PHASE III ENVIRONMENTAL SITE ASSESSMENT

IQALUIT AIRPORT, AREAS OF ENVIRONMENTAL CONCERN

Privileged and confidential document

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FINAL REPORT

June 26, 2014

O/Ref.: QE14-214-2

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Privileged and confidential document presented to

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Qikiqtaaluk environmental
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LIST OF ABBREVIATIONS

As:	Arsenic
BTEX:	Benzene, Toluene, Ethylbenzene and Xylenes
CCME:	Canadian Council of Ministers of the Environment
Characterization Guide:	*Site characterization guide,* ministère de l'Environnement du Québec, 2003
CRA:	*Conestoga-Rovers & Associates*
ESA:	Environmental Site Assessment
Guide d'échantillonnage:	*Guide d'échantillonnage à des fins d'analyses environnementales*, ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2008
	Cahier 1 : Généralités, 2008
	Cahier 3 : Échantillonnage des eaux souterraines, 2008
	Cahier 5 : Échantillonnage des eaux souterraines, June 2011, revised February 23rd 2012
	Cahier 8: Échantillonnage des matières dangereuses, 2008
Guideline:	Environmental Guideline for Contaminated Site Remediation (2010), Nunavut Department of Environment
DJSA:	Detailed Job safety analysis
PAH:	Polycyclic aromatic hydrocarbons
PID:	Photo Ionization Detector for VOC's in air
QA/QC:	Quality assurance and quality control
QE:	Qikiqtaaluk Environmental Inc.
Soil Quality Guideline:	Soil Quality Guidelines for the Protection of Environmental and Human Health, CCME
STOP:	Stop all Tasks and Observe to Prevent
TPH:	Total Petroleum Hydrocarbons concentration in soil according to CCME
VOC:	Volatile organic compounds
Water Quality Guideline:	Water Quality Guidelines for the Protection of Aquatic Life, CCME

1. INTRODUCTION

1.1 Mandate

Following our proposal dated April 30, 2014 and our response to questions posed by Sintra submitted on May 23, 2014, Qikiqtaaluk Environmental Inc. was mandated on May 28, 2014, by a representative of Arctic Infrastructure Partners, Mr. Geoffroy Lécureur from Sintra Inc. and Mr. Doug Thompson of Tower Arctic Ltd., to proceed with a Phase III ESA at the areas of environmental concern found on the Iqaluit Airport Property by CRA identified in their “Pre-Existing Environmental Contamination Management Plan.”.

The site being studied (hereafter referred to as the “Site”) is currently used as an airport operated by the Government of Nunavut.

Arctic Infrastructure Partners was awarded the contract to construct a new terminal and improve the supporting infrastructure at the Iqaluit Airport. Any contamination found outside of the areas to be disturbed is not to be remediated.

The present document provides a brief description of the Site and its surroundings, the previous studies carried out on the Site, the methodology used to conduct the current phase III ESA, as well as the findings, conclusions and recommendations of the ESA.

1.2 Previous Study

A Phase II ESA was conducted on the Site during July 2013 by CRA. A report entitled “Pre-Exsiting Environmental Contamination Management Plan” was provided to QE prior to starting the work, to allow for planning of the work to be completed.

The report pinpointed four areas of environmental concern that required further study in order to delineate the extents of the contamination and better estimate the volume of soil to be excavated. These areas are summarized in Table 1.

TABLE 1: Summary of Areas of Environmental Concern Identified by CRA

Area of Environmental Concern	Associated Contaminants	Location	Comments
Drum Cache 1 (TP-32)	Ethylbenzene	Located to the north-northwest of the new terminal location	Approximately 300 drums and 1 – 50,000 litre tank
LTU's and Underlying Soil (TP-24)	TPH (F1-F4)	Between the apron and the runway to the west of the new terminal location	Contaminated soils collected in a landfarm. Additional contamination found outside the landfarm
Arsenic Impacted Soil (TP-15)	As	East side of the runway, just past access road	Source unknown
PAH Impacted Groundwater (TP-06)	PAH	Next to drainage ditch to the northeast of the new terminal location	Source unknown

1.3 Objectives

The objectives of the Phase III ESA were to:

- Delineate the total area of impacted soils found at TP-15, TP-24, TP-32;
- Determine the extent of the PAH contamination in the water found in the location where a temporary by-pass ditch will be dug at TP-06, and where the ground water was coming from;
- Provide granulometry for the contaminated soils to be used as backfill; and,
- Present the results of the Phase III ESA in a report.

1.4 General Conditions and Limitations of the Study

The fieldwork was planned and executed based on the information available. The information included in this report is subject to the general conditions and limitations of the study as described in Appendix A.

2. SITE LOCATION

2.1 Location and Zoning

The Site, described as the airport in Iqaluit, has a total surface area of approximately 2.8 km².

The approximate geographical coordinates (central point of the property) in degrees minutes and seconds are:

- 63º 45'16" North;
- 68º 33'02" West.

The site is currently zoned as a transportation zone.

3. WORK PERFORMED AND METHODOLOGY (PHASE III)

3.1 Summary of Work Performed

There are currently no standards or guidelines for environmental sampling in Nunavut. As such, all fieldwork was conducted in accordance with the applicable guidelines established by the *ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC)* and the client's requirements, with the only exception being that samples were collected over a total depth of 1m.

In order to meet the objectives of the current study, the work performed included the completion of the following:

- Staking of sampling locations (test pits) on the Site;
- Identification and location of underground utilities;
- Excavation of 40 test pits on the property for soil sampling;
- Excavation of 6 trenches to test for PAH contamination in any water that accumulated in them;
- Description of the stratigraphy encountered at all sampling locations;
- Continuous soil sampling in all test pits;
- Chemical analysis of the soil and water samples in accordance with the established analytical program;
- Surveying of sample locations by QE and positioning of CRA's sampling locations;
- Preparation of a technical report detailing the findings of the Phase III ESA.

Photographs illustrating some of the fieldwork performed on the Site can be seen in the photographic report presented in Appendix C.

3.2 Sampling Strategy

Sampling locations were selected based on a combination of observations made onsite as well as information obtained from the pre-existing contamination management plan. The sampling strategy focused on areas around the contaminated samples found by CRA.

A total of 40 locations were chosen to conduct test pits on the Site and 6 trenches were also dug to check for PAH contamination of the groundwater. Sampling locations were chosen by setting up a grid consisting of squares that measured 25m by 25 m. A maximum of 16 squares were implemented and were centered on the test pit where the soil was reported as contaminated in the CRA report. The location of the test pit was set at the centre of each square. Only samples from the four squares immediately adjacent to the CRA sampling point were initially analyzed. All of the other test pits were dug, sampled and held at the lab to be analysed only if the initial 4 results showed contamination.

It should be noted that several test pits were relocated during the fieldwork due to logistical constraints on-Site. Figure 1 in Appendix B illustrates the final location of all test pits.

3.2.1 Timeline of Work Performed

The timeline of the different tasks carried out during the ESA is summarized below:

- June 2, 2014: mobilization to Iqaluit and preparation of sampling equipment and supplies, met with the airport manager regarding buried infrastructure and access to restricted areas in the airport;
- June 3, 2014: excavation of the trenches in the area where the temporary bypass trench is to be built. Setup and testing of survey equipment, layout of grid at TP-15;
- June 4, 2014: install test pit locations by survey and excavation of test pits at TP-32, TP-24 and TP-15;
- June 5, 2014: install test pit locations by survey and excavation of test pits at the new Taxiway location;
- June 5, 2014: sampling of water in the trenches and surveying of areas where contaminated soil could be placed.

3.2.2 Work Preparation

Before beginning fieldwork, preparation included:

- Logistical coordination between the QE Project Manager and Technician, the client representatives onsite and the Tower Arctic Ltd., who provided the heavy equipment used for digging the test pits;
- Identification and location of public and private underground utilities (water, sewer, fuel pipes, electrical lines etc.);
- Preparation of field equipment and materials;
- Development of Site and task-specific JSA.

Underground utilities were located in consultation with the airport manager. This step was essential in order to safely carry out the fieldwork and to identify, if applicable, utility corridors which may serve as preferential pathways for contaminant migration. The final location of the sampling points was confirmed following these verifications.

3.3 Soil Characterization

3.3.1 Test Pits

The Phase III ESA fieldwork included the excavation of 40 test pits as shown in Figure 1 of Appendix B.

All test pits were excavated using a Caterpillar 325 Excavator operated by a Tower Arctic Limited employee. Test pits were excavated to a depth of approximately 1 m.

The test pits were backfilled with the excavated material with care taken to respect the stratigraphy encountered. The backfilled materials were loosely compacted using the bucket of the excavator.

3.3.2 Soil Sampling

Soil sampling was conducted in accordance with the procedures described in the *Guide d'échantillonnage, Cahier 5* with the only exception being that samples were collected over a total depth of approximately 1 m. Soils were described according to unified classification ASTM D22487 and their organoleptic characteristics (visual and olfactory) were recorded. Samples collected in the areas where there was ethylbenzene and TPH contamination were also tested with a PID to determine if any contamination could be detected in the field to assist with delineating the contamination.

Composite samples were generally collected from various points and depths from the pile of soil excavated from the test pit, while respecting the individual strata (with no overlap of an individual sample between 2 separate strata). Samples were collected in Ziploc bags and transferred to jars as soon as possible following the collection of the sample. Technicians wore latex gloves and changed their gloves between each test pit. A new Ziploc bag was used for each sample.

In the Drum Cache 1 area, where there were visible signs of tar on the ground at the sampling location, a soil sample was collected between 0 and 0.2 m and a second sample was collected between 0.2 and 1.0 m to confirm the depth of the contamination.

Throughout the fieldwork a total of 40 soil samples were collected.

3.3.3 Water Sampling

Water samples were collected from each of the trenches separately. A clean jar was used to collect the water sample and transfer it into the sample jar provided by the laboratory. Sample jars could not be filled directly due to a conservation agent in the jar. A new jar was used for each sample collected. The technician wore latex gloves during sampling and new gloves were worn for each collection a sample.

One sample was also collected from the water flowing in the drainage ditch to allow for comparison with the samples collected from the trenches.

3.4 Cleaning of Sampling and Measuring Instruments

Since new disposable equipment was used for each sample, no cleaning of sampling equipment was required.

3.5 Sample Containers and Sample Conservation

All samples collected were placed in containers (jars and bottles) provided by an analytical laboratory. All samples were labeled and stored in coolers with ice packs also provided by the laboratory in order to maintain them at a temperature of approximately 4°C until delivery to the laboratory. Samples were stored overnight in a walk-in cooler located at QE's hazardous waste transfer centre. Samples were brought the next morning to First Air Cargo for transport to Ottawa where they were collected by Exova. First Air had instructions to keep the cooler containing the samples in a cooler during transport but not to allow the cooler to freeze.

Samples not selected for chemical analysis are stored by the laboratory for the period of this mandate. After this period, the samples will be destroyed by the laboratory unless otherwise instructed by an authorized representative of the client.

Finally, container types and conservation and transport methods for samples were selected in accordance with the guidelines presented in the *Guide d'échantillonnage, Cahiers 1, 3, 5 and 8*.

3.6 Surveying

All test pits were surveyed using a high precision GPS (Trimble R10 GNSS System). The benchmark CCM-8 (located along the northeastern side of federal road) was used to georeference the surveying data. All surveying was conducted by a QE Technician.

The QE technician also surveyed the area where contaminated soils are to be used as backfill according to the risk based criteria so that the depth of the soil to be placed can be calculated prior to returning to the site.

3.7 Sediments and Surface Water

No surface water was observed in the areas where the work was to be carried out, except for some residual snowmelt water located in the area where the new taxiway will be installed. No sediments were noticed in the surface water.

3.8 Laboratory Analyses

3.8.1 Analytical Program

The analytical program of the Phase III ESA is based on the environmental issues highlighted in the CRA Pre-Existing Contamination Management Plan, as well as the number of samples collected during the fieldwork.

The choice of analytical parameters for the samples sent for laboratory analysis was established based on the nature of organic and inorganic contaminants found and reported in the Pre-Existing Contamination Management Plan prepared by CRA.

Soil and water samples collected during the characterization work were delivered to the analytical laboratory as promptly as possible. The analytical laboratory chosen was accredited by *The Canadian Association for Laboratory Accreditation Inc.* (CALA) for all the analyses performed. Certificates of accreditation are available upon request. Furthermore, the analytical reports received are verified and signed by a member of the Association of the Chemical Profession of Ontario.

The samples selected were analyzed using the methods presented in Table 3. The detection limits associated with each parameter analyzed is also presented in Table 3.

TABLE 2: Analytical Program and Detection Methods

Matrix	Analysis	Method	Detection Limit	
Soil	TPH	CCME	µg/g	Variable
	PAH	P 8270	µg/g	Variable
	BTEX	V 8260B	µg/g	Variable
	Metals (Mercury, Silver, Arsenic, Barium, Cadmium, Cobalt, Chromium, Copper, Manganese, Molybdenum, Nickel, Lead, Selenium, Tin, Zinc)	EPA 200.8	µg/g	Variable
Water	PAH	P 8270	µg/L	Variable

From a total of 40 soil samples collected, 20 soil samples (including 5 field duplicates) and 8 water samples (1 from each of the 6 trenches plus one from the ditch and 1 duplicate) were selected for laboratory analysis. Table 5 presents the number of analyses performed for each parameter.

TABLE 3: Parameters Analyzed per Matrix (Number of Analyses)

	TPH	PAH	As	Metals	BTEX
Soil	7	3	4	3	12
Field duplicate– Soil	4	2	1	2	2
Water	0	7	0	0	0
Field duplicate - Water	0	1	0	0	0
Total	***11***	***13***	***5***	***5***	***14***

3.8.2 QA/QC program

All projects completed by QE include a QA/QC program in order to verify the reliability, precision and accuracy of the fieldwork analytical results.

3.8.2.1 Onsite

Several precautions were taken during the course of the fieldwork in order to eliminate the risk of contamination from equipment and sampling instruments and to ensure effective and representative sampling. The precautions taken, particularly during collection, transport, identification and conservation of samples included:

- Application of standardized work procedures through ongoing training of field technicians on the various standardized methods of sample collection and management;
- Constant supervision of employees by management;
- Calibration of each measurement instrument according to manufacturer specifications both before and during field work;
- Use of disposable nitrile gloves for each sample collected;
- Adequate cleaning of equipment, containers and sampling instruments before collecting each sample;
- Careful use and protection of the appropriate sampling containers and measuring instruments during sample collection, transport and conservation;
- Precise identification and labeling of all samples shipped to the laboratory accompanied by a completed and signed chain of custody form;
- Shipping of samples to the laboratory as promptly as possible, within 24 hours of collection, where possible;
- Conservation and storage of samples according to the standardized methods recommended by the *MDDELC*.

In addition, at least 10% of soil samples were adequately duplicated onsite and submitted to the laboratory for quality control. Soil samples TE-156, TE-170, TE-171, TE-250, and TE-

251, were duplicated to form the respective duplicates TE-156-DT1, TE-170-DT1, TE-171-DT1, TE-250-DT1, and TE-251-DT1.

One duplicate sample was collected from the water in the trenches from Fosse 4. This sample was named DT1-14605. The water for the duplicate sample was collected from the same location, using the same sampling equipment as the sample Fosse 4.

The analytical program for the field duplicates was presented previously in Table 3. The preparation of field duplicates allows the reproducibility and degree of homogeneity of the samples collected to be verified.

No field blanks were used during soil and groundwater sampling because no significant external sources of contamination (dust, atmospheric emissions, VOCs etc.) were identified on the Site in the vicinity of the sampling locations. For water, each sample was collected with new and dedicated materials for each sampling location. Finally, no trip blanks were used as all samples were conserved in hermetically sealed containers during their transport between the Site and the laboratory.

3.8.2.2 At the Laboratory

Exova applies its own QA/QC in accordance with the requirements of The Canadian Association for Laboratory Accreditation Inc. in order to provide analytical results of the highest possible quality and reliability. This program includes, among others, the following elements:

- Laboratory blank;
- Laboratory duplicate;
- Control/reference samples;
- Certified reference materials;
- Sample spiking;
- Surrogates (organics).

A summary of the laboratory's internal QA/QC program is available upon request.

4. RESULTS

4.1 Underground Utility Clearance

Identification and location of buried utilities and their potential associated preferential pathways was conducted by QE before beginning the fieldwork.

This identification was completed with the assistance of the airport manager John Hawkins who reviewed all sampling locations and provided information on the presence of any buried infrastructure in the areas where work was to occur.

The only buried infrastructure was buried electrical lines supplying lights next to the runway. Sampling locations were relocated to ensure that the electrical lines would not be disturbed during excavation of the test pits.

One communications cable was found, buried approximately 6” below the ground surface, during the excavation of the trenches beside the drainage ditch. This communications cable was lightly impacted by the excavator. QE attempted to determine whom the communications cable belonged to and if it is still active. At the time of publishing this report, no owner of the cable had been found. This tends to suggest that this cable is no longer in use.

4.2 Chemical Analysis

The results of the laboratory chemical analysis of soil and water samples are presented in Tables I and II of Appendix D as well as in the analytical certificates attached in Appendix E.

4.2.1 Soils

4.2.1.1 Applicable Soil Quality Criteria

The analytical results were compared to the CCME Soil Quality Guidelines for the Protection of Environmental and Human Health (industrial land use) and the Government of Nunavut’s Department of Environment’s Environmental Guideline for Contaminated Site Remediation quality criteria for commercial/industrial land use.

4.2.1.2 Analytical Results

The results of almost all of the soil samples were below CCME and Government of Nunavut Criteria, except for TE-191, which exceeded the guideline value for ethylbenzene. The duplicate sample taken at TE-250 was also found to exceed the criteria for chromium. The lab confirmed the result with a second analysis of the sample.

The analytical results are presented in Table I of Appendix D and the overall results of each sampling location are presented in Appendix E. The location of the sampling points are Figure 1 of Appendix B.

4.2.2 Water

4.2.2.1 Applicable Standards and Groundwater Quality Requirements

The analytical results were compared to the CCME Water Quality Guidelines for the Protection of Aquatic Life.

4.2.2.2 Analytical Results

Five of the 8 water samples showed concentrations exceeding the guideline value for various PAH's. These were samples Fosse 2, 5 and 6, the duplicate sample in Fosse 4 as well as the sample from the water in the ditch.

The analytical results of the groundwater samples are presented in Table II of Appendix D and the overall results of each sampling location are presented in Appendix E. The location of the sampling points are Figure 2 of Appendix B.

4.3 QA/QC Program

4.3.1 Onsite

6 field duplicate soil samples were collected during the environmental characterization work. These field duplicates were analyzed for the same parameters as their parent-samples.

An assessment of the analytical results of the quality control program revealed that the concentrations obtained for the field duplicates and their parent-samples are almost identical and below the analytical detection limit in most cases. This confirms the validity of the results.

4.3.2 Laboratory

The results of Exova's internal control measures are also considered to be acceptable and fall within *CALA's* suggested RPD for all analyses performed (laboratory blanks, laboratory duplicates, control/reference samples, certified reference materials, sample spiking and surrogates (organics)).

The results are presented in the laboratory's analytical certificates presented in Appendix E.

5. DATA INTERPRETATION

5.1 Soils

The analytical results, along with the information gathered onsite from the 40 test pits, indicate that the soils in the areas sampled are not impacted by contaminants over the guideline levels except for the sample collected in the Drum Cache 1 area.

5.2 Water in temporary by-pass ditch location

As previously indicated, water test results confirm the PAH contamination discovered by CRA. A solution should be developed with the authorities having jurisdiction to ensure that the work to be carried out in this area respects the regulations in place.

5.2.1 Infiltration of water

The trenches were dug down to a depth of 1 m. Frozen soil was encountered at approximately 0.5 to 0.75 m. The level of the bottom of the trenches was situated at approximately the same height as the surface level of the water flowing in the ditch. Once the trenches were dug, the water was mostly seeping in from the northeast side of the trench later in the day. There were also signs of water infiltration from the northwest side of the trench, but this appeared to originating primarily from melting soil.

There was a fair amount of water ponded on the corner of the road on the opposite side from where the trenches were excavated. Most of the water in the trenches seemed to be entering from the northeastern side. This is further demonstrated up by the fact that after 3 days the trenches were 2/3 filled with water. If the water was coming from the ditch side of the excavation, then the level of water should not have risen above the level of the water in the ditch.

The trenches were backfilled once the water samples were collected. The trenches were backfilled in such as way as to prevent any water from spilling out of them. They were compacted using the bucked of the excavator.

6. CONCLUSION

QE was contracted to perform a Phase III study of areas of environmental concern found by CRA and detailed in their report entitled Pre-Existing Contamination Management Plan for the Iqaluit Airport in July 2013.

6.1 Conclusions

The soil characterization work was carried out between the 2 and 6 of June 2014. The work conducted included the excavation of 40 test pits to test soil quality and 6 trenches to test the water quality.

A total of 40 soil samples were collected during the course of the fieldwork. Of the total soil samples collected, 20 (including 5 field duplicates) were submitted for laboratory analysis.

Furthermore, 8 water samples were collected from the trenches (including 1 field duplicate) and analyzed by the laboratory.

The results of the characterization study revealed the following with regards to the environmental quality of the Site's soils and groundwater.

- ***ENVIRONMENTAL QUALITY OF SOILS***

  The analytical results of the samples submitted to the laboratory showed that soils in the Drum Cache 1 area are impacted by ethylbenzene at concentrations above the Government of Nunavut's industrial criteria in the top 0.2 m at TE-191. This contamination is associated with the tar that leaked out of the drums that were stockpiled in this area.

  The duplicate soil sample from test pit TE-250 (called TE-250-DT1) was found to exceed the industrial criteria for chromium. This area is a backfilled area that where equipment is parked. The source of the backfill is unknown. The source of the chromium is also unknown. Further testing will be performed on the samples collected around TE-250 and an addendum to this report will be issued with the final results and recommendations.

  All other soil samples selected from the test pits and boreholes showed concentrations below the Industrial criteria.

  Several of the locations studied inside the secure area of the airport had scattered debris. The debris included pieces of metal, wood and plastic. The debris presents a danger for Flying Object Damage, (FOD), for an airplane and should be removed as part of any environmental remediation work. Furthermore, any areas used for the

backfill of contaminated soil that meets the site-specific risked based remediation criteria must also have all debris removed prior to the placement of soil to ensure that there is no impact on the compaction of the soils.

- ***ENVIRONMENTAL QUALITY OF WATER***

  The analytical results of the 8 groundwater samples collected from the excavated trenches and the river indicated that 6 of the samples showed concentrations exceeding the applicable guidelines for several different types of PAHs. The source of the water entering the excavated trenches appeared to originate primarily from the roadside of the excavation. However, this may due simply to the ground melting and the melt water flowing out of the ground.

6.2 Recommendations

All of the contaminated soil found by CRA should be excavated to a point half way between the CRA sampling point and the uncontaminated soil samples taken by QE. As such, at sampling location TP-15 approximately 258 m^3 of soil is to be excavated and at sampling location TP-24 approximately 443 m^3 of soil is to be excavated. Confirmatory sampling of the walls of the excavations should be conducted prior to backfilling to ensure that all of the contamination has been removed.

At the drum cache, all areas where tar is found in contact with the ground should be excavated to a depth of 20 cm. The walls and the bottom of the excavations should also be tested to ensure that no contamination remains. The volume of impacted soils above the industrial criteria in the Drum Cache 1 Area is estimated at maximum of 170 m^3 (853 m^2 by 0.2 m deep). There are many constraints related to the use of this material as backfill. The primary reason is due to the high volatility of this type of contaminant, thus, they will need to be disposed of off-site.

It is difficult to determine the source of the contamination of the groundwater where CRA discovered PAH contamination. However, the results show that the water is contaminated and an AANDC water resource officer should be contacted to determine how to proceed the water in the temporary diversion channel should be handled during the installation of the culverts. QE recommends that the temporary diversion channel be lined with an impermeable material to prevent the redirected water from coming into contact with the contaminated water found in the soils in this area.

A crew should be mobilised to collect all of the non-hazardous surficial debris around the airport, especially in areas where contaminated soils are to be excavated and placed.

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APPENDIX A

GENERAL CONDITIONS
AND LIMITATIONS OF THE STUDY

GENERAL CONDITIONS AND LIMITATIONS OF THE STUDY (PHASES II & III AND REHABILITATION)

This report has been prepared for the exclusive use of the person to whom it is addressed. Possession of this report does not confer the right to publish, use or rely on the information, conclusions or recommendations contained in the report to anyone other than the person to whom it is addressed. The contents of the report constitute an assessment of the conditions of certain areas of the subject property and cannot be applied to any other property or location. This report must be as a whole, as sections taken individually and out of context may be erroneously interpreted. In addition, the addressee of the report may only rely on the text of the final version; any other text, opinion, draft or preliminary version provided by QE cannot be used.

The results, comments, interpretations, conclusions and recommendations contained in this report are valid only at the time when the information on which they are based was collected. They have been formulated, in accordance with the scope of the review and the specific limitations of the study, as well as in the light of our knowledge of the current and/or planned use(s) of the site, its general location and the applicable environmental laws, regulations standards and criteria.

This report is based on the verbal and/or written information obtained during the assessment, the accuracy of which has not been verified. QE has relied upon the written information provided and information provided by persons interviewed during the execution of this mandate as has assumed this information to be valid, accurate and provided in good faith. This information is considered to have been obtained in accordance with known and accepted rules of conduct and professional practices.

QE cannot be held responsible for any costs, claims, damages or harm which is a direct or indirect consequence of a false, incorrect or deceitful declaration or information provided, or the non-disclosure, dissimulation or concealment of pertinent information by the persons.

QE cannot be held responsible for damages resulting from unforeseeable events or changes in the conditions on the site after the date that information has been collected. In addition, QE cannot be held responsible for damages resulting from any modifications to applicable environmental laws, regulations, standards or criteria after delivery of this report, from the use of this report by a third party and/or for purposes other than those for which it has been written, or for any real or perceived loss of property value, or failure of a transaction because of the factual information, interpretations, conclusions and recommendations contained in this.

The report does not guarantee that the site is free of contaminants or hazardous or potentially hazardous material or conditions or that latent or undiscovered conditions will not become evident in the future.

Unless otherwise indicated in the report, drilling, taking measurements, sampling or detailed listing of the wastes, products, soil, water or other material on the study site or its immediate surroundings were not part of the present assessment.

All opinions expressed and references made to environmental laws, regulations, standards or criteria are provided for the client's information only and should not, under any circumstances, be considered as legal advice or a legal opinion.

...2

Soil and Bedrock Conditions

The descriptions of soils and, in some cases, bedrock, are presented herein with the intention to provide a general overview of subsurface conditions. This information must not, under any circumstances, be used as geotechnical data on which to base construction design or development, unless that intention has been specifically indicated in the text of the report.

The descriptions and characteristics of the soils and bedrock have been developed from data obtained during drilling and/or excavation at a given time period. The points of contact between the different geological units identified must be considered approximate, given the limits of the equipment and the method(s) used, the frequency of sampling, and the intrinsic variability of the units encountered.

The data from drilling and/or excavation has been extrapolated between sampling points and may therefore actually differ in the unverified areas.

Groundwater and Surface Water Conditions

The precision and presentation of groundwater and surface water conditions must be interpreted as a function of the type of instrumentation used, the survey period and the number of observations recorded. Conditions may vary as a result of seasonal effects, precipitation levels, surface water levels and tidal patterns, as well as following work or other activities on the site or in surrounding areas.

Level of Contamination

The selection of the analytical parameters, the number and location of sampling stations, the sampling frequency and selection the samples to be analysed in the laboratory depends on the requirements of regulatory authorities at the time of the study, the scope and extent of the mandate, the available budget and the environmental conditions in and around the subject site. Note, however, that virtually no scope of work no matter how exhaustive can identify all contaminants or conditions above and below ground. Also, the fact that a substance has not been analysed for does not exclude the possibility that it is present on the site.

The concentrations of chemical compounds presented herein are determined based on the results of chemical analyses performed by accredited laboratories and correspond to the concentrations detected at the location of the sampling. QE does not warrant the accuracy of the results provided by the accredited laboratory.

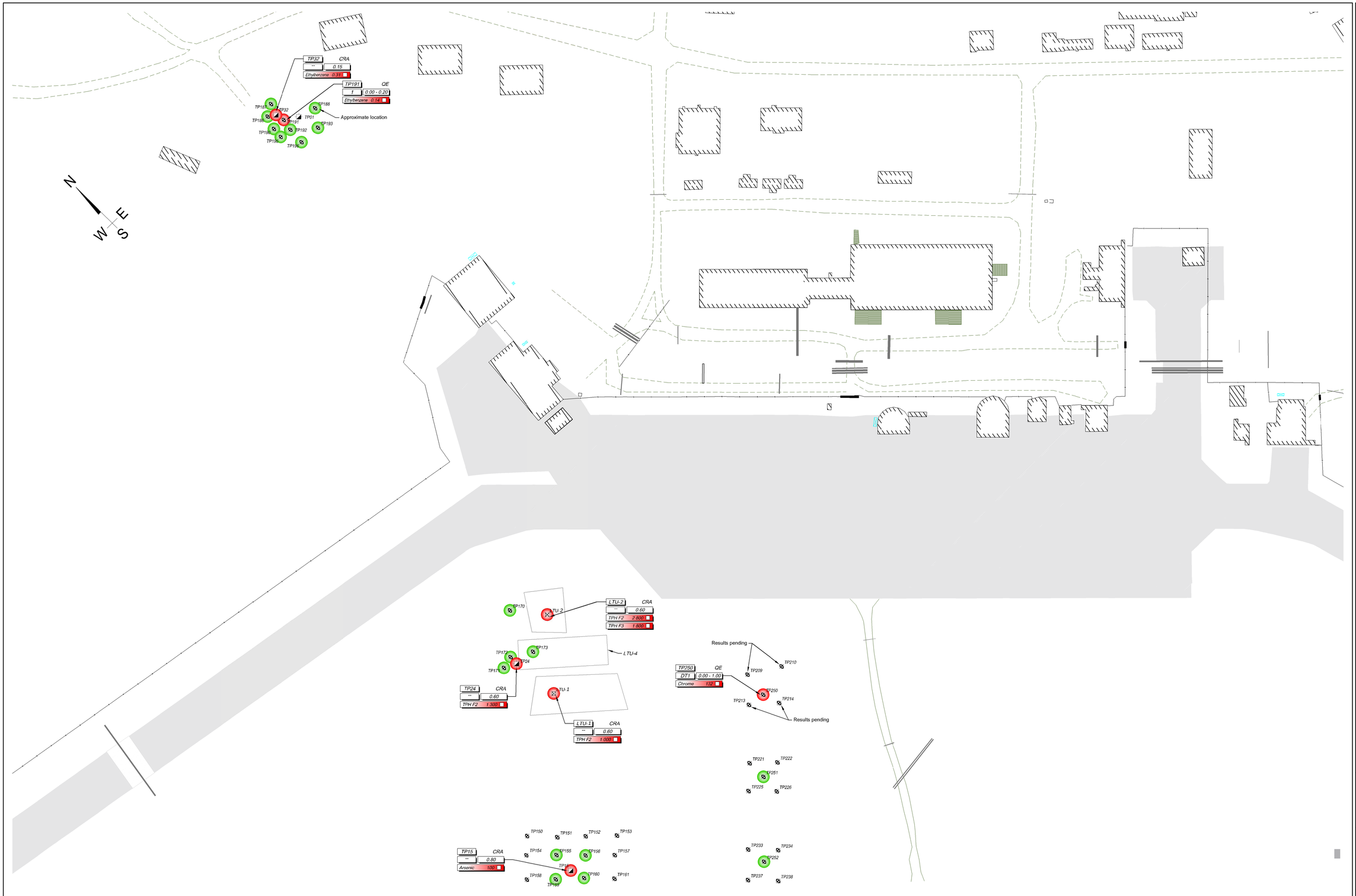
Contamination levels are established by comparing the concentrations obtained to the standards and/or criteria in force at the time the sampling was done. The nature and degree of the contamination identified may, however, vary between sampling stations as well as being a function of time and following work conducted on the site or in surrounding areas.

The assessment of the degree and extent of contamination and the estimates of volumes of contaminated soils, residual wastes, contaminated groundwater, surface water or other media provided herein are estimated and are not valid for areas other than the locations of the sampling stations, at the depths attained at those stations.

Hence, the quantities of contaminated media to be managed are provided for the information purposes only and may vary, either up or down, if other pertinent information becomes available.

APPENDIX B

FIGURES



This document shall not be used for construction, building or installation.

Legend

TP150	Test pit (Sanexen, June 2014)
TP15	Test pit (CRA, January 2014)
LTU-1	Land treatment unit location

Results box (soils)

Sample identification
Sample depth (m)
Company
TP191 QE
1 0.00 - 0.20
Ethylbenzene 0.14
Classification code
Analytical result (mg/kg)
Parameter

Code de classification

Concentrations exceeding the Canadian Environmental Quality Guidelines of the CCME

Environmental Classification of Soil Quality

The analytical parameter and result presented, which determine the concentration code, are the highest of the parameters measured, with respect to individual criteria and limit values. See the table of analytical results for other parameter values.

Concentration Codes

- Concentrations below the Canadian Environmental Quality Guidelines of the CCME
- Concentrations exceeding the Canadian Environmental Quality Guidelines of the CCME

CCME: Canadian Council of Ministers of the Environment

Notes:
TPH F2 (C_{10} to C_{16})
TPH F3 (C_{16} to C_{34})

Source :
- QE: the works were located by survey data (GPS), June 3-6;
- CRA: Figure 3, January 2014;
- Sintra Existing Airport Layout, June 2014

0 15 30 45 60 75m

CONFIDENTIAL

Figure 1
Location of Test Pits and Soil Analytical Results

PHASE III IQALUIT AIRPORT

Presented to:

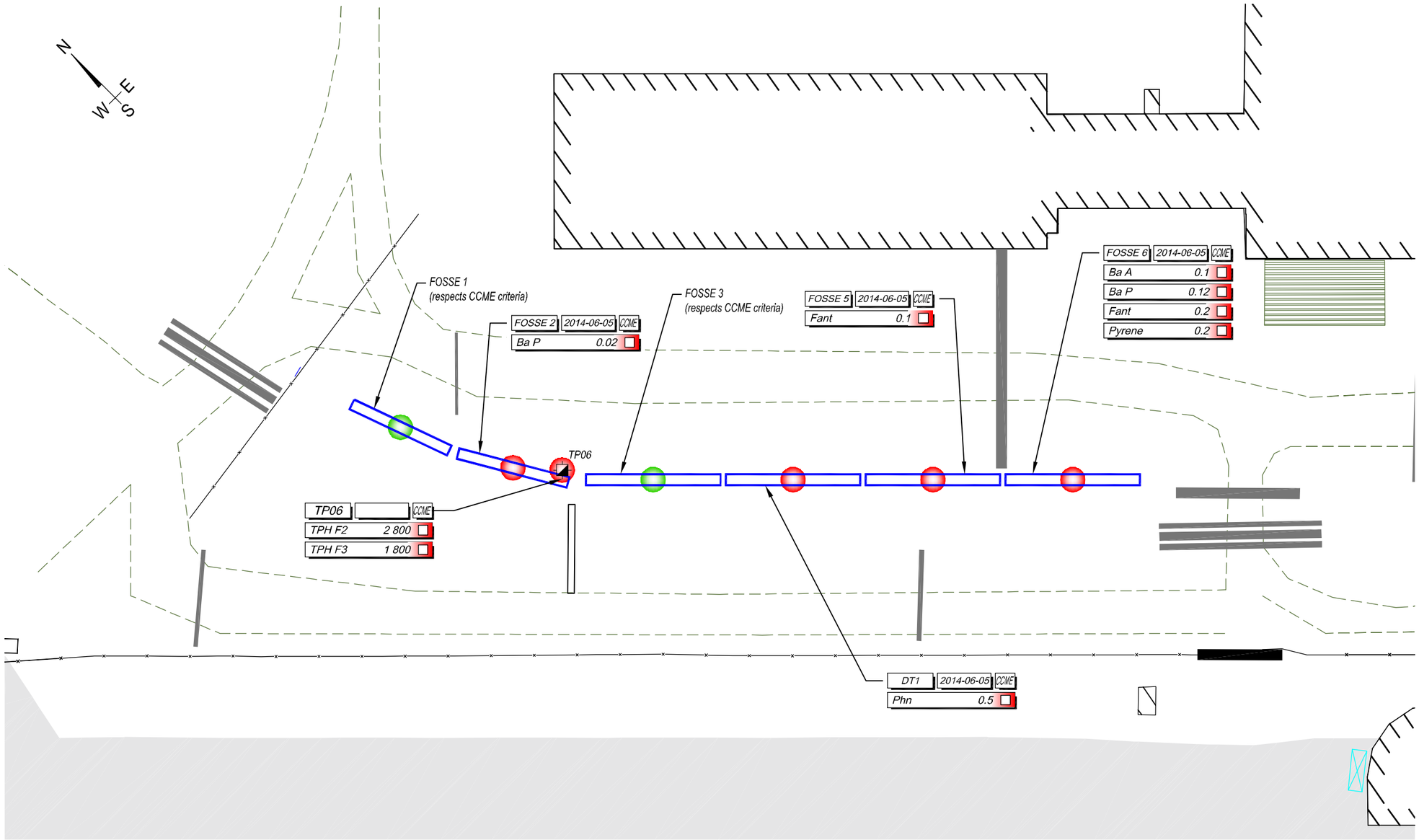
Arctic Infrastructure Partners

Property located at:

Iqaluit Airport, Nunavut

Scale: As shown	Design date: 2014-06-17		Revision date: 2014-06-26
Drawn by: D. Grant	Verified by: G. Johnson		Approved by: S. Laberge
Project no: QE14-214-2	Drawing no: QE14-214-2-01	Rev#: A	Geodetic reference: NTM/NAD83 Zone 19

Qikiqtaaluk environmental



Legend

TP06 Test pit (CRA, January 2014)

Source :
- *QE; the works were located by survey data (GPS); June 3-6;*
- *CRA; Figure 3, January 2014;*
- *Sintra Existing Airport Layout; June 2014.*

0 8 16 24 32 40m

CONFIDENTIAL

Results box (groundwater)

Sampling identification

Sampling date

FOSSE 2 | 2014-06-05 | CCME

Ba P 0.02

Classification code

Analytical result (µg/L)

Parameter

Classification Code

Concentrations exceeding the Canadian Environmental Quality Guidelines of CCME

Environmental Classification of Groundwater Quality

The analytical parameter and result presented, which determine the concentration code, are the highest of the parameters measured, with respect to individual criteria and limit values. See the table of analytical results for other parameter values.

Concentration codes

Concentrations below the Canadian Environmental Quality Guidelines of the CCME

Concentrations exceeding the Canadian Environmental Quality Guidelines of the CCME

CCME: Canadian Council of Ministers of the Environment

Notes:
Ba A: benzo(a)anthracene
Ba P: benzo(a)pyrene
Fant: fluoranthene
Phn: phenanthrene
TPH F2 (C_{10} to C_{16})
TPH F3 (C_{16} to C_{34})

This document shall not be used for construction, building or installation purposes.

Figure 2

Groundwater Analytical Results

PHASE III IQALUIT AIRPORT

Presented to:

Arctic Infrastructure Partners

Property located at:

Iqaluit Airport, Nunavut

Scale: As shown	Design date: 2014-06-17		Revision date: 2014-06-26
Drawn by: D. Grant	Verified by: G. Johnson		Approved by: S. Laberge
Project no.: QE14-214-2	Drawing no.: QE14-214-2-01	Layout: B	Geodetic reference: MTM/NAD83 Zone 19

Qikiqtaaluk environmental

APPENDIX C

PHOTOGRAPHIC REPORT

Photo 1: TE 170

Photo 2: Test Pit 171

Photo 3: Test Pit 172

Photo 4: TE 173

Photo 5: TE 186

Photo 6: TE 187

Photo 7: TE 188

Photo 8: TE 190

Photo 9: TE 191

Photo 10: TE 192

Photo 11: TE 193

Photo 12: TE 194

Photo 13: TE 195

Photo 14: TE 196

Photo 15: FOSSE 1

Photo 16: FOSSE 1

Photo 17: FOSSE 2

Photo 18: FOSSE 3

Photo 19: FOSSE 4

Photo 20: FOSSE 5

Photo 21: End of FOSSE 5 and Start of FOSSE 6

Photo 22: Excavation of FOSSE 6

Photo 23: Communications Cable Found

APPENDIX D

SUMMARY RESULTS TABLES

Qikiqtaaluk environmental

Table I
Soil Test Results

Sample Location	Analysis Performed	Exceedence	Result (µg\L)	Guideline (µg\L)
TE 155	As	None	N/A	N/A
TE 156	As	None	N/A	N/A
TE 156-DT1	As	None	N/A	N/A
TE 159	As	None	N/A	N/A
TE 160	As	None	N/A	N/A
TE 170	TPH	None	N/A	N/A
TE 170-DT1	TPH	None	N/A	N/A
TE 171	TPH	None	N/A	N/A
TE 171-DT1	TPH	None	N/A	N/A
TE 172	TPH	None	N/A	N/A
TE 173	TPH	None	N/A	N/A
TE 186	BTEX	None	N/A	N/A
TE 187	BTEX	None	N/A	N/A
TE 188	BTEX	None	N/A	N/A
TE 190	BTEX	None	N/A	N/A
TE 191-1	BTEX	Ethylbenzene	0.14	0.082
TE 191-2	BTEX	None	N/A	N/A
TE 192-1	BTEX	None	N/A	N/A
TE 192-2	BTEX	None	N/A	N/A
TE 193	BTEX	None	N/A	N/A
TE 195-1	BTEX	None	N/A	N/A
TE 195-2	BTEX	None	N/A	N/A
TE 196	BTEX	None	N/A	N/A
TE 250	13 Metals*	None	N/A	N/A
	PAH	None	N/A	N/A
	BETX	None	N/A	N/A
	TPH	None	N/A	N/A
TE 250-DT1	13 Metals*	None	N/A	N/A
	PAH	None	N/A	N/A
	BETX	None	N/A	N/A
	TPH	None	N/A	N/A
TE 251	13 Metals*	None	N/A	N/A
	PAH	None	N/A	N/A
	BETX	None	N/A	N/A
	TPH	None	N/A	N/A
TE 251-DT1	13 Metals*	None	N/A	N/A
	PAH	None	N/A	N/A
	BETX	None	N/A	N/A
	TPH	None	N/A	N/A
TE 252	13 Metals*	None	N/A	N/A
	PAH	None	N/A	N/A
	BETX	None	N/A	N/A
	TPH	None	N/A	N/A

* = 13 metals were Mercury, Silver, Arsenic, Barium, Cadmium, Cobalt, Chromium, Copper, Maganese, Molybdenum, Nickel, Lead, Selenium, Tin, Zinc

Sample Location	Analysis Performed	Exceedence	Result (µg\L)	Guideline (µg\L)
FOSSE 1 - 140605	PAH	None	N/A	N/A
FOSSE 2 - 140605	PAH	Benzo(a)pyrene	0.02	0.015
FOSSE 3 - 140605	PAH	None	N/A	N/A
FOSSE 4 - 140605	PAH	None	N/A	N/A
FOSSE 5 - 140605	PAH	Fluoranthene	0.1	0.04
FOSSE 6 - 140605	PAH	Benzo(a)anthracene	0.1	0.018
		Benzo(a)pyrene	0.12	0.015
		Fluoranthene	0.2	0.04
		Pyrene	0.2	0.025
DT- 1 (Duplicate FOSSE 4)	PAH	Phenanthrene	0.5	0.4
R - 140605	PAH	Phenanthrene	0.5	0.4

APPENDIX E

CERTIFICATES OF ANALYSIS

CHAIN OF CUSTODY

736140

Exova Accutest

☐ 146 Colonnade Rd., Unit 8
Ottawa, ON K2E 7Y1
Ph: (613) 727-5692 Fax: (613) 727-5222

☐ 608 Norris Court
Kingston, ON K7P 2R9
Ph: (613) 634-9307 Fax: (613) 634-9308

☐ 380 Vansickle Rd., Unit 630
St. Catharines, ON L2R 6P7
Ph: (905) 680-8887 Fax: (905) 680-4256

LABORATORY USE ONLY
Report #: 1410938

Company Name: Qikiqtaaluk Environmental Inc.	Address: 9935 ave de Catania, Entréee 1 bureau 200	☐ Fax Results to:
Report Attention: Greg Johnson	City/Prov: Brossard/QC Postal Code: J4Z 3V4	☑ E-mail Results to: gjohnson@qenv.ca
Phone: (514) 940-3332 Ext: 150	Project # QE 14-214-2 * Quotation # 14-082-284694	☑ Copy of Results to: slaberge@qenv.ca
* Waterworks Name:	* Waterworks Number:	*Note that for drinking water samples, all exceedances will be reported where (and how) the applicable legislation requires.*

Invoice to:
(if different from above)

SAMPLE ANALYSIS REQUIRED ⇦ Indicate: F=Filtered or P=Preserved

Sample ID	* Date/Time Collected	Sample Matrix i.e. Water, Soil, Paint	* Sample Type (see Codes below)	* MOE Reportable? Y = Yes N = No	# of Containers	** Service Required R = Rush S = Standard	BTEX								Criteria Required (i.e. Reg. 170, Reg. 153, CCME, PWQO etc.) Include sub-categories if appropriate	Laboratory Identification
TP191-1	2014/06/04	Soil		N	1	S	X								CCME	1109535
TP191-2							X									36
TP192-1							X									37
TP192-2							X									38
TP193							X									39
TP195-1							X									40
TP195-2							X									41
TP196							X									42

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
"MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By: Dusan/Martin	Date/Time: 2014/06/04	Relinquished By: Martin Lemay	Date/Time:	Comments	Cooler Temp (°C) on Receipt
Work Authorized By (signature):	Date/Time: 2014/06/04	Received By Lab:	Date/Time: June/14 10:30		

*** Indicates a required field.** If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided.
**** There may be surcharges applied to "Rush" service.** Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.

AFCOCR.2

Copies: White - Laboratory, Yellow - With Report, Pink - Sampler
Please print and submit, to the laboratory, 2 copies of this form with your samples.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Qikiytaaluk Enviromental 9935 Av de Catania, Entrance 1 , Suite 200 Brossard, QC J4X 3V4	Report Number:	1410938
Attention:	Ms. Greg Johnson	Date Submitted:	2014-06-09
PO#:	RQ11-105	Date Reported:	2014-06-13
Invoice to:	Qikiytaaluk Enviromental	Project:	QE14-214-2
		COC #:	786140

Dear Greg Johnson:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Charlie (Long) Qu
Laboratory Supervisor, Organics

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is certified and accredited for specific parameters by:
SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.
Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410938
Date Submitted: 2014-06-09
Date Reported: 2014-06-13
Project: QE14-214-2
COC #: 786140

				Lab I.D.	1109535	1109536	1109537	1109538
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-04	2014-06-04	2014-06-04	2014-06-04
				Sample I.D.	TP 191-1	TP 191-2	TP 192-1	TP 192-2
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		28.4	18.5	8.2	17.3
VOCs	Benzene	0.02	ug/g		<0.02	<0.02	<0.02	<0.02
	Ethylbenzene	0.05	ug/g		0.14	<0.05	<0.05	0.08
	m/p-xylene	0.05	ug/g		0.84	0.08	0.10	0.44
	o-xylene	0.05	ug/g		0.26	<0.05	<0.05	0.20
	Toluene	0.20	ug/g		<0.20	<0.20	<0.20	<0.20
	Toluene-d8	0	%		105	104	109	115

				Lab I.D.	1109539	1109540	1109541	1109542
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-04	2014-06-04	2014-06-04	2014-06-04
				Sample I.D.	TP 193	TP 195-1	TP 195-2	TP 196
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		13.4	13.5	11.3	7.6
VOCs	Benzene	0.02	ug/g		<0.02	<0.02	<0.02	<0.02
	Ethylbenzene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	m/p-xylene	0.05	ug/g		0.08	0.08	0.08	0.09
	o-xylene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Toluene	0.20	ug/g		<0.20	<0.20	<0.20	<0.20
	Toluene-d8	0	%		106	102	100	104

Guideline = *** = Guideline Exceedence**

**-Analysis completed in Mississauga
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410938
Date Submitted: 2014-06-09
Date Reported: 2014-06-13
Project: QE14-214-2
COC #: 786140

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 270856 **Analysis Date** 2014-06-10 **Method** V 8260B			
Benzene	<0.02 ug/g	80	80-120
Ethylbenzene	<0.05 ug/g	109	80-120
m/p-xylene	<0.05 ug/g	110	80-120
o-xylene	<0.05 ug/g	109	80-120
Toluene	<0.20 ug/g	114	80-120
Toluene-d8	103 %	103	
Run No 270857 **Analysis Date** 2014-06-12 **Method** C SM2540B			
Moisture	<0.1 %	100	80-120

Guideline = *** = Guideline Exceedence**

**-Analysis completed in Mississauga
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

786120

CHAIN OF CUSTODY

Exova Accutest

☐ 146 Colonnade Rd., Unit 8, Ottawa, ON K2E 7Y1, Ph: (613) 727-5692 Fax: (613) 727-5222

☐ 608 Norris Court, Kingston, ON K7P 2R9, Ph: (613) 634-9307 Fax: (613) 634-9308

☐ 380 Vansickle Rd., Unit 630, St. Catharines, ON L2R 6P7, Ph: (905) 680-8887 Fax: (905) 680-4256

LABORATORY USE ONLY Report #: 1410939

Company Name: Qikiqtaaluk Environmental Inc.	Address: 9935 ave de Catania, Entrée 1 bureau 200
Report Attention: Greg Johnson	City/Prov: Brossard/QC Postal Code: J4Z 3V4
Phone: (514) 940-3332 Ext: 150	Project # QE14-214-2 * Quotation # 14-082-284694
* Waterworks Name:	* Waterworks Number:

☐ Fax Results to:

☑ E-mail Results to: gjohnson@qenv.ca

☑ Copy of Results to: slaberge@qenv.ca

Note that for drinking water samples, all exceedances will be reported where (and how) the applicable legislation requires.

Invoice to:
(if different from above)

SAMPLE ANALYSIS REQUIRED ⇦ Indicate: F=Filtered or P=Preserved

Sample ID	* Date/Time Collected	Sample Matrix i.e. Water, Soil, Paint	* Sample Type (see Codes below)	* MOE Reportable? Y = Yes N = No	# of Containers	** Service Required R=Rush S=Standard	TPH (F1-F4)	BTEX							Criteria Required (i.e. Reg. 170, Reg. 153, CCME, PWQO etc.) Include sub-categories if appropriate	Laboratory Identification
TP 170	2014/06/04	soil		N	1	S	X								CCME	1109548
TP 170-DT1							X									44
TP 171							X									45
TP 171-DT1							X									46
TP 172							X									47
TP 173							X									48
TP 186	2014/06/04	soil		N	1			X							CCME	49
TP 187								X								50
TP 188								X								51
TP 190								X								52

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
"MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By: Dusan/Martin	Date/Time: 2014/06/04	Relinquished By: Martin Lemay	Date/Time:	Comments	Cooler Temp (°C) on Receipt
Work Authorized By (signature):	Date/Time: 2014/06/04	Received By Lab:	Date/Time: June 9/14 10:30		

*** Indicates a required field.** If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided.
**** There may be surcharges applied to "Rush" service.** Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.

AFCOCR.2

Copies: White - Laboratory, Yellow - With Report, Pink - Sampler
Please print and submit, to the laboratory, 2 copies of this form with your samples.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Qikiytaaluk Enviromental 9935 Av de Catania, Entrance 1 , Suite 200 Brossard, QC J4X 3V4
Attention:	Ms. Greg Johnson
PO#:	RQ11-105
Invoice to:	Qikiytaaluk Enviromental

Report Number:	1410939
Date Submitted:	2014-06-09
Date Reported:	2014-06-16
Project:	QE14-214-2
COC #:	786120

Dear Greg Johnson:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Charlie (Long) Qu
Laboratory Supervisor, Organics

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

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Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410939
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786120

				Lab I.D.	1109543	1109544	1109545	1109546
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-04	2014-06-04	2014-06-04	2014-06-04
				Sample I.D.	TP 170	TP 170-DT1	TP 171	TP 171-DT1
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		4.4	3.6	4.8	4.8
Hydrocarbons	F1 (C6-C10)	10	ug/g		<10	<10	<10	<10
	F2 (C10-C16)	10	ug/g				30	30
		50	ug/g		<50	<50		
	F3 (C16-C34)	100	ug/g		190	240		
		20	ug/g				120	120
	F4 (C34-C50)	100	ug/g		190	280		
		20	ug/g				90	100

				Lab I.D.	1109547	1109548	1109549	1109550
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-04	2014-06-04	2014-06-04	2014-06-04
				Sample I.D.	TP 172	TP 173	TP 186	TP 187
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		8.4	8.6	8.6	17.7
Hydrocarbons	F1 (C6-C10)	10	ug/g		<10	<10		
	F2 (C10-C16)	10	ug/g		<10	50		
	F3 (C16-C34)	20	ug/g		60	150		
	F4 (C34-C50)	20	ug/g		40	80		
VOCs	Benzene	0.02	ug/g				<0.02	<0.02
	Ethylbenzene	0.05	ug/g				<0.05	<0.05
	m/p-xylene	0.05	ug/g				0.08	0.06
	o-xylene	0.05	ug/g				<0.05	<0.05
	Toluene	0.20	ug/g				<0.20	<0.20
VOCs Surrogates (%	Toluene-d8	0	%				99	96

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410939
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786120

				Lab I.D.	1109551	1109552
				Sample Matrix	Soil	Soil
				Sample Type		
				Sampling Date	2014-06-04	2014-06-04
				Sample I.D.	TP 188	TP 190
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
General Chemistry	Moisture	0.1	%		17.2	9.7
VOCs	Benzene	0.02	ug/g		<0.02	<0.02
	Ethylbenzene	0.05	ug/g		<0.05	<0.05
	m/p-xylene	0.05	ug/g		0.09	0.07
	o-xylene	0.05	ug/g		<0.05	<0.05
	Toluene	0.20	ug/g		<0.20	<0.20
VOCs Surrogates (%	Toluene-d8	0	%		96	98

Guideline = *** = Guideline Exceedence**
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Methods references and/or additional QA/QC information available on request.

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410939
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786120

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 270854 **Analysis Date** 2014-06-12 **Method** CCME			
F1 (C6-C10)	<10 ug/g	93	80-120
Run No 270856 **Analysis Date** 2014-06-11 **Method** V 8260B			
Benzene	<0.02 ug/g	80	80-120
Ethylbenzene	<0.05 ug/g	109	80-120
m/p-xylene	<0.05 ug/g	110	80-120
o-xylene	<0.05 ug/g	109	80-120
Toluene	<0.20 ug/g	114	80-120
Toluene-d8	103 %	103	
Run No 270857 **Analysis Date** 2014-06-12 **Method** C SM2540B			
Moisture	<0.1 %	100	80-120
Run No 270947 **Analysis Date** 2014-06-16 **Method** CCME			
F2 (C10-C16)	<10 ug/g	85	50-120
F3 (C16-C34)	<20 ug/g	85	50-120
F4 (C34-C50)	<20 ug/g	85	50-120

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410939
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786120

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 270950 **Analysis Date** 2014-06-16 **Method** C SM2540B			
Moisture	<0.1 %	103	80-120

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
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Certificate of Analysis

Client:	Qikiytaaluk Enviromental 9935 Av de Catania, Entrance 1 , Suite 200 Brossard, QC J4X 3V4
Attention:	Ms. Greg Johnson
PO#:	RQ11-105
Invoice to:	Qikiytaaluk Enviromental

Report Number:	1410939
Date Submitted:	2014-06-09
Date Reported:	2014-06-16
Project:	QE14-214-2
COC #:	786120

Sample Comment Summary

Sample ID: 1109543	TP 170	F2-F4 MRL elevated due to matrix interference (dilution was done).
Sample ID: 1109544	TP 170-DT1	F2-F4 MRL elevated due to matrix interference (dilution was done).

Guideline = *** = Guideline Exceedence**

** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

786122

CHAIN OF CUSTODY

Exova Accutest

☐ 146 Colonnade Rd., Unit 8
Ottawa, ON K2E 7Y1
Ph: (613) 727-5692 Fax: (613) 727-5222

☐ 608 Norris Court
Kingston, ON K7P 2R9
Ph: (613) 634-9307 Fax: (613) 634-9308

☐ 380 Vansickle Rd., Unit 630
St. Catharines, ON L2R 6P7
Ph: (905) 680-8887 Fax: (905) 680-4256

LABORATORY USE ONLY
Report #: 410940

Company Name: Qikiqtaaluk Environmental Inc.	Address: 9935 ave de Catania, Entréee 1 bureau 200	☐ Fax Results to:
Report Attention: Greg Johnson	City/Prov: Brossard/QC Postal Code: J4Z 3V4	☑ E-mail Results to: gjohnson@qenv.ca
Phone: (514) 940-3332 Ext: 150	Project # QE14-214-2 * Quotation # 14-082-284694	☑ Copy of Results to: slaberge@qenv.ca
* Waterworks Name:	* Waterworks Number:	*Note that for drinking water samples, all exceedances will be reported where (and how) the applicable legislation requires.*

Invoice to:
(if different from above)

SAMPLE ANALYSIS REQUIRED

⇦ Indicate: F=Filtered or P=Preserved

Sample ID	* Date/Time Collected	Sample Matrix i.e. Water, Soil, Paint	* Sample Type (see Codes below)	* MOE Reportable? Y = Yes N = No	# of Containers	** Service Required R=Rush S=Standard	HAP PAH								Criteria Required (i.e. Reg. 170, Reg. 153, CCME, PWQO etc.) Include sub-categories if appropriate	Laboratory Identification
FOSSE 1-140605	2014/06/05	W			1	S	x								CCME	109553
FOSSE 2-140605	↓	↓			↓	↓	↓								↓	54
FOSSE 3-140605																55
FOSSE 4-140605																56
FOSSE 5-140605																57
FOSSE 6-140605																58
DT1-140605																59
R-140605																60

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
"MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By: Dusan/Martin	Date/Time: 2014/06/05	Relinquished By: Martin Lemay	Date/Time:	Comments	Cooler Temp (°C) on Receipt
Work Authorized By (signature):	Date/Time: 2014/06/05	Received By Lab:	Date/Time: June 8/14 1020		6

*** Indicates a required field.** If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided.
**** There may be surcharges applied to "Rush" service.** Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.

Page 1 of 1

AFCOCR.2

Copies: White - Laboratory, Yellow - With Report, Pink - Sampler
Please print and submit, to the laboratory, 2 copies of this form with your samples.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Qikiytaaluk Enviromental 9935 Av de Catania, Entrance 1 , Suite 200 Brossard, QC J4X 3V4
Attention:	Ms. Greg Johnson
PO#:	RQ11-105
Invoice to:	Qikiytaaluk Enviromental

Report Number:	1410940
Date Submitted:	2014-06-09
Date Reported:	2014-06-16
Project:	QE14-214-2
COC #:	786122

Dear Greg Johnson:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Charlie (Long) Qu
Laboratory Supervisor, Organics

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is accredited for specific parameters by:
SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410940
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786122

				Lab I.D.	1109553	1109554	1109555	1109556
				Sample Matrix	Water	Water	Water	Water
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	FOSSE 1 - 140605	FOSSE 2 - 140605	FOSSE 3 - 140605	FOSSE 4 - 140605
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
Semi-Volatiles	1-methylnaphthalene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	2-methylnaphthalene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Acenaphthene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Acenaphthylene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Anthracene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Benzo(a)anthracene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Benzo(a)pyrene	0.01	ug/L		<0.01	0.02	<0.01	<0.01
	Benzo(b)fluoranthene	0.05	ug/L		<0.05	<0.05	<0.05	<0.05
	Benzo(g,h,i)perylene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Benzo(k)fluoranthene	0.05	ug/L		<0.05	<0.05	<0.05	<0.05
	Chrysene	0.05	ug/L		<0.05	<0.05	<0.05	<0.05
	Dibenzo(a,h)anthracene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Fluoranthene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Fluorene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Indeno(1,2,3-c,d)pyrene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Naphthalene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Phenanthrene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Pyrene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410940
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786122

				Lab I.D.	1109557	1109558	1109559	1109560
				Sample Matrix	Water	Water	Water	Water
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	FOSSE 5 - 140605	FOSSE 6 - 140605	DT 1 - 140605	R - 140605
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
Semi-Volatiles	1-methylnaphthalene	0.1	ug/L		<0.1	<0.1	0.8	0.5
	2-methylnaphthalene	0.1	ug/L		<0.1	<0.1	1.1	0.7
	Acenaphthene	0.1	ug/L		0.2	<0.1	0.3	0.1
	Acenaphthylene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Anthracene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Benzo(a)anthracene	0.1	ug/L		<0.1	0.1	<0.1	<0.1
	Benzo(a)pyrene	0.01	ug/L		0.01	0.12	<0.01	<0.01
	Benzo(b)fluoranthene	0.05	ug/L		<0.05	0.10	<0.05	<0.05
	Benzo(g,h,i)perylene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Benzo(k)fluoranthene	0.05	ug/L		<0.05	0.10	<0.05	<0.05
	Chrysene	0.05	ug/L		<0.05	0.13	<0.05	<0.05
	Dibenzo(a,h)anthracene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Fluoranthene	0.1	ug/L		0.1	0.2	<0.1	<0.1
	Fluorene	0.1	ug/L		0.1	<0.1	0.4	0.4
	Indeno(1,2,3-c,d)pyrene	0.1	ug/L		<0.1	<0.1	<0.1	<0.1
	Naphthalene	0.1	ug/L		0.2	<0.1	<0.1	<0.1
	Phenanthrene	0.1	ug/L		0.2	0.2	0.5	0.5
	Pyrene	0.1	ug/L		<0.1	0.2	<0.1	<0.1

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EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410940
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786122

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 270808 **Analysis Date** 2014-06-11 **Method** P 8270			
1-methylnaphthalene	<0.1 ug/L	66	20-140
2-methylnaphthalene	<0.1 ug/L	66	20-140
Acenaphthene	<0.1 ug/L	68	20-140
Acenaphthylene	<0.1 ug/L	66	20-140
Anthracene	<0.1 ug/L	76	20-140
Benzo(a)anthracene	<0.1 ug/L	80	20-140
Benzo(a)pyrene	<0.01 ug/L	80	20-140
Benzo(b)fluoranthene	<0.05 ug/L	84	20-140
Benzo(g,h,i)perylene	<0.1 ug/L	82	20-140
Benzo(k)fluoranthene	<0.05 ug/L	83	20-140
Chrysene	<0.05 ug/L	77	20-140
Dibenzo(a,h)anthracene	<0.1 ug/L	84	20-140
Fluoranthene	<0.1 ug/L	86	20-140
Fluorene	<0.1 ug/L	72	20-140

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Certificate of Analysis

Exova

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9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410940
Date Submitted: 2014-06-09
Date Reported: 2014-06-16
Project: QE14-214-2
COC #: 786122

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Indeno(1,2,3-c,d)pyrene	<0.1 ug/L	82	20-140
Naphthalene	<0.1 ug/L	60	20-140
Phenanthrene	<0.1 ug/L	76	20-140
Pyrene	<0.1 ug/L	86	20-140

Guideline = *** = Guideline Exceedence**
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Methods references and/or additional QA/QC information available on request.

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786119

Exova Accutest

☐ 146 Colonnade Rd., Unit 8
Ottawa, ON K2E 7Y1
Ph: (613) 727-5692 Fax: (613) 727-5222

☐ 608 Norris Court
Kingston, ON K7P 2R9
Ph: (613) 634-9307 Fax: (613) 634-9308

☐ 380 Vansickle Rd., Unit 630
St. Catharines, ON L2R 6P7
Ph: (905) 680-8887 Fax: (905) 680-4256

LABORATORY USE ONLY
Report #: 1410937

Company Name: Qikiqtaaluk Environmental Inc.	Address: 9935 ave de Catania, Entrée 1 bureau 200	☐ Fax Results to:
Report Attention: Greg Johnson	City/Prov: Brossard/QC Postal Code: J4Z 3V4	☑ E-mail Results to: gjohnson@qenv.ca
Phone: (514) 940-3332 Ext: 150	Project # GE14-214-2 * Quotation #: 14-082-284694	☑ Copy of Results to: slaberge@qenv.ca
* Waterworks Name:	* Waterworks Number:	*Note that for drinking water samples, all exceedances will be reported where (and how) the applicable legislation requires.*

Invoice to:
(if different from above)

SAMPLE ANALYSIS REQUIRED — ⇦ Indicate: F=Filtered or P=Preserved

Sample ID	* Date/Time Collected	Sample Matrix i.e. Water, Soil, Paint	* Sample Type (see Codes below)	* MOE Reportable? Y = Yes N = No	# of Containers	** Service Required R=Rush S=Standard	HAP	ARSENIC	PHCs	PCBs (AES)					Criteria Required (i.e. Reg. 170, Reg. 153, CCME, PWQO etc.) Include sub-categories if appropriate	Laboratory Identification
TP 250	2014/06/05	S			2	S	X		X	X						1109525
TP 251					2		X		X	X						26
TP 252					2		X		X	X						27
TP 251-DT1					2		X		X	X						28
TP 250-DT1					2		X		X	X						29
TP 155					1			X								30
TP 156					1			X								31
TP 159					1			X								32
TP 160					1			X								33
TP 156-DT1					1			X								34

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
"MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By: Dusan/Martin	Date/Time: 2014/06/05	Relinquished By: Martin Lemay	Date/Time:	Comments
Work Authorized By (signature):	Date/Time: 2014/06/05	Received By Lab:	Date/Time: Aug/14 10:30	Cooler Temp (°C) on Receipt

*** Indicates a required field.** If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided.
**** There may be surcharges applied to "Rush" service.** Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.

Page 1 of 1

AFCOCR.2

Copies: White - Laboratory, Yellow - With Report, Pink - Sampler
Please print and submit, to the laboratory, 2 copies of this form with your samples.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client:	Qikiytaaluk Enviromental 9935 Av de Catania, Entrance 1 , Suite 200 Brossard, QC J4X 3V4
Attention:	Ms. Greg Johnson
PO#:	RQ11-105
Invoice to:	Qikiytaaluk Enviromental

Report Number:	1410937
Date Submitted:	2014-06-09
Date Reported:	2014-06-19
Project:	QE14-214-2
COC #:	786119

Dear Greg Johnson:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

Revised Report(PHC's and metals added as per client)

APPROVAL: _____

Lorna Wilson
Laboratory Supervisor, Inorganics

APPROVAL: _____

Charlie (Long) Qu
Laboratory Supervisor, Organics

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

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Guideline values listed on this report are provided for ease of use (informational purposes) only. Exova recommends consulting the official provincial or federal guideline as required.

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Qikiytaaluk Enviromental
9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
PO#: RQ11-105
Invoice to: Qikiytaaluk Enviromental

Report Number: 1410937
Date Submitted: 2014-06-09
Date Reported: 2014-06-19
Project: QE14-214-2
COC #: 786119

				Lab I.D.	1109525	1109526	1109527	1109528
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	TP 250	TP 251	TP 252	TP 251-DT1
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		7.0	12.0	8.3	12.0
Hydrocarbons	F1 (C6-C10)	10	ug/g		<10	<10	<10	
	F1-BTEX (C6-C10)	10	ug/g		<10	<10	<10	
	F2 (C10-C16)	10	ug/g		50	<10	20	
	F3 (C16-C34)	20	ug/g		60	<20	<20	
	F4 (C34-C50)	20	ug/g		100	<20	30	
Mercury	Hg	0.1	ug/g		<0.1	<0.1	<0.1	<0.1
Metals	Ag	0.2	ug/g		<0.2	<0.2	<0.2	<0.2
	As	1	ug/g		<1	<1	2	<1
	Ba	1	ug/g		40	27	29	34
	Cd	0.5	ug/g		<0.5	<0.5	<0.5	<0.5
	Co	1	ug/g		6	5	6	5
	Cr	1	ug/g		69	44	62	50
	Cu	1	ug/g		12	9	13	10
	Mn	1	ug/g		286	150	203	166
	Mo	1	ug/g		2	1	2	1
	Ni	1	ug/g		32	19	24	21
	Pb	1	ug/g		3	2	5	3
	Se	1	ug/g		<1	<1	<1	<1
	Sn	5	ug/g		<5	<5	<5	<5
	Zn	2	ug/g		40	28	39	30
Semi-Volatiles	1-methylnaphthalene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	2-methylnaphthalene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Acenaphthene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Acenaphthylene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Anthracene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05

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EXOVA OTTAWA

Certificate of Analysis

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9935 Av de Catania, Entrance 1 , Suite 200
Brossard, QC
J4X 3V4
Attention: Ms. Greg Johnson
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				Lab I.D.	1109525	1109526	1109527	1109528
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	TP 250	TP 251	TP 252	TP 251-DT1
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
Semi-Volatiles	Benzo(a)anthracene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Benzo(a)pyrene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Benzo(b)fluoranthene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Benzo(g,h,i)perylene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Benzo(k)fluoranthene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Chrysene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Dibenzo(a,h)anthracene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Fluoranthene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Fluorene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Indeno(1,2,3-c,d)pyrene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Naphthalene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Phenanthrene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Pyrene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
VOCs	Benzene	0.02	ug/g		<0.02	<0.02	<0.02	<0.02
	Ethylbenzene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	m/p-xylene	0.05	ug/g		0.07	0.06	0.06	0.07
	o-xylene	0.05	ug/g		<0.05	<0.05	<0.05	<0.05
	Toluene	0.20	ug/g		<0.20	<0.20	<0.20	<0.20
VOCs Surrogates (%	Toluene-d8	0	%		103	105	98	98

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EXOVA OTTAWA

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Exova

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Project: QE14-214-2
COC #: 786119

				Lab I.D.	1109529	1109530	1109531	1109532
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	TP 250-DT1	TP 155	TP 156	TP 159
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
General Chemistry	Moisture	0.1	%		6.6			
Mercury	Hg	0.1	ug/g		<0.1			
Metals	Ag	0.2	ug/g		<0.2			
	As	1	ug/g		<1	<1	<1	<1
	Ba	1	ug/g		45			
	Cd	0.5	ug/g		<0.5			
	Co	1	ug/g		8			
	Cr	1	ug/g		132			
	Cu	1	ug/g		19			
	Mn	1	ug/g		422			
	Mo	1	ug/g		3			
	Ni	1	ug/g		61			
	Pb	1	ug/g		5			
	Se	1	ug/g		<1			
	Sn	5	ug/g		<5			
	Zn	2	ug/g		52			
Semi-Volatiles	1-methylnaphthalene	0.05	ug/g		<0.05			
	2-methylnaphthalene	0.05	ug/g		<0.05			
	Acenaphthene	0.05	ug/g		<0.05			
	Acenaphthylene	0.05	ug/g		<0.05			
	Anthracene	0.05	ug/g		<0.05			
	Benzo(a)anthracene	0.05	ug/g		<0.05			
	Benzo(a)pyrene	0.05	ug/g		<0.05			
	Benzo(b)fluoranthene	0.05	ug/g		<0.05			
	Benzo(g,h,i)perylene	0.05	ug/g		<0.05			
	Benzo(k)fluoranthene	0.05	ug/g		<0.05			

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EXOVA OTTAWA

Certificate of Analysis

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J4X 3V4
Attention: Ms. Greg Johnson
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Report Number: 1410937
Date Submitted: 2014-06-09
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Project: QE14-214-2
COC #: 786119

				Lab I.D.	1109529	1109530	1109531	1109532
				Sample Matrix	Soil	Soil	Soil	Soil
				Sample Type				
				Sampling Date	2014-06-05	2014-06-05	2014-06-05	2014-06-05
				Sample I.D.	TP 250-DT1	TP 155	TP 156	TP 159
Group	**Analyte**	**MRL**	**Units**	**Guideline**				
Semi-Volatiles	Chrysene	0.05	ug/g		<0.05			
	Dibenzo(a,h)anthracene	0.05	ug/g		<0.05			
	Fluoranthene	0.05	ug/g		<0.05			
	Fluorene	0.05	ug/g		<0.05			
	Indeno(1,2,3-c,d)pyrene	0.05	ug/g		<0.05			
	Naphthalene	0.05	ug/g		<0.05			
	Phenanthrene	0.05	ug/g		<0.05			
	Pyrene	0.05	ug/g		<0.05			
VOCs	Benzene	0.02	ug/g		<0.02			
	Ethylbenzene	0.05	ug/g		<0.05			
	m/p-xylene	0.05	ug/g		0.07			
	o-xylene	0.05	ug/g		<0.05			
	Toluene	0.20	ug/g		<0.20			
VOCs Surrogates (%	Toluene-d8	0	%		102			

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EXOVA OTTAWA

Certificate of Analysis

Exova

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				Lab I.D.	1109533	1109534
				Sample Matrix	Soil	Soil
				Sample Type		
				Sampling Date	2014-06-05	2014-06-05
				Sample I.D.	TP 160	TP 156-DT1
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
Metals	As	1	ug/g		<1	<1

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 270768 **Analysis Date** 2014-06-11 **Method** EPA 200.8			
As	<1 ug/g	101	70-130
Run No 270809 **Analysis Date** 2014-06-12 **Method** P 8270			
1-methylnaphthalene	<0.05 ug/g	88	20-150
2-methylnaphthalene	<0.05 ug/g	85	20-150
Acenaphthene	<0.05 ug/g	86	20-150
Acenaphthylene	<0.05 ug/g	87	20-150
Anthracene	<0.05 ug/g	95	20-150
Benzo(a)anthracene	<0.05 ug/g	102	20-150
Benzo(a)pyrene	<0.05 ug/g	102	20-150
Benzo(b)fluoranthene	<0.05 ug/g	99	20-150
Benzo(g,h,i)perylene	<0.05 ug/g	108	20-150
Benzo(k)fluoranthene	<0.05 ug/g	99	20-150
Chrysene	<0.05 ug/g	97	20-150
Dibenzo(a,h)anthracene	<0.05 ug/g	101	20-150

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Fluoranthene	<0.05 ug/g	102	20-150
Fluorene	<0.05 ug/g	89	20-150
Indeno(1,2,3-c,d)pyrene	<0.05 ug/g	98	20-150
Naphthalene	<0.05 ug/g	80	20-150
Phenanthrene	<0.05 ug/g	94	20-150
Pyrene	<0.05 ug/g	104	20-150
Run No 270856 **Analysis Date** 2014-06-10 **Method** V 8260B			
Benzene	<0.02 ug/g	80	80-120
Ethylbenzene	<0.05 ug/g	109	80-120
m/p-xylene	<0.05 ug/g	110	80-120
o-xylene	<0.05 ug/g	109	80-120
Toluene	<0.20 ug/g	114	80-120
Toluene-d8	103 %	103	
Run No 270857 **Analysis Date** 2014-06-12 **Method** C SM2540B			
Moisture	<0.1 %	100	80-120
Run No 271062 **Analysis Date** 2014-06-17 **Method** CCME			
F1 (C6-C10)	<10 ug/g	93	80-120

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QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 271075 **Analysis Date** 2014-06-17 **Method** CCME			
F1-BTEX (C6-C10)			
Run No 271140 **Analysis Date** 2014-06-18 **Method** M SM3112B-3500B			
Hg	<0.1 ug/g	102	70-130
Run No 271157 **Analysis Date** 2014-06-18 **Method** EPA 200.8			
Ag	<0.2 ug/g	90	70-130
As	<1 ug/g	95	70-130
Ba	<1 ug/g	100	70-130
Cd	<0.5 ug/g	91	70-130
Co	<1 ug/g	93	70-130
Cr	<1 ug/g	93	70-130
Cu	<1 ug/g	96	70-130
Mn	<1 ug/g	94	70-130
Mo	<1 ug/g	97	70-130
Ni	<1 ug/g	94	70-130
Pb	<1 ug/g	95	70-130
Se	<1 ug/g	95	70-130

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July 16, 2014 **Transmission via email**

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Ref. No.: RQ14-214-3

Re: Addendum to Phase III Report Following Additional Sampling for Chromium Contamination

Mr. Lécureur,

During the Phase III work at the Iqaluit International Airport (the airport). An area where the Taxiway G is to be constructed (Test Pit -250) did not respect the Nunavut and the Canadian Council of Ministers of Environment (CCME) Guideline value for chromium contamination. Additional sampling was done to fully delimit the contamination in the footprint of Taxiway G. This report presents the results of the sampling.

1. Test Pits

The fieldwork included the excavation of the 22 test pits as shown in the attached figure1. Test pit logs are available upon request.
All test pits were excavated using a Caterpillar 325 Excavator operated by Tower Arctic Ltd. Test pits were excavated up to 1 m below the ground surface.

The test pits were backfilled with the excavated material with care taken to respect the stratigraphy encountered. The backfilled materials were loosely compacted using the bucket of the excavator.

2. Soil Sampling

Soil sampling was conducted in accordance with the procedures described in the *Guide d'échantillonnage, Cahier 5*[1] with the only exception being that samples were collected over approximately 1 m starting at a depth of 1 m below the ground surface. Soils were described according to unified classification ASTM D22487 and their organoleptic characteristics (visual and olfactory) were recorded. Samples collected were also tested with a PID to determine if any contamination could be detected in the field to assist with delineating the contamination.

Composite samples were collected from the pile of soil excavated from the test pit, while respecting the individual strata (with no overlap of an individual sample between 2 separate strata). Samples were collected in Ziploc bags and transferred to jars as soon as possible following the collection of the sample. Technicians wore latex gloves and changed their gloves between each test pit. A new Ziploc bag was used for each sample.

1. *Guide d'échantillonnage à des fins d'analyses environnementales*, ministère du Développement durable, de l'Environnement et des Parcs du Québec, 2008. Cahier 5 : *Échantillonnage des sols,* revised 2010.

3. Cleaning of Sampling and Measuring Instruments

Since new disposable equipment was used for each sample, no cleaning of sampling equipment was required.

4. Sample Containers and Sample Conservation

All samples collected were placed in containers (jars and bottles) provided by an analytical laboratory. All samples were labeled and stored in coolers with ice packs also provided by the laboratory in order to maintain them at a temperature of approximately 4°C until delivery to the laboratory. Samples were stored overnight in a walk-in cooler located at QE's hazardous waste transfer centre. They were brought the next morning to First Air Cargo for transport to Ottawa where they were collected by Exova. First Air had instructions to keep the cooler containing the samples in a cooler during transport but not to allow the cooler to freeze.

Finally, container types, conservation and transport methods for samples were selected in accordance with the requirements of the laboratory.

5. Laboratory Analyses

5.1. Analytical Program

The analytical program of the Complementary Characterization was based on the Chromium contamination found in TP-250, thus, all samples were only analyzed for Chromium.

Soil samples collected during the characterization work were delivered to the analytical laboratory as promptly as possible. The analytical laboratory chosen was accredited by The Canadian Association for Laboratory Accreditation Inc. for all the analyses performed. Certificates of accreditation are available upon request. Furthermore, the analytical reports received are verified and signed by a member of the Association of the Chemical Profession of Ontario.

The samples selected were analyzed using the Canadian Council of Ministers of the Environment (CCME) prescribed method. The detection limits associated with each parameter analyzed is presented in Table 1.

TABLE 1 : Analytical Program and Detection Methods

Matrix	Analysis	Method	Detection Limit	
Soil	Total Chromium	CCME	1	µg/g
Soil	Hexavalent Chromium	CCME	0.5	µg/g

A total of 24 soil samples (including 2 field duplicates) were selected for laboratory analysis for total chromium. Two samples were selected for analysis for Hexavalent Chromium.

5.2. QA/QC program

All projects completed by QE include a QA/QC program in order to verify the reliability, precision and accuracy of the fieldwork analytical results.

5.2.1. *Onsite*

Several precautions were taken during the course of the fieldwork in order to eliminate the risk of contamination from equipment and sampling instruments and to ensure effective and representative sampling. The precautions taken, particularly during collection, transport, identification and conservation of samples included:

- Application of standardized work procedures through ongoing training of field technicians on the various standardized methods of sample collection and management;
- Constant supervision of employees by management;
- Calibration of each measurement instrument according to manufacturer specifications both before and during field work;
- Use of disposable nitrile gloves for each sample collected;
- Adequate cleaning of equipment, containers and sampling instruments before collecting each sample;
- Careful use and protection of the appropriate sampling containers and measuring instruments during sample collection, transport and conservation;
- Precise identification and labeling of all samples shipped to the laboratory accompanied by a completed and signed chain of custody form;
- Shipping of samples to the laboratory as promptly as possible, within 24 hours of collection, where possible;
- Conservation and storage of samples according to the standardized methods and best practices.
- Duplicates of samples were taken to confirm the validity of the laboratory results.

Soil samples TP 208 and TP 218 were duplicated to form the respective duplicates TP 208-D and TP 218-D. The preparation of field duplicates allows the reproducibility and the degree of homogeneity of samples collected to be verified.

No field blanks were used during the soil sampling because no significant external sources of contamination (dust, atmospheric emissions, VOCs etc.) were identified on the Site in the vicinity of the sampling locations. No trip blanks were used as all samples were conserved in hermetically sealed containers during their transport between the Site and the laboratory.

5.2.2. At the Laboratory

Exova applies its own QA/QC in accordance with the requirements of The Canadian Association for Laboratory Accreditation Inc. in order to provide analytical results of the highest possible quality and reliability. This program includes, among others, the following elements:

- Laboratory blank;
- Laboratory duplicate;
- Control/reference samples;
- Certified reference materials;
- Sample spiking;
- Surrogates (organics).

A summary of the laboratory's internal QA/QC program is available upon request.

6. Results

The results of the laboratory chemical analysis of the soil samples are presented in Table 2 and as well as in the analytical certificates attached. Numbers in bold did not respect the criteria.

TABLE 2: Analytical Results for Total Chromium

Test Pit Number	Criteria (mg/Kg)	Result (mg/Kg)
TP 200	87	**114**
TP 201		76
TP 202		70
TP 203		**133**
TP 204		**102**
TP 205		**153**
TP 206		54
TP 207		**170**
TP 208		70
TP 209		**102**
TP 210		**190**
TP 211		**155**
TP 212		**138**
TP 213		**96**
TP 214		**137**
TP 215		**141**
TP 216		**138**
TP 217		**147**
TP 218		**159**
TP 219		**129**
TP 220		71
TP 223		78
TP 208-D		75
TP 218-D		**146**

TABLE 3: Analytical Results for Hexavalent Chromium

Test Pit Number	Criteria (mg/Kg)	Result (mg/Kg)
TP 207	1.4	<0.5
TP 218		<0.5

The analytical results were compared to the CCME's Soil Quality Guidelines for the Protection of Environmental and Human Health and the Government of Nunavut's Department of Environment's Environmental Guideline for Contaminated Site Remediation quality criteria for commercial & industrial land use coarse-grained soil.

The location of the sampling points is presented in the attached figure 1.

7. Onsite

Two field duplicate soil samples (representing approximately 10% of the original samples analyzed) were collected during the environmental characterization work. These field duplicates were analyzed for the same parameters as their parent-samples.

An assessment of the analytical results of the quality control program revealed that the concentrations obtained for the field duplicates and their parent-samples are identical and below the analytical detection limit. Therefore, the results are situated within the *MDDEFP* recommended confidence interval (relative percent difference (RPD) <30%). These results demonstrate the quality of the sample collections carried out onsite.

8. Laboratory

The results of EXOVA's internal control measures are also considered to be acceptable and fall within the suggested RPD for all analyses performed (laboratory blanks, laboratory duplicates, control/reference samples, certified reference materials, sample spiking and surrogates (organics)).

The results are presented in the laboratory's analytical certificates are attached to this letter.

9. Data Interpretation

The results show that chromium contamination can be found throughout the area sampled under the foot print of Taxiway G. There was no hexavalent chromium detected in the two samples that were analysed, which suggests that the contamination is from a natural source rather than from industrial activities. Figure 2 attached to this letter shows the area where contaminated soil needs to be managed.

10. Discussion

The area where the chromium contamination was found is an area that was backfilled to make a pad to park heavy equipment and machinery. The material was imported from another source, but that source was not able to be determined. Given the relatively low levels of contamination, it is recommended that the Government of Nunavut's Environmental Protection Division be contacted to see if these soils can be managed using a risk analysis approach to see these soils can safely used as backfill under a structure.

The area of the contaminated soil covers an area of 7,214 m^2. Contamination was measure down to a 1 m depth, thus, there is 7,214 m^3 of contaminated soil to be managed in the foot print of the Taxiway G

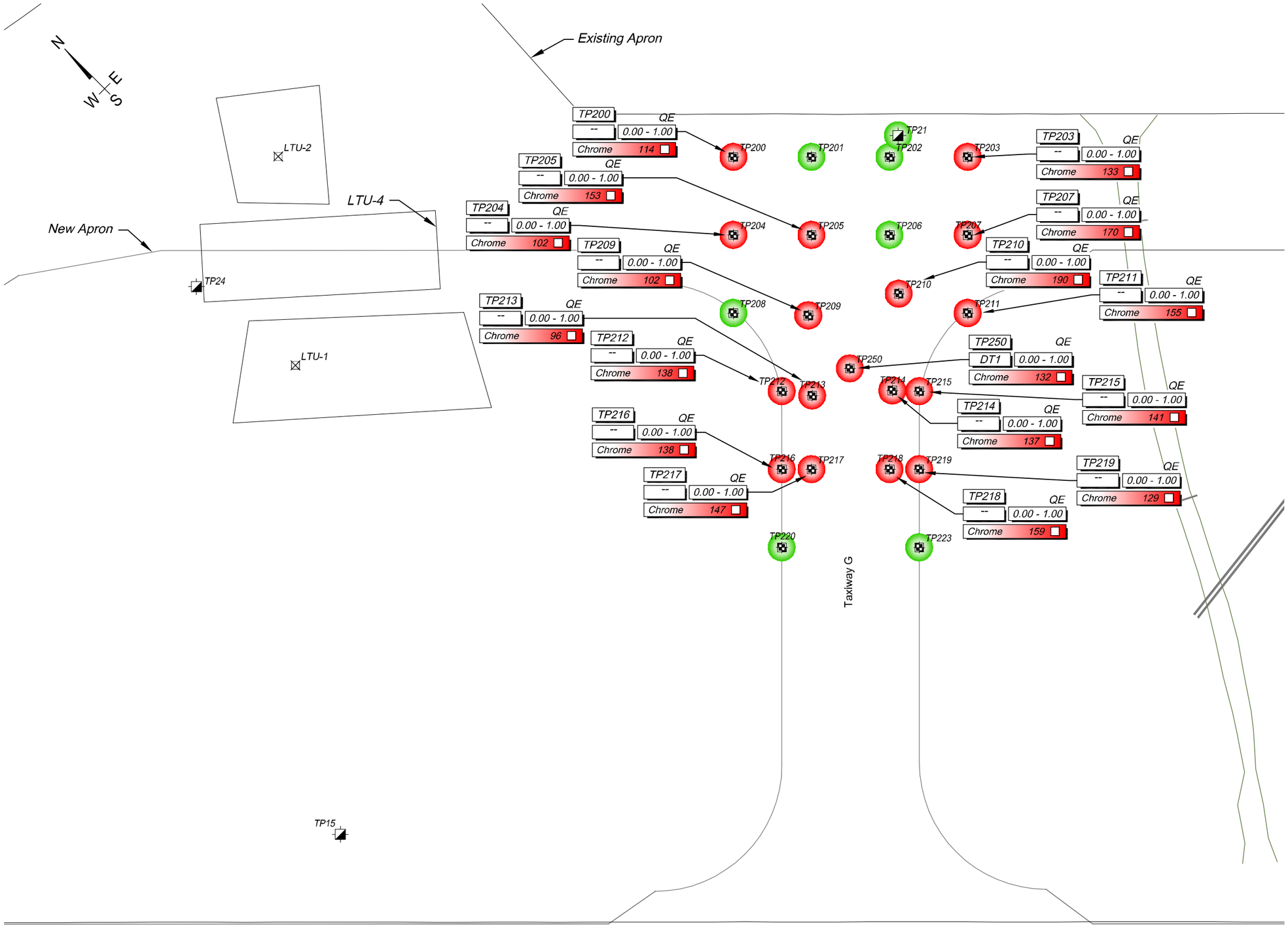
We trust this report will meet all your expectations. Please do not hesitate to contact us if you have any questions.

Sincerely,

Greg Johnson
Project Director
Email: gjohnson@qenv.ca
Tel: (514) 940-3332 x 150
Fax: (514) 940-3332

Attch: Figure showing location of test pits (1 page)
Figure showing area to be excavated (1 page)
Analytical results (13 pages)

Cc:



This document shall not be used for construction, building or installation purposes.

Legend

- TP150 — Test pit (Sanexen, June 2014)
- TP15 — Test pit (CRA, January 2014)
- LTU-1 — Land treatment unit location

Results box (soils)

Sample identification
Sample depth (m)
TP203 -- QE 0.00 - 1.00 Chrome 133
QE ← Company
Classification code
Analytical result (mg/kg)
Parameter

Code de classification

Concentrations exceeding the Canadian Environmental Quality Guidelines of the CCME

Environmental Classification of Soil Quality

The analytical parameter and result presented, which determine the concentration code, are the highest of the parameters measured, with respect to individual criteria and limit values. See the table of analytical results for other parameter values.

Concentration Codes

- Concentrations below the Canadian Environmental Quality Guidelines of the CCME
- Concentrations exceeding the Canadian Environmental Quality Guidelines of the CCME

CCME: Canadian Council of Ministers of the Environment

Source :
- *QE; the works were located by survey data (GPS); June 3-6;*
- *CRA; Figure 3, January 2014;*
- *Sintra Existing Airport Layout; June 2014.*

0.0 12.5 25.0 37.5 50.0 62.5m

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Figure 1

Soils Analytical Results

PHASE III IQALUIT AIRPORT

Presented to:

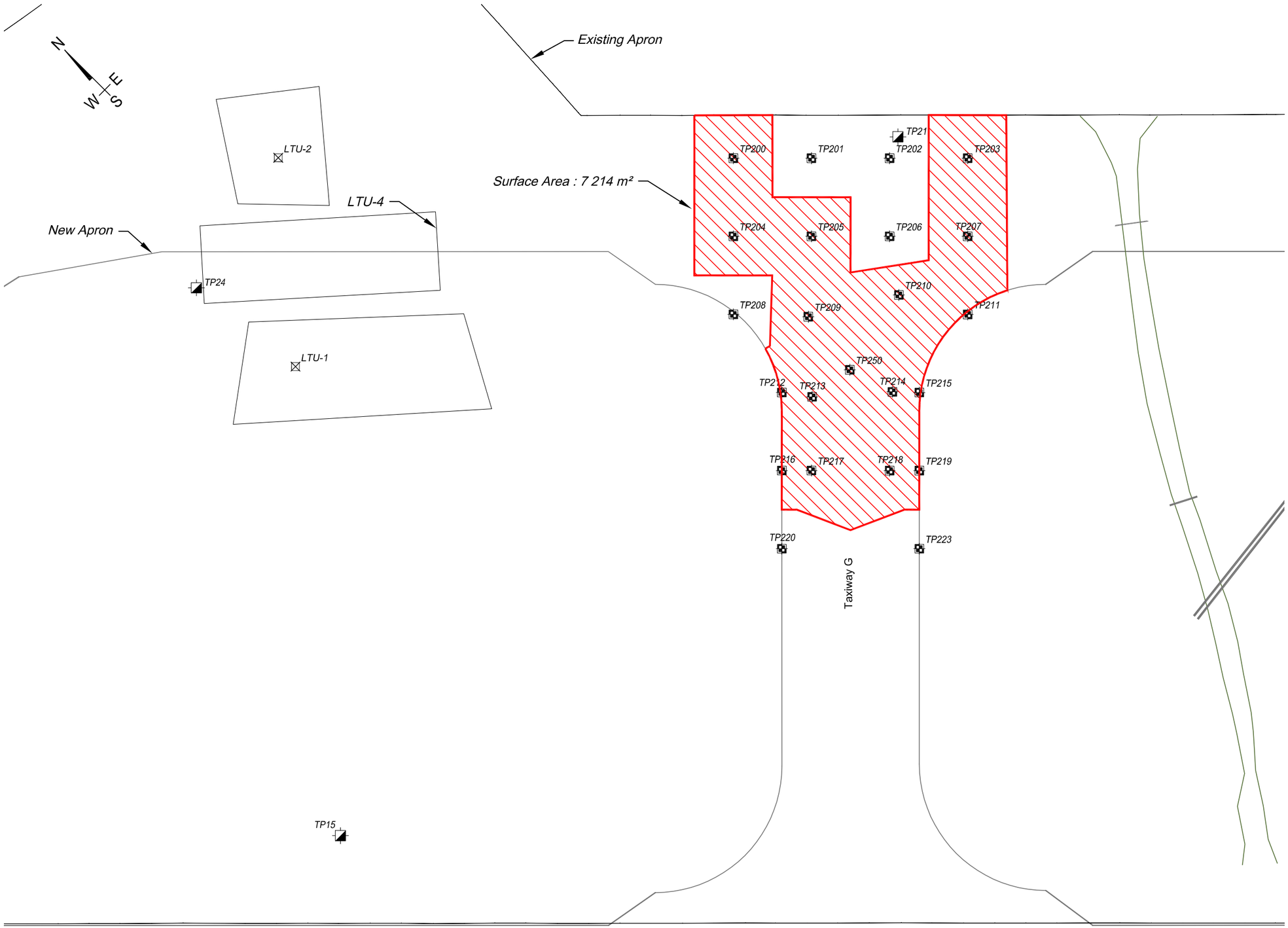
Arctic Infrastructure Partners

Property located at:

Iqaluit Airport, Nunavut

Scale:	Design date:	Revision date:
As shown	2014-06-17	2014-07-17
Drawn by: J. Bergeron	Verified by: G. Johnson	Approved by: S. Laberge
Project no.: QE14-214-3	Drawing no.: QE14-214-3-01 / Layout: A	Geodetic reference: MTM/NAD83 Zone 19

Qikiqtaaluk environmental



This document shall not be used for construction, building or installation purposes.

Legend

- Area to be excavated
- TP150 Test pit (Sanexen, June 2014)
- TP15 Test pit (CRA, January 2014)
- LTU-1 Land treatment unit location

Source :
- QE; the works were located by survey data (GPS); June 3-6;
- CRA; Figure 3, January 2014;
- Sintra Existing Airport Layout; June 2014.

0.0 12.5 25.0 37.5 50.0 62.5m

CONFIDENTIAL

Figure 2

Contaminated Areas to be Excavated

PHASE III IQALUIT AIRPORT

Presented to:

Arctic Infrastructure Partners

Property located at:

Iqaluit Airport, Nunavut

Scale: As shown	Design date: 2014-06-17		Revision date: 2014-07-17
Drawn by: J. Bergeron	Verified by: G. Johnson		Approved by: S. Laberge
Project no.: QE14-214-3	Drawing no.: QE14-214-3-01	Layout: B	Geodetic reference: MTM/NAD83 Zone 19

Qikiqtaaluk environmental