March 2017

QIKIQ15 BAFFIN REGION DEW LINE SITE MONITORING

2016 FOX-3 Monitoring Report

Submitted to:
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Executive Summary

Golder Associates Ltd. (Golder) has been contracted by Public Services and Procurement Canada (PSPC), on behalf of the Department of National Defence (DND), to complete the 2015-2018 Distant Early Warning (DEW) Line Sites Landfill Monitoring Program in the Baffin Region of Nunavut. The five DEW Line sites that were monitored in 2016 as part of the QIKIQ15 contract are FOX-2, FOX-3, FOX-4, FOX-5 and DYE-M. These sites are all now in the Post-Construction Monitoring Phase of their remedial program.

This Monitoring Report presents the 2016 post-construction inspection and monitoring results for four landfills at FOX-3: Station West Landfill, West Landfill, Non-Hazardous Waste Landfill and Tier II Disposal Facility. In addition, visual inspection of the Thermokarst Area was carried out during the 2016 monitoring event. The 2016 monitoring was year 5 for FOX-3; remediation was completed in 2011. FOX-3 has been monitored annually from 2012 to 2016.

Station West Landfill

Based on the visual inspection, there does not appear to be any significant erosion, settlement, exposed waste or indications of instability at the Station West Landfill. No ponding of water was observed on the cover surface or along the toe of the landfill. Red staining was observed on the cover surface in the northeastern corner of Lobe A and some black staining was observed on the south slope of Lobe F. The observed staining appears to be surficial (i.e., from equipment storage and/or spill) and not related to landfill seepage. Previously observed minor erosion appears to be self-armouring and has not visibly deteriorated since the last inspection. A new tension crack observed on the south slope of Lobe F appears to be insignificant. No exposed waste materials were observed. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the Station West Landfill has an “Acceptable” overall landfill performance.

The concentrations of most metal parameters were highest at F3-9, located downgradient of Lobe E2 and at F3-11, located downgradient of Lobe F of the landfill where black staining was observed on the southern slope. In a few cases, the 2016 concentrations were slightly higher than in earlier years (e.g., copper, lead and arsenic at F3-11); however in most cases they were similar to previous monitoring results. The concentrations of copper and arsenic in both samples at F3-11 exceeded the baseline mean concentrations plus three standard deviations (3σ). The modified total petroleum hydrocarbons (TPH) concentration observed in the shallow sample at F3-4 in 2016 remained below the concentration reported in 2012. No petroleum hydrocarbons (PHC) were detected at the remaining sampling locations and no detectable concentrations of cadmium, mercury or polychlorinated biphenyls (PCB) were noted in any of the samples in 2016.

In general, the data from this site are not indicative of increasing influence from the landfill with the possible exception of location F3-11, where results from both the shallow and deep samples may be reflective of a potential influence; insufficient data are currently available to confirm this.

It is recommended that a sample of the black stained cover material be collected in the next sample round and analyzed for the standard parameter list to determine if the staining is of concern. Should the observed black staining of the landfill cover increase, or should the quality of the next sample collected from F3-11 indicate further increases in parameter concentrations, additional actions may need to be considered. No modifications to the ongoing monitoring program at this landfill are recommended at this time.

West Landfill

Based on the visual inspection, there does not appear to be any significant erosion, cracking, settlement, exposed waste or indications of instability at the West Landfill. There was some minor self-armouring erosion on the north slope that is not considered a concern. Ponded water along the north toe does not appear to be impacting landfill stability. Previously observed areas of shallow settlement may be related to construction, rather than landfill performance or permafrost thaw, and are not considered a concern. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the West Landfill has an “Acceptable” overall landfill performance.

Ponding of water was observed along the northern toe of the landfill; however, no staining was observed in these areas. The highest concentrations of most metal parameters at the West Landfill were found observed at F3-1 (shallow sample), located near the southern toe of the landfill. At all sampling locations, the concentrations observed in 2016 were less than or similar to those observed in previous years. Modified TPH was reported at detectable concentrations at F3-1 and F3-2 for the first time, however, these only marginally exceeded or remained below baseline mean concentrations. No cadmium, mercury or PCB were detected in any of the samples in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

Given that the environmental sampling results are largely the same as the previous sampling sessions, there is no evident impact of the landfill on soil quality. No modifications to the ongoing monitoring program at this landfill are recommended at this time.

Non-Hazardous Waste Landfill

Based on the visual inspection, there does not appear to be any significant erosion, settlement, cracking, exposed waste or indications of instability at the Non-Hazardous Waste Landfill. Some minor self-armouring erosion on the north and west slopes does not appear to be worsening. Some shallow settlement depressions on the cover surface are observed, however they are not considered to be of concern. Two newly observed minor tension cracks along the north toe and north crest edge do not appear to have significant effect on the stability of the landfill. Shallow ponded water along the east and north toe appears to be from recent snow melt and/or precipitation and is not anticipated to have resulted in increased thawing of permafrost. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the Non-Hazardous Waste Landfill has an “Acceptable” overall landfill performance.

Concentrations of metal parameters were highest overall at the deep MW-06 sample location. At all four locations, the concentrations of most metals were similar to or less than those observed in previous years. No detectable concentrations of cadmium, mercury, PHC or PCB were noted in any of the soil samples in 2016. None of the reported soil values exceeded their baseline mean concentrations plus 3σ.

The concentrations of chromium and arsenic in the groundwater sample at MW-08 were greater than their baseline concentrations plus 3σ; these concentrations were similar to those observed in previous years. Higher concentrations of most metal parameters were noted at this location in comparison to MW-05 and MW-07. The groundwater results at MW-05 and MW-07 indicated all parameters were less than the baseline mean values. No detectable concentrations of PHC or PCB were noted in any of the groundwater samples in 2016. Mercury was reported above the detection limit for the first time at MW-08 in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater was highest at MW-05, and lowest towards the south at MW-08, which follows the topography in the area.

Based on the results, there does not appear to be significant impact to groundwater quality from the landfill at the monitoring wells adjacent to the landfill. No modifications to the ongoing monitoring program at this landfill are recommended at this time.

Tier II Disposal Facility

Based on the visual inspection, there were no indications of instability at the Tier II Disposal Facility. No erosion, cracks or exposed waste was observed. No ponded water was observed on the cover surface or along the toe of the landfill. Two stained are not considered to be a concern. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the Tier II Disposal Facility has an “Acceptable” overall landfill performance.

At MW-01 and MW-03 (most notably MW-01), metal concentrations in soil were generally greater than those observed in previous years. The concentration of arsenic in the shallow sample at MW-01 and the concentration of copper in the deep sample at MW-01 exceeded their respective baseline mean concentrations plus 3σ. At MW-02 and MW-04, metal concentrations were typically less than those observed in previous years. No detectable concentrations of cadmium, mercury, PHC or PCB were noted in any of the soil samples in 2016.

Similar to the soil sampling results, the highest concentrations in the groundwater samples were observed at MW-01 and MW-03. At MW-01, MW-02 and MW-04, these concentrations were generally lower than those reported in previous years and at MW-03, concentrations were generally less than or similar to those reported in previous years. No detectable concentrations of mercury, PHC or PCB were noted in any of the groundwater samples in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater in was highest at MW-01, and lowest towards the south at MW-04.

Based on the results, there does not appear to be significant impact to groundwater quality from the landfill at the four monitoring wells adjacent to the landfill. No modifications to the ongoing monitoring program at this landfill are recommended at this time.

Regraded Thermokarst Area

A visual inspection of the Regraded Thermokarst Area was carried out during the 2016 monitoring event to assess and document the condition of the 2013 remedial works that involved placement and grading of granular fill within the settlement areas and cracks. The Regraded Thermokarst Area is located on the east side of the airstrip along the Macbeth River. It appears that significant additional thaw settlement and cracking has occurred since the Thermokarst Area was regraded in 2013. However, the condition remained unchanged since the previous inspection in 2015. The Thermokarst Area was observed to have several large tension cracks around the perimeter of the thaw settlement with ponded water in the lowest part of the settlement depression. The Thermokarst Area was assessed to have a “Significant” Feature Severity Rating because of “Numerous” cracks extending around the perimeter of new thaw settlement. The size and frequency of the tension cracks indicate that the slopes around the settlement area are unstable and at risk of sloughing into the depression.

Airstrip Landfill (Lobes M, L, I)

A visual inspection of the Airstrip Landfill (Lobes M, L, I) located west of the Thermokarst Area was carried out during the 2016 monitoring event to ensure the integrity of these landfills has not been impacted from settlement in the Thermokarst Area. Based on the visual inspection, there does not appear to be any significant erosion, settlement, cracking, exposed waste or indications of instability at the Airstrip Landfill. The Airstrip Landfill (Lobes M, L, I) was assessed to have an “Acceptable” overall landfill performance.

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1.0 INTRODUCTION

Golder Associates Ltd. (Golder) has been contracted by Public Works and Government Services Canada (PSPC), on behalf of the Department of National Defence (DND), to complete the 2015-2018 Distant Early Warning (DEW) Line Sites Landfill Monitoring Program in the Baffin Region of Nunavut (hereafter referred to as the "Project"). The contract number with PSPC is W6837-151002/001/NCS. The DND file number for the Project is QIKIQ15. The contracted scope of work is in accordance with the project Terms of Reference (TOR) dated April 2015, Golder Proposal P1530908 dated June 16, 2015 ("Golder Proposal"), and the minutes of the May 12, 2016 meeting attended by Golder and DND.

The five DEW Line sites that were monitored in 2016 as part of the QIKIQ15 contract are FOX-2, FOX-3, FOX-4, FOX-5 and DYE-M. These sites are all now in the Post-Construction Monitoring Phase of their remedial program. Post-Construction Monitoring was carried out in accordance with the TOR and implemented as per Golder's Logistics and Work Plan (LWP) dated July 25, 2016. Monitoring activities included geotechnical visual inspection, thermal monitoring, soil and groundwater sampling. In addition to the landfill monitoring activities, a visual inspection of the regraded thermokarst area at FOX-3 was completed in 2016.

This Monitoring Report presents the 2016 post-construction inspection and monitoring results for FOX-3 (the site). The 2016 monitoring was year 5 for FOX-3; remediation was completed in 2011. FOX-3 has been monitored annually from 2012 to 2016.

Appendix A is a summary of the report limitations and forms part of the report.

1.1 Objective of the Study

The objective of the Landfill Monitoring Program is to collect sufficient information to assess the performance, integrity, and stability of the landfills from a geotechnical and environmental perspective for the protection of human health and the environment. The monitoring program is designed to monitor landfill integrity and to determine in the event of any evident deterioration, if remedial measures are required.

1.2 Scope of Work

The scope of work for this project includes the following:

1) Project management including liaison with DND, project team coordination, scope management, cost management, schedule management and resource coordination;

2) Preparation of a site-specific Health Safety and Environment Plan and procurement of safety equipment and supplies (e.g., personal protective equipment, first aid kits and satellite phones);

3) Development of a Logistics and Work Plan (LWP) for each field season that outlines the field schedule, travel plans, accommodation, hiring of local Inuit contract workers, all-terrain vehicle (ATV) and charter aircraft rental;

4) Completion of field work consisting of visual inspection, photographic documentation, thermistor data collection and soil and water sample collection;

5) Preparation of a Field Work Progress Report that summarizes field work activities completed each year (submitted under separate cover);

6) Preparation of a Consultant's Inuit Participation Plan (CIPP) and Report (CIPR), that contains the Inuit employment and subcontracting content (submitted under separate cover); and,

7) Preparation of draft and final Monitoring Reports for each site with visual inspection results, photographic log, thermistor data collection, figures of inspection features and photograph locations, soil and groundwater quality monitoring results, Quality Analysis / Quality Control (QA/QC) and data interpretation.

2.0 BACKGROUND

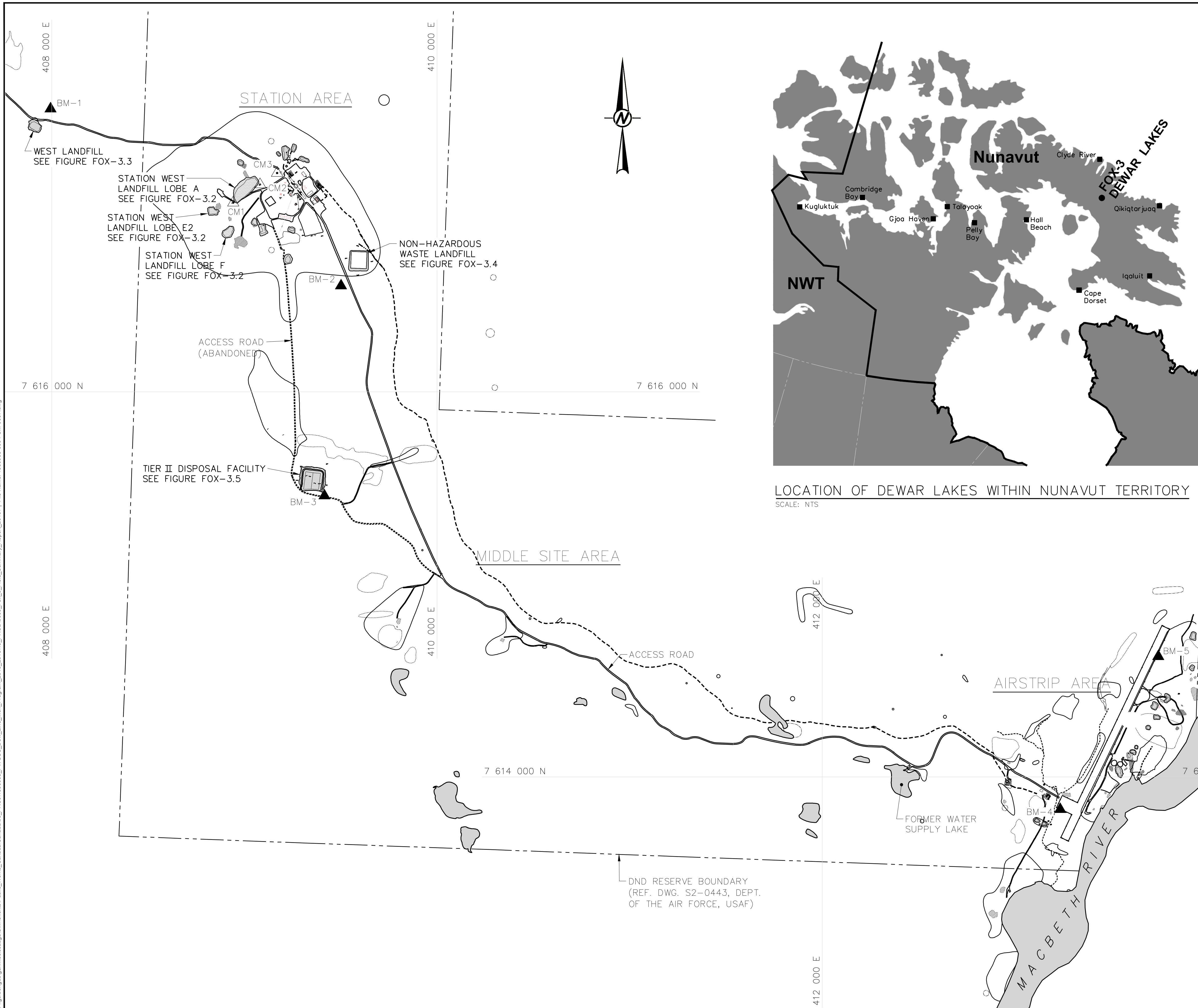
2.1 Site Description

FOX-3 (Dewar Lakes) is a land-locked site located in central Baffin Island, roughly 10 km south of the confluence of the Macbeth River and the Dewar Lakes system. The nearest community is Clyde River, located approximately 220 km to the northeast. For ease of discussion, the site has been classified into three areas: (i) the Station Area, (ii) the Middle Site Area and (iii) the Airstrip Area located adjacent to the Macbeth River. The access road connecting the Station Area and Airstrip Area is approximately six kilometres long.

The FOX-3 site is a former auxiliary radar site on the DEW Line system and was decommissioned in 1993. FOX-3 has been converted to a North Warning System (NWS) Long Range Radar site, and NWS now holds the reserve on the site. Because of ongoing use of the NWS facilities, most of the infrastructure was not slated for demolition, and no remedial activities were completed within the operational areas.

The following four landfills, shown on Figure FOX-3.1, are part of the FOX-3 long-term monitoring program:

- Station West Landfill;
- West Landfill;
- Non-Hazardous Waste Landfill; and,
- Tier II Disposal Facility.



LOCATION OF DEWAR LAKES WITHIN NUNAVUT TERRITORY

SCALE: NTS

LEGEND

- DND RESERVE BOUNDARY
- SURVEY CONTROL MONUMENT
- PERMANENT BENCHMARK LOCATION
- BODY OF WATER

NOTE

GRID PROJECTION IS NAD83 ZONE 19W.
ELEVATIONS ARE GEODETIC.

REFERENCE

PREVIOUS INSPECTION FIGURE PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

0 500 1,000

1:20,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
OVERALL SITE PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-10-18
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-3.1

25 mm

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

2.2 Site Geology, Hydrogeology and Hydrology

The site is on the northeastern edge of the Precambrian (Canadian) Shield. Most Precambrian bedrock has been metamorphosed (altered by intense heat and pressure) into granite. Surficial soils have been formed by the erosive forces of glaciation and deposited by retreating glaciers. Glacial retreat has deposited glacial till moraine, boulders and talus slopes over the landscape. The landscape is dominated by bedrock outcrops and boulder fields; tundra vegetation is generally limited to valleys.

The groundwater flow processes at the site are expected to be significantly influenced by the presence of continuous permafrost. Annual active thaw layers are typically limited to a few metres below ground surface, depending on ground cover, soil materials and surface water features. Shallow groundwater representing meltwater (both surficial and within the active layer) and infiltration from precipitation during the summer thaw is perched within the active layer during the short summer season. Movement of the groundwater is dictated by soil type, presence of shallow permafrost and hydraulic pressures resulting from topographic differences and distribution (elevation) of the water within the soils. Water elevations are only measured at some wells, and therefore the use of terms upgradient or downgradient may not be truly reflective of the actual flow direction. Nevertheless, for the purposes of this report, the terms upgradient and downgradient as they refer to the locations of the monitoring locations are used to maintain consistency with previous annual reports.

The landscape is characterized by a broad gently rolling upland flanked by extensively eroded terrain. Elevations range from 400 to 500 metres above sea level (masl) in the uplands, to 100 masl along the Macbeth River. Rugged topography and the presence of permafrost at the site create shallow perched lakes and seasonal streams from drainage of melting snow pack. Smaller, shallow surface water features typically freeze solid during the winter months. Some of the larger, deeper lakes may not freeze solid allowing them to support fish populations.

2.3 Land-Use Description

In the 1950s, DEW Line sites were constructed across a number of locations in the northern parts of Alaska, Canada and Greenland, between latitudes 65 and 70 degrees to maintain surveillance of the North American Airspace. In 1963, improvements in surveillance technology led to the closure of most of the DEW Line sites and their replacement with the NWS. Since the 1990s, investigations, decommissioning, and clean-up activities have been undertaken at the DEW Line sites. Clean-up and decommissioning activities involved the demolition of surplus buildings and structures, excavation of contaminated soils, and the regrading of existing landfills. New engineered landfills were also constructed for the disposal of excavated soils and building materials.

Landfills at DEW Line sites can be categorized as follows:

- **Regraded:** Existing landfills that were regraded and capped with gravel;
- **Leachate Contained:** Existing landfills that were capped with gravel and provided with an impermeable membrane keyed into the permafrost (either only on the sides or over the entire surface), to contain leachate;
- **New NH:** New non-hazardous waste landfills; and,
- **New Tier II:** New Tier II disposal facilities (used for the disposal of Tier II soils as described by the DEW Line Cleanup Criteria) have impermeable liners below and above the contaminated soil to encapsulate the contents and contain the leachate. Tier II landfills are designed with a saturated granular perimeter berm keyed into the permafrost and sufficient cover of granular material to promote permafrost aggradation into the landfilled materials.

The four landfills in the monitoring program at FOX-3 fall into the following categories:

- Station West Landfill (Regraded)
- West Landfill (Regraded)
- Non-Hazardous Waste Landfill (New NH Landfill)
- Tier II Disposal Facility (New Tier II)

The airstrip at FOX-3 is located adjacent to the Macbeth River, approximately 6 km from the Station Area. It is maintained for the purpose of ongoing NWS operations and long-term monitoring.

2.4 Field Program Staff and Schedule

Table 2-1 presents a list of field personnel, roles, responsibilities and dates for the FOX-3 2016 monitoring program.

Table 2-1: Field Personnel and Roles

Name (Affiliation)	Role / Responsibility	Site	Date
Reza Moghaddam (Golder)	Field Geotechnical Lead / Inspections	FOX-3	August 15-18
Jamie Bonany (Golder)	Field Environmental Lead / Soil and Water Sampling	FOX-3	August 15-18
Kent Bretzlaff (Golder)	Environmental Field Technician / Soil and Water Sampling	FOX-3	August 15-18
Jaypootie Moesesie (Inuit Subcontractor)	Wildlife Monitor	FOX-3	August 15-17
Jeremiah Toomasie (Inuit Subcontractor)	Wildlife Monitor	FOX-3	August 16-18

2.5 Weather Conditions

Table 2-2 presents a summary of weather conditions on each day of the FOX-3 monitoring program.

Table 2-2: Summary of Weather Conditions

Date	Weather
August 15	Sun and Cloud, 1°C to 6°C
August 16	Sun and Cloud, 1°C to 5°C
August 17	Sun and Cloud, 0°C to 5°C
August 18	Sun and Cloud, 0°C to 5°C

2.6 Project References

Canadian Council of Ministers of the Environment (CCME, 1993). "*Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volumes I and II, Main Report and Analytical Methods*".

Department of National Defence (DND, 2015). "*Terms of Reference, DEW Line Monitoring Program CAM-5, FOX-M, 2, 3, 4, 5, DYE-M*", QIKIQ15 Contract, April 2015.

Golder Associates Ltd. (Golder, 2015), "Solicitation No. W6837-151002/A Baffin Region Dew Line Sites Monitoring Program", Report P1530908, dated June 16, 2015.

Golder Associates Ltd. (Golder, 2016a), "*2015 FOX-3 Monitoring Report*", Report 1530908-1600-Rev2, dated March, 2016.

Golder Associates Ltd. (Golder, 2016b). "*Baffin Region DEW Line Site Monitoring Health Safety and Environment Plan*", Report 1530908-2000-V2, dated July 25, 2016.

Golder Associates Ltd. (Golder, 2016c), "*2016 Landfill Monitoring Program for QIKIQ15 Contract: Logistics and Work Plan*", Report 1530908-2000-R1-V2, dated July 25, 2016.

Golder Associates Ltd. (Golder, 2016d). "*2016 Baffin Region DEW Line Site Landfill Monitoring Field Work Progress Report*", Report 1530908-2000-R2-V2, dated October 7, 2016.

2.7 Report Structure

This report describes the monitoring program carried out in August 2016 at FOX-3. Results from visual inspection activities, thermal monitoring, soil sampling and groundwater sampling are presented in accordance with the TOR.

The report is organized into separate sections for each of the landfills (Sections 4.1 to 4.4). Each section contains the following 2016 monitoring information:

- Visual Inspection Checklist;
- Preliminary Stability Assessment Table;
- Table of visual inspection photographs;
- Landfill plan with photograph locations and observed features;
- Summary of thermal monitoring (if applicable for landfill);
- Summary of soil sampling analytical results;
- Summary of groundwater sampling analytical results (if applicable for landfill); and,
- Discussion of overall landfill performance based on available monitoring data.

Appendix A provides a Limitation of Responsibilities and forms part of the report. Thermal and groundwater monitoring field record sheets are included in Appendix B. Laboratory certificates of analysis, historical landfill monitoring results and QA/QC Reports are included in Appendix C. A photographic log is included in Appendix D. A visual inspection report on the regraded thermokarst area is included in Appendix E. An electronic version of the report, tables, figures, full resolution photos and laboratory certificates of analysis is saved on a DVD-ROM, which is appended to the hardcopy of the report.

3.0 APPROACH & METHODOLOGY (GENERAL)

3.1 Summary of Work

3.1.1 Health and Safety

Golder developed a Health and Safety Environment Plan (Golder, 2016b) for the QIKIQ15 field program, which describes potential hazards, risks and proposed mitigation measures. Unique health and safety risks included the potential for wildlife encounters, travel by air in light planes and on ATVs, long distances to the nearest emergency health care facilities and variable weather conditions. In addition, Golder developed a Logistics and Work Plan (Golder, 2016c) for the field program that contained the detailed schedule and travel plans, contact information, accommodation details, transportation, communications, field equipment and sampling protocols.

3.1.2 Field Program

Table 3-1 provides a summary of the monitoring schedule for the seven DEW Line sites that are part of the QIKIQ15 Project. FOX-3 was monitored in 2016 (Year 5) and will be monitored again in 2018 (Year 7). The field monitoring program consisted of the following activities:

- Visual inspection (of four landfills and thermokarst area) including photographic documentation of observed conditions;
- Thermal monitoring (i.e., datalogger downloading at landfills with thermistors);
- Soil sampling; and,
- Groundwater sampling (at landfills with monitoring wells).

Table 3-2 provides a summary of monitoring activities by landfill.

Table 3-1: Summary of QIKIQ15 Project Monitoring Schedule

DEW Line Site	Year			
	2015	2016	2017	2018
CAM-5 Mackar Inlet	Year 5		Year 7	
FOX-M Hall Beach			Year 10	
FOX-2 Longstaff Bluff	Year 4	Year 5		Year 7
FOX-3 Dewar Lakes	Year 4[(a)]	Year 5[(a)]		Year 7
FOX-4 Cape Hooper		Year 18		Year 20
FOX-5 Broughton Island		Year 10		
DYE-M Cape Dyer	Year 2	Year 3	Year 4	Year 5

Legend	
	Phase I Monitoring
	Phase II Monitoring

Note:

a) At FOX-3 in 2015 and 2016 (Years 4 and 5) – Complete a geotechnical inspection of the thermokarst regrade.

Table 3-2: Summary of Monitoring Requirements for Landfills at FOX-3

Landfill Designation	Type of Landfill	Visual Inspection ✓ = yes	Soil Sampling[a] Locations x Samples	Groundwater Sampling # of Monitoring Wells	Thermal Monitoring # of Thermistors
FOX-3					
Station West Landfill	Regraded	✓	9 x 2		
West Landfill	Regraded	✓	3 x 2		
Non-Hazardous Landfill	New NH	✓	4 x 2	4	
Tier II Disposal Facility	New Tier II	✓	4 x 2	4	4
	TOTAL	***4***	***40***	***8***	***4***

Notes:

a) (# x #) Indicates the number of sampling points at each landfill. Samples are collected from two depths at each sampling point; from 0-15 cm and from 40-50 cm (or at refusal).

3.1.3 Visual Inspection

At each of the FOX-3 landfill locations and the thermokarst area, a visual inspection was conducted to observe whether there were any visual signs of erosion, cracking, seepage, ponded water, stressed vegetation (potentially caused by the landfill) and for physical stability. Photographic records of the landfill (or thermokarst area) were taken to document the observed condition of the landfill and other notable features that were observed. Northing and Easting coordinates were recorded for all photograph and feature locations using a Garmin GLO portable GPS receiver with Bluetooth connection to a field tablet.

Visual inspection information was used to complete a Preliminary Stability Assessment for each landfill (or thermokarst area). Each observed feature was assigned a Severity Rating (Acceptable, Marginal, Significant or Unacceptable) and Extent (Isolated, Occasional, Numerous or Extensive) and then the landfill was assigned an overall Performance Rating (Acceptable, Marginal, Significant or Unacceptable). If a type of feature was not observed during the inspection then the Severity Rating was reported as “Not Observed” in the Preliminary Stability Assessment. Definitions of these terms are as follows:

Feature Severity Rating / Landfill Performance Rating	Description
Not Observed	This type of feature was not observed at the landfill during the inspection.
Acceptable	Noted 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, settlement.
Marginal	Physical/environmental performance appears to be deteriorating with time. Observations may include an increase in size or number of features of note, such as differential settlement, erosion or cracking. No significant impact on landfill stability to date, but potential for failure is assessed as low or moderate.

Feature Severity Rating / Landfill Performance Rating	Description
Significant	Significant or potentially significant changes affecting landfill stability, such as significant changes in slope geometry, significant erosion or differential settlement; scarp development. The potential for 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, impacting less than 50% of the surface area of the landfill
Extensive	Impacting greater than 50% of the surface area of the landfill

3.1.4 Thermal Monitoring

The landfills that require leachate containment (e.g., Tier II disposal facilities) and rely on permafrost aggradation incorporate ground temperature monitoring systems with vertical thermistor strings that measure temperature at various depths and automated dataloggers that allow for data collection. The data recorded on the dataloggers was downloaded using a laptop computer and Prolog software from Lakewood Systems Ltd. Thermistor inspection and data downloading details were recorded on field record sheets included in Appendix B.

At the FOX-3 site, thermistors and data loggers were installed only at the Tier II Disposal Facility.

3.1.5 Soil Sampling

Soil samples were collected in accordance with the TOR, the Golder Proposal, Logistics and Work Plan and Canadian Council of Ministers of the Environment (CCME) Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites – Volumes I and II, Main Report and Analytical Methods (CCME, 1993). Soil sampling procedures of note are as follows (deviations from the TOR are noted in *italics*):

- Soil samples were collected within 2 to 4 metres of monitoring wells (where applicable). Where there was no corresponding monitoring well soil samples were collected within 2 to 4 metres of previous sample locations. Previous consultants left pins and tags in the ground to indicate where they sampled soil. Golder sampled away from those locations and did not leave pins in the ground.
- Coordinates of the 2016 soil sampling locations were recorded using a field tablet equipped with a Garmin GPS and confirmed to be consistent with previous/required sampling locations prior to sampling.

- Test pits were dug with a shovel that was washed between sample locations. The shovel was decontaminated with soap and water, methyl hydrate and rinsed with distilled water before each use. Soil samples were collected by hand using a single-use disposable nitrile glove and placed into new/clean glass sample jars provided by the laboratory that were labelled with the sample location ID and depth.
- Soil samples were generally collected at 0 to 15 centimetres (cm) depth and at 40 to 50 cm depth at the locations in accordance with the TOR. *At some locations, the sample collection depth was adjusted where soil was frozen or refusal on rock was encountered. Where refusal on a large rock(s) was encountered near surface, the sampling location was moved slightly to avoid the large rock(s). When rocks were encountered prior to reaching the target sampling depth, the test pit was enlarged and the rock(s) were excavated if possible. If the specified sampling depth could not be reached after expending reasonable effort to enlarge the hole in an attempt to remove rock(s), a sample was collected at or near the zone of refusal (in accordance with the TOR). If refusal was encountered after the shallow soil sample depth and even with additional effort it was not possible to remove the rock(s) causing refusal, then only one soil sample was collected at that location (noted as "refusal" in summary tables below).*
- *At locations where the ground was covered with snow and ice, excavation of the snow was attempted but, in general, it was impossible to dig through the ice and frozen ground beneath the snow and soil samples were not collected (noted as "frozen" in summary tables below).*
- Inter-lab field duplicates were collected for approximately 10% of the total soil samples collected. The field duplicates were collected from relatively homogenous soil material *in the test pit*, such that the composition of the samples was the same and to minimize escape of volatile compounds.
- In order to assess the effectiveness of decontamination of the shovel used for soil sampling, an equipment rinsate (equipment blank) sample was completed following a typical decontamination procedure. This was conducted during sampling of the FOX-4 landfill, by pouring distilled water over the decontaminated shovel and capturing it in water sample bottles.

3.1.6 Groundwater Sampling

Groundwater samples were collected in accordance with the TOR, the Golder Proposal, Logistics and Work Plan and CCME (1993). Groundwater sampling procedures of note are as follows (*deviations in italics*):

- Water levels in the wells were measured with an interface probe that was decontaminated with soap and water, methyl hydrate and rinsed with distilled water before each use.
- *At monitoring well locations where there was snow on the ground surrounding the well and no measurable water level or water that could be pumped with the peristaltic pump, water samples were not collected (noted as "frozen" in the summary tables below).*
- *At monitoring well locations that had no measurable water level or water that could be pumped with the peristaltic pump, water samples were not collected (noted as "dry" in summary tables below).*
- *In wells with limited water depth and/or slow recharge, purging was only carried out until the field parameters were observed to stabilize* and then sampling was commenced in the priority order outlined in the TOR. *The number of water sample bottles collected and parameters that could not be analysed are listed in footnotes following the respective summary tables below.*

- Purging and sampling was carried out using a peristaltic pump and a low-flow purge rate of less than 100 mL/min was maintained. Peristaltic pump flexible tubing and nylon tubing extending down the well was single-use and disposed after use at each well (not reused). Sample tubing was removed from the wells after completion of the sampling event and disposed.
- Groundwater samples were pumped directly from the well into analysis-specific bottles provided by the laboratory that were labelled with the sample location ID. Groundwater samples were not field filtered and were not field-acidified or preserved (in accordance to the TOR).
- Where groundwater was insufficient, sampling was prioritized in the following order:
  - Petroleum hydrocarbons: F1 fraction;
  - Inorganic elements – total concentrations: arsenic, cadmium, chromium, cobalt, copper, lead, nickel, zinc and mercury. Samples are not to be filtered (which is why low turbidity is so important) or preserved;
  - Petroleum hydrocarbons: F2, F3 and F4 fractions; and
  - PCBs (polychlorinated biphenyls – Total Aroclor analysis).
- Inter-lab duplicates were collected for 10% of the total groundwater samples collected.
- A field blank was filled in the field with distilled water and analyzed for all parameters.
- A travel blank of laboratory prepared water accompanied the sampling containers for the whole duration of the program, and analyzed for the entire suite of parameters.
- In order to assess the effectiveness of decontamination of the groundwater level/interface probe, an equipment rinsate (equipment blank) sample was completed following a typical decontamination procedure. This was conducted during sampling of the FOX-2 landfill, by pouring distilled water over the decontaminated probe and capturing it in water sample bottles.
- No equipment blanks were required for the sample collection tubing as new tubing was used at each sampling location.

3.2 Field Notes and Data

Visual inspection photographs, features, locations and notes were recorded in the field with a tablet computer equipped with a camera and Global Positioning System (GPS). Field data and photographs from the tablet were uploaded to an online Geographic Information System (GIS) database that was used to generate the photograph log and figures presented in this report.

Thermistor inspection and monitoring data were recorded on field record sheets included in Appendix B. Thermistor locations were recorded with either the field tablet or a hand-held GPS.

Soil sampling locations were photographed before test pit excavation, at the maximum depth of the test pit excavation and after backfilling. Soil sampling locations were recorded with either the field tablet or a hand-held GPS.

Groundwater monitoring data was recorded on field record sheets included in Appendix B. Monitoring well locations were recorded with either the field tablet or a hand-held Global Positioning System (GPS).

3.3 QA/QC

Quality Assurance (QA) is the system of validation checks performed to measure quality in order to determine if the quality objectives have been met. Quality Control (QC) is the set of procedures which are incorporated into the project's standard operating procedures to ensure that it achieves its quality objectives.

The QC procedures incorporated into the monitoring program carried out at FOX-3 included:

- Using only ISO 17025 certified environmental labs to perform the soil and groundwater analyses. Golder used Paracel Laboratories Ltd. (Paracel) of Ottawa as the primary lab and AGAT Environmental (AGAT) of Mississauga for the duplicate samples. Both of these laboratories are ISO 17025 certified for the analyses performed. The laboratories also exchanged their "Standard Methods" for the analyses in the program to harmonize their procedures for the duplicate analysis;
- The field sampling for soil and groundwater was completed by a two-person team, which helped to ensure that all of the sampling and field identification procedures were followed in order;
- Duplicate soil samples were collected from relatively homogenous soil material *in the test pit*, such that the composition of the samples was the same and to minimize escape of petroleum hydrocarbon (F1 fraction) compounds;
- Duplicate groundwater samples were prepared by alternately filling bottles for each lab for each parameter type; the yield of the wells in some cases prevented filling the whole suite of sample bottles;
- To minimize the possibility of cross contamination, soil samples were collected directly from the test pits with nitrile gloved hands, at the designated depth intervals, and placed into lab-supplied sample jars leaving no headspace. New gloves were used for each sample. The shovel and trowel used to open the test pit were cleaned manually then rinsed with methyl-hydrate and distilled water;
- To minimize the risk of cross-contamination, groundwater samples were pumped from the monitoring wells using dedicated tubing inserted into the well and another dedicated length of tubing between the rollers in the peristaltic pump. Staff holding the sample bottles wore nitrile gloves. Samples were labelled at the monitoring well with identification, time and date;
- Groundwater samples were neither filtered nor preserved in the field. The low-flow sampling technique was employed to minimize the presence of sediment in the water sample;
- Soil samples were not preserved in the field;
- To minimize the time delay from actual sample collection to receipt at the lab, Golder sent coolers from the site to the staging point every time a resupply flight occurred. From the staging point communities, the coolers were sent via First Air to Ottawa Airport where Golder picked them up and took them to Golder's office in Ottawa, where they were checked for breakage, legibility of the labels and accuracy and completeness of the chain of custody. After being checked in Ottawa, the samples were dispatched to the primary and duplicate labs. The maximum allowable hold times for samples were largely met; where they were exceeded, it was by a maximum of two days due to the logistical limitations of flying in and out of the sites and the long chain of transport from the staging points to the labs.

QA was measured by the duplicate analysis and review of the QA/QC data contained in each laboratory certificate of results. In addition to the duplicate analyses, a field blank (consisting of bottles filled with distilled water in the field) was submitted to Paracel for analysis of all specified parameters. Trip blanks consisted of bottles filled with distilled water and sealed at the laboratory. A trip blank was brought to the field for the overall 2016 program and back, then submitted to Paracel for analysis of all specified parameters.

The soil samples and groundwater samples were collected with only dedicated single-use equipment. The water sampling tubing was single-use from the well to sample bottle, and soil samples were collected from the test pits into sample jars with single-use gloves on the technician's hands. This was possible because the texture of the soil samples was generally loose sandy soil. Nevertheless, equipment blanks were prepared for each type of sample. For groundwater sampling, the equipment blank was a sample of water poured over the water level probe, after it had been washed off, and for soil sampling it was a sample of water poured over the trowel after it had been washed between samples.

A discussion of the QA/QC results is provided in Section 5.

4.0 2016 MONITORING PROGRAM RESULTS

Photographs 1 through 44 (in Appendix D) document the observed conditions during the inspection of the Non-Hazardous Waste Landfill, Photographs 45 through 127 document the observed conditions during inspection of the Station West Landfill, Photographs 128 through 168 document the observed conditions during inspection of the Tier II disposal facility and Photographs 169 through 201 document the observed conditions during inspection of the West Landfill. A photograph was taken to document the condition of the groundwater monitoring well at each monitoring well location. At each soil sampling location, three photographs were taken to illustrate soil sample locations before excavation, at full depth of excavation and after backfilling. Photographs 142 through 145 illustrate the condition of the thermistors. A complete log of all photographs are included in Appendix D. Copies of all digital photograph files are included on a DVD attached to this report. Visual inspection photographs taken with the field tablet are identified by an “ATT number” in the file name which are noted in brackets in the visual inspection photograph log tables.

Many of the acceptable features observed during the inspection do not appear to be related to landfill performance. For example, shallow depressions that appear to be unchanged since construction of the landfill (i.e., as-built condition) or minor hydrocarbon staining from post-construction anthropogenic activities (e.g., ATVs). These acceptable features that do not appear to be related to landfill performance have been reported as “*not a concern*”. Self-armouring erosion, minor water ponding and seepage without staining have also been reported as “*not a concern*” because they are not indicative of deteriorating landfill performance and/or may just be weather related. In addition, some minor cracking that appears to be related to thaw creep does not indicate slope instability and is not considered to be a concern at the present time. Significant features that are related to landfill performance have been photographed and described in detail.

The monitoring program results are listed for each landfill in the sections below. In the tables, data which exceed the arithmetic mean background data and baseline arithmetic mean are identified by <u>underlined</u> and **bold** fonts, respectively. The background arithmetic mean limits for each landfill have been previously established using the arithmetic mean concentrations for soil samples collected outside of the landfill areas in 1990 and 2006. The baseline arithmetic mean limits were calculated based on the concentrations for soil samples collected at each of the current soil sampling locations adjacent to the landfills, between 2006 and 2011. Soil and groundwater quality data are also compared to the baseline concentration plus three standard deviations (3σ) and exceedances are shaded. This limit is based on the “three-sigma rule of thumb”, wherein it is expected that nearly all values lie within three standard deviations of the arithmetic mean.

A modified total petroleum hydrocarbons (TPH) value, calculated as the sum of the PHC F1, F2 and F3 fractions, is discussed throughout this report to allow for comparison to TPH baseline data.

Historical soil and groundwater results and charts are included in Appendix C. It should be noted there are discrepancies in the highlighting of baseline and background arithmetic mean exceedances between the 2016 soil and groundwater data summary tables within the body of the report and the historical chemistry tables in Appendix C; exceedances noted in the data tables within the body of the report are considered the correct interpretation of the 2016 results. It is recommended that seven data points be used as a minimum to identify a soil or groundwater quality trend for these landfills. As of the end of 2016, there are less than seven years of monitoring data available for these landfills, and there is therefore insufficient information available to establish a reliable trend. Discussion of the 2016 data in this report focused on identifying data results for locations where concentrations significantly different (typically greater) than previous years are observed, or locations where concentrations exceeded the baseline concentration plus 3σ.

Duplicate soil samples were collected at a total of four locations at FOX-3. This included the shallow F3-3 (0-15 cm), shallow F3-4 (0-15 cm), deep MW-01 (40-50 cm), and deep MW-06 (40-50 cm) sample locations. A duplicate groundwater sample was also collected at monitoring well MW-03. For these duplicate sample locations, the average of the two concentrations are presented in the tables and used to discuss in the results in Section 4.0. The reproducibility of the duplicate sample results is discussed in Section 5.0.

4.1 Station West Landfill

4.1.1 Landfill Description

The Station West landfill is located approximately 150 m west of the main station building northwest and west of the old station access road. The Station West Landfill consists of three individual lobes (A, E2 and F) extending over an area of approximately 14,800 m^2 (including sideslopes). The entire landfill area is gently sloping radially (but generally westerly) away from the active NWS buildings, from an elevation of 518 masl immediately southeast of Lobe A, to an elevation of 501 masl southwest of Lobe F. Based on satellite imagery, this area appears to drain to a linear water body located approximately 2 km to the west. The terrain in the area largely consists of boulders, with partially developed frost circles comprised of boulder perimeters with finer grained interiors.

Remediation activities at the Station West landfill consisted of the removal of surface and exposed debris and regrading. The long term monitoring plan consists of visual monitoring, and the periodic collection of soil samples. Approximate locations for the collection of soil samples are identified on Figure FOX - 3.2.

4.1.2 Summary of any Scope Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at F3-4, F3-7, F3-8 and F3-10 could not be collected due to refusal on rock.

4.1.3 Visual Inspection

At the Station West Landfill, there are multiple locations with observed minor settlement, erosion, staining, vegetation and cracking features. No ponded water or exposed waste was observed in 2016. Table 4-1 presents a summary of observed visual inspection features; Table 4-2 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall landfill performance because all observed features were assessed as “Acceptable”. Table 4-3 is a log of photographs taken during the 2016 visual inspection.

There is a large fuel tank (Feature Y) in the northeast corner of Lobe A, which was previously reported. Previously observed plastic conduit on the slopes of Lobe A (Features C and C/S) is not buried waste that has become exposed, but instead appears to be road edge safety markers that are used across the site. Previously observed geotextile (Feature I) beyond the northeast toe of Lobe E2 is partially buried with gravel. There does not appear to be buried waste under the geotextile, and therefore the exposed geotextile could be cut and removed at some point in the future. There is a large previously observed red stain on the northeast corner of Lobe A (Feature B) and some minor black staining on the south slope of Lobe F (Feature N). Both of the observed staining features appear to be surficial (i.e., from equipment storage and/or spill) and not related to landfill seepage.

Ponded water was not observed along the east toe of Lobe A in 2016 (Feature X – not shown on the figure). Previously observed small ponds of water at the north toe of Lobe A (Feature V), the northeast toe of Lobe E2 (Feature AA) and north and east toes of Lobe F (Feature AB) were not observed in 2016. Several depressions on the landfill cover surface (Features E, W, and K) were unchanged since the previous inspection.

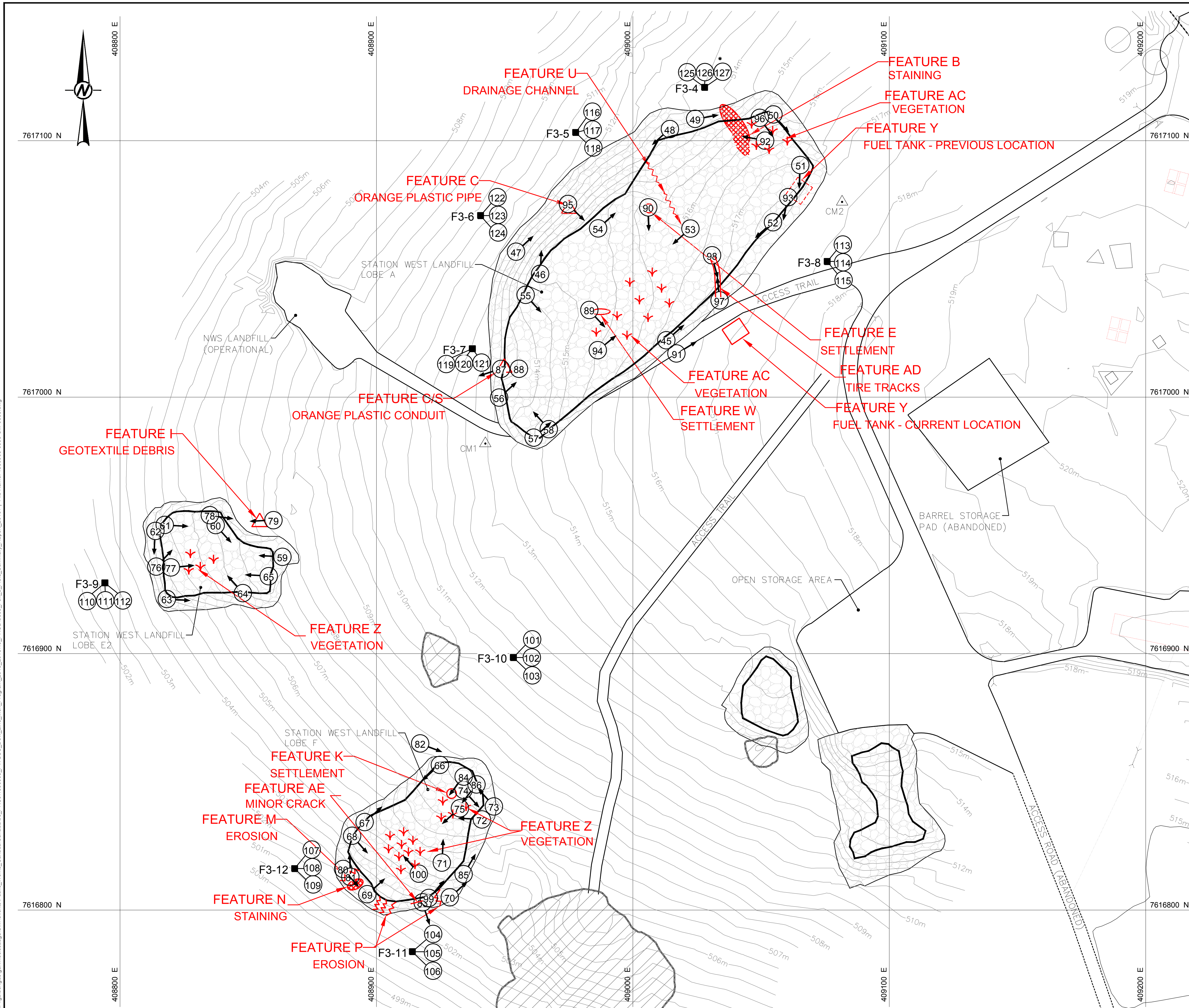
Previously observed minor depression (Feature J) was not identified in 2016. Previously observed shallow drainage channels on the northwest cover surface of Lobe A (Feature U) do not appear to be eroding the cover.

There is some minor self-armouring erosion on the south slope of Lobe F (Features M and P) that does not appear to have deteriorated since the last inspection and no exposed waste materials were observed. A minor tension crack that has developed on the south slope of Lobe F (new Feature AE) does not appear to have a significant effect on the stability of the landfill.

Moss and some sparse grass vegetation is becoming established on the cover surface of Lobes E2 and F (Feature Z) and on the cover surface of Lobe A (new Feature AC).

A tire track was observed as a new feature (Feature AD) on the cover surface of Lobe A.

Previously observed Features A, D, F, G, H, L, O, Q, R and T were not observed during the 2016 visual inspection.



LEGEND

- CM1 SURVEY CONTROL MONUMENT
- SOIL SAMPLING LOCATION
- SETTLEMENT (NTS)
- STAINING (NTS)
- PONDING (NTS)
- DEBRIS (NTS)
- DRAINAGE CHANNEL
- VEGETATION (NTS)
- TIRE TRACKS (NTS)
- CRACKING (NTS)
- 95 PHOTOGRAPH VIEWPOINT LOCATION
- TYPE 1 GRANULAR A

NOTE

GRID PROJECTION IS NAD83 ZONE 19W.
ELEVATIONS ARE GEODETIC.

REFERENCE

PREVIOUS INSPECTION FIGURE PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

0 25 50
1:1,500 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
STATION WEST LANDFILL

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-10-19
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-3.2

Table 4-1: Visual Inspection Checklist - Station West Landfill

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: Station West Landfill
DATE OF INSPECTION: August 16, 2016
DATE OF PREVIOUS INSPECTION: August 17, 2015
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 4
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-1: Visual Inspection Checklist – Station West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	W	Lobe A, central crest surface	408983	7617034	5	5	0.1	0.17%	Shallow depressions with no ponded water (Acceptable)	Unchanged since previous observation	89
		E	Lobe A, north crest surface	409006	7617074	2	2	0.1	0.03%	Shallow depressions with no ponded water (Acceptable)	Unchanged since previous observation	90
		J	Lobe E2, west crest							Previously observed as minor settlement	Not observed	76
		K	Lobe F, north crest surface	408934	7616852	1	1	0.1	0.01%	Shallow depression with no ponded water (Acceptable)	Unchanged since previous observation	84
Erosion	Y	M	Lobe F, southwest slope	408887	7616816	10	5	0.1	0.34%	Minor self armouring erosion (Acceptable)	Unchanged since previous observation	80
		P	Lobe F, southeast slope	408918	7616803	20	5	0.1	0.68%	Minor self armouring erosion (Acceptable)	Unchanged since previous observation	83
		U	Lobe A, cover surface	409022	7617065	25	0.2	0.05	0.03%	Drainage channel (Acceptable)	Unchanged since previous observation	48
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	Y	AE	Lobe F, southwest slope	408920	7616804	9	0.02	0.05	<0.01%	Minor tension crack (Acceptable)	New observation	99
Animal Burrows	N											

Table 4-1: Visual Inspection Checklist – Station West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Vegetation	Y	Z	Lobe E2, cover surface	408817	7616934	20	20	-	2.70%	Sparse vegetation (Acceptable)	Previously observed: approximately same area	77
		Z	Lobe F, cover surface	408939	7616849	20	20	-	2.70%	Moss and sparse grass (Acceptable)	Previously observed: approximately same area	86, 100
		AC	Lobe A, cover surface	408986	7617018	35	27	-	6.3%	Moss and sparse grass (Acceptable)	New observation	94, 96
Staining	Y	B	Lobe A, north crest edge	409052	7617100	20	5	-	0.68%	Red staining (Acceptable)	Unchanged since previous observation	92
		N	Lobe F, south slope	408890	7616813	2	2	-	0.03%	Black staining (Acceptable)	Unchanged since previous observation	81
Vegetation Stress	N											
Seepage or Ponded Water	N	X	Lobe A, east toe	409017	7617017	-	-	-	-	No running water along toe (Acceptable)	Not observed in 2016	91
		V	Lobe A, north toe	409034	7617132	-	-	-	-	No ponded water along toe (Acceptable)	Not observed in 2016	49
		AA	Lobe E2, north toe	408835	7616954	-	-	-	-	No ponded water along toe (Acceptable)	Not observed in 2016	78
		AB	Lobe F, east toe	408934	7616814	-	-	-	-	No ponded water along toe (Acceptable)	Not observed in 2016	85
		AB	Lobe F, north toe	408917	7616865	-	-	-	-	No ponded water along toe (Acceptable)	Not observed in 2016	82

Table 4-1: Visual Inspection Checklist – Station West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Debris and/or Liner Exposed	Y	C C / S	Lobe A, southwest crest	408974 408948	7617075 7617011	0.3	-	-	0.00%	Orange plastic conduit - used as road edge markers - not buried waste - recommend drop from features list. (Acceptable)	Unchanged since previous observation	87, 88, 95
		I	Lobe E2, northeast toe	408860	7616952	3	1	-	0.02%	Geotextile (Acceptable)	Previously surrounded with ponded water; no ponded water was observed.	79
Presence / Condition of Monitoring Instruments	N											
Features of Note/Other Observations	Y	Y	Lobe A, northeast crest	409034	7617038					Fuel tank (Acceptable)	Previously observed surrounded by some uneven ground but relocated to new location.	93, 98
		AD	Lobe A, east crest	409034	7617038	12	2	-	0.17%	Tire tracks ((Acceptable)	New Observation	97, 98

Landfill Area = 14,800 m^2.

Table 4-2: Preliminary Stability Assessment – Station West Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Acceptable	Occasional
Lateral Movement	Not Observed	-
Frost Action	Not Observed	-
Sloughing	Not Observed	-
Cracking	Acceptable	Isolated
Animal Burrows	Not Observed	-
Vegetation establishment	Acceptable	Occasional
Staining	Acceptable	Occasional
Vegetation Stress	Not Observed	-
Seepage/Ponded Water	Not Observed	-
Debris and/or liner exposure	Acceptable	Isolated
Other	Not Observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-3: Summary Table of Photographic Log – Station West Landfill

Photo	Description (file name)	Easting	Northing	Date
45	FOX-3 – Station West Landfill – East crest, facing northeast (ATT19_Photo19.jpg)	409013	7617022	16-Aug-2016
46	FOX-3 – Station West Landfill – West crest, facing north (ATT20_Photo20.jpg)	408964	7617048	16-Aug-2016
47	FOX-3 – Station West Landfill – West toe, facing northeast (ATT21_Photo21.jpg)	408954	7617057	16-Aug-2016
48	FOX-3 – Station West Landfill – West slope and toe, facing southwest (ATT22_Photo22.jpg)	409014	7617105	16-Aug-2016
49	FOX-3 – Station West Landfill – North west slope and toe, facing northeast (ATT23_Photo23.jpg)	409024	7617109	16-Aug-2016
50	FOX-3 – Station West Landfill – Northeast crest, facing southeast (ATT24_Photo24.jpg)	409055	7617110	16-Aug-2016
51	FOX-3 – Station West Landfill – Cover surface, facing south (ATT25_Photo25.jpg)	409065	7617091	16-Aug-2016
52	FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT26_Photo26.jpg)	409055	7617068	16-Aug-2016
53	FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT27_Photo27.jpg)	409022	7617066	16-Aug-2016

Table 4-3: Summary Table of Photographic Log – Station West Landfill

Photo	Description (file name)	Easting	Northing	Date
54	FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT28_Photo28.jpg)	408986	7617066	16-Aug-2016
55	FOX-3 – Station West Landfill – Southwest slope, facing southwest (ATT29_Photo29.jpg)	408958	7617040	16-Aug-2016
56	FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT30_Photo30.jpg)	408948	7617000	16-Aug-2016
57	FOX-3 – Station West Landfill – Southeast crest, facing northeast (ATT31_Photo31.jpg)	408961	7616984	16-Aug-2016
58	FOX-3 – Station West Landfill – Cover surface, facing northwest (ATT32_Photo32.jpg)	408967	7616988	16-Aug-2016
59	FOX-3 – Station West Landfill – Cover surface, facing west (ATT33_Photo33.jpg)	408863	7616938	16-Aug-2016
60	FOX-3 – Station West Landfill – Cover surface, facing southeast (ATT34_Photo34.jpg)	408838	7616954	16-Aug-2016
61	FOX-3 – Station West Landfill – Cover surface, facing east (ATT35_Photo35.jpg)	408817	7616950	16-Aug-2016
62	FOX-3 – Station West Landfill – Wet slope and toe, facing south (ATT36_Photo36.jpg)	408814	7616948	16-Aug-2016
63	FOX-3 – Station West Landfill – South slope and toe, facing east (ATT37_Photo37.jpg)	408818	7616921	16-Aug-2016
64	FOX-3 – Station West Landfill – Cover surface, facing northwest (ATT38_Photo38.jpg)	408848	7616924	16-Aug-2016
65	FOX-3 – Station West Landfill – Cover surface, facing west (ATT39_Photo39.jpg)	408858	7616930	16-Aug-2016
66	FOX-3 – Station West Landfill – Northwest slope, facing southwest (ATT40_Photo40.jpg)	408925	7616857	16-Aug-2016
67	FOX-3 – Station West Landfill – Northwest slope, facing northeast (ATT41_Photo41.jpg)	408895	7616834	16-Aug-2016
68	FOX-3 – Station West Landfill – Southwest slope, facing southeast (ATT42_Photo42.jpg)	408891	7616829	16-Aug-2016
69	FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT43_Photo43.jpg)	408896	7616806	16-Aug-2016
70	FOX-3 – Station West Landfill – Southeast slope, facing northeast (ATT44_Photo44.jpg)	408929	7616805	16-Aug-2016
71	FOX-3 – Station West Landfill – Cover surface, facing north (ATT45_Photo45.jpg)	408926	7616819	16-Aug-2016
72	FOX-3 – Station West Landfill – Cover surface, facing west (ATT46_Photo46.jpg)	408941	7616835	16-Aug-2016
73	FOX-3 – Station West Landfill – Northeast slope, facing northwest (ATT47_Photo47.jpg)	408946	7616840	16-Aug-2016

Table 4-3: Summary Table of Photographic Log – Station West Landfill

Photo	Description (file name)	Easting	Northing	Date
74	FOX-3 – Station West Landfill – Cover surface, facing south (ATT48_Photo48.jpg)	408934	7616847	16-Aug-2016
75	FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT49_Photo49.jpg)	408933	7616840	16-Aug-2016
76	FOX-3 – Station West Landfill – Lobe E2, west crest – previous minor settlement (previous Feature J), facing northeast (ATT22_Photo22.jpg)	408817	7616934	16-Aug-2016
77	FOX-3 – Station West Landfill – Lobe E2, cover surface – Feature Z – Sparse vegetation [Acceptable], facing northeast (ATT22_Photo22.jpg)	408817	7616934	16-Aug-2016
78	FOX-3 – Station West Landfill – Lobe E2, north toe – No ponded water along toe (previous Feature AA) [Acceptable], facing east (ATT21_Photo21.jpg)	408835	7616954	16-Aug-2016
79	FOX-3 – Station West Landfill – Lobe E2, northeast toe – Feature I – Geotextile [Acceptable], facing west (ATT20_Photo20.jpg)	408860	7616952	16-Aug-2016
80	FOX-3 – Station West Landfill – Lobe F, southwest slope – Feature M – Minor self-armouring erosion [Acceptable], facing southeast (ATT25_Photo25.jpg)	408887	7616816	16-Aug-2016
81	FOX-3 – Station West Landfill – Lobe F, south slope – Feature N – Minor black staining [Acceptable], facing north (ATT24_Photo24.jpg)	408890	7616813	16-Aug-2016
82	FOX-3 – Station West Landfill – Lobe F, north toe – No ponded water along toe (previous Feature AB) [Acceptable], facing southeast (ATT23_Photo23.jpg)	408917	76168650	16-Aug-2016
83	FOX-3 – Station West Landfill – Lobe F, southeast slope – Feature P – Minor self-armouring erosion [Acceptable], facing southeast (ATT26_Photo26.jpg)	408918	7616803	16-Aug-2016
84	FOX-3 – Station West Landfill – Lobe F, north crest surface – Feature K – shallow depression [Acceptable], facing southwest (ATT30_Photo30.jpg)	408934	7616852	16-Aug-2016
85	FOX-3 – Station West Landfill – Lobe F, east toe – No ponded water along toe (previous Feature AB) [Acceptable], facing northeast (ATT29_Photo29.jpg)	408934	7616814	16-Aug-2016
86	FOX-3 – Station West Landfill – Lobe F, cover surface – Feature Z – Moss and sparse grass [Acceptable], facing southwest (ATT31_Photo31.jpg)	408939	7616849	16-Aug-2016
87	FOX-3 – Station West Landfill – Lobe A, southwest crest – Feature C/S – Orange plastic conduit. [Acceptable], facing southwest (ATT19_Photo19.jpg)	408949	7617011	16-Aug-2016

Table 4-3: Summary Table of Photographic Log – Station West Landfill

Photo	Description (file name)	Easting	Northing	Date
88	FOX-3 – Station West Landfill – Lobe A, southwest crest – rough area around Feature C/S, facing southwest (ATT19_Photo19.jpg)	408949	7617011	16-Aug-2016
89	FOX-3 – Station West Landfill – Lobe A, central crest surface – Feature W – Shallow depressions [Acceptable], facing southeast (ATT11_Photo11.jpg)	408983	7617034	16-Aug-2016
90	FOX-3 – Station West Landfill – Lobe A, north crest surface – Feature E – Shallow depressions [Acceptable], facing south (ATT18_Photo18.jpg)	409006	7617074	16-Aug-2016
91	FOX-3 – Station West Landfill – Lobe A, east toe – No running water along toe (previous Feature X), facing northeast (ATT9_Photo9.jpg)	409017	7617017	16-Aug-2016
92	FOX-3 – Station West Landfill – Lobe A, north crest edge – Feature B – Red staining [Acceptable], facing northwest (ATT13_Photo13.jpg)	409052	7617100	16-Aug-2016
93	FOX-3 – Station West Landfill – Lobe A, the previous and current location of the fuel tank (Feature Y) [Acceptable], facing southwest (ATT15_Photo15.jpg)	409061	7617078	16-Aug-2016
94	FOX-3 – Station West Landfill – Lobe A, Feature AC - Sparse vegetation, facing northeast (ATT10_Photo10.jpg)	408986	7617018	16-Aug-2016
95	FOX-3 – Station West Landfill – Lobe A, Feature C - Plastic tube, facing southeast (ATT12_Photo12.jpg)	408975	7617075	16-Aug-2016
96	FOX-3 – Station West Landfill – Lobe A, Feature AC – Sparse vegetation, facing southeast (ATT14_Photo14.jpg)	409050	7617109	16-Aug-2016
97	FOX-3 – Station West Landfill – Lobe A, east crest and slope – Feature AD – Tire track on the cover surface and east slope, facing northwest (ATT16_Photo16.jpg)	409034	7617038	16-Aug-2016
98	FOX-3 – Station West Landfill – Lobe A, cover surface – Feature AD – Tire track on the cover surface and east slope – Feature Y is also shown, facing southeast (ATT17_Photo17.jpg)	409031	7617055	16-Aug-2016
99	FOX-3 – Station West Landfill – Lobe F, southeast toe – Feature AE – Minor tension crack at toe, (ATT27_Photo27.jpg)	408920	7616805	16-Aug-2016
100	FOX-3 – Station West Landfill – Lobe F, Feature Z – Sparse vegetation covers the cover surface, facing northwest (ATT28_Photo28.jpg)	408917	7616814	16-Aug-2016

4.1.4 Soil Sampling

Table 4-4 presents a summary of analytical results for soil samples collected at the Station West Landfill. Sampling locations F3-8 and F3-10 represent upgradient sampling locations of Lobe A and Lobe F, respectively. Sampling locations F3-4 through F3-7 (Lobe A), F3-9 (Lobe E3) and F3-11 and F3-12 (Lobe F) represent downgradient sampling locations. The deep soil samples at F3-4, F3-7, F3-8 and F3-10 could not be collected due to refusal on rock.

Table 4-4 also lists the arithmetic mean background and baseline values for the site, in addition to the baseline plus three-sigma (baseline plus 3σ) limit. At the Station West Landfill, the baseline arithmetic mean and the baseline plus 3σ for cobalt are both lower than the background arithmetic mean; the baseline arithmetic mean for arsenic is slightly lower than the background arithmetic mean.

F3-8

Sampling location F3-8 is located upgradient of Lobe A, approximately 12 m northeast of the toe of the landfill. The estimated elevation of this sampling point is 517.5 masl. As shown in Photograph 113 (Appendix D), the area is covered with loose coarse sand, gravel and stones with some vegetation. A fuel tank is located north of the sampling location; DND has indicated that this is a new tank awaiting commissioning and as of 2016 it had never contained fuel. The soil in the area of the sample location consisted of light brown sand and gravel.

For the shallow sample at F3-8 (0-15 cm), the concentration of arsenic was similar to those observed in previous years, whereas the concentrations of most other metals were less than those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-10

Sampling location F3-10 is located upgradient of Lobe F, approximately 30 m north of the toe. The estimated elevation of this sampling point is 510 masl. As shown in Photograph 101 (Appendix D), the area is covered with coarse sand, gravel and stones with some vegetation. The soil in the area of the sample location consisted of brown sand and gravel matrix.

For the shallow sample at F3-10 (0-15 cm), metal concentrations observed in 2016 were similar to those observed in previous years, with the exception of lead, which was the highest reported value to date. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-4

Sampling location F3-4 is located downgradient of Lobe A of the landfill, approximately 10 m north of the northern toe. The estimated elevation of this sampling point is 513.5 masl. As shown in Photo 125 (Appendix D), some red staining was observed on the northern part of landfill (Feature B). The native soil in the area of the sample location consisted of brown sand and gravel, largely covered with pink and grey igneous gravel, pebbles and stone and sparse vegetation (Photo 126).

For the shallow samples at F3-4 (0-15 cm, duplicate location), the calculated relative percent difference (RPD) values indicated the original and duplicate results differ by greater than 30% for zinc and should be interpreted with caution.

Metal concentrations at the shallow F3-4 sample in 2016 were similar to those observed in previous years. The modified TPH concentration observed in 2016 (50 mg/kg) remained below the concentration reported in 2012 (84 mg/kg). The average concentration of the PHC F3 fraction in 2016 was 43 mg/kg; this exceeded the baseline mean plus 3σ. The concentration of the PHC F4 fraction in 2016 was 19 mg/kg; no PHC were detected at this location in 2014 or 2015. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-5

Sampling location F3-5 is located downgradient of Lobe A of the landfill, approximately 12 m northwest of the toe. The estimated elevation of this sampling point is 511.5 masl. Photo 116 (Appendix D) illustrates the conditions in the area of the sample, which consist of weathered boulders surrounded by stony sand and gravel matrix covered with well-established vegetation. The soil in the area of the sample location (Photo 117) consisted of a wet grey sand and gravel matrix.

For the shallow sample at F3-5 (0-15 cm), metal concentrations observed in 2016 were similar to those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

The deep sample at F3-5 (40-50 cm) exhibited similar concentrations to those in the shallow sample. Metal concentrations were observed in previous years at similar concentrations. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-6

Sampling location F3-6 is located downgradient of the Lobe A of the landfill, immediately northwest of the toe. The estimated elevation of this sampling point is 511.5 masl. Photo 122 (Appendix D) illustrates the conditions in the area of the sample, which consist of boulders surrounded by stony sand and gravel matrix covered with well-established vegetation. The soil in the area of the sample location consisted of grey sand and gravel matrix.

For the shallow sample at F3-6 (0-15 cm), the concentrations of lead and arsenic were greater than those observed in previous years. In the case of arsenic, the concentration (20.2 mg/kg) was above the baseline mean, but slightly less than the baseline mean concentration plus 3σ (22 mg/kg). The concentrations of most other metals were less than or similar to those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

For the deep sample at F3-6 (30-40 cm), the concentration of arsenic (19.5 mg/kg) also represented an increase over values observed previously, and was slightly less than the baseline mean concentration plus 3σ (22 mg/kg). The concentrations of most other metals were less than or similar to those observed in previous years. No cadmium, mercury, PHC or PCB were detected from the deep sample at F3-6 in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-7

Sampling location F3-7 is located downgradient of Lobe A, approximately 10 m west of the landfill toe. The estimated elevation of this sampling point is 512 masl. Photo 119 (Appendix D) illustrates the area of sample location F3-7. The conditions in the area of the sample consist of rock surrounded by stony sand and gravel matrix covered with well-established vegetation. The soil in the area of the sample location consisted of brown sand and gravel matrix.

For the shallow sample at F3-7 (0-15 cm), the concentrations of metals were similar to those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-9

Sampling location F3-9 is located downgradient of the Lobe E2 of the landfill, approximately 10 m west of the western toe. The estimated elevation of this sampling point is 502.5 masl. As shown in Photo 110 (Appendix D), the area is covered with gravel and stones with some vegetation. The soil in the area of the sample location consisted of a wet brown sand and gravel matrix.

The metal concentrations at the shallow sample at F3-9 (0-15 cm), the concentrations of lead and arsenic were greater than those observed in previous years. In the case of arsenic, the concentration (20.1 mg/kg) was above the baseline mean, but slightly less than the baseline mean concentration plus 3σ (22 mg/kg). The concentrations of all other metals were similar to those in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

The metal concentrations at the deep sample at F3-9 (40-50 cm) were slightly higher than those in the shallow sample. The concentrations of copper, lead and arsenic reported in 2016 represent new historical maximum concentrations at this location. In the case of arsenic, the concentration (20.4 mg/kg) was above the baseline mean, but slightly less than the baseline mean concentration plus 3σ (22 mg/kg). The concentrations of most other metals were greater than those observed in 2015 but similar to those observed in 2012 and 2014. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-11

Sampling location F3-11 is located downgradient of Lobe F of the landfill, approximately 6 m south of the toe. The estimated elevation of this sampling point is 502.5 masl. As shown in Photo 81 (Appendix D), some black staining was observed on the southern slope of landfill (Feature N). As shown in Photo 104, the area is covered with boulders, gravel and stones; the areas where greater proportions of sand are present are covered with well-established vegetation. The soil in the area of the sample location consisted of brown sand and gravel matrix.

At F3-11, the metal concentrations in the shallow (0-15 cm) sample were slightly less than those in the deep (40-50 cm) sample for all parameters except cobalt. The concentrations of copper, lead and arsenic in both samples were greater than those observed in previous years, whereas the concentrations of most other metals were similar to those observed in previous years. The concentrations of copper and arsenic in both samples exceeded their baseline concentrations plus 3σ (62 mg/kg and 22 mg/kg, respectively). No cadmium, mercury, PHC or PCB were detected at this location in 2016.

F3-12

Sampling location F3-12 is located downgradient of Lobe F, approximately 8 m west of the western toe. The estimated elevation of this sampling point is 502 masl. As shown in Photo 107 (Appendix D), the area is covered with boulders, gravel and stones; the areas where greater proportions of sand are present are covered with well-established vegetation. The soil in the area of the sample location consisted of brown sand and gravel.

For the shallow (0-15 cm) and deep (40-50 cm) samples at F3-12, the concentrations of all metals, with the exception of lead in the shallow sample, were less than or similar to those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

Table 4-4: Soil Chemical Analysis Results – Station West Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.10	0.003	NA	NA	NA	NA
Baseline Mean		**39.5**	**31.4**	**12.5**	**1.0**	**10.0**	**70.8**	**77.3**	**10.0**	**0.10**	**0.10**	**10.0**	**4.0**	**9.0**	**NA**
Baseline + 3σ		62.5	43.1	17.5	1.0	21.0	116.8	104.5	21.9	0.10	0.19	10.0	9.5	19.2	NA
Upgradient															
F3-8a	0-15	26.1	21.7	7.8	<0.5	9.1	49.2	57.8	**11.6**	<0.1	<0.05	<7	<4	<8	<6
F3-8 (deep) [1]															
F3-10a	0-15	28.7	25.5	9.4	<0.5	**12.8**	58.4	69.2	**12.0**	<0.1	<0.05	<7	<4	<8	<6
F3-10 (deep) [1]															
Downgradient															
F3-4a	0-15	31.3	25.2	8.8	<0.5	8.2	60	68.4	**14.4**	<0.1	<0.05	<7	<4	**35**	19
F3-4a dup	0-15	36	**32**	9.4	<0.5	7.0	**86**	76	**18**	<0.10	<0.05	<5	<10	<50	<50
F3-4a (Dup Avg)	0-15	34	29	9.1	<0.5	7.6	**73**	72	**16**	<0.1	<0.05	<6	<7	**43**	35
F3-4 (deep) [1]															
F3-5b	0-15	39.1	27.8	10.0	<0.5	8.7	63.7	67.6	**14.5**	<0.1	<0.05	<7	<4	<8	<6
F3-5a	40-50	38.7	27.0	10.4	<0.5	9.1	60.5	70.1	**14.7**	<0.1	<0.05	<7	<4	<8	<6
F3-6b	0-15	36.7	27.2	9.5	<0.5	9.7	55.0	66.0	**20.2**	<0.1	<0.05	<7	<4	<8	<6
F3-6a	30-40	36.3	27.0	9.2	<0.5	9.5	56.0	68.3	**19.5**	<0.1	<0.05	<7	<4	<8	<6
F3-7a	0-15	33.2	26.8	9.6	<0.5	8.5	58.1	73.6	**14.3**	<0.1	<0.05	<7	<4	<8	<6
F3-7 (deep) [1]															
F3-9b	0-15	**49.0**	**31.6**	10.5	<0.5	**10.7**	61.0	76.2	**20.1**	<0.1	<0.05	<7	<4	<8	<6
F3-9a	40-50	**53.6**	**31.9**	11.0	<0.5	**10.5**	63.4	**77.5**	**20.4**	<0.1	<0.05	<7	<4	<8	<6
F3-11b	0-15	**66.3**	**37.5**	**13.5**	<0.5	**11.5**	69.2	**80.6**	**34.6**	<0.1	<0.05	<7	<4	<8	<6
F3-11a	40-50	**67.1**	**38.9**	**13.2**	<0.5	**12.6**	69.6	**82.5**	**38.2**	<0.1	<0.05	<7	<4	<8	<6
F3-12b	0-15	39.0	28.3	9.2	<0.5	8.4	54.3	69.5	**17.0**	<0.1	<0.05	<7	<4	<8	<6

Table 4-4: Soil Chemical Analysis Results – Station West Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.10	0.003	NA	NA	NA	NA
Baseline Mean		**39.5**	**31.4**	**12.5**	**1.0**	**10.0**	**70.8**	**77.3**	**10.0**	**0.10**	**0.10**	**10.0**	**4.0**	**9.0**	**NA**
Baseline + 3σ		62.5	43.1	17.5	1.0	21.0	116.8	104.5	21.9	0.10	0.19	10.0	9.5	19.2	NA
F3-12a	30-40	38.8	28.3	9.2	<0.5	8.6	53.5	69.0	**16.0**	<0.1	<0.05	<7	<4	<8	<6

Notes:

NA: Not available

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at F3-4, F3-7, F3-8 and F3-10 could not be collected due to refusal.

4.1.5 Conclusions and Overall Performance of the Station West Landfill

Based on the visual inspection, there does not appear to be any significant erosion, settlement, exposed waste or indications of instability at the Station West Landfill. No ponding of water on the cover surface or along the toe of the landfill was observed. Red staining was observed on the cover surface in the northeastern corner of Lobe A; black staining was observed on the south slope of Lobe F. The observed staining appears to be surficial (i.e., from equipment storage and/or spill) and not related to landfill seepage. Previously observed minor erosion appears to be self-armouring and has not visibly deteriorated since the last inspection. A new tension crack observed on the south slope of Lobe F appears to be insignificant. No exposed waste materials were observed. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the Station West Landfill has an “Acceptable” overall landfill performance.Two soil samples were collected at five of the nine designated locations in 2016; deep samples could not be collected at F3-4, F3-7, F3-8 and F3-10 as a result of refusal (boulders). The concentrations of most metal parameters were highest at F3-9, located downgradient of Lobe E2 and at F3-11, located downgradient of Lobe F of the landfill where black staining was observed on the southern slope. In a few cases, the 2016 concentrations were slightly higher than in earlier years (e.g., copper, lead and arsenic at F3-11); however in most cases they were similar to previous monitoring results. The concentrations of copper and arsenic in both samples at F3-11 exceeded the baseline mean concentrations plus 3σ. The modified TPH concentration observed in the shallow sample at F3-4 in 2016 remained below the concentration reported in 2012. No PHC were detected at the remaining sampling locations and no detectable concentrations of cadmium, mercury or PCB were noted in any of the samples in 2016.

In general, the data from this site are not indicative of increasing influence from the landfill, with the possible exception of location F3-11, where results from both the shallow and deep samples may be reflective of a potential influence; insufficient data are currently available to confirm this.

4.1.6 Recommendations for Station West Landfill

It is recommended that a sample of the black stained cover material be collected in the next sample round and analyzed for the standard parameter list to determine if the staining is of concern. Should the observed black staining of the landfill cover increase, or should the quality of the next sample collected from F3-11 indicate further increases in parameter concentrations, additional actions may need to be considered. No modifications to the ongoing monitoring program at this landfill are recommended at this time.

There does not appear to be buried waste under the previously observed geotextile (Feature I) located beyond the northeast toe of Lobe E2 at the Station West Landfill. Consideration could be given to cutting and removing this material in the future, if desired.

4.2 West Landfill

4.2.1 Landfill Description

The West Landfill is located approximately 1.3 km west of the station, and 0.5 km beyond the DEW Line Reserve boundary, in a former granular borrow area. There is an old access road leading to the area from the north end of the module train. The terrain in the vicinity of the landfill slopes to the northwest, from an elevation of 419 masl immediately east of the landfill, to an elevation of 411 masl to the west. Based on satellite imagery, this area appears to drain to adjacent small surface water channels, leading to a linear water body located approximately 2 km to the southwest.

The West Landfill is a regraded landfill extending over an area of approximately 3,350 m^2 (including sideslopes). The long term monitoring plan consists of visual inspection, and the periodic collection of soil samples. Approximate locations for the collection of soil samples are identified in Figure FOX-3.3.

4.2.2 Summary of any Scope Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at F3-1 and F3-2 could not be collected due to refusal on rock.

4.2.3 Visual Inspection

The West Landfill has some observed minor settlement, erosion and ponded water features. No cracking or exposed waste was observed. Table 4-5 presents a summary of observed visual inspection features and Table 4-6 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall landfill performance because all observed features were assessed as “Acceptable”. Table 4-7 is a log of photographs taken during the 2016 visual inspection.

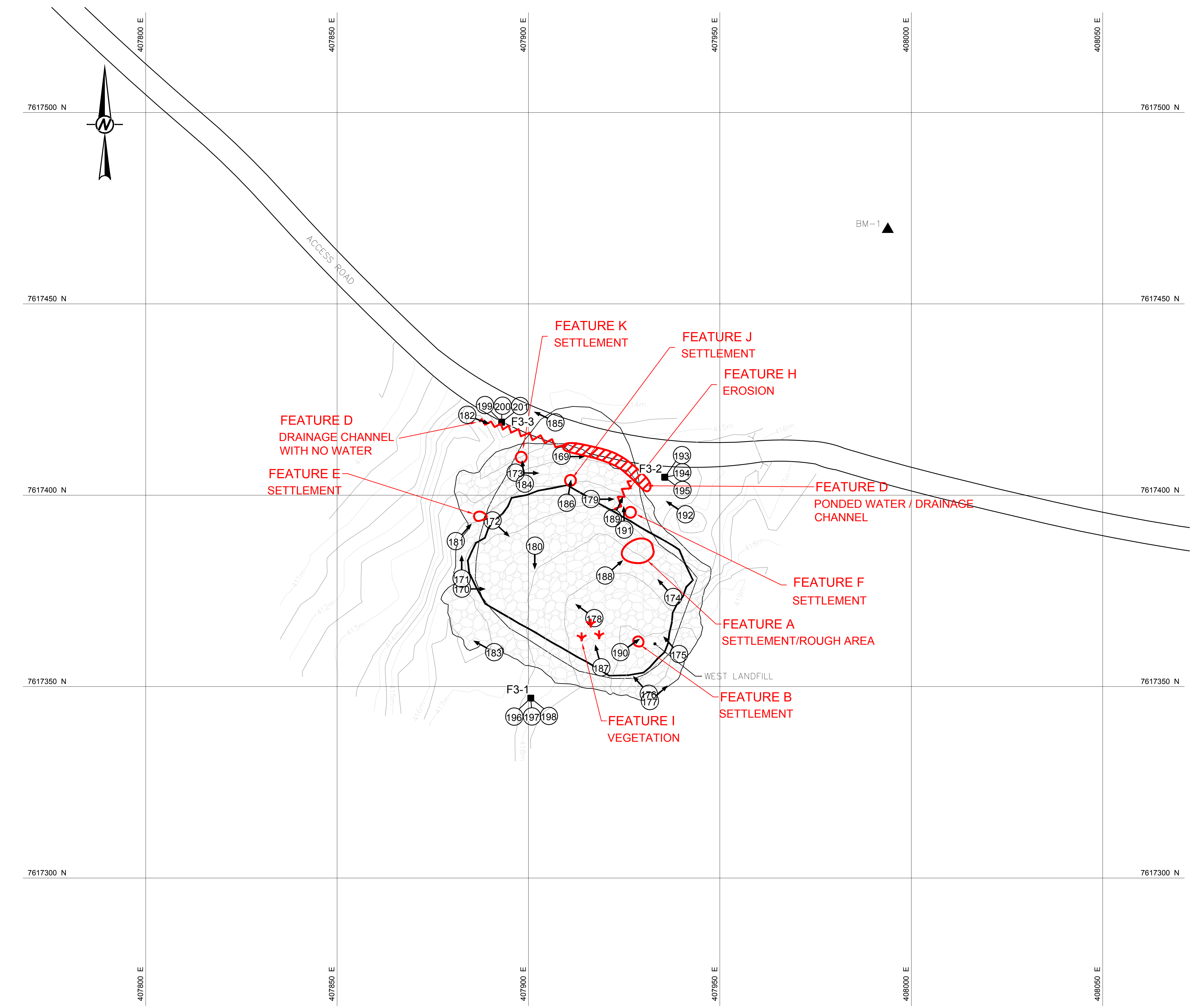
There were five previously observed areas of minor settlement (Features A, E, F, J and K). The observed settlement areas are all shallow and may be related to construction rather than landfill performance or permafrost thaw. These minor settlement areas are not considered a concern.

Ponded and running water that was previously observed along the entire north toe (Feature D) was significantly reduced in 2016. There was no water in the drainage channel at the west end of the north toe. The previously observed pond of water at the south toe (Feature G) was not observed in 2016. Additionally, no water was observed in the small, shallow depression on the landfill cover surface that was previously filled with water (Feature B).

There was some minor self-armouring erosion on the north slope (Feature H) that is not considered a concern.

Moss and sparse grass vegetation is becoming established in the southeast corner of the cover surface (Feature I).

Previously observed Feature C was not observed during the 2016 visual inspection.



LEGEND

- PERMANENT BENCHMARK LOCATION
- SOIL SAMPLING LOCATION
- SETTLEMENT (NTS)
- PHOTOGRAPH VIEWPOINT LOCATION
- PONDED WATER (NTS)
- EROSION (NTS)
- VEGETATION (NTS)
- TYPE 1 GRANULAR A

NOTES

GRID PROJECTION IS NAD83 ZONE 19W.
ELEVATIONS ARE GEODETIC.

REFERENCE

PREVIOUS INSPECTION FIGURE PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

0 25 50
1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
WEST LANDFILL

CONSULTANT

YYYY-MM-DD	2016-10-19
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-3.3

Table 4-5: Visual Inspection Checklist - West Landfill

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: West Landfill
DATE OF INSPECTION: August 17, 2016
DATE OF PREVIOUS INSPECTION: August 17, 2015
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 4
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-5: Visual Inspection Checklist – West Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	E	West slope	407881	7617388	3	3	0.1	0.27%	Minor settlement (Acceptable)	Unchanged since previous inspection	181
		F	North slope	407925	7617391	3	2	0.2	0.18%	Minor settlement (Acceptable)	Unchanged since previous inspection	191
		A	Cover surface	407920	7617379	3	3	0.1	0.27%	Minor settlement and rough area (Acceptable)	Unchanged since previous inspection	188
		J	North slope	407910	7617398	1	0.5	0.1	0.01%	Minor settlement (Acceptable)	Unchanged since previous inspection	186
		K	Northwest slope	407899	7617403	1	0.5	0.1	0.01%	Minor settlement (Acceptable)	Unchanged since previous inspection	184
		B	Cover surface	407924	7617359	1	1	0.1	0.03%	Minor settlement (Acceptable)	The settlement area was unchanged since previous observation with no ponded water	190
Erosion	Y	H	North slope	407922	7617394	10	1	0.1	0.30%	Minor self-armouring erosion (Acceptable)	Unchanged since previous inspection	189
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	N											
Animal Burrows	N											

Table 4-5: Visual Inspection Checklist – West Landfill

<table>
<tr><th>Checklist Item</th><th>Present (Y/N)</th><th>Feature ID (A, B, etc.)</th><th>Location Description</th><th>Easting</th><th>Northing</th><th>Length (m)</th><th>Width (m)</th><th>Depth (m)</th><th>Extent of Landfill Area (%)</th><th>Description (Severity Rating)</th><th>Comparison to Historical Observations</th><th>Photos</th></tr>
<tr><td>Vegetation</td><td>Y</td><td>I</td><td>Crest surface</td><td>407919</td><td>7617355</td><td>20</td><td>20</td><td>-</td><td>11.94%</td><td>Moss and sparse vegetation (Acceptable)</td><td>Approximately same area</td><td>187</td></tr>
<tr><td>Staining</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Vegetation Stress</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Seepage or Ponded Water</td><td rowspan="4">Y</td><td>G</td><td>South toe</td><td>407891</td><td>7617359</td><td>-</td><td>-</td><td>-</td><td>-</td><td>No ponded water (Acceptable)</td><td>Not observed in 2016</td><td>183</td></tr>
<tr><td rowspan="3">D</td><td rowspan="3">North toe along road</td><td>407941</td><td>7617395</td><td>-</td><td>-</td><td>-</td><td>-</td><td>Rough area with no water (Acceptable)</td><td>No running water was observed in 2016</td><td>192</td></tr>
<tr><td>407908</td><td>7617410</td><td>25</td><td>0.5</td><td>0.1</td><td>0.4%</td><td>Ponded water (Acceptable)</td><td>Previously observed. Less water in 2016</td><td>169</td></tr>
<tr><td>407884</td><td>7617421</td><td>20</td><td>3</td><td>0.3</td><td>1.7%</td><td>Drainage channel along the north toe with no running water (Acceptable)</td><td>Previously observed with running water but no water in 2016</td><td>182</td></tr>
<tr><td>Debris and/or Liner Exposed</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Presence / Condition of Monitoring Instruments</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Features of Note/Other Observations</td><td>N</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Landfill Area = 3,350 m^2.

Table 4-6: Preliminary Stability Assessment - West Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Acceptable	Isolated
Lateral Movement	Not Observed	-
Frost Action	Not Observed	-
Sloughing	Not Observed	-
Cracking	Not Observed	-
Animal Burrows	Not Observed	-
Vegetation establishment	Acceptable	Isolated
Staining	Not Observed	-
Vegetation Stress	Not Observed	-
Seepage/Ponded Water	Acceptable	Isolated
Debris and/or liner exposure	Not Observed	-
Other	Not Observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-7: Summary Table of Photographic Log - West Landfill

Photo	Description (file name)	Easting	Northing	Date
169	FOX-3 – West Landfill – Feature D – ponded water at the north toe, facing east (ATT86_Photo86.jpg)	407909	7617410	17-Aug-2016
170	FOX-3 – West Landfill – South crest, facing east (ATT87_Photo87.jpg)	407883	7617376	17-Aug-2016
171	FOX-3 – West Landfill – West crest, facing north (ATT88_Photo88.jpg)	407883	7617378	17-Aug-2016
172	FOX-3 – West Landfill – Cover surface, facing southeast (ATT89_Photo89.jpg)	407891	7617393	17-Aug-2016
173	FOX-3 – West Landfill – North slope, facing east (ATT90_Photo90.jpg)	407897	7617406	17-Aug-2016
174	FOX-3 – West Landfill – North slope, facing northwest (ATT91_Photo91.jpg)	407938	7617373	17-Aug-2016
175	FOX-3 – West Landfill – Cover surface, facing northwest (ATT92_Photo92.jpg)	407939	7617359	17-Aug-2016
176	FOX-3 – West Landfill – South crest, facing northwest (ATT93_Photo93.jpg)	407931	7617348	17-Aug-2016
177	FOX-3 – West Landfill – East crest, facing northeast (ATT94_Photo94.jpg)	407932	7617346	17-Aug-2016

Table 4-7: Summary Table of Photographic Log - West Landfill

Photo	Description (file name)	Easting	Northing	Date
178	FOX-3 – West Landfill – Cover surface, facing northwest (ATT95_Photo95.jpg)	407917	7617368	17-Aug-2016
179	FOX-3 – West Landfill – North slope, facing southeast (ATT96_Photo96.jpg)	407916	7617399	17-Aug-2016
180	FOX-3 – West Landfill – Cover, facing south (ATT97_Photo97.jpg)	407902	7617387	17-Aug-2016
181	FOX-3 – West Landfill – West slope – Feature E – Minor settlement [Acceptable], facing northeast (ATT56_Photo56.jpg)	407881	7617388	17-Aug-2016
182	FOX-3 – West Landfill – Drainage channel along the north toe with no water, previously observed with running water (Feature D), facing southeast [Acceptable] (ATT58_Photo58.jpg)	407884	7617421	17-Aug-2016
183	FOX-3 – West Landfill – South toe – No ponded water (previous Feature G), facing northwest (ATT55_Photo55.jpg)	407891	7617359	17-Aug-2016
184	FOX-3 – West Landfill – Northwest slope – Feature K – Minor settlement [Acceptable], facing north (ATT57_Photo57.jpg)	407899	7617403	17-Aug-2016
185	FOX-3 – West Landfill – North toe along road, northwest (ATT48_Photo48.jpg)	407907	7617419	17-Aug-2016
186	FOX-3 – West Landfill – North slope – Feature J – Minor settlement [Acceptable], facing north (ATT49_Photo49.jpg)	407910	7617398	17-Aug-2016
187	FOX-3 – West Landfill – Crest surface – Feature I – Moss and sparse vegetation, facing northwest (ATT54_Photo54.jpg)	407919	7617355	17-Aug-2016
188	FOX-3 – West Landfill – Cover surface – Feature A – Minor settlement and rough area [Acceptable], facing northeast (ATT52_Photo52.jpg)	407920	7617379	17-Aug-2016
189	FOX-3 – West Landfill – North slope – Feature H – minor self-armouring erosion [Acceptable], facing northeast (ATT51_Photo51.jpg)	407922	7617394	17-Aug-2016
190	FOX-3 – West Landfill – Cover surface – Feature B – Minor settlement with no ponded water. [Acceptable], facing northeast (ATT53_Photo53.jpg)	407924	7617359	17-Aug-2016
191	FOX-3 – West Landfill – North slope – Feature F – Minor settlement [Acceptable], facing north (ATT50_Photo50.jpg)	407925	7617391	17-Aug-2016
192	FOX-3 – West Landfill – Rough area at the north toe previously observed running water (Feature D) [Acceptable], facing northwest (ATT47_Photo47.jpg)	407941	7617395	17-Aug-2016

4.2.4 Soil Sampling

Table 4-8 presents a summary of analytical results for soil samples collected at the West Landfill. Sample location F3-1 represents an upgradient sampling location, whereas locations F3-2 and F3-3 represent downgradient sampling locations. The deep soil samples at F3-1 and F3-2 could not be collected due to refusal on rock.

Table 4-8 also lists the arithmetic mean background and baseline values for the site, in addition to the baseline plus three-sigma (baseline plus 3σ) limit. At the West Landfill, the baseline arithmetic mean and the baseline plus 3σ for cobalt are both lower than the background arithmetic mean; the baseline arithmetic means for copper, nickel, zinc, chromium, arsenic and mercury are slightly lower than the background arithmetic means.

F3-1

Sampling location F3-1 is located approximately 10 m south of the toe of the landfill. The estimated elevation of this sampling point is 417.5 masl. As shown in Photo 196, the soil in the area of the sample location consisted of sand, gravel and stone; the areas where greater proportions of sand are present are covered with well-established vegetation. The soil in the test hole consisted of brown sand and gravel matrix.

For the shallow sample at F3-1 (0-15 cm), concentrations of metals were similar to those reported in previous years. PHC were detected at this location for the first time; the modified TPH concentration in 2016 was 41 mg/kg and the concentration of the PHC F4 fraction in 2016 was 22 mg/kg. No cadmium, mecury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-2

Sampling location F3-2 is located downgradient of the landfill, approximately 8 m northeast of the toe. The estimated elevation of this sampling point is 414.5 masl. Photo 193 (Appendix D) illustrates the area of the sample and the drainage channel that runs along the northern toe of the landfill. The soil in the area of the sample location consisted of brown sand matrix with pink to grey igneous gravel, pebbles and stone. The excavation filled with water soon after the hole was completed.

For the shallow sample at F3-2 (0-15 cm), the concentrations of metals were greater than those reported in 2015 but generally similar to, or lower than the concentrations reported in 2012 and 2014. PHC were detected at this location for the first time;the concentration of modified TPH was 32 mg/kg. The reported concentrations of PHC F3 and F4 fractions were 26 mg/kg and 8 mg/kg, respectively. No cadmium, mercury or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

F3-3

Sampling location F3-3 is located downgradient of the landfill, approximately 6 m north of the toe of the landfill. The estimated elevation of this sampling point is 412.5 masl. Photo 199 (Appendix D) illustrates the area of the sample and the drainage channel that runs along the northern toe of the landfill. The soil in the area of the sample location consisted of brown sand with trace gravel.

In the shallow sample at F3-3 (0-15 cm), the concentrations of metals were less than those observed in 2015 but similar to those observed in 2012. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

For the deep samples at F3-3 (0-15 cm, duplicate location), the calculated RPD values indicated the original and duplicate results differ by greater than 30% for arsenic and these results should therefore be interpreted with caution. All metal concentrations at this location were less than those observed in 2012 and 2015. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

Table 4-8: Soil Chemical Analysis Results - West Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.50	0.0003	NA	NA	NA	NA
Baseline Mean		**24.3**	**20.0**	**9.0**	**1.0**	**10.0**	**48.7**	**54.6**	**8.7**	**0.10**	**0.10**	**0**	**0**	**0**	**NA**
Baseline + 3σ		38.6	32.8	14.9	1.0	14.8	76.8	87.8	15.8	0.10	0.13	0	0	0	NA
Upgradient															
F3-1a	0-15	**31.4**	**22.9**	8.2	<0.5	7.3	46.9	**56.3**	**9.4**	<0.1	<0.05	<7	<4	**35**	22
F3-1 (deep) [1]															
Downgradient															
F3-2a	0-15	**27.2**	**20.5**	7.4	<0.5	9.8	44.1	54.1	**10.3**	<0.1	<0.05	<7	<4	**26**	8
F3-2 (deep) [1]															
F3-3b	0-15	15.8	14.7	5.5	<0.5	5.8	36.7	39.9	7.7	<0.1	<0.05	<7	<4	<8	<6
F3-3a	40-50	16	15.5	6.2	<0.5	5.1	38.6	42.7	6.6	<0.1	<0.05	<7	<4	<8	<6
F3-3a dup	40-50	15	19	5.8	<0.5	4.0	48	47	**9.0**	<0.1	<0.05	<5	<10	<50	<50
F3-3a (Dup Avg)	40-50	16	17	6.0	<0.5	4.6	43	45	7.8	<0.1	<0.05	<6	<7	<29	<28

Notes:

NA: Not available

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

1: The deep soil samples at F3-1 and F3-2 could not be collected due to refusal.

4.2.5 Conclusions and Overall Performance of the West Landfill

Based on the visual inspection, there does not appear to be any significant erosion, cracking, settlement, exposed waste or indications of instability at the West Landfill. There was some minor self-armouring erosion on the north slope that is not considered to be a concern. Ponding of water along the north toe does not appear to be impacting landfill stability. Previously observed areas of shallow settlement may be related to construction rather than post-construction landfill performance or permafrost thaw and are not considered to be of concern. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the West Landfill has an “Acceptable” overall landfill performance.

Two soil samples were collected at one of the three designated locations in 2016; deep samples could not be collected at F3-1 and F3-2 as a result of refusal (rock). Ponding of water was observed along the northern toe of the landfill; however, no staining was observed in these areas. The highest concentrations of most metal parameters at the West Landfill were found observed at F3-1 (shallow sample), located near the southern toe of the landfill. At all sampling locations, the concentrations observed in 2016 were less than or similar to those observed in previous years. Modified TPH was reported at detectable concentrations at F3-1 and F3-2 for the first time, however, these only marginally exceeded or remained below baseline mean concentrations. No cadmium, mercury or PCB were detected in any of the samples in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

Given that the environmental sampling results are largely the same as the previous sampling sessions, there is no evident impact of the landfill on soil quality.

4.2.6 Recommendations for West Landfill

No modifications to the ongoing monitoring program at this landfill are recommended.

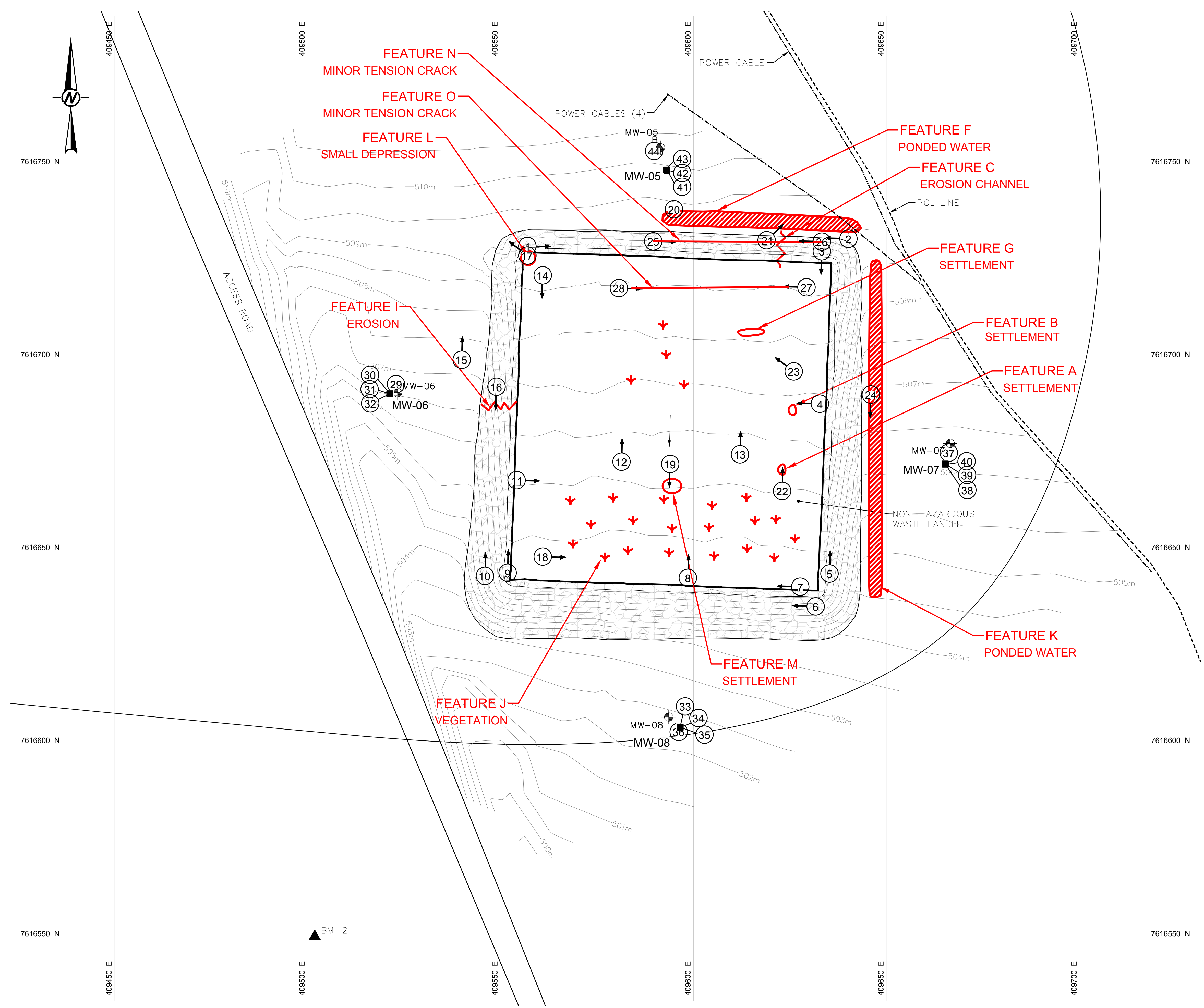
4.3 Non-Hazardous Waste Landfill

4.3.1 Landfill Description

The Non-Hazardous Waste Landfill is located approximately 400 m southeast of the station, on the east side of the main access road. The terrain in the vicinity of the landfill slopes to the south, from an elevation of 509.5 masl immediately north of the landfill, to an elevation of 503 masl to the south. Based on satellite imagery, this area appears to drain towards the Macbeth River, located approximately 4.8 km to the east.

The design of this landfill included perimeter berms and the placement of a compacted granular fill cover over the landfilled material. This landfill covers an area approximately 10,200 m^2 (including sideslopes). Four groundwater monitoring wells MW-05 through MW-08 are installed around the perimeter of the landfill, to the north, west, east and south.

The long term monitoring plan for this landfill consists of visual monitoring and the periodic collection of soil and groundwater samples. The approximate locations for the collection of soil and groundwater samples are identified on Figure FOX-3.4.



LEGEND

- MONITORING WELL LOCATION
- PERMANENT BENCHMARK LOCATION
- SOIL SAMPLING LOCATION
- PONDING (NTS)
- SETTLEMENT (NTS)
- EROSION (NTS)
- VEGETATION (NTS)
- CRACKING (NTS)
- PHOTOGRAPH VIEWPOINT LOCATION
- TYPE 1 GRANULAR A

NOTES

GRID PROJECTION IS NAD83 ZONE 19W.
ELEVATIONS ARE GEODETIC.

REFERENCE

PREVIOUS INSPECTION FIGURE PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

0 25 50
1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
NON-HAZARDOUS WASTE LANDFILL

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-03-24
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-3.4

4.3.2 Summary of any Scope Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil sample at MW-08 could not be collected due to refusal on rock.
- The groundwater sample at MW-06 could not be collected because the groundwater in the well was frozen.

4.3.3 Visual Inspection

The Non-Hazardous Waste Landfill exhibits some observed minor settlement, erosion, minor cracks, vegetation, and ponded water features. Table 4-9 presents a summary of observed visual inspection features and Table 4-10 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall landfill performance because all observed features were assessed as “Acceptable.” Table 4-11 is a log of photographs taken during the 2016 visual inspection.

A previously reported crack along the south crest edge (Feature D) was observed in 2015 and 2016 to be coarse fill where the fines have washed out. It is possible that when the fines were starting to wash out it may have looked like a crack was forming during previous inspections. The coarse rocks that remain along the crest edge are stable and no indications of cracking or slope movement (i.e., sloughing) were observed. However, two new extended minor cracks were observed along the north toe and north crest edge (Features N and O). Although the geometry of these two parallel cracks increases potential risk for a slope failure, no slope instability or deformation was observed. It is possible that these cracks were developed when the fines were starting to wash out similar to what was observed along the south crest edge.

There were five previously observed areas of minor settlement (Features A, B, G, L and M). The settlement areas were all shallow depressions on the cover surface and are not considered to be of concern.

There was some minor self-armouring erosion on the north slope (Feature C) and the west slope (Feature I) that is not considered a concern.

No ponded water was observed along the west toe (previous Feature H). Less water was ponded along north toe (previous Feature F) and east toe (new Feature K) in 2016 compared to the previous inspection in 2015.

Sparse vegetation is becoming established on the cover surface (Feature J - previously reported as Feature E during the 2013 visual inspection).

Table 4-9: Visual Inspection Checklist - Non-Hazardous Waste Landfill

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: Non-Hazardous Waste Landfill
DATE OF INSPECTION: August 17, 2016
DATE OF PREVIOUS INSPECTION: August 16, 2015
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 4
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-9: Visual Inspection Checklist - Non-Hazardous Waste Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	Y	G	Northeast crest	409626	7616697	3	3	0.1	0.09%	Small depressions (Acceptable)	Unchanged since previous observation but no ponded water	23
		A, B	East crest	409623	7616666	2	1	0.1	0.02%	Small depressions (Acceptable)	Unchanged since previous observation but no ponded water	4, 22
		L	Northwest crest corner	409557	7616727	3	1	0.1	0.03%	Small depressions (Acceptable)	Unchanged since previous observation but no ponded water	17
		M	Central crest surface	409594	7616673	2	2	0.1	0.04%	Small depression (Acceptable)	Unchanged since previous observation but no ponded water	19
Erosion	Y	I	West slope	409549	7616693	10	1	0	0.10%	Self-armouring erosion (Acceptable)	Unchanged since previous observation	16
		C	North slope	409619	7616731	10	1	0	0.10%	Self-armouring erosion (Acceptable)	Unchanged since previous observation	21
Lateral Movement	N											
Frost Action	N											
Sloughing	N											

Table 4-9: Visual Inspection Checklist - Non-Hazardous Waste Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Cracking	N	D	South crest edge						0.00%	Previous reported crack appears to be area of coarser fill where fines have washed out, not a crack. Dropped from feature list. (Acceptable)	Previously observed; not observed in 2015 and 2016	-
	Y	N	North slope	409589 409633	7616731 7616731	42	0.01-0.02	0.01	<0.01%	Minor tension crack (Acceptable)	New observation	25, 26
	Y	O	North crest	409629 409581	7616719 7616719	47	0.01-0.02	0.02	<0.01%	Minor tension crack (Acceptable)	New observation	27, 28
Animal Burrows	N											
Vegetation	Y	J (E in 2013)	Cover surface	409561	7616649	50	50	-	24.51%	Very sparse grass vegetation (Acceptable)	Approximately same area	18
Staining	N											
Vegetation Stress	N											
Seepage or Ponded Water	Y	F	North toe	409595	7616739	50	3	0.1	1.47%	Ponded water along toe (Acceptable)	Previously observed: less area	20
	N	H	West toe							No ponded water along toe (Acceptable)	Not observed in 2016	15
	Y	K	East toe	409646	7616691	80	0.2	0.05	0.002%	Running water along toe (Acceptable)	Previously observed: less area	24

Table 4-9: Visual Inspection Checklist - Non-Hazardous Waste Landfill

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Debris and/or Liner Exposed	N											
Presence / Condition of Monitoring Instruments	Y		MW-05,06,07,08							Monitoring wells intact		29,36, 37, 44
Features of Note / Other Observations	N											

Landfill Area = 10, 200 m^2.

Table 4-10: Preliminary Stability Assessment - Non-Hazardous Waste Landfill

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Acceptable	Isolated
Lateral Movement	Not Observed	-
Frost Action	Not Observed	-
Sloughing	Not Observed	-
Cracking	Not Observed	-
Animal Burrows	Not Observed	-
Vegetation establishment	Acceptable	Occasional
Staining	Not Observed	-
Vegetation Stress	Not Observed	-
Seepage/Ponded Water	Acceptable	Isolated
Debris and/or liner exposure	Not Observed	-
Other	Not Observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-11: Summary Table of Photographic Log - Non-Hazardous Waste Landfill

Photo	Description (file name)	Easting	Northing	Date
1	FOX-3 – Non-Hazardous Waste Landfill – North crest, facing east (ATT72_Photo72.jpg)	409557	7616727	17-Aug-2016
2	FOX-3 – Non-Hazardous Waste Landfill – North slope and toe, facing west (ATT73_Photo73.jpg)	409634	7616731	17-Aug-2016
3	FOX-3 – Non-Hazardous Waste Landfill – East crest, facing south (ATT74_Photo74.jpg)	409633	7616728	17-Aug-2016
4	FOX-3 – Non-Hazardous Waste Landfill – Cover surface, facing west (ATT75_Photo75.jpg)	409633	7616689	17-Aug-2016
5	FOX-3 – Non-Hazardous Waste Landfill – East slope, facing north (ATT76_Photo76.jpg)	409635	7616645	17-Aug-2016
6	FOX-3 – Non-Hazardous Waste Landfill – South slope and toe, facing west (ATT77_Photo77.jpg)	409632	7616636	17-Aug-2016
7	FOX-3 – Non-Hazardous Waste Landfill – South crest, facing west (ATT78_Photo78.jpg)	409628	7616641	17-Aug-2016
8	FOX-3 – Non-Hazardous Waste Landfill – Cover surface, facing north (ATT79_Photo79.jpg)	409599	7616644	17-Aug-2016

Table 4-11: Summary Table of Photographic Log - Non-Hazardous Waste Landfill

Photo	Description (file name)	Easting	Northing	Date
9	FOX-3 – Non-Hazardous Waste Landfill – West crest, facing north (ATT80_Photo80.jpg)	409552	7616645	17-Aug-2016
10	FOX-3 – Non-Hazardous Waste Landfill – West slope and toe, facing north (ATT81_Photo81.jpg)	409546	7616644	17-Aug-2016
11	FOX-3 – Non-Hazardous Waste Landfill – Cover surface, facing east (ATT82_Photo82.jpg)	409554	7616669	17-Aug-2016
12	FOX-3 – Non-Hazardous Waste Landfill – Cover surface, facing north (ATT83_Photo83.jpg)	409581	7616674	17-Aug-2016
13	FOX-3 – Non-Hazardous Waste Landfill – Cover surface, facing north (ATT84_Photo84.jpg)	409612	7616676	17-Aug-2016
14	FOX-3 – Non-Hazardous Waste Landfill – West crest, facing south (ATT85_Photo85.jpg)	409561	7616722	17-Aug-2016
15	FOX-3 – Non-Hazardous Waste Landfill – West toe – no ponded water along toe (previous Feature H), facing north (ATT43_Photo43.jpg)	409540	7616700	17-Aug-2016
16	FOX-3 – Non-Hazardous Waste Landfill – West slope – Feature I – Self-armouring erosion [Acceptable], facing south (ATT42_Photo42.jpg)	409549	7616693	17-Aug-2016
17	FOX-3 – Non-Hazardous Waste Landfill – Northwest crest corner – Feature L – Small depressions [Acceptable], facing northwest (ATT33_Photo33.jpg)	409557	7616727	17-Aug-2016
18	FOX-3 – Non-Hazardous Waste Landfill – Cover surface – Feature J – sparse grass vegetation along south crest [Acceptable], facing east (ATT41_Photo41.jpg)	409561	7616649	17-Aug-2016
19	FOX-3 – Non-Hazardous Waste Landfill – Central crest surface – Feature M – Small depression [Acceptable], facing south (ATT44_Photo44.jpg)	409594	7616673	17-Aug-2016
20	FOX-3 – Non-Hazardous Waste Landfill – North toe – Feature F – Ponded water along toe [Acceptable], facing west (ATT34_Photo34.jpg)	409595	7616739	17-Aug-2016
21	FOX-3 – Non-Hazardous Waste Landfill – North slope – Feature C – self-armouring erosion [Acceptable], facing northeast (ATT35_Photo35.jpg)	409619	7616731	17-Aug-2016
22	FOX-3 – Non-Hazardous Waste Landfill – East crest – Feature A – Small depressions [Acceptable], facing north (ATT39_Photo39.jpg)	409623	7616666	17-Aug-2016
23	FOX-3 – Non-Hazardous Waste Landfill – Cover surface – Feature G – Small depressions [Acceptable], northwest (ATT40_Photo40.jpg)	409626	7616697	17-Aug-2016

Table 4-11: Summary Table of Photographic Log - Non-Hazardous Waste Landfill

Photo	Description (file name)	Easting	Northing	Date
24	FOX-3 – Non-Hazardous Waste Landfill – East toe – Feature K – Ponded water running along toe [Acceptable], facing south (ATT38_Photo38.jpg)	409646	7616691	17-Aug-2016
25	FOX-3 – Non-Hazardous Waste Landfill – North slope – Feature N – Tension crack extended along the north slope below which the area is wet but no signs of seepage, facing east (ATT36_Photo36.jpg)	409590	7616731	17-Aug-2016
26	FOX-3 – Non-Hazardous Waste Landfill – North slope – Feature N – Tension crack extended along the north slope below which the area is wet but no signs of seepage, facing west (ATT37_Photo37.jpg)	409633	7616731	17-Aug-2016
27	FOX-3 – Non-Hazardous Waste Landfill – North crest – Feature O – Minor tension crack along the north crest, facing west (1 point) (ATT45_Photo45.jpg)	409629	7616719	17-Aug-2016
28	FOX-3 – Non-Hazardous Waste Landfill – North crest – Feature O – Minor tension crack along the north crest, facing east (ATT46_Photo46.jpg)	409581	7616719	17-Aug-2016
29	FOX-3 – Non-Hazardous Waste Landfill – Monitoring Well MW-06 (ATT99_Photo99.jpg)	409523	7616694	17-Aug-2016

4.3.4 Soil Sampling

Table 4-12 presents a summary of analytical results for soil samples collected at the Non-Hazardous Waste Landfill. MW-05 represents an upgradient sampling location, whereas MW-06 and MW-07 represent cross-gradient sampling locations and MW-08 represents a downgradient sampling location, based on topography. It is noted that MW-06 and MW-07 were historically recorded as downgradient sampling locations. The deep soil sample at MW-08 could not be collected due to refusal on rock.

Table 4-12 also lists the arithmetic mean background and baseline values for the site, in addition to the baseline plus three-sigma (baseline plus 3σ) limit. At the Non-Hazardous Waste Landfill, the baseline arithmetic mean and the baseline plus 3σ for cobalt are both lower than the background arithmetic mean.

MW-05

Sampling location MW-05 is located upgradient of the landfill, approximately 18 m north of the toe of the landfill. The estimated elevation of this sampling point is 510 masl. As shown in Photo 41 (Appendix D), some ponding of water was observed near the northern toe of the landfill in this area, between the landfill and the soil sample location. The area consists of boulders and rocks, infilled with stony sand and gravel and established vegetation. The soils consisted of a wet brown sand, gravel and stone.

For the shallow sample at MW-05 (0-15 cm), the concentrations of most metals were less than those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

For the deep sample at MW-05 (30-40 cm), the concentrations of most metals were less than those reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

MW-06

Sampling location MW-06 is located cross-gradient of the landfill, approximately 18 m west of the western toe of the landfill. The estimated elevation of this sampling point is 506 masl. As shown in Photo 30 (Appendix D), the area consists of boulders and rocks, infilled with stony sand and gravel and established vegetation. The soils consisted of brown sand, gravel and cobble.

It is noted there were two samples labelled MW-06a on the lab report, and no sample MW-06b. The two MW-06a sampling results were assigned to the shallow and depth intervals at MW-06 based on the correlation with the duplicate from the secondary lab. The corresponding lab sample ID's for the shallow and deep MW-06 samples are 1635243-27 and 1635243-09, respectively.

For the shallow sample at MW-06 (0-15 cm), the concentrations of metals were less than or similar to those reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

The deep samples at MW-06 (40-50 cm, duplicate location) exhibited metal concentrations higher than those in the shallow sample. The concentrations of all metals observed in 2016 were lower than those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

MW-07

Sampling location MW-07 is located cross-gradient of the landfill, approximately 18 m east of the eastern toe of the landfill. The estimated elevation of this sampling point is 506.5 masl. As shown in Photo 38, the area consists of weathered boulders and rocks, infilled with stony sand and gravel and established vegetation. The soils consisted of brown sand and gravel.

For the shallow sample at MW-07 (0-15 cm), concentrations of metals were less than those reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

For the deep sample at MW-07 (40-50 cm), the concentrations of metals were less than those observed in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

MW-08

Sampling location MW-08 is located downgradient of the landfill, approximately 16 m south of the southern toe of landfill. The estimated elevation of this sampling point is 502.5 masl. As shown in Photo 33, the area consists of boulders and rocks, infilled with stony sand and gravel and established vegetation. The soils consisted of brown sand with gravel and cobble.

For the shallow sample at MW-08 (0-15 cm), the concentrations of metals were similar to or less than those reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

Table 4-12: Soil Chemical Analysis Results – Non-Hazardous Waste Landfill

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCBs (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.05	0.0003	NA	NA	NA	NA
Baseline Mean		**37.9**	**32.5**	**12.4**	**1.0**	**10.0**	**67.6**	**80.0**	**12.5**	**0.10**	**0.10**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		64.4	44.0	17.3	1.0	14.6	91.8	110.3	26.5	0.10	0.151	NA	NA	NA	NA
Upgradient															
MW-05b	0-15	30.5	21.9	7.3	<0.5	6.2	44.4	52.3	10.1	<0.1	<0.05	<7	<4	<8	<6
MW-05a	30-40	31.8	25.0	10.4	<0.5	7.5	59.5	63.4	8.6	<0.1	<0.05	<7	<4	<8	<6
Cross-gradient															
MW-06b	0-15	28.3	24.5	8.3	<0.5	7.3	51.8	67.3	12.0	<0.1	<0.05	<7	<4	<8	<6
MW-06a	30-40	34.6	26.6	8.8	<0.5	7.5	54.1	73.3	**15.1**	<0.1	<0.05	<7	<4	<8	<6
MW-06a dup	30-40	35	**33**	9.1	<0.5	6.0	67	80	**16**	<0.10	<0.05	<5	<10	<50	<50
MW-06a (Dup Avg)	30-40	35	30	9.0	<0.5	6.8	61	77	**16**	<0.1	<0.05	<6	<7	<29	<28
MW-07b	0-15	30.0	23.6	7.7	<0.5	7.3	46.1	61.0	12.2	<0.1	<0.05	<7	<4	<8	<6
MW-07a	40-50	28.6	22.9	7.8	<0.5	7.6	47.3	61.3	9.9	<0.1	<0.05	<7	<4	<8	<6
Downgradient															
MW-08a	0-15	**39.5**	24.1	8.1	<0.5	8.5	50.0	60.8	**15.7**	<0.1	<0.05	<7	<4	<8	<6
MW-08 (deep) [1]															

Notes:
NA: Not available
ID: Soil sample location ID.
Underlined values: Results exceed Background arithmetic mean.
Bold Values: Results exceed Baseline arithmetic mean.
1: The deep soil sample at MW-08 could not be collected due to refusal.

4.3.5 Groundwater Sampling

Groundwater sampling and monitoring well inspection field records are included in Appendix B. Table 4-13 presents a summary of groundwater levels and analytical results for groundwater samples collected at the Non-Hazardous Waste Landfill. The groundwater sample at MW-06 could not be collected because the groundwater in the well was frozen.

MW-05

The depth to groundwater measured at MW-05 in 2016 was 0.25 m below grade. The concentrations of metals were similar or lower in comparison to those observed from 2014 and 2015. No cadmium, lead, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

MW-07

The depth to groundwater measured at MW-07 in 2016 was 0.20 m below grade. The concentrations of metals were similar or lower in comparison to those observed from 2012 to 2015. No cadmium, lead, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean plus 3σ.

MW-08

The depth to groundwater measured at MW-08 in 2016 was 0.47 m below grade. The groundwater results at MW-08 exhibited concentrations of chromium (0.011 mg/L) and arsenic (0.015 mg/L) greater than their baseline mean concentrations plus 3σ (0.0089 mg/L and 0.009 mg/L, respectively). The concentration of metals reported in 2016 were elevated in comparison to the results from 2015, but were generally within the range of historic results with the exception of mercury, which was reported above the detection limit for the first time at this location. No PHC or PCB were detected at this location in 2016. None of the other reported values exceeded their respective baseline mean plus 3σ.

Table 4-13: Monitoring Well Groundwater Levels and Groundwater Chemical Analysis Results – Non-Hazardous Waste Landfill

ID	GW Depth BGS (m)	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCBs (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Baseline Mean		**NA**	**NA**	**NA**	**NA**	**NA**	**0.14**	**0.005**	**0.003**	**0.0004**	**0.003**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		NA	NA	NA	NA	NA	0.81	0.0089	0.0090	0.0002	0.0027	NA	NA	NA	NA
Upgradient															
MW-05	0.25	0.0027	0.034	0.0052	<0.0001	<0.0001	0.023	<0.001	<0.001	<0.0001	<0.00012	<0.025	<0.100	<0.100	<0.100
Cross-gradient															
MW-06 [1]															
MW-07	0.20	0.0081	0.045	0.0049	<0.0001	<0.0001	0.009	<0.001	<0.001	<0.0001	<0.00050	<0.025	<0.100	<0.100	<0.100
Downgradient															
MW-08	0.47	0.0243	0.031	0.0039	0.0002	0.0200	**0.405**	**0.011**	**0.015**	0.0002	<0.00005	<0.025	<0.100	<0.100	<0.100

Notes:

ID: Monitoring well location ID.

GW: Groundwater.

BGS: Below ground surface.

NA: Not available

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The groundwater sample at MW-06 could not be collected because the groundwater in the well was frozen.

4.3.6 Conclusions and Overall Performance of the Non-Hazardous Waste Landfill

Based on the visual inspection, there does not appear to be any significant erosion, settlement, cracking, exposed waste or indications of instability at the Non-Hazardous Waste Landfill. Some minor self-armouring erosion on the north and west slopes does not appear to be worsening. Two new minor tension cracks were observed along the north toe and north crest edge, however there was no observed slope movement or sloughing. There are some shallow settlement depressions on the cover surface, however these are not considered to be of concern. Shallow ponded water along the north and east toe appears to be from recent snow melt and/or precipitation and is not anticipated to influence increased thawing of permafrost. The Preliminary Stability Assessment conducted based on the visual inspection indicates that the Non-Hazardous Waste Landfill has an “Acceptable” overall landfill performance.

Two soil samples were collected at three of the four designated locations in 2016; a deep sample could not be collected at MW-02 and MW-04 as a result of refusal (rock). Concentrations of metal parameters were highest overall at the deep MW-06 sample location. At all four locations, the concentrations of most metals were similar to or less than those observed in previous years. No detectable concentrations of cadmium, mercury, PHC or PCB were noted in any of the soil samples in 2016. None of the reported soil values exceeded their respective baseline mean concentration plus 3σ.

In 2016, groundwater samples were collected from three of four monitoring wells adjacent to the landfill; no sample was collected at MW-06 because the groundwater in the well was frozen. The concentrations of chromium and arsenic at MW-08 were greater than their baseline concentrations plus 3σ; these concentrations were similar to those observed in previous years. Higher concentrations of most metal parameters were noted at this location in comparison to MW-05 and MW-07. The groundwater results at MW-05 and MW-07 indicated all parameters were less than the baseline mean values. No detectable concentrations of PHC or PCB were noted in any of the groundwater samples in 2016. Mercury was reported above the detection limit for the first time at MW-08 in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater was highest at MW-05, and lowest towards the south at MW-08, which follows the topography in the area.

Based on the results, there does not appear to be significant impact to groundwater quality from the landfill at the monitoring wells adjacent to the landfill.

4.3.7 Recommendations for Non-Hazardous Waste Landfill

No modifications to the ongoing monitoring program at this landfill are recommended.

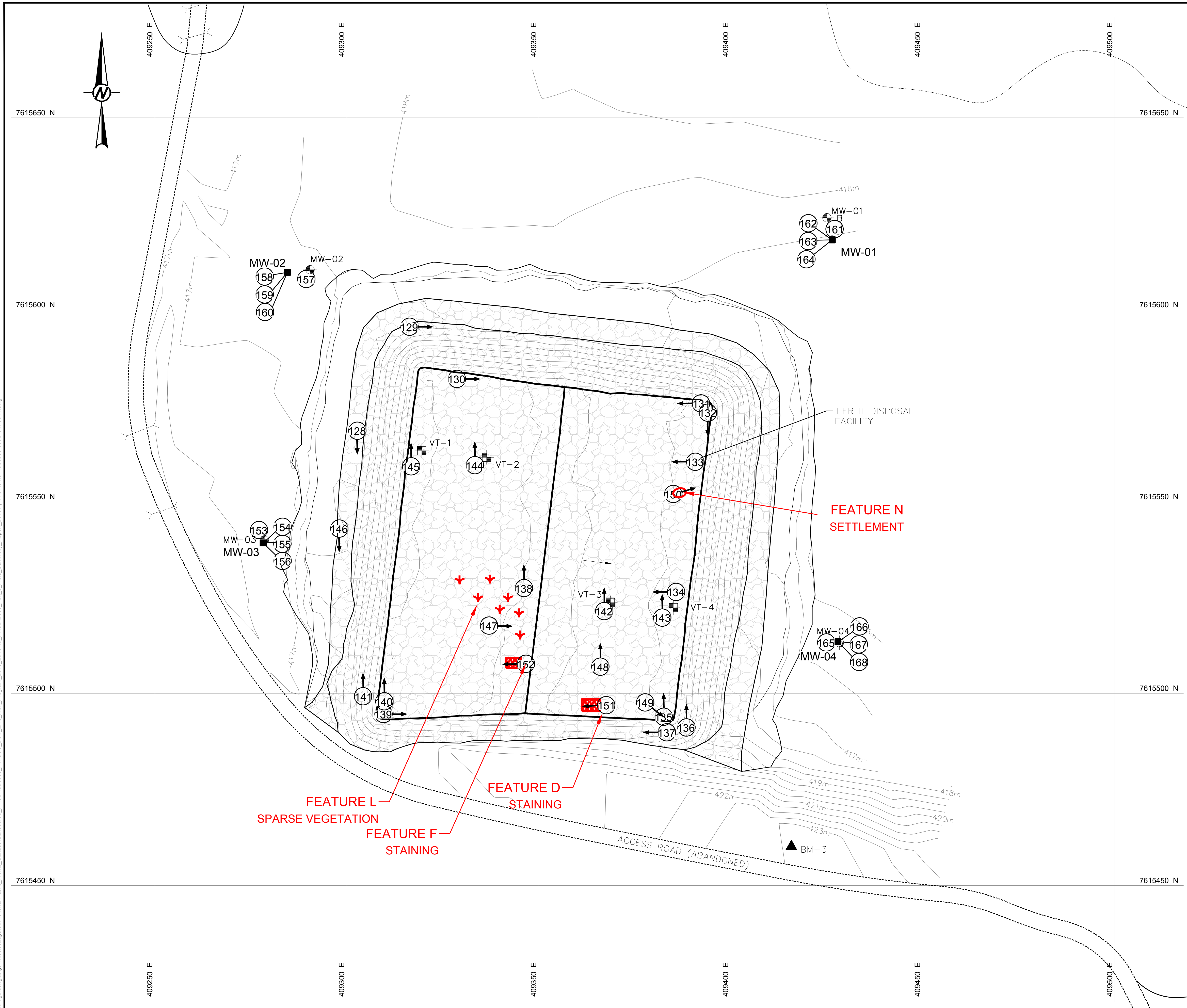
4.4 Tier II Disposal Facility

4.4.1 Landfill Description

The Tier II Disposal Facility is located in the northern portion of the Middle Site Area, east of the abandoned access road, west of the main access road. The terrain in the immediate vicinity of the landfill is relatively flat. Elevations immediately adjacent to the landfill range from approximately 420 masl at a local high point to the south, to elevations of 417 to 418 masl adjacent to the landfill. Based on satellite imagery, this area appears to drain towards the Macbeth River, located approximately 4.8 km to the southwest.

The landfill cell construction consisted of the placement of low-permeability, saturated, compacted berms, the installation of a liner system over the berms and along the landfill base, and the placement of a cover liner system over the landfill contents with sufficient overlying granular fill to promote freeze-back of landfill contents. The Tier II Disposal Facility is approximately 12,600 m^2 in area, including the sideslopes.

Four groundwater monitoring wells, MW-01 through MW-04 were installed around the landfill perimeter; four thermistors were installed within the landfill. The long term monitoring plan consists of visual monitoring, the collection of soil and groundwater samples, and monitoring of subsurface ground temperatures of the landfill. Approximate locations for the collection of soil and groundwater samples, and thermistor installation locations are identified on Figure FOX-3.5.



LEGEND

- MONITORING WELL LOCATION
- BACKGROUND MONITORING WELL LOCATION
- GROUND TEMPERATURE CABLE LOCATION
- PERMANENT BENCHMARK LOCATION
- SOIL SAMPLING LOCATION
- 129 PHOTOGRAPH VIEWPOINT LOCATION
- SETTLEMENT (NTS)
- PONDING (NTS)
- VEGETATION (NTS)
- STAINING (NTS)
- TYPE 1 GRANULAR A

NOTE

GRID PROJECTION IS NAD83 ZONE 19W.
ELEVATIONS ARE GEODETIC.

REFERENCE

PREVIOUS INSPECTION FIGURE PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

0 25 50
1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
TIER II DISPOSAL FACILITY

CONSULTANT
Golder Associates

YYYY-MM-DD	2016-10-20
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	FOX-3.5

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

4.4.2 Summary of any Scope Deviations

The field work was conducted as per the TOR with the following exceptions:

- The deep soil samples at MW-02 and MW-04 could not be collected due to refusal on rock.

4.4.3 Visual Inspection

The Tier II Disposal Facility has some observed minor settlement, vegetation and staining features. No ponded water, erosion, cracks or exposed waste were observed. Table 4-14 presents a summary of observed visual inspection features and Table 4-15 presents the Preliminary Stability Assessment results. This landfill was assessed to have an “Acceptable” overall landfill performance because all observed features were assessed as “Acceptable.” Table 4-16 is a log of photographs taken during the 2016 visual inspection.

There were five ponded water areas on the cover surface (Features H, I, J, K, M) that were previously observed during the 2015 inspection. However, no ponded water was observed on the cover surface during the 2016 inspection. These previously observed ponded water areas were associated with small shallow depressions. These shallow depressions on the cover surface with no water are not a concern. In addition, two other areas were previously reported as minor settlement (Features A and B) and were observed to have no ponded water during the 2016 inspection. A new settlement area was also observed at the edge of the east crest (Feature N).

Previously observed ponded water along the northwest toe (Feature J) and west toe (Feature K) was not observed during the 2016 inspection.

Two stained areas were observed on the cover surface (Features D and F) that are not considered to be a concern. Previously observed staining Features C, E and G were not observed during the 2016 visual inspection.

Sparse vegetation is becoming established on the cover surface (Feature L).

Table 4-14: Visual Inspection Checklist - Tier II Disposal Facility

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: Tier II Disposal Facility
DATE OF INSPECTION: August 16, 2016
DATE OF PREVIOUS INSPECTION: August 16, 2015
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 4
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table 4-14: Visual Inspection Checklist – Tier II Disposal Facility

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Settlement	N	A, B	Northeast crest surface	409380 409352	7615569 7615568	-	-	-	-	Previously reported depressions with ponded water. (Acceptable)	No water observed and insignificant depression areas	-
	Y	N	East crest	409385	7615552	2	2	0.05	0.032%	Minor settlement (Acceptable)	New	150
Erosion	N											
Lateral Movement	N											
Frost Action	N											
Sloughing	N											
Cracking	N											
Animal Burrows	N											
Vegetation	Y	L	Central cover surface	409337	7615517	20	20	-	3.17%	Some very sparse vegetation (Acceptable)	Approximately same area as reported previously	147
Staining	Y	D	Cover surface	409367	7615497	5	0.3	-	<0.01	Staining (Acceptable)	Unchanged since previous observation	151
		F	Cover surface	409347	7615508	1	1	-	<0.01	Staining (Acceptable)	Unchanged since previous observation	152
Vegetation Stress	N											

Table 4-14: Visual Inspection Checklist – Tier II Disposal Facility

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Extent of Landfill Area (%)	Description (Severity Rating)	Comparison to Historical Observations	Photos
Seepage or Ponded Water	N	H	Cover surface	409385	7615552					Previously reported as depression with ponded water (Acceptable)	No ponded water was observed in 2016	138
		I	Crest surface in southeast corner	409381	7615494					Previously reported as depression with ponded water (Acceptable)	No ponded water was observed in 2016	149
		J	Northwest toe	409326	7615602					Previously reported as ponded water along toe (Acceptable)	No ponded water was observed in 2016	-
		K	West toe	409298	7615543					Previously reported as ponded water along toe (Acceptable)	No ponded water was observed in 2016	146
		M	Cover surface	409366	7615507					Previously reported as cobbles and boulders with ponded water (Acceptable)	No ponded water was observed in 2016	148
Debris and/or Liner Exposed	N											
Presence / Condition of Monitoring Instruments	Y		VT-1,2,3,4 and MW-01,02,03,04							Thermistors and monitoring wells intact.		165,161, 157,153, 145,144, 143,142
Features of Note/Other Observations	N											

Landfill Area = 12,600 m^2.

Table 4-15: Preliminary Stability Assessment - Tier II Disposal Facility

Feature	Severity Rating	Extent
Settlement	Acceptable	Occasional
Erosion	Not Observed	-
Lateral Movement	Not Observed	-
Frost Action	Not Observed	-
Sloughing	Not Observed	-
Cracking	Not Observed	-
Animal Burrows	Not Observed	-
Vegetation establishment	Acceptable	Isolated
Staining	Acceptable	Occasional
Vegetation Stress	Not Observed	-
Seepage/Ponded Water	Not Observed	-
Debris and/or liner exposure	Not Observed	-
Other	Not Observed	-
Overall Landfill Performance	**Acceptable**	

Table 4-16: Summary Table of Photographic Log – Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
128	FOX-3 – Tier II Disposal Facility – West toe and slope, facing south (ATT5_Photo5.jpg)	409303	7615569	16-Aug-2016
129	FOX-3 – Tier II Disposal Facility – North slope and toe, facing east (ATT6_Photo6.jpg)	409316	7615596	16-Aug-2016
130	FOX-3 – Tier II Disposal Facility – North crest, facing east (ATT7_Photo7.jpg)	409329	7615582	16-Aug-2016
131	FOX-3 – Tier II Disposal Facility – North crest, facing west (ATT8_Photo8.jpg)	409392	7615576	16-Aug-2016
132	FOX-3 – Tier II Disposal Facility – East crest, facing south (ATT9_Photo9.jpg)	409394	7615573	16-Aug-2016
133	FOX-3 – Tier II Disposal Facility – Cover surface, facing west (ATT10_Photo10.jpg)	409391	7615560	16-Aug-2016
134	FOX-3 – Tier II Disposal Facility – Cover surface, facing west (ATT11_Photo11.jpg)	409386	7615527	16-Aug-2016
135	FOX-3 – Tier II Disposal Facility – East crest and slope, facing north (ATT12_Photo12.jpg)	409383	7615494	16-Aug-2016
136	FOX-3 – Tier II Disposal Facility – East slope and toe, facing north (ATT13_Photo13.jpg)	409388	7615491	16-Aug-2016

Table 4-16: Summary Table of Photographic Log – Tier II Disposal Facility

Photo	Description (file name)	Easting	Northing	Date
137	FOX-3 – Tier II Disposal Facility – South slope and toe, facing west (ATT14_Photo14.jpg)	409383	7615490	16-Aug-2016
138	FOX-3 – Tier II Disposal Facility – Cover surface, facing north (ATT15_Photo15.jpg)	409346	7615528	16-Aug-2016
139	FOX-3 – Tier II Disposal Facility – South crest, facing east (ATT16_Photo16.jpg)	409310	7615495	16-Aug-2016
140	FOX-3 – Tier II Disposal Facility – West crest, facing north (ATT17_Photo17.jpg)	409310	7615496	16-Aug-2016
141	FOX-3 – Tier II Disposal Facility – West slope, facing north (ATT18_Photo18.jpg)	409304	7615499	16-Aug-2016
142	FOX-3 – Tier II Disposal Facility – VT-3, facing north (ATT1_Photo1.jpg)	409367	7615522	16-Aug-2016
143	FOX-3 – Tier II Disposal Facility – VT-4, facing north (ATT2_Photo2.jpg)	409382	7615520	16-Aug-2016
144	FOX-3 – Tier II Disposal Facility – VT-2, facing north (ATT3_Photo3.jpg)	409333	7615560	16-Aug-2016
145	FOX-3 – Tier II Disposal Facility – VT-1, facing north (ATT4_Photo4.jpg)	409317	7615559	16-Aug-2016
146	FOX-3 – Tier II Disposal Facility – west toe – No ponded water along toe (previous Feature K), facing south (ATT2_Photo2.jpg)	409298	7615543	16-Aug-2016
147	FOX-3 – Tier II Disposal Facility – Central cover surface – Feature L – Some very sparse vegetation [Acceptable], facing east (ATT8_Photo8.jpg)	409337	7615518	16-Aug-2016
148	FOX-3 – Tier II Disposal Facility – Cover surface – Cobbles and boulders (previous Feature M- ponded water), no ponded water, facing north (ATT5_Photo5.jpg)	409366	7615507	16-Aug-2016
149	FOX-3 – Tier II Disposal Facility – Crest surface in southeast corner – (Previous Feature I- no ponded water- minor Depression), facing southeast (ATT4_Photo4.jpg)	409381	7615494	16-Aug-2016
150	FOX-3 – Tier II Disposal Facility – East crest – Feature N – minor settlement [Acceptable], facing northeast (ATT3_Photo3.jpg)	409385	7615552	16-Aug-2016
151	FOX-3 – Tier II Disposal Facility – Cover surface, Feature D – Staining, facing west (ATT6_Photo6.jpg)	409368	7615497	16-Aug-2016
152	FOX-3 – Tier II Disposal Facility – Cover surface, Feature F – Staining, facing west (ATT7_Photo7.jpg)	409347	7615508	16-Aug-2016

4.4.4 Thermal Monitoring

The data recorded on the thermistor dataloggers located at the Tier II Disposal Facility (VT-1, 2, 3 and 4) was downloaded using a laptop computer and Prolog software from Lakewood Systems Ltd. Thermistor inspection and data downloading details were recorded on field record sheets included in Appendix B.

4.4.5 Soil Sampling

Table 4-17 presents a summary of analytical results for soil samples collected at the Tier II Disposal Facility. MW-01 and MW-02 represent upgradient sampling locations, whereas MW-03 and MW-04 represent cross-gradient or downgradient sampling locations, although all locations are essentially at similar grades. The deep soil samples at MW-02 and MW-04 could not be collected due to refusal on rock.

Table 4-17 also lists the arithmetic mean background and baseline values for the site, in addition to the baseline plus three-sigma (baseline plus 3σ) limit. At the Tier II disposal facility, the baseline arithmetic mean and the baseline plus 3σ for cobalt are both lower than the background arithmetic mean.

MW-01

Sampling location MW-01 is located approximately 25 m northeast of the toe of the landfill. The estimated elevation of this sampling point is 417.5 masl. As shown in the background of Photo 161 and in Photo 162 (Appendix D), the area is covered with rock and stones with well-established vegetation. The soils in the sample location consist of brown sand, gravel and stone.

For the shallow sample at MW-01 (0-15 cm), the concentrations of most metals, notably arsenic, increased from those observed in previous years. The concentration of arsenic (39.2 mg/kg) exceeded the baseline mean concentration plus 3σ (32 mg/kg). None of the other reported values exceeded their respective baseline mean concentrations plus 3σ. No cadmium, mercury, PHC or PCB were detected at this location in 2016.The deep samples at MW-01 (40-50 cm, duplicate location) also exhibited elevated concentrations of metals, at similar concentrations to those in the shallow sample. The concentrations of most metals increased from those observed from 2013 to 2015, but were similar overall to those observed in 2012. The average concentration of copper (75 mg/kg) marginally exceeded the baseline mean concentration plus 3σ (74 mg/kg) and represents a new historical maximum concentration at this location. None of the other reported values exceeded their respective baseline mean concentrations plus 3σ. No cadmium, mercury, PHC or PCB were detected at this location in 2016.

MW-02

Sampling location MW-02 is located upgradient of the landfill, approximately 5 m northwest of the toe. The estimated elevation of this sampling point is 417.5 masl. As shown in Photo 158 (Appendix D), the area is covered with boulders, rock and stones with sparse vegetation in the areas where coarse soils are present. The soils in the sample location consist of brown sand, gravel and stone.

For the shallow sample at MW-02 (0-15 cm), the concentrations of all metals were generally less than the concentrations reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW-03

Sampling location MW-03 is located downgradient of the landfill, approximately 5 m west of the toe. The estimated elevation of this sampling point is 417 masl. As shown in Photo 154 (Appendix D), the area is covered with boulders, rock and stones with established vegetation in the areas where coarse soils are present. The soils in the sample location consist of brown sand with gravel and stone.

For both the shallow (0-15 cm) and deep (30-40 cm) samples at MW-03 metals concentrations were generally greater than those reported in previous years, and similar to those observed at MW-01. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW-04

Sampling location MW-04 is located downgradient of the landfill, approximately 5 m east of the eastern toe. The estimated elevation of this sampling point is 416.5 masl. As shown in Photo 166 (Appendix D), the area is covered with boulders, rock and stones with established vegetation in the areas where coarse soils are present. The soils in the sample location consist of grey sand with gravel and stone.

For the shallow sample at MW-04 (0-15 cm), the concentrations of all metals were generally less than or similar to the concentrations reported in previous years. No cadmium, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

Table 4-17: Soil Chemical Analysis Results - Tier II Disposal Facility

ID	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCBs (mg/kg)	F1 (mg/kg)	F2 (mg/kg)	F3 (mg/kg)	F4 (mg/kg)
Background Mean		31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.05	0.0030	NA	NA	NA	NA
Baseline Mean		**37.9**	**32.3**	**12.6**	**1.0**	**10.0**	**64.4**	**79.2**	**13.7**	**0.10**	**0.10**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		73.9	53.6	22.1	1.0	20.9	91.6	118.2	32.2	0.10	0.16	NA	NA	NA	NA
Upgradient															
MW-01b	0-15	**61.8**	**36.6**	10.7	<0.5	**10.7**	62.2	**100**	**39.2**	<0.1	<0.05	<7	<4	<8	<6
MW-01a	40-50	**72.3**	**36.2**	11.2	<0.5	**12.8**	**67.7**	**83.3**	**28.4**	<0.1	<0.05	<7	<4	<8	<6
MW-01a dup	40-50	**77**	**49**	12.7	<0.5	**11**	**91**	**98**	**32**	<0.10	<0.05	<5	<10	<50	<50
MW-01a (Dup Avg)	40-50	**75**	**43**	12.0	<0.5	**12**	**79**	**91**	**30**	<0.1	<0.05	<6	<7	<29	<28
MW-02a	0-15	32.2	23.4	8.1	<0.5	6.6	46.8	57.0	12.5	<0.1	<0.05	<7	<4	<8	<6
MW-02 (deep) [1]															
Downgradient															
MW-03b	0-15	**57.8**	**39.5**	**14.3**	<0.5	**11.2**	**65.5**	**86.1**	**26.9**	<0.1	<0.05	<7	<4	<8	<6
MW-03a	30-40	**64.1**	**41.4**	**14.7**	<0.5	**11.6**	**67.8**	**89.1**	**30.4**	<0.1	<0.05	<7	<4	<8	<6
MW-04a	0-15	25.7	28.1	9.1	<0.5	6.7	50.5	73.2	12.0	<0.1	<0.05	<7	<4	<8	<6
MW-04 (deep) [1]															

Notes:

NA: Not available.

ID: Soil sample location ID.

Underlined values: Results exceed Background arithmetic mean.

Bold Values: Results exceed Baseline arithmetic mean.

Shaded Values: Results exceed the Baseline arithmetic mean plus 3σ.

1: The deep soil samples at MW-02 and MW-04 could not be collected due to refusal

.

4.4.6 Groundwater Sampling

Groundwater sampling and monitoring well inspection field records are included in Appendix B. Table 4-18 presents a summary of groundwater levels and analytical results for groundwater samples collected at the Tier II Disposal Facility.

MW-01

The depth to groundwater measured at MW-01 in 2016 was 0.48 m below grade. The concentrations of most metals were less than or similar to those reported in 2015 and were well belowthose from 2012 to 2014. No arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW-02

The depth to groundwater measured at MW-02 in 2016 was 0.53 m below grade. The concentrations of all metals were lower in comparison to those observed from 2012 to 2015. No cadmium, chromium, arsenic, mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW-03

The depth to groundwater measured at MW-03 in 2016 was 0.69 m below grade. It is noted that the calculated RPD values indicated the original and duplicate sample results differ by more than 30% for some metals (i.e., Co, Cd, Pb, Zn, Cr, As); concentrations were typically higher in the duplicate sample reported by the secondary lab. These results should therefore be interpreted with caution. All metal concentrations were less than or similar to those observed in previous years. No mercury, PHC or PCB were detected at this location in 2016. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

MW-04

The depth to groundwater measured at MW-04 in 2016 was 0.31 m below grade. The concentrations of all metals were lower in comparison to those observed from 2012 to 2015. The only parameters detected at this location in 2016 were copper, nickel and cobalt. None of the reported values exceeded their respective baseline mean concentrations plus 3σ.

Table 4-18: Monitoring Well Groundwater Levels and Groundwater Chemical Analysis Results – Tier II Disposal Facility

ID	GW Depth BGS (m)	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCBs (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Baseline Mean		**NA**	**NA**	**NA**	**NA**	**NA**	**0.79**	**0.0050**	**0.0030**	**0.00040**	**0.003**	**NA**	**NA**	**NA**	**NA**
Baseline + 3σ		NA	NA	NA	NA	NA	5.0	0.025	0.013	0.00040	0.005	NA	NA	NA	NA
Upgradient															
MW-01	0.48	0.0347	0.246	0.0590	0.0009	0.0003	0.077	0.002	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW-02	0.53	0.0033	0.021	0.0028	<0.0001	0.0002	0.009	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
Cross-gradient															
MW-03	0.69	0.0337	0.084	0.0034	0.0001	<0.0001	0.114	<0.001	0.003	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
MW-03 dup	0.69	0.042	0.102	0.0132	0.001	0.0004	0.734	0.004	**0.009**	<0.0001	<0.00005	<0.025	<0.1	<0.1	<0.1
MW-03 (Dup Avg)	0.69	0.038	0.093	0.0083	0.0006	0.0003	0.424	0.003	**0.006**	<0.0001	<0.00005	<0.025	<0.1	<0.1	<0.1
MW-04	0.31	0.0008	0.030	0.0046	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100

Notes:

ID: Monitoring well location ID.

GW: Groundwater.

BGS: Below ground surface.

NA: Not available

Bold Values: Results exceed Baseline arithmetic mean.

4.4.7 Conclusions and Overall Performance of the Tier II Disposal Facility

Based on the visual inspection, there were no indications of instability at the Tier II Disposal Facility. No erosion, cracks or exposed waste was observed. No ponded water on the cover surface or along the toe of the landfill was observed in 2016. A new settlement area was observed at the edge of the east crest (Feature N) that is not considered to be a concern. Two stained areas were observed on the cover surface (Features D and F) that are not considered to be a concern.

Two soil samples were collected at two of the four designated locations in 2016; deep samples could not be collected at MW-02 and MW-04 as a result of refusal (rock). At MW-01 and MW-03 (most notably MW-01), metal concentrations in soil were generally greater than those observed in previous years. The concentration of arsenic in the shallow sample at MW-01 and the concentration of copper in the deep sample at MW-01 exceeded their respective baseline mean concentrations plus 3σ. At MW-02 and MW-04, metal concentrations were typically less than those observed in previous years. No detectable concentrations of cadmium, mercury, PHC or PCB were noted in any of the soil samples in 2016.

In 2016, groundwater samples were collected from all four monitoring wells adjacent to the landfill. Similar to the soil sampling results, the highest concentrations were observed at MW-01 and MW-03. At MW-01, MW-02 and MW-04, these concentrations were generally lower than those reported in previous years and at MW-03, concentrations were generally less than or similar to those reported in previous years. No detectable concentrations of mercury, PHC or PCB were noted in any of the groundwater samples in 2016.

Comparison of groundwater elevations based on estimated grade elevation and the measured water depth in the wells indicates that groundwater in was highest at MW-01, and lowest towards the south at MW-04.

Based on the results, there does not appear to be significant impact to groundwater quality from the landfill at the four monitoring wells adjacent to the landfill.

4.4.8 Recommendations for Tier II Disposal Facility

No modifications to the ongoing monitoring program at this landfill are recommended.

5.0 QA/QC RESULTS

This section contains the results of the QA/QC program described in Section 3.3. The results are described in terms of accuracy, reliability (blank analysis) and reproducibility (duplicate analysis).

The five DEW Line sites visited in 2016 were executed as a single field program by Golder and Inuit personnel, with standard operating procedures which were consistent from site to site for the duration of the field program. The QA/QC analysis below contains both program-level (applicable to all five sites) and site-level discussions, which focus on the FOX-3 site. The laboratory reports related to the QA/QC discussion are contained in Appendix C.

5.1 Hold Times

The generally accepted hold times for the parameters analyzed in this program are:

- Metals in soil: 180 days, metals in water 60 days
- Mercury in soil and water is 28 days
- PCB in soil: 365 days and 14 days in water
- PHC-F1 in soil: 48 hours (if unpreserved), PHC-F1 in water: 7 days
- PHC F2-F4 in soil: 14 days, PHC F2-F4 in water: 7 days

At FOX-3, the soil and groundwater sampling was carried out on August 16-17, 2016 and the samples were received at Paracel on August 23, 2016 but analysis commenced on August 24, 2016, which was eight days post-sampling for those collected on August 16th. The duplicate soil and groundwater samples were received at AGAT on August 23, 2016, six to seven days post-sampling for both media.

Maximum hold times were exceeded for PHC-F1 (soil) by 6 days due to its very short hold time of 48 hours. The very short hold time for unpreserved PHC-F1 in soil is a known issue but it has been decided to not preserve this parameter in order to maintain consistency with earlier years and data in the program. The hold times for PHC F2-F4 were all met for soil.

For groundwater, the 7 day hold time for PHC F1-F4 was also exceeded by one day for the samples taken on Aug. 16th. Given that the presence of PHC is usually spread across more than one fraction and no PHC was detected in any fraction in groundwater, it is unlikely that exceeding the PHC hold time by one day has masked any significant presence of this parameter. A similar reasoning applies to the exceedance of PHC F1 hold time in soil.

5.2 Accuracy

Accuracy is a measure of how close a measured value is to the true value. The accuracy of the laboratory data is generally evaluated by the laboratory through the use of matrix spikes or surrogate recoveries. For the FOX-3 samples, Paracel performed a spike analysis on water and one on soil. The spike recoveries for barium and zinc in soil were below the lower end of the acceptable range; however every other parameter met the acceptable data quantity objectives therefore Paracel accepted the batch. Their internal duplicate soil analysis of the PHC F2 and F3 parameters had RPDs of 86% and 100%, which were was outside of their acceptable range but it was attributed to inhomogeneity of the sample material. Paracel noted the peaks in gas chromatography-flame ionization detector chromatogram are not typical of petroleum hydrocarbon distillates and may be the result of high concentrations of non-mineral based compounds not entirely removed by the method cleanup. The lab blank analyses for soil and water at Paracel were all non-detect. AGAT also performed a lab blank, internal duplicate and matrix spike on FOX-3 soil and water samples and all of their results were within their own data quality objectives. AGAT's quality objectives were met for their lab blank and matrix spike for soil and water. There was insufficient water for AGAT to do an internal duplicate of PCB. Matrix spike recoveries outside the acceptable range of individual parameters indicate the barium and zinc soil results from Paracel should be interpreted with caution. All other spike recoveries for the monitoring program are within the acceptable limits and the accuracy of the results is considered acceptable on this basis.

5.3 Reliability

Reliability is a measure of certainty that the concentrations reported by the labs are reliable indicators of field conditions and have not been affected other sources of contamination such as ambient air or cross-contamination from other samples. The analysis of blanks provides a measure of reliability. A set of bottles of deionized water from Paracel accompanied the team on the entire 2016 monitoring program as a Trip Blank. These bottles were not opened at the sites. The analytical reports from Paracel indicate that no parameter was detected in the Trip Blank at the end of the trip. One Field Blank was prepared on the 2016 program. Sample bottles were filled with distilled water in the field at FOX-2. No parameter was detected in the Field Blank.

Two Equipment Blanks were prepared: one to test the decontamination of the groundwater probe, and the other to test the decontamination of the soil sample trowel. No parameter was detected in the Shovel Blank. Zinc was the only parameter detected in the Probe Blank, at a concentration (0.006 mg/L) marginally above the MDL of 0.005 mg/L. The Trip Blank, Field Blank and two Equipment Blank sample results are summarized in the table below.

Blank Samples

ID	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 (mg/L)	F2 (mg/L)	F3 (mg/L)	F4 (mg/L)
Trip Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
Field Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	NA	NA	NA
Shovel Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100
Probe Blank	<0.0005	<0.001	<0.0005	<0.0001	<0.0001	0.006	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	<0.100

Note: NA – Not analyzed.

The Trip Blank, Field Blank and two Equipment Blank sample results suggest that no external sources of contamination have affected the reported lab results from the 2016 monitoring program.

5.4 Reproducibility (Duplicate Analysis)

The reproducibility of lab results was measured through the testing of field duplicate samples. Duplicate soil samples were prepared in the field by mixing up a homogeneous batch of soil in the test pit being sampled, and taking portions of soil and alternately filling the sample jars for the two labs. Duplicate groundwater samples were prepared by alternately filling bottles for each lab for each parameter type.

The labs also performed internal duplicate analysis. Paracel's internal duplicate analysis of organic (PHC) parameters in soil got RPDs of 86% and 100%, which were was outside of their acceptable range (and the program's target of 30%) but it was attributed to inhomogeneity of the soil sample material. Paracel also did a duplicate analysis of metals in groundwater. Arsenic had a RPD of 25.9% and lead had an RPD of 24.1%. All other pairs me the program's target of 20%. AGAT performed a duplicate analysis of metals in soil and a maximum RPD of 4.9% and a duplicate analysis of metals in groundwater which achieved an RPD of 2.4%, thus all of their duplicates met the program requirements.

The total number of original soil samples collected for the 2016 program was 209, for which 21 duplicate soil samples were prepared and analyzed, providing a duplicate ratio of approximately 10%. A total of 42 groundwater samples were collected and six duplicates were analyzed, which is a duplicate ratio of greater than 10% for each site and for the program. The distribution of duplicate soil and groundwater samples over the five sites is provided in the table below.

Four soil duplicates and one groundwater duplicate were prepared at FOX-3.

Soil Samples and Duplicates

	DEW Line Site					Totals
	DYE-M	FOX-2	FOX-3	FOX-4	FOX-5	
Soil Samples Collected	93	31	31	34	24	213
Duplicate Soil Samples	7	4	4	4	2	21
Percent	8%	13%	13%	12%	8%	10%

Groundwater Samples and Duplicates

	DEW Line Site					Totals
	DYE-M	FOX-2	FOX-3	FOX-4	FOX-5	
Monitoring Well Sampled	9	9	7	7	9	41
Duplicate Groundwater Samples	2	1	1	1	1	6
Percent	22%	11%	14%	14%	11%	15%

To determine the reproducibility n of the original and duplicate sample results, the RPD was calculated according to the following equation:

$$RPD = \frac{|x_2 - x_1|}{\left(\frac{x_1 + x_2}{2}\right)} \times 100\%$$

Where, x_1 and x_2 are the original and duplicate concentrations of a given parameter in a pair. RPD can only be calculated if concentrations of given parameter are greater than the analytical method detection limits (MDL) in both the duplicate and original samples of the pair. Additionally, the RPD calculation is less meaningful when the reported concentrations are less than five (5) times the MDL. RPDs have been calculated wherever the concentrations of a parameter were five (5) times greater than the MDL in both the original and duplicate samples. Sample RPD were calculated by taking the average of the parameter RPD for a given sample-duplicate pair, and a program-level RPD was calculated by taking the average of all sample RPD to arrive at a program-wide indication of repeatability.

The TOR sets a data quality objective (DQO) for the RPD in soil and groundwater between a sample and its blind field duplicate of 30%. A discussion or the RPD for the program and at FOX-3 is provided below.

5.4.1 Soil Samples

Organics and PCB

All of the duplicate pairs of soil samples in the program had PCB concentrations below the detection limit.

PHC F3 was detected in five samples in the program and PHC F2 was detected in one of those five samples. In each case it was the sample analyzed by Paracel had the detection, whereas the duplicate sample analyzed by AGAT did not. Paracel's MDL was equal to the program's requirement whereas AGAT's MDL was greater and they showed no exceedance of their MDL. Paracel report two PHC-F2 detections and two PHC-F3 detections above the MDL. None of the above are at concentrations that are greater than five times the program MDL; therefore, RDPs were not calculated.

Metals

Program Level Interpretation

Mercury and cadmium were below detection limits for all 21 original and duplicate pairs in the program.

RPD calculations were undertaken on the seven remaining metals (copper, nickel, cobalt, lead, zinc, chromium and arsenic) for the 21 pairs of duplicate soil samples. The program-level average RPD for the soil sample duplicate analysis was 18%, which met the specified data quality objective for field duplicates for inorganics of 30%.

Two of the 21 soil sample pairs in the program had a sample average RPD of over 30%; but they were not collected at FOX-3. Fifteen parameter pairs had an RPD of over 30%; none of them were at FOX-3. Overall, the most frequent metals to have an RPD over 30% were zinc, copper and nickel. The results for the samples analyzed by AGAT exhibited generally higher metals concentrations in 15 cases; Paracel's overall concentrations were higher in four cases, and in two cases it was evenly spilt. There appears to be a bias in that results from AGAT were generally higher than those of Paracel but this does not impact the interpretation of results.

Site Level Interpretation

From the four soil sample duplicates taken at FOX-3 there were 28 potential parameter pairs for RPD analysis (7 metals times 4 samples). Mercury and cadmium were non-detect in all samples. As shown in the table below, all of the 28 potential metal parameter pairs had concentrations greater than 5 times the MDL in both the original and duplicate, and therefore all 28 individual RPDs were calculated. Two RPD exceeded 30% (zinc at F3-4a and arsenic at F3-3a). The individual RPDs ranged from 1% to 36%. Zinc had the highest RPD, from 21% to 36% and copper was the lowest, from 1% to 14%. The average of the 28 RPD calculations from the four samples was just 16%, which was on the low side of the range of RPD in the program and met the filed data quality objective of less than 30%. The table below shows the metals results and RPD calculations for FOX-3.

All of the individual RPDs at FOX-3 were below 30%, with the exception of zinc at F3-4a (36%) and arsenic at F3-3a (31%) and the site average RPD was 16%. In light of the relatively low average RPD, it concluded that the reproducibility of the soil sample results at FOX-3 was acceptable.

Relative Percent Difference Analysis of Soil Data at FOX-3

		Parameter Concentrations (mg/kg)								
Sample ID	**Lab**	**Cu**	**Ni**	**Co**	**Pb**	**Zn**	**Cr**	**As**	**Sample Average RPD**	**Any Over 30%?**
MDL		<1	<1	<1	<1	<1	<1	<1		
F3-4a	Paracel	31.3	25.2	8.8	8.2	60	68.4	14.4	18%	1 (Zn)
F3-4a (duplicate)	AGAT	36	32	9.4	7.0	86	76	18		
RPD		14%	14%	24%	16%	36%	11%	22%		
MW-01a	Paracel	72.3	36.2	11.2	12.8	67.7	83.3	28.4	17%	no
MW-01a (duplicate)	AGAT	77	49	12.7	11	91	98	32		
RPD		1%	6%	30%	15%	29%	16%	12%		
F3-3a	Paracel	16	15.5	6.2	5.1	38.6	42.7	6.6	17%	1 (As)
F3-3a (duplicate)	AGAT	15	19	5.8	**4.0**	48	47	9.0		
RPD		1%	6%	20%		22%	10%	**31%**		
MW-06a	Paracel	34.6	26.6	8.8	7.5	54.1	73.3	15.1	12%	no
MW-06a (duplicate)	AGAT	35	33	9.1	6.0	67	80	16		
RPD		1%	21%	3%	22%	21%	9%	6%		
									16%	1

Note: Parameters with concentrations <5 x MDL are **bold and highlighted yellow**.

5.4.2 Groundwater Samples

Organics and PCB

All six of the duplicate pairs of groundwater samples in the program had PHC F1-F4 results which were below the detection limit and all PCB concentrations were below the detection limit. The reliability of these results is therefore not a concern.

Metals

Program Level Interpretation

Mercury was non-detect in every original-duplicate pair, therefore the reproducibility of the results is not a concern. With six groundwater duplicate samples and eight metals detected at greater than the MDL in one or more samples, there were 48 potential parameter pairs for duplicate analysis via RPD calculation (6 samples times 8 metals). The metals concentrations were in general very low, in fact 33 of the possible 48 pairs had one or both values less than five times the MDL so, in addition to analyzing the QC by RPD analysis it is useful to note that of the 48 parameter pairs there were:

- 22 where both labs reported non-detect for the same metals in the parameter pair (good repeatability)
- 10 where one lab reported non-detect and the other lab reported a value less than five times the MDL for the pair (good repeatability)
- 1 where both labs reported values that were less than five times the MDL (good repeatability)
- 10 where both labs reported values that were greater than five times the MDL, so an RPD could be calculated. Of those:
  - 6 RPDs were under 30% (good repeatability)
  - 4 RPDs were over 30% (poor repeatability)
- 5 where one lab reported a value less than five times the MDL and the other lab reported a value over five times the MDL and the RPD was over 30% (poor repeatability).

The average RPD for water analysis of metals, considering only the 10 parameter pairs where both parameters were over five times the MDL, was 50%, which exceeds the data quality objective of 15%. This however omits the 38 other parameter pairs. A broader representation of program level RPD can be achieved by including all parameter pairs which either had values reported or non-detect in both parameters. This leaves out only the 10 pairs where one member was non-detect. An RPD of zero has been assigned to pairs which were both non-detect. Using this metric, the program level RPD is 26%.

Site Level Interpretation

MW-03 was the groundwater sample that had a duplicate at FOX-3. As shown in the table below, there were only four groundwater parameter pairs for which the concentrations in the original and duplicate were over 5 times the MDL (copper, nickel, cobalt, zinc) thus four RPDs were calculated for the groundwater duplicate at FOX-3. The RPDs for cobalt and zinc were rather high (118%, 146%). The actual concentrations of metals in groundwater at FOX-3 were low, however, with five of the nine metals at less than 5 times the MDL and the others just over that threshold. A possible reason for the higher than desirable RPD was that little purging was performed due to the very limited volume of groundwater available in the well, and priority being given to obtaining the groundwater sample before all available groundwater was removed.

Relative Percent Difference Analysis of Groundwater Data at FOX-3

		Parameter Concentrations (mg/L)									
Sample ID	**Lab**	**Cu**	**Ni**	**Co**	**Cd**	**Pb**	**Zn**	**Cr**	**As**	**Average RPD**	**Any Over 30%?**
MDL		<0.0005	<0.001	<0.0005	<0.0001	<0.0001	<0.005	<0.001	<0.001		
MW-03	Paracel	0.0337	0.084	0.0034	**0.0001**	**<0.0001**	0.114	**<0.001**	**0.003**	76%	2
MW-03 (Duplicate)	AGAT	0.042	0.102	0.0132	0.001	**0.0004**	0.734	**0.004**	0.009		
RPD		22%	19%	118%			146%				

Note: Parameters with concentrations <5 x MDL are **bold and highlighted yellow**.

5.4.3 Overall Lab Data Reproducibility

With a sample average of the field RPDs for soil of 16% and only two individual pairs slightly over 30% we can conclude that that the lab data is acceptably representative of the site conditions. The reproducibility of groundwater data was not as good and significant differences were seen between the results for cobalt and zinc from the two labs. The cause is likely the small volume of water available which renders the standard purge volumes impractical without drying out the well, all the more so when drawing two sets of samples. Parameter concentrations in both soil and groundwater are often not much more than the MDLs, which makes the RPD calculations sensitive to greater variation than if the concentrations were generally much higher than the MDLs.

5.5 QA/QC Conclusions

The QA/QC analysis has shown that:

- Achieving maximum hold times of PHCs is a challenge given the long transportation chain from the DEW Lines to the lab;
- With the exception of zinc detected in the Probe Blank, the concentrations of parameters in the two equipment blanks and one field blank were non-detect, as they should be to indicate that no spurious contaminates were biasing the samples while in transit;
- The duplicate analyses for soil met the program data quality objectives;
- The duplicate analyses for water indicated some wide relative difference in concentrations for cobalt and zinc reported by the two labs, however in absolute terms the reported concentrations are very low.

Report Signature Page

We trust that this Monitoring Report meets the Project requirements of DND. Please direct any questions to the undersigned.

GOLDER ASSOCIATES LTD.

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APPENDIX A

Report Limitations

REPORT LIMITATIONS

This report has been prepared as an assessment of the environmental condition and visual inspection of the subject site. The monitoring program described in this report was conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. The scope of work was carried out in accordance with the agreement between Golder Associates Ltd. and the client.

The assessment of environmental conditions at this Site has been made using the results of chemical analysis of soil and groundwater from a limited number of locations. The Site conditions between sampling locations have been inferred based on conditions observed at sampling locations. Subsurface conditions may vary from those encountered at the sample locations. Additional study, including further subsurface investigation, can reduce the inherent uncertainties associated with this type of study. However, it is never possible, even with exhaustive sampling and testing, to dismiss the possibility that part of a Site may be contaminated and remain undetected. Visual inspection comments are based on observed conditions at the time of the inspection and may change with time.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibility of such third parties. Golder Associates Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on the information contained in this report.

The content of this report is based on information collected during our monitoring program, our present understanding of the Site conditions, and our professional judgement in light of such information at the time of writing this report. This report provides a professional opinion and therefore no warranty is expressed, implied, or made as to the conclusions and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered, Golder Associates Ltd. should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

APPENDIX B

Field Records

Monitoring Well Sampling Logs

Thermistor Inspection Record Sheets

Soil Sampling Record Sheets

Appendix B1

FOX-3 Thermistor Sheets

ANNEX M: Thermistor Inspection Template

Inspector Name:	Reza Moghaddam	Inspection Date:	August 16 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-3**	Landfill:	Tier II Disposal Facility		
Thermistor Number:	**VT-1**	Inclination:	Vertical		
Datalogger model no:		Datalogger cable download model:			
*Install Date:	**2011-09-07**	First Date Event	**2012**	Last Date Event	**16-Aug-16**
*Coordinates and Elevation	N **7615563**	E **409318**		Elev	**422 m**
Length of Cable (m)	**9.54**	Cable Lead Above Ground (m)	3.71		
Datalogger Serial #	**9100022**	Nodal Points	14		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	X	☐	
Battery Installation Date	**2011-09-07**		
Battery Levels	Main 11.34	Aux 14.23	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4737	17.7954
2	1.373	14.2529
3	1.2451	9.9388
4	1.1511	6.8418
5	1.0219	8.6140
6	0.9326	-0.3337
7	0.9025	-1.3408
8	0.896	-2.2322

Bead	ohms	Degrees C
9	0.8533	-3.0037
10	0.8273	-3.8942
11	0.8065	-4.6111
12	0.7883	-5.2463
13	0.7776	-5.6209
14	0.7614	-6.1919

Battery Information

Batteries changed ? Yes ☐ No ☒ x Monitoring Year: 2016

Battery model number installed: Existing ULB1 and ULB15

Expected battery life (years): 2018

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Memory 79% used.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Reza Moghaddam	Inspection Date:	August 16 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-3**	Landfill:	Tier II Disposal Facility		
Thermistor Number:	**VT-2**	Inclination:	Vertical		
Datalogger model no:		Datalogger cable download model:			
*Install Date:	**2011-09-07**	First Date Event	**2012**	Last Date Event	**16-Aug-16**
*Coordinates and Elevation		N **7615562**	E **409336**	Elev	**422.44 m**
Length of Cable (m)	**7.52**	Cable Lead Above Ground (m)	3.92		
Datalogger Serial #	**9100028**	Nodal Points	10		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	X	☐	
Battery Installation Date	**2011-09-07**		
Battery Levels	Main 11.34	Aux 13.99	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4939	18.5240
2	1.4548	17.1179
3	1.3394	13.1044
4	1.2365	9.6554
5	1.128	6.0873
6	1.003	1.9924
7	0.9224	-0.6745
8	0.8935	-1.5765

Bead	ohms	Degrees C
9	0.8669	-2.5422
10	0.8390	-3.4936

Battery Information

Batteries changed ? Yes ☐ No ☒ x Monitoring Year: 2016

Battery model number installed: Existing ULB1 and ULB15

Expected battery life (years): 2018

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Memory 79% used.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Reza Moghaddam	Inspection Date:	August 16 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-3**	Landfill:	Tier II Disposal Facility		
Thermistor Number:	**VT-3**	Inclination:	Vertical		
Datalogger model no:		Datalogger cable download model:			
*Install Date:	**2011-09-07**	First Date Event	**2012**	Last Date Event	**16-Aug-16**
*Coordinates and Elevation		N **7615523**	E **409367**	Elev	**422.59m**
Length of Cable (m)	**8.05**	Cable Lead Above Ground (m)	4.32		
Datalogger Serial #	**9100048**	Nodal Points	11		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	X	☐	
Battery Installation Date	**2011-09-07**		
Battery Levels	Main 11.34	Aux 13.50	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.5042	18.8996
2	1.5133	19.2853
3	1.4285	16.1856
4	1.2516	10.1567
5	1.1745	7.6101
6	1.0408	3.2344
7	0.9302	-0.4151
8	0.9114	-1.0442

Bead	ohms	Degrees C
9	0.8689	-2.4750
10	0.8449	-3.2901
11	0.8191	-4.1755

Battery Information

Batteries changed ? Yes [ ] No [x] Monitoring Year: 2016

Battery model number installed: Existing ULB1 and ULB15

Expected battery life (years): 2018

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Memory 79% used.

ANNEX M: Thermistor Inspection Template

Inspector Name:	Reza Moghaddam	Inspection Date:	August 16 , 2016
Inspector Signature / Prepared By:			

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name:	**FOX-3**	Landfill:	Tier II Disposal Facility		
Thermistor Number:	**VT-4**	Inclination:	Vertical		
Datalogger model no:		Datalogger cable download model:			
*Install Date:	**2011-09-07**	First Date Event	**2012**	Last Date Event	**16-Aug-16**
*Coordinates and Elevation		N **7615522**	E **409384**	Elev	**422.56 m**
Length of Cable (m)	**10**	Cable Lead Above Ground (m)	4.05		
Datalogger Serial #	**9100049**	Nodal Points	15		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	X	☐	
Cover	X	☐	
Data Logger	X	☐	
Cable	X	☐	
Beads	X	☐	
Lock condition	X	☐	
Battery Installation Date	**2011-09-07**		
Battery Levels	Main 11.34	Aux 13.75	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4711	17.6994
2	1.4393	16.5677
3	1.27	10.7665
4	1.2019	8.5110
5	1.09	4.8446
6	0.9628	0.6664
7	0.9143	-0.9447
8	0.8840	-1.9643

Bead	ohms	Degrees C
9	0.8584	2.8298
10	0.8327	-3.7081
11	0.8103	-4.4815
12	0.7859	-5.3291
13	0.7711	-5.8493
14	0.7565	-6.3679
15	0.7455	-6.7594

Battery Information

Batteries changed ? Yes ☐ No x Monitoring Year: 2016

Battery model number installed: Existing ULB1 and ULB15

Expected battery life (years): 2018

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Memory 79% used.

Appendix B2

FOX-3 Monitoring Well Data

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3 Landfill Name: Tier II Disposal
Monitoring Well ID: MW-01
Sample Number(s) include dups.: 1
Bottles filled (by parameter type) All
Date of Sampling Event: 16 August 2016 Time: 14:20
Weather Slight wind, sunny, 10% cloud cover, +5
Names of Samplers KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
Casing is good, ponding inside casing; around 0.2m from top of casing.
Lock (condition, presence, model, manufacturer): Needs lock, none present
- locked on 17 Aug/2016 with new lock

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4
Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 60
Static water level (cm) from top of pipe: 108
Static water level (cm) (below ground surface) calculated: 48
Measured well refusal depth (cm) (measured after sampling from top of pipe): 193
Thickness of water column (cm): 85 Static Volume of water in well (mL): 1292
Free product thickness (mm): - Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): - Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	6.82	6.79	6.72	
Conductivity (mS/cm)	1.02	0.747	0.572	
Turbidity (NTU)	88.2	182	273	
Temperature (degC)	12.06	9.27	8.72	

Visual/olfactory observations:
Slightly brown, no sheen or odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water decom
Number of washes: 1 Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Tier II Disposal
Monitoring Well ID: MW-02
Sample Number(s) include dups.: 1
Bottles filled (by parameter type) All
Date of Sampling Event: 16 August 2016 Time: 13:30
Weather Sunny, slight overcast clouds developing, slight wind, +5
Names of Samplers KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
Dry ground, well casing is about 3 inches off ground with exposed grout, soft grout up to top of well
Lock (condition, presence, model, manufacturer): Present, good condition.

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 79
Static water level (cm) from top of pipe: 132
Static water level (cm) (below ground surface) calculated: 53
Measured well refusal depth (cm) (measured after sampling from top of pipe): 221
Thickness of water column (cm): 89
Static Volume of water in well (mL): 1353
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.56	7.55	7.49	
Conductivity (mS/cm)	0.194	0.163	0.153	
Turbidity (NTU)	76.4	126	173	
Temperature (degC)	12.7	9.72	9.57	

Visual/olfactory observations:
Slightly silty, no sheen or odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap, methyl hydrate, water decon
Number of washes: 1
Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Tier II Disposal
Monitoring Well ID: MW-03
Sample Number(s) include dups.: 2
Bottles filled (by parameter type) All
Date of Sampling Event: 16 August 2016 Time: 12:30
Weather Sunny, slight breeze, +5
Names of Samplers KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
No ponding water, well in good condition, dry ground.
Lock (condition, presence, model, manufacturer): Present, good condition.

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 80
Static water level (cm) from top of pipe: 149
Static water level (cm) (below ground surface) calculated: 69
Measured well refusal depth (cm) (measured after sampling from top of pipe): 220
Thickness of water column (cm): 71
Static Volume of water in well (mL): 1080
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.64	7.43	7.22	
Conductivity (mS/cm)	0.741	0.743	0.76	
Turbidity (NTU)	0	0	0	
Temperature (degC)	10.61	8.62	7.43	

Visual/olfactory observations:
No sheen or odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Soap, methyl hydrate, water decon
Number of washes: 1
Number of rinses: 1

Other relevant comments: Duplicate taken

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Tier II Disposal
Monitoring Well ID: MW-04
Sample Number(s) include dups.: 1
Bottles filled (by parameter type): All
Date of Sampling Event: 16 August 2016 Time: 15:00
Weather: Sunny, slight south-west wind, +5
Names of Samplers: KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
Casing is in good condition, no ponding water , dry ground.
Lock (condition, presence, model, manufacturer): Lock in good condition

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 63
Static water level (cm) from top of pipe: 94
Static water level (cm) (below ground surface) calculated: 31
Measured well refusal depth (cm) (measured after sampling from top of pipe): 211
Thickness of water column (cm): 117
Static Volume of water in well (mL): 1779
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.37	7.37	7.32	
Conductivity (mS/cm)	0.266	0.301	0.304	
Turbidity (NTU)	181	220	266	
Temperature (degC)	14.07	8.8	8.32	

Visual/olfactory observations:
Slightly silty, nosheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water decon
Number of washes: 1
Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3 Landfill Name: Non Haz Waste
Monitoring Well ID: MW-05
Sample Number(s) include dups.: 1
Bottles filled (by parameter type) All except PCBs only 25%
Date of Sampling Event: 17 August 2016 Time: 13:20
Weather Slight wind, overcast, +4
Names of Samplers KB, JEB
Description of well condition and surrounding ground conditions (note ponding of water):
Well in good condition, slight ponding (less than 1cm), dry outside.
Lock (condition, presence, model, manufacturer): Present and good

Pre-Measured Data (from water well record log)

Depth of well installation (cm): - Diameter of well (cm): 4.4
Depth to top of screen (cm): - Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 65
Static water level (cm) from top of pipe: 90
Static water level (cm) (below ground surface) calculated: 25
Measured well refusal depth (cm) (measured after sampling from top of pipe): 206
Thickness of water column (cm): 116 Static Volume of water in well (mL): 1764
Free product thickness (mm): - Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): - Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.89	7.78	7.61	
Conductivity (mS/cm)	0.355	0.358	0.395	
Turbidity (NTU)	16.2	9	8.6	
Temperature (degC)	7.99	6.77	6.39	

Visual/olfactory observations:
Clear, no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water
Number of washes: 1 Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Non Haz Waste
Monitoring Well ID: MW-06
Sample Number(s) include dups.: -
Bottles filled (by parameter type) -
Date of Sampling Event: 17 August 2016 Time: 11:30
Weather: Slight wind, 50% clouds, +4
Names of Samplers: KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
No ponding water, dry ground, slight upheave of well.
Lock (condition, presence, model, manufacturer): Present and good

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 81
Static water level (cm) from top of pipe: -
Static water level (cm) (below ground surface) calculated: -
Measured well refusal depth (cm) (measured after sampling from top of pipe): 200
Thickness of water column (cm): -
Static Volume of water in well (mL): -
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: Dry
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	-	-	-	
Conductivity (mS/cm)	-	-	-	
Turbidity (NTU)	-	-	-	
Temperature (degC)	-	-	-	

Visual/olfactory observations:
Dry

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water decon
Number of washes: 1
Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Non Haz Waste
Monitoring Well ID: MW-07
Sample Number(s) include dups.: 1
Bottles filled (by parameter type) All except PCBs only 25%
Date of Sampling Event: 17 August 2016 Time: 12:55
Weather Slight wind, overcast, +5
Names of Samplers KB, JEB
Description of well condition and surrounding ground conditions (note ponding of water):
Casing in good condition, ponding inside, dry outside.
Lock (condition, presence, model, manufacturer): Good

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 63
Static water level (cm) from top of pipe: 83
Static water level (cm) (below ground surface) calculated: 20
Measured well refusal depth (cm) (measured after sampling from top of pipe): 186
Thickness of water column (cm): 103
Static Volume of water in well (mL): 1566
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	8.8	8.34	8.05	
Conductivity (mS/cm)	0.738	0.811	0.719	
Turbidity (NTU)	115	128	327	
Temperature (degC)	8.41	7.77	7.11	

Visual/olfactory observations:
Faint milky colour, no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water
Number of washes: 1
Number of rinses: 1

Other relevant comments:

Annex J: Monitoring Wells Sampling Log

Site Name: FOX3
Landfill Name: Non Haz Waste
Monitoring Well ID: MW-08
Sample Number(s) include dups.: 1
Bottles filled (by parameter type) All
Date of Sampling Event: 17 August 2016 Time: 11:45
Weather 15km/h wind, 50% clouds, +4
Names of Samplers KB, JB
Description of well condition and surrounding ground conditions (note ponding of water):
No ponding water, dry ground, slight heave upwards of entire well and slanted
Lock (condition, presence, model, manufacturer): Good condition

Pre-Measured Data (from water well record log)

Depth of well installation (cm): -
Diameter of well (cm): 4.4
Depth to top of screen (cm): -
Length of screened section (cm): -

Field Measurements

Measurement method (interface probe, tape, etc): Interface Probe
Well pipe height above ground (cm) (to top of pipe): 67
Static water level (cm) from top of pipe: 114
Static water level (cm) (below ground surface) calculated: 47
Measured well refusal depth (cm) (measured after sampling from top of pipe): 197
Thickness of water column (cm): 83
Static Volume of water in well (mL): 1262
Free product thickness (mm): -
Evidence of Sludge or siltation: -

Purge Information Summary

Purging/sampling equipment, sampling technique and equipment calibration information:
-

Well purged (Y/N): -
Recharge Rate: 250ml / 3min
Volume Purged (L) (note multiple purging events): -

Parameter	Initial	Stablized	Final	Notes
pH	7.87	8.66	9.1	
Conductivity (mS/cm)	0.334	0.294	0.225	
Turbidity (NTU)	968	786	573	
Temperature (degC)	9.07	8.46	7.45	

Visual/olfactory observations:
Milky white, no sheen or odour

Decontamination of sampling equipment

Type of decontamination fluid(s): Methyl hydrate, soap, water decon
Number of washes: 1
Number of rinses: 1

Other relevant comments:

Appendix B3

FOX-3 Thermistor Inspection Sheets

ANNEX M: Thermistor Inspection Template

Inspector Name: Reza Moghaddam	Inspection Date: Aug 16, 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some information can be pre-populated from thermistor logs)

Site Name: Fox 3 [redacted]		Landfill: Tier II	
Thermistor Number: VT [redacted]		Inclination: Vertical	
Datalogger model no: [redacted]		Datalogger cable download model: [redacted]	
*Install Date:		First Date Event 16 Aug 15	Last Date Event 16 Aug 16
*Coordinates and Elevation	N 7615563	E 409318	Elev 422
Length of Cable (m) 9.54		Cable Lead Above Ground (m) 3.71	
Datalogger Serial # 9100022		Nodal Points 14	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☑	☐	

Battery Installation Date

Battery Levels Main 14.34 Aux 14.23

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4737	17.7984
2	1.3330	14.2529
3	1.2451	9.9388
4	1.1511	6.8419
5	1.0219	2.6140
6	0.9326	-0.3337
7	0.9025	-1.3409
8	0.8760	-2.2392

Bead	ohms	Degrees C
9	0.8533	-3.0037
10	0.8273	-3.8942
11	0.8065	-4.6111
12	0.7883	-5.2463
13	0.7776	-5.6209
14	0.7614	-6.1919
15		

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed:

Expected battery life (years):

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

7.99% Memory

ANNEX M: Thermistor Inspection Template

Inspector Name: Reza Moghaddam	Inspection Date: 16 Aug 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: Fox 3 [redacted]	Landfill: Tier II
Thermistor Number: VT[redacted]	Inclination: Vertical
Datalogger model no: [redacted]	Datalogger cable download model: [redacted]
*Install Date: 2011-09-07	First Date Event 16 Aug 16 Last Date Event 16 Aug 16
*Coordinates and Elevation	N 7615502 E 409336 Elev 427.44 m
Length of Cable (m) 10	Cable Lead Above Ground (m)
Datalogger Serial # 91000 28	Nodal Points 10

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☑	☐	

Battery Installation Date

Battery Levels Main 11.34 Aux 13.99

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4939	18.5240
2	1.4548	17.1179
3	1.3394	13.1044
4	1.2365	9.6554
5	1.1280	6.0873
6	1.0030	1.9924
7	0.9224	-0.6745
8	0.8955	-1.5765

Bead	ohms	Degrees C
9	0.8669	-2.5422
10	0.8390	-3.4936
11		
12		
13		
14		
15		
16		

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed:

Expected battery life (years):

Datalogger Programming (Describe programming completed; beads and frequency)

Memory 79%

Observations and Proposed Maintenance

ANNEX M: Thermistor Inspection Template

Inspector Name: Reza Moghaddam	Inspection Date: Aug 16, 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some Information can be pre-populated from thermistor logs)

Site Name: FOX 3 [redacted]	Landfill: T.01 II		
Thermistor Number: VT [redacted]	Inclination: vertical		
Datalogger model no: [redacted]	Datalogger cable download model: [redacted]		
*Install Date: 2011-09-07	First Date Event 16 Aug 15	Last Date Event 16 Aug 16	
*Coordinates and Elevation	N 7615523	E 409367	Elev 422.59m
Length of Cable (m) 8.05	Cable Lead Above Ground (m) 4.32		
Datalogger Serial # 9100048	Nodal Points 11		

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☑	☐	
Battery Installation Date	2011-09-07		
Battery Levels	Main 11.34	Aux 13.50	

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.5042	18.8996
2	1.5133	19.2853
3	1.4285	16.1856
4	1.2516	10.1567
5	1.1745	7.6161
6	1.0408	3.2344
7	0.9302	-0.4151
8	0.9114	-1.0442

Bead	ohms	Degrees C
9	0.8689	-2.4750
10	0.8449	-3.2901
11	0.8191	-4.1755
12	—	
13	—	
14	—	
15	—	
16	—	

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year:

Battery model number installed:

Expected battery life (years):

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

memory 79%

ANNEX M: Thermistor Inspection Template

Inspector Name: Reba Stoffhedem	Inspection Date: Aug/16, 2016
Inspector Signature / Prepared By:	

Thermistor Information (*Some information can be pre-populated from thermistor logs)

Site Name: FOX3 [redacted]		Landfill: Tier II	
Thermistor Number: VT [redacted]		Inclination: Vertical	
Datalogger model no: [redacted]		Datalogger cable download model: [redacted]	
*Install Date: 2011-09-07		First Date Event 16 Aug 15	Last Date Event 16 Aug 16
*Coordinates and Elevation	N 7615522	E 409384	Elev 422.56m
Length of Cable (m) 10		Cable Lead Above Ground (m) 4.05	
Datalogger Serial # 91000149		Nodal Points 15	

Thermistor Inspection

	Good	Needs Maintenance	Description
Casing	☑	☐	
Cover	☑	☐	
Data Logger	☑	☐	
Cable	☑	☐	
Beads	☑	☐	
Lock condition	☑	☐	

Battery Installation Date ______

Battery Levels Main 11.34 Aux 13.75

Manual Ground Temperature Readings

Bead	ohms	Degrees C
1	1.4711	17.6994
2	1.4393	16.5679
3	1.2700	10.7665
4	1.2019	8.5110
5	1.0900	4.8445
6	0.9628	0.6604
7	0.9143	-0.9447
8	0.8840	-1.9643

Bead	ohms	Degrees C
9	0.8584	2.8298
10	0.8327	-3.7061
11	0.8103	-4.4815
12	0.7859	-5.3291
13	0.7711	-5.8493
14	0.7565	-6.3679
15	0.7455	-6.7594
16		

Battery Information

Batteries changed ? Yes ☐ No ☑ Monitoring Year: ______

Battery model number installed: ______

Expected battery life (years): ______

Datalogger Programming (Describe programming completed; beads and frequency)

Observations and Proposed Maintenance

Memory 79%

Appendix B4

FOX-3 Monitoring Well Log Sheets

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Tier II Disposal Facility.

Monitoring Well ID: MW-01

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): ALL

Date of Sampling Event: 16 Aug 16 Time: 14:20

Weather: 5°c, Slight wind, Sunny, 10% cloud cover.

Names of Samplers: KB, JB.

Description of Well Condition and Surrounding ground conditions (note ponding of water): Casing is good, ponding inside casing, ~0.2 m from top of casing

Lock (condition, presence, model, manufacturer): needs lock, none present - Locked on 17 Aug 16 with new Lock.

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface

Well pipe height above ground (cm) (to top of pipe)= 60

Static water level (cm) from top of pipe = 108

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 193

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate: 250 mL / 3 min

Volume Purged (L) (note multiple purging events if applicable):

Paremeter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	6.82	6.79	6.72	
Conductivity (uS/cm)	1.02	0.747	0.572	
Turbidity (NTU)	88.2	182	273	
Temperature (degC)	12.06	9.27	8.72	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): Slightly brown, no Sheen or odour.

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl hydrate, Soap, water. decon

Number washes: 1 Number rinses: 1

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Tier II Disposal facility.

Monitoring Well ID: MW-02

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): all

Date of Sampling Event: 16 Aug 16 Time: 13:30

Weather: 5°c, Sunny, Slight Overcast clouds developing, Slight wind

Names of Samplers: KB, JB

Description of Well Condition and Surrounding ground conditions (note ponding of water): No ponding water, dry ground, well casing is ~ 3" off ground w exposed grout, Soft grout up to top of well

Lock (condition, presence, model, manufacturer): present, good condition.

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ______ Diameter of well (cm)= ______

*Depth to top of screen (cm)= ______ Length screened section (cm)= ______

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface

Well pipe height above ground (cm) (to top of pipe)= 79

Static water level (cm) from top of pipe = 132

Static water level (cm) (below ground surface) calculated = ______

Measured well refusal depth (cm) (measure after sampling)= 221

Thickness of water column (cm)= ______ Static volume of water in well (mL)= ______

Free product thickness (mm)= ______ Evidence of sludge or siltation: ______

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ______

Well purged (Y/N): ______ Recharge Rate: 250mL/3min

Volume Purged (L) (note multiple purging events if applicable): ______

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.56	7.55	7.49	
Conductivity (uS/cm)	0.194	0.163	0.153	
Turbidity (NTU)	76.4	126	173	
Temperature (degC)	12.70	9.72	9.57	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): clear, no sheen / no odour
↳ Slightly Silty

Decontamination of sampling equipment

Type of decontamination fluid (s): Soap, methyl hydrate, water decon

Number washes: 1 Number rinses: 1

Other Relevant Comments: ______

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Tier II Disposal facility

Monitoring Well ID: MW-03

Sample Number(s) include dups.: 2

Bottles filled (by parameter type): all

Date of Sampling Event: 16 Aug 15 Time: 12:30

Weather: 5°C, Sunny, Slight breeze

Names of Samplers: KB, JB

Description of Well Condition and Surrounding ground conditions (note ponding of water): No ponding water, well in good condition, dry ground

Lock (condition, presence, model, manufacturer): present, good condition

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface probe

Well pipe height above ground (cm) (to top of pipe)= 80

Static water level (cm) from top of pipe = 149

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 220

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate: 250mL/3min

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.64	7.43	7.22	
Conductivity (uS/cm)	.741	0.743	0.760	
Turbidity (NTU)	0.0	0.0	0.0	
Temperature (degC)	10.61	8.62	7.43	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): soap, methyl hydrate, water decon

Number washes: 1 Number rinses: 1

Other Relevant Comments: duplicate taken

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Tier II Disposal Facility

Monitoring Well ID: MW-04

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): all

Date of Sampling Event: 16 Aug 16 Time: 15:00

Weather: 5°C, Sunny, Slight SW wind

Names of Samplers: KB, JB

Description of Well Condition and Surrounding ground conditions (note ponding of water):

Casing in good condition, no ponding water, dry ground

Lock (condition, presence, model, manufacturer): Lock in good condition

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc):

Well pipe height above ground (cm) (to top of pipe)= 63

Static water level (cm) from top of pipe = 94

Static water level (cm) (below ground surface) calculated =

Measured well refusal depth (cm) (measure after sampling)= 211

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate: 250mL / 3 min

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.37	7.37	7.32	
Conductivity (uS/cm)	0.266	0.301	0.304	
Turbidity (NTU)	181	220	266	
Temperature (degC)	14.07	8.80	8.32	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): slightly silty, no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl hydrate, soap, water decon

Number washes: 1 Number rinses: 1

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Non-Haz waste Landfill

Monitoring Well ID: MW-05

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): All except PCBs - only 25%.

Date of Sampling Event: 17 Aug 16 Time: 13:20

Weather: 5°C, slight wind, overcast

Names of Samplers: KB, JEB

Description of Well Condition and Surrounding ground conditions (note ponding of water):
well in good condition, slight ponding (<1cm), dry outside.

Lock (condition, presence, model, manufacturer): present & good.

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ______ Diameter of well (cm)= ______

*Depth to top of screen (cm)= ______ Length screened section (cm)= ______

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface probe

Well pipe height above ground (cm) (to top of pipe)= 65

Static water level (cm) from top of pipe = 90

Static water level (cm) (below ground surface) calculated = ______

Measured well refusal depth (cm) (measure after sampling)= 2.06

Thickness of water column (cm)= ______ Static volume of water in well (mL)= ______

Free product thickness (mm)= ______ Evidence of sludge or siltation: ______

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ______

Well purged (Y/N): ______ Recharge Rate: 250 mL / 8 min

Volume Purged (L) (note multiple purging events if applicable): ______

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.89	7.78	7.61	
Conductivity (uS/cm)	0.355	0.358	0.395	
Turbidity (NTU)	16.2	9.0	8.6	
Temperature (degC)	7.99	6.77	6.39	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation…): Clear, no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl hydrate, soap, water

Number washes: 1 Number rinses: 1

Other Relevant Comments: ______

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Non-Haz Waste Landfill

Monitoring Well ID: MW-06

Sample Number(s) include dups.: Ø

Bottles filled (by parameter type): Ø

Date of Sampling Event: 17Aug16 Time: 11:30

Weather: 4°, Slight wind, 50% Clouds

Names of Samplers: KB/JB

Description of Well Condition and Surrounding ground conditions (note ponding of water):

No ponding water, dry ground, slight upheave of well

Lock (condition, presence, model, manufacturer): present & good

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= Diameter of well (cm)=

*Depth to top of screen (cm)= Length screened section (cm)=

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface probe

Well pipe height above ground (cm) (to top of pipe)= 0.81m

Static water level (cm) from top of pipe = Ø

Static water level (cm) (below ground surface) calculated = Ø

Measured well refusal depth (cm) (measure after sampling)= 2.0m

Thickness of water column (cm)= Static volume of water in well (mL)=

Free product thickness (mm)= Evidence of sludge or siltation:

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information:

Well purged (Y/N): Recharge Rate: Dry.

Volume Purged (L) (note multiple purging events if applicable):

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH				
Conductivity (uS/cm)				
Turbidity (NTU)				
Temperature (degC)				

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): Dry

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl Hydrate, Soap, water clean

Number washes: 1 Number rinses: 1

Other Relevant Comments:

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Non-Haz waste Landfil

Monitoring Well ID: MW-07

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): ~~All~~ All except PCBs - Only 25%

Date of Sampling Event: 17Aug16 Time: 12:55

Weather: 5°C, slight wind, overcast

Names of Samplers: KB | JEB

Description of Well Condition and Surrounding ground conditions (note ponding of water):
Casing in good condition, ponding inside, dry out side

Lock (condition, presence, model, manufacturer): present e good

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ____ Diameter of well (cm)= ____

*Depth to top of screen (cm)= ____ Length screened section (cm)= ____

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface probe

Well pipe height above ground (cm) (to top of pipe)= 63

Static water level (cm) from top of pipe = ~~85~~ 83

Static water level (cm) (below ground surface) calculated = ____

Measured well refusal depth (cm) (measure after sampling)= 186

Thickness of water column (cm)= ____ Static volume of water in well (mL)= ____

Free product thickness (mm)= ____ Evidence of sludge or siltation: ____

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ____

Well purged (Y/N): ____ Recharge Rate: 250 mL/3 min

Volume Purged (L) (note multiple purging events if applicable): ____

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	8.80	8.34	8.05	
Conductivity (uS/cm)	0.738	0.811	0.719	
Turbidity (NTU)	115	128	327	
Temperature (degC)	8.41	7.77	7.11	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): faint milky colour, no sheen, no odour

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl hydrate, Soap, water

Number washes: 1 Number rinses: 1

Other Relevant Comments: ____

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

ANNEX J: Monitoring Well Sampling Log (Complete All Fields)

Site Name: Fox-3 Landfill Name: Non-Haz Waste Landfill

Monitoring Well ID: MW-08

Sample Number(s) include dups.: 1

Bottles filled (by parameter type): ALL.

Date of Sampling Event: 17 Aug 16 Time: 11:45

Weather: 4°c, ~15 km/h wind, 50% clouds

Names of Samplers: KB / JB

Description of Well Condition and Surrounding ground conditions (note ponding of water): No ponding water, dry ground, Slight heave upwards of entire well + Slanted

Lock (condition, presence, model, manufacturer): Good Condition

Pre-Measured Data (From Water Well Record Log)

*Depth of well installation (cm)= ____ Diameter of well (cm)= ____

*Depth to top of screen (cm)= ____ Length screened section (cm)= ____

*note: *depths are from ground surface*

Field Measurements

Measurement method (interface probe, tape, etc): Interface

Well pipe height above ground (cm) (to top of pipe)= 67

Static water level (cm) from top of pipe = 114

Static water level (cm) (below ground surface) calculated = ____

Measured well refusal depth (cm) (measure after sampling)= 197

Thickness of water column (cm)= ____ Static volume of water in well (mL)= ____

Free product thickness (mm)= ____ Evidence of sludge or siltation: ____

Purging Information Summary*

Purging/sampling equipment, sampling technique and equipment calibration information: ____

Well purged (Y/N): ____ Recharge Rate: 250 mL/3 min

Volume Purged (L) (note multiple purging events if applicable): ____

Parameter	Initial	Stabilized	Final	Notes (if not stabilized)
pH	7.87	8.66	9.10	
Conductivity (uS/cm)	0.334	0.294	0.225	
Turbidity (NTU)	968	786	573	
Temperature (degC)	9.07	8.46	7.45	

Visual/olfactory observations (incl. colour, odour, presence of free product/sheen/globules, siltation...): Milky white, no Sheen, No odour

Decontamination of sampling equipment

Type of decontamination fluid (s): methyl hydrate Soap, water deion

Number washes: 1 Number rinses: 1

Other Relevant Comments: ____

* Complete field notes including full suite of water quality indicator parameters VS time as per EPA low flow sampling procedures should be apended to this summary.

Appendix B5

FOX-3 Soil Field Notes

SITE NAME: [illegible]

RECORD OF SAMPLING

DATE: 16 Aug 16

SAMPLER NAME: KB/JB

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
Tier II Disposal facility	MW-03A	.40	Silty Sand, Some gravel, moist, brown Some Small Cobble	← refusal on Rock			3	Y
Tier II Disposal facility	MW-03B	30	Silty Sand, Some gravel, moist, brown, Some Small Cobble				3	Y
Tier II Disposal facility	MW-02A	20	moist brown sand with gravel + small cobble -refusal on rock				3	Y
Tier II Disposal facility	MW-01A	50	moist brown sand, some gravel, small cobble	Dup taken			3	Y
Tier II Disposal facility	MW-01B	30	moist brown sand some gravel, small cobble.				3	Y
Tier II Disposal facility	MW-04A	<30	wet brown sand ~~trace~~ organics, some gravel				3	Y
Station West Landfill	F3-10A	20	dry brown sand ~~Some~~ with some gravel, Small coble trace organics	← refusal on rock			3	Y
Station west landfill	F3-11A	50	moist brown sand some gravel, small cobble				3	Y
Station west landfill	F3-11B	30	moist brown sand Some gravel, small cobble				3	Y
Station West Landfill	F3-12A	40	wet, brown Sand with Gravel and Small Cobble	← refusal on Rock			3	Y

RECORD OF . SAMPLING

D 18Aug16

SAMPLER NAME KB/JB

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
Station West Landfill	F3-12B	30	moist, brown Sand with some gravel & small cobble				3	Y
Station West Landfill	F3-9A	50	~~Wet~~, brown Sand w trace gravel & trace cobble				3	Y
Station West Landfill	F3-9B	30	moist, brown sand w trace gravel & trace cobble				3	Y
Station West Landfill	F3-8A	20	moist ~~Dry~~, brown Sand with gravel & cobble (small)	-refusal on Rock	Aug 17th		3	Y
Non-Haz Waste Landfill	MW-06 A	40	moist, brown Sand with some gravel and small ~~gravel~~ cobble	-Dup taken -refusal on rock			3	Y
Non-Haz Waste Landfill	MW-06 B	30	moist brown Sand with some gravel, small cobble & trace organics				3	Y
Non-haz waste landfill	MW-08A	30	moist brown sand with gravel, small cobble	-refusal on rock	Aug 17th		3	Y
Non-haz waste landfill	MW-07A	50	wet brown sand, some gravel, small cobble				3	Y
Non-haz waste landfill	MW-07B	30	moist brown sand, some gravel, small cobble				3	Y
Non-haz waste Landfill	MW-05A	40	wet, brown Sand, Some gravel, small cobble	Refusal on Rock			3	Y

Golder Project #1530908 Phase 1000

SITE NAME: F-X-J

RECORD OF SOIL SAMPLING

DATE: 17 Aug 16

SAMPLER NAME: KB/JEB

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
Non-haz waste Landfill	MW-05B	30	moist brown Sand, Some gravel & Small gravel.				3	Y
West Landfill	F3-2A	20	brown Sand & gravel, wet, ponding noted in area Some cobble.	refusal on Rock			3	Y
West landfill	F3-1A	30	dry brown sand, Some gravel Small cobble trace organics	refusal on rock			3	Y
west landfill	F3-3A	50	moist brown sand, trace gravel, + cobble.	-roadside drainage ditch	dup taken		3	Y
west landfill	F3-3B	30	moist brown sand Some gravel + small cobble				3	Y
Station west landfill	F3-5A	50	wet brown sand some large cobble				3	Y
Station west landfill	F3-5B	30	moist brown sand, some large cobble				3	Y
Station west landfill	F3-7A	20	moist brown sand with gravel & cobble	refusal on rock			3	Y
Station west landfill	F3-6A	40	moist brown sand, some gravel, small cobble	refusal on rock			3	Y
Station west landfill	F3-6B	30	moist brown sand, some gravel, small cobble				3	Y

SITE NAME: FOX-3

RECORD OF SOIL SAMPLING

DATE: Aug 17, 2016
SAMPLER NAME:

LANDFILL NAME	SOIL SAMPLE ID	DEPTH (m)	SOIL DESCRIPTION	GPS Northing	GPS Easting	GPS Elevation	Photographs	Backfilled (Y/N)
Station west landfill	F3-4A	30	- mast brown sand, some gravel and small cobble.	- refusal on rock, duplicate taken			3	Y

APPENDIX C

Laboratory Certificates of Analysis and QA/QC Reports Historical Monitoring Results

Appendix C1

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Aug. 30, 2016; Order #1635243

PARACEL LABORATORIES LTD. | TRUSTED. RESPONSIVE. RELIABLE.

300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
1-800-749-1947
www.paracellabs.com

Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 102359/60/62/61

Report Date: 30-Aug-2016
Order Date: 23-Aug-2016

Order #: 1635243

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1635243-01	F3-1a
1635243-02	F3-4a
1635243-03	F3-6a
1635243-04	F3-6b
1635243-05	F3-10a
1635243-06	F3-12a
1635243-07	MW-01a
1635243-08	MW-04a
1635243-09	MW-06a
1635243-10	MW-07b
1635243-11	F3-2a
1635243-12	F3-3a
1635243-13	F3-3b
1635243-14	F3-5b
1635243-15	F3-8a
1635243-16	F3-9a
1635243-17	F3-11a
1635243-18	MW-03a
1635243-19	MW-03b
1635243-20	F3-11b
1635243-21	F3-5a
1635243-22	F3-7a
1635243-23	F3-9b
1635243-24	F3-12b
1635243-25	MW-01b
1635243-26	MW-02a
1635243-27	MW-06a
1635243-28	MW-05a
1635243-29	MW-05b
1635243-30	MW-07a

Approved By: Tim McCooeye
Senior Advisor

1635243-31 MW-08a

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
CCME-SQG: Metals by ICP-OES	based on MOE E3470, ICP-OES	25-Aug-16	25-Aug-16
Mercury by CVAA	EPA 7471B - CVAA, digestion	25-Aug-16	29-Aug-16
PCBs, total	SW846 8082A - GC-ECD	24-Aug-16	27-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	25-Aug-16	29-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	25-Aug-16	26-Aug-16
Solids, %	Gravimetric, calculation	25-Aug-16	25-Aug-16

PARACEL LABORATORIES LTD.

Order #: 1635243

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

	Client ID:	F3-1a	F3-4a	F3-6a	F3-6b
	Sample Date:	17-Aug-16	17-Aug-16	17-Aug-16	17-Aug-16
	Sample ID:	1635243-01	1635243-02	1635243-03	1635243-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	90.4	91.0	87.6	87.5
Metals					
Arsenic	1.0 ug/g dry	9.4	14.4	19.5	20.2
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	56.3	68.4	68.3	66.0
Cobalt	1.0 ug/g dry	8.2	8.8	9.2	9.5
Copper	1.0 ug/g dry	31.4	31.3	36.3	36.7
Lead	1.0 ug/g dry	7.3	8.2	9.5	9.7
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	22.9	25.2	27.0	27.2
Zinc	1.0 ug/g dry	46.9	60.0	56.0	55.0
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	35	35	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	22	19	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	70.1%	91.6%	96.3%	95.2%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 30-Aug-2016
Order Date: 23-Aug-2016
Project Description: 1530908-2000

	Client ID:	F3-10a	F3-12a	MW-01a	MW-04a
	Sample Date:	16-Aug-16	16-Aug-16	16-Aug-16	16-Aug-16
	Sample ID:	1635243-05	1635243-06	1635243-07	1635243-08
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	86.2	87.4	83.0	84.8
Metals					
Arsenic	1.0 ug/g dry	12.0	16.0	28.4	12.0
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	69.2	69.0	83.3	73.2
Cobalt	1.0 ug/g dry	9.4	9.2	11.2	9.1
Copper	1.0 ug/g dry	28.7	38.8	72.3	25.7
Lead	1.0 ug/g dry	12.8	8.6	12.8	6.7
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	25.5	28.3	36.2	28.1
Zinc	1.0 ug/g dry	58.4	53.5	67.7	50.5
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	86.4%	86.2%	102%	84.9%

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 30-Aug-2016
Order Date: 23-Aug-2016
Project Description: 1530908-2000

	Client ID:	MW-06a	MW-07b	F3-2a	F3-3a
	Sample Date:	17-Aug-16	17-Aug-16	17-Aug-16	17-Aug-16
	Sample ID:	1635243-09	1635243-10	1635243-11	1635243-12
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	87.5	86.6	91.2	94.3
Metals					
Arsenic	1.0 ug/g dry	15.1	12.2	10.3	6.6
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	73.3	61.0	54.1	42.7
Cobalt	1.0 ug/g dry	8.8	7.7	7.4	6.2
Copper	1.0 ug/g dry	34.6	30.0	27.2	16.0
Lead	1.0 ug/g dry	7.5	7.3	9.8	5.1
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	26.6	23.6	20.5	15.5
Zinc	1.0 ug/g dry	54.1	46.1	44.1	38.6
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	26	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	8	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	95.9%	98.9%	102%	116%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

Client ID:		F3-3b	F3-5b	F3-8a	F3-9a
Sample Date:		17-Aug-16	17-Aug-16	16-Aug-16	16-Aug-16
Sample ID:		1635243-13	1635243-14	1635243-15	1635243-16
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	86.6	85.7	85.7	86.5
Metals					
Arsenic	1.0 ug/g dry	7.7	14.5	11.6	20.4
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	39.9	67.6	57.8	77.5
Cobalt	1.0 ug/g dry	5.5	10.0	7.8	11.0
Copper	1.0 ug/g dry	15.8	39.1	26.1	53.6
Lead	1.0 ug/g dry	5.8	8.7	9.1	10.5
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	14.7	27.8	21.7	31.9
Zinc	1.0 ug/g dry	36.7	63.7	49.2	63.4
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	87.8%	102%	90.7%	93.7%

PARACEL LABORATORIES LTD.

Order #: 1635243

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

	Client ID:	F3-11a	MW-03a	MW-03b	F3-11b
	Sample Date:	16-Aug-16	16-Aug-16	16-Aug-16	16-Aug-16
	Sample ID:	1635243-17	1635243-18	1635243-19	1635243-20
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	86.2	87.9	88.0	85.5
Metals					
Arsenic	1.0 ug/g dry	38.2	30.4	26.9	34.6
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	82.5	89.1	86.1	80.6
Cobalt	1.0 ug/g dry	13.2	14.7	14.3	13.5
Copper	1.0 ug/g dry	67.1	64.1	57.8	66.3
Lead	1.0 ug/g dry	12.6	11.6	11.2	11.5
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	38.9	41.4	39.5	37.5
Zinc	1.0 ug/g dry	69.6	67.8	65.5	69.2
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	94.8%	97.0%	89.5%	83.9%

PARACEL LABORATORIES LTD.

Order #: 1635243

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

	Client ID:	F3-5a	F3-7a	F3-9b	F3-12b
	Sample Date:	17-Aug-16	17-Aug-16	16-Aug-16	16-Aug-16
	Sample ID:	1635243-21	1635243-22	1635243-23	1635243-24
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	87.2	86.2	85.2	90.6
Metals					
Arsenic	1.0 ug/g dry	14.7	14.3	20.1	17.0
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	70.1	73.6	76.2	69.5
Cobalt	1.0 ug/g dry	10.4	9.6	10.5	9.2
Copper	1.0 ug/g dry	38.7	33.2	49.0	39.0
Lead	1.0 ug/g dry	9.1	8.5	10.7	8.4
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	27.0	26.8	31.6	28.3
Zinc	1.0 ug/g dry	60.5	58.1	61.0	54.3
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	73.3%	85.0%	83.6%	53.3% [4]

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

	Client ID:	MW-01b	MW-02a	MW-06a	MW-05a
	Sample Date:	16-Aug-16	16-Aug-16	17-Aug-16	17-Aug-16
	Sample ID:	1635243-25	1635243-26	1635243-27	1635243-28
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	83.4	87.3	85.7	82.2
Metals					
Arsenic	1.0 ug/g dry	39.2	12.5	12.0	8.6
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	<0.5
Chromium	1.0 ug/g dry	100	57.0	67.3	63.4
Cobalt	1.0 ug/g dry	10.7	8.1	8.3	10.4
Copper	1.0 ug/g dry	61.8	32.2	28.3	31.8
Lead	1.0 ug/g dry	10.7	6.6	7.3	7.5
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	<0.1
Nickel	1.0 ug/g dry	36.6	23.4	24.5	25.0
Zinc	1.0 ug/g dry	62.2	46.8	51.8	59.5
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	<7
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	<4
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	<8
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	<6
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	<0.05
Decachlorobiphenyl	Surrogate	89.4%	84.7%	99.0%	91.8%

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 30-Aug-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

	Client ID:	MW-05b	MW-07a	MW-08a	-
	Sample Date:	17-Aug-16	17-Aug-16	17-Aug-16	-
	Sample ID:	1635243-29	1635243-30	1635243-31	-
	MDL/Units	Soil	Soil	Soil	-
Physical Characteristics					
% Solids	0.1 % by Wt.	88.5	80.2	84.9	-
Metals					
Arsenic	1.0 ug/g dry	10.1	9.9	15.7	-
Cadmium	0.5 ug/g dry	<0.5	<0.5	<0.5	-
Chromium	1.0 ug/g dry	52.3	61.3	60.8	-
Cobalt	1.0 ug/g dry	7.3	7.8	8.1	-
Copper	1.0 ug/g dry	30.5	28.6	39.5	-
Lead	1.0 ug/g dry	6.2	7.6	8.5	-
Mercury	0.1 ug/g dry	<0.1	<0.1	<0.1	-
Nickel	1.0 ug/g dry	21.9	22.9	24.1	-
Zinc	1.0 ug/g dry	44.4	47.3	50.0	-
Hydrocarbons					
F1 PHCs (C6-C10)	7 ug/g dry	<7	<7	<7	-
F2 PHCs (C10-C16)	4 ug/g dry	<4	<4	<4	-
F3 PHCs (C16-C34)	8 ug/g dry	<8	<8	<8	-
F4 PHCs (C34-C50)	6 ug/g dry	<6	<6	<6	-
PCBs					
PCBs, total	0.05 ug/g dry	<0.05	<0.05	<0.05	-
Decachlorobiphenyl	Surrogate	102%	84.9%	105%	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g						
F2 PHCs (C10-C16)	ND	4	ug/g						
F3 PHCs (C16-C34)	ND	8	ug/g						
F4 PHCs (C34-C50)	ND	6	ug/g						
Metals									
Arsenic	ND	1.0	ug/g						
Cadmium	ND	0.5	ug/g						
Chromium	ND	1.0	ug/g						
Cobalt	ND	1.0	ug/g						
Copper	ND	1.0	ug/g						
Lead	ND	1.0	ug/g						
Mercury	ND	0.1	ug/g						
Nickel	ND	1.0	ug/g						
Zinc	ND	1.0	ug/g						
PCBs									
PCBs, total	ND	0.05	ug/g						
Surrogate: Decachlorobiphenyl	*0.106*		*ug/g*		*106*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	7	ug/g dry	ND				40	
F2 PHCs (C10-C16)	99	4	ug/g dry	39			86.1	30	ORG12, QR-04
F3 PHCs (C16-C34)	408	8	ug/g dry	136			100.0	30	ORG12, QR-04
F4 PHCs (C34-C50)	ND	6	ug/g dry	ND				30	
Metals									
Antimony	ND	1.0	ug/g dry	ND				30	
Arsenic	10.3	1.0	ug/g dry	9.38			9.3	30	
Barium	130	1.0	ug/g dry	122			6.1	30	
Beryllium	ND	1.0	ug/g dry	ND			0.0	30	
Boron	3.63	1.0	ug/g dry	3.49			3.9	30	
Cadmium	ND	0.5	ug/g dry	ND				30	
Chromium	60.2	1.0	ug/g dry	56.3			6.6	30	
Cobalt	8.74	1.0	ug/g dry	8.24			5.9	30	
Copper	33.1	1.0	ug/g dry	31.4			5.3	30	
Lead	8.33	1.0	ug/g dry	7.29			13.3	30	
Mercury	ND	0.1	ug/g dry	ND			0.0	30	
Molybdenum	ND	1.0	ug/g dry	ND			0.0	30	
Nickel	24.7	1.0	ug/g dry	22.9			7.5	30	
Selenium	ND	1.0	ug/g dry	ND			0.0	30	
Silver	ND	0.5	ug/g dry	ND			0.0	30	
Thallium	ND	1.0	ug/g dry	ND			0.0	30	
Tin	ND	5.0	ug/g dry	ND			0.0	30	
Uranium	ND	1.0	ug/g dry	ND				30	
Vanadium	48.7	1.0	ug/g dry	45.7			6.3	30	
Zinc	49.7	1.0	ug/g dry	46.9			5.9	30	
PCBs									
PCBs, total	ND	0.05	ug/g dry	ND				40	
Surrogate: Decachlorobiphenyl	*0.0860*		*ug/g dry*		*77.8*	*60-140*			
Physical Characteristics									
% Solids	83.9	0.1	% by Wt.	84.1			0.2	25	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	177	7	ug/g		88.5	80-120			
F2 PHCs (C10-C16)	105	4	ug/g	ND	102	60-140			
F3 PHCs (C16-C34)	290	8	ug/g	ND	137	60-140			
F4 PHCs (C34-C50)	192	6	ug/g	ND	135	60-140			
Metals									
Antimony	247		ug/L	ND	98.6	70-130			
Arsenic	406		ug/L	188	87.3	70-130			
Barium	2590		ug/L	2440	57.8	70-130			QM-07
Beryllium	215		ug/L	1.06	85.7	70-130			
Boron	296		ug/L	69.8	90.3	70-130			
Cadmium	311		ug/L	ND	124	70-130			
Chromium	1300		ug/L	1130	70.9	70-130			
Cobalt	369		ug/L	165	81.7	70-130			
Copper	836		ug/L	628	83.4	70-130			
Lead	330		ug/L	146	73.8	70-130			
Mercury	1.39	0.1	ug/g	ND	92.4	70-130			
Molybdenum	226		ug/L	14.4	84.7	70-130			
Nickel	647		ug/L	458	75.5	70-130			
Selenium	201		ug/L	8.47	77.2	70-130			
Silver	188		ug/L	0.50	75.0	70-130			
Thallium	186		ug/L	1.11	73.8	70-130			
Tin	233		ug/L	18.8	85.8	70-130			
Uranium	327		ug/L	ND	131	70-130			
Vanadium	1100		ug/L	914	74.3	70-130			
Zinc	1090		ug/L	938	61.7	70-130			QM-07
PCBs									
PCBs, total	0.535	0.05	ug/g	ND	121	60-140			
Surrogate: Decachlorobiphenyl	*0.103*		*ug/g*		*93.1*	*60-140*			

Qualifier Notes:

Sample Qualifiers :

4 : The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.

QC Qualifiers :

ORG12 : Peak(s) in the GC-FID Chromatogram are not typical of petroleum hydrocarbon distillates. May be the result of high concentrations of non-mineral based compounds not completely removed by the method cleanup.

QM-07 : The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on other acceptable QC.

QR-04 : Duplicate results exceeds RPD limits due to non-homogeneous matrix.

Sample Data Revisions

None

Work Order Revisions / Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Soil results are reported on a dry weight basis when the units are denoted with 'dry'.
Where %Solids is reported, moisture loss includes the loss of volatile hydrocarbons.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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Chain of Custody (Lab Use Only)

№ 102359

Page 1 of 5

Client Name: Golder Associates	Project Reference: 1530908-2000
Contact Name: Alyssa Troke	Quote # 16-010
Address: 1931 Robertson Road Ottawa	PO #
Telephone: 613-592-9600	Email Address: atroke@golder.com dplenderleith@golder.com

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ________ [ ] Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1635243

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	See Quote 16-010	Dow Line Monitoring					
1	F3-1a	S		2	Aug 17/16									X		250 + 60mL Jar				
2	F3-4a	↓		↓	↓									X		↓				
3	F3-6a													X						
4	F3-6b													X						
5	F3-10a													X						
6	F3-12a				Aug 16/16									X						
7	MW-01a				Aug 16/16									X						
8	MW-04a				Aug 16/16									X						
9	MW-06a				Aug 16/16									X						
10	MW-07b	↓		↓	Aug 17/16									X		↓				

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign): Alyssa Troke	Received by Driver/Depot: [signature]	Received at Lab: SUNEEPORN DOKMAI	Verified By: Rachel Subject
Relinquished By (Print): Alyssa Troke	Date/Time: 08/23/16 1:25pm	Date/Time: AUG 23, 2016 05.15	Date/Time: Aug 24/16 12:39
Date/Time: Aug. 23, 2016 1:00	Temperature: 12.7 °C	Temperature: 11.9 °C	pH Verified [X] By: N/A

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Chain of Custody (Lab Use Only)

№ 102360

Page 2 of 5

Client Name: GAL
Contact Name: Alyssa Troke
Address: see pg. 1
Telephone:

Project Reference: 1530908-2000
Quote # 16-010
PO #
Email Address: see pg. 1

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day
Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1635243

Required Analyses

#	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see Quote # 16-010					
1	F3-2a	S		2	Aug 17/16									X	-60ml + 250ml-				
2	F3-3a													X					
3	F3-3b													X					
4	F3-5b													X					
5	F3-8a				AUG 16/16									X					
6	F3-9a				Aug 16/16									X					
7	F3-11a				Aug 16/16									X					
8	MW-03a													X					
9	MW-03b													X					
10	F3-11b				Aug 16/16									X					

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign): Alyssa Troke
Relinquished By (Print): Alyssa Troke
Date/Time: Aug 23, 2016 1:00

Received by Driver/Depot:
Date/Time: 08/23/16 1:25PM
Temperature: 12.4 °C

Received at Lab: SUNEE PORN DOKMAI
Date/Time: AUG 23, 2016 05.15
Temperature: 11.8 °C

Verified By: Rachel Subject
Date/Time: Aug 24/16 12:39
pH Verified [X] By: N/A

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Chain of Custody
(Lab Use Only)
№ 102362

Client Name: GAL	Project Reference: 1530908-2000
Contact Name: see pg. 1	Quote # 16-010
Address:	PO #
Telephone:	Email Address: see pg. 1

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1635243

Required Analyses

#	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote #16-010						
1	F3-5a	S		2	Aug17/16									X		-60mL+250mL-				
2	F3-7a				Aug17/16									X						
3	F3-9b				Aug16/16									X						
4	F3-12b				Aug16/16									X						
5	MW-01b													X						
6	MW-02a													X						
7	MW-06a				Aug17/16									X						
8	MW-05a													X						
9	MW-05b													X						
10	MW-07a													X						

Comments:

Method of Delivery: Walk-in

Relinquished By	Received by Driver/Depot	Received at Lab	Verified By
Relinquished By (Sign): Alyssa Troke	SUMEEPORN DOKMAI	[signature]	Rachel Subject
Relinquished By (Print): Alyssa Troke			
Date/Time: Aug. 23/16 1:00	Date/Time: AUG 23, 2016 05:15	Date/Time: 08/23/16 1:25pm	Date/Time: Aug 24/16 12:39
	Temperature: 11.8 °C	Temperature: 12.9 °C	pH Verified [X] By: N/A

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Chain of Custody
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Nº 102361

Client Name: GAL	Project Reference: 1530908-2000
Contact Name: see pg. 1	Quote # 16-010
Address:	PO #
Telephone:	Email Address: see pg 1

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ________ [ ] Other: ________

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1635243

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote 16-010						
1	MW-08a	S		2	Aug 17/16									X		-	60ml + 250ml -			/
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign): Alyssa Trake	Received by Driver/Depot: SUMEPORN DOKMAI	Received at Lab: [signature]	Verified By: Rachel Subject
Relinquished By (Print): Alyssa Trake	Date/Time: AUG 23, 2016 05.15	Date/Time: 08/23/16 1:25pm	Date/Time: Aug 24/16 12:39
Date/Time: Aug. 23/16 1:00	Temperature: 11.8 °C	Temperature: 18E °C	pH Verified [X] By: N/A

Appendix C2

Certificate Of Analysis –
Paracel Laboratories Ltd.,
Sept. 30, 2016; Order #1635246

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Certificate of Analysis

Golder Associates Ltd. (Ottawa)

1931 Robertson Rd.
Ottawa, ON K2H 5B7
Attn: Alyssa Troke

Client PO:
Project: 1530908-2000
Custody: 102363

Report Date: 2-Sep-2016
Order Date: 23-Aug-2016

Revised Report **Order #: 1635246**

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1635246-01	MW-03
1635246-02	MW-04
1635246-03	MW-02
1635246-04	MW-07
1635246-05	MW-01
1635246-06	MW-05
1635246-07	MW-08

Approved By:

Tim McCooeye
Senior Advisor

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 23-Aug-2016
Project Description: 1530908-2000

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Mercury by CVAA	EPA 245.1 - Cold Vapour AA	25-Aug-16	29-Aug-16
Metals, ICP-MS	EPA 200.8 - ICP-MS	29-Aug-16	29-Aug-16
PCBs, total	EPA 608 - GC-ECD	25-Aug-16	25-Aug-16
PHC F1	CWS Tier 1 - P&T GC-FID	23-Aug-16	24-Aug-16
PHCs F2 to F4	CWS Tier 1 - GC-FID, extraction	24-Aug-16	25-Aug-16

Certificate of Analysis

Client: Golder Associates Ltd. (Ottawa)

Client PO:

Report Date: 02-Sep-2016

Order Date: 23-Aug-2016

Project Description: 1530908-2000

Client ID:		MW-03	MW-04	MW-02	MW-07
Sample Date:		16-Aug-16	16-Aug-16	16-Aug-16	17-Aug-16
Sample ID:		1635246-01	1635246-02	1635246-03	1635246-04
	MDL/Units	Water	Water	Water	Water
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic	0.001 mg/L	0.003	<0.001	<0.001	<0.001
Cadmium	0.0001 mg/L	0.0001	<0.0001	<0.0001	<0.0001
Chromium	0.001 mg/L	<0.001	<0.001	<0.001	<0.001
Cobalt	0.0005 mg/L	0.0034	0.0046	0.0028	0.0049
Copper	0.0005 mg/L	0.0337	0.0008	0.0033	0.0081
Lead	0.0001 mg/L	<0.0001	<0.0001	0.0002	<0.0001
Nickel	0.001 mg/L	0.084	0.030	0.021	0.045
Zinc	0.005 mg/L	0.114	<0.005	0.009	0.009
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025 [2]	<0.025 [2]	<0.025 [2]	<0.025
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	<0.100 [3]
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	<0.100 [3]
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	<0.100 [3]
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00005	<0.00005	<0.00050 [1]
Decachlorobiphenyl	Surrogate	71.2%	60.0%	69.6%	83.0% [1]

Certificate of Analysis
Client: Golder Associates Ltd. (Ottawa)
Client PO:

Report Date: 02-Sep-2016
Order Date: 23-Aug-2016
Project Description: 1530908-2000

	Client ID:	MW-01	MW-05	MW-08	-
	Sample Date:	16-Aug-16	17-Aug-16	17-Aug-16	-
	Sample ID:	1635246-05	1635246-06	1635246-07	-
	MDL/Units	Water	Water	Water	-
Metals					
Mercury	0.0001 mg/L	<0.0001	<0.0001	0.0002	-
Arsenic	0.001 mg/L	<0.001	<0.001	0.015	-
Cadmium	0.0001 mg/L	0.0009	<0.0001	0.0002	-
Chromium	0.001 mg/L	0.002	<0.001	0.011	-
Cobalt	0.0005 mg/L	0.0590	0.0052	0.0039	-
Copper	0.0005 mg/L	0.0347	0.0027	0.0243	-
Lead	0.0001 mg/L	0.0003	<0.0001	0.0200	-
Nickel	0.001 mg/L	0.246	0.034	0.031	-
Zinc	0.005 mg/L	0.077	0.023	0.405	-
Hydrocarbons					
F1 PHCs (C6-C10)	0.025 mg/L	<0.025 [2]	<0.025	<0.025	-
F2 PHCs (C10-C16)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	-
F3 PHCs (C16-C34)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	-
F4 PHCs (C34-C50)	0.100 mg/L	<0.100 [3]	<0.100 [3]	<0.100 [3]	-
PCBs					
PCBs, total	0.00005 mg/L	<0.00005	<0.00012 [1]	<0.00005	-
Decachlorobiphenyl	Surrogate	75.7%	76.7% [1]	62.8%	-

Method Quality Control: Blank

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L						
F2 PHCs (C10-C16)	ND	0.100	mg/L						
F3 PHCs (C16-C34)	ND	0.100	mg/L						
F4 PHCs (C34-C50)	ND	0.100	mg/L						
Metals									
Mercury	ND	0.0001	mg/L						
Arsenic	ND	0.001	mg/L						
Cadmium	ND	0.0001	mg/L						
Chromium	ND	0.001	mg/L						
Cobalt	ND	0.0005	mg/L						
Copper	ND	0.0005	mg/L						
Lead	ND	0.0001	mg/L						
Nickel	ND	0.001	mg/L						
Zinc	ND	0.005	mg/L						
PCBs									
PCBs, total	ND	0.00005	mg/L						
Surrogate: Decachlorobiphenyl	*.00022*		*mg/L*		*87.8*	*60-140*			

Method Quality Control: Duplicate

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	ND	0.025	mg/L	ND				30	
Metals									
Mercury	ND	0.0001	mg/L	ND			0.0	20	
Arsenic	0.0015	0.001	mg/L	0.0019			25.9	20	QR-01
Cadmium	ND	0.0001	mg/L	ND			0.0	20	
Chromium	ND	0.001	mg/L	ND			0.0	20	
Cobalt	ND	0.0005	mg/L	ND			0.0	20	
Copper	0.00106	0.0005	mg/L	0.00120			12.5	20	
Lead	0.00018	0.0001	mg/L	0.00023			24.1	20	QR-01
Nickel	0.0011	0.001	mg/L	0.0011			3.4	20	
Zinc	0.033	0.005	mg/L	0.038			14.1	20	

Method Quality Control: Spike

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Hydrocarbons									
F1 PHCs (C6-C10)	2.18	0.025	mg/L		109	68-117			
F2 PHCs (C10-C16)	1.85	0.100	mg/L		103	60-140			
F3 PHCs (C16-C34)	3.81	0.100	mg/L		103	60-140			
F4 PHCs (C34-C50)	2.68	0.100	mg/L		108	60-140			
Metals									
Mercury	0.00280	0.0001	mg/L	ND	93.4	70-130			
Arsenic	44.3		ug/L	1.9	84.7	80-120			
Cadmium	48.0		ug/L	0.03	96.0	80-120			
Chromium	48.3		ug/L	0.3	95.9	80-120			
Cobalt	46.6		ug/L	0.08	93.1	80-120			
Copper	46.0		ug/L	1.20	89.6	80-120			
Lead	42.0		ug/L	0.23	83.6	80-120			
Nickel	47.1		ug/L	1.1	92.0	80-120			
Zinc	50		ug/L		99.1	80-120			
PCBs									
PCBs, total	0.00109	0.00005	mg/L		109	60-140			
Surrogate: Decachlorobiphenyl	*.00022*		*mg/L*		*91.3*	*60-140*			

Qualifier Notes:

Login Qualifiers :

Sample - One or more parameter received past hold time -
Applies to samples: MW-03, MW-04, MW-02, MW-01, MW-08

Sample - Insufficient volume - PCB bottle
Applies to samples: MW-07, MW-05

Sample Qualifiers :

1 : Elevated Reporting Limits due to limited sample volume.

2 : Holding time had been exceeded upon receipt of the sample at the laboratory.

3 : Holding time had been exceeded upon sample receipt at the laboratory

QC Qualifiers :

QR-01 : Duplicate RPD is high, however, the sample result is less than 10x the MDL.

Sample Data Revisions

None

Work Order Revisions / Comments:

Revision 1, all results reports as mg/L.

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

CCME PHC additional information:

- The method for the analysis of PHCs complies with the Reference Method for the CWS PHC and is validated for use in the laboratory. All prescribed quality criteria identified in the method has been met.
- F1 range corrected for BTEX.
- F2 to F3 ranges corrected for appropriate PAHs where available.
- The gravimetric heavy hydrocarbons (F4G) are not to be added to C6 to C50 hydrocarbons.
- In the case where F4 and F4G are both reported, the greater of the two results is to be used for comparison to CWS PHC criteria.

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www.paracellabs.com

Chain of Custody (Lab Use Only)

Nº 102363

Client Name: GAL	Project Reference: 1530908-2000
Contact Name: Alyssa Trolke	Quote # 16-010
Address: see pg. 1	PO #
Telephone:	Email Address: see pg. 1

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day

Date Required:

Criteria: [ ] O. Reg. 153/04 (As Amended) Table __ [ ] RSC Filing [ ] O. Reg. 558/00 [ ] PWQO [X] CCME [ ] SUB (Storm) [ ] SUB (Sanitary) Municipality: ______ [ ] Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1635246.

Required Analyses

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	PHCs F1-F4+BTEX	VOCs	PAHs	Metals by ICP	Hg	CrVI	B (HWS)	see quote 16-010						
1	MW-03	GW		6	Aug 16/16	12:30								X						
2	MW-04			6		15:00								X						
3	MW-02			6		1:30								X						
4	M.W-07			6	Aug 17/16	12:55								X		-Analyze PCBs if possible				
5	MW-01			6	Aug 16/16	14:20								X						
6	MW-05			6	Aug 17/16	13:20								X		-Analyze PCBs if possible				
7	MW-08			6	Aug 17/16	11:45								X						
8																				
9																				
10																				

Comments: Proceed regardless of any hold time exceedances + mixed MDLs

Method of Delivery: Walk-in

Relinquished By (Sign): Alyssa Trolke	Received by Driver/Depot: [signature]	Received at Lab: SUNTEPORN DORMAT	Verified By: Rachel Subject
Relinquished By (Print): Alyssa Trolke	Date/Time: 08/23/16 1:25pm	Date/Time: AUG 23, 2016 05:15	Date/Time: Aug 24/16 12:45
Date/Time: Aug 23/16 1:00 pm	Temperature: 12.9 °C	Temperature: 11.8 °C	pH Verified [✓] By: RS

Review Items

Lab Number	Analysis	Analyte	Exception
			Default Report (not modified)
			VERSION 6.18:2002
	Arsenic - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Cadmium - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Chromium - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Cobalt - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Copper - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Lead - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	Mercury by CVAA	(Water)	Special Units: mg/L (ug/L)
	Nickel - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
	PCBs, total	(Water)	Special Units: mg/L (ug/L)
	PHCs F1	(Water)	Special Units: mg/L (ug/L)
	PHCs F2 to F4	(Water)	Special Units: mg/L (ug/L)
	Zinc - (low level) ICPMS	(Water)	Special Units: mg/L (ug/L)
1619806-DUP1	Arsenic - (low level) ICPMS	Arsenic	Exceeds RPD control limit
1619806-DUP1	Arsenic - (low level) ICPMS	Arsenic	QR-01: Duplicate RPD is high, however, the sample result is less than 10x the MDL.
1619806-DUP1	Lead - (low level) ICPMS	Lead	Exceeds RPD control limit
1619806-DUP1	Lead - (low level) ICPMS	Lead	QR-01: Duplicate RPD is high, however, the sample result is less than 10x the MDL.
1635246-01			LG-SMP006: Sample - One or more parameter received past hold time -
1635246-01			REV 6: Revision 1, all results reports as mg/L.
1635246-01	PHCs F1		H-01: Holding time had been exceeded upon receipt of the sample at the laboratory.
1635246-01	PHCs F1		Sampled->Analyzed [Day] > 7 days
1635246-01	PHCs F2 to F4		H-08: Holding time had been exceeded upon sample receipt at the laboratory
1635246-01	PHCs F2 to F4		Sampled->Prepared > 7.00 days
1635246-02			LG-SMP006: Sample - One or more parameter received past hold time -
1635246-02	PHCs F1		H-01: Holding time had been exceeded upon receipt of the sample at the laboratory.
1635246-02	PHCs F1		Sampled->Analyzed [Day] > 7 days
1635246-02	PHCs F2 to F4		H-08: Holding time had been exceeded upon sample receipt at the laboratory
1635246-02	PHCs F2 to F4		Sampled->Prepared > 7.00 days
1635246-03			LG-SMP006: Sample - One or more parameter received past hold time -
1635246-03	PHCs F1		H-01: Holding time had been exceeded upon receipt of the sample at the laboratory.
1635246-03	PHCs F1		Sampled->Analyzed [Day] > 7 days
1635246-03	PHCs F2 to F4		H-08: Holding time had been exceeded upon sample receipt at the laboratory
1635246-03	PHCs F2 to F4		Sampled->Prepared > 7.00 days
1635246-04			LG-SMP009: Sample - Insufficient volume - PCB bottle
1635246-04	PCBs, total		GEN01: Elevated Reporting Limits due to limited sample volume.
1635246-04	PHCs F2 to F4		H-08: Holding time had been exceeded upon sample receipt at the laboratory
1635246-04	PHCs F2 to F4		Sampled->Prepared > 7.00 days
1635246-05			LG-SMP006: Sample - One or more parameter received past hold time -
1635246-05	PHCs F1		H-01: Holding time had been exceeded upon receipt of the sample at the laboratory.
1635246-05	PHCs F1		Sampled->Analyzed [Day] > 7 days
1635246-05	PHCs F2 to F4		H-08: Holding time had been exceeded upon sample receipt at the laboratory
1635246-05	PHCs F2 to F4		Sampled->Prepared > 7.00 days
1635246-06			LG-SMP009: Sample - Insufficient volume - PCB bottle

Appendix C3

Certificate Of Analysis –
AGAT Laboratories Ltd.,
Sept. 15, 2016; Order #16Z129701

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD
1931 ROBERTSON ROAD
OTTAWA, ON K2H5B7
(613) 592-9600

ATTENTION TO: Alyssa Troke

PROJECT: 1530908-2000

AGAT WORK ORDER: 16Z129701

SOIL ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

TRACE ORGANICS REVIEWED BY: Oksana Gushyla, Trace Organics Lab Supervisor

WATER ANALYSIS REVIEWED BY: Mike Muneswar, BSc (Chem), Senior Inorganic Analyst

DATE REPORTED: Sep 15, 2016

PAGES (INCLUDING COVER): 9

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

CCME Metals Scan (Soil) (incl. Hg)

DATE RECEIVED: 2016-08-23

DATE REPORTED: 2016-09-15

			SAMPLE DESCRIPTION:	MW-06a dup	F3-3a dup	MW-01a dup	F3-4a dup
			SAMPLE TYPE:	Soil	Soil	Soil	Soil
			DATE SAMPLED:	8/17/2016	8/17/2016	8/16/2016	8/17/2016
Parameter	Unit	G / S	RDL	7797937	7797944	7797946	7797948
Arsenic	mg/kg		1	16	9	32	18
Cadmium	mg/kg		0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	mg/kg		0.5	9.1	5.8	12.7	9.4
Chromium	mg/kg		1	80	47	98	76
Copper	mg/kg		1	35	15	77	36
Lead	mg/kg		1	6	4	11	7
Mercury	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10
Nickel	mg/kg		1	33	19	49	32
Zinc	mg/kg		1	67	48	91	86

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

PCBs - Soil

DATE RECEIVED: 2016-08-23

DATE REPORTED: 2016-09-15

			SAMPLE DESCRIPTION:	MW-06a dup	F3-3a dup	MW-01a dup	F3-4a dup
			SAMPLE TYPE:	Soil	Soil	Soil	Soil
			DATE SAMPLED:	8/17/2016	8/17/2016	8/16/2016	8/17/2016
Parameter	Unit	G / S	RDL	7797937	7797944	7797946	7797948
PCBs	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits					
Decachlorobiphenyl	%	60-130		112	88	92	112

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
7797937-7797948 Results are based on the dry weight of soil extracted.

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
ATTENTION TO: Alyssa Troke
SAMPLING SITE:DEW Line
SAMPLED BY:

Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil

DATE RECEIVED: 2016-08-23
DATE REPORTED: 2016-09-15

			SAMPLE DESCRIPTION:	MW-06a dup	F3-3a dup	MW-01a dup	F3-4a dup
			SAMPLE TYPE:	Soil	Soil	Soil	Soil
			DATE SAMPLED:	8/17/2016	8/17/2016	8/16/2016	8/17/2016
Parameter	Unit	G / S	RDL	7797937	7797944	7797946	7797948
C6 - C10 (F1)	mg/kg		5	<5	<5	<5	<5
C>10 - C16 (F2)	mg/kg		10	<10	<10	<10	<10
C>16 - C34 (F3)	mg/kg		50	<50	<50	<50	<50
C>34 - C50 (F4)	mg/kg		50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	mg/kg		50	NA	NA	NA	NA
Moisture Content	%		0.1	13.2	8.6	10.3	10.0

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7797937-7797948 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.
The soil sample was prepared in the lab using the Methanol extraction technique. The sample was not field preserved with methanol and an Encore was not provided for analysis.

Certified By:

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Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD

PROJECT: 1530908-2000

SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701

ATTENTION TO: Alyssa Troke

SAMPLED BY:

Soil Analysis

RPT Date: Sep 15, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
CCME Metals Scan (Soil) (incl. Hg)															
Arsenic	7795253		6	6	0.0%	< 1	110%	70%	130%	104%	80%	120%	102%	70%	130%
Cadmium	7795253		<0.5	<0.5	NA	< 0.5	103%	70%	130%	100%	80%	120%	101%	70%	130%
Cobalt	7795253		13.6	14.1	3.6%	< 0.5	89%	70%	130%	94%	80%	120%	89%	70%	130%
Chromium	7795253		24	25	4.1%	< 1	91%	70%	130%	104%	80%	120%	90%	70%	130%
Copper	7795253		20	21	4.9%	< 1	95%	70%	130%	99%	80%	120%	82%	70%	130%
Lead	7795253		20	20	0.0%	< 1	101%	70%	130%	93%	80%	120%	87%	70%	130%
Mercury	7795253		<0.10	<0.10	NA	< 0.10	111%	70%	130%	99%	80%	120%	97%	70%	130%
Nickel	7795253		29	29	0.0%	< 1	97%	70%	130%	101%	80%	120%	94%	70%	130%
Zinc	7795253		93	94	1.1%	< 1	100%	70%	130%	96%	80%	120%	87%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

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CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908-2000
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Trace Organics Analysis

RPT Date: Sep 15, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
PCBs - Soil															
PCBs	7803372		< 0.05	< 0.05	NA	< 0.05	112%	60%	140%	108%	60%	140%	108%	60%	140%
PCBs (water)															
PCBs		TW	< 0.05	< 0.05	NA	< 0.05	108%	60%	140%	113%	60%	140%	113%	60%	140%
Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil															
C6 - C10 (F1)	7805396		< 5	< 5	NA	< 5	71%	60%	130%	86%	60%	130%	102%	60%	130%
C>10 - C16 (F2)	7795053		<10	<10	NA	< 10	96%	70%	130%	82%	70%	130%	75%	70%	130%
C>16 - C34 (F3)	7795053		< 50	< 50	NA	< 50	98%	70%	130%	94%	70%	130%	93%	70%	130%
C>34 - C50 (F4)	7795053		< 50	< 50	NA	< 50	96%	70%	130%	101%	70%	130%	74%	70%	130%
Petroleum Hydrocarbon F1 - F4 in Water															
F1 (C6 to C10)	7807613		< 25	< 25	NA	< 25	111%	60%	140%	104%	60%	140%	116%	60%	140%
F2 (C10 to C16)	7806697		< 100	< 100	NA	< 100	96%	60%	140%	68%	60%	140%	73%	60%	140%
F3 (C16 to C34)	7806697		< 100	< 100	NA	< 100	94%	60%	140%	84%	60%	140%	84%	60%	140%
F4 (C34 to C50)	7806697		< 100	< 100	NA	< 100	82%	60%	140%	74%	60%	140%	74%	60%	140%

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908-2000
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Water Analysis

RPT Date: Sep 15, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals - (Water) - (incl. Hg)															
Arsenic	7815687		0.003	0.003	NA	< 0.001	105%	90%	110%	98%	90%	110%	102%	70%	130%
Cadmium	7815687		< 0.0001	< 0.0001	NA	< 0.0001	101%	90%	110%	103%	90%	110%	102%	70%	130%
Chromium	7815687		0.002	0.002	NA	< 0.001	102%	90%	110%	97%	90%	110%	103%	70%	130%
Cobalt	7815687		0.0005	0.0006	NA	< 0.0005	94%	90%	110%	105%	90%	110%	97%	70%	130%
Copper	7815687		0.006	0.007	NA	< 0.005	100%	90%	110%	107%	90%	110%	99%	70%	130%
Lead	7815687		0.0010	0.0010	0.0%	< 0.0001	99%	90%	110%	104%	90%	110%	94%	70%	130%
Mercury	7797950	7797950	<0.0001	<0.0001	NA	< 0.0001	102%	90%	110%	102%	90%	110%	100%	80%	120%
Nickel	7815687		0.004	0.004	NA	< 0.001	100%	90%	110%	98%	90%	110%	102%	70%	130%
Zinc	7815687		0.333	0.341	2.4%	< 0.005	98%	90%	110%	104%	90%	110%	99%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

AGAT Laboratories

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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD
AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000
ATTENTION TO: Alyssa Troke
SAMPLING SITE:DEW Line
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Trace Organics Analysis			
PCBs	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
Initial Sample Volume			GC/FID
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 8081A & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
F1 (C6 to C10)	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
F2 (C10 to C16)	VOL-91-5010	MOE PHC-E3421	GC/FID
F3 (C16 to C34)	VOL-91-5010	MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010		GC/FID
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL - 5012	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	Balance
Water Analysis			
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

AGAT Laboratories

16G

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
www.agatlabs.com webearth.agatlabs.com

Laboratory Use Only

Work Order #: 16Z129701

Cooler Quantity: 1

Arrival Temperatures: 7.8 | 7.6 | 7.0
8.4 | 8 | 7.2

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: On ice

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Report Information:

Company: Golder Associates
Contact: Alyssa Troke
Address: 1931 Robertson Rd
Ottawa
Phone: 613592-9600 Fax:
Reports to be sent to:
1. Email: atroke@golder.com
2. Email: dplenderleith@golder.com

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐Regulation 153/04 — Table (Indicate One): ☐Ind/Com ☐Res/Park ☐Agriculture
Soil Texture (Check One): ☐Coarse ☐Fine

☐Sewer Use: ☐Sanitary ☐Storm — Region (Indicate One)

☐Regulation 558
☒CCME
☐Prov. Water Quality Objectives (PWQO)
☐Other (Indicate One)

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on *Certificate of Analysis* ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: 1530908-2000
Site Location:
Sampled By:
AGAT Quote #: 69566 PO:

Please note: If quotation number is not provided, client will be billed full price for analysis

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

(Check Applicable)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐B-HWS ☐Cl ☐CN ☐Cr6+ ☐EC ☐FOC ☐NO3/NO2 ☐Total N ☐Hg ☐pH ☐SAR	Nutrients: ☐TP ☐NH3 ☐TKN ☐NO3 ☐NO2 ☐NO3/NO2	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	see Quote 69566
MW-06a dup	Aug 17/16		2	S																	X
F3-3a dup	Aug 17/16		2	S																	X
MW-01 dup	Aug 16/16		2	S																	X
F3-4a dup	Aug 17/16		2	S																	X
MW-03 dup	Aug 16/16		5	GW																	X

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
Alyssa Troke / Alyssa Troke	Aug. 23/16	1:00	Berthelet	23-Aug-16	14h45
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time
			S	16/8/24	9:24

Page 1 of 1

Nº: T 011321

Document ID: DIV-78-1511.009

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

Date Issued: Jan 8, 2015

Appendix C4

Certificate Of Analysis –
AGAT Laboratories Ltd.,
Nov. 2, 2016; Order #16Z129701

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME:	GOLDER ASSOCIATES LTD 1931 ROBERTSON ROAD OTTAWA, ON K2H5B7 (613) 592-9600
ATTENTION TO:	Alyssa Troke
PROJECT:	1530908-2000
AGAT WORK ORDER:	16Z129701
SOIL ANALYSIS REVIEWED BY:	Mike Muneswar, BSc (Chem), Senior Inorganic Analyst
TRACE ORGANICS REVIEWED BY:	Oksana Gushyla, Trace Organics Lab Supervisor
WATER ANALYSIS REVIEWED BY:	Mike Muneswar, BSc (Chem), Senior Inorganic Analyst
DATE REPORTED:	Nov 02, 2016
PAGES (INCLUDING COVER):	9
VERSION*:	1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line

ATTENTION TO: Alyssa Troke
SAMPLED BY:

PCBs (water)

DATE RECEIVED: 2016-08-23

DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW-03 dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-16
Parameter	Unit	G / S	RDL	7797950
PCBs	mg/L		0.00005	<0.00005
Initial Sample Volume				0.85
Surrogate	Unit	Acceptable Limits		
Decachlorobiphenyl	%	60-130		105

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
SAMPLING SITE:DEW Line
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Petroleum Hydrocarbon F1 - F4 in Water

DATE RECEIVED: 2016-08-23
DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW-03 dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-16
Parameter	Unit	G / S	RDL	7797950
F1 (C6 to C10)	mg/L		0.025	<0.025
F2 (C10 to C16)	mg/L		0.1	<0.1
F3 (C16 to C34)	mg/L		0.1	<0.1
F4 (C34 to C50)	mg/L		0.1	<0.1
Gravimetric Heavy Hydrocarbons	mg/L		0.5	NA
Surrogate	Unit	Acceptable Limits		
Terphenyl	%	60-140		110

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7797950 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6-C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153/04, results are considered valid without determining the PAH contribution if not requested by the client.
NA = Not Applicable

Certified By:

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Certificate of Analysis

AGAT WORK ORDER: 16Z129701
PROJECT: 1530908-2000

CLIENT NAME: GOLDER ASSOCIATES LTD
ATTENTION TO: Alyssa Troke
SAMPLING SITE:DEW Line
SAMPLED BY:

CCME Metals - (Water) - (incl. Hg)

DATE RECEIVED: 2016-08-23
DATE REPORTED: 2016-11-02

			SAMPLE DESCRIPTION:	MW-03 dup
			SAMPLE TYPE:	Water
			DATE SAMPLED:	2016-08-16
Parameter	Unit	G / S	RDL	7797950
Arsenic	mg/L		0.001	0.009
Cadmium	mg/L		0.0001	0.0010
Chromium	mg/L		0.001	0.004
Cobalt	mg/L		0.0005	0.0132
Copper	mg/L		0.005	0.042
Lead	mg/L		0.0001	0.0004
Mercury	mg/L		0.0001	<0.0001
Nickel	mg/L		0.001	0.102
Zinc	mg/L		0.005	0.734

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD

PROJECT: 1530908-2000

SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701

ATTENTION TO: Alyssa Troke

SAMPLED BY:

Soil Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
CCME Metals Scan (Soil) (incl. Hg)															
Arsenic	7795253		6	6	0.0%	< 1	110%	70%	130%	104%	80%	120%	102%	70%	130%
Cadmium	7795253		<0.5	<0.5	NA	< 0.5	103%	70%	130%	100%	80%	120%	101%	70%	130%
Cobalt	7795253		13.6	14.1	3.6%	< 0.5	89%	70%	130%	94%	80%	120%	89%	70%	130%
Chromium	7795253		24	25	4.1%	< 1	91%	70%	130%	104%	80%	120%	90%	70%	130%
Copper	7795253		20	21	4.9%	< 1	95%	70%	130%	99%	80%	120%	82%	70%	130%
Lead	7795253		20	20	0.0%	< 1	101%	70%	130%	93%	80%	120%	87%	70%	130%
Mercury	7795253		<0.10	<0.10	NA	< 0.10	111%	70%	130%	99%	80%	120%	97%	70%	130%
Nickel	7795253		29	29	0.0%	< 1	97%	70%	130%	101%	80%	120%	94%	70%	130%
Zinc	7795253		93	94	1.1%	< 1	100%	70%	130%	96%	80%	120%	87%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
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FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908-2000
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701
ATTENTION TO: Alyssa Troke
SAMPLED BY:

Trace Organics Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
PCBs - Soil															
PCBs	7803372		< 0.05	< 0.05	NA	< 0.05	112%	60%	140%	108%	60%	140%	108%	60%	140%
PCBs (water)															
PCBs		TW	< 0.05	< 0.05	NA	< 0.05	108%	60%	140%	113%	60%	140%	113%	60%	140%
Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil															
C6 - C10 (F1)	7805396		< 5	< 5	NA	< 5	71%	60%	130%	86%	60%	130%	102%	60%	130%
C>10 - C16 (F2)	7795053		<10	<10	NA	< 10	96%	70%	130%	82%	70%	130%	75%	70%	130%
C>16 - C34 (F3)	7795053		< 50	< 50	NA	< 50	98%	70%	130%	94%	70%	130%	93%	70%	130%
C>34 - C50 (F4)	7795053		< 50	< 50	NA	< 50	96%	70%	130%	101%	70%	130%	74%	70%	130%
Petroleum Hydrocarbon F1 - F4 in Water															
F1 (C6 to C10)	7807613		< 25	< 25	NA	< 25	111%	60%	140%	104%	60%	140%	116%	60%	140%
F2 (C10 to C16)	7806697		< 100	< 100	NA	< 100	96%	60%	140%	68%	60%	140%	73%	60%	140%
F3 (C16 to C34)	7806697		< 100	< 100	NA	< 100	94%	60%	140%	84%	60%	140%	84%	60%	140%
F4 (C34 to C50)	7806697		< 100	< 100	NA	< 100	82%	60%	140%	74%	60%	140%	74%	60%	140%

Comments: Tap water analysis has been performed as QC sample testing for duplicate and matrix spike due to insufficient sample volume.
When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

Certified By:

AGAT Laboratories

5835 COOPERS AVENUE
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CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD

PROJECT: 1530908-2000

SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701

ATTENTION TO: Alyssa Troke

SAMPLED BY:

Water Analysis

RPT Date: Nov 02, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper	Recovery	Acceptable Limits Lower	Acceptable Limits Upper
CCME Metals - (Water) - (incl. Hg)															
Arsenic	7815687		0.003	0.003	NA	< 0.001	105%	90%	110%	98%	90%	110%	102%	70%	130%
Cadmium	7815687		< 0.0001	< 0.0001	NA	< 0.0001	101%	90%	110%	103%	90%	110%	102%	70%	130%
Chromium	7815687		0.002	0.002	NA	< 0.001	102%	90%	110%	97%	90%	110%	103%	70%	130%
Cobalt	7815687		0.0005	0.0006	NA	< 0.0005	94%	90%	110%	105%	90%	110%	97%	70%	130%
Copper	7815687		0.006	0.007	NA	< 0.005	100%	90%	110%	107%	90%	110%	99%	70%	130%
Lead	7815687		0.0010	0.0010	0.0%	< 0.0001	99%	90%	110%	104%	90%	110%	94%	70%	130%
Mercury	7797950	7797950	<0.0001	<0.0001	NA	< 0.0001	102%	90%	110%	102%	90%	110%	100%	80%	120%
Nickel	7815687		0.004	0.004	NA	< 0.001	100%	90%	110%	98%	90%	110%	102%	70%	130%
Zinc	7815687		0.333	0.341	2.4%	< 0.005	98%	90%	110%	104%	90%	110%	99%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By:

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD
PROJECT: 1530908-2000
SAMPLING SITE:DEW Line

AGAT WORK ORDER: 16Z129701
ATTENTION TO: Alyssa Troke
SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Mercury	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Trace Organics Analysis			
PCBs	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
Initial Sample Volume			GC/FID
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 3510 & 8082	GC/ECD
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5112	EPA SW-846 8081A & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
F1 (C6 to C10)	VOL-91-5010	MOE PHC-E3421	(P&T)GC/FID
F2 (C10 to C16)	VOL-91-5010	MOE PHC-E3421	GC/FID
F3 (C16 to C34)	VOL-91-5010	MOE PHC-E3421	GC/FID
F4 (C34 to C50)	VOL-91-5010	MOE PHC-E3421	GC/FID
Gravimetric Heavy Hydrocarbons	VOL-91-5010	MOE PHC-E3421	BALANCE
Terphenyl	VOL-91-5010		GC/FID
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	P & T GC/FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method, EPA SW846 8015	GC / FID
Gravimetric Heavy Hydrocarbons	VOL - 5012	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	Balance
Water Analysis			
Arsenic	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cadmium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Chromium	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Copper	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Lead	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Mercury	MET-93-6100	EPA SW-846 7470 & 245.1	CVAAS
Nickel	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Zinc	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

AGAT Laboratories 16G

5835 Coopers Avenue
Mississauga, Ontario L4Z 1Y2
Ph: 905.712.5100 Fax: 905.712.5122
www.agatlabs.com webearth.agatlabs.com

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water intended for human consumption)

Laboratory Use Only

Work Order #: 16Z129701

Cooler Quantity: 1

Arrival Temperatures: 7.8 | 7.6 | 7.0
8.4 | 8 | 7.2

Custody Seal Intact: ☐Yes ☐No ☐N/A

Notes: On ice

Report Information:

Company: Golder Associates
Contact: Alyssa Troke
Address: 1931 Robertson Rd
Ottawa
Phone: 613592-9600 Fax:
Reports to be sent to:
1. Email: atroke@golder.com
2. Email: dplenderleith@golder.com

Regulatory Requirements: ☐ No Regulatory Requirement

(Please check all applicable boxes)

☐Regulation 153/04
Table ____ Indicate One
☐Ind/Com
☐Res/Park
☐Agriculture
Soil Texture (Check One)
☐Coarse
☐Fine

☐Sewer Use
☐Sanitary
☐Storm
Region ____ Indicate One

☐Regulation 558
☒CCME
☐Prov. Water Quality Objectives (PWQO)
☐Other
____ Indicate One

Is this submission for a **Record of Site Condition?** ☐ Yes ☒ No

Report Guideline on Certificate of Analysis ☐ Yes ☒ No

Turnaround Time (TAT) Required:

Regular TAT ☒ 5 to 7 Business Days

Rush TAT (Rush Surcharges Apply)

☐ 3 Business Days ☐ 2 Business Days ☐ 1 Business Day

OR Date Required (Rush Surcharges May Apply):

Please provide prior notification for rush TAT
**TAT is exclusive of weekends and statutory holidays*

Project Information:

Project: 1530908-2000
Site Location:
Sampled By:
AGAT Quote #: 69566 PO:
Please note: If quotation number is not provided, client will be billed full price for analysis

Invoice Information:

Bill To Same: Yes ☐ No ☐

Company:
Contact:
Address:
Email:

Sample Matrix Legend

B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

(Check Applicable)

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Metals and Inorganics	Metal Scan	Hydride Forming Metals	Client Custom Metals	ORPs: ☐B-HWS ☐Cl ☐CN ☐Cr6+ ☐EC ☐FOC ☐Hg ☐NO3/NO2 ☐pH ☐SAR ☐Total N	Nutrients: ☐TP ☐NH3 ☐TKN ☐NO3 ☐NO2 ☐NO3/NO2	Volatiles: ☐VOC ☐BTEX ☐THM	CCME Fractions 1 to 4	ABNs	PAHs	Chlorophenols	PCBs	Organochlorine Pesticides	TCLP Metals/Inorganics	Sewer Use	see Quote 69566							
MW-06a dup	Aug17/16		2	S																	X							
F3-3a dup	Aug17/16		2	S																	X							
MW-01 dup	Aug16/16		2	S																	X							
F3-4a dup	Aug17/16		2	S																	X							
MW-03 dup	Aug.16/16		5	GW																	X							

Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign):	Date	Time	
Alyssa Troke / Alyssa Troke	Aug. 23/16	1:00	Berthelet	23-Aug-16	14h45	Page 1 of 1
Samples Relinquished By (Print Name and Sign):	Date	Time	Samples Received By (Print Name and Sign): S	16/8/24	9:24	Nº: T 011321

Document ID: DIV-78-1511.009

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Date Issued: Jan 8, 2015

Appendix C5

Historical Soil Water Chemistry Data

FOX-3 - Tier II Disposal Facility- Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Background Data - Arithmetic mean*						31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.05	0.0030				N/A
Baseline Data - Arithmetic mean*						**37.9**	**32.3**	**12.6**	**1.0**	**10.0**	**64.4**	**79.2**	**13.7**	**0.10**	**0.10**				**10**
Baseline Data - Standard Deviation						12.0	7.1	3.2	0.0	3.6	9.1	13.0	6.2	0.00	0.021				8.1
Baseline Data mean + 3xStandard Deviation						73.9	53.6	22.1	1.0	20.9	91.6	118.2	32.2	0.10	0.16				34
If baseline or background arithmetic mean was below the detection limit, the mean has been modified to match the detection limit value.																			
DEW Line Cleanup Tier I Criteria										*200*					*1.0*				
DEW Line Cleanup Tier II Criteria & Hydrocarbon Action Level						*100*	*100*	*50*	*5.0*	*500*	*500*	*250*	*61*	*2.0*	*5.0*				*2500*
Monitoring Data																			
Upgradient																			
	MW # 1 surface																		
12-19388/89**	MW-1	2012	1	1	0-10	48	40	10	<0.50	9.1	75	78	20	0.014	0.020	<5.0	<10	<50	33
2013-F3-MW-01-A	MW-1	2013	2	1	0-10	48	39	9.3	<0.10	7.0	71	79	18	<0.050	<0.010	<10	<10	<10	15
F3-MW-1-S-A-2014	MW-1	2014	3	1	0-10	36	36	9.0	<0.50	7.0	65	87	29	<0.10	<0.020	<10	<10	<20	20
MW-01 (0-15) (Dup Avg)	MW-1	2015	4	1	0-15	46	39	11.3	<0.5	9	71	89	29	<0.1	<0.1	<6	<4	<8	9
MW-01b	MW-1	2016	5	1	0-15	61.8	36.6	10.7	<0.5	10.7	62.2	100	39.2	<0.1	<0.05	<7	<4	<8	10
	MW-1		7	2															#N/A
	MW-1		10	2															#N/A
	MW-1		15	2															#N/A
	MW-1		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	MW # 1 depth																		
12-19390/91**	MW-1	2012	1	1	30-40	51	48	12	<0.50	9.5	87	110	33	0.011	<0.020	<5.0	<10	<50	33
2013-F3-MW-01-B	MW-1	2013	2	1	40 - 50	33	32	8.7	<0.10	6.0	61	73	16	<0.050	<0.010	<10	<10	<10	15
F3-MW-1-S-B-2014	MW-1	2014	3	1	40 - 50	44	35	9.0	<0.50	8.0	70	89	23	<0.10	<0.020	<10	<10	<20	20
MW-01 (40-50)	MW-1	2015	4	1	40 - 50	48.6	38	10.8	<0.5	9.9	66.7	87.9	28.7	<0.1	<0.05	<7	<4	<8	10
MW-01a (Dup Avg)	MW-1	2016	5	1	40-50	75	43	12.0	<0.5	12	79	91	30	<0.1	<0.05	<6	<7	<29	21
	MW-1		7	2															#N/A
	MW-1		10	2															#N/A
	MW-1		15	2															#N/A
	MW-1		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Tier II Disposal Facility- Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Downgradient																			
	MW # 2 surface																		
12-19392/93**	MW-2	2012	1	1	0-10	**57**	**42**	12	<0.50	**12**	**88**	**100**	**28**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-F3-MW-02-A	MW-2	2013	2	1	1 -10	31	29	9.3	<0.1	8.0	60	69	**14**	<0.05	<0.010	<10	<10	22.00	**32**
F3-MW-2-S-A-2014	MW-2	2014	3	1	0-10	34	**35**	9.0	<0.50	7.0	**65**	**80**	**18**	<0.10	<0.020	<10	<10	<20	**20**
MW-02 (0-15)	MW-2	2015	4	1	0-15	27.5	24.7	8	<0.5	7.9	51.8	61.8	**14.7**	<0.1	<0.05	<7	<4	<8	10
MW-02a	MW-2	2016	5	1	0-15	32.2	23.4	8.1	<0.5	6.6	46.8	57	12.5	<0.1	<0.05	<7	<4	<8	10
	MW-2		7	2															#N/A
	MW-2		10	2															#N/A
	MW-2		15	2															#N/A
	MW-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	MW # 2 depth																		
12-19394/95**	MW-2	2012	1	1	30-40	**47**	**39**	12	<0.50	**12**	**81**	**87**	**18**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-C5-MW-06-B	MW-2	2013	2	1	40 - 50	30	29	8.9	<0.1	8.0	63	71	11	<0.050	<0.010	<10	<10	<10	**15**
F3-MW-2-S-B-2014	MW-2	2014	3	1	40 - 50	35	**45**	11	<0.50	7.0	**73**	**104**	**14**	<0.10	<0.020	<10	<10	<20	**20**
MW-02 (40-50)	MW-2	2015	4	1	40 - 50	29.1	24.1	8.2	<0.5	8.2	51.4	59.7	13.4	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	MW-2	2016	5	1															#N/A
	MW-2		7	2															#N/A
	MW-2		10	2															#N/A
	MW-2		15	2															#N/A
	MW-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	MW # 3 surface																		
12-19396/97**	MW-3	2012	1	1	0-10	37	**36**	10	<0.50	7.2	**77**	**88**	**17**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-F3-MW-03-A/03-A-D	MW-3	2013	2	1	0-10	34	**34**	10	<0.10	7.0	**67**	75	**14**	<0.050	0.015	<10	<10	<10	**15**
F3-MW-3-S-A-2014	MW-3	2014	3	1	0-10	**44**	**37**	11	<0.50	6.0	**70**	**83**	**15**	<0.10	<0.020	<10	<10	<20	**20**
MW-03 (0-15)	MW-3	2015	4	1	0-15	29	**33.8**	10.6	<0.5	6.2	59.5	70.1	12.5	<0.1	<0.05	<7	<4	<8	10
MW-03b	MW-3	2016	5	1	0-15	**57.8**	**39.5**	**14.3**	<0.5	**11.2**	**65.5**	**86.1**	**26.9**	<0.1	<0.05	<7	<4	<8	10
	MW-3		7	2															#N/A
	MW-3		10	2															#N/A
	MW-3		15	2															#N/A
	MW-3		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Tier II Disposal Facility- Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	MW # 3 depth																		
12-19398/99**	MW-3	2012	1	1	30-40	**49**	**45**	**13**	<0.50	9.7	**100**	**100**	**21**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-F3-MW-03-B	MW-3	2013	2	1	40 - 50	30	**33**	11	<0.10	6.0	61	74	12	<0.050	<0.010	<10	<10	<10	**15**
not sampled - bedrock reached at 0.15m	MW-3	2014	3	1															#N/A
MW-03 (40-50)	MW-3	2015	4	1	40 - 50	36	**36.7**	11.8	<0.5	8.2	62.9	77.6	**16.1**	<0.1	<0.05	<7	<4	<8	10
MW-03a	MW-3	2016	5	1	30-40	**64.1**	**41.4**	**14.7**	<0.5	**11.6**	**67.8**	**89.1**	**30.4**	<0.1	<0.05	<7	<4	<8	10
	MW-3		7	2															#N/A
	MW-3		10	2															#N/A
	MW-3		15	2															#N/A
	MW-3		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	MW # 4 surface																		
12-19384/85**	MW-4	2012	1	1	0-10	**49**	**51**	**14**	<0.50	**11**	**93**	**120**	**26**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-F3-MW-04-A	MW-4	2013	2	1	0 -10	35	**38**	11	<0.10	7.0	63	**85**	**19**	<0.050	<0.010	<10	<10	11	**21**
F3-MW-4-S-A-2014	MW-4	2014	3	1	0-10	**43**	**50**	12	<0.50	8.0	**70**	**116**	**37**	<0.10	<0.020	<10	<10	30	**40**
MW-04 (0-15)	MW-4	2015	4	1	0-15	26.6	23.7	7.9	<0.5	8.1	50.4	65.1	13.6	<0.1	<0.05	<7	<4	<8	10
MW-04a	MW-4	2016	5	1	0-15	25.7	28.1	9.1	<0.5	6.7	50.5	73.2	12	<0.1	<0.05	<7	<4	<8	10
	MW-4		7	2															#N/A
	MW-4		10	2															#N/A
	MW-4		15	2															#N/A
	MW-4		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	MW # 4 depth																		
12-19386/87**	MW-4	2012	1	1	30-40	30	32	9.7	<0.50	6.9	64	**81**	**15**	<0.010	<0.020	<5.0	<10	<50	**33**
2013-F3-MW-04-B	MW-4	2013	2	1	40 - 50	**39**	**38**	11	<0.10	8.0	**70**	**88**	**21**	<0.050	<0.010	<10	<10	<10	**15**
not sampled - bedrock reached at 0.15m depth	MW-4	2014	3	1															#N/A
MW-04 (40-50)	MW-4	2015	4	1	40 - 50	34.4	25.3	8.4	<0.5	**10**	54.7	66.7	12.6	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	MW-4	2016	5	1															#N/A
	MW-4		7	2															#N/A
	MW-4		10	2															#N/A
	MW-4		15	2															#N/A
	MW-4		25	2															#N/A
																			#N/A
																			#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

** two samples taken, one analyzed for inorganics and PCBs, one analyzed for TPH

Legend

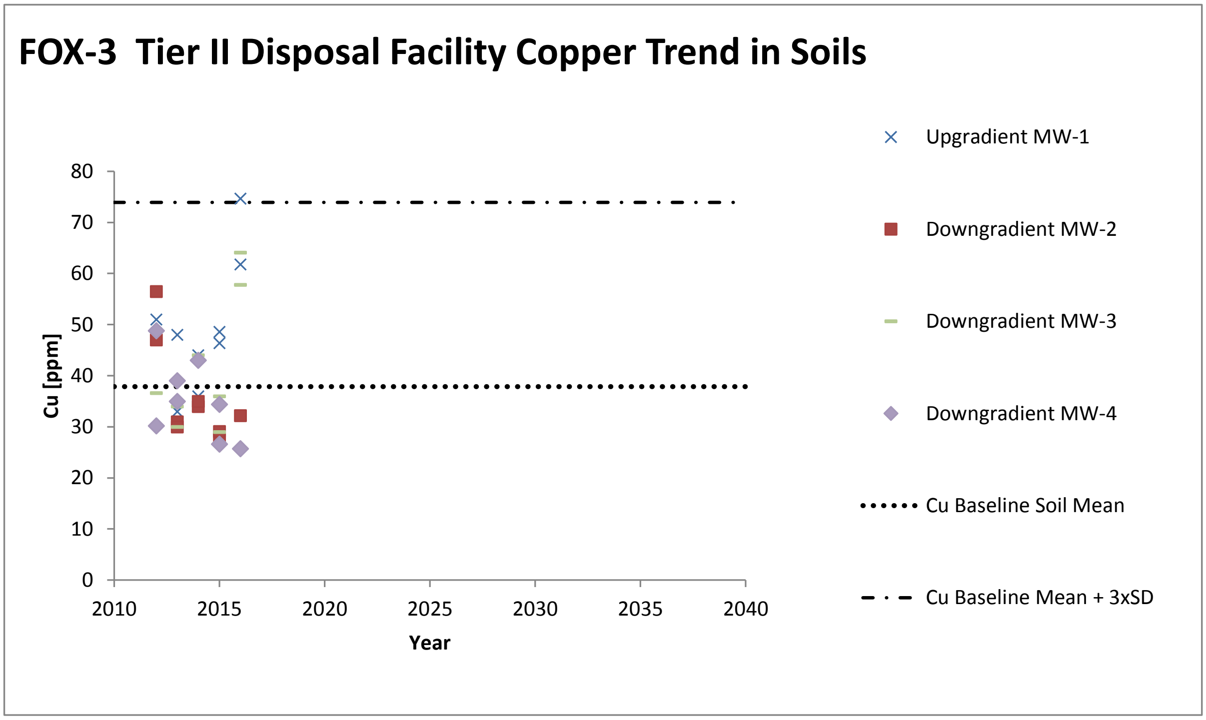
XX sample exceeds background

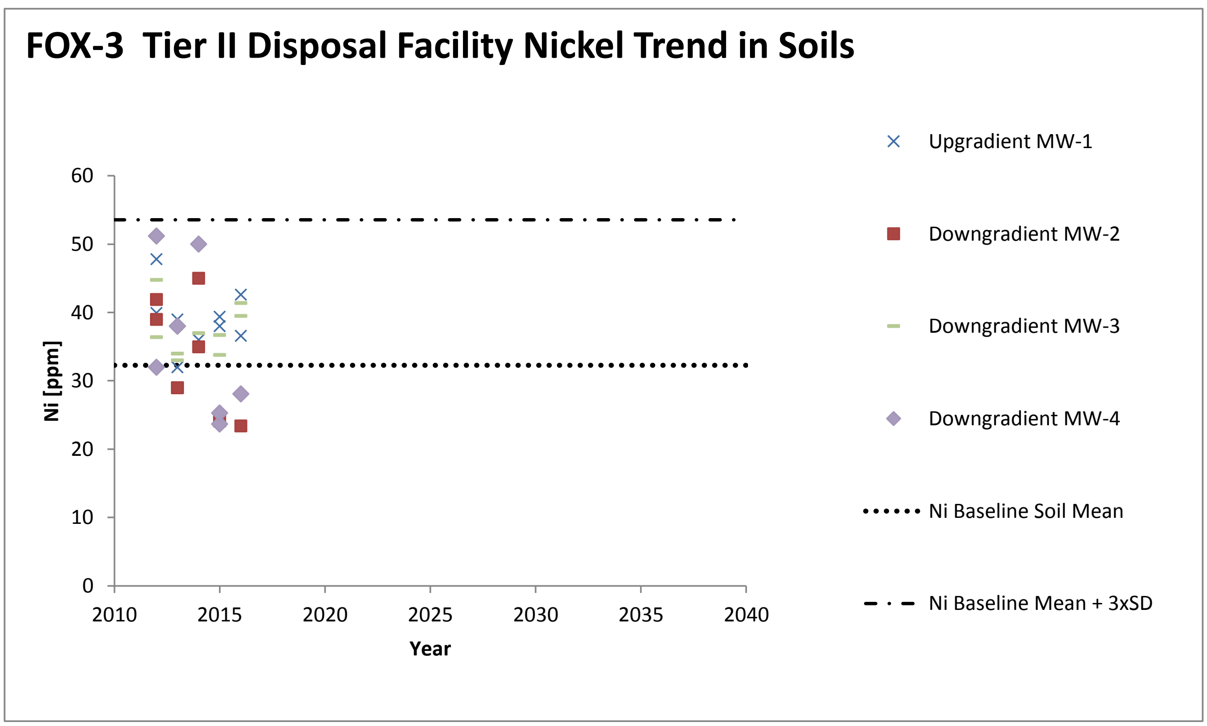
XX **sample exceeds baseline**

XX *sample exceeds DLCU Tier I criteria*

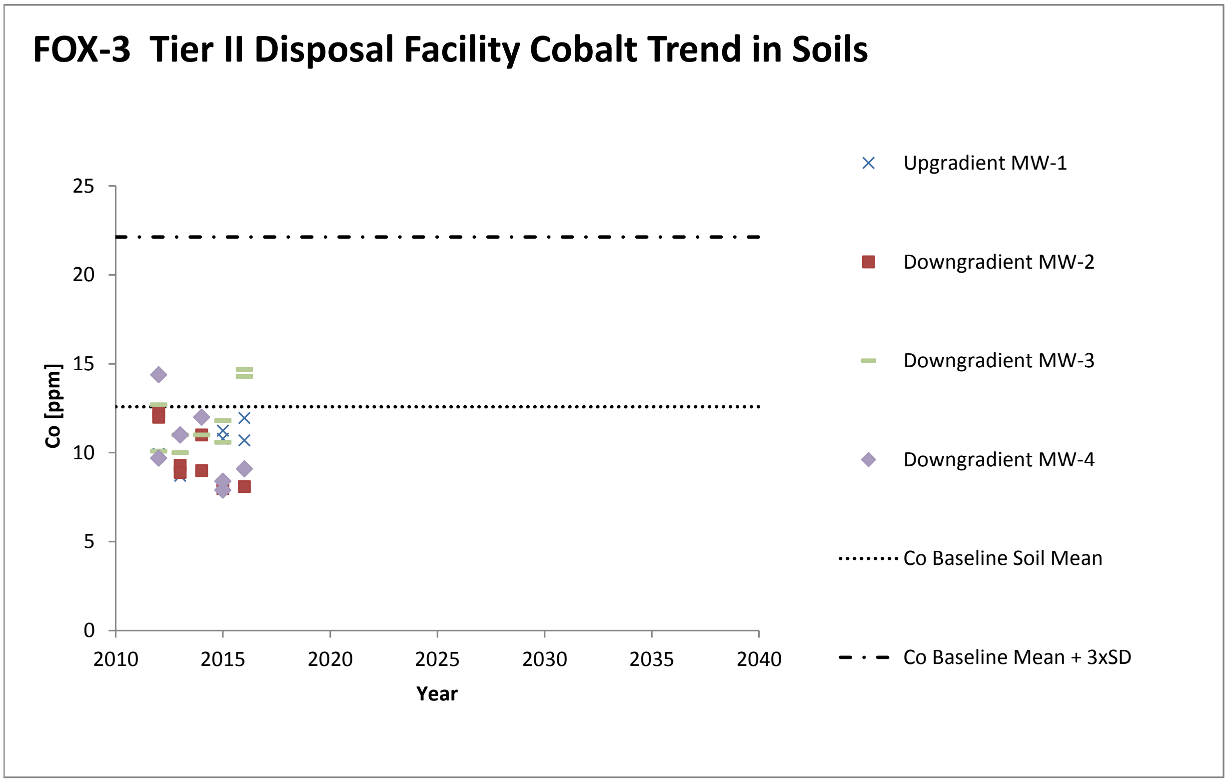
XX *sample exceeds DLCU Tier II criteria*

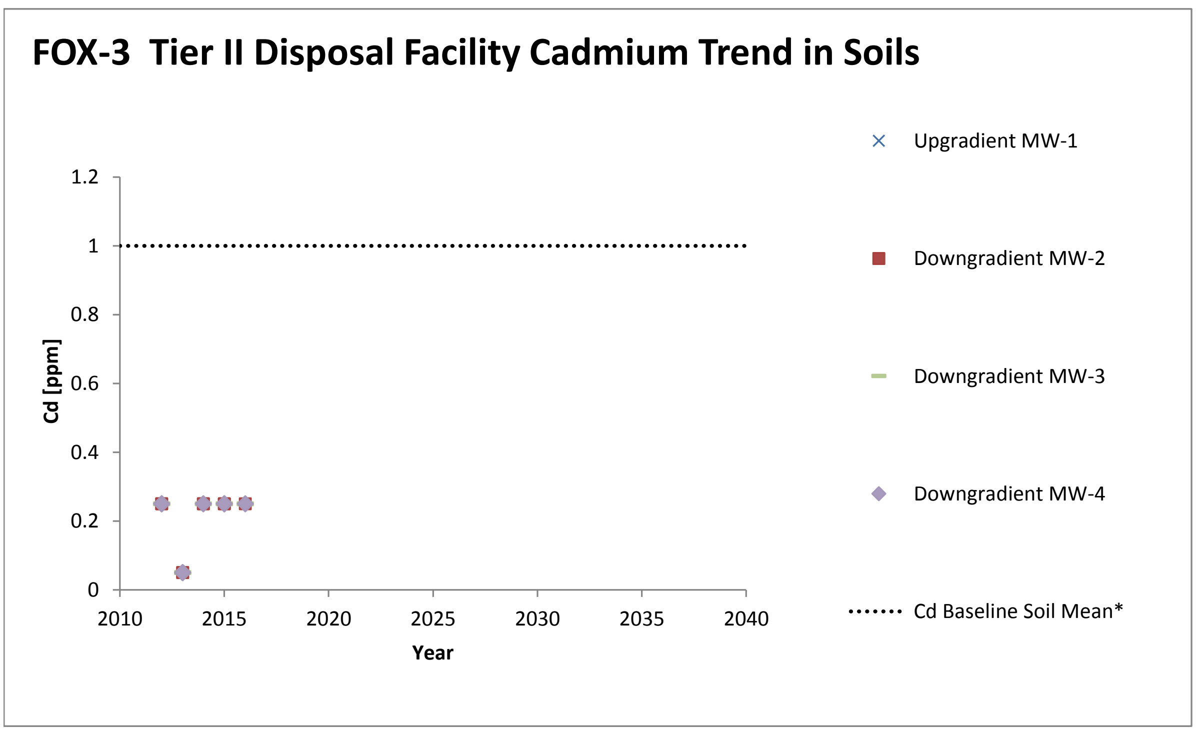
FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)
Where results are below detection, half of the detection limit has been used in the charts for the sample points. Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.





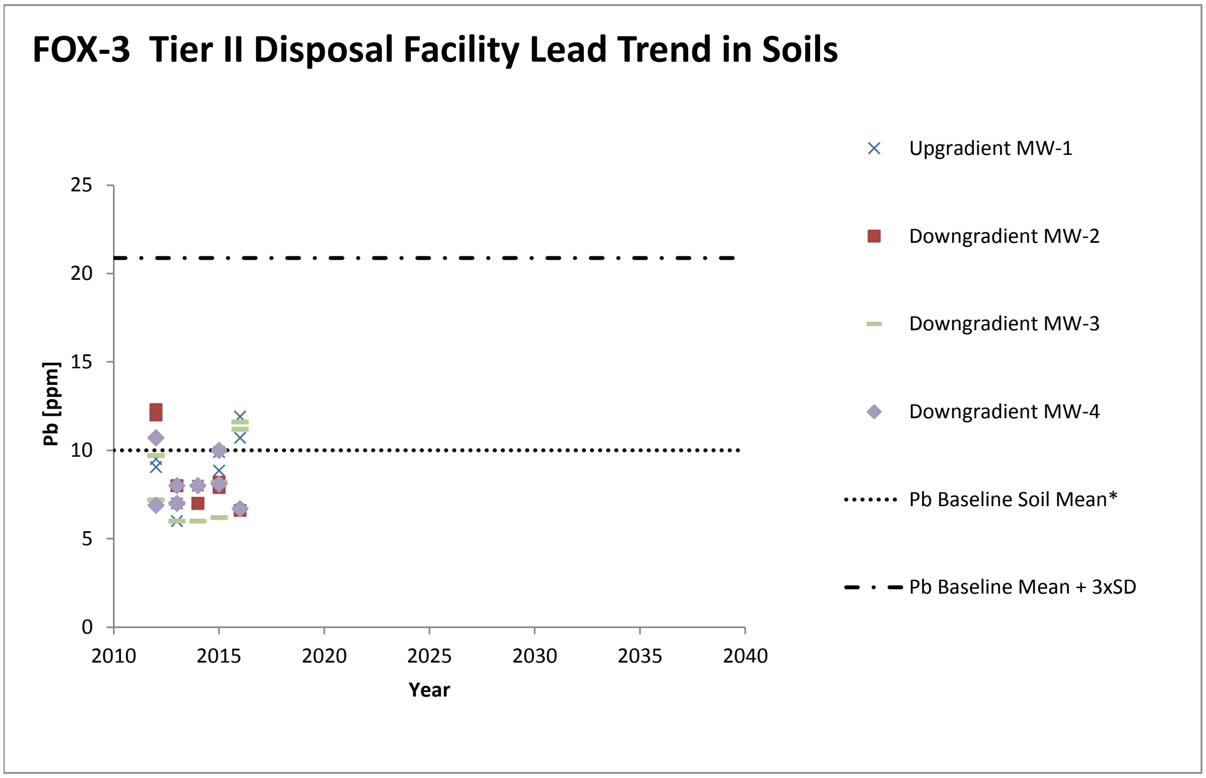
FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



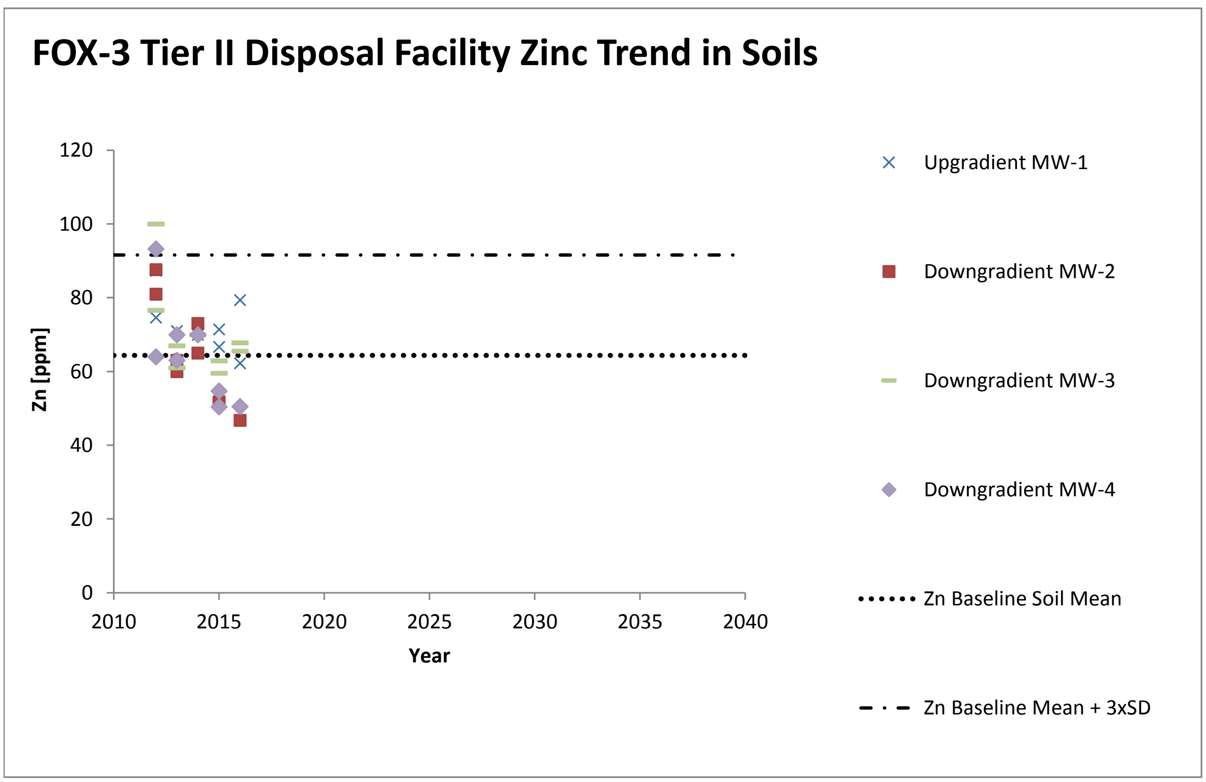


*Cd Baseline Mean is equal to the baseline detection limit.
**Cd Baseline SD = 0

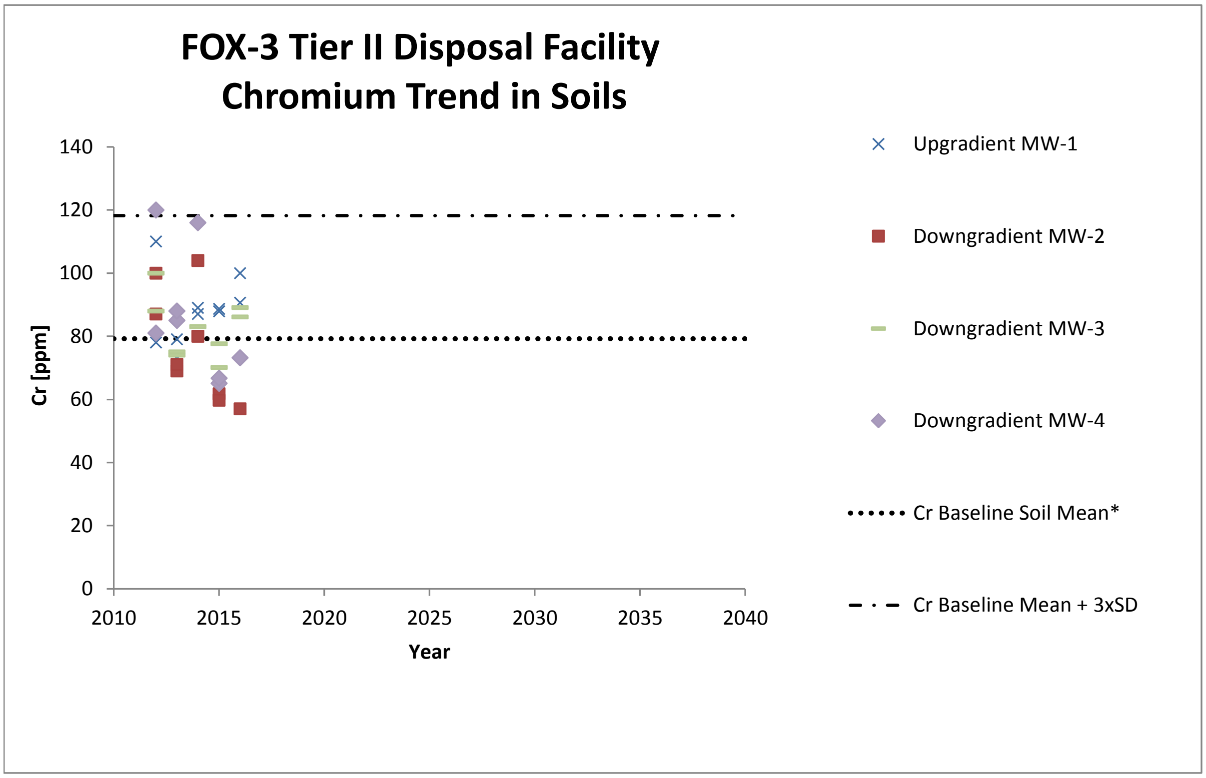
FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

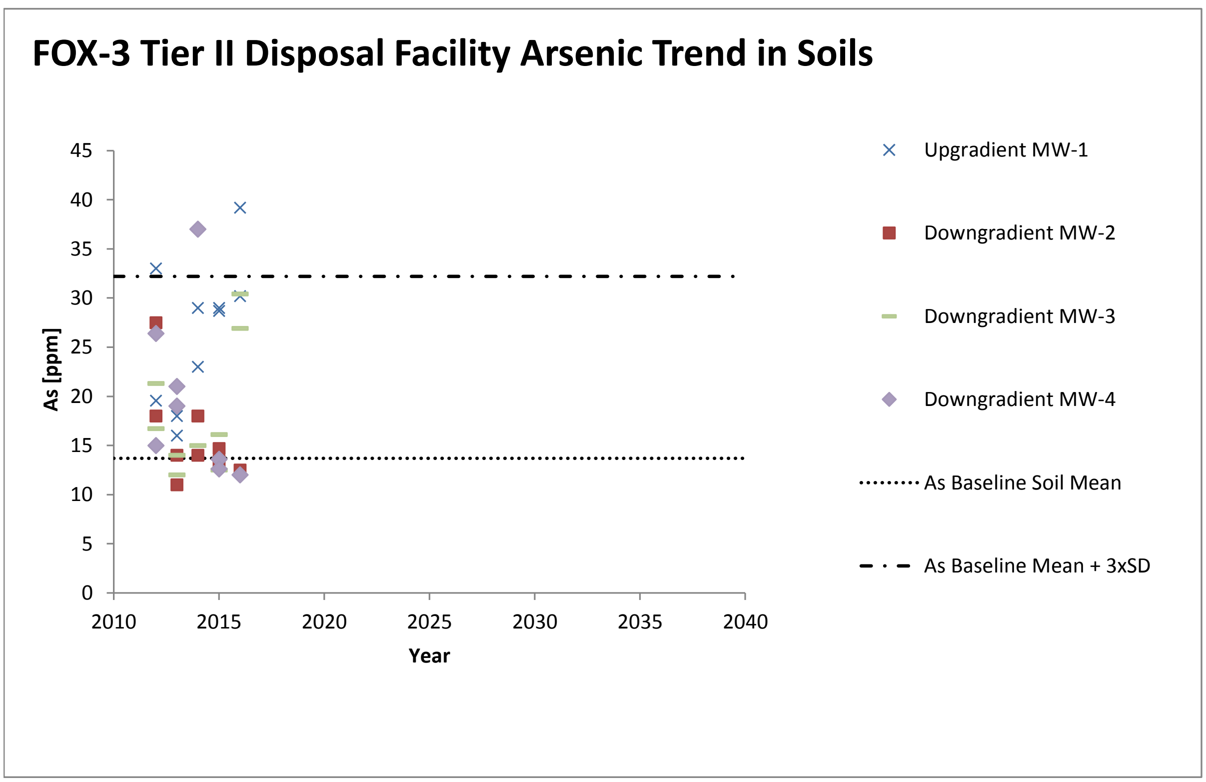


*Pb Baseline Mean is equal to the baseline detection limit.

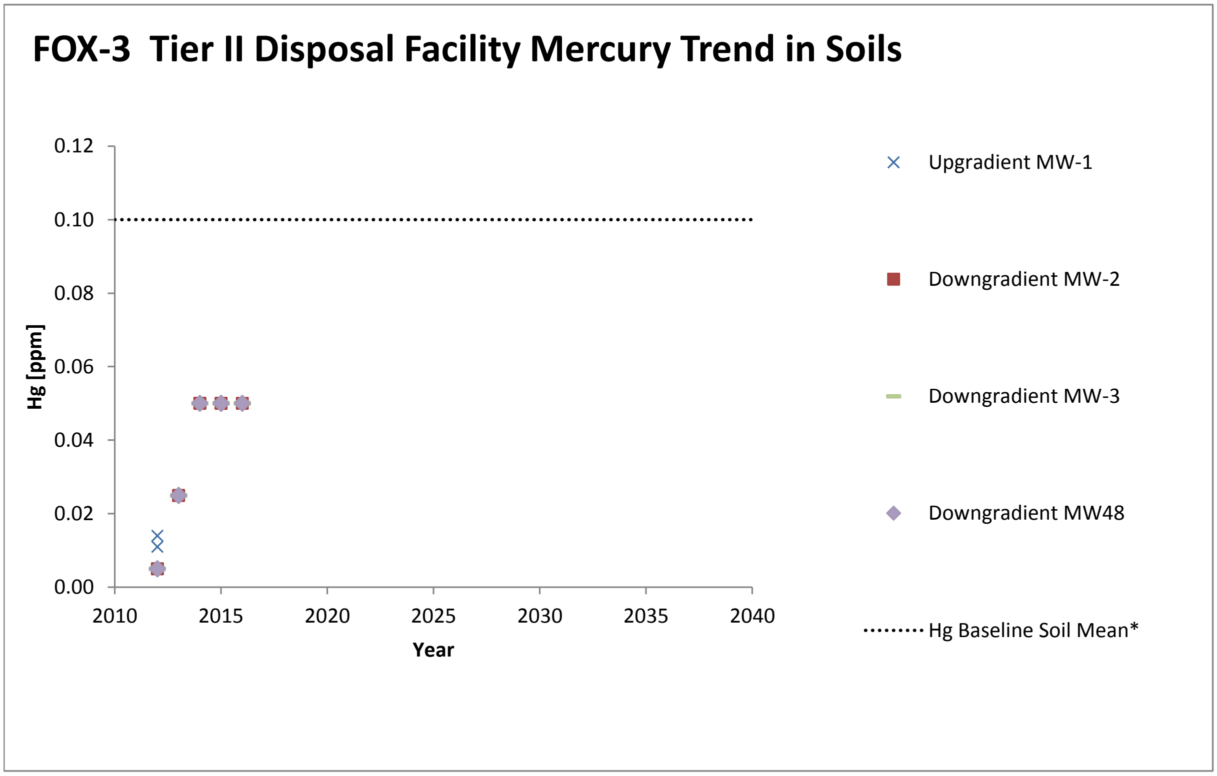


FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

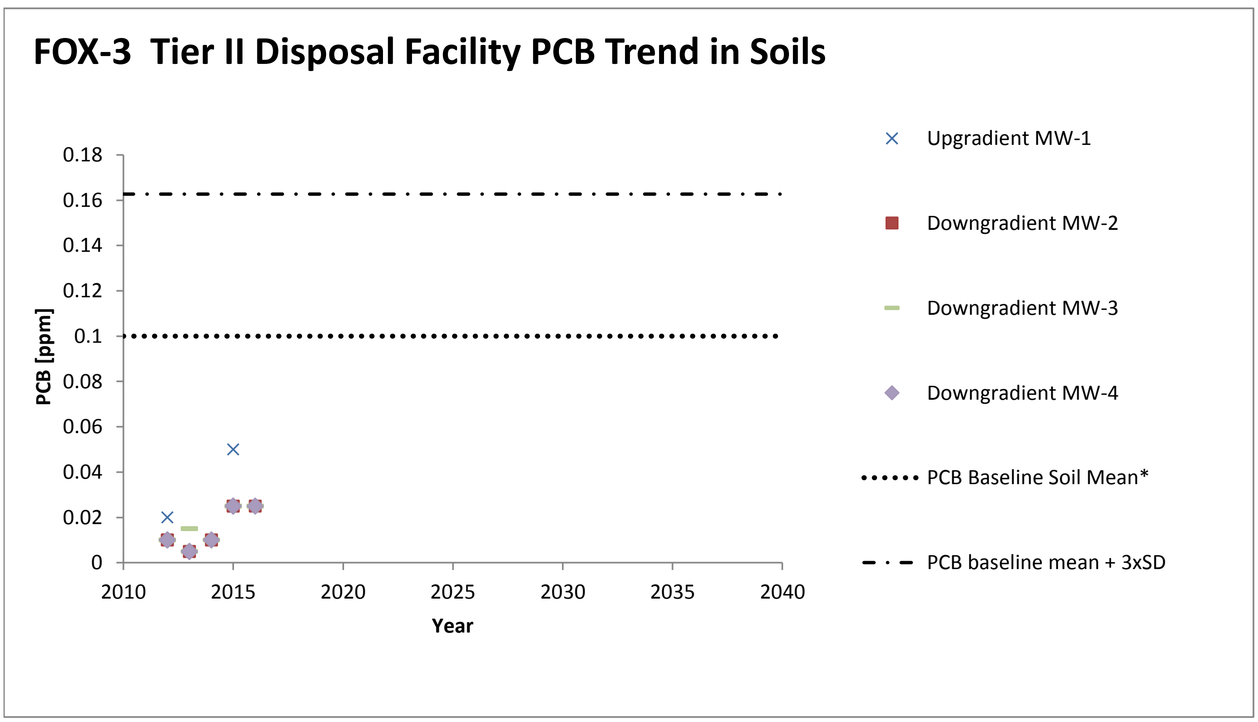




FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

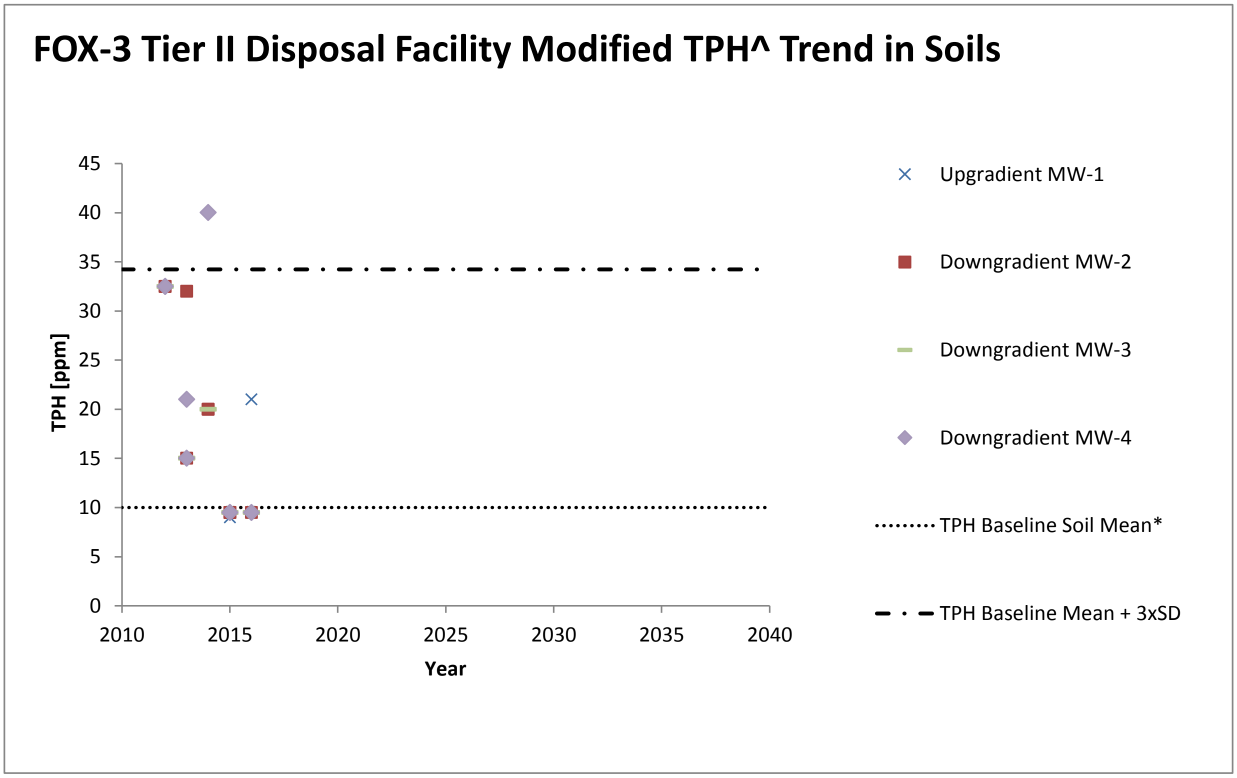


*Hg Baseline Mean is equal to the baseline detection limit.
** Hg Baseline SD = 0



*PCB Baseline Mean is equal to the baseline detection limit.

FOX-3 Tier II Disposal Facility Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



*TPH Baseline Mean is equal to the baseline detection limit.

^ Modified TPH is Sum of F1, F2 and F3 fractions (C_6 - C_{34})

FOX-3 - Tier II Disposal Facility - Summary of Monitoring Groundwater Analytical Data

Sample ID	Location	Date	Monitoring Year	Monitoring Phase	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 C_6-C_{10} (mg/L)	F2 C_{10}-C_{16} (mg/L)	F3 C_{16}-C_{34} (mg/L)	Modified TPH^ - Total C6-C34 (mg/L)
Baseline Data																		
Upgradient:																		
09-27668	MW-01	2009			0.014	0.034	0.0090	<0.0010	<0.010	0.2	<0.0050	0.00500	0.00050	<0.000020	0.05	<0.50	<1.0	0.80
10-35994	MW-01	2010			0.008	0.055	0.011	<0.0010	<0.010	0.14	0.019	0.011	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.78
11-28765	MW-01	2011			0.006	0.14	0.0097	<0.0010	<0.010	0.094	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	<0.50	<1.0	0.78
																		0.00
Downgradient:																		
10-36009	MW-02	2010			0.014	0.030	0.0062	<0.0010	<0.010	0.058	<0.0050	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.78
10-36004	MW-03	2010			0.0060	0.082	0.017	<0.0010	<0.010	3.5	<0.0050	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.78
10-35999	MW-04	2010			<0.0050	0.0071	<0.0030	<0.0010	<0.010	<0.010	0.0072	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.78
11-28766	MW-02	2011			0.027	0.022	<0.0030	<0.0010	<0.010	<0.010	0.0070	<0.0030	<0.00040	<0.0030	<0.050	<0.50	<1.0	0.78
11-28767	MW-03	2011			0.030	0.18	0.018	0.0012	<0.010	2.5	0.016	0.0034	<0.00040	<0.0030	<0.050	<0.50	<1.0	0.78
11-28768	MW-04	2011			0.0067	0.12	0.040	0.0015	<0.010	0.042	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	<0.50	<1.0	0.78
		N value			9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0				10
		Arithmetic Mean			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.79**	**0.0074**	**0.0029**	**0.00020**	**0.00067**				**0.25**
		Arithmetic Mean Corrected for Detection Limit			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.79**	**0.0050**	**0.0030**	**0.00040**	**0.003**				**1.0**
		Standard Deviation			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	1.4	0.0067	0.0033	0.0	0.00079				0.0083
		Arithmetic Mean + 3xStandard Deviation			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	5.0	0.025	0.013	0.00040	0.005				1.03
		Detection Limit			0.0050	0.010	0.0030	0.0010	0.010	0.0010	0.0050	0.0030	0.00040	0.0030				1.0
Monitoring Data																		
Upgradient - MW- 1																		
12-50004	MW-1	2012	1	1	0.20	0.53	0.087	0.0015	0.024	0.52	**0.15**	**0.06**	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.20
2013-F3-MW-01	MW-1	2013	2	1	0.37	0.72	0.13	0.0028	0.054	0.56	**0.39**	**0.13**	0.000040	<0.000010	<0.025	<0.10	<0.10	0.11
F3-MW-1-2014	MW-1	2014	3	1	0.16	0.43	0.090	<0.0080	0.030	0.35	**0.24**	**0.05**	<0.00010	<0.00010	<0.020	<0.020	0.34	0.36
MW0901	MW-1	2015	4	1	0.0282	0.073	0.0161	0.0004	0.0113	0.09	**0.006**	**0.004**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.1125
MW-01	MW-1	2016	5	1	0.0347	0.246	0.059	0.0009	0.0003	0.077	0.002	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.1125
	MW-1		7	2														#N/A
	MW-1		10	2														#N/A
	MW-1		15	2														#N/A
	MW-1		25	2														#N/A
																		#N/A

FOX-3 - Tier II Disposal Facility - Summary of Monitoring Groundwater Analytical Data

Sample ID	Location	Date	Monitoring Year	Monitoring Phase	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 C_6-C_{10} (mg/L)	F2 C_{10}-C_{16} (mg/L)	F3 C_{16}-C_{34} (mg/L)	Modified TPH^ - Total C6-C34 (mg/L)
Downgradient - MW-2																		
12-50006	MW-2	2012	1	1	0.062	0.032	<0.0050	<0.00090	0.010	0.064	**0.010**	<0.010	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.20
2013-F3-MW-02	MW-2	2013	2	1	0.015	0.043	0.0035	0.00033	0.00086	0.017	**0.028**	0.0022	<0.000010	<0.000010	<0.025	<0.10	<0.10	0.11
F3-MW-2-2014*	MW-2	2014	3	1	0.19	0.14	0.020	<0.0080	0.060	0.26	<0.050	<0.020	<0.0001	<0.00010				#N/A
MW0902	MW-2	2015	4	1	0.0979	0.054	0.0051	0.0002	0.0184	0.239	**0.011**	**0.008**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.11
MW-02	MW-2	2016	5	1	0.0033	0.021	0.0028	<0.0001	0.0002	0.009	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.11
	MW-2		7	2														#N/A
	MW-2		10	2														#N/A
	MW-2		15	2														#N/A
	MW-2		25	2														#N/A
																		#N/A
Downgradient - MW-3																		
12-50007/08**	MW-3	2012	1	1	0.032	0.11	0.016	0.0012	0.0014	**2.1**	**0.019**	**0.0055**	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.2
2013-F3-MW-03	MW-3	2013	2	1	0.037	0.11	0.020	0.0012	0.00044	0.37	**0.020**	**0.0079**	0.000020	<0.000010	<0.025	<0.10	<0.10	0.1
F3-MW-3-2014*	MW-3	2014	3	1	0.040	0.30	0.020	<0.0080	<0.010	**2.4**	**0.26**	<0.020	<0.00010	<0.00010				#N/A
MW0903	MW-3	2015	4	1	0.0374	0.038	0.0045	0.0002	0.0011	**2.06**	<0.001	**0.005**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.1
MW-03 (Dup Avg)	MW-3	2016	5	1	0.038	0.093	0.0083	0.0006	0.0003	0.424	0.003	**0.006**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.1
	MW-3		7	2														#N/A
	MW-3		10	2														#N/A
	MW-3		15	2														#N/A
	MW-3		25	2														#N/A
																		#N/A
Downgradient - MW-4																		
12-50003	MW-4	2012	1	1	0.018	0.24	0.075	0.0019	0.0022	0.089	**0.080**	0.0011	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.2
2013-F3-MW-04/04-D	MW-4	2013	2	1	0.016	0.24	0.079	0.0018	0.0019	0.096	**0.048**	0.0022	<0.00001	<0.000010	<0.025	<0.10	<0.10	0.1
F3-MW-4-2014	MW-4	2014	3	1	0.040	0.28	0.080	<0.0080	0.010	0.15	**0.11**	<0.020	<0.00010	<0.00010	<0.020	<0.020	<0.050	0.0
MW0904	MW-4	2015	4	1	<0.0005	0.103	0.0377	0.0008	0.0019	0.06	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.1
MW-04	MW-4	2016	5	1	0.0008	0.03	0.0046	<0.0001	<0.0001	<0.005	<0.001	<0.001	<0.0001	<0.00005	<0.025	<0.100	<0.100	0.1
	MW-4		7	2														#N/A
	MW-4		10	2														#N/A
	MW-4		15	2														#N/A
	MW-4		25	2														#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

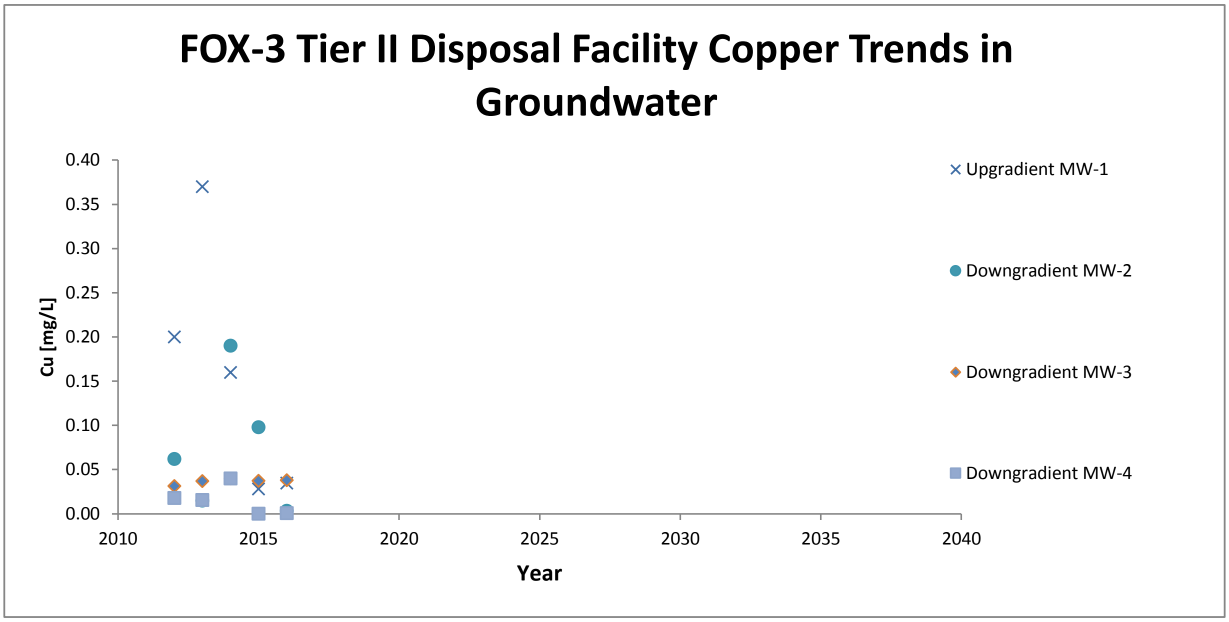
Some baseline ground water results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. These results were excluded from the baseline average calculation but kept in the summary table for reference and are highlighted blue.

* insufficient volume for analysis of TPH

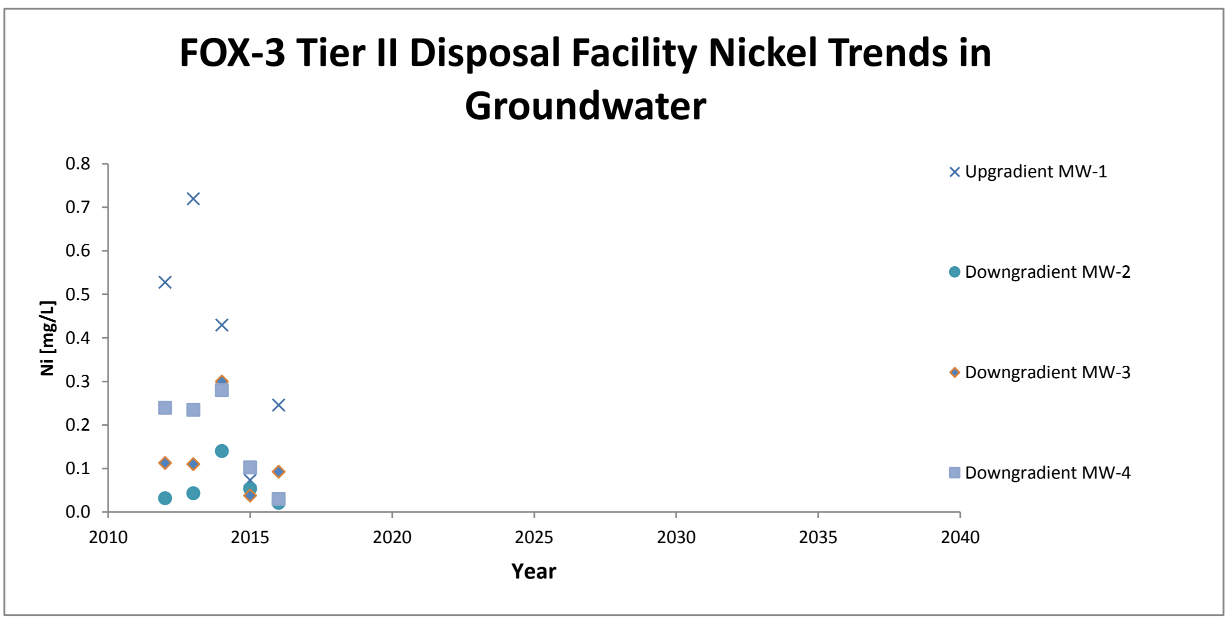
** two samples taken, one analyzed for inorganics and PCBs, one analyzed for TPH

FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

Where results are below detection, half of the detection limit has been used in the charts for the sample points. Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.

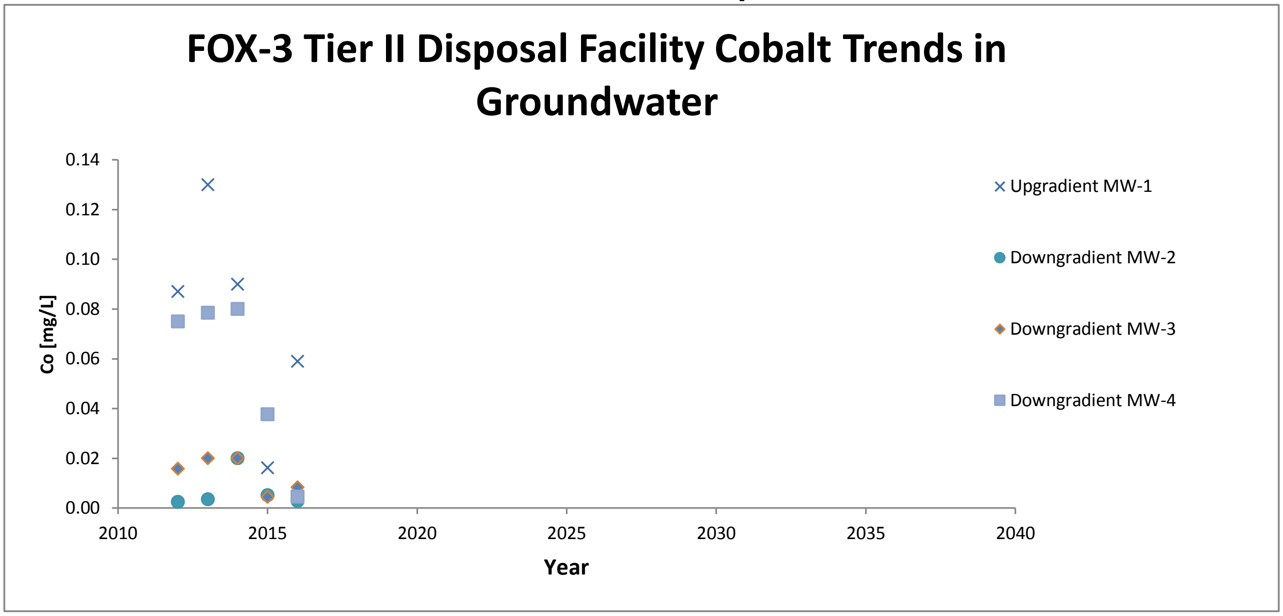


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for copper in Tier II GW.

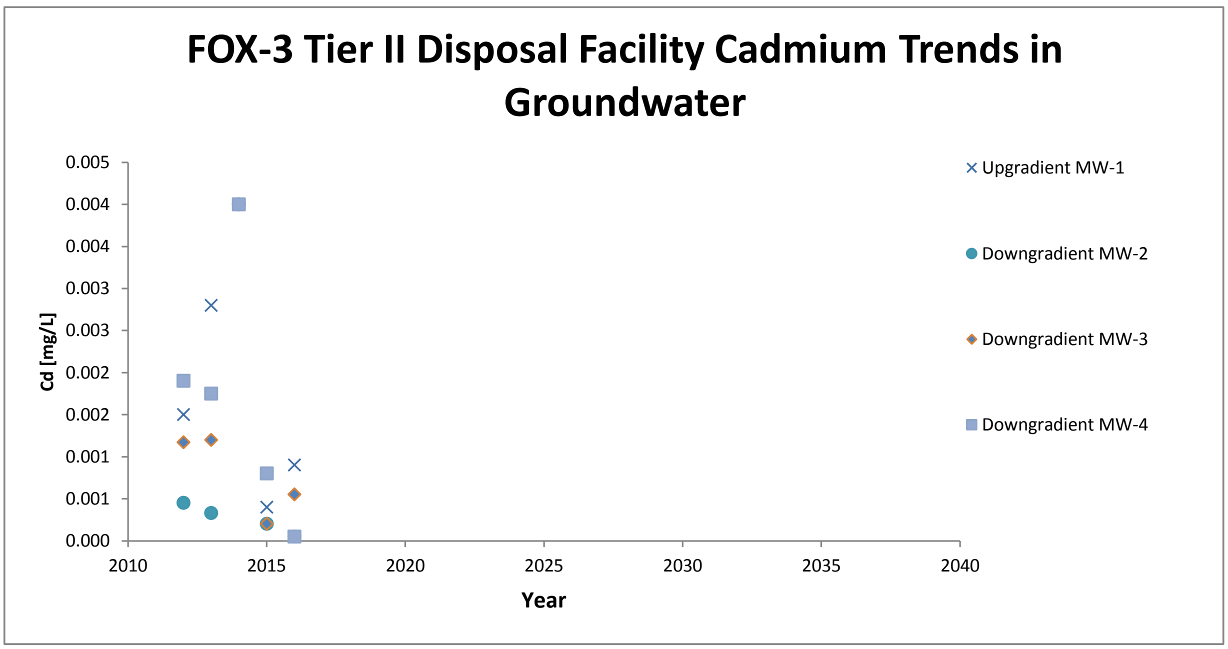


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for nickel in Tier II GW.

FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

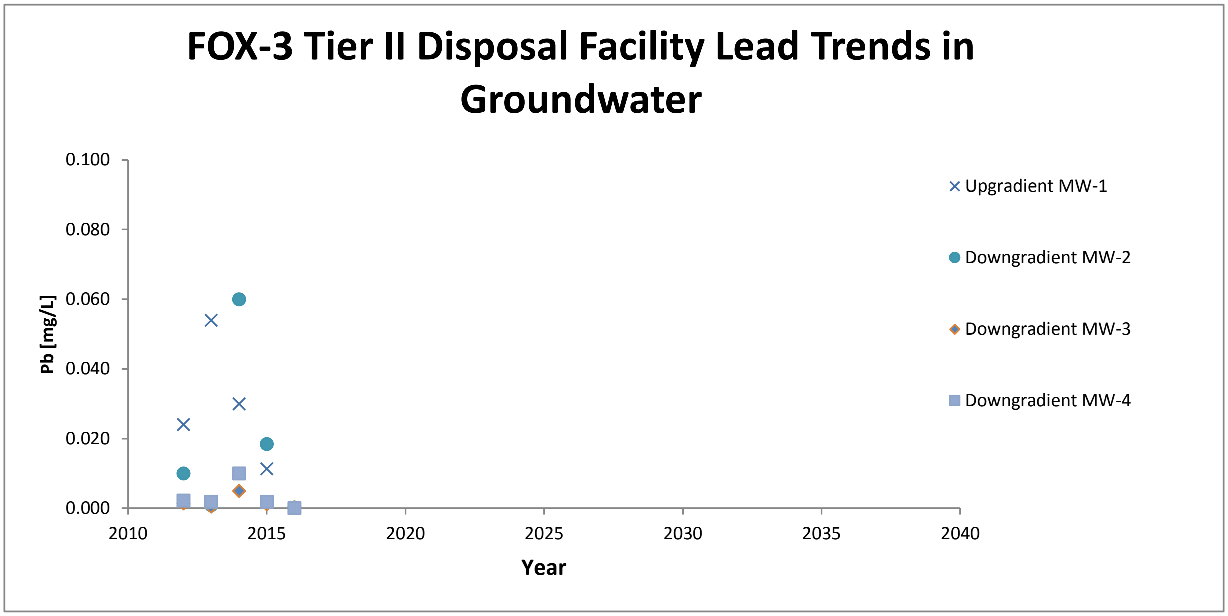


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for cobalt in Tier II GW.

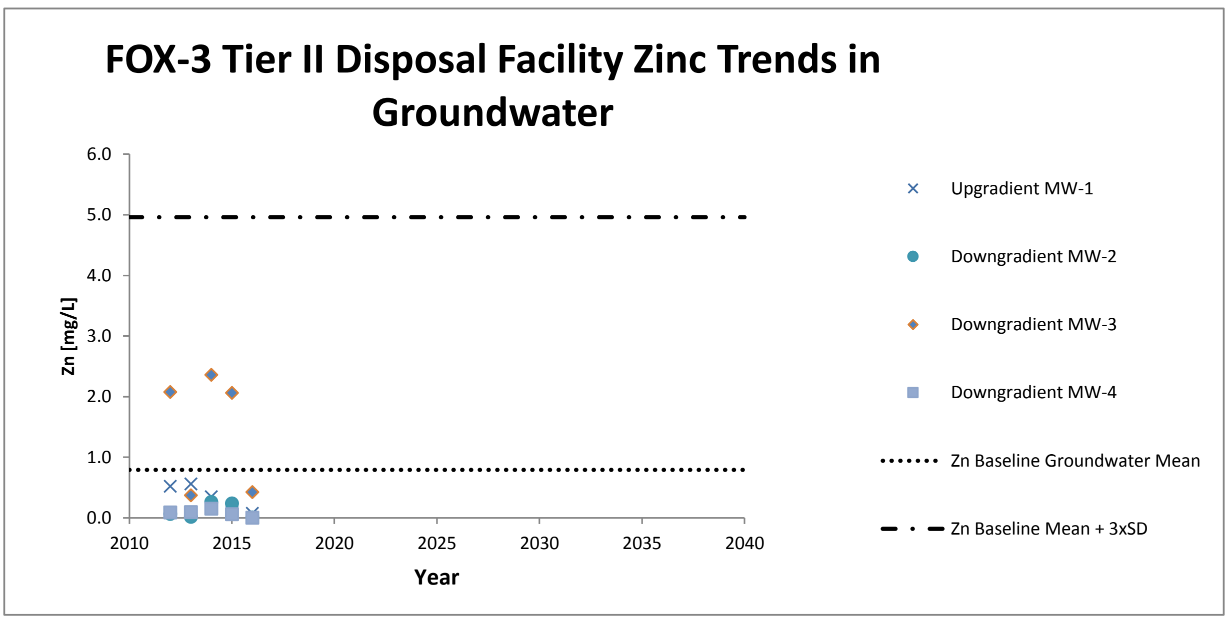


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for cadmium in Tier II GW.

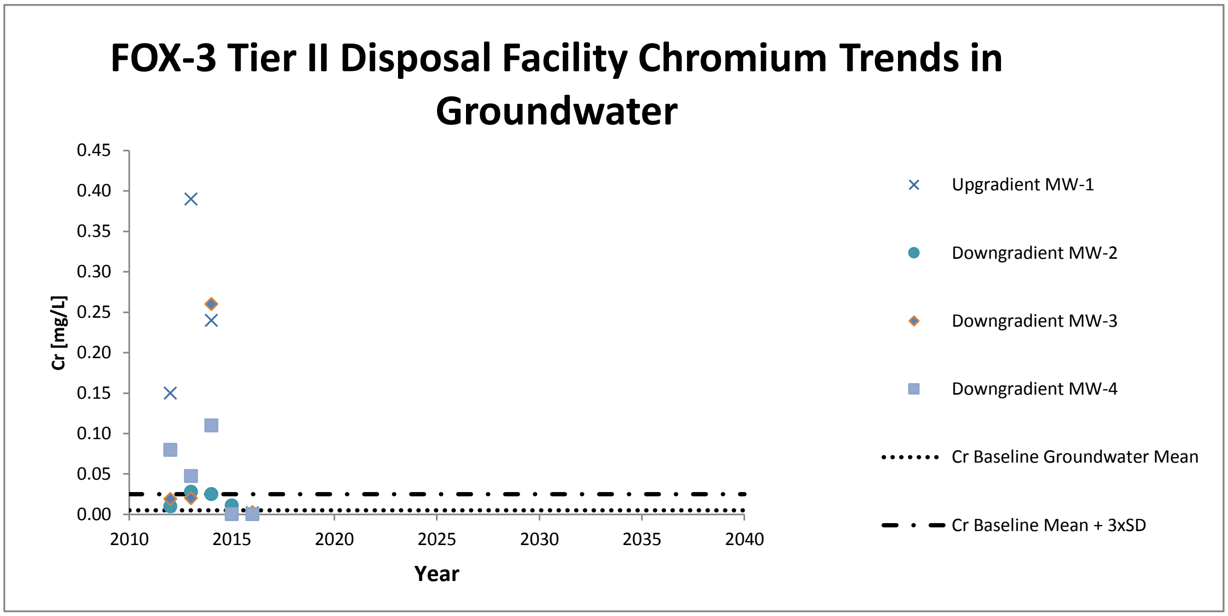
FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



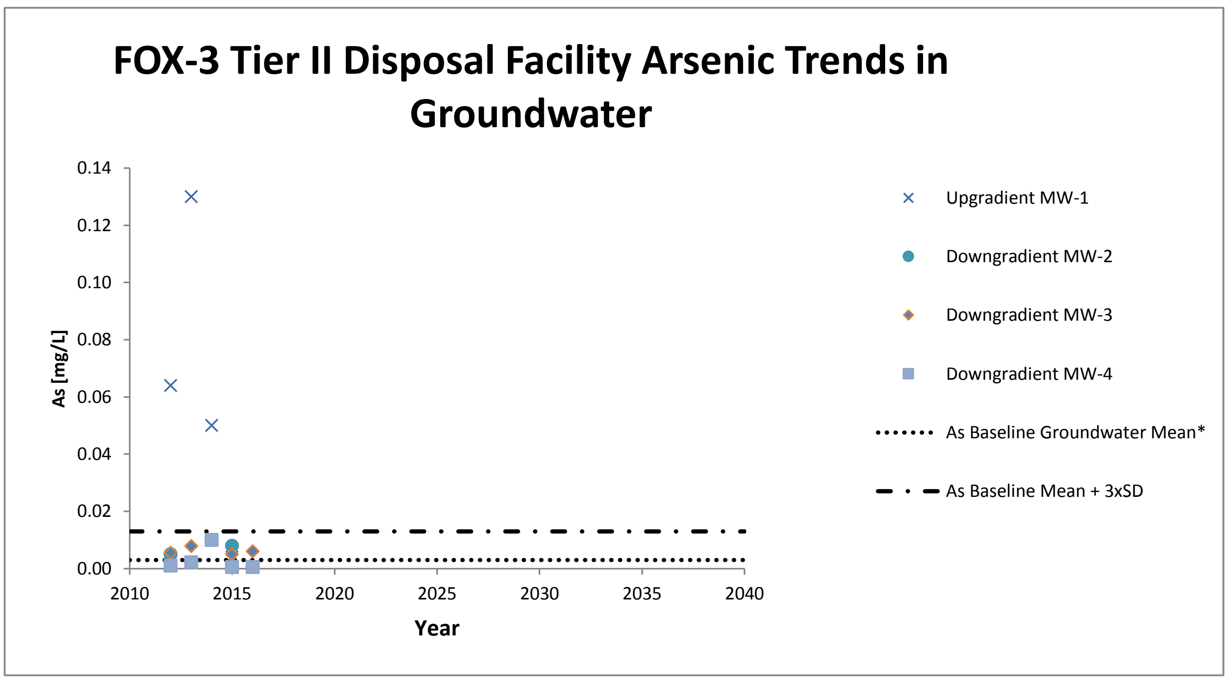
Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for lead in Tier II GW.



FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

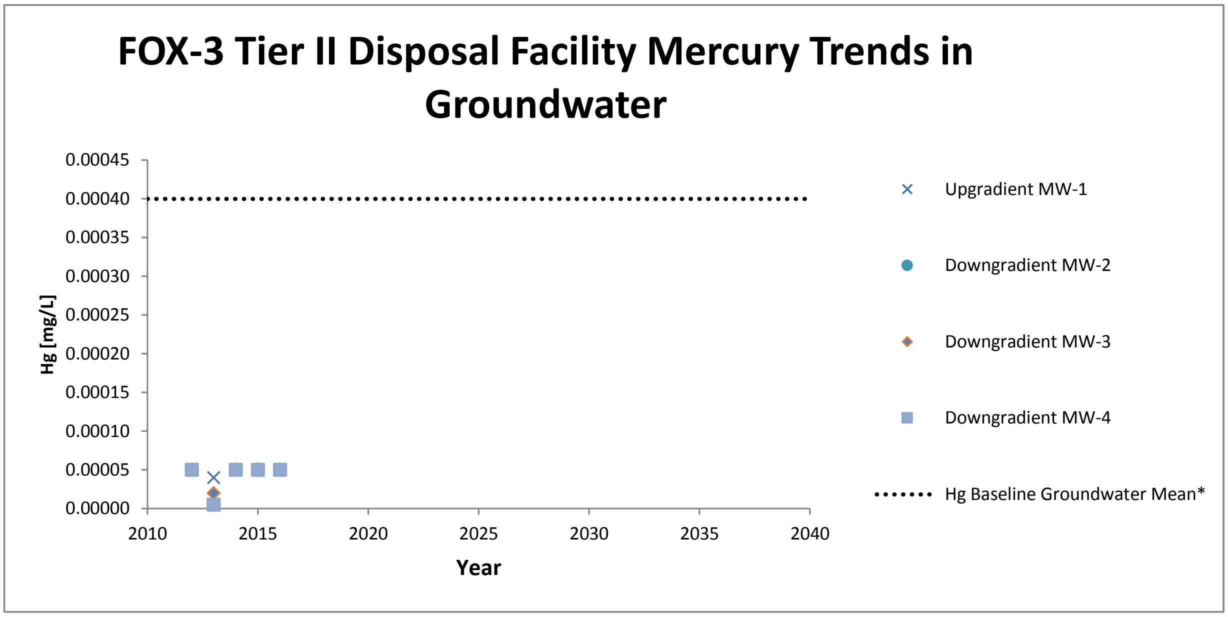


* Cr Baseline Arithmetic Mean is equal to the baseline detection limit

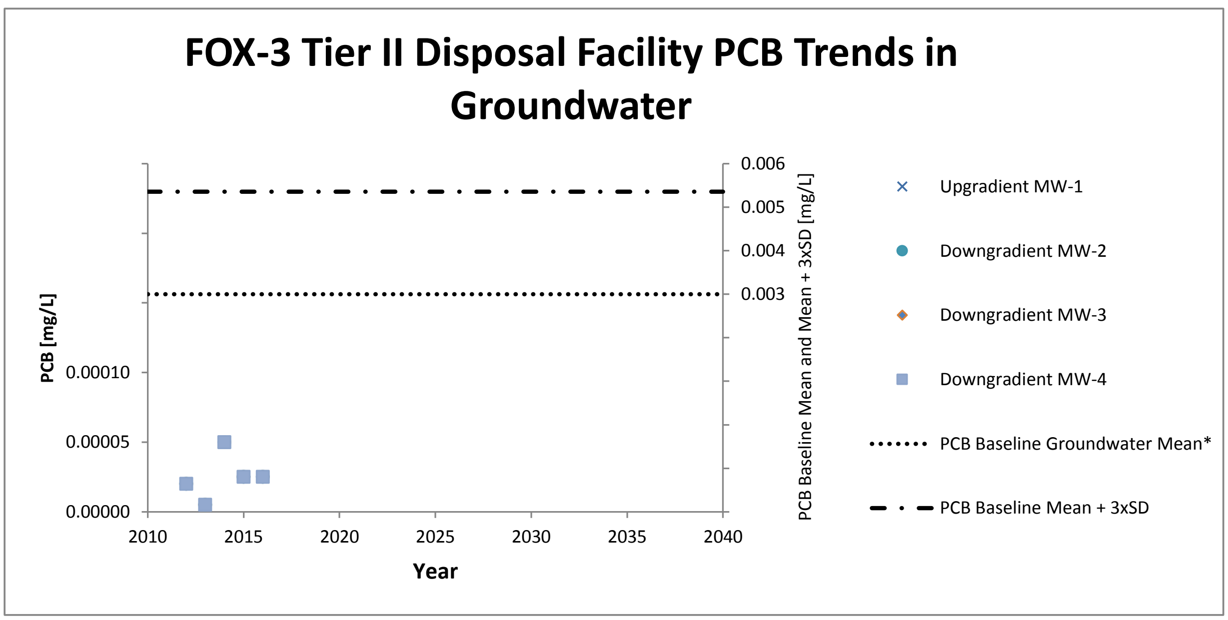


* As Baseline Arithmetic Mean is equal to the baseline detection limit

FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

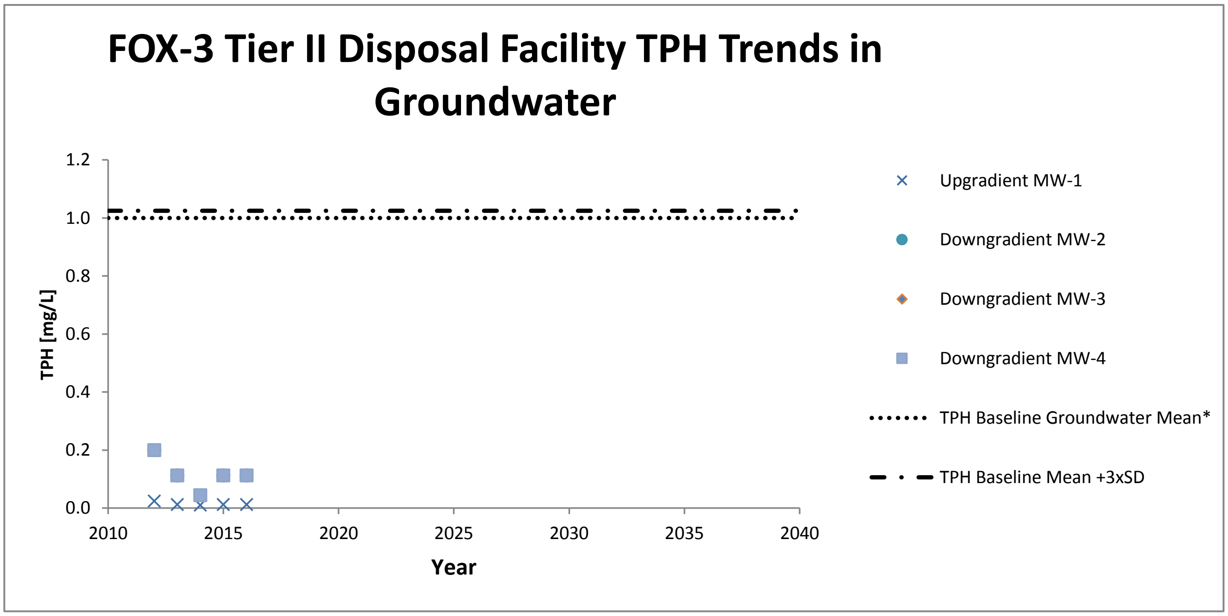


*Hg Baseline Mean is equal to the baseline detection limit.
*Hg Baseline SD = 0



*PCB Baseline Arithmetic Mean is equal to the baseline detection limit.

FOX-3 Tier II Disposal Facility Graphs of Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



*TPH Baseline Arithmetic Mean is equal to the baseline detection limit.

FOX-3- Non Hazardous Waste Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Background Data - Arithmetic Mean*						31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.05	0.0003				
Baseline Data - Arithmetic Mean*						**37.9**	**32.5**	**12.4**	**1.0**	**10.0**	**67.6**	**80.0**	**12.5**	**0.10**	**0.10**				**19**
Baseline Data - Standard Deviation						8.8	3.8	1.6	0.0	1.5	8.1	10.1	4.7	0.0	0.017				17
Baseline Data Mean + 3xStandard Deviation						64.4	44.0	17.3	1.0	14.6	91.8	110.3	26.5	0.10	0.151				69
**** If baseline or background arithmetic mean was below the detection limit, the mean has been modified to match the detection limit value.***																			
DEW Line Cleanup Tier I Criteria										*200*					*1*				
DEW Line Cleanup Tier II Criteria & Hydrocarbon Action Level						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*61*	*2.0*	*5*				*2500*
Monitoring Data																			
Upgradient																			
	MW-5 surface																		
12-19368/69**	MW-5	2012	1	1	0-10	**55**	**38**	9.8	<0.50	7.2	**97**	**84**	**16**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-5-S-A-2014	MW-5	2014	3	1	0-10	28	30	8.0	<0.50	5.0	62	75	10	<0.10	<0.020	<10	<10	<20	**20**
MW-05 (0-15)	MW-5	2015	4	1	0-15	**40.4**	31.8	10.3	<0.5	**10.1**	**67.6**	**82.1**	**15.8**	<0.1	<0.05	<7	<4	<8	10
MW-05b	MW-5	2016	5	1	0-15	30.5	21.9	7.3	<0.5	6.2	44.4	52.3	10.1	<0.1	<0.05	<7	<4	<8	10
	MW-5		10	2															#N/A
	MW-5		15	2															#N/A
	MW-5		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	MW-5 depth																		
12-19370/71**	MW-5	2012	1	1	30-40	**41**	31	8.7	<0.50	7.7	**75**	78	**21**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-5-S-B-2014	MW-5	2014	3	1	40-50	31	**38**	10	<0.50	6.0	67	**93**	**18**	<0.10	<0.020	<10	<10	<20	**20**
MW-05 (40-50)	MW-5	2015	4	1	40-50	**42.9**	30.6	10.4	<0.5	8.9	65.7	79.8	**15.7**	<0.1	<0.05	<7	<4	<8	10
MW-05a	MW-5	2016	5	1	30-40	31.8	25	10.4	<0.5	7.5	59.5	63.4	8.6	<0.1	<0.05	<7	<4	<8	10
	MW-5		10	2															#N/A
	MW-5		15	2															#N/A
	MW-5		25	2															#N/A
																			#N/A
																			#N/A

FOX-3- Non Hazardous Waste Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Downgradient																			
	MW-6 surface																		
12-19372/73**	MW-6	2012	1	1	0-10	**55**	**40**	12	<0.50	**11**	**88**	**94**	**19**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-6-S-A-2014	MW-6	2014	3	1	0-10	**40**	**33**	10	<0.50	7.0	**74**	**82**	**16**	<0.10	<0.020	<10	<10	<20	**20**
MW-06 (0-15)	MW-6	2015	4	1	0-15	29.3	26.4	8.3	<0.5	7.8	53.7	69.3	**14.1**	<0.1	<0.05	<7	<4	<8	10
MW-06b	MW-6	2016	5	1	0-15	28.3	24.5	8.3	<0.5	7.3	51.8	67.3	12	<0.1	<0.05	<7	<4	<8	10
	MW-6		10	2															#N/A
	MW-6		15	2															#N/A
	MW-6		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	MW-6 depth																		
12-19374/75**	MW-6	2012	1	1	30-40	**50**	**42**	12	<0.50	**22**	**91**	**110**	**24**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-6-S-B-2014	MW-6	2014	3	1	40-50	**44**	**36**	11.0	<0.50	8.0	**76**	**91**	**18**	<0.10	<0.020	<10	<10	<20	**20**
MW-06 (40-50)	MW-6	2015	4	1	40-50	**40.1**	30.1	9.7	<0.5	9.4	64.6	78.8	**17.7**	<0.1	<0.05	<7	<4	<8	10
MW-06a (Dup Avg)	MW-6	2016	5	1	30-40	35	30	9.0	<0.5	6.8	61	77	**16**	<0.1	<0.05	<6	<7	<29	**21**
	MW-6		10	2															#N/A
	MW-6		15	2															#N/A
	MW-6		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	MW-7 surface																		
12-19376/77**	MW-7	2012	1	1	0-10	**42**	**39**	11	<0.50	8.1	**87**	**91**	**18**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-7-S-A-2014	MW-7	2014	3	1	0-10	36	**38**	10	<0.50	6.0	**75**	**98**	**14**	<0.10	<0.020	<10	<10	<20	**20**
MW-07 (0-15)	MW-7	2015	4	1	0-15	**42.5**	30.9	9.9	<0.5	**10.2**	64.8	**82.9**	**21**	<0.1	<0.05	<7	<4	<8	10
MW-07b	MW-7	2016	5	1	0-15	30	23.6	7.7	<0.5	7.3	46.1	61	12.2	<0.1	<0.05	<7	<4	<8	10
	MW-7		10	2															#N/A
	MW-7		15	2															#N/A
	MW-7		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3- Non Hazardous Waste Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	MW-7 depth																		
12-19378/79**	MW-7	2012	1	1	30-40	**52**	**43**	12	<0.50	8.5	**95**	**110**	**19**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-7-S-B-2014	MW-7	2014	3	1	40-50	**38**	**34**	10	<0.50	6.0	**73**	**85**	**16**	<0.10	<0.020	<10	<10	<20	**20**
MW-07 (40-50)	MW-7	2015	4	1	40-50	**41**	29.2	9.4	<0.5	9.1	62	76	**18.8**	<0.1	<0.05	<7	<4	<8	10
MW-07a	MW-7	2016	5	1	40-50	28.6	22.9	7.8	<0.5	7.6	47.3	61.3	9.9	<0.1	<0.05	<7	<4	<8	10
	MW-7		10	2															#N/A
	MW-7		15	2															#N/A
	MW-7		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	MW-8 surface																		
12-19380/81**	MW-8	2012	1	1	0-10	**42**	**36**	10	<0.50	**10**	67	**84**	**17**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-8-S-A-2014	MW-8	2014	3	1	0-10	**40**	**38**	10.0	<0.50	7	**80**	**85**	**14**	<0.10	<0.020	<10	<10	<20	**20**
MW-08 (0-15)	MW-8	2015	4	1	0-15	25.8	26.6	8.6	<0.5	7.3	57.1	68.3	12.1	<0.1	<0.05	<7	<4	<8	10
MW-08a	MW-8	2016	5	1	0-15	**39.5**	24.1	8.1	<0.5	8.5	50	60.8	**15.7**	<0.1	<0.05	<7	<4	<8	10
	MW-8		10	2															#N/A
	MW-8		15	2															#N/A
	MW-8		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	MW-8 depth																		
12-19382/83**	MW-8	2012	1	1	30-40	31	25	7.4	<0.50	7.4	61	63	11	<0.010	<0.020	<5.0	<10	<50	**33**
F3-MW-8-S-B-2014	MW-8	2014	3	1	40-50	**38**	**40**	11	<0.50	7.0	**85**	**96**	**18**	<0.10	<0.020	<10	<10	<20	**20**
MW-08 (30-40)	MW-8	2015	4	1	30-40	29.4	30.3	9.8	<0.5	7.3	62.9	75.6	**13.1**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	MW-8	2016	5	1															#N/A
	MW-8		10	2															#N/A
	MW-8		15	2															#N/A
	MW-8		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

N/A = not analyzed

** two samples taken, one analyzed for inorganics and PCBs, one analyzed for TPH

Soil and Groundwater samples were not sampled at the NHWL in 2013

Legend

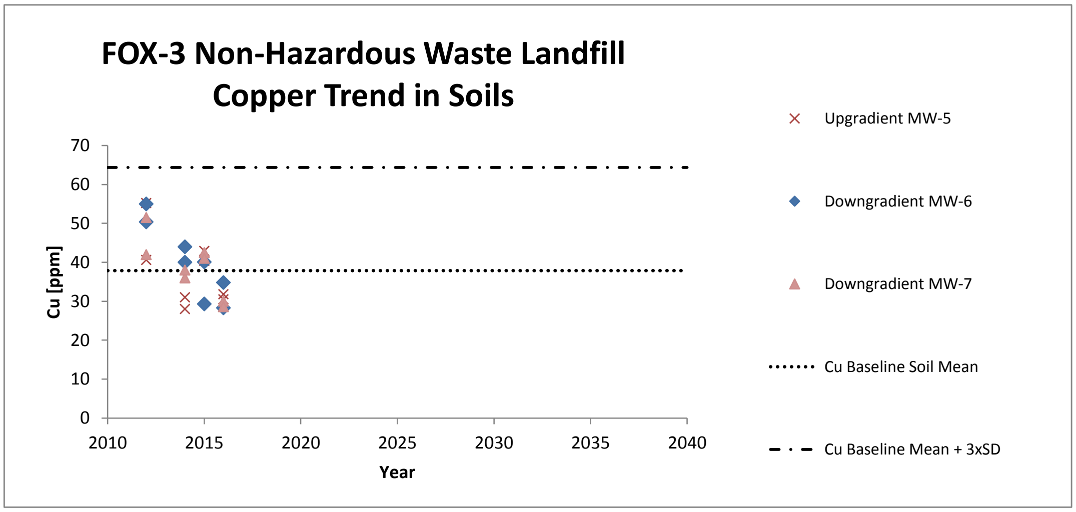
XX sample exceeds background

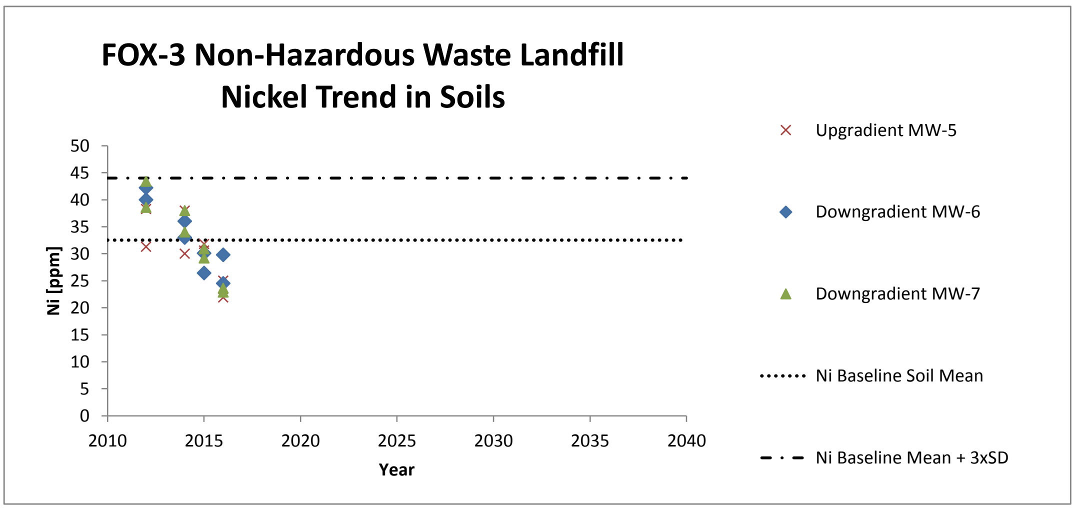
XX sample exceeds baseline

XX sample exceeds DLCU Tier I criteria

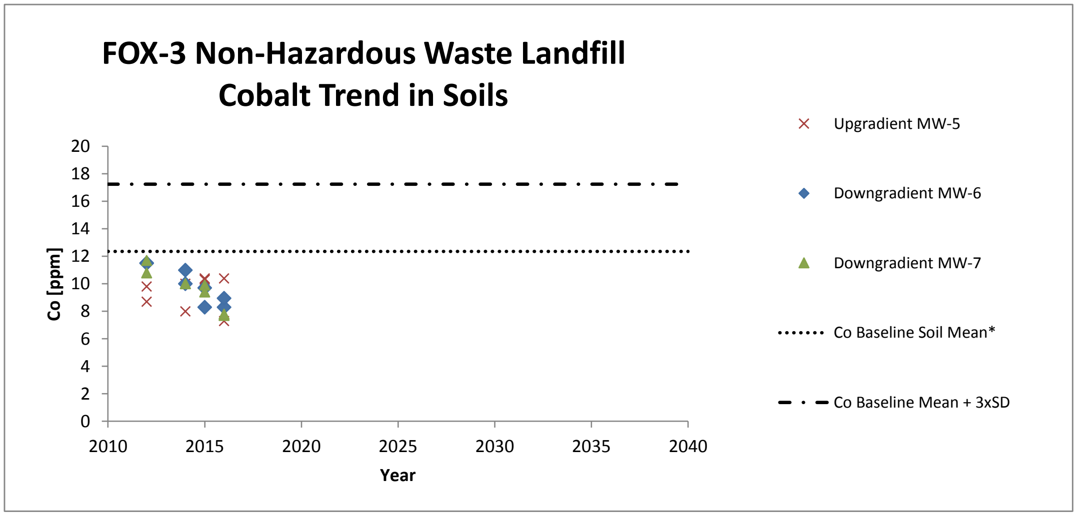
XX sample exceeds DLCU Tier II criteria

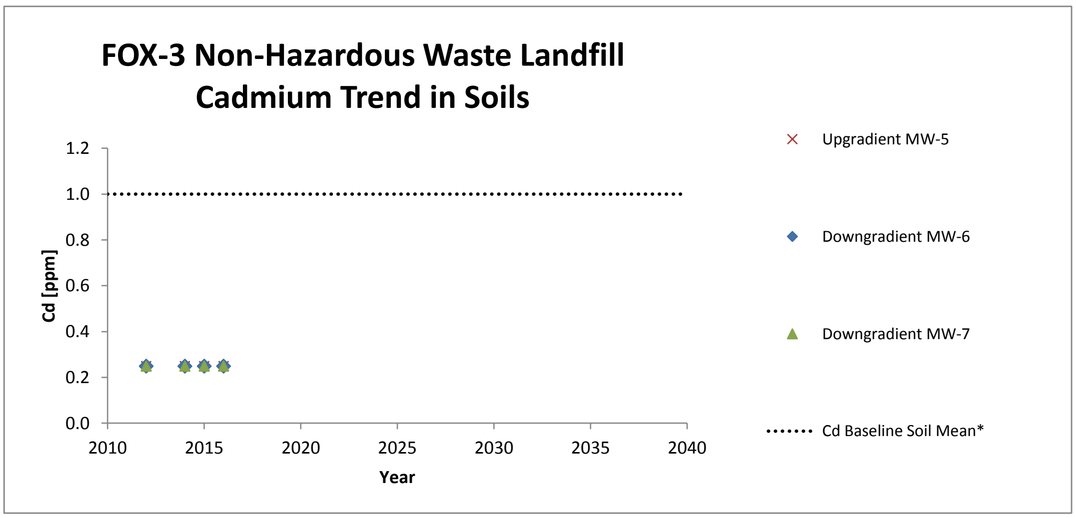
FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)
Where results are below detection, half of the detection limit has been used in the charts for the sample points.
Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.





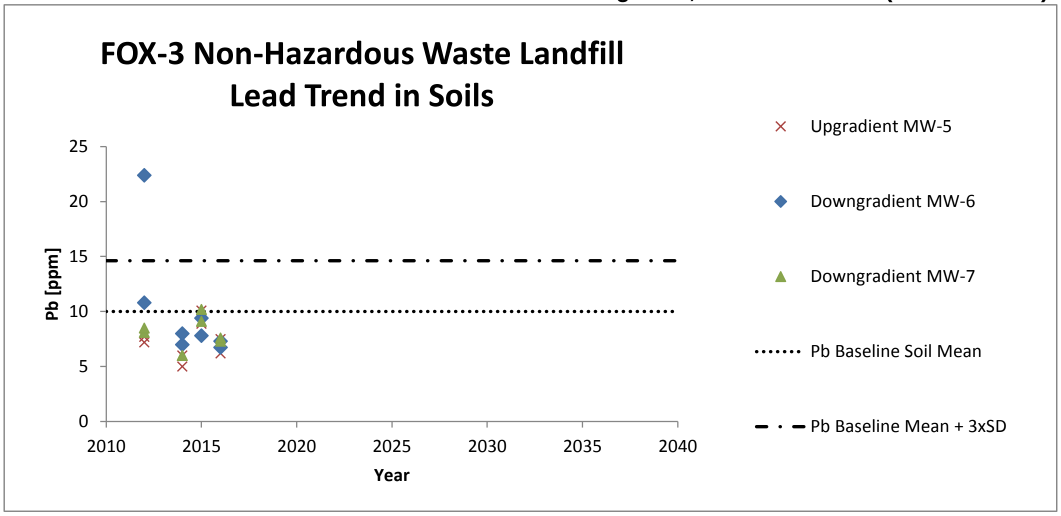
FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



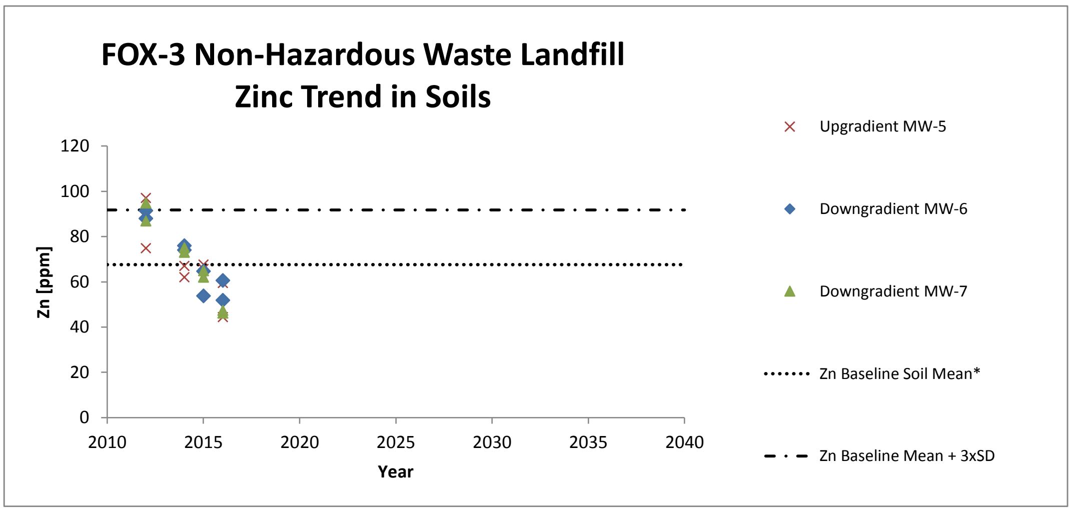


*Cd Baseline Arithmetic Mean is equal to the baseline detection limit.
*Cd Baseline SD = 0

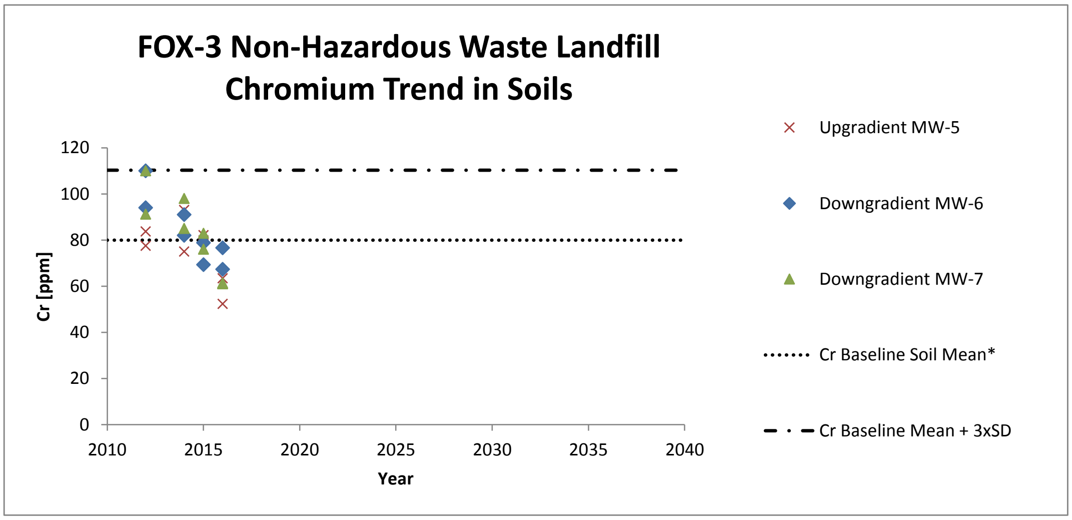
FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

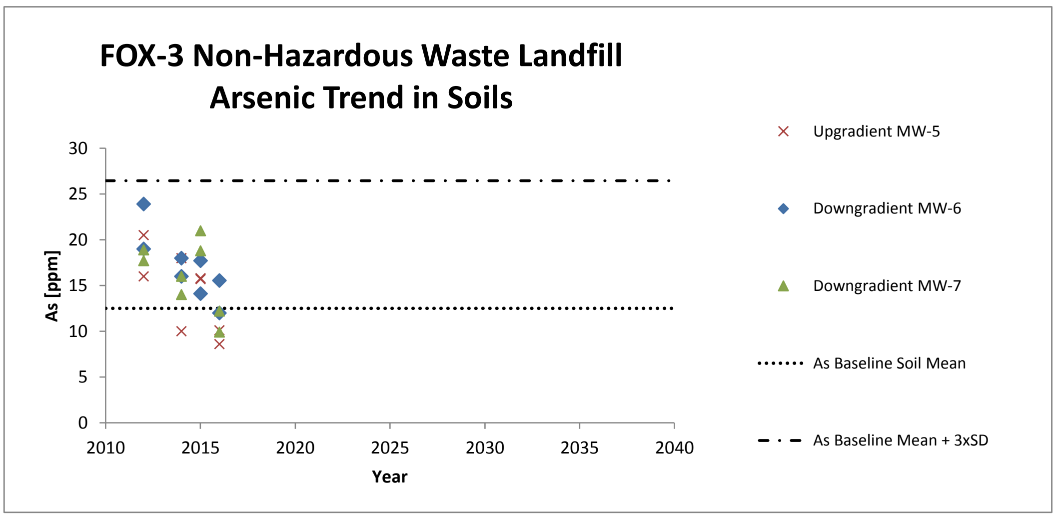


*Pb Baseline Arithmetic Mean is equal to the baseline detection limit.

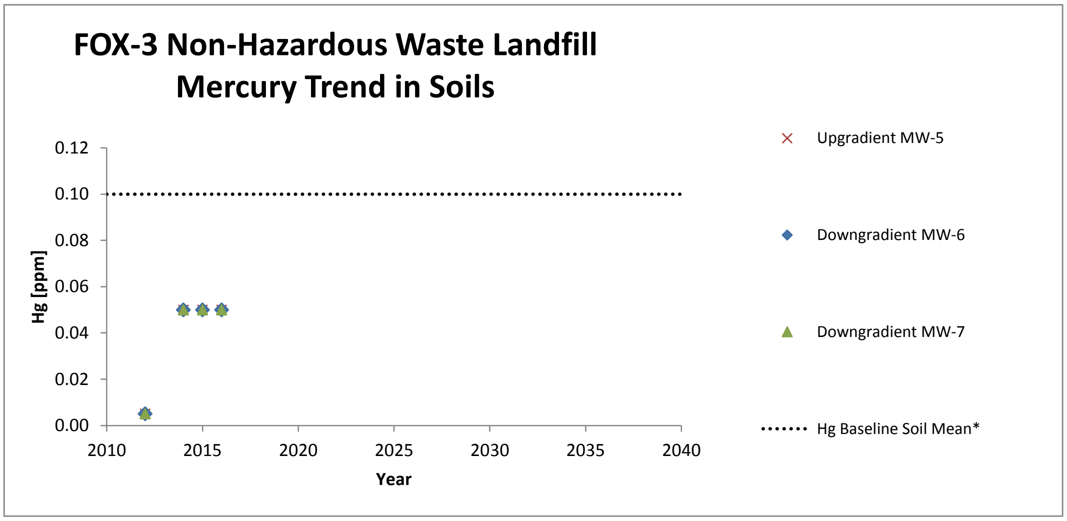


FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

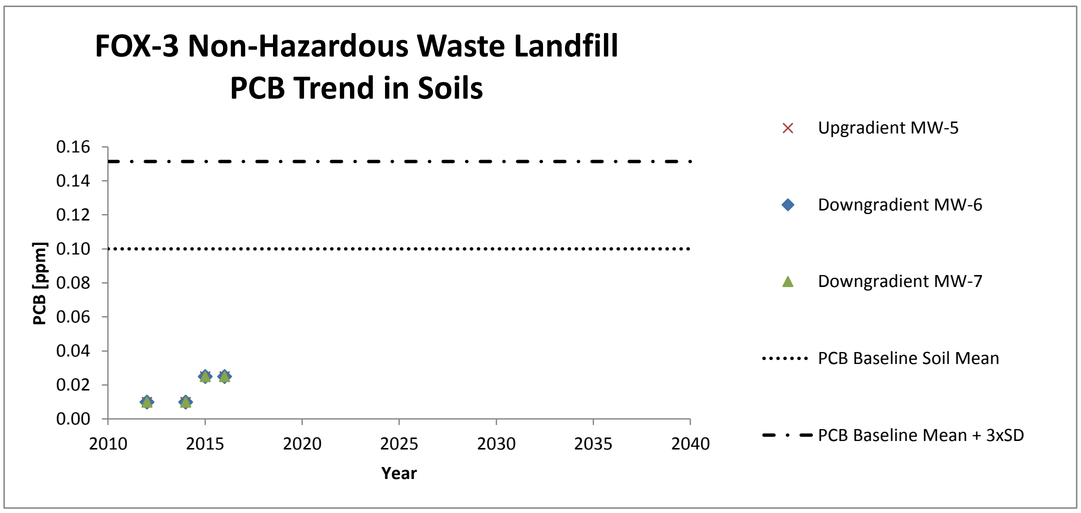




FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

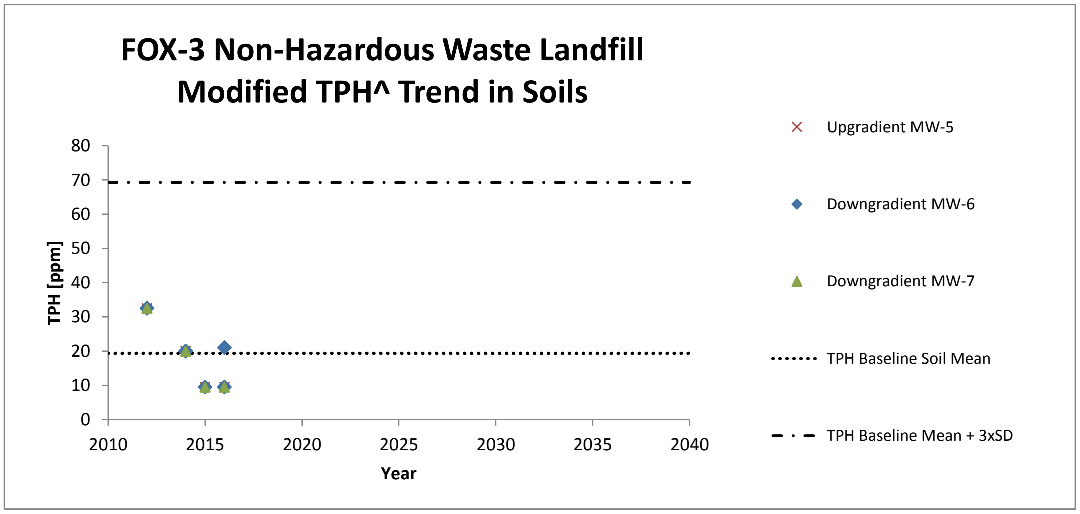


*Hg Baseline Arithmetic Mean is equal to the baseline detection limit.
** Hg results below detection for all monitoring samples. Trendlines reflect changes in detection limit.



*PCB Baseline Arithmetic mean is equal to the detection limit

FOX-3 Non-Hazardous Waste Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



^ Modified TPH is Sum of F1, F2 and F3 fractions (C_6 - C_{34})

FOX-3 - Non Hazardous Waste Landfill - Summary of Monitoring Groundwater Analytical Data

Sample ID	Location	Date	Monitoring Year	Monitoring Phase	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 C_6-C_{10} (mg/L)	F2 C_{10}-C_{16} (mg/L)	F3 C_{16}-C_{34} (mg/L)	Modified TPH^ - Total C6-C34 (mg/L)
Baseline Data																		
Upgradient:																		
09-27693	MW-05	2009			0.013	0.018	<0.0030	<0.0010	<0.010	<0.010	<0.0050	<0.0030	<0.00040	<0.000020	0.26	8.7	2.3	11
10-36019	MW-05	2010			0.0098	0.044	0.0040	<0.0010	<0.010	<0.010	<0.0050	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.8
11-28769	MW-05	2011			0.0086	0.23	0.062	0.0012	<0.010	0.37	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	< 0.50	<1.0	0.8
																		0.0
Downgradient:																		
09-27701	MW-06	2009			<0.0050	0.033	<0.0030	<0.0010	<0.010	0.018	<0.0050	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.8
09-27684	MW-07	2009			0.014	0.061	0.0080	<0.0010	<0.010	0.018	<0.0050	0.004	<0.00040	<0.000020	<0.050	0.5	<1.0	1.0
09-27676	MW-08	2009			0.009	0.007	<0.0030	<0.0010	<0.010	0.017	<0.0050	0.026	<0.00040	<0.000020	<0.050	0.7	<1.0	1.2
10-36014	MW-06	2010			<0.0050	<0.0050	<0.0030	<0.0010	<0.010	0.019	0.006	<0.0030	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.8
10-36029	MW-07	2010			0.008	0.054	0.0129	<0.0010	<0.010	0.040	<0.0050	0.0061	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.8
10-36024	MW-08	2010			0.006	0.007	<0.0030	<0.0010	<0.010	<0.010	0.007	0.0060	<0.00040	<0.000020	<0.050	<0.50	<1.0	0.8
11-28770	MW-06	2011			0.014	0.102	0.0281	<0.0010	<0.010	0.061	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	< 0.50	<1.0	0.8
11-28771	MW-07	2011			0.016	0.15	0.0170	<0.0010	<0.010	0.600	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	< 0.50	<1.0	0.8
11-28772	MW-08	2011			0.009	0.007	<0.0030	<0.0010	<0.010	0.012	<0.0050	<0.0030	<0.00040	<0.0030	<0.050	< 0.50	<1.0	0.8
		N value			12	12	12	12	12	12	12	12	12	12				13
		Arithmetic Mean			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.14**	**0.0035**	**0.0026**	**0.00020**	**0.00051**				**1.0**
		Arithmetic Mean Corrected for Detection Limit			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**0.14**	**0.005**	**0.003**	**0.0004**	**0.003**				**1.0**
		Standard Deviation			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	0.22	0.0018	0.0021	0.0	0.00073				3.0
		Arithmetic Mean + 3xStandard Deviation			**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	0.81	0.0089	0.0090	0.0002	0.0027				10
		Detection Limit			0.0050	0.0050	0.0030	0.0010	0.010	0.010	0.0050	0.0030	0.0004	0.0030				1.0
Monitoring Data																		
Upgradient - MW- 5																		
12-50009*	MW-5	2012	1	1									<0.00080^	<0.00080^	<0.05	0.25	0.65	0.93
F3-MW-5-2014*	MW-5	2014	3	1	0.18	0.27	0.07	<0.008	0.09	**5.3**	**0.23**	**0.04**	<0.00010	<0.00050				#N/A
MW0905	MW-5	2015	4	1	0.0036	0.033	0.0087	0.0007	0.0023	**0.377**	**0.005**	0.002	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.1
MW-05	MW-5	2016	5	1	0.0027	0.034	0.0052	<0.0001	<0.0001	0.023	<0.001	<0.001	<0.0001	<0.00012	<0.025	<0.100	<0.100	0.1
	MW-5		10	2														#N/A
	MW-5		15	2														#N/A
	MW-5		25	2														#N/A
																		#N/A
																		#N/A
																		#N/A
																		#N/A

FOX-3 - Non Hazardous Waste Landfill - Summary of Monitoring Groundwater Analytical Data

Sample ID	Location	Date	Monitoring Year	Monitoring Phase	Cu (mg/L)	Ni (mg/L)	Co (mg/L)	Cd (mg/L)	Pb (mg/L)	Zn (mg/L)	Cr (mg/L)	As (mg/L)	Hg (mg/L)	Total PCB (mg/L)	F1 C_6-C_{10} (mg/L)	F2 C_{10}-C_{16} (mg/L)	F3 C_{16}-C_{34} (mg/L)	Modified TPH^ - Total C6-C34 (mg/L)
Downgradient - MW-6																		
12-50000	MW-6	2012	1	1	0.043	0.021	0.0033	0.00030	0.0056	**0.17**	**0.013**	**0.0056**	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.20
F3-MW-6-2014*	MW-6	2014	3	1	0.14	0.090	<0.010	<0.0080	0.03	**0.68**	**0.090**	<0.020	<0.00010	<0.00010				#N/A
MW0906 (Dup Avg)	MW-6	2015	4	1	0.04	0.02	0.002	0.0002	0.01	0.13	0.004	**0.0065**	0.000023	<0.00005	<0.025	<0.1	<0.1	0.11
Not sampled - frozen	MW-6	2016	5	1														#N/A
	MW-6		10	2														#N/A
	MW-6		15	2														#N/A
	MW-6		25	2														#N/A
																		#N/A
																		#N/A
																		#N/A
																		#N/A
Downgradient - MW-7																		
12-50001	MW-7	2012	1	1	0.093	0.85	0.034	0.00093	0.026	**0.95**	**0.15**	**0.017**	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.20
F3-MW-7-2014*	MW-7	2014	3	1	0.16	0.42	0.030	<0.0080	0.030	**1.1**	**0.03**	**0.54**	<0.00010	<0.00010				#N/A
MW0907	MW-7	2015	4	1	0.0267	0.045	0.0061	0.0002	0.004	**0.336**	**0.02**	**0.004**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.11
MW-07	MW-7	2016	5	1	0.0081	0.045	0.0049	<0.0001	<0.0001	0.009	<0.001	<0.001	<0.0001	<0.00050	<0.025	<0.100	<0.100	0.11
	MW-7		10	2														#N/A
	MW-7		15	2														#N/A
	MW-7		25	2														#N/A
																		#N/A
																		#N/A
																		#N/A
																		#N/A
Downgradient - MW-8																		
12-50002	MW-8	2012	1	1	0.026	0.012	0.0012	0.00021	0.0077	**0.27**	**0.0075**	**0.010**	<0.00010	<0.000040	<0.05	<0.10	<0.25	0.20
F3-MW-8-2014*	MW-8	2014	3	1	0.04	0.10	<0.010	<0.0080	0.02	**0.51**	**0.14**	<0.020	<0.00010	<0.00010				#N/A
MW0908	MW-8	2015	4	1	0.0062	0.012	0.0014	0.0001	0.0075	**0.323**	**0.005**	**0.009**	<0.0001	<0.00005	<0.025	<0.1	<0.1	0.11
MW-08	MW-8	2016	5	1	0.0243	0.031	0.0039	0.0002	0.02	**0.405**	**0.011**	**0.015**	0.0002	<0.00005	<0.025	<0.100	<0.100	0.11
	MW-8		10	2														#N/A
	MW-8		15	2														#N/A
	MW-8		25	2														#N/A
																		#N/A
																		#N/A
																		#N/A
																		#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

Some baseline ground water results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. These results were excluded from the baseline average calculation but kept in the summary table for reference and highlighted blue.

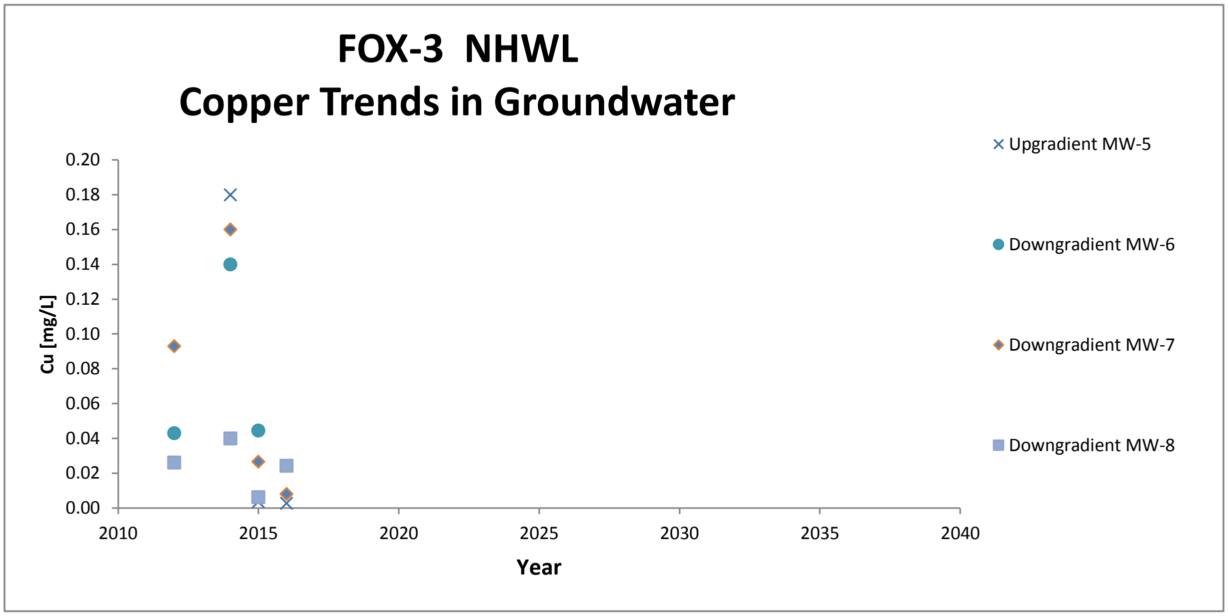
* insufficient volume at these wells to analyze all analytes

^ detection limit adjusted for this sample 50009 due to sample matrix effects and reextraction with lower sample volume. These higher detection limits have been removed from the charts.

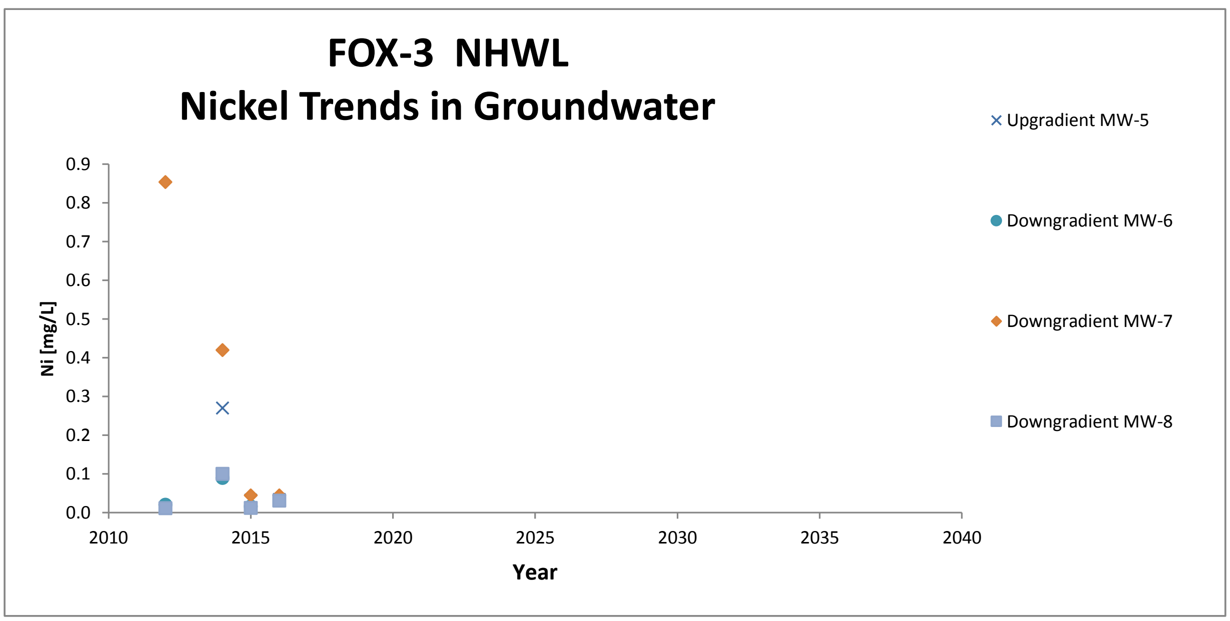
Soil and Groundwater samples were not sampled at the NHWL in 2013

FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

Where results are below detection, half of the detection limit has been used in the charts for the sample points. Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.

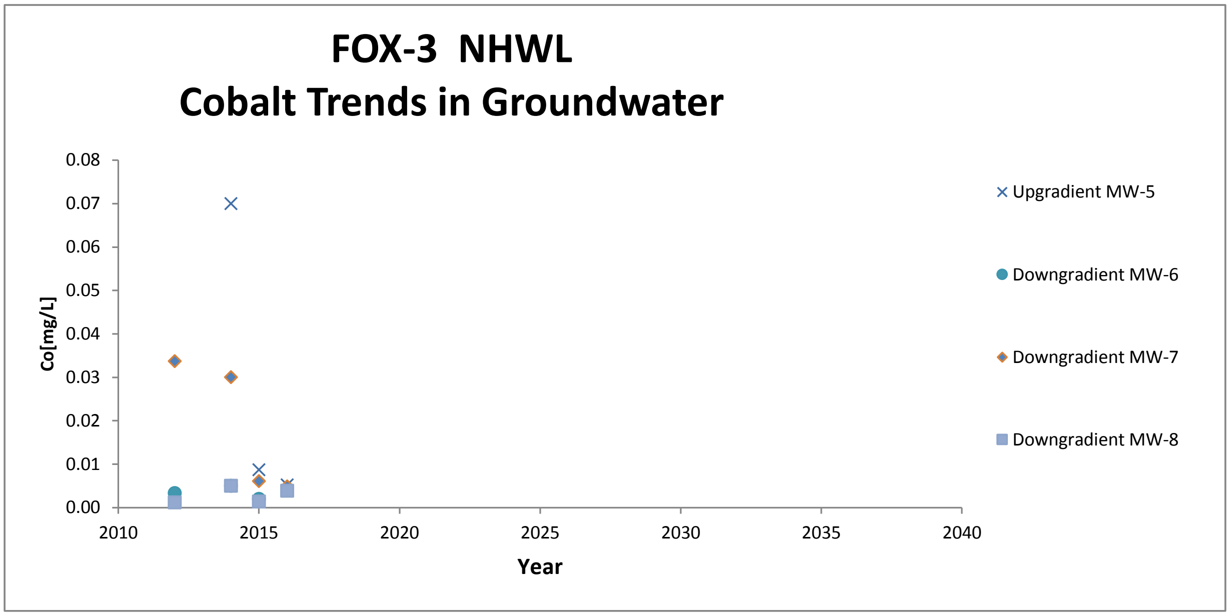


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for copper in Tier II GW.

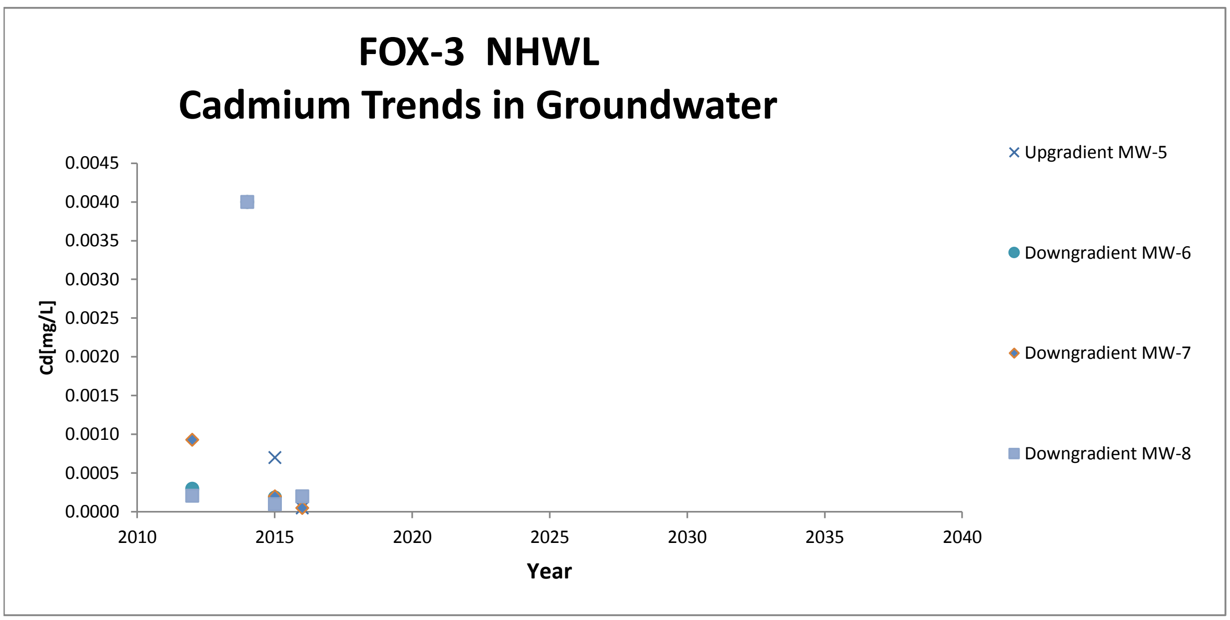


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for nickel in Tier II GW.

FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

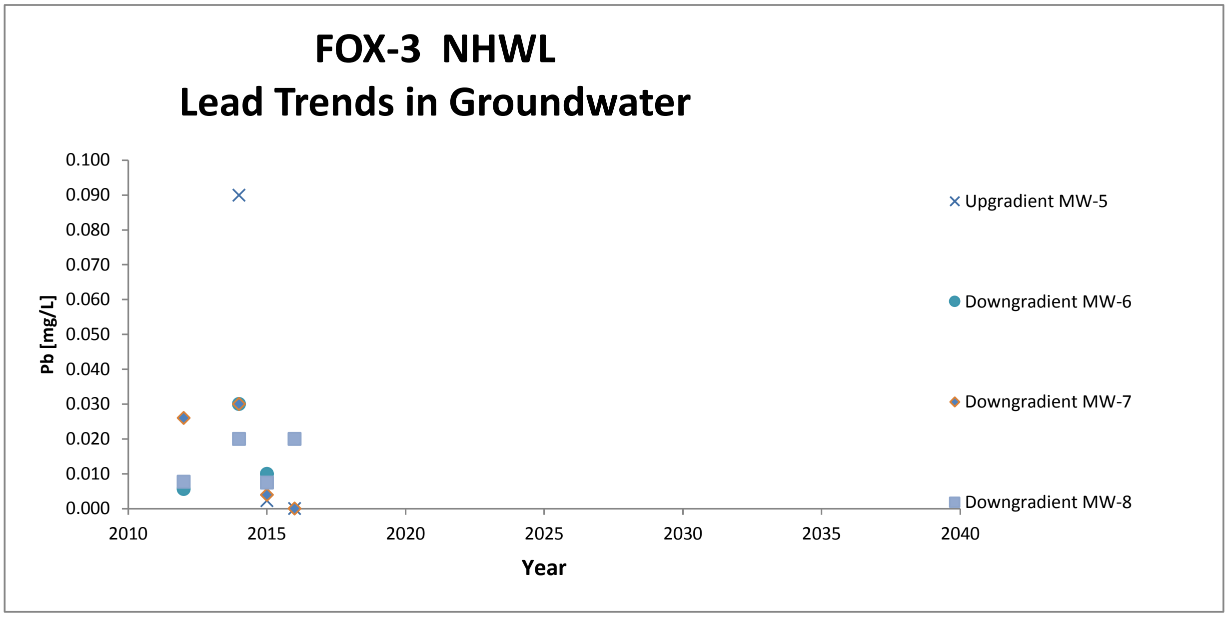


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for cobalt in Tier II GW.



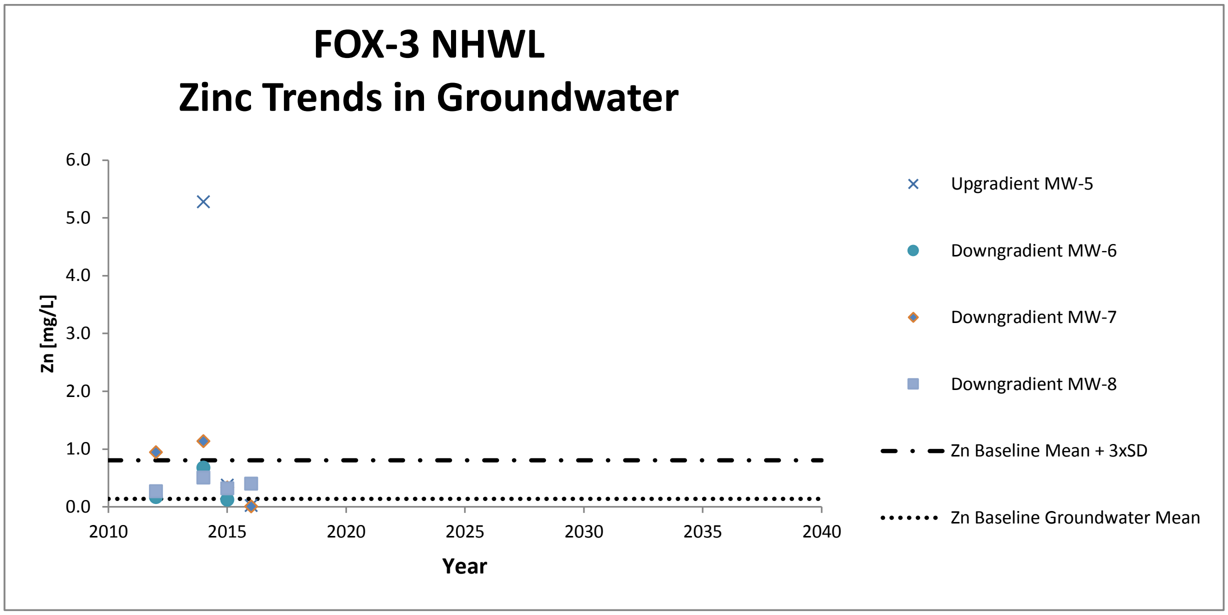
Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for cadmium in Tier II GW.

FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

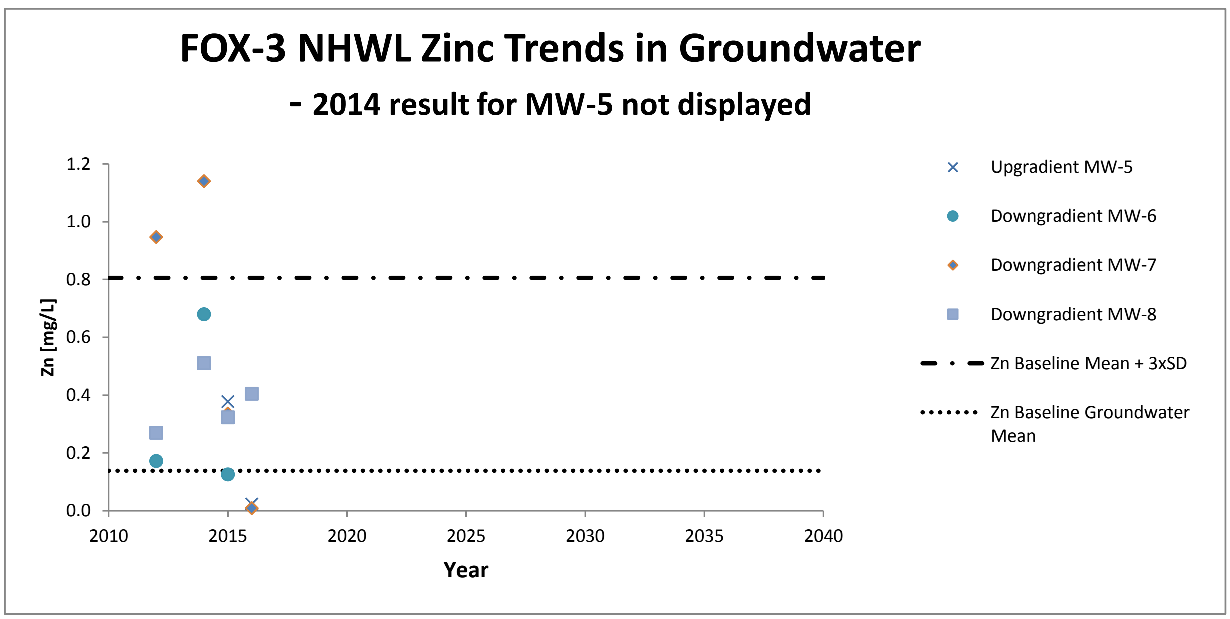


Some baseline groundwater results for inorganic elements were reported as dissolved instead of total in 2009, 2010, and 2011. As a result, there is no baseline average for lead in Tier II GW.

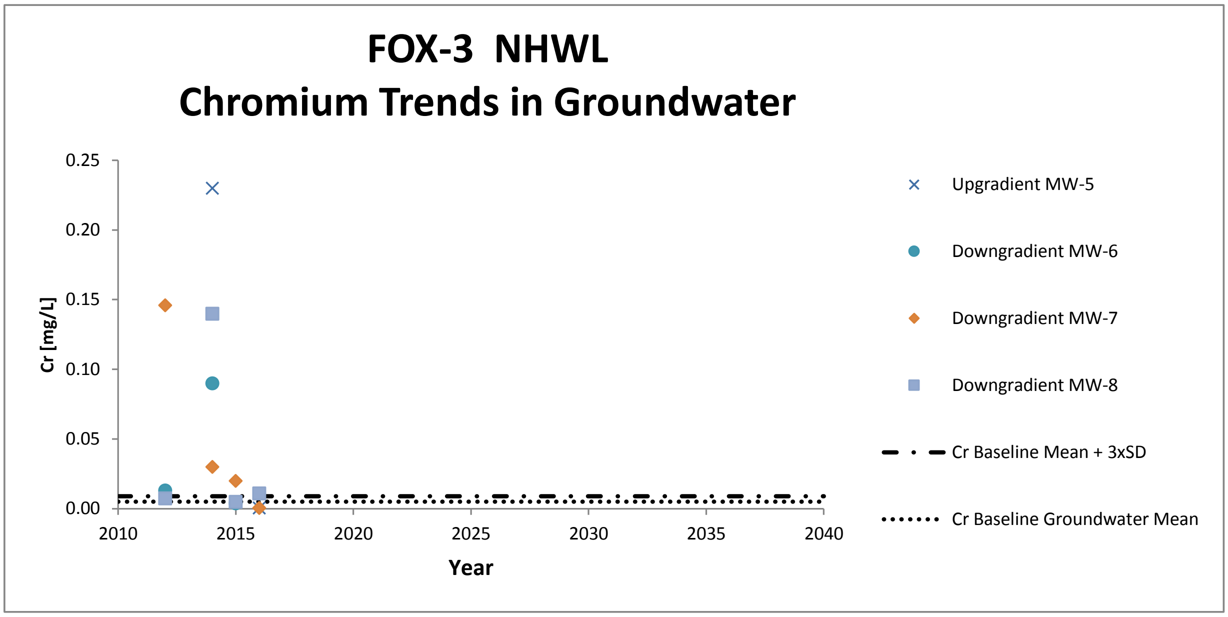
FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



Zinc chart after removal of the 2014 MW-5 Upgradient result of 5.3 mg/L.

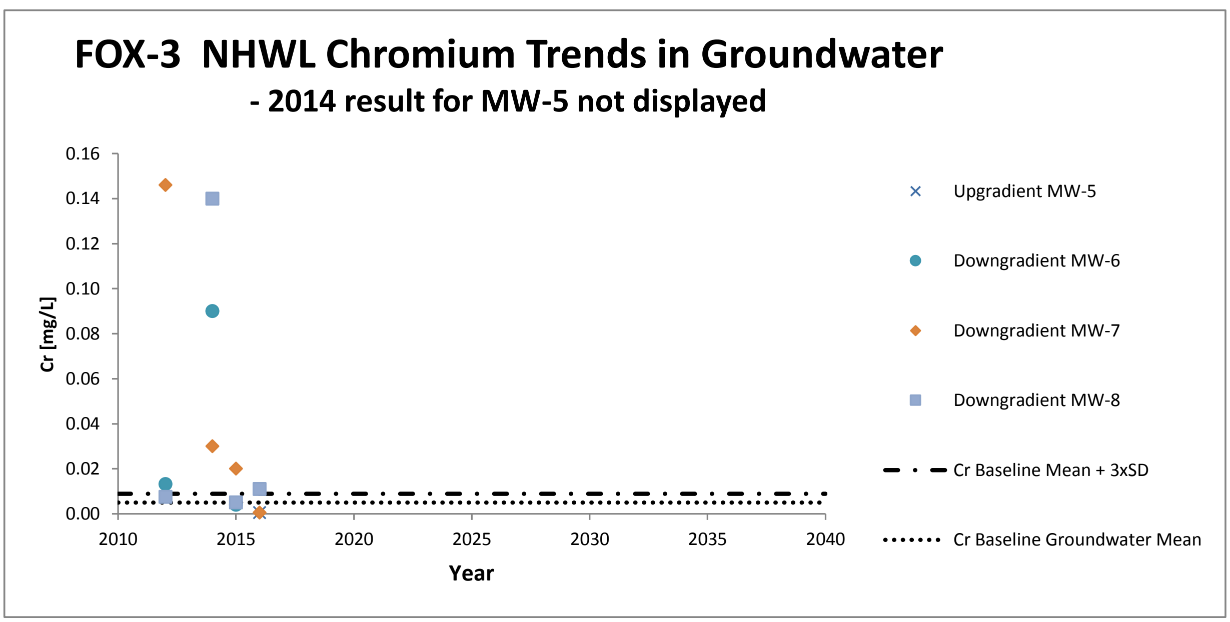


FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

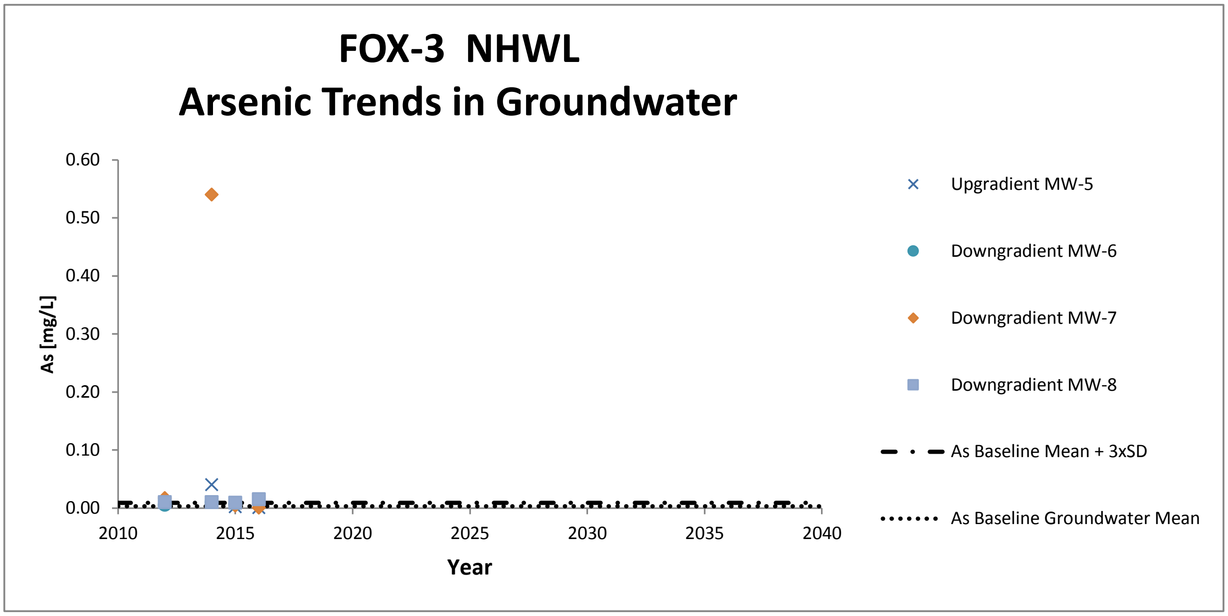


* Cr Baseline Arithmetic mean equals the baseline detection limit

Chromium chart after removal of the 2014 MW-5 Upgradient result of 0.23 mg/L.

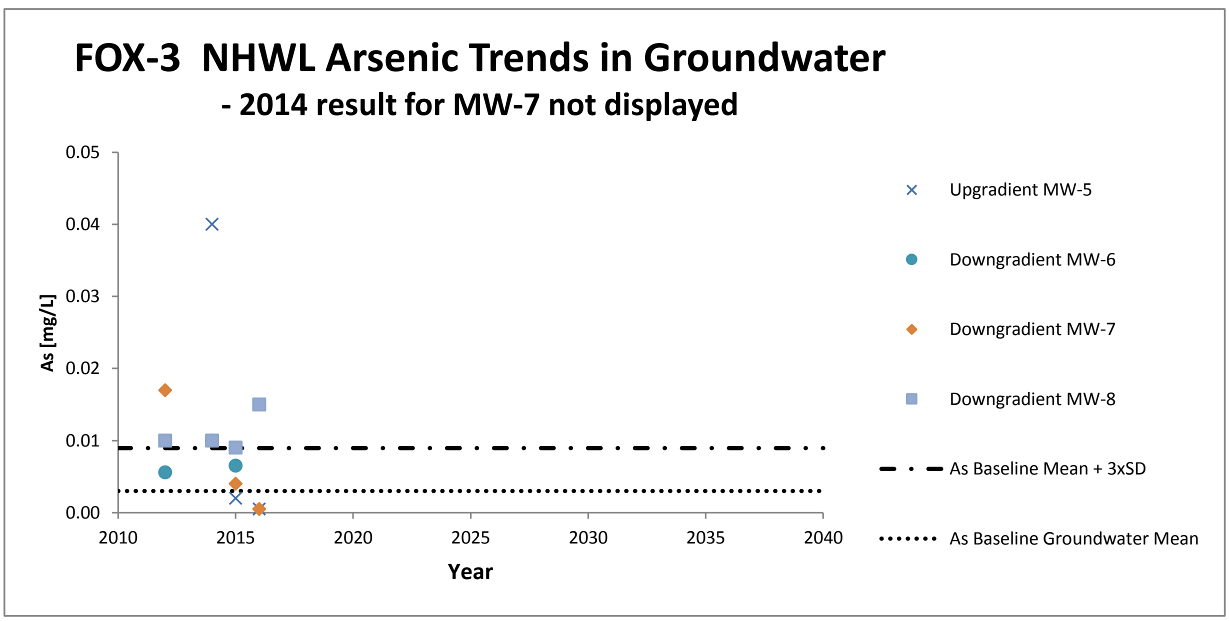


FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

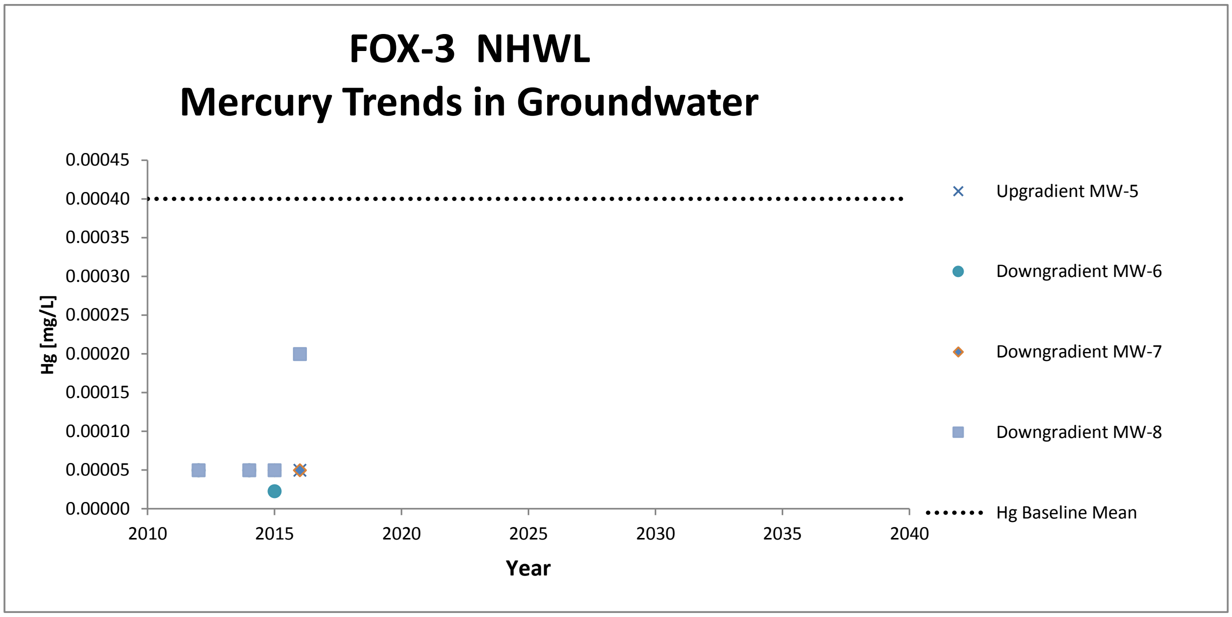


* As Baseline Arithmetic mean equals the baseline detection limit

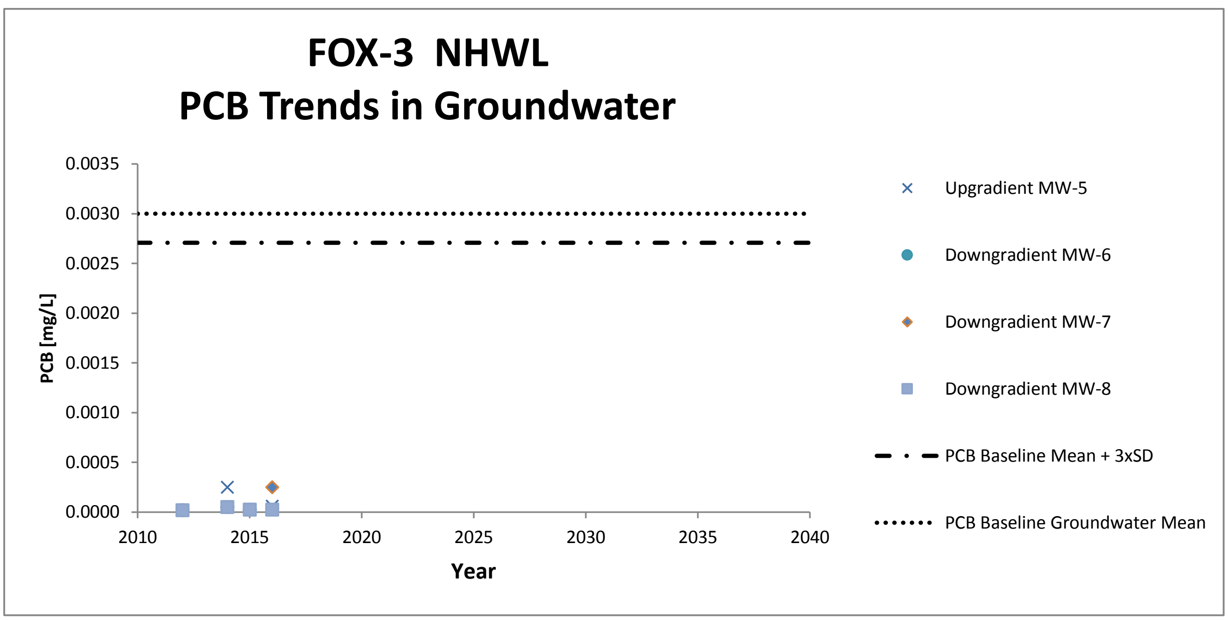
Arsenic chart after removal of 2014 MW-7 Downgradient result of 0.54 mg/L.



FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples

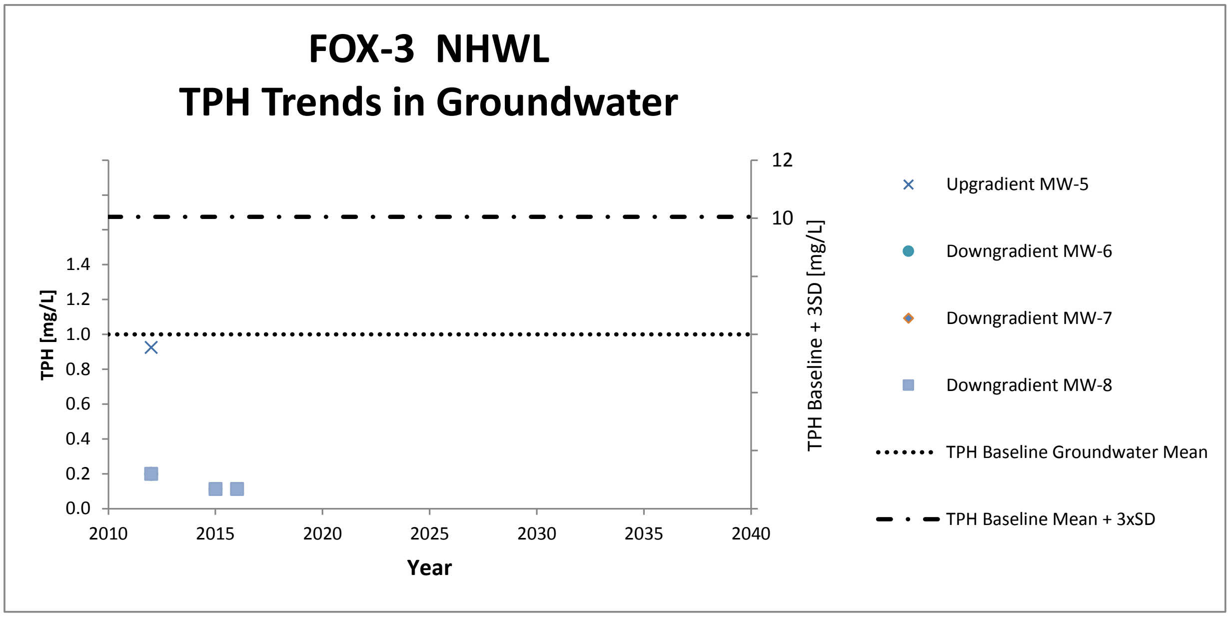


*Hg Baseline Mean is equal to the baseline detection limit.
*Hg Baseline SD = 0



* PCB Baseline Arithmetic mean equals the baseline detection limit

FOX-3 Non-Hazardous Waste Landfill Trends for Inorganic Elements, PCBs and TPH in Groundwater Samples



* TPH Baseline Arithmetic mean equals the baseline detection limit

FOX-3 - West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Background Data - Arithmetic Mean*						31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.50	0.0003				N/A
Baseline Data - Arithmetic Mean*						**24.3**	**20.0**	**9.0**	**1.0**	**10.0**	**48.7**	**54.6**	**8.7**	**0.10**	**0.10**	**0.0**	**0**	**0**	**27**
Baseline Data - Standard Deviation						4.8	4.3	2.0	0.0	1.6	9.4	11.1	2.4	0.0	0.011	0.0	0	0.0	27
Baseline Data Mean + 3xStandard Deviation						38.6	32.8	14.9	1.0	14.8	76.8	87.8	15.8	0.10	0.13	0	0	0	108
**** If baseline or background arithmetic mean was below the detection limit, the mean has been modified to match the detection limit value.***																			
DEW Line Cleanup Tier I Criteria										*200*					*1*				
DEW Line Cleanup Tier II Criteria & Hydrocarbon Action Level						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*61*	*2.0*	*5*				*2500*
Monitoring Data																			
Upgradient																			
	F3-1 surface																		
12-19356/57**	F3-1	2012	1	1	0-10	**28**	**25**	7.9	<0.50	6.8	**63**	**62**	**11**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-1-A-2014	F3-1	2014	3	1	0-10	**30**	**39**	8	<0.50	9.0	**52**	**86**	**10**	<0.10	<0.020	<10	<10	<20	20
F3-1 (0-15)	F3-1	2015	4	1	0-15	24.2	19.3	6.7	<0.5	7.2	42.8	49.1	**12**	<0.1	<0.05	<7	<4	<8	10
F3-1a	F3-1	2016	5	1	0-15	**31.4**	**22.9**	8.2	<0.5	7.3	46.9	**56.3**	**9.4**	<0.1	<0.05	<7	<4	35	**41**
	F3-1		10	2															#N/A
	F3-1		15	2															#N/A
	F3-1		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-1 depth																		
12-19358/59**	F3-1	2012	1	1	30-40	**37**	**31**	**9.2**	<0.50	**10**	**70**	**72**	**14**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-1-B-2014	F3-1	2014	3	1	40-50	24	**69**	8.0	<0.50	5.0	**57**	**163**	6.0	<0.10	<0.020	<10	<10	<20	20
F3-1 (40-50)	F3-1	2015	4	1	40-50	**24.9**	17.4	6.2	<0.5	7.3	39.5	45.7	**12.3**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	F3-1	2016	5	1															#N/A
	F3-1		10	2															#N/A
	F3-1		15	2															#N/A
	F3-1		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Downgradient																			
	F3-2 surface																		
12-19360/61**	F3-2	2012	1	1	0-10	23	**24**	7.5	<0.50	7.1	**61**	**60**	**10**	<0.010	<0.020	<5.0	<10	<50	**33**
F3-2-A-2014	F3-2	2014	3	1	0-10	**26**	**43**	8.0	<0.50	6.0	**56**	**109**	**9.0**	<0.10	<0.020	<10	<10	<20	20
F3-2 (0-15)	F3-2	2015	4	1	0-15	19.1	**22.7**	7.6	<0.5	5.3	**49.3**	**57.1**	**9.7**	<0.1	<0.05	<7	<4	<8	10
F3-2a	F3-2	2016	5	1	0-15	**27.2**	**20.5**	7.4	<0.5	9.8	44.1	54.1	**10.3**	<0.1	<0.05	<7	<4	26	**32**
	F3-2		10	2															#N/A
	F3-2		15	2															#N/A
	F3-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-2 depth																		
12-19362/63**	F3-2	2012	1	1	30-40	**39**	**25**	7.7	<0.50	7.2	**65**	**66**	**14**	<0.010	<0.020	<5.0	<10	<50	**33**
not sampled - bedrock reached at 0.18 m	F3-2	2014	3	1															#N/A
F3-2 (40-50)	F3-2	2015	4	1	40-50	17.6	19.6	6.5	<0.5	4.7	42.7	49.3	**9.8**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	F3-2	2016	5	1															#N/A
	F3-2		10	2															#N/A
	F3-2		15	2															#N/A
	F3-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3-3 surface																		
12-19364/65**	F3-3	2012	1	1	0-10	15	16	5.0	<0.50	4.1	**51**	41	5.1	<0.010	<0.020	<5.0	<10	<50	**33**
F3-3-A-2014 - lost in transport	F3-3	2014	3	1															#N/A
F3-3 (0-15)	F3-2	2015	4	1	0-15	22.4	**20.2**	7	<0.5	7	45.8	49.8	**13.1**	<0.1	<0.05	<7	<4	<8	10
F3-3b	F3-2	2016	5	1	0-15	15.8	14.7	5.5	<0.5	5.8	36.7	39.9	7.7	<0.1	<0.05	<7	<4	<8	10
	F3-2		10	2															#N/A
	F3-2		15	2															#N/A
	F3-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-3 depth																		
12-19366/67**	F3-3	2012	1	1	30-40	21	**21**	6.6	<0.50	5.2	**63**	**56**	8.5	<0.010	<0.020	<5.0	<10	<50	**33**
not sampled - bedrock reached at 0.22 m	F3-3	2014	3	1															#N/A
F3-3 (40-50)	F3-2	2015	4	1	40-50	**29.9**	**20.9**	7.9	<0.5	9.5	**53.2**	54.6	**12.2**	<0.1	<0.05	<7	<4	<8	10
F3-3a (Dup Avg)	F3-2	2016	5	1	40-50	16	17	6.0	<0.5	4.6	43	45	7.8	<0.1	<0.05	<6	<7	<29	21
	F3-2		10	2															#N/A
	F3-2		15	2															#N/A
	F3-2		25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
																			#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

** two samples taken, one analyzed for inorganics and PCBs, one analyzed for TPH

Soil and Groundwater samples were not sampled at the West Landfill in 2013

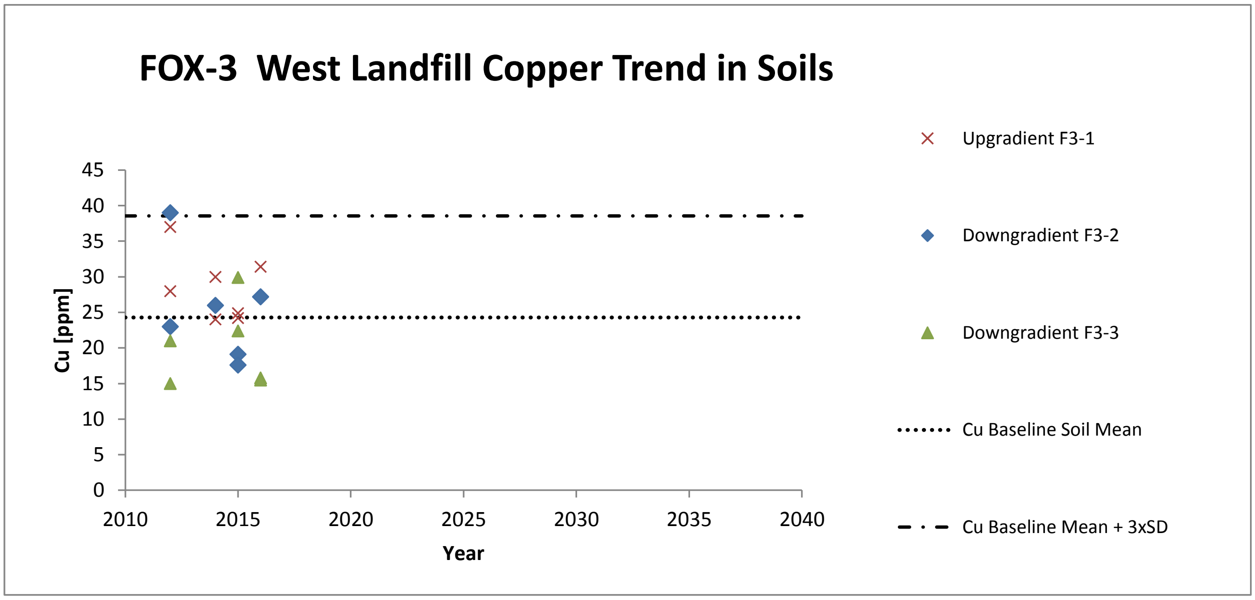
site-specific As criteria

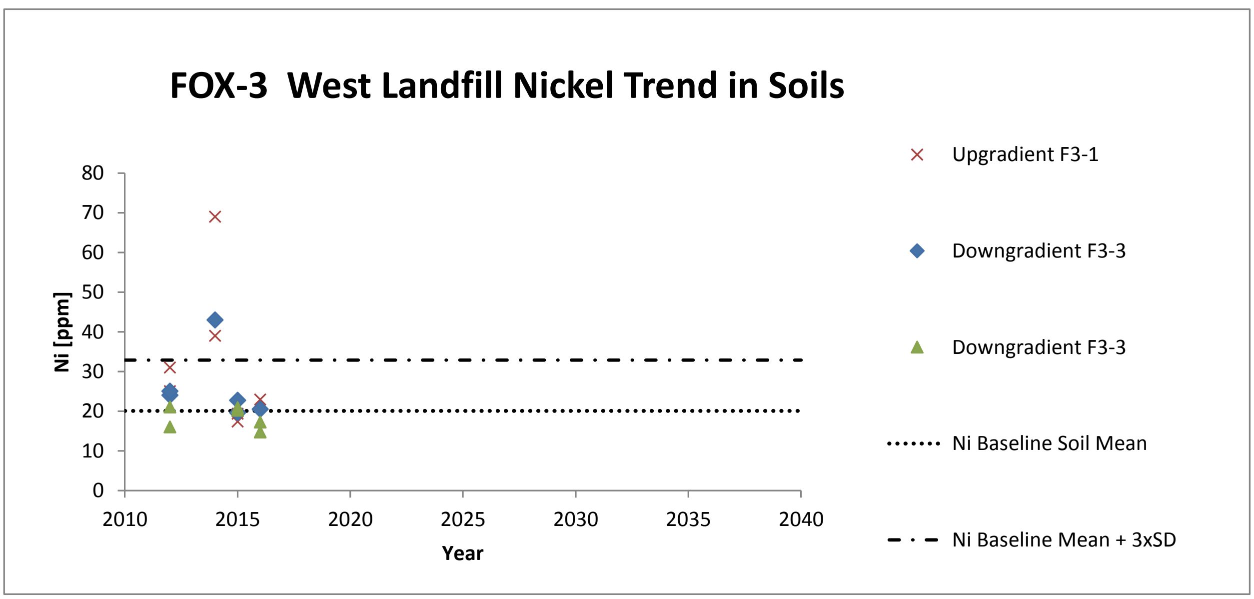
Legend

XX	sample exceeds background
XX	**sample exceeds baseline**
XX	*sample exceeds DLCU Tier I criteria*
XX	*sample exceeds DLCU Tier II criteria*

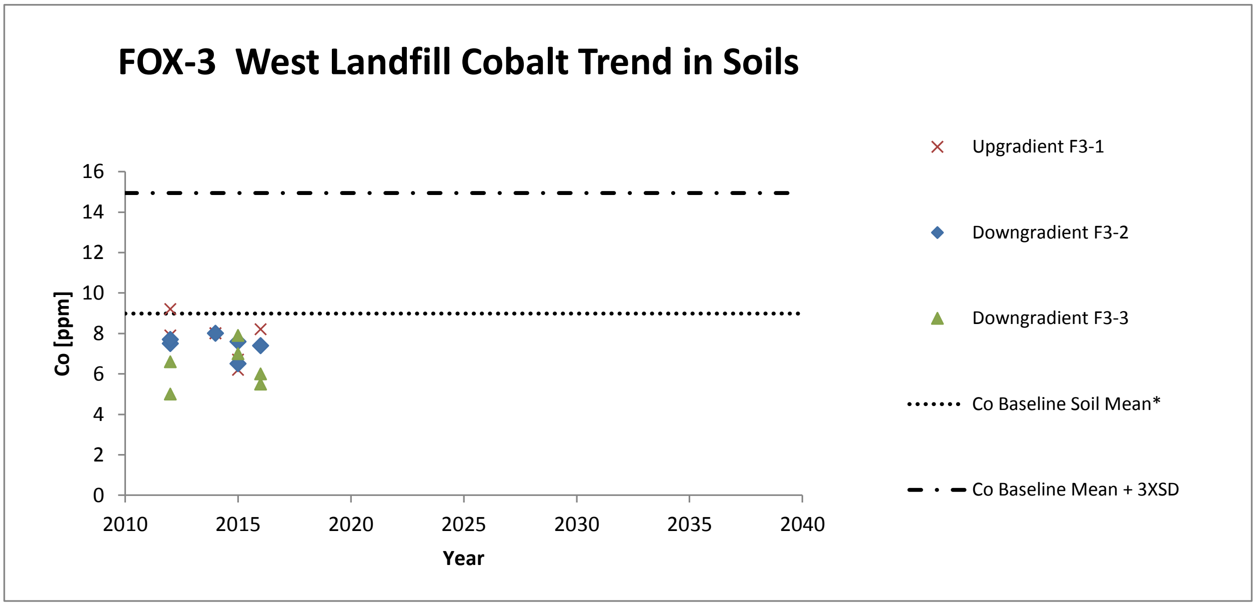
FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

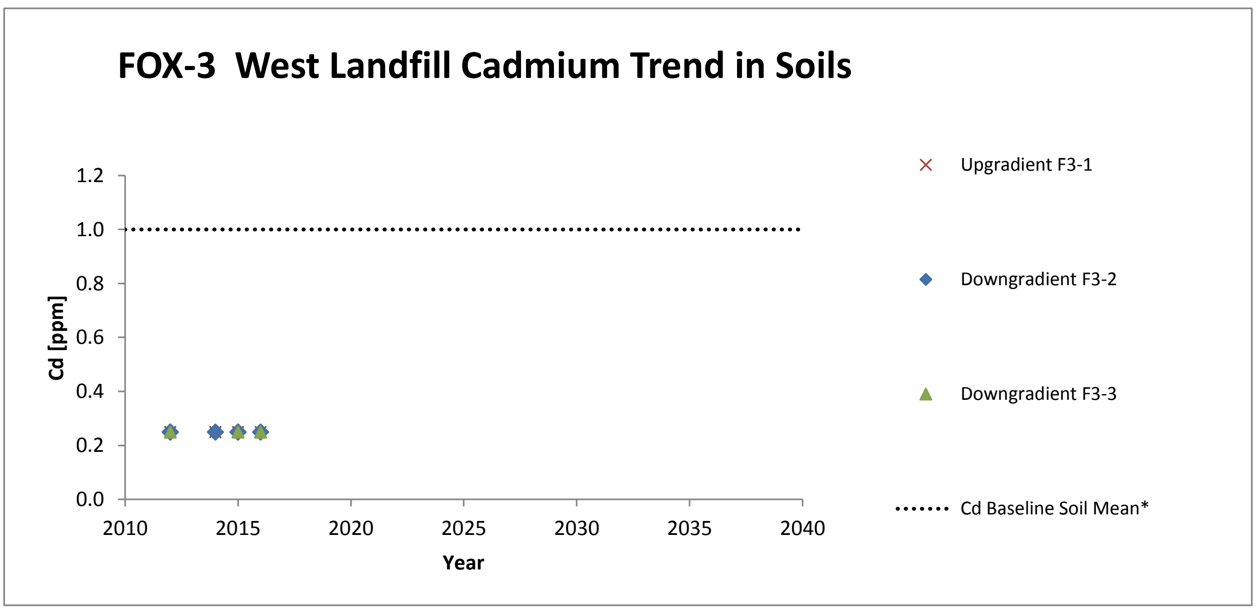
Where results are below detection, half of the detection limit has been used in the charts for the sample points. Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.





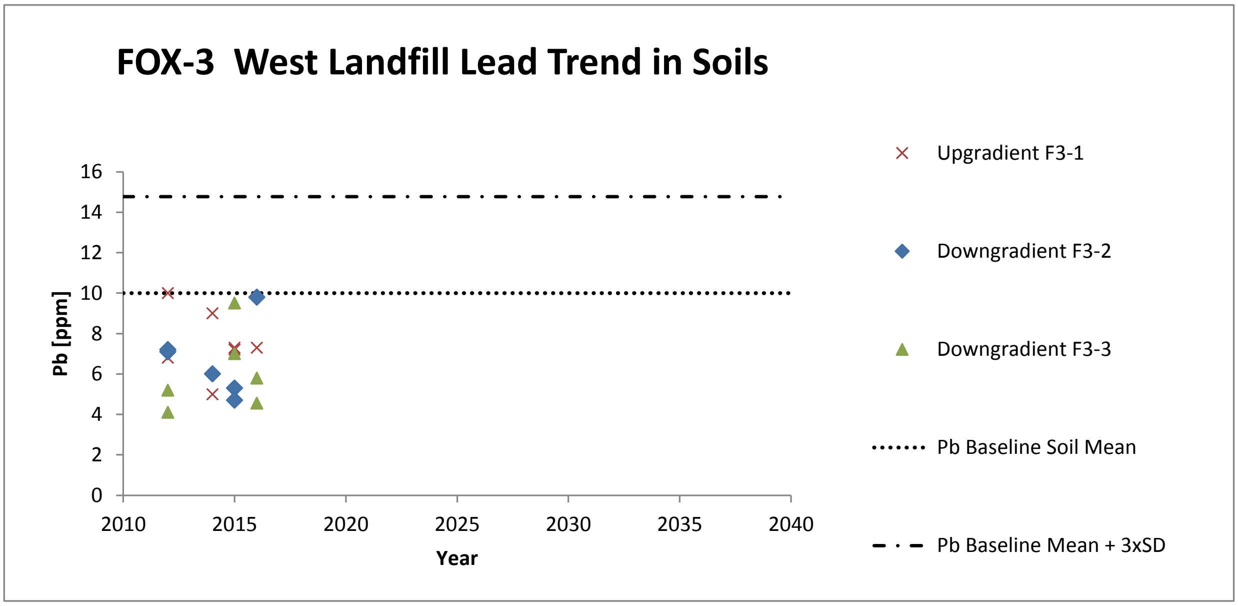
FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



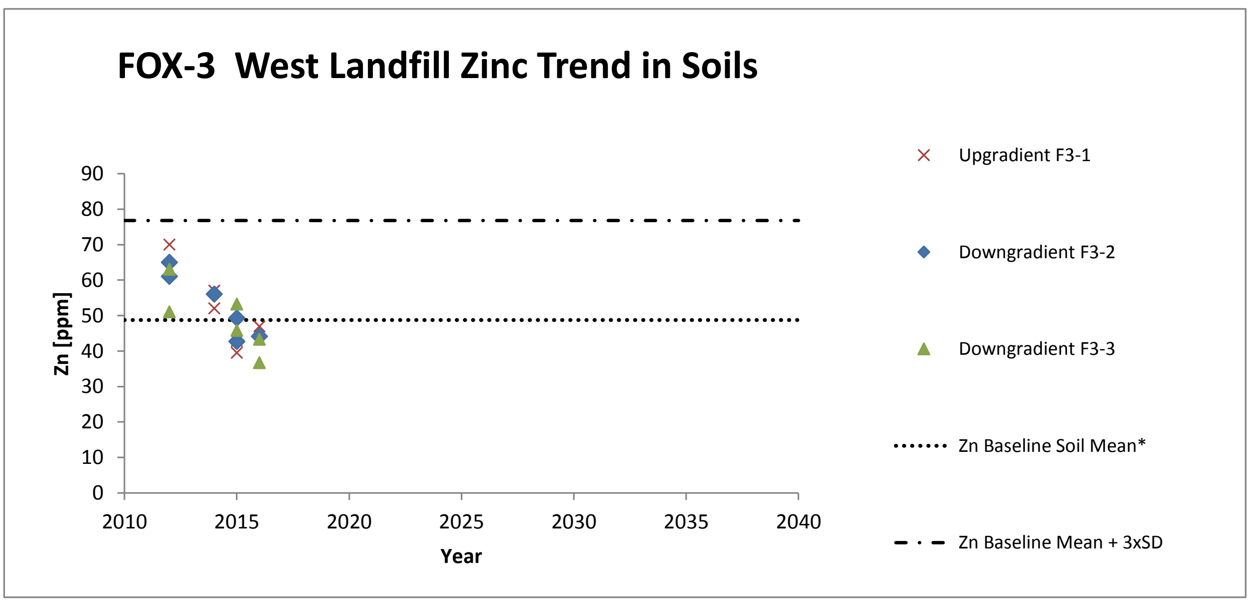


*Cd Baseline Arithmetic Mean is equal to the baseline detection limit.
*Cd Baseline SD = 0

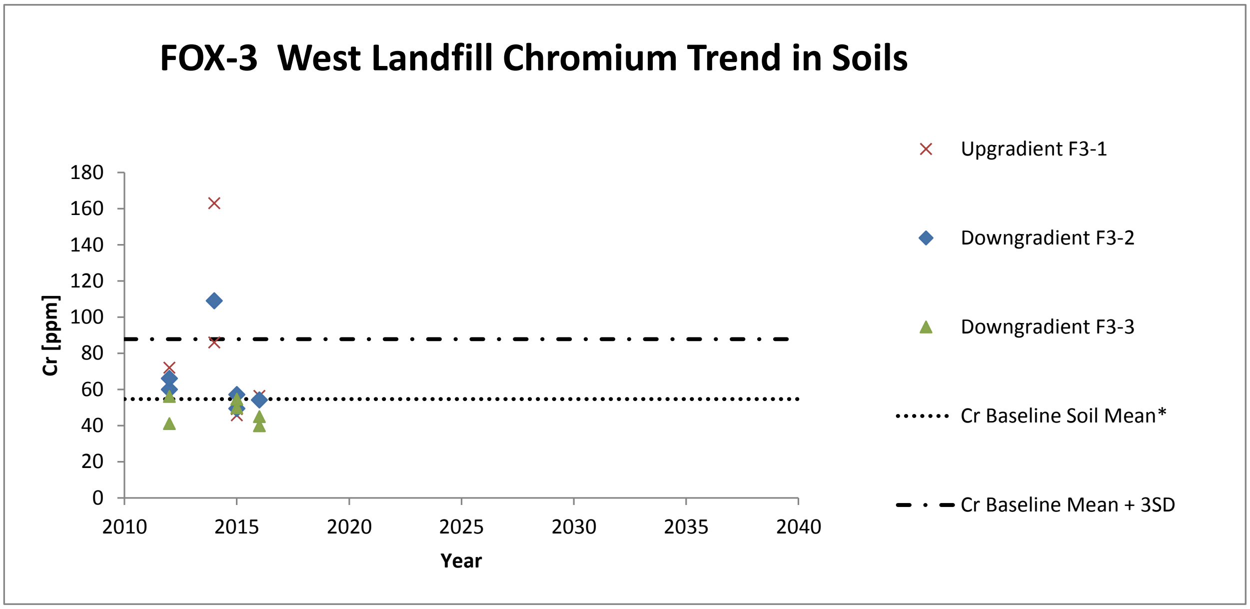
FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

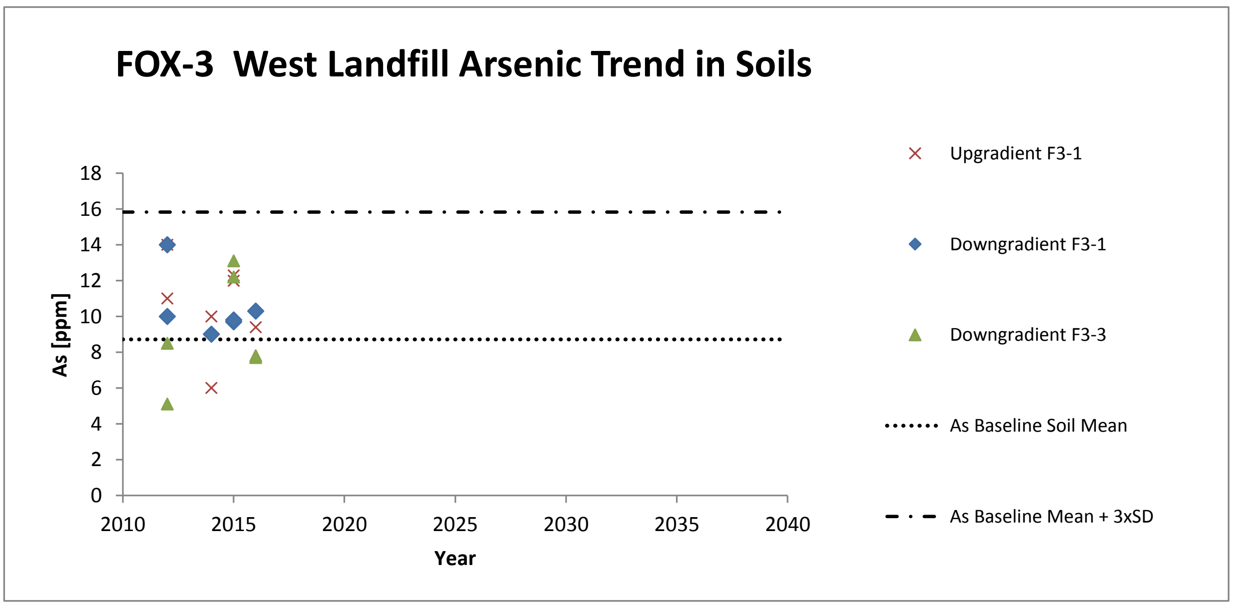


*Pb Baseline Arithmetic Mean is equal to the baseline detection limit.

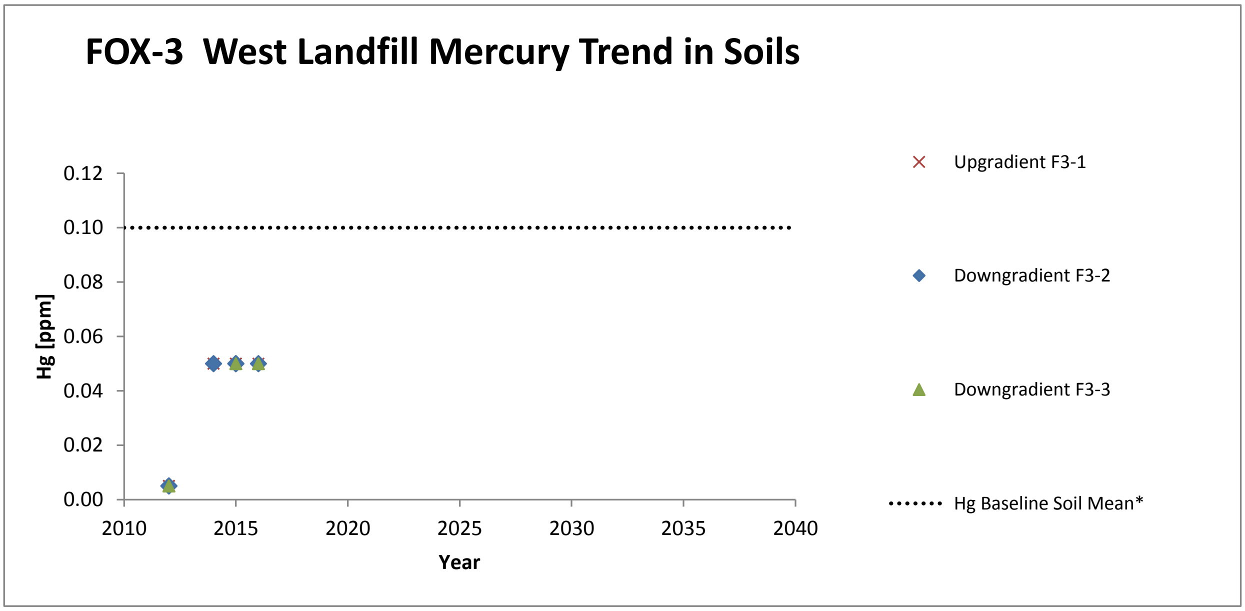


FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

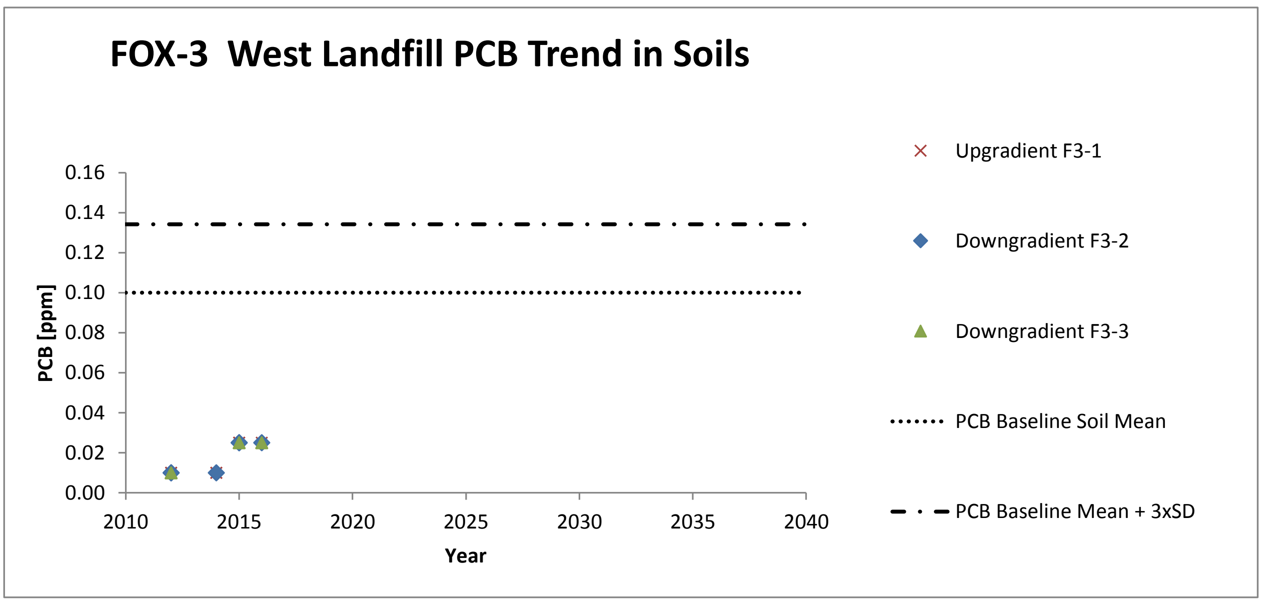




FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

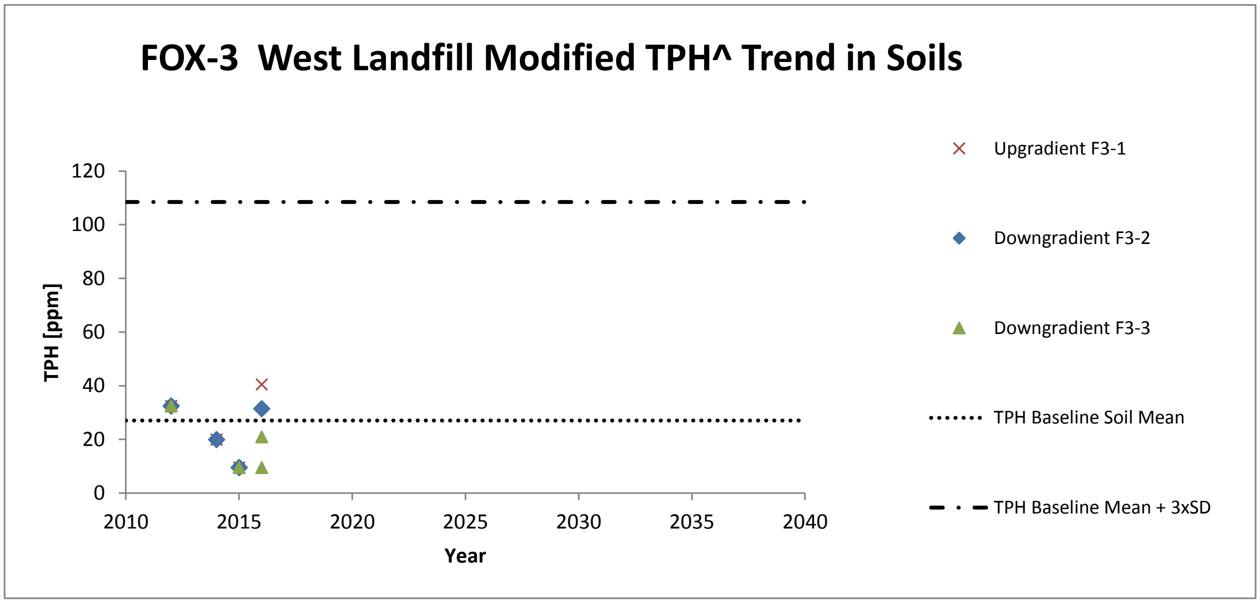


*Hg Baseline Arithmetic Mean is equal to the baseline detection limit.
Hg Baseline SD=0



*PCB Baseline Arithmetic Mean is equal to the baseline detection limit.

FOX-3 West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



^ Modified TPH is Sum of F1, F2 and F3 fractions (C_6 - C_{34})

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
Background Data - Arithmetic Mean*						31.8	27.4	32.2	1.0	10.0	59.0	67.4	10.9	0.10	0.003				40
Baseline Data - Arithmetic Mean*						**39.5**	**31.4**	**12.5**	**1.0**	**10.0**	**70.8**	**77.3**	**10.0**	**0.10**	**0.10**	10	4.0	9.0	**40**
Baseline Data - Standard Deviation						7.6	3.9	1.7	0.0	3.7	15.3	9.1	3.9	0.0	0.029	0.0	1.8	3.4	436
Baseline Data Mean + 3xStandard Deviation						62.5	43.1	17.5	1.0	21.0	116.8	104.5	21.9	0.10	0.19	10	9.5	19	1347
**** If baseline or background arithmetic mean was below the detection limit, the mean has been modified to match the detection limit value.***																			
DEW Line Cleanup Tier I Criteria										*200*					*1*				
DEW Line Cleanup Tier II Criteria & Hydrocarbon Action Level						*100*	*100*	*50*	*5*	*500*	*500*	*250*	*61*	*2.0*	*5*				*2500*
Monitoring Data																			
Upgradient																			
	F3-8 surface																		
12-19336/37**	F3-8	2012	1	1	0-10	29	30	8.7	<0.50	**16**	**72**	69	10	<0.010	<0.020	<5.0	<10	<50	33
F3-8-A-2014	F3-8	2014	3	1	0-10	38	**34**	10	<0.50	7.0	**78**	**87**	**14**	<0.10	<0.020	<10	<10	<20	20
F3-8 (0-15)	F3-8	2015	4	1	0-15	38.9	28.8	9.6	<0.5	9.4	64.8	70.1	**13.6**	<0.1	<0.05	<7	<4	<8	10
F3-8a	F3-8	2016	5	1	0-15	26.1	21.7	7.8	<0.5	9.1	49.2	57.8	**11.6**	<0.1	<0.05	<7	<4	<8	10
	F3-8	2021	10	2															#N/A
	F3-8	2026	15	2															#N/A
	F3-8	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-8 depth																		
12-19338/39**	F3-8	2012	1	1	30-40	35	**32**	9.5	<0.50	6.8	**79**	76	**14**	<0.010	<0.020	<5.0	<10	<50	33
F3-8-B-2014	F3-8	2014	3	1	40-50	**42**	**33**	10	<0.50	8.0	**74**	77	**17**	<0.1	<0.020	<10	<10	<20	20
F3-8 (40-50)	F3-8	2015	4	1	40-50	39.3	28.2	9.7	<0.5	8.9	64.9	68.1	**12**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	F3-8	2016	5	1															#N/A
	F3-8	2021	10	2															#N/A
	F3-8	2026	15	2															#N/A
	F3-8	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3-10 surface																		
12-19344/45**	F3-10	2012	1	1	0-10	32	31	9.2	<0.50	5.8	**75**	72	**11**	<0.010	<0.020	<5.0	<10	<50	33
F3-10-A-2014	F3-10	2014	3	1	0-10	39	**41**	11	<0.50	8.0	**82**	**97**	**13**	<0.10	<0.020	<10	<10	<20	20
F3-10 (0-15)	F3-10	2015	4	1	0-15	31.7	25.9	9.1	<0.5	7.4	55.5	63.2	**11.3**	<0.1	<0.05	<7	<4	<8	10
F3-10a	F3-10	2016	5	1	0-15	28.7	25.5	9.4	<0.5	**12.8**	58.4	69.2	**12**	<0.1	<0.05	<7	<4	<8	10
	F3-10	2021	10	2															#N/A
	F3-10	2026	15	2															#N/A
	F3-10	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-10 depth																		
12-19346/47**	F3-10	2012	1	1	30-40	34	**32**	9.5	<0.50	5.6	70	74	**11**	<0.010	<0.020	<5.0	<10	<50	33
F3-10-B-2014	F3-10	2014	3	1	40-50	30	**38**	9	<0.50	5.0	67	**95**	**12**	<0.10	<0.020	<10	<10	<20	20
F3-10 (40-50) (Dup Avg)	F3-10	2015	4	1	40-50	28	27	9.5	<0.5	7	63	66	10	<0.1	<0.1	<6	<4	<8	9
Not sampled - refusal	F3-8	2016	5	1															#N/A
	F3-10	2021	10	2															#N/A
	F3-10	2026	15	2															#N/A
	F3-10	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
Downgradient																			
	F3-4 surface																		
12-19320/21**	F3-4	2012	1	1	0-10	**59**	28	8.5	<0.50	**51**	**130**	69	**11**	0.012	0.073	<5.0	<10	76	**84**
F3-4-A-2014	F3-4	2014	3	1	0-10	27	28	9	<0.50	6	63.0	74	**23**	<0.10	<0.020	<10	<10	<20	20
F3-4 (0-15)	F3-4	2015	4	1	0-15	**43.3**	29.3	10	<0.5	**10.1**	66.3	71.6	**16.4**	<0.1	<0.05	<7	<4	<8	10
F3-4a (Dup Avg)	F3-4	2016	5	1	0-15	34	29	9.1	<0.5	7.6	**73**	72	**16**	<0.1	<0.05	<6	<7	**43**	**50**
	F3-4	2021	10	2															#N/A
	F3-4	2026	15	2															#N/A
	F3-4	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3-4 depth																		
12-19322/23**	F3-4	2012	1	1	30-40	**47**	**32**	8.6	<0.50	**34**	**110**	**84**	**15**	<0.010	<0.020	<5.0	<10	<50	33
F3-4-B-2014	F3-4	2014	3	1	40-50	**42**	**32**	9.0	0.5	8.0	**72**	**84**	**19**	<0.10	<0.020	<10	<10	<20	20
F3-4 (40-50)	F3-4	2015	4	1	40-50	38.4	28.3	9.8	<0.5	9.3	64.8	70.4	**17.7**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	F3-4	2016	5	1															#N/A
	F3-4	2021	10	2															#N/A
	F3-4	2026	15	2															#N/A
	F3-4	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-5 surface																		
12-19324/25**	F3-5	2012	1	1	0-10	32	30	8.9	<0.50	5.6	**74**	75	**13**	<0.010	<0.020	<5.0	<10	<50	33
F3-5-A-2014	F3-5	2014	3	1	0-10	**45**	**38**	12	<0.50	9.0	**97**	**82**	**14**	<0.10	<0.020	<10	<10	<20	20
F3-5 (0-15) (Dup Avg)	F3-5	2015	4	1	0-15	29	28	9.4	<0.5	7	66	72	**13**	<0.1	<0.1	<6	<4	<8	9
F3-5b	F3-5	2016	5	1	0-15	39.1	27.8	10	<0.5	8.7	63.7	67.6	**14.5**	<0.1	<0.05	<7	<4	<8	10
	F3-5	2021	10	2															#N/A
	F3-5	2026	15	2															#N/A
	F3-5	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-5 depth																		
12-19326/27**	F3-5	2012	1	1	30-40	32	26	7.9	<0.50	5.3	**73**	66	**13**	<0.010	<0.020	<5.0	<10	<50	33
F3-5-B-2014	F3-5	2014	3	1	40-50	**40**	**37**	12	<0.50	7.0	**82**	**83**	**14**	<0.10	<0.020	<10	<10	<20	20
F3-5 (40-50)	F3-5	2015	4	1	40-50	38	29.5	10.3	<0.5	8.9	61.8	72.8	**15.3**	<0.1	<0.05	<7	<4	<8	10
F3-5a	F3-5	2016	5	1	40-50	38.7	27	10.4	<0.5	9.1	60.5	70.1	**14.7**	<0.1	<0.05	<7	<4	<8	10
	F3-5	2021	10	2															#N/A
	F3-5	2026	15	2															#N/A
	F3-5	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3- 6 surface																		
12-19328/29**	F3-6	2012	1	1	0-10	34	28	8.7	<0.50	6.3	**73**	69	**16**	<0.010	<0.020	<5.0	<10	<50	33
F3-6-A-2014	F3-6	2014	3	1	0-10	34	**34**	8	<0.50	6.0	**72**	**81**	**13**	<0.10	<0.020	<10	<10	<20	20
F3-6 (0-15)	F3-6	2015	4	1	0-15	37.9	29.1	9.8	<0.5	8.9	64	67.5	**15.3**	<0.1	<0.05	<7	<4	<8	10
F3-6b	F3-6	2016	5	1	0-15	36.7	27.2	9.5	<0.5	9.7	55	66	**20.2**	<0.1	<0.05	<7	<4	<8	10
	F3-6	2021	10	2															#N/A
	F3-6	2026	15	2															#N/A
	F3-6	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-6 depth																		
12-19330/31**	F3-6	2012	1	1	30-40	31	27	8.0	<0.50	6.8	70	65	**14**	<0.010	<0.020	<5.0	<10	<50	33
not sampled - bedrock reached at 0.2m	F3-6	2014	3	1															#N/A
F3-6 (40-50)	F3-6	2015	4	1	40-50	**44.7**	30.1	10	<0.5	9.3	64.5	68.4	**16.3**	<0.1	<0.05	<7	<4	<8	10
F3-6a	F3-6	2016	5	1	30-40	36.3	27	9.2	<0.5	9.5	56	68.3	**19.5**	<0.1	<0.05	<7	<4	<8	10
	F3-6	2021	10	2															#N/A
	F3-6	2026	15	2															#N/A
	F3-6	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3-7 surface																		
12-19332/33**	F3-7	2012	1	1	0-10	28	26	7.6	<0.50	5.1	62	68	**11**	<0.010	<0.020	<5.0	<10	<50	33
F3-7-A-2014	F3-7	2014	3	1	0-10	**40**	**40**	9	<0.50	7.0	66	**94**	**17**	<0.10	<0.020	<10	160	1050	**1215**
F3-7 (0-15)	F3-7	2015	4	1	0-15	34.6	28.3	9.5	<0.5	8.5	60	67.6	**13.5**	<0.1	<0.05	<7	<4	<8	10
F3-7a	F3-7	2016	5	1	0-15	33.2	26.8	9.6	<0.5	8.5	58.1	73.6	**14.3**	<0.1	<0.05	<7	<4	<8	10
	F3-7	2021	10	2															#N/A
	F3-7	2026	15	2															#N/A
	F3-7	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3-7 depth																		
12-19334/35**	F3-7	2012	1	1	30-40	31	27	8.0	<0.50	6.3	**78**	73	**14**	<0.010	<0.020	<5.0	<10	<50	33
F3-7-B-2014	F3-7	2014	3	1	40-50	33	28	8.0	<0.50	5.0	58	63	10	<0.10	<0.020	<10	30	240	**275**
F3-7 (40-50)	F3-7	2015	4	1	40-50	**40.1**	30.4	10.4	<0.5	8.8	64.9	71.9	**17.5**	<0.1	<0.05	<7	<4	<8	10
Not sampled - refusal	F3-7	2016	5	1															#N/A
	F3-7	2021	10	2															#N/A
	F3-7	2026	15	2															#N/A
	F3-7	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3- 9 surface																		
12-19340/41**	F3-9	2012	1	1	0-10	34	30	8.8	<0.50	6.3	71	70	**12**	<0.010	<0.020	<5.0	<10	<50	33
F3-9-A-2014	F3-9	2014	3	1	0-10	**48**	**39**	11	<0.50	8.0	**81**	**83**	**16**	<0.10	<0.020	<10	<10	<20	20
F3-9 (0-15)	F3-9	2015	4	1	0-15	38.5	30.9	10.9	<0.5	8.4	62.9	74.5	**16.9**	<0.1	<0.05	<7	<4	<8	10
F3-9b	F3-9	2016	5	1	0-15	**49**	**31.6**	10.5	<0.5	**10.7**	61	76.2	**20.1**	<0.1	<0.05	<7	<4	<8	10
	F3-9	2021	10	2															#N/A
	F3-9	2026	15	2															#N/A
	F3-9	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3- 9 depth																		
12-19342/43**	F3-9	2012	1	1	30-40	**47**	**35**	10	<0.50	7.4	**80**	**78**	**17**	<0.010	<0.020	<5.0	<10	<50	33
F3-9-B-2014	F3-9	2014	3	1	40-50	**45**	**41**	11	<0.5	7.0	**75**	**87.0**	**15**	<0.1	<0.02	<10	<10	<20	20
F3-9 (40-50)	F3-9	2015	4	1	40-50	36.4	28.8	10.1	<0.5	8.2	58.1	64.5	**14.2**	<0.1	<0.05	<7	<4	<8	10
F3-9a	F3-9	2016	5	1	40-50	**53.6**	**31.9**	11	<0.5	**10.5**	63.4	**77.5**	**20.4**	<0.1	<0.05	<7	<4	<8	10
	F3-9	2021	10	2															#N/A
	F3-9	2026	15	2															#N/A
	F3-9	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3- 11 surface																		
12-19348/49**	F3-11	2012	1	1	0-10	37	**33**	10	<0.50	6.5	**73**	73	**16**	<0.010	<0.020	<5.0	<10	<50	33
F3-11-A-2014	F3-11	2014	3	1	0-10	**50**	**51**	**16**	<0.50	6.0	**80**	**87**	**21**	<0.10	<0.020	<10	<10	<20	20
F3-11 (0-15)	F3-11	2015	4	1	0-15	39	30.8	10.5	<0.5	8.8	60.4	68.3	**18.1**	<0.1	<0.05	<7	<4	<8	10
F3-11b	F3-11	2016	5	1	0-15	**66.3**	**37.5**	**13.5**	<0.5	**11.5**	69.2	**80.6**	**34.6**	<0.1	<0.05	<7	<4	<8	10
	F3-11	2021	10	2															#N/A
	F3-11	2026	15	2															#N/A
	F3-11	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3- 11 depth																		
12-19350/51**	F3-11	2012	1	1	30-40	**47**	**36**	11	<0.50	7.1	**76**	**81**	**21**	<0.010	<0.020	<5.0	<10	<50	33
F3-11-B-2014	F3-11	2014	3	1	40-50	**56**	**54**	**16**	<0.5	7.0	**87**	**85**	**24**	<0.10	<0.020	<10	<10	<20	20
F3-11 (40-50)	F3-11	2015	4	1	40-50	**39.9**	**32.7**	10.9	<0.5	8.5	64.8	73	**18.7**	<0.1	<0.05	<7	<4	<8	10
F3-11a	F3-11	2016	5	1	40-50	**67.1**	**38.9**	**13.2**	<0.5	**12.6**	69.6	**82.5**	**38.2**	<0.1	<0.05	<7	<4	<8	10
	F3-11	2021	10	2															#N/A
	F3-11	2026	15	2															#N/A
	F3-11	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

FOX-3 - Station West Landfill - Summary of Monitoring Soil Analytical Data

Sample ID	Location	Year	Monitoring Year	Monitoring Phase	Depth (cm)	Cu (mg/kg)	Ni (mg/kg)	Co (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Zn (mg/kg)	Cr (mg/kg)	As (mg/kg)	Hg (mg/kg)	Total PCB (mg/kg)	F1 C_6-C_{10} (mg/kg)	F2 C_{10}-C_{16} (mg/kg)	F3 C_{16}-C_{34} (mg/kg)	Modified TPH^ - Total C6-C34 (mg/kg)
	F3- 12 surface																		
12-19352/53**	F3-12	2012	1	1	0-10	**43**	**37**	9.7	<0.50	7.4	**75**	**79**	**19**	<0.010	<0.020	<5.0	<10	<50	33
F3-12-A-2014	F3-12	2014	3	1	0-10	**55**	**39**	11	<0.50	8.0	**80**	**87**	**24**	<0.10	<0.020	<10	<10	<20	20
F3-12 (0-15) (Dup Avg)	F3-12	2015	4	1	0-15	39	**34**	11.2	<0.5	8	69	76	**16**	<0.1	<0.1	<6	<4	<8	9
F3-12b	F3-12	2016	5	1	0-15	39	28.3	9.2	<0.5	8.4	54.3	69.5	**17**	<0.1	<0.05	<7	<4	<8	10
	F3-12	2021	10	2															#N/A
	F3-12	2026	15	2															#N/A
	F3-12	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A
	F3- 12 depth																		
12-19354/55**	F3-12	2012	1	1	30-40	31	27	7.7	<0.50	5.6	**72**	66	**12**	<0.010	<0.020	<5.0	<10	<50	33
F3-12-B-2014	F3-12	2014	3	1	40-50	**50**	**39**	11	<0.5	7.0	**78**	**89**	**22**	<0.10	<0.020	<10	<10	<20	20
F3-12 (40-50)	F3-12	2015	4	1	40-50	**43.9**	**33.5**	10.9	<0.5	9.1	65.3	75.7	**18.1**	<0.1	<0.05	<7	<4	<8	10
F3-12a	F3-12	2016	5	1	30-40	38.8	28.3	9.2	<0.5	8.6	53.5	69	**16**	<0.1	<0.05	<7	<4	<8	10
	F3-12	2021	10	2															#N/A
	F3-12	2026	15	2															#N/A
	F3-12	2036	25	2															#N/A
																			#N/A
																			#N/A
																			#N/A

Note: Modified TPH Total (C_6-C_{34}) has been calculated by adding results for F1, F2 and F3.

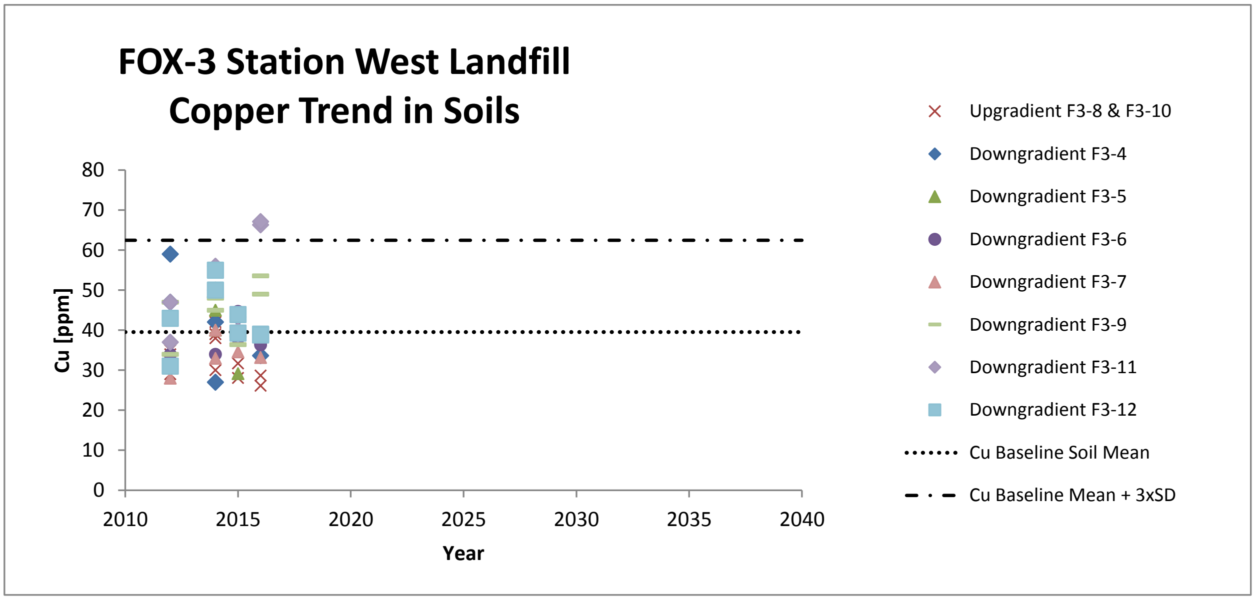
N/A = not analyzed

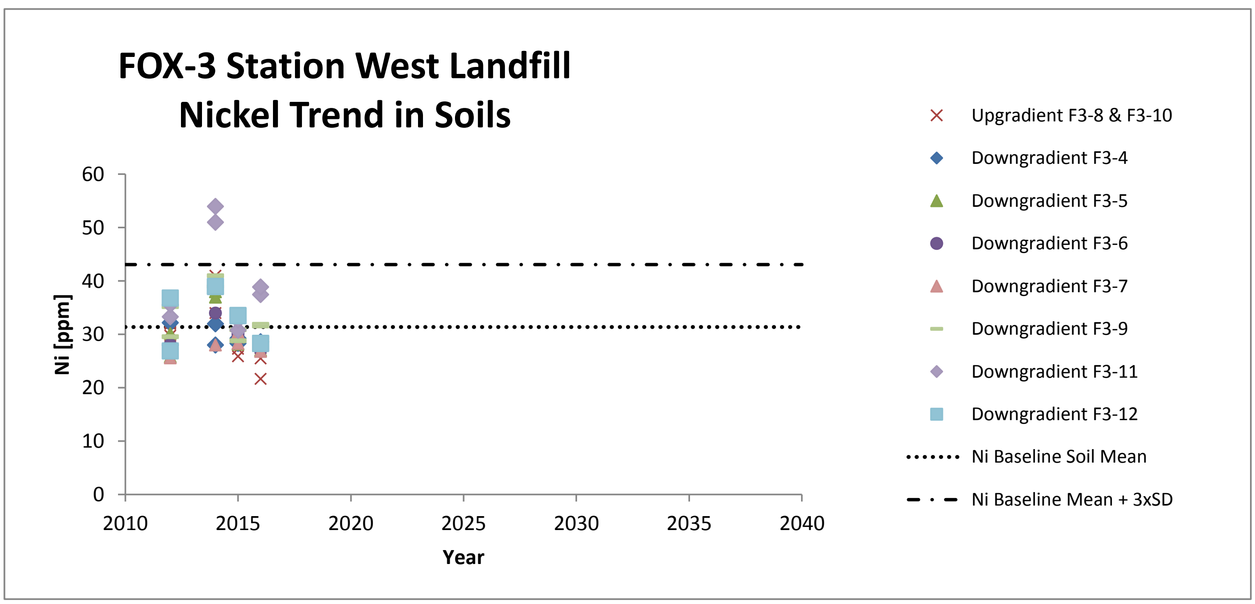
Soil and Groundwater samples were not sampled at the Station West Landfill in 2013

Legend

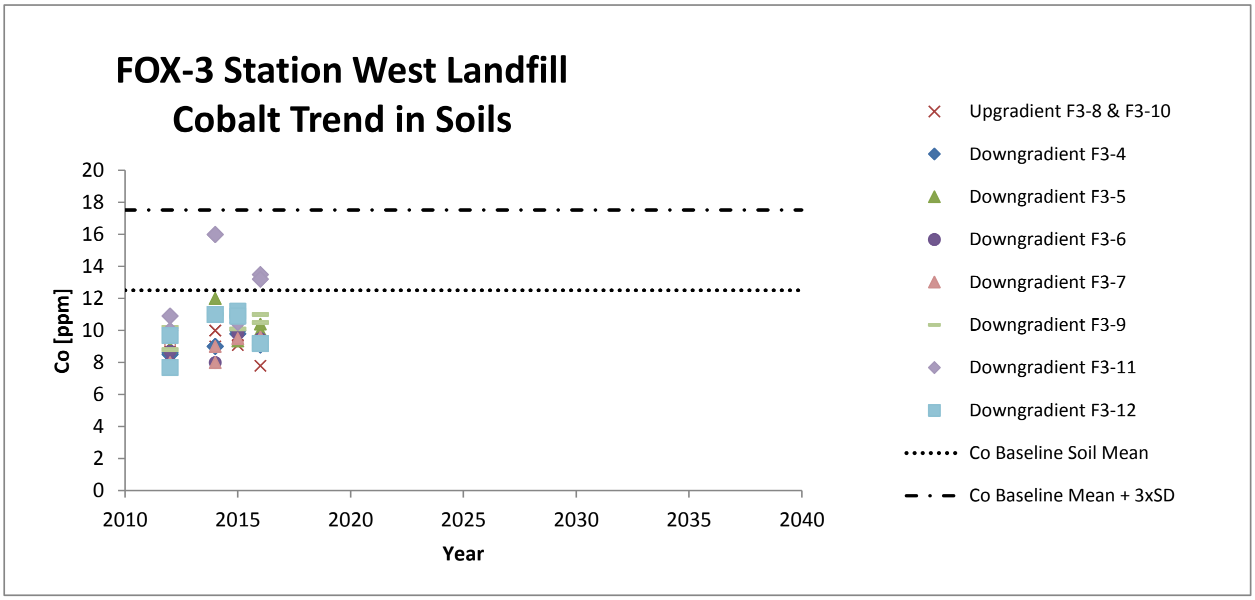
XX	sample exceeds background
XX	**sample exceeds baseline**
XX	*sample exceeds DLCU Tier I criteria*
XX	*sample exceeds DLCU Tier II criteria*

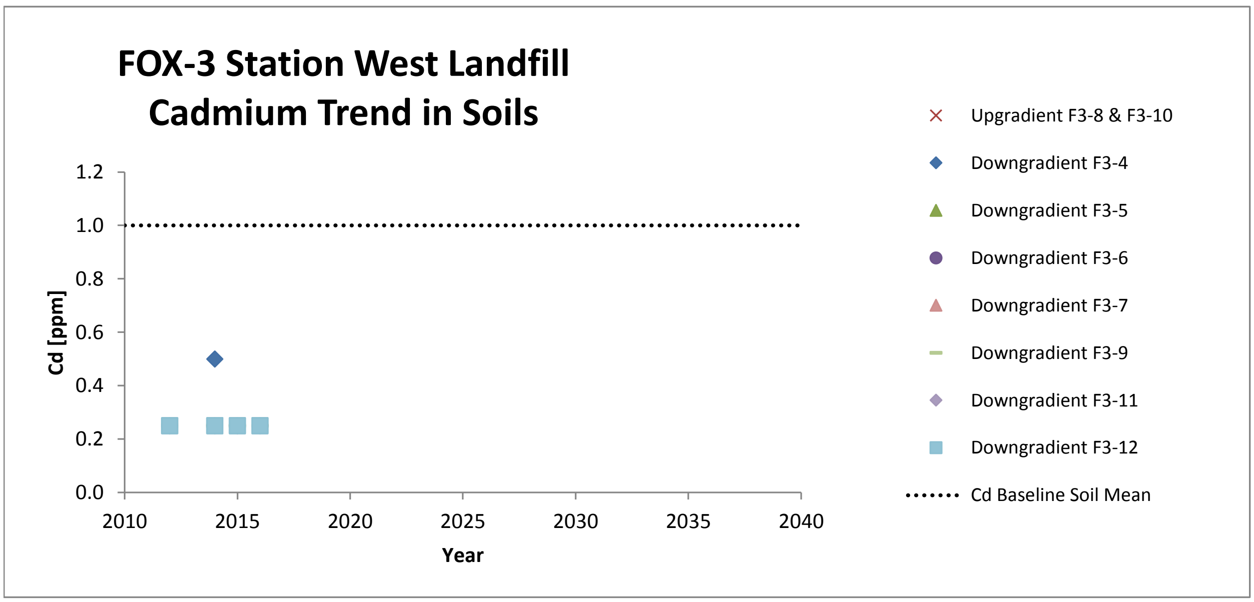
FOX-3   Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)
Where results are below detection, half of the detection limit has been used in the charts for the sample points.
Trendlines are intended for visual interpretation of temporal trends. When all monitoring results are below detection, trendlines are a reflection of changes in detection limit. Users should refer to data tables.





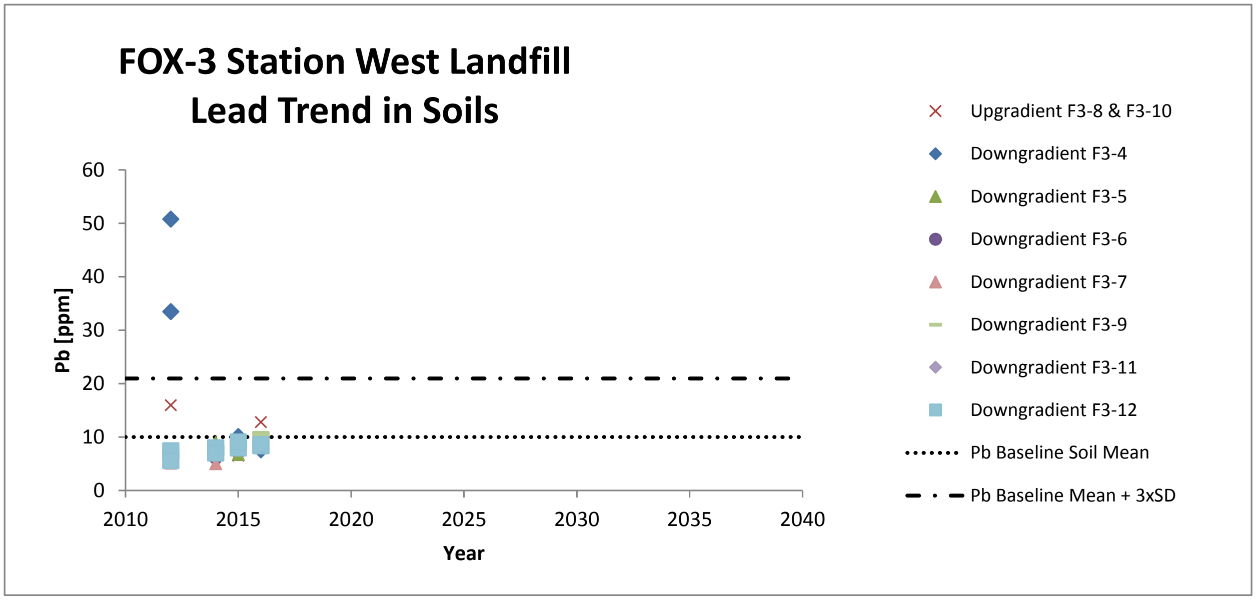
FOX-3 Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

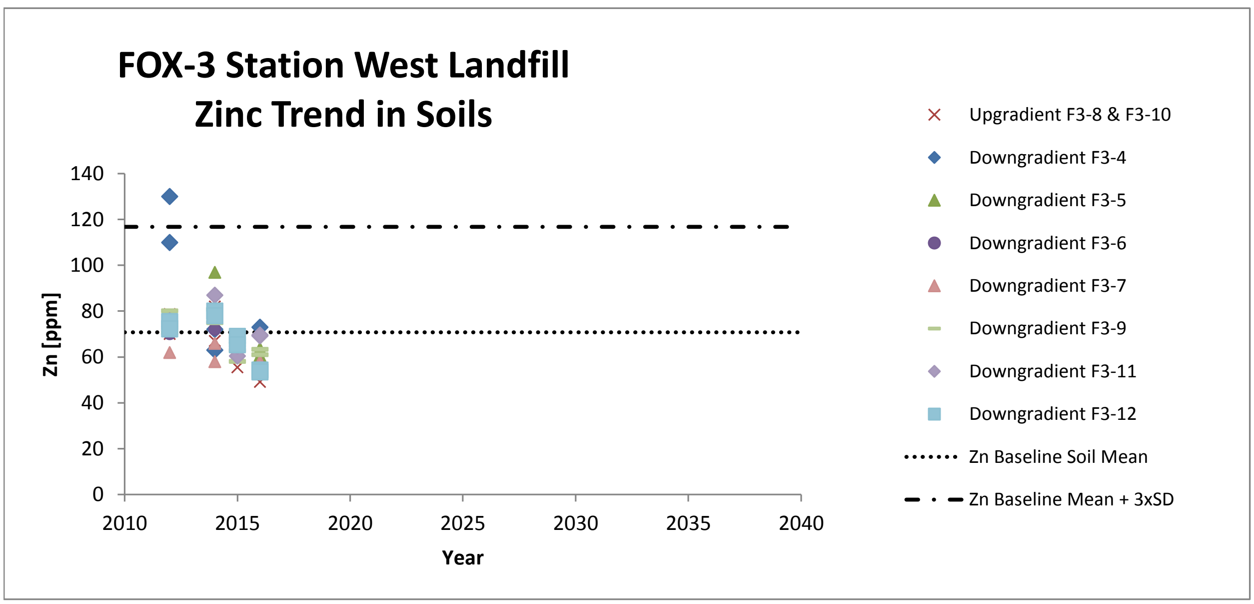




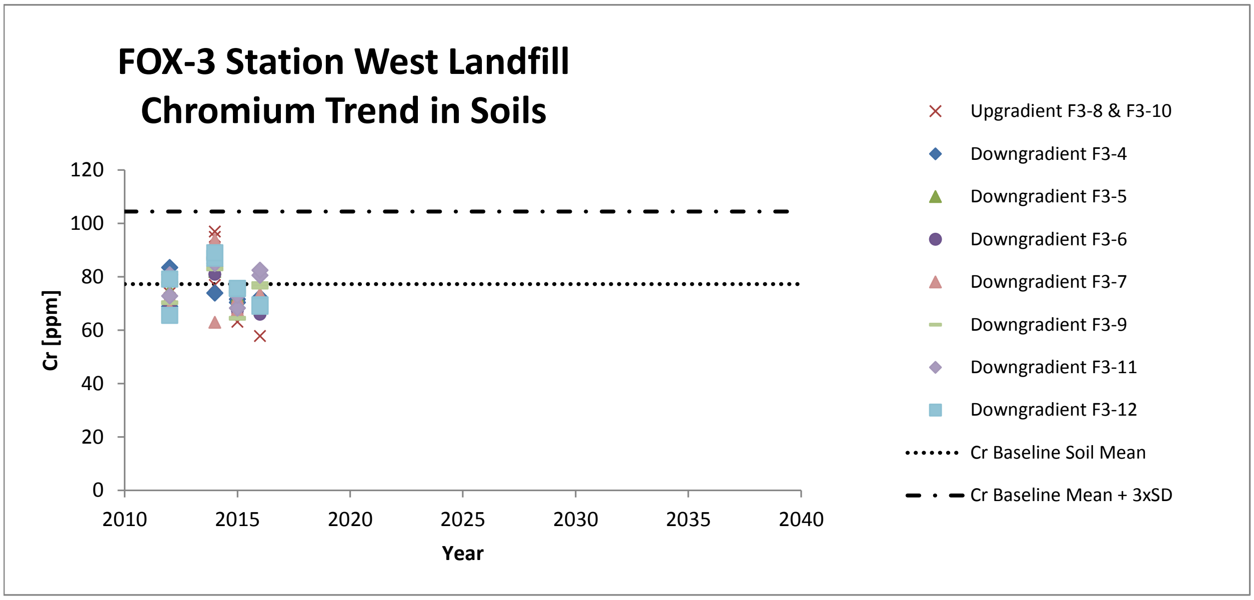
*Cd Baseline Arithmetic Mean is equal to the baseline detection limit.
*Cd Baseline SD = 0

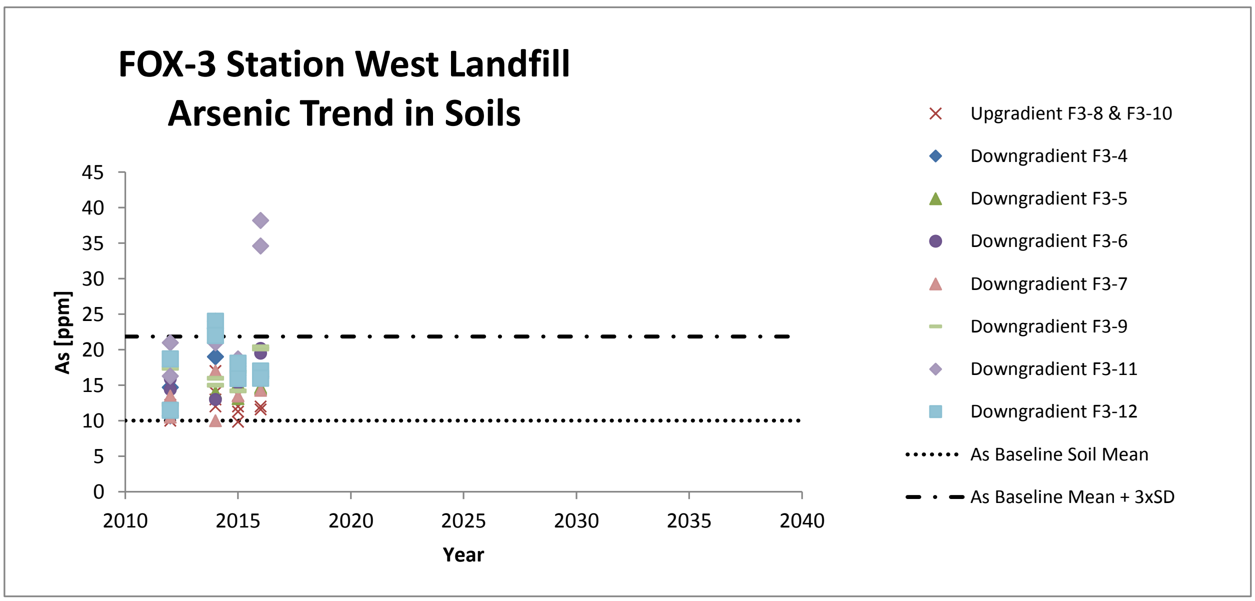
FOX-3 Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



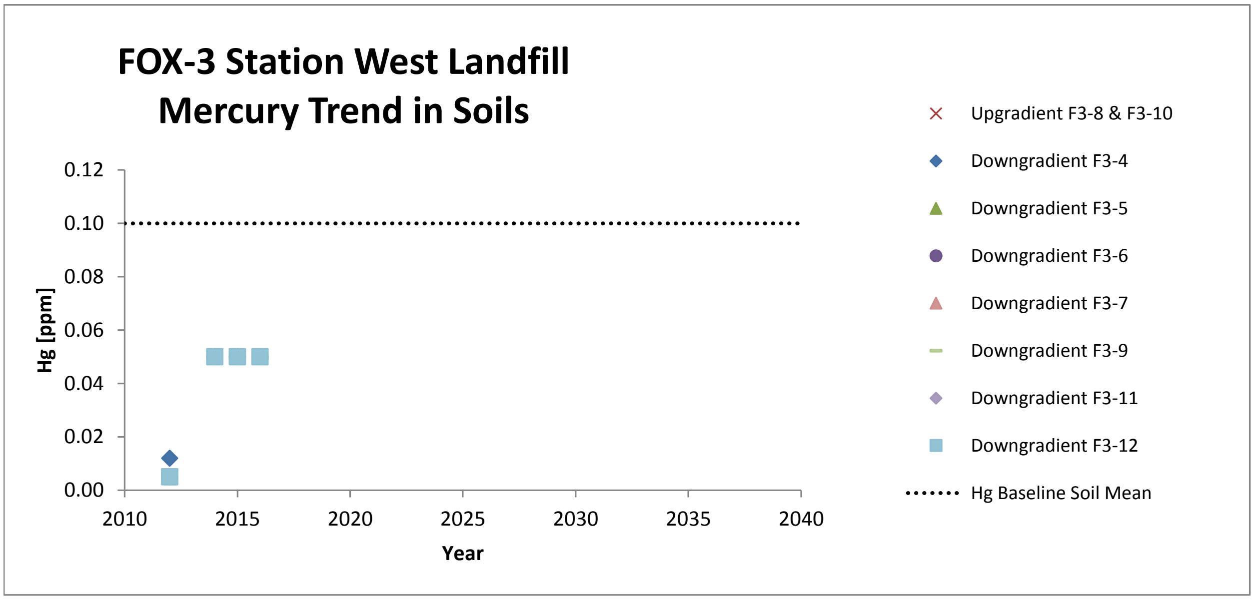


FOX-3 Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)

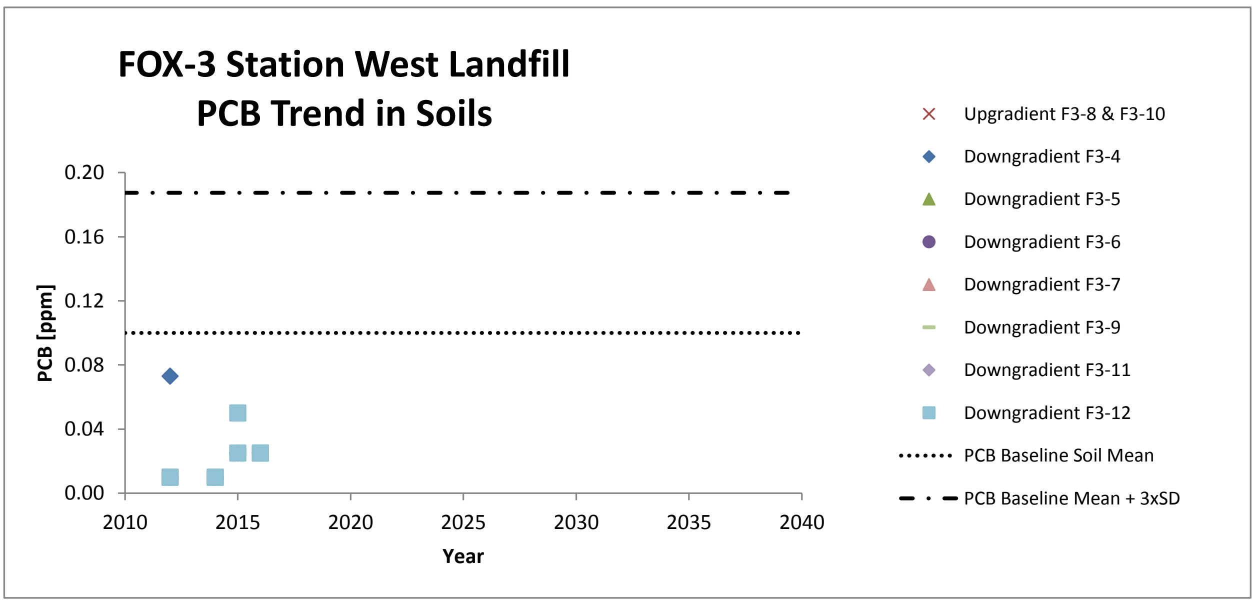




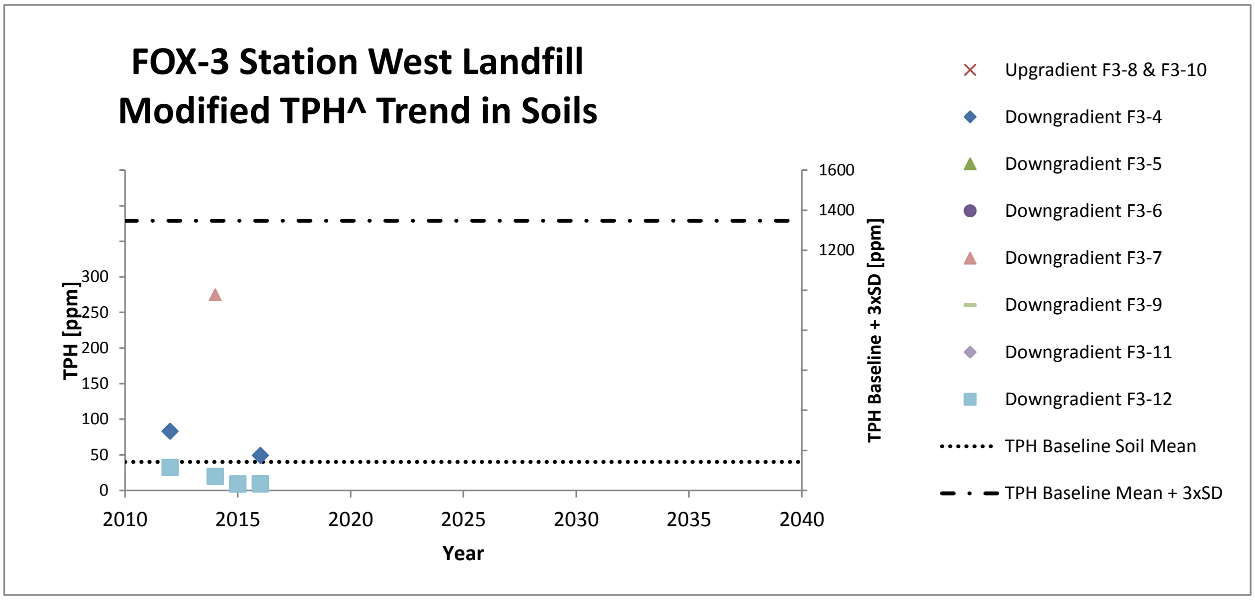
FOX-3 Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



*Hg Baseline Arithmetic Mean is equal to the baseline detection limit.
** Hg results below detection for all monitoring samples. Trendlines reflect changes in detection limit.



FOX-3 Station West Landfill Trends in Soil Inorganics, PCBs and PHCs (modified TPH)



APPENDIX D

Photograph Log

Visual Inspection Photographs

Thermistor Photographs

Monitoring Well Photographs

Soil Sampling Photographs

PHOTOS

Photo 1: FOX-3 – Non Hazardous Waste Landfill – North crest, facing east (ATT72_Photo72.jpg)

Photo 2: FOX-3 – Non Hazardous Waste Landfill – North slope and toe, facing west (ATT73_Photo73.jpg)

Photo 3: FOX-3 – Non Hazardous Waste Landfill – East crest, facing south (ATT74_Photo74.jpg)

Photo 4: FOX-3 – Non Hazardous Waste Landfill – Cover surface, facing west (ATT75_Photo75.jpg)

Photo 5: FOX-3 – Non Hazardous Waste Landfill – East slope, facing north (ATT76_Photo76.jpg)

Photo 6: FOX-3 – Non Hazardous Waste Landfill – South slope and toe, facing west (ATT77_Photo77.jpg)

Photo 7: FOX-3 – Non Hazardous Waste Landfill – South crest, facing west (ATT78_Photo78.jpg)

Photo 8: FOX-3 – Non Hazardous Waste Landfill – Cover surface, facing north (ATT79_Photo79.jpg)

Photo 9: FOX-3 – Non Hazardous Waste Landfill – West crest, facing north (ATT80_Photo80.jpg)

Photo 10: FOX-3 – Non Hazardous Waste Landfill – West slope and toe, facing north (ATT81_Photo81.jpg)

Photo 11: FOX-3 – Non Hazardous Waste Landfill – Cover surface, facing east (ATT82_Photo82.jpg)

Photo 12: FOX-3 – Non Hazardous Waste Landfill – Cover surface, facing north (ATT83_Photo83.jpg)

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Photo 13: FOX-3 – Non Hazardous Waste Landfill – Cover surface, facing north (ATT84_Photo84.jpg)

Photo 14: FOX-3 – Non Hazardous Waste Landfill – West crest, facing south (ATT85_Photo85.jpg)

Photo 15: FOX-3 – Non Hazardous Waste Landfill – West toe – no ponded water along toe (previous Feature H), facing north (ATT43_Photo43.jpg)

Photo 16: FOX-3 – Non Hazardous Waste Landfill – West slope – Feature I – Self-armouring erosion [Acceptable], facing south (ATT42_Photo42.jpg)

Photo 17: FOX-3 – Non Hazardous Waste Landfill – Northwest crest corner – Feature L – Small depressions [Acceptable], facing northwest (ATT33_Photo33.jpg)

Photo 18: FOX-3 – Non Hazardous Waste Landfill – Cover surface – Feature J – sparse grass vegetation along south crest [Acceptable], facing east (ATT41_Photo41.jpg)

Photo 19: FOX-3 – Non Hazardous Waste Landfill – Central crest surface – Feature M – Small depression [Acceptable], facing south (ATT44_Photo44.jpg)

Photo 20: FOX-3 – Non Hazardous Waste Landfill – North toe – Feature F – Ponded water along toe [Acceptable], facing west (ATT34_Photo34.jpg)

Photo 21: FOX-3 – Non Hazardous Waste Landfill – North slope – Feature C – self-armouring erosion [Acceptable], facing northeast (ATT35_Photo35.jpg)

Photo 22: FOX-3 – Non Hazardous Waste Landfill – East crest – Feature A – Small depressions [Acceptable], facing north (ATT39_Photo39.jpg)

Photo 23: FOX-3 – Non Hazardous Waste Landfill – Cover surface – Feature G – Small depressions [Acceptable], northwest (ATT40_Photo40.jpg)

Photo 24: FOX-3 – Non Hazardous Waste Landfill – East toe – Feature K – Ponded water running along toe [Acceptable], facing south (ATT38_Photo38.jpg)

Photo 25: FOX-3 – Non Hazardous Waste Landfill – North slope – Feature N – Tension crack extended along the north slope below which the area is wet but no signs of seepage, facing east (ATT36_Photo36.jpg)

Photo 26: FOX-3 – Non Hazardous Waste Landfill – North slope – Feature N – Tension crack extended along the north slope below which the area is wet but no signs of seepage, facing west (ATT37_Photo37.jpg)

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Photo 27: FOX-3 – Non Hazardous Waste Landfill – North crest – Feature O – Minor tension crack along the north crest, facing west (1 point) (ATT45_Photo45.jpg)

Photo 28: FOX-3 – Non Hazardous Waste Landfill – North crest – Feature O – Minor tension crack along the north crest, facing east (ATT46_Photo46.jpg)

Photo 29: FOX-3 – Non Hazardous Waste Landfill – Monitoring Well MW-06 (ATT99_Photo99.jpg)

Photo 30: FOX-3 – Non Hazardous Waste Landfill – Soil sampling before excavation at MW-06 (ATT100_Photo100.jpg)

Photo 31: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after excavation at MW-06 (ATT101_Photo101.jpg)

Photo 32: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after backfilling at MW-06 (ATT102_Photo102.jpg)

Photo 33: FOX-3 – Non Hazardous Waste Landfill – Soil sampling before excavation at MW-08 (ATT103_Photo103.jpg)

Photo 34: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after excavation at MW-08 (ATT104_Photo104.jpg)

Photo 35: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after backfilling at MW-08 (ATT105_Photo105.jpg)

Photo 36: FOX-3 – Non Hazardous Waste Landfill – Monitoring Well MW-08 (ATT106_Photo106.jpg)

Photo 37: FOX-3 – Non Hazardous Waste Landfill – Monitoring Well MW-07 (ATT107_Photo107.jpg)

Photo 38: FOX-3 – Non Hazardous Waste Landfill – Soil sampling before excavation at MW-07 (ATT108_Photo108.jpg)

Photo 39: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after excavation at MW-07 (ATT109_Photo109.jpg)

Photo 40: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after backfilling at MW-07 (ATT110_Photo110.jpg)

Photo 41: FOX-3 – Non Hazardous Waste Landfill – Soil sampling before excavation at MW-05 (ATT111_Photo111.jpg)

Photo 42: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after excavation at MW-05 (ATT112_Photo112.jpg)

Photo 43: FOX-3 – Non Hazardous Waste Landfill – Soil sampling after backfilling at MW-05 (ATT113_Photo113.jpg)

Photo 44: FOX-3 – Non Hazardous Waste Landfill – Monitoring Well MW-05 (ATT114_Photo114.jpg)

Photo 45: FOX-3 – Station West Landfill – East crest, facing northeast (ATT19_Photo19.jpg)

Photo 46: FOX-3 – Station West Landfill – West crest, facing north (ATT20_Photo20.jpg)

Photo 47: FOX-3 – Station West Landfill – West toe, facing northeast (ATT21_Photo21.jpg)

Photo 48: FOX-3 – Station West Landfill – West slope and toe, facing southwest (ATT22_Photo22.jpg)

Photo 49: FOX-3 – Station West Landfill – North west slope and toe, facing northeast (ATT23_Photo23.jpg)

Photo 50: FOX-3 – Station West Landfill – Northeast crest, facing southeast (ATT24_Photo24.jpg)

Photo 51: FOX-3 – Station West Landfill – Cover surface, facing south (ATT25_Photo25.jpg)

Photo 52: FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT26_Photo26.jpg)

Photo 53: FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT27_Photo27.jpg)

Photo 54: FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT28_Photo28.jpg)

Photo 55: FOX-3 – Station West Landfill – Southwest slope, facing southwest (ATT29_Photo29.jpg)

Photo 56: FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT30_Photo30.jpg)

Photo 57: FOX-3 – Station West Landfill – Southeast crest, facing northeast (ATT31_Photo31.jpg)

Photo 58: FOX-3 – Station West Landfill – Cover surface, facing northwest (ATT32_Photo32.jpg)

Photo 59: FOX-3 – Station West Landfill – Cover surface, facing west (ATT33_Photo33.jpg)

Photo 60: FOX-3 – Station West Landfill – Cover surface, facing southeast (ATT34_Photo34.jpg)

Photo 61: FOX-3 – Station West Landfill – Cover surface, facing east (ATT35_Photo35.jpg)

Photo 62: FOX-3 – Station West Landfill – Wet slope and toe, facing south (ATT36_Photo36.jpg)

Photo 63: FOX-3 – Station West Landfill – South slope and toe, facing east (ATT37_Photo37.jpg)

Photo 64: FOX-3 – Station West Landfill – Cover surface, facing northwest (ATT38_Photo38.jpg)

Photo 65: FOX-3 – Station West Landfill – Cover surface, facing west (ATT39_Photo39.jpg)

Photo 66: FOX-3 – Station West Landfill – Northwest slope, facing southwest (ATT40_Photo40.jpg)

Photo 67: FOX-3 – Station West Landfill – Northwest slope, facing northeast (ATT41_Photo41.jpg)

Photo 68: FOX-3 – Station West Landfill – Southwest slope, facing southeast (ATT42_Photo42.jpg)

Photo 69: FOX-3 – Station West Landfill – Cover surface, facing northeast (ATT43_Photo43.jpg)

Photo 70: FOX-3 – Station West Landfill – Southeast slope, facing northeast (ATT44_Photo44.jpg)

Photo 71: FOX-3 – Station West Landfill – Cover surface, facing north (ATT45_Photo45.jpg)

Photo 72: FOX-3 – Station West Landfill – Cover surface, facing west (ATT46_Photo46.jpg)

Photo 73: FOX-3 – Station West Landfill – Northeast slope, facing northwest (ATT47_Photo47.jpg)

Photo 74: FOX-3 – Station West Landfill – Cover surface, facing south (ATT48_Photo48.jpg)

Photo 75: FOX-3 – Station West Landfill – Cover surface, facing southwest (ATT49_Photo49.jpg)

Photo 76: FOX-3 – Station West Landfill – Lobe E2, west crest – previous minor settlement (previous Feature J), facing northeast (ATT22_Photo22.jpg)

Photo 77: FOX-3 – Station West Landfill – Lobe E2, cover surface – Feature Z – Sparse vegetation [Acceptable], facing northeast (ATT22_Photo22.jpg)

Photo 78: FOX-3 – Station West Landfill – Lobe E2, north toe – No ponded water along toe (previous Feature AA) [Acceptable], facing east (ATT21_Photo21.jpg)

Photo 79: FOX-3 – Station West Landfill – Lobe E2, northeast toe – Feature I – Geotextile [Acceptable], facing west (ATT20_Photo20.jpg)

Photo 80: FOX-3 – Station West Landfill – Lobe F, southwest slope – Feature M – Minor self-armouring erosion [Acceptable], facing southeast (ATT25_Photo25.jpg)

Photo 81: FOX-3 – Station West Landfill – Lobe F, south slope – Feature N – Minor black staining [Acceptable], facing north (ATT24_Photo24.jpg)

Photo 82: FOX-3 – Station West Landfill – Lobe F, north toe – No ponded water along toe (previous Feature AB) [Acceptable], facing southeast (ATT23_Photo23.jpg)

Photo 83: FOX-3 – Station West Landfill – Lobe F, southeast slope – Feature P – Minor self-armouring erosion [Acceptable], facing southeast (ATT26_Photo26.jpg)

Photo 84: FOX-3 – Station West Landfill – Lobe F, north crest surface – Feature K – shallow depression [Acceptable], facing southwest (ATT30_Photo30.jpg)

Photo 85: FOX-3 – Station West Landfill – Lobe F, east toe – No ponded water along toe (previous Feature AB) [Acceptable], facing northeast (ATT29_Photo29.jpg)

Photo 86: FOX-3 – Station West Landfill – Lobe F, cover surface – Feature Z – Moss and sparse grass [Acceptable], facing southwest (ATT31_Photo31.jpg)

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Photo 89: FOX-3 – Station West Landfill – Lobe A, central crest surface – Feature W – Shallow depressions [Acceptable], facing southeast (ATT11_Photo11.jpg)

Photo 90: FOX-3 – Station West Landfill – Lobe A, north crest surface – Feature E – Shallow depressions [Acceptable], facing south (ATT18_Photo18.jpg)

Photo 91: FOX-3 – Station West Landfill – Lobe A, east toe – No running water along toe (previous Feature X), facing northeast (ATT9_Photo9.jpg)

Photo 92: FOX-3 – Station West Landfill – Lobe A, north crest edge – Feature B – Red staining [Acceptable], facing northwest (ATT13_Photo13.jpg)

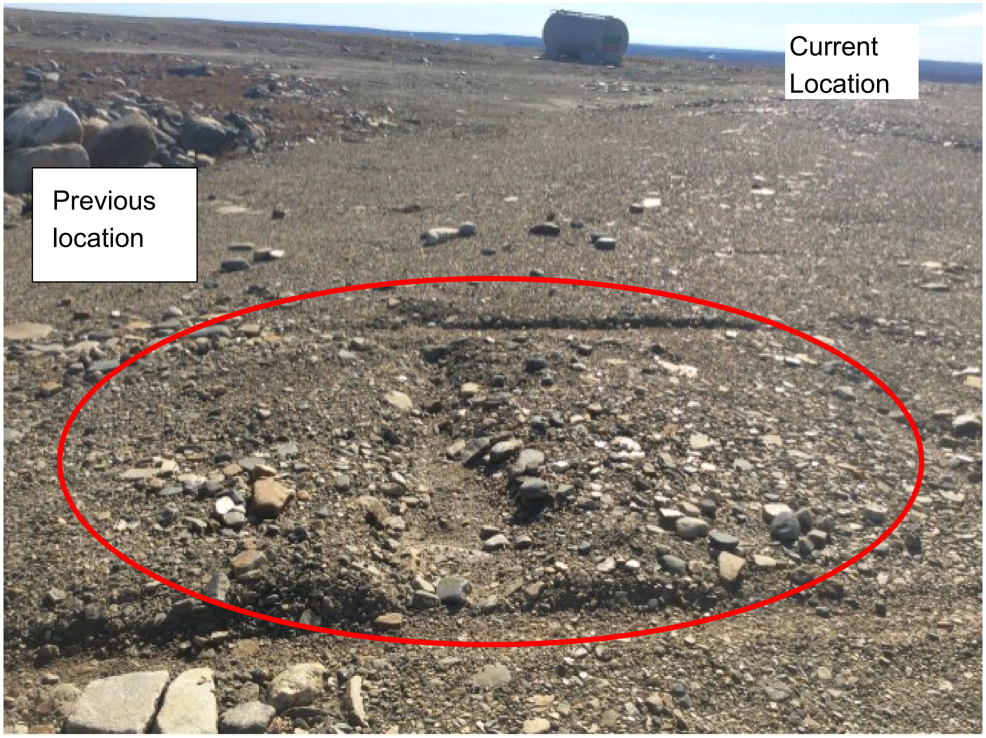

Photo 93: FOX-3 – Station West Landfill – Lobe A, the previous and current location of the fuel tank (Feature Y) [Acceptable], facing southwest (ATT15_Photo15.jpg)

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Photo 96: FOX-3 – Station West Landfill – Lobe A, Feature AC – Sparse vegetation, facing southeast (ATT14_Photo14.jpg)

Photo 97: FOX-3 – Station West Landfill – Lobe A, east crest and slope – Feature AD – Tire track on the cover surface and east slope, facing northwest (ATT16_Photo16.jpg)

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Photo 100: FOX-3 – Station West Landfill – Lobe F, Feature Z – Sparse vegetation covers the cover surface, facing northwest (ATT28_Photo28.jpg)

Photo 101: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-10 (ATT84_Photo84.jpg)

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Photo 103: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-10 (ATT86_Photo86.jpg)

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Photo 106: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-11 (ATT89_Photo89.jpg)

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Photo 108: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-12 (ATT91_Photo91.jpg)

Photo 109: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-12 (ATT92_Photo92.jpg)

Photo 110: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-9 (ATT93_Photo93.jpg)

Photo 111: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-9 (ATT94_Photo94.jpg)

Photo 112: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-9 (ATT95_Photo95.jpg)

Photo 113: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-8 (ATT96_Photo96.jpg)

Photo 114: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-8 (ATT97_Photo97.jpg)

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Photo 116: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-5 (ATT124_Photo124.jpg)

Photo 117: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-5 (ATT125_Photo125.jpg)

Photo 118: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-5 (ATT126_Photo126.jpg)

Photo 119: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-7 (ATT127_Photo127.jpg)

Photo 120: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-7 (ATT128_Photo128.jpg)

Photo 121: FOX-3 – Station West Landfill – Soil sampling after backfilling at F3-7 (ATT129_Photo129.jpg)

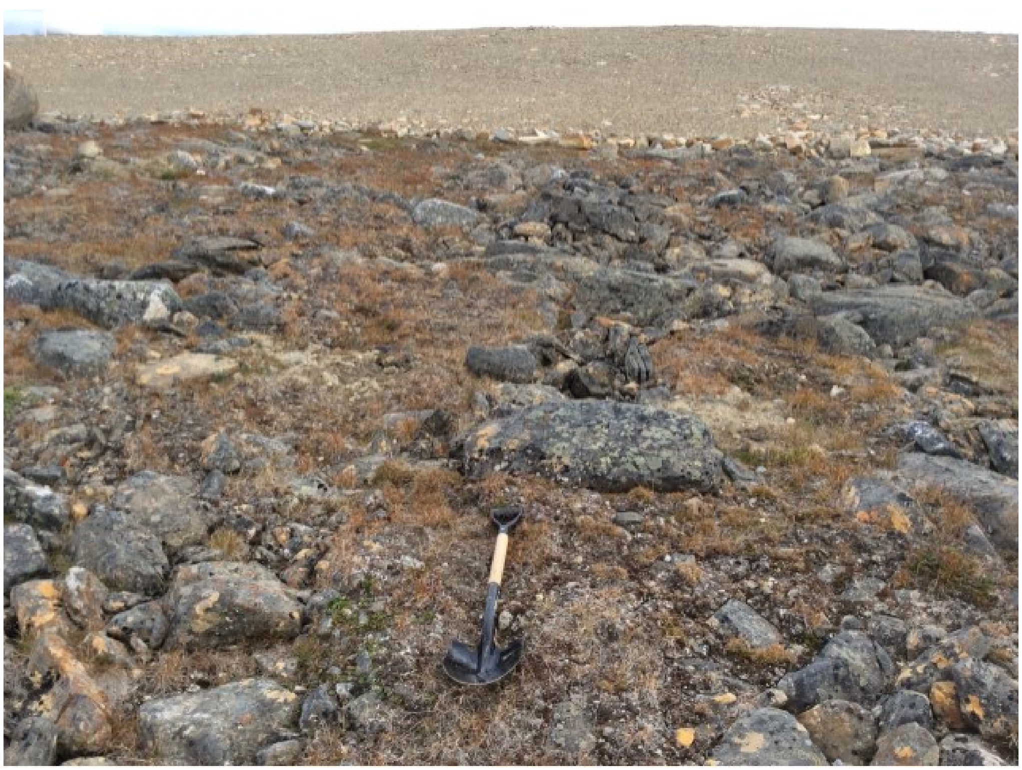

Photo 122: FOX-3 – Station West Landfill – Soil sampling before excavation at F3-6 (ATT130_Photo130.jpg)

Photo 123: FOX-3 – Station West Landfill – Soil sampling after excavation at F3-6 (ATT131_Photo131.jpg)

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Photo 129: FOX-3 – Tier II Disposal Facility – North slope and toe, facing east (ATT6_Photo6.jpg)

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Photo 133: FOX-3 – Tier II Disposal Facility – Cover surface, facing west (ATT10_Photo10.jpg)

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Photo 135: FOX-3 – Tier II Disposal Facility – East crest and slope, facing north (ATT12_Photo12.jpg)

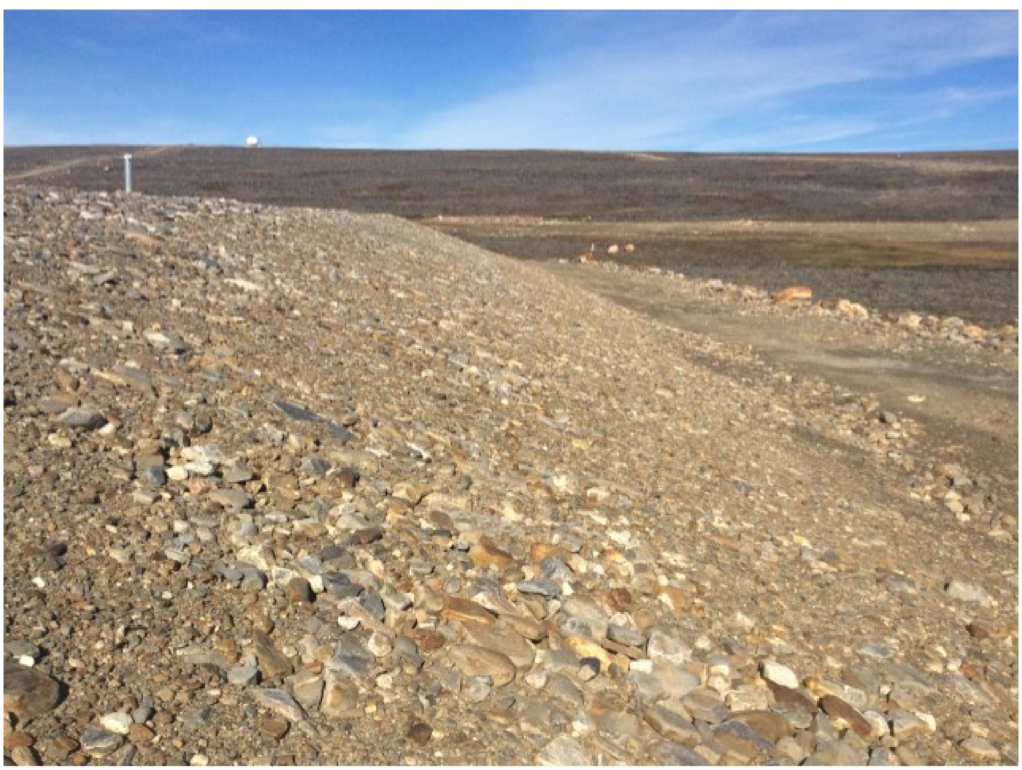

Photo 136: FOX-3 – Tier II Disposal Facility – East slope and toe, facing north (ATT13_Photo13.jpg)

Photo 137: FOX-3 – Tier II Disposal Facility – South slope and toe, facing west (ATT14_Photo14.jpg)

Photo 138: FOX-3 – Tier II Disposal Facility – Cover surface, facing north (ATT15_Photo15.jpg)

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Photo 141: FOX-3 – Tier II Disposal Facility – West slope, facing north (ATT18_Photo18.jpg)

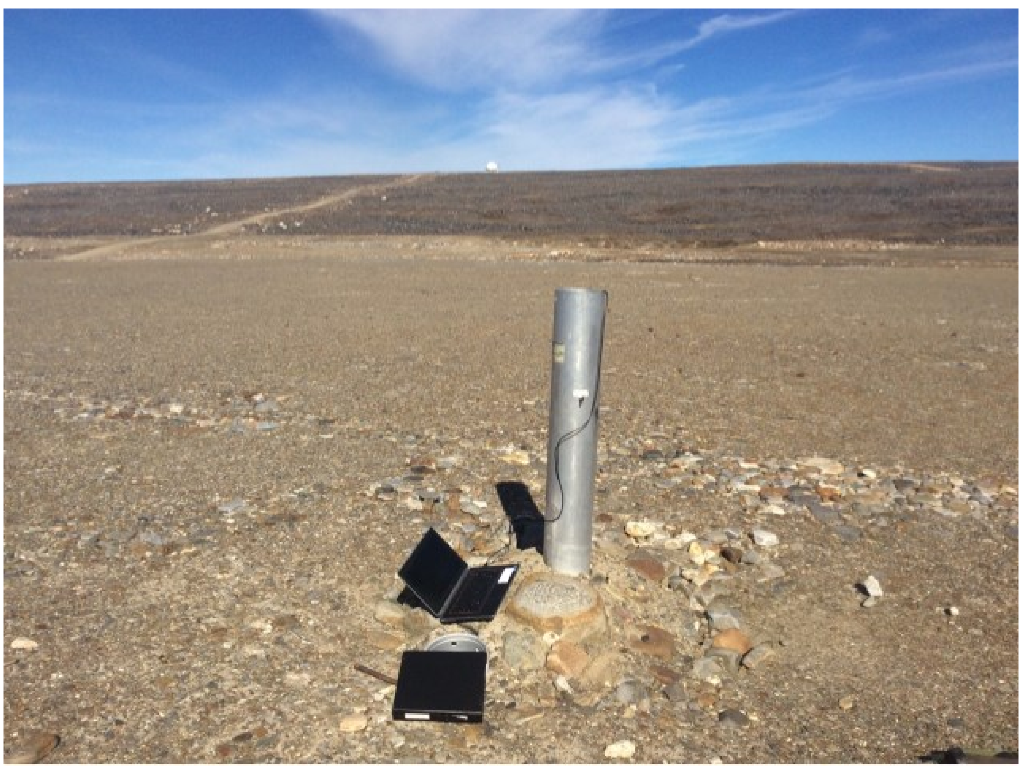

Photo 142: FOX-3 – Tier II Disposal Facility – VT-3, facing north (ATT1_Photo1.jpg)

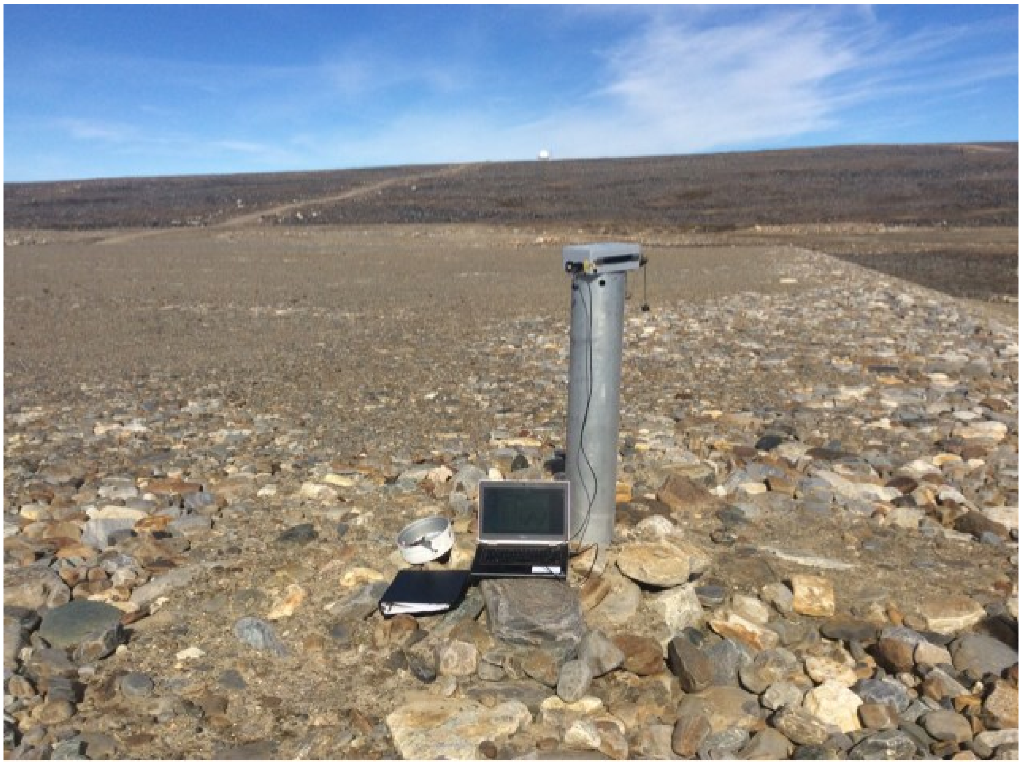

Photo 143: FOX-3 – Tier II Disposal Facility – VT-4, facing north (ATT2_Photo2.jpg)

Photo 144: FOX-3 – Tier II Disposal Facility – VT-2, facing north (ATT3_Photo3.jpg)

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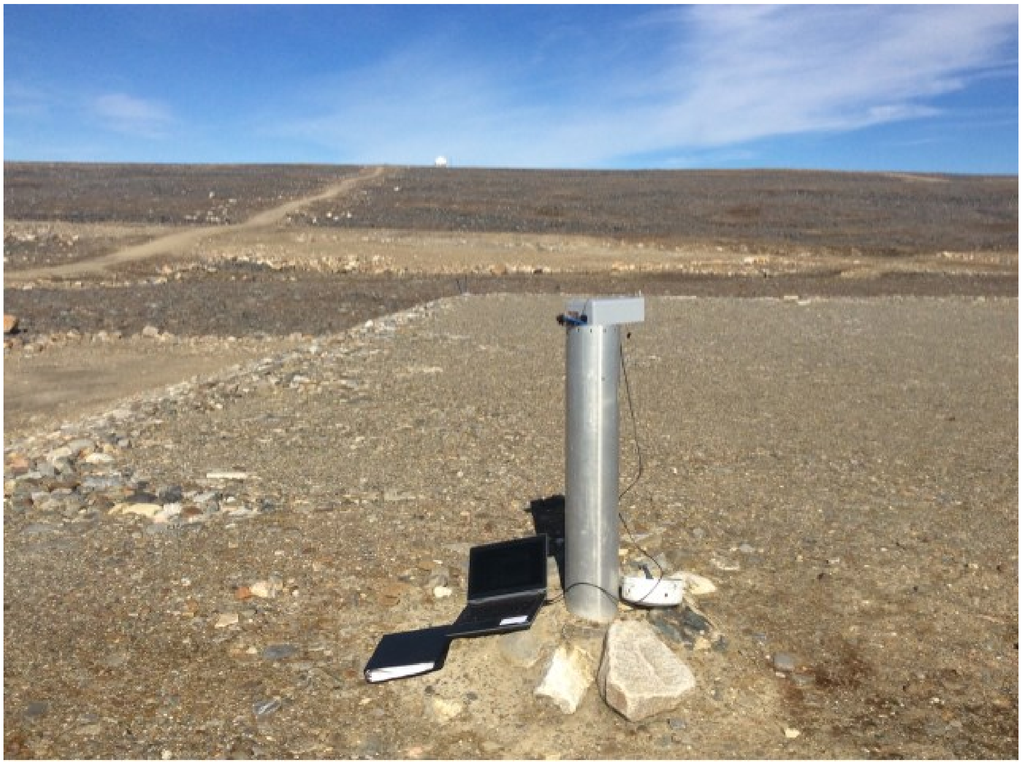

Photo 145: FOX-3 – Tier II Disposal Facility – VT-1, facing north (ATT4_Photo4.jpg)

Photo 146: FOX-3 – Tier II Disposal Facility – west toe – No ponded water along toe (previous Feature K), facing south (ATT2_Photo2.jpg)

Photo 147: FOX-3 – Tier II Disposal Facility – Central cover surface – Feature L – Some very sparse vegetation [Acceptable], facing east (ATT8_Photo8.jpg)

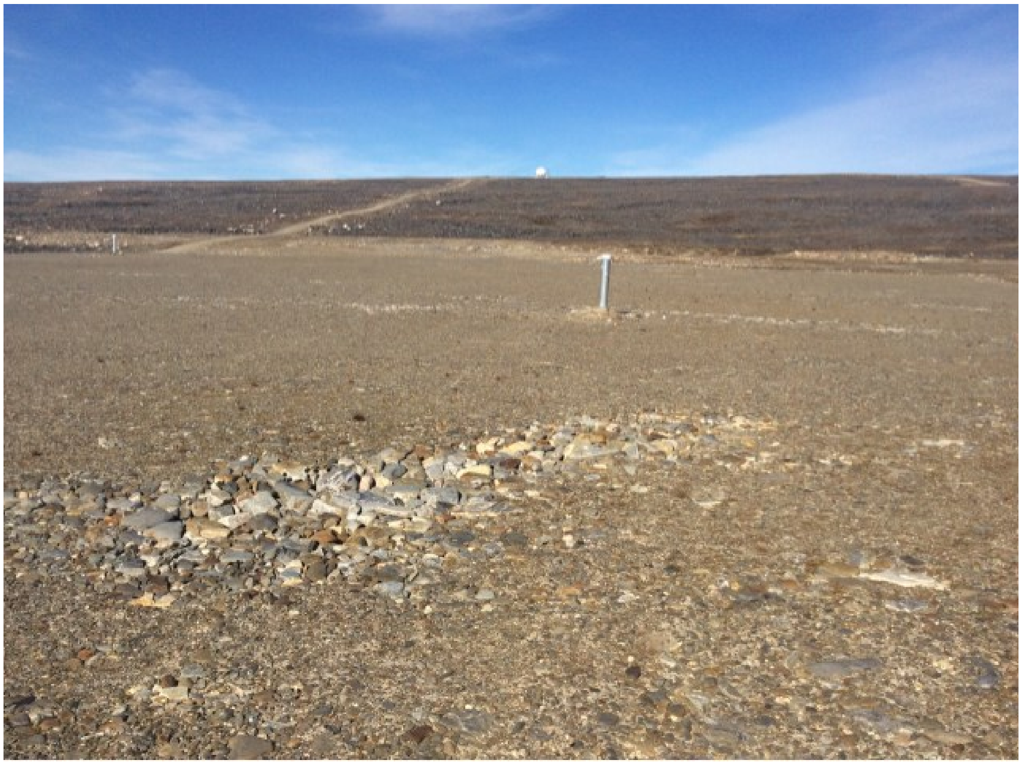

Photo 148: FOX-3 – Tier II Disposal Facility – Cover surface – Cobbles and boulders (previous Feature M- ponded water), no ponded water, facing north (ATT5_Photo5.jpg)

Photo 149: FOX-3 – Tier II Disposal Facility – Crest surface in southeast corner – (Previous Feature I- no ponded water- minor Depression), facing southeast (ATT4_Photo4.jpg)

Photo 150: FOX-3 – Tier II Disposal Facility – East crest – Feature N – minor settlement [Acceptable], facing northeast (ATT3_Photo3.jpg)

Photo 151: FOX-3 – Tier II Disposal Facility – Cover surface, Feature D – Staining, facing west (ATT6_Photo6.jpg)

Photo 152: FOX-3 – Tier II Disposal Facility – Cover surface, Feature F– Staining, facing west (ATT7_Photo7.jpg)

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Photo 162: FOX-3 – Tier II Disposal Facility – Soil sampling before excavation at MW-01 (ATT77_Photo77.jpg)

Photo 163: FOX-3 – Tier II Disposal Facility – Soil sampling after excavation at MW-01 (ATT78_Photo78.jpg)

Photo 164: FOX-3 – Tier II Disposal Facility – Soil sampling after backfilling at MW-01 (ATT79_Photo79.jpg)

Photo 165: FOX-3 – Tier II Disposal Facility – Monitoring Well MW-04 (ATT80_Photo80.jpg)

Photo 166: FOX-3 – Tier II Disposal Facility – Soil sampling before excavation at W-04 (ATT81_Photo81.jpg)

Photo 167: FOX-3 – Tier II Disposal Facility – Soil sampling after excavation at MW-04 (ATT82_Photo82.jpg)

Photo 168: FOX-3 – Tier II Disposal Facility – Soil sampling after backfilling at MW-04 (ATT83_Photo83.jpg)

Photo 169: FOX-3 – West Landfill – Feature D – ponded water at the north toe, facing east (ATT86_Photo86.jpg)

Photo 170: FOX-3 – West Landfill – South crest, facing east (ATT87_Photo87.jpg)

Photo 171: FOX-3 – West Landfill – West crest, facing north (ATT88_Photo88.jpg)

Photo 172: FOX-3 – West Landfill – Cover surface, facing southeast (ATT89_Photo89.jpg)

Photo 173: FOX-3 – West Landfill – North slope, facing east (ATT90_Photo90.jpg)

Photo 174: FOX-3 – West Landfill – North slope, facing northwest (ATT91_Photo91.jpg)

Photo 175: FOX-3 – West Landfill – Cover surface, facing northwest (ATT92_Photo92.jpg)

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Photo 178: FOX-3 – West Landfill – Cover surface, facing northwest (ATT95_Photo95.jpg)

Photo 179: FOX-3 – West Landfill – North slope, facing southeast (ATT96_Photo96.jpg)

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Photo 182: FOX-3 – West Landfill – Drainage channel along the north toe with no water, previously observed with running water (Feature D), facing southeast [Acceptable] (ATT58_Photo58.jpg)

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Photo 188: FOX-3 – West Landfill – Cover surface – Feature A – Minor settlement and rough area [Acceptable], facing northeast (ATT52_Photo52.jpg)

Photo 189: FOX-3 – West Landfill – North slope – Feature H – minor self-armouring erosion [Acceptable], facing northeast (ATT51_Photo51.jpg)

Photo 190: FOX-3 – West Landfill – Cover surface – Feature B – Minor settlement with no ponded water. [Acceptable], facing northeast (ATT53_Photo53.jpg)

Photo 191: FOX-3 – West Landfill – North slope – Feature F – Minor settlement [Acceptable], facing north (ATT50_Photo50.jpg)

Photo 192: FOX-3 – West Landfill – North toe, east end – Rough area at the north toe previously observed running water (Feature D) [Acceptable], facing northwest (ATT47_Photo47.jpg)

Photo 193: FOX-3 – West Landfill – Soil sampling before excavation at F3-2 (ATT115_Photo115.jpg)

Photo 194: FOX-3 – West Landfill – Soil sampling after excavation at F3-2 (ATT116_Photo116.jpg)

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Photo 196: FOX-3 – West Landfill – Soil sampling before excavation at F3-1 (ATT118_Photo118.jpg)

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Photo 198: FOX-3 – West Landfill – Soil sampling after backfilling at F3-1 (ATT120_Photo120.jpg)

Photo 199: FOX-3 – West Landfill – Soil sampling before excavation at F3-3 (ATT121_Photo121.jpg)

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APPENDIX E

2016 FOX-3 Thermokast Regrade Visual Inspection Report

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1.0 BACKGROUND

The 2006 site investigation at FOX-3 identified a large thermokarst pond located on the east side of the airstrip along the Macbeth River ("Thermokarst Area"). An historical air photo review indicated that the pond was the result of significant borrow material extraction from the glaciofluvial terrace alongside the river and the resulting disruption of drainage courses that directed surface water from the uplands to the river. Ground disturbance from borrow activity impeded the outflow of the drainage courses to the river, resulting in ponding of water and, through permafrost degradation, development of a thermokarst pond. Over time, the pond grew in size, causing instability of the surrounding terrain. It was anticipated that pond size progression would continue and would accelerate over time as the thermal effects increased with pond size.

If the thermokarst pond continued to increase in size as anticipated, there was potential for nearby landfill lobes to the west and north of the pond, as well as the airstrip, to be negatively impacted. As a result, a remediation design was developed to stabilize and prevent further expansion of the thermokarst pond. The design consisted of backfilling the existing pond area with granular fill to an elevation above the average peak flow water level of the Macbeth River channel and establishing a direct outflow from the remediated pond area to the river channel to provide unrestricted flow of surface water and allow it to discharge to the river. The design of the finished graded surface incorporated a drainage gradient sloping towards the outflow area to prevent ponding.

On the basis of more detailed survey data obtained during remediation, the remedial design was revised to increase the elevation and gradient of the final remediated surface. The pond area was backfilled with Type 3 granular fill to a final surface elevation approximately 1 m above the estimated average peak flow level of the river and was graded with a cross-sectional gradient of 3% and longitudinal discharge gradient of 1.5%. The Type 3 granular fill used to backfill the pond was excavated from the side slopes of the pond. Attempts to dewater the pond before beginning granular fill placement were not successful. Remediation of the pond area began in August 2010 and was completed in September 2011.

In 2012, the DEW Line Clean-up (DLCU) first-year monitoring program at FOX-3 identified settlement areas and cracking in the Thermokarst Area, with the potential for continued deterioration. In 2013, a DLCU Quality Assurance Maintenance Program completed remedial works to place granular fill within the settlement areas in the northwest and southwest portions of the Thermokarst Area; cracks in the northwest portion of the area were backbladed. The goal of the 2013 maintenance program was to prevent further degradation of the underlying permafrost and mitigate further slope movement.

Golder Associates Ltd. carried out a visual inspection of the Thermokarst Area on August 17, 2015 as part of the QIKIQ15 contract to assess and document the condition of the 2013 maintenance program. Based on the 2015 visual inspection, which identified settlement, tension cracks and ponded water on the northwest side of the area and cracks on the northeast side, it appeared that potential ongoing settlement and cracking could occur, resulting in additional slope instability at the north end of the Thermokarst Area. Evaluation of the 2013 remedial work areas and the 2015 visual inspection results indicated that it may not be possible to mitigate ongoing degradation (i.e., thaw) of the underlying permafrost by placing and grading additional granular fill over the settlement areas. The thawing of permafrost and related settlement may be related to subsurface groundwater flow and the adjacent river. Therefore, it is considered likely that potential further settlement and slope movement could continue even if additional granular fill is placed in this area. It was also noted that additional settlement and slope movement in the Thermokarst Area is not expected to impact the airstrip because of the distance of the airstrip from the Thermokarst Area. However, ongoing inspection of landfills located in closer proximity to the Thermokarst Area settlement depression and tension cracks (i.e., Airstrip Landfill Lobes M, L, I) was recommended in order to evaluate whether or not their stability might be at risk, possibly requiring relocation in the future.

Golder (2015) recommended that ongoing DLCU monitoring at FOX-3 should include the Thermokarst Area and nearby Airstrip Landfill (Lobes M, L and I) to ensure the integrity of these landfills is not impacted from ongoing settlement in the Thermokarst Area.

The 2016 visual inspection of the Thermokarst Area and Airstrip Landfill (Lobes M, L, I) was carried out on August 17, 2016.

2.0 SUMMARY OF ANY SCOPE DEVIATIONS

The field work was conducted as per the TOR. The 2016 visual inspection of the Thermokarst Area as well as the nearby Airstrip Landfill (Lobes M, L, I) was not part of the original QIKIQ15 contract scope of work and was therefore carried out in accordance with Change Order #1.

3.0 VISUAL INSPECTION RESULTS

3.1 Thermokarst Area

No notable increase in thaw settlement, cracking or ponding appears to have occurred since the last inspection in 2015. The 2016 visual inspection covered the same area as the 2015 visual inspection. The northwest end of the Thermokarst Area was observed to have several large tension cracks around the perimeter of a large thaw settlement feature with ponded water in the lowest part of the settlement depression, as shown on Figure E-1. Table E-1 presents a summary of observed visual inspection features and Table E-2 presents the Preliminary Stability Assessment results. Table E-3 is a log of photographs taken during the 2016 visual inspection.

An area of settlement (Feature A), approximately 70 m long and 15 m wide, oriented southwest to northeast, is located in the northwest corner of the Thermokarst Area, as shown on Figure E-1. This settlement area (Feature A) is located in the vicinity of former settlement areas that were regraded during the 2013 QA maintenance program. Several large tension cracks (Features B and D), each approximately 10-80 m in length, were observed around the perimeter of the settlement area and indicate ongoing settlement and slope movement and a potential for future slope failure. Ponded water was present in the lowest part of the settlement depression (Feature C). At the southwest end of the thaw settlement area (Feature A) there is ponded water (Feature C – Photo E1) that is likely contributing to permafrost thaw and related settlement. However, the water level in Feature C was observed to be lower in 2016 compared to 2015. The second ponded water area observed in 2015 was not observed (i.e., dry) in 2016. Additional tension cracks (Features E and F), approximately 5-20 m in length, were observed on the northeast slopes of the Thermokarst Area; these are located in the approximate vicinity of former cracks that were back-bladed during the 2013 QA maintenance program. However, a settlement depression has not been observed with historic and recently observed cracking in this area (Features E and F) which indicates that the cracking is likely related to gradual slope creep (i.e., rather than slope movement as a result of settlement at the base of the slope). Some of the cracking was observed to be weathered (Feature F) indicating that slope movement and crack development is not active or slowing down. Photos E1 to E28 illustrate the thaw settlement, ponded water and tension cracks observed in the Thermokarst Area during the 2016 inspection. No other large or obvious settlement features were observed in the Thermokarst Area.

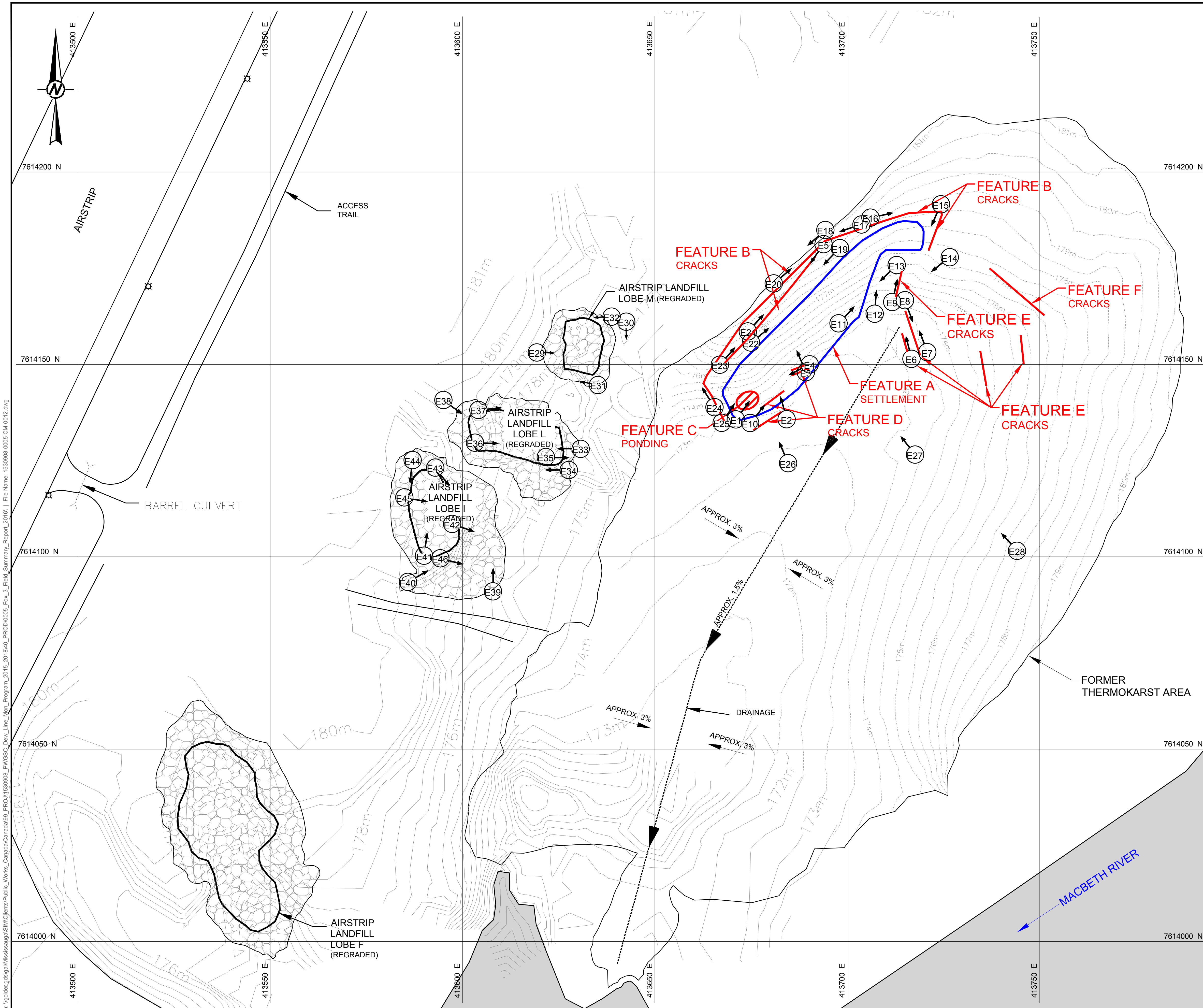
The Thermokarst Area was assessed to have a “Significant” overall performance rating because of “Numerous” cracks extending around the perimeter of the observed thaw settlement area. The size and frequency of the tension cracks indicate that the slopes around the thaw settlement area (Feature A) are unstable and are at risk of sloughing into the depression at some point in the future. However, the results of the 2016 visual inspection did not note any significant deterioration since the 2015 inspection, which could indicate that the rate of thaw settlement has potentially slowed down.

3.2 Airstrip Landfill (Lobes M, L, I)

The Airstrip Landfill – Lobes M, L, I are located at the FOX-3 DEW Line Site to the west of the Thermokarst Area adjacent to the airstrip and the Macbeth River. These three individual lobes (i.e., M, L and I) of the Airstrip Landfill extend over an area of approximately 2,500 m^2 (including side slopes). The area where these three lobes are located is gently sloping away from the airstrip, from an elevation of 180 masl immediately northwest of lobes, to an elevation of 176 masl southeast of lobes. Lobe M is the closest landfill to the Thermokarst Area, located approximately 25 m to the northwest. Photos E29 through E46 illustrate the observed conditions of the Airstrip Landfill (Lobes M, L, I) during the 2016 visual inspection.

No notable thaw settlement, erosion or cracking was observed at these landfills during the 2016 inspection. Some rough areas were observed on the cover surface of all lobes, which are not considered significant features. Some sparse vegetation was observed along the north and east toes of Lobe M outside of the landfill (Photo E30 and E32). Table E-4 presents a summary of observed visual inspection features and Table E-5 presents the Preliminary Stability Assessment results. Table E-6 is a log of photographs taken during the 2016 visual inspection.

The Airstrip Landfill (Lobes M, L, I) was assessed to have an “Acceptable” overall performance rating with no significant features identified.



LEGEND

- PHOTOGRAPH VIEWPOINT LOCATION
- SETTLEMENT (NTS)
- PONDING (NTS)
- CRACKS (NTS)
- TYPE 1 GRANULAR

NOTE

GRID PROJECTION IS NAD83 ZONE 19N. ELEVATIONS ARE GEODETIC.

REFERENCES

BASEMAPPING PROVIDED BY BIOGENIE, A DIVISION OF ENGLOBE CORPORATION, PROJECT NO.CD2655_400_403, DATED JUNE 2015.

CONTOURING IN AREA OF REGRADED THERMOKARST PROVIDED BY DEPARTMENT OF NATIONAL DEFENCE, DRAWING NO. H-D67/1-9101-112, DATED 2007-08-24

0 25 50

1:1,000 METRES

CLIENT
DEPARTMENT OF NATIONAL DEFENCE CANADA

PROJECT
2016 FOX-3 MONITORING REPORT

TITLE
THERMOKARST AREA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-09-15
DESIGNED	RM
PREPARED	TDR
REVIEWED	DCJ
APPROVED	DP

PROJECT NO.	PHASE	REV.	FIGURE
1530908	2000	A	E-1

Table E-1: Visual Inspection Checklist – Thermokarst Area

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: Thermokarst Area
DATE OF INSPECTION: August 17, 2016
DATE OF PREVIOUS INSPECTION: August 17, 2015
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 2
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table E-1: Visual Inspection Checklist – Thermokarst Area

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Description	Photos
Settlement	Y	A	Northwest side of regraded thermokarst area	413705	7614162	70	15	3	Deep thaw settlement with ponded water at lowest point	E11, E12, E13, E14, E15, E19, E22, E26, E27, E28
Erosion	N									
Lateral Movement	N									
Frost Action	N									
Sloughing	N									
Cracking	Y	B	Top of northwest slope around settlement area	413721	7614179	100	0.1	0.3	Upper tension crack that extends around depression	E15, E16, E17, E18, E20, , E24
		B	Northwest slope immediately above settlement area	413667	7614150	40	0.05-0.1	0.1	Lower secondary tension crack	E5, E21, E23
		D	Southwest end of settlement area	413687	7614140	30	0.01-0.05	0.03-0.1	Set of tension cracks	E2, E3, E4
		E	Southeast of settlement area	413733	7614147	40	0.03-0.05	0.03-0.1	Sets of tension cracks	E6, E7, E8, E9
		F	East of settlement area	413746	7614172	20	0.05	0.1	Weathered tension crack	
Lateral Movement	N									
Animal Burrows	N									
Vegetation	N									
Staining	N									
Animal Burrows	N									

Table E-1: Visual Inspection Checklist – Thermokarst Area

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Description	Photos
Vegetation Stress	N									
Seepage or Ponded Water	Y	C	Low point of thermokarst settlement area	413670	7614132	5	0.7-1.5	0.4	Ponded water (less water in 2016 than in 2015)	E1, E10
Debris and/or Liner Exposed	N									
Presence / Condition of Monitoring Instruments	N									
Features of Note / Other Observations	N									

Table E-2: Preliminary Stability Assessment – Thermokarst Area

Feature	Severity Rating	Extent
Settlement	Significant	Isolated
Erosion	Not observed	-
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Significant	Numerous
Animal Burrows	Not observed	-
Vegetation establishment	Not observed	-
Staining	Not observed	-
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Marginal	Isolated
Debris and/or liner exposure	Not observed	-
Other	Not observed	-
Overall Performance	**Significant**	

Table E-3: Summary Table of Photographic Log – Thermokarst Area

Photo Number	Caption	Easting	Northing	Date
E1	FOX-3 – Thermokarst Area – Feature C – Ponded water in low point of thermokarst settlement area, facing northeast (ATT59_Photo59.jpg)	413671.0	7614135.7	17 Aug 2016
E2	FOX-3 – Thermokarst Area – Feature D – Crack along the ponding area, facing northwest (ATT60_Photo60.jpg)	413684.3	7614135.8	17 Aug 2016
E3	FOX-3 – Thermokarst Area – Area of ponded water observed in 2015 (Feature C not shown on Figure E 1). No water in 2016, facing northwest (ATT61_Photo61.jpg)	413689.2	7614148.0	17 Aug 2016
E4	FOX-3 – Thermokarst Area – Feature D – Cracking, facing southwest (ATT62_Photo62.jpg)	413690.3	7614150.0	17 Aug 2016
E5	FOX-3 – Thermokarst Area – Feature B – Cracking along the edge of settlement – Looking south (ATT63_Photo63.jpg)	413693.9	7614181.3	17 Aug 2016
E6	FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing northwest (ATT64_Photo64.jpg)	413716.7	7614151.4	17 Aug 2016

Table E-3: Summary Table of Photographic Log – Thermokarst Area

E7	FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing northwest (ATT65_Photo65.jpg)	413720.8	7614153.2	17 Aug 2016
E8	FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing southeast (ATT66_Photo66.jpg)	413715.0	7614166.7	17 Aug 2016
E9	FOX-3 – Thermokarst Area – Feature E – Cracking extended along the edge of settlement, facing north (ATT67_Photo67.jpg)	413712.7	7614166.5	17 Aug 2016
E10	FOX-3 – Thermokarst Area – Feature C – Ponded water in low point of thermokarst settlement area, facing northeast (ATT98_Photo98.jpg)	413674.2	7614133.9	17 Aug 2016
E11	FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A), facing northeast (ATT99_Photo99.jpg)	413697.8	7614160.7	17 Aug 2016
E12	FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A), facing north (ATT100_Photo100.jpg)	413707.1	7614163.2	17 Aug 2016
E13	FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A) facing southwest (ATT101_Photo101.jpg)	413712.9	7614175.8	17 Aug 2016
E14	FOX-3 – Thermokarst Area – Settlement area overview, facing southwest (ATT102_Photo102.jpg)	413726.6	7614177.9	17 Aug 2016
E15	FOX-3 – Thermokarst Area –Settlement area (Feature A), facing southwest (ATT103_Photo103.jpg)	413723.1	7614195.2	17 Aug 2016
E16	FOX-3 – Thermokarst Area – Settlement area (Feature A), facing northeast (ATT104_Photo104.jpg)	413704.0	7614187.1	17 Aug 2016
E17	FOX-3 – Thermokarst Area – Top of upper tension crack (Feature B), facing southwest (ATT105_Photo105.jpg)	413703.7	7614186.4	17 Aug 2016
E18	FOX-3 – Thermokarst Area – Top of upper tension crack (Feature B), facing southwest (ATT106_Photo106.jpg)	413694.8	7614183.4	17 Aug 2016
E19	FOX-3 – Thermokarst Area – Perimeter of thaw settlement (Feature A), facing southwest (ATT107_Photo107.jpg)	413698.1	7614180.2	17 Aug 2016
E20	FOX-3 – Thermokarst Area – Top of tension crack (Feature B), facing northeast (ATT108_Photo108.jpg)	413680.9	7614171.1	17 Aug 2016
E21	FOX-3 – Thermokarst Area – Top of tension crack (Feature B), facing northeast (ATT109_Photo109.jpg)	413674.2	7614158.6	17 Aug 2016
E22	FOX-3 – Thermokarst Area – Perimeter of thaw settlement (Feature A), facing northeast (ATT110_Photo110.jpg)	413675.0	7614155.7	17 Aug 2016
E23	FOX-3 – Thermokarst Area – Extended tension crack (Feature B), facing northeast (ATT111_Photo111.jpg)	413666.9	7614149.9	17 Aug 2016

Table E-3: Summary Table of Photographic Log – Thermokarst Area

E24	FOX-3 – Thermokarst Area – Extension of tension crack (Feature B), facing northwest (ATT112_Photo112.jpg)	413665.5	7614138.9	17 Aug 2016
E25	FOX-3 – Thermokarst Area – Perimeter of thaw settlement, facing northeast (ATT113_Photo113.jpg)	413669.2	7614134.2	17 Aug 2016
E26	FOX-3 – Thermokarst Area – Overview, facing northwest (ATT114_Photo114.jpg)	413684.6	7614124.3	17 Aug 2016
E27	FOX-3 – Thermokarst Area – Overview, facing northwest (ATT115_Photo115.jpg)	413717.6	7614126.6	17 Aug 2016
E28	FOX-3 – Thermokarst Area – Overview, facing northwest (ATT116_Photo116.jpg)	413744.2	7614101.6	17 Aug 2016

Table E-4: Visual Inspection Checklist – Airstrip Landfill – Lobes M, L, I

SITE NAME: FOX-3 Dewar Lakes
LANDFILL DESIGNATION: Airstrip Landfill – Lobes M, L, I
DATE OF INSPECTION: August 17, 2016
DATE OF PREVIOUS INSPECTION: N/A
INSPECTED BY: Reza Moghaddam
REPORT PREPARED BY: Reza Moghaddam
MONITORING EVENT NUMBER: 1
The inspector/reporter represents to the best of his/her knowledge that the following statements and observations are true and correct and to the best of the preparer's actual knowledge, no material facts have been suppressed or misstated.

Table E-4: Visual Inspection Checklist – Airstrip Landfill – Lobes M, L, I

Checklist Item	Present (Y/N)	Feature ID (A, B, etc.)	Location Description	Easting	Northing	Length (m)	Width (m)	Depth (m)	Description	Photos
Settlement	N									
Erosion	N									
Lateral Movement	N									
Frost Action	N									
Sloughing	N									
Cracking	N									
Lateral Movement	N									
Animal Burrows	N									
Vegetation	N									
Staining	N									
Animal Burrows	N									
Vegetation Stress	N									
Seepage or Ponded Water	N									
Debris and/or Liner Exposed	N									
Presence / Condition of Monitoring Instruments	N									
Features of Note / Other Observations	N									

Table E-5: Preliminary Stability Assessment – Airstrip Landfill (Lobes M, L, I)

Feature	Severity Rating	Extent
Settlement	Not observed	-
Erosion	Not observed	-
Lateral Movement	Not observed	-
Frost Action	Not observed	-
Sloughing	Not observed	-
Cracking	Not observed	-
Animal Burrows	Not observed	-
Vegetation establishment	Not observed	-
Staining	Not observed	-
Vegetation Stress	Not observed	-
Seepage/Ponded Water	Not observed	-
Debris and/or liner exposure	Not observed	-
Other	Not observed	-
Overall Performance	**Acceptable**	

Table E-6: Summary Table of Photographic Log – Airstrip Landfill (Lobes M, L, I)

Photo Number	Caption	Easting	Northing	Date
E29	FOX-3 – Airstrip Landfill (Lobe M) – cover surface facing east (ATT123_Photo123.jpg)	413619.3	7614153.1	17 Aug 2016
E30	FOX-3 – Airstrip Landfill (Lobe M) – east slope facing south (ATT124_Photo124.jpg)	413642.5	7614161.1	17 Aug 2016
E31	FOX-3 – Airstrip Landfill (Lobe M) – south slope facing west (ATT125_Photo125.jpg)	413635.1	7614144.6	17 Aug 2016
E32	FOX-3 – Airstrip Landfill (Lobe M) – north slope facing west (ATT126_Photo126.jpg)	413638.7	7614162.4	17 Aug 2016
E33	FOX-3 – Airstrip Landfill (Lobe L) – east slope facing west (ATT117_Photo117.jpg)	413630.7	7614128.0	17 Aug 2016
E34	FOX-3 – Airstrip Landfill (Lobe L) – south slope facing west (ATT118_Photo118.jpg)	413627.6	7614122.5	17 Aug 2016
E35	FOX-3 – Airstrip Landfill (Lobe L) – east slope facing east (ATT119_Photo119.jpg)	413621.6	7614125.9	17 Aug 2016
E36	FOX-3 – Airstrip Landfill (Lobe L) – cover surface facing east (ATT120_Photo120.jpg)	413603.2	7614129.6	17 Aug 2016
E37	FOX-3 – Airstrip Landfill (Lobe L) – north slope facing east (ATT121_Photo121.jpg)	413604.1	7614138.2	17 Aug 2016
E38	FOX-3 – Airstrip Landfill (Lobe L) – west slope facing southeast (ATT122_Photo122.jpg)	413595.0	7614140.7	17 Aug 2016

Table E-6: Summary Table of Photographic Log – Airstrip Landfill (Lobes M, L, I)

Photo Number	Caption	Easting	Northing	Date
E39	FOX-3 – Airstrip Landfill (Lobe I) – east slope and toe facing North (ATT127_Photo127.jpg)	413607.9	7614091.0	17 Aug 2016
E40	FOX-3 – Airstrip Landfill (Lobe I) – south slope facing northeast (ATT128_Photo128.jpg)	413585.8	7614093.4	17 Aug 2016
E41	FOX-3 – Airstrip Landfill (Lobe I) – cover surface facing north (ATT129_Photo129.jpg)	413590.4	7614100.3	17 Aug 2016
E42	FOX-3 – Airstrip Landfill (Lobe I) – east slope facing east (ATT130_Photo130.jpg)	413597.3	7614108.5	17 Aug 2016
E43	FOX-3 – Airstrip Landfill (Lobe I) – northeast slope and crest facing southeast (ATT131_Photo131.jpg)	413592.9	7614123.2	17 Aug 2016
E44	FOX-3 – Airstrip Landfill (Lobe I) – west slope facing south (ATT132_Photo132.jpg)	413587.0	7614125.1	17 Aug 2016
E45	FOX-3 – Airstrip Landfill (Lobe I) – cover surface facing east (ATT133_Photo133.jpg)	413584.8	7614115.4	17 Aug 2016
E46	FOX-3 – Airstrip Landfill (Lobe I) – east slope facing southeast (ATT134_Photo134.jpg)	413592.6	7614100.0	17 Aug 2016

4.0 CONCLUSIONS OF THERMOKARST AREA VISUAL INSPECTION

The Thermokarst Area was assessed to have a “Significant” overall performance rating because of “Numerous” cracks (Features B and D) extending around the perimeter of a thaw settlement depression (Feature A) indicating ongoing settlement, slope movement and a potential for future slope movement (i.e., slope failure). However, there was no notable increase in thaw settlement or cracking and there was less ponded water in the settlement depression in 2016 compared to 2015. Based on the 2016 inspection results, it appears that ongoing degradation (i.e., thaw) of the underlying permafrost will not be prevented by placing and grading additional granular fill over the settlement area (Feature A). Therefore, potential further settlement and slope movement should be expected to occur even if additional granular fill is placed in this area. The thaw of permafrost and related settlement is likely related to groundwater flow and the nearby river.

There were some additional tension cracks (Features E and F) observed on the northeast side of the Thermokarst Area; in the approximate vicinity of former settlement cracks that were back-bladed during the 2013 QA maintenance program. However, a settlement depression has not been observed with this cracking which indicates that it may be related to gradual slope creep (i.e., rather than slope movement as a result of settlement at the base of the slope).

The size and frequency of tension cracks around the thaw settlement area (Feature A) indicate that the slopes are unstable and are at risk of sloughing into the depression at some point in the future. However, the 2016 visual inspection did not observe increased thaw settlement or cracking since the 2015 inspection, which could indicate that the rate of thaw settlement has slowed down.

Settlement and slope movement in the Thermokarst Area to date has not impacted the airstrip or the Airstrip Landfill (Lobes M, L, I). Based on Thermokarst Area settlement observed to date it is considered unlikely that the airstrip or the Airstrip Landfill (Lobes M, L, I) will be impacted by ongoing thaw settlement in the area.

5.0 RECOMMENDATIONS FOR THERMOKARST AREA

No additional placement or regrading of granular fill in the Thermokarst Area is recommended at this time. However, it is recommended that ongoing DLCU monitoring at FOX-3 should include visual inspection of the Thermokarst Area to characterize the rate of any ongoing thaw settlement and crack development.

It is not considered necessary to carry out ongoing visual inspection of the Airstrip Landfill (Lobes M, L, I) at the present time. However, this requirement should be reconsidered if slope instability in the Thermokarst Area approaches the Airstrip Landfill (Lobes M, L, I).

ATTACHMENT

Photographs E1 to E46

PHOTOS

Photo E1: FOX-3 – Thermokarst Area – Feature C – Ponded water in low point of thermokarst settlement area, facing northeast (ATT59_Photo59.jpg)

Photo E2: FOX-3 – Thermokarst Area – Feature D – Crack along the ponding area, facing northwest (ATT60_Photo60.jpg)

Photo E3: *FOX-3 – Thermokarst Area – Area of ponded water observed in 2015 (Feature C-not shown on Figure E-1). No water in 2016, facing northwest (ATT61_Photo61.jpg)*

Photo E4: *FOX-3 – Thermokarst Area – Feature D – Cracking, facing southwest (ATT62_Photo62.jpg)*

Photo E5: FOX-3 – Thermokarst Area – Feature B – Cracking along the edge of settlement – Looking south (ATT63_Photo63.jpg)

Photo E6: FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing northwest (ATT64_Photo64.jpg)

Photo E7: FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing northwest (ATT65_Photo65.jpg)

Photo E8: FOX-3 – Thermokarst Area – Feature E – Cracking extended towards the settlement area, facing southeast (ATT66_Photo66.jpg)

Photo E9: FOX-3 – Thermokarst Area – Feature E – Cracking extended along the edge of settlement, facing north (ATT67_Photo67.jpg)

Photo E10: FOX-3 – Thermokarst Area – Feature C – Ponded water in low point of thermokarst settlement area, facing northeast (ATT98_Photo98.jpg)

Photo E11: FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A), facing northeast (ATT99_Photo99.jpg)

Photo E12: FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A), facing north (ATT100_Photo100.jpg)

Photo E13: FOX-3 – Thermokarst Area – Edge of thaw settlement (Feature A) facing southwest(ATT101_Photo101.jpg)

Photo E14: FOX-3 – Thermokarst Area – Settlement area overview, facing southwest (ATT102_Photo102.jpg)

Photo E15: FOX-3 – Thermokarst Area – Settlement area (Feature A), facing southwest (ATT103_Photo103.jpg)

Photo E16: FOX-3 – Thermokarst Area – Settlement area (Feature A), facing northeast (ATT104_Photo104.jpg)

Photo E17: FOX-3 – Thermokarst Area – Top of upper tension crack (Feature B), facing southwest (ATT105_Photo105.jpg)

Photo E18: FOX-3 – Thermokarst Area – Top of upper tension crack (Feature B), facing southwest (ATT106_Photo106.jpg)

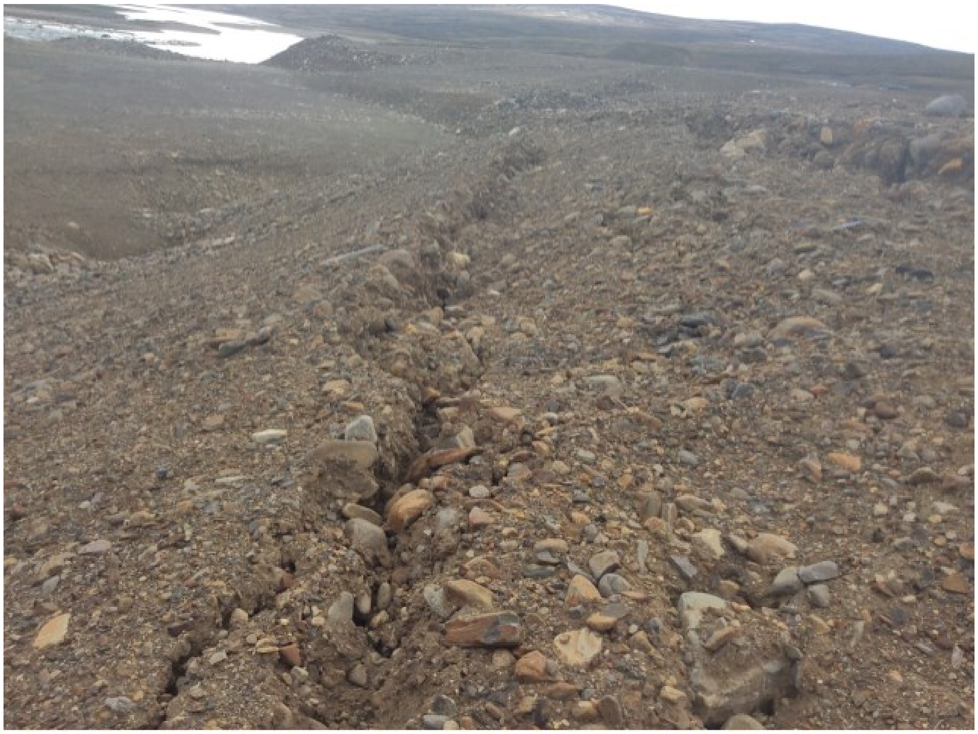


Photo E19: *FOX-3 – Thermokarst Area – Perimeter of thaw settlement (Feature A), facing southwest (ATT107_Photo107.jpg)*

Photo E20: *FOX-3 – Thermokarst Area – Top of tension crack (Feature B), facing northeast (ATT108_Photo108.jpg)*

Photo E21: FOX-3 – Thermokarst Area – Top of tension crack (Feature B), facing northeast (ATT109_Photo109.jpg)

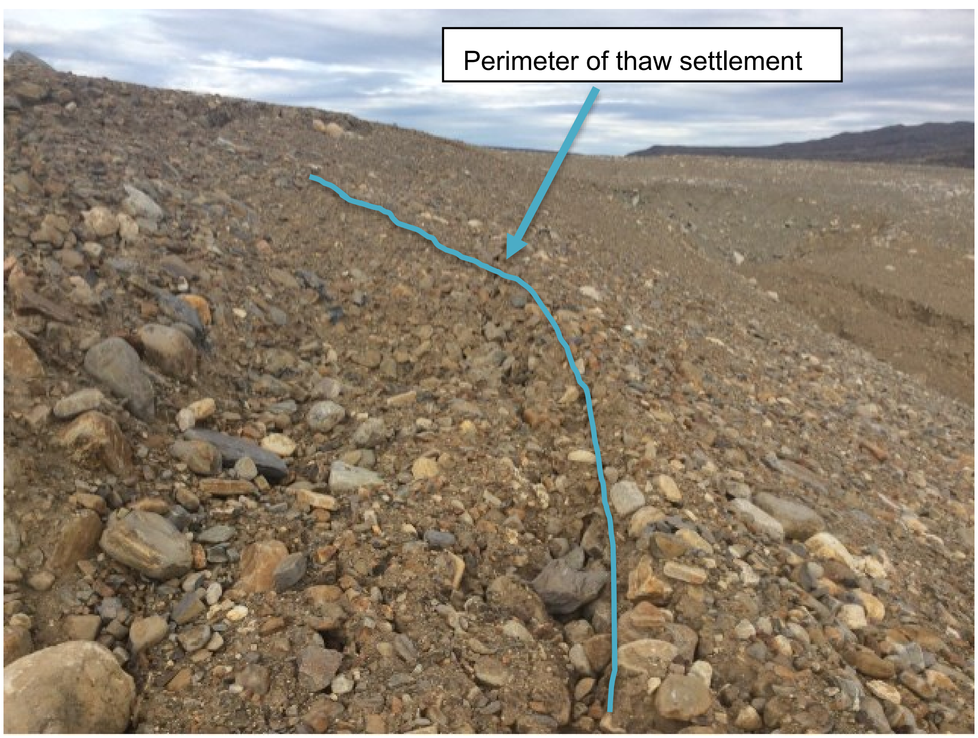


Photo E22: FOX-3 – Thermokarst Area – Perimeter of thaw settlement (Feature A), facing northeast (ATT110_Photo110.jpg)

Photo E23: FOX-3 – Thermokarst Area – Extended tension crack (Feature B), facing northeast (ATT111_Photo111.jpg)

Photo E24: FOX-3 – Thermokarst Area – Extension of tension crack (Feature B), facing northwest (ATT112_Photo112.jpg)

Photo E25: FOX-3 – Thermokarst Area – Perimeter of thaw settlement, facing northeast (ATT113_Photo113.jpg)

Photo E26: FOX-3 – Thermokarst Area – Overview, facing northwest (ATT114_Photo114.jpg)

Photo E27: FOX-3 – Thermokarst Area – Overview, facing northwest (ATT115_Photo115.jpg)

Photo E28: FOX-3 – Thermokarst Area – Overview, facing northwest (ATT116_Photo116.jpg)

Photo E29: FOX-3 – Airstrip Landfill (Lobe M) – cover surface, facing east (ATT123_Photo123.jpg)

Photo E30: FOX-3 – Airstrip Landfill (Lobe M) – east slope, facing south (ATT124_Photo124.jpg)

Photo E31: FOX-3 – Airstrip Landfill (Lobe M) – south slope, facing west (ATT125_Photo125.jpg)

Photo E32: FOX-3 – Airstrip Landfill (Lobe M) – north slope, facing west (ATT126_Photo126.jpg)

Photo E33: FOX-3 – Airstrip Landfill (Lobe L) – east slope, facing west (ATT117_Photo117.jpg)

Photo E34: FOX-3 – Airstrip Landfill (Lobe L) – south slope, facing west (ATT118_Photo118.jpg)

Photo E35: FOX-3 – Airstrip Landfill (Lobe L) – east slope, facing east (ATT119_Photo119.jpg)

Photo E36: FOX-3 – Airstrip Landfill (Lobe L) – cover surface, facing east (ATT120_Photo120.jpg)

Photo E37: FOX-3 – Airstrip Landfill (Lobe L) – north slope, facing east (ATT121_Photo121.jpg)

Photo E38: FOX-3 – Airstrip Landfill (Lobe L) – west slope, facing southeast (ATT122_Photo122.jpg)

Photo E39: FOX-3 – Airstrip Landfill (Lobe I) – east slope and toe, facing north (ATT127_Photo127.jpg)

Photo E40: FOX-3 – Airstrip Landfill (Lobe I) – south slope, facing northeast (ATT128_Photo128.jpg)

Photo E41: FOX-3 – Airstrip Landfill (Lobe I) – cover surface, facing north (ATT129_Photo129.jpg)

Photo E42: FOX-3 – Airstrip Landfill (Lobe I) – east slope, facing east (ATT130_Photo130.jpg)

Photo E43: FOX-3 – Airstrip Landfill (Lobe I) – northeast slope and crest, facing southeast (ATT131_Photo131.jpg)

Photo E44: FOX-3 – Airstrip Landfill (Lobe I) – west slope, facing south (ATT132_Photo132.jpg)

Photo E45: FOX-3 – Airstrip Landfill (Lobe I) – cover surface, facing east (ATT133_Photo133.jpg)

Photo E46: FOX-3 – Airstrip Landfill (Lobe I) – east slope, facing southeast (ATT134_Photo134.jpg)

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