Report to:

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

2012 Environmental Investigation
Lobstick Maintenance Compound
Waskesiu Lake, Saskatchewan

Document No. 1018901603-REP-V0001-02

TETRA TECH

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Report to:

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

2012 ENVIRONMENTAL INVESTIGATION LOBSTICK MAINTENANCE COMPOUND WASKESIU LAKE, SASKATCHEWAN

FEBRUARY 2013

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REVISION HISTORY

REV. NO	ISSUE DATE	PREPARED BY AND DATE	REVIEWED BY AND DATE	APPROVED BY AND DATE	DESCRIPTION OF REVISION

EXECUTIVE SUMMARY

Public Works and Government Services Canada (PWGSC), on behalf of Parks Canada, retained Tetra Tech WEI Inc. (Tetra Tech) to undertake a Phase III Environmental Investigation at the Lobstick maintenance compound in Prince Albert National Park (herein after referred to as the site). Tetra Tech completed the field investigation between October 10 and October 17, 2012.

The Lobstick maintenance compound is located in Prince Albert National Park approximately 800 m southwest of the centre of the Town of Waskesiu Lake, Saskatchewan. The site has operated as a maintenance compound and storage area for grounds-keeping equipment for the surrounding Lobstick Golf Course since initial course development in the 1930s. The site is located entirely within the boundaries of the Lobstick Golf Course.

Current site infrastructure comprises two single storey wood-frame maintenance garages (Shop A and Shop B) enclosing a small gravelled courtyard where a newer chemical storage building, an aboveground used oil tank, and propane storage tank are located. Three additional buildings associated with the maintenance compound, comprising smaller storage sheds and stores buildings are located on a north/south access road to the east of the compound. A 7000 L dual compartment ConVault® tank is located to the south of the Shop B building.

Environmental assessments have been completed in 1996 and 2010 to present in the form of soil and groundwater investigations. A Preliminary Quantitative Risk Assessment (PQRA), Remedial Action Plan (RAP) and Remediation Options Analysis (ROA) were conducted in 2011.

The objectives of the Phase III Investigation were:

- To assess impacts at the site since land use changed from parkland to commercial land use since the previous assessment.
- To further delineate previously-identified petroleum hydrocarbon (PHC) and dissolved metal impacts to soil and groundwater. The impacts are potentially associated with a former underground storage tank (UST), an operating used oil tank, and an operating aboveground dual-compartment petroleum storage tank that were located at the west end of the gravelled surface between the Shop A and Shop B Maintenance Garages. These facilities are located in close proximity to each other and are therefore considered together as one Area of Potential Environmental Concern (APEC). In addition, undertake the assessment of potential impacts from historical storage and handling of

dichloro-diphenyl-tricholorethane-trichloroethane (DDT) between the 1940s to 1970s for pesticide control;

- To characterize the natural attenuation potential of the subsurface environment at the site;
- To assess the potential for intrusion of PHC-impacted vapours into the current and future buildings at the site;
- To update the remediation options analysis (ROA) completed for the site in 2011 with additional options that may include innovative remediation technologies for the PHC impacts, and the DDT impacts at the site. (provided under separate cover); and
- To update the score and rank the site using the Canadian Council of Ministers of the Environment (CCME) *National Classification System for Contaminated Sites Guidance Document PN1403* (November 2010)(NCSCS).

SCOPE OF WORK

The executed scope of work for the 2012 Environmental Investigation included the following activities:

- Previous investigations referenced guidelines for residential/parkland land use since it was unclear what the future land use would be at the site at the time of the previous investigations. Parks Canada Agency PCA considered the use of the most conservative guidelines to be acceptable at that time. For the purposes of this 2012 investigation, PCA confirmed that the future land use in the area of investigation will remain as a maintenance compound and will be limited to commercial activities Therefore, the guidelines for commercial land use were referenced during this assessment.
- Field Program:
  - Borehole Drilling: Drilled and/or hand augered 20 boreholes ranging in depth from 1.05 metres below ground surface (mbgs) to 9 mbgs; completed three boreholes as groundwater monitoring wells; and completed four boreholes as soil vapour wells. Selected soil samples were analysed for PHCs, DDT, grain size, and fraction organic carbon. The hand augered borehole for DDT soil sample collection was drilled to 1.45 mbgs.
  - Environmental Monitoring: 18 new and existing groundwater monitoring wells at the site were inspected and monitored for physical condition, the presence / absence of light non-aqueous phase liquids (LNAPL), water levels, and geochemical parameters indicative of biodegradation. Groundwater wells were also measured for water quality parameters that included pH, electrical conductivity (EC), temperature, combustible vapour well headspace concentrations, and dissolved oxygen (DO). Groundwater samples were analysed for PHCs, dissolved metals, routine water parameters, and microbial parameters.

- Soil Vapour Sampling: Developed two of four soil vapour wells that did not have saturated screens after installation.
- Site Survey: All boreholes, monitoring wells, and soil vapour wells were located using a Global Position System (GPS) unit
- Surface Water Body Observation: A visual and GPS survey of the surface water bodies surrounding the site was undertaken.
- Quality Assurance/Quality Control (QA/QC) sample collection

SIGNIFICANT FINDINGS AND CONCLUSIONS

- The stratigraphy at this site is somewhat heterogeneous, but generally comprised a surface covering of sand or gravel fill within the parking or roadway areas to a depth of approximately 1 mbgs. Outside of the areas with prepared surfaces, organic silts were encountered. In either case these materials were underlain by silt that was encountered in all boreholes at depths of approximately 2.75 mbgs to 3.5 mbgs (occasionally deeper). The silt was typically underlain by olive-brown clay with periodic cobbles and silt or sand seams to the total investigated depth of 10.25 mbgs. Discontinuous lenses of wet sand were generally encountered at depths greater than 7 mbgs at six of 39 borehole locations. Four boreholes were re-drilled due to auger refusal on cobbles or hard packed materials.
- PHCs at concentrations exceeding the Canadian Council of Ministers of the Environment (CCME), *Canadian Environmental Quality Guidelines* (CEQG) (2008) commercial guidelines were identified in soil samples obtained from borehole BH39-12. The identified PHC impacts to soil have been delineated. Based on the results of the October 2012 drilling program, the volume of PHC-impacted soil is estimated to be in the order of 2800 m^3.
- Detectable DDT soil concentrations did not exceed the CCME CEQG (2008) commercial land use guideline. DDT was measured in surficial soils (0 mbgs to 0.3 mbgs) collected from boreholes BH32-12, BH33-12, BH34-12, BH42-12, BH45-12, and in soil samples collected from borehole BH44-12 at depths of 0.75 mbgs to 1.5 mbgs.
- Dissolved benzene and PHC fraction F1 at concentrations exceeding the Federal Contaminated Sites Action Plan 2012, *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites. (*FIGQG) commercial land use guidelines were identified in groundwater samples collected from monitoring wells BH-12 and BH23. Dissolved-phase PHCs were delineated.
- One or more dissolved metals were detected in groundwater samples collected from all of the monitoring wells at the site; however, there are no applicable FIGQG (2012) commercial land use guidelines for dissolved metals.
- Groundwater monitoring wells were inspected on October 10, 2012. LNAPL was not detected on the groundwater surface in any of the monitoring wells at the site on this date. Groundwater levels ranged from 0.47 mbgs to 7.89 mbgs and the groundwater appeared to be mounded with an inferred radial groundwater flow away from the maintenance compound.

- A natural attenuation assessment was completed during the October 2012 event. Trends indicative of biodegradation were observed. The results of this assessment indicate that the site has the potential to naturally attenuate the dissolved PHC impacts.
- Soil vapour samples collected from two of the four soil vapour wells installed had analytical results that were 1,400 to 2,700,000 times less than the soil vapour objectives. Two of the soil vapour wells were flooded with groundwater or had saturated soil surrounding the well and could not be sampled during this event.
- The NCSCS Site Score for the former Lobstick maintenance compound and the surrounding affected areas is 48.1, which corresponds with a Site Classification Category of 3 (Low Priority for Action).

Tetra Tech is of the opinion that the identified impacts pose low risk to human and environmental receptors at this site. Specifically, it was observed that the bulk of the PHC-impacted soils at this site lie below an approximately 20 m wide lightly forested strip that acts as a buffer between the maintenance compound and the 14th hole of the Lobstick Golf Course. Within this location impacts are generally located from approximately 2.5 mbgs to approximately 6.9 mbgs. It would be anticipated that if the Lobstick maintenance compound were to be redeveloped that the buffer strip would be retained suggesting that there would be few risks to allowing these impacts to attenuate in place.

TABLE OF CONTENTS

1.0 INTRODUCTION 1

1.1 PROJECT OBJECTIVES 1
1.2 SCOPE OF WORK 2
1.3 SCOPE CHANGES 3

2.0 SITE SETTING 4

2.1 SITE OVERVIEW 4
2.2 SITE HISTORY 5
2.3 ADJACENT LAND USE 5
2.4 TOPOGRAPHY 5
2.5 SURFACE WATER/HYDROLOGY 6
2.6 REGIONAL AND LOCAL GEOLOGY 6
2.7 REGIONAL AND LOCAL HYDROGEOLOGY 7
2.8 PREVIOUS SITE INVESTIGATIONS 7
2.8.1 SUMMARY OF INVESTIGATIONS 7
2.8.2 SUMMARY OF KEY ISSUES 9

3.0 ENVIRONMENTAL QUALITY GUIDELINES 11

3.1 FEDERAL ENVIRONMENTAL GUIDELINES FOR SOIL 11
3.1.1 FEDERAL SOIL GUIDELINES FOR PHCS IN SOIL 11
3.1.2 PATHWAY MODIFICATION OR ELIMINATIONS 11
3.1.3 TIER 1 ASSESSMENT FOR SOILS 12
3.1.4 TIER 2 ASSESSMENT FOR SOILS 12
3.1.5 SITE-SPECIFIC TIER 2 ASSESSMENT FOR SOILS 13
3.1.5.1 Soil Ingestion And Dermal Contact 13
3.1.5.2 Inhalation of Indoor Air Check 13
3.1.5.3 Ecological Soil Contact 13
3.1.5.4 Potable Groundwater Check 13
3.1.5.5 Groundwater for Freshwater Aquatic Life Check 14
3.1.5.6 Management Limit 14
3.1.5.7 Land Use Assessment 14
3.1.5.8 Determination of Grain Size 15
3.1.5.9 Assessment Guidelines for PHCs in Soil 15
3.1.5.10 Commercial Land Use for Coarse-Grained Surface Soils 15
3.1.5.11 Commercial Land Use for Coarse-Grained Subsoils 16
3.1.6 FEDERAL GUIDELINES FOR OTHER POTENTIAL CONTAMINANTS IN SOIL - DDT 16

3.2 FEDERAL ENVIRONMENTAL GUIDELINES FOR GROUNDWATER 16
3.2.1 PATHWAY MODIFICATION AND ADJUSTMENT FOR GROUNDWATER 17
3.2.2 TIER 2 ASSESSMENT FOR GROUNDWATER 17
3.2.3 SITE-SPECIFIC TIER 2 ASSESSMENT FOR GROUNDWATER 18

3.2.3.1 Inhalation 18
3.2.3.2 Soil Organisms - Direct Contact 18
3.2.3.3 Drinking Water 18
3.2.3.4 Freshwater Life 18
3.2.4 Assessment Guidelines for Groundwater 19
3.3 Soil Vapour 19
4.0 INVESTIGATION METHODOLOGY 21
4.1 Site Safety 21
4.1.1 Site-Specific Safety Plan 21
4.1.2 Utility Locates 22
4.2 Borehole Drilling and Monitoring Well Installation 22
4.2.1 Borehole Drilling 22
4.2.2 Hand Auger 23
4.2.3 Groundwater Monitoring Well Installation 23
4.2.4 Soil Vapour Well Installation 23
4.3 Soil Sampling and Analysis 23
4.3.1 Soil Sample Collection 23
4.3.2 Combustible Headspace Vapour Measurements 24
4.3.3 Soil Analyses 24
4.3.4 Shelby Tube Sampling 25
4.4 Groundwater Sampling and Field Analysis 25
4.4.1 Monitoring Well Development 25
4.4.2 Combustible Headspace Vapour Measurements 25
4.4.3 Groundwater Depth 25
4.4.4 Groundwater Field Analysis 26
4.4.5 Groundwater Sample Collection 26
4.5 Natural Attenuation Assessment 26
4.5.1 Inorganic Chemistry and Geochemical Indicators of Biodegradation 26
4.5.1.1 Dissolved Oxygen 27
4.5.1.2 Nitrate-Nitrogen 27
4.5.1.3 Dissolved Manganese 27
4.5.1.4 Dissolved Iron 27
4.5.1.5 Sulphate 28
4.5.1.6 Alkalinity 28
4.5.1.7 Temperature, pH and Redox Potential Measurements 28
4.5.1.8 Electrical Conductivity Measurements 29
4.5.1.9 Expressed Assimilative Capacity of BTEX 29
4.6 Groundwater Analyses 29
4.7 Soil Vapour Sampling 29
4.7.1 Vapour Well Development 30
4.7.2 Soil Vapour Sample Collection 30
4.8 Site Survey 31
5.0 INVESTIGATION RESULTS 32
5.1 Field Observations 32
5.1.1 Combustible Headspace Vapour Concentrations 32

5.2 SOIL SAMPLE ANALYTICAL RESULTS 33
5.2.1 SOIL GRAIN SIZE ANALYTICAL RESULTS 33
5.2.2 GEOTECHNICAL ANALYSES 33
5.2.3 PETROLEUM HYDROCARBON ANALYSES 33
5.2.4 PESTICIDE ANALYSES 34
5.2.5 FRACTION ORGANIC CARBON ANALYSES 34
5.3 GROUNDWATER MONITORING 34
5.3.1 GROUNDWATER ELEVATIONS 34
5.4 GROUNDWATER SAMPLE RESULTS 35
5.4.1 FIELD MEASUREMENTS 35
5.4.1.1 Dissolved Oxygen 35
5.4.1.2 Temperature 35
5.4.1.3 pH 36
5.4.1.4 Redox Potential 36
5.4.1.5 Electrical Conductivity 36
5.4.2 LABORATORY ANALYSES 36
5.4.2.1 Petroleum Hydrocarbon Analyses 36
5.4.2.2 Dissolved Metals Analyses 37
5.4.2.3 Dissolved Nitrate-Nitrogen 37
5.4.2.4 Alkalinity 37
5.4.2.5 Dissolved Manganese 37
5.4.2.6 Dissolved Iron 38
5.4.2.7 Sulphate 38
5.4.2.8 Biological Analyses 38
5.5 SOIL VAPOUR ANALYTICAL RESULTS 38
5.5.1 PETROLEUM HYDROCARBON ANALYSES 38
5.5.2 HELIUM ANALYSES 39
5.6 WASTE CHARACTERIZATION 39
5.6.1 WASTE SOIL 39
5.6.2 WASTE WATER ANALYSES 39
6.0 QUALITY ASSURANCE/QUALITY CONTROL 40
6.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL 40
6.1.1 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL 41
7.0 DISCUSSION 44
7.1 SOIL QUALITY 44
7.1.1 PHC-IMPACTED SOIL 44
7.1.2 DDT-IMPACTED SOIL 44
7.2 GROUNDWATER QUALITY 45
7.2.1 PHC-IMPACTED GROUNDWATER 45
7.2.2 METALS-IMPACTED GROUNDWATER 45
7.3 GROUNDWATER FLOW CONDITION 46
7.3.1 NATURAL ATTENUATION ASSESSMENT 46
7.4 PETROLEUM HYDROCARBON VAPOURS IN SOIL 47
8.0 NATIONAL CLASSIFICATION SYSTEM FOR CONTAMINATED SITES 48
8.1 DISCUSSION 48

9.0 CONCLUSIONS 50
10.0 REFERENCES 52
11.0 LIMITATIONS 54

APPENDIX A PHOTOGRAPHS
APPENDIX B FIGURES
APPENDIX C TECHNICAL MEMORANDUM
APPENDIX D UTILITY LOCATES
APPENDIX E BOREHOLE LOGS
APPENDIX F TABLES
APPENDIX G LABORATORY ANALYTICAL REPORTS
APPENDIX H NATIONAL CLASSIFICATION SYSTEM FOR CONTAMINATED SITES

LIST OF TABLES

Table 1	Summary of Groundwater Well Monitoring Results
Table 2	Soil Grain Size Laboratory Analytical Results
Table 3	Soil Petroleum Hydrocarbon and Polychlorinated Biphenyl (PCB) Laboratory Analytical Results
Table 4	Soil Organochlorinated Pesticide Laboratory Analytical Results
Table 5	Waste Soil Organochlorinated Pesticide Laboratory Analytical Results
Table 6	Soil Geotechnical Laboratory Analytical Results
Table 7	Groundwater Petroleum Hydrocarbon Laboratory Analytical Results
Table 8	Total and Dissolved Metals Laboratory Analytical Results
Table 9	Groundwater Routine Water Quality Laboratory Analytical Results
Table 10	Groundwater Geochemical Parameter Field Measurements
Table 11	Groundwater Geochemical Parameter and Microbiological Laboratory Results
Table 12	Assimilative Capacity for BTEX Biodegradation in Groundwater
Table 13	Soil Vapour Petroleum Hydrocarbon Laboratory Analytical Results

1.0 INTRODUCTION

Public Works and Government Services Canada (PWGSC), on behalf of Parks Canada Agency (PCA), retained Tetra Tech WEI Inc. (Tetra Tech) in October 2012 to undertake an environmental investigation program at the Lobstick Golf Course, Waskesiu Lake in Prince Albert National Park, Saskatchewan (herein after referred to as the site). The environmental investigation program was required in follow-up to a previously-completed 2011 Remedial Options Analysis (ROA) and Preliminary Quantitative Risk Assessment of the site.

1.1 PROJECT OBJECTIVES

- To update the ROA completed for the site in 2011 with additional options that may include innovative remediation technologies for the petroleum hydrocarbon (PHC) impacts, and the dichloro-diphenyl-tricholorethane-trichloroethane (DDT) impacts at the site. The ROA was updated prior to field data being collected in 2012 to facilitate the fieldwork scope development.
- To further delineate previously-identified PHC impacts to soil and groundwater in the vicinity of a former underground storage tank (UST) (the potential source) that was located at the west end of the gravelled surface between the Shop A and Shop B Maintenance Garages. This area comprises the primary Area of Potential Environmental Concern (APEC) at the site and is hereafter referred to as the site, or area of investigation. Other APEC locations are present at this site, notably an operating used oil tank and an operating aboveground dual-compartment petroleum storage tank. However, these facilities are located in close proximity to the former UST and they are therefore considered together with the aforementioned APEC.
- To characterize the natural attenuation potential of the subsurface environment at the site.
- To assess the potential for intrusion of subsurface PHC vapours into the current and future buildings at the site.
- To update the score and rank the site using the Canadian Council of Ministers of the Environment (CCME) *National Classification System for Contaminated Sites Guidance Document PN1403* (November 2010) (NCSCS).

1.2 SCOPE OF WORK

The scope of work for the 2012 Environmental Investigation included the following activities:

- Safety Management:
  - Completion of a Parks Canada Safety Attestation Form; and
  - Development of a Site-Specific Safety Plan (SSSP).
- Field Program:
  - Borehole Drilling: Drilling and/or hand augering of a total of 20 boreholes comprising drilling of 10 PHC and/or DDT delineation boreholes; drilling and/or hand augering of three shallow boreholes for DDT assessment; completion of three boreholes as groundwater monitoring wells; and completion of four boreholes as soil vapour wells, including:
    - Documentation on borehole logs of soil stratigraphy;
    - Continuous soil sampling in boreholes and submission of all soil samples to the laboratory;
    - Analysing of soil samples for PHCs, DDT, grain size, and fraction organic carbon; and
    - Selection of Shelby tube recovered from boreholes completed as soil vapour wells.
  - Environmental Monitoring: Completion of inspections of 18 new and existing groundwater monitoring wells at the site, including:
    - Documentation of each monitoring well's physical condition;
    - Determination of the presence/ absence of light non-aqueous phase liquids (LNAPL) using an interface probe;
    - Determination of the depth to groundwater; and
    - Measurement of geochemical parameters indicative of biodegradation using a low flow pump and flow through cell.
  - Groundwater Sampling, including:
    - Purging of the monitoring wells;
    - Measurement of water quality parameters at each well including pH, electrical conductivity (EC), temperature, combustible vapour well headspace concentrations, and dissolved oxygen (DO); and
    - Collection of groundwater samples for the laboratory analysis of PHCs, dissolved metals, routine water parameters, and microbial parameters.
  - Soil Vapour Sampling:
    - Development of the soil vapour wells after installation; and
    - Sampling of the soil vapour wells with a Summa® canister, using helium as a tracer gas.
  - Site Survey:
    - Locating of all boreholes, monitoring wells, and soil vapour wells using a Global Positioning System (GPS) unit.
  - Surface Water Body Observation:
    - Completion of a visual and GPS survey of the surface water bodies surrounding the site.

- Quality Assurance/Quality Control (QA/QC):
  - Collection of two duplicate soil samples and two duplicate groundwater samples for analysis of the respective media parameters as a field QA/QC measure.
- Technical Report Preparation.
- Update the Remedial Options Analysis (provided under separate cover).

1.3 SCOPE CHANGES

- Borehole BH33-12 was moved from the original proposed location due to excessive trees, after discussions with the on-site PCA representative.
- Boreholes VW25-12, VW26-12, BH37-12 and BH38-12 were moved from the original proposed locations to further away from the maintenance shop buildings, because groundwater in the original locations was shallower than the proposed vapour well screens.
- Borehole BH41-12 was the only PHC delineation borehole to be completed to the original proposed depth of 9 metres below ground surface (mbgs), due to refusal on cobbles. Boreholes BH33-12, BH39-12, and BH42-12 were completed to a depth of 7.8 mbgs. Boreholes BH29-12, BH30-12, BH31-12, BH34-12, and BH40-12 were completed to a depth of 8 mbgs. Boreholes BH32-12 and BH37-12 were completed to a depth of 8.3 mbgs. Boreholes BH35-12 and BH38-12 were completed to a depth of 8.5 mbgs.
- Monitoring well MW30-12 did not have sufficient groundwater recharge to sample for laboratory analyses.
- Monitoring wells MW29-12 and MW20-12 had not stabilized during the groundwater monitoring event, rendering their groundwater elevations invalid in the average depth to groundwater calculation.
- Soil vapour wells VW26-12 and VW28-12 could not be sampled during this event due to groundwater infiltration into the well or saturated soil surrounding the well.

2.0 SITE SETTING

2.1 SITE OVERVIEW

The Lobstick maintenance compound is located in Prince Albert National Park approximately 800 m southwest of the centre of the Town of Waskesiu Lake, Saskatchewan. The Town of Waskesiu Lake is located on the eastern shore of Waskesiu Lake which in turn is located approximately 85 km north-northwest of the City of Prince Albert, Saskatchewan.

The site has operated as a maintenance compound and storage area for grounds-keeping equipment for the surrounding Lobstick Golf Course since initial course development in the 1930s.

Current site infrastructure comprises two single storey wood-frame maintenance garages (Shop A and Shop B) enclosing a small gravelled courtyard where a newer chemical storage building, an aboveground used oil tank and propane storage tank are located. Shop A is serviced by potable water; however, Shop B is not. The locations of the underground water distribution and sewage piping are unknown. These services were not identified in the area of investigation during the utility locates conducted prior to drilling. Three additional buildings associated with the maintenance compound, comprising smaller storage sheds and stores buildings are located on a north/south access road to the east of the compound. A 7000 L dual compartment ConVault® tank is located to the south of the Shop B building.

The maintenance compound is located along the eastern edge of the Lobstick Golf Course and is bordered to the west and south by the fairways and greens for holes 13 and 14. The area to the east and north of the compound comprises a grassy laydown area followed by small fens and sloughs. The site is accessed by an unnamed gravelled service road that is accessed from a parking lot along Wapiti Drive near the Town centre. Access to the site via this road is secured to vehicle entry with a gate; however, access to the maintenance compound is generally unrestricted to foot traffic along this road or from the adjoining golf course fairways.

Selected photographs of the area of investigation are presented in Appendix A. A general location and site plan are presented as Figures 1 and 2, in Appendix B. The locations of utilities at and adjacent to the subject site are indicated on Figure 2, in Appendix B.

2.2 SITE HISTORY

In a report prepared by Environmental Services for Public Works and Government Services Canada in July 1996 entitled: *Contamination Assessment, Lobstick Golf Course Maintenance Yard, Prince Albert National Park, Saskatchewan*, it was reported that historical (pre-1995) petroleum infrastructure at the site comprised one 2200 L steel single-wall UST that was located west of the current chemical storage building. It was reported that there were also one 900 L and one 1300 L aboveground petroleum storage tanks (AST) at the site, but their location was unknown. All three of these tanks were removed and replaced with one aboveground 7000 L dual compartment ConVault® storage tank located to the east of the current chemical storage building. During a site inspection by Tetra Tech in the fall of 2010 it was observed that the ConVault® tank had been relocated to a gravelled area approximately 10 m to the south of the Shop B building (Tetra Tech 2011b).

PCA informed Tetra Tech that the site was also known to store DDT for historical pesticide application programs that occurred in the park between the 1940s to 1970s. It is unknown how long DDT chemical storage and handling occurred specifically at the site. Activities also expected to have occurred historically at the site include fuelling, lubricating and servicing of grounds-keeping equipment; storage of fertilizer and herbicides; used oil storage and handling; and painting.

2.3 ADJACENT LAND USE

The site is located inside Prince Albert National Park and entirely within the boundaries of the Lobstick Golf Course. The surrounding land uses include:

- North: Lobstick Golf Course, followed by seasonal residential properties at a distance of approximately 375 m, followed by Waskesiu Lake at a distance of approximately 530 m.
- East: Lobstick Golf Course, followed by seasonal residential properties at a distance of approximately 700 m.
- South: Lobstick Golf Course, followed by Lakeview Drive at a distance of approximately 350 m, and then forested parkland.
- West: Lobstick Golf Course, followed by Lakeview Drive and Waskesiu Lake at a distance of approximately 685 m.

2.4 TOPOGRAPHY

The area of investigation at the Lobstick maintenance compound comprises a gravelled yard, with forest to the north and east and golf course fairways to the south and west. Surface drainage immediately adjacent to the site will likely be to the west and northwest based on observed surficial topography. However, regionally surface drainage appears to be to the east and northeast.

A topographical map of the area is provided as Figure 1 in Appendix B.

2.5 SURFACE WATER/HYDROLOGY

As part of the 2012 investigation, Tetra Tech made note of the proximity of surface water bodies to the subject site and their potential utilization by wildlife. Nine water bodies were identified to the east and northeast of the maintenance compound, all of which are less than 150 m in diameter. The three smallest bodies are sloughs, located approximately 150 m to 350 m to the east of the maintenance compound. The three largest water bodies are ponds, which lie northeast of the site at approximate distances ranging from 350 m to 450 m from the site. Extensive algal growth was observed in all seven of the sloughs visited by Tetra Tech staff. Beavers appear to inhabit the three ponds as evidenced by existing lodges on each and observations of recently gnawed tree stumps and branches. Muskrats and other small rodents were also sighted in and around these ponds. Some of the surface water bodies may also be utilized as drinking water by wildlife that was seen near the site throughout the investigation, including elk, deer, a fox, grouse, and other birds.

Waskesiu Lake is located north and west of the site. The closest approach of the lake to the site is a shallow cove that is located approximately 530 northwest of the site. The next closest approach is approximately 600 m to the west.

Selected photographs of the water bodies are presented in Appendix A.

2.6 REGIONAL AND LOCAL GEOLOGY

The Town of Waskesiu Lake is located in north central Saskatchewan. The topography of the Waskesiu Lake area comprises undulating moraine deposits of stratified glacial sediments of sand, gravel, and clay that were deposited from Wisconsinan glacial ice during periods of advance, stagnation, and retreat. These deposits, that are collectively referred to as drift, are approximately 160 m thick in the Waskesiu Lake area. The glacial drift overlies the southern limit of the Lower Cretaceous Ashville Formation (part of the Lower Colorado Group). The Ashville Formation is an aquitard that comprises dark grey to black non-calcareous siltstone and claystone.

The stratigraphy at this site is somewhat heterogeneous, but generally comprised a surface covering of sand or gravel fill within the parking or roadway areas to a depth of approximately 1 mbgs. Outside of the areas with prepared surfaces, organic silts were encountered. In either case these materials were underlain by silt that was encountered in all boreholes at depths of approximately 2.75 mbgs to 3.5 mbgs (occasionally deeper). The silt was typically underlain by olive-brown clay with periodic cobbles and silt or sand seams to the maximum investigated depth of 10.25 mbgs. Wet sand sequences were observed in boreholes BH-13 (3.0 mbgs to 3.15 mbgs), BH20 (7.5 mbgs to 10.25 mbgs), BH21 (7.0 mbgs to 7.25 mbgs), BH30-12 (4.5 mbgs to

5.9 mbgs), BH33-21 (7.65 mbgs to 7.8 mbgs), and BH38-12 (0.5 mbgs to 4.0 mbgs); however, they do not appear to be continuous across the site.

2.7 Regional and Local Hydrogeology

A review of the Saskatchewan Watershed Authority (SWA) database indicated that there was no registered groundwater withdrawal wells located in the vicinity of the subject site.

Communications with officials from PCA revealed that the Town of Waskesiu Lake obtains it potable water from Waskesiu Lake.

Groundwater investigations at this site (November 2010 and February/March 2011) revealed that the apparent direction of shallow groundwater flow was to the north. Rising head test data for monitoring well BH-9 (screened in the silt from approximately 2.0 mbgs to 6.0 mbgs) revealed that the average horizontal hydraulic conductivity value for the soil within the screened interval of the well was 3.3×10^{-5} cm/s.

Using select wells, the average depth to groundwater during the November 2010 event was 2 mbgs; this had fallen to a depth of approximately 4 mbgs when the site was inspected again during the March 2011 inspection and sampling event. The average depth to groundwater during the October 2012 event was 1.6 mbgs. The observed groundwater elevations and interpreted flow direction for the October 2012 inspection and sampling event are provided on Figures 4 and 7 in Appendix B.

2.8 Previous Site Investigations

2.8.1 *Summary of Investigations*

Two Environmental Site Assessments (ESAs) and the Preliminary Qualitative Risk Assessment (PQRA) were reviewed for background information. In 1996, a limited ESA was conducted by PWGSC and a Phase III ESA was completed by Tetra Tech in 2010. A brief review of both ESAs is presented below.

The Environmental Services branch of PWGSC conducted a limited environmental site assessment of the subject site in 1996 to assess PHC impacts, to identify remedial strategies, and to determine if closure was possible based on observed impact levels relative to federal and provincial standards of the day. Three boreholes were drilled to the east of the former UST location and in a semi-circular pattern around the aboveground ConVault® tank, which at the time was located between the two maintenance garages. None of the boreholes were completed as monitoring wells, so no groundwater analytical data was obtained. Additionally, no borehole logs were submitted with the report from which the general site stratigraphy could have been interpreted. Five soil samples were submitted to Accutest Laboratories for PHC

analyses. These analyses revealed that all of the submitted samples contained detectable concentrations of PHCs. The report concluded by recommending that the site needed to be remediated (PWGSC 1996).

Tetra Tech conducted a two stage Phase III ESA in October/November 2010 and January/February 2011 to delineate PHC impacts to soil and groundwater identified in the vicinity of a former UST. The ESAs included drilling 24 boreholes, installing 16 groundwater monitoring wells, and collecting soil and groundwater samples. Soil analysis identified PHCs at concentrations that exceeded CCME *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil* (CWS) (2008) coarse-grained soil quality guidelines in a residential/parkland land use setting in eight of the new boreholes drilled. PHC concentrations in groundwater were greater than the Federal Contaminated Sites Action Plan, *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, 2010 (FIGQG) guidelines for coarse-grained soil in a residential/parkland land use setting in six of the monitoring wells. Dissolved and/or total regulated metals were also identified in all of the wells sampled at the site. The site was classified according to the National Classification System for Contaminated Sites based on the results of the 2011 ESA. Tetra Tech recommended annual groundwater sampling to determine if natural attenuation of dissolved-phase PHCs is occurring and also recommended further groundwater assessment to determine background concentrations of metals for the area. The report concluded with a recommendation for a risk assessment to evaluate potential subsurface PHC vapour inhalation risks to occupants of current and proposed structures at the site (Tetra Tech 2011b).

Tetra Tech completed a groundwater sampling event and a Preliminary Quantitative Risk Assessment (PQRA) in April 2012. The assessment included sampling of three proximate Town of Waskesiu Lake water wells, considered to represent background groundwater conditions, as well as the sampling of 11 groundwater monitoring wells at the site. One or more of dissolved aluminum, cadmium, copper and/or iron were identified at concentrations greater than the FIGQG (2010) guidelines in all samples obtained from the Town of Waskesiu Lake water wells. The PQRA evaluated the potential exposure by human, terrestrial, wildlife, and aquatic receptors to current PHC impacts at the maintenance compound. Risks were estimated using conservative assumptions such as exposure to maximum concentrations and screening level modelling approaches, which are commensurate with this level of risk assessment. The risk assessment focussed on direct soil and groundwater exposure, and vapour intrusion. Groundwater to surface water pathways were evaluated as a secondary exposure pathway as dissolved-phase PHCs at the site are not expected to impact surface water quality. This secondary exposure pathway was referred to as a groundwater check, which evaluated the potential for impacts to migrate to Waskesiu Lake and nearby beaver ponds.

2.8.2 SUMMARY OF KEY ISSUES

The previous environmental investigations identified approximately 4200 m^3 of PHC-impacted soil at this site at concentrations in excess of the CCME CEQG and CWS (2008) environmental quality guidelines (EQG) for residential/parkland land use that were used for assessment purposes. These impacts are present to the south and west of the former gasoline UST (the potential source) that was located at the west end of the gravelled surface between the Shop A and Shop B Maintenance Garages. PHC impacts appear to have migrated in a west to northwesterly direction based on laboratory data received, away from the former UST and are now present beneath a lightly forested area that buffers the Lobstick maintenance compound from the 14th hole of the Lobstick Golf Course. These impacts to soil were delineated vertically and horizontally.

Impacts to soil associated with the former UST were detected at a depth of 2.5 mbgs and were detected to be present to a depth of 6.85 mbgs based on the results of laboratory analyses. PHC-impacted soils were detected at grade, near the filler spout of the used oil tank that is located on the west side of the Shop A Maintenance Garage. Impacts to the soil at this location overlap with the area that was affected by PHCs from the UST as described above.

Metals in soils were not encountered within the area of investigation at concentrations in excess of the CCME CEQG (2008) residential/parkland EQG, used for assessment purposed at the time, for the identified operable receptor pathways during previous environmental investigations.

DDT (total) was detected in soil samples recovered from two locations on the site. The soil sample analytical results indicated the presence of DDT (total) in two samples at concentrations above the CCME CEQG (2008) residential/parkland guidelines used for assessment purposes at the time. Detectable concentrations of DDT (total) were identified in four other soil samples. The DDT was generally found in the surficial soil from surface to 0.3 mbgs.

PHCs were detected in groundwater samples collected from monitoring wells BH-12 and BH23 within the area of investigation at concentrations in excess of the FIGQG (2010) residential/parkland guidelines used for assessment purposes at the time. These groundwater impacts were found to correlate with the plume of PHC-impacted soil. PHC concentrations in groundwater were at a maximum (benzene concentration of 19 mg/L) in monitoring well BH-12, near the potential source. PHC concentrations in groundwater were found to decrease to less than the assessment guidelines in the periphery wells.

Dissolved metals (including aluminum, silver, cadmium, iron, nickel and lead) were identified in groundwater samples collected from monitoring wells BH-4, BH-6, BH-7, BH-9, BH-10, BH-12, BH-13, BH-14, BH17, and BH21 at concentrations above the

FIGQG (2010) residential/parkland guidelines. The definitive source of these metals is not known.

3.0 ENVIRONMENTAL QUALITY GUIDELINES

3.1 FEDERAL ENVIRONMENTAL GUIDELINES FOR SOIL

As the site is located within a national park, federal environmental guidelines are considered applicable at the site. The environmental quality guidelines (EQG) used for assessment purposes during this project are presented in the documents entitled:

- *Canadian Environmental Quality Guidelines (CEQG),* CCME, 2008.
- *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil (CWS),* CCME, 2008.
- *Guidelines for Canadian Drinking Water Quality (DW),* Health Canada, 2012.
- *Federal Contaminated Sites Action Plan, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* 2012.

3.1.1 FEDERAL SOIL GUIDELINES FOR PHCS IN SOIL

The CCME CEQG (2008) present soil quality guidelines that were derived specifically for the protection of ecological receptors in the environment and for the protection of human health associated with four land uses: agricultural, residential/parkland, commercial, and industrial. These guidelines are further subdivided based on the predominant soil texture that controls contaminant migration.

The CCME CWS (2008) sets standards for PHC-impacted soils that are to be implemented across Canada. These guidelines present target values for PHC fractions F1 to F4. The CCME CWS (2008) are also based on four land uses: agricultural, residential/parkland, commercial, and industrial, and present different target values based on soil texture.

3.1.2 PATHWAY MODIFICATION OR ELIMINATIONS

The CCME CWS (2008) was developed for the assessment of PHC-impacted sites in Canada.

These guidelines have been developed to provide guidance in assessing the potential risks from PHC impacts to human and environmental receptors at sites throughout Canada. The guidelines were calculated using a number of conservative assumptions regarding site conditions at and in the vicinity of potentially PHC-impacted sites. The

guidelines do not apply in all situations and have not been developed for all potential constituents that may be of concern at a given site.

The standards were developed for various land use categories and can be applied at any one of three levels or "Tiers": Tier 1 standards provide generic numerical standards corresponding to four generic land use scenarios (agricultural, residential/parkland, commercial, and industrial). Where site specific information is available that can be used in place of (or to supplement) the generic information used in developing the Tier 1 standards, the Tier 1 guidelines can be adjusted to Tier 2 standards. At Tier 3 site-specific risk assessment and/or risk management standards can be developed. At all three Tiers the same degree of human health and environmental protection is required; however, higher Tiers require more detailed supporting site-specific data.

3.1.3 *Tier 1 Assessment for Soils*

As discussed Tier 1 guidelines represent generic values for the assessment of impacts to soil or groundwater at a given site. No modification of the generic values or pathway elimination is permitted at Tier 1. However, for soils, sites can be assessed with respect to land use and the predominant soil type (coarse or fine-grained) that controls constituent migration at the site.

For the area of investigation encompassed by this report, Tetra Tech has determined that pathway modification or elimination is possible and has therefore elected to assess this site to the more appropriate Tier 2 guidelines.

3.1.4 *Tier 2 Assessment for Soils*

A Tier 2 assessment provides a mechanism whereby impacts to soil and groundwater can be assessed to site-specific guidelines, based on various combinations of receptors and potential pathways that may be present at the site. Specifically, the completion of a Tier 2 assessment permits the adjustment of guidelines where it can be shown that, based on site conditions or on the application of administrative controls, either the pathway is incomplete or the receptor is not present.

The following sections assess the applicability of exposure to PHCs at the subject site via selected Tier 2 exposure pathways (including, but not limited to: soil and/or food ingestion check, dermal contact, inhalation, ecological soil contact check, nutrient and energy cycling check, potable groundwater check, aquatic life check, and management limit).

Once the pathway adjustment has been completed, Tier 2 standards, based on the most conservative values of all the active exposure pathways, are selected as the appropriate assessment guidelines for the site.

3.1.5 Site-Specific Tier 2 Assessment for Soils

3.1.5.1 Soil Ingestion And Dermal Contact

The soil ingestion and dermal contact pathways are considered applicable to sites where there is a potential for direct contact with PHC-impacted soil.

PHC impacts to soil were observed at surface in the vicinity of the used oil tank that is located on the west side of the north maintenance shop (Shop A). Therefore, the soil ingestion and dermal contact pathways are considered applicable to this site.

3.1.5.2 Inhalation of Indoor Air Check

The vapour inhalation pathway is operable for all sites which may have buildings located within 30 m of identified PHC impacts to soil or groundwater (CCME CWS, 2008).

PHC impacts to soil have been observed in boreholes BH-7 and BH-8, among others, that were drilled adjacent to the Shop A and Shop B maintenance garages and as such, the vapour inhalation pathway is considered applicable for this site.

3.1.5.3 Ecological Soil Contact

The site is covered by gravel and grass and PHC impacts to soil have been identified at surface; as such, ecological receptors could potentially come in contact with PHC constituents in soil and groundwater. Therefore, the ecological soil contact pathway is considered applicable to this site.

The ecological soil contact pathway is operable for all soils exhibiting PHC impacts at depths less than 3 mbgs. However, section 3.2.4 of the CCME *Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soils, User Guidance PN 1398* states that:

- The ecological soil contact pathway may be eliminated for soils below 3 m depth.

Consequently, the ecological soil contact pathway has been eliminated at this site for PHC impacts that are located at depths that are greater than 3 mbgs.

3.1.5.4 Potable Groundwater Check

Environmental investigations to date have revealed that PHC impacts to soil are present at this site from surface to approximately 8 mbgs. The maximum depth of the environmental investigations to date was 10.25 mbgs in borehole BH20. Through to this depth no potential domestic use aquifer was observed; therefore, the potable

groundwater check is eliminated due to the absence of an operable pathway. Further it has been reported that residents of Waskesiu Lake obtain their potable water from Waskesiu Lake. Therefore, even if the site were underlain by a potential domestic use aquifer it is unlikely that it would be used for potable purposes due to the proximal and abundant source that is Waskesiu Lake.

It should be noted; however, that wet sand was observed in borehole BH20 from 7.5 mbgs to approximately 9 mbgs and in borehole BH33-12 at 7.65 mbgs to 7.8 mbgs (the maximum depth of investigation of this borehole). This sand was not observed in any of the surrounding boreholes (BH17, BH29-12, BH42-12) suggesting that this sand is discontinuous and not likely to be sufficient to provide a viable aquifer.

3.1.5.5 GROUNDWATER FOR FRESHWATER AQUATIC LIFE CHECK

The groundwater for freshwater aquatic life check is applicable within 500 m of the impacts. Groundwater flow to the north/northeast was reported at this site in the fall of 2010 and in the winter of 2011. Sloughs were observed at distances of approximately of 150 m and 300 m to the east and the closest beaver pond was observed at a distance of approximately 300 m from the site to the east. Dissolved PHC-impacts have been delineated to non-detectable levels in the perimeter monitoring wells BH16, BH17, BH19, BH21, BH29-12, and BH31-12, which are between 20 m and 40 m from the source area. A review of natural attenuation parameters, including dissolved oxygen (DO), nitrate-nitrogen, dissolved iron, dissolved manganese, and alkalinity, in the groundwater suggests there are trends indicative of biodegradation of PHC occurring at the site. Therefore for the purposes of this assessment, the freshwater aquatic life pathway is not considered applicable.

3.1.5.6 MANAGEMENT LIMIT

Management Limits only apply to PHC Fractions F1 to F4, and are imposed at all sites in order to address other effects related to PHC impacts, including: free phase formation, exposure of workers in trenches to PHC vapours, fire and explosion hazards, effects on buried infrastructure, and aesthetic considerations.

Management limits are not adjustable at Tier 2 and always apply, regardless of depth of impact, and take into account the potential for direct human contact with soil brought to the surface during construction or other disturbances.

3.1.5.7 LAND USE ASSESSMENT

The site is located within Prince Albert National Park; however, the area of investigation has operated as a maintenance compound for the Lobstick Golf Course since it was developed in the 1930s. Previous investigations referenced guidelines for residential/parkland land use since it was unclear what the future land use would be at the site at the time of the previous investigations. PCA considered the use of the most

conservative guidelines to be acceptable at that time. For the purposes of this 2012 investigation, PCA confirmed that the future land use in the area of investigation will remain as a maintenance compound and will be limited to commercial activities Therefore, the guidelines for commercial land use were referenced during this assessment.

3.1.5.8 DETERMINATION OF GRAIN SIZE

The assessment EQG are dependent upon the soil grain size that governs fate and transport of constituents of concern via the various transport and exposure pathways.

Laboratory grain size analyses supplemented by visual assessment of soil textures indicated that the soils at this site contain a mixture of fine and coarse-grained soil types and that there was a potential for PHC impacts to move through the coarse-grained fraction. Therefore, the site has been assessed against coarse-grained EQG.

3.1.5.9 ASSESSMENT GUIDELINES FOR PHCS IN SOIL

Based on a review of the pathway applicability (above), it is Tetra Tech's opinion, for the purposes of this assessment, that the following EQG are the most suitable for assessing the level of PHC impact to the soil at the subject site. When more than one pathway may be active, the more stringent EQG for the limiting pathway is presented.

For this site Tetra Tech has elected to select guidelines based on a 10^{-5} incremental cancer risk in accordance with the recommendations (Essentially Negligible Cancer Risk for Contaminated Site Risk Assessment) that is found within the Health Canada *Federal Contaminated Site Risk Assessment In Canada Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA)*.

3.1.5.10 COMMERCIAL LAND USE FOR COARSE-GRAINED SURFACE SOILS

- Benzene and xylenes: *Canadian Environmental Quality Guidelines*, CCME, 2008, Inhalation of indoor air check (slab-on-grade).
- Toluene and ethylbenzene: *Canadian Environmental Quality Guidelines*, CCME, 2008, Ecological soil contact.
- PHC Fraction F1: *Canada Wide Standard for Petroleum Hydrocarbons in Soils*, CCME, 2008, Vapour inhalation (Indoor – slab-on-grade) and Ecological soil contact.
- PHC Fractions F2, F3 and F4: *Canada Wide Standard for Petroleum Hydrocarbons in Soils,* CCME, 2008, Ecological soil contact.

3.1.5.11 COMMERCIAL LAND USE FOR COARSE-GRAINED SUBSOILS

- Benzene and xylenes: *Canadian Environmental Quality Guidelines*, CCME, 2008, Inhalation of indoor air check (slab-on-grade).
- Toluene and ethylbenzene: *Canadian Environmental Quality Guidelines*, CCME, 2008, Ecological soil contact and Inhalation of indoor air check (slab-on-grade).
- PHC Fraction F1: *Canada Wide Standard for Petroleum Hydrocarbons in Soils,* CCME, 2008, Vapour inhalation (Indoor – slab-on-grade) and Ecological soil contact.
- PHC Fractions F2, F3 and F4: *Canada Wide Standard for Petroleum Hydrocarbons in Soils*. 2008, Ecological soil contact and Management Limits.

3.1.6 FEDERAL GUIDELINES FOR OTHER POTENTIAL CONTAMINANTS IN SOIL - DDT

During previous investigations Tetra Tech identified a concern regarding the potential presence of DDT in surface soils at the site. The concern is that soil disposal facilities that are licenced to accept PHC-impacted soils are not normally permitted to receive soils that are also impacted with DDT. Further assessment of the surface soils in the area of investigation for DDT impacts will allow for the appropriate disposal of all soils, should the proposed excavation proceed.

- *Canadian Environmental Quality Guidelines* (CEQG), CCME, Commercial, 2008.

3.2 FEDERAL ENVIRONMENTAL GUIDELINES FOR GROUNDWATER

Since the site is located in Prince Albert National Park federal environmental guidelines are considered applicable. The EQG used for groundwater assessment purposes during this project are presented in the documents entitled:

- *Canadian Environmental Quality Guidelines* (CEQG), CCME, 2008.
- *Guidelines for Canadian Drinking Water Quality* (DW), Health Canada, 2012.
- *Federal Contaminated Sites Action Plan, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, 2012.

The FIGQG (2012) comprise groundwater quality guidelines that were developed to assist federal custodians in assessing and remediating/risk managing federal contaminated sites funded under the *Federal Contaminated Sites Action Plan* (FCSCAP). These guidelines present target values based on four land uses: agricultural, residential/ parkland, commercial, and industrial. Similarly to the process for soils as outlined in the CCME CWS (2008), these guidelines follow a tiered framework. But, unlike the CCME CWS (2008), the FIGQG include comparative guidelines for inorganic parameters, metals, hydrocarbons (including PAHs),

halogenated aliphatics, chlorinated aromatics, phenols, pesticides, and other organics in one common document. The tiered approach follows the following rationale:

- Tier 1: direct application of the generic numerical guidelines; specifically, application of the lowest guideline for any pathway.
- Tier 2: allows for the development of site-specific remediation objectives through the consideration of site-specific conditions, by modifying (within limits) the numerical guidelines based on site-specific conditions and focusing on exposure pathways and receptors that are applicable to the site.
- Tier 3: use of site-specific risk assessment to develop Site-Specific Remediation Objectives.

The CCME CEQG (2008) provides guidelines to provide protection of freshwater and marine life from anthropogenic stressors such as chemical inputs or change to physical components (i.e., pH, temperature and debris). These guidelines are numerical limits or narrative statements based on the most current, scientifically defensible toxicological data available for the parameter of interest. These guidelines are meant to protect all forms of aquatic life and all aspects of the aquatic life cycles. However, these guidelines only apply within 10 m of the normal high water mark and in the transition zone of the receiving surface water body. As the groundwater monitoring wells at this site are located greater than 10 m from any potential receiving surface water bodies the CCME CEQG (2008) will not be considered further.

The Health Canada DW (2012) provides guidelines for drinking water quality. These guidelines are based on current, published scientific research related to health effects, aesthetic effects, and operational considerations. There are no potential domestic use aquifers within the area (Tetra Tech 2011b). Residents of Waskesiu Lake obtain drinking water from Waskesiu Lake. Therefore, groundwater as a potable water source will not be considered further.

3.2.1 Pathway Modification and Adjustment for Groundwater

For the area of investigation encompassed by this report, Tetra Tech has determined that pathway modification or adjustment is possible and has therefore elected to assess the groundwater at this site to the Tier 2 guidelines as outlined in the FIGQG (2012).

3.2.2 Tier 2 Assessment for Groundwater

A Tier 2 assessment, following the FIGQG (2012), provides a framework whereby various impacts to groundwater can be assessed to site-specific guidelines, based on various combinations of receptors and potential pathways that may be present at the site.

For this site the following sections assess the applicability of exposure to groundwater impacts at the subject site via selected Tier 2 water use exposure pathways (including: inhalation, soil organisms - direct contact, drinking water, freshwater life and wildlife watering) for commercial sites with coarse-grained soils.

3.2.3 SITE-SPECIFIC TIER 2 ASSESSMENT FOR GROUNDWATER

3.2.3.1 INHALATION

The inhalation pathway applies to all sites which may have buildings located within 30 m of identified impacts to groundwater.

Impacts to groundwater have been observed within monitoring wells BH-12 and BH23, among others, that are located less than 30 m from the occupied Shop A and Shop B maintenance garages. Therefore, the inhalation pathway is considered applicable for this site.

3.2.3.2 SOIL ORGANISMS - DIRECT CONTACT

PHC impacts to groundwater have been observed within several groundwater samples obtained from monitoring wells located within the area of investigation.

Therefore, there is the potential that impacted groundwater could come into direct contract with soil organisms. Consequently, Tetra Tech is of the opinion that due to these soil organisms, the direct contact exposure pathway is operable at this site.

3.2.3.3 DRINKING WATER

The drinking water guidelines are applied to groundwater that is used as a potable water source or to groundwater defined as a potential water source by the province or other agency with jurisdiction over drinking water issues.

For this site, there is no evidence that groundwater is being used for potable purposes and it is unlikely, because of current land use and the availability of potable water from nearby Waskesiu Lake, that groundwater at this site would be used for potable purposes.

For this reason Tetra Tech is of the opinion that the drinking water exposure pathway is not applicable at this site.

3.2.3.4 FRESHWATER LIFE

The groundwater for freshwater aquatic life check is applicable within 500 m of the impacts. Groundwater flow to the north/northeast was reported at this site in the fall of

2010 and in the winter of 2011. Sloughs were observed at distances of approximately of 150 m and 300 m to the east and the closest beaver pond was observed at a distance of approximately 300 m from the site. Dissolved PHC-impacts have been delineated to non-detectable levels in the perimeter monitoring wells BH16, BH17, BH19, BH21, BH-29-12, and BH31-12, which are between 20 m and 40 m from the source area. A review of natural attenuation parameters, including DO, nitrate-nitrogen, dissolved iron, dissolved manganese, and alkalinity, in the groundwater suggest there are trends indicative of biodegradation of PHC occurring at the site (discussed further in Section 7.4 of this report). Therefore for the purposes of this assessment, the freshwater aquatic life pathway is not considered applicable.

3.2.4 Assessment Guidelines for Groundwater

Based on a review of the pathway applicability (above), it is Tetra Tech's opinion, for the purposes of this assessment, that the following EQG are the most suitable for assessing the level of impact to groundwater at the subject site. When more than one pathway may be active, the more stringent EQG for the limiting pathway is presented.

- Benzene: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Inhalation.
- Toluene: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Soil organisms direct contact.
- Ethylbenzene: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Soil organisms direct contact.
- Xylenes: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Inhalation.
- Petroleum Hydrocarbon Fractions F1 and F2: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Inhalation and Soil organism direct contact.
- Metals: *Federal Contaminated Sites Action Plan 2012, Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites,* Soil organisms direct contact.

3.3 Soil Vapour

Soil vapour objectives are not published by provincial or federal regulatory agencies; therefore, soil vapour objectives were calculated by Tetra Tech. Methods used to calculate the soil vapour objectives are presented within the *Technical Memorandum*

Methodology for Developing Soil Vapour Objectives for Properties with Petroleum Hydrocarbon Contamination, Tetra Tech, 2012, in Appendix C. The approach used to calculate the soil vapour objectives is based entirely on the approach published in the CCME CWS (2008). The equations and model assumptions were taken directly from the CCME CWS (2008) document. While CCME does not publish soil vapour objectives, the approach used to calculate soil guidelines for the vapour inhalation pathway is used to derive the soil vapour objectives.

4.0 INVESTIGATION METHODOLOGY

The primary objective of this Phase III Investigation was to further delineate previously-identified PHC impacts to soil and groundwater in order to fill data gaps in support of remedial action planning. As well, to further assess previously-identified DDT impacts and to assess the potential intrusion of PHC vapours into existing and future buildings at the site.

Prior to the start of the October 2012 drilling, during discussions with PWGSC and Parks Canada, Tetra Tech proposed the locations of the boreholes, monitoring wells, and soil vapour wells to delineate the soil and groundwater impacts and to assess the highest potential soil vapour intrusion locations.

PHC delineation borehole locations were chosen to aid in the reduction of the previously-estimated PHC-impacted area and volume. Two sentry groundwater monitoring wells were placed downgradient of the area of investigation and one sentry groundwater monitoring well was placed crossgradient of the area of investigation to facilitate contaminant delineation and future groundwater monitoring. Shallow DDT sample locations were chosen to assess DDT over the entire area of investigation. A soil vapour well was placed adjacent to each of the maintenance shops to assess the potential for vapour intrusion into the buildings. Two additional soil vapour wells were placed in areas where PHC impacts to the vapour inhalation pathway were highest.

4.1 SITE SAFETY

4.1.1 SITE-SPECIFIC SAFETY PLAN

Prior to the start of site activities on October 10, 2012, Tetra Tech developed a Site-Specific Safety Plan (SSSP) outlining: the project scope, the applicable Occupational Health and Safety (OH&S) Acts and Regulations, hazards related to the type of work being performed, and the safety responsibilities/expectations for those individuals (employees and contractors) involved with the project. The SSSP was submitted to PWGSC for review prior to commencing the field work. Prior to being allowed on the site, all personnel involved with the field activities were required to review and sign-off on the SSSP. At the start of each day, Tetra Tech held a toolbox meeting that included: discussion of the scope of work, job hazards, safe work practices, and emergency procedures.

4.1.2 UTILITY LOCATES

Underground and aboveground site services and public utilities were identified, where possible, and marked by the appropriate utility companies prior to the initiation of the borehole drilling program. A private line locator, Hundseth Power Line Construction Corp. of Saskatoon, was retained by Tetra Tech to identify and mark the locations of buried infrastructure not located by the public utilities (electrical cables, steel piping networks, conduits, etc.) at the subject site prior to borehole drilling. All underground polyvinyl chloride (PVC) irrigation pipeline locations were shown to Tetra Tech staff and the drilling contractors by the Lobstick Golf Course Superintendent, Mr. Gary Cross, upon arrival at the site.

A copy of the utility location information can be found in Appendix D.

4.2 BOREHOLE DRILLING AND MONITORING WELL INSTALLATION

4.2.1 BOREHOLE DRILLING

The October 2012 borehole drilling program was undertaken by Intercore Environmental Services Inc. of Maidstone, Saskatchewan with a track-mounted 7822DT Geoprobe® direct-push rig equipped with 75 mm diameter hollow-core tooling. Nineteen boreholes (VW25-12 to VW28-12; BH29-12 to BH35-12; and BH37-12 to BH44-12) were drilled to approximate depths of 1.0 mbgs to 9.0 mbgs. Drilling started on October 12 and was completed on October 14, 2012.

Borehole BH41-12 was the only PHC delineation borehole to be completed to the original proposed depth of 9 mbgs due to refusal on cobbles. Boreholes BH33-12, BH39-12, and BH42-12 were completed to a depth of 7.8 mbgs. Boreholes BH29-12, BH30-12, BH31-12, BH34-12, and BH40-12 were completed to a depth of 8 mbgs. Boreholes BH32-12 and BH37-12 were completed to a depth of 8.3 mbgs. Boreholes BH35-12 and BH38-12 were completed to a depth of 8.5 mbgs. DDT assessment boreholes BH43-12 and BH44-12 were completed to a depth of 1.5 mbgs. Soil vapour wells VW25-12 to VW28-12 were completed to a depth of 1.05 mbgs.

Soil cuttings from the 2012 drilling activities were temporarily stored at the subject site in a 1 m^3 soil bag. A waste characterization sample was submitted to the laboratory for analyses before being picked-up and disposed of by Envirotec Services of Saskatoon, Saskatchewan.

The borehole locations from the 2012 drilling program are presented on Figure 2 in Appendix B. Soil boring information is provided on the borehole logs presented in Appendix E.

4.2.2 HAND AUGER

One borehole (BH45-12) was hand augered to a depth of 1.45 mbgs using a 100 mm diameter stainless steel hand auger. Hand augering was completed on October 15, 2012. The location of borehole BH45-12 is presented on Figure 2 in Appendix B. Soil boring information is provided on the borehole log presented in Appendix E.

4.2.3 GROUNDWATER MONITORING WELL INSTALLATION

Three boreholes (BH29-12, BH30-12 and BH31-12) were completed as groundwater monitoring wells.

The groundwater monitoring wells were constructed with 51 mm diameter schedule 40 PVC casing threaded into No. 10 factory slot well screen to the borehole base. The borehole annulus was backfilled with clean silica sand from the base of the screen to approximately 150 mm above the top of the screened section of each well. The annulus of the borehole adjacent to the solid casing was filled with hydrated granular bentonite pellets. Each monitoring well was covered with a lockable "stick-up" above ground steel casing or a protective steel bolt-down road box installed at grade. Well construction details are provided on the borehole logs in Appendix E.

4.2.4 SOIL VAPOUR WELL INSTALLATION

Four boreholes (VW25-12 to VW28-12) were completed as soil vapour wells.

The soil vapour wells were constructed with solid 25 mm diameter schedule 40 PVC casing of variable length threaded into a 30 cm long No. 10 factory slot well screen. All soil vapour wells were completed to a depth of 1.0 mbgs. The borehole annulus adjacent to the well screen was backfilled with clean silica approximately 15 cm above and below the screened interval. The annulus of the borehole adjacent to the solid casing was filled with hydrated granular bentonite. The wells were capped with 25 mm socket weld PVC caps equipped with threaded brass ball valves and male hose barb fittings sealed with Teflon® tape. Each soil vapour well was covered with a protective steel bolt-down road box installed at grade. Well construction details are provided on the borehole logs in Appendix E.

4.3 SOIL SAMPLING AND ANALYSIS

4.3.1 SOIL SAMPLE COLLECTION

During the borehole drilling program, soil samples were collected from the sample tube at approximately 0.75 m intervals for the samples for potential PHC analyses and at approximately 0.25 m intervals for the samples for potential DDT analysis. Additional soil samples were collected at stratigraphic boundaries and at apparent PHC impact for

field logging and potential laboratory analysis. The samples were split, with one half placed into plastic single-use sampling bags for combustible headspace vapour concentration measurements, and the other half was placed in laboratory-supplied glass jars for potential laboratory analyses. All samples were stored in ice-chilled coolers prior to submission to the laboratory.

Soil from each borehole was logged in general accordance with the United Soil Classification System listing soil type, colour, texture, plasticity, moisture content, percent recovery, noticeable inclusions, and evidence of impact. These observations are presented on the borehole logs in Appendix E.

4.3.2 Combustible Headspace Vapour Measurements

To obtain a preliminary indication of the presence of potential PHC impacts, soil samples were collected for combustible headspace vapour concentration measurements. These measurements were recorded using a portable RKI Eagle® combustible gas indicator that was calibrated on a daily basis to hexane (a standard used for the assessment of gasoline impacted sites). The RKI Eagle® was operated in the methane elimination mode.

When using the RKI Eagle®, if vapour concentrations exceeded 500 parts per million (ppm), they were recorded as a percentage of the Lower Explosive Limit (%LEL). One percent (1%) LEL is approximately equal to 110 ppm for hexane. It should be noted that the headspace test is a semi-quantitative screening method and can only be considered to represent relative volatile contaminant concentrations.

4.3.3 Soil Analyses

Thirty-three soil samples, including a duplicate, were collected during the borehole drilling program and submitted to Maxxam Analytics Inc. (Maxxam) in Calgary, Alberta and analyzed for benzene, toluene, ethylbenzene, xylenes, and PHC Fractions F1 to F4 content. Samples were selected for analyses based on a review of field observations, soil headspace vapour concentrations, and the investigation objectives.

Twenty-five soil samples, including two duplicates, were collected during the borehole drilling program and were submitted to Maxxam for analysis of DDT. Samples were selected for analyses based on the investigation objectives.

Four soil samples were collected during the borehole drilling program and were submitted to Maxxam for analysis of fraction of organic carbon content (FOC). FOC analysis can be used to develop site-specific soil vapour objectives. Samples were selected for analysis based on the expected screen interval of the soil vapour wells.

4.3.4 *Shelby Tube Sampling*

To assess the soil surrounding the screen interval of the soil vapour well for pneumatic permeability, bulk density, grain size and moisture content, which can be used to develop site-specific soil vapour objectives, two Shelby tube soil samples were taken.

The Shelby tube samples were collected from soil vapour wells VW26-12 and VW28-12 at a depth interval of 0.5 mbgs to 1 mbgs below grade to collect an undisturbed representative soil sample. The ends of the tube were covered with clean PVC caps and sealed with duct tape to maintain sample moisture. The tubes were submitted to MDH Engineered Solutions Inc. (MDH) in Saskatoon, Saskatchewan for analysis.

4.4 Groundwater Sampling and Field Analysis

4.4.1 *Monitoring Well Development*

Groundwater monitoring well development activities of the newly-installed monitoring wells included the removal of groundwater from the monitoring well using a disposable bailer until the purge water appeared clean and free of sediments. One day after installation, monitoring wells MW29-12, MW30-12 and MW31-12 did not produce sufficient groundwater to develop the wells of three well volumes. The monitoring wells were purged dry and left to recharge.

4.4.2 *Combustible Headspace Vapour Measurements*

To obtain a preliminary indication of the presence of potential PHC impacts, subsurface combustible headspace vapour concentrations were recorded from each groundwater monitoring well. These were recorded using a portable RKI Eagle® combustible gas indicator that was calibrated on a daily basis to hexane (a standard used for the assessment of gasoline impacted sites). The RKI Eagle® was operated in the methane elimination mode.

When using the RKI Eagle®, if vapour concentrations exceeded 500 ppm, they were recorded as a %LEL. One %LEL is approximately equal to 110 ppm for hexane. It should be noted that the headspace test is a semi-quantitative screening method and can only be considered to represent relative volatile contaminant concentrations.

4.4.3 *Groundwater Depth*

Liquid levels (i.e groundwater and potential light non-aqueous phase liquids (LNAPL)) in each monitoring well were measured from the top of the well casing using an electronic water-oil interface probe.

4.4.4 GROUNDWATER FIELD ANALYSIS

To obtain a representative sample of the in-situ groundwater in the existing monitoring wells, the monitoring wells were purged until parameters such as DO, pH, temperature, oxidation reduction potential and electrical conductivity stabilized to within 10% for three consecutive readings. These parameters were obtained using a peristaltic pump and flow-through cell and measured with an YSI 600 XL multi-parameter instrument.

4.4.5 GROUNDWATER SAMPLE COLLECTION

Groundwater samples were collected using the low-flow peristaltic pump immediately after parameter stabilization to limit the loss of volatiles and to maintain sample integrity during sample collection. A dedicated disposable bailer was used to collect groundwater samples for the microbial analyses. The groundwater samples were collected in appropriate laboratory-supplied sample bottles, preserved and filtered as necessary, and stored in an ice-chilled cooler prior to submission to the laboratory.

Field duplicate groundwater samples were collected from selected groundwater monitoring wells to evaluate Tetra Tech's quality control procedures.

4.5 NATURAL ATTENUATION ASSESSMENT

The protocol used in the determination of the natural attenuation potential of the subsurface environment was developed from technical protocols developed by the United States Air Force Center for Environmental Excellence (AFCEE). The protocols used during this assessment are detailed in the document entitled: *Technical Protocol for Implementing Intrinsic Remediation with Long-Term Monitoring for Natural Attenuation for Fuel Contamination Dissolved in Groundwater*, Volume I and II, November 11, 1995 (AFCEE, 1995).

4.5.1 INORGANIC CHEMISTRY AND GEOCHEMICAL INDICATORS OF BIODEGRADATION

The natural attenuation capacity of a site is determined by measuring the potential for microbial mediated degradation of hydrocarbon compounds. During the microbial degradation of hydrocarbons, the energy needed for cell maintenance and production is obtained by the transfer of electrons from electron donor compounds (hydrocarbons) to electron acceptor compounds (DO, nitrate-nitrogen, dissolved manganese, dissolved iron, sulphate, and carbon dioxide). Measurements of some of these compounds in the groundwater were used to determine the capacity of the groundwater to degrade dissolved-phase PHC constituents.

During microbial degradation of PHCs, oxygen will be utilized first by aerobic microorganisms as a terminal electron acceptor, since it is the most thermodynamically-favoured electron acceptor. When oxygen becomes depleted in subsurface environments, anaerobic microorganisms will begin to degrade hydrocarbons as a

source of carbon and energy. The most thermodynamically-favoured terminal electron acceptor in the absence of oxygen is nitrate followed by manganese and iron.

4.5.1.1 *Dissolved Oxygen*

Oxygen is the most thermodynamically-favoured aerobic electron acceptor used by microorganisms during hydrocarbon degradation and will be utilized by microorganisms first in the groundwater. Areas with lower DO concentrations may indicate increased microbial activity and biodegradation. Anaerobic bacteria typically cannot function at DO concentrations above 0.5 mg/L.

DO concentrations were collected in this study as an indicator of biodegradation of BTEX constituents in the groundwater. As stated in the literature (AFCEE, 1995), for each 1.0 mg/L of DO utilized an estimated 0.32 mg/L of BTEX will be degraded by microorganisms in the groundwater. Therefore, the average mass of BTEX degraded per 1 mg of oxygen consumed is approximately 0.32 mg.

4.5.1.2 *Nitrate-Nitrogen*

Dissolved nitrate-nitrogen concentrations were recorded in this investigation as an indicator of biodegradation of BTEX constituents in the groundwater. Nitrate-nitrogen is the second most thermodynamically-favoured terminal electron acceptor; however, it can only function once oxygen is depleted in the groundwater, making the system anaerobic. As BTEX components are degraded in the subsurface environment, the nitrate-nitrogen concentrations will decrease through denitrification and nitrate reduction. The average mass of BTEX mineralized per 1 mg/L of nitrate-nitrogen consumed is approximately 0.21 mg/L.

4.5.1.3 *Dissolved Manganese*

Dissolved manganese (Mn^{2+}) concentrations were recorded in this investigation as an indicator of biodegradation of BTEX constituents in the groundwater. The reduction of manganese may be occurring if the environment is sufficiently reducing and other electron acceptors have been depleted. The reduction of manganese (Mn^{4+}) to the soluble form [Mn^{2+}, manganese (II)] through microbially-mediated oxidation of organic matter (or organic pollutants) in groundwater is a common occurrence. The average mass of BTEX mineralized per 1 mg/L of Mn^{2+} produced is approximately 0.06 mg/L.

4.5.1.4 *Dissolved Iron*

Dissolved iron concentrations (Fe^{2+}) were recorded in this investigation as an indicator of biodegradation of BTEX constituents in the groundwater. Once the available oxygen, nitrate-nitrogen, and manganese have been depleted ferric iron (Fe^{3+}) can be used as an electron acceptor. The reduction of insoluble iron [Fe^{3+}, ferric iron, or iron (III)] to the soluble form [Fe^{2+}, ferrous iron, or iron (II)] through microbially mediated oxidation of

organic matter (or organic pollutants) in groundwater is a common occurrence. The average mass of BTEX mineralized per 1 mg/L of ferrous iron produced is approximately 0.05 mg/L.

4.5.1.5 SULPHATE

Dissolved sulphate concentrations were recorded in this investigation as an indicator of biodegradation of BTEX constituents in the groundwater. Sulphate is an electron acceptor used by microorganisms during anaerobic respiration once oxygen, nitrate-nitrogen, manganese and iron are depleted in the groundwater. As BTEX components are degraded in the subsurface environment, the sulphate concentrations will decrease and potentially sulphide concentrations will increase. The average mass of BTEX mineralized per 1 mg/L of sulphate consumed is approximately 0.21 mg/L.

4.5.1.6 ALKALINITY

The total alkalinity of a groundwater system is indicative of water's capacity to neutralize acid. Alkalinity is important in the maintenance of the groundwater pH because it buffers the groundwater against acids generated during both aerobic and anaerobic biodegradation. Areas with PHC degradation typically exhibit a total alkalinity higher than background areas. Alkalinity concentrations (measured as $CaCO_3$ concentrations) were determined in this study to indicate the occurrence of biodegradation of BTEX constituents in the groundwater. As BTEX constituents are degraded in the subsurface environment, the $CaCO_3$ concentration will increase due to the production of CO_2 during biodegradation. The measure of the difference between the background alkalinity and the alkalinity of groundwater containing BTEX constituents can give an indication of the assimilation potential of the aquifer. The average mass of BTEX mineralized per 1 mg/L of $CaCO_3$ produced is approximately 0.13 mg/L.

4.5.1.7 TEMPERATURE, PH AND REDOX POTENTIAL MEASUREMENTS

Temperature significantly affects the growth and survival of microorganisms. Literature sources have documented that a 10ºC rise in temperature may double the metabolic activity of the microbial populations over the range of 5ºC to 25ºC. When groundwater temperatures drop below 5ºC, biodegradation has been shown to be inhibited. However, DO is more soluble at lower temperatures.

The pH significantly affects the growth and survival of microorganisms. The pH of groundwater will determine the species and concentrations of organisms able to survive under those conditions. The optimal range of pH for most microorganisms is between 6 and 8.

Redox potential is the measure of the tendency of a solution to lose or accept electrons. During aerobic conditions, the redox potential of a solution is generally around +800mV.

In the case of anaerobic conditions the redox potential of a solution can range from +700mV, in the case denitrification, to -200mV, in the case of sulfanogenesis.

4.5.1.8 *Electrical Conductivity Measurements*

Conductivity is a measure of the ability of a solution to conduct electricity. As the ion concentration increases, the electrical conductivity of the solution also increases. The groundwater conductivity within an area of PHC impact may be used to determine the groundwater flow path and if samples are from different hydrogeologic zones.

4.5.1.9 *Expressed Assimilative Capacity of BTEX*

In this assessment, the expressed assimilative capacity of the groundwater to degrade BTEX is estimated by summing the assimilative capacity of DO (aerobic respiration), dissolved nitrate-nitrogen (denitrification), dissolved iron reduction, dissolved manganese reduction, and dissolved sulphate (sulfanogenesis) of groundwater from selected wells. This value is then compared to the total BTEX concentration to determine if the groundwater has the capacity to degrade the BTEX impacts and by extension the petroleum hydrocarbon fraction F1 and F2 impacts.

4.6 Groundwater Analyses

Groundwater samples were collected from 18 monitoring wells at the site, including two field duplicates, a field blank, a trip blank, and an equipment blank and were submitted to Maxxam for analysis of parameters including BTEX, PHC fractions F1 to F4, dissolved metals, nitrate-nitrogen, sulfate, alkalinity, pH, temperature, electrical conductivity, heterotrophic plate count (HPC), and hydrocarbon degrading bacteria.

4.7 Soil Vapour Sampling

A review of the historical soil sample analytical data from the drilled boreholes revealed that eight boreholes (BH-4, BH-5, BH-5B, BH-8, BH-11, BH-12, BH23, and BH39-12) had PHC concentrations in soil that were greater than the CCME CEQG and CWS (2008) Tier 2B soil guidelines for the vapour inhalation pathway assuming slab-on-grade construction and commercial land use. The locations of the boreholes are presented on Figure 2 in Appendix B. The historical soil samples that contain PHCs at concentrations in excess of the CCME (2008) Tier 2B guidelines for the slab-on-grade vapour inhalation pathway were collected at depths ranging from 0.7 mbgs to 6.85 mbgs.

A review of the historical groundwater sample analytical data from the monitoring wells revealed that two monitoring wells (BH-12 and BH23) had PHC concentrations in groundwater that were greater than the FIGQG (2012) for the inhalation pathway in a commercial land use setting. Since concentrations of benzene, and/or PHC fraction F1 were greater than soil guidelines and groundwater guidelines for the vapour inhalation

pathway, vapour intrusion of these substances from subsurface sources may result in indoor air exposure for occupants of buildings. Soil and groundwater concentrations alone are not a reliable indicator for potential indoor vapour concentrations (Interstate Technology and Regulatory Council (ITRC) 2007). Therefore, a soil vapour monitoring program was initiated at the subject site. The purpose of the soil vapour program was to measure soil vapour concentrations adjacent to both maintenance buildings; at the location of highest PHC impacts measured (near borehole BH-5); and in an area potentially outside the proposed excavation area, but within the proposed new building footprint (between boreholes BH-4 and BH-12), for comparison to the soil vapour objectives (Tetra Tech, 2012).

Soil vapour wells VW25-12, VW26-12, VW27-12 and VW28-12 were drilled to a depth of 1.0 mbgs. The location of the soil vapour wells are shown on Figure 2 in Appendix B.

4.7.1 Vapour Well Development

Prior to sampling, all soil vapour wells were purged of a minimum of three well and sand pack annulus volumes so that the collected soil vapour samples were representative of subsurface conditions. The soil vapour wells were developed by Tetra Tech staff using a Gilian® GilAir 5 air sampling pump with a Gilian® Low Flow Module calibrated at a flow rate of 50 mL/min.

4.7.2 Soil Vapour Sample Collection

Soil vapour sampling was conducted by Tetra Tech staff on October 15 and 16, 2012. Soil vapour well sampling was conducted in general accordance with Health Canada (2007) protocols. Soil vapour samples were collected by connecting the soil vapour monitoring well to a 1.4 L Summa® canister and a helium detector probe using 6 mm diameter Teflon™ tubing and a tee connector. The 1.4 L Summa® canisters were supplied by Maxxam of Mississauga, Ontario. Each canister was equipped with a dedicated controller. The controller was pre-calibrated by Maxxam to obtain a flow rate of 50 mL/min.

Prior to collecting soil vapour samples, a leak detection test was conducted on each soil vapour well and the testing apparatus. To test for leaks, helium gas was used as a leak detector, since helium was not expected to be present at the site as a constituent of concern. The sampling equipment apparatus (including the vapour well, the Summa® canister and all the connections) were sheltered underneath a plastic shroud. After ensuring that the soil vapour well and the Summa® canister remained closed, helium gas was slowly added to the shroud until a measured concentration of approximately 40% (400,000 ppm) was reached (when measured with a Helium Detector MGD-2002). Then, the concentration of helium was measured within the soil vapour test apparatus using the helium detector probe. If helium concentrations were non-detectable or low (i.e., less than 1%), then it was determined that there was no or minor leakage within the tubing and connections. After the leak detection test was completed, and prior to

sample collection, helium was slowly added to the shroud until a measured concentration of approximately 100% was reached.

Soil vapour wells VW26-12 and VW28-12 were sampled during the October 2012 sampling event. Vapour wells VW25-12 and VW27-12 were not sampled during the October sampling event due to either groundwater infiltration into the wells or saturated soil surrounding the well. Weather conditions recorded during the sampling event were an average temperature of approximately 5°C with no precipitation the day of sampling or the previous day.

Samples were kept at ambient temperature until shipment to Maxxam within the required holding period and analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX), PHC fractions F1 and F2, and helium.

4.8 SITE SURVEY

The boreholes and monitoring wells were measured with a laser level to determine elevations with respect to a benchmark with an assumed elevation of 100.000 m that was used in prior investigations. This benchmark comprised the southeast corner of the steel beam acting as part of the foundation for the chemical storage shed. A second more permanent benchmark was established and measured at an elevation of 97.385 m relative to the assumed benchmark at the chemical storage shed. This new benchmark is a spike in the power pole to the northeast of Shop A. Borehole elevations were collected in order to determine the apparent groundwater flow direction and gradient.

The borehole and monitoring well physical locations were measured in relation to existing infrastructure using easting and northing coordinates obtained with a Garmin GPS 60 CSX.

5.0 INVESTIGATION RESULTS

5.1 FIELD OBSERVATIONS

The stratigraphy at this site is somewhat heterogeneous, but generally comprised a surface covering of sand or gravel fill within the parking or roadway areas to a depth of approximately 1.5 mbgs. Outside of these areas with prepared surfaces, organic silts were encountered. In either case these materials were underlain by silt that was encountered in all boreholes at depths of approximately 2.75 mbgs to 3.5 mbgs (occasionally deeper). The silt was typically underlain by olive-brown clay with periodic cobbles and silt or sand seams to the total investigated depth of 10.25 mbgs. Wet sand was observed in boreholes BH30-12 from 4.5 mbgs to 5.9 mbgs, BH31-12 from 4.5 mbgs to 6 mbgs, BH33-12 from 7.65 mbgs to 7.8 mbgs, and BH38-12 from 0.5 mbgs to 4 mbgs; however, from this and previous investigations the sand does not appear to be continuous across the site.

Several boreholes (BH31-12, BH35-12, BH38-12, and BH41-12) were re-drilled due to refusal on apparent cobbles or in some cases cobbles entered the sampling tube preventing sample recovery. These boreholes were backfilled with bentonite to 0.3 m below ground surface and then filled with apparently clean soil cuttings.

5.1.1 *COMBUSTIBLE HEADSPACE VAPOUR CONCENTRATIONS*

The maximum headspace vapour concentration measured at the site was 41% LEL in a sample recovered from 3.75 mbgs in borehole BH40-12. Elevated headspace vapour concentrations (greater than 10% LEL) were measured in soil samples recovered from boreholes BH39-12 at 6 mbgs and BH40-12 at 4.5 mbgs. Headspace vapour concentrations did not exceed 6% LEL in the soil samples recovered from the remaining boreholes. Visible staining and/or grey colouring was observed in borehole BH33-12 at 6.6 mbgs, borehole BH37-12 at 3.25 mbgs, borehole BH38-12 from 4 mbgs to 6 mbgs, and borehole BH40-12 from 3 mbgs to 8 mbgs.

These and other observations made during borehole drilling program are presented on the borehole logs that are provided in Appendix E.

5.2 SOIL SAMPLE ANALYTICAL RESULTS

5.2.1 SOIL GRAIN SIZE ANALYTICAL RESULTS

Soil grain size is defined as fine-grained if greater than or equal to 50% of soil particles pass through a 75 µm sieve. Soil grain size is defined as coarse-grained if less than 50% of soil particles pass through a 75 µm sieve. Soil grain size analyses using a hydrometer, which partitions the soil into percent sand, silt, and clay, were conducted on six soil samples, which were submitted for laboratory analyses during this borehole drilling program. Two samples were classified as coarse-grained and four samples were classified as fine-grained.

The soil grain size laboratory analytical results, along with historical results, are summarized on Tables 2 and 6 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.2.2 GEOTECHNICAL ANALYSES

The geotechnical analyses, including bulk density, pneumatic permeability, and grain size, were completed on the Shelby tube soil samples collected from soil vapour wells VW26-12 and VW28-12 at a depth interval of 0.5 mbgs to 1 mbgs.

Pneumatic permeability for both samples could not be calculated due to insufficient data to satisfy the ASTM requirements. Thus, site-specific soil vapour objectives could not be calculated for the site. Conservative default values from CCME CWS (2008) were used in the derivation of soil vapour objectives.

The soil geotechnical laboratory analytical results are presented on Table 6 in Appendix F. A copy of the laboratory analytical report is provided in Appendix G.

5.2.3 PETROLEUM HYDROCARBON ANALYSES

Benzene was identified at concentrations three times greater than the assessment EQG in a soil sample and its duplicate, which were obtained from borehole BH39-12 at a depth of 6 mbgs. Detectable PHC soil concentrations below the assessment EQG were measured in the remaining twelve sampling locations. .

The soil sample petroleum hydrocarbon laboratory analytical results, along with historical results, are presented on Table 3 in Appendix F and on Figure 3 in Appendix B. Copies of the laboratory analytical reports are provided in Appendix G.

5.2.4 PESTICIDE ANALYSES

DDT plus metabolites was identified at concentrations above the laboratory detection limit in soil samples, including a duplicate, which were obtained from boreholes BH32-12 at 0.1 mbgs, BH33-12 at 0.05 mbgs, BH34-12 at 0.25 mbgs, BH42-12 at 0.3 mbgs, BH43-12 at 0.2 mbgs, BH44-12 at 0.75 mbgs, BH44-12 at 1 mbgs, BH44-12 at 1.5 mbgs, and BH45-12 at 0.25 mbgs. Detectable analytical concentrations of DDT were between 1.3 and 6000 times less than the assessment EQG. DDT constituents in the remaining soil samples analyzed were not detected at concentrations above the laboratory detection limit.

The DDT sample laboratory analytical results, along with historical results, are presented on Table 4 in Appendix F and on Figure 6 in Appendix B. Copies of the laboratory analytical reports are provided in Appendix G.

5.2.5 FRACTION ORGANIC CARBON ANALYSES

Fraction organic carbon analyses were completed on soil samples collected from boreholes BH37-12 at 0.75 mbgs, BH38-12 at 1 mbgs, BH39-12 at 0.75 mbgs, and BH40-12 at 0.5 mbgs. Sample locations and depths were chosen for their proximity to each of the soil vapour well screen intervals.

The fraction organic carbon laboratory analytical results are presented on Table 6 in Appendix F. A copy of the laboratory analytical report is provided in Appendix G.

5.3 GROUNDWATER MONITORING

5.3.1 GROUNDWATER ELEVATIONS

From October 10 to 16, 2012 Tetra Tech staff inspected each of the accessible groundwater monitoring wells at the site. Significant results from these inspections are as follows:

- LNAPL was not detected, using the interface probe, on the groundwater surface in any of the groundwater monitoring wells at the site on these dates.
- Well casing combustible vapour concentrations ranged from non-detect in monitoring wells BH-4, BH-13, BH-14 and BH20 to a maximum of 270 ppm in monitoring well BH-12.
- Groundwater did not appear to be stabilized in new monitoring wells BH29-12 and BH30-12 one day after installation.
- Depth to groundwater ranged from 0.13 mbgs to 7.89 mbgs.

- Monitoring well BH23 had measured depth to groundwater of 0.13 mbgs, which is above the screen interval. No evidence was observed to explain the high groundwater elevation.
- Groundwater elevations ranged from 96.01 m to 99.27 m in the remaining groundwater monitoring wells that were inspected; and,
- Groundwater appeared to be mounded with an interpreted radial groundwater flow direction away from the maintenance compound during this monitoring event.

A summary of the results from the October 2012 monitoring well inspection event, along with historical results, is presented on Table 1 in Appendix F. A site plan presenting the October 2012 groundwater elevation data and groundwater contours is provided as Figure 7 in Appendix B.

5.4 GROUNDWATER SAMPLE RESULTS

5.4.1 *FIELD MEASUREMENTS*

5.4.1.1 *DISSOLVED OXYGEN*

The groundwater DO results ranged from 0.4 mg/L in monitoring wells BH16 and BH21 to 12.8 mg/L in monitoring well BH29-12. DO concentrations appear to be depleted (i.e. less than 1 mg/L) or low (less than background levels, i.e. less than 3 mg/L) in the PHC-impacted area and increase in concentration to background levels as they get further from the source area. DO in monitoring well BH21 appears to be depleted and is outside the PHC-impacted area. This did not affect the interpretation that there is a trend indicative of biodegradation within the DO results.

The results of the DO measurements are presented on Table 10 in Appendix F.

5.4.1.2 *TEMPERATURE*

The groundwater temperature ranged from 5.9ºC in monitoring well BH20 to 9.6ºC in monitoring well BH23. The optimal temperature range for bacterial growth is between 5ºC and 25ºC.

The groundwater temperature measurements from selected monitoring wells are presented on Table 10 in Appendix F.

5.4.1.3 pH

The pH in the groundwater ranged from approximately 6.4 in monitoring well BH-9 to approximately 7.6 in monitoring well BH30-12. The optimal pH range for bacterial growth is 6 to 8.

The pH results are presented on Table 10 in Appendix F.

5.4.1.4 Redox Potential

The redox potential of the groundwater ranged from -219.8 mV in monitoring well BH16 to 155.4 mV in monitoring well BH-10.

The range of redox potential is considered to be within the threshold for ferric iron reduction and sulfanogenesis (AFCEE, 1995).

The results of the redox potential measurements are presented on Table 10 in Appendix F.

5.4.1.5 Electrical Conductivity

The electrical conductivity of the groundwater ranged from 0.66 ms/cm in monitoring well BH16 to 1.44 ms/cm in monitoring well BH24.

The results of the electrical conductivity measurements are presented on Table 10 in Appendix F.

5.4.2 Laboratory Analyses

5.4.2.1 Petroleum Hydrocarbon Analyses

Benzene and/or PHC fraction F1 were identified at concentrations exceeding the referenced guidelines in groundwater samples, including duplicates, which were collected from monitoring wells BH-12 and BH23. PHC constituents in the remaining groundwater samples were not detected at concentrations exceeding the referenced groundwater guidelines and/or laboratory detection limits.

The dissolved-phase PHC in groundwater sample laboratory analytical results are summarized on Table 7 in Appendix F and on Figure 4 in Appendix B. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.2 DISSOLVED METALS ANALYSES

Dissolved metals were detected in groundwater samples collected from the monitoring wells. The results of several dissolved metal parameters were above the laboratory detection limits; however, there are no applicable FIGQG (2012) guidelines for dissolved metals for commercial/industrial land use with soil organisms direct contact pathway.

The results for dissolved metals analyses, along with historical analytical results, are summarized on Table 9 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.3 DISSOLVED NITRATE-NITROGEN

Dissolved nitrate-nitrogen in the groundwater samples ranged from less than 0.003 mg/L in monitoring wells BH-6 and BH23 to 6.8 mg/L in monitoring well BH19. Dissolved nitrate-nitrogen concentrations were generally lower in groundwater samples collected from PHC-impacted area and down-gradient of this area. Increased dissolved nitrate-nitrogen concentrations were measured in groundwater samples collected from non-PHC impacted wells at the edges of the PHC plume. It appears there is a trend indicative of biodegradation.

The results of the dissolved nitrate-nitrogen laboratory analyses are presented on Table 9 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.4 ALKALINITY

Total alkalinity (as $CaCO_3$) groundwater results ranged from 230 mg/L in monitoring well BH-9 to 760 mg/L in monitoring well BH24. It appears that there is a trend of increased alkalinity in PHC-impacted wells near the center of the source area.

The results of the total alkalinity laboratory analyses are presented on Table 9 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.5 DISSOLVED MANGANESE

Dissolved manganese (Mn^{2+}) groundwater results ranged from 0.011 mg/L in monitoring well BH18 to 2.6 mg/L in monitoring well BH-2. It appears that there is a trend of increased dissolved manganese concentrations in the PHC-impacted area.

The results of the dissolved manganese laboratory analyses are presented on Table 8 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.6 DISSOLVED IRON

Dissolved iron groundwater results ranged from less than0.03 mg/L in monitoring wells BH-4, BH-6, BH-7, BH-10, BH-13, BH-14, BH18, BH19, BH24, BH29-12, BH31-12 to 2.9 mg/L in monitoring well BH20. It appears that there is a trend of increased dissolved iron concentrations in the source area.

The results of the dissolved iron laboratory analyses are presented on Table 8 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.7 SULPHATE

Sulphate results ranged from less than 1.0 mg/L in monitoring well BH-12 to 91 mg/L in monitoring well BH23. Trends in the sulphate concentrations indicative of biodegradation were not observed during this monitoring event.

The results of the sulphate laboratory analyses are presented on Table 9 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.4.2.8 BIOLOGICAL ANALYSES

Heterotrophic plate count (HPC) and hydrocarbon degrading bacteria were identified in all wells sampled. The results ranged from 1,000 CFU/mL to 2,800,000 CFU/mL for the HPC and from 10 MPN/mL to 55,000 MPN/mL for the hydrocarbon degrading bacteria. Based on these results, HPC and hydrocarbon degrading bacteria appear to be more numerous within the dissolved PHC plume area.

The results of the bacterial laboratory analyses are presented on Table 11 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.5 SOIL VAPOUR ANALYTICAL RESULTS

5.5.1 PETROLEUM HYDROCARBON ANALYSES

Measured PHC concentrations in vapour samples collected from soil vapour wells VW25-12 and VW27-12 were 1,400 to 2,700,000 times less than the soil vapour objectives. The concentration of ethylbenzene did not exceed the analytical detection limit in sample VW25-12. The concentrations of the remaining analyzed parameters exceeded the laboratory detection limits, but were well below the site-specific soil vapour objectives. Soil vapour samples could not be collected from soil vapour wells VW26-12 and VW28-12 due to infiltration of groundwater into the wells or saturated soil surrounding the wells. Groundwater adjacent to these locations was at a depth of approximately 0.6 mbgs, the vapour wells are screened from 0.7 mbgs to 1 mbgs below ground.

The soil vapour laboratory analytical results are presented on Table 13 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.5.2 *Helium Analyses*

The target helium concentration indicating insignificant leakage is less than 1% helium. Concentrations of greater than 10% helium indicate that the sample was compromised by significant leakage. When helium concentrations are between 1% and 10% a mass-balance calculation can be done to correct the concentrations (Atlantic PIRI, 2006). Helium concentrations of less than 1% were measured in soil vapour samples collected from soil vapour wells BH25-12 and BH27- 12 indicating that no significant leakage occurred during sampling; and therefore, the soil vapour analytical results were not corrected using the aforementioned mass-balance calculation.

The analytical results of the helium used as a tracer in the leakage test are presented in Table 13 as percent helium in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.6 Waste Characterization

5.6.1 *Waste Soil*

A waste characterization sample was collected from the soil cuttings that were stored in a soil bag at the site. The results of the BTEX, PHC fractions F1 to F4, PCBs, and pesticide analyses were not detected at concentrations exceeding the laboratory detection limits.

The waste soil characterization laboratory analytical results are presented on Tables 3 and 5 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

5.6.2 *Waste Water Analyses*

A waste characterization water sample was collected from the waste water drums that are stored at the site. BTEX and PHC fractions F2, F3 and F4 were identified at concentrations exceeding the laboratory detection limit. The remaining constituent of PHC fraction F1 was not detected at a concentration exceeding the laboratory detection limit. The concentrations of several dissolved metals were above the laboratory detection limits.

The waste water characterization laboratory analytical results are presented on Tables 7, 8 and 9 in Appendix F. Copies of the laboratory analytical reports are provided in Appendix G.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL

Field Quality Assurance/Quality Control (QA/QC) procedures undertaken by Tetra Tech field staff included the cleaning of sampling equipment, and sample collection, handling and management procedures, as summarized below:

- New, clean, disposable nitrile gloves were worn when handling samples or sampling equipment. New gloves were worn for every sample collected.
- Sampling equipment was cleaned before and between samples by washing the equipment in laboratory-grade detergent and potable water and rinsing twice with distilled water.
- Helium leakage tests were conducted prior to collecting each soil vapour sample to identify whether there was any leakage within the soil vapour sampling apparatus and the borehole annulus.
- New, clean and disposable Teflon tubing and compression fittings were used during collecting soil vapour samples.
- Soil vapour samples submitted for laboratory analyses were labeled on the tags attached to the Summa® canisters.
- Soil vapour samples obtained using Summa® canisters were not placed in ice-chilled coolers for transport since volatiles may condense out the vapour phase at lower temperatures.
- Samples submitted for laboratory analyses were identified on both the caps and labels of the laboratory supplied sample bottles and jars.
- Precautions were taken to ensure that each sample was handled in such a way as to minimize the possible loss of volatiles before quantitative analyses at the laboratory. These included:
  - Packing the samples so that minimal headspace remained in the sample containers.
  - Samples were placed in ice-chilled coolers throughout the duration of site activities and during shipment to the laboratory.
- During groundwater monitoring activities, the interface probe, YSI multi-parameter meter, Mega Monsoon pump®, and flow-through cell were washed and rinsed between each measurement and between groundwater monitoring well locations.

- To evaluate field QA/QC procedures a trip blank, a field blank and two equipment blanks were collected as follows:
  - A field blank sample was prepared from laboratory-supplied organic-free water while on the site and returned it to the laboratory for analyses at the end of sampling event. The collected field blank provides a means to monitor potential contamination that may impact volatile organics, such as BTEX, due to the ambient air conditions.
  - The field staff brought a laboratory-prepared trip blank sample, which was prepared with organic-free water, to the site and returned it to the laboratory unopened for analyses at the end of sampling event. An analysis of trip blank helps to identify any potential cross-contamination that may have occurred with volatile organics, such as BTEX
  - Using analyte-free water, staff prepared two equipment blank samples while on the site by exposing the water to any field apparatus and then collecting the water in an appropriate sampling containers and returning it to the laboratory for analyses. An equipment blank is used to evaluate artifacts or cross-contamination from field equipment and is analyzed for all potential contaminants of concern.
- The RKI Eagle® vapour meter was calibrated daily with hexane prior to the commencement of field activities. The vapour meter was inspected for battery charge daily.
- The YSI multi-parameter meter was calibrated prior to the commencement of field activities for all parameters, except DO. DO was calibrated daily using ambient air. The multi-meter was inspected for battery charge daily.
- Duplicate samples were submitted to the laboratory at a rate of approximately one duplicate for every ten samples.
- Field duplicate soil vapour samples were obtained simultaneously using a Y-splitter that was supplied by the laboratory and was certified as clean.

6.2 LABORATORY QUALITY ASSURANCE/QUALITY CONTROL

Each laboratory report provided by Maxxam includes a Quality Assurance Report. Each laboratory report was analyzed using a Tetra Tech Lab Data Checklist which ensures that both laboratory and field quality control measures are within acceptable parameters.

Laboratory analytical results for the collected field duplicates were compared using the relative percent different (RPD_{DUP}), which is defined as the absolute value of the difference between the two samples, divided by the average. Due to analytical errors near the method detection limit, the RPD_{DUP} should only be applied where the analyte concentrations are greater than the practical quantitation limit (PQL) (defined as five times the method detection limit). For organic and inorganic parameters measured in soil, an RPD_{DUP} value of less than 100% is considered acceptable. For organic

parameters in groundwater, an RPD_{DUP} value of less than 80% is considered acceptable. For inorganic parameters in water, an RPD_{DUP} value of less than 50% is considered acceptable. For organic parameters in soil vapour, an RPD_{DUP} value of less than 50% is considered acceptable.

The following comments were noted on the Tetra Tech Lab Data Checklists:

- The calculated RPD_{DUP} values for BTEX and PHC fractions F1 to F4 ranged from 17% to 36%, (where analyte concentrations were greater than the PQL) for the soil samples that were obtained from borehole BH39-12 at 6 mbgs. These results are considered acceptable.
- The calculated RPD_{DUP} values for BTEX and PHC fractions F1 to F4 ranged from 0% to 34%, (where analyte concentrations were greater than the PQL) for the soil samples that were obtained from borehole BH40-12 at 3.75 mbgs. These results are considered acceptable.
- The calculated RPD_{DUP} values for the soil samples obtained from borehole BH42-12 at 0.3 mbgs ranged from 18% to 40%. These results are considered acceptable.
- The calculated RPD_{DUP} values for the soil samples obtained from borehole BH44-12 at 0.3 mbgs could not be calculated because results did not exceed the laboratory detection limits.
- The calculated RPD_{DUP} values for BTEX and PHC fractions F1 to F4 ranged from 0% to 17%, (where analyte concentrations were greater than the PQL) for the water samples that were obtained from monitoring well BH-12. These results are considered acceptable.
- The calculated RPD_{DUP} values for metals and routine parameters in the groundwater samples obtained from monitoring well BH-12 ranged from 0% to 28%, (where analyte concentrations were greater than the PQL) which is considered acceptable.
- The calculated RPD_{DUP} values for BTEX and PHC fractions F1 to F4 ranged from 0% to 90%, (where analyte concentrations were greater than the PQL) for the water samples that were obtained from monitoring well BH23. These results are considered acceptable.
- The calculated RPD_{DUP} values for metals and routine parameters in the groundwater samples obtained from monitoring well BH23 ranged from 0% to 8%, (where analyte concentrations were greater than the PQL) which is considered acceptable.
- Analytical results for BTEX and/or PHC fractions F1 to F4 in water for the trip blank, field blank, equipment blanks (putty knife and tubing) did not exceed the laboratory detection limits.
- Analytical results for dissolved metals analysis in the equipment blank (tubing) did not exceed the laboratory detection limits except for aluminum, copper, cadmium,

molybdenum and uranium; however, these results were below the PQL. These results do not indicate a data quality problem.

- Analytical results for routine water parameters on the equipment blank (tubing) were within normal ranges for analyte-free water.

The remaining laboratory calibration checks, quality control standard recoveries, spikes, and RPDs were within the laboratory's quality control limits. The Maxxam Quality Assurance Reports and Tetra Tech Lab Data Checklists are included at the back of each analytical report, which are provided in Appendix G.

7.0 DISCUSSION

7.1 SOIL QUALITY

7.1.1 PHC-IMPACTED SOIL

PHC-impacted soil has been identified at the site at concentrations in excess of the assessment EQG for the identified operable receptor exposure pathways. These impacts are present at, and to the south and east of the former gasoline UST (the potential source) that was located at the west end of the gravelled surface between the Shop A and Shop B Maintenance Garages. PHC impacts appear to have migrated in a west and northwesterly direction based on laboratory data collected, away from the former UST and are now present beneath a lightly forested area that buffers the Lobstick maintenance compound from the 14th hole of the Lobstick Golf Course. These impacts to soil appear to be delineated vertically and horizontally. Since it is reasonably assumed that the Lobstick maintenance compound and the Lobstick Golf Course comprise one property then only one property is affected by these impacts. Based on the October 2012 drilling program, that further delineated the PHC-impacted soil, the volume of PHC-impacted soil is estimated to be in the order of 2800 m^3. This is a reduction from the previously estimated volume of 4200 m^3. The estimated volume of PHC-impacted soil was calculated using an area midway between the maximum and minimum areas and the depth of impacted soil as presented on Figure 5 in Appendix B.

Impacts to soil associated with the former UST were detected at a depth of 2.5 mbgs and were detected to be present to depths up to 6.85 mbgs in soil samples analyzed from the boreholes.

PHC-impacted soils were detected at grade, near the filler spout of the used oil tank that is located on the west side of the Shop A Maintenance Garage. Impacts to the soil at this location overlap with the area that was affected by PHCs from the UST as described above.

7.1.2 DDT-IMPACTED SOIL

To further assess the DDT concentrations in soil at the site, Tetra Tech staff collected 24 soil samples, including two duplicates, across the site at varying near surface depths. The soil sample analytical results indicated the presence of DDT (total) in nine soil samples at concentrations above the laboratory detection limit but below the referenced CCME commercial land use guideline. Samples were submitted from

surface to 1.5 mbgs, with DDT detected in soil samples collected from boreholes BH32-12 at 0.1 mbgs, BH33-12 at 0.05 mbgs, BH34-12 at 0.25 mbgs, BH42-12 at 0.3 mbgs, and BH45 at 0.25 mbgs. DDT was not detected at concentrations exceeding the laboratory detection limit in samples collected from the same boreholes at depths below those indicated above. These results indicate that DDT is generally present at the site in the near surface soils. Therefore, these results should be considered if soil is to be disposed of the site at a soil disposal facility.

In borehole BH44-12, which is located adjacent to the chemical storage shed, DDT was not detected at a concentration greater than the laboratory detection limit in the near surface soil; however, DDT was detected at a concentration less than the referenced EQG in soil samples collected from depths of 0.75 mbgs, 1 mbgs and 1.5 mbgs, the maximum depth of investigation in this borehole. Borehole BH44-12 is located within the PHC-impacted soil area and any excavation would likely remove the DDT in this area.

7.2 GROUNDWATER QUALITY

7.2.1 *PHC-IMPACTED GROUNDWATER*

PHCs were detected in groundwater samples collected from monitoring wells BH-12 and BH23 within the area of investigation at concentrations in excess of the assessment EQG for the identified operable receptor exposure pathways. These groundwater impacts correlate with the plume of PHC-impacted soil. PHC concentrations in groundwater are at a maximum in monitoring well BH-12, near the potential source, and then decline to generally non-detectable levels in the periphery wells.

With the addition of three sentry monitoring wells in October 2012, PHC impacts are generally delineated within the area of investigation. PHCs previously detected in groundwater samples collected from monitoring well BH20 have been delineated to non-detect levels in monitoring well BH29-12, located in the 14th hole to the northwest. Due to slow groundwater recharge, monitoring well BH30-12, northeast of the site on the side of the service road, could not be sampled during this event. However, a field measurement showed background levels of DO in the groundwater. This would suggest that there are insignificant concentrations of PHCs in the groundwater at this location and support this well as being a sentry well. In addition, groundwater samples collected from monitoring wells BH18 and BH19, which are southwest of BH30-12, had non-detectable PHC concentrations.

7.2.2 *METALS-IMPACTED GROUNDWATER*

Various dissolved metals were identified in all wells that were sampled at this site at concentrations in excess of the laboratory detection limits. There are no applicable FIGQG (2012) guidelines for dissolved metals in groundwater.

7.3 GROUNDWATER FLOW CONDITION

The average depth to groundwater from ground during the October 2012 monitoring event was 1.55 mbgs and the average groundwater elevation was 98.27 m above datum. From the groundwater monitoring events observed since 2010, groundwater elevations are at their highest in early winter (November/December) and their lowest in mid-winter (February). Previous groundwater monitoring events have assessed the groundwater flow direction to be north/northwest. The groundwater appeared to be mounded with an apparent radial groundwater flow direction away from the maintenance compound during this monitoring event. Monitoring well BH23 had measured depth to groundwater of 0.13 mbgs, which is above the screen interval. No evidence was observed to explain the high groundwater elevation. Groundwater did not appear to be stabilized in new monitoring wells BH29-12 and BH30-12 one day after installation

7.3.1 *NATURAL ATTENUATION ASSESSMENT*

Increasing trends of dissolved manganese, dissolved iron, and alkalinity, and decreasing trends of DO and nitrate-nitrogen were identified in the groundwater of PHC-impacted wells, when compared to the groundwater of non-PHC-impacted wells. As well, hydrocarbon degrading bacteria were detected in groundwater samples collected from the site, in numbers more numerous within the dissolved PHC plume.

In general, based on the results of the October 2012 monitoring and sampling event the trends suggest that biodegradation of PHC constituents has likely occurred and/or is occurring via aerobic respiration, manganese reduction, denitrification, and iron reduction. These degradation pathways may still be active, through denitrification, manganese reduction, and iron reduction typically take place as aerobic respiration rates begin to decrease. The concentrations of DO, nitrate-nitrogen, dissolved manganese, and dissolved iron in the groundwater suggest it is possible that as aerobic respiration is exhausted the anaerobic processes are being utilized until the DO concentrations are sufficient to begin aerobic respiration again.

The assimilative capacity to degrade BTEX components was calculated by summing the geochemical indicators' potential for biodegradation. The depleted DO concentrations in the groundwater suggest that it is possible that aerobic respiration has taken place, and may continue to take place at the site.

The expressed total assimilative capacity of BTEX in the groundwater sampled in the area of investigation is calculated to be in the range of approximately 1 mg/L (monitoring wells BH-12 and BH16) to 20 mg/L (monitoring well BH23). The assimilative capacities for each of the monitoring wells are above the observed concentration of BTEX detected, except for monitoring well BH-12. Monitoring well BH-12 is in the middle of the plume and has had the highest dissolved PHCs in the four sampling events that have been conducted. This calculation implies that there are not

enough nutrients in the water at this location to biodegrade the PHCs. However, away from this location, the remaining monitoring wells show that there is the potential for biodegradation to occur.

The assimilative capacity for BTEX degradation is presented on Table 12 in Appendix F.

7.4 Petroleum Hydrocarbon Vapours in Soil

One soil vapour sampling event has been completed at the site; in the fall of 2012, and only two of the four soil vapour wells could be sampled. Analytical results for PHCs in soil vapour that have been obtained thus far, from soil vapour wells VW25-12 and VW27-12, were 1,400 to 2,700,000 times less than the referenced soil vapour objectives. Soil vapour samples could not be collected from soil vapour wells VW26-12 and VW28-12 due to infiltration of groundwater and/or saturated soil surrounding the screen interval. Groundwater in monitoring wells BH-9 and BH-12, which are adjacent to the flooded vapour wells VW26-12 and VW28-12, respectively, was measured at a level above the screen of the vapour wells. Previous groundwater monitoring events have shown that the groundwater fluctuates to a level below the screen of the vapour well inferring that soil vapours could be sampled in these wells during a different season.

Recommendations from the ITRC (2007) and Geosyntec (2008) suggest that soil vapour monitoring programs can be concluded if measured soil vapour concentrations were 10 times less than risk-based objectives and that at least two sampling events during different seasons have been completed.

From the limited data available it does not appear that the intrusion of subsurface vapours to indoor air would be expected to result in adverse health effects for occupants of existing buildings or future building occupants. However, additional soil vapour sampling is required to support this statement. The additional soil vapour sampling at soil vapour wells VW25-12 and VW27-12 should occur during a different season, preferably in the early spring before groundwater begins to rise. Soil vapour wells VW26-12 and VW28 -12 should be sampled during two different seasons when groundwater is sufficiently below the soil vapour screen interval. Based on historical monitoring data, groundwater is expected to be sufficiently below the soil vapour screen interval to allow the sampling of all four soil vapor wells during the early spring and potentially during the mid-summer months.

8.0 NATIONAL CLASSIFICATION SYSTEM FOR CONTAMINATED SITES

A National Classification System for Contaminated Sites (NCSCS) worksheet was completed for the subject site. This classification was compiled in accordance with the procedures established in the CCME *National Classification System for Contaminated Sites Guidance Document PN 1403*.

For this site, the NCSCS Site Score was determined by assessing the maintenance compound and the surrounding areas that are known or suspected to have been affected by contaminants that may have originated at the subject site. The Site Score was determined by assessing all affected areas as a whole. Individual areas, if assessed separately, may have a lower Site Score.

The NCSCS Site Score for the Lobstick maintenance compound and the surrounding affected areas is 48.1 (Site Letter Grade C; certainty percentage 69%) which corresponds with a Site Classification Category of 3 (Low Priority for Action).

A copy of the NCSCS Score Summary Sheet with the calculated Site Score is provided in Appendix H.

8.1 DISCUSSION

This site score is primarily derived from the nature of the potential risks that are associated with the contaminants that are present at the site, in particular benzene, which has a relatively large effect on the overall site score. Additionally, impacts in surface soils (upper 1.5 m), impacts to groundwater, and potential risks to building occupants from vapour ingress drive up the score.

Tetra Tech is of the opinion that the identified impacts pose a low risk to human and environmental receptors at this site. The bulk of the PHC-impacted soils at this site lie below an approximately 20 m wide lightly forested strip that acts as a buffer between the maintenance compound and the 14th hole of the Lobstick Golf Course. The impacts are generally located from approximately 2.5 m to approximately 6.9 mbgs. It would be anticipated that if the Lobstick maintenance compound were to be redeveloped that this natural vegetation (the buffer strip) would be retained, suggesting that there would be few risks to allowing these impacts to attenuate in place. None the less, with the current data collected, the identified PHC impacts may still pose a vapour inhalation risk to occupants of the current and proposed structures at this site due to the possible migration of PHC vapours through the near surface coarse-grained soils, into the occupiable spaces of these structures. At least two additional soil vapour sampling

events would be required to assess if subsurface vapours to indoor air may be expected to result in adverse health effects to current or future occupants at the site. In lieu of continued vapour sampling, or in conjunction with, a vapour management system could be installed beneath any new building construction within the footprint of the PHC plume.

9.0 CONCLUSIONS

- The stratigraphy at this site is somewhat heterogeneous, but generally comprised a surface covering of sand or gravel fill within the parking or roadway areas to a depth of approximately 1 mbgs, outside of these areas organic silts were encountered. These materials were underlain by silt at depths of approximately 2.75 mbgs to 3.5 mbgs. The silt was typically underlain by olive-brown clay with periodic cobbles and silt or sand seams to the total investigated depth of 10.25 mbgs. Wet sand sequences were observed in boreholes BH-13, BH20, BH21, BH30-12, BH31-12, BH33-12 and BH38-12; however, these appeared to be discontinuous. Eleven boreholes were terminated due to contact with cobbles.

- PHC impacts to soil have been identified at concentrations exceeding the assessment EQGs in samples that were obtained from boreholes: BH-4, BH-5, BH-8, BH-11, BH-12, BH23, BH39-12, and in the surface soil sample collected near the used oil tank. The identified PHC impacts to soil have been delineated. Based on the results of the October 2012 drilling program, that further delineated the PHC-impacted soil, the volume of PHC-impacted soil is estimated to be in the order of 2800 m^3.

- DDT (total) in soil was not identified at concentrations exceeding the assessment EQG in any samples collected and analysed.
- PHC impacts to groundwater were also identified at concentrations exceeding the referenced groundwater guidelines in samples that were collected from monitoring wells BH-12 and BH23. Dissolved-phase PHCs are delineated.
- One or more dissolved and/or total metals were identified in all the groundwater monitoring wells that were sampled at this site. There are no applicable assessment EQGs for metals in groundwater at this site.
- Groundwater monitoring well inspections were conducted in November, 2010, February, March, and December 2011, and October 2012. LNAPL was not detected on the groundwater surface in any of the groundwater monitoring wells at the site and the inferred groundwater flow direction appears to be mounded with radial groundwater flow away from the maintenance compound during the latest event.
- Trends indicative of biodegradation were observed during the natural attenuation assessment. These include an increase in manganese, iron and alkalinity and a decrease in DO and nitrate nitrogen within wells containing dissolved PHCs when compared with well that do not contain dissolved PHCs. As well, the capacity of the monitoring wells at the site to assimilate BTEX is greater than the dissolved

BTEX concentrations measured in all the wells, except monitoring well BH-12. Monitoring well BH-12 is in the centre of the suspected area of impact.

- Soil vapour samples were collected from two of the four soil vapour wells installed at the site. Analytical results for PHC in soil vapour were 1,400 to 2,700,000 times less than the referenced soil vapour objectives.
- The NCSCS Site Score for the former Lobstick maintenance compound and the surrounding affected areas is 48.1 which corresponds with a Site Classification Category of 3 (Low Priority for Action).

10.0 REFERENCES

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11.0 LIMITATIONS

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Tetra Tech WEI Inc. makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgment, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which are assumed to be correct. Except as provided, Tetra Tech WEI Inc. has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of sample points, and the number of samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based will consequently change Tetra Tech WEI Inc. conclusions and recommendations.

APPENDIX A

PHOTOGRAPHS

SITE PHOTOGRAPHS

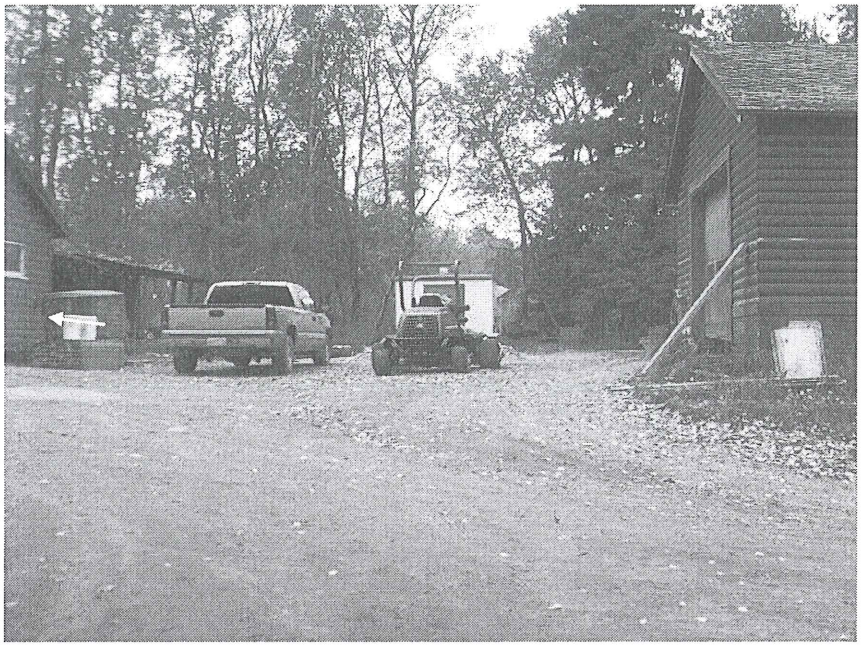

Photo 1: East-facing view looking toward the site from the access road.

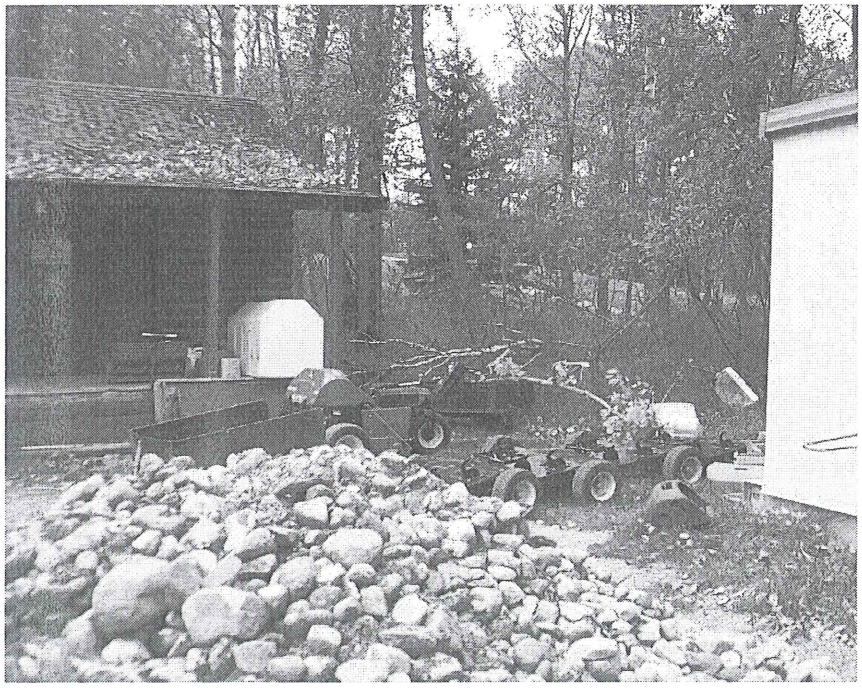

Photo 2: Southwest-facing view looking toward the 14th hole.

SITE PHOTOGRAPHS

Photo 1: East-facing view looking toward the site from the access road.

Photo 2: Southwest-facing view looking toward the 14th hole.

SITE PHOTOGRAPHS

Photo 3: North-facing view looking along the access road toward the site from the 13th hole.

Photo 4: East-facing view toward the site from the 14th hole.

SITE PHOTOGRAPHS

Photo 5: Northeast-facing view toward the site from the 14th hole.

Photo 6: Southwest-facing view of the septic tank and power pole from the access road.

SITE PHOTOGRAPHS

Photo 7: Southeast-facing view of the location of monitoring well BH29-12.

Photo 8: Southwest-facing view of a water body located approximately 159 m east of site.

SITE PHOTOGRAPHS

Photo 9: West-facing view of a water body, including a beaver lodge, located approximately 365 m northeast of the site.

Photo 10: East-facing view of a water body, including a beaver lodge, located approximately 465 m northeast of the site.

APPENDIX B

FIGURES

REFERENCE DRAWINGS: 073G16, WASKESIU LAKE (2009, MAPPING SERVICES BRANCH)

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TETRA TECH

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DATE: 12/12/03

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DRAWING DESCRIPTION
FIGURE 1: TOPOGRAPHICAL MAP SHOWING LOCATION - LOBSTICK MAINTENANCE COMPOUND - WASKESIU LAKE, SK

DESIGNED BY:	KO/TL	DRAWN BY:	KH	DRAWING NO.	REV.
REVIEWED BY:	TL	SCALE:	1:60,000	1018901603-SKT-V0001	00

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REFERENCE DRAWINGS: 073G16, WASKESIU LAKE (2009, MAPPING SERVICES BRANCH)

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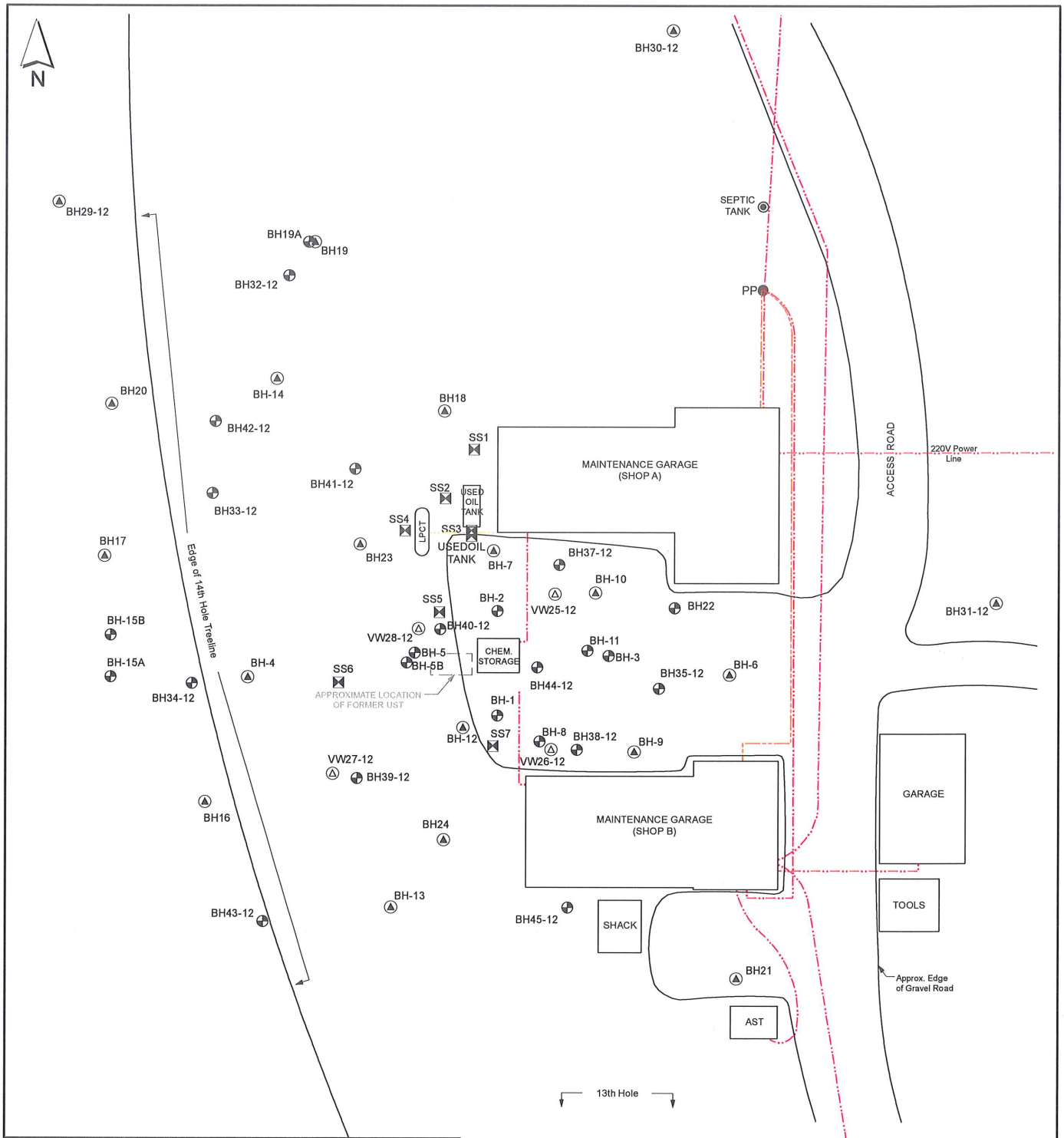
DRAWING DESCRIPTION
FIGURE 1: TOPOGRAPHICAL MAP SHOWING LOCATION - LOBSTICK MAINTENANCE COMPOUND - WASKESIU LAKE, SK

DESIGNED BY:	DRAWN BY:	DRAWING NO.	REV.
KO/TL	KH	1018901603-SKT-V0001	00
REVIEWED BY: TL	SCALE: 1:60,000		

A4 (216 x 279)



LEGEND

- MONITORING WELL
- BOREHOLE
- SURFACE SOIL SAMPLE
- SOIL VAPOUR WELL
- REMOVED INFRASTRUCTURE
- ELECTRICAL LINE
- TELEPHONE LINE
- GAS LINE
- PP POWER POLE
- SEPTIC TANK

NOTE:
- LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE ONLY AND ARE NOT RELIABLE FOR CONSTRUCTION PURPOSES.

TETRA TECH

NO.	DATE	DESCRIPTION OF REVISION	ISSUED BY
00	12.12.03	ISSUED TO CLIENT	TL

REVISIONS/ISSUE

CLIENT

PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

DRAWING DESCRIPTION

FIGURE 2: SITE PLAN LOBSTICK MAINTENANCE COMPOUND - WASKESIU LAKE, SK

APPROVED BY:	JN	CLIENT DRAWING NO.	NOT APPLICABLE
DATE:	12/12/03		

DRAFTED BY:	KH	DESIGNED BY:	KO/TL	DRAWING NO.	REV.
REVIEWED BY:	TL	SCALE:	1:400	1018901603-SKT-V0002	00

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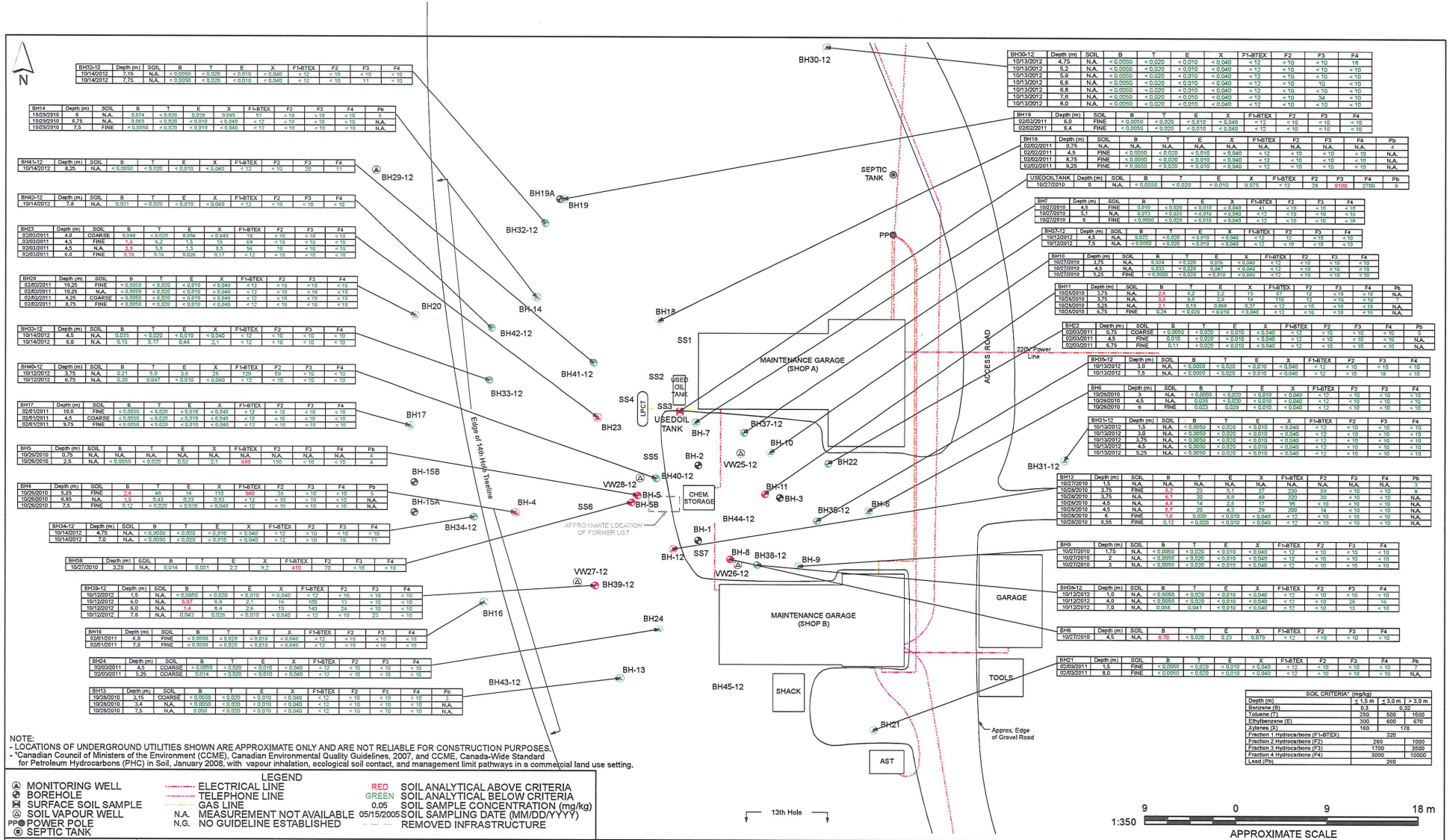

BH32-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	7,15	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/14/2012	7,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	11	< 10

BH14	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/29/2010	6	N.A.	0,074	< 0,029	0,039	0,085	51	< 10	< 10	< 10	6
10/29/2010	6,75	N.A.	0,065	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
10/29/2010	7,5	FINE	< 0,0050	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH41-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	8,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	20	11

BH42-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	7,8	N.A.	0,031	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH23	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/03/2011	4,0	COARSE	0,048	< 0,029	0,096	< 0,040	16	< 10	< 10	< 10
02/03/2011	4,5	FINE	1,8	6,2	1,5	10	69	< 10	< 10	< 10
02/03/2011	4,5	N.A.	2,0	5,9	1,3	8,5	56	10	< 10	< 10
02/03/2011	6,0	FINE	0,79	0,16	0,026	0,17	< 12	< 10	< 10	< 10

BH20	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/02/2011	10,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	10,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	8,25	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	8,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH33-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	4,5	N.A.	0,035	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/14/2012	6,0	N.A.	0,19	0,17	0,44	2,1	< 12	< 10	< 10	< 10

BH40-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	3,75	N.A.	0,21	5,0	3,6	28	120	59	< 10	< 10
10/12/2012	6,75	N.A.	0,20	0,047	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH17	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/01/2011	10,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	4,5	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	9,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH5	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/26/2010	0,75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	4
10/26/2010	2,5	N.A.	< 0,0050	< 0,029	0,52	2,1	680	150	< 10	< 10	4

BH4	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/26/2010	5,25	FINE	2,8	46	18	110	580	35	< 10	< 10	5
10/26/2010	6,85	N.A.	1,9	0,43	0,33	0,53	< 12	< 10	< 10	< 10	N.A.
10/26/2010	7,5	FINE	0,12	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH34-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	4,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/14/2012	7,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	19	11

BH5B	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/27/2010	3,25	N.A.	0,014	0,031	2,2	9,2	410	70	< 10	< 10

BH39-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	1,5	N.A.	< 0,0050	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/12/2012	6,0	N.A.	0,97	6,9	2,1	16	100	53	< 10	< 10
10/12/2012	6,0	N.A.	1,4	8,4	2,6	19	140	24	< 10	< 10
10/12/2012	7,8	N.A.	0,043	0,028	< 0,010	< 0,040	< 12	< 10	23	< 10

BH16	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/01/2011	6,0	FINE	< 0,0050	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	7,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH24	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/03/2011	4,5	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/03/2011	5,25	COARSE	0,014	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH13	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/28/2010	3,15	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	3
10/28/2010	3,4	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
10/28/2010	7,5	N.A.	0,050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH30-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	4,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	18
10/13/2012	5,2	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	5,9	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	6,6	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	10	< 10
10/13/2012	6,8	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	7,6	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	34	< 10
10/13/2012	8,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH19	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/02/2011	6,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	6,4	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH16	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/02/2011	0,75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	6
02/02/2011	4,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/02/2011	8,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/02/2011	9,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

USEDOILTANK	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/27/2010	0	N.A.	< 0,0050	< 0,020	< 0,010	0,075	< 12	28	9100	2700	9

BH7	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/27/2010	4,5	FINE	0,018	< 0,020	< 0,010	< 0,040	41	< 10	< 10	< 10
10/27/2010	5,1	N.A.	0,013	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/27/2010	6	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH37-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	4,5	N.A.	0,022	< 0,020	< 0,010	< 0,040	< 12	12	< 10	< 10
10/12/2012	7,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH10	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/27/2010	3,75	N.A.	0,024	< 0,020	0,016	< 0,040	< 12	< 10	< 10	< 10
10/27/2010	4,5	N.A.	0,033	< 0,020	0,047	< 0,040	< 12	< 10	< 10	< 10
10/27/2010	5,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH11	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/25/2010	3,75	N.A.	3,8	8,2	2,2	15	67	12	< 10	< 10	N.A.
10/25/2010	3,75	N.A.	3,9	9,8	2,9	19	110	12	< 10	< 10	7
10/26/2010	5,25	N.A.	2,1	0,19	0,068	0,37	< 12	< 10	< 10	< 10	N.A.
10/26/2010	6,75	FINE	0,24	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH22	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/03/2011	0,75	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	5
02/03/2011	4,5	FINE	0,010	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/03/2011	6,75	FINE	0,11	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH35-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	3,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	7,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	18	< 10

BH6	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/26/2010	3	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/26/2010	4,5	N.A.	0,035	< 0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/26/2010	6	FINE	0,023	0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH31-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	1,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	3,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	3,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	4,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	5,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/27/2010	1,5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3
10/28/2010	3,75	FINE	5,2	22	5,1	37	230	59	< 10	< 10	8
10/28/2010	3,75	N.A.	6,1	30	6,9	49	320	30	< 10	< 10	N.A.
10/28/2010	4,5	N.A.	4,8	14	2,5	17	95	< 10	< 10	< 10	N.A.
10/28/2010	4,5	N.A.	5,7	20	4,3	29	200	14	< 10	< 10	N.A.
10/28/2010	6	FINE	1,6	0,039	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
10/28/2010	6,55	FINE	0,12	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH9	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/27/2010	1,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/27/2010	2	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/27/2010	3	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH36-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	1,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/12/2012	4,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	28	16
10/12/2012	7,0	N.A.	0,058	0,041	< 0,010	< 0,040	< 12	< 10	13	< 10

BH8	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/27/2010	4,5	N.A.	0,70	< 0,020	0,23	0,079	< 12	< 10	< 10	< 10

BH21	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/03/2011	1,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	7
02/03/2011	8,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

SOIL CRITERIA* (mg/kg)		
Depth (m)	< 1,5 m	< 3,0 m / > 3,0 m
Benzene (B)	0,3	0,22
Toluene (T)	250	500 / 1500
Ethylbenzene (E)	300	600 / 670
Xylenes (X)	160	170
Fraction 1 Hydrocarbons (F1-BTEX)	320	
Fraction 2 Hydrocarbons (F2)	260	1000
Fraction 3 Hydrocarbons (F3)	1700	3500
Fraction 4 Hydrocarbons (F4)	3000	10000
Lead (Pb)	260	

NOTE:
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- *Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines, 2007, and CCME, Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

LEGEND

- MONITORING WELL
- BOREHOLE
- SURFACE SOIL SAMPLE
- SOIL VAPOUR WELL
- POWER POLE
- SEPTIC TANK
- ELECTRICAL LINE
- TELEPHONE LINE
- GAS LINE
- N.A. MEASUREMENT NOT AVAILABLE
- N.G. NO GUIDELINE ESTABLISHED
- RED SOIL ANALYTICAL ABOVE CRITERIA
- GREEN SOIL ANALYTICAL BELOW CRITERIA
- 0.05 SOIL SAMPLE CONCENTRATION (mg/kg)
- 05/15/2005 SOIL SAMPLING DATE (MM/DD/YYYY)
- REMOVED INFRASTRUCTURE

1:350 — 9 0 9 18 m — APPROXIMATE SCALE

NO.	DESCRIPTION
REFERENCE DRAWINGS	

NO.	DATE	DESCRIPTION OF REVISION	DRAFTED	DESIGNED	REVIEWED	APPROVED
00	12.12.03	ISSUED TO CLIENT	KH	TL		

REVISIONS/ISSUE

TETRA TECH

APPROVED BY: JN
DATE: 12/12/03
CLIENT DRAWING NO.: NOT APPLICABLE

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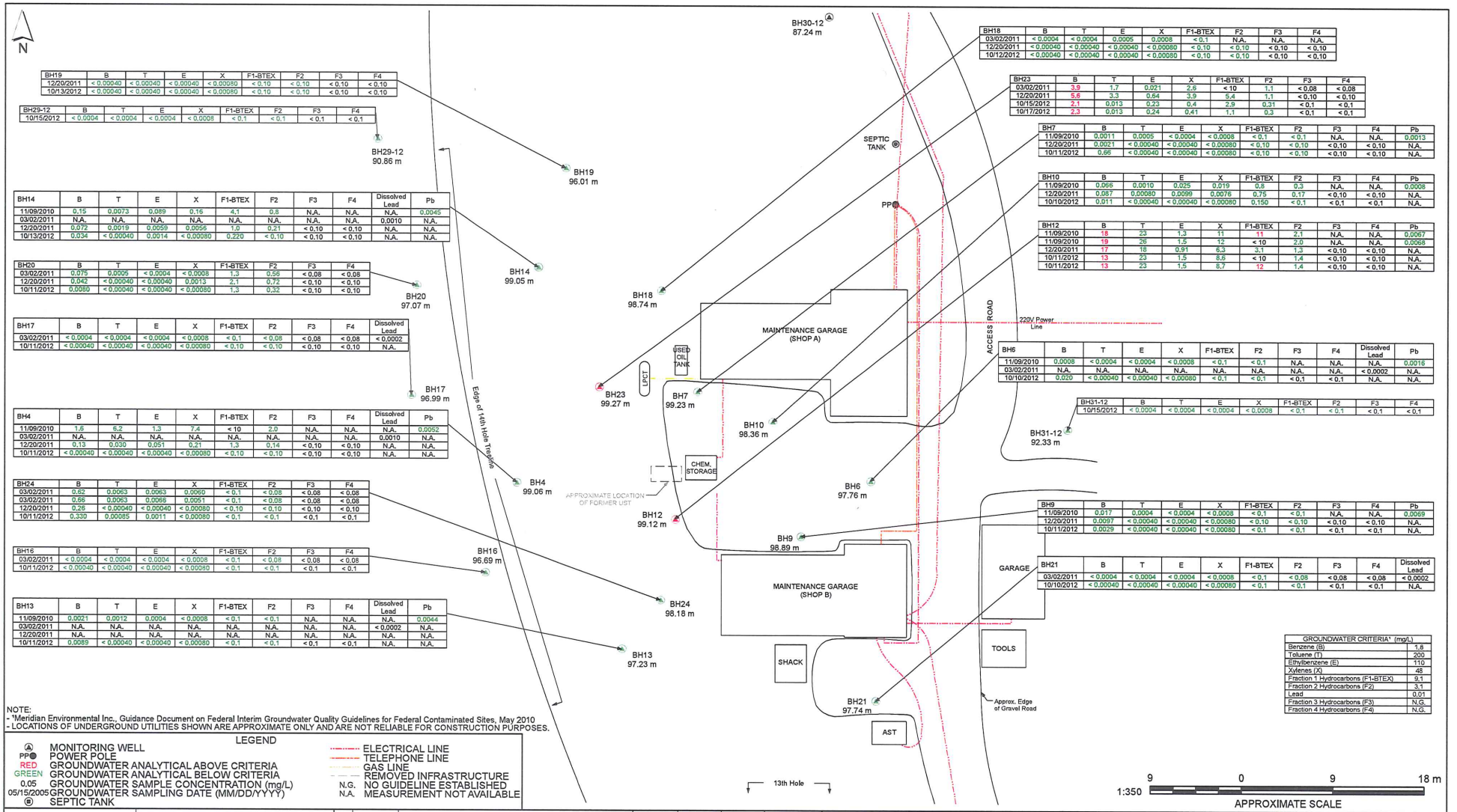
CLIENT: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

DRAWING DESCRIPTION:
FIGURE 3: SITE PLAN SHOWING
HISTORICAL SOIL ANALYTICAL RESULTS
LOBSTICK MAINTENANCE COMPOUND, WASKESIU LAKE, SK

DRAFTED BY:	KH	DESIGNED BY:	KO/TL	DRAWING NO.	REV.
REVIEWED BY:	TL	SCALE:	1:350	1018901603-SKT-V0003	00



BH19	B	T	E	X	F1-BTEX	F2	F3	F4
12/20/2011	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
10/13/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10

BH29-12	B	T	E	X	F1-BTEX	F2	F3	F4
10/15/2012	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	< 0.1	< 0.1

BH14	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead	Pb
11/09/2010	0.15	0.0073	0.089	0.16	4.1	0.8	N.A.	N.A.	N.A.	0.0045
03/02/2011	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0010	N.A.
12/20/2011	0.072	0.0019	0.0059	0.0056	1.0	0.21	< 0.10	< 0.10	N.A.	N.A.
10/13/2012	0.034	< 0.00040	0.0014	< 0.00080	0.220	< 0.10	< 0.10	< 0.10	N.A.	N.A.

BH20	B	T	E	X	F1-BTEX	F2	F3	F4
03/02/2011	0.075	0.0005	< 0.0004	< 0.0008	1.3	0.56	< 0.08	< 0.08
12/20/2011	0.042	< 0.00040	< 0.00040	0.0013	2.1	0.72	< 0.10	< 0.10
10/11/2012	0.0080	< 0.00040	< 0.00040	< 0.00080	1.3	0.32	< 0.10	< 0.10

BH17	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead
03/02/2011	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08	< 0.0002
10/11/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10	N.A.

BH4	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead	Pb
11/09/2010	1.6	6.2	1.3	7.4	< 10	2.0	N.A.	N.A.	N.A.	0.0052
03/02/2011	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	0.0010	N.A.
12/20/2011	0.13	0.030	0.051	0.21	1.3	0.14	< 0.10	< 0.10	N.A.	N.A.
10/11/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10	N.A.	N.A.

BH24	B	T	E	X	F1-BTEX	F2	F3	F4
03/02/2011	0.62	0.0063	0.0063	0.0060	< 0.1	< 0.08	< 0.08	< 0.08
03/02/2011	0.66	0.0063	0.0056	0.0051	< 0.1	< 0.08	< 0.08	< 0.08
12/20/2011	0.26	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
10/11/2012	0.330	0.00085	0.0011	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1

BH16	B	T	E	X	F1-BTEX	F2	F3	F4
03/02/2011	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08
10/11/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1

BH13	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead	Pb
11/09/2010	0.0021	0.0012	0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.	N.A.	0.0044
03/02/2011	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	< 0.0002	N.A.
12/20/2011	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
10/11/2012	0.0089	< 0.00040	< 0.00040	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1	N.A.	N.A.

BH18	B	T	E	X	F1-BTEX	F2	F3	F4
03/02/2011	< 0.0004	< 0.0004	0.0005	0.0008	< 0.1	N.A.	N.A.	N.A.
12/20/2011	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
10/12/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10

BH23	B	T	E	X	F1-BTEX	F2	F3	F4
03/02/2011	3.9	1.7	0.021	2.6	< 10	1.1	< 0.08	< 0.08
12/20/2011	5.6	3.3	0.64	3.9	5.4	1.1	< 0.10	< 0.10
10/15/2012	2.1	0.013	0.23	0.4	2.9	0.31	< 0.1	< 0.1
10/17/2012	2.3	0.013	0.24	0.41	1.1	0.3	< 0.1	< 0.1

BH7	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
11/09/2010	0.0011	0.0005	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.	0.0013
12/20/2011	0.0021	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10	N.A.
10/11/2012	0.66	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10	N.A.

BH10	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
11/09/2010	0.066	0.0010	0.025	0.019	0.8	0.3	N.A.	N.A.	0.0008
12/20/2011	0.087	0.00080	0.0099	0.0076	0.75	0.17	< 0.10	< 0.10	N.A.
10/10/2012	0.011	< 0.00040	< 0.00040	< 0.00080	0.150	< 0.1	< 0.1	< 0.1	N.A.

BH12	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
11/09/2010	18	23	1.3	11	11	2.1	N.A.	N.A.	0.0067
11/09/2010	19	26	1.5	12	< 10	2.0	N.A.	N.A.	0.0068
12/20/2011	17	18	0.91	6.3	3.1	1.3	< 0.10	< 0.10	N.A.
10/11/2012	13	23	1.5	8.8	< 10	1.4	< 0.10	< 0.10	N.A.
10/11/2012	13	23	1.5	8.7	12	1.4	< 0.10	< 0.10	N.A.

BH6	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead	Pb
11/09/2010	0.0008	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.	N.A.	0.0018
03/02/2011	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	< 0.0002	N.A.
10/10/2012	0.020	< 0.00040	< 0.00040	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1	N.A.	N.A.

BH31-12	B	T	E	X	F1-BTEX	F2	F3	F4
10/15/2012	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	< 0.1	< 0.1

BH9	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
11/09/2010	0.017	0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.	0.0059
12/20/2011	0.0097	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10	N.A.
10/11/2012	0.0029	< 0.00040	< 0.00040	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1	N.A.

BH21	B	T	E	X	F1-BTEX	F2	F3	F4	Dissolved Lead
03/02/2011	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08	< 0.0002
10/10/2012	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.1	< 0.1	< 0.1	< 0.1	N.A.

GROUNDWATER CRITERIA* (mg/L)	
Benzene (B)	1.8
Toluene (T)	200
Ethylbenzene (E)	110
Xylenes (X)	48
Fraction 1 Hydrocarbons (F1-BTEX)	9.1
Fraction 2 Hydrocarbons (F2)	3.1
Lead	0.01
Fraction 3 Hydrocarbons (F3)	N.G.
Fraction 4 Hydrocarbons (F4)	N.G.

NOTE:
- *Meridian Environmental Inc., Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites, May 2010
- LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE ONLY AND ARE NOT RELIABLE FOR CONSTRUCTION PURPOSES.

LEGEND

- MONITORING WELL
- POWER POLE
- RED GROUNDWATER ANALYTICAL ABOVE CRITERIA
- GREEN GROUNDWATER ANALYTICAL BELOW CRITERIA
- 0.05 GROUNDWATER SAMPLE CONCENTRATION (mg/L)
- 05/15/2005 GROUNDWATER SAMPLING DATE (MM/DD/YYYY)
- SEPTIC TANK
- ELECTRICAL LINE
- TELEPHONE LINE
- GAS LINE
- REMOVED INFRASTRUCTURE
- N.G. NO GUIDELINE ESTABLISHED
- N.A. MEASUREMENT NOT AVAILABLE

1:350 — 9 0 9 18 m
APPROXIMATE SCALE

NO.	DATE	DESCRIPTION OF REVISION	DRAFTED	DESIGNED	REVIEWED	APPROVED
00	12.12.03	ISSUED TO CLIENT	KH	TL		

REVISIONS/ISSUE

NO.	DESCRIPTION

REFERENCE DRAWINGS

TETRA TECH

APPROVED BY: JN
DATE: 12/12/03
CLIENT DRAWING NO: NOT APPLICABLE

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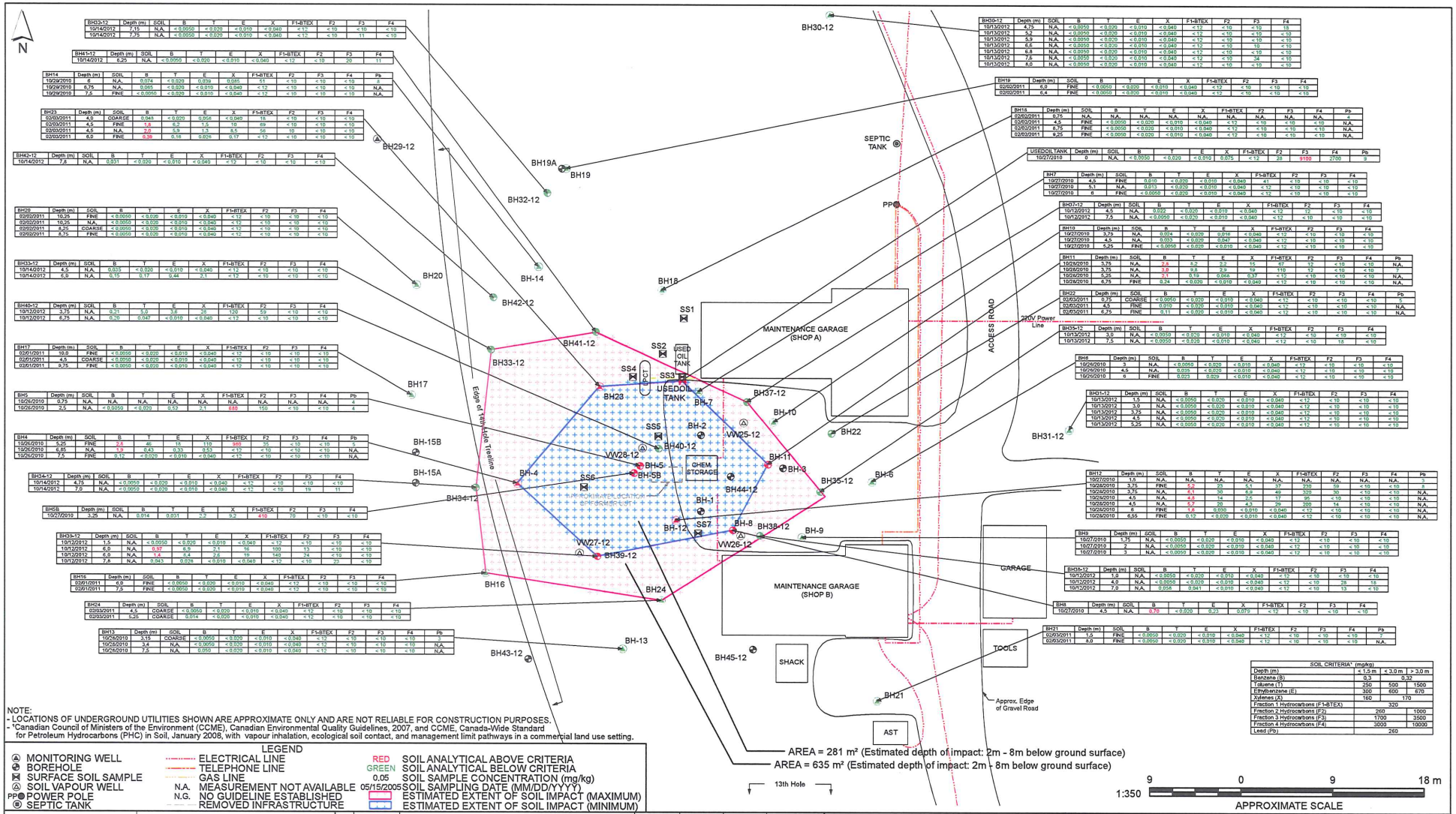
CLIENT: PUBLIC WORKS AND GOVERNMENT SERVICES CANADA

DRAWING DESCRIPTION:
FIGURE 4: SITE PLAN SHOWING
HISTORICAL GROUNDWATER ANALYTICAL RESULTS
LOBSTICK MAINTENANCE COMPOUND, WASKESIU LAKE, SK

DRAFTED BY:	DESIGNED BY:	DRAWING NO.	REV.
KH	KO/TL	1018901603-SKT-V0004	00
REVIEWED BY: TL	SCALE: 1:350		



BH33-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/14/2012	7,15	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/14/2012	7,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	11	< 10

BH45-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	6,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	20	11

BH14	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
19/29/2010	6	N.A.	0,074	< 0,020	0,039	0,085	51	< 10	< 10	< 10	5
19/29/2010	6,75	N.A.	0,065	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
19/29/2010	7,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH23	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/03/2011	4,0	COARSE	0,043	< 0,020	0,056	< 0,040	15	< 10	< 10	< 10
02/03/2011	4,5	FINE	1,8	6,2	1,5	10	69	< 10	< 10	< 10
02/03/2011	4,5	N.A.	2,0	5,9	1,3	8,5	56	10	< 10	< 10
02/03/2011	6,0	FINE	0,39	0,16	0,026	0,17	< 12	< 10	< 10	< 10

BH42-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	7,8	N.A.	0,031	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH20	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/02/2011	10,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	10,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	8,25	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	8,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH33-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	4,5	N.A.	0,035	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/14/2012	6,0	N.A.	0,15	0,17	0,44	3,1	< 12	< 10	< 10	< 10

BH40-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	3,75	N.A.	0,21	3,9	3,8	28	120	59	< 10	< 10
10/12/2012	6,75	N.A.	0,20	0,047	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH17	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/01/2011	10,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	4,5	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	9,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH5	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/26/2010	0,75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	4
10/26/2010	2,5	N.A.	< 0,0050	< 0,020	0,52	2,1	680	150	< 10	< 10	4

BH4	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
19/26/2010	5,25	FINE	2,5	46	15	110	580	35	< 10	< 10	5
19/26/2010	6,85	N.A.	1,9	0,43	0,33	0,53	< 12	< 10	< 10	< 10	N.A.
19/26/2010	7,5	FINE	0,12	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH34-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/14/2012	4,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/14/2012	7,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	19	11

BH5B	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/27/2010	3,25	N.A.	0,014	0,031	2,2	9,2	410	70	< 10	< 10

BH33-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	1,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/12/2012	6,0	N.A.	0,37	0,9	2,1	16	100	13	< 10	< 10
10/12/2012	6,0	N.A.	1,4	5,4	2,6	19	140	24	< 10	< 10
10/12/2012	7,8	N.A.	0,043	0,028	< 0,010	< 0,040	< 12	< 10	23	< 10

BH16	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/01/2011	6,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/01/2011	7,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH24	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/03/2011	4,5	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/03/2011	5,25	COARSE	0,014	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH13	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
19/26/2010	3,15	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	5
19/26/2010	3,4	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
19/26/2010	7,5	N.A.	0,059	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH30-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	4,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	18
10/13/2012	5,2	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	5,9	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	6,6	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	10	< 10
10/13/2012	6,8	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	7,6	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	34	< 10
10/13/2012	8,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH19	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
02/02/2011	6,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
02/02/2011	6,4	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH15	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/02/2011	0,75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	4
02/02/2011	4,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/02/2011	6,75	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/02/2011	9,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

USEDOIL TANK	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/27/2010	0	N.A.	< 0,0050	< 0,020	< 0,010	0,075	< 12	28	9100	2700	9

BH7	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/27/2010	4,5	FINE	0,010	< 0,020	< 0,010	< 0,040	41	< 10	< 10	< 10
19/27/2010	5,1	N.A.	0,013	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/27/2010	6	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH37-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	4,5	N.A.	0,022	< 0,020	< 0,010	< 0,040	< 12	12	< 10	< 10
10/12/2012	7,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH10	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/27/2010	3,75	N.A.	0,024	< 0,020	0,016	< 0,040	< 12	< 10	< 10	< 10
19/27/2010	4,5	N.A.	0,033	< 0,020	0,047	< 0,040	< 12	< 10	< 10	< 10
19/27/2010	5,25	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH11	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
10/26/2010	3,75	N.A.	0,8	8,2	2,2	15	87	12	< 10	< 10	N.A.
10/26/2010	3,75	N.A.	3,0	9,8	2,9	19	110	12	< 10	< 10	7
19/26/2010	5,25	N.A.	2,1	8,19	0,065	0,37	< 12	< 10	< 10	< 10	N.A.
10/26/2010	6,75	FINE	0,24	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH22	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/03/2011	0,75	COARSE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	5
02/03/2011	4,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
02/03/2011	6,75	FINE	0,11	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH35-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	3,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	7,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	18	< 10

BH6	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/26/2010	3	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/26/2010	4,5	N.A.	0,035	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/26/2010	6	FINE	0,023	0,029	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH31-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/13/2012	1,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	3,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	3,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	4,5	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/13/2012	5,25	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
19/27/2010	1,5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	3
19/26/2010	3,75	FINE	5,2	23	5,1	37	230	59	< 10	< 10	8
19/26/2010	3,75	N.A.	6,1	30	6,9	49	320	30	< 10	< 10	N.A.
19/26/2010	4,5	N.A.	4,8	14	2,5	17	95	< 10	< 10	< 10	N.A.
19/26/2010	4,5	N.A.	5,7	20	4,3	29	200	14	< 10	< 10	N.A.
19/26/2010	8	FINE	1,6	0,030	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.
10/26/2010	6,55	FINE	0,12	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

BH9	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/27/2010	1,75	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/27/2010	2	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
19/27/2010	3	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10

BH38-12	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
10/12/2012	1,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10
10/12/2012	4,0	N.A.	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	28	18
10/12/2012	7,0	N.A.	0,058	0,041	< 0,010	< 0,040	< 12	< 10	13	< 10

BH8	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4
19/27/2010	4,5	N.A.	0,70	< 0,020	0,23	0,079	< 12	< 10	< 10	< 10

BH21	Depth (m)	SOIL	B	T	E	X	F1-BTEX	F2	F3	F4	Pb
02/03/2011	1,5	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	7
02/03/2011	8,0	FINE	< 0,0050	< 0,020	< 0,010	< 0,040	< 12	< 10	< 10	< 10	N.A.

SOIL CRITERIA* (mg/kg)			
Depth (m)	< 1,5 m	< 3,0 m	> 3,0 m
Benzene (B)	0,3		0,32
Toluene (T)	250	500	1500
Ethylbenzene (E)	300	600	670
Xylenes (X)	160	170	
Fraction 1 Hydrocarbons (F1-BTEX)		320	
Fraction 2 Hydrocarbons (F2)	260		1000
Fraction 3 Hydrocarbons (F3)	1700		3500
Fraction 4 Hydrocarbons (F4)	3500		10000
Lead (Pb)	260		

NOTE:
- LOCATIONS OF UNDERGROUND UTILITIES SHOWN ARE APPROXIMATE ONLY AND ARE NOT RELIABLE FOR CONSTRUCTION PURPOSES.
- "Canadian Council of Ministers of the Environment (CCME), Canadian Environmental Quality Guidelines, 2007, and CCME, Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

LEGEND

- MONITORING WELL
- BOREHOLE
- SURFACE SOIL SAMPLE
- SOIL VAPOUR WELL
- PP POWER POLE
- SEPTIC TANK
- ELECTRICAL LINE
- TELEPHONE LINE
- GAS LINE
- N.A. MEASUREMENT NOT AVAILABLE
- N.G. NO GUIDELINE ESTABLISHED
- REMOVED INFRASTRUCTURE
- RED SOIL ANALYTICAL ABOVE CRITERIA
- GREEN SOIL ANALYTICAL BELOW CRITERIA
- 0.05 SOIL SAMPLE CONCENTRATION (mg/kg)
- 05/15/2005 SOIL SAMPLING DATE (MM/DD/YYYY)
- ESTIMATED EXTENT OF SOIL IMPACT (MAXIMUM)
- ESTIMATED EXTENT OF SOIL IMPACT (MINIMUM)

NO.	DESCRIPTION
REFERENCE DRAWINGS	

NO.	DATE	DESCRIPTION OF REVISION	DRAFTED	DESIGNED	REVIEWED	APPROVED
00	12.12.03	ISSUED TO CLIENT	KH	TL		

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FIGURE 5: SITE PLAN SHOWING
ESTIMATE OF SOIL IMPACTS
LOBSTICK MAINTENANCE COMPOUND, WASKESIU LAKE, SK

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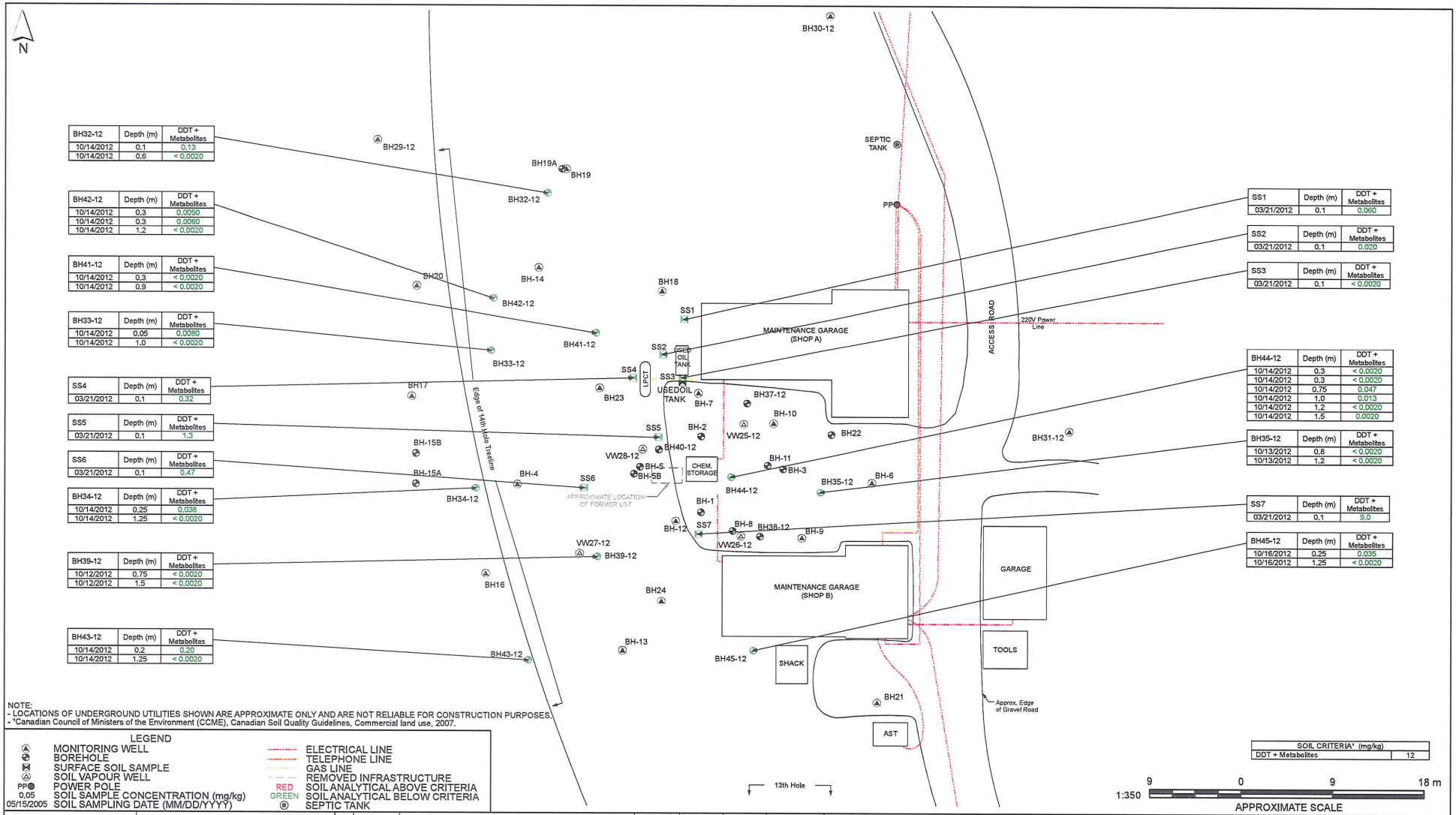
REVIEWED BY: TL	SCALE: 1:350		



NOTE:
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- *Canadian Council of Ministers of the Environment (CCME), Canadian Soil Quality Guidelines, Commercial land use, 2007.

LEGEND

- MONITORING WELL
- BOREHOLE
- SURFACE SOIL SAMPLE
- SOIL VAPOUR WELL
- PP POWER POLE
- 0.05 SOIL SAMPLE CONCENTRATION (mg/kg)
- 05/15/2005 SOIL SAMPLING DATE (MM/DD/YYYY)
- ELECTRICAL LINE
- TELEPHONE LINE
- GAS LINE
- REMOVED INFRASTRUCTURE
- RED SOIL ANALYTICAL ABOVE CRITERIA
- GREEN SOIL ANALYTICAL BELOW CRITERIA
- (E) SEPTIC TANK

NO.	DESCRIPTION

REFERENCE DRAWINGS

NO.	DATE	DESCRIPTION OF REVISION	DRAFTED	DESIGNED	REVIEWED	APPROVED
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FIGURE 6: SITE PLAN SHOWING
HISTORICAL DDT ANALYTICAL RESULTS
LOBSTICK MAINTENANCE COMPOUND, WASKESIU LAKE, SK

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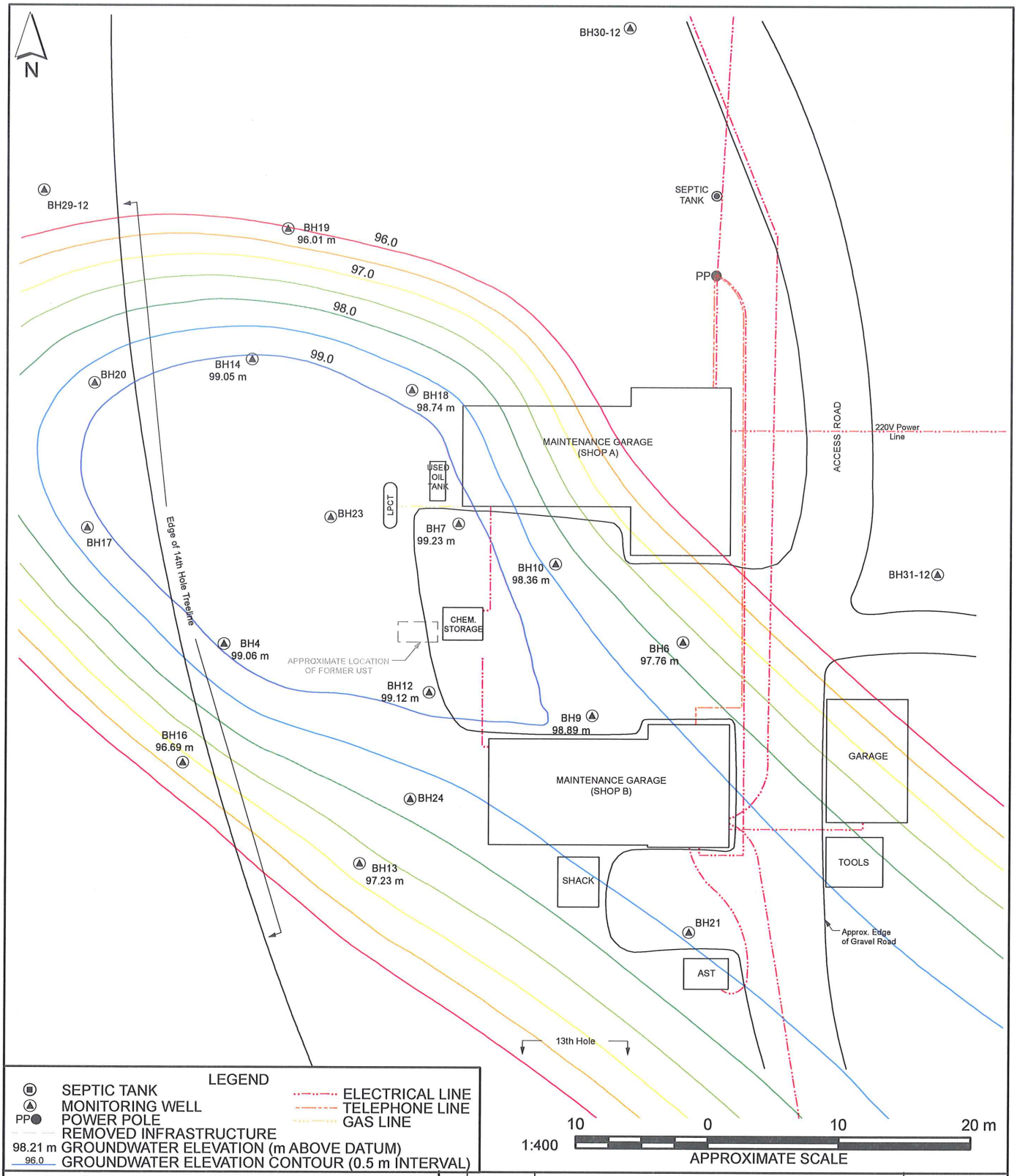

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FIGURE 7: SITE PLAN SHOWING GROUNDWATER ELEVATIONS - OCTOBER 12, 2012 LOBSTICK MAINTENANCE COMPOUND, WASKESIU LAKE, SK

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REVIEWED BY:	TL	SCALE:	1:400	1018901603-SKT-V0007	00

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APPENDIX C

TECHNICAL MEMORANDUM

Technical Memorandum Methodology for Developing Soil Vapour Objectives for Properties with Petroleum Hydrocarbon Contamination (June 14, 2012)

Document No. 0413480108-REP-V0002-00

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Technical Memorandum
Methodology for Developing Soil Vapour Objectives for Properties with Petroleum Hydrocarbon Contamination (June 14, 2012)

Association of Professional Engineers & Geoscientists of Saskatchewan

CERTIFICATE OF AUTHORIZATION
Tetra Tech WEI Inc.
Number C0032

Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
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JUNE 2012

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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 DERIVATION OF SOIL VAPOUR OBJECTIVES FOR VAPOUR INHALATION 2

3.0 VAPOUR TRANSPORT MODEL UNCERTAINTIES 6

4.0 REFERENCES 8

5.0 LIMITATIONS 9

LIST OF TABLES

Table 1 Chemical, Physical, and Toxicological Properties for Benzene, Toluene, Ethylbenzene, Xylene and PHC Fractions

Table 2 Soil Properties for Evaluation of Vapour Transport

Table 3 Building Properties for Evaluation of Vapour Transport

Table 4 Generic Soil Vapour Objectives

LIST OF APPENDICES

Appendix A Tables

ACRONYMS AND ABBREVIATIONS

BTEX	Benzene, toluene, ethylbenzene, and xylenes
CCME	Canadian Council of Ministers of the Environment
cm	Centimetre
cm^2	Square centimetre
cm^2/s	Square centimetres per second
cm^3/s	Cubic centimetres per second
DFi	Dilution factor term
F1	Fraction 1 (C6-C10)
F2	Fraction 2 (C>10-C16)
F3	Fraction 3 (C>16-C34)
F4	Fraction 4 (C>34)
g/cm^3	Grams per cubic centimetre
g/cm-s	Grams per centimetre-second
$g/cm\text{-}s^2$	Grams per centimetre square second
g/g	Grams per gram
g/kg	Grams per kilogram
h^{-1}	Per hour
JEM	Johnson and Ettinger model
mg/kg	Milligrams per kilogram
mg/m^3	Milligrams per cubic metre
mL/g	Millilitres per gram
PHC	Petroleum hydrocarbon
TM	Technical memorandum

1.0 INTRODUCTION

This technical memorandum provides the equations and input parameters used to derive generic soil vapour objectives presented in the main report. Petroleum hydrocarbons in soil vapour may migrate through the subsurface to indoor air. Therefore, soil vapour samples have been collected on sites where previous site investigations have found that concentrations of benzene, toluene, ethylbenzene, xylenes (BTEX), and/or petroleum hydrocarbon fractions F1 and F2 in soil exceeded applicable pathway-specific criteria for the vapour inhalation pathway. Soil vapour objectives are not published by provincial or federal regulatory agencies; therefore, generic soil vapour objectives were calculated. Methods used to calculate the soil vapour objectives are presented within this technical memorandum. Section 2 describes the methods that were used to derive risk-based generic objectives for soil vapour. Uncertainties associated with the vapour transport model used to derive the objectives are summarized in Section 3. References are provided in Section 4, and tables are provided in Appendix A.

The approach used to calculate the generic soil vapour objectives is based entirely on the approach published by the Canadian Council of Ministers of Environment (CCME) *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil* (CCME 2008). The equations and model assumptions were taken directly from the Canada-Wide Standard (2008) document. While CCME does not publish soil vapour objectives, the approach used to calculate soil guidelines for the vapour inhalation pathway is used to derive the soil vapour objectives.

2.0 DERIVATION OF SOIL VAPOUR OBJECTIVES FOR VAPOUR INHALATION

As published by the CCME, the generic soil vapour objectives are developed using the Johnson and Ettinger (1991) model (JEM). The JEM is a one-dimensional model that incorporates both advective and diffusive mechanisms for estimating the transport of contaminated vapours emanating from the subsurface into indoor spaces located directly above or in close proximity to the source of contamination. The JEM provides an estimated attenuation coefficient that relates the vapour concentration in the indoor space to the vapour concentration at the source of contamination. Since the JEM was developed for use as a screening-level model, it is based on a number of simplifying assumptions regarding distribution and occurrence of chemicals, subsurface characteristics, transport mechanisms, and building construction. The uncertainties associated with the assumptions inherent in the JEM are summarized in Section 3.

The model used to derive risk-based soil vapour objectives considers the migration of soil vapour through the soil column, intrusion of vapour into indoor air and then exposure to the chemicals by people that occupy the building (either residential or commercial). Therefore, physical assumptions and chemical properties are necessary as inputs to the model. Assumptions used in the migration of soil vapour in the soil column for soil porosity, moisture content, vapour permeability and fraction organic carbon were based on assumptions for fine and coarse-grained soils as published by CCME (2008). The chemical properties (e.g., Henry's Law constants and partition coefficients) that represent how volatile chemicals migrate within soil and air are found in scientific literature and also applied by CCME. Intrusion of soil vapour into indoor air requires assumptions regarding building (commercial or residential) characteristics such as, ventilation rates, foundation properties, size of the building. Finally, determining an acceptable concentration in indoor air requires an understanding of how people take chemicals into the body and toxicity of the chemicals. This information is based on standard risk assessment assumptions as documented by CCME (2008). All assumptions and chemical-specific information used to derive the soil vapour objectives herein were the same as used by CCME in its guideline derivation process (CCME 2008), and described in more detail below.

The sections below present the specific JEM model equations used to derive the objectives for soil vapour. The equation for substances that are not carcinogens (i.e., threshold substances) is used to derive objectives for all PHCs except benzene. The equation for carcinogenic (i.e., non-threshold) substances is used to derive the objective for benzene.

Threshold Substances:

$$SV = \frac{(RfC - C_a)(SAF)(DFi)}{ET} \quad (2\text{-}1)$$

Non-threshold Substances:

$$SV = \frac{(RSC)(DFi)}{ET} \quad (2\text{-}2)$$

Where:

SV = Risk-based Soil Vapour Objective (mg/m^3)
RfC = Reference air concentration (mg/m^3)
RSC = Risk-specific concentration (mg/m^3)
C_a = Background indoor/outdoor air concentration (mg/m^3)
SAF = Soil allocation factor (unitless)
DF_i = Dilution factor from soil gas to indoor air (unitless); see Equations 2-3 through 2-8
ET = Exposure term (unitless); the ET is 1 for residential receptors and 0.275 for commercial and industrial receptors

The dilution factor term (DF_i) represents the dilution of contaminant concentrations between soil gas and indoor air. DF_i is calculated using the equations below (2-3 to 2-8), and is based on the attenuation between the contaminant vapour concentration in the building and the contaminant vapour concentration at the source.

$$DF_i = \frac{1}{\alpha} \quad (2\text{-}3)$$

DF_i = Dilution factor from soil gas to indoor air (unitless)
α = Attenuation coefficient (contaminant vapour concentration in Building/vapour concentration at the contaminant source)

Where:

$$\alpha = \frac{\left(\frac{D_T^{eff} A_B}{Q_B L_T}\right) exp\left(\frac{Q_{soil} L_{crack}}{D_{crack} A_{crack}}\right)}{exp\left(\frac{Q_{soil} L_{crack}}{D_{crack} A_{crack}}\right) + \left(\frac{D_T^{eff} A_B}{Q_B L_T}\right) + \left(\frac{D_T^{eff} A_B}{Q_{soil} L_T}\right) + \left[exp\left(\frac{Q_{soil} L_{crack}}{D_{crack} A_{crack}}\right) - 1\right]} \quad (2\text{-}4)$$

D_T^{eff} = Effective porous media diffusion coefficient (cm^2/s); see Equation 2-5
A_B = Building area exposed to soil, including basement wall area (cm^2)
Q_B = Building ventilation rate (cm^3/s); see Equation 2-7
L_T = Distance from contaminant source to foundation (cm)

Q_{soil} = Volumetric flow rate of soil gas into the building (cm^3/s); see Equation 2-8
L_{crack} = Thickness of the foundation (cm)
D_{crack} = Effective vapour pressure diffusion coefficient through the crack (cm^2/s); see Equation 2-6
A_{crack} = Area of cracks through which contaminant vapours enter the building (cm^2)

$$D_T^{eff} \approx D_a \left(\frac{\theta_a^{10/3}}{n^2} \right) \quad (2\text{-}5)$$

D_T^{eff} = Overall effective porous media diffusion coefficient based on vapour-phase concentrations for the region between the source and the foundation (cm^2/s)
D_A = Pure component molecular diffusivities in air (cm^2/s)
θ_a = Vapour-filled porosity (unitless)
n = Total soil porosity (unitless)

$$D_{crack} \approx D_a \left(\frac{\theta_{a\_c}^{10/3}}{n_c^2} \right) \quad (2\text{-}6)$$

D_{crack} = Effective diffusion coefficient through foundation crack (cm^2/s)
D_a = Pure component molecular diffusivities in air (cm^2/s)
θ_{a_c} = Air-filled porosity if soil-filled foundation crack (unitless)
n_c = Total soil porosity in foundation crack (unitless; assumed to be the same as total soil porosity)

$$Q_B = L_B W_B H_B (ACH)/(3600 s/h) \quad (2\text{-}7)$$

Q_B = Building ventilation rate (cm^3/s)
L_B = Building length (cm)
W_B = Building width (cm)
H_B = Building height, including basement (cm)
ACH = Air exchanges per hour (h^{-1})

$$Q_{soil} = \frac{2\pi \Delta P k_v X_{crack}}{\mu \ln\left[\frac{2(Z_{crack})}{r_{crack}}\right]} \quad (2\text{-}8)$$

Q_{soil} = Volumetric flow rate of soil gas into the building (cm^3/s)
ΔP = Pressure differential ($g/cm\text{-}s^2$)
k_V = Soil vapour permeability to vapour flow (cm^2)
X_{crack} = Length of idealized cylinder (cm)
μ = Vapour viscosity (g/cm-s)
Z_{crack} = Distance below grade to idealized cylinder (cm)
r_{crack} = Radius of idealized cylinder (cm)

The generic input values used for chemical, soil, and building properties and for assumptions of exposure in the equations above are provided in Tables 1 through 3. For the PHC fractions, objectives for vapour inhalation are only developed for F1 and F2, because only these two fractions are considered volatile (all PHC fractions are evaluated for direct contact and ecological exposure). For the PHC fractions F1 and F2, the soil vapour objectives are calculated for each subfraction and then combined using the following equation:

$$SV_{Fraction\_i} = \frac{1}{\sum \frac{MF_{subfraction\_j}}{SV_{subfraction\_j}}} \quad (2\text{-}9)$$

Where:

$SV_{fraction\_i}$ = Risk-based Soil Vapour Objective for the Fraction *i* (mg/m^3)
$SV_{subfraction\_j}$ = Risk-based Soil Vapour Objective (mg/m^3) for each subfraction within Fraction *i*
$MF_{subfraction\_j}$ = Mass fraction of each subfraction within the Fraction *i*

The default parameter values from CCME (2008) presented in Tables 1 through 3 in Appendix A, were used to derive the generic soil vapour objectives. The generic soil vapour objectives used to compare measured soil vapours at sites are presented in Table 4 in Appendix A.

3.0 VAPOUR TRANSPORT MODEL UNCERTAINTIES

The screening-level JEM used to derive the soil vapour objectives incorporates simplified assumptions regarding distribution and occurrence of chemicals, subsurface characteristics, transport mechanisms, and building construction. This section highlights the major assumptions associated with the JEM. As discussed below, each of the major assumptions is conservative and likely results in an underestimate of attenuation between subsurface and indoor air. Likewise, the following assumptions also likely result in conservative (lower) estimates of risk-based concentrations for PHC in soil vapour (U.S. EPA 2002, 2004):

- The source concentration underlying the building footprint is homogeneous. This assumption ignores the likelihood that concentrations throughout the subsurface may vary across the building footprint.
- Source concentrations are assumed to remain constant over time; that is, concentrations do not decrease through medium transfer, lateral migration, hydrolysis, photolysis, or biodegradation. In reality, each of these processes occurs to some degree and is expected to result in a decrease of chemical concentrations over time. The assumption of non-depleting source concentrations can over-predict risk by one to three orders of magnitude.
- Buildings are continuously under-pressurized. This assumption neglects situations where neutral or positive pressurized building conditions may exist and may therefore overestimate advective transport of contaminated vapours to indoor air.
- Vapour-phase diffusion is the dominant transport mechanism for sources of contamination located away from the building foundation to the soil region near the foundation. This assumption ignores potential effects from variations in atmospheric pressure, which may create conditions for transport of chemicals away from the building foundation.
- Vapour transport occurs in a single (vertical) dimension. This assumption ignores the potential for vapour migration in multiple directions away from the source area and is likely to result in an overestimation of vapour emissions and higher indoor concentrations.
- Convective flow of vapours near the foundation is uniform. This assumption ignores the potential for the vapour flow rate to vary by location throughout the foundation.

- Convective velocity of vapours through foundation cracks is uniform. This assumption ignores the potential that the size of cracks and other foundation openings may vary and assumes a constant pressure field between interior spaces and the soil surface.
- The advection rate of vapours through the building foundation is uniform and occurs through coarse-grained, relatively sandy soils (that is, relatively permeable soils). This assumption does not account for any reduction in vapour flow that may be caused by finer-grained soils (that is, less permeable soils) near the building foundation.
- Each building is a single-story building, and indoor air concentrations resulting from subsurface vapour intrusion are uniform throughout the building. This assumption ignores potential dilution to indoor air concentrations that may occur in buildings that have more than one level.

The exchange rate between indoor and outdoor air does not exceed one-quarter air change per hour for residential exposure. This assumption ignores the dilution to indoor air concentrations that may occur when air exchange rates are higher (for example, from open windows, open doors, or building ventilation systems).

4.0 REFERENCES

Canadian Council of Ministers of the Environment (CCME). 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – User Guidance*. PN 1398. January.

Johnson, P.C., and R.A. Ettinger. 1991. *Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapors into Buildings. Environ. Sci. Technol.*, 25:1445-1452.

U.S. Environmental Protection Agency (EPA). 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance).* Office of Solid Waste and Emergency Response. November 29.

EPA. 2004. *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings.* Office of Emergency and Remedial Response. February 22.

5.0 LIMITATIONS

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Tetra Tech WEI Inc. makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgment, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which are assumed to be correct. Except as provided, Tetra Tech WEI Inc. has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of sample points, and the number of samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based will consequently change Tetra Tech WEI Inc.'s conclusions and recommendations.

APPENDIX A

TABLES

TABLE 1
Chemical, Physical, and Toxicological Properties for Benzene, Toluene, Ethylbenzene, Xylenes and PHC Fractions

Parameter		Units	Benzene	Toluene	Ethylbenzene	Xylene	F1			F2			
							Aliphatic C>6-C8	Aliphatic C>8-C10	Aromatic C>8-C10	Aliphatic C>10-C12	Aliphatic C>12-C16	Aromatic C>10-C12	Aromatic C>12-C16
RfC	Reference air concentration	mg/m^3	--	3.8	1	1.8	18.4	1	0.2	1	1	0.2	0.2
RSC	Risk-specific concentration	mg/m^3	0.003	--	--	--	--	--	--	--	--	--	--
C_a	Background indoor/outdoor air concentration	mg/m^3	0	0.0442	0.0075	0.0182	0.09111	0.03881	0.03745	0	0	0	0
K_{OC}	Organic partition coefficient	mL/g	8.1E+01	2.3E+02	5.4E+02	5.9E+02	4.0E+03	3.2E+04	1.6E+03	2.5E+05	5.0E+06	2.5E+03	5.0E+03
H'	Unitless Henry's Law Constant	unitless	0.225	0.274	0.358	0.252	50	80	0.48	120	520	0.14	0.053
H	Henry's Law Constant	$atm\text{-}m^2/mol$	0.00549	0.00668	0.00873	0.00615	1.2	1.9	0.012	2.9	12.5	0.0034	0.0013
D_a	Pure component molecular diffusivity in air	cm^2/s	0.088	0.087	0.075	0.078	0.05	0.05	0.05	0.05	0.05	0.05	0.05
BSC	Background soil concentration	mg/kg	0	0	0	0	0	0	0	0	0	0	0
AF	Adjustment factor	unitless	10	10	10	10	10	10	10	10	10	10	10
SAF	Soil allocation factor	unitless	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
MF	Mass Fraction in Soil (Coarse and Fine)	unitless	--	--	--	--	0.55	0.36	0.09	0.36	0.44	0.09	0.11
	Mass Fraction in Soil Vapour - Coarse Soil	unitless	--	--	--	--	0.854	0.141	0.005	0.767	0.205	0.023	0.005
	Mass Fraction in Soil - Fine Soil	unitless	--	--	--	--	0.842	0.153	0.005	0.766	0.206	0.023	0.005

Notes: Benzene properties from Environment Canada (2005b).
Toluene, ethylbenzene, and xylene properties from Environment Canada (2005a).
F1 and F2 properties from CCME (2008).

$atm\text{-}m^2/mol$ Atmosphere-square metres per mole
cm^2/s Square centimetres per second
F1 Fraction 1 (C6-C10)
F2 Fraction 2 (C>10-C16)
mg/kg Milligram per kilogram
mL/g Millilitres per gram
mg/m^3 Milligrams per cubic metre
PHC Petroleum hydrocarbon
-- not applicable

References: Canadian Council of Ministers of the Environment (CCME). 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*. PN 1398. January.

Environment Canada (2005a). *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Toluene, Ethylbenzene, and Xylenes. Scientific Supporting Document.* Prepared by National Guidelines and Standards Office, Water Policy and Coordination Directorate. Ottawa. Report 1-9. February.

Environment Canada (2005b). *Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Benzene. Scientific Supporting Document*. Prepared by National Guidelines and Standards Office, Water Policy and Coordination Directorate. Ottawa. Report 1-9. August.

TABLE 2
Soil Properties for Evaluation of Vapour Transport

Parameter		Units	Coarse-Grained Soil	Fine-Grained Soil
θ_a	Vapour-filled porosity	unitless	0.241	0.302
f_{OC}	Fraction organic carbon	g/g	0.005	0.005
ρ_b	Dry bulk density	g/cm^3	1.7	1.4
n	Total soil porosity	unitless	0.36	0.47
θ_{a_c}	Air-filled porosity of soil-filled foundation crack	unitless	0.36	0.47
k_v	Soil vapour permeability to vapour flow	cm^2	5.0E-08	1.0E-09
θ_w	Moisture-filled porosity	unitless	0.119	0.168
T	Absolute temperature	K	294	294
R	Gas constant	$atm\text{-}m^2/mol\text{-}^\circ K$	8.2E-05	8.2E-05
μ	Vapour viscosity	g/cm-s	0.000173	0.000173

Notes: Values from CCME (2008).

$atm\text{-}m^2/mol\text{-}^\circ K$	Atmosphere-square metres per mole degrees Kelvin
cm	Centimetre
cm^2	Square centimetre
g/cm-s	Grams per centimetre-second
g/cm^3	Grams per cubic centimetre
g/g	Grams per centimetre - square second
K	Degrees Kelvin
PHC	Petroleum hydrocarbon

References: Canadian Council of Ministers of the Environment (CCME). 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil.* PN 1398. January.

TABLE 3
Building Properties for Evaluation of Vapour Transport

Parameter		Units	Residential Land Use		Commercial and Industrial Land Use
			Basement	Slab-on-grade	Slab-on-grade
L_B	Building length	cm	1,225	1,225	2,000
W_B	Building width	cm	1,225	1,225	1,500
A_B	Building area exposed to soil, including basement wall area	cm^2	2.7E+06	1.5E+06	3.0E+06
H_B	Building height	cm	360	360	300
L_{crack}	Thickness of the foundation	cm	11.25	11.25	11.25
Z_{crack}	Distance below grade to idealized cylinder	cm	244	11.25	11.25
r_{crack}	Radius of idealized cylinder	cm	0.2	0.2	0.26
A_{crack}	Area of cracks through which contaminant vapours enter the building	cm^2	994.5	994.5	1,846
X_{crack}	Length of idealized cylinder	cm	4,900	4,900	7,000
L_T	Distance from contaminant source to building foundation	cm	30	30	30
ACH	Air exchanges per hour	h^{-1}	0.5	0.5	0.9
ΔP	Pressure differential	$g/cm\text{-}s^2$	40	40	20

Notes: Values taken from CCME (2008).
cm Centimetre
cm^2 Square centimetre
$g/cm\ s^2$ Grams per centimetre - square second
h^{-1} Per hour

References: Canadian Council of Ministers of the Environment (CCME). 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*. PN 1398. January.

TABLE 4
Generic Soil Vapour Objectives

Parameter	Units	Residential Land Use				Commercial Land Use	
		Basement		Slab-on-grade		Slab-on-grade	
		Fine-Grained	Coarse-Grained	Fine-Grained	Coarse-Grained	Fine-Grained	Coarse-Grained
Benzene	mg/m^3	68	5	62	4	420	47
Toluene		43,000	3,400	39,000	2,400	270,000	30,000
Ethylbenzene		13,000	900	12,000	640	80,000	7,900
Xylenes		2,200	160	2,000	110	14,000	1,400
PHC F1		75,000	4200	64,000	3,200	480,000	37,000
PHC F2		16,000	850	14,000	650	100,000	7,600
Benzene	$\mu g/m^3$	68,000	5,000	62,000	4,000	420,000	47,000
Toluene		43,000,000	3,400,000	39,000,000	2,400,000	270,000,000	30,000,000
Ethylbenzene		13,000,000	900,000	12,000,000	640,000	80,000,000	7,900,000
Xylenes		2,200,000	160,000	2,000,000	110,000	14,000,000	1,400,000
PHC F1		75,000,000	4,200,000	64,000,000	3,200,000	480,000,000	37,000,000
PHC F2		16,000,000	850,000	14,000,000	650,000	100,000,000	7,600,000

Notes:

mg/m3 milligrams per cubic metre

µg/m3 micrograms per cubic metre

TETRA TECH

APPENDIX D

UTILITY LOCATES

From: Allyson Bain
To: Lange, Troy
Subject: RE: Waskesiu utility locates
Date: Wednesday, October 03, 2012 2:05:08 PM

Good afternoon,

You will be clear for your work at this location.

Thanks

Allyson Bain

www.myaccess.ca

CSR . Access Communications Co-operative Limited

Phone via Team Leader at ext 6607 . Email Allyson.Bain@myaccess.coop
Fax
2250 Park St . Regina . Saskatchewan . S4N 7K7

From: Lange, Troy [Troy.Lange@tetratech.com]
Sent: Tuesday, October 02, 2012 4:40 PM
To: locates.engineering@myaccess.coop
Subject: Waskesiu utility locates

Hello,

I'm wondering if Access has any utility lines at the Lobstick golf course maintenance compound in Waskesiu, SK? I've attached some site figures to assist with identifying the location.

Thanks,

Troy Lange | Junior Environmental Scientist
Direct: 306.649.1506 | Cell: 306.321.4920 | Fax: 306.664.7074
Troy.Lange@tetratech.com

Tetra Tech, WEI | Infra-Environmental Division
1400-410 22nd St E | Saskatoon, SK S7K 5T6 | www.tetratech.com

PLEASE NOTE: This message, including any attachments, may include confidential and/or inside information. Any distribution or use of this communication by anyone other than the intended recipient is strictly prohibited and may be unlawful. If you are not the intended recipient, please notify the sender by replying to this message and then delete it from your system.

Think Green - Not every email needs to be printed.

Ticket No: 2012401772

Header Code: **ROUTINE LOCATE**

MAGNA ELECTRIC CORPORATION

'ATTENTION CONTRACTOR' PLEASE REMOVE LOCATE FLAGS UPON COMPLETION OF EXCAVATION

Work Planned for: Thu, 10/04/2012 16:36 PM
Locate to be completed by: Thu, 10/04/2012 16:36 PM
Original Call Date: Tue, 10/02/2012 16:36 PM

Contractor: TETRA TECH
Contact Name: TROY LANGE
Alt. Contact:
Working for: TETRA TECH

Contact Phone: (306)-649-1506 ext.
Contact Fax:
Alt Contact Phone:
Contact Cell (306)-321-4920 ext.

troy.lange@tetratech.com

City: WASKESIU
Address: To: WAPITI DRIVE
Nearest Intersecting Street:

Subdivision: GOLF COURSE MAINTENANCE

Add. Dig Info: W1210021506340 THE MAINTENANCE COMPOUND CAN ACCCESSED VIA THE ROAD THAT BRANCHES OFF THE SOUTHSIDE OF WAPITI DR, EAST OF THE CHATEAU PARK CHALETS.

FRONT LOT,BACK LOT,CONTACT CALLER TO CONFIRM LOC COMPLETE,

Type Of Work: BORE HOLES
Locator: SKOROBOHACH, RANDY

Remarks to excavator: ***** NOT CLEAR TO DIG OUTSIDE WORK AREA *****

CLEAR

Locate Info:

SASKPOWER - LA2 URBAN Status: Marked 2 Uti Completed: 10/02/2012 13:00:00 Notes:.
SASKTEL - LA2 URBAN Status: No Fac 2 Uti Completed: 10/02/2012 13:00:00 Notes:.

ANY CONCERNS OR QUESTIONS REGARDING THIS LOCATE, PLEASE CONTACT THE LOCATING SERVICES DEPARTEMENT AT 877-955-8131 OR BY EMAIL AT locates@magnaelectric.com.

DRILLING / BOREHOLE / EXCAVATIONS CHECKLIST

(attach to completed JSA)

Site location, name: Lobstick

Project scope: Enviro Drilling

Date: Oct 10/12

Contractor: Tetra Tech

Sub-contractor: Intercore

Supervisor: Troy Lange

ACTIVITY	Yes	No/ N/A	COMMENTS INCLUDING JUSTIFICATION IF A RESPONSE IS NO OR NOT APPLICABLE
• Worker's properly briefed on potential site/work hazards and safety Sub-surface Clearance Protocols have been reviewed with all site personnel involved in subsurface disturbance activities.	✓		
• All applicable local, provincial and federal permits have been obtained.	✓		
• All crossing agreements for third party and owner facilities are in place and conditions have been met.	✓		
• Site access/permission has been secured. Landowner/occupant has been contacted.	✓		
• Most recent as-built drawings and/or site plans, surveys, (including UST, product and vent lines) obtained.	✓		
• Reviewed site information to identify subsurface structures relevant to planned site activities (easements, right-of-ways, historical plot plans, previous site investigations, soil surveys, boring logs, etc.).	✓		
• Utility locates have been performed by public utility company(s), One-Call companies, within required timeframe. Locates are clear/visible.	✓		
• Subsurface structure locates performed by private locate company within required timeframe. Locates clear/ visible.	✓		
• Location of all aboveground indicators of subsurface utilities/services that may be leading to or from buildings within planned work area are identified.	✓		
• Location of area lights/signs and associated subsurface lines identified.	✓		
• Location of all tele-communication and associated subsurface lines identified.	✓		
• Location of all drains and associated interconnecting lines identified.		NA	
• Location of all electrical junction boxes and associated interconnecting lines identified	✓		
• Location of all natural gas meters or connections and all interconnecting lines identified	✓		
• Dispenser pan/Sump inspected to determine piping materials and whether piping is rigid or flexible		NA	
• Orientation, arrangement, location, sizes, of tanks, STP and extractor covers identified. Burial depth of tank determined if relevant.		NA	
• Location of paving/soil scars indicative of product lines or other subsurface structures identified		NA	
• Presence of underground pipelines associated with pumps and pump galleries, manifolds, tank fields, compressors, production wells, loading racks and equipment identified		NA	
• Presence of underground lines for instrumentation, process analyzer, and motor-operated valves are inspected/identified		NA	
• Presence and tracing of process/storm sewers identified / understood. If other cement, fiberglass, untraced PVC lines are potentially in the ground disturbance area, identify means of identification in comments section.	✓		Groundskeeper identified irrigation lines

DRILLING / BOREHOLE / EXCAVATIONS CHECKLIST

(attach to completed JSA)

ACTIVITY	Yes	No/ N/A	COMMENTS INCLUDING JUSTIFICATION IF A RESPONSE IS NO OR NOT APPLICABLE
• Location of other pertinent features surface or sub-surface that may be of relevance to work scope has been identified.		NA	
• Clearance methods reviewed with Project Manager.	✓		
• Critical zones - 5 meters of pipeline crossing area, or the distance defined in the pipeline crossing agreement. 3 meter distance from edge of tank, pumps and pump galleries, manifolds, on/below grade transformers, compressors, production wells, flowlines, loading racks, other process equipment, operating dispenser islands and suspected hazardous/critical utilities, product lines, and other subsurface structures (and entire area between tank field and dispensers at retail sites) have been identified. • Identify critical zones in Comments section.	✓		
• Ground disturbance locations reviewed by Project Manager.	✓		
• Work area is secured. Site work permits have been obtained. Emergency shut-off switch is located. Fire extinguishers/warning signs/barriers are present. Signage in place for overhead power lines. Other safety equipment as needed.	✓		
• Required paving or surface improvement has been removed to allow clear visibility of subsurface conditions.		NA	
• If conducting borehole advancement activities: • First 1.2 meters or deeper in areas where expected frost levels are greater than 1.2 meters, has been delineated utilizing most effective method (e.g. vacuum digging, probing, hand digging, etc.) • Note methods used in Comments.		NA	
• If conducting borehole advancement activities in critical zones (and non-critical zones if possible): • Second 1.2 meters (total of 2.4 meters) has been delineated. • Note methods used in Comments.		NA	
• If conducting trenching/excavation activities in critical zone: • First 1.2 meters, or deeper in areas where expected frost levels are greater than 1.2 meters, assessed for below grade issues. • Note methods used in Comments.		NA	
• If subsurface structures exposed, extra precautions have been taken to ensure structural integrity.	✓		

Comments / Findings	Actions to Close Out Items	Person Completing / Date

Completed by: Tyler Aye (Name (print)) Tetra Tech (Company)

(Signature) Oct. 19, 2012 (Date)

TETRA TECH

GROUND DISTURBANCE CHECKLIST | SF-HS202-001E

This checklist must be completed and approved prior to starting any ground disturbance. If completing this form in the field, approval may be obtained by phone.

1. General Information

Date(s) of Disturbance: Oct. 12/12	Ground Disturbance Supervisor: Troy Lange
Location: Lobstick – 101-3901603	
Type of Ground Disturbance Activity: Borehole drilling	
Contractor(s): Intercore	
Client: Public Works + Gov't Services Canada	

2. Ground Disturbance Details

Have the boundaries or locations of the proposed ground disturbance activity been clearly defined (including the proposed depth)? *Attach a sketch or drawing of the proposed ground disturbance activity.*	☑ Yes ☐ No
Has the Search Area been established (i.e., 30 m setback from gas pipelines)?	☑ Yes ☐ No
Will the ground disturbance activity be within a Critical Zone (within 5 m of a pipeline or within 3 m of other buried infrastructure)?	☐ Yes ☑ No
Will daylighting be performed (daylighting is required when a ground disturbance is within a Critical Zone)? If no, provide an explanation of why not:	☐ Yes ☑ No
If buried infrastructure is being exposed to confirm location, will these specific lines be clearly identified by the locator? *To be confirmed at the ground disturbance location after exposure.*	☐ Yes ☐ No
If buried infrastructure is being exposed, have measures been taken to ensure its structural integrity?	☑ Yes ☐ No
Will the ground disturbance activity be within a road allowance?	☐ Yes ☑ No
Will the ground disturbance activity be within an infrastructure (utility) right-of-way?	☐ Yes ☑ No
Will the ground disturbance be considered a confined space? *If yes, follow Wardrop HS procedure HS204.*	☐ Yes ☑ No
Will a backfill inspection be required?	☐ Yes ☑ No
Are there any overhead powered cables within the Search Area (i.e. power, phone, cable)?	☑ Yes ☐ No
If yes, have appropriate setbacks been established (based on line voltage)?	☑ Yes ☐ No

3. Searches and Notifications of Buried Infrastructure

3.1 One-Call Centres

Is there a provincial One-Call Centre? *If no, proceed to Section 3.2*				☑ Yes ☐ No
Locate ticket number:	Date: (yyyy-mm-dd)			
Name of company conducting the locate: Magna Electric Corp.				
Provide the names of the companies/owners included on the One-Call ticket:				
1: Sask Energy	Type:	pot. gas	Is there a conflict?	☐ Yes ☑ No
2: Sask Power	Type:	electrical	Is there a conflict?	☐ Yes ☑ No
3: Sask Tel	Type:	telephone + cable	Is there a conflict?	☐ Yes ☑ No
4:	Type:		Is there a conflict?	☐ Yes ☐ No
5:	Type:		Is there a conflict?	☐ Yes ☐ No
6:	Type:		Is there a conflict?	☐ Yes ☐ No
7:	Type:		Is there a conflict?	☐ Yes ☐ No
8:	Type:		Is there a conflict?	☐ Yes ☐ No
9:	Type:		Is there a conflict?	☐ Yes ☐ No
10:	Type:		Is there a conflict?	☐ Yes ☐ No

3. Searches and Notifications of Buried Infrastructure (cont.)

3.2 Non-Members of One-Call Centres (Non-Members must be contacted directly)

Provide the names of the infrastructure owners contacted directly, the type of buried infrastructure and whether or not the buried infrastructure is within the Search Area of the ground disturbance activity (and therefore should be located):

1: Lobstick	Type: Irrigation/Propane	Is there a conflict?	☐ Yes ☑ No
2: Waskesiu	Type: Water + sewer	Is there a conflict?	☐ Yes ☑ No
3:	Type:	Is there a conflict?	☐ Yes ☐ No
4:	Type:	Is there a conflict?	☐ Yes ☐ No
5:	Type:	Is there a conflict?	☐ Yes ☐ No
6:	Type:	Is there a conflict?	☐ Yes ☐ No
7:	Type:	Is there a conflict?	☐ Yes ☐ No
8:	Type:	Is there a conflict?	☐ Yes ☐ No
9:	Type:	Is there a conflict?	☐ Yes ☐ No
10:	Type:	Is there a conflict?	☐ Yes ☐ No

3.3 Other Sources of Buried Infrastructure Information

Will a private locate be performed? Yes	☐ Yes ☐ No
If yes, by whom? Hundseth Date: (yyyy-mm-dd) 2012-10-10	
Has the Certificate(s) of Title been reviewed for caveats, easements, registrants, etc.?	☐ Yes ☑ No ☐ N/A
Has the Alberta Energy and Utilities Board been contacted regarding high-pressure pipelines?	☐ Yes ☐ No ☑ N/A
Has the National Energy Board been contacted regarding pipelines?	☐ Yes ☑ No ☐ N/A
Has the local or regional government been contacted (if on public property)?	☑ Yes ☐ No ☐ N/A
Have as-builts, facility and/or plot plans been reviewed?	☑ Yes ☐ No ☐ N/A
Have local operations personnel been contacted?	☑ Yes ☐ No ☐ N/A
Has the landowner been consulted?	☑ Yes ☐ No ☐ N/A
Have all types of buried infrastructure been considered?	☐ Yes ☐ No

This includes, but is not limited to (check after presence or absence of type has been verified):

☑ Power ☐ Telephone ☑ Water ☑ Wastewater
☐ Cable ☐ Fibreoptic ☐ Communication ☐ Irrigation
☐ High-pressure and low-pressure oil & gas pipelines

Are there any company markers for buried infrastructure within the search area?	☐ Yes ☑ No
Are there any visible indicators of previous development within or nearby the Search Area (i.e. vegetation, land contour, improvements, above ground infrastructure)? If yes, provide details on the visible indicators:	☐ Yes ☑ No
Is there any buried infrastructure that cannot be located (i.e. plastic water lines, clay sewer pipe, etc)?	☐ Yes ☑ No
If the proposed ground disturbance activity will extend beyond the expiry date of buried infrastructure locates (typically 14 days), will control over the work area be maintained throughout the activity?	☐ Yes ☑ No
Are all required third party and owner crossing agreements in place and the conditions met?	☑ Yes ☐ No

4. Authorization

	Name	Signature	Position
Completed by:	Troy Lange		Site Supervisor
Approved by:			

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APPENDIX E

BOREHOLE LOGS

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RECORD OF BOREHOLE

BH29-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 13, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: 17 m northwest of BH20.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	MONITORING WELL BH29-12
3" Direct Push	0 / 0	98.54	Ground Surface								Flush Mount Casing
		0.00	**Sand** Some silt, trace coarse-grained sand, trace small gravel, brown, medium dense, moist, trace oxidation.		BH29-12-0.75	C				0	
	1 / 5				BH29-12-1.5	C				0	
		96.54									
	2	2.00	**Silt** Some fine-grained sand, trace coarse-grained sand, trace small gravel, brown, medium, non-plastic, moist, trace oxidation.		BH29-12-2.25	C				5	
	3 / 10				BH29-12-3.0	C				15	
		95.34									
		3.20	**Silt** Little fine-grained sand, little clay, trace coarse-grained sand, brown, medium, low plasticity, moist, trace oxidation.		BH29-12-3.75	C				0	
	4 / 15				BH29-12-4.5	C				0	
		93.54									
	5	5.00	**Clay** Some fine-grained sand, brown, medium, low plasticity, moist.		BH29-12-5.1	C				0	
		93.44			BH29-12-5.25	C				0	
		5.10	**Clay** Little silt, trace fine-grained sand, brown, medium, medium plasticity, little oxidation.								
	6 / 20				BH29-12-6.0	C				0	
					BH29-12-6.75	C				10	
		91.79									
	7	6.75	**Clay** Little silt, little fine-grained sand, trace coarse-grained sand, trace small gravel, brown, medium to stiff, medium plasticity, moist, trace oxidation. -Below 7.0 m: Grey, stiff.		BH29-12-7.4	C				35	
	25										
					BH29-12-8.0	C				15	
	8	90.54 8.00	-Refusal at 8.0 m due to hard material. ***End of Borehole at 8.00m***								
	9										

Flush Mount Casing: 98.54 / 98.41
Bentonite Chips: 98.24
51 mm Sch. 40 PVC
95.34
95.04
10/20 Silica Sand
51 mm Sch. 40 PVC - 0.25 mm
90.54
▽ 90.86 Oct. 15, 2012

SCALE 1: 50.0
LOGGED BY: TL/KO
CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00D.GPJ 11/20/12

Intercore Environmental Services Ltd., Geoprobe 7822DT

TETRA TECH

RECORD OF BOREHOLE

BH29-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
PROJECT TITLE: Lobstick Maintenance Compound
BOREHOLE LOCATION: 17 m northwest of BH20.

DATE DRILLED: October 13, 2012
PROJECT SITE: Waskesiu Lake, SK

DATUM: Assumed
NORTHING:
EASTING:

BORING METHOD	DEPTH SCALE m / ft	SUBSURFACE PROFILE: ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	MONITORING WELL BH29-12

Flush Mount Casing

0.00 — 98.54 — Ground Surface

Sand
Some silt, trace coarse-grained sand, trace small gravel, brown, medium dense, moist, trace oxidation.

BH29-12-0.75 C — 10
BH29-12-1.5 C — 0

96.54 — 2.00

Silt
Some fine-grained sand, trace coarse-grained sand, trace small gravel, brown, medium, non-plastic, moist, trace oxidation.

BH29-12-2.25 C — 5
BH29-12-3.0 C — 15

95.34 — 3.20

Silt
Little fine-grained sand, little clay, trace coarse-grained sand, brown, medium, low plasticity, moist, trace oxidation.

BH29-12-3.75 C — 0
BH29-12-4.5 C — 0

93.54 — 5.00

Clay
Some fine-grained sand, brown, medium, low plasticity, moist.

BH29-12-5.1 C — 0
BH29-12-5.25 C — 0

93.44 — 5.10

Clay
Little silt, trace fine-grained sand, brown, medium, medium plasticity, little oxidation.

BH29-12-6.0 C — 0

BH29-12-6.75 C — 10

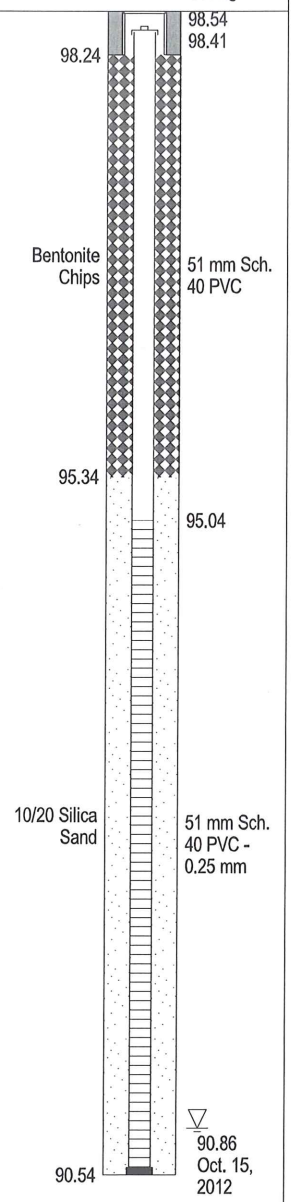
91.79 — 6.75

Clay
Little silt, little fine-grained sand, trace coarse-grained sand, trace small gravel, brown, medium to stiff, medium plasticity, moist, trace oxidation.
-Below 7.0 m: Grey, stiff.

BH29-12-7.4 C — 35
BH29-12-8.0 C — 15

90.54 — 8.00

-Refusal at 8.0 m due to hard material.
End of Borehole at 8.00m



Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00D.GPJ 11/20/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH30-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 13, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

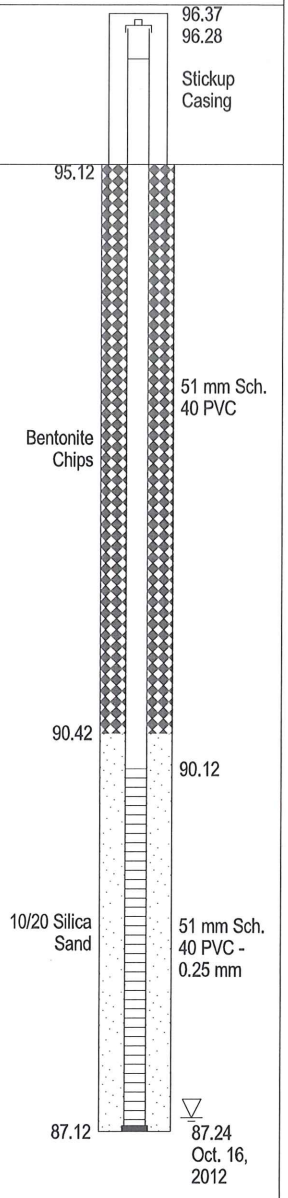
BOREHOLE LOCATION: North of Shop A; 3 m south of edge of access road.
EASTING:

Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)
	0.00	95.12	Ground Surface							
			Sand Fine-grained, few silt, trace clay, trace coarse-grained sand, brown, medium dense, moist.		BH30-12-0.75	C				0
					BH30-12-1.5	C				0
		93.62			BH30-12-1.7	C				0
	5	1.50	**Sand** Fine-grained, light brown, loose, dry.							
		93.42								
		1.70	**Sand** Fine-grained, some silt, trace coarse-grained sand, brown, medium dense, moist, trace oxidation.		BH30-12-2.25	C				0
					BH30-12-3.0	C				0
	10	92.12								
		3.00	**Poor Recovery** 0.15 m of recovery due to cobbles; appears the same as 1.7-3.0 m.							
		90.62								
	15	4.50	**Sand** Fine-grained, few silt, few clay, trace coarse-grained sand, brown, dense. -Below 4.9 m: Trace small gravel, greyish brown.		BH30-12-4.75	C	BTEX & PHC F1- F4	Moisture	PASS	0
					BH30-12-5.2	C	BTEX & PHC F1- F4	Moisture	PASS	0
		89.22			BH30-12-5.9	C	BTEX & PHC F1- F4	Moisture	PASS	5
	20	5.90	**Clay** Few silt, grey, medium, medium plasticity, moist. -From 6.6-6.8 m: Little fine-grained sand. -Below 6.8 m: Trace small gravel.		BH30-12-6.6	C	BTEX & PHC F1- F4	Moisture	PASS	5
					BH30-12-6.8	C	BTEX & PHC F1- F4	Moisture	PASS	
	25				BH30-12-7.6	C	BTEX & PHC F1- F4	Moisture	PASS	0
		87.12			BH30-12-8.0	C	BTEX & PHC F1- F4	Moisture	PASS	0
		8.00	-Refusal at 8.0 m due to hard material. ***End of Borehole at 8.00m***							
	30									
	35									

MONITORING WELL

BH30-12



SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

BH31-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada DATE DRILLED: October 13, 2012 DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound PROJECT SITE: Waskesiu Lake, SK NORTHING:

BOREHOLE LOCATION: East of Shop A; ~5 m north of east-west access road; ~7 m east of north-south access road. EASTING:

BORING METHOD	DEPTH SCALE m / ft	SUBSURFACE PROFILE: ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	MONITORING WELL BH31-12

97.26
97.15
Stickup Casing

0.00 / 96.31 **Ground Surface**

Sand
Fine-grained, some silt, few clay, trace small gravel, light brown, medium dense, dry, rootlets, poor recovery.

BH31-12-1.5 | C | BTEX & PHC F1- F4 | Moisture & Grain Size | PASS | 0

94.81 / 1.50

Sand
Fine-grained, few silt, trace coarse-grained sand, medium dense, moist, trace oxidation.

BH31-12-2.25 | C | 0

94.21 / 2.10

Silt
Trace clay, trace fine-grained sand, light brown, medium, non-plastic, moist.

93.81 / 2.50

Silt
Few fine-grained sand, little clay, brown, medium to stiff, low plasticity, moist, trace oxidation.
-At 3.0 m: Large gravel.

BH31-12-3.0 | C | BTEX & PHC F1- F4 | Moisture | PASS | 0

-Below 3.5 m: Trace coarse-grained sand, grey.

BH31-12-3.75 | C | BTEX & PHC F1- F4 | Moisture | PASS | 0

BH31-12-4.5 | C | BTEX & PHC F1- F4 | Moisture | PASS | 0

91.81 / 4.50

Sand
Fine-grained, some silt, few clay, trace coarse-grained sand, brown, dense, trace oxidation.

BH31-12-5.25 | C | BTEX & PHC F1- F4 | Moisture & Grain Size | PASS | 0

BH31-12-6.0 | C | 0

90.31 / 6.00

Clay
Some silt, trace fine-grained sand, brown, soft to medium, moist, poor recovery.

BH31-12-7.5 | C | 15

88.81 / 7.50

Clay
Some silt, trace fine-grained sand, trace coarse-grained sand, dark greyish brown, stiff, medium plasticity, moist, trace oxidation.

BH31-12-8.0 | C | 10

88.31 / 8.00

-Refusal at 8.0 m due to hard material.
End of Borehole at 8.00m

96.31
Bentonite Chips
51 mm Sch. 40 PVC
92.33 Oct. 16, 2012
91.61
91.31
10/20 Silica Sand
51 mm Sch. 40 PVC - 0.25 mm
88.31

Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0 LOGGED BY: TL/KO CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH32-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southwest of BH19; north of BH-14.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE
		0.00 / 99.33	Ground Surface								
		99.33 / 0.00	Surface: Loose leaf litter, moist.		BH32-12-0.1	C	DDT		PASS		99.33
		99.23 / 0.10	**Topsoil** Dark brown, leaves, roots, peaty.		BH32-12-0.3	C					
		98.73 / 0.60	**Silt** Trace fine-grained sand, light brown, soft to medium, non-plastic, dry, rootlets.		BH32-12-0.6	C	DDT		PASS		
	1				BH32-12-0.9	C					
			Silt Little clay, little fine-grained sand, brown, medium, low-plasticity, wet.		BH32-12-1.2	C					
	5				BH32-12-1.5	C					
			-Below 1.5 m: Trace coarse-grained sand, trace small gravel, moist.								
	2				BH32-12-2.25	C				0	
			-Below 2.75 m: Medium to stiff.		BH32-12-3.0	C				30	
	3 10				BH32-12-3.75	C				0	
	4										Bentonite Chips
		94.83 / 4.50	**Clay** Some silt, trace fine-grained sand, brown, stiff, low plasticity, moist, trace oxidation.		BH32-12-4.5	C				0	
	5 15				BH32-12-5.25	C				0	
	6	93.33 / 6.00	**Silt** Little clay, brown, soft to medium, non-plastic, wet.		BH32-12-6.0	C				10	
	20	92.93 / 6.40	**Clay** Some silt, little fine-grained sand, little coarse-grained sand, trace small gravel, dark brown, stiff, moist, low plasticity.		BH32-12-6.4	C				0	
	7				BH32-12-7.15	C	BTEX & PHC F1- F4	Moisture	PASS	210	
	25				BH32-12-7.75	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	8	91.03			BH32-12-8.3	C				0	91.03
		8.30	-Refusal at 8.3 m due to hard material. ***End of Borehole at 8.30m***								
	9										

Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH33-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southeast of BH20; northeast of BH17.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE
3" Direct Push	0.00	99.45	Ground Surface								BH33-12
		99.45	Surface: Grass, moist.		BH33-12-0.05	C					99.45
		0.00			BH33-12-0.25	C					
		99.40	**Topsoil**								
		0.05	Peaty.		BH33-12-0.5	C	DDT		PASS		
			Silt								
			Some clay, little fine-grained sand, light brown, soft, moist, roots.		BH33-12-0.75	C					
	1		-From 0.2-2.4 m: Wet.		BH33-12-1.0	C	DDT		PASS		
			-Below 0.5 m: No roots.		BH33-12-1.25	C					
			-Below 1.0 m: Few fine-grained sand.		BH33-12-1.5	C					
	5		-Below 1.5 m: Little clay.								
	2				BH33-12-2.25	C				0	
			-At 2.3 m: Large gravel.								
					BH33-12-3.0	C				0	
	3	96.45									
	10	3.00	**Clay**								
			Some silt, trace fine-grained sand, trace coarse-grained sand, brown, medium to stiff, medium plasticity, moist, trace oxidation.		BH33-12-3.75	C				0	
	4				BH33-12-4.5	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	15										
	5				BH33-12-5.25	C				5	
			-Below 5.4 m: Stiff.								
					BH33-12-6.0	C	BTEX & PHC F1- F4	Moisture	PASS	65	
	6										
	20										
			-At 6.6 m: 5 cm fine-grained sand seam, grey.		BH33-12-6.75	C				60	
	7										
					BH33-12-7.5	C				5	
		91.95								0	
	25	7.50	**Silt**		BH33-12-7.65	C				0	
		91.80	Some fine-grained sand, brown, stiff, wet.		BH33-12-7.8	C	Grain Size	Moisture		0	
		7.65									
	8	91.65	**Sand**								91.65
		7.80	Fine-grained, few silt, little clay, brown, dense, wet.								
			-Refusal at 7.8 m due to hard material.								
			End of Borehole at 7.80m								
	9										

Bentonite Chips

Intercore Environmental Services Ltd., Geoprobe 7822DT

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00D.GPJ 11/22/12

TETRA TECH

RECORD OF BOREHOLE

BH34-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: West of BH-4; southeast of BH17.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / % LEL (20 40 60 80)	BACKFILLED HOLE BH34-12
3" Direct Push	0.00 / 100.35 Ground Surface										
		100.35	Surface: Grass, moist.		BH34-12-0.1	C				5	100.35
		0.00	**Topsoil**		BH34-12-0.25	C	DDT		PASS		
		100.25	Peaty.		BH34-12-0.5	C					
		0.10	**Silt**		BH34-12-0.75	C					
			Trace fine-grained sand, light brown, soft, dry, non-plastic.		BH34-12-1.0	C				20	
	1	99.35	-At 0.5 m: Root inclusion.							0	
		1.00	**Sand**		BH34-12-1.25	C	DDT		PASS		
			Fine-grained, some silt, trace coarse-grained sand, brown, medium, moist, trace oxidation, trace grey silt seams.		BH34-12-1.5	C					
	5	98.75									
		1.60	**Silt**		BH34-12-1.75	C					
	2		Trace fine-grained sand, trace coarse-grained sand, brown, medium, non-plastic, moist.								
			-Below 1.9 m: Soft, wet.		BH34-12-2.5	C				0	
		97.85									
		2.50	**Silt**								
	3 10		Little fine-grained sand, trace coarse-grained sand, trace small gravel, brown, medium, non-plastic, moist.		BH34-12-3.25	C				35	
					BH34-12-4.0	C				25	Bentonite Chips
	4	96.15									
		4.20	**Clay**								
	15		Some silt, few fine-grained sand, brown, medium, medium plasticity, trace oxidation.		BH34-12-4.75	C	BTEX & PHC F1- F4	Moisture	PASS	25	
	5		-At 5.0 m: Trace coarse-grained sand, trace small gravel.		BH34-12-5.5	C	Grain Size	Moisture		0	
	6 20				BH34-12-6.25	C				0	
			-Below 6.5 m: Stiff.		BH34-12-7.0	C	BTEX & PHC F1- F4	Moisture	PASS	55	
	7				BH34-12-7.5	C				30	
	25										
		92.35			BH34-12-8.0	C				30	92.35
	8	8.00	-Refusal at 8.0 m due to hard material.								
			End of Borehole at 8.00m								
	9										

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH35-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 13, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Northeast of BH-9; west of BH-6.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	SUBSURFACE PROFILE DESCRIPTION	SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE
3" Direct Push	0.00 / 0	99.57	Ground Surface								
		99.57	Surface: Sand and gravel, moist.		BH35-12-0.25	C				0	99.57
		0.00	**Sand & Gravel**								
		99.17								20	
		0.40	Wood inclusion.		BH35-12-0.6	C					
		99.07	**Sand**		BH35-12-0.8	C	DDT		PASS	10	
		0.50	Fine-grained, little silt, trace clay, grey, loose, moist.		BH35-12-1.0	C				0	
	1	98.77	-At 0.7 m: Wet.		BH35-12-1.2	C	DDT		PASS		
		0.80	**Sand**		BH35-12-1.5	C				0	
	5	97.97	Fine-grained, some clay, grey, loose, wet.								
		1.60	**Sand**		BH35-12-1.7	C				0	
		97.87	Fine-grained sand, grey, loose, wet.								
		1.70	**Clay**								
	2		Some fine-grained sand, mottled grey and brown, soft to medium, low plasticity.		BH35-12-2.25	C				0	
			-Below 2.5 m: Little small gravel, brown.								
					BH35-12-3.0	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	3	10									
	4										
		95.07			BH35-12-4.5	C				10	Bentonite Chips
		4.50	**Silt**								
			Few fine-grained sand, little coarse-grained sand, trace small gravel, brown, medium, non-plastic, trace oxidation.		BH35-12-5.25	C				0	
	5	15									
		93.87									
		5.70	**Silt**		BH35-12-6.0	C	Grain Size	Moisture		0	
		93.57	Some clay, trace fine-grained sand, brown, medium to stiff, low plasticity, trace oxidation.								
	6	6.00	**Silt**								
		20	Some clay, grey, stiff, non-plastic (crumbly structure), moist, trace oxidation.		BH35-12-6.7	C				0	
	7	92.47			BH35-12-7.2	C				0	
		7.10	**Clay**		BH35-12-7.5	C	BTEX & PHC F1- F4	Moisture	PASS	0	
			Some silt, trace coarse-grained sand, grey, medium to stiff, medium plasticity, trace oxidation.								
		25									
	8				BH35-12-8.0	C				0	
		91.07			BH35-12-8.5	C				0	91.07
		8.50	-Refusal at 8.5 m due to hard material.								
			End of Borehole at 8.50m								
	9										

BACKFILLED HOLE

BH35-12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00D.GPJ 11/20/12

TETRA TECH

RECORD OF BOREHOLE

BH37-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: East of BH-7; northwest of BH-10.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE BH37-12
3" Direct Push	0.00 / 0	99.63	Ground Surface								99.63
		99.23	**Sand & Gravel**								
	1 / 5	0.40	**Silt** Some fine-grained sand, trace small gravel, light brown, soft to medium, low plasticity. -From 0.7-0.8 m: Fine-grained sand lens.		BH37-12-0.75	C	TOC			0	
					BH37-12-1.5	C				5	
		97.93									
	2 / 10	1.70	**Silt** Some clay, brown, stiff, low plasticity, moist, trace oxidation.		BH37-12-2.25	C				5	
					BH37-12-3.0	C				0	
		96.38									
	3 / 15	3.25	**Clay** Some silt, brown with grey streaks, stiff, moist, trace oxidation.		BH37-12-3.75	C				0	
	4 / 15				BH37-12-4.5	C	BTEX & PHC F1- F4	Moisture	PASS	460	Bentonite Chips
	5 / 20		-Below 6.3 m: Few fine-grained sand.		BH37-12-5.25	C				10	
					BH37-12-6.0	C				10	
	6 / 20				BH37-12-6.75	C				5	
	7 / 25				BH37-12-7.5	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	8 / 25	91.33			BH37-12-8.3	C				0	91.33
	9	8.30	-Refusal at 8.3 m due to hard material. ***End of Borehole at 8.30m***								

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

BH38-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: West of BH-9; east of BH-12
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE
3" Direct Push	0.00	99.54	Ground Surface								99.54
		99.54	Surface: Grass.								
		0.00	**Topsoil**								
		99.24	**Sand & Gravel**		BH38-12-0.5	C				140	
		0.30	Light brown, moist, roots.								
		99.04	**Sand**								
		0.50	Fine-grained sand, few clay, little silt, trace small		BH38-12-1.0	C	BTEX & PHC F1- F4	Moisture & TOC	PASS	45	
	1	98.54	gravel, brown, dense, moist, trace oxidation.								
		1.00	**Sand**								
	5		Some silt, trace clay, brownish grey, medium dense, wood inclusion.		BH38-12-1.5	C				5	
			-Below 1.5 m: Loose, wet.								
					BH38-12-2.0	C				0	
	2	97.54									
		2.00	**Sand**		BH38-12-2.25	C				0	
		97.14	Fine-grained, little silt, brown with grey streaks, medium dense, moist.								
		2.40			BH38-12-2.5	C				0	
		97.04	**Silt**								
		2.50	Some fine-grained sand, grey, medium, moist.								
			Sand								
	3 10		Fine-grained, little silt, brown with grey streaks, medium dense, moist.		BH38-12-3.25	C				10	
			-From 2.7-2.8 m: Wet.								
		95.94								15	
		3.60	**Sand**		BH38-12-3.7	C				20	
		95.84	Fine-grained, brown, medium dense, wet.		BH38-12-4.0	C	BTEX & PHC F1- F4	Moisture & Grain Size	PASS		
		3.70									
	4	95.54	**Sand**								
		4.00	Fine-grained, few silt, few clay, brown with grey streaks, medium dense, moist.								
		95.04	**Clay**								
	15	4.50	Some fine-grained sand, few silt, brown with grey streaks, soft to medium, low plasticity, moist.		BH38-12-4.75	C				0	
	5		**Clay**								
			Some fine-grained sand, little silt, trace small gravel, brown with grey streaks, medium to stiff.		BH38-12-5.3	C				15	
					BH38-12-6.0	C				0	
		93.54									
	6 20	6.00	**Silt**		BH38-12-6.25	C				5	
		93.14	Some clay, brown, medium to stiff, medium plasticity, moist.								
		6.40	**Clay**								
			Some silt, brown, stiff, medium plasticity, moist, little oxidation.		BH38-12-7.0	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	7		-From 6.6-7.0 m: Crumbly structure with slight								
		92.34	fracturing.								
		7.20	**Clay**								
	25		Some silt, grey, stiff, low plasticity, moist.		BH38-12-7.75	C				0	
	8				BH38-12-8.5	C				5	
		91.04									91.04
		8.50	-Refusal at 8.5 m due to hard material.								
			End of Borehole at 8.50m								
	9										

Bentonite Chips

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH39-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Northeast of BH16; southwest of BH-12.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE BH39-12
3" Direct Push	0 / 0	100.80	Ground Surface								100.80
		100.60	**Topsoil**								
		0.20	**Sand**								
		100.50	Fine-grained, little silt, light brown, loose, dry.								
		0.30	**Sand**								
	1 /		Fine-grained, few silt,brown, medium dense, moist, roots, trace oxidation.		BH39-12-0.75	C	DDT	TOC	PASS	25	
		99.30			BH39-12-1.5	C	BTEX & PHC F1- F4	DDT & Moisture	PASS	40	
	5 /	1.50	**Clay**								
			Some silt, brown, stiff, moist, low plasticity, trace rootlets, trace oxidation.		BH39-12-2.25	C				20	
	2 /				BH39-12-3.0	C				0	
	10 / 3				BH39-12-3.75	C				80	
					BH39-12-4.5	C				75	
	4 / 15				BH39-12-5.2	C				440	
	5 /		-From 5.0-5.1 m: Few fine-grained sand, oxidation, crumbly structure.								
		95.40									
		5.40	**Clay**								
			Few silt, few fine-grained sand, trace small gravel, brown, medium, medium plasticity, moist, little oxidation.		BH39-12-6.0 + DUP	C	BTEX & PHC F1- F4	Moisture	FAIL	22	
	6 / 20				BH39-12-6.6	C				110	
			-Below 6.8 m: Greyish brown								
	7 /				BH39-12-7.3	C				110	
	25 /	93.00			BH39-12-7.8	C	BTEX & PHC F1- F4	Moisture	PASS	20	93.00
	8 /	7.80	-Refusal at 7.8 m due to hard material.								
			End of Borehole at 7.80m								
	9 /										

Bentonite Chips

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH40-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southeast of BH23; southwest of BH-7.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE
3" Direct Push	0.00 / 0	99.74	Ground Surface								99.74
		99.24	**Topsoil** Dark brown, trace roots.		BH40-12-0.5	C	TOC			60	
	1 / 5	0.50	**Sand** Fine-grained, few small gravel, little silt, trace clay, greyish brown, wet, trace roots.		BH40-12-1.5	C				20	
	2		-Below 1.5 m: Few silt, light brown, low recovery.								
	3 / 10	96.74			BH40-12-3.0	C				40	
		3.00	**Clay** Some fine-grained sand, trace coarse-grained sand, brown with grey streaking, soft to medium, medium plasticity, moist, trace oxidation. -Below 3.1 m: Stiff.		BH40-12-3.1	C				6	
	4				BH40-12-3.75	C	BTEX & PHC F1- F4	Moisture	PASS	41	Bentonite Chips
					BH40-12-4.5	C				13	
	5 / 15				BH40-12-5.25	C				160	
					BH40-12-6.0	C				180	
	6 / 20				BH40-12-6.75	C	BTEX & PHC F1- F4	Moisture	PASS	0	
	7				BH40-12-7.5	C				0	
	25	91.74			BH40-12-8.0	C				0	91.74
	8	8.00	-Refusal at 8.0 due to hard material. ***End of Borehole at 8.00m***								
	9										

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH41-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: North of BH23; southwest of BH18.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	● VAPOURS ● ppm (100 200 300 400) × VAPOURS LEL × % LEL (20 40 60 80)	BACKFILLED HOLE
3" Direct Push	0.00 / 0	99.75	Ground Surface								99.75
		99.75	Surface: Loose leaf litter, moist.		BH41-12-0.1	C					
		0.00	**Topsoil**		BH41-12-0.3	C	DDT		PASS		
		99.65	Peaty, dark brown, roots, leaves.		BH41-12-0.6	C					
		0.10	**Sand**		BH41-12-0.9	C	DDT		PASS		
		99.45	Fine-grained, few silt, light brown, wet.		BH41-12-1.2	C					
	1 / 5	0.30	**Silt**		BH41-12-1.5	C					
			Some fine-grained sand, trace small gravel, light brown, soft, medium plasticity, moist to wet, trace oxidation.								
			-Below 1.2 m: Soft to medium, moist.								
	2				BH41-12-2.25	C				5	
	3 / 10		-Below 3.0 m: Low recovery.		BH41-12-3.0	C				25	
					BH41-12-3.75	C				10	
	4	95.65									
		4.10	**Clay**		BH41-12-4.5	C				10	Bentonite Chips
	15		Some silt, light brown, medium, high plasticity, moist.								
			-From 4.5-7.5 m: Low recovery.								
	5				BH41-12-5.25	C				30	
					BH41-12-6.0	C				35	
	6 / 20		-Below 6.0 m: Soft to medium.								
					BH41-12-6.75	C				15	
	7		-Below 7.2 m: Grey.		BH41-12-7.5	C				30	
	25		-Below 7.7 m: Trace sand, trace small gravel.								
	8				BH41-12-8.25	C	BTEX & PHC F1- F4	Moisture	PASS	150	
					BH41-12-9.0	C				20	
	9 / 30	90.75									90.75
		9.00	***End of Borehole at 9.00m***								

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH42-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: East of BH20; southwest of BH-14.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / % LEL (20 40 60 80)	BACKFILLED HOLE BH42-12
3" Direct Push	0.00 / 0	99.45	Ground Surface								99.45
		99.45 / 0.00	Surface: Grass, moist.		BH42-12-0.1	C					
		99.35 / 0.10	**Topsoil** Peaty, dark brown, roots, leaves.		BH42-12-0.3 & DUP	C	DDT		PASS		
			Silt Some fine-grained sand, light brown, soft, low plasticity, wet. -Below 0.5 m: Medium to stiff, moist.		BH42-12-0.6	C					
	1				BH42-12-0.9	C					
					BH42-12-1.2	C					
		98.25 / 1.20	**Sand** Fine-grained, few silt, trace small gravel, light brown, medium dense, wet.		BH42-12-1.5	C					
	5	97.95 / 1.50	**Silt** Some fine-grained sand, light brown, soft to medium, moist. -Below 2.25 m: Trace small gravel.		BH42-12-2.25	C				5	
	2				BH42-12-3.0	C				0	
	10	96.35 / 3.10	**Clay** Some silt, light brown, stiff, low plasticity, moist, trace oxidation.		BH42-12-3.75	C				0	
	4				BH42-12-4.5	C				0	
	15				BH42-12-5.1	C				0	
	5	94.15 / 5.30	**Silt** Little clay, light brown, soft, non-plastic, moist.		BH42-12-5.6	C				0	
		93.85 / 5.60	**Clay** Few silt, little fine-grained sand, trace small gravel, brown, stiff, medium plasticity, moist, trace oxidation.		BH42-12-6.2	C				0	
	6 20				BH42-12-6.9	C				0	
	7		-Below 6.9 m: Few fine-grained sand.								
		92.25 / 7.20	**Clay** Some silt, trace fine-grained sand, trace small gravel, brown, stiff, medium plasticity, moist, trace oxidation.		BH42-12-7.8	C	BTEX & PHC F1- F4	Moisture	PASS	50	91.65
	25	91.65 / 7.80	-Refusal at 7.8 m due to hard material. ***End of Borehole at 7.80m***								Bentonite Chips
	8										
	9										

Intercore Environmental Services Ltd., Geoprobe 7822DT

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

TETRA TECH

RECORD OF BOREHOLE

BH43-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: West of BH-13; southeast of BH16.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE BH43-12
Intercore Environmental Services Ltd., Geoprobe 7822DT 3" Direct Push	0.00	99.95	Ground Surface								
		99.95	Surface: Grass, moist.								99.95
		0.00	**Topsoil**		BH43-12-0.2	C	DDT		PASS		
		99.75	Peaty, dark brown, loose, rootlets, leaves.								
		0.20	**Silt**								
			Little fine-grained sand, trace coarse-grained sand, light brown, medium, dry.		BH43-12-0.5	C					
					BH43-12-0.75	C					
					BH43-12-1.0	C					Bentonite Chips
	1		-Below 1.0 m: Brown, moist.		BH43-12-1.25	C	DDT		PASS		
					BH43-12-1.5	C					
		98.45									98.45
	5	1.50	***End of Borehole at 1.50m***								
	2										
	3										
	10										

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TABLE 9

Groundwater Routine Water Quality Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Units	Analytical Results											Environmental Quality Guidelines [a]
		BH18	BH19	BH20	BH21	BH23	BH23 DUP [b]	BH24	BH29-12	BH31-12	EQUIP BLANK - TUBING	WASTE WATER	
		12-Oct-12	13-Oct-12	11-Oct-12	10-Oct-12	17-Oct-12		11-Oct-12	15-Oct-12	15-Oct-12	16-Oct-12	17-Oct-12	
Anion Sum	meq/L	11	13	12	12	13	13	17	12	14	0	11	N.G.
Cation Sum	meq/L	12	14	13	7.6	12	12	16	11	12	0	11	N.G.
Hardness (CaCO3)	mg/L	540	650	600	340	530	530	780	530	580	< 0.50	240	N.G.
Ion Balance	N/A	1.0	1.0	1.0	0.65	0.93	0.93	0.96	0.98	0.87	NC	0.98	N.G.
Dissolved Nitrate (NO3)	mg/L	20	30	0.020	3.4	< 0.013	< 0.013	0.11	1.4	8.6	< 0.013	17	N.G.
Nitrate plus Nitrite (N)	mg/L	4.6	6.8	0.0050	0.91	< 0.0030	< 0.0030	0.031	0.32	1.9	< 0.0030	4.0	N.G.
Dissolved Nitrite (NO2)	mg/L	< 0.0099	0.13	< 0.0099	0.46	< 0.0099	< 0.0099	0.016	< 0.0099	< 0.0099	< 0.0099	0.20	N.G.
Total Dissolved Solids	mg/L	570	660	600	500	650	650	810	570	660	<10	560	N.G.
Miscellaneous Inorganics													
Conductivity	uS/cm	960	1100	1000	960	1100	1100	1400	990	1200	2.0	980	N.G.
pH	N/A	7.73 *	7.75	7.36 *	7.57	7.70	7.72	8.03	8.07	7.87	5.97	8.73	N.G.
Anions													
Alkalinity (PP as CaCO3)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	36	N.G.
Alkalinity (Total as CaCO3)	mg/L	470	560	550	530	530	540	760	520	650	< 0.50	490	N.G.
Bicarbonate (HCO3)	mg/L	570	690	670	650	650	660	930	630	790	<0.50	520	N.G.
Carbonate (CO3)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	43	N.G.
Hydroxide (OH)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	N.G.
Dissolved Sulphate (SO4)	mg/L	36	43	22	24	91	84	36	37	35	<1.0	10	N.G.
Dissolved Chloride (Cl)	mg/L	26	24	25	16	19	19	34	20	18	<1.0	20	N.G.
Nutrients													
Dissolved Nitrite (N)	mg/L	< 0.0030	0.041	< 0.0030	0.14	< 0.0030	< 0.0030	0.0048	< 0.0030	< 0.0030	< 0.0030	0.062	N.G.
Dissolved Nitrate (N)	mg/L	4.6	6.8	0.0045	0.77	< 0.0030	< 0.0030	0.026	0.32	1.9	< 0.0030	3.9	N.G.

Notes: Concentrations in excess of referenced EQG are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[b] Sample collected as a field duplicate.

N.A. = Not Analzyed, N.G. = No Guideline, EQG = Environmental Quality Guideline

* Analysis requested and approved past method-specific hold-time.

TETRA TECH

RECORD OF BOREHOLE

BH44-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 14, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: East of chemical storage shed; southwest of BH-10.
EASTING:

BORING METHOD	DEPTH SCALE m ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE BH44-12
	0.00	99.57	Ground Surface								
		99.57	Surface: Grass, moist.								99.57
		0.00	**Clay** Few silt, trace fine-grained sand, brown, medium, medium plasticity, moist.		BH44-12-0.3 & DUP	C	DDT		PASS		
		99.27									
		0.30	**Sand** Fine-grained, little medium-grained sand, little coarse-grained sand, dark brown, loose, moist, rootlets.								
		99.17									
		0.40			BH44-12-0.5	C					
			Sand Fine-grained, trace coarse-grained sand, greyish brown, medium dense, moist.		BH44-12-0.75	C	DDT		PASS		Bentonite Chips
		98.77									
		0.80	**Clay** Some fine-grained sand, grey, soft, medium plasticity, wet.		BH44-12-1.0	C	DDT		PASS		
	1	98.57									
		1.00	**Clay** Some fine-grained sand, greyish brown, medium, medium plasticity, moist.		BH44-12-1.5	C	DDT		PASS		
		98.07									98.07
	5	1.50	***End of Borehole at 1.50m***								
	2										
	3										
	10										

Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

BH45-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 15, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: East of BH-13; south of Shop B.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	BACKFILLED HOLE BH45-12
Tetra Tech Inc., 100 mm Hand Auger Hand Auger	0.00 / 0	100.07	Ground Surface								
		100.07 0.00	Surface: Leaf litter, moist.		BH45-12-0.1	H					100.07
		99.97 0.10	**Topsoil** Peaty, dark brown, loose, moist, leaves, organics.		BH45-12-0.25	H	DDT		PASS		
		99.77 0.30	**Silt** Some fine-grained sand, trace small and large gravel, grey, soft, non-plastic, moist, roots.		BH45-12-0.55	H					
	1 / 5		**Silt** Few fine-grained sand, little clay, trace small and large gravel, greyish brown, medium, low plasticity, rootlets.		BH45-12-0.75	H					Bentonite Chips
			-Below 0.75 m: Trace oxidation.		BH45-12-1.0	H					
					BH45-12-1.25	H	DDT		PASS		
		98.77 1.30	**Clay** Some silt, trace fine-grained sand, grey, medium, medium plasticity, moist.		BH45-12-1.45	H					98.62
		98.62 1.45	***End of Borehole at 1.45m***								
	2										
	3 / 10										

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

VW25-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southeast of BH-7; west of BH-10.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	VAPOUR MONITORING WELL VW25-12
Intercore Environmental Services Ltd., Geoprobe 7822DT 3" Direct Push	0.00 / 0	99.65	Ground Surface								Flush Mount Casing
			Sand & Gravel								99.65 Flush Mount Casing; 99.63
		99.25									99.45 Granular Bentonite
		0.40	**Silt** Some fine-grained sand, trace small gravel, light brown, soft to medium, low plasticity. -From 0.7-0.8 m: Fine grained sand lens.		VW25-12-1.05	C					99.00 10/20 Silica sand; 98.95 25 mm Sch. 40 PVC - 0.25 mm
	1	98.60									98.60
		1.05	***End of Borehole at 1.05m***								98.65
	5										25 mm Sch. 40 PVC
	2										
	3 / 10										

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

VW26-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: West of BH-9; east of BH-12
EASTING:

BORING METHOD: Intercore Environmental Services Ltd., Geoprobe 7822DT, 3" Direct Push

DEPTH SCALE m / ft

ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON
0.00 / 99.58	Ground Surface						
99.28 / 0.30	**Topsoil**						
99.08 / 0.50	**Sand and Gravel** Light brown, moist, roots.						
98.58 / 1.00	**Sand** Fine-grained, few clay, little silt, trace small gravel, brown, dense, moist, trace oxidation.		VW26-12	SH	Geotechnical Analyses		
98.53 / 1.05	**Sand** Fine-grained, some silt, trace clay, brownish grey, medium dense, wood inclusion.						
	End of Borehole at 1.05m						

VAPOURS ppm: 100 200 300 400
VAPOURS LEL % LEL: 20 40 60 80

VAPOUR MONITORING WELL

VW26-12

Flush Mount Casing
99.58
99.55
99.38
25 mm Sch. 40 PVC
Granular Bentonite
98.93
98.88
10/20 Silica sand
25 mm Sch. 40 PVC - 0.25 mm
98.58
98.53

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

VW27-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Northeast of BH16; southwest of BH-12.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	VAPOUR MONITORING WELL VW27-12
Intercore Environmental Services Ltd., Geoprobe 7822DT 3" Direct Push	0.00 / 100.76 Ground Surface										Flush Mount Casing 100.76
		100.56	**Topsoil**								100.74
		0.20	**Sand** Fine-grained, few silt, brown, medium dense, moist, roots, trace oxidation.								100.56 Granular Bentonite 25 mm Sch. 40 PVC
	1				VW27-12-1.0	C					100.11 10/20 Silica sand 100.06 25 mm Sch. 40 PVC - 0.25 mm
		99.71 1.05	***End of Borehole at 1.05m***								99.71 99.76
	2										
	3 / 5 / 10										

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

VW28-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southeast of BH23; southwest of BH-7.
EASTING:

Intercore Environmental Services Ltd., Geoprobe 7822DT
3" Direct Push

BORING METHOD	DEPTH SCALE m / ft	ELEV DEPTH (m)	DESCRIPTION	SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLE TYPE	LAB TESTING (Primary)	LAB TESTING (Secondary)	GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	VAPOUR MONITORING WELL VW28-12
	0.00	99.80	Ground Surface								Flush Mount Casing 99.80
			Topsoil Dark brown, trace roots.								99.77
		99.30									99.60
		0.50	**Sand** Fine-grained, few small gravel, little silt, trace clay, greyish brown, wet, trace roots.		VW28-12	SH	Geotechnical Analyses				Granular Bentonite 25 mm Sch. 40 PVC
	1	98.75									99.15
		1.05	***End of Borehole at 1.05m***								10/20 Silica sand 99.10
											25 mm Sch. 40 PVC - 0.25 mm 98.80
	5										98.75
	2										
	3	10									

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

TETRA TECH

RECORD OF BOREHOLE

VW28-12

Sheet 1 of 1

1018901603-BOR-V0001-00

CLIENT: Public Works and Government Services Canada
DATE DRILLED: October 12, 2012
DATUM: Assumed

PROJECT TITLE: Lobstick Maintenance Compound
PROJECT SITE: Waskesiu Lake, SK
NORTHING:

BOREHOLE LOCATION: Southeast of BH23; southwest of BH-7.
EASTING:

BORING METHOD	DEPTH SCALE m / ft	SUBSURFACE PROFILE: ELEV DEPTH (m)	SUBSURFACE PROFILE: DESCRIPTION	SUBSURFACE PROFILE: SYMBOLS	SAMPLES: SAMPLE NAME	SAMPLES: SAMPLE TYPE	SAMPLES: LAB TESTING (Primary)	SAMPLES: LAB TESTING (Secondary)	SAMPLES: GUIDELINE COMPARISON	VAPOURS ppm (100 200 300 400) / VAPOURS LEL % LEL (20 40 60 80)	VAPOUR MONITORING WELL VW28-12
Intercore Environmental Services Ltd., Geoprobe 7822DT 3" Direct Push	0.00 / 0	99.80	Ground Surface								Flush Mount Casing
			Topsoil Dark brown, trace roots.								99.80 Flush Mount Casing; 99.77
		99.30									99.60 Granular Bentonite; 25 mm Sch. 40 PVC
		0.50	**Sand** Fine-grained, few small gravel, little silt, trace clay, greyish brown, wet, trace roots.		VW28-12	SH	Geotechnical Analyses				99.15 10/20 Silica sand; 99.10 25 mm Sch. 40 PVC - 0.25 mm
	1	98.75									98.80
		1.05	***End of Borehole at 1.05m***								98.75
	5										
	2										
	3 / 10										

SCALE 1: 50.0

LOGGED BY: TL/KO

CHECKED BY: JN

WARDROP LOG - ANALYTICAL 1018901603-BOR-V0001-00F.GPJ 11/30/12

APPENDIX F

TABLES

TABLE 1

Summary of Groundwater Well Monitoring Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Well ID [a]	Date	Well Casing Elevation (m above datum)	Ground Elevation (m above datum)	Depth to Groundwater (m below ground)	Depth to Groundwater (m below top of well casing)	Groundwater Elevation (m above datum)	Vapour Concentration [b]	Groundwater Observations
BH4	9-Nov-10	100.96	100.03	1.95	2.88	98.08	8% LEL	Clear
	28-Feb-11	100.96	100.03	2.93	3.86	97.10	75 ppm	Clear
	18-Dec-11	100.96	100.03	2.40	3.32	97.64	20 ppm	Clear
	10-Oct-12	100.96	100.03	0.97	1.90	99.06	N.D.	
BH6	9-Nov-10	99.26	99.46	2.51	2.31	96.95	90 ppm	Cloudy, brown
	28-Feb-11	99.26	99.46	4.01	4.01	95.25	20 ppm	Clear
	18-Dec-11	99.26	99.46	-	-	-	-	Not Located
	10-Oct-12	99.26	99.47	1.71	1.50	97.76	N.A. [c]	Vented.
BH7	9-Nov-10	99.79	99.82	2.05	2.02	97.77	170 ppm	Cloudy, brown
	28-Feb-11	99.79	99.82	3.61	3.58	96.21	45 ppm	Well frozen, no observations
	18-Dec-11	99.79	99.82	2.79	2.76	97.03	25 ppm	Clear
	10-Oct-12	99.79	99.82	0.59	0.56	99.23	15 ppm	
BH9	9-Nov-10	99.44	99.48	1.39	1.35	98.09	5 ppm	Cloudy, brown
	28-Feb-11	99.44	99.48	-	-	-	-	Not located (buried under snow piles)
	18-Dec-11	99.44	99.48	2.45	2.41	97.02	70 ppm	Clear
	10-Oct-12	99.44	99.48	0.59	0.55	98.89	95 ppm	
BH10	9-Nov-10	99.57	99.63	2.26	2.20	97.37	55 ppm	Cloudy, brown
	28-Feb-11	99.57	99.63	-	-	-	-	Not located (buried under snow piles)
	18-Dec-11	99.57	99.63	1.63	1.57	98.00	20 ppm	Clear
	10-Oct-12	99.57	99.63	1.27	1.21	98.36	N.A. [c]	Vented.
BH12	9-Nov-10	100.36	99.67	1.43	2.12	98.24	62% LEL	Clear
	28-Feb-11	100.36	99.67	-	-	-	-	Inaccessible, well frozen shut
	18-Dec-11	100.36	99.67	1.98	2.67	97.69	170 ppm	Clear
	10-Oct-12	100.36	99.67	0.56	1.25	99.12	270 ppm	
BH13	9-Nov-10	100.98	100.02	1.89	2.85	98.13	160 ppm	Clear
	28-Feb-11	100.98	100.02	2.88	3.84	97.14	35 ppm	Clear
	18-Dec-11	100.98	100.02	2.67	3.63	97.35	15 ppm	Clear
	10-Oct-12	100.98	100.02	2.79	3.75	97.23	N.D.	
BH14	9-Nov-10	100.52	99.52	2.45	3.45	97.07	19% LEL	Clear
	28-Feb-11	100.52	99.52	3.65	4.65	95.87	45 ppm	Clear
	18-Dec-11	100.52	99.52	3.00	3.99	96.53	10 ppm	Clear
	10-Oct-12	100.52	99.52	0.47	1.46	99.05	N.D.	

Notes:

ppm = parts per million
LEL = Lower Explosive Limit (1% LEL~ 110 ppm)
N.D. = Not Detected
N.A. = Not Available
[a] Historical records indicate that 19 wells were installed at this site.
- = monitoring well not monitored on this date
[b] Measurement for the October 2012 monitoring event was obtained with RKI Eagle (SN E790781 and SN E073065) vapour meters, operating in the methane elimination mode. The meters were calibrated on October 10, 2012.
[c] = monitoring well vented
[d] = vapour concentration not taken

TABLE 1

Summary of Groundwater Well Monitoring Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Well ID [a]	Date	Well Casing Elevation (m above datum)	Ground Elevation (m above datum)	Depth to Groundwater (m below ground)	Depth to Groundwater (m below top of well casing)	Groundwater Elevation (m above datum)	Vapour Concentration [b]	Groundwater Observations
BH16	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.02	100.08	3.34	3.28	96.74	10 ppm	Clear
	18-Dec-11	100.02	100.08					
	10-Oct-12	100.02	100.08	3.40	3.34	96.69	N.A. [c]	Vented. Some suspended black specks. GW clear.
BH17	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.83	100.91	5.45	5.37	95.46	75 ppm	Clear
	18-Dec-11	100.83	100.91					
	10-Oct-12	100.83	100.91	3.92	3.83	96.99	N.A. [c]	Vented.
BH18	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.95	100.01	5.88	6.82	94.13	25 ppm	Clear
	18-Dec-11	100.95	100.01	3.00	3.94	97.01	10 ppm	Clear
	10-Oct-12	100.95	100.01	1.26	2.21	98.74	5 ppm	
BH19	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.00	99.11	5.90	6.79	93.21	25 ppm	Clear, insufficient water to sample
	18-Dec-11	100.00	99.11	3.20	4.09	95.91	10 ppm	Clear
	10-Oct-12	100.00	99.11	3.11	4.00	96.01	35 ppm	
BH20	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.19	100.22	5.62	5.59	94.60	6% LEL	Clear
	18-Dec-11	100.19	100.22	5.10	5.07	95.12	5 ppm	Clear
	10-Oct-12	100.19	100.22	3.14	3.12	97.07	N.D.	
BH21	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	99.86	99.90	3.85	3.81	96.05	ND	Clear
	18-Dec-11	99.86	99.00					
	10-Oct-12	99.86	99.90	2.16	2.12	97.74	N.A. [c]	Vented.
BH23	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.24	99.39	5.02	5.87	94.37	66% LEL	Clear
	18-Dec-11	100.24	99.39	1.93	2.78	97.47	10 ppm	Clear
	10-Oct-12	100.24	99.39	0.13	0.98	99.27	5 ppm	
BH24	9-Nov-10	-	-	-	-	-	-	-
	28-Feb-11	100.87	100.03	3.03	3.87	97.00	50 ppm	Clear
	18-Dec-11	100.87	100.03	2.67	3.51	97.36	30 ppm	Clear
	10-Oct-12	100.87	100.03	1.85	2.69	98.18	35 ppm	
BH29-12	15-Oct-12	98.41	98.54	7.68	7.55	90.86	N.A. [d]	
BH30-12	16-Oct-12	96.28	95.12	7.89	9.04	87.24	N.A. [d]	
BH31-12	16-Oct-12	97.15	96.31	3.98	4.82	92.33	N.A. [d]	

Notes:

ppm = parts per million
N.D. = Not Detected
[a] Historical records indicate that 19 wells were installed at this site.
[b] Measurement for the October 2012 monitoring event was obtained with RKI Eagle (SN E790781 and SN E073065) vapour meters, operating in the methane elimination mode. The meters were calibrated on October 10, 2012.
[c] = monitoring well vented
LEL = Lower Explosive Limit (1% LEL~ 110 ppm)
N.A. = Not Available
- = monitoring well not monitored on this date
[d] = vapour concentration not taken

TABLE 2

Soil Grain Size Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	% Retained on -10 + 200 mesh	% Passing 200 mesh	Moisture (%)	Soil Classification
BH4@5.25 m	46	54	11	FINE
BH4@6.85 m	NA	NA	17	NA
BH4@7.5 m	1	99	19	NA
BH5@0.75 m	NA	NA	13	NA
BH5@2.5 m	NA	NA	13	NA
BH5B@3.25 m	NA	NA	13	NA
BH6@3 m	NA	NA	10	NA
BH6@4.5 m	NA	NA	17	NA
BH6@6 m	0.2	100	19	FINE
BH7@4.5 m	9.2	91	17	FINE
BH7@5.1 m	NA	NA	19	NA
BH7@6 m	38	62	12	FINE
BH8@4.5 m	NA	NA	11	NA
BH9@1.75 m	NA	NA	13	NA
BH9@2 m	NA	NA	18	NA
BH9@3 m	NA	NA	11	NA
BH10@3.75 m	NA	NA	18	NA
BH10@4.5 m	NA	NA	19	NA
BH10@5.25 m	<0.2	100	16	FINE
BH11@3.75 m	NA	NA	16	NA
BH11@3.75 m DUP [a]	NA	NA	17	NA
BH11@5.25 m	NA	NA	18	NA
BH11@6.75 m	0.3	100	16	FINE
BH12@1.5 m	NA	NA	9.1	NA
BH12@3.75 m	0.6	99	18	FINE
BH12@3.75 m DUP [a]	NA	NA	19	NA
BH12@4.5 m	NA	NA	18	NA
BH12@4.5 m DUP [a]	NA	NA	18	NA
BH12@6 m	< 0.2	100	21	FINE
BH12@6.55 m	41	59	12	FINE
BH13@3.15 m	73	27	10	COARSE
BH13@3.4 m	NA	NA	9.8	NA
BH13@7.5 m	NA	NA	13	NA
BH14@6 m	NA	NA	19	NA
BH14@6.75 m	NA	NA	13	NA
BH14@7.5 m	15	85	18	FINE

Notes: Coarse-Grained = >50% of soil particles >75 μm (Retained on -10, + 200 mesh)
Fine-Grained = >50% of soil particles ≤75 μm (Passes 200 mesh)
[a] Sample collected as a field duplicate
NA = Not Analyzed

TABLE 2

Soil Grain Size Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	% Retained on -10 + 200 mesh	% Passing 200 mesh	Moisture (%)	Soil Classification
BH30-12-4.75	N.A.	N.A.	9.7	N.A.
BH30-12-5.2	N.A.	N.A.	9.0	N.A.
BH30-12-5.9	N.A.	N.A.	11	N.A.
BH30-12-6.6	N.A.	N.A.	17	N.A.
BH30-12-6.8	N.A.	N.A.	16	N.A.
BH30-12-7.6	N.A.	N.A.	17	N.A.
BH30-12-8.0	N.A.	N.A.	17	N.A.
BH31-12-1.5	N.A.	N.A.	6.0	N.A.
BH31-12-3.0	N.A.	N.A.	9.1	N.A.
BH31-12-3.75	N.A.	N.A.	12	N.A.
BH31-12-4.5	N.A.	N.A.	9.8	N.A.
BH31-12-5.25	N.A.	N.A.	11	N.A.
BH32-12-7.15	N.A.	N.A.	12	N.A.
BH32-12-7.75	N.A.	N.A.	12	N.A.
BH33-12-4.5	N.A.	N.A.	19	N.A.
BH33-12-6.0	N.A.	N.A.	18	N.A.
BH34-12-4.75	N.A.	N.A.	16	N.A.
BH34-12-7.0	N.A.	N.A.	19	N.A.
BH35-12-3.0	N.A.	N.A.	11	N.A.
BH35-12-7.5	N.A.	N.A.	18	N.A.
BH37-12-4.5	N.A.	N.A.	18	N.A.
BH37-12-7.5	N.A.	N.A.	14	N.A.
BH38-12-1.0	N.A.	N.A.	11	N.A.
BH38-12-4.0	N.A.	N.A.	18	N.A.
BH38-12-7.0	N.A.	N.A.	19	N.A.
BH39-12-1.5	N.A.	N.A.	17	N.A.
BH39-12-6.0	N.A.	N.A.	20	N.A.
BH39-12-6.0 DUP [a]	N.A.	N.A.	20	N.A.
BH39-12-7.8	N.A.	N.A.	13	N.A.
BH40-12-3.75	N.A.	N.A.	18	N.A.
BH40-12-6.75	N.A.	N.A.	10	N.A.
BH41-12-8.25	N.A.	N.A.	14	N.A.
BH42-12-7.8	N.A.	N.A.	15	N.A.
WASTESOIL	N.A.	N.A.	17	N.A.

Notes: Coarse-Grained = >50% of soil particles >75 μm (Retained on -10, + 200 mesh)
Fine-Grained = >50% of soil particles ≤75 μm (Passes 200 mesh)
[a] Sample collected as a field duplicate
NA = Not Analyzed

TABLE 3

Soil Petroleum Hydrocarbon and Polychlorinated Biphenyl (PCB) Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Analytical Results (mg/kg)								
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)	PCB
BH4@5.25 m	26-Oct-10	**2.8**	46	18	110	**980**	35	< 10	< 10	N.A.
BH4@6.85 m	26-Oct-10	**1.9**	0.43	0.33	0.53	< 12	< 10	< 10	< 10	N.A.
BH4@7.5 m	26-Oct-10	0.12	<0.020	<0.010	<0.040	<12	< 10	< 10	< 10	N.A.
BH5@2.5 m	26-Oct-10	< 0.0050	< 0.020	0.52	2.1	**680**	150	< 10	< 10	N.A.
BH5B@3.25 m	27-Oct-10	0.031	0.031	2.2	9.2	**410**	70	< 10	< 10	N.A.
BH6@3 m	26-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH6@4.5 m	26-Oct-10	0.035	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH6@6 m [c]	26-Oct-10	0.023	0.029	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH7@4.5 m	27-Oct-10	0.010	< 0.020	< 0.010	< 0.040	41	< 10	< 10	< 10	N.A.
BH7@5.1 m	27-Oct-10	0.013	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH7@6 m [c]	27-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH8@4.5 m	27-Oct-10	**0.70**	< 0.020	0.23	0.079	< 12	< 10	< 10	< 10	N.A.
BH9@1.75 m	27-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH9@2 m	27-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH9@3 m	27-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH10@3.75 m	27-Oct-10	0.024	< 0.020	0.016	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH10@4.5 m	27-Oct-10	0.033	< 0.020	0.047	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH10@5.25 m [c]	27-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH11@3.75 m	28-Oct-10	**3.0**	9.8	2.9	19	110	12	< 10	< 10	N.A.
BH11@3.75 m DUP [b]		**2.8**	8.2	2.2	15	67	12	< 10	< 10	N.A.
BH11@5.25 m	28-Oct-10	**2.1**	0.19	0.068	0.37	< 12	< 10	< 10	< 10	N.A.
BH11@6.75 m [c]	28-Oct-10	0.24	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
Environmental Quality Guidelines for Coarse-Grained Soils [a]	**≤1.5m**	**0.30**	**250**	**300**	**160**	**320**	**260**	**1700**	**3000**	**33**
	≤3m	**0.32**	**500**	**600**	**170**					
	>3m		**1500**	**670**			**1000**	**3500**	**10000**	

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Canadian Council of Ministers of the Environment (CCME), *Canadian Environmental Quality Guidelines*, 2007, and CCME, *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Sample results were analyzed past recommended CCME hold times, as requested by Tetra Tech.

N.A. = Not Analyzed

TABLE 3

Soil Petroleum Hydrocarbon and Polychlorinated Biphenyl (PCB) Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Analytical Results (mg/kg)								
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)	PCB
BH12@3.75 m	28-Oct-10	**5.2**	23	5.1	37	230	59	< 10	< 10	N.A.
BH12@3.75 m DUP [b]		**6.1**	30	6.9	49	320	30	< 10	< 10	N.A.
BH12@4.5 m	28-Oct-10	**4.8**	14	2.5	17	95	< 10	< 10	< 10	N.A.
BH12@4.5 m DUP [b]		**5.7**	20	4.3	29	200	14	< 10	< 10	N.A.
BH12@6 m	28-Oct-10	**1.6**	0.030	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH12@6.55 m [c]	28-Oct-10	0.12	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH13@3.15 m	28-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH13@3.4 m	28-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH13@7.5 m	28-Oct-10	0.050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH14@6 m	29-Oct-10	0.074	< 0.020	0.039	0.085	51	< 10	< 10	< 10	N.A.
BH14@6.75 m	29-Oct-10	0.065	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH14@7.5 m [c]	29-Oct-10	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH16@6.0 m	1-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH16@7.5 m	1-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH17@4.5 m	1-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH18@8.75 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH18@9.25 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH19@6.0 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH19@6.4 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH20@8.25 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH20@8.75 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH20@10.25 m	2-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH20@10.25 m DUP [b]		< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
Environmental Quality Guidelines for Coarse-Grained Soils [a]	**≤1.5m**	**0.30**	**250**	**300**	**160**	**320**	**260**	**1700**	**3000**	**33**
	≤3m	**0.32**	**500**	**600**	**170**					
	>3m		**1500**	**670**			**1000**	**3500**	**10000**	

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Canadian Council of Ministers of the Environment (CCME), *Canadian Environmental Quality Guidelines*, 2007, and CCME, *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Sample results were analyzed past recommended CCME hold times, as requested by Tetra Tech.

N.A. = Not Analyzed

TABLE 3

Soil Petroleum Hydrocarbon and Polychlorinated Biphenyl (PCB) Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Analytical Results (mg/kg)								
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)	PCB
BH21@1.5 m	3-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH21@8.0 m	3-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH22@0.75 m	3-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH22@4.5 m	3-Feb-11	0.010	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH22@6.75 m	3-Feb-11	0.11	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH23@4.0 m	3-Feb-11	0.048	< 0.020	0.056	< 0.040	18	< 10	< 10	< 10	N.A.
BH23@4.5 m	3-Feb-11	**1.8**	6.2	1.5	10	69	< 10	< 10	< 10	N.A.
BH23@4.5 m DUP [b]		**2.0**	5.9	1.3	8.5	56	10	< 10	< 10	N.A.
BH23@6.0 m	3-Feb-11	**0.39**	0.16	0.026	0.17	< 12	< 10	< 10	< 10	N.A.
BH24@4.5 m	3-Feb-11	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH24@5.25 m	3-Feb-11	0.014	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH30-12-4.75	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	18	N.A.
BH30-12-5.2	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH30-12-5.9	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH30-12-6.6	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	10	< 10	N.A.
BH30-12-6.8	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH30-12-7.6	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	34	< 10	N.A.
BH30-12-8.0	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH31-12-1.5	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH31-12-3.0	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH31-12-3.75	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH31-12-4.5	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH31-12-5.25	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
Environmental Quality Guidelines for Coarse-Grained Soils [a]	**≤1.5m**	**0.30**	**250**	**300**	**160**	**320**	**260**	**1700**	**3000**	**33**
	≤3m	**0.32**	**500**	**600**	**170**					
	>3m		**1500**	**670**			**1000**	**3500**	**10000**	

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Canadian Council of Ministers of the Environment (CCME), *Canadian Environmental Quality Guidelines*, 2007, and CCME, *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Sample results were analyzed past recommended CCME hold times, as requested by Tetra Tech.

N.A. = Not Analyzed

TABLE 3

Soil Petroleum Hydrocarbon and Polychlorinated Biphenyl (PCB) Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Analytical Results (mg/kg)								
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)	PCB
BH32-12-7.15	14-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH32-12-7.75	14-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	11	< 10	N.A.
BH33-12-4.5	14-Oct-12	0.035	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH33-12-6.0	14-Oct-12	0.15	0.17	0.44	2.1	< 12	< 10	< 10	< 10	N.A.
BH34-12-4.75	14-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH34-12-7.0	14-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	19	11	N.A.
BH35-12-3.0	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH35-12-7.5	13-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	18	< 10	N.A.
BH37-12-4.5	12-Oct-12	0.022	< 0.020	< 0.010	< 0.040	< 12	12	< 10	< 10	N.A.
BH37-12-7.5	12-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH38-12-1.0	12-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH38-12-4.0	12-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	28	18	N.A.
BH38-12-7.0	12-Oct-12	0.058	0.041	< 0.010	< 0.040	< 12	< 10	13	< 10	N.A.
BH39-12-1.5	12-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH39-12-6.0	12-Oct-12	**0.97**	6.9	2.1	16	100	13	< 10	< 10	N.A.
BH39-12-6.0 DUP [b]		**1.4**	8.4	2.6	19	140	24	< 10	< 10	N.A.
BH39-12-7.8	12-Oct-12	0.043	0.028	< 0.010	< 0.040	< 12	< 10	23	< 10	N.A.
BH40-12-3.75	12-Oct-12	0.21	5.0	3.6	28	120	59	< 10	< 10	N.A.
BH40-12-6.75	12-Oct-12	0.20	0.047	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
BH41-12-8.25	14-Oct-12	< 0.0050	< 0.020	< 0.010	< 0.040	< 12	< 10	20	11	N.A.
BH42-12-7.8	14-Oct-12	0.031	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	N.A.
USED OIL TANK	27-Oct-10	< 0.0050	< 0.020	< 0.010	0.075	< 12	28	**9100**	2700	N.A.
Waste Characterization										
WASTE SOIL	17-Oct-12	< 0.010	< 0.020	< 0.010	< 0.040	< 12	< 10	< 10	< 10	< 0.010
Environmental Quality Guidelines for Coarse-Grained Soils [a]	**≤1.5m**	**0.30**	**250**	**300**	**160**	**320**	**260**	**1700**	**3000**	**33**
	≤3m	**0.32**	**500**	**600**	**170**					
	>3m		**1500**	**670**			**1000**	**3500**	**10000**	

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Canadian Council of Ministers of the Environment (CCME), *Canadian Environmental Quality Guidelines*, 2007, and CCME, *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil*, January 2008, with vapour inhalation, ecological soil contact, and management limit pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Sample results were analyzed past recommended CCME hold times, as requested by Tetra Tech.

N.A. = Not Analyzed

TABLE 4

Soil Organochlorinated Pesticide Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Analytical Results (mg/kg)			
		o,p-DDT	p,p-DDT	o,p-DDT + p,p-DDT	DDT + Metabolites [a]
SS1	21-Mar-12	- -	- -	- -	0.060
SS2	21-Mar-12	- -	- -	- -	0.020
SS3	21-Mar-12	- -	- -	- -	< 0.0020
SS4	21-Mar-12	- -	- -	- -	0.32
SS5	21-Mar-12	- -	- -	- -	1.3
SS6	21-Mar-12	- -	- -	- -	0.47
SS7	21-Mar-12	- -	- -	- -	9.0
BH32-12-0.1	14-Oct-12	0.0090	0.070	0.080	0.13
BH32-12-0.6	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH33-12-0.05	14-Oct-12	< 0.0020	0.0050	0.0050	0.0080
BH33-12-1.0	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH34-12-0.25	14-Oct-12	0.0020	0.015	0.017	0.038
BH34-12-1.25	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH35-12-0.8	13-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH35-12-1.2	13-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH39-12-0.75	12-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH39-12-1.5	12-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH41-12-0.3	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH41-12-0.9	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH42-12-0.3	14-Oct-12	< 0.0020	0.0020	0.0020	0.0050
BH42-12-0.3 DUP [b]		< 0.0020	0.0030	0.0030	0.0060
BH42-12-1.2	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH43-12-0.2	14-Oct-12	0.011	0.10	0.11	0.20
BH43-12-1.25	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH44-12-0.3	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH44-12-0.3 DUP [b]		< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH44-12-0.75	14-Oct-12	0.0020	0. 14	0. 16	0.047
BH44-12-1.0	14-Oct-12	< 0.0020	0.0030	0.0030	0.013
BH44-12-1.2	14-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
BH44-12-1.5	14-Oct-12	< 0.0020	0.0020	0.0020	0.0020
BH45-12-0.25 m	16-Oct-12	0.0030	0.022	0.025	0.035
BH45-12-1.25 m	16-Oct-12	< 0.0020	< 0.0020	< 0.0020	< 0.0020
Environmental Quality Guidelines [c]		**N.G.**	**N.G.**	**N.G.**	**12**

Notes: Concentrations in excess of environmental quality guidelines are presented in ***BOLD*** text.

[a] DDT + Metabolites includes a summation of concentrations of p,p-DDT, o,p-DDT, p,p-DDE, o,p-DDE, p,p-DDD and o,p-DDD.

[b] Sample collected as a field duplicate

[c] Canadian Council of Ministers of the Environment (CCME), *Canadian Soil Quality Guidelines*, Commercial land use, 2007.

- - = Not Available, N.G. = No Guideline

TABLE 5

Waste Soil Organochlorinated Pesticides Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameters	Analytical Results (mg/L)	Environmental Quality Guidelines [a]
Sample ID	**WASTE SOIL**	
Sampling Date	**17-Oct-12**	
Aldrin	< 0.0020	**N.G.**
a-Chlordane	< 0.0020	**N.G.**
g-Chlordane	< 0.0020	**N.G.**
Total Chlordane	< 0.0020	**N.G.**
o,p-DDD	< 0.0020	**N.G.**
p,p-DDD	< 0.0020	**N.G.**
o,p-DDD + p,p-DDD	< 0.0020	**N.G.**
o,p-DDE	< 0.0020	**N.G.**
p,p-DDE	< 0.0020	**N.G.**
o,p-DDE + p,p-DDE	< 0.0020	**N.G.**
o,p-DDT	< 0.0020	**N.G.**
p,p-DDT	< 0.0020	**N.G.**
o,p-DDT + p,p-DDT	< 0.0020	**N.G.**
DDT + Metabolites	< 0.0020	**12**
Dieldrin	< 0.0020	**N.G.**
Lindane	< 0.0020	**N.G.**
Endosulfan I (alpha)	< 0.0020	**N.G.**
Endosulfan II	< 0.0020	**N.G.**
Total Endosulfan	< 0.0020	**N.G.**
Endrin	< 0.0020	**N.G.**
Heptachlor	< 0.0020	**N.G.**
Heptachlor epoxide	< 0.0020	**N.G.**
Hexachlorobenzene	< 0.0020	**N.G.**
Hexachlorobutadiene	< 0.0050	**N.G.**
Methoxychlor	< 0.0050	**N.G.**
Total PCB	< 0.015	**N.G.**
alpha-BHC	< 0.0020	**N.G.**
beta-BHC	< 0.0020	**N.G.**
delta-BHC	< 0.0020	**N.G.**
Endosulfan sulfate	< 0.0020	**N.G.**
Endrin aldehyde	< 0.0020	**N.G.**
Endrin ketone	< 0.0020	**N.G.**
Mirex	< 0.0020	**N.G.**
Octachlorostyrene	< 0.0020	**N.G.**
Toxaphene	< 0.080	**N.G.**

Notes: Concentrations in excess of referenced EQG are presented in ***BOLD*** text.

[a] Canadian Council of Ministers of the Environment (CCME), *Canadian Soil Quality Guidelines*, Commercial land use, 2007.

[a] Detection limit greater than referenced EQG.

N.G. = No Guideline

TABLE 6

Soil Geotechnical Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Analytical Results												
	Hydrometer Analysis				Grain Size Analysis				Fraction Organic Carbon (g/g)	Total Organic Carbon (%)	Moisture Content (%)	Dry Density (kg/m^3)	Pneumatic Permeability (k_p, darcy) [a]
	Sand (%)	Silt (%)	Clay (%)	Texture	Gravel (%)	Sand (%)	Silt (%)	Clay (%)					
BH31-12-1.5	40	39	21	LOAM	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH31-12-5.25	48	28	23	LOAM	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH33-12-7.8	75	16	9.0	SANDY LOAM	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH34-12-5.5	30	35	35	CLAY LOAM	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH35-12-6.0	4.7	53	42	SILTY CLAY	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH37-12-0.75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		0.0017	0.17	N.A.	N.A.	N.A.
BH38-12-1.0	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		0.0047	0.47	N.A.	N.A.	N.A.
BH38-12-4.0	62	21	17	SANDY LOAM	N.A.	N.A.	N.A.		N.A.	N.A.	N.A.	N.A.	N.A.
BH39-12-0.75	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		0.0035	0.35	N.A.	N.A.	N.A.
BH40-12-0.5	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.		0.021	2.1	N.A.	N.A.	N.A.
VW26-12	N.A.	N.A.	N.A.	N.A.	1	54	45		N.A.	N.A.	15.1	1807	- -
VW28-12	N.A.	N.A.	N.A.	N.A.	16	67	17		N.A.	N.A.	15.4	1847	- -

Notes: [a] Results do not meet ASTM requirements as less than 3 test points lie outside the upper and lower limit lines.
N.A. = Not Analyzed; - - = Not Available

TABLE 7

Groundwater Petroleum Hydrocarbon Concentrations
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample ID	Sampling Date	Analytical Results (mg/L)							
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)
BH04	9-Nov-10	1.6	6.2	1.3	7.4	< 10 [c]	2.0	N.A.	N.A.
BH04	20-Dec-11	0.13	0.030	0.051	0.21	1.3	0.14	< 0.10	< 0.10
BH4	11-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH06	9-Nov-10	0.0008	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.
BH-6	10-Oct-12	0.020	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH07	9-Nov-10	0.0011	0.0005	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.
BH07	20-Dec-11	0.0021	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
BH7	11-Oct-12	0.66	< 0.00040	< 0.00040	<0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH09	9-Nov-10	0.017	0.0004	< 0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.
BH09	20-Dec-11	0.0097	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
BH-9	11-Oct-12	0.0029	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH10	9-Nov-10	0.066	0.0010	0.025	0.019	0.8	0.3	N.A.	N.A.
BH10	20-Dec-11	0.087	0.00080	0.0099	0.0076	0.75	0.17	< 0.10	< 0.10
BH-10	10-Oct-12	0.011	< 0.00040	< 0.00040	< 0.00080	0.150	< 0.10	< 0.10	< 0.10
BH12	9-Nov-10	***19***	26	1.5	12	< 10 [c]	2.0	N.A.	N.A.
BH12 DUP [b]		***18***	23	1.3	11	***11***	2.1	N.A.	N.A.
BH12	20-Dec-11	***17***	18	0.91	6.3	3.1	1.3	< 0.10	< 0.10
BH12	11-Oct-12	***13***	23	1.5	8.7	***12***	1.4	< 0.10	< 0.10
BH12 DUP [b]		***13***	23	1.5	8.6	< 10 [c]	1.4	< 0.10	< 0.10
BH13	9-Nov-10	0.0021	0.0012	0.0004	< 0.0008	< 0.1	< 0.1	N.A.	N.A.
BH-13	11-Oct-12	0.0089	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH14	9-Nov-10	0.15	0.0073	0.089	0.16	4.1	0.8	N.A.	N.A.
BH14	20-Dec-11	0.072	0.0019	0.0059	0.0056	1.0	0.21	< 0.10	< 0.10
BH14	13-Oct-12	0.034	< 0.00040	0.0014	<0.00080	0.220	< 0.10	< 0.10	< 0.10
BH16	2-Mar-11	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08
BH16	11-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH17	2-Mar-11	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08
BH17	11-Oct-12	< 0.00040	< 0.00040	< 0.00040	<0.00080	< 0.100	< 0.10	< 0.10	< 0.10
Environmental Quality Guidelines [a]		**1.8**	**200**	**110**	**48**	**9.1**	**3.1**	**N.G.**	**N.G.**

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites* , May 2010, with vapour inhalation and soil organisms direct contact pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Analytical detection limit is greater than the guideline.

N.A. = Not Analyzed, N.G. = No Guideline.

TABLE 7

Groundwater Petroleum Hydrocarbon Concentrations
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample ID	Sampling Date	Analytical Results (mg/L)							
		Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (C6 - C10)	F2 (C10 - C16)	F3 (C16 - C34)	F4 (C34 - C50)
BH18	2-Mar-11	< 0.0004	< 0.0004	0.0005	0.0008	< 0.1	N.A.	N.A.	N.A.
BH18	20-Dec-11	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
BH18	12-Oct-12	< 0.00040	< 0.00040	< 0.00040	<0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH19	20-Dec-11	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
BH19	13-Oct-12	< 0.00040	< 0.00040	< 0.00040	<0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH20	2-Mar-11	0.075	0.0005	< 0.0004	< 0.0008	1.3	0.56	< 0.08	< 0.08
BH20	20-Dec-11	0.042	< 0.00040	< 0.00040	0.0013	2.1	0.72	< 0.10	< 0.10
BH20	11-Oct-12	0.0080	< 0.00040	< 0.00040	<0.00080	1.3	0.32	< 0.10	< 0.10
BH21	2-Mar-11	< 0.0004	< 0.0004	< 0.0004	< 0.0008	< 0.1	< 0.08	< 0.08	< 0.08
BH21	10-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH23	2-Mar-11	***3.9***	1.7	0.021	2.6	< 10 [c]	1.1	< 0.08	< 0.08
BH23	20-Dec-11	***5.6***	3.3	0.64	3.9	5.4	1.1	< 0.10	< 0.10
BH23	17-Oct-12	***2.1***	0.013	0.230	0.400	2.9	0.31	< 0.10	< 0.10
BH23 DUP		***2.3***	0.013	0.240	0.410	1.1	0.30	< 0.10	< 0.10
BH24	2-Mar-11	0.66	0.0063	0.0066	0.0051	< 0.1	< 0.08	< 0.08	< 0.08
BH24 DUP [b]		0.62	0.0063	0.0063	0.0060	< 0.1	< 0.08	< 0.08	< 0.08
BH24	20-Dec-11	0.26	< 0.00040	< 0.00040	< 0.00080	< 0.10	< 0.10	< 0.10	< 0.10
BH24	11-Oct-12	0.330	0.00085	0.0011	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH29-12	15-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
BH31-12	15-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
QA/QC Samples									
EQUIP BLANK - TUBING	16-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
EQUIP BLANK - PUTTY KNIFE	16-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
FIELD BLANK	16-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	< 0.10	< 0.10
TRIP BLANK	10-Oct-12	< 0.00040	< 0.00040	< 0.00040	< 0.00080	< 0.100	< 0.10	N.A.	N.A.
Waste Characterization									
WASTE WATER	17-Oct-12	0.190	0.150	0.016	0.069	< 0.100	4.0	3.1	0.45
Environmental Quality Guidelines [a]		**1.8**	**200**	**110**	**48**	**9.1**	**3.1**	**N.G.**	**N.G.**

Notes: Concentrations in excess of environmental quality guidelines are presented in **BOLD** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010, with vapour inhalation and soil organisms direct contact pathways in a commercial land use setting.

[b] Sample collected as a field duplicate

[c] Analytical detection limit is greater than the guideline.

N.A. = Not Analyzed, N.G. = No Guideline.

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Background Wells			Monitoring Wells			
	TEST WELL 7	TEST WELL 8	TEST WELL 9	BH4 *	BH4	BH4 DUP [c]	
	20-Dec-11	20-Dec-11	20-Dec-11	9-Nov-10	2-Mar-11		
Aluminum (Al)	0.0069	0.0043	0.58	0.50	0.003	0.004	N.G.
Antimony (Sb)	N.A.	N.A.	N.A.	< 0.0002	0.0003	0.0003	N.G.
Arsenic (As)	N.A.	N.A.	N.A.	0.0007	0.0007	0.0008	N.G.
Barium (Ba)	N.A.	N.A.	N.A.	0.22	0.19	0.19	N.G.
Beryllium (Be)	N.A.	N.A.	N.A.	< 0.001	< 0.001	< 0.001	N.G.
Boron (B)	N.A.	N.A.	N.A.	0.06	0.04	0.04	N.G.
Cadmium (Cd)	0.000086	0.00036	0.0018	0.00046	0.00024	0.00022	N.G.
Calcium (Ca)	N.A.	N.A.	N.A.	150	130	130	N.G.
Chromium (Cr)	N.A.	N.A.	N.A.	0.002	< 0.001	< 0.001	N.G.
Cobalt (Co)	N.A.	N.A.	N.A.	0.0066	0.0074	0.0072	N.G.
Copper (Cu)	0.0013	0.0075	0.012	0.011	0.0037	0.0027	N.G.
Iron (Fe)	4.9	0.097	4.3	1.2	0.06	0.07	N.G.
Lead (Pb)	< 0.00020	< 0.00020	0.0030	0.0052	0.0010	0.0010	N.G.
Lithium (Li)	N.A.	N.A.	N.A.	0.03	0.42	0.16	N.G.
Magnesium (Mg)	N.A.	N.A.	N.A.	80	70	70	N.G.
Manganese (Mn)	N.A.	N.A.	N.A.	3.3	4.2	4.2	N.G.
Molybdenum (Mo)	N.A.	N.A.	N.A.	0.0015	0.0009	0.0009	N.G.
Nickel (Ni)	0.0022	0.0027	0.0042	0.030	0.037	0.036	N.G.
Phosphorus (P)	N.A.	N.A.	N.A.	0.2	0.1	0.2	N.G.
Potassium (K)	N.A.	N.A.	N.A.	6.2	5.9	5.6	N.G.
Selenium (Se)	N.A.	N.A.	N.A.	0.0002	0.0003	0.0004	N.G.
Silicon (Si)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.G.
Silver (Ag)	< 0.00010	< 0.00010	< 0.00010	< 0.0001	< 0.0001	< 0.0001	N.G.
Sodium (Na)	N.A.	N.A.	N.A.	11	11	11	N.G.
Strontium (Sr)	N.A.	N.A.	N.A.	0.35	0.33	0.33	N.G.
Sulphur (S)	N.A.	N.A.	N.A.	9.7	8.6	8.6	N.G.
Thallium (Tl)	N.A.	N.A.	N.A.	< 0.0002	< 0.0002	< 0.0002	N.G.
Tin (Sn)	N.A.	N.A.	N.A.	< 0.001	< 0.001	< 0.001	N.G.
Titanium (Ti)	N.A.	N.A.	N.A.	0.015	< 0.001	< 0.001	N.G.
Uranium (U)	N.A.	N.A.	N.A.	0.0079	0.0076	0.0074	N.G.
Vanadium (V)	N.A.	N.A.	N.A.	0.004	< 0.001	< 0.001	N.G.
Zinc (Zn)	N.A.	N.A.	N.A.	0.007	0.011	0.004	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Monitoring Wells						
	BH4	BH6 *	BH6	BH-6	BH7 *	BH7	
	11-Oct-12	9-Nov-10	2-Mar-11	10-Oct-12	9-Nov-10	11-Oct-12	
Aluminum (Al)	0.0058	0.87	0.006	0.28	0.31	0.0013	N.G.
Antimony (Sb)	<0.00060	< 0.0002	0.0004	<0.00060	< 0.0002	<0.00060	N.G.
Arsenic (As)	0.00046	0.0004	0.0002	0.0013	0.0003	0.00042	N.G.
Barium (Ba)	0.32	0.27	0.24	0.18	0.19	0.20	N.G.
Beryllium (Be)	<0.0010	< 0.001	< 0.001	<0.0010	< 0.001	<0.0010	N.G.
Boron (B)	0.055	0.06	0.03	0.044	0.07	0.063	N.G.
Cadmium (Cd)	0.00019	0.00014	0.00012	0.000099	0.00017	0.00017	N.G.
Calcium (Ca)	150	160	150	130	140	120	N.G.
Chromium (Cr)	<0.0010	0.003	< 0.001	<0.0010	0.002	<0.0010	N.G.
Cobalt (Co)	0.00069	0.0016	0.0007	0.0014	0.0016	<0.00030	N.G.
Copper (Cu)	0.0094	0.0072	0.0046	0.0082	0.0056	0.0060	N.G.
Iron (Fe)	<0.060	1.6	< 0.06	0.36	0.86	<0.060	N.G.
Lead (Pb)	0.00022	0.0016	< 0.0002	0.00088	0.0013	<0.00020	N.G.
Lithium (Li)	<0.020	< 0.02	< 0.02	<0.020	0.03	<0.020	N.G.
Magnesium (Mg)	46	53	52	37	51	31	N.G.
Manganese (Mn)	1.1	0.15	0.23	0.30	0.48	0.10	N.G.
Molybdenum (Mo)	0.00095	0.0014	0.0013	0.0021	0.0038	0.0021	N.G.
Nickel (Ni)	0.013	0.0080	0.0072	0.0072	0.0099	0.0063	N.G.
Phosphorus (P)	<0.10	0.2	0.1	0.30	0.1	<0.10	N.G.
Potassium (K)	41	10	8.8	12	8.3	18	N.G.
Selenium (Se)	0.00066	< 0.0002	< 0.0002	<0.00020	< 0.0002	<0.00020	N.G.
Silicon (Si)	8.5	N.A.	N.A.	9.3	N.A.	8.6	N.G.
Silver (Ag)	<0.00010	< 0.0001	< 0.0001	<0.00010	< 0.0001	<0.00010	N.G.
Sodium (Na)	11	17	10	42	14	11	N.G.
Strontium (Sr)	0.25	0.19	0.22	0.19	0.26	0.17	N.G.
Sulphur (S)	14	5.8	4.2	7.9	12	6.7	N.G.
Thallium (Tl)	<0.00020	< 0.0002	< 0.0002	<0.00020	< 0.0002	<0.00020	N.G.
Tin (Sn)	<0.0010	< 0.001	< 0.001	<0.0010	< 0.001	<0.0010	N.G.
Titanium (Ti)	<0.0010	0.048	< 0.001	0.0074	0.021	<0.0010	N.G.
Uranium (U)	0.0035	0.0031	0.0033	0.0035	0.0050	0.0016	N.G.
Vanadium (V)	<0.0010	0.005	< 0.001	0.0015	0.003	<0.0010	N.G.
Zinc (Zn)	0.0039	0.008	0.004	0.070	0.005	0.039	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Monitoring Wells						
	BH9 *	BH-9	BH10 *	BH-10	BH12 *	BH12 DUP[c]*	
	9-Nov-10	11-Oct-12	9-Nov-10	10-Oct-12	9-Nov-10		
Aluminum (Al)	4.4	0.074	0.10	0.0053	0.38	0.37	N.G.
Antimony (Sb)	0.0003	<0.00060	< 0.0002	<0.00060	< 0.0002	< 0.0002	N.G.
Arsenic (As)	0.0021	0.0034	0.0003	0.00074	0.0007	0.0008	N.G.
Barium (Ba)	0.23	0.062	0.20	0.20	0.23	0.24	N.G.
Beryllium (Be)	< 0.001	<0.0010	< 0.001	<0.0010	< 0.001	< 0.001	N.G.
Boron (B)	0.07	0.070	0.05	0.047	0.03	0.03	N.G.
Cadmium (Cd)	0.00048	0.000077	0.00023	0.00013	0.0019	0.002	N.G.
Calcium (Ca)	140	52	150	140	180	180	N.G.
Chromium (Cr)	0.007	<0.0010	< 0.001	<0.0010	0.001	0.002	N.G.
Cobalt (Co)	0.024	0.0045	0.0019	0.0015	0.0023	0.0023	N.G.
Copper (Cu)	0.017	0.010	0.0041	0.0018	0.061	0.061	N.G.
Iron (Fe)	5.4	2.4	0.39	<0.060	0.78	0.94	N.G.
Lead (Pb)	0.0069	<0.00020	0.0008	<0.00020	0.0068	0.0067	N.G.
Lithium (Li)	< 0.02	<0.020	0.05	0.052	0.04	0.05	N.G.
Magnesium (Mg)	47	17	81	64	78	80	N.G.
Manganese (Mn)	8.9	2.2	1.6	2.2	1.4	1.4	N.G.
Molybdenum (Mo)	0.0070	0.0019	0.0055	0.0087	0.0034	0.0035	N.G.
Nickel (Ni)	0.036	0.0079	0.016	0.018	0.019	0.018	N.G.
Phosphorus (P)	2.1	0.45	< 0.1	0.12	0.1	0.2	N.G.
Potassium (K)	13	35	8.9	6.1	6.2	6.4	N.G.
Selenium (Se)	0.0005	<0.00020	< 0.0002	<0.00020	0.0005	0.0005	N.G.
Silicon (Si)	N.A.	4.7	N.A.	11	N.A.	N.A.	N.G.
Silver (Ag)	< 0.0001	<0.00010	< 0.0001	<0.00010	0.0004	0.0004	N.G.
Sodium (Na)	29	6.9	13	45	10	10	N.G.
Strontium (Sr)	0.16	0.078	0.36	0.33	0.37	0.38	N.G.
Sulphur (S)	19	8.0	9.1	11	2.1	2	N.G.
Thallium (Tl)	< 0.0002	<0.00020	< 0.0002	<0.00020	< 0.0002	< 0.0002	N.G.
Tin (Sn)	< 0.001	<0.0010	< 0.001	<0.0010	< 0.001	< 0.001	N.G.
Titanium (Ti)	0.020	<0.0010	0.009	<0.0010	0.021	0.027	N.G.
Uranium (U)	0.0037	0.00063	0.0081	0.0099	0.0057	0.0056	N.G.
Vanadium (V)	0.022	0.0018	0.002	<0.0010	0.002	0.003	N.G.
Zinc (Zn)	0.017	0.078	0.004	0.028	0.006	0.007	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Monitoring Wells						
	BH12	BH12 DUP[c]	BH13 *	BH13	BH-13	BH14 *	
	11-Oct-12		9-Nov-10	2-Mar-11	11-Oct-12	9-Nov-10	
Aluminum (Al)	0.0018	0.0017	0.95	0.002	0.012	0.97	N.G.
Antimony (Sb)	<0.00060	<0.00060	< 0.0002	0.0004	<0.00060	< 0.0002	N.G.
Arsenic (As)	0.0029	0.0028	0.0007	0.0003	0.00026	0.0007	N.G.
Barium (Ba)	0.18	0.17	0.26	0.27	0.31	0.23	N.G.
Beryllium (Be)	<0.0010	<0.0010	< 0.001	< 0.001	<0.0010	< 0.001	N.G.
Boron (B)	0.031	0.032	0.03	< 0.02	<0.020	0.04	N.G.
Cadmium (Cd)	0.000039	0.000040	0.0002	0.000097	0.00011	0.00029	N.G.
Calcium (Ca)	170	160	200	180	180	160	N.G.
Chromium (Cr)	<0.0010	<0.0010	0.005	< 0.001	<0.0010	0.003	N.G.
Cobalt (Co)	0.0031	0.0031	0.0026	0.0005	<0.00030	0.0036	N.G.
Copper (Cu)	0.0013	0.0015	0.0074	0.0027	0.0027	0.0076	N.G.
Iron (Fe)	0.83	0.82	2.1	< 0.06	<0.060	1.8	N.G.
Lead (Pb)	0.00021	0.00020	0.0044	< 0.0002	<0.00020	0.0045	N.G.
Lithium (Li)	0.038	0.041	0.03	0.03	0.039	0.03	N.G.
Magnesium (Mg)	69	68	83	74	65	65	N.G.
Manganese (Mn)	2.6	2.6	0.40	0.30	0.14	0.96	N.G.
Molybdenum (Mo)	0.0053	0.0048	0.0056	0.0055	0.0036	0.0028	N.G.
Nickel (Ni)	0.021	0.021	0.011	0.0078	0.0048	0.014	N.G.
Phosphorus (P)	<0.10	<0.10	0.4	< 0.1	0.10	0.3	N.G.
Potassium (K)	3.8	3.7	6.0	5.4	5.4	5.0	N.G.
Selenium (Se)	0.0018	0.0022	< 0.0002	< 0.0002	<0.00020	< 0.0002	N.G.
Silicon (Si)	10	10	N.A.	N.A.	11	N.A.	N.G.
Silver (Ag)	<0.00010	<0.00010	< 0.0001	< 0.0001	<0.00010	< 0.0001	N.G.
Sodium (Na)	29	29	19	16	12	12	N.G.
Strontium (Sr)	0.33	0.32	0.37	0.36	0.39	0.25	N.G.
Sulphur (S)	5.3	4.7	19	18	9.9	9.5	N.G.
Thallium (Tl)	<0.00020	<0.00020	< 0.0002	< 0.0002	<0.00020	< 0.0002	N.G.
Tin (Sn)	<0.0010	<0.0010	< 0.001	< 0.001	<0.0010	< 0.001	N.G.
Titanium (Ti)	<0.0010	<0.0010	0.052	< 0.001	<0.0010	0.030	N.G.
Uranium (U)	0.0053	0.0054	0.0064	0.0062	0.0053	0.0041	N.G.
Vanadium (V)	<0.0010	<0.0010	0.006	< 0.001	<0.0010	0.007	N.G.
Zinc (Zn)	0.0049	0.0065	0.011	0.007	0.0047	0.010	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Monitoring Wells						
	BH14	BH14	BH16	BH17	BH17	BH18	
	2-Mar-11	13-Oct-12	11-Oct-12	2-Mar-11	11-Oct-12	12-Oct-12	
Aluminum (Al)	0.002	0.0079	0.023	0.006	0.0030	0.0024	N.G.
Antimony (Sb)	0.0003	<0.00060	<0.00060	0.0004	<0.00060	<0.00060	N.G.
Arsenic (As)	0.0003	0.00052	0.00082	0.0004	0.00042	0.00030	N.G.
Barium (Ba)	0.20	0.17	0.12	0.11	0.098	0.17	N.G.
Beryllium (Be)	< 0.001	<0.0010	<0.0010	< 0.001	<0.0010	<0.0010	N.G.
Boron (B)	0.02	0.029	<0.020	0.11	0.088	0.042	N.G.
Cadmium (Cd)	0.000073	0.00020	0.000013	0.000061	0.000019	0.00012	N.G.
Calcium (Ca)	130	140	72	130	120	140	N.G.
Chromium (Cr)	< 0.001	0.0098	<0.0010	< 0.001	<0.0010	0.0016	N.G.
Cobalt (Co)	0.0035	0.00067	0.00057	0.0024	0.00092	<0.00030	N.G.
Copper (Cu)	0.0018	0.0024	0.0019	0.0019	0.00037	0.0026	N.G.
Iron (Fe)	0.13	<0.060	2.7	< 0.06	0.67	<0.060	N.G.
Lead (Pb)	0.0010	0.00020	<0.00020	< 0.0002	<0.00020	<0.00020	N.G.
Lithium (Li)	0.03	0.025	0.026	0.10	0.090	0.029	N.G.
Magnesium (Mg)	53	46	36	69	62	44	N.G.
Manganese (Mn)	2.5	0.53	0.79	0.75	0.37	0.011	N.G.
Molybdenum (Mo)	0.0054	0.0045	0.0019	0.010	0.0055	0.015	N.G.
Nickel (Ni)	0.020	0.0071	0.0030	0.0066	0.0057	0.0026	N.G.
Phosphorus (P)	0.1	<0.10	0.87	0.2	<0.10	<0.10	N.G.
Potassium (K)	6.3	4.9	13	8.7	6.7	5.0	N.G.
Selenium (Se)	< 0.0002	0.00025	0.0016	0.0007	0.0015	<0.00020	N.G.
Silicon (Si)	N.A.	12	8.6	N.A.	9.2	11	N.G.
Silver (Ag)	< 0.0001	<0.00010	<0.00010	< 0.0001	<0.00010	<0.00010	N.G.
Sodium (Na)	11	14	6.3	23	16	16	N.G.
Strontium (Sr)	0.28	0.21	0.23	0.54	0.42	0.28	N.G.
Sulphur (S)	7.4	4.5	16	15	16	11	N.G.
Thallium (Tl)	< 0.0002	<0.00020	<0.00020	< 0.0002	<0.00020	<0.00020	N.G.
Tin (Sn)	< 0.001	<0.0010	<0.0010	< 0.001	<0.0010	<0.0010	N.G.
Titanium (Ti)	< 0.001	<0.0010	0.0016	< 0.001	<0.0010	<0.0010	N.G.
Uranium (U)	0.0047	0.0036	0.00049	0.027	0.013	0.0064	N.G.
Vanadium (V)	< 0.001	<0.0010	0.0026	< 0.001	<0.0010	<0.0010	N.G.
Zinc (Zn)	0.006	0.0053	0.0078	0.006	0.0040	0.0066	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in **BOLD** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)						Environmental Quality Guidelines [a]
	Monitoring Wells						
	BH19	BH20	BH21	BH21	BH23	BH23 DUP [c]	
	13-Oct-12	11-Oct-12	2-Mar-11	10-Oct-12	17-Oct-12		
Aluminum (Al)	0.0036	0.0048	0.033	0.022	0.022	0.0045	N.G.
Antimony (Sb)	<0.00060	<0.00060	0.0002	<0.00060	<0.00060	<0.00060	N.G.
Arsenic (As)	0.00023	0.0018	0.0002	0.0011	0.00089	0.00096	N.G.
Barium (Ba)	0.16	0.24	0.12	0.081	0.20	0.21	N.G.
Beryllium (Be)	<0.0010	<0.0010	< 0.001	<0.0010	<0.0010	<0.0010	N.G.
Boron (B)	0.055	0.022	0.05	0.023	0.043	0.042	N.G.
Cadmium (Cd)	0.000092	0.000061	0.000056	0.000063	0.000021	0.000074	N.G.
Calcium (Ca)	120	150	110	67	130	130	N.G.
Chromium (Cr)	<0.0010	<0.0010	< 0.001	<0.0010	<0.0010	<0.0010	N.G.
Cobalt (Co)	<0.00030	0.0067	0.0008	0.00065	0.0059	0.0059	N.G.
Copper (Cu)	0.0020	0.00079	0.0029	0.0020	0.0015	0.00088	N.G.
Iron (Fe)	<0.060	2.9	< 0.06	0.28	1.9	2.0	N.G.
Lead (Pb)	<0.00020	0.00080	< 0.0002	<0.00020	<0.00020	<0.00020	N.G.
Lithium (Li)	0.087	0.021	0.10	0.036	<0.020	<0.020	N.G.
Magnesium (Mg)	84	54	110	43	50	49	N.G.
Manganese (Mn)	0.047	1.6	0.21	0.13	1.5	1.5	N.G.
Molybdenum (Mo)	0.013	0.0036	0.0063	0.0026	0.0054	0.0052	N.G.
Nickel (Ni)	0.0033	0.019	0.0044	0.0049	0.014	0.014	N.G.
Phosphorus (P)	<0.10	<0.10	0.1	0.47	<0.10	<0.10	N.G.
Potassium (K)	6.1	4.7	7.1	13	11	11	N.G.
Selenium (Se)	0.00064	0.00028	0.0005	<0.00020	0.00080	0.00078	N.G.
Silicon (Si)	9.8	10	N.A.	6.9	8.0	8.1	N.G.
Silver (Ag)	<0.00010	<0.00010	< 0.0001	<0.00010	<0.00010	<0.00010	N.G.
Sodium (Na)	10	8.4	16	8.2	27	27	N.G.
Strontium (Sr)	0.54	0.22	0.53	0.22	0.22	0.23	N.G.
Sulphur (S)	13	6.5	10	5.7	33	33	N.G.
Thallium (Tl)	<0.00020	<0.00020	< 0.0002	<0.00020	<0.00020	<0.00020	N.G.
Tin (Sn)	<0.0010	<0.0010	< 0.001	0.0015	<0.0010	<0.0010	N.G.
Titanium (Ti)	<0.0010	<0.0010	0.002	0.0015	0.0012	<0.0010	N.G.
Uranium (U)	0.017	0.0032	0.025	0.0078	0.0062	0.0061	N.G.
Vanadium (V)	<0.0010	<0.0010	< 0.001	<0.0010	<0.0010	<0.0010	N.G.
Zinc (Zn)	0.0072	0.0062	0.007	2.1	0.0091	0.0042	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 8

Total and Dissolved Metals Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Analytical Results (mg/L)					Environmental Quality Guidelines [a]
	Monitoring Wells					
	BH24	BH29-12	BH31-12	EQUIP BLANK - TUBING	WASTE WATER	
	11-Oct-12	15-Oct-12	15-Oct-12	16-Oct-12	17-Oct-12	
Aluminum (Al)	0.0046	0.0097	0.0062	0.0020	0.069	N.G.
Antimony (Sb)	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	N.G.
Arsenic (As)	0.00025	0.00037	<0.00020	<0.00020	0.00082	N.G.
Barium (Ba)	0.33	0.090	0.097	<0.010	0.026	N.G.
Beryllium (Be)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	N.G.
Boron (B)	<0.020	0.049	0.067	<0.020	0.029	N.G.
Cadmium (Cd)	0.00025	0.00013	0.00023	0.000012	0.00025	N.G.
Calcium (Ca)	190	120	120	<0.30	49	N.G.
Chromium (Cr)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	N.G.
Cobalt (Co)	0.0012	0.00099	0.00078	<0.00030	0.0020	N.G.
Copper (Cu)	0.0027	0.0039	0.0018	0.00034	0.015	N.G.
Iron (Fe)	<0.060	<0.060	<0.060	<0.060	0.12	N.G.
Lead (Pb)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	N.G.
Lithium (Li)	0.044	0.083	0.073	<0.020	<0.020	N.G.
Magnesium (Mg)	73	54	68	<0.20	28	N.G.
Manganese (Mn)	0.65	0.44	0.22	<0.0040	0.24	N.G.
Molybdenum (Mo)	0.0024	0.044	0.0071	0.00030	0.0042	N.G.
Nickel (Ni)	0.013	0.0042	0.0071	<0.00050	0.0064	N.G.
Phosphorus (P)	<0.10	<0.10	<0.10	<0.10	0.11	N.G.
Potassium (K)	3.3	9.8	6.3	<0.30	4.5	N.G.
Selenium (Se)	<0.00020	0.00052	0.00077	<0.00020	0.00032	N.G.
Silicon (Si)	9.9	9.5	9.4	<0.10	3.6	N.G.
Silver (Ag)	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	N.G.
Sodium (Na)	14	15	14	<0.50	140	N.G.
Strontium (Sr)	0.39	0.43	0.51	<0.020	0.080	N.G.
Sulphur (S)	9.8	12	13	<0.20	16	N.G.
Thallium (Tl)	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	N.G.
Tin (Sn)	<0.0010	0.013	0.0011	<0.0010	<0.0010	N.G.
Titanium (Ti)	<0.0010	<0.0010	<0.0010	<0.0010	0.0024	N.G.
Uranium (U)	0.0042	0.017	0.014	0.00014	0.0029	N.G.
Vanadium (V)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	N.G.
Zinc (Zn)	0.21	0.0079	0.0061	<0.0030	0.050	N.G.

Notes: Concentrations greater than the environmental quality guideline are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways

[c] Sample collected as a field duplicate.

* Analyzed as total metals.

N.G. - No Guideline. N.A. - Not Analyzed

TABLE 9

Groundwater Routine Water Quality Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Parameter	Units	Analytical Results											Environmental Quality Guidelines [a]
		BH4	BH-6	BH7	BH-9	BH-10	BH12	BH12 DUP [b]	BH-13	BH14	BH16	BH17	
		11-Oct-12	10-Oct-12	11-Oct-12	11-Oct-12	10-Oct-12	11-Oct-12		11-Oct-12	13-Oct-12	11-Oct-12	11-Oct-12	
Anion Sum	meq/L	12	11	9.0	5.5	15	16	16	16	11	6.7	11	N.G.
Cation Sum	meq/L	13	11	9.7	5.3	14	15	15	15	12	7.3	12	N.G.
Hardness (CaCO3)	mg/L	570	470	440	200	610	700	690	720	540	330	550	N.G.
Ion Balance	N/A	1.0	1.0	1.1	0.96	0.97	0.99	0.97	0.96	1.1	1.1	1.0	N.G.
Dissolved Nitrate (NO3)	mg/L	8.6	< 0.013	13	0.020	0.20	0.082	0.021	0.25	0.78	0.038	0.025	N.G.
Nitrate plus Nitrite (N)	mg/L	1.9	0.0050	3.2	0.014	0.38	0.019	0.0050	0.062	0.18	0.020	0.0060	N.G.
Dissolved Nitrite (NO2)	mg/L	< 0.0099	0.016	0.95	0.031	1.1	< 0.0099	< 0.0099	0.020	< 0.0099	0.038	< 0.0099	N.G.
Total Dissolved Solids	mg/L	650	560	470	290	720	740	740	750	540	340	560	N.G.
Miscellaneous Inorganics													
Conductivity	uS/cm	1100	940	810	540	1200	1300	1300	1300	940	600	980	N.G.
pH	N/A	7.38 *	7.14	7.48 *	6.83	7.53	7.30 *	7.31 *	7.53	7.65	7.51	7.53 *	N.G.
Anions													
Alkalinity (PP as CaCO3)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	N.G.
Alkalinity (Total as CaCO3)	mg/L	530	500	390	230	660	740	740	700	500	310	530	N.G.
Bicarbonate (HCO3)	mg/L	650	610	470	290	810	900	910	850	610	370	640	N.G.
Carbonate (CO3)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	N.G.
Hydroxide (OH)	mg/L	< 0.50	< 0.50	< 0.50	< 0.50	<0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	N.G.
Dissolved Sulphate (SO4)	mg/L	42	25	21	19	37	< 1.0	< 1.0	37	16	2.0	40	N.G.
Dissolved Chloride (Cl)	mg/L	27	18	19	15	27	29	29	34	21	19	5.6	N.G.
Nutrients													
Dissolved Nitrite (N)	mg/L	< 0.0030	0.0048	0.29	0.0094	0.33	< 0.0030	< 0.0030	0.0062	< 0.0030	0.012	< 0.0030	N.G.
Dissolved Nitrate (N)	mg/L	1.9	< 0.0030	2.9	0.0046	0.045	0.019	0.0048	0.056	0.18	0.0085	0.0057	N.G.

Notes: Concentrations in excess of referenced EQG are presented in ***BOLD*** text.

[a] Meridian Environmental Inc., *Guidance Document on Federal Interim Groundwater Quality Guidelines for Federal Contaminated Sites*, May 2010 Table 3 - Commercial/Industrial Land Use with soil organisms direct contact pathways.

[b] Sample collected as a field duplicate.

N.A. = Not Analzyed, N.G. = No Guideline, EQG = Environmental Quality Guideline

* Analysis requested and approved past method-specific hold-time.

TABLE 10

Groundwater Geochemical Parameter Field Measurements
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Monitoring Well	Sampling Date	Dissolved Oxygen (mg/L)	Temperature (°C)	pH	Redox Potential (mV)	Electrical Conductivity (ms/cm)
BH4	11-Oct-12	1.7	7.4	6.9	127.6	1.092
BH6	10-Oct-12	2.5	7.9	6.8	130.1	0.944
BH-7	11-Oct-12	1.2	8.2	7.0	127.2	0.838
BH9	11-Oct-12	0.7	6.2	6.4	-119.4	0.878
BH10	10-Oct-12	0.6	8.4	7.1	155.4	1.224
BH-12	11-Oct-12	1.6	6.5	7.0	-120.3	1.361
BH13	11-Oct-12	2.4	6.5	7.0	154.3	1.294
BH14	13-Oct-12	3.0	7.6	7.1	-20.6	0.944
BH16	11-Oct-12	0.4	7.1	7.3	-219.8	0.661
BH17	11-Oct-12	0.5	6.1	7.1	-110.9	0.973
BH-18	12-Oct-12	6.4	8.0	7.2	73.4	0.962
BH19	13-Oct-12	1.6	6.7	7.1	66.1	1.116
BH20	11-Oct-12	0.6	5.9	7.0	-77.7	1.032
BH21	10-Oct-12	0.4	6.3	6.8	77.9	1.151
BH23	15-Oct-12	0.6	9.6	6.9	-185.6	1.139
BH24	11-Oct-12	0.6	6.2	7.0	58.6	1.414
BH29-12	15-Oct-12	12.8	7.0	7.3	39.6	0.975
BH30-12	16-Oct-12	8.1	6.3	7.6	12.6	1.112
BH31-12	16-Oct-12	5.8	6.4	7.0	13.3	1.141

Notes: Measurements obtained with a YSI556 Multi-meter.

TABLE 11

Groundwater Geochemical Parameter and Microbiological Laboratory Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Sample Identification	Sampling Date	Geochemical Parameters (mg/L)					Microbiological	
		Nitrate-N	Alkalinity (Total as CaCO3)	Dissolved Manganese	Dissolved Iron	Sulphate	Heterotrophic Plate Count (CFU/mL)	Hydrocarbon Degrading Bacteria (MPN/mL)
BH4	11-Oct-12	1.9	530	1.1	< 0.060	42	1,300	85
BH-6	10-Oct-12	< 0.0030	500	0.30	0.36	25	1,600,000	11,000
BH7	11-Oct-12	2.9	390	0.10	< 0.060	21	51,000	2,400
BH-9	11-Oct-12	0.0046	230	2.2	2.4	19	2,800,000	55,000
BH-10	10-Oct-12	0.045	660	2.2	< 0.060	37	1,500,000	5,500
BH12	11-Oct-12	0.019	740	2.6	0.83	< 1.0	92,000	1,600
BH12 DUP [a]		0.0048	740	2.6	0.82	< 1.0	90,000	650
BH-13	11-Oct-12	0.062	700	0.14	< 0.060	37	1,700	22
BH14	13-Oct-12	0.18	500	0.53	< 0.060	16	12,000	160
BH16	11-Oct-12	0.0085	310	0.79	2.7	2.0	24,000	46
BH17	11-Oct-12	0.0057	530	0.37	0.67	40	30,000	130
BH18	12-Oct-12	4.6	470	0.011	< 0.060	36	3,800	160
BH19	13-Oct-12	6.8	560	0.047	< 0.060	43	12,000	240
BH20	11-Oct-12	0.0045	550	1.6	2.9	22	1,000,000	1,200
BH21	10-Oct-12	0.77	530	0.13	0.28	24	180,000	2,400
BH23	17-Oct-12	< 0.0030	530	1.5	1.9	91	50,000	55
BH23 DUP [a]		< 0.0030	540	1.5	2.0	84	37,000	160
BH24	11-Oct-12	0.026	760	0.65	< 0.060	36	1,000	65
BH29-12	15-Oct-12	0.32	520	0.44	< 0.060	37	82,000	10
BH31-12	15-Oct-12	1.9	650	0.22	< 0.060	35	1,200	10

Notes: [a] Sample collected as field duplicate.
N.A. = Not Available

TABLE 12

Assimilative Capacity for BTEX Biodegradation in Groundwater
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Monitoring Well	Sampling Date	Assimilative Capacity (mg/L)					Total BTEX Assimilative Capacity (mg/L)	Total BTEX in Sample (mg/L)
		Aerobic Respiration	Denitrification	Manganese IV Reduction	Iron III Reduction	Sulfanogenesis		
BH-4	11-Oct-12	0.7	0.4	0.1	N.D.	8.8	10	0.0
BH-6	10-Oct-12	1.0	N.D.	0.0	0.0	5.3	6	0.0
BH-7	11-Oct-12	0.4	0.6	0.0	N.D.	4.4	5	0.7
BH-9	11-Oct-12	0.3	0.0	0.1	0.1	4.0	5	0.0
BH-10	10-Oct-12	0.4	0.0	0.1	N.D.	7.8	8	0.0
BH-12	11-Oct-12	0.7	0.0	0.2	0.0	N.D.	1	46.2
BH-12 DUP [a]			0.0	0.2	0.0	N.D.	1	46.1
BH-13	11-Oct-12	0.4	0.0	0.0	N.D.	7.8	8	0.0
BH-14	13-Oct-12	0.9	0.0	0.0	N.D.	3.4	4	0.0
BH16	11-Oct-12	0.3	0.0	0.0	0.1	0.4	1	0.0
BH17	11-Oct-12	0.4	0.0	0.0	0.0	8.4	9	0.0
BH18	12-Oct-12	1.6	1.0	0.0	N.D.	7.6	10	0.0
BH19	13-Oct-12	0.5	1.4	0.0	N.D.	9.0	11	0.0
BH20	11-Oct-12	0.4	0.0	0.1	0.1	4.6	5	0.0
BH21	10-Oct-12	0.2	0.2	0.0	0.0	5.0	5	0.0
BH23	17-Oct-12	0.3	N.D.	0.1	0.1	19.1	20	2.7
BH23 DUP [a]			N.D.	0.1	0.1	17.6	18	3.0
BH24	11-Oct-12	0.4	0.0	0.0	N.D.	7.6	8	0.3
BH29-12	15-Oct-12	4.2	0.1	0.0	N.D.	7.8	12	0.0
BH30-12	N.A.	2.6	0.0	0.0	0.0	0.0	3	N.A.
BH31-12	15-Oct-12	2.0	0.4	0.0	N.D.	7.4	10	0.0

Notes: [a] Sample collected as a field duplicate
N.A. = Not Analyzed, N.D. = Not Detected

TABLE 13

Soil Vapour Petroleum Hydrocarbon Laboratory Analytical Results
Public Works and Government Services Canada
Lobstick Maintenance Compound - Waskesiu Lake, Saskatchewan

Soil Vapour Monitoring Well [a]	Sample Identification	Sampling Date	Helium (%)	Analytical Results (µg/m^3)					
				Benzene	Toluene	Ethyl-benzene	Xylenes	F1 - BTEX (>nC_6-nC_{10})	F2 (>nC_{10} - nC_{16})
VW25-12	VW-25-12-B	16-Oct-12	0.6	4.8	11.1	< 1.6	4.0	293	89.3
VW26-12 [c]	N.A.	--	--	--	--	--	--	--	--
VW27-12	VW-27-12	16-Oct-12	0.4	32.6	51.2	11.2	55.6	615	155
VW28-12 [c]	N.A.	--	--	--	--	--	--	--	--
Soil Vapour Objective [b]		**Commercial Coarse-Grained**		**47,000**	**30,000,000**	**7,900,000**	**1,400,000**	**37,000,000**	**7,600,000**

Notes: Concentrations in excess of the soil vapour objectives are presented in ***BOLD*** text.

Concentrations within 10 times the Soil Vapour Objectives are presented in **UNDERLINED** text, as per Interstate Technology & Regulatory Council, 2007. *Vapour Intrusion Pathway: A Practical Guideline*.

[a] All soil vapour wells installed to 1.0 mbg.

[b] TetraTech, *Technical Memorandum Methodology for Developing Soil Vapour Objectives for Properties with Petroleum Hydrocarbon Contamination,* June 2012.

[c] Soil vapour wells VW26-12 and VW28-12 were not sampled due to water covering the vapour screen.

mbg = metres below ground surface

TETRA TECH

APPENDIX G

LABORATORY ANALYTICAL REPORTS

PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	100
	3/8"	9.5	100
	# 4	4.75	99
	# 10	2.00	97
	# 20	0.850	90
	# 40	0.425	80
	# 60	0.250	69
	# 100	0.150	57
	# 200	0.075	45
Hydrometer Analysis		0.0665	41.7
		0.0482	34.4
Dispersing agent:		0.0343	32.1
Sodium Hexametaphosphate		0.0244	30.6
		0.0174	28.6
Dosage of dispersing agent:		0.0128	26.3
40 g/L		0.0093	23.8
		0.0065	21.5
		0.0046	20.9
		0.0033	19.0
		0.0025	17.3
		0.0008	14.6

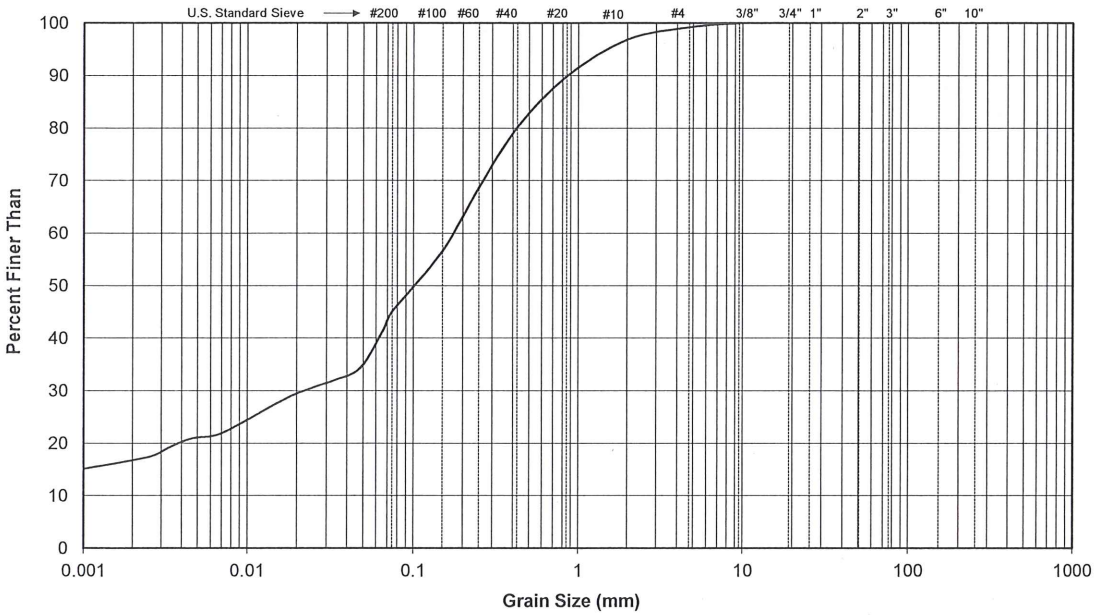
MDH ENGINEERED SOLUTIONS
Member of the SNC-LAVALIN Group

CLIENT:	Tetratech
PROJECT:	Lobstick Golf Course
MDH Job No:	1018901603
SAMPLE:	VW-26-12
DATE:	1-Nov-12

PARTICLE SIZE DISTRIBUTION SUMMARY

% GRAVEL	1
% SAND	54
% FINES (SILT, CLAY)	45

COMMENTS:



FINES (SILT, CLAY)	SAND			GRAVEL		COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Coarse		

Unified Soil Classification System

The testing services reported here have been performed in accordance with accepted local industry standards.

The results presented are for the sole use of the designated client only.

This report constitutes a testing service only. It does not represent any interpretation or opinion regarding specification compliance or material suitability.

Engineering interpretation will be provided by MDH Engineered Solutions Corp upon request.

PARTICLE-SIZE ANALYSIS REPORT

(Test Reference: ASTM D 422)

Sieve Analysis	Sieve	Diameter (mm)	% Finer
	3"	76.2	100
	2"	50.8	100
	1"	25.4	100
	3/4"	19.1	100
	3/8"	9.5	97
	# 4	4.75	84
	# 10	2.00	66
	# 20	0.850	50
	# 40	0.425	35
	# 60	0.250	26
	# 100	0.150	20
	# 200	0.075	17
Hydrometer Analysis		0.0705	16.6
		0.0503	14.5
Dispersing agent:		0.0360	11.7
Sodium Hexametaphosphate		0.0256	10.0
		0.0183	8.0
Dosage of dispersing agent:		0.0134	6.7
40 g/L		0.0096	5.0
		0.0068	4.6
		0.0048	3.0
		0.0034	2.7
		0.0025	2.7
		0.0014	2.2

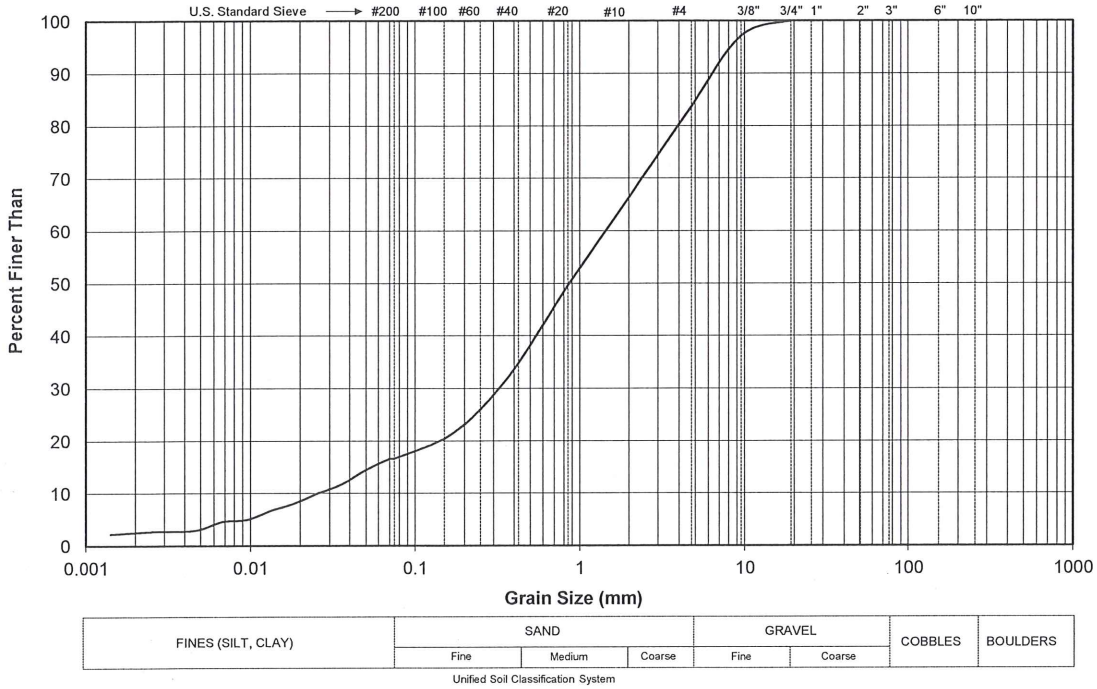
MDH ENGINEERED SOLUTIONS
Member of the SNC-LAVALIN Group

CLIENT:	Tetratech
PROJECT:	Lobstick Golf Course
MDH Job No:	1018901603
SAMPLE:	VW 28-12
DATE:	2-Nov-12

PARTICLE SIZE DISTRIBUTION SUMMARY

% GRAVEL	16
% SAND	67
% FINES (SILT, CLAY)	17

COMMENTS:



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PNEUMATIC PERMEABILITY TEST REPORT

(Test Reference - ASTM D 6539-00)

MDH ENGINEERED SOLUTIONS
Member of the SNC-LAVALIN Group

Client:	TetraTech	MDH Job No.	611472
Project:	Lobstick Golf Course	Tested by:	DS
Date:	30-Oct-12	Checked by:	JG
Sample:	**VW 26-12**		

Run No.	Temp	Inflow Pressure	Outflow Pressure	Pressure drop	Bubblemeter reading		Q_{av}			Permeability: pneumatic	Permeability: *water equivalent
	°C	Pa	Pa	Pa	cc/min	m^3/s	m^3/s	cc/min	outlier or valid data	K_p, darcy	k, cm/s
1	22	120000	18	119982	2.4	4.00E-08	2.53E-08	1.52E+00	outlier	-	-
2	22	140000	22	139978	4.0	6.67E-08	3.97E-08	2.38E+00	outlier	-	-
3	22	160000	27	159973	7.2	1.20E-07	6.76E-08	4.06E+00	valid data	2.87E-04	2.75E-07
4	22	180000	36	179964	10.4	1.73E-07	9.26E-08	5.55E+00	valid data	3.49E-04	3.35E-07
5	22	200000	50	199950	17.6	2.93E-07	1.49E-07	8.94E+00	outlier	-	-
									**Average	N/A	N/A (see footnote)

Test Method: B with Flexible wall

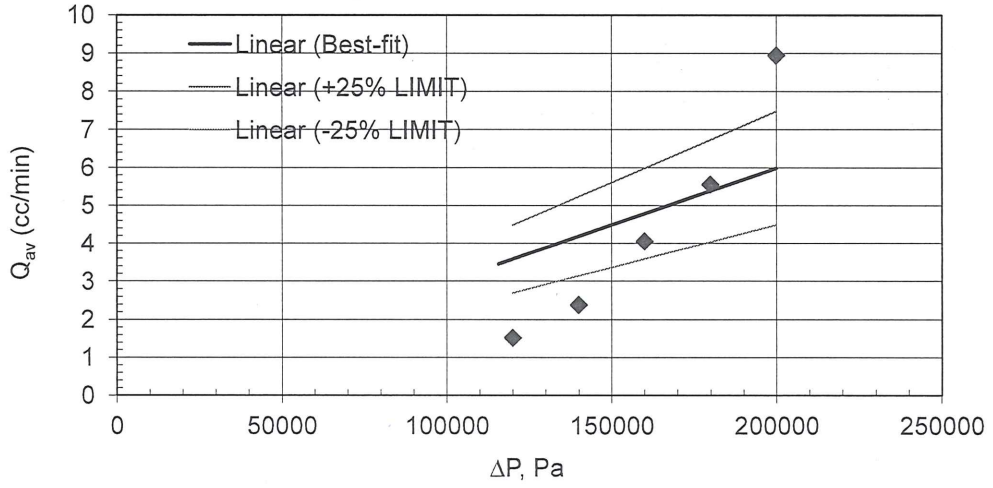
Test gas: Air

Barometric pressure, kPa = 103.2

Diameter =	4.80E-02	m
Length =	6.62E-02	m
Mass of test specimen =	264.87	g
Bulk density =	2.213	Mg/m^3
Water content =	11.8%	
Dry Density =	1.979	
Specific gravity =	2.65	(assumed)
Void ratio =	0.34	
Degee of saturation =	92%	
Type of specimen:	Shelby	
Cell pressure =	276	kPa

Comments: Results do not meet ASTM requirements as less than 3 test points lie outside the upper and lower limit lines.

Best -fit line $(Q_{av}/\Delta P)$ = 2.99E-05



* 1 darcy = 9.613 x 10^{-4} cm/s (for water at 20 °C). Bear, J. 1972. *Dynamics of fluids in Porous Media* . American Elsevier, NY

**average of valid data

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PNEUMATIC PERMEABILITY TEST REPORT

(Test Reference - ASTM D 6539-00)

MDH ENGINEERED SOLUTIONS
Member of the SNC-LAVALIN Group

Client:	TetraTech	MDH Job No.	611472
Project:	Lobstick Golf Course	Tested by:	DS
Date:	30-Oct-12	Checked by:	JG
Sample:	**VW 28-12**		

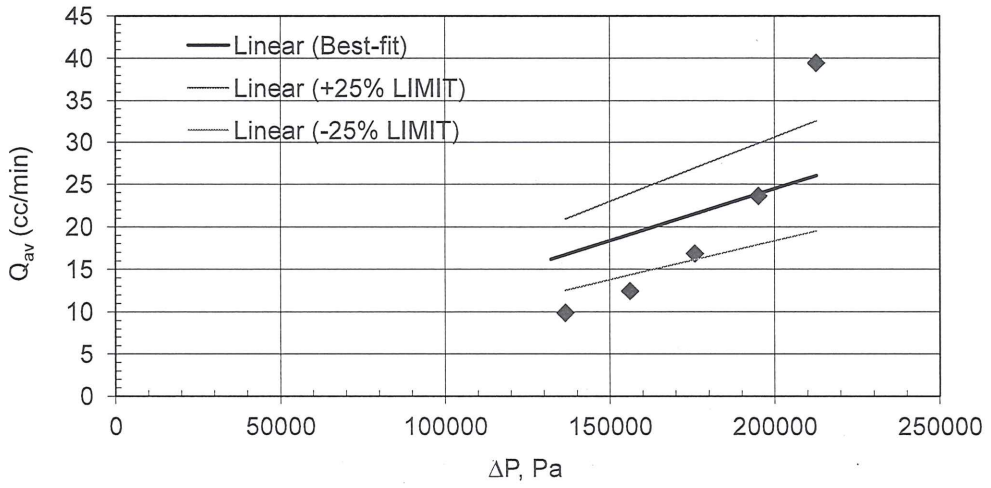
Run No.	Temp	Inflow Pressure	Outflow Pressure	Pressure drop	Bubblemeter reading		Q_{av}			Permeability: pneumatic	Permeability: *water equivalent
	°C	Pa	Pa	Pa	cc/min	m^3/s	m^3/s	cc/min	outlier or valid data	K_p, darcy	k, cm/s
1	22	140000	3489	136511	16.8	2.80E-07	1.65E-07	9.88E+00	outlier	-	-
2	22	160000	3885	156115	22.4	3.73E-07	2.07E-07	1.24E+01	outlier	-	-
3	22	180000	4158	175842	32.0	5.33E-07	2.81E-07	1.69E+01	valid data	9.86E-04	9.48E-07
4	22	200000	4859	195141	47.2	7.87E-07	3.93E-07	2.36E+01	valid data	1.24E-03	1.20E-06
5	22	220000	7314	212686	83.2	1.39E-06	6.58E-07	3.95E+01	outlier	-	-
									**Average	N/A	N/A (see footnote)

Test Method: B with Flexible wall
Test gas: Air
Barometric pressure, kPa = 102.5

Diameter =	4.82E-02	m
Length =	6.10E-02	m
Mass of test specimen =	226.9	g
Bulk density =	2.035	Mg/m^3
Water content =	14.6%	
Dry Density =	1.775	
Specific gravity =	2.65	(assumed)
Void ratio =	0.49	
Degee of saturation =	79%	
Type of specimen:	Shelby	
Cell pressure =	275	kPa

Comments: Results do not meet ASTM requirements as less than 3 test points lie outside the upper and lower limit lines.

Best -fit line $(Q_{av}/\Delta P)$ = 1.23E-04



* 1 darcy = 9.613 x 10^{-4} cm/s (for water at 20 °C). Bear, J. 1972. *Dynamics of fluids in Porous Media* . American Elsevier, NY

**average of valid data

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MDH
ENGINEERED SOLUTIONS
Member of the SNC-LAVALIN Group

WATER CONTENTS & BULK DENSITIES

Client: TetraTech 1018901603
Project: Lobstick Golf Course
MDH # 611472
Tech: DS
Date: 23-Oct-12

Sample #	VW 26-12		VW 28-12			
Tare #	R5R		J44			
Tare Mass (g)	86.49		85.23			
Wet sample + tare (g)	206.44		239.68			
Dry sample + tare (g)	190.69		219.12			
Wt. Dry sample (g)	104.20		133.89			
Water Content (%)	15.1		15.4			
Bulk Density						
Sample #	VW 26-12		VW 28-12			
Mass of sample in air (g):	149.51					
Mass of sample + wax in air (g):	161.40					
Mass of sample + wax in water (g):	76.17					
Wet density (kg/m^3):	2080		2131			
Dry density (kg/m^3):	1807		1847			
Sample #						
Tare #						
Tare Mass (g)						
Wet sample + tare (g)						
Dry sample + tare (g)						
Wt. Dry sample (g)						
Water Content (%)						
Bulk Density						
Sample #						
Mass of sample in air (g):						
Mass of sample + wax in air (g):						
Mass of sample + wax in water (g):						
Wet density (kg/m^3):						
Dry density (kg/m^3):						

Comments: VW 28-12 was completed with measurements rather than waxing - was too fragile.

Maxxam

Success Through Science®

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A014439

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/10/29
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B292855
Received: 2012/10/13, 10:30

Sample Matrix: Water
Samples Received: 7

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	7	N/A	2012/10/16	AB SOP-00005	SM 2320-B
BTEX/F1 in Water by HS GC/MS	2	N/A	2012/10/17	AB SOP-00039	CCME, EPA 8260C
BTEX/F1 in Water by HS GC/MS	5	N/A	2012/10/20	AB SOP-00039	CCME, EPA 8260C
Cadmium - low level CCME - Dissolved	7	N/A	2012/10/17	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	7	N/A	2012/10/16	AB SOP-00020	EPA 325.2
Conductivity @25C	7	N/A	2012/10/16	AB SOP-00005	SM 2510-B
CCME Hydrocarbons (F2-F4 in water)	4	2012/10/17	2012/10/18	CAL SOP-00086 AB SOP-00037	EPA3510C/CCME PHCCWS
CCME Hydrocarbons (F2-F4 in water)	3	2012/10/17	2012/10/19	CAL SOP-00086 AB SOP-00037	EPA3510C/CCME PHCCWS
Hardness	7	N/A	2012/10/15	AB WI-00065	SM 2340B
Elements by ICP - Dissolved	7	N/A	2012/10/15	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	2	N/A	2012/10/16	AB SOP-00043	EPA 200.8
Elements by ICPMS - Dissolved	5	N/A	2012/10/18	AB SOP-00043	EPA 200.8
Ion Balance	7	N/A	2012/10/15	AB WI-00065	SM 1030E
Sum of cations, anions	7	N/A	2012/10/15	AB WI-00065	SM 1030E
Nitrate and Nitrite	7	N/A	2012/10/19	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	7	N/A	2012/10/19	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	7	N/A	2012/10/19	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	7	N/A	2012/10/16	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	7	N/A	2012/10/16	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Calculated)	7	N/A	2012/10/18	AB WI-00065	SM 1030E

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

../2

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A014439

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/10/29
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Geraldyn Gouthro, Client Service Specialist
Email: GGouthro@maxxam.ca
Phone# (403) 291-3077

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		ES8643	ES8643	ES8645	ES8646	ES8647		
Sampling Date		2012/10/10	2012/10/10	2012/10/10	2012/10/10	2012/10/11		
COC Number		A014439	A014439	A014439	A014439	A014439		
	UNITS	**BH21**	**BH21 Lab-Dup**	**BH-6**	**BH-10**	**BH-9**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	0.10	6260602
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	0.10	6260602
F4 (C34-C50 Hydrocarbons)	mg/L	<0.10	N/A	<0.10	<0.10	<0.10	0.10	6260602
Reached Baseline at C50	mg/L	Yes	N/A	Yes	Yes	Yes	N/A	6260602
Volatiles								
Benzene	ug/L	<0.40	<0.40	20	11	2.9	0.40	6260175
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	6260175
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	6260175
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	6260175
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	6260175
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	<0.80	<0.80	0.80	6260175
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	150	<100	100	6260175
(C6-C10)	ug/L	<100	<100	<100	160	<100	100	6260175
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	107	109	103	104	99	N/A	6260175
4-BROMOFLUOROBENZENE (sur.)	%	105	106	95	95	92	N/A	6260175
D4-1,2-DICHLOROETHANE (sur.)	%	108	116	93	94	101	N/A	6260175
O-TERPHENYL (sur.)	%	101	N/A	71	71	85	N/A	6260602

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		ES8648	ES8649	ES8650	ES8650		
Sampling Date		2012/10/11	2012/10/11	2012/10/11	2012/10/11		
COC Number		A014439	A014439	A014439	A014439		
	UNITS	**BH24**	**BH-13**	**BH16**	**BH16 Lab-Dup**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon							
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	6260602
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	6260602
F4 (C34-C50 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	6260602
Reached Baseline at C50	mg/L	Yes	Yes	Yes	Yes	N/A	6260602
Volatiles							
Benzene	ug/L	330	8.9	<0.40	N/A	0.40	6260175
Toluene	ug/L	0.85	<0.40	<0.40	N/A	0.40	6260175
Ethylbenzene	ug/L	1.1	<0.40	<0.40	N/A	0.40	6260175
o-Xylene	ug/L	<0.40	<0.40	<0.40	N/A	0.40	6260175
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	N/A	0.80	6260175
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	N/A	0.80	6260175
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	N/A	100	6260175
(C6-C10)	ug/L	350	<100	<100	N/A	100	6260175
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	103	89	106	N/A	N/A	6260175
4-BROMOFLUOROBENZENE (sur.)	%	94	82	106	N/A	N/A	6260175
D4-1,2-DICHLOROETHANE (sur.)	%	99	90	111	N/A	N/A	6260175
O-TERPHENYL (sur.)	%	103	103	112	80	N/A	6260602

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		ES8643	ES8643		ES8645	ES8646	ES8647		
Sampling Date		2012/10/10	2012/10/10		2012/10/10	2012/10/10	2012/10/11		
COC Number		A014439	A014439		A014439	A014439	A014439		
	UNITS	**BH21**	**BH21 Lab-Dup**	**RDL**	**BH-6**	**BH-10**	**BH-9**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	meq/L	12	N/A	N/A	11	15	5.5	N/A	6255252
Cation Sum	meq/L	7.6	N/A	N/A	11	14	5.3	N/A	6255252
Hardness (CaCO3)	mg/L	340	N/A	0.50	470	610	200	0.50	6255249
Ion Balance	N/A	0.65	N/A	0.010	1.0	0.97	0.96	0.010	6255250
Dissolved Nitrate (NO3)	mg/L	3.4	N/A	0.013	<0.013	0.20	0.020	0.013	6255254
Nitrate plus Nitrite (N)	mg/L	0.91	N/A	0.0030	0.0050	0.38	0.014	0.0030	6255255
Dissolved Nitrite (NO2)	mg/L	0.46	N/A	0.0099	0.016	1.1	0.031	0.0099	6255254
Total Dissolved Solids	mg/L	500	N/A	10	560	720	290	10	6255257
Misc. Inorganics									
Conductivity	uS/cm	960	N/A	1.0	940	1200	540	1.0	6258522
pH	N/A	7.57	N/A	N/A	7.14	7.53	6.83	N/A	6258523
Low Level Elements									
Dissolved Cadmium (Cd)	ug/L	0.063	N/A	0.0050	0.099	0.13	0.077	0.0050	6255657
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	N/A	0.50	<0.50	<0.50	<0.50	0.50	6258496
Alkalinity (Total as CaCO3)	mg/L	530	N/A	0.50	500	660	230	0.50	6258496
Bicarbonate (HCO3)	mg/L	650	N/A	0.50	610	810	290	0.50	6258496
Carbonate (CO3)	mg/L	<0.50	N/A	0.50	<0.50	<0.50	<0.50	0.50	6258496
Hydroxide (OH)	mg/L	<0.50	N/A	0.50	<0.50	<0.50	<0.50	0.50	6258496
Dissolved Sulphate (SO4)	mg/L	24	N/A	1.0	25	37	19	1.0	6258215
Dissolved Chloride (Cl)	mg/L	16	N/A	1.0	18	27	15	1.0	6258213
Nutrients									
Dissolved Nitrite (N)	mg/L	0.14	0.14	0.0030	0.0048	0.33	0.0094	0.0030	6268139
Dissolved Nitrate (N)	mg/L	0.77	0.77	0.0030	<0.0030	0.045	0.0046	0.0030	6268139
Elements									
Dissolved Aluminum (Al)	mg/L	0.022	0.024	0.0010	0.28	0.0053	0.074	0.0010	6258708
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	0.00060	<0.00060	<0.00060	<0.00060	0.00060	6258708
Dissolved Arsenic (As)	mg/L	0.0011	0.0011	0.00020	0.0013	0.00074	0.0034	0.00020	6258708
Dissolved Barium (Ba)	mg/L	0.081	N/A	0.010	0.18	0.20	0.062	0.010	6255963
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Boron (B)	mg/L	0.023	N/A	0.020	0.044	0.047	0.070	0.020	6255963

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		ES8643	ES8643		ES8645	ES8646	ES8647		
Sampling Date		2012/10/10	2012/10/10		2012/10/10	2012/10/10	2012/10/11		
COC Number		A014439	A014439		A014439	A014439	A014439		
	UNITS	**BH21**	**BH21 Lab-Dup**	**RDL**	**BH-6**	**BH-10**	**BH-9**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	67	N/A	0.30	130	140	52	0.30	6255963
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Cobalt (Co)	mg/L	0.00065	0.00062	0.00030	0.0014	0.0015	0.0045	0.00030	6258708
Dissolved Copper (Cu)	mg/L	0.0020	0.0022	0.00020	0.0082	0.0018	0.010	0.00020	6258708
Dissolved Iron (Fe)	mg/L	0.28	N/A	0.060	0.36	<0.060	2.4	0.060	6255963
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	0.00020	0.00088	<0.00020	<0.00020	0.00020	6258708
Dissolved Lithium (Li)	mg/L	0.036	N/A	0.020	<0.020	0.052	<0.020	0.020	6255963
Dissolved Magnesium (Mg)	mg/L	43	N/A	0.20	37	64	17	0.20	6255963
Dissolved Manganese (Mn)	mg/L	0.13	N/A	0.0040	0.30	2.2	2.2	0.0040	6255963
Dissolved Molybdenum (Mo)	mg/L	0.0026	0.0027	0.00020	0.0021	0.0087	0.0019	0.00020	6258708
Dissolved Nickel (Ni)	mg/L	0.0049	0.0049	0.00050	0.0072	0.018	0.0079	0.00050	6258708
Dissolved Phosphorus (P)	mg/L	0.47	N/A	0.10	0.30	0.12	0.45	0.10	6255963
Dissolved Potassium (K)	mg/L	13	N/A	0.30	12	6.1	35	0.30	6255963
Dissolved Selenium (Se)	mg/L	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	0.00020	6258708
Dissolved Silicon (Si)	mg/L	6.9	N/A	0.10	9.3	11	4.7	0.10	6255963
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	6258708
Dissolved Sodium (Na)	mg/L	8.2	N/A	0.50	42	45	6.9	0.50	6255963
Dissolved Strontium (Sr)	mg/L	0.22	N/A	0.020	0.19	0.33	0.078	0.020	6255963
Dissolved Sulphur (S)	mg/L	5.7	N/A	0.20	7.9	11	8.0	0.20	6255963
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	0.00020	<0.00020	<0.00020	<0.00020	0.00020	6258708
Dissolved Tin (Sn)	mg/L	0.0015	0.0014	0.0010	<0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Titanium (Ti)	mg/L	0.0015	<0.0010	0.0010	0.0074	<0.0010	<0.0010	0.0010	6258708
Dissolved Uranium (U)	mg/L	0.0078	0.0080	0.00010	0.0035	0.0099	0.00063	0.00010	6258708
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	0.0010	0.0015	<0.0010	0.0018	0.0010	6258708
Dissolved Zinc (Zn)	mg/L	2.1 (1)	2.1	0.015	0.070	0.028	0.078	0.0030	6258708

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		ES8648		ES8649	ES8650		
Sampling Date		2012/10/11		2012/10/11	2012/10/11		
COC Number		A014439		A014439	A014439		
	UNITS	**BH24**	**RDL**	**BH-13**	**BH16**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	17	N/A	16	6.7	N/A	6255252
Cation Sum	meq/L	16	N/A	15	7.3	N/A	6255252
Hardness (CaCO3)	mg/L	780	0.50	720	330	0.50	6255249
Ion Balance	N/A	0.96	0.010	0.96	1.1	0.010	6255250
Dissolved Nitrate (NO3)	mg/L	0.11	0.013	0.25	0.038	0.013	6255254
Nitrate plus Nitrite (N)	mg/L	0.031	0.0030	0.062	0.020	0.0030	6255255
Dissolved Nitrite (NO2)	mg/L	0.016	0.0099	0.020	0.038	0.0099	6255254
Total Dissolved Solids	mg/L	810	10	750	340	10	6255257
Misc. Inorganics							
Conductivity	uS/cm	1400	1.0	1300	600	1.0	6258522
pH	N/A	8.03	N/A	7.53	7.51	N/A	6258523
Low Level Elements							
Dissolved Cadmium (Cd)	ug/L	0.25	0.0050	0.11	0.013	0.0050	6255657
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6258496
Alkalinity (Total as CaCO3)	mg/L	760	0.50	700	310	0.50	6258496
Bicarbonate (HCO3)	mg/L	930	0.50	850	370	0.50	6258496
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6258496
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6258496
Dissolved Sulphate (SO4)	mg/L	36	1.0	37	2.0 (1)	1.0	6258215
Dissolved Chloride (Cl)	mg/L	34 (2)	2.0	34	19	1.0	6258213
Nutrients							
Dissolved Nitrite (N)	mg/L	0.0048	0.0030	0.0062	0.012	0.0030	6268139
Dissolved Nitrate (N)	mg/L	0.026	0.0030	0.056	0.0085	0.0030	6268139
Elements							
Dissolved Aluminum (Al)	mg/L	0.0046	0.0010	0.012	0.023	0.0010	6258708
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	<0.00060	<0.00060	0.00060	6258708
Dissolved Arsenic (As)	mg/L	0.00025	0.00020	0.00026	0.00082	0.00020	6258708
Dissolved Barium (Ba)	mg/L	0.33	0.010	0.31	0.12	0.010	6255963
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Boron (B)	mg/L	<0.020	0.020	<0.020	<0.020	0.020	6255963

RDL = Reportable Detection Limit
(1) Sample run by IC.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

ROUTINE WATER & DISS. REGULATED METALS (WATER)

Maxxam ID		ES8648		ES8649	ES8650		
Sampling Date		2012/10/11		2012/10/11	2012/10/11		
COC Number		A014439		A014439	A014439		
	UNITS	**BH24**	**RDL**	**BH-13**	**BH16**	**RDL**	**QC Batch**
Dissolved Calcium (Ca)	mg/L	190	0.30	180	72	0.30	6255963
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Cobalt (Co)	mg/L	0.0012	0.00030	<0.00030	0.00057	0.00030	6258708
Dissolved Copper (Cu)	mg/L	0.0027	0.00020	0.0027	0.0019	0.00020	6258708
Dissolved Iron (Fe)	mg/L	<0.060	0.060	<0.060	2.7	0.060	6255963
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	<0.00020	<0.00020	0.00020	6258708
Dissolved Lithium (Li)	mg/L	0.044	0.020	0.039	0.026	0.020	6255963
Dissolved Magnesium (Mg)	mg/L	73	0.20	65	36	0.20	6255963
Dissolved Manganese (Mn)	mg/L	0.65	0.0040	0.14	0.79	0.0040	6255963
Dissolved Molybdenum (Mo)	mg/L	0.0024	0.00020	0.0036	0.0019	0.00020	6258708
Dissolved Nickel (Ni)	mg/L	0.013	0.00050	0.0048	0.0030	0.00050	6258708
Dissolved Phosphorus (P)	mg/L	<0.10	0.10	0.10	0.87	0.10	6255963
Dissolved Potassium (K)	mg/L	3.3	0.30	5.4	13	0.30	6255963
Dissolved Selenium (Se)	mg/L	<0.00020	0.00020	<0.00020	0.0016	0.00020	6258708
Dissolved Silicon (Si)	mg/L	9.9	0.10	11	8.6	0.10	6255963
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	<0.00010	<0.00010	0.00010	6258708
Dissolved Sodium (Na)	mg/L	14	0.50	12	6.3	0.50	6255963
Dissolved Strontium (Sr)	mg/L	0.39	0.020	0.39	0.23	0.020	6255963
Dissolved Sulphur (S)	mg/L	9.8	0.20	9.9	16	0.20	6255963
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	<0.00020	<0.00020	0.00020	6258708
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	<0.0010	<0.0010	0.0010	6258708
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0010	<0.0010	0.0016	0.0010	6258708
Dissolved Uranium (U)	mg/L	0.0042	0.00010	0.0053	0.00049	0.00010	6258708
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	<0.0010	0.0026	0.0010	6258708
Dissolved Zinc (Zn)	mg/L	0.21	0.0030	0.0047	0.0078	0.0030	6258708

RDL = Reportable Detection Limit

Maxxam Job #: B292855
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

General Comments

Sample ES8643-01: Anion - Cation balance exceeds normal acceptance limits, major ions reanalyzed, possible matrix interference.

Results relate only to the items tested.

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report

Maxxam Job Number: CB292855

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6255963 PL	Matrix Spike	Dissolved Barium (Ba)	2012/10/15		97	%	80 - 120
		Dissolved Boron (B)	2012/10/15		98	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/15		101	%	80 - 120
		Dissolved Iron (Fe)	2012/10/15		99	%	80 - 120
		Dissolved Lithium (Li)	2012/10/15		95	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/15		91	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/15		96	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/15		107	%	80 - 120
		Dissolved Potassium (K)	2012/10/15		94	%	80 - 120
		Dissolved Silicon (Si)	2012/10/15		81	%	80 - 120
		Dissolved Sodium (Na)	2012/10/15		NC	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/15		95	%	80 - 120
	Spiked Blank	Dissolved Barium (Ba)	2012/10/15		98	%	80 - 120
		Dissolved Boron (B)	2012/10/15		102	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/15		108	%	80 - 120
		Dissolved Iron (Fe)	2012/10/15		103	%	80 - 120
		Dissolved Lithium (Li)	2012/10/15		98	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/15		101	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/15		101	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/15		103	%	80 - 120
		Dissolved Potassium (K)	2012/10/15		100	%	80 - 120
		Dissolved Silicon (Si)	2012/10/15		89	%	80 - 120
		Dissolved Sodium (Na)	2012/10/15		98	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/15		97	%	80 - 120
	Method Blank	Dissolved Barium (Ba)	2012/10/15	<0.010		mg/L	
		Dissolved Boron (B)	2012/10/15	<0.020		mg/L	
		Dissolved Calcium (Ca)	2012/10/15	<0.30		mg/L	
		Dissolved Iron (Fe)	2012/10/15	<0.060		mg/L	
		Dissolved Lithium (Li)	2012/10/15	<0.020		mg/L	
		Dissolved Magnesium (Mg)	2012/10/15	<0.20		mg/L	
		Dissolved Manganese (Mn)	2012/10/15	<0.0040		mg/L	
		Dissolved Phosphorus (P)	2012/10/15	<0.10		mg/L	
		Dissolved Potassium (K)	2012/10/15	<0.30		mg/L	
		Dissolved Silicon (Si)	2012/10/15	<0.10		mg/L	
		Dissolved Sodium (Na)	2012/10/15	<0.50		mg/L	
		Dissolved Strontium (Sr)	2012/10/15	<0.020		mg/L	
		Dissolved Sulphur (S)	2012/10/15	<0.20		mg/L	
	RPD	Dissolved Calcium (Ca)	2012/10/15	0.7		%	20
		Dissolved Iron (Fe)	2012/10/15	NC		%	20
		Dissolved Magnesium (Mg)	2012/10/15	0.3		%	20
		Dissolved Manganese (Mn)	2012/10/15	NC		%	20
		Dissolved Potassium (K)	2012/10/15	2.3		%	20
		Dissolved Sodium (Na)	2012/10/15	0.8		%	20
6258213 ZI	Matrix Spike	Dissolved Chloride (Cl)	2012/10/16		110	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2012/10/16		104	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2012/10/16	<1.0		mg/L	
	RPD	Dissolved Chloride (Cl)	2012/10/16	0.7		%	20
6258215 ZI	Matrix Spike	Dissolved Sulphate (SO4)	2012/10/16		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2012/10/16		103	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2012/10/16	<1.0		mg/L	
	RPD	Dissolved Sulphate (SO4)	2012/10/16	1.3		%	20
6258496 JLD	Spiked Blank	Alkalinity (Total as CaCO3)	2012/10/16		96	%	80 - 120
	Method Blank	Alkalinity (PP as CaCO3)	2012/10/16	<0.50		mg/L	
		Alkalinity (Total as CaCO3)	2012/10/16	<0.50		mg/L	
		Bicarbonate (HCO3)	2012/10/16	<0.50		mg/L	

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB292855

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6258496 JLD	Method Blank	Carbonate (CO3)	2012/10/16	<0.50		mg/L	
		Hydroxide (OH)	2012/10/16	<0.50		mg/L	
	RPD	Alkalinity (PP as CaCO3)	2012/10/16	NC		%	20
		Alkalinity (Total as CaCO3)	2012/10/16	0.5		%	20
		Bicarbonate (HCO3)	2012/10/16	0.5		%	20
		Carbonate (CO3)	2012/10/16	NC		%	20
		Hydroxide (OH)	2012/10/16	NC		%	20
6258522 JLD	Spiked Blank	Conductivity	2012/10/16		100	%	90 - 110
	Method Blank	Conductivity	2012/10/16	<1.0		uS/cm	
	RPD	Conductivity	2012/10/16	1.0		%	20
6258523 JLD	Spiked Blank	pH	2012/10/16		100	%	97 - 102
6258708 TDB	Matrix Spike						
	[ES8643-01]	Dissolved Aluminum (Al)	2012/10/16		117	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/16		89	%	80 - 120
		Dissolved Arsenic (As)	2012/10/16		95	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/16		96	%	80 - 120
		Dissolved Chromium (Cr)	2012/10/16		93	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/16		90	%	80 - 120
		Dissolved Copper (Cu)	2012/10/16		91	%	80 - 120
		Dissolved Lead (Pb)	2012/10/16		91	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/16		98	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/16		90	%	80 - 120
		Dissolved Selenium (Se)	2012/10/16		90	%	80 - 120
		Dissolved Silver (Ag)	2012/10/16		90	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/16		90	%	80 - 120
		Dissolved Tin (Sn)	2012/10/16		93	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/16		90	%	80 - 120
		Dissolved Uranium (U)	2012/10/16		96	%	80 - 120
		Dissolved Vanadium (V)	2012/10/16		98	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/16		NC	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2012/10/16		105	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/16		92	%	80 - 120
		Dissolved Arsenic (As)	2012/10/16		97	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/16		94	%	80 - 120
		Dissolved Chromium (Cr)	2012/10/16		97	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/16		96	%	80 - 120
		Dissolved Copper (Cu)	2012/10/16		98	%	80 - 120
		Dissolved Lead (Pb)	2012/10/16		95	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/16		95	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/16		98	%	80 - 120
		Dissolved Selenium (Se)	2012/10/16		97	%	80 - 120
		Dissolved Silver (Ag)	2012/10/16		91	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/16		91	%	80 - 120
		Dissolved Tin (Sn)	2012/10/16		94	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/16		98	%	80 - 120
		Dissolved Uranium (U)	2012/10/16		91	%	80 - 120
		Dissolved Vanadium (V)	2012/10/16		100	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/16		99	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2012/10/16	<0.0010		mg/L	
		Dissolved Antimony (Sb)	2012/10/16	<0.00060		mg/L	
		Dissolved Arsenic (As)	2012/10/16	<0.00020		mg/L	
		Dissolved Beryllium (Be)	2012/10/16	<0.0010		mg/L	
		Dissolved Chromium (Cr)	2012/10/16	<0.0010		mg/L	
		Dissolved Cobalt (Co)	2012/10/16	<0.00030		mg/L	
		Dissolved Copper (Cu)	2012/10/16	<0.00020		mg/L	

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB292855

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6258708 TDB	Method Blank	Dissolved Lead (Pb)	2012/10/16	<0.00020		mg/L	
		Dissolved Molybdenum (Mo)	2012/10/16	<0.00020		mg/L	
		Dissolved Nickel (Ni)	2012/10/16	<0.00050		mg/L	
		Dissolved Selenium (Se)	2012/10/16	<0.00020		mg/L	
		Dissolved Silver (Ag)	2012/10/16	<0.00010		mg/L	
		Dissolved Thallium (Tl)	2012/10/16	<0.00020		mg/L	
		Dissolved Tin (Sn)	2012/10/16	<0.0010		mg/L	
		Dissolved Titanium (Ti)	2012/10/16	<0.0010		mg/L	
		Dissolved Uranium (U)	2012/10/16	<0.00010		mg/L	
		Dissolved Vanadium (V)	2012/10/16	<0.0010		mg/L	
		Dissolved Zinc (Zn)	2012/10/16	<0.0030		mg/L	
	RPD [ES8643-01]	Dissolved Aluminum (Al)	2012/10/16	8.4		%	20
		Dissolved Antimony (Sb)	2012/10/16	NC		%	20
		Dissolved Arsenic (As)	2012/10/16	0.2		%	20
		Dissolved Beryllium (Be)	2012/10/16	NC		%	20
		Dissolved Chromium (Cr)	2012/10/16	NC		%	20
		Dissolved Cobalt (Co)	2012/10/16	NC		%	20
		Dissolved Copper (Cu)	2012/10/16	8.2		%	20
		Dissolved Lead (Pb)	2012/10/16	NC		%	20
		Dissolved Molybdenum (Mo)	2012/10/16	1.9		%	20
		Dissolved Nickel (Ni)	2012/10/16	0.9		%	20
		Dissolved Selenium (Se)	2012/10/16	NC		%	20
		Dissolved Silver (Ag)	2012/10/16	NC		%	20
		Dissolved Thallium (Tl)	2012/10/16	NC		%	20
		Dissolved Tin (Sn)	2012/10/16	NC		%	20
		Dissolved Titanium (Ti)	2012/10/16	NC		%	20
		Dissolved Uranium (U)	2012/10/16	3.0		%	20
		Dissolved Vanadium (V)	2012/10/16	NC		%	20
		Dissolved Zinc (Zn)	2012/10/16	0.9		%	20
6260175 GP4	Matrix Spike [ES8645-02]	1,4-Difluorobenzene (sur.)	2012/10/20		103	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		96	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		103	%	70 - 130
		Benzene	2012/10/20		84	%	70 - 130
		Toluene	2012/10/20		81	%	70 - 130
		Ethylbenzene	2012/10/20		83	%	70 - 130
		o-Xylene	2012/10/20		88	%	70 - 130
		m & p-Xylene	2012/10/20		84	%	70 - 130
		(C6-C10)	2012/10/20		95	%	70 - 130
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/20		104	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		97	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		105	%	70 - 130
		Benzene	2012/10/20		83	%	70 - 130
		Toluene	2012/10/20		80	%	70 - 130
		Ethylbenzene	2012/10/20		82	%	70 - 130
		o-Xylene	2012/10/20		88	%	70 - 130
		m & p-Xylene	2012/10/20		83	%	70 - 130
		(C6-C10)	2012/10/20		98	%	70 - 130
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/17		106	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/17		105	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/17		103	%	70 - 130
		Benzene	2012/10/17	<0.40		ug/L	
		Toluene	2012/10/17	<0.40		ug/L	
		Ethylbenzene	2012/10/17	<0.40		ug/L	
		o-Xylene	2012/10/17	<0.40		ug/L	

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB292855

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6260175 GP4	Method Blank	m & p-Xylene	2012/10/17	<0.80		ug/L	
		Xylenes (Total)	2012/10/17	<0.80		ug/L	
		F1 (C6-C10) - BTEX	2012/10/17	<100		ug/L	
		(C6-C10)	2012/10/17	<100		ug/L	
	RPD [ES8643-02]	Benzene	2012/10/17	NC		%	40
		Toluene	2012/10/17	NC		%	40
		Ethylbenzene	2012/10/17	NC		%	40
		o-Xylene	2012/10/17	NC		%	40
		m & p-Xylene	2012/10/17	NC		%	40
		Xylenes (Total)	2012/10/17	NC		%	40
		F1 (C6-C10) - BTEX	2012/10/17	NC		%	40
		(C6-C10)	2012/10/17	NC		%	40
6260602 NK3	Matrix Spike	O-TERPHENYL (sur.)	2012/10/18		103	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/18		104	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/18		98	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/18		89	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/18		55	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/18		94	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/18		75	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/18		101	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/18		87	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/18	<0.10		mg/L	
		F3 (C16-C34 Hydrocarbons)	2012/10/18	<0.10		mg/L	
		F4 (C34-C50 Hydrocarbons)	2012/10/18	<0.10		mg/L	
	RPD [ES8650-02]	F2 (C10-C16 Hydrocarbons)	2012/10/18	NC		%	40
		F3 (C16-C34 Hydrocarbons)	2012/10/18	NC		%	40
		F4 (C34-C50 Hydrocarbons)	2012/10/18	NC		%	40
6268139 JBX	Matrix Spike [ES8643-01]	Dissolved Nitrite (N)	2012/10/19		100	%	80 - 120
		Dissolved Nitrate (N)	2012/10/19		100	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2012/10/19		102	%	90 - 110
		Dissolved Nitrate (N)	2012/10/19		102	%	90 - 110
	Method Blank	Dissolved Nitrite (N)	2012/10/19	<0.0030		mg/L	
		Dissolved Nitrate (N)	2012/10/19	<0.0030		mg/L	
	RPD [ES8643-01]	Dissolved Nitrite (N)	2012/10/19	0.4		%	20
		Dissolved Nitrate (N)	2012/10/19	0.2		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B292855

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Janet Gao, Senior Analyst, Organics Department

Luba Shymushovska, Senior Analyst, Organic Department

Lili Zhou, Senior analyst, Inorganic department.

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Chain of Custody A014439

Page 1 of 1

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Gov't Services Canada - Natalie Robinson	Tetra Tech Joel Nolin
Contact:		
Address:	1650, 635 8th Ave SW, Calgary AB T2P 3M3	115 200 Rivercrest Dr SE Calgary AB T2C 2V6
Contact #s:	ph: 403-292-6982 fax: 403-860-4015	ph: 403-718-3210 c: 403-990-1361

Report Distribution (E-Mail): joel.nolin, andrew.eason, labresultsyyk@tetratech.com, troy.lange, krista.olafsson

REGULATORY GUIDELINES: ☐ AT1 ☑ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:

Project # / Name: 1018901603

Site Location: Lobstick Golf Course

Quote #:

Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity ↓	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs	☐BTEX F1	☐BTEX F1-F2	☑BTEX F1-F4	Routine Water ☐ Turb ☐ F	☐TOC	☐DOC	Regulated Metals (CCME / AT1) Total	Dissolved	☐ Total ☐ Dissolved Mercury	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH21		GW	12/10/10									✓	✓					✓		NO3 / NO2 ✓			2
2	BH-6																				Sample bottles lack "-" b/w "BH" and #			
3	BH-10																							
4	BH-9			12/10/11																				
5	BH24																							
6	BH-13																							
7	BH16		↓	↓									↓	↓					↓		↓			↓
8																								
9																								
10																								
11																								
12																								

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print)	Date (YY/MM/DD)	Time (24:00)	Received By:	Date:	Time:
Troy Lange	12/10/11	14:00			
Relinquished By (Signature/Print)	Date (YY/MM/DD)	Time (24:00)	JENELLE FELLER	2012/10/13	10:30

Special Instructions: 2nd Cooler with copy of COC

# of Jars Used & Not Submitted:

LAB USE ONLY

Maxxam Job #: B292855

Custody Seal	Temperature	Ice
Y	5.1 C	Y
	5.1 C	

Lab Comments:

AB ECD-00301 Feb01 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam

Success Through Science®

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A072026

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/10/29
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B293223
Received: 2012/10/15, 08:35

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	9	N/A	2012/10/20	AB SOP-00005	SM 2320-B
BTEX/F1 in Water by HS GC/MS	9	N/A	2012/10/19	AB SOP-00039	CCME, EPA 8260C
Cadmium - low level CCME - Dissolved	9	N/A	2012/10/18	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	9	N/A	2012/10/20	AB SOP-00020	EPA 325.2
Conductivity @25C	9	N/A	2012/10/20	AB SOP-00005	SM 2510-B
CCME Hydrocarbons (F2-F4 in water)	2	2012/10/17	2012/10/20	CAL SOP-00086 AB SOP-00037	EPA3510C/CCME PHCCWS
CCME Hydrocarbons (F2-F4 in water)	7	2012/10/17	2012/10/21	CAL SOP-00086 AB SOP-00037	EPA3510C/CCME PHCCWS
Hardness	9	N/A	2012/10/20	AB WI-00065	SM 2340B
Elements by ICP - Dissolved	9	N/A	2012/10/16	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	9	N/A	2012/10/17	AB SOP-00043	EPA 200.8
Ion Balance	9	N/A	2012/10/20	AB WI-00065	SM 1030E
Sum of cations, anions	9	N/A	2012/10/20	AB WI-00065	SM 1030E
Nitrate and Nitrite	9	N/A	2012/10/22	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	9	N/A	2012/10/22	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	9	N/A	2012/10/22	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	9	N/A	2012/10/20	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	9	N/A	2012/10/20	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Calculated)	9	N/A	2012/10/21	AB WI-00065	SM 1030E

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403) 291-3077

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A072026

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/10/29
This report supersedes all previous reports with the same Maxxam job number

CERTIFICATE OF ANALYSIS

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		ET1034	ET1034	ET1035	ET1036		ET1037		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/12		2012/10/11		
COC Number		A072026	A072026	A072026	A072026		A072026		
	UNITS	**BH14**	**BH14 Lab-Dup**	**BH19**	**BH18**	**RDL**	**BH12**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	1.4	0.10	6267020
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	6267020
F4 (C34-C50 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	6267020
Reached Baseline at C50	mg/L	Yes	Yes	Yes	Yes	N/A	Yes	N/A	6267020
Volatiles									
Benzene	ug/L	34	N/A	<0.40	<0.40	0.40	13000	40	6263950
Toluene	ug/L	<0.40	N/A	<0.40	<0.40	0.40	23000	40	6263950
Ethylbenzene	ug/L	1.4	N/A	<0.40	<0.40	0.40	1500	40	6263950
o-Xylene	ug/L	<0.40	N/A	<0.40	<0.40	0.40	2000	40	6263950
m & p-Xylene	ug/L	<0.80	N/A	<0.80	<0.80	0.80	6700	80	6263950
Xylenes (Total)	ug/L	<0.80	N/A	<0.80	<0.80	0.80	8700	80	6263950
F1 (C6-C10) - BTEX	ug/L	220	N/A	<100	<100	100	12000	10000	6263950
(C6-C10)	ug/L	260	N/A	<100	<100	100	59000	10000	6263950
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	107	N/A	108	107	N/A	105	N/A	6263950
4-BROMOFLUOROBENZENE (sur.)	%	95	N/A	94	95	N/A	97	N/A	6263950
D4-1,2-DICHLOROETHANE (sur.)	%	98	N/A	97	101	N/A	92	N/A	6263950
O-TERPHENYL (sur.)	%	103	93	93	93	N/A	80	N/A	6267020

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

AT1 BTEX AND F1-F4 IN WATER (WATER)

Maxxam ID		ET1038	ET1039	ET1040	ET1041		ET1042		
Sampling Date		2012/10/11	2012/10/11	2012/10/11	2012/10/11		2012/10/11		
COC Number		A072026	A072026	A072026	A072026		A072026		
	UNITS	**BH17**	**BH20**	**BH4**	**BH7**	**RDL**	**BH12 DUP**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	0.32	<0.10	<0.10	0.10	1.4	0.10	6267020
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	6267020
F4 (C34-C50 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	0.10	<0.10	0.10	6267020
Reached Baseline at C50	mg/L	Yes	Yes	Yes	Yes	N/A	Yes	N/A	6267020
Volatiles									
Benzene	ug/L	<0.40	80	<0.40	0.66	0.40	13000	40	6263950
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	23000	40	6263950
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	1500	40	6263950
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	0.40	2000	40	6263950
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	6600	80	6263950
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	<0.80	0.80	8600	80	6263950
F1 (C6-C10) - BTEX	ug/L	<100	1300	<100	<100	100	<10000	10000	6263950
(C6-C10)	ug/L	<100	1300	<100	<100	100	50000	10000	6263950
Surrogate Recovery (%)									
1,4-Difluorobenzene (sur.)	%	108	108	107	110	N/A	107	N/A	6263950
4-BROMOFLUOROBENZENE (sur.)	%	97	98	95	91	N/A	96	N/A	6263950
D4-1,2-DICHLOROETHANE (sur.)	%	106	91	101	100	N/A	99	N/A	6263950
O-TERPHENYL (sur.)	%	82	85	89	94	N/A	90	N/A	6267020

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ROUTINE WATER (WATER)

Maxxam ID		ET1034	ET1034		ET1035			ET1036		
Sampling Date		2012/10/13	2012/10/13		2012/10/13			2012/10/12		
COC Number		A072026	A072026		A072026			A072026		
	UNITS	**BH14**	**BH14 Lab-Dup**	**RDL**	**BH19**	**RDL**	**QC Batch**	**BH18**	**RDL**	**QC Batch**
Calculated Parameters										
Anion Sum	meq/L	11	N/A	N/A	13	N/A	6273033	11	N/A	6273033
Cation Sum	meq/L	12	N/A	N/A	14	N/A	6273033	12	N/A	6273033
Hardness (CaCO3)	mg/L	540	N/A	0.50	650	0.50	6272938	540	0.50	6272938
Ion Balance	N/A	1.1	N/A	0.010	1.0	0.010	6273032	1.0	0.010	6273032
Dissolved Nitrate (NO3)	mg/L	0.78	N/A	0.013	30	0.013	6272939	20	0.013	6272939
Nitrate plus Nitrite (N)	mg/L	0.18	N/A	0.0030	6.8	0.0030	6272636	4.6	0.0030	6272636
Dissolved Nitrite (NO2)	mg/L	<0.0099	N/A	0.0099	0.13	0.0099	6272939	<0.0099	0.0099	6272939
Total Dissolved Solids	mg/L	540	N/A	10	660	10	6271920	570	10	6273125
Misc. Inorganics										
Conductivity	uS/cm	940	950	1.0	1100	1.0	6273942	960	1.0	6273942
pH	N/A	7.65	7.69	N/A	7.75	N/A	6273943	7.73 (1)	N/A	6273943
Anions										
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	6273941	<0.50	0.50	6273941
Alkalinity (Total as CaCO3)	mg/L	500	500	0.50	560	0.50	6273941	470	0.50	6273941
Bicarbonate (HCO3)	mg/L	610	610	0.50	690	0.50	6273941	570	0.50	6273941
Carbonate (CO3)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	6273941	<0.50	0.50	6273941
Hydroxide (OH)	mg/L	<0.50	<0.50	0.50	<0.50	0.50	6273941	<0.50	0.50	6273941
Dissolved Sulphate (SO4)	mg/L	16	N/A	1.0	43 (2)	2.0	6273993	36	1.0	6273993
Dissolved Chloride (Cl)	mg/L	21	N/A	1.0	24	1.0	6273991	26	1.0	6273991
Nutrients										
Dissolved Nitrite (N)	mg/L	<0.0030	<0.0030	0.0030	0.041	0.0030	6278532	<0.0030	0.0030	6278532
Dissolved Nitrate (N)	mg/L	0.18	0.19	0.0030	6.8	0.0030	6278532	4.6	0.0030	6278532

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) Sample analysis requested and approved past method-specified hold time.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ROUTINE WATER (WATER)

Maxxam ID		ET1037		ET1038		ET1039		
Sampling Date		2012/10/11		2012/10/11		2012/10/11		
COC Number		A072026		A072026		A072026		
	UNITS	**BH12**	**RDL**	**BH17**	**RDL**	**BH20**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	meq/L	16	N/A	11	N/A	12	N/A	6273033
Cation Sum	meq/L	15	N/A	12	N/A	13	N/A	6273033
Hardness (CaCO3)	mg/L	700	0.50	550	0.50	600	0.50	6272938
Ion Balance	N/A	0.99	0.010	1.0	0.010	1.0	0.010	6273032
Dissolved Nitrate (NO3)	mg/L	0.082	0.013	0.025	0.013	0.020	0.013	6272939
Nitrate plus Nitrite (N)	mg/L	0.019	0.0030	0.0060	0.0030	0.0050	0.0030	6272636
Dissolved Nitrite (NO2)	mg/L	<0.0099	0.0099	<0.0099	0.0099	<0.0099	0.0099	6272939
Total Dissolved Solids	mg/L	740	10	560	10	600	10	6273125
Misc. Inorganics								
Conductivity	uS/cm	1300	1.0	980	1.0	1000	1.0	6273942
pH	N/A	7.30 (1)	N/A	7.53 (1)	N/A	7.36 (1)	N/A	6273943
Anions								
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6273941
Alkalinity (Total as CaCO3)	mg/L	740	0.50	530	0.50	550	0.50	6273941
Bicarbonate (HCO3)	mg/L	900	0.50	640	0.50	670	0.50	6273941
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6273941
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	0.50	<0.50	0.50	6273941
Dissolved Sulphate (SO4)	mg/L	<1.0	1.0	40 (2)	2.0	22	1.0	6273993
Dissolved Chloride (Cl)	mg/L	29	1.0	5.6	1.0	25	1.0	6273991
Nutrients								
Dissolved Nitrite (N)	mg/L	<0.0030	0.0030	<0.0030	0.0030	<0.0030	0.0030	6278532
Dissolved Nitrate (N)	mg/L	0.019	0.0030	0.0057	0.0030	0.0045	0.0030	6278532

RDL = Reportable Detection Limit
(1) Sample analysis requested and approved past method-specified hold time.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ROUTINE WATER (WATER)

Maxxam ID		ET1040		ET1041	ET1042		
Sampling Date		2012/10/11		2012/10/11	2012/10/11		
COC Number		A072026		A072026	A072026		
	UNITS	**BH4**	**RDL**	**BH7**	**BH12 DUP**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	meq/L	12	N/A	9.0	16	N/A	6273033
Cation Sum	meq/L	13	N/A	9.7	15	N/A	6273033
Hardness (CaCO3)	mg/L	570	0.50	440	690	0.50	6272938
Ion Balance	N/A	1.0	0.010	1.1	0.97	0.010	6273032
Dissolved Nitrate (NO3)	mg/L	8.6	0.013	13	0.021	0.013	6272939
Nitrate plus Nitrite (N)	mg/L	1.9	0.0030	3.2	0.0050	0.0030	6273124
Dissolved Nitrite (NO2)	mg/L	<0.0099	0.0099	0.95	<0.0099	0.0099	6272939
Total Dissolved Solids	mg/L	650	10	470	740	10	6273125
Misc. Inorganics							
Conductivity	uS/cm	1100	1.0	810	1300	1.0	6273942
pH	N/A	7.38 (1)	N/A	7.48 (1)	7.31 (1)	N/A	6273943
Anions							
Alkalinity (PP as CaCO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6273941
Alkalinity (Total as CaCO3)	mg/L	530	0.50	390	740	0.50	6273941
Bicarbonate (HCO3)	mg/L	650	0.50	470	910	0.50	6273941
Carbonate (CO3)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6273941
Hydroxide (OH)	mg/L	<0.50	0.50	<0.50	<0.50	0.50	6273941
Dissolved Sulphate (SO4)	mg/L	42 (2)	2.0	21	<1.0	1.0	6273993
Dissolved Chloride (Cl)	mg/L	27	1.0	19	29	1.0	6273991
Nutrients							
Dissolved Nitrite (N)	mg/L	<0.0030	0.0030	0.29	<0.0030	0.0030	6278532
Dissolved Nitrate (N)	mg/L	1.9	0.0030	2.9	0.0048	0.0030	6278532

RDL = Reportable Detection Limit
(1) Sample analysis requested and approved past method-specified hold time.
(2) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		ET1034		ET1035	ET1036	ET1036	ET1037		
Sampling Date		2012/10/13		2012/10/13	2012/10/12	2012/10/12	2012/10/11		
COC Number		A072026		A072026	A072026	A072026	A072026		
	UNITS	**BH14**	**QC Batch**	**BH19**	**BH18**	**BH18 Lab-Dup**	**BH12**	**RDL**	**QC Batch**
Low Level Elements									
Dissolved Cadmium (Cd)	ug/L	0.20	6259185	0.092	0.12	N/A	0.039	0.0050	6260027
Elements									
Dissolved Aluminum (Al)	mg/L	0.0079	6260601	0.0036	0.0024	N/A	0.0018	0.0010	6260601
Dissolved Antimony (Sb)	mg/L	<0.00060	6260601	<0.00060	<0.00060	N/A	<0.00060	0.00060	6260601
Dissolved Arsenic (As)	mg/L	0.00052	6260601	0.00023	0.00030	N/A	0.0029	0.00020	6260601
Dissolved Barium (Ba)	mg/L	0.17	6259161	0.16	0.17	0.17	0.18	0.010	6259161
Dissolved Beryllium (Be)	mg/L	<0.0010	6260601	<0.0010	<0.0010	N/A	<0.0010	0.0010	6260601
Dissolved Boron (B)	mg/L	0.029	6259161	0.055	0.042	0.041	0.031	0.020	6259161
Dissolved Calcium (Ca)	mg/L	140	6259161	120	140	140	170	0.30	6259161
Dissolved Chromium (Cr)	mg/L	0.0098	6260601	<0.0010	0.0016	N/A	<0.0010	0.0010	6260601
Dissolved Cobalt (Co)	mg/L	0.00067	6260601	<0.00030	<0.00030	N/A	0.0031	0.00030	6260601
Dissolved Copper (Cu)	mg/L	0.0024	6260601	0.0020	0.0026	N/A	0.0013	0.00020	6260601
Dissolved Iron (Fe)	mg/L	<0.060	6259161	<0.060	<0.060	<0.060	0.83	0.060	6259161
Dissolved Lead (Pb)	mg/L	0.00020	6260601	<0.00020	<0.00020	N/A	0.00021	0.00020	6260601
Dissolved Lithium (Li)	mg/L	0.025	6259161	0.087	0.029	0.030	0.038	0.020	6259161
Dissolved Magnesium (Mg)	mg/L	46	6259161	84	44	43	69	0.20	6259161
Dissolved Manganese (Mn)	mg/L	0.53	6259161	0.047	0.011	0.011	2.6	0.0040	6259161
Dissolved Molybdenum (Mo)	mg/L	0.0045	6260601	0.013	0.015	N/A	0.0053	0.00020	6260601
Dissolved Nickel (Ni)	mg/L	0.0071	6260601	0.0033	0.0026	N/A	0.021	0.00050	6260601
Dissolved Phosphorus (P)	mg/L	<0.10	6259161	<0.10	<0.10	<0.10	<0.10	0.10	6259161
Dissolved Potassium (K)	mg/L	4.9	6259161	6.1	5.0	5.0	3.8	0.30	6259161
Dissolved Selenium (Se)	mg/L	0.00025	6260601	0.00064	<0.00020	N/A	0.0018	0.00020	6260601
Dissolved Silicon (Si)	mg/L	12	6259161	9.8	11	11	10	0.10	6259161
Dissolved Silver (Ag)	mg/L	<0.00010	6260601	<0.00010	<0.00010	N/A	<0.00010	0.00010	6260601
Dissolved Sodium (Na)	mg/L	14	6259161	10	16	15	29	0.50	6259161
Dissolved Strontium (Sr)	mg/L	0.21	6259161	0.54	0.28	0.28	0.33	0.020	6259161
Dissolved Sulphur (S)	mg/L	4.5	6259161	13	11	11	5.3	0.20	6259161
Dissolved Thallium (Tl)	mg/L	<0.00020	6260601	<0.00020	<0.00020	N/A	<0.00020	0.00020	6260601
Dissolved Tin (Sn)	mg/L	<0.0010	6260601	<0.0010	<0.0010	N/A	<0.0010	0.0010	6260601
Dissolved Titanium (Ti)	mg/L	<0.0010	6260601	<0.0010	<0.0010	N/A	<0.0010	0.0010	6260601
Dissolved Uranium (U)	mg/L	0.0036	6260601	0.017	0.0064	N/A	0.0053	0.00010	6260601

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		ET1034		ET1035	ET1036	ET1036	ET1037		
Sampling Date		2012/10/13		2012/10/13	2012/10/12	2012/10/12	2012/10/11		
COC Number		A072026		A072026	A072026	A072026	A072026		
	UNITS	**BH14**	**QC Batch**	**BH19**	**BH18**	**BH18 Lab-Dup**	**BH12**	**RDL**	**QC Batch**
Dissolved Vanadium (V)	mg/L	<0.0010	6260601	<0.0010	<0.0010	N/A	<0.0010	0.0010	6260601
Dissolved Zinc (Zn)	mg/L	0.0053	6260601	0.0072	0.0066	N/A	0.0049	0.0030	6260601

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		ET1038	ET1039	ET1040	ET1041	ET1042		
Sampling Date		2012/10/11	2012/10/11	2012/10/11	2012/10/11	2012/10/11		
COC Number		A072026	A072026	A072026	A072026	A072026		
	UNITS	**BH17**	**BH20**	**BH4**	**BH7**	**BH12 DUP**	**RDL**	**QC Batch**
Low Level Elements								
Dissolved Cadmium (Cd)	ug/L	0.019	0.061	0.19	0.17	0.040	0.0050	6260027
Elements								
Dissolved Aluminum (Al)	mg/L	0.0030	0.0048	0.0058	0.0013	0.0017	0.0010	6260601
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	6260601
Dissolved Arsenic (As)	mg/L	0.00042	0.0018	0.00046	0.00042	0.0028	0.00020	6260601
Dissolved Barium (Ba)	mg/L	0.098	0.24	0.32	0.20	0.17	0.010	6259161
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6260601
Dissolved Boron (B)	mg/L	0.088	0.022	0.055	0.063	0.032	0.020	6259161
Dissolved Calcium (Ca)	mg/L	120	150	150	120	160	0.30	6259161
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6260601
Dissolved Cobalt (Co)	mg/L	0.00092	0.0067	0.00069	<0.00030	0.0031	0.00030	6260601
Dissolved Copper (Cu)	mg/L	0.00037	0.00079	0.0094	0.0060	0.0015	0.00020	6260601
Dissolved Iron (Fe)	mg/L	0.67	2.9	<0.060	<0.060	0.82	0.060	6259161
Dissolved Lead (Pb)	mg/L	<0.00020	0.00080	0.00022	<0.00020	0.00020	0.00020	6260601
Dissolved Lithium (Li)	mg/L	0.090	0.021	<0.020	<0.020	0.041	0.020	6259161
Dissolved Magnesium (Mg)	mg/L	62	54	46	31	68	0.20	6259161
Dissolved Manganese (Mn)	mg/L	0.37	1.6	1.1	0.10	2.6	0.0040	6259161
Dissolved Molybdenum (Mo)	mg/L	0.0055	0.0036	0.00095	0.0021	0.0048	0.00020	6260601
Dissolved Nickel (Ni)	mg/L	0.0057	0.019	0.013	0.0063	0.021	0.00050	6260601
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6259161
Dissolved Potassium (K)	mg/L	6.7	4.7	41	18	3.7	0.30	6259161
Dissolved Selenium (Se)	mg/L	0.0015	0.00028	0.00066	<0.00020	0.0022	0.00020	6260601
Dissolved Silicon (Si)	mg/L	9.2	10	8.5	8.6	10	0.10	6259161
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	6260601
Dissolved Sodium (Na)	mg/L	16	8.4	11	11	29	0.50	6259161
Dissolved Strontium (Sr)	mg/L	0.42	0.22	0.25	0.17	0.32	0.020	6259161
Dissolved Sulphur (S)	mg/L	16	6.5	14	6.7	4.7	0.20	6259161
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6260601
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6260601
Dissolved Titanium (Ti)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6260601
Dissolved Uranium (U)	mg/L	0.013	0.0032	0.0035	0.0016	0.0054	0.00010	6260601
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6260601

RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

REGULATED METALS (CCME/AT1) - DISSOLVED

Maxxam ID		ET1038	ET1039	ET1040	ET1041	ET1042		
Sampling Date		2012/10/11	2012/10/11	2012/10/11	2012/10/11	2012/10/11		
COC Number		A072026	A072026	A072026	A072026	A072026		
	UNITS	**BH17**	**BH20**	**BH4**	**BH7**	**BH12 DUP**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.0040	0.0062	0.0039	0.039	0.0065	0.0030	6260601

RDL = Reportable Detection Limit

Maxxam Job #: B293223
Report Date: 2012/10/29

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

AT1 BTEX AND F1-F4 IN WATER (WATER) Comments

Sample ET1037-02 BTEX/F1 in Water by HS GC/MS: Detection limits raised due to dilution to bring analyte within the calibrated range.

Sample ET1042-02 BTEX/F1 in Water by HS GC/MS: Detection limits raised due to dilution to bring analyte within the calibrated range.

Results relate only to the items tested.

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report

Maxxam Job Number: CB293223

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6259161 PL	Matrix Spike						
	[ET1036-01]	Dissolved Barium (Ba)	2012/10/16		95	%	80 - 120
		Dissolved Boron (B)	2012/10/16		100	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/16		NC	%	80 - 120
		Dissolved Iron (Fe)	2012/10/16		97	%	80 - 120
		Dissolved Lithium (Li)	2012/10/16		97	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/16		98	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/16		99	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/16		112	%	80 - 120
		Dissolved Potassium (K)	2012/10/16		103	%	80 - 120
		Dissolved Silicon (Si)	2012/10/16		NC	%	80 - 120
		Dissolved Sodium (Na)	2012/10/16		102	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/16		96	%	80 - 120
	Spiked Blank	Dissolved Barium (Ba)	2012/10/16		94	%	80 - 120
		Dissolved Boron (B)	2012/10/16		100	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/16		110	%	80 - 120
		Dissolved Iron (Fe)	2012/10/16		99	%	80 - 120
		Dissolved Lithium (Li)	2012/10/16		97	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/16		105	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/16		101	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/16		107	%	80 - 120
		Dissolved Potassium (K)	2012/10/16		105	%	80 - 120
		Dissolved Silicon (Si)	2012/10/16		89	%	80 - 120
		Dissolved Sodium (Na)	2012/10/16		104	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/16		96	%	80 - 120
	Method Blank	Dissolved Barium (Ba)	2012/10/16	<0.010		mg/L	
		Dissolved Boron (B)	2012/10/16	<0.020		mg/L	
		Dissolved Calcium (Ca)	2012/10/16	<0.30		mg/L	
		Dissolved Iron (Fe)	2012/10/16	<0.060		mg/L	
		Dissolved Lithium (Li)	2012/10/16	<0.020		mg/L	
		Dissolved Magnesium (Mg)	2012/10/16	<0.20		mg/L	
		Dissolved Manganese (Mn)	2012/10/16	<0.0040		mg/L	
		Dissolved Phosphorus (P)	2012/10/16	<0.10		mg/L	
		Dissolved Potassium (K)	2012/10/16	<0.30		mg/L	
		Dissolved Silicon (Si)	2012/10/16	<0.10		mg/L	
		Dissolved Sodium (Na)	2012/10/16	<0.50		mg/L	
		Dissolved Strontium (Sr)	2012/10/16	<0.020		mg/L	
		Dissolved Sulphur (S)	2012/10/16	<0.20		mg/L	
	RPD [ET1036-01]	Dissolved Barium (Ba)	2012/10/16	0.4		%	20
		Dissolved Boron (B)	2012/10/16	NC		%	20
		Dissolved Calcium (Ca)	2012/10/16	0.4		%	20
		Dissolved Iron (Fe)	2012/10/16	NC		%	20
		Dissolved Lithium (Li)	2012/10/16	NC		%	20
		Dissolved Magnesium (Mg)	2012/10/16	0.5		%	20
		Dissolved Manganese (Mn)	2012/10/16	NC		%	20
		Dissolved Phosphorus (P)	2012/10/16	NC		%	20
		Dissolved Potassium (K)	2012/10/16	0.7		%	20
		Dissolved Silicon (Si)	2012/10/16	1.5		%	20
		Dissolved Sodium (Na)	2012/10/16	7.3		%	20
		Dissolved Strontium (Sr)	2012/10/16	0.8		%	20
		Dissolved Sulphur (S)	2012/10/16	2.0		%	20
6260601 MB5	Matrix Spike	Dissolved Aluminum (Al)	2012/10/17		NC	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/17		92	%	80 - 120
		Dissolved Arsenic (As)	2012/10/17		102	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/17		96	%	80 - 120

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB293223

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6260601 MB5	Matrix Spike	Dissolved Chromium (Cr)	2012/10/17		94	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/17		91	%	80 - 120
		Dissolved Copper (Cu)	2012/10/17		89	%	80 - 120
		Dissolved Lead (Pb)	2012/10/17		83	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/17		NC	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/17		93	%	80 - 120
		Dissolved Selenium (Se)	2012/10/17		101	%	80 - 120
		Dissolved Silver (Ag)	2012/10/17		82	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/17		86	%	80 - 120
		Dissolved Tin (Sn)	2012/10/17		83	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/17		101	%	80 - 120
		Dissolved Uranium (U)	2012/10/17		97	%	80 - 120
		Dissolved Vanadium (V)	2012/10/17		NC	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/17		90	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2012/10/17		117	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/17		110	%	80 - 120
		Dissolved Arsenic (As)	2012/10/17		114	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/17		112	%	80 - 120
		Dissolved Chromium (Cr)	2012/10/17		111	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/17		108	%	80 - 120
		Dissolved Copper (Cu)	2012/10/17		110	%	80 - 120
		Dissolved Lead (Pb)	2012/10/17		113	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/17		113	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/17		112	%	80 - 120
		Dissolved Selenium (Se)	2012/10/17		114	%	80 - 120
		Dissolved Silver (Ag)	2012/10/17		104	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/17		110	%	80 - 120
		Dissolved Tin (Sn)	2012/10/17		114	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/17		113	%	80 - 120
		Dissolved Uranium (U)	2012/10/17		115	%	80 - 120
		Dissolved Vanadium (V)	2012/10/17		113	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/17		113	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2012/10/17	<0.0010		mg/L	
		Dissolved Antimony (Sb)	2012/10/17	<0.00060		mg/L	
		Dissolved Arsenic (As)	2012/10/17	<0.00020		mg/L	
		Dissolved Beryllium (Be)	2012/10/17	<0.0010		mg/L	
		Dissolved Chromium (Cr)	2012/10/17	<0.0010		mg/L	
		Dissolved Cobalt (Co)	2012/10/17	<0.00030		mg/L	
		Dissolved Copper (Cu)	2012/10/17	<0.00020		mg/L	
		Dissolved Lead (Pb)	2012/10/17	<0.00020		mg/L	
		Dissolved Molybdenum (Mo)	2012/10/17	0.00024, RDL=0.00020		mg/L	
		Dissolved Nickel (Ni)	2012/10/17	<0.00050		mg/L	
		Dissolved Selenium (Se)	2012/10/17	<0.00020		mg/L	
		Dissolved Silver (Ag)	2012/10/17	<0.00010		mg/L	
		Dissolved Thallium (Tl)	2012/10/17	<0.00020		mg/L	
		Dissolved Tin (Sn)	2012/10/17	<0.0010		mg/L	
		Dissolved Titanium (Ti)	2012/10/17	<0.0010		mg/L	
		Dissolved Uranium (U)	2012/10/17	<0.00010		mg/L	
		Dissolved Vanadium (V)	2012/10/17	<0.0010		mg/L	
		Dissolved Zinc (Zn)	2012/10/17	<0.0030		mg/L	
	RPD	Dissolved Aluminum (Al)	2012/10/17	0.6		%	20
		Dissolved Antimony (Sb)	2012/10/17	NC		%	20
		Dissolved Arsenic (As)	2012/10/17	0.8		%	20
		Dissolved Beryllium (Be)	2012/10/17	NC		%	20
		Dissolved Chromium (Cr)	2012/10/17	NC		%	20

TETRA TECH
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Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB293223

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6260601 MB5	RPD	Dissolved Cobalt (Co)	2012/10/17	NC		%	20
		Dissolved Copper (Cu)	2012/10/17	NC		%	20
		Dissolved Lead (Pb)	2012/10/17	NC		%	20
		Dissolved Molybdenum (Mo)	2012/10/17	0.2		%	20
		Dissolved Nickel (Ni)	2012/10/17	2.0		%	20
		Dissolved Selenium (Se)	2012/10/17	1.4		%	20
		Dissolved Silver (Ag)	2012/10/17	NC		%	20
		Dissolved Thallium (Tl)	2012/10/17	NC		%	20
		Dissolved Tin (Sn)	2012/10/17	NC		%	20
		Dissolved Titanium (Ti)	2012/10/17	NC		%	20
		Dissolved Uranium (U)	2012/10/17	2.0		%	20
		Dissolved Vanadium (V)	2012/10/17	0.8		%	20
		Dissolved Zinc (Zn)	2012/10/17	NC		%	20
6263950 GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/19		104	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/19		101	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/19		96	%	70 - 130
		Benzene	2012/10/19		89	%	70 - 130
		Toluene	2012/10/19		99	%	70 - 130
		Ethylbenzene	2012/10/19		94	%	70 - 130
		o-Xylene	2012/10/19		94	%	70 - 130
		m & p-Xylene	2012/10/19		93	%	70 - 130
		(C6-C10)	2012/10/19		88	%	70 - 130
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/19		103	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/19		102	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/19		113	%	70 - 130
		Benzene	2012/10/19		84	%	70 - 130
		Toluene	2012/10/19		96	%	70 - 130
		Ethylbenzene	2012/10/19		93	%	70 - 130
		o-Xylene	2012/10/19		91	%	70 - 130
		m & p-Xylene	2012/10/19		91	%	70 - 130
		(C6-C10)	2012/10/19		86	%	70 - 130
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/19		110	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/19		93	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/19		101	%	70 - 130
		Benzene	2012/10/19	<0.40		ug/L	
		Toluene	2012/10/19	<0.40		ug/L	
		Ethylbenzene	2012/10/19	<0.40		ug/L	
		o-Xylene	2012/10/19	<0.40		ug/L	
		m & p-Xylene	2012/10/19	<0.80		ug/L	
		Xylenes (Total)	2012/10/19	<0.80		ug/L	
		F1 (C6-C10) - BTEX	2012/10/19	<100		ug/L	
		(C6-C10)	2012/10/19	<100		ug/L	
	RPD	Benzene	2012/10/19	NC		%	40
		Toluene	2012/10/19	NC		%	40
		Ethylbenzene	2012/10/19	3.0		%	40
		o-Xylene	2012/10/19	1.9		%	40
		m & p-Xylene	2012/10/19	2.5		%	40
		Xylenes (Total)	2012/10/19	2.4		%	40
		F1 (C6-C10) - BTEX	2012/10/19	18.8		%	40
		(C6-C10)	2012/10/19	15.7		%	40
6267020 JP0	Matrix Spike [ET1042-02]	O-TERPHENYL (sur.)	2012/10/20		104	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		NC	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		130	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		126	%	50 - 130

TETRA TECH
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Quality Assurance Report (Continued)

Maxxam Job Number: CB293223

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6267020 JP0	Spiked Blank	O-TERPHENYL (sur.)	2012/10/20		103	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		99	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		96	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		99	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/20		103	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20	<0.10		mg/L	
		F3 (C16-C34 Hydrocarbons)	2012/10/20	<0.10		mg/L	
		F4 (C34-C50 Hydrocarbons)	2012/10/20	<0.10		mg/L	
	RPD [ET1034-02]	F2 (C10-C16 Hydrocarbons)	2012/10/21	NC		%	40
		F3 (C16-C34 Hydrocarbons)	2012/10/21	NC		%	40
		F4 (C34-C50 Hydrocarbons)	2012/10/21	NC		%	40
6273941 BE3	Spiked Blank	Alkalinity (Total as CaCO3)	2012/10/20		97	%	80 - 120
	Method Blank	Alkalinity (PP as CaCO3)	2012/10/20	<0.50		mg/L	
		Alkalinity (Total as CaCO3)	2012/10/20	<0.50		mg/L	
		Bicarbonate (HCO3)	2012/10/20	<0.50		mg/L	
		Carbonate (CO3)	2012/10/20	<0.50		mg/L	
		Hydroxide (OH)	2012/10/20	<0.50		mg/L	
	RPD [ET1034-01]	Alkalinity (PP as CaCO3)	2012/10/20	NC		%	20
		Alkalinity (Total as CaCO3)	2012/10/20	0.3		%	20
		Bicarbonate (HCO3)	2012/10/20	0.3		%	20
		Carbonate (CO3)	2012/10/20	NC		%	20
		Hydroxide (OH)	2012/10/20	NC		%	20
6273942 BE3	Spiked Blank	Conductivity	2012/10/20		100	%	90 - 110
	Method Blank	Conductivity	2012/10/20	<1.0		uS/cm	
	RPD [ET1034-01]	Conductivity	2012/10/20	1.7		%	20
6273943 BE3	Spiked Blank	pH	2012/10/20		100	%	97 - 102
	RPD [ET1034-01]	pH	2012/10/20	0.5		%	5
6273991 RK6	Matrix Spike	Dissolved Chloride (Cl)	2012/10/20		106	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2012/10/20		110	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2012/10/20	<1.0		mg/L	
	RPD	Dissolved Chloride (Cl)	2012/10/20	NC		%	20
6273993 RK6	Matrix Spike	Dissolved Sulphate (SO4)	2012/10/20		NC (1)	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2012/10/20		98	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2012/10/20	<1.0		mg/L	
	RPD	Dissolved Sulphate (SO4)	2012/10/20	0.3		%	20
6278532 JBX	Matrix Spike						
	[ET1034-01]	Dissolved Nitrite (N)	2012/10/22		102	%	80 - 120
		Dissolved Nitrate (N)	2012/10/22		103	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2012/10/22		101	%	90 - 110
		Dissolved Nitrate (N)	2012/10/22		103	%	90 - 110
	Method Blank	Dissolved Nitrite (N)	2012/10/22	<0.0030		mg/L	
		Dissolved Nitrate (N)	2012/10/22	<0.0030		mg/L	
	RPD [ET1034-01]	Dissolved Nitrite (N)	2012/10/22	NC		%	20
		Dissolved Nitrate (N)	2012/10/22	7.2		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.
(1) The recovery in the matrix spike was not calculated (NC). Spiked concentration was less than 2x that native concentration of the sample.

Validation Signature Page

Maxxam Job #: B293223

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Scientific Specialist

Janet Gao, Senior Analyst, Organics Department

Lili Zhou, Senior analyst, Inorganic department.

Michael Sheppard, Organics Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Calgary: 4000-19th St NE, T2E 6P8, Ph: (403) 291-3077, Fax: (403) 291-2132, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4, Ph: (780) 577-7100, Fax: (780) 450-1180, Toll free: (877) 555-5999
www.maxxamanalytics.com

Chain of Custody A072026

Page: 1 of 1

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Govt Services Canada - Natalie Robinson	Tetra Tech	joel.nolan@tetratech.com
Contact:		Joel Nolan	andrew.eason@tetratech.com
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr, SE Calgary	laboresults@tetratech.com
	Prov: PO: T2P 3M3	Prov: AB PO: T2P 2V6	traylorage@tetratech.com
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4108	Ph: 403-718-3216 Cell: 403-990-1300	krista.olafson@tetratech.com

REGULATORY GUIDELINES: ☐ AT1 ☒ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 90 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 101-9901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: KOLA

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐BTEX F1	☐BTEX F1-F2	☒BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Regulated Metals (CCME / AT1) Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH14		GW	12/10/13								X					X					8
2	BH19			12/10/13																		8
3	BH18			12/10/12																		8
4	BH12			12/10/11																		8
5	BH17			12/10/11																		8
6	BH20			12/10/11																		8
7	BH4			12/10/11																		8
8	BH7			12/10/11																		8
9	~~BH12~~ BH12 NUP		GW	12/10/11																		8
10																						
11																						
12																						

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Krista Olafson	13/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Analyze; Do not Hold

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B293223
Gabriel Regpot	13/10/15		Custody Seal: N
Lab Comments: Melissa Pare MELISSA PARÉ 2013/10/16 8:35			Temperature: 2.2, 5.0, 5.1 / 10.0, 9.6, 9.9 / 9.3, 9.6, 9.9 / 2.4, 5.6, 6.9 / 10.0, 2.1, 13.1
			Ice: Y / Y

AB FCD-00331 Rev3 2010-06

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Success Through Science®

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Your C.O.C. #: A073649, A073650, A073644, A014440, A073648, A073645, A073646, A073647

Report Date: 2012/11/06

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B293234
Received: 2012/10/15, 15:00

Sample Matrix: Soil
Samples Received: 30

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 by HS GC/MS (MeOH extract)	2	2012/10/17	2012/10/19	AB SOP-00039	CCME, EPA 8260C
BTEX/F1 by HS GC/MS (MeOH extract)	7	2012/10/17	2012/10/20	AB SOP-00039	CCME, EPA 8260C
BTEX/F1 by HS GC/MS (MeOH extract)	4	2012/10/18	2012/10/20	AB SOP-00039	CCME, EPA 8260C
BTEX/F1 by HS GC/MS (MeOH extract)	12	2012/10/19	2012/10/24	AB SOP-00039	CCME, EPA 8260C
BTEX/F1 by HS GC/MS (MeOH extract)	1	2012/10/19	2012/10/31	AB SOP-00039	CCME, EPA 8260C
CCME Hydrocarbons (F2-F4 in soil) (1)	8	2012/10/17	2012/10/20	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil) (1)	1	2012/10/17	2012/10/22	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil) (1)	4	2012/10/18	2012/10/20	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil)	12	2012/10/19	2012/10/22	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
CCME Hydrocarbons (F2-F4 in soil)	1	2012/10/19	2012/10/24	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
Fraction of Organic Carbon	4	N/A	2012/11/01	Calc	
Moisture	9	N/A	2012/10/18	AB SOP-00002	CCME PHC-CWS
Moisture	4	N/A	2012/10/19	AB SOP-00002	CCME PHC-CWS
Moisture	12	N/A	2012/10/20	AB SOP-00002	CCME PHC-CWS
Moisture	1	N/A	2012/10/22	AB SOP-00002	CCME PHC-CWS
Total Organic Carbon LECO Method	4	2012/10/31	2012/10/31	CAL SOP-00243	LECO# 203-821-170
Texture by Hydrometer	4	N/A	2012/10/23	AB SOP-00030	SSMA CH55.3
Texture Class	4	N/A	2012/10/23	AB SOP-00030	SSMA CH55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Edmonton Environmental

../2

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Your C.O.C. #: A073649, A073650, A073644, A014440, A073648, A073645, A073646, A073647

Report Date: 2012/11/06

CERTIFICATE OF ANALYSIS

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403) 291-3077

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		ET1089	ET1090	ET1090	ET1091	ET1092	ET1093		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-4.75**	**BH30-12-5.2**	**BH30-12-5.2 Lab-Dup**	**BH30-12-5.9**	**BH30-12-6.6**	**BH30-12-6.8**	**RDL**	**QC Batch**
Physical Properties									
Moisture	%	9.7	9.0	9.5	11	17	16	0.30	6273924

RDL = Reportable Detection Limit

Maxxam ID		ET1094	ET1095	ET1096	ET1097	ET1098	ET1099		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-7.6**	**BH30-12-8.0**	**BH31-12-1.5**	**BH31-12-3.0**	**BH31-12-3.75**	**BH31-12-4.5**	**RDL**	**QC Batch**
Physical Properties									
% sand by hydrometer	%	N/A	N/A	40	N/A	N/A	N/A	2.0	6280915
% silt by hydrometer	%	N/A	N/A	39	N/A	N/A	N/A	2.0	6280915
Clay Content	%	N/A	N/A	21	N/A	N/A	N/A	2.0	6280915
Texture	N/A	N/A	N/A	LOAM	N/A	N/A	N/A	N/A	6272266
Moisture	%	17	17	6.0	9.1	12	9.8	0.30	6273924

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET1100	ET1100		ET1114	ET1114	ET1124		
Sampling Date		2012/10/13	2012/10/13		2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650		A073644	A073644	A014440		
	UNITS	**BH31-12-5.25**	**BH31-12-5.25 Lab-Dup**	**QC Batch**	**BH35-12-3.0**	**BH35-12-3.0 Lab-Dup**	**BH35-12-6.0**	**RDL**	**QC Batch**
Physical Properties									
% sand by hydrometer	%	48	50	6280915	N/A	N/A	4.7	2.0	6280915
% silt by hydrometer	%	28	27	6280915	N/A	N/A	53	2.0	6280915
Clay Content	%	23	23	6280915	N/A	N/A	42	2.0	6280915
Texture	N/A	LOAM	N/A	6272266	N/A	N/A	SILTY CLAY	N/A	6272266
Moisture	%	11	N/A	6273924	11	11	N/A	0.30	6264145

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		ET1127		ET1136		ET1140	ET1155		
Sampling Date		2012/10/13		2012/10/12		2012/10/12	2012/10/12		
COC Number		A014440		A073648		A073648	A073645		
	UNITS	**BH35-12-7.5**	**QC Batch**	**BH40-12-3.75**	**QC Batch**	**BH40-12-6.75**	**BH37-12-0.75**	**RDL**	**QC Batch**
Misc. Inorganics									
Fraction of Organic Carbon	g/g	N/A	N/A	N/A	N/A	N/A	0.0017	0.00020	6272937
Physical Properties									
Moisture	%	18	6264145	18	6268540	10	N/A	0.30	6264145

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET1160	ET1164		ET1166		ET1171		
Sampling Date		2012/10/12	2012/10/12		2012/10/12		2012/10/12		
COC Number		A073645	A073645		A073645		A073646		
	UNITS	**BH37-12-4.5**	**BH37-12-7.5**	**QC Batch**	**BH38-12-1.0**	**QC Batch**	**BH38-12-4.0**	**RDL**	**QC Batch**
Misc. Inorganics									
Fraction of Organic Carbon	g/g	N/A	N/A	6272937	0.0047	6272937	N/A	0.00020	N/A
Physical Properties									
% sand by hydrometer	%	N/A	N/A	N/A	N/A	N/A	62	2.0	6280915
% silt by hydrometer	%	N/A	N/A	N/A	N/A	N/A	21	2.0	6280915
Clay Content	%	N/A	N/A	N/A	N/A	N/A	17	2.0	6280915
Texture	N/A	N/A	N/A	N/A	N/A	N/A	SANDY LOAM	N/A	6272266
Moisture	%	18	14	6264145	11	6268540	18	0.30	6264145

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET1176	ET1204		ET1205		ET1211		
Sampling Date		2012/10/12	2012/10/12		2012/10/12		2012/10/12		
COC Number		A073646	A073647		A073647		A073647		
	UNITS	**BH38-12-7.0**	**BH39-12-0.75**	**QC Batch**	**BH39-12-1.5**	**QC Batch**	**BH39-12-6.0**	**RDL**	**QC Batch**
Misc. Inorganics									
Fraction of Organic Carbon	g/g	N/A	0.0035	6272937	N/A	N/A	N/A	0.00020	N/A
Physical Properties									
Moisture	%	19	N/A	6264145	17	6268540	20	0.30	6264145

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		ET1214	ET1215		ET8875		EU2859		
Sampling Date		2012/10/12	2012/10/12		2012/10/12		2012/10/12		
COC Number		A073647	A073647		A073647		A073649		
	UNITS	**BH39-12-7.8**	**BH40-12-0.5**	**QC Batch**	**BH39-12-6.0 DUP**	**QC Batch**	**BH40-12-3.75DUP**	**RDL**	**QC Batch**
Misc. Inorganics									
Fraction of Organic Carbon	g/g	N/A	0.021	6272937	N/A	N/A	N/A	0.00020	N/A
Physical Properties									
Moisture	%	13	N/A	6264145	20	6268540	16	0.30	6275877

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET1089	ET1090	ET1091	ET1092	ET1093	ET1094		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-4.75**	**BH30-12-5.2**	**BH30-12-5.9**	**BH30-12-6.6**	**BH30-12-6.8**	**BH30-12-7.6**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6274231
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	<10	10	<10	34	10	6274231
F4 (C34-C50 Hydrocarbons)	mg/kg	18	<10	<10	<10	<10	<10	10	6274231
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	Yes	Yes	N/A	6274231
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	70	78	74	95	86	59	N/A	6274231

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET1095	ET1096	ET1097	ET1098	ET1099	ET1100		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-8.0**	**BH31-12-1.5**	**BH31-12-3.0**	**BH31-12-3.75**	**BH31-12-4.5**	**BH31-12-5.25**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6274231
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6274231
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6274231
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	Yes	Yes	N/A	6274231
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	81	88	90	94	89	98	N/A	6274231

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET1114	ET1114	ET1127	ET1136	ET1140	ET1160		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/12	2012/10/12	2012/10/12		
COC Number		A073644	A073644	A014440	A073648	A073648	A073645		
	UNITS	**BH35-12-3.0**	**BH35-12-3.0 Lab-Dup**	**BH35-12-7.5**	**BH40-12-3.75**	**BH40-12-6.75**	**BH37-12-4.5**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	59	<10	12	10	6268500
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	18	<10	<10	<10	10	6268500
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6268500
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	Yes	Yes	N/A	6268500
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	92	88	80	98	87	87	N/A	6268500

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET1164	ET1166	ET1171	ET1176		ET1205		
Sampling Date		2012/10/12	2012/10/12	2012/10/12	2012/10/12		2012/10/12		
COC Number		A073645	A073645	A073646	A073646		A073647		
	UNITS	**BH37-12-7.5**	**BH38-12-1.0**	**BH38-12-4.0**	**BH38-12-7.0**	**QC Batch**	**BH39-12-1.5**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	6268500	<10	10	6271918
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	<10	28	13	6268500	<10	10	6271918
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	18	<10	6268500	<10	10	6271918
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	6268500	Yes	N/A	6271918
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	80	90	76	88	6268500	104	N/A	6271918

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET1211	ET1214	ET8875		EU2859		
Sampling Date		2012/10/12	2012/10/12	2012/10/12		2012/10/12		
COC Number		A073647	A073647	A073647		A073649		
	UNITS	**BH39-12-6.0**	**BH39-12-7.8**	**BH39-12-6.0 DUP**	**QC Batch**	**BH40-12-3.75DUP**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/kg	13	<10	24	6271918	73	10	6274567
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	23	<10	6271918	<10	10	6274567
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	6271918	<10	10	6274567
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	6271918	Yes	N/A	6274567
Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	89	95	95	6271918	85	N/A	6274567

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1089	ET1089	ET1090	ET1091	ET1092		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-4.75**	**BH30-12-4.75 Lab-Dup**	**BH30-12-5.2**	**BH30-12-5.9**	**BH30-12-6.6**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	6276412
Toluene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6276412
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	6276412
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6276412
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6276412
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6276412
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	<12	12	6276412
(C6-C10)	mg/kg	<12	<12	<12	<12	<12	12	6276412
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	93	94	94	95	95	N/A	6276412
4-BROMOFLUOROBENZENE (sur.)	%	96	93	94	92	95	N/A	6276412
D10-ETHYLBENZENE (sur.)	%	88	81	88	81	83	N/A	6276412
D4-1,2-DICHLOROETHANE (sur.)	%	81	82	82	82	82	N/A	6276412

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1093	ET1094	ET1095	ET1096	ET1097		
Sampling Date		2012/10/13	2012/10/13	2012/10/13	2012/10/13	2012/10/13		
COC Number		A073650	A073650	A073650	A073650	A073650		
	UNITS	**BH30-12-6.8**	**BH30-12-7.6**	**BH30-12-8.0**	**BH31-12-1.5**	**BH31-12-3.0**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0050	6276412
Toluene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6276412
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	6276412
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6276412
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6276412
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6276412
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	<12	12	6276412
(C6-C10)	mg/kg	<12	<12	<12	<12	<12	12	6276412
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	95	93	95	95	93	N/A	6276412
4-BROMOFLUOROBENZENE (sur.)	%	92	96	91	96	91	N/A	6276412
D10-ETHYLBENZENE (sur.)	%	83	82	84	88	85	N/A	6276412
D4-1,2-DICHLOROETHANE (sur.)	%	83	84	83	83	81	N/A	6276412

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1098	ET1099	ET1100		ET1114		
Sampling Date		2012/10/13	2012/10/13	2012/10/13		2012/10/13		
COC Number		A073650	A073650	A073650		A073644		
	UNITS	**BH31-12-3.75**	**BH31-12-4.5**	**BH31-12-5.25**	**QC Batch**	**BH35-12-3.0**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	6276412	<0.0050	0.0050	6268155
Toluene	mg/kg	<0.020	<0.020	<0.020	6276412	<0.020	0.020	6268155
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	6276412	<0.010	0.010	6268155
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	6276412	<0.040	0.040	6268155
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	6276412	<0.040	0.040	6268155
o-Xylene	mg/kg	<0.020	<0.020	<0.020	6276412	<0.020	0.020	6268155
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	6276412	<12	12	6268155
(C6-C10)	mg/kg	<12	<12	<12	6276412	<12	12	6268155
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	94	95	95	6276412	95	N/A	6268155
4-BROMOFLUOROBENZENE (sur.)	%	93	91	93	6276412	90	N/A	6268155
D10-ETHYLBENZENE (sur.)	%	85	83	85	6276412	83	N/A	6268155
D4-1,2-DICHLOROETHANE (sur.)	%	82	82	81	6276412	84	N/A	6268155

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1127	ET1136	ET1140	ET1160	ET1164		
Sampling Date		2012/10/13	2012/10/12	2012/10/12	2012/10/12	2012/10/12		
COC Number		A014440	A073648	A073648	A073645	A073645		
	UNITS	**BH35-12-7.5**	**BH40-12-3.75**	**BH40-12-6.75**	**BH37-12-4.5**	**BH37-12-7.5**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	0.21	0.20	0.022	<0.0050	0.0050	6268155
Toluene	mg/kg	<0.020	5.0	0.047	<0.020	<0.020	0.020	6268155
Ethylbenzene	mg/kg	<0.010	3.6	<0.010	<0.010	<0.010	0.010	6268155
Xylenes (Total)	mg/kg	<0.040	28	<0.040	<0.040	<0.040	0.040	6268155
m & p-Xylene	mg/kg	<0.040	20	<0.040	<0.040	<0.040	0.040	6268155
o-Xylene	mg/kg	<0.020	7.4	<0.020	<0.020	<0.020	0.020	6268155
F1 (C6-C10) - BTEX	mg/kg	<12	120	<12	<12	<12	12	6268155
(C6-C10)	mg/kg	<12	150	<12	<12	<12	12	6268155
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	90	92	95	97	99	N/A	6268155
4-BROMOFLUOROBENZENE (sur.)	%	88	90	90	95	95	N/A	6268155
D10-ETHYLBENZENE (sur.)	%	74	72	85	80	76	N/A	6268155
D4-1,2-DICHLOROETHANE (sur.)	%	78	80	86	87	86	N/A	6268155

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1166	ET1171	ET1176	ET1205	ET1211		
Sampling Date		2012/10/12	2012/10/12	2012/10/12	2012/10/12	2012/10/12		
COC Number		A073645	A073646	A073646	A073647	A073647		
	UNITS	**BH38-12-1.0**	**BH38-12-4.0**	**BH38-12-7.0**	**BH39-12-1.5**	**BH39-12-6.0**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	<0.0050	0.058	<0.0050	0.97	0.0050	6268155
Toluene	mg/kg	<0.020	<0.020	0.041	<0.020	6.9	0.020	6268155
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	2.1	0.010	6268155
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	16	0.040	6268155
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	12	0.040	6268155
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	4.0	0.020	6268155
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	100	12	6268155
(C6-C10)	mg/kg	<12	<12	<12	<12	130	12	6268155
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	98	102	101	99	96	N/A	6268155
4-BROMOFLUOROBENZENE (sur.)	%	97	94	91	97	92	N/A	6268155
D10-ETHYLBENZENE (sur.)	%	78	82	77	79	78	N/A	6268155
D4-1,2-DICHLOROETHANE (sur.)	%	85	89	89	87	84	N/A	6268155

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET1214	ET8875		EU2859		
Sampling Date		2012/10/12	2012/10/12		2012/10/12		
COC Number		A073647	A073647		A073649		
	UNITS	**BH39-12-7.8**	**BH39-12-6.0 DUP**	**QC Batch**	**BH40-12-3.75DUP**	**RDL**	**QC Batch**
Volatiles							
Benzene	mg/kg	0.043	1.4	6268155	0.16	0.0050	6300359
Toluene	mg/kg	0.028	8.4	6268155	4.6	0.020	6300359
Ethylbenzene	mg/kg	<0.010	2.6	6268155	3.6	0.010	6300359
Xylenes (Total)	mg/kg	<0.040	19	6268155	28	0.040	6300359
m & p-Xylene	mg/kg	<0.040	15	6268155	20	0.040	6300359
o-Xylene	mg/kg	<0.020	4.8	6268155	8.1	0.020	6300359
F1 (C6-C10) - BTEX	mg/kg	<12	140	6268155	170	12	6300359
(C6-C10)	mg/kg	<12	170	6268155	210	12	6300359
Surrogate Recovery (%)							
1,4-Difluorobenzene (sur.)	%	98	96	6268155	102	N/A	6300359
4-BROMOFLUOROBENZENE (sur.)	%	94	95	6268155	104	N/A	6300359
D10-ETHYLBENZENE (sur.)	%	80	77	6268155	89	N/A	6300359
D4-1,2-DICHLOROETHANE (sur.)	%	87	81	6268155	98	N/A	6300359

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

MISCELLANEOUS (SOIL)

Maxxam ID		ET1155	ET1155	ET1166	ET1204	ET1215		
Sampling Date		2012/10/12	2012/10/12	2012/10/12	2012/10/12	2012/10/12		
COC Number		A073645	A073645	A073645	A073647	A073647		
	UNITS	**BH37-12-0.75**	**BH37-12-0.75 Lab-Dup**	**BH38-12-1.0**	**BH39-12-0.75**	**BH40-12-0.5**	**RDL**	**QC Batch**
Misc. Inorganics								
Total Organic Carbon (C)	%	0.17	0.14	0.47	0.35	2.1	0.020	6306155

RDL = Reportable Detection Limit

Maxxam Job #: B293234
Report Date: 2012/11/06

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

General Comments

DDT Pesticide results are attached to this report file. The reference number from Campobello Maxxam for these results is B2G5030.

Results relate only to the items tested.

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report

Maxxam Job Number: CB293234

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6264145 AN0	Method Blank	Moisture	2012/10/18	<0.30		%	
	RPD [ET1114-01]	Moisture	2012/10/18	3.6		%	20
6268155 WZ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/20		100	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		87	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/20		81	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		83	%	60 - 140
		Benzene	2012/10/20		84	%	60 - 140
		Toluene	2012/10/20		86	%	60 - 140
		Ethylbenzene	2012/10/20		93	%	60 - 140
		m & p-Xylene	2012/10/20		98	%	60 - 140
		o-Xylene	2012/10/20		98	%	60 - 140
		(C6-C10)	2012/10/20		69	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/19		99	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/19		93	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/19		85	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/19		83	%	60 - 140
		Benzene	2012/10/19		90	%	60 - 140
		Toluene	2012/10/19		87	%	60 - 140
		Ethylbenzene	2012/10/19		94	%	60 - 140
		m & p-Xylene	2012/10/19		100	%	60 - 140
		o-Xylene	2012/10/19		102	%	60 - 140
		(C6-C10)	2012/10/19		109	%	60 - 140
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/19		94	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/19		92	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/19		81	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/19		83	%	60 - 140
		Benzene	2012/10/19	<0.0050		mg/kg	
		Toluene	2012/10/19	<0.020		mg/kg	
		Ethylbenzene	2012/10/19	<0.010		mg/kg	
		Xylenes (Total)	2012/10/19	<0.040		mg/kg	
		m & p-Xylene	2012/10/19	<0.040		mg/kg	
		o-Xylene	2012/10/19	<0.020		mg/kg	
		F1 (C6-C10) - BTEX	2012/10/19	<12		mg/kg	
		(C6-C10)	2012/10/19	<12		mg/kg	
	RPD	Benzene	2012/10/20	NC		%	50
		Toluene	2012/10/20	NC		%	50
		Ethylbenzene	2012/10/20	NC		%	50
		Xylenes (Total)	2012/10/20	NC		%	50
		m & p-Xylene	2012/10/20	NC		%	50
		o-Xylene	2012/10/20	NC		%	50
		F1 (C6-C10) - BTEX	2012/10/20	NC		%	50
		(C6-C10)	2012/10/20	NC		%	50
6268500 PK4	Matrix Spike [ET1114-01]						
		O-TERPHENYL (sur.)	2012/10/20		84	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		70	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		76	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		75	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/20		79	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		82	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		89	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		87	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/20		86	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F4 (C34-C50 Hydrocarbons)	2012/10/20	<10		mg/kg	

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB293234

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6268500 PK4	RPD [ET1114-01]	F2 (C10-C16 Hydrocarbons)	2012/10/20	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/20	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/20	NC		%	50
6268540 AN0	Method Blank	Moisture	2012/10/19	<0.30		%	
	RPD	Moisture	2012/10/19	9.5		%	20
6271918 PK4	Matrix Spike	O-TERPHENYL (sur.)	2012/10/20		109	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		94	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		96	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		92	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/20		97	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		89	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		92	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		89	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/20		100	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F4 (C34-C50 Hydrocarbons)	2012/10/20	<10		mg/kg	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/20	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/20	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/20	NC		%	50
6273924 KSA	Method Blank	Moisture	2012/10/20	<0.30		%	
	RPD [ET1090-01]	Moisture	2012/10/20	5.4		%	20
6274231 DO1	Matrix Spike	O-TERPHENYL (sur.)	2012/10/22		62	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22		65	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/22		68	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/22		68	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/22		65	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22		76	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/22		80	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/22		83	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/21		83	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/21	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/21	<10		mg/kg	
		F4 (C34-C50 Hydrocarbons)	2012/10/21	<10		mg/kg	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/22	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/22	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/22	NC		%	50
6274567 DO1	Matrix Spike	O-TERPHENYL (sur.)	2012/10/22		77	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22		84	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/22		81	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/22		81	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/23		74	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/23		82	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/23		83	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/23		79	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/22		81	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/22	<10		mg/kg	
		F4 (C34-C50 Hydrocarbons)	2012/10/22	<10		mg/kg	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/22	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/22	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/22	NC		%	50
6275877 JA7	Method Blank	Moisture	2012/10/22	0.40, RDL=0.30		%	
	RPD	Moisture	2012/10/22	1.3		%	20
6276412 GP4	Matrix Spike [ET1089-01]	1,4-Difluorobenzene (sur.)	2012/10/24		94	%	60 - 140

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
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Quality Assurance Report (Continued)

Maxxam Job Number: CB293234

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6276412 GP4	Matrix Spike						
	[ET1089-01]	4-BROMOFLUOROBENZENE (sur.)	2012/10/24		92	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/24		84	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/24		80	%	60 - 140
		Benzene	2012/10/24		81	%	60 - 140
		Toluene	2012/10/24		80	%	60 - 140
		Ethylbenzene	2012/10/24		85	%	60 - 140
		m & p-Xylene	2012/10/24		83	%	60 - 140
		o-Xylene	2012/10/24		86	%	60 - 140
		(C6-C10)	2012/10/24		98	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/24		96	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/24		95	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/24		89	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/24		84	%	60 - 140
		Benzene	2012/10/24		87	%	60 - 140
		Toluene	2012/10/24		85	%	60 - 140
		Ethylbenzene	2012/10/24		91	%	60 - 140
		m & p-Xylene	2012/10/24		88	%	60 - 140
		o-Xylene	2012/10/24		90	%	60 - 140
		(C6-C10)	2012/10/24		88	%	60 - 140
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/24		94	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/24		94	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/24		87	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/24		80	%	60 - 140
		Benzene	2012/10/24	<0.0050		mg/kg	
		Toluene	2012/10/24	<0.020		mg/kg	
		Ethylbenzene	2012/10/24	<0.010		mg/kg	
		Xylenes (Total)	2012/10/24	<0.040		mg/kg	
		m & p-Xylene	2012/10/24	<0.040		mg/kg	
		o-Xylene	2012/10/24	<0.020		mg/kg	
		F1 (C6-C10) - BTEX	2012/10/24	<12		mg/kg	
		(C6-C10)	2012/10/24	<12		mg/kg	
	RPD [ET1089-01]	Benzene	2012/10/24	NC		%	50
		Toluene	2012/10/24	NC		%	50
		Ethylbenzene	2012/10/24	NC		%	50
		Xylenes (Total)	2012/10/24	NC		%	50
		m & p-Xylene	2012/10/24	NC		%	50
		o-Xylene	2012/10/24	NC		%	50
		F1 (C6-C10) - BTEX	2012/10/24	NC		%	50
		(C6-C10)	2012/10/24	NC		%	50
6280915 KVD	QC Standard	% sand by hydrometer	2012/10/23		93	%	80 - 120
		% silt by hydrometer	2012/10/23		105	%	78 - 122
		Clay Content	2012/10/23		112	%	75 - 125
	RPD [ET1100-01]	% sand by hydrometer	2012/10/23	3.9		%	35
		% silt by hydrometer	2012/10/23	3.6		%	35
		Clay Content	2012/10/23	3.9		%	35
6300359 WZ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/31		102	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/31		106	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/31		87	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/31		100	%	60 - 140
		Benzene	2012/10/31		97	%	60 - 140
		Toluene	2012/10/31		97	%	60 - 140
		Ethylbenzene	2012/10/31		108	%	60 - 140
		m & p-Xylene	2012/10/31		105	%	60 - 140
		o-Xylene	2012/10/31		107	%	60 - 140

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB293234

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6300359 WZ0	Matrix Spike	(C6-C10)	2012/10/31		111	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/31		100	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/31		95	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/31		95	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/31		103	%	60 - 140
		Benzene	2012/10/31		106	%	60 - 140
		Toluene	2012/10/31		98	%	60 - 140
		Ethylbenzene	2012/10/31		108	%	60 - 140
		m & p-Xylene	2012/10/31		104	%	60 - 140
		o-Xylene	2012/10/31		108	%	60 - 140
		(C6-C10)	2012/10/31		126	%	60 - 140
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/31		91	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/31		80	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/31		76	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/31		90	%	60 - 140
		Benzene	2012/10/31	<0.0050		mg/kg	
		Toluene	2012/10/31	<0.020		mg/kg	
		Ethylbenzene	2012/10/31	<0.010		mg/kg	
		Xylenes (Total)	2012/10/31	<0.040		mg/kg	
		m & p-Xylene	2012/10/31	<0.040		mg/kg	
		o-Xylene	2012/10/31	<0.020		mg/kg	
		F1 (C6-C10) - BTEX	2012/10/31	<12		mg/kg	
		(C6-C10)	2012/10/31	<12		mg/kg	
	RPD	Benzene	2012/10/31	NC		%	50
		Toluene	2012/10/31	NC		%	50
		Ethylbenzene	2012/10/31	NC		%	50
		Xylenes (Total)	2012/10/31	NC		%	50
		m & p-Xylene	2012/10/31	NC		%	50
		o-Xylene	2012/10/31	NC		%	50
		F1 (C6-C10) - BTEX	2012/10/31	NC		%	50
		(C6-C10)	2012/10/31	NC		%	50
6306155 CT6	QC Standard	Total Organic Carbon (C)	2012/10/31		108	%	75 - 125
	Spiked Blank	Total Organic Carbon (C)	2012/10/31		100	%	75 - 125
	Method Blank	Total Organic Carbon (C)	2012/10/31	<0.020		%	
	RPD [ET1155-01]	Total Organic Carbon (C)	2012/10/31	16.6		%	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B293234

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Scientific Specialist

Halina Solway, Lab Supervisor

Janet Gao, Senior Analyst, Organics Department

Karla Offord, Senior Analyst, Organics Department

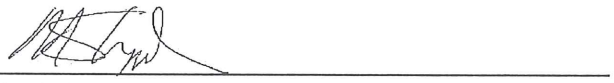
Luba Shymushovska, Senior Analyst, Organic Department

Validation Signature Page

Maxxam Job #: B293234

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Lili Zhou, Senior analyst, Inorganic department.



Michael Sheppard, Organics Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Chain of Custody A073643

Page: 1 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.epsoa
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr. SE Calgary	jabresultssk @tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 2V6	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4035	Ph: 403-718-3210 Cell: 403-990-1861	kristoofatsson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 90 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1016901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs ☐BTEX F1	☐BTEX F1-F2	☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1): Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH29-12-3.0	M	soil	12/10/13	✓																✓	2
2	BH29-12-3.75																					
3	BH29-12-4.5																					
4	BH29-12-5.25																					1
5	BH29-12-6.0																					2
6	BH29-12-6.75																					
7	BH29-12-7.4																					
8	BH29-12-8.0																					
9	BH30-12-0.75																					
10	BH30-12-1.5																					
11	BH30-~~0.25~~-0-225																					
12	BH30-12-3.0	↓	↓	↓	✓																↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/14 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Hold all Samples

# of Jars Used & Not Submitted:

LAB USE ONLY
Received By: Date: 12/15/10 Time: 3:00pm
Lab Comments: Melissa Pars 2013/10/16 8:35 MELISSA PARS

Maxxam Job #: B293234

Custody Seal	Temperature	Ice
N	2-2, 2-2, 1-1 10.0, 9.6, 9.4 9.3, 9.6, 9.9 10.1, 6.6, 6.9 11.0, 7.1, 13.1	N

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Maxxam

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Chain of Custody A073650

Page: 2 of 8

	Invoice To: CC Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Att: Joel Nolin	andrew.eason
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr SE Calgary	labresultsyk@tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 0W6	Troy.Lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4015	Ph: 403-718-3210 Cell: 403-930-1361	krista.klatt-sson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise

PO #:
Project # / Name: 101890403
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED:
☐ RUSH (Contact lab to reserve)
Date Required:
☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	SOIL: Sieve (75 micron)	SOIL: Regulated Metals (CCME / AT1)	SOIL: Salinity 4	SOIL: Assessment ICP Metals	SOIL: Basic Class II Landfill	WATER: ☐VOCs ☐BTEX F1	WATER: ☐BTEX F1-F2 ☐BTEX F1-F4	WATER: ☐Routine Water ☐Turb ☐F	WATER: ☐TOC ☐DOC	WATER: Regulated Metals (CCME / AT1) Total	WATER: Dissolved	WATER: Mercury ☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH30-12-4.75	m	Soil	12/10/13	✓														✓	2
2	BH30-12-5.2																			1
3	BH30-12-5.9																			1
4	BH30-12-6.6																			1
5	BH30-12-6.8																			1
6	BH30-12-7.6																			2
7	BH30-12-8.0																			2
8	BH31-12-1.5																			1
9	BH31-12-~~2.5~~3.0																			1
10	BH31-12-3.75																			2
11	BH31-12-4.5																			1
12	BH31-12-5.25	↓	↓	↓	✓														↓	1

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/16/14 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted

LAB USE ONLY
Received By: Date: Time: 12/15/10 9:00
Maxxam Job #: B293234
Custody Seal: N
Temperature: 2.2, 5.0, 5.1, 10.0, 9.6, 9.4, 9.3, 9.6, 9.9
Ice: Y
Lab Comments: Melissa Pare 2013/10/16 8:35 MELISSA PARE

1.9, 6.9, 8.7, 18.0, 7.1, 13.1 X

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Chain of Custody

A073644

Page: 3 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Cont'l Services Can.	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.eason
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr SE Calgary	labresults-ab@tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 2V6	troy.lange
Contact #s:	Ph: 403-232-6882 Cell: 403-860-4015	Ph: 403-718-3210 Cell: 403-990-1361	kristo.olafsson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt. Unless specified otherwise.

PO #:
Project # / Name: 10189016.03
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

	Sample ID	Depth (unit)	Matrix SW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	Total / DOT	WATER: BTEX F1 ☐VOCs	BTEX F1-F2	BTEX F1-F4	Routine Water ☐ Turb ☐ F	TOC	DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH31-12-6.0	M	soil	12/10/13	✓																		✓	2
2	BH31-12-7.5																							1
3	BH31-12-8.0																							2
4	BH35-12-0.25										✓													1
5	BH35-12-0.6																							1
6	BH35-12-0.8																							1
7	BH35-12-1.0																					Insufficient Sample		1
8	BH35-12-1.2																							1
9	BH35-12-1.5										✓													2
10	BH35-12-2.25																							1
11	BH35-12-3.0																							2
12	BH35-12-4.5	↓	↓	↓	↓																		↓	2

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/14 Time (24:00):
Re-relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Hold all Samples

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By: Date: Time: 12/15/10 3 pm
Maxxam Job #: B493234

Custody Seal: N

Temperature: 2.2, 3.0, 5.1 / 10.0 9.6, 9.4 / 9.3, 9.4, 9.9 / 6.4, 6.6, 6.7 / 11.0, 7.1, 13.1

Ice: 1

Lab Comments: Melissa Paré 2013/10/15 8:35 Melissa PARÉ

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Chain of Custody A014440

Page 4 of 8

	Invoice To:	C/O Report Address ☐	Report To:	Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can.		Tetra Tech		joel.nolin
Contact:	Natalie Robinson		Joel Nolin		andrew.eason, labresultssk
Address:	1650, 635 8th Ave SW, Calgary		115, 200 Rivercrest Dr, SE, Calgary		@TetraTech.com
	Prov: AB PC: T2P 3N5		Prov: AB PC: T2P 2W6		troy.lange, krista.tiitsson
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4645		Ph: 403-718-3210 Cell: 403-990-1361		

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 45 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	1018901603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs ☐BTEX F1	☐BTEX F1-F4 ☐BTEX F1-F2	☐Routine Water ☐Turb ☐F	☐TOC ☐DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH35-12-5.25	m	soil	12/10/13	✓															✓	2
2	BH35-12-6.0																				2
3	BH35-12-6.7																				2
4	BH35-12-7.2																				1
5	BH35-12-7.5																				2
6	BH35-12-8.0																				1
7	BH35-12-8.5			↓																	1
8	VW25-12-1.0			12/10/12																	2
9	VW27-12-1.0			12/10/12																	2
10																					
11					↓																
12		↓	↓																		

Please Indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print): Troy Lange	Date (YY/MM/DD): 12/10/14	Time (24:00):
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all Samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B295234		
	12/15/10	3:00	Custody Seal	Temperature	Ice
Lab Comments: Melissa Paré 2012/10/16 B:55 Melissa PARÉ			N	2.2, 5.0, 5.1 2.0, 9.6, 9.1 8.3, 9.6, 9.9 6.4, 6.6, 6.9	Y
			Yes	11.0, 7.1, 13.1	N

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Chain of Custody A073648

Page: 5 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can.	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.eason
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary	labresultssk@tetratech.com
	Prov: AB PC: T2P 3N3	Prov: AB PC: T2P 5M6	Tony.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-380-4015	Ph: 403-718-3210 Cell: 403-999-4321	krista.matsson)

REGULATORY GUIDELINES: ☐ AT1 ☑ CCME ☐ Regulated Drinking Water ☐ Other

All samples are held for 60 calendar days after sample receipt, unless specified otherwise

PO #:	
Project # / Name:	10189160.3
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KD

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐BTEX F1 ☐BTEX F1-F2 ☐Routine Water ☐TOC ☐VOCs ☐BTEX F1-F4 ☐Turb ☐F ☐DOC Regulated Metals (CCME / AT1): Total / Dissolved / Mercury ☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH40-12-1.5	m	soil	12/10/12	✓								✓	1
2	BH40-12-3.0													1
3	BH40-12-3.75													2
4	BH40-12-4.5													1
5	BH40-12-5.25													
6	BH40-12-6.0													
7	BH40-12-6.75													
8	BH40-12-7.5													
9	BH40-12-8.0	↓	↓	↓	↓									✓
10	BH29-12-0.75	m	soil	12/10/13	✓									1
11	BH29-12-1.5	↓	↓	↓	↓									1
12	BH29-12-2.25	↓	↓	↓	↓								✓	2

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Tray Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B249234		
	12/15/10	3:30	Custody Seal	Temperature	Ice
Lab Comments: Melissa Paré 20121011 8:35 MELISSA PARÉ	N	2.2, 5.0, 5.1 / 6.0, 12.6, 9.4 / 9.3, 9.2, 9.9	✓
	Y	5.7, 6.6, 6.9 / 6.0, 7.1, 13.1	✓

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Chain of Custody A073645

Page: 6 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)	Report Distribution (E-Mail):
Company:	Public Works and Gov't Services Can.	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.mason
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE Calgary	tobi.soltesk @TetraTech.com
Prov / PC:	AB / T2P 3M3	AB / T2P 2V6	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4005	Ph: 403-718-3210 Cell: 403-990-1261	krista.klatissen

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018701603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KD

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW/SW/Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Regulated Metals (CCME / AT1) Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH37-12-0.75	m	soil	12/10/12	✓														✓	2
2	BH37-12-1.5	↓	↓	↓	↓														↓	↓
3	BH37-12-2.25	↓	↓	↓	↓														↓	↓
4	BH37-12-3.0	↓	↓	↓	↓														↓	↓
5	BH37-12-3.75	↓	↓	↓	↓														↓	↓
6	BH37-12-4.5	↓	↓	↓	↓														↓	↓
7	BH37-12-5.25	↓	↓	↓	↓														↓	↓
8	BH37-12-6.0	↓	↓	↓	↓														↓	↓
9	BH37-12-6.75	↓	↓	↓	↓														↓	↓
10	BH37-12-7.5	↓	↓	↓	↓														↓	↓
11	BH37-12-8.3	↓	↓	↓	↓														↓	↓
12	BH38-12-1.0	↓	↓	↓	↓														↓	↓

Please Indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/14 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted

Page 28 of 39

LAB USE ONLY

Received By: [signature] Date: 12/10/16 Time:
Maxxam Job #: B293234

Lab Comments: Melissa Pare 2012/10/16 8:33 / MELISSA PARE

Custody Seal	Temperature	Ice
N	2.2, 5.0, 5.1 / 10.0, 9.6, 9.4 / 9.5, 9.6, 9.9	Y

Y 6.4, 6.6, 6.4 - Y

AB FCD 00031 Rev3 2010/05

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Edmonton: 9331 - 48 Street, T6B 2R4; Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
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Chain of Custody

A073646

Page: 7 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.mason
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE Calgary	lobresultssk @tetratech.com
Prov: / PC:	AB / T2P 3M7	AB / T2Z 2V6	troy.lange
Contact #s:	Ph: 403-292-6882 Fax: 403-860-4815	Ph: 403-718-3216 Cell: 403-990-1361	krista.olafsson

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve)
- Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Regulated Metals (CCME / AT1) Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH38-12-1.5	m	soil	12/10/12	✓														✓	2
2	BH38-12-2.0																			1
3	BH38-12-2.25																			2
4	BH38-12-3.25																			2
5	BH38-12-4.0																			2
6	BH38-12-4.75																			2
7	BH38-12-5.3																			1
8	BH38-12-6.0																			2
9	BH38-12-6.25																			
10	BH38-12-7.0																			
11	BH38-12-7.75																			
12	BH38-12-8.5	↓	↓	↓	↓														↓	↓

Please Indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print): Troy Lange — Date (YY/MM/DD): 12/10/14 — Time (24:00):
Relinquished By (Signature/Print): — Date (YY/MM/DD): — Time (24:00):

Special Instructions: Hold All Samples

# of Jars Used & Not Submitted:

Page 29 of 39

LAB USE ONLY
Received By: [signature] — Date: 12/10/15 — Time:
Maxxam Job #: B293234
Lab Comments: Melissa Paré 20121016 8:35 Melissa Paré
Custody Seal: N — Temperature: 2.2, 5.0, 5.1 / 10.0, 9.6, 7.4 / 9.3, 9.6, 7.9 — Ice: Y
Y 6.4, 6.6, 6.7 / 7.1, 7.1, 8.1 — Y

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Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187. Toll free: (877) 485-8389
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Chain of Custody A073647

Page: 8 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Govt Services Can.	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.enson
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary	labresultssk @tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 3V6	tray.lange
Contact #s:	ph: 403-292-6882 cell: 403-560-4015	ph: 403-718-3210 cell: 403-990-1561	krista.lolatsson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 10189101603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KD

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐BTEX F1 ☐VOCs	☐BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH39-12-0.75	m	Soil	12/10/12	✓															✓	2
2	BH39-12-~~0.75~~ 1.5																				
3	BH39-12-2.25																				
4	BH39-12-3.0																				
5	BH39-12-3.75																				
6	BH39-12-4.5																				
7	BH39-12-5.2																				
8	BH39-12-~~5.2~~ 6.0																				
9	BH39-12-6.6																				
10	BH39-12-7.3																				
11	BH39-12-7.8																				✓
12	BH40-12-0.5	↓	↓	↓	✓															✓	1

Please indicate Filtered, Preserved or Both (F, P, F/P) → ✓

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Tray Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold All Samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B293234
Melissa Paré	20121011 16	8:35	
MELISSA PARÉ			

Custody Seal	Temperature	Ice
N	2.4, 5.0, 5.1, 10.0, 8.6, 9.9, 9.3, 9.6, 9.9	Y
Y	6.4, 6.6, 6.9, 10, 7.1, 13.1	Y

Lab Comments:

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Chain of Custody A073649

Page: ____ of ____

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can	Tetra Tech	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.nason
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr SE Calgary	jabrasalihsak @tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 2V2	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4415	Ph: 403-718-3210 Cell: 403-880-1561	kirsten.olsen

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other

All samples are held for 60 calendar days after sample receipt, unless specified otherwise

PO #:	
Project # / Name:	101980603
Site Location:	Interior Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve)
- Date Required: ____
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	SOIL: Sieve (75 micron)	SOIL: Regulated Metals (CCME / AT1)	SOIL: Salinity 4	SOIL: Assessment ICP Metals	SOIL: Basic Class II Landfill	SOIL	SOIL	WATER: ☐BTEX F1 ☐VOCs	WATER: ☐BTEX F1-F2 ☐BTEX F1-F4	WATER: ☐ Routine Water ☐ Turb ☐ F	WATER: ☐ TOC ☐ DOC	WATER: Total – Regulated Metals (CCME / AT1)	WATER: Dissolved – Regulated Metals (CCME / AT1)	WATER: Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH29-12-3.0	m	soil	12/10/13																		
2	BH29-12-3.75																					
3	BH29-12-4.5																					
4	BH29-12-5.25																					
5	BH29-12-6.0																					
6	BH29-12-6.75																					
7	BH29-12-7.4																					
8	BH29-12-8.0																					
9	BH30-12-0.75																					
10	BH30-12-1.5																					
11	BH30-12-0.25																					
12	BH30-12-3.0																					

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments					

AB FCD 00331 Rev3 2010/05

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B293234

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Chain of Custody

AD73650

Page: ____ of ____

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Bill - Hawkeye Services Ltd.	Tetra Tech	
Contact:	Melanie Robinson	Tetra Tech Yukon	
Address:	#20, 635 8th Ave SW Calgary	#5, 2000 Riverside Dr SE Calgary	
	Prov: AB PC: T2P 3M2	Prov: AB PC: T2C 2W4	
Contact #s:	Ph: 403-693-6882 Fax: 403-640-1445	Ph: 403-718-2010 Fax: 403-910-1217	

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All results are held for 90 calendar days after sample receipt, unless specified otherwise

PO #:	
Project # / Name:	1018704603
Site Location:	Whistle Golf Course
Quote #:	
Sampled By:	TL KO

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required: ____
- ☑ REGULAR (5 to 7 Days)

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	SOIL: Sieve (75 micron)	SOIL: Regulated Metals (CCME / AT1)	SOIL: Salinity 4	SOIL: Assessment ICP Metals	SOIL: Basic Class II Landfill	WATER: ☐ VOCs ☐ BTEX F1	WATER: ☐ BTEX F1-F2 ☐ BTEX F1-F4	WATER: ☐ Routine Water ☐ Turb ☐ F	WATER: ☐ DOC ☐ TOC	WATER: Regulated Metals (CCME/AT1) Total	WATER: Regulated Metals (CCME/AT1) Dissolved	WATER: Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH30-12-4.75	m	soil	12/10/13	✓														✓	2
2	BH30-12-5.2																			1
3	BH30-12-5.9																			1
4	BH30-12-6.6																			1
5	BH30-12-6.8																			1
6	BH30-12-7.6																			2
7	BH30-12-8.0																			2
8	BH31-12-1.5					X														1
9	BH31-12-2.530																			1
10	BH31-12-3.75																			2
11	BH31-12-4.5																			1
12	BH31-12-5.35	↓	↓	↓	✓	X													↓	1

Please indicate Filtered, Preserved or Both (F, P, F/P) →

	Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
	Tay Lange	12/10/14	
	Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice

Lab Comments:

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam

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Edmonton: 9331 - 48 Street T6B 2R4 Ph: (780) 577-7100, Fax: (780) 450-4187, Toll Free: (877) 485-8396
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Chain of Custody AU73644

Page ____ of ____

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Rille Works & Gen'l Services Co.	Tajfa Tool	
Contact:	Natalie Robinson	Tool Natin	
Address:	#150, 535 9th Ave SW Calgary	#5, 200 Rivervalley Dr SE Calgary	
	Prov: AB PC: T3P 0W7	Prov: AB PC: T3P 0W6	
Contact #s:	Ph: 403-202-6882 Cell: 403-860-4365	Ph: 403-719-3210 Cell: 403-990-4786	

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt unless specified otherwise

PO #:	
Project # / Name:	1018901603
Site Location:	Lochiel Golf Course
Quote #:	
Sampled By:	TT, KD

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ____ ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs ☐BTEX F1 ☐BTEX F1-F2	☐BTEX F1-F4 ☐ Routine Water ☐ TOC	☐ Turb ☐ F ☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH31-12-6.0	m	soil	12/10/13		✓													✓	2
2	BH31-12-7.5																			1
3	BH31-12-8.0																			2
4	BH35-12-0.25																			1
5	BH35-12-0.6																			1
6	BH35-12-0.8									X										1
7	BH35-12-1.0																	Insufficient sample		1
8	BH35-12-1.2									X										1
9	BH35-12-1.5																			2
10	BH35-12-2.25																			1
11	BH35-12-3.0																			2
12	BH35-12-4.5	↓	↓	↓															↓	2

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	13/10/11	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: # of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam

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Edmonton: 9331 - 48 Street, T6B 2R4 Ph: (780) 577-7100 Fax: (780) 450-4187 Toll free: (877) 465-8889
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Chain of Custody A014440

Page: ____ of ____

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)
Company:	Public Works & Gov't Services Can.	Tetra Tech.
Contact:	Natalie Robinson	Joel Nolik
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr. SE Calgary
Prov: / PC:	AB / T2P 3M3	AB / T2C 2X5
Contact #s:	Ph 403-292-6882 Cell 403-660-4615	Ph 403-718-3210 Cell 403-990-1361

Report Distribution (E-Mail): joel.nolik, andrew.mason, labresultscalgary, troy.longe, krista.wilson @TetraTech.com

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 101890160S
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ____ ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	DDT	HOLD - Do not Analyze	# of Containers Submitted
1	BH35-12-5.25	m	soil	12/10/13	✓							✓	2
2	BH35-12-6.0	↓	↓	↓		X						↓	2
3	BH35-12-6.7												2
4	BH35-12-7.2												1
5	BH35-12-7.5												2
6	BH35-12-8.0												1
7	BH35-12-8.5												1
8	VW26-12-1.0			12/10/12									[illegible]
9	VW27-12-1.0			12/10/12									2
10													
11													
12													

WATER: ☐BTEX F1, ☐VOCs, ☐BTEX F1-F2, ☐BTEX F1-F4, ☐ Routine Water, ☐ Turb, ☐ F, ☐ TOC, ☐ DOC, Total / Dissolved Regulated Metals (CCME / AT1), Mercury ☐ Total ☐ Dissolved

Other Analysis

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Longe	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all Samples

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #
			Custody Seal / Temperature / Ice

Lab Comments:

AB FCD 00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Edmonton: 9331 - 48 Street T6B 2R4 Ph: (780) 577-7100 Fax: (780) 450-4187 Toll free: (877) 465-8889
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Chain of Custody A073648

Page: ____ of ____

Invoice To:	C/O Report Address ☐
Company:	Public Works & Gov't Services Can.
Contact:	Natalie Robinson
Address:	850, 635 8th Ave SW Calgary
Prov: AB	PC: T2P 3M3
Contact #s: Ph:	403-292-6882 Cell: 403-810-4015

Report To:	Same as Invoice ☐
Company:	Tetra Tech
Contact:	Joel Nolin
Address:	115, 200 Rivercrest Dr. SE Calgary
Prov: AB	PC: T2C 2X5
Ph: 403-718-3210	Cell: 403-[illegible]

Report Distribution (E-Mail):
joel.nolin
kathleen.mason
johnny.thorsk } @tetratech.com
troy.lange
kristen.[illegible]

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	1018801603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ____ ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

Analyses — SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill. WATER: ☐BTEX F1 ☐VOCs; ☐BTEX F1-F2 ☐BTEX F1-F4; ☐ Routine Water ☐ Turb ☐ F; ☐ TOC ☐ DOC; Regulated Metals (CCME / AT1) Total / Dissolved; Mercury ☐ Total ☐ Dissolved. Other Analysis.

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	HOLD - Do not Analyze	# of Containers Submitted
1	BH40-12-1.5	m	soil	12/10/12		✓	1
2	BH40-12-3.0	↓	↓	↓		↓	1
3	BH40-12-3.75				X		2
4	BH40-12-4.5						
5	BH40-12-5.25						
6	BH40-12-6.0						
7	BH40-12-6.75						
8	BH40-12-7.5						
9	BH40-12-8.0	↓	↓	↓		↓	
10	BH39-12-0.75	m	soil	12/10/13			1
11	BH39-12-1.5	↓	↓	↓			1
12	BH39-12-2.25	↓	↓	↓		↓	2

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
[signature] Troy Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:
			Custody Seal / Temperature / Ice

Lab Comments:

AB FCD 00351 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam

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Edmonton 9331 - 48 Street, T6B 2R4 Ph (780) 577-7100, Fax (780) 450-4187 Toll free (877) 465-8889
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Chain of Custody A073645

Page: ___ of ___

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works and Gov Services	Tetra Tech	joel. nolin
Contact:	Natalie Robinson	Joel Nolin	andrea. ...
Address:	1650 - 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary	...
Prov / PC	AB T2P 3M3	AB T2C 2X5	troy. lange
Contact #s:	Ph 403-292-6882	Ph 403-723-3210	Krista. Skaften

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise

PO #:	
Project # / Name:	1018901603
Site Location:	Lethbridge Golf Course
Quote #:	
Sampled By:	TL KD

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve)
- Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	FOC			☐BTEX F1 / ☐BTEX F1-F2	☐VOCs / ☐BTEX F1-F4	☐ Routine Water / ☐ Turb ☐ F	☐ TOC / ☐ DOC	Total / Dissolved Regulated Metals (CCME / AT1)	Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH37-12-0.75	m	soil	12/10/12	–						X										✓	2
2	BH37-12-1.5	↓	↓	↓																	↓	↓
3	BH37-12-2.25																					
4	BH37-12-3.0																					
5	BH37-12-3.75																					
6	BH37-12-4.5																					
7	BH37-12-5.25																					
8	BH37-12-6.0																					
9	BH37-12-6.75																					
10	BH37-12-7.5																					
11	BH37-12-8.3																					
12	BH38-12-1.0	↓	↓	↓	X						X										↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Hold all Samples

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice

Lab Comments:

AB FCD-00331 Rev3 2010/05
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Edmonton: 9331 - 48 Street, T6B 2R4, Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 405-8813
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Chain of Custody A073646

Page ___ of ___

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Civil Services Co.	Tetra Tech	
Contact:	Natalie Robinson	Joel Wolfe	
Address:	1456, 636 8th Ave SW Calgary	115, 200 Rivercrest Dr SE Calgary	
	Fax: AB PC: T2P 2M5	Fax: AB PC: T2P 2M5	
Contact #s:	Ph: 403-292-6882 Cell: 403-660-4015	Ph: 403-718-3226 Cell: 403-990-1261	

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt. Unless specified otherwise.

PO #:	
Project # / Name:	104904643
Site Location:	Lakeside Golf Course
Quote #:	
Sampled By:	TL KD

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ___ ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	EDC	WATER: ☐ BTEX F1-F4	☐ BTEX F1-F2	☐ Routine Water ☐ Turb ☐ F	☐ TOC	☐ DOC	Total	Dissolved	Mercury	Regulated Metals (circle ATI) ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH36-12-1.5	m	soil	12/10/12																		✓	2
2	BH36-12-2.0																						1
3	BH36-12-2.25																						2
4	BH36-12-3.25																						2
5	BH36-12-4.0					X					WAIT												2
6	BH36-12-4.75																						2
7	BH36-12-5.3																						1
8	BH36-12-6.0																						2
9	BH36-12-6.25																						1
10	BH36-12-7.0																						2
11	BH36-12-7.75																						2
12	BH36-12-8.5	↓	↓	↓																		↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Tray Lange	12/10/11	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions:	# of Jars Used & Not Submitted
1 WL21 Sample	

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam

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Edmonton: 9331 - 48 Street, T6B 2R4 Ph: (780) 577-7100, Fax: (780) 450-9187, Toll Free: (877) 463-0699
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Chain of Custody A073647

Page ____ of ____

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Civil Services Dept.	Tara Teal	
Contact:	Natalie Robinson	Teal Water	
Address:	#650, 625 8th Ave SW Calgary	#6, 300 Crowfoot Dr SE Calgary	
	Prov: AB PC: T2P 3M3	Prov: AB PC: T3G 3N8	
Contact #s:	Ph: 403-292-6852 Cell: 403-660-4015	Ph: 403-714-3310 Cell: 403-998-1581	

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise

PO #:	
Project # / Name:	Bearspaw
Site Location:	Bearspaw Golf Course
Quote #:	
Sampled By:	TT, KD

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: BTEX F1 ☐VOCs	BTEX F1-F2 ☐BTEX F1-F4	Routine Water ☐ THM ☐ F2	☐ TOC ☐ DOC	Regulated Metals (basic / AT1): Total ☐ Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH39-12-0.75	m	soil	12/10/12		✓				X						X		✓	2
2	BH39-12-0.75-1.5				X											X			2
3	BH39-12-2.25																		1
4	BH39-12-3.0																		1
5	BH39-12-3.75																		1
6	BH39-12-4.5																		1
7	BH39-12-5.2																		1
8	BH39-12-5.2-6.0																		1
9	BH39-12-6.6																		1
10	BH39-12-7.3																		1
11	BH39-12-7.8																	✓	1
12	BH40-12-0.5	↓	↓	↓						X								✓	1

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
[signature] Tara Teal	12/10/11	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions:	# of Jars Used & Not Submitted
Rush All Samples	

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

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Edmonton: 9331 - 48 Street, T6B 2R4 · Ph: (780) 577-7100 · Fax: (780) 450-4187 · Toll free: (877) 465-8889
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Chain of Custody

A072034

Page: 8 of 8

Invoice To:	C/O Report Address ☐
Company:	Public Works & Gov't Services Can
Contact:	Natalie Robinson
Address:	#60-635 8th Ave SW Calgary
Prov: AB	PC: T2P 3M3
Contact #s:	Ph: 403-292-4880 · Fax: 403-[illegible]

Report To:	Same as Invoice ☐
	Tetra Tech
	Joel Nolin
	115-200 Rivercrest Dr SE Calgary
Prov: AB	PC: T2C 2X5
Ph: 403-723-3270	Fax: 403-[illegible]

Report Distribution (E-Mail): joel.nolin@tetratech.com; [illegible]; troy.lange@tetratech.com; [illegible]

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	1018201403
Site Location:	[illegible] Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) · Date Required: · ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill		☐BTEX F1	☐VOCs	☐BTEX F1-F2	☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME/AT1) Total	Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH43-12-1.25																						
2	BH43-12-1.5	m	soil	12/10/14							X												
3	BH44-12-0.3	↓	↓	↓																			
4	BH44-12-0.5										X											X	1
5	BH44-12-0.75																					↓	↓
6	BH44-12-1.0										X												
7	BH44-12-1.5	↓	↓	↓							X												
8	BH43-[illegible] DUP										X												
9	BH43-12-0.3 DUP	m	soil	12/10/19							X												
10	BH41-12-0.3 DUP	m	soil	↓							X										split 4oz jar into two — one labelled BH42-12-0.3	↓	2
11	BH41-12-6.0 DUP	m	↓	12/10/12	X						X												
12	BH41-12-3.75 DUP	m	↓	12/10/12	X																		

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished by (Signature/Print): [signature] Troy Lange	Date (YY/MM/DD): 12/10/16	Time (24:00):
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions:		# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #
Lab Comments		Custody Seal	Temperature · Ice

AB FCD 00331 Rev3 2010/06

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Maxxam

Success Through Science®

Your Project #: B293234
Your C.O.C. #: na

Attention: Wendy Sears
Maxxam Analytics
2021 41st Ave NE
Calgary, AB
T2E 6P2

Report Date: 2012/10/30

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2G5030
Received: 2012/10/23, 09:26

Sample Matrix: Soil
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	4	N/A	2012/10/26	CAM SOP-00445	R.Carter,1993
OC Pesticides (Selected) & PCB (1)	4	2012/10/25	2012/10/25	CAM SOP-00307	SW846 8081, 8082

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy,
Email: kpomeroy@maxxam.ca
Phone# (905) 817-5700

==========

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Total cover pages: 1

Maxxam Job #: B2G5030
Report Date: 2012/10/30

Maxxam Analytics
Client Project #: B293234

RESULTS OF ANALYSES OF SOIL

Maxxam ID		PI0724	PI0725	PI0726	PI0727		
Sampling Date		2012/10/13	2012/10/13	2012/10/12	2012/10/12		
COC Number		na	na	na	na		
	Units	**ET1109 \ BH35-12-0.8**	**ET1111 \ BH35-12-1.2**	**ET1204 \ BH39-12-0.75**	**ET1205 \ BH39-12-1.5**	**RDL**	**QC Batch**
Moisture	%	13	16	7.6	14	1.0	3015497

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G5030
Report Date: 2012/10/30

Maxxam Analytics
Client Project #: B293234

ORGANOCHLORINATED PESTICIDES BY GC-ECD (SOIL)

Maxxam ID		PI0724	PI0725	PI0726	PI0726	PI0727		
Sampling Date		2012/10/13	2012/10/13	2012/10/12	2012/10/12	2012/10/12		
COC Number		na	na	na	na	na		
	Units	**ET1109 \ BH35-12-0.8**	**ET1111 \ BH35-12-1.2**	**ET1204 \ BH39-12-0.75**	**ET1204 \ BH39-12-0.75 Lab-Dup**	**ET1205 \ BH39-12-1.5**	**RDL**	**QC Batch**
o,p-DDT	ug/g	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3014559
p,p-DDT	ug/g	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3014559
o,p-DDT + p,p-DDT	ug/g	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3014559
DDT+ Metabolites	ug/g	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3014559
Surrogate Recovery (%)								
2,4,5,6-Tetrachloro-m-xylene	%	90	88	86	89	85	N/A	3014559
Decachlorobiphenyl	%	75	79	73	72	72	N/A	3014559

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G5030
Report Date: 2012/10/30

Maxxam Analytics
Client Project #: B293234

Test Summary

Maxxam ID PI0724 **Collected** 2012/10/13
Sample ID ET1109 \ BH35-12-0.8 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3015497	N/A	2012/10/26	Thoai Truyen Huynh
OC Pesticides (Selected) & PCB	GC/ECD	3014559	2012/10/25	2012/10/25	Nemanja Zubac

Maxxam ID PI0725 **Collected** 2012/10/13
Sample ID ET1111 \ BH35-12-1.2 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3015497	N/A	2012/10/26	Thoai Truyen Huynh
OC Pesticides (Selected) & PCB	GC/ECD	3014559	2012/10/25	2012/10/25	Nemanja Zubac

Maxxam ID PI0726 **Collected** 2012/10/12
Sample ID ET1204 \ BH39-12-0.75 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3015497	N/A	2012/10/26	Thoai Truyen Huynh
OC Pesticides (Selected) & PCB	GC/ECD	3014559	2012/10/25	2012/10/25	Nemanja Zubac

Maxxam ID PI0726 Dup **Collected** 2012/10/12
Sample ID ET1204 \ BH39-12-0.75 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
OC Pesticides (Selected) & PCB	GC/ECD	3014559	2012/10/25	2012/10/25	Nemanja Zubac

Maxxam ID PI0727 **Collected** 2012/10/12
Sample ID ET1205 \ BH39-12-1.5 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3015497	N/A	2012/10/26	Thoai Truyen Huynh
OC Pesticides (Selected) & PCB	GC/ECD	3014559	2012/10/25	2012/10/25	Nemanja Zubac

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B2G5030
Report Date: 2012/10/30

Maxxam Analytics
Client Project #: B293234

Package 1	4.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Analytics
Attention: Wendy Sears
Client Project #: B293234
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: MB2G5030

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3014559 NZ1	Matrix Spike	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		90	%	50 - 130
		Decachlorobiphenyl	2012/10/25		72	%	50 - 130
	Matrix Spike (PI0726)	o,p-DDT	2012/10/25		102	%	50 - 130
		p,p-DDT	2012/10/25		109	%	50 - 130
	Spiked Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		86	%	50 - 130
	Spiked Blank DUP	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		82	%	50 - 130
	Spiked Blank	Decachlorobiphenyl	2012/10/25		69	%	50 - 130
	Spiked Blank DUP	Decachlorobiphenyl	2012/10/25		82	%	50 - 130
	Spiked Blank	o,p-DDT	2012/10/25		95	%	50 - 130
		p,p-DDT	2012/10/25		95	%	50 - 130
	Method Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		88	%	50 - 130
		Decachlorobiphenyl	2012/10/25		70	%	50 - 130
		o,p-DDT	2012/10/25	<0.0020		ug/g	
		p,p-DDT	2012/10/25	<0.0020		ug/g	
		o,p-DDT + p,p-DDT	2012/10/25	<0.0020		ug/g	
		DDT+ Metabolites	2012/10/25	<0.0020		ug/g	
	RPD - Sample/Sample Dup	o,p-DDT	2012/10/25	NC		%	40
		p,p-DDT	2012/10/25	NC		%	40
		o,p-DDT + p,p-DDT	2012/10/25	NC		%	40
		DDT+ Metabolites	2012/10/25	NC		%	40
3015497 JL2	RPD - Sample/Sample Dup	Moisture	2012/10/26	5.3		%	20

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B2G5030

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Charles Ancker, B.Sc., M.Sc., C.Chem, Senior Analyst

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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Maxxam

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Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Your C.O.C. #: A072027, A072028, A072029, A072030, A072031, A072032, A072033, A072034

Report Date: 2012/11/05

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B293624
Received: 2012/10/17, 08:45

Sample Matrix: Soil
Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 by HS GC/MS (MeOH extract)	8	2012/10/18	2012/10/20	AB SOP-00039	CCME, EPA 8260C
CCME Hydrocarbons (F2-F4 in soil) (1)	8	2012/10/18	2012/10/20	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
Moisture	8	N/A	2012/10/18	AB SOP-00002	CCME PHC-CWS
Texture by Hydrometer	2	N/A	2012/10/23	AB SOP-00030	SSMA CH55.3
Texture Class	2	N/A	2012/10/23	AB SOP-00030	SSMA CH55.3

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Edmonton Environmental

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403) 291-3077

==========

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Total cover pages: 1

Maxxam

Success Through Science®

Maxxam Job #: B293624
Report Date: 2012/11/05

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		ET3360	ET3361	ET3378	ET3379	ET3381	ET3393		
Sampling Date		2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		A072028	A072028	A072029	A072029	A072029	A072030		
	UNITS	**BH32-12-7.15**	**BH32-12-7.75**	**BH34-12-4.75**	**BH34-12-5.5**	**BH34-12-7.0**	**BH33-12-4.5**	**RDL**	**QC Batch**
Physical Properties									
% sand by hydrometer	%	N/A	N/A	N/A	30	N/A	N/A	2.0	6280915
% silt by hydrometer	%	N/A	N/A	N/A	35	N/A	N/A	2.0	6280915
Clay Content	%	N/A	N/A	N/A	35	N/A	N/A	2.0	6280915
Texture	N/A	N/A	N/A	N/A	CLAY LOAM	N/A	N/A	N/A	6274092
Moisture	%	12	12	16	N/A	19	19	0.30	6265471

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET3395	ET3402		ET3417	ET3417		
Sampling Date		2012/10/14	2012/10/14		2012/10/14	2012/10/14		
COC Number		A072030	A072031		A072032	A072032		
	UNITS	**BH33-12-6.0**	**BH33-12-7.8**	**QC Batch**	**BH41-12-8.25**	**BH41-12-8.25 Lab-Dup**	**RDL**	**QC Batch**
Physical Properties								
% sand by hydrometer	%	N/A	75	6280915	N/A	N/A	2.0	N/A
% silt by hydrometer	%	N/A	16	6280915	N/A	N/A	2.0	N/A
Clay Content	%	N/A	9.0	6280915	N/A	N/A	2.0	N/A
Texture	N/A	N/A	SANDY LOAM	6274092	N/A	N/A	N/A	N/A
Moisture	%	18	N/A	6265471	14	14	0.30	6268347

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET3444	ET3444		
Sampling Date		2012/10/14	2012/10/14		
COC Number		A072033	A072033		
	UNITS	**BH42-12-7.8**	**BH42-12-7.8 Lab-Dup**	**RDL**	**QC Batch**
Physical Properties					
Moisture	%	15	17	0.30	6265471

RDL = Reportable Detection Limit

Maxxam Job #: B293624
Report Date: 2012/11/05

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET3360	ET3361	ET3378	ET3381	ET3393	ET3395		
Sampling Date		2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		A072028	A072028	A072029	A072029	A072030	A072030		
	UNITS	**BH32-12-7.15**	**BH32-12-7.75**	**BH34-12-4.75**	**BH34-12-7.0**	**BH33-12-4.5**	**BH33-12-6.0**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon									
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	<10	<10	<10	<10	10	6268500
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	11	<10	19	<10	<10	10	6268500
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	<10	<10	11	<10	<10	10	6268500
Reached Baseline at C50	mg/kg	Yes	Yes	Yes	Yes	Yes	Yes	N/A	6268500
Surrogate Recovery (%)									
O-TERPHENYL (sur.)	%	84	91	118	100	93	94	N/A	6268500

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET3417	ET3444		
Sampling Date		2012/10/14	2012/10/14		
COC Number		A072032	A072033		
	UNITS	**BH41-12-8.25**	**BH42-12-7.8**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon					
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	<10	10	6268500
F3 (C16-C34 Hydrocarbons)	mg/kg	20	<10	10	6268500
F4 (C34-C50 Hydrocarbons)	mg/kg	11	<10	10	6268500
Reached Baseline at C50	mg/kg	Yes	Yes	N/A	6268500
Surrogate Recovery (%)					
O-TERPHENYL (sur.)	%	108	93	N/A	6268500

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293624
Report Date: 2012/11/05

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET3360	ET3361	ET3378	ET3381	ET3393		
Sampling Date		2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		A072028	A072028	A072029	A072029	A072030		
	UNITS	**BH32-12-7.15**	**BH32-12-7.75**	**BH34-12-4.75**	**BH34-12-7.0**	**BH33-12-4.5**	**RDL**	**QC Batch**
Volatiles								
Benzene	mg/kg	<0.0050	<0.0050	<0.0050	<0.0050	0.035	0.0050	6268195
Toluene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6268195
Ethylbenzene	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	6268195
Xylenes (Total)	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6268195
m & p-Xylene	mg/kg	<0.040	<0.040	<0.040	<0.040	<0.040	0.040	6268195
o-Xylene	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	0.020	6268195
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	<12	<12	12	6268195
(C6-C10)	mg/kg	<12	<12	<12	<12	<12	12	6268195
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	96	95	97	103	103	N/A	6268195
4-BROMOFLUOROBENZENE (sur.)	%	87	92	90	95	91	N/A	6268195
D10-ETHYLBENZENE (sur.)	%	82	79	77	80	73	N/A	6268195
D4-1,2-DICHLOROETHANE (sur.)	%	87	84	87	91	93	N/A	6268195

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293624
Report Date: 2012/11/05

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET3395	ET3417	ET3444		
Sampling Date		2012/10/14	2012/10/14	2012/10/14		
COC Number		A072030	A072032	A072033		
	UNITS	**BH33-12-6.0**	**BH41-12-8.25**	**BH42-12-7.8**	**RDL**	**QC Batch**
Volatiles						
Benzene	mg/kg	0.15	<0.0050	0.031	0.0050	6268195
Toluene	mg/kg	0.17	<0.020	<0.020	0.020	6268195
Ethylbenzene	mg/kg	0.44	<0.010	<0.010	0.010	6268195
Xylenes (Total)	mg/kg	2.1	<0.040	<0.040	0.040	6268195
m & p-Xylene	mg/kg	1.8	<0.040	<0.040	0.040	6268195
o-Xylene	mg/kg	0.26	<0.020	<0.020	0.020	6268195
F1 (C6-C10) - BTEX	mg/kg	<12	<12	<12	12	6268195
(C6-C10)	mg/kg	<12	<12	<12	12	6268195
Surrogate Recovery (%)						
1,4-Difluorobenzene (sur.)	%	101	97	99	N/A	6268195
4-BROMOFLUOROBENZENE (sur.)	%	88	88	87	N/A	6268195
D10-ETHYLBENZENE (sur.)	%	74	74	72	N/A	6268195
D4-1,2-DICHLOROETHANE (sur.)	%	89	86	88	N/A	6268195

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B293624
Report Date: 2012/11/05

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: TL

General Comments

DDT results are attached to this report file. The reference number from Maxxam Campobello for these results is B2G4974.

Results relate only to the items tested.

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report

Maxxam Job Number: CB293624

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6265471 KSA	Method Blank	Moisture	2012/10/18	<0.30		%	
	RPD [ET3444-01]	Moisture	2012/10/18	12.1		%	20
6268195 WZ0	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/20		101	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		94	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/20		77	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		87	%	60 - 140
		Benzene	2012/10/20		86	%	60 - 140
		Toluene	2012/10/20		82	%	60 - 140
		Ethylbenzene	2012/10/20		88	%	60 - 140
		m & p-Xylene	2012/10/20		96	%	60 - 140
		o-Xylene	2012/10/20		100	%	60 - 140
		(C6-C10)	2012/10/20		80	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/20		103	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		92	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/20		88	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		90	%	60 - 140
		Benzene	2012/10/20		98	%	60 - 140
		Toluene	2012/10/20		95	%	60 - 140
		Ethylbenzene	2012/10/20		101	%	60 - 140
		m & p-Xylene	2012/10/20		105	%	60 - 140
		o-Xylene	2012/10/20		110	%	60 - 140
		(C6-C10)	2012/10/20		109	%	60 - 140
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/20		96	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/20		90	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/20		90	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/20		84	%	60 - 140
		Benzene	2012/10/20	<0.0050		mg/kg	
		Toluene	2012/10/20	<0.020		mg/kg	
		Ethylbenzene	2012/10/20	<0.010		mg/kg	
		Xylenes (Total)	2012/10/20	<0.040		mg/kg	
		m & p-Xylene	2012/10/20	<0.040		mg/kg	
		o-Xylene	2012/10/20	<0.020		mg/kg	
		F1 (C6-C10) - BTEX	2012/10/20	<12		mg/kg	
		(C6-C10)	2012/10/20	<12		mg/kg	
	RPD	Benzene	2012/10/20	NC		%	50
		Toluene	2012/10/20	NC		%	50
		Ethylbenzene	2012/10/20	NC		%	50
		Xylenes (Total)	2012/10/20	NC		%	50
		m & p-Xylene	2012/10/20	NC		%	50
		o-Xylene	2012/10/20	NC		%	50
		F1 (C6-C10) - BTEX	2012/10/20	NC		%	50
		(C6-C10)	2012/10/20	NC		%	50
6268347 JA7	Method Blank	Moisture	2012/10/18	<0.30		%	
	RPD [ET3417-01]	Moisture	2012/10/18	2.2		%	20
6268500 PK4	Matrix Spike	O-TERPHENYL (sur.)	2012/10/20		84	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		70	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		76	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		75	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/20		79	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		82	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		89	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		87	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/20		86	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/20	<10		mg/kg	

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB293624

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6268500 PK4	Method Blank	F4 (C34-C50 Hydrocarbons)	2012/10/20	<10		mg/kg	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/20	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/20	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/20	NC		%	50
6280915 KVD	QC Standard	% sand by hydrometer	2012/10/23		93	%	80 - 120
		% silt by hydrometer	2012/10/23		105	%	78 - 122
		Clay Content	2012/10/23		112	%	75 - 125
	RPD	% sand by hydrometer	2012/10/23	3.9		%	35
		% silt by hydrometer	2012/10/23	3.6		%	35
		Clay Content	2012/10/23	3.9		%	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

Maxxam Job #: B293624

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Janet Gao, Senior Analyst, Organics Department

Karla Offord, Senior Analyst, Organics Department

Luba Shymushovska, Senior Analyst, Organic Department

Lili Zhou, Senior analyst, Inorganic department.

Michael Sheppard, Organics Supervisor

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam

Calgary: 4000 19th St. NE, T2E 6P8. Edmonton: 9331 - 48 Street, T6B 2R4. www.maxxamanalytics.com

Chain of Custody A072027

Page: 1 of 8

	Invoice To:	Report To:	Report Distribution (E-Mail):
Company:	Public Works & Gov't	Tetra Tech	joel.nalin
Contact:	Services Can. - Natalie Robinson	Joel Nalin	andrew.ensor
Address:	1650, 635 8th Ave SW, Calgary AB T2P 3M3	115, 200 Rivercrest Dr SE, Calgary AB T2C 2V6	Troy Lange
Contact #s:	403-292-6882 403-860-4145	403-718-3210	403-880-1221

REGULATORY GUIDELINES: ☐ AT1 ☒ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

#	Sample ID	Depth (unit)	Matrix GW/SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH32-12-0.1	m	soil	12/10/14							Insufficient sample	✓	1
2	BH32-12-0.3	↓	↓	↓								↓	↓
3	BH32-12-0.6												
4	BH32-12-0.9												
5	BH32-12-1.2												
6	BH32-12-1.5												↓
7	BH32-12-2.25												2
8	BH32-12-3.0												
9	BH32-12-3.75												
10	BH32-12-4.5												
11	BH32-12-5.25												↓
12	BH32-12-6.0	↓	↓	↓								↓	1

Water analyses (none marked): BTEX F1 / VOCs; BTEX F1-F2 / BTEX F1-F4; Routine Water; TOC / DOC; Total / Dissolved Regulated Metals; Mercury Total / Dissolved

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):

Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Samples split between coolers

# of Jars Used & Not Submitted

LAB USE ONLY: Received By: Melissa Pare Date: 2012/10/17 Time: 0845 Maxxam Job #: B293624 Custody Seal: Yes Temperature: Ice: Y

Lab Comments:

AB FCD-00391 Rev5 2010/05

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www.maxxamanalytics.com

Chain of Custody A072028

Page: 2 of 8

	Invoice To:	Report To:
Company:	Public Works & Gov't	Tetra Tech
Contact:	Services Can - Natalie Robinson	Joel Nalin
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr. SE Calgary
Prov: / PC:	AB / T2P 3M3	AB / T2C 2X5
Contact #s:	Ph: 403-292-6682 Cell: 403-860-4015	Ph: 403-716-3010 Cell: 403-990-1361

Report Distribution (E-Mail): joel.nalin, andrew.eason, labresultssk, troy.lange, kristen.watson @tetratech.com

REGULATORY GUIDELINES:
- ☐ AT1
- ☒ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	101890/603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill

WATER: BTEX/F1; VOCs; BTEX/F1-F2; BTEX/F1-F4; Routine Water; Turb; TIP; TOC; DOC; Total / Dissolved Regulated Metals (CCME/AT1); Mercury Total / Dissolved

#	Sample ID	Depth (unit)	Matrix GW/SW/Soil	Date/Time Sampled YY/MM/DD 24:00	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH32-12-6.4	m	soil	12/10/14		✓	2
2	BH32-12-7.15	↓	↓	↓			2
3	BH32-12-7.75						1
4	BH32-12-8.3						2
5	BH34-12-0.1 ~~0.05~~				Insufficient sample		1
6	BH34-12-0.25				Insufficient sample		
7	BH34-12-0.5				Insufficient sample		
8	BH34-12-0.75					↓	
9	BH34-12-1.0						
10	BH34-12-1.25						
11	BH34-12-1.5						
12	BH34-12-~~2.25~~ 1.75	↓	↓	↓		↓	

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print): [signature] Troy Lange	Date (YY/MM/DD): 12/10/16	Time (24:00):
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions: Samples split between coolers		# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:
Melissa Paw / MELISSA PARK	2012/10/17	0845	B2H3661

Lab Comments: — Custody Seal: Y; Temperature: ; Ice: Y

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Maxxam

Calgary: 4000 19th St. N.E. T2E 6P8. Edmonton: 9331 - 48 Street, T6B 2R4. www.maxxamanalytics.com

Chain of Custody A072029

Page: 3 of 8

Company:	Invoice To: Public Works & Gov't Services Can.	Report To: Tetra Tech	Report Distribution (E-Mail): joel.nolin, andrew.eason, labresultssk, troy.lange, krista.olafsson @tetratech.com
Contact:	Natalie Robinson	Joel Nolin	
Address:	1650, 635 8th Ave SW, Calgary, AB T2P 3M3	115 200 Rivercrest Dr. SE, Calgary, AB T2C 2X5	
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4025	Ph: 403-203-3210 Cell: 403-990-[illegible]	

REGULATORY GUIDELINES: ☐ AT1 ☑ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	1018/901603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

Analyses — SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill. WATER: BTEX F1 / VOCs; BTEX F1-F2 / BTEX F1-F4; Routine Water / Turb. / F; TOC / DOC; Total / Dissolved Regulated Metals (CCME / AT1); Mercury Total / Dissolved. Other Analysis.

#	Sample ID	Depth (unit)	Matrix GW/SW Soil	Date/Time Sampled YY/MM/DD 24:00	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH34-12-~~3.0~~ 2.5	m	soil	12/10/14		✓	2
2	BH34-12-3.25	↓	↓	↓		↓	↓
3	BH34-12-4.0	↓	↓	↓		↓	↓
4	BH34-12-4.75	↓	↓	↓		↓	✓
5	BH34-12-5.5	↓	↓	↓		↓	1
6	BH34-12-6.25	↓	↓	↓		↓	2
7	BH34-12-7.0	↓	↓	↓		✓	2
8	~~BH34-12-7.5~~						
9	BH34-12-8.0	m	soil	12/10/14		✓	2
10	BH33-12-0.05	↓	↓	↓	Insufficient sample	↓	1
11	BH33-~~0~~-12-~~0~~.25	↓	↓	↓		↓	1
12	BH33-12-0.5	↓	↓	↓		✓	1

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
[signature] Troy Lange	12/10/16	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Samples split between Coolers

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #: B29362
Melissa Parc / MELISSA PARC	2012/10/17	08:45	

Custody Seal	Temperature	Ice
Y		Y

Lab Comments:

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Chain of Custody A072030

Page: 4 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)
Company:	Public Works & Gov't Services Can.	Tetra Tech
Contact:	Natalie Robinson	Joel Nolin
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary
Prov: / PC:	AB / T2P 3M3	AB / T2P 2V6
Contact #s:	Ph 403-292-6882 / 403-660-4005	Ph 403-718-3210 / 403-990-1341

Report Distribution (E-Mail): joel.nolin, andrew.eason, labresultssk, troy.lange, krista.watson } @tetratech.com

REGULATORY GUIDELINES:
- ☐ AT1
- ☒ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	101890 1603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill

WATER: ☐ BTEX F1 / ☐ VOCs; ☐ BTEX F1-F4 / ☐ BTEX F1-F4; ☐ Routine Water / ☐ Turb / ☐ F; ☐ TOC / ☐ DOC; Total / Dissolved Regulated Metals (CCME/AT1); Mercury ☐ Total ☐ Dissolved

Other Analysis

#	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YY/MM/DD 24:00	HOLD - Do not Analyze	# of Containers Submitted
1	BH33-12-0.75	m	soil	12/10/14	✓	1
2	BH33-12-1.0	↓	↓	↓	↓	↓
3	BH33-12-1.25					
4	BH33-12-1.5					↓
5	BH33-12-2.25					2
6	BH33-12-3.0					
7	BH33-12-3.75					
8	BH33-12-4.5					
9	BH33-12-5.25					
10	BH33-12-6.0					
11	BH33-12-6.75					
12	BH33-12-7.5	↓	↓	↓	↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
[signature] Troy Lange	12/10/16	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Samples split between coolers

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:
Melissa Pare / MELISSA PARE	2012/10/17	0815	B2J3624

Lab Comments:

Custody Seal	Temperature	Ice
X		Y

AB FCD-00331 Rev2 2010/05

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PAGE 06/09
10/16/2012 01:44 3056535219 HAWOOD INN

Maxxam

Chain of Custody A072031

Page: 5 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Can.	Joel Nolin Tetra Tech.	joel.nolin
Contact:	Natalie Robinson	Joel Nolin	andrew.eason
Address:	1650, 635 8th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary	labresultsk @tetratech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 2V6	troy.lange
Contact #s:	ph: 403-292-5882 fx: 403-860-4815	ph: 403-718-3210 fx: 403-930-1336	Krista.Watson

REGULATORY GUIDELINES:
☐ AT
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt unless specified otherwise.

PO #:
Project # / Name: 10189016.03
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX/F1-F4	Sieve (75 micron)	Regulated Metals (CCME/AT1)	Salinity	Assessment ICP Metals	Basic Class II Landfill	WATER: BTEX VOCs	BTEX F1-F2	Chlorinated Volatiles	PHCs F1	PHCs F2	BTEX	Total Xylenes	Total Hydrocarbons	Hexavalent Chromium	Mercury	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH33-12-7.5	m	soil	12/10/14																		✓	—
2	BH33-12-7.8																						—
3	BH41-12-0.1																				Insufficient sample		
4	BH41-12-0.3																						
5	BH41-12-0.6																						
6	BH41-12-0.9																						
7	BH41-12-1.2																						
8	BH41-12-1.5																						↓
9	BH41-12-2.25																						
10	BH41-12-3.0																						
11	BH41-12-3.75																						
12	BH41-12-4.5	↓	↓	↓																		✓	F/P

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: Samples split between coolers

# of Jars Used & Not Submitted:

LAB USE ONLY
Received By: Melissa Price Date: 2012/10/17 Time: 0845
Maxxam Job #: B203614
Custody Seal: X
Temperature:
Ice: Y
Lab Comments:

AB FCD-03331 Rev3 2010/09

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Chain of Custody A072032

Page: 6 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services	Tetra Tech	joel.nolin
Contact:	Can - Natalie Robinson	Joel Nolin	andrew.eason
Address:	1650-635 8th Ave SW Calgary	115, 200 Rivercrest Dr SE Calgary	labresultsss
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2C 2X5	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4065	Ph: 403-718-8210 Cell: 403-990-1361	krista.olafsson

(E-mail addresses bracketed: @tetratech.com)

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

- PO #:
- Project # / Name: 1018801603
- Site Location: Lobstick Golf Course
- Quote #:
- Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

Analyses — SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill. WATER: ☐ BTEX F1 ☐ VOCs; ☐ BTEX F1-F2 ☐ BTEX F1-F4; ☐ Routine Water ☐ Tank, E.F.; ☐ TOC ☐ DOC; Total / Dissolved Regulated Metals (CCME / AT1); Mercury ☐ Total ☐ Dissolved. Other Analysis.

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH41-12-5.25	m	soil	12/10/14		✓	1
2	BH41-12-6.0	↓	↓	↓		↓	1
3	BH41-12-6.75						1
4	BH41-12-7.5						2
5	BH41-12-8.25						1
6	BH42-12-0.1				Insufficient sample		1
7	BH42-12-0.3						↓
8	BH42-12-0.6						
9	BH42-12-0.9						
10	BH42-12-1.2						
11	BH42-12-1.5						
12	BH42-12-2.25	↓	↓	↓		↓	2

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

- Relinquished By (Signature/Print): [signature] Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):
- Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):
- Special Instructions: samples split between coolers
- # of Jars Used & Not Submitted:

LAB USE ONLY
- Received By: Melissa Paré / MELISSA PARÉ Date: 2012/10/17 Time: 0945
- Maxxam Job #: B293624
- Custody Seal: Y Temperature: Ice: Y
- Lab Comments:

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PAGE 08/09
HAWOOD INN 3655635219 10/15/2012 01:44
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Chain of Custody A072033

Page: 1 of 8

	Invoice To:	C/O Report Address ☐	Report To:	Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Grit Services Can.		Tetra Tech		joel.nolin
Contact:	Natalie Robinson		Joel Nolin		andrew.eason
Address:	1650-635 8th Ave SW Calgary		115-800 Rivercrest Dr SE Calgary		laboresultssk @tetratech.com
	Prov: AB PC: T2P 3M3		Prov: AB PC: T2P 0V6		tray.lange
Contact #:	Ph: 403-292-6882 Cell: 403-860-4015		Ph: 403-716-3210 Cell: 403-990-1861		krista.olafsson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after completion, unless specified otherwise.

PO #:
Project # / Name: 101890603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity	Assessment (CP Metals)	Basic Class II Landfill	WATER: BTEX/F1-F4	VOC's	Regulated Metals	Total	Dissolved	Mercury	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH42-12-3.0	m	Soil	12/10/14														✓	2
2	BH42-12-3.75																		
3	BH42-12-4.5																		
4	BH42-12-5.1																		
5	BH42-12-5.6																		
6	BH42-12-6.2																		
7	BH42-12-6.9																		
8	BH42-12-7.8																		
9	BH43-12-0.2																		
10	BH43-12-0.5																		
11	BH43-12-0.75																		
12	BH43-12-1.0																		

Please Indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
TL, Tray Lange	12/10/16	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: samples split between coolers

Are Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:	
Melissa Pare	2012/10/17	08:15	B2B362	
Melissa Pare			Cooler(s) Present:	Temperature:
Lab Comments:			X	

AB FOC-00331 Rev0 2010/05

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Chain of Custody A072034

Page: 8 of 8

Invoice To:	C/O Report Address ☐
Company:	Public Works & Gov't Services Can.
Contact:	Natalie Robinson
Address:	1650-635 8th Ave SW, Calgary
Prov:	AB PC: T2P 3M3
Contact #s:	Ph: 403-292-6882 Fx: 403-850-4015

Report To:	Same as Invoice ☐
Company:	Tetra Tech
Contact:	Joel Nolin
Address:	115-200 Rivercrest Dr SE Calgary
Prov:	AB PC: T2C 2X5
Contact #s:	Ph: 403-718-3210 Cell: 403-990-1361

Report Distribution (E-Mail):
joel.nolin
andrew.eason
labresultssk @tetratech.com
troy.lange
krista.olafsson

REGULATORY GUIDELINES:
- ☐ ATI
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	101890603
Site Location:	Lobstick Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

Analyses — SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill. WATER: BTEX F1 / VOCs; BTEX F1-F2 / BTEX F1-F4; Routine Water / Turb / EC; TOC / DOC; Total / Dissolved Regulated Metals (CCME / AT1); Mercury Total / Dissolved. Other Analysis.

#	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YYMMDD 24:00	HOLD - Do not Analyze	# of Containers Submitted
1	BH43-12-1.25	m	soil	12/10/14	✓	1
2	BH43-12-1.5	↓	↓	↓	↓	↓
3	BH44-12-0.3	↓	↓	↓	↓	↓
4	BH44-12-0.5	↓	↓	↓	↓	↓
5	BH44-12-0.75	↓	↓	↓	↓	↓
6	BH44-12-1.0	↓	↓	↓	↓	↓
7	BH44-12-1.5	↓	↓	↓	↓	2
8	BH41-12-9.0	↓	↓	↓	✓	1
9						
10						
11						
12						

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/16	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Samples split between coolers

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:
Melissa Pare / MELISSA PARE	2012/10/17	0845	B2J5621
Custody Seal: X	Temperature:	Ice: X	

Lab Comments:

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Wendy Sears

From: Jones, Kelly <Kelly.Jones@tetratech.com>
Sent: Wednesday, October 17, 2012 11:19 AM
To: Wendy Sears
Subject: FW: Samples sent to Lab

Hi Wendy,

See email train below. When you get the Lobstick coolers, the following are the samples we want run for BTEX,F1-F4:

BH32-12-7.15
BH32-12-7.75
BH33-12-6.0
BH33-12-4.5
BH34-12-7.0
BH34-12-4.75
BH41-12-8.75
BH42-12-7.8

Some of them will be at day 5 today and some at day 5 tomorrow. Please let me know when you get them. Thank you

Kelly

Kelly Jones, B.Sc. | Environmental Scientist
Direct: 306.352.1688 Ext: 223 | Fax: 306.352.1697 | Cell: 306.529.7932
Kelly.Jones@tetratech.com

Tetra Tech | Infrastructure and Environmental
812 Victoria Avenue East | Regina, SK, S4N 0P2 Canada | www.tetratech.com

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Think Green - Not every email needs to be printed.

From: Cruickshank, Alix
Sent: Wednesday, October 17, 2012 9:07 AM
To: WEI.SKT - Labresults
Cc: Smith, Jeffrey; Jones, Kelly; Fedorchuk, Andrea; Lange, Troy; Olafsson, Krista
Subject: Samples sent to Lab

Hello,

5 coolers of samples were dropped off at Purolator in Saskatoon last night at approximately 6:15 pm headed to Maxxam in Calgary.
Samples were from Rosetown – 2 coolers (9913482911) and Lobstick – 3 coolers (1018901603)

Waybills: 1036 223 4295
1036 223 4337
COCs:

1

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A072029

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Gov't Services Can - Public Relations	Total Test Joel Nolin
Contact:		
Address:	1650, 635 8th Ave SW Calgary	115, 240 Riverpoint Dr. SE
Prov:	AB PC: T2P 3M3	Prov: AB PC: T2C 2X6
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4805	Ph: 403-278-3210 Cell: 403-990-[illegible]

Report Distribution (E-Mail): joel.nolin, Andrew.eason, tobreuthaste, troy.lange, etc/kristen.olsson

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1010140/1003
Site Location: Lochrick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required:
☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	DDT	WATER: ☐VOCs	☐BTEX F1-F2	☐BTEX F1-F4	☐Routine Water ☐Turb ☐F	☐DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH34-12-3.05	m	soil	12/10/14																		✓	2
2	BH34-12-3.25																						1
3	BH34-12-4.6																						1
4	BH34-12-4.75																						1
5	BH34-12-5.5					X																	1
6	BH34-12-6.25																						1
7	BH34-12-7.0																						1
8	~~BH34-12-7.5~~																						
9	BH34-12-8.0	m	soil	12/10/14																		✓	2
10	BH32-12-0.05										X												1
11	BH33-12-0.12-0.25																				Insufficient Sample		1
12	BH33-12-0.5																					✓	1

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

	Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
	Troy Lange	12/10/14	
	Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: # of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice

Lab Comments:

Maxxam

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Chain of Custody A072030

Page: 4 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)
Company:	Public Works & Gov't Services Can.	Tetra Tech
Contact:	Natalie Robinson	Joel Nolin
Address:	1650, 635 8th Ave SW Calgary Prov: AB PC: T2P 3M3	115, 200 Rivercrest Dr SE Calgary Prov: AB PC: T2P 2L6
Contact #s:	Ph: 403-292-6883 Cell: 403-860-4015	Ph: 403-718-3210 Cell: 403-990-1511

Report Distribution (E-Mail): joel.nolin, andrew.eysen, labresults.sk, troy.lange, krista.watson @tetratech.com

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

- PO #:
- Project # / Name: 1018901603
- Site Location: Lobstick Golf Course
- Quote #:
- Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

SOIL: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill; DDT

WATER: ☐BTEX F1 ☐VOCs; ☐BTEX F1-F2 ☐BTEX F1-F4; ☐Routine Water ☐Turb ☐F; ☐TOC ☐DOC; Regulated Metals (CCME / AT1) Total / Dissolved; Mercury ☐Total ☐Dissolved

Other Analysis

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	DDT	HOLD - Do not Analyze	# of Containers Submitted
1	BH33-12-0.75	m	soil	12/10/14		✓	1
2	BH33-12-1.0	↓	↓	↓	X		↓
3	BH33-12-1.25					↓	
4	BH33-12-1.5						
5	BH33-12-2.25						2
6	BH33-12-3.0						↓
7	BH33-12-3.75						
8	BH33-12-4.5						
9	BH33-12-5.25						
10	BH33-12-6.0						
11	BH33-12-6.75						
12	BH33-12-7.5	↓	↓	↓		↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F / P

Relinquished By (Signature/Print): [signature] Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):

Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions: # of Jars Used & Not Submitted

LAB USE ONLY

Received By: Date: Time: Maxxam Job #:

Custody Seal | Temperature | Ice

Lab Comments:

Maxxam

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Edmonton: 9331 - 48 Street, T6B 2R4 Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 485-8869
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Chain of Custody

A072031

Page: 5 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Gov't Services Can.	~~Joel Atalla~~ Tetra Tech
Contact:	Akotsia Robinson	Joel Atalla
Address:	1530, 633 6th Ave SW, Calgary	115, 200 Rivercrest Dr SE, Calgary
Prov:	AB PC: T2P 3M8	Prov: AB PC: T2P 2W2
Contact #s:	Ph: 403-292-8882 Cell: 403-860-4115	Ph: 403-718-3210 Cell: 403-710-1361

Report Distribution (E-Mail): joel.atalla@tetratech.com, Andrew.Anson@tetratech.com, labresults-ab@tetratech.com, tracy.lange@tetratech.com, kristin.watson@tetratech.com

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KB

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required:
☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME + AT1)	Salinity 4:1	Assessment ICP Metals	Basic Class II Landfill	DDT	WATER: ☐VOCs	☐BTEX F1-F2	☐BTEX F1-F4	☐Routine Water ☐Turb. ☐F.	☐TOC ☐DOC	Total	Dissolved	Regulated Metals (CCME / AT1)	Mercury	☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH33-12-7.65	m	soil	12/10/14																				1
2	BH33-12-7.8					X																		1
3	BH41-12-0.1										X													1
4	BH41-12-0.3										X												Insufficient Sample	1
5	BH41-12-0.6																							
6	BH41-12-0.9										X													
7	BH41-12-1.2																							
8	BH41-12-1.5																							
9	BH41-12-2.25																							
10	BH41-12-3.0																							
11	BH41-12-3.75																							
12	BH41-12-4.5																							

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
~~Joel Atalla~~ Tracy Lange	12/10/14	
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Special Instructions:	# of Jars Used & Not Submitted	

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam

Calgary: 4000 10st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-1187, Toll free: (877) 485-8858
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Chain of Custody A072032

Page: 6 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Civil Services	Tetra Tech
Contact:	Attn: Natalie Robinson	Joel Nolin
Address:	#650-625 5th Ave SW Calgary	#5, 360 Riverstone Blvd E Cochrane
Prov:	AB	AB
PC:	T2P 3H2	T4C 0A4
Contact #s:	Ph: 403-542-6882 Cell: 403-860-4485	Ph: 403-718-3316 Cell: 403-988-1261

Report Distribution (E-Mail): joel.nolin@tetratech.com; andrew.person@tetratech.com; labcoquitlam@tetratech.com; Kay.Lange@tetratech.com; kristen.olafson@tetratech.com

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	10890/1403
Site Location:	Lakeside Golf Course
Quote #:	
Sampled By:	KL KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	DDT	WATER: ☐ VOCs	☐ BTEX F1	☐ BTEX F1-F2	☐ BTEX F1-F4	☐ Routine Water	☐ Turp	☐ IF	☐ DOC	☐ TOC	Regulated Metals (CCME/AT1) Total	Dissolved	☐ Total ☐ Dissolved	Mercury	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH41-12-5.25	NA	soil	12/10/14																						✓	1
2	BH41-12-6.0																										
3	BH41-12-6.75																										
4	BH41-12-7.5																										
5	BH41-12-8.25																										
6	BH42-12-0.1																										
7	BH42-12-0.3										X														Inv. Element + Sample		1
8	BH42-12-0.6																										
9	BH42-12-0.9																										
10	BH42-12-1.2										X																
11	BH42-12-1.5																										
12	BH42-12-2.25	↓	↓	↓																						✓	2

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):		Date (YY/MM/DD):	Time (24:00):
Relinquished By (Signature/Print): Tay Lange		Date (YY/MM/DD): 12/10/16	Time (24:00):
Special Instructions:		# of Jars Used & Not Submitted	

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
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Chain of Custody A072033

Page: 7 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Govt Services Can.	Tetra Tech	joel.nelin
Contact:	Natalie Robinson	Joel Nelin	andrew.wasa...
Address:	1650-635 8th Ave SW, Calgary	115-200 Rivercrest Dr SE Calgary	...@TetraTech.com
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2C 2X5	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4415	Ph: 403-718-3210 Cell: 403-990-1361	krista.olafsson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

Soil analyses: BTEX F1-F4; Sieve (75 micron); Regulated Metals (CCME / AT1); Salinity 4; Assessment ICP Metals; Basic Class II Landfill; ODT
Water analyses: ☐BTEX F1 ☐VOCs; ☐BTEX F1-F2 ☐BTEX F1-F4; ☐ Routine Water ☐ Turb ☐ F; ☐ TOC ☐ DOC; Regulated Metals (CCME / AT1) Total / Dissolved; Mercury ☐ Total ☐ Dissolved
Other Analysis

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	ODT	HOLD - Do not Analyze	# of Containers Submitted
1	BH42-12-3.0	m	soil	12/10/14			2
2	BH42-12-3.75	↓	↓	↓		✓	↓
3	BH42-12-4.5						
4	BH42-12-5.1						
5	BH42-12-5.6						
6	BH42-12-6.2						
7	BH42-12-6.9						
8	BH42-12-7.8						
9	BH43-12-0.2				X		1
10	BH43-12-0.5						
11	BH43-12-0.75						
12	BH43-12-1.0	↓	↓	↓		↓	↓

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):
Special Instructions:
# of Jars Used & Not Submitted

LAB USE ONLY
Received By: Date: Time: Maxxam Job #:
Custody Seal | Temperature | Ice
Lab Comments:

Maxxam

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Chain of Custody

A072034

Page: 8 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Gov't Services Can.	Tetra Tech
Contact:	Natalie Robinson	Joel Nolin
Address:	1550-635 8th Ave SW, Calgary	115-200 Rivercrest Dr SE Calgary
Prov: / PC:	AB / T2P 3M3	AB / T2C 2X5
Contact #s:	Ph: 403-292-6683 Fax: 403-260-4615	Ph: 403-716-3210 Cell: 403-990-1861

Report Distribution (E-Mail): joel.nolin@tetratech.com, trey.lange@tetratech.com, kyle.atkinson@tetratech.com

REGULATORY GUIDELINES: ☐ AT1 ☑ CCME ☐ Regulated Drinking Water ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	1018901603
Site Location:	Lakelet Golf Course
Quote #:	
Sampled By:	TL, KO

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	SOIL	WATER: ☐VOCs	☐BTEX F1	☐BTEX F1-F2	☐BTEX F1-F4	☐Routine Water	☐TOC	☐Turb.	☐DOC	☐F.	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH43-12-1.25	m	soil	12/10/14							X															
2	BH43-12-1.5																									
3	BH44-12-0.3										X															
4	BH44-12-0.5																									
5	BH44-12-0.75										X															
6	BH44-12-1.0										X															
7	BH44-12-1.5	↓	↓	↓							X															
8	BH42-12-0.3 DUP	m	soil	12/10/14							X														one to be labelled BH42-12-0.3	
9	BH44-12-0.3 DUP	m	soil	12/10/14							X	Split the Jar into two														
10	~~BH39-12-1.0 DUP~~	~~m~~	~~soil~~	~~12/10/14~~							~~X~~															
11	~~BH44-12-3.5 DUP~~	~~m~~	~~soil~~	~~12/10/14~~							~~X~~															
12																										

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Relinquished By (Signature/Print): Trey Lange	Date (YY/MM/DD): 12/10/16	Time (24:00):

Special Instructions:

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam

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Chain of Custody A072027

Page: 1 of 8

	Invoice To: (C/O Report Address ☐)	Report To: (Same as Invoice ☐)
Company:	Public Works & Gov't	Tetra Tech
Contact:	Service Can - Natalia Robinson	Joel Nolin
Address:	1650, 635 8th Ave SW Calgary	115, 200 Rivercrest Dr SE
Prov: / PC:	AB PC: T2P 3M3	Calgary AB PC: T2C 2X5
Contact #s:	Ph: 403-292-6882 Cell: 403-860-4475	Ph: 403-718-3310 Cell: 403-990-[illegible]

Report Distribution (E-Mail): joel.nolin, andrew.[illegible], [illegible], troy.lange, [illegible] @tetratech.com

REGULATORY GUIDELINES:
- ☐ AT1
- ☒ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

- PO #:
- Project # / Name: 1018901603
- Site Location: Lobstick Golf Course
- Quote #:
- Sampled By: TL, KO

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required:
- ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

Soil analyses: BTEX F1-F4 · Sieve (75 micron) · Regulated Metals (CCME / AT1) · Salinity 4 · Assessment ICP Metals · Basic Class II Landfill · DDT

Water analyses: ☐BTEX F1 · ☐VOCs · ☐BTEX F1-F2 · ☐BTEX F1-F4 · ☐ Routine Water ☐ Turb ☐ F · ☐ TOC · ☐ DOC · Regulated Metals (CCME / AT1) Total / Dissolved · Mercury ☐ Total ☐ Dissolved

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	DDT	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH32-12-0.1	m	soil	12/10/14	X			1
2	BH32-12-0.3				X	Insufficient sample	✓	1
3	BH32-12-0.6				X			
4	BH32-12-0.9							
5	BH32-12-1.2							
6	BH32-12-1.5							
7	BH32-12-2.25							
8	BH32-12-3.0							2
9	BH32-12-3.75							
10	BH32-12-4.5							
11	BH32-12-5.25							
12	BH32-12-6.0							1

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Troy Lange Date (YY/MM/DD): 12/10/16 Time (24:00):

Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions:

# of Jars Used & Not Submitted

LAB USE ONLY
Received By: Date: Time: Maxxam Job #:
Custody Seal | Temperature | Ice
Lab Comments:

AB FCD-00331 Rev3 2010/05

B293624

Maxxam

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Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 485-8889
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Chain of Custody AU16020

Page: 2 of 8

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works - R Golf Service Cov - Metals Reclam	Tetra Tech
Contact:		Joel Nelson
Address:	#850, 635 8th Ave SW, Calgary	#15, 900 Rivercrest Dr SE Cal
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2P 2V6
Contact #s:	Ph: 403-391-4882 Cell: 403-860-4415	Ph: 403-718-3310 Cell: 403-998-1388

Report Distribution (E-Mail): joel.nelson@tetratech.com, andrew.cooper@tetratech.com, troy.lange@tetratech.com, [illegible]

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lost Ck Golf Course
Quote #:
Sampled By: TL KD

SERVICE REQUESTED:
☐ RUSH (Contact lab to reserve) Date Required:
☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	ODT	WATER: ☐BTEX F1	☐BTEX F1-F2	☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐ F	☐ TOC	☐ DOC	Regulated Metals (CCME/AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH32-12-0.4	m	soil	12/10/14																				3
2	BH32-12-7.15																							3
3	BH32-12-7.75																							3
4	BH32-12-8.3																							3
5	BH32#12-8.85																					Insufficient sample		1
6	BH34-12-0.25										X											Insufficient sample		1
7	BH34-12-0.5																					Insufficient sample		1
8	BH34-12-0.75																							3
9	BH34-12-1.0																							3
10	BH34-12-1.25										X													3
11	BH34-12-1.5																							3
12	BH34-12-2.25	1.75	↓	↓																				3

Please Indicate Filtered, Preserved or Both (F, P, F/P) → F/P F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
[illegible]	12/10/14	
Relinquished By (Signature/Print): Troy Lange	Date (YY/MM/DD): 12/10/14	Time (24:00):

Special Instructions: # of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

Maxxam

Success Through Science®

Your Project #: B293624
Your C.O.C. #: na

Attention: Wendy Sears
Maxxam Analytics
2021 41st Ave NE
Calgary, AB
T2E 6P2

Report Date: 2012/10/31

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2G4974
Received: 2012/10/23, 09:26

Sample Matrix: Soil
Samples Received: 18

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	18	N/A	2012/10/27	CAM SOP-00445	R.Carter,1993
OC Pesticides (Selected) & PCB (1)	18	2012/10/27	2012/10/30	CAM SOP-00307	SW846 8081, 8082

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy,
Email: kpomeroy@maxxam.ca
Phone# (905) 817-5700

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 1

Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

O'REG 153 OC PESTICIDES (SOIL)

Maxxam ID		PI0523		PI0524	PI0525	PI0525	PI0526		
Sampling Date		2012/10/14		2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		na		na	na	na	na		
	Units	**ET3343 \ BH32-12-0.1**	**RDL**	**ET3345 \ BH32-12-0.6**	**ET3364 \ BH34-12-0.25**	**ET3364 \ BH34-12-0.25 Lab-Dup**	**ET3368 \ BH34-12-1.25**	**RDL**	**QC Batch**
Moisture	%	29	1.0	6.5	8.3	7.6	12	1.0	3017063
o,p-DDT	ug/g	0.0090	0.0020	<0.0020	0.0020	N/A	<0.0020	0.0020	3017028
p,p-DDT	ug/g	0.070	0.010	<0.0020	0.015	N/A	<0.0020	0.0020	3017028
o,p-DDT + p,p-DDT	ug/g	0.080	0.010	<0.0020	0.017	N/A	<0.0020	0.0020	3017028
DDT+ Metabolites	ug/g	0.13	0.010	<0.0020	0.038	N/A	<0.0020	0.0020	3017028
Surrogate Recovery (%)									
2,4,5,6-Tetrachloro-m-xylene	%	76	N/A	80	78	N/A	85	N/A	3017028
Decachlorobiphenyl	%	63	N/A	69	67	N/A	74	N/A	3017028

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		PI0526	PI0527	PI0528	PI0529	PI0530	PI0531		
Sampling Date		2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		na	na	na	na	na	na		
	Units	**ET3368 \ BH34-12-1.25 Lab-Dup**	**ET3383 \ BH33-12-0.05**	**ET3387 \ BH33-12-1.0**	**ET3404 \ BH41-12-0.3**	**ET3406 \ BH41-12-0.9**	**ET3419 \ BH42-12-0.3**	**RDL**	**QC Batch**
Moisture	%	N/A	28	16	12	11	16	1.0	3017063
o,p-DDT	ug/g	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3017028
p,p-DDT	ug/g	<0.0020	0.0050	<0.0020	<0.0020	<0.0020	0.0020	0.0020	3017028
o,p-DDT + p,p-DDT	ug/g	<0.0020	0.0050	<0.0020	<0.0020	<0.0020	0.0020	0.0020	3017028
DDT+ Metabolites	ug/g	<0.0020	0.0080	<0.0020	<0.0020	<0.0020	0.0050	0.0020	3017028
Surrogate Recovery (%)									
2,4,5,6-Tetrachloro-m-xylene	%	82	76	79	80	84	79	N/A	3017028
Decachlorobiphenyl	%	75	72	72	72	76	72	N/A	3017028

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

O'REG 153 OC PESTICIDES (SOIL)

Maxxam ID		PI0532		PI0533		PI0534	PI0535		
Sampling Date		2012/10/14		2012/10/14		2012/10/14	2012/10/14		
COC Number		na		na		na	na		
	Units	**ET3422 \ BH42-12-1.2**	**RDL**	**ET3445 \ BH43-12-0.2**	**RDL**	**ET3450 \ BH43-12-1.25**	**ET3452 \ BH44-12-0.3**	**RDL**	**QC Batch**
Moisture	%	15	1.0	30	1.0	8.5	13	1.0	3017063
o,p-DDT	ug/g	<0.0020	0.0020	0.011	0.0020	<0.0020	<0.0020	0.0020	3017028
p,p-DDT	ug/g	<0.0020	0.0020	0.10	0.010	<0.0020	<0.0020	0.0020	3017028
o,p-DDT + p,p-DDT	ug/g	<0.0020	0.0020	0.11	0.010	<0.0020	<0.0020	0.0020	3017028
DDT+ Metabolites	ug/g	<0.0020	0.0020	0.20	0.010	<0.0020	<0.0020	0.0020	3017028
Surrogate Recovery (%)									
2,4,5,6-Tetrachloro-m-xylene	%	87	N/A	85	N/A	83	83	N/A	3017028
Decachlorobiphenyl	%	76	N/A	74	N/A	68	72	N/A	3017028

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		PI0536	PI0537	PI0538	PI0539	PI0540		
Sampling Date		2012/10/14	2012/10/14	2012/10/14	2012/10/14	2012/10/14		
COC Number		na	na	na	na	na		
	Units	**ET3454 \ BH44-12-0.75**	**ET3455 \ BH44-12-1.0**	**ET3456 \ BH44-12-1.5**	**ET3403 \ BH42-12-0.3 DUP**	**ET3404 \ BH44-12-0.3 DUP**	**RDL**	**QC Batch**
Moisture	%	10	14	14	16	13	1.0	3017063
o,p-DDT	ug/g	0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0020	3017028
p,p-DDT	ug/g	0.014	0.0030	0.0020	0.0030	<0.0020	0.0020	3017028
o,p-DDT + p,p-DDT	ug/g	0.016	0.0030	0.0020	0.0030	<0.0020	0.0020	3017028
DDT+ Metabolites	ug/g	0.047	0.013	0.0020	0.0060	<0.0020	0.0020	3017028
Surrogate Recovery (%)								
2,4,5,6-Tetrachloro-m-xylene	%	86	82	83	81	81	N/A	3017028
Decachlorobiphenyl	%	72	69	67	70	73	N/A	3017028

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

Test Summary

Maxxam ID PI0523 **Collected** 2012/10/14
Sample ID ET3343 \ BH32-12-0.1 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0524 **Collected** 2012/10/14
Sample ID ET3345 \ BH32-12-0.6 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0525 **Collected** 2012/10/14
Sample ID ET3364 \ BH34-12-0.25 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0525 Dup **Collected** 2012/10/14
Sample ID ET3364 \ BH34-12-0.25 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani

Maxxam ID PI0526 **Collected** 2012/10/14
Sample ID ET3368 \ BH34-12-1.25 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0526 Dup **Collected** 2012/10/14
Sample ID ET3368 \ BH34-12-1.25 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

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Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

Test Summary

Maxxam ID PI0527 **Collected** 2012/10/14
Sample ID ET3383 \ BH33-12-0.05 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0528 **Collected** 2012/10/14
Sample ID ET3387 \ BH33-12-1.0 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0529 **Collected** 2012/10/14
Sample ID ET3404 \ BH41-12-0.3 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0530 **Collected** 2012/10/14
Sample ID ET3406 \ BH41-12-0.9 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0531 **Collected** 2012/10/14
Sample ID ET3419 \ BH42-12-0.3 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0532 **Collected** 2012/10/14
Sample ID ET3422 \ BH42-12-1.2 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

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Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

Test Summary

Maxxam ID PI0533 **Collected** 2012/10/14
Sample ID ET3445 \ BH43-12-0.2 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0534 **Collected** 2012/10/14
Sample ID ET3450 \ BH43-12-1.25 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0535 **Collected** 2012/10/14
Sample ID ET3452 \ BH44-12-0.3 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0536 **Collected** 2012/10/14
Sample ID ET3454 \ BH44-12-0.75 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0537 **Collected** 2012/10/14
Sample ID ET3455 \ BH44-12-1.0 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0538 **Collected** 2012/10/14
Sample ID ET3456 \ BH44-12-1.5 **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

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Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

Test Summary

Maxxam ID PI0539 **Collected** 2012/10/14
Sample ID ET3403 \ BH42-12-0.3 DUP **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0540 **Collected** 2012/10/14
Sample ID ET3404 \ BH44-12-0.3 DUP **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3017063	N/A	2012/10/27	Valentina Kaftani
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

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Maxxam Job #: B2G4974
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B293624

Package 1	4.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Sample PI0523-01: OC Pesticide Analysis: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Sample PI0533-01: OC Pesticide Analysis: Due to high concentrations of the target analytes, sample required dilution. Detection limits were adjusted accordingly.

Results relate only to the items tested.

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Maxxam Analytics
Attention: Wendy Sears
Client Project #: B293624
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: MB2G4974

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3017028 MAK	Matrix Spike	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		76	%	50 - 130
		Decachlorobiphenyl	2012/10/30		69	%	50 - 130
	Matrix Spike (PI0526)						
		o,p-DDT	2012/10/30		83	%	50 - 130
		p,p-DDT	2012/10/30		83	%	50 - 130
	Spiked Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		80	%	50 - 130
		Decachlorobiphenyl	2012/10/30		69	%	50 - 130
		o,p-DDT	2012/10/30		84	%	50 - 130
		p,p-DDT	2012/10/30		82	%	50 - 130
	Method Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		83	%	50 - 130
		Decachlorobiphenyl	2012/10/30		71	%	50 - 130
		o,p-DDT	2012/10/30	<0.0020		ug/g	
		p,p-DDT	2012/10/30	<0.0020		ug/g	
		o,p-DDT + p,p-DDT	2012/10/30	<0.0020		ug/g	
		DDT+ Metabolites	2012/10/30	<0.0020		ug/g	
	RPD - Sample/Sample Dup						
		o,p-DDT	2012/10/30	NC		%	40
		p,p-DDT	2012/10/30	NC		%	40
		o,p-DDT + p,p-DDT	2012/10/30	NC		%	40
		DDT+ Metabolites	2012/10/30	NC		%	40
3017063 N_P	RPD - Sample/Sample Dup						
		Moisture	2012/10/27	8.8		%	20

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B2G4974

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Charles Ancker, B.Sc., M.Sc., C.Chem, Senior Analyst

Cristina Carriere, Scientific Services

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Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A073651, A072837, A073652, A073638

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/11/02

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B294090
Received: 2012/10/18, 8:40

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
BTEX/F1 by HS GC/MS (MeOH extract)	1	2012/10/18	2012/10/22	AB SOP-00039	CCME, EPA 8260C
CCME Hydrocarbons (F2-F4 in soil) (1)	1	2012/10/18	2012/10/20	AB SOP-00040 AB SOP-00036	CCME PHC-CWS
Moisture	1	N/A	2012/10/19	AB SOP-00002	CCME PHC-CWS
Polychlorinated Biphenyls	1	2012/10/24	2012/10/26	CAL SOP-00149	EPA 3550B, EPA 8082A

Sample Matrix: Water
Samples Received: 9

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Alkalinity @25C (pp, total), CO3,HCO3,OH	6	N/A	2012/10/20	AB SOP-00005	SM 2320-B
BTEX/F1 in Water by HS GC/MS	9	N/A	2012/10/21	AB SOP-00039	CCME, EPA 8260C
Cadmium - low level CCME - Dissolved	6	N/A	2012/10/22	AB SOP-00043	EPA 200.8
Chloride by Automated Colourimetry	5	N/A	2012/10/19	AB SOP-00020	EPA 325.2
Chloride by Automated Colourimetry	1	N/A	2012/10/23	AB SOP-00020	EPA 325.2
Conductivity @25C	6	N/A	2012/10/20	AB SOP-00005	SM 2510-B
CCME Hydrocarbons (F2-F4 in water)	8	2012/10/19	2012/10/22	AB SOP-00040 AB SOP-00037	EPA3510C/CCME PHCCWS
CCME Hydrocarbons in Water (F2; C10-C16)	1	2012/10/19	2012/10/22	AB SOP-00040 AB SOP-00037	EPA3510C/CCME PHCCWS
Hardness	6	N/A	2012/10/19	AB WI-00065	SM 2340B
Elements by ICP - Dissolved	6	N/A	2012/10/19	AB SOP-00042	EPA 200.7
Elements by ICPMS - Dissolved	6	N/A	2012/10/20	AB SOP-00043	EPA 200.8
Ion Balance	6	N/A	2012/10/19	AB WI-00065	SM 1030E
Sum of cations, anions	6	N/A	2012/10/19	AB WI-00065	SM 1030E
Nitrate and Nitrite	6	N/A	2012/10/24	AB SOP-00023	SM4110B
Nitrate + Nitrite-N (calculated)	6	N/A	2012/10/24	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	5	N/A	2012/10/23	AB SOP-00023	SM 4110-B
Nitrogen, (Nitrite, Nitrate) by IC	1	N/A	2012/10/24	AB SOP-00023	SM 4110-B
pH @25°C (Alkalinity titrator)	6	N/A	2012/10/20	AB SOP-00005	SM 4500-H+B
Sulphate by Automated Colourimetry	5	N/A	2012/10/19	AB SOP-00018	EPA 375.4
Sulphate by Automated Colourimetry	1	N/A	2012/10/23	AB SOP-00018	EPA 375.4
Total Dissolved Solids (Calculated)	5	N/A	2012/10/20	AB WI-00065	SM 1030E
Total Dissolved Solids (Calculated)	1	N/A	2012/10/23	AB WI-00065	SM 1030E

../2

Your P.O. #: 700228686
Your Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your C.O.C. #: A073651, A072837, A073652, A073638

Attention: JOEL NOLIN
TETRA TECH
115, 200 RIVERCREST DR SE
CALGARY, AB
CANADA T2P 2V6

Report Date: 2012/11/02

CERTIFICATE OF ANALYSIS

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Edmonton Environmental

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403) 291-3077

==========

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Total cover pages: 2

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		ET6972		
Sampling Date		2012/10/17		
COC Number		A072837		
	UNITS	**WASTE SOIL**	**RDL**	**QC Batch**
Physical Properties				
Moisture	%	17	0.30	6268540

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET6972		
Sampling Date		2012/10/17		
COC Number		A072837		
	UNITS	**WASTE SOIL**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon				
F2 (C10-C16 Hydrocarbons)	mg/kg	<10	10	6271918
F3 (C16-C34 Hydrocarbons)	mg/kg	<10	10	6271918
F4 (C34-C50 Hydrocarbons)	mg/kg	<10	10	6271918
Reached Baseline at C50	mg/kg	Yes	N/A	6271918
Surrogate Recovery (%)				
O-TERPHENYL (sur.)	%	101	N/A	6271918

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

POLYCHLORINATED BIPHENYLS BY GC-ECD (SOIL)

Maxxam ID		ET6972	ET6972		
Sampling Date		2012/10/17	2012/10/17		
COC Number		A072837	A072837		
	UNITS	**WASTE SOIL**	**WASTE SOIL Lab-Dup**	**RDL**	**QC Batch**
Polychlorinated Biphenyls					
Aroclor 1016	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1221	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1232	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1242	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1248	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1254	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1260	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1262	mg/kg	<0.010	<0.010	0.010	6291459
Aroclor 1268	mg/kg	<0.010	<0.010	0.010	6291459
Total Aroclors	mg/kg	<0.010	<0.010	0.010	6291459
Surrogate Recovery (%)					
NONACHLOROBIPHENYL (sur.)	%	86	96	N/A	6291459

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

VOLATILE ORGANICS BY GC-MS (SOIL)

Maxxam ID		ET6972		
Sampling Date		2012/10/17		
COC Number		A072837		
	UNITS	**WASTE SOIL**	**RDL**	**QC Batch**
Volatiles				
Benzene	mg/kg	<0.010 (1)	0.010	6273978
Toluene	mg/kg	<0.020	0.020	6273978
Ethylbenzene	mg/kg	<0.010	0.010	6273978
Xylenes (Total)	mg/kg	<0.040	0.040	6273978
m & p-Xylene	mg/kg	<0.040	0.040	6273978
o-Xylene	mg/kg	<0.020	0.020	6273978
F1 (C6-C10) - BTEX	mg/kg	<12	12	6273978
(C6-C10)	mg/kg	<12	12	6273978
Surrogate Recovery (%)				
1,4-Difluorobenzene (sur.)	%	93	N/A	6273978
4-BROMOFLUOROBENZENE (sur.)	%	88	N/A	6273978
D10-ETHYLBENZENE (sur.)	%	88	N/A	6273978
D4-1,2-DICHLOROETHANE (sur.)	%	79	N/A	6273978

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) Detection limit raised due to interferent.

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		ET6361	ET6812	ET6816	ET6817		ET6902		
Sampling Date		2012/10/17 09:38	2012/10/15	2012/10/15	2012/10/15		2012/10/16		
COC Number		A073652	A073652	A073652	A073652		A073638		
	UNITS	**BH23 DUP**	**BH 23**	**BH29-12**	**BH31-12**	**QC Batch**	**EQUIP BLANK - TUBING**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	meq/L	13	13	12	14	6265553	0.0000	N/A	6265553
Cation Sum	meq/L	12	12	11	12	6265553	0.000	N/A	6265553
Hardness (CaCO3)	mg/L	530	530	530	580	6265478	<0.50	0.50	6265478
Ion Balance	N/A	0.93	0.93	0.98	0.87	6265551	NC	0.010	6265551
Dissolved Nitrate (NO3)	mg/L	<0.013	<0.013	1.4	8.6	6265555	<0.013	0.013	6265555
Nitrate plus Nitrite (N)	mg/L	<0.0030	<0.0030	0.32	1.9	6265557	<0.0030	0.0030	6265557
Dissolved Nitrite (NO2)	mg/L	<0.0099	<0.0099	<0.0099	<0.0099	6265555	<0.0099	0.0099	6265555
Total Dissolved Solids	mg/L	650	650	570	660	6264337	<10	10	6265559
Misc. Inorganics									
Conductivity	uS/cm	1100	1100	990	1200	6269615	2.0	1.0	6269615
pH	N/A	7.72	7.70	8.07	7.87	6269617	5.97	N/A	6269617
Low Level Elements									
Dissolved Cadmium (Cd)	ug/L	0.021	0.074	0.13	0.23	6264331	0.012	0.0050	6264331
Anions									
Alkalinity (PP as CaCO3)	mg/L	<0.50	<0.50	<0.50	<0.50	6269575	<0.50	0.50	6269575
Alkalinity (Total as CaCO3)	mg/L	540	530	520	650	6269575	<0.50	0.50	6269575
Bicarbonate (HCO3)	mg/L	660	650	630	790	6269575	<0.50	0.50	6269575
Carbonate (CO3)	mg/L	<0.50	<0.50	<0.50	<0.50	6269575	<0.50	0.50	6269575
Hydroxide (OH)	mg/L	<0.50	<0.50	<0.50	<0.50	6269575	<0.50	0.50	6269575
Dissolved Sulphate (SO4)	mg/L	84	91	37	35	6271234	<1.0	1.0	6271234
Dissolved Chloride (Cl)	mg/L	19	19	20	18	6271232	<1.0	1.0	6271232
Nutrients									
Dissolved Nitrite (N)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	6280502	<0.0030	0.0030	6280502
Dissolved Nitrate (N)	mg/L	<0.0030	<0.0030	0.32	1.9	6280502	<0.0030	0.0030	6280502

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

RESULTS OF CHEMICAL ANALYSES OF WATER

Maxxam ID		ET6995		
Sampling Date		2012/10/17		
COC Number		A072837		
	UNITS	**WASTE WATER**	**RDL**	**QC Batch**
Calculated Parameters				
Anion Sum	meq/L	11	N/A	6265554
Cation Sum	meq/L	11	N/A	6265554
Hardness (CaCO3)	mg/L	240	0.50	6265550
Ion Balance	N/A	0.98	0.010	6265552
Dissolved Nitrate (NO3)	mg/L	17	0.013	6265556
Nitrate plus Nitrite (N)	mg/L	4.0	0.0030	6265558
Dissolved Nitrite (NO2)	mg/L	0.20	0.0099	6265556
Total Dissolved Solids	mg/L	560	10	6265559
Misc. Inorganics				
Conductivity	uS/cm	980	1.0	6269615
pH	N/A	8.73	N/A	6269617
Low Level Elements				
Dissolved Cadmium (Cd)	ug/L	0.25	0.0050	6264331
Anions				
Alkalinity (PP as CaCO3)	mg/L	36	0.50	6269575
Alkalinity (Total as CaCO3)	mg/L	490	0.50	6269575
Bicarbonate (HCO3)	mg/L	520	0.50	6269575
Carbonate (CO3)	mg/L	43	0.50	6269575
Hydroxide (OH)	mg/L	<0.50	0.50	6269575
Dissolved Sulphate (SO4)	mg/L	10	1.0	6282432
Dissolved Chloride (Cl)	mg/L	20	1.0	6282430
Nutrients				
Dissolved Nitrite (N)	mg/L	0.062	0.0030	6283331
Dissolved Nitrate (N)	mg/L	3.9	0.0030	6283331

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		ET6361	ET6365	ET6812	ET6816	ET6817		
Sampling Date		2012/10/17 09:38	2012/10/16	2012/10/15	2012/10/15	2012/10/15		
COC Number		A073652	A073652	A073652	A073652	A073652		
	UNITS	**BH23 DUP**	**FIELD BLANK**	**BH 23**	**BH29-12**	**BH31-12**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	0.30	<0.10	0.31	<0.10	<0.10	0.10	6271375
F3 (C16-C34 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6271375
F4 (C34-C50 Hydrocarbons)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6271375
Reached Baseline at C50	mg/L	Yes	Yes	Yes	Yes	Yes	N/A	6271375
Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	96	95	98	96	96	N/A	6271375

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam ID		ET6840		ET6902	ET6904	ET6995		
Sampling Date		2012/10/10		2012/10/16	2012/10/10	2012/10/17		
COC Number		A073638		A073638	A073638	A072837		
	UNITS	**TRIP BLANK**	**QC Batch**	**EQUIP BLANK - TUBING**	**EQUIP BLANK - PUTTY KNIFE**	**WASTE WATER**	**RDL**	**QC Batch**
Ext. Pet. Hydrocarbon								
F2 (C10-C16 Hydrocarbons)	mg/L	N/A	N/A	<0.10	<0.10	4.0	0.10	6271375
F3 (C16-C34 Hydrocarbons)	mg/L	N/A	N/A	<0.10	<0.10	3.1	0.10	6271375
F4 (C34-C50 Hydrocarbons)	mg/L	N/A	N/A	<0.10	<0.10	0.45	0.10	6271375
Reached Baseline at C50	mg/L	N/A	N/A	Yes	Yes	Yes	N/A	6271375
Hydrocarbons								
F2 (C10-C16 Hydrocarbons)	mg/L	<0.10	6273950	N/A	N/A	N/A	0.10	N/A
Surrogate Recovery (%)								
O-TERPHENYL (sur.)	%	94	6273950	94	99	98	N/A	6271375

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ET6361	ET6812	ET6816	ET6817	ET6902		
Sampling Date		2012/10/17 09:38	2012/10/15	2012/10/15	2012/10/15	2012/10/16		
COC Number		A073652	A073652	A073652	A073652	A073638		
	UNITS	**BH23 DUP**	**BH 23**	**BH29-12**	**BH31-12**	**EQUIP BLANK - TUBING**	**RDL**	**QC Batch**
Elements								
Dissolved Aluminum (Al)	mg/L	0.0045	0.022	0.0097	0.0062	0.0020	0.0010	6273288
Dissolved Antimony (Sb)	mg/L	<0.00060	<0.00060	<0.00060	<0.00060	<0.00060	0.00060	6273288
Dissolved Arsenic (As)	mg/L	0.00096	0.00089	0.00037	<0.00020	<0.00020	0.00020	6273288
Dissolved Barium (Ba)	mg/L	0.21	0.20	0.090	0.097	<0.010	0.010	6265531
Dissolved Beryllium (Be)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6273288
Dissolved Boron (B)	mg/L	0.042	0.043	0.049	0.067	<0.020	0.020	6265531
Dissolved Calcium (Ca)	mg/L	130	130	120	120	<0.30	0.30	6265531
Dissolved Chromium (Cr)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6273288
Dissolved Cobalt (Co)	mg/L	0.0059	0.0059	0.00099	0.00078	<0.00030	0.00030	6273288
Dissolved Copper (Cu)	mg/L	0.00088	0.0015	0.0039	0.0018	0.00034	0.00020	6273288
Dissolved Iron (Fe)	mg/L	2.0	1.9	<0.060	<0.060	<0.060	0.060	6265531
Dissolved Lead (Pb)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6273288
Dissolved Lithium (Li)	mg/L	<0.020	<0.020	0.083	0.073	<0.020	0.020	6265531
Dissolved Magnesium (Mg)	mg/L	49	50	54	68	<0.20	0.20	6265531
Dissolved Manganese (Mn)	mg/L	1.5	1.5	0.44	0.22	<0.0040	0.0040	6265531
Dissolved Molybdenum (Mo)	mg/L	0.0052	0.0054	0.044	0.0071	0.00030	0.00020	6273288
Dissolved Nickel (Ni)	mg/L	0.014	0.014	0.0042	0.0071	<0.00050	0.00050	6273288
Dissolved Phosphorus (P)	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6265531
Dissolved Potassium (K)	mg/L	11	11	9.8	6.3	<0.30	0.30	6265531
Dissolved Selenium (Se)	mg/L	0.00078	0.00080	0.00052	0.00077	<0.00020	0.00020	6273288
Dissolved Silicon (Si)	mg/L	8.1	8.0	9.5	9.4	<0.10	0.10	6265531
Dissolved Silver (Ag)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00010	6273288
Dissolved Sodium (Na)	mg/L	27	27	15	14	<0.50	0.50	6265531
Dissolved Strontium (Sr)	mg/L	0.23	0.22	0.43	0.51	<0.020	0.020	6265531
Dissolved Sulphur (S)	mg/L	33	33	12	13	<0.20	0.20	6265531
Dissolved Thallium (Tl)	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	0.00020	6273288
Dissolved Tin (Sn)	mg/L	<0.0010	<0.0010	0.013	0.0011	<0.0010	0.0010	6273288
Dissolved Titanium (Ti)	mg/L	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	0.0010	6273288
Dissolved Uranium (U)	mg/L	0.0061	0.0062	0.017	0.014	0.00014	0.00010	6273288
Dissolved Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010	6273288

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ET6361	ET6812	ET6816	ET6817	ET6902		
Sampling Date		2012/10/17 09:38	2012/10/15	2012/10/15	2012/10/15	2012/10/16		
COC Number		A073652	A073652	A073652	A073652	A073638		
	UNITS	**BH23 DUP**	**BH 23**	**BH29-12**	**BH31-12**	**EQUIP BLANK - TUBING**	**RDL**	**QC Batch**
Dissolved Zinc (Zn)	mg/L	0.0042	0.0091	0.0079	0.0061	<0.0030	0.0030	6273288

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID		ET6995		
Sampling Date		2012/10/17		
COC Number		A072837		
	UNITS	WASTE WATER	RDL	QC Batch
Elements				
Dissolved Aluminum (Al)	mg/L	0.069	0.0010	6273288
Dissolved Antimony (Sb)	mg/L	<0.00060	0.00060	6273288
Dissolved Arsenic (As)	mg/L	0.00082	0.00020	6273288
Dissolved Barium (Ba)	mg/L	0.026	0.010	6265531
Dissolved Beryllium (Be)	mg/L	<0.0010	0.0010	6273288
Dissolved Boron (B)	mg/L	0.029	0.020	6265531
Dissolved Calcium (Ca)	mg/L	49	0.30	6265531
Dissolved Chromium (Cr)	mg/L	<0.0010	0.0010	6273288
Dissolved Cobalt (Co)	mg/L	0.0020	0.00030	6273288
Dissolved Copper (Cu)	mg/L	0.015	0.00020	6273288
Dissolved Iron (Fe)	mg/L	0.12	0.060	6265531
Dissolved Lead (Pb)	mg/L	<0.00020	0.00020	6273288
Dissolved Lithium (Li)	mg/L	<0.020	0.020	6265531
Dissolved Magnesium (Mg)	mg/L	28	0.20	6265531
Dissolved Manganese (Mn)	mg/L	0.24	0.0040	6265531
Dissolved Molybdenum (Mo)	mg/L	0.0042	0.00020	6273288
Dissolved Nickel (Ni)	mg/L	0.0064	0.00050	6273288
Dissolved Phosphorus (P)	mg/L	0.11	0.10	6265531
Dissolved Potassium (K)	mg/L	4.5	0.30	6265531
Dissolved Selenium (Se)	mg/L	0.00032	0.00020	6273288
Dissolved Silicon (Si)	mg/L	3.6	0.10	6265531
Dissolved Silver (Ag)	mg/L	<0.00010	0.00010	6273288
Dissolved Sodium (Na)	mg/L	140	0.50	6265531
Dissolved Strontium (Sr)	mg/L	0.080	0.020	6265531
Dissolved Sulphur (S)	mg/L	16	0.20	6265531
Dissolved Thallium (Tl)	mg/L	<0.00020	0.00020	6273288
Dissolved Tin (Sn)	mg/L	<0.0010	0.0010	6273288
Dissolved Titanium (Ti)	mg/L	0.0024	0.0010	6273288
Dissolved Uranium (U)	mg/L	0.0029	0.00010	6273288
Dissolved Vanadium (V)	mg/L	<0.0010	0.0010	6273288
Dissolved Zinc (Zn)	mg/L	0.050	0.0030	6273288

RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		ET6361		ET6365		ET6812		ET6816		
Sampling Date		2012/10/17 09:38		2012/10/16		2012/10/15		2012/10/15		
COC Number		A073652		A073652		A073652		A073652		
	UNITS	**BH23 DUP**	**RDL**	**FIELD BLANK**	**RDL**	**BH 23**	**RDL**	**BH29-12**	**RDL**	**QC Batch**
Volatiles										
Benzene	ug/L	2300 (1)	4.0	<0.40	0.40	2100 (1)	4.0	<0.40	0.40	6274385
Toluene	ug/L	13	0.40	<0.40	0.40	13	0.40	<0.40	0.40	6274385
Ethylbenzene	ug/L	240	0.40	<0.40	0.40	230	0.40	<0.40	0.40	6274385
o-Xylene	ug/L	5.3	0.40	<0.40	0.40	5.0	0.40	<0.40	0.40	6274385
m & p-Xylene	ug/L	410	0.80	<0.80	0.80	390	0.80	<0.80	0.80	6274385
Xylenes (Total)	ug/L	410	0.80	<0.80	0.80	400	0.80	<0.80	0.80	6274385
F1 (C6-C10) - BTEX	ug/L	1100	100	<100	100	2900	100	<100	100	6274385
(C6-C10)	ug/L	4100	100	<100	100	5600	100	<100	100	6274385
Surrogate Recovery (%)										
1,4-Difluorobenzene (sur.)	%	106	N/A	102	N/A	106	N/A	101	N/A	6274385
4-BROMOFLUOROBENZENE (sur.)	%	98	N/A	93	N/A	96	N/A	93	N/A	6274385
D4-1,2-DICHLOROETHANE (sur.)	%	95	N/A	96	N/A	99	N/A	83	N/A	6274385

N/A = Not Applicable
RDL = Reportable Detection Limit
(1) Detection limits raised due to dilution to bring analyte within the calibrated range.

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		ET6817	ET6840	ET6902	ET6904	ET6995		
Sampling Date		2012/10/15	2012/10/10	2012/10/16	2012/10/10	2012/10/17		
COC Number		A073652	A073638	A073638	A073638	A072837		
	UNITS	**BH31-12**	**TRIP BLANK**	**EQUIP BLANK - TUBING**	**EQUIP BLANK - PUTTY KNIFE**	**WASTE WATER**	**RDL**	**QC Batch**
Volatiles								
Benzene	ug/L	<0.40	<0.40	<0.40	<0.40	190	0.40	6274385
Toluene	ug/L	<0.40	<0.40	<0.40	<0.40	150	0.40	6274385
Ethylbenzene	ug/L	<0.40	<0.40	<0.40	<0.40	16	0.40	6274385
o-Xylene	ug/L	<0.40	<0.40	<0.40	<0.40	14	0.40	6274385
m & p-Xylene	ug/L	<0.80	<0.80	<0.80	<0.80	55	0.80	6274385
Xylenes (Total)	ug/L	<0.80	<0.80	<0.80	<0.80	69	0.80	6274385
F1 (C6-C10) - BTEX	ug/L	<100	<100	<100	<100	<100	100	6274385
(C6-C10)	ug/L	<100	<100	<100	<100	410	100	6274385
Surrogate Recovery (%)								
1,4-Difluorobenzene (sur.)	%	103	104	103	102	105	N/A	6274385
4-BROMOFLUOROBENZENE (sur.)	%	92	93	92	93	93	N/A	6274385
D4-1,2-DICHLOROETHANE (sur.)	%	96	96	106	96	101	N/A	6274385

N/A = Not Applicable
RDL = Reportable Detection Limit

Maxxam Job #: B294090
Report Date: 2012/11/02

TETRA TECH
Client Project #: 1018901603
Site Location: LOBSTICK GOLF COURSE
Your P.O. #: 700228686
Sampler Initials: KO

General Comments

Please find attached your microbiological analysis results from Bio-Chem Consulting Report No BC18721A for Heterotrophic Plate Count and Hydrocarbon Degrading Bacteria.

DDT results are attached to this report file. The reference number from Maxxam Campobello for these results is B2G5066 and B2G2886.

Sample ET6817-01: Cation anion balance investigated, data quality confirmed.

Results relate only to the items tested.

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report

Maxxam Job Number: CB294090

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6265531 STI	Matrix Spike	Dissolved Barium (Ba)	2012/10/19		97	%	80 - 120
		Dissolved Boron (B)	2012/10/19		99	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/19		95	%	80 - 120
		Dissolved Iron (Fe)	2012/10/19		96	%	80 - 120
		Dissolved Lithium (Li)	2012/10/19		100	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/19		90	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/19		96	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/19		107	%	80 - 120
		Dissolved Potassium (K)	2012/10/19		98	%	80 - 120
		Dissolved Silicon (Si)	2012/10/19		81	%	80 - 120
		Dissolved Sodium (Na)	2012/10/19		NC	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/19		99	%	80 - 120
	Spiked Blank	Dissolved Barium (Ba)	2012/10/19		105	%	80 - 120
		Dissolved Boron (B)	2012/10/19		109	%	80 - 120
		Dissolved Calcium (Ca)	2012/10/19		106	%	80 - 120
		Dissolved Iron (Fe)	2012/10/19		106	%	80 - 120
		Dissolved Lithium (Li)	2012/10/19		111	%	80 - 120
		Dissolved Magnesium (Mg)	2012/10/19		107	%	80 - 120
		Dissolved Manganese (Mn)	2012/10/19		106	%	80 - 120
		Dissolved Phosphorus (P)	2012/10/19		107	%	80 - 120
		Dissolved Potassium (K)	2012/10/19		109	%	80 - 120
		Dissolved Silicon (Si)	2012/10/19		92	%	80 - 120
		Dissolved Sodium (Na)	2012/10/19		110	%	80 - 120
		Dissolved Strontium (Sr)	2012/10/19		106	%	80 - 120
	Method Blank	Dissolved Barium (Ba)	2012/10/19	<0.010		mg/L	
		Dissolved Boron (B)	2012/10/19	<0.020		mg/L	
		Dissolved Calcium (Ca)	2012/10/19	<0.30		mg/L	
		Dissolved Iron (Fe)	2012/10/19	<0.060		mg/L	
		Dissolved Lithium (Li)	2012/10/19	<0.020		mg/L	
		Dissolved Magnesium (Mg)	2012/10/19	<0.20		mg/L	
		Dissolved Manganese (Mn)	2012/10/19	<0.0040		mg/L	
		Dissolved Phosphorus (P)	2012/10/19	<0.10		mg/L	
		Dissolved Potassium (K)	2012/10/19	<0.30		mg/L	
		Dissolved Silicon (Si)	2012/10/19	<0.10		mg/L	
		Dissolved Sodium (Na)	2012/10/19	<0.50		mg/L	
		Dissolved Strontium (Sr)	2012/10/19	<0.020		mg/L	
		Dissolved Sulphur (S)	2012/10/19	<0.20		mg/L	
	RPD	Dissolved Calcium (Ca)	2012/10/19	1.7		%	20
		Dissolved Iron (Fe)	2012/10/19	NC		%	20
		Dissolved Magnesium (Mg)	2012/10/19	5.0		%	20
		Dissolved Manganese (Mn)	2012/10/19	1.1		%	20
		Dissolved Potassium (K)	2012/10/19	1.2		%	20
		Dissolved Sodium (Na)	2012/10/19	2.1		%	20
6268540 AN0	Method Blank	Moisture	2012/10/19	<0.30		%	
	RPD	Moisture	2012/10/19	9.5		%	20
6269575 BE3	Spiked Blank	Alkalinity (Total as CaCO3)	2012/10/20		98	%	80 - 120
	Method Blank	Alkalinity (PP as CaCO3)	2012/10/19	<0.50		mg/L	
		Alkalinity (Total as CaCO3)	2012/10/19	<0.50		mg/L	
		Bicarbonate (HCO3)	2012/10/19	<0.50		mg/L	
		Carbonate (CO3)	2012/10/19	<0.50		mg/L	
		Hydroxide (OH)	2012/10/19	<0.50		mg/L	
	RPD	Alkalinity (PP as CaCO3)	2012/10/19	NC		%	20
		Alkalinity (Total as CaCO3)	2012/10/19	0.7		%	20
		Bicarbonate (HCO3)	2012/10/19	0.7		%	20
		Carbonate (CO3)	2012/10/19	NC		%	20

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB294090

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6269575 BE3	RPD	Hydroxide (OH)	2012/10/19	NC		%	20
6269615 BE3	Spiked Blank	Conductivity	2012/10/19		101	%	90 - 110
	Method Blank	Conductivity	2012/10/19	1.1, RDL=1.0		uS/cm	
	RPD	Conductivity	2012/10/19	0.4		%	20
6269617 BE3	Spiked Blank	pH	2012/10/19		100	%	97 - 102
	RPD	pH	2012/10/19	0.2		%	5
6271232 ZI	Matrix Spike	Dissolved Chloride (Cl)	2012/10/19		NC	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2012/10/19		104	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2012/10/19	<1.0		mg/L	
	RPD	Dissolved Chloride (Cl)	2012/10/19	1.4		%	20
6271234 ZI	Matrix Spike	Dissolved Sulphate (SO4)	2012/10/19		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2012/10/19		100	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2012/10/19	<1.0		mg/L	
	RPD	Dissolved Sulphate (SO4)	2012/10/19	0.7		%	20
6271375 DO1	Matrix Spike	O-TERPHENYL (sur.)	2012/10/22		84	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22		93	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/22		86	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/22		86	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/22		95	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22		102	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/22		92	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/22		83	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/22		96	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/22	<0.10		mg/L	
		F3 (C16-C34 Hydrocarbons)	2012/10/22	<0.10		mg/L	
		F4 (C34-C50 Hydrocarbons)	2012/10/22	<0.10		mg/L	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/22	NC		%	40
		F3 (C16-C34 Hydrocarbons)	2012/10/22	NC		%	40
		F4 (C34-C50 Hydrocarbons)	2012/10/22	NC		%	40
6271918 PK4	Matrix Spike	O-TERPHENYL (sur.)	2012/10/20		109	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		94	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		96	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		92	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/20		97	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20		89	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/10/20		92	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/10/20		89	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/20		100	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F3 (C16-C34 Hydrocarbons)	2012/10/20	<10		mg/kg	
		F4 (C34-C50 Hydrocarbons)	2012/10/20	<10		mg/kg	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/20	NC		%	50
		F3 (C16-C34 Hydrocarbons)	2012/10/20	NC		%	50
		F4 (C34-C50 Hydrocarbons)	2012/10/20	NC		%	50
6273288 TDB	Matrix Spike	Dissolved Aluminum (Al)	2012/10/20		91	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/20		91	%	80 - 120
		Dissolved Arsenic (As)	2012/10/20		97	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/20		92	%	80 - 120
		Dissolved Chromium (Cr)	2012/10/20		91	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/20		84	%	80 - 120
		Dissolved Copper (Cu)	2012/10/20		NC	%	80 - 120
		Dissolved Lead (Pb)	2012/10/20		85	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/20		97	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/20		89	%	80 - 120
		Dissolved Selenium (Se)	2012/10/20		NC	%	80 - 120

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
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Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB294090

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6273288 TDB	Matrix Spike	Dissolved Silver (Ag)	2012/10/20		NC	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/20		87	%	80 - 120
		Dissolved Tin (Sn)	2012/10/20		100	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/20		99	%	80 - 120
		Dissolved Uranium (U)	2012/10/20		92	%	80 - 120
		Dissolved Vanadium (V)	2012/10/20		96	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/20		86	%	80 - 120
	Spiked Blank	Dissolved Aluminum (Al)	2012/10/20		98	%	80 - 120
		Dissolved Antimony (Sb)	2012/10/20		84	%	80 - 120
		Dissolved Arsenic (As)	2012/10/20		97	%	80 - 120
		Dissolved Beryllium (Be)	2012/10/20		89	%	80 - 120
		Dissolved Chromium (Cr)	2012/10/20		94	%	80 - 120
		Dissolved Cobalt (Co)	2012/10/20		90	%	80 - 120
		Dissolved Copper (Cu)	2012/10/20		95	%	80 - 120
		Dissolved Lead (Pb)	2012/10/20		89	%	80 - 120
		Dissolved Molybdenum (Mo)	2012/10/20		90	%	80 - 120
		Dissolved Nickel (Ni)	2012/10/20		95	%	80 - 120
		Dissolved Selenium (Se)	2012/10/20		101	%	80 - 120
		Dissolved Silver (Ag)	2012/10/20		86	%	80 - 120
		Dissolved Thallium (Tl)	2012/10/20		94	%	80 - 120
		Dissolved Tin (Sn)	2012/10/20		81	%	80 - 120
		Dissolved Titanium (Ti)	2012/10/20		90	%	80 - 120
		Dissolved Uranium (U)	2012/10/20		97	%	80 - 120
		Dissolved Vanadium (V)	2012/10/20		96	%	80 - 120
		Dissolved Zinc (Zn)	2012/10/20		99	%	80 - 120
	Method Blank	Dissolved Aluminum (Al)	2012/10/20	<0.0010		mg/L	
		Dissolved Antimony (Sb)	2012/10/20	<0.00060		mg/L	
		Dissolved Arsenic (As)	2012/10/20	<0.00020		mg/L	
		Dissolved Beryllium (Be)	2012/10/20	<0.0010		mg/L	
		Dissolved Chromium (Cr)	2012/10/20	<0.0010		mg/L	
		Dissolved Cobalt (Co)	2012/10/20	<0.00030		mg/L	
		Dissolved Copper (Cu)	2012/10/20	<0.00020		mg/L	
		Dissolved Lead (Pb)	2012/10/20	<0.00020		mg/L	
		Dissolved Molybdenum (Mo)	2012/10/20	<0.00020		mg/L	
		Dissolved Nickel (Ni)	2012/10/20	<0.00050		mg/L	
		Dissolved Selenium (Se)	2012/10/20	<0.00020		mg/L	
		Dissolved Silver (Ag)	2012/10/20	<0.00010		mg/L	
		Dissolved Thallium (Tl)	2012/10/20	<0.00020		mg/L	
		Dissolved Tin (Sn)	2012/10/20	<0.0010		mg/L	
		Dissolved Titanium (Ti)	2012/10/20	<0.0010		mg/L	
		Dissolved Uranium (U)	2012/10/20	<0.00010		mg/L	
		Dissolved Vanadium (V)	2012/10/20	<0.0010		mg/L	
		Dissolved Zinc (Zn)	2012/10/20	<0.0030		mg/L	
	RPD	Dissolved Aluminum (Al)	2012/10/20	NC		%	20
		Dissolved Antimony (Sb)	2012/10/20	NC		%	20
		Dissolved Arsenic (As)	2012/10/20	NC		%	20
		Dissolved Beryllium (Be)	2012/10/20	NC		%	20
		Dissolved Chromium (Cr)	2012/10/20	NC		%	20
		Dissolved Cobalt (Co)	2012/10/20	NC		%	20
		Dissolved Copper (Cu)	2012/10/20	NC		%	20
		Dissolved Lead (Pb)	2012/10/20	NC		%	20
		Dissolved Molybdenum (Mo)	2012/10/20	NC		%	20
		Dissolved Nickel (Ni)	2012/10/20	NC		%	20
		Dissolved Selenium (Se)	2012/10/20	NC		%	20
		Dissolved Silver (Ag)	2012/10/20	NC		%	20

TETRA TECH
Attention: JOEL NOLIN
Client Project #: 1018901603
P.O. #: 700228686
Site Location: LOBSTICK GOLF COURSE

Quality Assurance Report (Continued)

Maxxam Job Number: CB294090

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6273288 TDB	RPD	Dissolved Thallium (Tl)	2012/10/20	NC		%	20
		Dissolved Tin (Sn)	2012/10/20	NC		%	20
		Dissolved Titanium (Ti)	2012/10/20	NC		%	20
		Dissolved Uranium (U)	2012/10/20	NC		%	20
		Dissolved Vanadium (V)	2012/10/20	NC		%	20
		Dissolved Zinc (Zn)	2012/10/20	NC		%	20
6273950 DO1	Matrix Spike	O-TERPHENYL (sur.)	2012/10/21		94	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/21		108	%	50 - 130
	Spiked Blank	O-TERPHENYL (sur.)	2012/10/21		95	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/21		113	%	70 - 130
	Method Blank	O-TERPHENYL (sur.)	2012/10/21		96	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/10/21	<0.10		mg/L	
	RPD	F2 (C10-C16 Hydrocarbons)	2012/10/21	12.1		%	40
6273978 GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/22		93	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/22		92	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/22		91	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/22		79	%	60 - 140
		Benzene	2012/10/22		84	%	60 - 140
		Toluene	2012/10/22		84	%	60 - 140
		Ethylbenzene	2012/10/22		90	%	60 - 140
		m & p-Xylene	2012/10/22		87	%	60 - 140
		o-Xylene	2012/10/22		87	%	60 - 140
		(C6-C10)	2012/10/22		72	%	60 - 140
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/21		93	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/21		92	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/21		96	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/21		78	%	60 - 140
		Benzene	2012/10/21		90	%	60 - 140
		Toluene	2012/10/21		88	%	60 - 140
		Ethylbenzene	2012/10/21		95	%	60 - 140
		m & p-Xylene	2012/10/21		93	%	60 - 140
		o-Xylene	2012/10/21		93	%	60 - 140
		(C6-C10)	2012/10/21		64	%	60 - 140
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/21		94	%	60 - 140
		4-BROMOFLUOROBENZENE (sur.)	2012/10/21		91	%	60 - 140
		D10-ETHYLBENZENE (sur.)	2012/10/21		92	%	60 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/21		80	%	60 - 140
		Benzene	2012/10/21	<0.0050		mg/kg	
		Toluene	2012/10/21	<0.020		mg/kg	
		Ethylbenzene	2012/10/21	<0.010		mg/kg	
		Xylenes (Total)	2012/10/21	<0.040		mg/kg	
		m & p-Xylene	2012/10/21	<0.040		mg/kg	
		o-Xylene	2012/10/21	<0.020		mg/kg	
		F1 (C6-C10) - BTEX	2012/10/21	<12		mg/kg	
		(C6-C10)	2012/10/21	<12		mg/kg	
	RPD	Benzene	2012/10/22	NC		%	50
		Toluene	2012/10/22	NC		%	50
		Ethylbenzene	2012/10/22	NC		%	50
		Xylenes (Total)	2012/10/22	NC		%	50
		m & p-Xylene	2012/10/22	NC		%	50
		o-Xylene	2012/10/22	NC		%	50
		F1 (C6-C10) - BTEX	2012/10/22	NC		%	50
		(C6-C10)	2012/10/22	NC		%	50
6274385 GP4	Matrix Spike	1,4-Difluorobenzene (sur.)	2012/10/21		102	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/21		94	%	70 - 130

TETRA TECH
Attention: JOEL NOLIN
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Quality Assurance Report (Continued)

Maxxam Job Number: CB294090

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6274385 GP4	Matrix Spike	D4-1,2-DICHLOROETHANE (sur.)	2012/10/21		93	%	70 - 130
		Benzene	2012/10/21		92	%	70 - 130
		Toluene	2012/10/21		87	%	70 - 130
		Ethylbenzene	2012/10/21		91	%	70 - 130
		o-Xylene	2012/10/21		96	%	70 - 130
		m & p-Xylene	2012/10/21		92	%	70 - 130
		(C6-C10)	2012/10/21		95	%	70 - 130
	Spiked Blank	1,4-Difluorobenzene (sur.)	2012/10/21		99	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/21		97	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/21		93	%	70 - 130
		Benzene	2012/10/21		91	%	70 - 130
		Toluene	2012/10/21		88	%	70 - 130
		Ethylbenzene	2012/10/21		91	%	70 - 130
		o-Xylene	2012/10/21		96	%	70 - 130
		m & p-Xylene	2012/10/21		92	%	70 - 130
		(C6-C10)	2012/10/21		111	%	70 - 130
	Method Blank	1,4-Difluorobenzene (sur.)	2012/10/21		103	%	70 - 130
		4-BROMOFLUOROBENZENE (sur.)	2012/10/21		93	%	70 - 130
		D4-1,2-DICHLOROETHANE (sur.)	2012/10/21		96	%	70 - 130
		Benzene	2012/10/21	<0.40		ug/L	
		Toluene	2012/10/21	<0.40		ug/L	
		Ethylbenzene	2012/10/21	<0.40		ug/L	
		o-Xylene	2012/10/21	<0.40		ug/L	
		m & p-Xylene	2012/10/21	<0.80		ug/L	
		Xylenes (Total)	2012/10/21	<0.80		ug/L	
		F1 (C6-C10) - BTEX	2012/10/21	<100		ug/L	
		(C6-C10)	2012/10/21	<100		ug/L	
	RPD	Benzene	2012/10/21	NC		%	40
		Toluene	2012/10/21	NC		%	40
		Ethylbenzene	2012/10/21	NC		%	40
		o-Xylene	2012/10/21	NC		%	40
		m & p-Xylene	2012/10/21	NC		%	40
		Xylenes (Total)	2012/10/21	NC		%	40
		F1 (C6-C10) - BTEX	2012/10/21	NC		%	40
		(C6-C10)	2012/10/21	NC		%	40
6280502 LT	Matrix Spike	Dissolved Nitrite (N)	2012/10/23		102	%	80 - 120
		Dissolved Nitrate (N)	2012/10/23		104	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2012/10/23		102	%	90 - 110
		Dissolved Nitrate (N)	2012/10/23		102	%	90 - 110
	Method Blank	Dissolved Nitrite (N)	2012/10/23	<0.0030		mg/L	
		Dissolved Nitrate (N)	2012/10/23	<0.0030		mg/L	
	RPD	Dissolved Nitrite (N)	2012/10/23	NC		%	20
		Dissolved Nitrate (N)	2012/10/23	NC		%	20
6282430 ZI	Matrix Spike	Dissolved Chloride (Cl)	2012/10/23		107	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2012/10/23		106	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2012/10/23	<1.0		mg/L	
	RPD	Dissolved Chloride (Cl)	2012/10/23	NC		%	20
6282432 ZI	Matrix Spike	Dissolved Sulphate (SO4)	2012/10/23		NC	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2012/10/23		100	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2012/10/23	<1.0		mg/L	
	RPD	Dissolved Sulphate (SO4)	2012/10/23	0.4		%	20
6283331 JBX	Matrix Spike	Dissolved Nitrite (N)	2012/10/24		102	%	80 - 120
		Dissolved Nitrate (N)	2012/10/24		103	%	80 - 120
	Spiked Blank	Dissolved Nitrite (N)	2012/10/24		103	%	90 - 110
		Dissolved Nitrate (N)	2012/10/24		103	%	90 - 110

TETRA TECH
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Quality Assurance Report (Continued)

Maxxam Job Number: CB294090

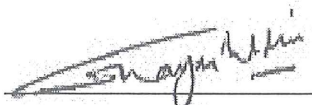
QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	UNITS	QC Limits
6283331 JBX	Method Blank	Dissolved Nitrite (N)	2012/10/24	<0.0030		mg/L	
		Dissolved Nitrate (N)	2012/10/24	0.0050, RDL=0.0030		mg/L	
	RPD	Dissolved Nitrite (N)	2012/10/24	NC		%	20
		Dissolved Nitrate (N)	2012/10/24	NC		%	20
6291459 SJ1	Matrix Spike						
	[ET6972-01]	NONACHLOROBIPHENYL (sur.)	2012/10/26		106	%	30 - 130
		Aroclor 1260	2012/10/26		76	%	30 - 130
	Spiked Blank	NONACHLOROBIPHENYL (sur.)	2012/10/26		97	%	30 - 130
		Aroclor 1260	2012/10/26		72	%	30 - 130
	Method Blank	NONACHLOROBIPHENYL (sur.)	2012/10/26		103	%	30 - 130
		Aroclor 1016	2012/10/26	<0.010		mg/kg	
		Aroclor 1221	2012/10/26	<0.010		mg/kg	
		Aroclor 1232	2012/10/26	<0.010		mg/kg	
		Aroclor 1242	2012/10/26	<0.010		mg/kg	
		Aroclor 1248	2012/10/26	<0.010		mg/kg	
		Aroclor 1254	2012/10/26	<0.010		mg/kg	
		Aroclor 1260	2012/10/26	<0.010		mg/kg	
		Aroclor 1262	2012/10/26	<0.010		mg/kg	
		Aroclor 1268	2012/10/26	<0.010		mg/kg	
		Total Aroclors	2012/10/26	<0.010		mg/kg	
	RPD [ET6972-01]	Aroclor 1016	2012/10/26	NC		%	50
		Aroclor 1221	2012/10/26	NC		%	50
		Aroclor 1232	2012/10/26	NC		%	50
		Aroclor 1242	2012/10/26	NC		%	50
		Aroclor 1248	2012/10/26	NC		%	50
		Aroclor 1254	2012/10/26	NC		%	50
		Aroclor 1260	2012/10/26	NC		%	50
		Aroclor 1262	2012/10/26	NC		%	50
		Aroclor 1268	2012/10/26	NC		%	50
		Total Aroclors	2012/10/26	NC		%	50

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

Validation Signature Page

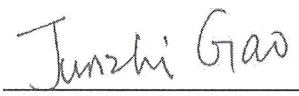
Maxxam Job #: B294090

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ghayasuddin Khan, M.Sc., B.Ed., P.Chem, Scientific Specialist

Halina Solway, Lab Supervisor



Janet Gao, Senior Analyst, Organics Department

Luba Shymushovska, Senior Analyst, Organic Department

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Chain of Custody

A073851

Page: 1 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works & Gov't Services	Joel Nolin
Contact:	Gisele - Natalie Robinson	Tetra Tech
Address:	1650-635 8th Ave SW	115-200 Rivercrest Dr. SE
	Prov: Calgary AB PC: T2P 3M3	Prov: AB PC:
Contact #s:	Ph: 403.292.6882 Cell: 403.860.4165	Ph: 403.718.3210 Cell: 9901361

Report Distribution (E-Mail): joel.nolin, andrew.eason, labresultssk@tetratech.com, troy.lange, kristen.olafsson

REGULATORY GUIDELINES:
☐ AT1
☒ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 1018901603
Site Location: Lobstick Golf Course
Quote #:
Sampled By: KO TL

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class 1 Landfill	WATER: BTEX F1 ☐ VOCs	BTEX F1-F2 ☐ BTEX F1-F4	Routine Water ☐ Turb ☐ F-	TOC ☐ DOC	Total	Regulated Metals (CCME / AT1)	Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis: HPC	Hydrocarbon from Pending Batch							HOLD - Do not Analyze	# of Containers Submitted
1	BH-4		GW	12/10/17 9:36															✓	✓						-1		1
2	BH-6			10:20																						0		
3	BH-7			10:02																						-2		
4	BH-9			9:48																						0		
5	BH-10			9:58																						-2		
6	BH-12			9:39																						-1		
7	BH-12 DUP			9:34																						-2		
8	BH-13			9:30																						0		
9	BH-14			9:52																						0		
10	BH 16			10:32																						0		
11	BH 17			10:30																						-2		
12	BH 18			9:56																						-1		1

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions:

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By: Jason BL Jason Bu Date: 12/10/18 Time: 0840 Maxxam Job #: B294090

Lab Comments:

Custody Seal	Temperature	Ice
Yes	-1/-2/0 -2/-3/1	Yes

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Chain of Custody A073652

Page: 2 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works + Gov't Services	Joel Nolin	Joel.Nolin
Contact:	Canada - Natalie Robinson	Tetra Tech	andrew.eason
Address:	1650 - 635 8th Ave, SW	115-200 Rivercrest Drive SE	labresultsyyc @ tetratech
	Prov: Calgary, AB PC: T2P 3M3	Prov: Alb PC: T2C 2X5	troy.lange
Contact #s:	Ph: 403-292-6882 Cell: 403.860.4015	Ph: 403.718.7210 Cell: 990.1361	krysta.dalkin

REGULATORY GUIDELINES:
☐ AT1
☒ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 90 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: to18901603
Site Location: Labstick Golf Course
Quote #:
Sampled By: KD TL

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (units)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs	☐BTEX F1-F2	☐BTEX F1-F4	☒ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME/AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis: HPC	Hydrocarbon degradation factors	NO2/NO3	HOLD - Do not Analyze	# of Containers Submitted
1	BH 19		GW	12/10/17 10:00																X	X		-1	1
2	BH 20			10:10																			-2	
3	BH 21			10:27																			-2	
4	BH 23			9:30																			-3	
5	BH 23 DUP			9:50																			-2	
6	BH 24			9:32																			-1	
7	BH 29-12			10:34																			-3	
8	BH 31-12			10:30																			1	
9	BH23			2012/10/15								X	X				X					X		8
10	BH 30-12			2012/10/16							X													3
11	BH29-12											X	X				X					X		8
12	BH 31-12											X	X				X					X		8

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Excess Headspace in one F, BH30-12 Bottle

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
	12/10/18	0840	Custody Seal	Temperature	Ice

Lab Comments:

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Chain of Custody

A073638

Page: 3 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐
Company:	Public Works + Gov't Services Canada - Natalie Robinson	Joel Nolin Tetra Tech
Contact:		
Address:	1650, 635 8th Ave SW Calgary	115-200 Rivercrest Drive SE
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2C 2X5
Contact #s:	Ph: 403.292.6882 Cell: 403.860.4105	Ph: 403.718.3210 Cell: 990.1361

Report Distribution (E-Mail):
joel.nolin
andrew.eason
labresultsyk @ tetratech.com
troy.large
krista.dickson

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name: 101840603
Site Location: Carstairs Golf Course
Quote #:
Sampled By: CO/TC

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☒ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME/AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐ VOCs	☐ BTEX F1	☐ BTEX F1-F2	☒ BTEX F1-F4	☒ Routine Water ☐ Jurn. W.F.	☐ TOC	☐ DOC	Regulated Metals (CCME/AT1): Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis: Hg	Hydrocarbon degrading bacteria	NO3/NO3				HOLD - Do not Analyze	# of Containers Submitted
1	Field Blank		GW	12/10/16									X	X					X			X	X	X					9
2	Trip Blank			& 12/10/16									X	X	F1-F2 only														5
3	Equip Blank - Tubing			12/10/16									X	X					X					X					1
4	Equip Blank - ~~Hand Auger~~ Putty & Bowl												X						X										1
5																													
6																													
7																													
8																													
9																													
10																													
11																													
12																													

Please Indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Large	12/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Trip Blank Analyze for F1 to F2 only

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
JASON RH	12/10/18	16 0730 0840	Custody Seal	Temperature	Ice

Lab Comments:

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Chain of Custody

A072837

Page: 4 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services Canada - Natalie Robinson	Joel Nolin	joel.nolin, andrew.eason, ladysmithsk, trey.lange, kristin.olafson @tetratech.com
Contact:		Tetra Tech	
Address:	1650, 635 8th Ave SW Calgary	115-200 Rivercrest Drive	
Prov:	AB PC: T2P 3M3	Prov: AB PC: T2C 2X5	
Contact #s:	Ph: 403.292.6882 Cell: 403.860.4045	Ph: 403.718.3210 Cell: 990.1361	

REGULATORY GUIDELINES:
☐ AT1
☑ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:	
Project # / Name:	101890163
Site Location:	Ladysmith Golf Course
Quote #:	
Sampled By:	JG TL

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment IGP Metals	Basic Class II Landfill	PCB	Pesticides / Herbicides	DDT	WATER: VOCs	BTEX F1-F2	BTEX F1-F4	Routine Water ☐ Turb ☐ F	TOC	DOC	Regulated Metals (CCME/AT1) Total	Dissolved	Mercury	Total ☐ Dissolved	Other Analysis: HPC	Hydrocarbon Aerograding	NO_2/NO_3	HOLD - Do not Analyze	# of Containers Submitted
1	BH23 DUP	m	GW	*											X	X					X			X	X	X		8
2	BH 45-12 - 0.1		Soil	12/10/16																							X	1
3	BH 45-12 - 0.25																											
4	BH 45-12 - 0.55																											
5	BH 45-12 - 0.75																											
6	BH 45-12 - 1.0																											
7	BH 45-12 - 1.25																											
8	Waste Soil	m	Soil	12/10/17	X						X	X																1
9	Waste Water		GW	↓											X						X							5
10	BH 45-12 - 1.45	m	Soil	12/10/16																							X	1
11																												
12																												

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Trey Lange	12/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions:
*Dissolved metals: 12/10/17; others: 12/10/15

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
	12/10/16	0840	Custody Seal	Temperature	Ice

Lab Comments:

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Chain of Custody

A073651

Page: 1 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	[illegible]	[illegible]	[illegible]
Contact:	[illegible]	[illegible]	[illegible]
Address:	[illegible]	[illegible]	[illegible]
Phone: / Fax:	[illegible]	[illegible]	[illegible]
Contact #s:	[illegible]	[illegible]	[illegible]

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt unless specified otherwise.

PO #:
Project # / Name: 10-958-11.03
Site Location: [illegible]
Quote #:
Sampled By: KA-TF

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐ VOCs	☒ BTEX F1	☐ BTEX F1-F2	☐ Routine Water ☐ Turb. ☐ F	☐ TOC	☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis: Hydrocarbon Fingerprint	Hydrocarbon Petrogenic	HOLD - Do not Analyze	# of Containers Submitted
1	BH-4		GW	12/10/13								X						X			X	X		1
2	BH-6			10:00																				
3	BH-7			10:02																				
4	BH-9			9:49																				
5	BH-10			9:58																				
6	BH-12			9:30																				
7	BH-12 DUP			9:34																				
8	BH-13			9:30																				
9	BH-14			[illegible]																				
10	BH-16			10:32																				
11	BH-17			10:35																				
12	BH-18			[illegible]																				

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):	Received By:	Date:	Time:
[illegible] Troy Lange	13/10/17	17:15			
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):			

Special Instructions:

# of Jars Used & Not Submitted

LAB USE ONLY

Maxxam Job #: B329402

Custody Seal	Temperature	Ice

Lab Comments:

Maxxam Analytics International Corporation o/a Maxxam Analytics

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Chain of Custody AU73852

Page 2 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):	REGULATORY GUIDELINES:
Company:				☐ AT1
Contact:				☑ CCME
Address:				☐ Regulated Drinking Water
Contact #s:				☐ Other

All samples are held for 90 calendar days after sample receipt unless specified otherwise.

PO #:	
Project # / Name:	
Site Location:	
Quote #:	
Sampled By:	

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity	Assessment ICP Metals	Basic Class II Landfill	WATER: BTEX F1 ☐VOCs	BTEX F1-F2 ☐BTEX F1-F4	☐ Routine Water ☐ Turb ☐F	☐TOC ☐DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury ☐ Total ☐ Dissolved	Other Analysis: TOC	Hydrocarbon distribution	NO2 / NO3							HOLD - Do not Analyze	# of Containers Submitted
1	BH 19																	X	X								1
2	BH 20																										
3	BH 21																										
4	BH 22																										
5	BH 23 Dup																										
6	BH 24																										
7	BH 24-12																										
8	BH 21-12																										
9	BH 23											X	X			X				X							3
10	BH 20-12				X																						3
11	BH 29-12											X	X			X				X							3
12	BH 31-12											X	X			X				X							3

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Tracy Lange Date (YY/MM/DD): 17/12/12 Time (24:00): 17:15

Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):

Special Instructions:

# of Jars Used & Not Submitted

LAB USE ONLY

Received By: Date: Time: Maxxam Job #:

Custody Seal | Temperature | Ice

Lab Comments

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Chain of Custody A073638

Page: 3 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:			
Contact:			
Address:			
Phone: FC:		Phone: FC:	
Contact #s:	Ph: Cell:	Ph: Cell:	

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #:
Project # / Name:
Site Location:
Quote #:
Sampled By:

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☐ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW / Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	WATER: ☐VOCs	☐BTEX F1	☐BTEX F1-F4	☐Routine Water	☐TOC	☐DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury	☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	Field Blank		GW	12/10/16									X	✓				X			X	3
2	Trip Blank			12/10/16							X	X										2
3	Trip Blank - Tuesday			12/10/16									X	X				X			X	2
4	Trip Blank - Party Site												X					X				2
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

Please indicate Filtered, Preserved or Both (F, P, F/P)

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	16/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: Trip Blank for F1 to F4 only

# of Jars Used & Not Submitted:

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice

Lab Comments:

Maxxam

Calgary: 4000 19th St. NE, T2E 6P8 Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4 Ph: (780) 577-7100 Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

Chain of Custody

A072837

Page: 4 of 4

	Invoice To: C/O Report Address ☐	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	Public Works & Gov't Services	Joel Nolin	Joel.nolin@...
Contact:	Canada - Natalie Robinson	Tetra Tech	...
Address:	... 635 8th Ave SW Calgary	115 - 200 Rivercrest Drive	... @tetratech...
	Prov: AB PC: T2P 3M3	Prov: AB PC: T2C 2X5	...
Contact #s:	Ph: 403 292 6882 Cell: 403 860 4185	Ph: 403 718 3910 Cell: ...	...

REGULATORY GUIDELINES:
- ☐ AT1
- ☑ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #: ...
Project # / Name: 1012800...
Site Location: ...
Quote #:
Sampled By: ... T...

SERVICE REQUESTED: ☐ RUSH (Contact lab to reserve) Date Required: ☐ REGULAR (5 to 7 Days)

See reverse for package specifics

#	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	PCB	Pesticides / Herbicides	DDT	☐BTEX F1 / ☐VOCs	☐BTEX F1-F2 / ☐BTEX F1-F4	☑ Routine Water ☐ Turb ☐ F	☐ TOC ☐ DOC	Regulated Metals (CCME / AT1) Total	Dissolved	Mercury ☐ Total ☐ Dissolved	HPC	Hydrocarbon degraders	NO_2/NO_3	HOLD - Do not Analyze	# of Containers Submitted
1	BH23 Dup	m	GW	*											X	X			X		X	X	X		8
2	BH 45-12-0.1		Soil	12/10/16																				X	1
3	BH 45-12-0.25												X												1
4	BH 45-12-0.55																								1
5	BH 45-12-0.5																								1
6	BH 45-12-1.0																								1
7	BH 45-12-...25												X												1
8	Waste Soil	m	Soil	12/10/17	X						X	X													[illegible]
9	Waste Water		GW	"											X				X		X				8
10	... 45 ... 1.45	m	Soil	12/10/16																				X	1
11																									
12																									

Please indicate Filtered, Preserved or Both (F, P, F/P) →

Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):
Troy Lange	12/10/17	17:15
Relinquished By (Signature/Print):	Date (YY/MM/DD):	Time (24:00):

Special Instructions: *Dissolved metals: 12/10/17; others: 12/10/15

# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:		
			Custody Seal	Temperature	Ice
Lab Comments:					

AB FCD 00031 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

Bio-Chem Consulting Services Ltd.

Analytical Test Report

Test Report #: BC18721A **Revision #:** 0 **Issue Date:** 1-Nov-12

Client: Maxxam Analytics Inc. **Code:** MAX
Contact: Customer Service
Job #: B294090 **P.O.#:**
Address: 4000 - 19 St. NE
Calgary AB
T2E 6P8
Internal Project #: BC18721
Sampled By: Not Specified
Sample Location: Not Specified
Sample Date: 17-Oct-12
Date Received: 18-Oct-12

Analytical	# of Pages
Microbiology	1
QC Report	To Follow
Total (incl. Cover)	2

Comments: None.

Approved By: _____

Michael Busse, B.Sc.
Technical Supervisor, Analytical Services Division

1) THIS REPORT MAY NOT BE REPRODUCED IN PART WITHOUT THE EXPRESSED WRITTEN CONSENT OF THE LABORATORY.
2) ANY REMAINING SAMPLES WILL BE DISPOSED OF 30 DAYS FOLLOWING ANALYSIS. CONTACT THE LABORATORY IF ADDITIONAL SAMPLE STORAGE TIME IS REQUIRED.
3) ALL LABORATORY ANALYSES INCORPORATE STANDARD QC PROTOCOLS; HOWEVER, UNSIGNED TEST REPORTS ARE PRELIMINARY AND UNOFFICIAL.
4) REPORTED TEST RESULTS RELATE ONLY TO THE SAMPLES AS RECEIVED BY THE LABORATORY.
5) BIO-CHEM CONSULTING SERVICES LTD. ASSUMES NO LIABILITY FOR THE USE OR INTERPRETATION OF THE TEST RESULTS.
6) WHERE APPLICABLE, ESTIMATION OF THE MEASUREMENT UNCERTAINTY IS AVAILABLE ON REQUEST.

#118, 339 - 50TH Avenue S.E.
Calgary, Alberta T2G-2B3
Telephone: (403) 253-7026
Fax: (403) 253-7072
E-mail: reporting@bio-chemconsulting.com
www.bio-chemconsulting.com

Bio-Chem Consulting Services Ltd.

CERTIFICATE OF ANALYSIS
Environmental Microbiology Report

B.C. Report No. : BC18721A Rev. 0
Sub-Contracted: No
Client Job No.: B294090

Date Analyzed: 18-Oct-12
Page Issue Date: 1-Nov-12

Sample #	Sample Description	Heterotrophic Plate Count (CFU/mL)	Hydrocarbon Degrading Bacteria (MPN/mL)			
1	ET6334-01R \ BH-4	1,300	85			
2	ET6346-01R \ BH-6	1,600,000	11,000			
3	ET6347-01R \ BH-7	51,000	2,400			
4	ET6348-01R \ BH-9	2,800,000	55,000			
5	ET6349-01R \ BH-10	1,500,000	5,500			
6	ET6350-01R \ BH-12	92,000	1,600			
7	ET6351-01R \ BH-12DUP	90,000	650			
8	ET6352-01R \ BH-13	1,700	22			
9	ET6353-01R \ BH-14	12,000	160			
10	ET6354-01R \ BH-16	24,000	46			
11	ET6355-01R \ BH-17	30,000	130			
12	ET6356-01R \ BH-18	3,800	160			
13	ET6357-01R \ BH-19	12,000	240			
14	ET6358-01R \ BH-20	1,000,000	1,200			
15	ET6359-01R \ BH-21	180,000	2,400			
16	ET6360-01R \ BH-23	50,000	55			
17	ET6361-01R \ BH-23DUP	37,000	160			
18	ET6362-01R \ BH-24	1,000	65			
19	ET6363-01R \ BH-29-12	82,000	10			
20	ET6364-01R \ BH-31-12	1,200	10			
21	ET6365-01R \ FIELD BLANK	1,500	1,200			
	Detection Limit:	1	10			

Comments:
None.

Maxxam

Success Through Science®

Your Project #: B294090
Your C.O.C. #: na

Attention: Wendy Sears
Maxxam Analytics
2021 41st Ave NE
Calgary, AB
T2E 6P2

Report Date: 2012/10/31

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2G5066
Received: 2012/10/23, 09:26

Sample Matrix: Soil
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	2	N/A	2012/10/27	CAM SOP-00445	R.Carter,1993
OC Pesticides (Selected) & PCB (1)	2	2012/10/27	2012/10/30	CAM SOP-00307	SW846 8081, 8082

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy,
Email: kpomeroy@maxxam.ca
Phone# (905) 817-5700

==========

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Total cover pages: 1

Maxxam Job #: B2G5066
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B294090

RESULTS OF ANALYSES OF SOIL

Maxxam ID		PI0841	PI0842		
Sampling Date		2012/10/16	2012/10/16		
COC Number		na	na		
	Units	**ET6944 \ BH45-12 - 0.25M**	**ET6948 \ BH45-12 - 1.25M**	**RDL**	**QC Batch**
Moisture	%	11	15	1.0	3016856

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G5066
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B294090

ORGANOCHLORINATED PESTICIDES BY GC-ECD (SOIL)

Maxxam ID		PI0841	PI0842		
Sampling Date		2012/10/16	2012/10/16		
COC Number		na	na		
	Units	**ET6944 \ BH45-12 - 0.25M**	**ET6948 \ BH45-12 - 1.25M**	**RDL**	**QC Batch**
o,p-DDT	ug/g	0.0030	<0.0020	0.0020	3017028
p,p-DDT	ug/g	0.022	<0.0020	0.0020	3017028
o,p-DDT + p,p-DDT	ug/g	0.025	<0.0020	0.0020	3017028
DDT+ Metabolites	ug/g	0.035	<0.0020	0.0020	3017028
Surrogate Recovery (%)					
2,4,5,6-Tetrachloro-m-xylene	%	78	87	N/A	3017028
Decachlorobiphenyl	%	63	70	N/A	3017028

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G5066
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B294090

Test Summary

Maxxam ID PI0841 **Collected** 2012/10/16
Sample ID ET6944 \ BH45-12 - 0.25M **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3016856	N/A	2012/10/27	Gaurav Kalia
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

Maxxam ID PI0842 **Collected** 2012/10/16
Sample ID ET6948 \ BH45-12 - 1.25M **Shipped**
Matrix Soil **Received** 2012/10/23

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3016856	N/A	2012/10/27	Gaurav Kalia
OC Pesticides (Selected) & PCB	GC/ECD	3017028	2012/10/27	2012/10/30	Mahmudul Khan

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Maxxam Job #: B2G5066
Report Date: 2012/10/31

Maxxam Analytics
Client Project #: B294090

Package 1	4.3°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Results relate only to the items tested.

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Maxxam Analytics
Attention: Wendy Sears
Client Project #: B294090
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: MB2G5066

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3016856 THT	RPD - Sample/Sample Dup	Moisture	2012/10/27	4.8		%	20
3017028 MAK	Matrix Spike	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		76	%	50 - 130
		Decachlorobiphenyl	2012/10/30		69	%	50 - 130
		o,p-DDT	2012/10/30		83	%	50 - 130
		p,p-DDT	2012/10/30		83	%	50 - 130
	Spiked Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		80	%	50 - 130
		Decachlorobiphenyl	2012/10/30		69	%	50 - 130
		o,p-DDT	2012/10/30		84	%	50 - 130
		p,p-DDT	2012/10/30		82	%	50 - 130
	Method Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/30		83	%	50 - 130
		Decachlorobiphenyl	2012/10/30		71	%	50 - 130
		o,p-DDT	2012/10/30	<0.0020		ug/g	
		p,p-DDT	2012/10/30	<0.0020		ug/g	
		o,p-DDT + p,p-DDT	2012/10/30	<0.0020		ug/g	
		DDT+ Metabolites	2012/10/30	<0.0020		ug/g	
	RPD - Sample/Sample Dup	o,p-DDT	2012/10/30	NC		%	40
		p,p-DDT	2012/10/30	NC		%	40
		o,p-DDT + p,p-DDT	2012/10/30	NC		%	40
		DDT+ Metabolites	2012/10/30	NC		%	40

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B2G5066

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Charles Ancker, B.Sc., M.Sc., C.Chem, Senior Analyst

Cristina Carriere, Scientific Services

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Maxxam

Success Through Science®

Your Project #: B294090
Your C.O.C. #: NA

Attention: Wendy Sears
Maxxam Analytics
2021 41st Ave NE
Calgary, AB
T2E 6P2

Report Date: 2012/10/29

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2G2886
Received: 2012/10/19, 09:45

Sample Matrix: Soil
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Moisture	1	N/A	2012/10/24	CAM SOP-00445	R.Carter,1993
OC Pesticides (Selected) & PCB (1)	1	2012/10/22	2012/10/25	CAM SOP-00307	SW846 8081, 8082

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Chlordane (Total) = Alpha Chlordane + Gamma Chlordane

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Ken Pomeroy,
Email: kpomeroy@maxxam.ca
Phone# (905) 817-5700

==========

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Total cover pages: 1

Maxxam Job #: B2G2886
Report Date: 2012/10/29

Maxxam Analytics
Client Project #: B294090

RESULTS OF ANALYSES OF SOIL

Maxxam ID		PG8299		
Sampling Date		2012/10/17		
COC Number		NA		
	Units	**ET6972-02\WASTE SOIL**	**RDL**	**QC Batch**
Moisture	%	16	1.0	3013301

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G2886
Report Date: 2012/10/29

Maxxam Analytics
Client Project #: B294090

ORGANOCHLORINATED PESTICIDES BY GC-ECD (SOIL)

Maxxam ID		PG8299		
Sampling Date		2012/10/17		
COC Number		NA		
	Units	**ET6972-02\WASTE SOIL**	**RDL**	**QC Batch**
Aldrin	ug/g	<0.0020	0.0020	3011290
a-Chlordane	ug/g	<0.0020	0.0020	3011290
g-Chlordane	ug/g	<0.0020	0.0020	3011290
Chlordane (Total)	ug/g	<0.0020	0.0020	3011290
o,p-DDD	ug/g	<0.0020	0.0020	3011290
p,p-DDD	ug/g	<0.0020	0.0020	3011290
o,p-DDD + p,p-DDD	ug/g	<0.0020	0.0020	3011290
o,p-DDE	ug/g	<0.0020	0.0020	3011290
p,p-DDE	ug/g	<0.0020	0.0020	3011290
o,p-DDE + p,p-DDE	ug/g	<0.0020	0.0020	3011290
o,p-DDT	ug/g	<0.0020	0.0020	3011290
p,p-DDT	ug/g	<0.0020	0.0020	3011290
o,p-DDT + p,p-DDT	ug/g	<0.0020	0.0020	3011290
DDT+ Metabolites	ug/g	<0.0020	0.0020	3011290
Dieldrin	ug/g	<0.0020	0.0020	3011290
Lindane	ug/g	<0.0020	0.0020	3011290
Endosulfan I (alpha)	ug/g	<0.0020	0.0020	3011290
Endosulfan II	ug/g	<0.0020	0.0020	3011290
Total Endosulfan	ug/g	<0.0020	0.0020	3011290
Endrin	ug/g	<0.0020	0.0020	3011290
Heptachlor	ug/g	<0.0020	0.0020	3011290
Heptachlor epoxide	ug/g	<0.0020	0.0020	3011290
Hexachlorobenzene	ug/g	<0.0020	0.0020	3011290
Hexachlorobutadiene	ug/g	<0.0050	0.0050	3011290
Methoxychlor	ug/g	<0.0050	0.0050	3011290
Aroclor 1016	ug/g	<0.015	0.015	3011290
Aroclor 1221	ug/g	<0.015	0.015	3011290
Aroclor 1232	ug/g	<0.015	0.015	3011290
Aroclor 1242	ug/g	<0.015	0.015	3011290
Aroclor 1248	ug/g	<0.015	0.015	3011290
Aroclor 1254	ug/g	<0.015	0.015	3011290
Aroclor 1260	ug/g	<0.015	0.015	3011290
Aroclor 1262	ug/g	<0.015	0.015	3011290

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G2886
Report Date: 2012/10/29

Maxxam Analytics
Client Project #: B294090

ORGANOCHLORINATED PESTICIDES BY GC-ECD (SOIL)

Maxxam ID		PG8299		
Sampling Date		2012/10/17		
COC Number		NA		
	Units	**ET6972-02\WASTE SOIL**	**RDL**	**QC Batch**
Aroclor 1268	ug/g	<0.015	0.015	3011290
Total PCB	ug/g	<0.015	0.015	3011290
alpha-BHC	ug/g	<0.0020	0.0020	3011290
beta-BHC	ug/g	<0.0020	0.0020	3011290
delta-BHC	ug/g	<0.0020	0.0020	3011290
Endosulfan sulfate	ug/g	<0.0020	0.0020	3011290
Endrin aldehyde	ug/g	<0.0020	0.0020	3011290
Endrin ketone	ug/g	<0.0020	0.0020	3011290
Mirex	ug/g	<0.0020	0.0020	3011290
Octachlorostyrene	ug/g	<0.0020	0.0020	3011290
Toxaphene	ug/g	<0.080	0.080	3011290
Surrogate Recovery (%)				
2,4,5,6-Tetrachloro-m-xylene	%	111	N/A	3011290
Decachlorobiphenyl	%	110	N/A	3011290

N/A = Not Applicable
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B2G2886
Report Date: 2012/10/29

Maxxam Analytics
Client Project #: B294090

Test Summary

Maxxam ID PG8299
Sample ID ET6972-02\WASTE SOIL
Matrix Soil

Collected 2012/10/17
Shipped
Received 2012/10/19

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Moisture	BAL	3013301	N/A	2012/10/24	Gaurav Kalia
OC Pesticides (Selected) & PCB	GC/ECD	3011290	2012/10/22	2012/10/25	Mahmudul Khan

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B2G2886
Report Date: 2012/10/29

Maxxam Analytics
Client Project #: B294090

Package 1	6.0°C

Each temperature is the average of up to three cooler temperatures taken at receipt

GENERAL COMMENTS

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Analytics
Attention: Wendy Sears
Client Project #: B294090
P.O. #:
Site Location:

Quality Assurance Report

Maxxam Job Number: MB2G2886

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3011290 MAK	Matrix Spike	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		87	%	50 - 130
		Decachlorobiphenyl	2012/10/25		81	%	50 - 130
		Aldrin	2012/10/25		89	%	50 - 130
		a-Chlordane	2012/10/25		92	%	50 - 130
		g-Chlordane	2012/10/25		91	%	50 - 130
		o,p-DDD	2012/10/25		90	%	50 - 130
		p,p-DDD	2012/10/25		97	%	50 - 130
		o,p-DDE	2012/10/25		95	%	50 - 130
		p,p-DDE	2012/10/25		96	%	50 - 130
		o,p-DDT	2012/10/25		105	%	50 - 130
		p,p-DDT	2012/10/25		110	%	50 - 130
		Dieldrin	2012/10/25		102	%	50 - 130
		Lindane	2012/10/25		87	%	50 - 130
		Endosulfan I (alpha)	2012/10/25		67	%	50 - 130
		Endosulfan II	2012/10/25		52	%	50 - 130
		Endrin	2012/10/25		106	%	50 - 130
		Heptachlor	2012/10/25		93	%	50 - 130
		Heptachlor epoxide	2012/10/25		90	%	50 - 130
		Hexachlorobenzene	2012/10/25		86	%	50 - 130
		Hexachlorobutadiene	2012/10/25		77	%	50 - 130
		Methoxychlor	2012/10/25		104	%	50 - 130
		alpha-BHC	2012/10/25		93	%	30 - 130
		beta-BHC	2012/10/25		91	%	30 - 130
		delta-BHC	2012/10/25		96	%	30 - 130
		Endosulfan sulfate	2012/10/25		41	%	30 - 130
		Endrin aldehyde	2012/10/25		61	%	30 - 130
		Endrin ketone	2012/10/25		81	%	30 - 130
		Mirex	2012/10/25		86	%	30 - 130
		Octachlorostyrene	2012/10/25		91	%	30 - 130
	Spiked Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		79	%	50 - 130
	Spiked Blank DUP	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		82	%	50 - 130
	Spiked Blank	Decachlorobiphenyl	2012/10/25		86	%	50 - 130
	Spiked Blank DUP	Decachlorobiphenyl	2012/10/25		86	%	50 - 130
	Spiked Blank	Aldrin	2012/10/25		88	%	50 - 130
		a-Chlordane	2012/10/25		87	%	50 - 130
		g-Chlordane	2012/10/25		84	%	50 - 130
		o,p-DDD	2012/10/25		86	%	50 - 130
		p,p-DDD	2012/10/25		90	%	50 - 130
		o,p-DDE	2012/10/25		91	%	50 - 130
		p,p-DDE	2012/10/25		91	%	50 - 130
		o,p-DDT	2012/10/25		96	%	50 - 130
		p,p-DDT	2012/10/25		98	%	50 - 130
		Dieldrin	2012/10/25		88	%	50 - 130
		Lindane	2012/10/25		79	%	50 - 130
		Endosulfan I (alpha)	2012/10/25		59	%	50 - 130
		Endosulfan II	2012/10/25		63	%	50 - 130
		Endrin	2012/10/25		98	%	50 - 130
		Heptachlor	2012/10/25		91	%	50 - 130
		Heptachlor epoxide	2012/10/25		84	%	50 - 130
		Hexachlorobenzene	2012/10/25		74	%	50 - 130
		Hexachlorobutadiene	2012/10/25		78	%	50 - 130
		Methoxychlor	2012/10/25		96	%	50 - 130
	Spiked Blank DUP	Aroclor 1242	2012/10/25		108	%	60 - 130
	RPD	Aroclor 1242	2012/10/25	NC		%	40
	Spiked Blank DUP	Total PCB	2012/10/25		108	%	60 - 130

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Maxxam Analytics
Attention: Wendy Sears
Client Project #: B294090
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: MB2G2886

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3011290 MAK	RPD	Total PCB	2012/10/25	NC		%	40
	Spiked Blank	alpha-BHC	2012/10/25		83	%	30 - 130
		beta-BHC	2012/10/25		82	%	30 - 130
		delta-BHC	2012/10/25		87	%	30 - 130
		Endosulfan sulfate	2012/10/25		72	%	30 - 130
		Endrin aldehyde	2012/10/25		83	%	30 - 130
		Endrin ketone	2012/10/25		80	%	30 - 130
		Mirex	2012/10/25		90	%	30 - 130
		Octachlorostyrene	2012/10/25		89	%	30 - 130
	Spiked Blank DUP	Toxaphene	2012/10/25		118	%	30 - 130
	RPD	Toxaphene	2012/10/25	NC		%	50
	Method Blank	2,4,5,6-Tetrachloro-m-xylene	2012/10/25		83	%	50 - 130
		Decachlorobiphenyl	2012/10/25		79	%	50 - 130
		Aldrin	2012/10/25	<0.0020		ug/g	
		a-Chlordane	2012/10/25	<0.0020		ug/g	
		g-Chlordane	2012/10/25	<0.0020		ug/g	
		Chlordane (Total)	2012/10/25	<0.0020		ug/g	
		o,p-DDD	2012/10/25	<0.0020		ug/g	
		p,p-DDD	2012/10/25	<0.0020		ug/g	
		o,p-DDD + p,p-DDD	2012/10/25	<0.0020		ug/g	
		o,p-DDE	2012/10/25	<0.0020		ug/g	
		p,p-DDE	2012/10/25	<0.0020		ug/g	
		o,p-DDE + p,p-DDE	2012/10/25	<0.0020		ug/g	
		o,p-DDT	2012/10/25	<0.0020		ug/g	
		p,p-DDT	2012/10/25	<0.0020		ug/g	
		o,p-DDT + p,p-DDT	2012/10/25	<0.0020		ug/g	
		DDT+ Metabolites	2012/10/25	<0.0020		ug/g	
		Dieldrin	2012/10/25	<0.0020		ug/g	
		Lindane	2012/10/25	<0.0020		ug/g	
		Endosulfan I (alpha)	2012/10/25	<0.0020		ug/g	
		Endosulfan II	2012/10/25	<0.0020		ug/g	
		Total Endosulfan	2012/10/25	<0.0020		ug/g	
		Endrin	2012/10/25	<0.0020		ug/g	
		Heptachlor	2012/10/25	<0.0020		ug/g	
		Heptachlor epoxide	2012/10/25	<0.0020		ug/g	
		Hexachlorobenzene	2012/10/25	<0.0020		ug/g	
		Hexachlorobutadiene	2012/10/25	<0.0050		ug/g	
		Methoxychlor	2012/10/25	<0.0050		ug/g	
		Aroclor 1016	2012/10/25	<0.015		ug/g	
		Aroclor 1221	2012/10/25	<0.015		ug/g	
		Aroclor 1232	2012/10/25	<0.015		ug/g	
		Aroclor 1242	2012/10/25	<0.015		ug/g	
		Aroclor 1248	2012/10/25	<0.015		ug/g	
		Aroclor 1254	2012/10/25	<0.015		ug/g	
		Aroclor 1260	2012/10/25	<0.015		ug/g	
		Aroclor 1262	2012/10/25	<0.015		ug/g	
		Aroclor 1268	2012/10/25	<0.015		ug/g	
		Total PCB	2012/10/25	<0.015		ug/g	
		alpha-BHC	2012/10/25	<0.0020		ug/g	
		beta-BHC	2012/10/25	<0.0020		ug/g	
		delta-BHC	2012/10/25	<0.0020		ug/g	
		Endosulfan sulfate	2012/10/25	<0.0020		ug/g	
		Endrin aldehyde	2012/10/25	<0.0020		ug/g	
		Endrin ketone	2012/10/25	<0.0020		ug/g	
		Mirex	2012/10/25	<0.0020		ug/g	

Maxxam Analytics
Attention: Wendy Sears
Client Project #: B294090
P.O. #:
Site Location:

Quality Assurance Report (Continued)

Maxxam Job Number: MB2G2886

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3011290 MAK	Method Blank	Octachlorostyrene	2012/10/25	<0.0020		ug/g	
		Toxaphene	2012/10/25	<0.080		ug/g	
	RPD - Sample/Sample Dup	Dieldrin	2012/10/25	NC		%	40
3013301 THT	RPD - Sample/Sample Dup	Moisture	2012/10/24	7.1		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B2G2886

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Charles Ancker, B.Sc., M.Sc., C.Chem, Senior Analyst

Cristina Carriere, Scientific Services

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam

Success Through Science

ACCREDITED IN ACCORDANCE WITH nelac

Your Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE
Your C.O.C. #: 11490

Attention: Joel Nolin
Tetra Tech WEI Inc.
115, 200 Rivercrest Dr. SE
Calgary, AB
CANADA T2C 2X5

Report Date: 2012/11/01

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B2G2809
Received: 2012/10/19, 10:51

Sample Matrix: AIR
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
BTEX and CCME Compounds in Air(TO-15mod) (1)	2	N/A	2012/10/25	BRL SOP-00304	EPA TO-15mod
Canister Pressure (TO-15) (1)	2	N/A	2012/10/25	BRL SOP-00304	EPA TO-15
Helium (1)	2	N/A	2012/11/01	CAM SOP-00223	ASTM D1946-90

(1) This test was performed by Maxxam Analytics Mississauga

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Theresa Stephenson, Project Manager
Email: TStephenson@maxxam.ca
Phone# (905) 817-5763

==========

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Total cover pages: 1

Maxxam Job #: B2G2809
Report Date: 2012/11/01

Tetra Tech WEI Inc.
Client Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE

RESULTS OF ANALYSES OF AIR

Maxxam ID		PG7795	PG7796	
Sampling Date		2012/10/16 14:45	2012/10/16 09:15	
COC Number		11490	11490	
	Units	**VW25-12-B / SX0610**	**VW27-12 / SX1327**	**QC Batch**
Volatile Organics				
Pressure on Receipt	psig	(-3.6)	(-2.6)	3014588

QC Batch = Quality Control Batch

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Maxxam Job #: B2G2809
Report Date: 2012/11/01

Tetra Tech WEI Inc.
Client Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE

COMPRESSED GAS PARAMETERS (AIR)

Maxxam ID		PG7795	PG7796		
Sampling Date		2012/10/16 14:45	2012/10/16 09:15		
COC Number		11490	11490		
	Units	**VW25-12-B / SX0610**	**VW27-12 / SX1327**	**RDL**	**QC Batch**
Gas					
Helium	% v/v	0.6	0.4	0.2	3022642

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G2809
Report Date: 2012/11/01

Tetra Tech WEI Inc.
Client Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE

VOLATILE ORGANIC HYDROCARBONS BY GC/MS (AIR)

Maxxam ID		PG7795	PG7796		
Sampling Date		2012/10/16 14:45	2012/10/16 09:15		
COC Number		11490	11490		
	Units	**VW25-12-B / SX0610**	**VW27-12 / SX1327**	**RDL**	**QC Batch**
Volatile Organics					
F1-BTEX, C6-C10 (as Toluene)	ug/m3	293	615	5.0	3014630
F2, C10-C16 (as Decane)	ug/m3	89.3	155	5.0	3014630
Benzene	ug/m3	4.8	32.6	1.2	3014630
Toluene	ug/m3	11.1	51.2	1.6	3014630
Ethylbenzene	ug/m3	<1.6	11.2	1.6	3014630
Total Xylenes	ug/m3	4.0	55.6	2.2	3014630
Surrogate Recovery (%)					
1,4-Difluorobenzene	%	78	77		3014630
Bromochloromethane	%	78	77		3014630
D5-Chlorobenzene	%	66	65		3014630

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B2G2809
Report Date: 2012/11/01

Tetra Tech WEI Inc.
Client Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE

Test Summary

Maxxam ID PG7795
Sample ID VW25-12-B / SX0610
Matrix AIR

Collected 2012/10/16
Shipped
Received 2012/10/19

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX and CCME Compounds in Air(TO-15	GC/MS	3014630	N/A	2012/10/25	Diane Temniuk
Canister Pressure (TO-15)	PRES	3014588	N/A	2012/10/25	Diane Temniuk
Helium		3022642	N/A	2012/11/01	Bhushan Borole

Maxxam ID PG7796
Sample ID VW27-12 / SX1327
Matrix AIR

Collected 2012/10/16
Shipped
Received 2012/10/19

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
BTEX and CCME Compounds in Air(TO-15	GC/MS	3014630	N/A	2012/10/25	Diane Temniuk
Canister Pressure (TO-15)	PRES	3014588	N/A	2012/10/25	Diane Temniuk
Helium		3022642	N/A	2012/11/01	Bhushan Borole

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Maxxam Job #: B2G2809
Report Date: 2012/11/01

Tetra Tech WEI Inc.
Client Project #: 1018901603
Site Location: LOBSTICK, GOLF COURSE

GENERAL COMMENTS

Helium Analysis: Canisters were pressurized with Nitrogen to enable sampling. Results and DLs adjusted accordingly.

Results relate only to the items tested.

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Tetra Tech WEI Inc.
Attention: Joel Nolin
Client Project #: 1018901603
P.O. #:
Site Location: LOBSTICK, GOLF COURSE

Quality Assurance Report

Maxxam Job Number: GB2G2809

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	%Recovery	Units	QC Limits
3014630 DVO	Spiked Blank	1,4-Difluorobenzene	2012/10/25		100	%	60 - 140
		Bromochloromethane	2012/10/25		98	%	60 - 140
		D5-Chlorobenzene	2012/10/25		95	%	60 - 140
		Benzene	2012/10/25		100	%	70 - 130
		Toluene	2012/10/25		103	%	70 - 130
		Ethylbenzene	2012/10/25		102	%	70 - 130
		Total Xylenes	2012/10/25		100	%	70 - 130
	Method Blank	1,4-Difluorobenzene	2012/10/25		98	%	60 - 140
		Bromochloromethane	2012/10/25		95	%	60 - 140
		D5-Chlorobenzene	2012/10/25		87	%	60 - 140
		F1-BTEX, C6-C10 (as Toluene)	2012/10/25	<5.0		ug/m3	
		F2, C10-C16 (as Decane)	2012/10/25	<5.0		ug/m3	
		Benzene	2012/10/25	<1.2		ug/m3	
		Toluene	2012/10/25	<1.6		ug/m3	
		Ethylbenzene	2012/10/25	<1.6		ug/m3	
		Total Xylenes	2012/10/25	<2.2		ug/m3	
3022642 BHB	Method Blank	Helium	2012/11/01	<0.1		% v/v	
	RPD - Sample/Sample Dup	Helium	2012/11/01	NC		%	10

Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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RUSH AIR

Form - Summa™ Canister

11490

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Page 1 of 1

ANALYSIS REQUESTED

19-Oct-12 10:51
Theresa Stephenson
B2G2809
ABH AIR-001

CLIENT INFORMATION SECTION

Company Name: Tetra Tech
Project Manager: Joel Nolin
e-mail: Joel.nolin@tetratech.com
Address: 115-200 Rivercrest Drive SE
Calgary, AB T2C 2X5
Phone: 403.718.3210 Fax: 403.990.1361
Sampled by: KO / TC

MAXXAM use only	Field Sample ID	Canister Serial #	Flow Regulator Serial #	Collection Time	Collection Date	Helium	Btex F_1 + F_2	Hold
	Uw 25-12-B	SX0610	FX0676	14:45	2012/10/16	X	X	
	Uw 27-12	SX1327	FX0704	09:15	2012/10/16	X	X	
	Uw 25-12-A	SX0882	FX0322	12:32	2012/10/15			X
	Uw 25-12-A-DUP	SX1257	"	"	"			X

TAT Requirement
STD 10 Business day ☐
Rush 5 Business day * ☐
Rush 2 Business day * ☐
Rush 1 Business day * ☐
Other (specify): 5-7 days

PROJECT INFORMATION
Project #: 101890603
Name: Lobstick, Golf Course
PO #:
Maxxam Quote #:
Maxxam Contact: Theresa Stephenson

REPORTING REQUIREMENTS
Summary Report only ☒
Summary Report & Full Data Package ☐
EDD ☐

PROJECT SPECIFIC COMMENTS
Send copy of report to:
andrew.eason
labresultssk
troy.lange
krista.olafsson
} @tetratech.com

* = need approval from Maxxam

Client Signature:
Affiliation: Tetra Tech
Date/Time: 12/10/18 13:20

Received by:
Affiliation:
Date/Time: Oct 18/12

ASAD. BRAZDU 2012/10/19 10:51

COC-1003 (03/10) - Summa Canister

Tetra Tech Lab Data Checklist

MDH Job Number:	611472	Client:	Public Works & Gov't Services
Chain of Custody #	NA	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	NA	
Was **Temperature** acceptable upon arrival to lab.?	NA	
Were samples analysed within the **hold time**?	NA	
Methanol Extracted within 48 hrs?	NA	
Is the **Quality Control Validation Page** signed?	NA	
Is the **Certificate of Analysis** signed?	NA	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	NA	
Matrix Spike Recovery	NA	
Spike blank Recovery	NA	
Blank Concentration	NA	
Matrix Duplicate **RPD**	NA	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	NA	No field duplicate in submission.

Data quality check performed by: Marcia Mitschke

Date: 5-Nov-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B292855	Client:	Public Works & Gov't Services
Chain of Custody #	A014439	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	Y	
Was **Temperature** acceptable upon arrival to lab.?	Y	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	NA	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	Y	
Spike blank Recovery	Y	
Blank Concentration	Y	
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	NA	No field duplicate in submission.

Data quality check performed by: Marcia Mitschke

Date: 23-Oct-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B293223	Client:	Public Works & Gov't Services
Chain of Custody #	A072026	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	Y	
Was **Temperature** acceptable upon arrival to lab.?	Y	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	NA	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	Y	
Spike blank Recovery	Y	
Blank Concentration	Y	MB for Dissolved Mo >RDL but <PQL. Results are acceptable.
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	Y	

Data quality check performed by: Marcia Mitschke

Date: 23-Oct-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B293234	Client:	Public Works & Govt' Services
Chain of Custody #	A073649, A073650, A073644, A014440, A073648, A073645, A073646, A073647	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	Y	
Was **Temperature** acceptable upon arrival to lab.?	Y	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	Y	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	Y	
Spike blank Recovery	Y	
Blank Concentration	Y	MB for Moisture >RDL but <PQL. Results are acceptable.
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	Y	

Data quality check performed by: Marcia Mitschke

Date: 7-Nov-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B293624	Client:	Public Works & Gov't Services
Chain of Custody #	A072027, A072028, A072029, A072030, A072031, A072032, A072033, A072034	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	Y	
Was **Temperature** acceptable upon arrival to lab.?	Y	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	Y	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	Y	
Spike blank Recovery	Y	
Blank Concentration	Y	
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	Y	

Data quality check performed by: Marcia Mitschke

Date: 6-Nov-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B294090	Client:	Public Works & Gov't Services
Chain of Custody #	A073651, A072837, A073652, A073638	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	Y	
Was **Temperature** acceptable upon arrival to lab.?	Y	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	Y	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	Y	
Spike blank Recovery	Y	
Blank Concentration	Y	MB for Conductivity and Dissolved Nitrate >RDL but <PQL. Results are acceptable.
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	Y	
Trip Blank Concentration	Y	
Equipment Blank Concentration	Y	Lab rechecked EB TUBING for Dissolved Al, Cu, Mo, U, and Cd. Original results were confirmed.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	Y	

Data quality check performed by: Marcia Mitschke

Date: 9-Nov-12

Tetra Tech Lab Data Checklist

Maxxam Job Number:	B2G2809	Client:	Public Works and Gov't Services
Chain of Custody #	11490	Location No.:	Lobstick
		Tetra Tech Project Number:	1018901603

General

Questions	Answers (Y/N)	Comments
Was **Chain of Custody** completed correctly?	NA	
Was **Temperature** acceptable upon arrival to lab.?	NA	
Were samples analysed within the **hold time**?	Y	
Methanol Extracted within 48 hrs?	NA	
Is the **Quality Control Validation Page** signed?	Y	
Is the **Certificate of Analysis** signed?	Y	

Laboratory Quality Control Check

Are the following within acceptable criteria?	Answers (Y/N)	Comments
Surrogates	Y	
Matrix Spike Recovery	NA	
Spike blank Recovery	Y	
Blank Concentration	Y	
Matrix Duplicate **RPD**	Y	

Field Quality Control Samples

Are the following within alert limits?	Answers (Y/N)	Comments
Field Blank Concentration	NA	No field blank in submission.
Trip Blank Concentration	NA	No trip blank in submission.
Equipment Blank Concentration	NA	No equipment blank in submission.
Helium Concentration <1%	NA	Only applicable to air samples.
Field Duplicate RPD	NA	No field duplicate in submission.

Data quality check performed by: Marcia Mitschke

Date: 2-Nov-12

TETRA TECH

APPENDIX H

NATIONAL CLASSIFICATION SYSTEM FOR CONTAMINATED SITES

CCME National Classification System for Contaminated Sites (2008, 2010 v 1.2)
Pre-Screening Checklist

Question	Response (yes / no)	Comment
1. Are **Radioactive material**, **Bacterial contamination** or **Biological hazards** likely to be present at the site?	No	If yes, do not proceed through the NCSCS. Contact applicable regulatory agency immediately.
2. Are there **no contamination exceedances** (known or suspected)? Determination of exceedances may be based on: 1) CCME environmental quality guidelines; 2) equivalent provincial guidelines/standards if no CCME guideline exists for a specific chemical in a relevant medium; or 3) toxicity benchmarks derived from the literature for chemicals not covered by CCME or provincial guidelines/standards.	No	If yes (i.e., there are no exceedances), do not proceed through the NCSCS.
3. Have **partial/incompleted or no environmental site investigations** been conducted for the Site?	No	If yes, do not proceed through the NCSCS.
4. Is there direct and signficant evidence of **impacts to humans** at the site, or off-site due to migration of contaminants from the site?	No	If yes, automatically rate the site as Class 1, a priority for remediation or risk management, regardless of the total score obtained should one be calculated (e.g., for comparison with other Class 1 sites).
5. Is there direct and significant evidence of **impacts to ecological receptors** at the site, or off-site due to migration of contaminants from the site?	No	Some low levels of impact to ecological receptors are considered acceptable, particularly on commercial and industrial land uses. However, if ecological effects are considered to be severe, the site may be categorized as Class 1, regardless of the numerical total NCSCS score. For the purpose of application of the NCSCS, effects that would be considered severe include observed effects on survival, growth or reproduction which could threaten the viability of a population of ecological receptors at the site. Other evidence that qualifies as severe adverse effects may be determined based on professional judgement and in consultation with the relevant jurisdiction.
6. Are there indicators of significant **adverse effects in the exposure zone** (i.e., the zone in which receptors may come into contact with contaminants)? Some examples are as follows: -Hydrocarbon sheen or NAPL in the exposure zone -Severely stressed biota or devoid of biota; -Presence of material at ground surface or sediment with suspected high concentration of contaminants such as ore tailings, sandblasting grit, slag, and coal tar.	No	If yes, automatically rate the site as Class 1, a priority for remediation or risk management, regardless of the total score obtained should one be calculated (e.g., for comparison with other Class 1 sites).
7. Do measured concentrations of volatiles or unexploded ordnances represent an **explosion hazard**?	No	If yes, automatically rate the site as Class 1, a priority for remediation or risk management, and do not continue until the safety risks have been addressed. Consult your jurisdiction's occupational health and safety guidance or legislation on exposive hazards and measurement of lower explosive limits.

If none of the above applies, proceed with the NCSCS scoring.

CCME National Classification System for Contaminated Sites (2008, 2010 v 1.2)
Summary of Site Conditions

Subject Site:	Test Site	
Civic Address: *(or other description of location)*	Lobstick Golf Course, Waskesiu Lake, Prince Albert National Park, SK	
Site Common Name : *(if applicable)*	Lobstick Maintenance Compound	
Site Owner or Custodian: *(Organization and Contact Person)*	Parks Canada Agency	
Legal description *or* metes and bounds:		
Approximate Site area:	1200 m2	
PID(s) : *(or Parcel Identification Numbers [PIN] if untitled Crown land)*		
Centre of site: *(provide latitude/longitude or UTM coordinates)*	Latitude: Longitude:	___53___ degrees __55____ min ___1.8___ secs 106 degrees __5____ min ___21.4___ secs
	UTM Coordinate:	Northing _____ Easting _____
Site Land Use:	Current:	Commercial - maintenance compound for a golf course
	Proposed:	same
Site Plan	**To delineate the bounds of the Site a site plan MUST be attached. The plan must be drawn to scale indicating the boundaries in relation to well-defined reference points and/or legal descriptions. Delineation of the contamination should also be indicated on the site plan.**	
Provide a brief description of the Site:	The Lobstick Maintenance Compound is located in Prince Albert National Park approximately 800 m southwest of the centre of the Town of Waskesiu Lake, SK. The Town of Waskesiu Lake is located on the eastern shore of Waskesiu Lake which in turn is located approximately 85 km north-northwest of the City of Prince Albert, SK. The site has operated as a maintenance compound and storage area for groundskeeping equipment for the surrounding Waskesiu Golf Course since initial course development in the 1930s. Current site infrastructure comprises two single storey wood-frame maintenance garages enclosing a small gravelled courtyard where a newer chemical storage building, an aboveground used oil tank and propane storage tank are located. Three additional buildings associated with the maintenance compound, comprising smaller storage sheds and stores buildings are located on a north/south access road to the east of the compound. A 7000 L dual compartment ConVault® tank is located to the south of the Shop B building. The maintenance compound is located along the eastern edge of the Waskesiu Golf Course and is bordered to the west and south by the fairways and greens for holes 13 and 14. The area to the east and north of the compound comprises a grassy laydown area followed by small fens and sloughs. The site is accessed by an unnamed gravelled service road that is accessed from a parking lot along Wapiti Drive near the Town centre. Access to the site via this road is secured to vehicle entry with a gate; however, access to the maintenance compound is generally unrestricted to foot traffic along this road or from the adjoining golf course fairways	

CCME National Classification System for Contaminated Sites (2008, 2010 v 1.2)
Summary of Site Conditions

Affected media and Contaminants of Potential Concern (COPC):	Contaminants of potential concern primarily comprise adsorbed and dissolved-phase petroleum hydrocarbons (PHCs), specifically PHCs in the gasoline range (containing Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and Petroleum Hydrocarbon Fractions F1 and F2), regulated metals (dissolved-phase only), and DDT.

Please fill in the "letter" that best describes the level of information available for the site being assessed:

Site Letter Grade C

If letter grade is F, do not continue, you must have a minimum of a Phase I Environmental Site Assessment or equivalent.

Scoring Completed By:	**Troy Lange**
Date Scoring Completed:	**7-Nov-12**

CCME National Classification System (2008, 2010 v 1.2)

(I) Contaminant Characteristics

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method of Evaluation	Notes
1. Residency Media (replaces physical state)				
Which of the following residency media are known (or strongly suspected) to have one or more exceedances of the applicable CCME guidelines? yes = has an exceedance or strongly suspected to have an exceedance no = does not have an exceedance or strongly suspected not to have an exceedance		Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	The overall score is calculated by adding the individual scores from each residency media (having one or more exceedance of the most conservative media specific and land-use appropriate CCME guideline). Summary tables of the Canadian Environmental Quality Guidelines for soil, water (aquatic life, non-potable groundwater environments, and agricultural water uses) and sediment are available on the CCME website at http://www.ccme.ca/publications/cegg_rcqe.html?category_id=124. For potable groundwater environments, guidelines for Canadian Drinking Water Quality (for comparison with groundwater monitoring data) are available on the Health Canada website at http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/sum_guide-res_recom/index_e.html.	An increasing number of residency media containing chemical exceedances often equates to a greater potential risk due to an increase in the number of potential exposure pathways.
A. Soil	Yes			
Yes No Do Not Know				
B. Groundwater	Yes			
Yes No Do Not Know				
C. Surface water	No			
Yes No Do Not Know				
D. Sediment	No			
Yes No Do Not Know				
"Known" -score	4			
"Potential" - score	---			
2. Chemical Hazard				
What is the relative degree of chemical hazard of the contaminant in the list of hazard rankings proposed by the Federal Contaminated Sites Action Plan (FCSAP)?	High	Benzene is principle contaminant of concern (Benzene has high hazard rating)	The relative degree of chemical hazard should be selected based on the most hazardous contaminant known or suspected to be present at the site. The degree of hazard has been defined by the Federal Contaminated Sites Action Plan (FCSAP) and a list of substances with their associated hazard (Low, Medium and High) has been provided as a separate sheet in this file. *See Attached Reference Material for Contaminant Hazard Rankings.*	Hazard as defined in the revised NCS pertains to the physical properties of a chemical which can cause harm. Properties can include toxic potency, propensity to biomagnify, persistence in the environment, etc. Although there is some overlap between hazard and contaminant exceedance factor below, it will not be possible to derive contaminant exceedance factors for many substances which have a designated chemical hazard designation, but don't have a CCME guideline. The purpose of this category is to avoid missing a measure of toxic potential.
High Medium Low Do Not Know				
"Known" -score	8			
"Potential" - score	---			
3. Contaminant Exceedence Factor				
What is the ratio between the measured contaminant concentration and the applicable CCME guidelines (or other "standards")?	dium (10x to 10	Benzene in BH12 @ 3.75 m exceeds criteria by 19 times. See Table 3, Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Ranking of contaminant "exceedance" is determined by comparing contaminant concentrations with the *most conservative media-specific and land-use appropriate CCME* environmental quality guidelines. **Ranking should be based on contaminant with greatest exceedance of CCME guidelines.** Ranking of contaminant hazard as high, medium and low is as follows: High = One or more measured contaminant concentration is greater than 100 X appropriate CCME guidelines Medium = One or more measured contaminant concentration is 10 - 99.99 X appropriate CCME guidelines Low = One or more measured contaminant concentration is 1 - 9.99 X appropriate CCME guidelines Mobile NAPL = Contaminant is a non-aqueous phase liquid (i.e., due to its low solubility, it does not dissolve in water, but remains as a separate liquid) and is present at a sufficiently high saturation (i.e., greater than residual NAPL saturation) such that there is significant potential for mobility either downwards or laterally. Other standards may include local background concentration or published toxicity benchmarks. Results of toxicity testing with site samples can be used as an alternative. This approach is only relevant for contaminants that do not biomagnify in the food web, since toxicity tests would not indicate potential effects at higher trophic levels. High = lethality observed. Medium = no lethality, but sub lethal effects observed. Low = neither lethal nor sub lethal effects observed.	In the event that elevated levels of a material with no associated CCME guidelines are present, check provincial and USEPA environmental criteria. Hazard Quotients (sometimes referred to as a screening quotient in risk assessments) refer to the ratio of measured concentration to the concentration believed to be the threshold for toxicity. A similar calculation is used here to determine the contaminant exceedance factor (CEF). Concentrations greater than one times the applicable CCME guideline (i.e., CEF=>1) indicate that risks are possible. Mobile NAPL has the highest associated score (8) because of its highly concentrated nature and potential for increase in the size of the impacted zone.
Mobile NAPL High (>100x) Medium (10x to 100x) Low (1x to 10x) Do Not Know				
"Known" -score	4			
"Potential" - score	---			

CCME National Classification System (2008, 2010 v 1.2)

(I) Contaminant Characteristics

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method of Evaluation	Notes
4. Contaminant Quantity (known or strongly suspected)				
What is the known or strongly suspected quantity of all contaminants? >10 hectare (ha) or 5000 m^3 2 to 10 ha or 1000 to 5000 m^3 <2 ha or 1000 m^3 Do Not Know	2 to 10 ha or 1000 to 5000 m3	Estimated 3200m3. Volume calculated from average thickness of impacted soil (from soil logs and the data provided in Table 3) multiplied by the approximate areal extent of impacts. Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Measure or estimate the area or quantity of total contamination (i.e, all contaminants known or strongly suspected to be present on the site). The "Area of Contamination" is defined as the area or volume of contaminated media (soil, sediment, groundwater, surface water) exceeding appropriate environmental criteria.	A larger quantity of a potentially toxic substance can result in a larger frequency of exposure as well as a greater probability of migration, therefore, larger quantities of these substances earn a higher score.
"Known" -score	6			
"Potential" - score	---			
5. Modifying Factors				
Does the chemical fall in the class of persistent chemicals based on its behavior in the environment? Yes No Do Not Know	No	PHC not considered persistent. DDT is persistent but is not present at concentrations exceeding the applicable CCME guideline. Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Persistent chemicals, e.g., PCBs, chlorinated pesticides etc. either do not degrade or take longer to degrade, and therefore may be available to cause effects for a longer period of time. Canadian Environmental Protection Act (CEPA) classifies a chemical as persistent when it has at least one of the following characteristics: (a) in air, (i) its half-life is equal to or greater than 2 days, or (ii) it is subject to atmospheric transport from its source to a remote area; (b) in water, its half-life is equal to or greater than 182 days; (c) in sediments, its half-life is equal to or greater than 365 days; or (d) in soil, its half-life is equal to or greater than 182 days. This list does not include metals or metalloids, which in their elemental form do not degrade. However metals and metalloids form chemical species in the environment, many of which are not readily bioavailable.	*Examples of Persistent Substances are provided in attached Reference Materials*
Are there contaminants present that could cause damage to utilities and infrastructure, either now or in the future, given their location? Yes No Do Not Know	No			Some contaminants may react or absorb into underground utilities and infrastructure. For example, organic solvents may degrade some plastics, and salts could cause corrosion of metal.
How many different contaminant classes have representative CCME guideline exceedances? one two to four five or more Do Not Know	two to four	Volatile petroleum hydrocarbons and heavy extractable petroleum hydrocarbons. See Tables 3 and 7, Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	For the purposes of the revised NCS ranking system, the following chemicals represent distinct chemical "classes": inorganic substances (including metals), volatile petroleum hydrocarbons, light extractable petroleum hydrocarbons, heavy extractable petroleum hydrocarbons, PAHs, phenolic substances, chlorinated hydrocarbons, halogenated methanes, phthalate esters, pesticides.	*Refer to the Reference Material sheet for a list of example substances that fall under the various chemical classes.*
"Known" - Score	2			
"Potential" - Score	---			

Contaminant Characteristic Total

Raw Total Scores- "Known"	24
Raw Total Scores- "Potential"	0
Raw Combined Total Scores	24
Total Score (Raw Combined / 40 * 33)	19.8

(II) Migration Potential (Evaluation of contaminant migration pathways)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
1. Groundwater Movement				
A. Known COPC exceedances and an operable groundwater pathway within and/or beyond the property boundary.				
i) For **potable groundwater environments**, 1) groundwater concentrations exceed background concentrations and 1X the Guideline for Canadian Drinking Water Quality (GCDWQ) or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater contamination. For **non-potable environments** (typically urban environments with municipal services), 1) groundwater concentrations exceed 1X the applicable non potable guidelines or modified generic guidelines (which exclude ingestion of drinking water pathway) or 2) there is known contact of contaminants with groundwater, based on physical evidence of groundwater impacts.	12	Non-potable environment. Town obtains water from Waskesiu Lake. Dissolved-phase PHCs (benzene) are present in two monitoring wells at concentrations up to 10 times the applicable criteria for the vapour inhalation pathway. Dissolved-phase PHCs have been delineated to non-detectable or near non-detectable concentrations in perimeter monitoring wells located between 20 m and 40 m from source area. Natural attenuation trends are indicative of biodegradation of dissolved-phase PHCs. Freshwater aquaitic pathway not considered applicable. See Table 3, Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Review chemical data and evaluate groundwater quality. The evaluation method concentrates on 1) a potable or non-potable groundwater environment; 2) the groundwater flow system and its potential to be an exposure pathway to known or potential receptors An aquifer is defined as a geologic unit that yields groundwater in usable quantities and drinking water quality. The aquifer can currently be used as a potable water supply or could have the potential for use in the future. Non-potable groundwater environments are defined as areas that are serviced with a reliable alternative water supply (most commonly provided in urban areas). The evaluation of a non-potable environment will be based on a site specific basis. Physical evidence includes significant sheens, liquid phase contamination, or contaminant saturated soils. Seeps and springs are considered part of the groundwater pathway. In Arctic environments, the potability and evaluation of the seasonal active layer (above the permafrost) as a groundwater exposure pathway will be considered on a site-specific basis.	The 1992 NCS rationale evaluated the off-site migration as a regulatory issue. The exposure assessment and classification of hazards should be evaluated regardless of the property boundaries. Someone experienced must provide a thorough description of the sources researched to determine the presence/absence of a groundwater supply source in the vicinity of the contaminated site. This information must be documented in the NCS Site Classification Worksheet including contact names, phone numbers, e-mail correspondence and/or reference maps/reports and other resources such as internet links. Note that for potable groundwater that also daylights into a nearby surface water body, the more stringent guidelines for both drinking water and protection of aquatic life should be considered. **Selected References** Potable Environments Guidelines for Canadian Drinking Water Quality: www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-appui/sum_guide-res_recom/index_e.html Non-Potable Environments Canadian Water Quality Guidelines for Protection of Aquatic Life. CCME. 1999 www.ccme.ca Compilation and Review of Canadian Remediation Guidelines, Standards and Regulations. Science Applications International Corporation (SAIC Canada), report to Environment Canada, January 4, 2002.
ii) Same as (i) except the information is not known but strongly suspected based on indirect observations.	9			
iii) Meets GCDWQ for **potable environments**; meets non-potable criteria or modified generic criteria (excludes ingestion of drinking water pathway) for **non-potable environments** **or** Absence of groundwater exposure pathway (i.e., there is no aquifer (see definition at right) at the site or there is an adequate isolating layer between the aquifer and the contamination, and within 5 km of the site there are no aquatic receiving environments and the groundwater does not daylight).	0			
Score	Go to Potential —			
NOTE: If a score is assigned here for Known COPC Exceedances, then you can skip Part B (Potential for groundwater pathway) and go to Section 2 (Surface Water Pathway)				
B. Potential for groundwater pathway.				
a. Relative Mobility High Moderate Low Insignificant Do Not Know		Benzene has Log Koc of 1.77 (therefore high)	Organics Koc (L/kg) / Metals with higher mobility at acidic conditions / Metals with higher mobility at alkaline conditions Koc < 500 (i.e., log Koc < 2.7) — pH < 5 — pH > 8.5 Koc = 500 to 5000 (i.e., log Koc = 2.7 to 3.7) — pH = 5 to 6 — pH = 7.5 to 8.5 Koc = 5,000 to 100,000 (i.e., log Koc = 3.7 to 5) — pH > 6 — pH < 7.5 Koc > 100,000 (i.e., log Koc > 5)	Reference: US EPA Soil Screening Guidance (Part 5 - Table 39) If a score of zero is assigned for relative mobility, it is still recommended that the following sections on potential for groundwater pathway be evaluated and scored. Although the Koc of an individual contaminant may suggest that it will be relatively immobile, it is possible that, with complex mixtures, there could be enhanced mobility due to co-solvent effects. Therefore, the Koc cannot be relied on solely as a measure of mobility. An evaluation of other factors such as containment, thickness of confining layer, hydraulic conductivities and precipitation infiltration rate are still useful in predicting potential for groundwater migration, even if a contaminant is expected to have insignificant mobility based on its chemistry alone.
	High			
Score	4			
b. Presence of engineered sub-surface containment? No containment Partial containment Full containment Do Not Know			Review the existing engineered systems or natural attenuation processes for the site and determine if full or partial containment is achieved. Full containment is defined as an engineered system or natural attenuation processes, monitored as being effective, which provide for full capture and/or treatment of contaminants. All chemicals of concern must be contained for "Full Containment" scoring. Natural attenuation must have sufficient data, and reports cited with monitoring data to support steady state conditions and the attenuation processes. If there is no containment or insufficient natural attenuation process, this category is evaluated as high. If there is less than full containment or if uncertain, then evaluate as medium. In Arctic environments, permafrost will be evaluated, as appropriate, based on detailed evaluations, effectiveness and reliability to contain/control contaminant migration.	Someone experienced must provide a thorough description of the sources researched to determine the containment of the source at the contaminated site. This information must be documented in the NCS Site Classification Worksheet including contact names, phone numbers, e-mail correspondence and/or reference maps, geotechnical reports or natural attenuation studies and other resources such as internet links. **Selected Resources:** United States Environmental Protection Agency (USEPA) 1998. Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater. EPA/600/R-98/128. Environment Canada – Ontario Region – Natural Attenuation Technical Assistance Bulletins (TABS) Number 19 –21.
	No containment			
Score	3			
c. Thickness of confining layer over aquifer of concern or groundwater exposure pathway 3 m or less including no confining layer or discontinuous confining layer 3 to 10 m > 10 m Do Not Know		A potential domestic aquifer has not been identified during investigations conducted at the site to date. Maximum depth of investigation has been to 10.25 m below grade. Source of potable water is Waskesiu Lake. Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	The term "confining layer" refers to geologic material with little or no permeability or hydraulic conductivity (such as unfractured clay); water does not pass through this layer or the rate of movement is extremely slow. Measure the thickness and extent of materials that will impede the migration of contaminants to the groundwater exposure pathway. The evaluation of this category is based on: 1) The presence and thickness of saturated subsurface materials that impede the vertical migration of contaminants to lower aquifer units which can or are used as drinking water sources or 2) The presence and thickness of unsaturated subsurface materials that impede the vertical migration of contaminants from the source location to the saturated zone (e.g., water table aquifer, first hydrostratigraphic unit or other groundwater pathway).	
	3 to 10 m			
Score	0.5			
d. Hydraulic conductivity of confining layer >10^{-4} cm/s or no confining layer 10^{-4} to 10^{-6} cm/s <10^{-6} cm/s Do Not Know		Rising head test data indicate a k of 3.3 x 10-5 cm/s. Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Determine the nature of geologic materials and estimate hydraulic conductivity from published material (or use "Range of Values of Hydraulic Conductivity and Permeability" figure in the Reference Material sheet). Unfractured clays should be scored low. Silts should be scored medium. Sand, gravel should be scored high. The evaluation of this category is based on: 1) The presence and hydraulic conductivity ("K") of saturated subsurface materials that impede the vertical migration of contaminants to lower aquifer units which can or are used as a drinking water source, groundwater exposure pathway or 2) The presence and permeability ("K") of unsaturated subsurface materials that impede the vertical	

(II) Migration Potential (Evaluation of contaminant migration pathways)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
	10-4 to 10-6 cm/s		migration of contaminants from the source location to the saturated water table aquifer, first hydrostratigraphic unit or other groundwater pathway.	
Score	0.5			
B. Potential for groundwater pathway.				
e. Precipitation infiltration rate (Annual precipitation factor x surface soil relative permeability factor) High Moderate Low Very Low None Do Not Know	Low	Assume precipitation similar to Prince Albert: 424 mm (Environment Canada) = 0.4 score Permeability: various surface covers include gravel or topsoil underlain sand and/or loam: use 0.6 score Run-off potential = 0.4 * 0.6 = 0.24	Precipitation Refer to Environment Canada precipitation records for relevant areas. Divide annual precipitation by 1000 and round to nearest tenth (e.g., 667 mm = 0.7 score). Permeability For surface soil relative permeability (i.e., infiltration) assume: gravel (1), sand (0.6), loam (0.3) and pavement or clay (0). Multiply the surface soil relative permeability factor with precipitation factor to obtain the score for precipitation infiltration rate.	
Score	0.4			
f. Hydraulic conductivity of aquifer $>10^{-2}$ cm/s 10^{-2} to 10^{-4} cm/s $<10^{-4}$ cm/s Do Not Know	<10-4 cm/s	A potential domestic aquifer has not been identified during investigations conducted at the site to date. Maximum depth of investigation has been to 10.25 m below grade. Rising head test data indicate a k of 3.3 x 10-5 cm/s. Tetra Tech, 2012. Environmental Investigation, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Determine the nature of geologic materials and estimate hydraulic conductivity of all aquifers of concern from published material (refer to "Range of Values of Hydraulic Conductivity and Permeability" in the Reference Material sheet).	
Score	0			
Potential groundwater pathway total	8.4			
Allowed Potential score	8.4	Note: If a "known" score is provided, the "potential" score is disallowed.		
Groundwater pathway total	8.4			
2. Surface Water Movement				
A. Demonstrated migration of COPC in surface water above background conditions				
Known concentrations of surface water: i) Concentrations exceed background concentrations and exceed CCME CWQG for protection of aquatic life, irrigation, livestock water, and/or recreation (whichever uses are applicable at the site) by >1 X; or There is known contact of contaminants with surface water based on site observations. or In the absence of CWQG, chemicals have been proven to be toxic based on site specific testing (e.g. toxicity testing; or other indicator testing of exposure).	12	COPC have been identified in groundwater; however, the COPC have been delineated to at or near nondetectable concentrations in peripheral monitoring wells, therefore PHC impacts are not expected in surface water receiving bodies . See Table 6 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Collect all available information on quality of surface water near to site. Evaluate available data against Canadian Water Quality Guidelines (select appropriate guidelines based on local water use, e.g., recreation, irrigation, aquatic life, livestock watering, etc.). The evaluation method concentrates on the surface water flow system and its potential to be an exposure pathway. Contamination is present on the surface (above ground) and has the potential to impact surface water bodies. Surface water is defined as a water body that supports one of the following uses: recreation, irrigation, livestock watering, aquatic life.	General Notes: Someone experienced must provide a thorough description of the sources researched to classify the surface water body in the vicinity of the contaminated site. This information must be documented in the NCS Site Classification Worksheet including contact names, phone numbers, e-mail correspondence and/or reference maps/reports and other resource such as internet links. Selected References: CCME, 1999. Canadian Water Quality Guidelines for the Protection of Aquatic Life www.ccme.ca CCME, 1999. Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses (Irrigation and Livestock Water) www.ccme.ca Health and Welfare Canada. 1992. Guidelines for Canadian Recreational Water Quality.
ii) Same as (i) except the information is not known but strongly suspected based on indirect observations.	8			
iii) Meets CWQG or absence of surface water exposure pathway (i.e., Distance to nearest surface water is > 5 km.)	0			
Score	Go to Potential —			
NOTE: If a score is assigned here for Demonstrated Migration in Surface Water, then you can skip Part B (Potential for migration of COPCs in surface water) and go to Section 3 (Surface Soils)				
B. Potential for migration of COPCs in surface water				
a. Presence of containment No containment Partial containment Full containment Do Not Know	No containment		Review the existing engineered systems and relate these structures to site conditions and proximity to surface water and determine if full containment is achieved: score low if there is full containment such as capping, berms, dikes; score medium if there is partial containment such as natural barriers, trees, ditches, sedimentation ponds; score high if there are no intervening barriers between the site and nearby surface water. Full containment must include containment of all chemicals.	
Score	5			
b. Distance to Surface Water 0 to <100 m 100 - 300 m >300 m Do Not Know	100 - 300 m	Sloughs (east at ~150 m and ~300 m) and a beaver pond ~350 m to the northeast. See Tetra Tech, 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Review available mapping and survey data to determine distance to nearest surface water bodies.	
Score	2			

(II) Migration Potential (Evaluation of contaminant migration pathways)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
c. Topography Contaminants above ground level and slope is steep Contaminants at or below ground level and slope is steep Contaminants above ground level and slope is intermediate Contaminants at or below ground level and slope is intermediate Contaminants above ground level and slope is flat Contaminants at or below ground level and slope is flat Do Not Know			Review engineering documents on the topography of the site and the slope of surrounding terrain. Steep slope = >50% Intermediate slope = between 5 and 50% Flat slope = < 5% Note: Type of fill placement (e.g., trench, above ground, etc.).	
	At/below and interme			
Score	1			
d. Run-off potential High (rainfall run-off score > 0.6) Moderate (0.4 < rainfall run-off score <0.6) Low (0.2 < rainfall run-off score <0.4) Very Low (0 < rainfall run-off score < 0.2) None (rainfall run-off score = 0) Do Not Know		Assume precipitation similar to Prince Albert: 424 mm (Environment Canada) = 0.4 score Permeability: various surface covers include is gravel or topsoil underlain sand and/or loam: use 0.6 score Run-off potential = 0.4 * 0.6 = 0.24	Rainfall Refer to Environment Canada precipitation records for relevant areas. Divide rainfall by 1000 and round to nearest tenth (e.g., 667 mm = 0.7 score). The former definition of "annual rainfall" did not include the precipitation as snow. This minor adjustment has been made. The second modification was the inclusion of permeability of surface materials as an evaluation factor. Permeability For infiltration assume: gravel (0), sand (0.3), loam (0.6) and pavement or clay (1). Multiply the infiltration factor with precipitation factor to obtain rainfall run off score.	Selected Sources: Environment Canada web page link: www.msc.ec.gc.ca Snow to rainfall conversion apply ratio of 15 (snow):1(water)
	Low			
Score	0.4			
e. Flood potential 1 in 2 years 1 in 10 years 1 in 50 years Not in floodplain Do Not Know		Personal communication with Kevin Ferrie of PANP's Resource Conservation division (306-663-4538) indicated that recorded water levels in Waskesiu Lake have never been high enough to flood the area where the maintenance compound is located	Review published data such as flood plain mapping or flood potential (e.g., spring or mountain run-off) and Conservation Authority records to evaluate flood potential of nearby water courses both up and down gradient. Rate zero if site not in flood plain.	
	Not in floodplain			
Score	0			
Potential surface water pathway total	8.4			
Allowed Potential score	8.4	Note: If a "known" score is provided, the "potential" score is disallowed.		
Surface water pathway total	8.4			
3. Surface Soils (potential for dust, dermal and ingestion exposure)				
A. Demonstrated concentrations of COPC in surface soils (top 1.5 m)				
COPCs measured in surface soils exceed the CCME soil quality guideline.	12	PHC fraction F3 was detected in one soil sample (USED OIL TANK) recovered from a surficial stain at a concentration of approx 5 times the criteria. The surficial stain is located immediately adjacent to the waste oil tank on the west side of Shop A and covers an area of approximately 5 m by 5 m. The surfical staining is localized at the front and side of the waste oil tank and is not expected to be representative of the surfical soil quality at the entire maintenance compound. Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Collect all available information on quality of surface soils (i.e., top 1.5 metres) at the site. Evaluate available data against Canadian Soil Quality Guidelines. Select appropriate guidelines based on current (or proposed future) land use (i.e, agricultural, residential/parkland, commercial, or industrial), and soil texture if applicable (i.e., coarse or fine).	Selected References: CCME, 1999, Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health www.ccme.ca
Strongly suspected that soils exceed guidelines	9			
COPCs in surface soils does not exceed the CCME soil quality guideline or is not present (i.e., bedrock).	0			
	Go to Potential			
Score	—			
NOTE: If a score is assigned here for Demonstrated Concentrations in Surface Soils, then you can skip Part B (Potential for a surface soils migration pathway) and go to Section 4 (Vapour)				
B. Potential for a surface soils (top 1.5 m) migration pathway				
a. Are the soils in question covered? Exposed Vegetated Landscaped Paved Do Not Know		PHC fraction F3 detected in one soil sample (USED OIL TANK) recovered from a surficial stain at a concentration of approx 5 times the criteria. Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Consult engineering or risk assessment reports for the site. Alternatively, review photographs or perform a site visit. Landscaped surface soils must include a minimum of 0.5 m of topsoil.	The possibility of contaminants in blowing snow have not been included in the revised NCS as it is difficult to assess what constitutes an unacceptable concentration and secondly, spills to snow or ice are most efficiently mitigated while freezing conditions remain.
	Exposed			
Score	6			
b. For what proportion of the year does the site remain covered by snow? 0 to 10% of the year 10 to 30% of the year More than 30% of the year Do Not Know		Assume days with snow cover > 1 cm similar to Prince Alberta: 146 days (Environment Canada)	Consult climatic information for the site. The increments represent the full span from soils which are always wet or covered with snow (and therefore less likely to generate dust) to those soils which are predominantly dry and not covered by snow (and therefore are more likely to generate dust).	
	>30% of year			
Score	0			
Potential surface soil pathway total	6			
Allowed Potential score	6	Note: If a "known" score is provided, the "potential" score is disallowed.		
Soil pathway total	6			

(III) Exposure (Demonstrates the presence of an exposure pathway and receptors)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
1. Human				
A. Known exposure				
Documented adverse impact or high quantified exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to humans as a result of the contaminated site. (Class 1 Site*) Same as above, but "Strongly Suspected" based on observations or indirect evidence. No quantified or suspected exposures/impacts in humans. Score	22 10 0 10 10	A Preliminary Quantitative Risk Assessment (PQRA) has been performed. Hazard Quotient < 0.2 for non-carcinogens ILCR > 1 x 10-5 for carcinogens Tetra Tech 2012, Preliminary Quantitative Risk Assessment (PQRA) and Summary Remedial Action Plan (RAP), Lobstick Maintenance Compound, Prince Albert National Park.	*Where adverse effects on humans are documented, the site should be automatically designated as a Class 1 site (i.e., action required). There is no need to proceed through the NCS in this case. However, a scoring guideline (22) is provided in case a numerical score for the site is still desired (e.g., for comparison with other Class 1 sites). This category can be based on the outcomes of risk assessments and applies to studies which have reported Hazard Quotients >1 for noncarcinogenic chemicals and incremental cancer risks that exceed acceptable levels defined by the jurisdiction for carcinogenic chemicals (for most jurisdictions this is typically either >10^{-5} or >10^{-6}). Known impacts can also be evaluated based on blood testing (e.g. blood lead >10 ug/dL) or other health based testing. This category can be based on the outcomes of risk assessments and applies to studies which have reported Hazard Quotients of less than 0.2 for non-carcinogenic chemicals and incremental lifetime cancer risks for carcinogenic chemicals that are within acceptable levels as defined by the jurisdiction (for most jurisdictions this is less than either 10^{-6} or 10^{-5}).	Known adverse impact includes domestic and traditional food sources. Adverse effects based on food chain transfer to humans and/or animals can be scored in this category. However, the weight of evidence must show a direct link of a contaminated food source/supply and subsequent ingestion/transfer to humans. Any associated adverse effects to the environment are scored separately later in this worksheet. Someone experienced must provide a thorough description of the sources researched to evaluate and determine the quantified exposure/impact (adverse effect) in the vicinity of the contaminated site. **Selected References:** Health Canada – Federal Contaminated Site Risk Assessment in Canada Parts 1 and 2 Guidance on Human Heath Screening Level Risk Assessments (www.hc-sc.gc.ca/ewh-semt/pubs/contamsite/index_e.html) United States Environmental Protection Agency, Integrated Risk Information System (IRIS) – http://toxnet.nml.nih.gov
NOTE: If a score is assigned here for Known Exposure, then you can skip Part B (Potential for Human Exposure) and go to Section 2 (Human Exposure Modifying Factors)				
B. Potential for human exposure				
a) Land use (provides an indication of potential human exposure scenarios) Agricultural Residential / Parkland Commercial Industrial Do Not Know Score	Commercial 1	The site is a maintenance compound located within the Waskesiu Golf Course.	Review zoning and land use maps over the distances indicated. If the proposed future land use is more "sensitive" than the current land use, evaluate this factor assuming the proposed future use is in place. Agricultural land use is defined as uses of land where the activities are related to the productive capability of the land or facility (e.g., greenhouse) and are agricultural in nature, or activities related to the feeding and housing of animals as livestock. Residential/Parkland land uses are defined as uses of land on which dwelling on a permanent, temporary, or seasonal basis is the activity (residential), as well as uses on which the activities are recreational in nature and require the natural or human designed capability of the land to sustain that activity (parkland). Commercial/Industrial land uses are defined as land on which the activities are related to the buying, selling, or trading of merchandise or services (commercial), as well as land uses which are related to the production, manufacture, or storage of materials (industrial).	This is the main "receptor" factor used in site scoring. A higher score implies a greater exposure and/or exposure of more sensitive human receptors (e.g., children).
b. Indicate the level of accessibility to the contaminated portion of the site (e.g., the potential for coming in contact with contamination) Limited barriers to prevent site access; contamination not covered Moderate access or no intervening barriers, contaminants are covered. Remote locations in which contaminants not covered. Controlled access or remote location and contaminants are covered Do Not Know Score	Access, not covered 2	PHC fraction F3 at surface at used oil tank.	Review location and structures and contaminants at the site and determine if there are intervening barriers between the site and humans. A low rating should be assigned to a (covered) site surrounded by a fence or in a remote location, whereas a high score should be assigned to a site that has no cover, fence, natural barriers or buffer.	
B. Potential for human exposure				
c) Potential for intake of contaminated soil, water, sediment or foods for operable or potentially operable pathways, as identified in Worksheet II (Migration Potential). i) direct contact Is dermal contact with contaminated surface water, groundwater, sediments or soils anticipated? Yes No Do Not Know Score	Yes 3	PHC fraction F3 at surface at used oil tank. Dermal contact is possible. See Table 3 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	If soils or potable groundwater are present exceeding their respective CCME guidelines, dermal contact is assumed. Exposure to surface water, non-potable groundwater or sediments exceeding their respective CCME guidelines will depend on the site. Select "Yes" if dermal exposure to surface water, non-potable groundwater or sediments is expected. For instance, dermal contact with sediments would not be expected in an active port. Only soils in the top 1.5 m are defined by CCME (2003) as surface soils. If contaminated soils are only located deeper than 1.5 m, direct contact with soils is not anticipated to be an operable contaminant exposure pathway.	Exposure via the skin is generally believed to be a minor exposure route. However for some organic contaminants, skin exposure can play a very important component of overall exposure. Dermal exposure can occur while swimming in contaminated waters, bathing with contaminated surface water/groundwater and digging in contaminated dirt, etc.
ii) inhalation (i.e., inhalation of dust, vapour) Vapour - Are there inhabitable buildings on the site within 30 m of soils or groundwater with volatile contamination as determined in Worksheet II (Migration Potential)? Yes No Do Not Know Score	No 0	PHC impacts to soil and GW located within 30 m of north and south maintenance garages. Soil vapour samples collected from two soil vapour wells did not exceed the objectives.	If inhabitable buildings are on the site within 30 m of soils or groundwater exceeding their respective guidelines for volatile chemicals, there is a potential of risk to human health (Health Canada, 2004). Review site investigations for location of soil samples (having exceedances of volatile substances) relative to buildings. Refer to (II) Migration Potential worksheet, 4B.a), *Potential for COPCs in Vapour* for a definition of volatility.	Exposure via the lungs (inhalation) can be a very important exposure pathway. Inhalation can be via both particulates (dust) and gas (vapours). Vapours can be a problem where buildings have been built on former industrial sites or where volatile contaminants have migrated below buildings resulting in the potential for vapour intrusion. Assesses the potential for humans to be exposed to vapours originating from site soils. The closer the receptor is to a source of volatile chemicals in soil, the greater the potential of exposure. Also, coarser-grained soil will convey vapour much more efficiently in the soil than finer grained material such as clays and silts. General Notes; Someone experienced must provide a thorough description of the sources researched to determine the presence/absence of a vapour migration and/or dust generation in the vicinity of the contaminated site. This information must be documented in the NCS Site Classification Worksheet including contact names, phone numbers, e-mail correspondence and/or reference maps/reports and other resource such as internet links. Selected References; Canadian Council of Ministers of the Environment (CCME). 2006. Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. PN 1332. www.ccme.ca Golder, 2004. Soil Vapour Intrusion Guidance for Health Canada Screening Level Risk Assessment (SLRA) Submitted to Health Canada, Burnaby, BC
Dust - If there is contaminated surface soil (e.g. top 1.5 m) , indicate whether the soil is fine or coarse textured. If it is known that surface soil is not contaminated, enter a score of zero. Fine Coarse Surface soil is not contaminated or absent (bedrock) Do Not Know Texture Score inhalation total	Coarse 1 1	PHC fraction F3 at surface at used oil tank. See Table 3 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan. Surface cover typically gravel; ie coarse	Consult grain size data for the site. If soils (containing exceedances of the CCME soil quality guidelines) predominantly consist of fine material (having a median grain size of 75 microns; as defined by CCME (2006)) then these soils are more likely to generate dusts.	

(III) Exposure (Demonstrates the presence of an exposure pathway and receptors)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
B. Potential for human exposure				
iii) Ingestion (i.e., ingestion of food items, water and soils [for children]), including traditional foods.			Review available site data to determine if drinking water (groundwater, surface water, private, commercial or municipal supply) is known or suspected to be contaminated above Guidelines for Canadian Drinking Water Quality. If drinking water supply is known to be contaminated, some immediate action (e.g., provision of alternate drinking water supply) should be initiated to reduce or eliminate exposure.	**Selected References:** Guidelines for Canadian Drinking Water Quality: www.hc-sc.gc.ca/hecs-sesc/water/publications/drinking_water_quality_guidelines/toc.htm
Drinking Water: Choose a score based on the proximity to a drinking water supply, to indicate the potential for contamination (present or future).				Drinking water can be an extremely important exposure pathway to humans. If site groundwater or surface water is not used for drinking, then this pathway is considered to be inoperable.
0 to 100 m 100 to 300 m 300 m to 1 km 1 to 5 km No drinking water present Do Not Know	300 m to 1 km	Potable water is obtained from Waskesiu Lake whose closest approach to the site is a shallow cove that is located approximately 530 northwest of the site.	The evaluation of significant potential for exceedances of the water supply in the future may be based on the capture zones of the drinking water wells; contaminant travel times; computer modelling of flow and contaminant transport.	Consider both wild foods such as salmon, venison, caribou, as well as agricultural sources of food items if the contaminated site is on or adjacent to agricultural land uses.
Score	2			
Is an alternative water supply readily available? Yes No Do Not Know	No			
Score	1			
Is human ingestion of contaminated soils possible? Yes No Do Not Know	Yes	PHC fraction F3 at surface at used oil tank. Ingestion is possible, though highly unlikely. See Table 3 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	If contaminated soils are located within the top 1.5 m, it is assumed that ingestion of soils is an operable exposure pathway. Exposure to soils deeper than 1.5 m is possible, but less likely, and the duration is shorter. Refer to human health risk assessment reports for the site in question.	
Score	3			
Are food items consumed by people, such as plants, domestic animals or wildlife harvested from the contaminated land and its surroundings? Yes No Do Not Know	No	Contaminated land is a maintenance compound for the golf course. Food items harvested for consumption not expected.	Use human health risk assessment reports (or others) to determine if there is significant reliance on traditional food sources associated with the site. Is the food item in question going to spend a large proportion of its time at the site (e.g., large mammals may spend a very small amount of time at a small contaminated site)? Human health risk assessment reports for the site in question will also provide information on potential bioaccumulation of the COPC in question.	
Score	0			
Ingestion total	6			
Human Health Total "Potential" Score	13	Note if a "Known" Human Health score is provided, the "Potential" score is disallowed.		
Allowed "Potential" Score	---			
2. Human Exposure Modifying Factors				
a) Strong reliance of local people on natural resources for survival (i.e., food, water, shelter, etc.) Yes No Do Not Know	No	Site is used as a maintenance compound for a golf course.		
Known	0			
Potential	---			
Raw Human "known" total	10			
Raw Human "potential" total	0			
Raw Human Exposure Total Score	10			
Human Health Total (max 22)	**10.0**			
3. Ecological				
A. Known exposure				
Documented adverse impact or high quantified exposure which has or will result in an adverse effect, injury or harm or impairment of the safety to terrestrial or aquatic organisms as a result of the contaminated site.	18		Some low levels of impact to ecological receptors are considered acceptable, particularly on commercial and industrial land uses. However, if ecological effects are deemed to be severe, the site may be categorized as class one (i.e., a priority for remediation or risk management), regardless of the numerical total NCS score. For the purpose of application of the NCS, effects that would be considered severe include observed effects on survival, growth or reproduction which could threaten the viability of a population of ecological receptors at the site. Other evidence that qualifies as severe adverse effects may be determined based on professional judgement and in consultation with the relevant jurisdiction. If ecological effects are determined to be severe and an automatic Class 1 is assigned, there is no need to proceed through the NCS. However, a scoring guideline (18) is provided in case a numerical score for the site is still desired (e.g., for comparison with other Class 1 sites).	CCME, 1999: Canadian Water Quality Guidelines for the Protection of Aquatic Life. www.ccme.ca CCME, 1999: Canadian Water Quality Guidelines for the Protection of Agricultural Water Uses. www.ccme.ca Sensitive receptors- review: Canadian Council on Ecological Areas; www.ccea.org.
Same as above, but "Strongly Suspected" based on observations or indirect evidence.	12		This category can be based on the outcomes of risk assessments and applies to studies which have reported Hazard Quotients >1. Alternatively, known impacts can also be evaluated based on a weight of evidence assessment involving a combination of site observations, tissue testing, toxicity testing and quantitative community assessments. Scoring of adverse effects on individual rare or endangered species will be completed on a case-by-case basis with full scientific justification.	Ecological effects should be evaluated at a population or community level, as opposed to at the level of individuals. For example, population-level effects could include reduced reproduction, growth or survival in a species. Community-level effects could include reduced species diversity or relative abundances. Further discussion of ecological assessment endpoints is provided in *A Framework for Ecological Risk Assessment: General Guidance* (CCME 1996).
No quantified or suspected exposures/impacts in terrestrial or aquatic organisms	0		This category can be based on the outcomes of risk assessments and applies to studies which have reported Hazard Quotients of less than 1 and no other observable or measurable sign of impacts. Alternatively, it can be based on a combination of other lines of evidence showing no adverse effects, such as site observations, tissue testing, toxicity testing and quantitative community assessments.	Notes: Someone experienced must provide a thorough description of the sources researched to classify the environmental receptors in the vicinity of the contaminated site. This information must be documented in the NCS Site Classification Worksheet including contact names, phone numbers, e-mail correspondence and/or reference maps/reports and other resource such as internet links.
	Go to Potential			
Score	---			
NOTE: If a score is assigned here for Known Exposure, then you can skip Part B (Potential for Ecological Exposure) and go to Section 4 (Ecological Exposure Modifying Factors)				

(II) Migration Potential (Evaluation of contaminant migration pathways)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
4. Vapour				
A. Demonstrated COPCs in vapour.				
Vapour has been measured (indoor or outdoor) in concentrations exceeding risk based concentrations.	12	Soil vapour samples collected from two soil vapour wells did not exceed the objectives . See Table 13 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Consult previous investigations, including human health risk assessments, for reports of vapours detected.	
Strongly suspected (based on observations and/or modelling)	9			
Vapour has not been measured and volatile hydrocarbons have not been found in site soils or groundwater.	0			
	0			
Score	0			
NOTE: If a score is assigned here for Demonstrated COPCs in Vapour, then you can skip Part B (Potential for COPCs in vapour) and go to Section 5 (Sediment)				
B. Potential for COPCs in vapour				
a. Relative Volatility based on Henry's Law Constant, H' (dimensionless) High (H' > 1.0E-1) Moderate (H' = 1.0E-1 to 1.0E-3) Low (H' < 1.0E-3) Not Volatile Do Not Know			Reference: US EPA Soil Screening Guidance (Part 5 - Table 36) *Provided in Attached Reference Materials*	If the Henry's Law Constant for a substance indicates that it is not volatile, and a score of zero is assigned here for relative volatility, then the other three questions in this section on Potential for COPCs will be automatically assigned scores of zero and you can skip to section 5.
	Do Not Know			
Score	2.5			
b. What is the soil grain size? Fine Coarse Do Not Know			Review soil permeability data in engineering reports. The greater the permeability of soils, the greater the possible movement of vapours. Fine-grained soils are defined as those which contain greater than 50% by mass particles less than 75 µm mean diameter (D50 < 75 µm). Coarse-grained soils are defined as those which contain greater than 50% by mass particles greater than 75 µm mean diameter (D50 > 75 µm).	
	Do Not Know			
Score	3			
c. Is the depth to the source less than 10m? Yes No Do Not Know			Review groundwater depths below grade for the site.	
	Do Not Know			
Score	1			
d. Are there any preferential pathways? Yes No Do Not Know			Visit the site during dry summer conditions and/or review available photographs. Where bedrock is present, fractures would likely act as preferential pathways.	Preferential pathways refer to areas where vapour migration is more likely to occur because there is lower resistance to flow than in the surrounding materials. For example, underground conduits such as sewer and utility lines, drains, or septic systems may serve as preferential pathways. Features of the building itself that may also be preferential pathways include earthen floors, expansion joints, wall cracks, or foundation perforations for subsurface features such as utility pipes, sumps, and drains.
	Do Not Know			
Score	1			
Potential vapour pathway total	7.5			
Allowed Potential score	—	Note: If a "known" score is provided, the "potential" score is disallowed.		
Vapour pathway total	0			
5. Sediment Movement				
A. Demonstrated migration of sediments containing COPCs				
There is evidence to suggest that sediments originally deposited to the site (exceeding the CCME sediment quality guidelines) have migrated.	12	As noted above in Section 2A, PHC impacts are not expected in surface water receiving bodies, thus impacts would not be encoutered in sediments in those freshwater aquatic bodies.	Review sediment assessment reports. Evidence of migration of contaminants in sediments must be reported by someone experienced in this area.	Usually not considered a significant concern in lakes/marine environments, but could be very important in rivers where transport downstream could be significant.
Strongly suspected (based on observations and/or modelling)	9			
Sediments have been contained and there is no indication that sediments will migrate in future. or Absence of sediment exposure pathway (i.e., within 5 km of the site there are no aquatic receiving environments, and therefore no sediments).	0			
	0			
Score	0			
NOTE: If a score is assigned here for Demonstrated Migration of Sediments, then you can skip Part B (Potential for Sediment Migration) and go to Section 6 (Modifying Factors)				

(II) Migration Potential (Evaluation of contaminant migration pathways)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
B. Potential for sediment migration				
a. Are the sediments having COPC exceedances capped with sediments having no exceedances ("clean sediments")?	Do Not Know		Review existing sediment assessments. If sediment coring has been completed, it may indicate that historically contaminated sediments have been covered over by newer "clean" sediments. This assessment will require that cores collected demonstrate a low concentration near the top and higher concentration with sediment depth.	
Yes				
No				
Do Not Know	2			
b. For lakes and marine habitats, are the contaminated sediments in shallow water and therefore likely to be affected by tidal action, wave action or propeller wash?	Do Not Know		Review existing sediment assessments. If the sediments present at the site are in a river, select "no" for this question.	
Yes				
No				
Do Not Know	2			
c. For rivers, are the contaminated sediments in an area prone to sediment scouring?	Do Not Know		Review existing sediment assessments. It is important that the assessment is made under worst case flows (high yearly flows). Under high yearly flows, areas which are commonly depositional may	
Yes				
No				
Do Not Know	2			
Potential sediment pathway total	6			
Allowed Potential score	—	Note: If a "known" score is provided, the "potential" score is disallowed.		
Sediment pathway total	0			
6. Modifying Factors				
		Subsurface utilities have not been exposed during investigations to date.		
Are there subsurface utility conduits in the area affected by contamination?	Do Not Know		Consult existing engineering reports. Subsurface utilities can act as conduits for contaminant migration.	
Yes				
No				
Do Not Know				
Known	—			
Potential	2			

Migration Potential Total		
Raw "known" total	0	
Raw "potential" total	24.8	
Raw combined total	24.8	Note: If "Known" and "Potential" scores are provided, the checklist defaults to known. Therefore, the total "Potential" Score may not reflect the sum of the individual "Potential" scores.
Total (max 33)	**12.8**	

(III) Exposure (Demonstrates the presence of an exposure pathway and receptors)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
B. Potential for ecological exposure (for the contaminated portion of the site)				
a) Terrestrial i) Land use Agricultural (or Wild lands) Residential/Parkland Commercial Industrial Do Not Know	Commercial	Site is used as a maintenance compound for a golf course.	Review zoning and land use maps. If the proposed future land use is more "sensitive" than the current land use, evaluate this factor assuming the proposed future use is in place (indicate in the worksheet that future land use is the consideration). Agricultural land use is defined as uses of land where the activities are related to the productive capability of the land or facility (e.g., greenhouse) and are agricultural in nature, or activities related to the feeding and housing of animals as livestock. Wild lands are grouped with agricultural land due to the similarities in receptors that would be expected to occur there (e.g., herbivorous mammals and birds) and the similar need for a high level of protection to ensure ecological functioning. Residential/Parkland land uses are defined as uses of land on which dwelling on a permanent, temporary, or seasonal basis is the activity (residential), as well as uses on which the activities are recreational in nature and require the natural or human designed capability of the land to sustain that activity (parkland). Commercial/Industrial land uses are defined as land on which the activities are related to the buying, selling, or trading of merchandise or services (commercial), as well as land uses which are related to the production, manufacture, or storage of materials (industrial).	
Score	1			
ii) Uptake potential Direct Contact - Are plants and/or soil invertebrates likely exposed to contaminated soils at the site? Yes No Do Not Know	Yes	PHC fraction F3 at surface at used oil tank. Drrect contact possible. See Table 3 - Tetra Tech Inc., 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	If contaminated soils are located within the top 1.5 m, it is assumed that direct contact of soils with plants and soil invertebrates is an operable exposure pathway. Exposure to soils deeper than 1.5 m is possible, but less likely.	
Score	1			
iii) Ingestion (i.e., wildlife or domestic animals ingesting contaminated food items, soils or water) Are terrestrial animals likely to be ingesting contaminated water at the site? Yes No Do Not Know	No	Groundwater has not been observed to daylight at this site.	Refer to an Ecological Risk Assessment for the site. If there is contaminated surface water at the site, assume that terrestrial organisms will ingest it.	
Score	0			
Are terrestrial animals likely to be ingesting contaminated soils at the site? Yes No Do Not Know	Yes	Grazing ungulates observed in the vicinity of the site; soil ingestion possible.	Refer to an Ecological Risk Assessment report. Most animals will co-ingest some soil while eating plant matter or soil invertebrates.	
Score	1			
Can the contamination identified bioaccumulate? Yes No Do Not Know	No	DDT bioaccumulates; however, detected concentrations did not exceed the applicable CCME guidelines.	Bioaccumulation of contaminants within food items is considered possible if: 1) The Log(Kow) of the contaminant is greater than 4 (as per the chemical characteristics work sheet) and concentrations in soils exceed the most conservative CCME soil quality guideline for the intended land use, or 2) The contaminant in collected tissue samples exceeds the Canadian Tissue Residue Guidelines.	
Score	0			
Distance to sensitive terrestrial ecological area 0 to 300 m 300 m to 1 km 1 to 5 km > 5 km Do Not Know	300 m to 1 km	Beaver pond approximately 350 m to the northeast. Tetra Tech, 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	It is considered that within 300 m of a site, there is a concern for contamination. Therefore an environmental receptor located within this area of the site will be subject to further evaluations. It is also considered that any environmental receptor located greater than 5 km will not be a concern for evaluation. Review Conservation Authority mapping and literature including Canadian Council on Ecological Areas link: www.ccea.org.	Environmental receptors include: local, regional or provincial species of interest or significance; arctic environments (on a site specific basis); nature preserves, habitats for species at risk, sensitive forests, natural parks or forests.
Score	2			
Raw Terrestrial Total Potential	5	Note if a "Known" Ecological Effects score is provided, the "Potential" score is disallowed.		
Allowed Terrestrial Total Potential	5			
B. Potential for ecological exposure (for the contaminated portion of the site)				
b) Aquatic i) Classification of aquatic environment Sensitive Typical Not Applicable (no aquatic environment present) Do Not Know	Typical	Sloughs (east at ~150 m and ~300 m) and a beaver pond ~350 m to the northeast. See Tetra Tech, 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	"Sensitive aquatic environments" include those in or adjacent to shellfish or fish harvesting areas, marine parks, ecological reserves and fish migration paths. Also includes those areas deemed to have ecological significance such as for fish food resources, spawning areas or having rare or endangered species. "Typical aquatic environments" include those in areas other than those listed above.	
Score	1			
ii) Uptake potential Does groundwater daylighting to an aquatic environment exceed the CCME water quality guidelines for the protection of aquatic life at the point of contact? Yes No (or Not Applicable) Do Not Know	No	COPC have been identified in groundwater; however, the COPC have been delineated to at or near nondetectable concentrations in peripheral monitoring wells, therefore PHC impacts do not exceed CCME guidelines at point of contact. See Table 6 - Tetra Tech, 2012. Environmental Investigations, Lobstick Maintenance Compound, Waskesiu, Saskatchewan.	Groundwater concentrations of contaminants at the point of contact with an aquatic receiving environment can be estimated in three ways: 1) by comparing collected nearshore groundwater concentrations to the CCME water quality guidelines (this will be a conservative comparison, as contaminant concentrations in groundwater often decrease between nearshore wells and the point of discharge). 2) by conducting groundwater modeling to estimate the concentration of groundwater immediately before discharge. 3) by installing water samplers, "peepers", in the sediments in the area of daylighting groundwater.	
Score	0			
Distance from the contaminated site to an important surface water resource 0 to 300 m 300 m to 1 km 1 to 5 km > 5 km Do Not Know	300 m to 1 km	Waskesiu Lake at ~530 m	It is considered that within 300 m of a site, there is a concern for contamination. Therefore an environmental receptor or important water resource located within this area of the site will be subject to further evaluation. It is also considered that any environmental receptor located greater than 5 km away will not be a concern for evaluation. Review Conservation Authority mapping and literature including Canadian Council on Ecological Areas link: www.ccea.org.	Environmental receptors include: local, regional or provincial species of interest or significance, sensitive wetlands and fens and other aquatic environments.
Score	2			
			Bioaccumulation of food items is possible if:	

(III) Exposure (Demonstrates the presence of an exposure pathway and receptors)

Test Site

Definition	Score	Rationale for Score (document any assumptions, reports, or site-specific information; provide references)	Method Of Evaluation	Notes
Are aquatic species (i.e., forage fish, invertebrates or plants) that are consumed by predatory fish or wildlife consumers, such as mammals and birds, likely to accumulate contaminants in their tissues?		Since PHC impacts do not exceed CCME guidelines at point of contact, aquatic species not expected to accumulate contaminants.	1) The Log(Kow) of the contaminant is greater than 4 (as per the chemical characteristics work sheet) and concentrations in sediments exceed the CCME ISQGs. 2) The contaminant in collected tissue samples exceeds the CCME tissue quality guidelines.	
Yes				
No				
Do Not Know	No			
Score	0			
Raw Aquatic Total Potential	3	Note if a "Known" Ecological Effects score is provided, the "Potential" score is disallowed.		
Allowed Aquatic Total Potential	3			
4. Ecological Exposure Modifying Factors				
a) Known occurrence of a species at risk.			Consult any ecological risk assessment reports. If information is not present, utilize on-line databases such as Eco Explorer, Regional, Provincial (Environment Ministries), or Federal staff (Fisheries and Oceans or Environment Canada) should be able to provide some guidance.	Species at risk include those that are extirpated, endangered, threatened, or of special concern. For a list of species at risk, consult Schedule 1 of the federal Species at Risk Act (http://www.sararegistry.gc.ca/species/schedules_e.cfm?id=1). Many provincial governments may also provide regionally applicable lists of species at risk. For example, in British Columbia, consult: BCMWLAP. 2005. Endangered Species and Ecosystems in British Columbia. Provincial red and blue lists. Ministry of Sustainable Resource Management and Water, Land and Air Protection. http://srmwww.gov.bc.ca/atrisk/red-blue.htm
Is there a potential for a species at risk to be present at the site?		Rare plants in the area Source = Saskatchewan Conservation Data Centre		
Yes				
No				
Do Not Know	Yes			
	2			
Score	---			
b) Potential impact of aesthetics (e.g., enrichment of a lake or tainting of food flavor).				
Is there evidence of aesthetic impact to receiving water bodies?	No		Documentation may consist of environmental investigation reports, press articles, petitions or other records.	This Item will require some level of documentation by user, including contact names, addresses, phone numbers, e-mail addresses. Evidence of changes must be documented, please attach copy of report containing relevant information.
Yes				
No	0			
Do Not Know	---	Visual observations		
Is there evidence of olfactory impact (i.e., unpleasant smell)?	No		Examples of olfactory change can include the smell of a COPC or an increase in the rate of decay in an aquatic habitat.	
Yes				
No	0			
Do Not Know	---	Olfactory observations		
Is there evidence of increase in plant growth in the lake or water body?	No		A distinct increase of plant growth in an aquatic environment may suggest enrichment. Nutrients e.g., nitrogen or phosphorous releases to an aquatic body can act as a fertilizer.	
Yes				
No	0			
Do Not Know	---	Visual observations		
Is there evidence that fish or meat taken from or adjacent to the site smells or tastes different?	Do Not Know		Some contaminants can result in a distinctive change in the way food gathered from the site tastes or smells.	
Yes	---			
No	1			
Do Not Know		No known evidence; no observations		
Ecological Modifying Factors Total - Known	2			
Ecological Modifying Factors Total - Potential	1			
Raw Ecological Total - Known	2			
Raw Ecological Total - Potential	9			
Raw Ecological Total	11			
Ecological Total (Max 18)	11.0			
5. Other Potential Contaminant Receptors				
a) Exposure of permafrost (leading to erosion and structural concerns)		no permafrost observed during investigations		Plants and lichens provide a natural insulating layer which will help prevent thawing of the permafrost during the summer. Plants and lichens may also absorb less solar radiation. Solar radiation is turned into heat which can also cause underlying permafrost to melt.
Are there improvements (roads, buildings) at the site dependant upon the permafrost for structural integrity?	No		Consult engineering reports, site plans or air photos of the site. When permafrost melts, the stability of the soil decreases, leading to erosion. Human structures, such as roads and/or buildings are often dependent on the stability that the permafrost provides.	
Yes				
No	0			
Do Not Know	---			
Is there a physical pathway which can transport soils released by damaged permafrost to a nearby aquatic environment?	No	no permafrost observed during investigations	Melting permafrost leads to a decreased stability of underlying soils. Wind or surface run-off erosion can carry soils into nearby aquatic habitats. The increased soil loadings into a river can cause an increase in total dissolved solids and a resulting decrease in aquatic habitat quality. In addition, the erosion can bring contaminants from soils to aquatic environments.	
Yes				
No	0			
Do Not Know	---			
Other Potential Receptors Total - Known	0			
Other Potential Receptors Total - Potential	0			

Exposure Total		
Raw Human Health + Ecological Total - Known	12	Only includes "Allowed potential" - if a "Known" score was supplied under a given category then the "Potential" score was not included.
Raw Human Health + Ecological Total - Potential	9	
Raw Total	21	
Exposure Total (max 34)	15.5	

CCME National Classification System (2008, 2010 v 1.2)
Score Summary

Scores from individual worksheets are tallied in this worksheet.
Refer to this sheet after filling out the revised NCS completely.

I. Contaminant Characteristics	Known	Potential
1. Residency Media	4	---
2. Chemical Hazard	8	---
3. Contaminant Exceedance Factor	4	---
4. Contaminant Quantity	6	---
5. Modifying Factors	2	---
Raw Total Score	24	0
Raw Total Score (Known + Potential)	24	
Adjusted Total Score (Raw Total / 40 *33)	19.8	(max 33)

II. Migration Potential	Known	Potential
1. Groundwater Movement	---	8.4
2. Surface Water Movement	---	8.4
3. Soil	---	6
4. Vapour	0	---
5. Sediment Movement	0	---
6. Modifying Factors	---	2
Raw Total Score	0	24.8
Raw Total Score (Known + Potential)	24.8	
Adjusted Total Score (Raw Total / 64 * 33)	12.8	(max 33)

III. Exposure	Known	Potential
1. Human Receptors		
A. Known Impact	10	
B Potential		
a. Land Use		---
b. Accessibility		---
c. Exposure Route		
i. Direct Contact		---
ii. Inhalation		---
iii. Ingestion		---
2. Human Receptors Modifying Factors	0	---
Raw Total Human Score	10	0
Raw Total Human Score (Known + Potential)	10	
Adjusted Total Human Score	10.0	(maximum 22)
3. Ecological Receptors		
A. Known Impact	---	
B. Potential		
a. Terrestrial		5
b. Aquatic		3
4. Ecological Receptors Modifying Factors	2	1
Raw Total Ecological Score	2	9
Raw Total Ecological Score (Known + Potential)	11	
Adjusted Total Ecological Score	11.0	(maximum 18)
5. Other Receptors	0	0
Total Other Receptors Score (Known + Potential)	0	
Total Exposure Score (Human + Ecological + Other)	21.0	
Adjusted Total Exposure Score (Total Exposure / 46 * 34)	15.5	(max 34)

Site Score

Test Site	
Site Letter Grade	C
Certainty Percentage	69%
% Responses that are "Do Not Know"	-12%
Total NCSCS Score for site	48.1
Site Classification Category	3

Site Classification Categories*:

Class 1 - High Priority for Action (Total NCS Score >70)
Class 2 - Medium Priority for Action (Total NCS Score 50 - 69.9)
Class 3 - Low Priority for Action (Total NCS Score 37 - 49.9)
Class N - Not a Priority for Action (Total NCS Score <37)
Class INS - Insufficient Information (>15% of responses are "Do Not Know")

* NOTE: The term "action" in the above categories does not necessarily refer to remediation, but could also include risk assessment, risk management or further site characterization and data collection.

CCME National Classification System (2008, 2010 v 1.2)

Contaminant Hazard Ranking

(Based on the Proposed Hazard Ranking developed for the FCSAP Contaminated Sites Classification System)

This information is used in Sheet I (Contaminant Characteristics), section 2 (Chemical Hazard).

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Acetaldehyde	H	*	PHC	
Acetone	L			
Acrolein	H	*		
Acrylonitrile	H	*	PHC	
Alachlor	M			
Aldicarb	H			
Aldrin	H			
Allyl Alcohol	H			
Aluminum	L			
Ammonia	L	*		
Antimony	H			
Arsenic	H	*		
Atrazine	M			
Azinphos-Methyl	H			
Barium	L			
Bendiocarb	H			
Benzene	H	*	CHC	BTEX
Benzidine	H	*	CHC	
Beryllium	H		CHC	
Biphenyl, 1,1-	M			
2,3,4,5-Bis(2-Butylene)tetrahydro-2-furfural	H			
Bis(Chloromethyl)Ether	H	*	CHC	
Bis(2-Chloroethyl)Ether	H		CHC	
Bis(2-Chloroisopropyl)Ether	H			
Bis(2-Ethylhexyl)Phthalate	H	*		PH
Boron	L			
Bromacil	M			
Bromate	M			
Bromochlorodifluoromethane	M	*		HM
Bromochloromethane	H	*		HM
Bromodichloromethane	H			HM
Bromoform (Tribromomethane)	H		PHC	HM
Bromomethane	M			HM
Bromotrifluoromethane	M	*		HM
Bromoxynil	H			
Butadiene, 1,3-	H	*	CHC	
Cadmium	H	*	CHC	
Carbofuran	M			
Carbon Tetrachloride (Tetrachloromethane)	H		PHC	HM
Captafol	M			
Chloramines	M	*		
Chloride	L			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Chloroaniline, P-	H			
Chlorobenzene (mono)	M			
Chlorobenzilate	M			
Chlorodimeform	M			
Chloroform	H		PHC	HM
Chloromethane	M			
Chloromethyl Methyl Ether	M	*		
(4-Chlorophenyl)Cyclopropylmethanone, O-((4-Nitrophenyl)Methyl)Oxime	H			
Chlorinated Benzenes				
Monochlorobenzene	M			
Dichlorobenzene, 1,2- (O-DCB)	M			
Dichlorobenzene, 1,3- (M-DCB)	M			
Dichlorobenzene, 1,4- (P-DCB)	H			
Trichlorobenzene, 1,2,3-	M			
Trichlorobenzene, 1,2,4-	M			
Trichlorobenzene, 1,3,5-	M			
Tetrachlorobenzene, 1,2,3,4-	M			
Tetrachlorobenzene, 1,2,3,5-	M			
Tetrachlorobenzene, 1,2,4,5-	M			
Pentachlorobenzene	M			
Hexachlorobenzene	H			
Chlorinated Ethanes				
Dichloroethane, 1,1-	M			
Dichloroethane, 1,2- (Ethylene Dichloride (EDC))	H		PHC	
Trichloroethane, 1,1,1-	H	*		
Trichloroethane, 1,1,2-	M			
Tetrachloroethane, 1,1,1,2-	M			
Tetrachloroethane, 1,1,2,2-	M			
Chlorinated Ethenes				
Monochloroethene (Vinyl Chloride)	H	*	CHC	
Dichloroeth(yl)ene, 1,1-	H			
Dichloroeth(yl)ene, 1,2- (cis or trans)	M			
Trichloroeth(yl)ene (TCE)	H	*		
Tetrachloroeth(yl)ene (PCE)	H	*		
Chlorinated Phenols		*		
Monochlorophenols	M			
Chlorophenol, 2-	M			
Dichlorophenols				
Dichlorophenol, 2,4-	M			
Trichlorophenols				
Trichlorophenol, 2,4,5-	H			
Trichlorophenol, 2,4,6-	H		PHC	
Tetrachlorophenols				
Tetrachlorophenol, 2,3,4,6-	H			
Pentachlorophenol (PCP)	H			
Chloromethane	M			HM
Chlorophenol, 2-	M			CP
Chlorothalonil	H			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Chlorpyrifos	H			
Chromium (Total)	M	*		
Chromium (III)	L	*		
Chromium (VI)	H	*	CHC	
Coal Tar	H		CHC	Refer to PAHs
Cobalt	L			
Copper	L			
Creosote	M	*		Refer to PAHs
Crocidolite	L			
Cyanide (Free)	H			
Cyanazine	M			
Dibenzofuran	H	*		DF
Dibromoethane, 1,2- (Ethylene Dibromide (EDB))	H		PHC	
1,2-Dibromo-3-Chloropropane	H		PHC	
Dibromochloromethane	M	*		HM
Dibromotetrafluoroethane	M			
Dichlorobenzene, 1,2- (O-DCB)	M			CB
Dichlorobenzene, 1,3- (M-DCB)	M			CB
Dichlorobenzene, 1,4- (P-DCB)	H			CB
Dichlorobenzidine, 3,3'-	H		PHC	
DDD	H			
DDE	H			
DDT	H		PHC	
Deltamethrin	M			
Diazinon	M			
Dicamba	H			
Dichloroethane, 1,1-	H			CEA
Dichloroethane, 1,2- (EDC)	H		PHC	CEA
Dichloroeth(yl)ene, 1,1-	H			CEE
Dichloroeth(yl)ene, Cis-1,2-	M			CEE
Dichloroeth(yl)ene, Trans-1,2-	M			CEE
Dichloromethane (Methylene Chloride)	H		PHC	HM
Dichlorophenol, 2,4-	M			CP
Dichloropropane, 1,2-	H			
Dichloropropene, 1,3-	H		PHC	
Diclofop-Methyl	H			
Didecyl Dimethyl Ammonium Chloride	H			
Dieldrin	H			
Dimethoate	H			
Diethyl Phthalate	M			PH
Diethylene Glycol	L			GL
Dimethyl Phthalate	M			PH
Dimethylphenol, 2,4-	L			
Dinitrophenol, 2,4-	M			
Dinitrotoluene, 2,4-	H			
Dinoseb	H			
Di-n-octyl Phthalate	H			
Dioxane, 1,4-	H		PHC	
Dioxins/Furans	H			
Diquat	M			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Diuron	M			
Endosulfan	H			
Endrin	H			
Ethylbenzene	M			BTEX
Ethylene Dibromide (EDB)	H		PHC	
Ethylene Glycol	L			GL
Ethylene Oxide	H		CHC	
Fluoroacetamide	M			
Fluorides	L	*		
Glycols				
Ethylene Glycol	L			
Diethylene Glycol	L			
Propylene Glycol	L			
Glyphosate	M			
Halogenated Methanes				
Bromochlorodifluoromethane	M	*		
Bromochloromethane	M	*		
Bromodichloromethane	H		PHC	
Bromomethane	M			
Bromotrifluoromethane	M	*		
Chloroform	M		PHC	HM
Chloromethane	M			
Dibromochloromethane	M			
Dichloromethane (Methylene Chloride)	H		PHC	
Methyl Bromide	M	*		
Tetrachloromethane (Carbon Tetrachloride)	H			
Tribromomethane (Bromoform)	H			
Trihalomethanes (THM)	M			
Heptachlor	H			
Heptachlor Epoxide	H			
Hexachlorobenzene	H		PHC	
Hexachlorobutadiene	H			
Hexachlorocyclohexane, Gamma	H		PHC	
Hexachloroethane	H		PHC	
Hydrobromofluorocarbons (HBFCS)	M	*		
Hydrochlorofluorocarbons (HCFCS)	M	*		
3-Iodo-2-propynyl Butyl Carbamate	H			
Iron	L			
Lead	H	*		neurotoxins / teratogens
Lead Arsenate	H			
Leptophos	H			
Lindane	H			
Linuron	H			
Lithium	L			
Malathion	M			
Manganese	L			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Mercury	H	*		
Methamidophos	H			
Methoxylchlor	H			
Methyl Bromide (Bromomethane)	M	*		
2-Methyl-4-chloro-phenoxy Acetic Acid	M			
Methyl Ethyl Ketone	L			
Methyl Isobutyl Ketone	L			
Methyl Mercury	H			
Methyl-Parathion	H			
Methyl Tert Butyl Ether (MTBE)	M			
Metolachlor	M			
Metribuzin	H			
Molybdenum	L			
Monochloramine	M			
Monocrotophos	H			
Nickel	H	*		CEPA - inhalation
Nitrilotriacetic Acid	H		PHC	
Nitrate	L			
Nitrite	M			
Nonylphenol + Ethoxylates	H	*		
Organotins				
Tributyltin	H			
Tricyclohexyltin	H			
Triphenyltin	H			
Parathion	H			
Paraquat (as Dichloride)	H			
Pentachlorobenzene	M			CB
Pentachlorophenol (PCP)	H			CP
Petroleum Hydrocarbons				Ranking based upon fraction of toxic and mobile components in product. Lighter compounds such as benzene are more toxic and mobile.
Petroleum Hydrocarbons (Gasoline)	H			
Petroleum Hydrocarbons (Kerosene incl. Jet Fuels)	H			
Petroleum Hydrocarbons (Diesel incl Heating Oil)	M			
Petroleum Hydrocarbons (Heavy Oils)	L			
Petroleum Hydrocarbons (CCME F1)	H			
Petroleum Hydrocarbons (CCME F2)	M			
Petroleum Hydrocarbons (CCME F3)	L			
Petroleum Hydrocarbons (CCME F4)	L			
Phenol	L			
Phenoxy Herbicides	M			
Phorate	H			
Phosphamidon	H			
Phthalate Esters				
Bis(2-Ethylhexyl)Phthalate	H	*		
Diethyl Phthalate	H			
Dimethyl Phthalate	H			
Di-n-octyl Phthalate	H			
Polybrominated Biphenyls (PBB)	H	*		
Polychlorinated Biphenyls (PCB)	H			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Polychlorinated Terphenyls	H	*		
Polycyclic Aromatic Hydrocarbons	H	*	PHC	
Acenaphthene	M			
Acenaphthylene	M			
Acridine	H			
Anthracene	M			
Benzo(a)anthracene	H		PHC	
Benzo(a)pyrene	H		PHC	
Benzo(b)fluoranthene	H		PHC	
Benzo(g,h,i)perylene	H			
Benzo(k)fluoranthene	H		PHC	
Chrysene	M			
Dibenzo(a,h)anthracene	H		PHC	
Fluoranthene	M			
Fluorene	M			
Indeno(1,2,3-c,d)pyrene	H		PHC	
Methylnaphthalenes	M			
Naphthalene	M			
Phenanthrene	M			
Pyrene	M			
Quinoline	H			
Propylene Glycol	L			GL
Radium	H			
Radon	H			
Selenium	M			
Silver	L			
Simazine	M			
Sodium	L			
Strontium-90	H			
Strychnine	H			
Styrene	H			
Sulphate	L			
Sulphide	L			
2,3,7,8-Tetrachlorodibenzo-p-dioxins (TCDD)	H	*		DF
Tebuthiuron	H			
Tetrachloroeth(yl)ene (PCE)	H	*		CEE
Tetraethyl Lead	H			
Tetrachlorobenzene, 1,2,3,4-	H			CB
Tetrachlorobenzene, 1,2,3,5-	H			CB
Tetrachlorobenzene, 1,2,4,5-	H			CB
Tetrachloroethane, 1,1,1,2-	M			CEA
Tetrachloroethane, 1,1,2,2-	M			CEA
Tetrachlorophenol, 2,3,4,6-	H			CP
Tetramethyl Lead	H	*		
Thallium	M			
Thiophene	M			
Tin	L			
Toluene	M			BTEX
Toxaphene	H			

Chemical/Parameter	Hazard	CEPA	Carcinogenicity	Notes
Triallate	M			
Tribromomethane (Bromoform)	H			HM
Tributyltetradecylphosphonium Chloride	H	*		
Trichlorobenzene, 1,2,3-	H			CB
Trichlorobenzene, 1,2,4-	H			CB
Trichlorobenzene, 1,3,5-	H			CB
Trichloroethane, 1,1,1-	H	*		CEA
Trichloroethane, 1,1,2-	M			CEA
Trichloroeth(yl)ene (TCE)	H	*		CEE
Tricyclohexyltin Hydroxide	H			
Trichlorophenol, 2,4,5-	H			CP
Trichlorophenol, 2,4,6-	H		PHC	CP
Trifluralin	H			
Trihalomethanes (THM)	M			
Tris(2,3-Dibromopropyl)phosphate	H			
Tritium	L			
Uranium (Non-radioactive) / (Radioactive)	M/H			
Vanadium	M			
Vinyl Chloride	H	*	CHC	CEE
Xylenes	M			BTEX
Zinc	L			

H = High Hazard
M = Medium Hazard
L = Low Hazard
Hazard ratings based on a number of factors including potential human and ecological health effects.

PHC = Potential Human Carcinogen
CHC = Confirmed Human Carcinogen

BTEX = benzene, toluene, ethylbenzene, and xylenes
CB = chlorobenzenes
CEA = chlorinated ethanes
CEE = chlorinated ethenes
CP = chlorophenols
DF = dioxins and furans
GL = glycols
HM = halomethanes
PAH = polycyclic aromatic hydrocarbons
PH = phthalate esters

CCME National Classification System (2008, 2010 v 1.2)
Reference Material (Information to assist in scoring)

Examples of Persistent Substances
This information is used in Sheet I (Chemical Characteristics), section 5 (Modifying Factors).

aldrin
benzo(a)pyrene
chlordane
DDT
DDE
dieldrin
hexachlorobenzene
methylmercury
mirex
octachlorostyrene
PCBs
PCDDs/PCDFs (dioxins and furans)
toxaphene
alkylated lead

Examples of Substances in the Various Chemical Classes
This information is used in Sheet I (Chemical Characteristics), section 5 (Modifying Factors).

Chemical Class	Examples *
inorganic substances (including metals)	arsenic, barium, cadmium, hexavalent chromium, copper, cyanide, fluoride, lead, mercury, nickel, selenium, sulphur, zinc; brines or salts
volatile petroleum hydrocarbons	benzene, toluene, ethylbenzene, xylenes, PHC F1
light extractable petroleum hydrocarbons	PHC F2
heavy extractable petroleum hydrocarbons	PHC F3
PAHs	Benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenz(a,h0anthracene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene, pyrene
phenolic substances	phenol, pentachlorophenol, chlorophenols, nonchlorinated phenols (e.g., 2,4-dinitrophenol, cresol, etc.)
chlorinated hydrocarbons	PCBs, tetrachloroethylene, trichloroethylene, dioxins and furans, trichlorobenzene, tetrachlorobenzene, pentachlorobenzene, hexachlorobenzene
halogenated methanes	carbon tetrachloride, chloroform, dichloromethane
phthalate esters	di-isononyl phthalate (DINP), di-isodecyl phthalate (DIDP), di-2-ethylhexyl phthalate (DEHP)
pesticides	DDT, hexachlorocyclohexane

* Note: Specific chemicals that belong to the various classes are not limited to those listed in this table. These lists are not exhaustive and are meant just to provide examples of substances that are typically encountered.

Chemical-specific Properties
(Adapted from USEPA Soil Screening Criteria)

The information on Koc is used in Sheet II (Migration Potential), section 1,B,a (Relative Mobility).
The information on the dimensionless Henry's law constant is used in Sheet II (Migration Potential), section 4,B,a (Relative Volatility).
The information on log Kow is used in Sheet III (Exposure), section 3,B,a,iii (Potential for Ecological Exposure - terrestrial ingestion), and section 3,B,b,ii (Potential for Ecological Exposure - aquatic uptake potential).

CAS No.	Compound	Solubility in Water @ 20-25°C (mg/L)	Henry's Law Constant (atm-m3/mol)	Dimensionless Henry's law constant (HLC [atm-m3/mol] * 41) (25 °C).	log Kow	Log Koc (L/kg)
83-32-9	Acenaphthene	4.24E+00	1.55E-04	6.36E-03	3.92	3.85
67-64-1	Acetone	1.00E+06	3.88E-05	1.59E-03	-0.24	-0.24
309-00-2	Aldrin	1.80E-01	1.70E-04	6.97E-03	6.5	6.39
120-12-7	Anthracene	4.34E-02	6.50E-05	2.67E-03	4.55	4.47
56-55-3	Benz(a)anthracene	9.40E-03	3.35E-06	1.37E-04	5.7	5.6
71-43-2	Benzene	1.75E+03	5.55E-03	2.28E-01	2.13	1.77
205-99-2	Benzo(b)fluoranthene	1.50E-03	1.11E-04	4.55E-03	6.2	6.09
207-08-9	Benzo(k)fluoranthene	8.00E-04	8.29E-07	3.40E-05	6.2	6.09
65-85-0	Benzoic acid	3.50E+03	1.54E-06	6.31E-05	1.86	—
50-32-8	Benzo(a)pyrene	1.62E-03	1.13E-06	4.63E-05	6.11	6.01
111-44-4	Bis(2-chloroethyl)ether	1.72E+04	1.80E-05	7.38E-04	1.21	1.19
117-81-7	Bis(2-ethylhexyl)phthalate	3.40E-01	1.02E-07	4.18E-06	7.3	7.18
75-27-4	Bromodichloromethane	6.74E+03	1.60E-03	6.56E-02	2.1	1.74
75-25-2	Bromoform	3.10E+03	5.35E-04	2.19E-02	2.35	1.94
71-36-3	Butanol	7.40E+04	8.81E-06	3.61E-04	0.85	0.84
85-68-7	Butyl benzyl phthalate	2.69E+00	1.26E-06	5.17E-05	4.84	4.76
86-74-8	Carbazole	7.48E+00	1.53E-08	6.26E-07	3.59	3.53
75-15-0	Carbon disulfide	1.19E+03	3.03E-02	1.24E+00	2	1.66
56-23-5	Carbon tetrachloride	7.93E+02	3.04E-02	1.25E+00	2.73	2.24
57-74-9	Chlordane	5.60E-02	4.86E-05	1.99E-03	6.32	5.08
106-47-8	*p-Chloroaniline*	5.30E+03	3.31E-07	1.36E-05	1.85	1.82
108-90-7	Chlorobenzene	4.72E+02	3.70E-03	1.52E-01	2.86	2.34
124-48-1	Chlorodibromomethane	2.60E+03	7.83E-04	3.21E-02	2.17	1.8
67-66-3	Chloroform	7.92E+03	3.67E-03	1.50E-01	1.92	1.6
95-57-8	2-Chlorophenol	2.20E+04	3.91E-04	1.60E-02	2.15	—
218-01-9	Chrysene	1.60E-03	9.46E-05	3.88E-03	5.7	5.6
72-54-8	DDD	9.00E-02	4.00E-06	1.64E-04	6.1	6
72-55-9	DDE	1.20E-01	2.10E-05	8.61E-04	6.76	6.65
50-29-3	DDT	2.50E-02	8.10E-06	3.32E-04	6.53	6.42
53-70-3	Dibenz(a,h)anthracene	2.49E-03	1.47E-08	6.03E-07	6.69	6.58
84-74-2	Di-n-butyl phthalate	1.12E+01	9.38E-10	3.85E-08	4.61	4.53
95-50-1	1,2-Dichlorobenzene	1.56E+02	1.90E-03	7.79E-02	3.43	2.79

CAS No.	Compound	Solubility in Water @ 20-25°C (mg/L)	Henry's Law Constant (atm-m3/mol)	Dimensionless Henry's law constant (HLC [atm-m3/mol] * 41) (25 °C).	log Kow	Log Koc (L/kg)
106-46-7	1,4-Dichlorobenzene	7.38E+01	2.43E-03	9.96E-02	3.42	2.79
91-94-1	3,3-Dichlorobenzidine	3.11E+00	4.00E-09	1.64E-07	3.51	2.86
75-34-3	1,1-Dichloroethane	5.06E+03	5.62E-03	2.30E-01	1.79	1.5
107-06-2	1,2-Dichloroethane	8.52E+03	9.79E-04	4.01E-02	1.47	1.24
75-35-4	1,1-Dichloroethylene	2.25E+03	2.61E-02	1.07E+00	2.13	1.77
156-59-2	cis-1,2-Dichloroethylene	3.50E+03	4.08E-03	1.67E-01	1.86	1.55
156-60-5	trans-1,2-Dichloroethylene	6.30E+03	9.38E-03	3.85E-01	2.07	1.72
120-83-2	2,4-Dichlorophenol	4.50E+03	3.16E-06	1.30E-04	3.08	—
78-87-5	1,2-Dichloropropane	2.80E+03	2.80E-03	1.15E-01	1.97	1.64
542-75-6	1,3-Dichloropropene	2.80E+03	1.77E-02	7.26E-01	2	1.66
60-57-1	Dieldrin	1.95E-01	1.51E-05	6.19E-04	5.37	4.33
84-66-2	Diethylphthalate	1.08E+03	4.50E-07	1.85E-05	2.5	2.46
105-67-9	2,4-Dimethylphenol	7.87E+03	2.00E-06	8.20E-05	2.36	2.32
51-28-5	2,4-Dinitrophenol	2.79E+03	4.43E-07	1.82E-05	1.55	—
121-14-2	2,4-Dinitrotoluene	2.70E+02	9.26E-08	3.80E-06	2.01	1.98
606-20-2	2,6-Dinitrotoluene	1.82E+02	7.47E-07	3.06E-05	1.87	1.84
117-84-0	Di-n-octyl phthalate	2.00E-02	6.68E-05	2.74E-03	8.06	7.92
115-29-7	Endosulfan	5.10E-01	1.12E-05	4.59E-04	4.1	3.33
72-20-8	Endrin	2.50E-01	7.52E-06	3.08E-04	5.06	4.09
100-41-4	Ethylbenzene	1.69E+02	7.88E-03	3.23E-01	3.14	2.56
206-44-0	Fluoranthene	2.06E-01	1.61E-05	6.60E-04	5.12	5.03
86-73-7	Fluorene	1.98E+00	6.36E-05	2.61E-03	4.21	4.14
76-44-8	Heptachlor	1.80E-01	1.09E-03	4.47E-02	6.26	6.15
1024-57-3	Heptachlor epoxide	2.00E-01	9.50E-06	3.90E-04	5	4.92
118-74-1	Hexachlorobenzene	6.20E+00	1.32E-03	5.41E-02	5.89	4.74
87-68-3	Hexachloro-1,3-butadiene	3.23E+00	8.15E-03	3.34E-01	4.81	4.73
319-84-6	a-HCH (a-BHC)	2.00E+00	1.06E-05	4.35E-04	3.8	3.09
319-85-7	b-HCH (b-BHC)	2.40E-01	7.43E-07	3.05E-05	3.81	3.1
58-89-9	g -HCH (Lindane)	6.80E+00	1.40E-05	5.74E-04	3.73	3.03
77-47-4	Hexachlorocyclopentadiene	1.80E+00	2.70E-02	1.11E+00	5.39	5.3
67-72-1	Hexachloroethane	5.00E+01	3.89E-03	1.59E-01	4	3.25
193-39-5	Indeno(1,2,3-cd)pyrene	2.20E-05	1.60E-06	6.56E-05	6.65	6.54
78-59-1	Isophorone	1.20E+04	6.64E-06	2.72E-04	1.7	1.67
7439-97-6	Mercury	—	1.14E-02	4.67E-01	—	—
72-43-5	Methoxychlor	4.50E-02	1.58E-05	6.48E-04	5.08	4.99
74-83-9	Methyl bromide	1.52E+04	6.24E-03	2.56E-01	1.19	1.02
75-09-2	Methylene chloride	1.30E+04	2.19E-03	8.98E-02	1.25	1.07
95-48-7	2-Methylphenol	2.60E+04	1.20E-06	4.92E-05	1.99	1.96
91-20-3	Naphthalene	3.10E+01	4.83E-04	1.98E-02	3.36	3.3
98-95-3	Nitrobenzene	2.09E+03	2.40E-05	9.84E-04	1.84	1.81

CAS No.	Compound	Solubility in Water @ 20-25°C (mg/L)	Henry's Law Constant (atm-m3/mol)	Dimensionless Henry's law constant (HLC [atm-m3/mol] * 41) (25 °C).	log Kow	Log Koc (L/kg)
86-30-6	N-Nitrosodiphenylamine	3.51E+01	5.00E-06	2.05E-04	3.16	3.11
621-64-7	N-Nitrosodi-n-propylamine	9.89E+03	2.25E-06	9.23E-05	1.4	1.38
1336-36-3	PCBs	—	—	—	5.58	5.49
87-86-5	Pentachlorophenol	1.95E+03	2.44E-08	1.00E-06	5.09	—
108-95-2	Phenol	8.28E+04	3.97E-07	1.63E-05	1.48	1.46
129-00-0	Pyrene	1.35E-01	1.10E-05	4.51E-04	5.11	5.02
100-42-5	Styrene	3.10E+02	2.75E-03	1.13E-01	2.94	2.89
79-34-5	1,1,2,2-Tetrachloroethane	2.97E+03	3.45E-04	1.41E-02	2.39	1.97
127-18-4	Tetrachloroethylene	2.00E+02	1.84E-02	7.54E-01	2.67	2.19
108-88-3	Toluene	5.26E+02	6.64E-03	2.72E-01	2.75	2.26
8001-35-2	Toxaphene	7.40E-01	6.00E-06	2.46E-04	5.5	5.41
120-82-1	1,2,4-Trichlorobenzene	3.00E+02	1.42E-03	5.82E-02	4.01	3.25
71-55-6	1,1,1-Trichloroethane	1.33E+03	1.72E-02	7.05E-01	2.48	2.04
79-00-5	1,1,2-Trichloroethane	4.42E+03	9.13E-04	3.74E-02	2.05	1.7
79-01-6	Trichloroethylene	1.10E+03	1.03E-02	4.22E-01	2.71	2.22
95-95-4	2,4,5-Trichlorophenol	1.20E+03	4.33E-06	1.78E-04	3.9	—
88-06-2	2,4,6-Trichlorophenol	8.00E+02	7.79E-06	3.19E-04	3.7	—
108-05-4	Vinyl acetate	2.00E+04	5.11E-04	2.10E-02	0.73	0.72
75-01-4	Vinyl chloride	2.76E+03	2.70E-02	1.11E+00	1.5	1.27
108-38-3	m-Xylene	1.61E+02	7.34E-03	3.01E-01	3.2	2.61
95-47-6	o-Xylene	1.78E+02	5.19E-03	2.13E-01	3.13	2.56
106-42-3	p-Xylene	1.85E+02	7.66E-03	3.14E-01	3.17	2.59

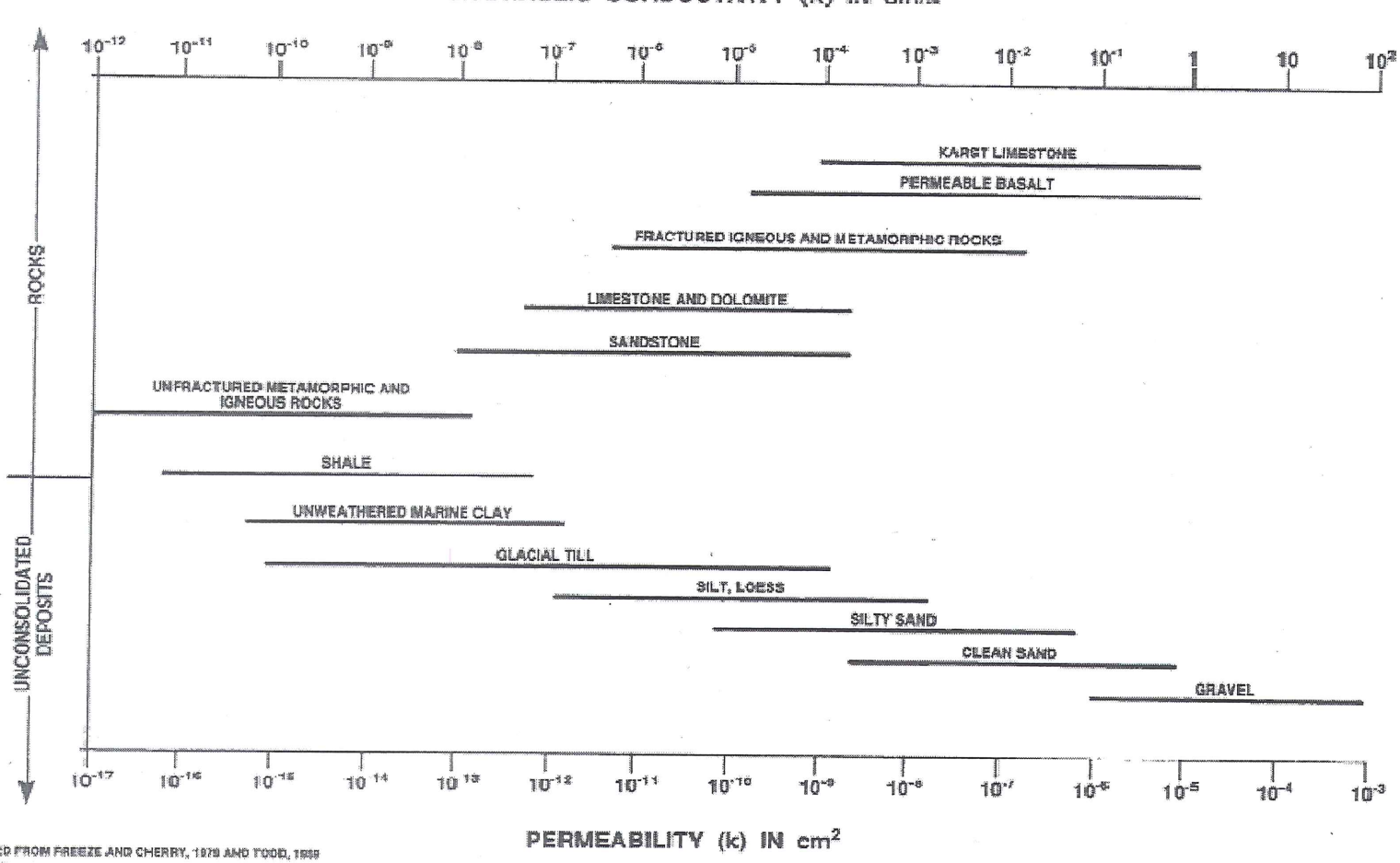
Source: United States Environmental Protection Agency. 1996. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128 (http://www.epa.gov/superfund/resources/soil/toc.htm#p5)

CAS = Chemical Abstracts Service

Kow = Octanol/water partition coefficient

RANGE OF VALUES OF HYDRAULIC CONDUCTIVITY AND PERMEABILITY

The information on Koc is used in Sheet II (Migration Potential), section 1,B,f (Hydraulic Conductivity)



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