfill Visual Inspection Checklist / Report – Maintenance Area Dump

LANDFILL VISUAL INSPECTION

Site Name: BAF-5, Resolution Island
Landfill Designation: Maintenance Area Dump
Date of Inspection: August 8, 2010
Date of Previous Inspection: August 18, 2009
Inspected by: Nicolas Audet, P.Eng., M.Sc.

The inspector/reporter represents to the bestof their knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge and that no material facts have been suppressed or misstated.

MAINTENANCE AREA DUMP

Checklist Item	Present (Yes/No)	Location	Length	Width	Depth	Extent	Description	Photographic Record	Severity Rating	Additional Comments
Settlement	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Erosion	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Ponded Water	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Frost Action	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Animal Burrows	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Vegetation	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Staining	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Seepage Points	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Debris Exposed	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Presence/Condition of Monitoring Instruments	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Other Features of Note	No	N/A	N/A	N/A	N/A	None	N/A	N/A	Not observed	N/A
Overall Landfill Performance:	**Acceptable**									

Table XVIII : Preliminary Stability Assessment – Maintenance Area Dump

Feature	Severity Rating	Extent
Settlement	Not observed	None
Erosion	Not observed	None
Frost Action	Not observed	None
Staining	Not observed	None
Vegetation Stress	Not observed	None
Seepage/Ponded Water	Not observed	None
Debris exposure	Not observed	None
Overall Landfill Performance	**Acceptable**	

Performance/ Severity Rating	Description
Acceptable	Observed features are of little consequence. The landfill is performing as designed. Minor deviations in environmental or physical performance may be observed, such as isolated areas of erosion and settlement.
Marginal	The physical/environmental performance appears to be deteriorating with time. An increase in size or number of features of note, such as differential settlement, erosion or cracking may be observed. No significant impact on landfill stability to date, but the potential of failure is assessed as low or moderate.
Significant	Significant or potentially significant changes affecting landfill stability in such aspects as slope geometry, erosion or settlement; scarp development. The potential of failure is assessed as imminent.
Unacceptable	Stability of landfill is compromised to the extent that ability to contain waste materials is compromised. Examples may include:
	• Debris exposed in erosion channels or areas of differential settlement.
	• Liner exposed.
	• Slope failure.

Extent	Description
Isolated	Singular feature
Occasional	Features of note occurring at irregular intervals/locations
Numerous	Many features of note, impacted less than 50% of the surface area of the landfill
Extensive	Impacting more than 50% of the surface area of the landfill

Table XIX : Soil Chemical Analysis Results – Maintenance Area Dump

Sample #	Location	Depth (cm)	As [mg/kg]	Cd [mg/kg]	Cr [mg/kg]	Co [mg/kg]	Cu [mg/kg]	Pb [mg/kg]	Ni [mg/kg]	Zn [mg/kg]	PCBs [mg/kg]	TPH Lube Oil and Grease [mg/kg]	TPH Fuel [mg/kg]
RI10-007 (1)	MW21	0-15	1.0	<1.0	39	16.0	54.3	<10	67.3	116	0.0113	163	<40
RI10-006	MW22	0-15	1.5	<1.0	41	28.5	68.1	<10	70.7	181	0.0568	<40	<40
RI10-006 DUP	MW22	0-15	1.5	<1.0	45	24.8	76.1	<10	75.6	179	0.0537	<40	<40

(1) Average result of duplicate for the PCBs

Table XX : Evaluation of Soil Chemical Analysis Results – Maintenance Area Dump

Parameter	Minimum (mg/kg)	Maximum (mg/kg)	Comments
Arsenic	1.0	1.5	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
Cadmium	<1.0	<1.0	All concentrations are below the method detection limit of 1.0 mg/kg.
Chromium	39	41	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
Cobalt	16.0	28.5	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
Copper	54.3	68.1	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
Lead	<10	<10	All concentrations are below the method detection limit of 10 mg/kg.
Nickel	67.3	70.7	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
Zinc	116	181	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
PCBs	0.113	0.568	The lowest and highest concentrations were observed at MW21 and MW22, respectively, both downgradient of the landfill.
TPH	<40	163	Detected concentration of 163mg/kg (lube oil and grease) was observed at MW21, downgradient of the landfill.

Table XXI : Groundwater Chemical Analysis Results – Maintenance Area Dump

Sample #	Location	As [µg/L]	Cd [µg/L]	Cr [µg/L]	Co [µg/L]	Cu [µg/L]	Pb [µg/L]	Ni [µg/L]	Zn [µg/L]	PCBs [µg/L]	TPH Lube Oil and Grease [µg/L]	TPH Fuel [µg/L]
-	MW21	-	-	-	-	-	-	-	-	-	-	-
RI-10-MW 22	MW22	<3	<1	<5	<3	<5	<10	<5	<10	<0.020	<1000	<1000

Table XXII : Evaluation of 2010 Groundwater Analytical Data – Maintenance Area Dump

Parameter	Minimum (µg/L)	Maximum (µg/L)	Comments
Arsenic	<3	<3	Concentration was below the method detection limit of 3 µg/L.
Cadmium	<1	<1	Concentration was below the method detection limit of 1 µg/L.
Chromium	<5	<5	Concentration was below the method detection limit of 5 µg/L.
Cobalt	<3	<0.003	Concentration was below the method detection limit of 0.003 µg/L.
Copper	<5	<5	Concentration was below the method detection limit of 5 µg/L.
Lead	<10	<10	Concentration was below the method detection limit of 10 µg/L.
Nickel	<5	<5	Concentration was below the method detection limit of 5 µg/L.
Zinc	<10	<10	Concentration was below the method detection limit of 10 µg/L.
PCBs	<0.020	<0.020	Concentration was below the method detection limit of 0.020 µg/L.
TPH	<1000	<1000	Concentration was below the method detection limit of 1000 µg/L.

APPENDIX D

Range of the Report and Limitation of Responsibilities

RANGE OF THE REPORT AND LIMITATION OF RESPONSIBILITIES

A – Recipient and Use

This report ("Report") was prepared by Biogenie, a division of EnGlobe Corp., ("Biogenie") at the request and for the sole benefit of the Client ("Client"), and is intended to be used exclusively by the Client.

B –Site Conditions

Any description of the target site ("Site"), soil and/or groundwater included in the Report is only provided as an indication to the Client, and unless otherwise specifically mentioned in the Report such description shall not at any time and under any circumstances be used for purposes other than to gain a better understanding of the Site and to fulfil the requirements of the mandate assigned to Biogenie by the Client ("Mandate").

All information, including but not limiting the comprehensiveness of the data, charts, descriptions, drawings, tables, analysis results, compilations, and any conclusion and recommendation included in the Report, shall arise from the direct observation of the Site during a specific period, namely the fulfilment of the Mandate, and from the interpretation of such information and data available during the same period.

The content of the Report shall not apply in any way or to any part of the Site or to any parameter, material or analysis excluded from the Mandate.

Biogenie shall not be held responsible for the presence of any substance or material of a different nature, or of a similar nature but with different concentrations, as those indicated in the Report, and this in any part or parts of the Site excluded from the Mandate.

The content of the Report, including its conclusions and recommendations, shall not apply to any period preceding or following the Mandate. The physiochemical conditions of the Site, and the type and degree of contamination identified on the Site, may vary within a given period depending on a number of factors, especially the current activities taking place on the Site and/or on lands adjacent to the Site.

A review of the Report and/or changes in the parameters, conclusions and/or recommendations may prove to be necessary in the event of a change in the Site conditions or the discovery of pertinent information subsequent to the production of the Report.

C - Legislation, Regulations, Guidelines and Policies

The interpretation of the data and observations concerning the Site, as well as the conclusions and recommendations resulting from these, shall take into account the laws, regulations, standards, policies and/or guidelines applicable to the Project and that are in effect at the time of the fulfilment of the Mandate. In the event no current law, regulation, policy, guideline or standard applies to the project, Biogenie shall take into account proven environmental and professional rules and practices when drawing up the Report.

Any change in the legislation, regulations, standards, policies and/or guidelines applicable to the project may result in the need to review the Report and/or modify its parameters, conclusions and/or recommendations.

D – Use of Report

The Report is intended for the exclusive use of the Client and shall only be used for the purpose it was meant for.

The content of the Report and its conclusions and recommendations only apply to the Site and may not, at any time and under any circumstances, apply to any land adjacent to the Site or to any other land located in the vicinity of the Site.

Any reproduction in any form whatsoever and any distribution or use of the Report, in whole or in part, by a person other that the Client, is strictly forbidden without the prior written consent of Biogenie. Biogenie makes no declaration and pledges no responsibility towards any person other than the Client with regard to the content of the Report and the conclusions and recommendations expressed therein.

Biogenie is in no way responsible for any loss, fine or penalty, or for any expense, damage or other prejudice of any type whatsoever, sustained by a person other than the Client as a result of the unauthorized use of the Report.

No provision of the Report shall be construed as or considered to be a legal opinion of Biogenie’s.

APPENDIX E

Certificates of Analysis

Analytical Services Unit
School of Environmental Studies
Biosciences Complex
Queen's University, Kingston, Ontario, Canada K7L 3N6
Tel 613 533-2642 Fax 613 533-2897

ASU #	13077			Report ID:	ASU 13077 RI metals				
Client:	INAC			Date Submitted:	18-Aug-10				
				Date Tested:	19-Aug-10				
Site:	Resolution Island			Date Reported:	20-Aug-10				
				Matrix:	Soil				
Results relate only to the items tested									
	Laboratory Report of Analysis								
Sample	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	
RI10-001	51.2	28.9	8.2	<1.0	10	40	47	2.4	
RI10-001 DUP	64.1	37.9	10.7	<1.0	<10	49	48	1.4	
RI10-002	48.4	51.4	13.5	<1.0	30	77	40	2.0	
RI10-003	115.1	118.4	29.5	<1.0	21	109	62	2.0	*
RI10-004	49.7	25.7	6.7	<1.0	<10	35	34	1.4	
RI10-005	44.7	47.8	8.2	<1.0	<10	44	33	1.2	
RI10-006	68.1	70.7	28.5	<1.0	<10	181	41	1.5	
RI10-006 DUP	76.1	75.6	24.8	<1.0	<10	179	45	1.5	
RI10-007	54.3	67.3	16.0	<1.0	<10	116	39	1.0	
RI10-008	65.4	58.9	15.1	<1.0	31	93	45	1.2	
RI10-009	60.1	77.3	15.5	<1.0	14	97	37	1.1	*
RI10-010	66.0	75.1	15.7	<1.0	10	135	45	1.7	
RI10-043	77.9	63.3	13.5	<1.0	35	233	42	2.0	
BLANK	<5.0	<5.0	<5.0	<1.0	<10	<15	<20	<1.0	
MESS-3	28.3	34.4	12.3	<1.0	17	125	44	16.0	
RI10-003	107.5	113.4	28.3	<1.0	20	102	59	2.0	
RI10-003	122.8	123.3	30.8	<1.0	23	115	66	2.0	
RI10-009	59.9	65.4	15.5	<1.0	14	97	37	1.0	
RI10-009	60.4	89.3	15.5	<1.0	14	98	38	1.1	

Allison Rutter, PhD
Director

Prepared by P. Whitley

Authorized by A. Rutter

Analytical Services Unit
School of Environmental Studies
Biosciences Complex
Queen's University, Kingston, Ontario, Canada K7L 3N6
Tel 613 533-2642 Fax 613 533-2897

ASU #: 13077
Client: INAC

Report I.D: ASU 13077 PCB in Soil uL
Date Submitted: 18-Aug-10
Date Analysed: 7-Oct-10
Date Reported: 13-Oct-10
Matrix: Soil

Method: Gas Chromatography GC/ECD

RESULTS

Sample	Units	PCB conc
RI-10-001	ng/g	24.4
RI-10-001 Dup	ng/g	42.6
RI-10-002	ng/g	231
RI-10-003	ng/g	144
Ri-10-004	ng/g	8.2
RI-10-005	ng/g	6.0
RI-10-006	ng/g	56.8
RI-10-006 Dup	ng/g	53.7
RI-10-007*	ng/g	11.3
RI-10-008	ng/g	108
RI-10-009	ng/g	60.8
RI-10-010	ng/g	10.5
RI-10-043*	ng/g	106

* Average result of duplicate

QUALITY CONTROL DATA

Blank	ng/g	<3.0 ; <3.0
Control	ng/g	7.7 ; 8.9
Control Target	ng/g	10.0
RI-10-007	ng/g	18.7 ; 3.9
RI-10-043	ng/g	124 ; 87.8

Prepared by: P. Whaley

Authorization: B Kettlewell

B. Kettlewell, PhD
Research Associate

Analytical Services Unit
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Tel 613 533-2642 Fax 613 533-2897

ASU #:	13077	Report I.D.:	ASU 13077 TPH soil
	INAC	Date Submitted:	18-Aug-10
Client:	Resolution Island	Date Reported:	12-Oct-10
		Matrix:	Soil

Method: TPH by Gas Chromatography GC/FID

Report of Analysis:

Sample	TPH -Fuel (ug/g)	TPH – Lube (ug/g)
RI-10-001	<40	<40
RI-10-001 Dup	<40	<40
RI-10-002	422	682
RI-10-003	<40	<40
Ri-10-004	<40	<40
RI-10-005	<40	<40
RI-10-006	<40	<40
RI-10-006 Dup	<40	<40
RI-10-007	<40	163
RI-10-008	<40	<40
RI-10-009	<40	1970
RI-10-010*	<40	<40
RI-10-043*	<40	100

*Average result of duplicate

Quality Control Data:

Sample	TPH –Fuel (ug/g)	TPH – Lube (ug/g)
Blank	<40 ; <40	<40 ; <40
Control	146 ; 130	-
Control Target	150	-
RI-10-010	<40 ; <40	<40 ; <40
RI-10-043	<40 ; <40	78 ; 121

Prepared By: _____ Authorization: _____

ASU 13077 TPH soil
Page 1 of 1

Allison Rutter, PhD
Director

Analytical Services Unit
School of Environmental Studies
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Queen's University, Kingston, Ontario, Canada K7L 3N6
Tel 613 533-2642 Fax 613 533-2897

ASU #	13076			Report ID:	ASU 13076 RI metals				
Client:	INAC			Date Submitted:	18-Aug-10				
				Date Tested:	8-Oct-10				
Site:	Resolution Island			Date Reported:	8-Oct-10				
				Matrix:	Water				
Laboratory Report of Analysis									
Dissolved Metals	Results in mg/L								
SAMPLE	Cu	Ni	Co	Cd	Pb	Zn	Cr	As	
RI-10 MW 1	<0.005	0.020	0.010	<0.001	<0.010	0.019	<0.005	<0.003	
RI-10 MW 2	0.008	0.277	0.068	0.001	<0.010	0.170	<0.005	<0.003	
RI-10 MW 3A	<0.005	0.072	0.025	<0.001	<0.010	0.034	<0.005	<0.003	
RI-10 MW 3A Dup	<0.005	0.069	0.024	<0.001	<0.010	0.048	<0.005	<0.003	
RI-10 MW 4	<0.005	0.051	0.039	<0.001	<0.010	<0.010	<0.005	<0.003	
RI-10 MW 5A	0.023	0.047	0.024	<0.001	<0.010	0.051	<0.005	<0.003	
RI-10 MW 5B	0.005	0.049	0.015	<0.001	<0.010	0.138	<0.005	<0.003	
RI-10 MW 5B Dup	0.006	0.054	0.016	<0.001	<0.010	0.161	<0.005	<0.003	
RI-10 MW 6	<0.005	0.098	0.029	<0.001	<0.010	0.126	<0.005	<0.003	
RI-10 MW 11	<0.005	0.010	<0.003	<0.001	<0.010	0.010	<0.005	<0.003	
RI-10 MW 12	<0.005	0.005	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
RI-10 MW 13	<0.005	0.012	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
RI-10 MW 14	<0.005	0.007	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
RI-10 MW 22	<0.005	<0.005	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	*
Blank	<0.005	<0.005	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
Control	1.44	1.62	1.61	0.80	8.06	3.00	0.82	0.76	
Control Target	1.60	1.60	1.60	0.80	8.00	3.00	0.80	0.80	
RI-10 MW 22	<0.005	<0.005	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
RI-10 MW 22	<0.005	<0.005	<0.003	<0.001	<0.010	<0.010	<0.005	<0.003	
Results relate only to the items tested									

Prepared by P. Whiteley

Authorized by

Allison Rutter, PhD
Director

Analytical Services Unit
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ASU #: 13076
Client: Resolution Island INAC

Report I.D: ASU 13076 LL PCB waters
Date Submitted: 18-Aug-10
Date Analysed: 28-Sept-10
Date Reported: 22-Oct-10
Matrix: Water

Method: Gas Chromatography GC/ECD

RESULTS

Sample	Units	Total PCB conc
RI-10-MW 1A	ug/L	0.032
RI-10-MW 2	ug/L	<0.020
RI-10-MW 3A	ug/L	<0.020
RI-10-MW 3A Dup	ug/L	<0.020
RI-10-MW 4	ug/L	<0.020
RI-10-MW 5A	ug/L	<0.020
RI-10-MW 5B	ug/L	<0.020
RI-10-MW 5B Dup	ug/L	<0.020
RI-10-MW 6	ug/L	<0.020
RI-10-MW 11	ug/L	0.062
RI-10-MW 12	ug/L	0.054
RI-10-MW 13	ug/L	<0.020
RI-10-MW 14	ug/L	0.020
RI-10-MW 22	ug/L	<0.020

QUALITY CONTROL DATA

Blank	ug/L	<0.020 ; <0.020 ; <0.020 ; 0.036
Control	ug/L	0.051 ; 0.055 ; 0.071
Control Target	ug/L	0.063

Prepared by: P. Whiteley

Authorization: A. Rutter

Allison Rutter, PhD
Director

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ASU #:	13076	Report I.D.:	ASU 13076 TPH water-amend
Client:	INAC	Date Submitted:	18-Aug-10
	Resolution Island	Date Reported:	26-Oct-10
		Matrix:	Water

Method: TPH by Gas Chromatography GC/FID
Report of Analysis:
AMENDED REPORT

Sample	Fuel (mg/L)	Lubricating Oil & Grease (mg/L)
RI-10-MW 1A	<1.0	<1.0
RI-10-MW 2	<1.0	<1.0
RI-10-MW 3A	<1.0	<1.0
RI-10-MW 3A Dup	<1.0	<1.0
RI-10-MW 4	<1.0	<1.0
RI-10-MW 5A	<1.0	<1.0
RI-10-MW 5B	<1.0	<1.0
RI-10-MW 5B Dup	<1.0	<1.0
RI-10-MW 6	<1.0	<1.0
RI-10-MW 11	<1.0	<1.0
RI-10-MW 12	<1.0	<1.0
RI-10-MW 13	<1.0	<1.0
RI-10-MW 14	<1.0	<1.0
RI-10-MW 22	<1.0	<1.0

Prepared By: P. Hadley

Authorization: A. Rutter

Allison Rutter, PhD
Director

* Average result of duplicates

Quality Control Data:

Sample	Fuel (mg/L)	Lubricating Oil & Grease (mg/L)
Blanks	<1.0 , <1.0	<1.0 , <1.0
Controls	17.0 ; 14.7	-
Control Target	13.3	-

Prepared by: ____________ Authorization: ____________

APPENDIX F

Photographic Records

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Tier II Landfill
Date Inspected: August 6-7, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
1		P1000101	2010-08-06	412671,7	6830272,6	Looking SW at VT-3.
2		P1000102	2010-08-06	412671,7	6830272,6	Downloading thermistor data at VT-3.
3		P1000103	2010-08-06	412671,7	6830272,6	Looking E at VT-3. MW2 in background.
4		P1000105	2010-08-06	412608,3	6830274,2	Looking N at MW4. Stain of hydrocarbon running south of the well.
5		P1000106	2010-08-06	412608,3	6830274,2	Looking N at MW4. Stain of hydrocarbon running south of the well.
6		P1000174	2010-08-07	412736,6	6830255,4	Looking W at the south berm of Tier II Landfill.
7		P1000175	2010-08-07	412736,6	6830255,4	Looking NE at the south berm of Tier II Landfill.
8		P1000176	2010-08-07	412726,6	6830345,5	Looking NW at the south berm of Tier II Landfill.
9		P1000177	2010-08-07	412660,3	6830347,1	Looking NE from the top of the ridge on the north side of the Tier II Landfill.

All photo locations in local coordinates unless otherwise noted.

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Tier II Landfill
Date Inspected: August 6-7, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
10		P1000178	2010-08-07	412660,3	6830347,1	Looking SE from the top of the ridge on the north side of the Tier II Landfill.
11		P1000179	2010-08-07	412660,3	6830347,1	Looking SW from the top of the ridge on the north side of the Tier II Landfill.
12		P1000180	2010-08-07	412626,3	6830286,1	Looking NE at the west berm of Tier II Landfill.
13		P1000181	2010-08-07	412620,2	6830277,0	Looking W from the top of the west berm of the Tier II Landfill.
14		P1000182	2010-08-07	412615,8	6830277,1	Looking SW from the top of the west berm of the Tier II Landfill.
15		P1000183_ Panorama	2010-08-07	412618,0	6830277,0	180 panoramic view looking NE to SW from the south berm of the Tier II Landfill.
16		P1000187	2010-08-07	412618,0	6830277,0	Looking W at the south berm of Tier II Landfill.
17		P1000188	2010-08-07	412669,6	6830264,3	Looking N at the west berm of the Tier II Landfill.
18		P1000189	2010-08-07	412669,6	6830264,3	Looking NE at the west berm of the Tier II Landfill. MW4 in background.

All photo locations in local coordinates unless otherwise noted.

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Tier II Landfill
Date Inspected: August 6-7, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
19		P1000190	2010-08-07	412669,6	6830264,3	Looking SE at the west berm of the Tier II Landfill.
20		P1000191	2010-08-07	412669,6	6830264,3	Looking S from the west berm of the Tier II Landfill.
21		P8060097	2010-08-06	412608,3	6830274,2	Hydrocarbon sheen running south of MW4 on the west end of Tier II Landfill.
22		P8060098	2010-08-06	412608,3	6830274,2	Hydrocarbon sheen running south of MW4 on the west end of Tier II Landfill.
23		P8060099	2010-08-06	412608,3	6830274,2	Hydrocarbon sheen running south of MW4 on the west end of Tier II Landfill.
24		P8070139	2010-08-07	412736,6	6830340,4	Looking SW at the east berm of Tier II Landfill.
25		P8070140	2010-08-07	412726,6	6830345,5	Looking NW at the south berm of Tier II Landfill.

All photo locations in local coordinates unless otherwise noted.

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Airstrip Landfill
Date Inspected: August 7, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
26		P1000192	2010-08-07	411770,5	6830269,4	Looking SW towards the Airstrip Landfill from MW12.
27		P1000193	2010-08-07	411770,5	6830269,4	Looking S towards the Airstrip Landfill from MW12.
28		P1000194	2010-08-07	411745,0	6830599,5	Looking NE towards the Airstrip Landfill from MW13.
29		P8060100	2010-08-06	411772,5	6830572,3	Looking E towards the Airstrip Landfill.
30		P8060101	2010-08-06	411772,5	6830572,3	Looking E towards the Airstrip Landfill.
31		P8060102	2010-08-06	411753,8	6830573,9	Erosion on the west end of the Airstrip Landfill.
32		P8060103	2010-08-06	411753,8	6830573,9	Erosion on the west end of the Airstrip Landfill.

All photo locations in local coordinates unless otherwise noted.

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Airstrip Landfill
Date Inspected: August 7, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
33		P8060104	2010-08-06	411757,0	6830533,0	Looking SE towards the Airstrip Landfill.
34		P8060105	2010-08-06	411718,2	6830503,2	Looking S towards the Airstrip Landfill.
35		P8060106	2010-08-06	411757,0	6830533,0	Looking SE towards the Airstrip Landfill.
36		P8060109	2010-08-06	411845,4	6830486,4	Looking SW towards MW11 close to the the Airstrip Landfill.
37		P8070141	2010-08-06	411770,5	6830269,4	Looking SE from MW12 at the the Airstrip Landfill.
38		P8070142	2010-08-06	411745,0	6830599,5	Looking E from MW13 at the the Airstrip Landfill.

All photo locations in local coordinates unless otherwise noted.

LANDFILL VISUAL INSPECTION PHOTO LOG

Site Name: BAF-5, Resolution Island
Landfill: Maintenance Area Dump
Date Inspected: August 8, 2010
Inspected by: Nicolas Audet, P.Eng., M.Sc.

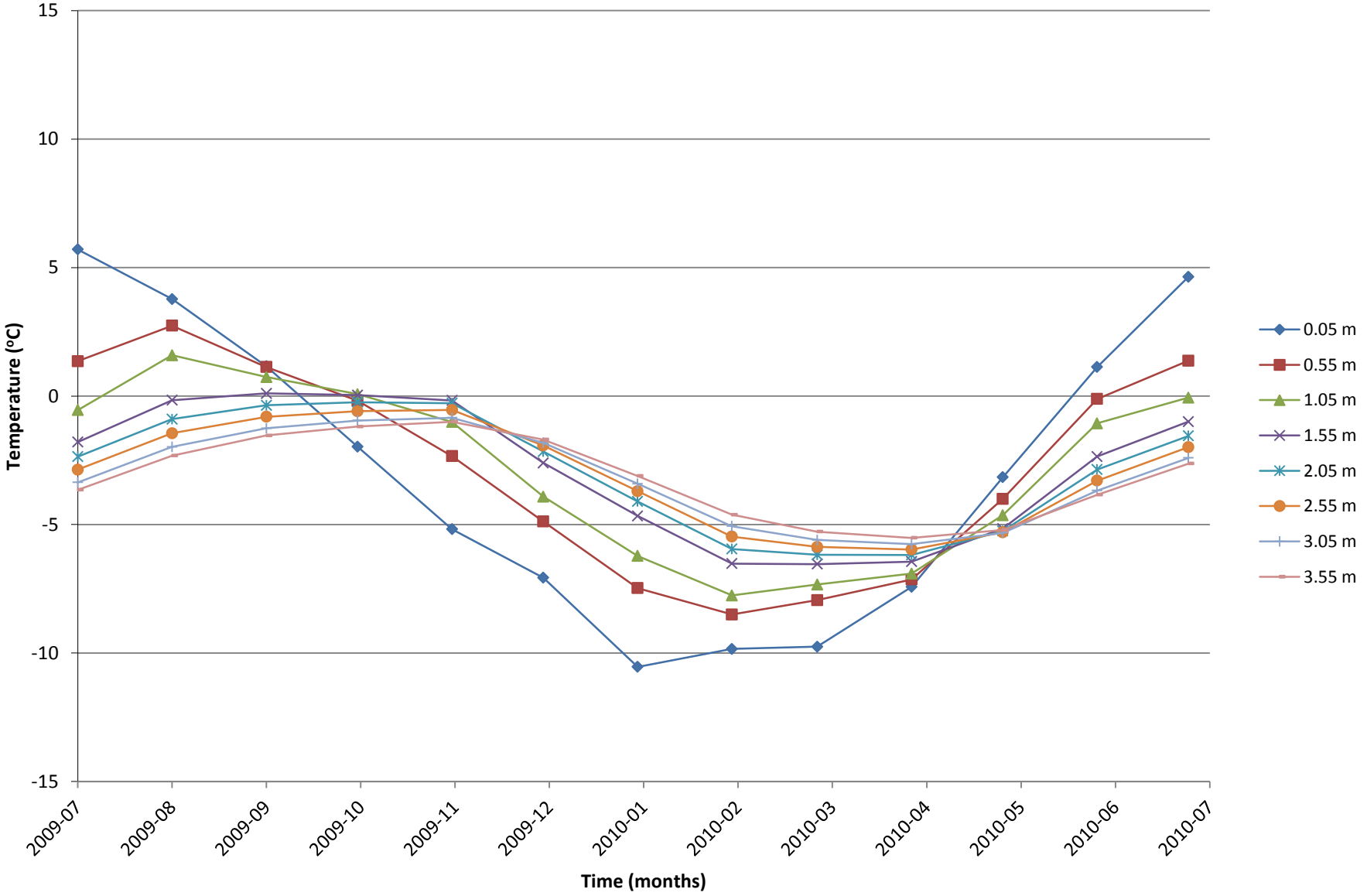
Photo	Thumbnail	Filename	Date	Vantage Point		Caption
				Easting	Northing	
39		P1000243_ Panorama	2010-08-08	412487,098	6830199,216	90 panoramic view NW to NE of the Maintenance Area Dump from the side of the road.
40		P1000250_ Panorama	2010-08-08	412490,613	6830297,257	180 panoramic view NE to SW of the Maintenance Area Dump from the ridge on the northern side.
41		P1000252	2010-08-08	412490,613	6830297,257	Looking S from the ridge on the northern side at the Maintenance Area Dump. MW21 and MW22 in the background.

All photo locations in local coordinates unless otherwise noted.

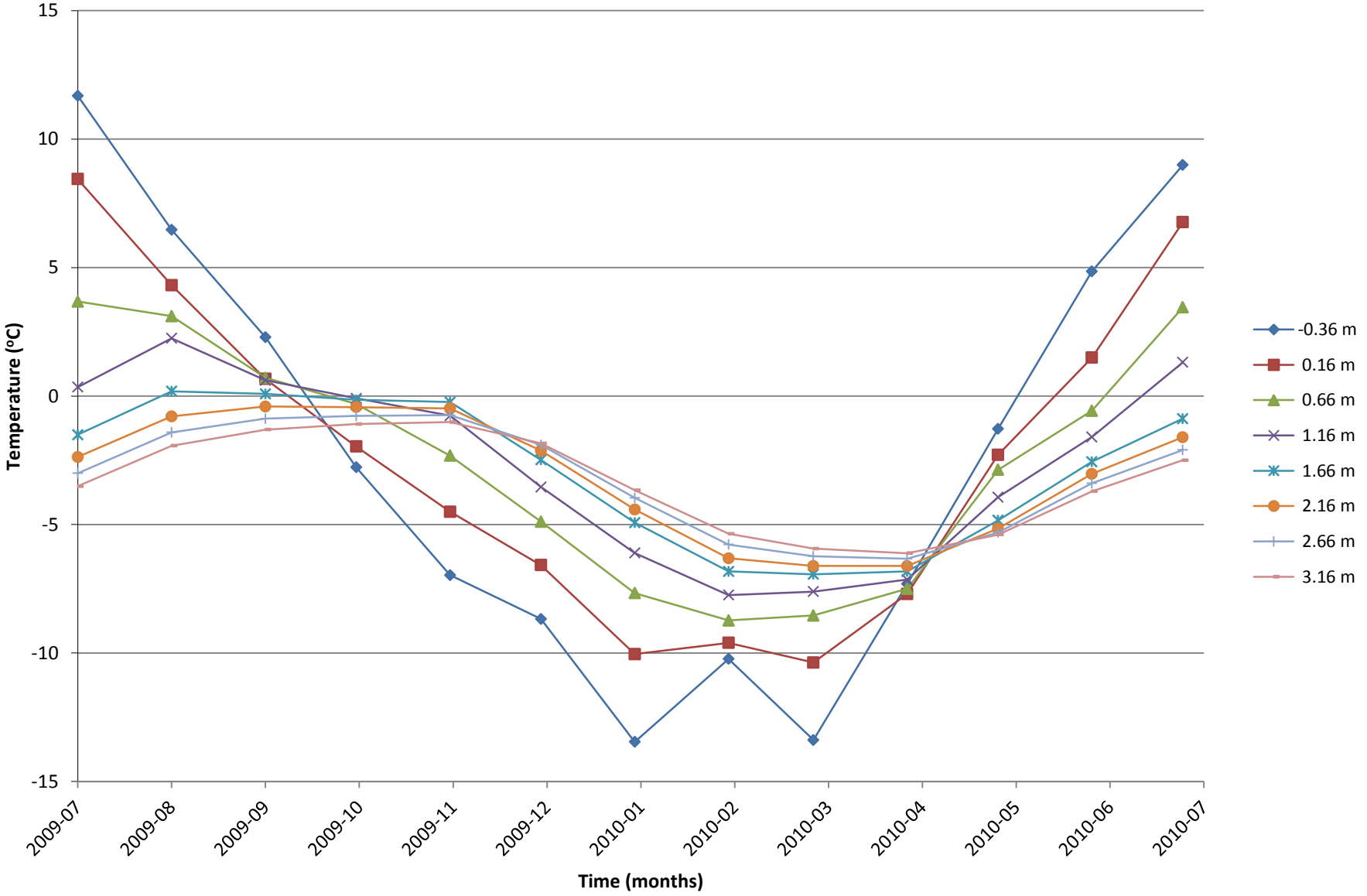
APPENDIX G

Graphs

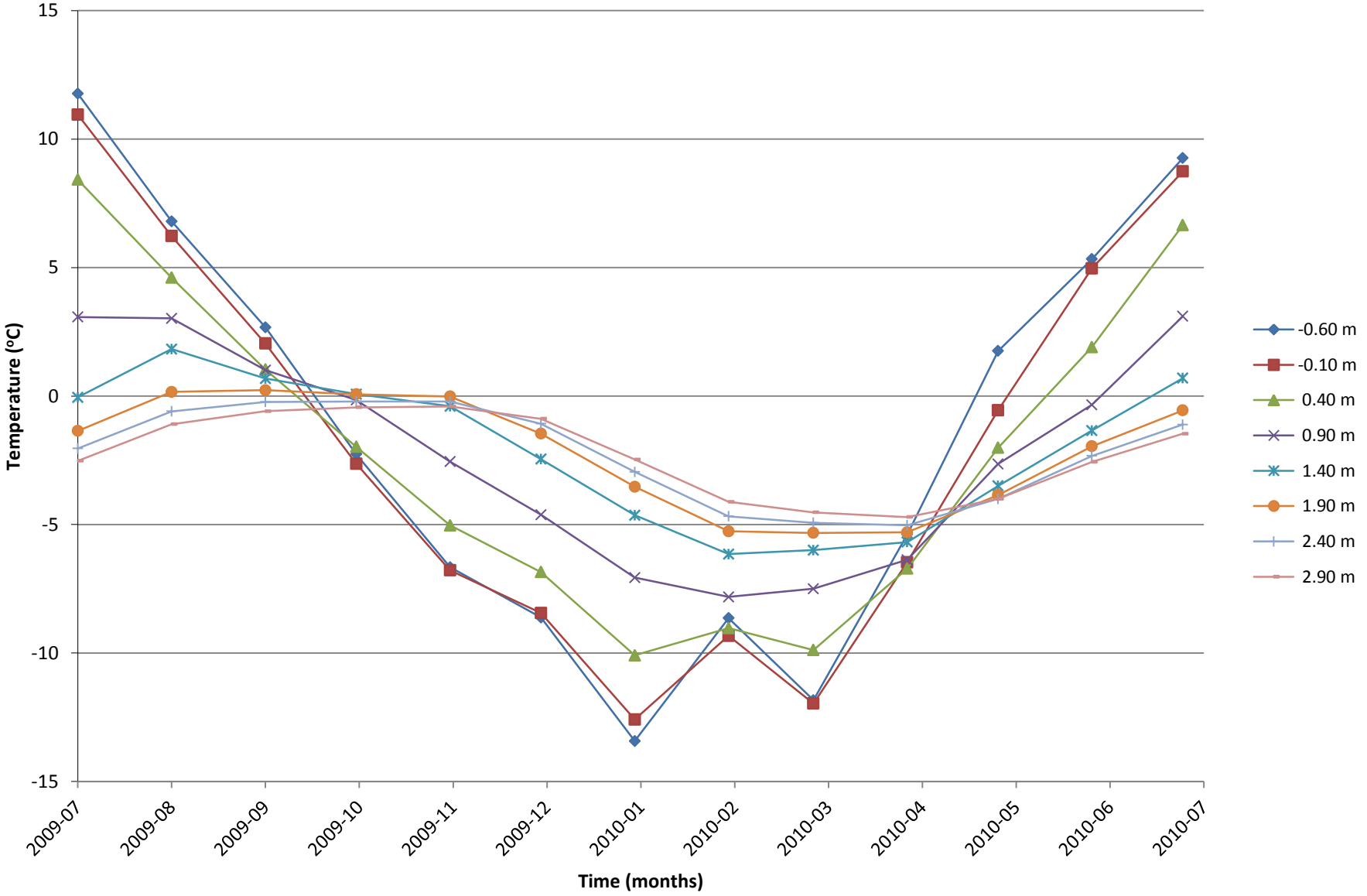
Graph 1: Thermistor Data From VT-1
Average Monthly Temperatures From July 2009 to July 2010



Graph 2: Thermistor Data From VT-2
Average Monthly Temperatures From July 2009 to July 2010



Graph 3: Thermistor Data From VT-3
Average Monthly Temperatures From July 2009 to July 2010



Graph 4: Thermistor Data From VT-4
Average Monthly Temperatures From July 2009 to July 201