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2017 ENVIRONMENTAL MONITORING PROGRAM

Resolute Bay Airport Land Treatment Units

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Resolute Bay Airport Land Treatment Units

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EXECUTIVE SUMMARY

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (PSPC) on behalf of Transport Canada (TC) to conduct an Environmental Monitoring Program at the Resolute Bay Airport Land Treatment Units (LTUs) in Resolute Bay, NU. The monitoring program was undertaken to meet Nunavut Water Board (NWB) License No. 1BR-RLF1520 requirements. The site activities were conducted under PSPC Project Number R.086448.001, Northern Standing Offer Contract EW699/141143/001/NCS.

The Resolute Bay Airport LTUs (identified as LTU 1 and LTU 2) were constructed in 2002 as part of the remediation of a former firefighter training area. The volume of soil in the LTUs has been reported to be 5,800 m^3.

In 2015, TC was granted NWB Licence No. 1BR-RLF1520 for the operation, maintenance and eventual decommissioning of the LTUs. The licence stipulates sampling, reporting, water use, waste, and other requirements for the operation of the LTUs.

The objectives of this 2017 Environmental Monitoring Program were to: visually assess the condition of the groundwater monitoring well network; complete a groundwater monitoring and sampling program to assess for dissolved chemicals of concern in groundwater as required by NWB License No. 1BR-RLF1520; and, visually assess the integrity of the LTU 1 and LTU 2 liners.

Arcadis conducted the field work from July 22 to 29, 2017. All six monitoring wells were inspected and their condition recorded. Five of the wells were observed to be in fair to poor condition, with only MW-1 observed to be in good condition. MW-2, MW-3 and MW-4 were dry and the groundwater in MW-5 and MW-6 was frozen. Only MW-1 had groundwater that could be collected and analyzed. Additionally, MW-4 and MW-6 were observed to be screened above the ground surface therefore any results from groundwater sampling would be considered unreliable, due to potential surface water infiltration, even if water samples could have been collected from them.

As one objective of this Environmental Monitoring Program was to fulfill the requirements of the NWB License, in their current condition, the monitoring wells did not allow the achievement of these requirements. Therefore, while on-site, and after discussions with PSPC/TC, the only other similar media that could be collected to partly satisfy the NWB License requirements was ponded water located adjacent to the LTUs. Therefore, surface water samples were collected from the ponded water areas north of LTU 1; west of LTU 2; south of LTU 2; and a background sample from an area 160 metres south of the site.

The one groundwater sample and four surface water samples were analyzed for the parameters listed in NWB License No. 1BR-RLF1520, which included Total Suspended Solids, Total Hardness, Conductivity, Ammonia Nitrogen, pH, Total Alkalinity, Nitrate-Nitrite, Chloride, Total Phenols, Oil and Grease, Calcium, Sodium, Chloride, Magnesium, Potassium, Sulphate, Total Metals content, Petroleum Hydrocarbons (PHCs), Polycyclic Aromatic Hydrocarbons (PAHs), and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX). These results were compared to the Effluent Quality Limits, also listed in NWB License No. 1BR-RLF1520 as well as the CCME CWQG-PAL guidelines.

The analytical results from MW-1 that exceeded guidelines were:

- Toluene concentration exceeded the NWB License Effluent Quality Limits and CCME CWQG-PAL guideline of 2.0 µg/L at a measured concentration of 3.0 µg/L; and,
- The following Metals exceeded the CCME CWQG-PAL guidelines:
  - Total Cadmium (guideline of 0.09 µg/L vs measured concentration of 2.37 µg/L),
  - Total Chromium (guideline of 1 µg/L vs. measured concentration of 16 µg/L),
  - Total Iron (guideline of 300 vs. measured concentration of 9990 µg/L),
  - Total Silver (guideline of 0.25 µg/L vs. measured concentration of 0.50 µg/L), and
  - Total Zinc (guideline of 30 µg/L vs measured concentration of 297 µg/L).

With only one exception (SW-B), none of the analytical results from the four surface water samples exceeded either the NWB License No. 1BR-RLF1520 Effluent Quality Limits or the CCME CWQG-PAL guidelines. The background surface water sample, SW-B, contained a concentration of phenols slightly above the CCME CWQG-PAL guideline of 0.004 mg/L at 0.0056 mg/L. Due to the location of this sample, this exceedance is not suspected of being related to the operation of LTU 1 or LTU 2 but from other airport operations. As well, the majority of PHC and PAH concentrations were below the laboratory reportable detection limit, with the exception of o-xylene in sample SW-2, which had a concentration of 0.71 µg/L (there is no NWB License No. 1BR-RLF1520 Effluent Quality Limit or the CCME CWQG-PAL guideline for o-xylene or Total Xylenes).

During the site visit, Arcadis also assessed, where possible, the integrity of the liners of each LTU. Small rips and tears in the liners covering the bermed areas were observed at numerous locations. In particular, the liner on the southern berm of LTU 2 (downgradient side of the LTU) showed several large tears/rips. As well, a significant portion of the south-western berm of LTU 2 appears to have been eroded and is very low.

A significant observation was also made during the July 2017 site visit. The ponded water located outside the south end of LTU 2 was surrounded by green vegetation (e.g. moss, small grass tufts), which was not observed in any other areas around the LTUs at the time of the 2017 site visit. The other areas surrounding the LTUs were predominantly brown silt mixed with rock and stones. Based on the review of previous environmental reports, in 2002 and 2003, nutrients (quantity unknown) were mixed with the soils in LTU 1 and LTU 2 to enhance the microbial activity of the bioremediation process. If the presence of this green vegetation is related to the application of fertilizers, this may suggest that the integrity of the LTU 2 liner is compromised and the nutrients applied to the soil in 2002 and 2003 are being leached to this area outside LTU 2.

Based on the results from the 2017 Environmental Monitoring Program, Arcadis recommends the following future work at the Resolute Bay Airport LTUs:

1. Groundwater monitoring is required as part of the NWB License requirements. However, with only one exception, liquid groundwater could not be sampled during either the 2015, 2016 or 2017 monitoring programs, even though these site visits were conducted during the warmest time periods experienced at Resolute Bay.

   Resolute Bay is subject to continuous permafrost and based on temperature data obtained from Environment and Climate Change Canada, the warmest (maximum) air temperature recorded annually in Resolute Bay is during the month of July at 6.8˚C. Without going to extreme measures, the probability of collecting liquid groundwater, even from properly installed monitoring wells, in this area is assessed to be very low.

   Consequently, Arcadis recommends that TC contact the NWB to have the groundwater monitoring requirement waived because collection of groundwater is not possible due to permafrost.

2. It is also recommended that a Preliminary Quantitative Risk Assessment (PQRA) be conducted to assess any potential risk to human and ecological assessors. The results from the PQRA may also further support the revision of the NWB conditions recommended above.

3. Monitoring wells MW-4 and MW-6 were observed to be screened above the ground surface. Therefore, any analytical results from groundwater collected from these wells would be considered unreliable due to potential surface water infiltration. It is recommended that these two wells be properly decommissioned.

4. The green vegetation (e.g. moss, small grass tufts) observed south of LTU 2, may be related to the discharge of nutrients from LTU 2. It is recommended that this be confirmed by sampling the ponded water in LTU 2 and the ponded water in the area south of LTU 2, analyzing these samples for nutrients and perfluoronated compounds (PFCs), and comparing the results.

5. The southwest portion of the berm of LTU 2 should be built up where it has eroded.

6. All tears and rips located in the liners should be repaired and the berms covered by overburden.

1 INTRODUCTION

Arcadis Canada Inc. (Arcadis) was retained by Public Services and Procurement Canada (PSPC) on behalf of Transport Canada (TC) to conduct an Environmental Monitoring Program at the Resolute Bay Airport Land Treatment Units (LTUs) in Resolute Bay, NU. The monitoring program was undertaken to meet Nunavut Water Board (NWB) License No. 1BR-RLF1520 requirements. The site activities were conducted under PSPC Project No. R.086448.001.

This report is submitted under PSPC Northern Standing Offer Contract EW699/141143/001/NCS, Purchase Order No. 700360610 and conducted in according with the Terms of Reference (ToR) entitled, "*TOR, Environmental Monitoring Services, Resolute Bay Airport FTA LTU, Nunavut*" and the Arcadis proposal entitled, "*Proposal for Resolute Bay Airport Land Treatment Units Environmental Monitoring, 2017*" dated, August 9, 2017.

2 BACKGROUND INFORMATION

The Resolute Bay Airport is located five kilometres northwest of the Inuit hamlet of Resolute, on Cornwallis Island in the Qikiqtaaluk Region of Nunavut, as shown on **Figure 1**. The airport was constructed by the Royal Canadian Air Force in 1949. From 1964 to July 1, 1995, the airport was owned by the Government of Canada and operated by Transport Canada (TC). From July 1, 1995 until April 1, 1999, the airport was owned by the Government of Northwest Territories (GNWT) and operated by the Arctic Airports Division of the Department of Transportation. Since April 1, 1999, the airport has been owned by the Government of Nunavut (GN) and operated by the Nunavut Airports Division of the Nunavut Department of Community Government, Housing and Transportation (TC, 2012).

As a condition of the 1995 transfer agreement between GNWT and TC, the environmental issues which existed prior to the airport transfer were to be remediated. The main environmental issue identified was the former firefighter training area (FFTA) that had been located north of the airport. In 2002, Winnipeg Environmental Remediation Inc. (WERI) conducted demolition and remediation activities at the FFTA to bring the Resolute Bay Airport into compliance with environmental legislation. Remediation of the FFTA and associated confirmatory soil sampling was completed between 2002 and 2005. Contaminated soils were excavated from the FFTA and placed in two LTUs (LTU 1 and LTU 2) constructed by WERI.

There are reportedly approximately 5,800 m^3 of contaminated soil in the two LTUs. LTU 1 has external dimensions of 70 metres (m) x 40 m and is divided into three zones. It is reported that Zones 1 and 2 (western half of LTU 1) contain soils contaminated with heavier hydrocarbons while Zone 3 (eastern half) contains soils contaminated with lighter hydrocarbons. LTU 2 has external dimensions of 80 m x 30 m. LTU 2 contains soils contaminated with lighter hydrocarbons and was not subdivided into zones.

In 2002 and 2003, nutrients (quantity unknown) were mixed with the soils in LTU 1 and LTU 2 to enhance the microbial activity of the bioremediation process. Additionally, in 2004, a ground heating system was installed in LTU 2 to further enhance the bioremediation process in an attempt to provide an optimum temperature for microbial growth, but the system only operated once in 2004.

Between 2002 and 2005, soil sampling was completed annually to assess if the hydrocarbon contaminant levels were being reduced.

Two smaller LTUs are also present in the area (LTU 3 and LTU 4); however, no background information on the source of the contents or construction of the LTUs is available. TC has indicated that it is not the custodian of these smaller LTUs. Arcadis was not able to obtain any additional information regarding these LTUs while in Resolute Bay in 2015, 2016 or 2017.

In 2015, TC was granted Licence No. 1BR-RLF1520 by the Nunavut Water Board (NWB) for the operation, maintenance and eventual decommissioning of LTU 1 and LTU 2. The licence stipulates sampling, reporting, water use, waste, and other requirements for the operation of the LTUs. The licence does not include requirements for LTU 3 or LTU 4.

In 2015, Arcadis was retained by PSPC to collect soil samples from LTU 1 and LTU 2 and have them analyzed for petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), metals and perfluorinated compounds (PFCs). The analytical results confirmed that PHCs and PFCs exceeded the applicable federal guidelines in soil. Groundwater was frozen at the time of the 2015 site visit and, as a result, no samples were collected from the six on-site monitoring wells. As well, PSPC attempted to retain a contractor to remove the heating infrastructure and till the soil in LTU 1 and LTU 2, but no bids were received, therefore, these activities have never been completed.

In 2016, Arcadis was retained by PSPC to complete an environmental monitoring program to assess groundwater for dissolved chemicals of concern to meet NWB License No. 1BR-RLF1520 requirements; evaluate the integrity of the liners of LTU 1 and LTU 2; assess the condition of the existing groundwater monitoring well network; and, attach labels with tri-lingual signage (English, French, and Inuktitut) to the monitoring wells in accordance with Section 3 of the NWB licence.

During the 2016 site visit, the six monitoring wells were inspected and observed to be in good condition. However, three of the wells were dry and the remaining three wells had insufficient volumes of water to sample, thereby preventing analysis of the groundwater at the site for the dissolved chemicals of concern listed in the NWB license. The liners of both LTU 1 and LTU 2 were found to be in good condition with only minor degradation of the exposed portion at the northwest corner of LTU 1. It was concluded that the LTUs were containing the soils as designed. Lastly, Arcadis appended tri-lingual signage to each well.

3 OBJECTIVES

The objectives of the 2017 Environmental Monitoring Program, as outlined in the ToR, were to:

1. Visually assess the condition of the monitoring well network;
2. Complete a groundwater monitoring and sampling program at the site to assess groundwater for dissolved chemicals of concern to meet NWB License No. 1BR-RLF1520 requirements; and,
3. Visually assess the integrity of the LTU 1 and LTU 2 liners.

4 REGULATORY GUIDELINES

Analytical results from the water samples collected were evaluated against the NWB License No. 1BR-RLF1520, Part D, Effluent Quality Limits, as well as, the Canadian Council of Ministers of the Environment (CCME) *Canadian Water Quality Guidelines* (CWQG).

The *Canadian Environmental Quality Guidelines* were first introduced in 1987, with the creation of the CWQG which were the first nationally endorsed, science-based guidelines developed collaboratively by federal, provincial and territorial governments. Since that time, the CCME has developed guidelines for community water supplies, recreational water quality, water quality (for the protection of aquatic life, and agricultural uses), sediment quality, soil quality, and tissue residue. As groundwater is not used as a source of potable water on-site or in the area of the Resolute Bay Airport, the analytical results were compared to the CCME CWQG for Protection of Aquatic Life (PAL) (freshwater and marine). The CCME CWQG-PAL are intended to protect freshwater and marine life from anthropogenic stressors such as chemical inputs or changes to physical conditions.

5 INVESTIGATION METHODOLOGY

The following sections outline the investigation methodology implemented during 2017 field program to satisfy the project objectives.

5.1 Health and Safety Plan

Arcadis prepared a site-specific health and safety plan (HASP) prior to the monitoring program. The HASP included the documentation of all foreseeable work hazards and mitigative actions. It also contained a listing of emergency contact numbers and provided protocols to follow in the event of an incident. Arcadis ensured that the HASP was thoroughly reviewed and communicated to site personnel ensuring that they were aware of the contaminants of concern, associated precautions, and required personal protective equipment.

A health and safety kick-off meeting and daily tailgate meetings, including task specific job safety analyses, were conducted to inform on-site personnel of the potential risks and appropriate safety controls. The HASP has been retained on file by Arcadis.

5.2 Groundwater Monitoring Well Network Assessment

The groundwater monitoring well network is comprised of six monitoring wells located around the LTUs:

- MW-1 is located immediately east of LTU 1;
- MW-2 and MW-3 are located immediately west of LTU 2;
- MW-4 is located immediately north of LTU 2; and,
- MW-5 and MW-6 are located immediately south of LTU 2.

All six groundwater monitoring wells were inspected prior to conducting the groundwater monitoring and sampling program and their condition recorded. The locations of all six groundwater monitoring wells are shown on **Figure 2**.

5.3 Groundwater Monitoring and Sampling Program

In accordance with NWB License No. 1BR-RLF1520, the sampling plan developed by Arcadis and implemented during the 2017 field program was reviewed and approved by Maxxam Analytics Inc. (Maxxam) prior to the field program. Maxxam is certified by the Canadian Association for Laboratory Accreditation Inc. (CALA). **Appendix A** contains the letter from Maxxam in response to their review and approval of the Arcadis 2017 sampling plan.

During the 2017 field program, only one well (MW-1) contained groundwater. Three of the six wells were dry (MW-2, MW-3, and MW-4), and the groundwater in the remaining two wells (MW-5 and MW-6) was frozen. As a result, only one groundwater sample could be collected and analyzed for the parameters outlined in the NWB license, which included Total Suspended Solids, Total Hardness, Conductivity, Ammonia Nitrogen, pH, Total Alkalinity, Nitrate-Nitrite, Chloride, Total Phenols, Oil and Grease, Calcium, Sodium, Chloride, Magnesium, Potassium, Sulphate, Total Metals content, Petroleum Hydrocarbons (PHCs), Polycyclic Aromatic Hydrocarbons (PAHs), and Benzene, Toluene, Ethylbenzene and Xylenes (BTEX).

5.4 Surface Water Sampling Program

As stated above, only one monitoring well contained groundwater during the 2017 field program. One objective of this Environmental Monitoring Program was to fulfill the requirements of the NWB License and, in their current condition, monitoring wells MW-2, MW-2, MW-4, MW-5 and MW-6 did not allow the collection of groundwater to satisfy this objective. Therefore, while on-site, after discussion with PSPC/TC, the only other similar media that could be collected to partly fulfill the NWB License requirements was the ponded water observed in areas around the LTUs. Consequently, surface water samples were collected from the small ponded area north of LTU 1 (SW-1); west of LTU 2 (SW-2); and south of LTU 2 (SW-3) to attempt to measure the presence of contaminants from the LTUs in the local environment. Background Sample (SW-B) was also collected from a ponded area located approximately 160 metres south of the LTUs. These locations are shown on **Figure 6.**

5.5 LTU Liner Integrity Assessment

During the site visit, Arcadis made observations about the condition of the LTU geomembrane liners.

Because the soil in the LTUs was frozen at the time of the site visit, it was not possible to observe and assess the portion of the liners under the soil in the LTUs. However, the condition of the exposed liners and berm areas was recorded.

6 INVESTIGATION RESULTS

6.1 Site Conditions

The 2017 field program was conducted from July 22 to 29, 2017. The temperature ranged from 1 to 3°C with gusting winds. Minor snow accumulation was observed at areas away from the LTUs but none was observed in the LTUs or immediately surrounding the LTUs.

6.2 Geology and Surficial Geology

Based on geological mapping, surficial geology in the area of site consists of colluvial deposits. Colluvial deposits are residual materials deposited as veneers and blankets of debris through downslope movement and in place disintegration of bedrock, including areas of rock outcrop. Specifically, the overburden is comprised of colluvial rubble, which contains rubble and silt derived from carbonate and consolidated fine clastic sedimentary rock substrate. The bedrock is of Paleozoic era, specifically the Arctic Platform and is composed of Silurian carbonate and siliciclastic rocks (Canada-Nunavut Geoscience Office, 2006).

During the site visit, it was observed that the ground immediately at and surrounding the LTUs comprises weathered bedrock. Bedrock outcroppings can be observed approximately 450 metres west of the LTUs.

The Resolute Bay area is subject to continuous permafrost. Groundwater is not used as a drinking water source as glacial melt water is readily available and is used as the potable water supply.

Soils in the LTUs consist of brown silt mixed with rock and stones. At the time of the 2017 site visit, the soils were frozen.

6.3 Monitoring Well Network Assessment Results

Six groundwater monitoring wells are located around the LTUs. Most of the wells were observed to be in fair to poor condition, with only MW-1 observed to be in good condition. The condition of each well was recorded in the field and is presented below in Table 6-1 and shown pictorially in **Figure 3.**

Table 6-1: Monitoring Well Network Observations on July 25, 2017

Monitoring Well ID	GPS Coordinates (UTM)	Observations
MW-1	0441209 E 8295900 N	Well in good condition. No apparent heaving from frost.
MW-2	0441149 E 8295868 N	Well in fair condition. Casing at a slight angle, potentially from frost heaving.
MW-3	0441155 E 8295853 N	Well in fair condition. Casing at a steep angle, potentially from frost heaving.
MW-4	0441241 E 8295900 N	Well in poor condition and is not effective to collect groundwater samples as approximately 1 cm of screen is currently above ground level (may have been caused by frost heaving). Presence of ice at bottom of well.
MW-5	0441257 E 8295811 N	Well in fair condition. Casing at a slight angle, potentially from frost heaving.
MW-6	0441241 E 8295809 N	Well in poor condition and is not effective to collect groundwater samples as approximately 5.5 cm of screen is currently above ground level (may have been caused by frost heaving). Casing at a steep angle. Presence of ice at bottom of well.

No protective monuments have been installed around the monitoring well stickup PVC casings. As a result, the casings showed weathering from the elements. Monuments are generally installed on stickup wells in southern Canada to protect the well casing that extends above ground surface. The monitoring wells around the LTUs were installed without such monuments, likely as the result of high installation costs. Installing the monuments would require extensive reworking of the wells, including excavating around the wells at ground surface, shortening the riser pipe so that it will fit in the monument, and placing bentonite around the casing, therefore this was not completed as part of this work program.

Frost heaving is suspected of having occurred at the locations of monitoring wells MW-2, MW-3, MW04, MW-5 and MW-6. The casing of monitoring wells MW-3 and MW-6 was observed to be at a steep angle.

All monitoring wells contained dedicated bailers. With the exception of the bailer in MW-5, all bailers were removed prior to monitoring and sampling attempts. The bailer in MW-5 was frozen in place and could not be removed.

6.4 Groundwater Monitoring Results

From July 22 to 29, Arcadis attempted to measure groundwater levels from the six monitoring wells surrounding LTU 1 and LTU 2 using a Solinst interface probe. Only one well (MW-1) had groundwater, three of the six wells recorded dry groundwater conditions (MW-2, MW-3, and MW-4), and the groundwater in the remaining two wells (MW-5 and MW-6) was frozen. The water level, depth of well, and height of the top of casing of each well was recorded in the field and is presented in Table 6-2.

Table 6-2: Groundwater Monitoring Results

Monitoring Well ID	GPS Coordinates (UTM)	Depth to Bottom (mbtoc)	Length of Casing Below Ground (m)	Length of Casing Above Ground (m)	Depth to Top of Screen (mbtoc)	Depth to Water (mbtoc)
MW-1	0441209 E 8295900 N	1.170	0.470	0.700	1.005	1.060
MW-2	0441149 E 8295868 N	1.191	0.411	0.780	0.980	Dry
MW-3	0441155 E 8295853 N	1.240	0.410	0.830	1.000	Dry
MW-4	0441241 E 8295900 N	1.250	0.210	1.040	1.030*	Dry
MW-5	0441257 E 8295811 N	-	0.550**	0.700	1.000	Frozen at 1.240
MW-6	0441241 E 8295809 N	-	0.530**	1.055	1.000*	Frozen at 1.530

Notes:

- mbtoc: metres below top of casing

* Screen above ground

** Depth to Frozen Water

6.5 Groundwater Sampling

The groundwater sample from MW-1 was collected using a peristaltic pump and dedicated tubing. Due to the small volume of groundwater present in monitoring well MW-1, the purge water was actually collected in laboratory supplied containers. The well was left to recharge overnight and the water levels in all wells were re-assessed. MW-1 recharged slightly over the 24-hr period and using this water and the purged water one groundwater sample was collected (MW-1). Water that was purged was clear and no odours or sheen were observed.

From July 22 to 29, MW-2, MW-3 and MW-4 remained dry and MW-5 and MW-6 remained frozen; therefore, no other groundwater samples could be collected.

Arcadis is unaware of any well installation logs and did not survey the elevations of the monitoring wells. As a result, it is not possible to assess groundwater flow direction. Based on the topography of the area, Arcadis expects that shallow groundwater flow present during the short un-frozen ground period would be from east to west across the LTU area, towards Resolute Bay.

6.6 Groundwater Analytical Results

Monitoring well MW-1 was sampled and analyzed for the following parameters: petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), total metals, total suspended solids, pH, total hardness, total alkalinity, conductivity, nitrate-nitrite, ammonia nitrogen, chloride, oil and grease, and total phenols. The analytical results are summarized in Tables 1 through 4 and compared to the NWB License No. 1BR-RLF1520 Effluent Quality Limits and CCME CWQG-PAL guidelines.

The analytical results that exceeded guidelines are summarized below and are presented on **Figure 4**:

- Toluene concentration exceeded the NWB License Effluent Quality Limits and CCME CWQG-PAL guideline of 2.0 µg/L at a measured concentration of 3.0 µg/L; and,
- The following Metals exceeded the CCME CWQG-PAL guidelines:
  - Total Cadmium (guideline of 0.09 µg/L vs measured concentration of 2.37 µg/L),
  - Total Chromium (guideline of 1 µg/L vs. measured concentration of 16 µg/L),
  - Total Iron (guideline of 300 vs. measured concentration of 9990 µg/L),
  - Total Silver (guideline of 0.25 µg/L vs. measured concentration of 0.50 µg/L), and
  - Total Zinc (guideline of 30 µg/L vs measured concentration of 297 µg/L).

- Xylenes concentration was measured but at a concentration of 3.3 µg/L (no applicable NWB License or CCME CWQG-PAL guideline).
- Benzene and PHC F1 – F4 were all below the Reportable Detection Limit (RDL).
- The PAHs, 1-Methylnaphthalene and 2-Methylnaphthalene, were measured at concentrations of 0.050 µg/L and 0.040 µg/L, which is 4-5 times above the RDL of 0.010 µg/L; however, there is no applicable NWB License or CCME CWQG-PAL guidelines for these compounds.

6.7 Site Surficial Drainage

Based on observation made during the 2017 site visit, site surficial drainage appears to be from north to south, as shown in **Figure 5**.

Small areas of ponded water were noted at three areas around the LTUs: north of LTU 1; west of LTU 2; and south of LTU 2. At the south end of LTU 2, it was observed that the area of ponded water was surrounded by green vegetation (e.g. moss, small grass tufts), which was not observed in any other areas around the LTUs at the time of the 2017 site visit. The other areas surrounding the LTUs were predominantly brown silt mixed with rock and stones. Based on the review of previous environmental reports, it is known that fertilizers were applied by WERI in 2002 and 2003 to augment the LTU treatment process. If the presence of this green vegetation is related to the application of fertilizers, this may suggest that the integrity of the LTU 2 liner is compromised and the nutrients applied to the soil in 2002 and 2003 are being leached to this area outside LTU 2.

6.8 Surface Water Conditions

During the 2017 site visit, a groundwater sample could only be collected from monitoring well MW-1. As monitoring wells MW-4 and MW-6 were observed to be screened above the ground surface, the results from any groundwater sampled would be considered unreliable due to potential surface water infiltration, even if groundwater samples could have been collected from them. Monitoring wells MW-2 and MW-3 were dry, which could indicate borehole refusal on bedrock or permafrost at the time of drilling/installation. Monitoring well MW-5 appears to have been installed satisfactorily; however, groundwater was frozen during the site visit. Therefore, to partly fulfill the NWB License requirements, surface water samples were collected from the small ponded area north of LTU 1 (SW-1); west of LTU 2 (SW-2); and south of LTU 2 (SW-3) to attempt to measure the presence of contaminants from the LTUs in the local environment. Background Sample (SW-B) was also collected from a ponded area located approximately 160 metres south of the LTUs.

The four surface water samples were analyzed for the parameters listed in the NWB License. The analytical results are summarized in Tables 1 through 4 and compared to the NWB License No. 1BR-RLF1520 Effluent Quality Limits and CCME CWQG FWAL guidelines:

- With only one exception (SW-B), none of the analytical results from the four surface water samples exceeded either the NWB License No. 1BR-RLF1520 Effluent Quality Limits or the CCME CWQG-PAL guidelines.
- Background Surface Water Sample, SW-B, contained a concentration of phenols slightly above the CCME CWQG-PAL guideline of 0.004 mg/L at 0.0056 mg/L. Phenols are typically found in plastics, formaldehyde, and is a component of industrial paint strippers used in the aviation industry for the removal of epoxy and other chemically resistant coatings (Callington, 2009). Due to the location of this sample, this exceedance is not suspected of being related to the operation of LTU 1 or LTU 2 but from other airport operations.
- With only one exception (SW-2), BTEX and PHC F1-F4 were all below the RDL. Xylenes were detected in SW-2 at a concentration of 0.71 µg/L, just slightly above the RDL of 0.40 µg/L.

All measured PAH concentrations were below the CCME CWQG FWAL guidelines. PAHs were not detected in any of the surface water samples with the following exceptions:

- The PAHs, 1-Methylnaphthalene, 2-Methylnaphthalene and Naphthalene, were measured at concentrations 1 to 6 times above the RDL of 0.010 µg/L (no applicable NWB License or CCME CWQG-PAL guideline for 1-Methylnaphthalene or 2-Methylnaphthalene and significantly below the CCME CWQG-PAL guideline of 1.1 µg/L for Naphthalene).

All measured metal concentrations were below the CCME CWQG FWAL guidelines. In surface water samples where there were detections and for which guidelines are available, the concentrations were 10-20 x below the CCME CWQG FWAL guidelines and only slightly above (3-4 x) the RDL.

6.9 LTU Observations

During the site visit, Arcadis observed the condition of the berms constructed around each LTU. The berms varied in width from one to two metres. It was observed that the liner granular cover on LTU 1 was very thin or non-existent along the majority of the berm walls, which resulted in exposure of the liner to atmospheric conditions and sunlight. The exposed areas of the liners are shown on **Figure 7**.

Rips and tears in the liner covering the bermed areas were also observed at numerous locations. In particular, the liner on the southern berm of LTU 2 (downgradient side of the LTU) showed several tears/rips that ranged from 1 to 10 centimetres in length. As well, there is a low spot in the liner wall along the south-western berm of LTU 2, suggesting that the secondary containment for the LTU may have been breached and the runoff water from the impacted soils may be discharging to the environment, potentially resulting in the green vegetation discussed in Section 6.6.

The areas where tears/rips were observed are shown on **Figure 7**.

7 QUALITY ASSURANCE/QUALITY CONTROL

To assess the reliability of the laboratory analytical data, Arcadis typically collects one duplicate sample for approximately every ten samples collected. As a total of five water samples (one groundwater sample and four surface water samples) were collected during this field program, Arcadis collected one duplicate water sample. The duplicate water sample was generated by alternately placing approximately 10% of the sample volume into the primary sample container and then placing the same amount into the duplicate container. Arcadis continued placing aliquots of approximately 10% of the container volume into each container until all containers were filled.

Arcadis collected a duplicate surface water sample of SW-3. The analytical data quality was assessed by submitting the following:

- Surface water sample SW-3 (primary) and DUP-1 (duplicate) were analyzed for PHC fractions F1-F4, BTEX, PAHs, total alkalinity, nitrate-nitrite, ammonia nitrogen, oil and grease, total phenols, calcium, magnesium, sodium, potassium, chloride, sulphate, total metals, total suspended solids and total dissolved solids analysis.

For this set of duplicates, the relative percent difference (RPD) was calculated using the following formula:

$$RPD = \frac{|X_1 - X_2|}{X_{average}} \times 100$$

where, X_1 and X_2 are the duplicate concentrations and $X_{average}$ is the mean of these two values. Results for duplicate analyses of field duplicate samples were considered acceptable where RPD values were <50% for water duplicate analyses, consistent with common industry practices.

RPDs can be calculated only when the compound is detected in both the original and the duplicate sample at a concentration above the method detection limit. Alternative criteria are used to evaluate duplicate pairs where one or both of the results is less than five times the detection or quantitation limit, or where one or both of the results is less than the detection or quantitation limit (i.e., nd or 'not-detected').

A summary of the analytical results for the original and duplicate sample, along with the calculated RPDs, are included in the analytical results shown in Tables 1 to 4. As shown, with only one exception, the calculated RPDs for surface water DUP-1 were all significantly below 50%. The RPD for the PAH, 2-methylnaphthalene, was calculated to be 57.1%.

Overall, Arcadis considers that the results of the QA/QC analysis indicate that the analytical results from the surface water samples can be considered representative of site conditions.

8 DISCUSSION AND RECOMMENDATIONS

During the 2017 Environmental Monitoring Program, all six monitoring wells were inspected and their condition recorded. Five of the wells were observed to be in fair to poor condition, with only MW-1 observed to be in good condition. MW-2, MW-3 and MW-4 were dry and the groundwater in MW-5 and MW-6 was frozen. Only MW-1 had groundwater that could be collected and analyzed. Additionally, MW-4 and MW-6 were observed to be screened above the ground surface therefore any results from groundwater sampling would be considered unreliable, due to potential surface water infiltration.

As one objective of this Environmental Monitoring Program was to fulfill the requirements of the NWB License, in their current condition, the monitoring wells do not allow the achievement of these requirements. Therefore, while on-site, and after discussions with PSPC/TC, the only other similar media that could be collected to partly satisfy the NWB License requirements was ponded water located adjacent to the LTUs. As a result, surface water samples were collected from the small ponded water areas north of LTU 1; west of LTU 2; south of LTU 2; and a background sample from an area 160 metres south of the site.

The one groundwater sample and four surface water samples were analyzed for the parameters listed in NWB License No. 1BR-RLF1520 and compared to the Effluent Quality Limits, also listed in NWB License No. 1BR-RLF1520 as well as the CCME CWQG-PAL guidelines.

The analytical results from MW-1 that exceeded guidelines were:

- Toluene concentration exceeded the NWB License Effluent Quality Limits and CCME CWQG-PAL guideline of 2.0 µg/L at a measured concentration of 3.0 µg/L; and,
- The following Metals exceeded the CCME CWQG-PAL guidelines:
  - Total Cadmium (guideline of 0.09 µg/L vs measured concentration of 2.37 µg/L),
  - Total Chromium (guideline of 1 µg/L vs. measured concentration of 16 µg/L),
  - Total Iron (guideline of 300 vs. measured concentration of 9990 µg/L),
  - Total Silver (guideline of 0.25 µg/L vs. measured concentration of 0.50 µg/L), and
  - Total Zinc (guideline of 30 µg/L vs measured concentration of 297 µg/L).

With only one exception, none of the analytical results from the four surface water samples exceeded either the NWB License No. 1BR-RLF1520 Effluent Quality Limits or the CCME CWQG-PAL guidelines. The background surface water sample, SW-B, contained a concentration of phenols slightly above the CCME CWQG-PAL guideline of 0.004 mg/L at 0.0056 mg/L. Due to the location of this sample, this exceedance is not suspected of being related to the operation of LTU 1 or LTU 2 but from other airport operations.

During the site visit, Arcadis also assessed, where possible, the integrity of the liners of each LTU. Small rips and tears in the liners covering the bermed areas were observed at numerous locations. In particular, the liner on the southern berm of LTU 2 (downgradient side of the LTU) showed several large tears/rips. As well, a significant portion of the south-western berm of LTU 2 appears to have been eroded and is very low.

A significant observation was also made during the July 2017 site visit. The ponded water located outside the south end of LTU 2 was surrounded by green vegetation (e.g. moss, small grass tufts), which is very rare in the area of Resolute Bay. Based on the review of previous environmental reports, in 2002 and 2003, nutrients were mixed with the soils in LTU 1 and LTU 2 to enhance the microbial activity of the bioremediation process. If the presence of this green vegetation is related to the application of fertilizers, this may suggest that the integrity of the LTU 2 liner is compromised and the nutrients applied to the soil in 2002 and 2003 are being leached to this area outside LTU 2.

Based on the results from the 2017 Environmental Monitoring Program, Arcadis recommends the following future work at the Resolute Bay Airport LTUs:

1. Groundwater monitoring is required as part of the NWB License requirements. However, with only one exception, liquid groundwater could not be sampled during either the 2015, 2016 or 2017 monitoring programs, even though these site visits were conducted during the warmest time periods experienced at Resolute Bay.

Resolute Bay is subject to continuous permafrost and based on temperature data obtained from Environment and Climate Change Canada, the warmest (maximum) air temperature recorded annually in Resolute Bay is during the month of July at 6.8˚C. Without going to extreme measures, the probability of collecting liquid groundwater, even from properly installed monitoring wells, in this area is assessed to be very low.

Consequently, Arcadis recommends that TC contact the NWB to have the groundwater monitoring requirement waived because collection of groundwater is not possible due to permafrost.

2. It is also recommended that a Preliminary Quantitative Risk Assessment (PQRA) be conducted to assess any potential risk to human and ecological assessors. The results of the PQRA may also further support the revision of the NWB conditions recommended above.

3. Monitoring wells MW-4 and MW-6 were observed to be screened above the ground surface. Therefore, any analytical results from groundwater collected from these well would be considered unreliable due to potential surface water infiltration. It is recommended that these two wells be properly decommissioned.

4. The green vegetation observed south of LTU 2, may be related to the discharge of nutrients from LTU 2. It is recommended that this be confirmed by sampling the ponded water in LTU 2 and the ponded water in the area south of LTU 2, analyzing these samples for nutrients and perfluoronated compounds (PFCs), and comparing the results.

5. The southwest portion of the berm of LTU 2 should be built up where it has eroded.

6. All tears and rips located in the liners should be repaired and covered by overburden.

9 REFERENCES

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10 LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by Arcadis Canada Inc. (Arcadis) for Public Services and Procurement Canada (PSPC). It is intended for the sole and exclusive use of PSPC. Any use, reliance on or decision made by any other person other than PSPC based on this report is the sole responsibility of such other person. PSPC and Arcadis make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

This report has been prepared in accordance with generally accepted engineering and environmental practices for the exclusive use of PSPC. This report is based on the historical information provided and information obtained during this work program.

Third party information reviewed and used to compile the data and conclusions contained in this report is assumed to be complete and correct. Arcadis used this information in good faith and will not accept any responsibility for deficiencies, misinterpretation or incompleteness of the information contained in documents prepared by third parties.

The investigation undertaken by Arcadis with respect to this report and any conclusions or recommendations made in this report reflect Arcadis' judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of preparation of this report. This report has been prepared for specific application to the site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. Notwithstanding these limitations, this report is believed to provide a reasonable representation of activities completed and Site conditions as of August 2017.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by PSPC, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Arcadis. Nothing in this report is intended to constitute or provide a legal opinion.

FIGURES

Title: Site Location

ARCADIS

Project: Resolute Bay Airport
Land Treatment Units
Resolute Bay, Nunavut

Date: November 2017

Client: PWGSC/TC

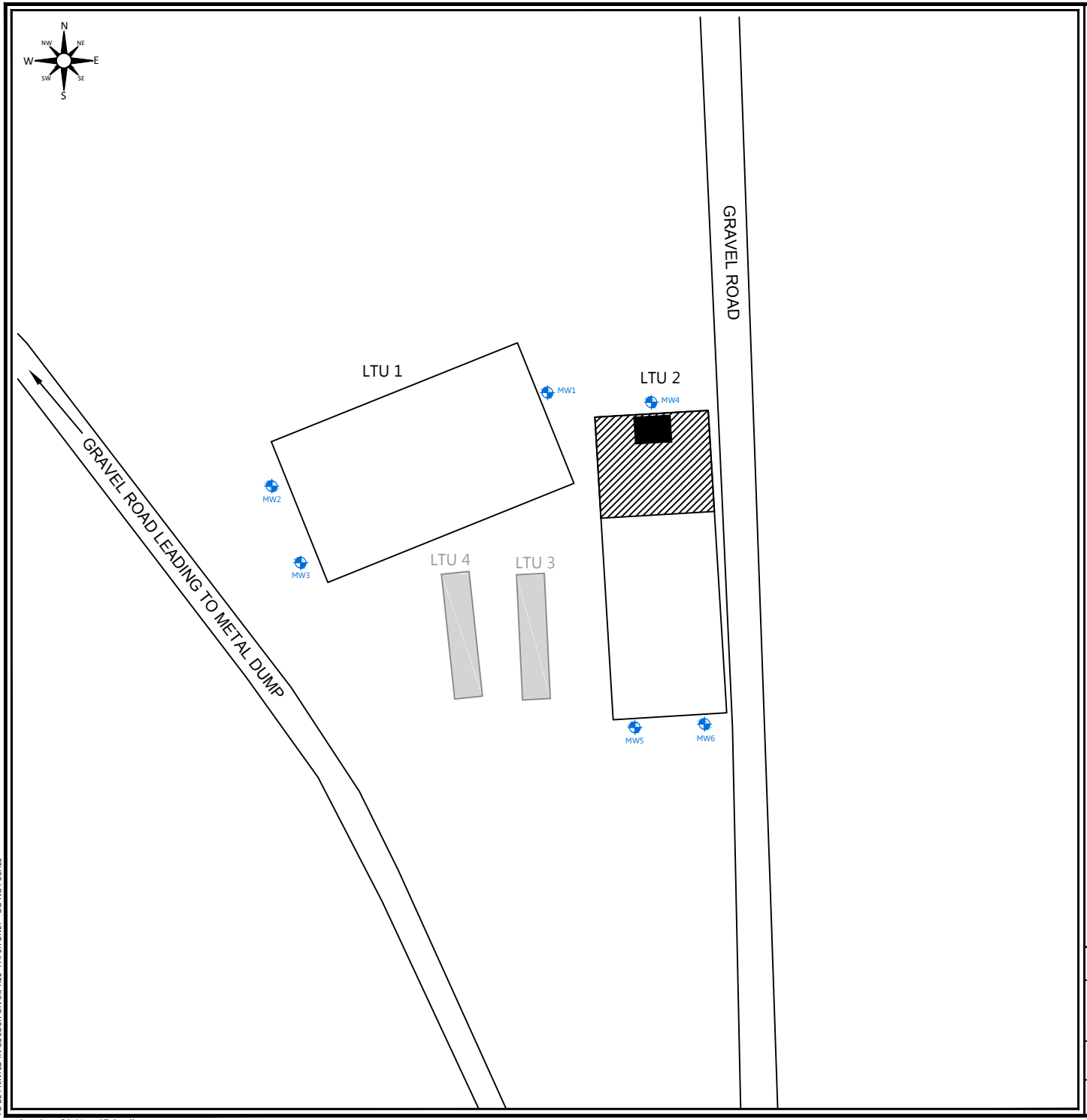
150 0 Meters 150 300
1:22000

Figure 1

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

Z:\Projects\2017\100463-003 PWGSC - Resolute Bay\Figures\1-CAD\100463-003 TC Resolute Bay LTUs..dwg(layout)



Legend

- Monitoring Well (installed by others)
- Former Heating Unit
- Tarp
- LTU 3 and LTU 4 are the property of Transport Canada (TC)

Title: Site Plan

ARCADIS

Project: Resolute Bay Airport
Land Treatment Units
Resolute Bay, Nunavut

Date: November 2017

Client: PWGSC/TC

1.5 0 1.5 3 Metres

1:1500

Figure 2

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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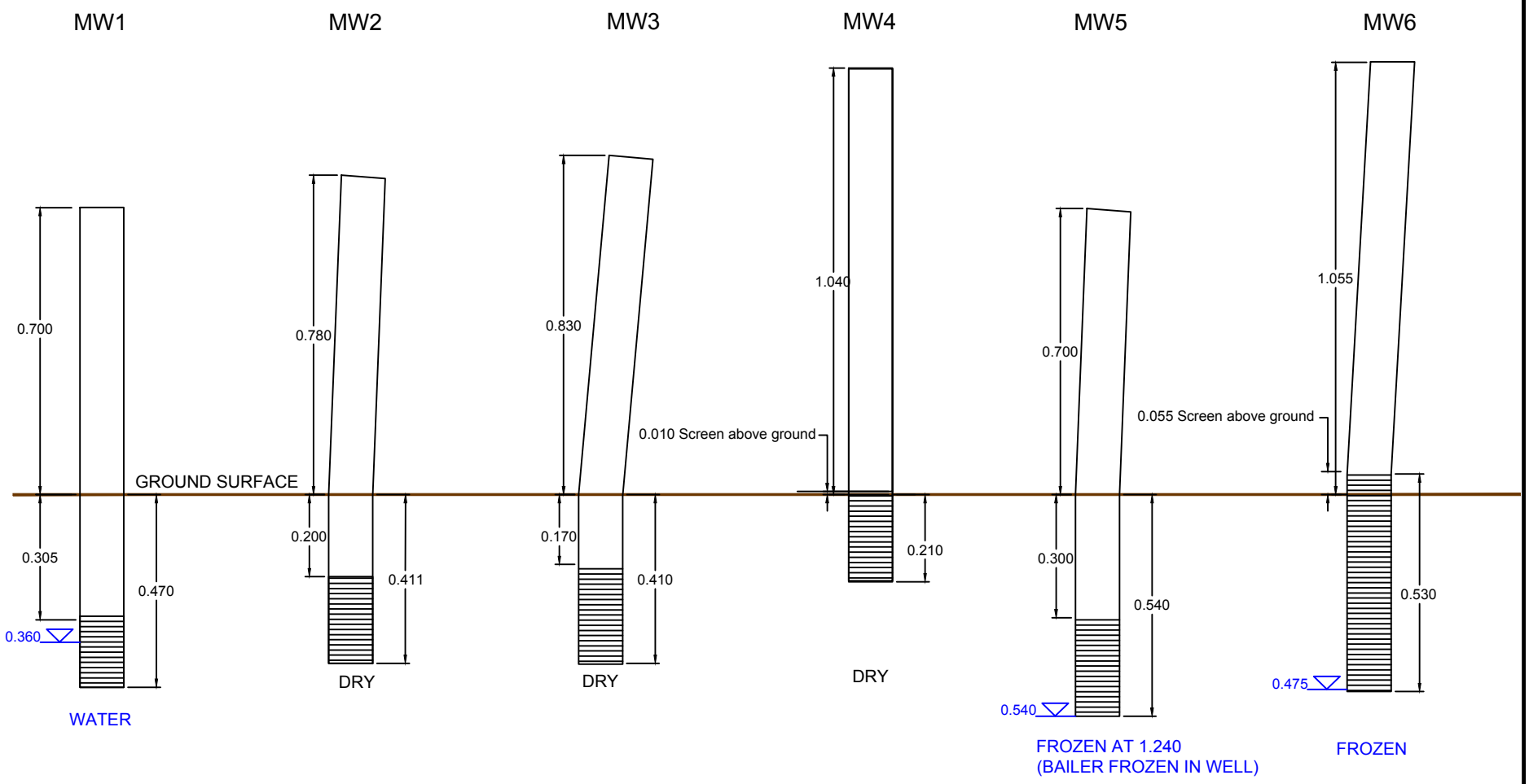

Legend

- Ground Surface
- Screen
- 0.360 Groundwater Level

Title:	Monitoring Well Observations
ARCADIS	Project: Resolute Bay Airport Land Treatment Units Resolute Bay, Nunavut
Date: November 2017	Client: PWGSC/TC
0.125 0 0.125 0.25 Metres 1:15	Figure 3

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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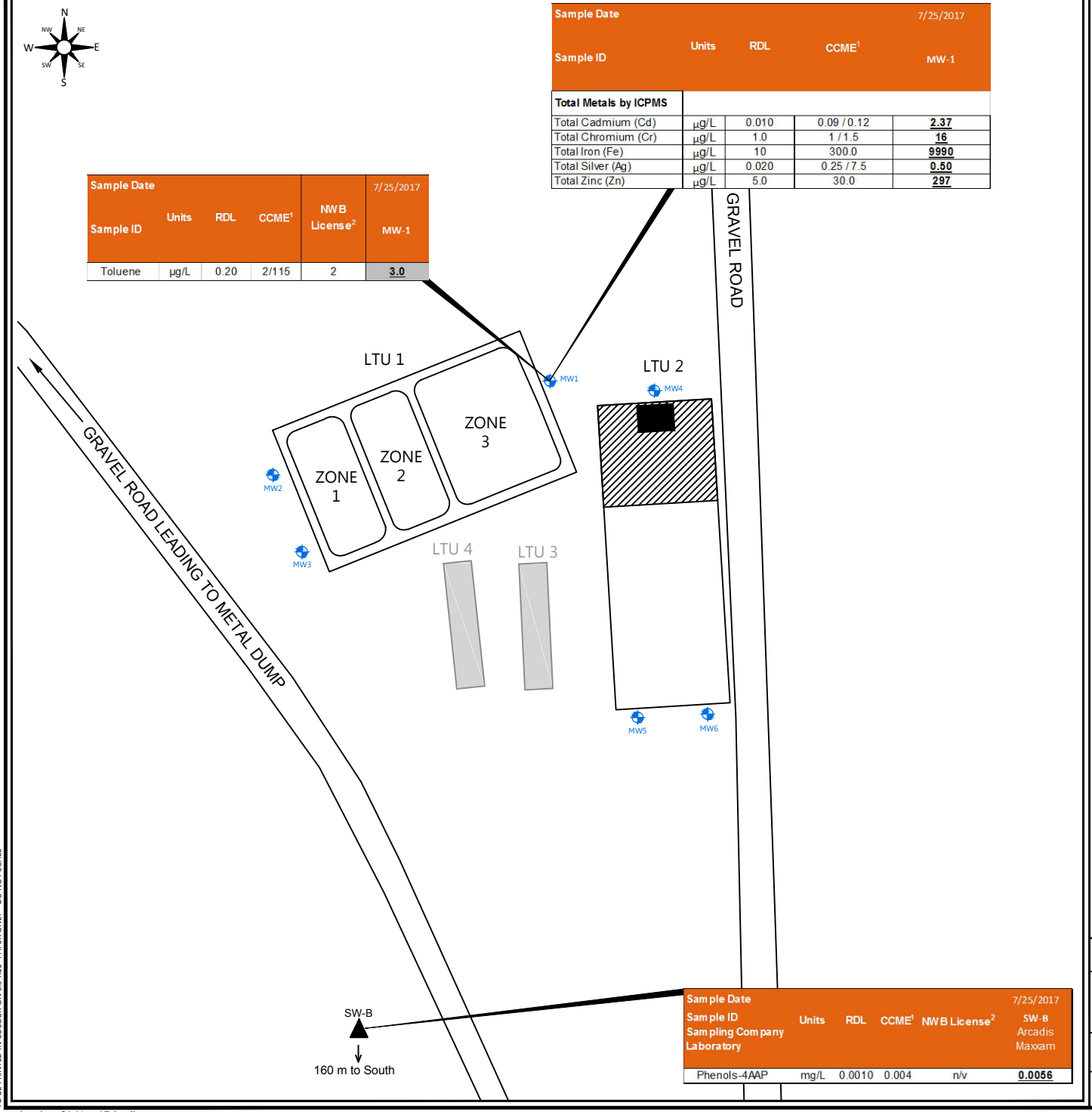

Sample Date					7/25/2017
Sample ID	Units	RDL	CCME[1]	NWB License[2]	MW-1
Toluene	µg/L	0.20	2/115	2	**3.0**

Sample Date				7/25/2017
Sample ID	Units	RDL	CCME[1]	MW-1
Total Metals by ICPMS				
Total Cadmium (Cd)	µg/L	0.010	0.09 / 0.12	**2.37**
Total Chromium (Cr)	µg/L	1.0	1 / 1.5	**16**
Total Iron (Fe)	µg/L	10	300.0	**9990**
Total Silver (Ag)	µg/L	0.020	0.25 / 7.5	**0.50**
Total Zinc (Zn)	µg/L	5.0	30.0	**297**

Sample Date					7/25/2017
Sample ID Sampling Company Laboratory	Units	RDL	CCME[1]	NWB License[2]	SW-B Arcadis Maxxam
Phenols-4AAP	mg/L	0.0010	0.004	n/v	**0.0056**

Legend

- Monitoring Well (installed by others)
- Former Heating Unit
- Tarp
- LTU 3 and LTU 4 are not the property of Transport Canada (TC)

LTU 1, Zones 1 & 2 - Soils containing heavier hydrocarbons

LTU 1, Zone 3 - Soils containing lighter hydrocarbons

Notes:

1. CCME Water Quality Guidelines for the Protection of Aquatic Life, (Freshwater/Marine)
2. CCME CWQG for Protection of Aquatic Life (PAL) (freshwater and marine).

6.5 **Concentration exceeds the CCME guideline**

Concentration exceeds the NWB License guideline

RDL Reportable Detection Limit

Title: Groundwater Exceedances

ARCADIS

Project: Resolute Bay Airport
Land Treatment Units
Resolute Bay, Nunavut

Date: November 2017

Client: PWGSC/TC

12 0 12 24 Metres
1:1500

Figure 4

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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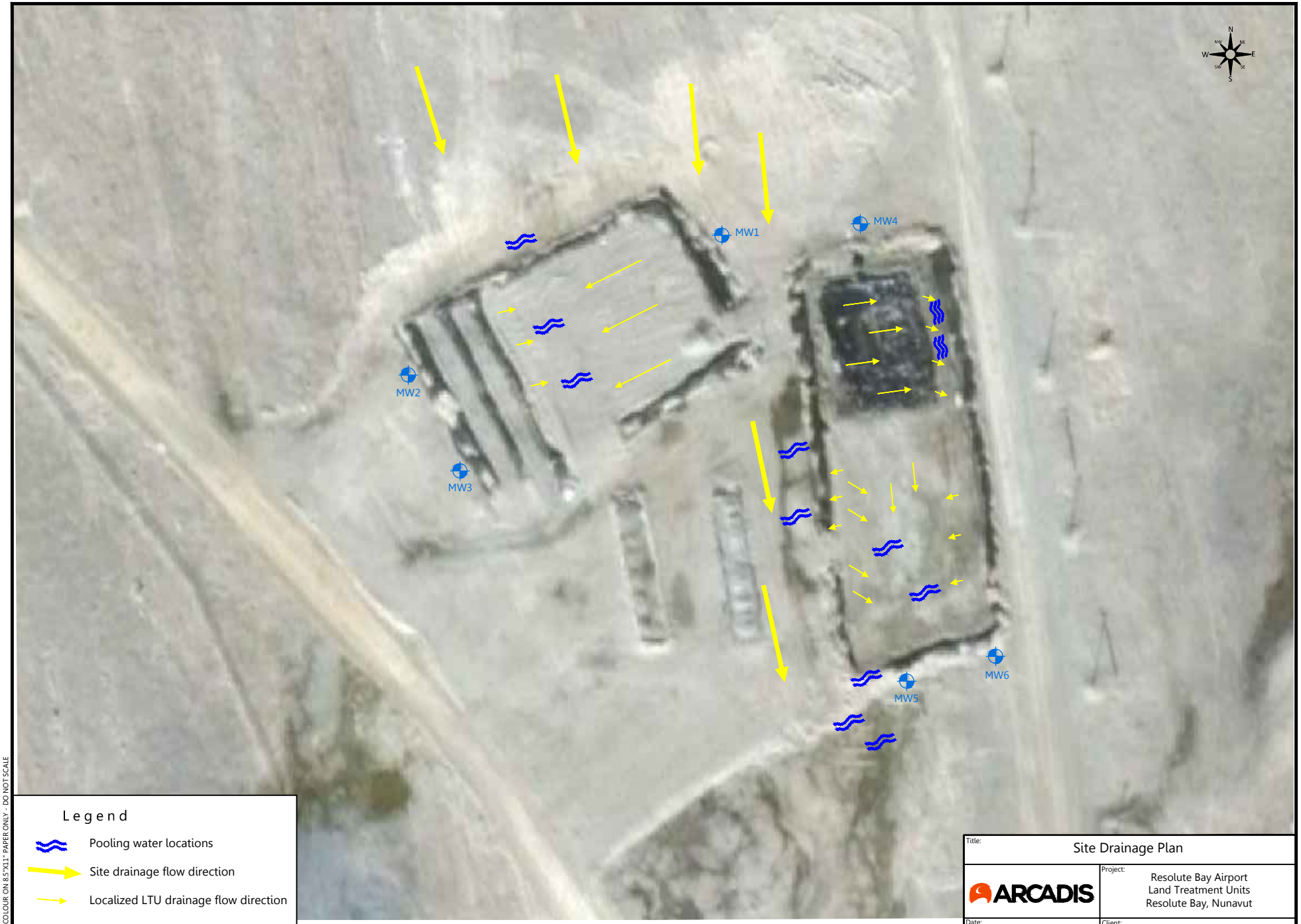

Legend

- Pooling water locations
- Site drainage flow direction
- Localized LTU drainage flow direction

Title: Site Drainage Plan

ARCADIS

Project: Resolute Bay Airport
Land Treatment Units
Resolute Bay, Nunavut

Date: November 2017

Client: PWGSC/TC

10 0 10 20 Metres
1:1000

Figure 5

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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Legend

- Monitoring Well (installed by others)
- SW-1 Surface Water Sample Location
- Area of Green Vegetation
- 4 Photo Locations (each photo is shown in PhotoLog, Appendix B)

Title:	Groundwater Exceedances
ARCADIS	Project: Resolute Bay Airport Land Treatment Units Resolute Bay, Nunavut
Date: November 2017	Client: PWGSC/TC
10 0 Metres 10 20 1:1000	Figure 6

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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Legend

Exposed areas of liner

Tears/rips in liner (1-10cm in length)

Title: Liner Condition Plan

ARCADIS

Project: Resolute Bay Airport
Land Treatment Units
Resolute Bay, Nunavut

Date: November 2017

Client: PWGSC/TC

10 0 10 20 Metres
1:1000

Figure 7

TO BE PRINTED IN COLOUR ON 8.5"X11" PAPER ONLY - DO NOT SCALE

updated on: 21-Nov-17 by dlogan

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TABLES

Table 1
Groundwater and Surface Water Analytical Results
Petroleum Hydrocarbons

Sample Date					2017-07-25	2017-07-25	2017-07-25	2017-07-25	2017-07-25		2017-07-25
Sample ID	Units	RDL	CCME[1]	NWB License[2]	MW-1	SW-1	SW-2	SW-3	DUP-1 (Duplicate of SW-3)	% RPD	SW-B
Sampling Company					Arcadis	Arcadis	Arcadis	Arcadis	Arcadis		Arcadis
Laboratory					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam		Maxxam
Volatiles											
Benzene	µg/L	0.20	370/110	370	<0.20	<0.20	<0.20	<0.20	<0.20	nc	<0.20
Toluene	µg/L	0.20	2/115	2	**3.0**	<0.20	<0.20	<0.20	<0.20	nc	<0.20
Ethylbenzene	µg/L	0.20	90/25	90	0.36	<0.20	<0.20	<0.20	<0.20	nc	<0.20
o-Xylene	µg/L	0.20	n/v	n/v	1.2	<0.20	0.71	<0.20	<0.20	nc	<0.20
m & p-Xylene	µg/L	0.40	n/v	n/v	2.1	<0.40	<0.40	<0.40	<0.40	nc	<0.40
Total Xylenes	µg/L	0.40	n/v	n/v	3.3	<0.40	0.71	<0.40	<0.40	nc	<0.40
F1 (C6-C10)	µg/L	25	n/v	n/v	<25	<25	<25	<25	<25	nc	<25
F1 (C6-C10) - BTEX	µg/L	25	n/v	n/v	<25	<25	<25	<25	<25	nc	<25
Petroleum Hydrocarbons											
F2 (C10-C16 Hydrocarbons)	µg/L	100	n/v	n/v	<100	<100	<100	<100	<100	nc	<100
F3 (C16-C34 Hydrocarbons)	µg/L	200	n/v	n/v	<200	<200	<200	<200	<200	nc	<200
F4 (C34-C50 Hydrocarbons)	µg/L	200	n/v	n/v	<200	<200	<200	<200	<200	nc	<200
Reached Baseline at C50	µg/L	N/A	n/v	n/v	Yes	Yes	Yes	Yes	Yes	N/A	Yes

Notes:

[1]	CCME Water Quality Guidelines for the Protection of Aquatic Life, (Freshwater/Marine)
6.5	**Concentration exceeds the CCME guideline**
	Concentration exceeds the NWB License guideline
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
N/A	Not applicable.
RPD	Relative Percent Difference
ITALICS	RPD alert limit exceeded
RDL	Reportable Detection Limit
nc	Not calculable

Table 2
Groundwater and Surface Water Analytical Results
Polycyclic Aromatic Hydrocarbons

Sample Date				2017-07-25	2017-07-25	2017-07-25	2017-07-25	2017-07-25		2017-07-25
Sample ID	Units	RDL	CCME[1]	MW-1	SW-1	SW-2	SW-3	DUP-1 (Duplicate of SW-3)	% RPD	SW-B
Sampling Company				Arcadis	Arcadis	Arcadis	Arcadis	Arcadis		Arcadis
Laboratory				Maxxam	Maxxam	Maxxam	Maxxam	Maxxam		Maxxam
Polycyclic Aromatics										
Acenaphthene	µg/L	0.010	5.8	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Acenaphthylene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Anthracene	µg/L	0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Benzo(a)anthracene	µg/L	0.010	0.018	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Benzo(a)pyrene	µg/L	0.010	0.015	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Benzo(b/j)fluoranthene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Benzo(g,h,i)perylene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Benzo(k)fluoranthene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Chrysene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Dibenz(a,h)anthracene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Fluoranthene	µg/L	0.010	0.04	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Fluorene	µg/L	0.010	3	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Indeno(1,2,3-cd)pyrene	µg/L	0.010	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
1-Methylnaphthalene	µg/L	0.010	n/v	0.050	<0.010	0.060	0.015	0.025	50.0%	<0.010
2-Methylnaphthalene	µg/L	0.010	n/v	0.040	<0.010	0.045	0.045	0.025	57.1%	0.025
Naphthalene	µg/L	0.010	1.1/1.4	0.050	<0.010	0.055	0.025	0.015	50.0%	<0.010
Phenanthrene	µg/L	0.010	0.4	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010
Pyrene	µg/L	0.010	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	nc	<0.010

Notes:

[1]	CCME Water Quality Guidelines for the Protection of Aquatic Life, (Freshwater/Marine)
6.5	**Concentration exceeds the CCME guideline**
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
RPD	Relative Percent Difference
ITALICS	RPD alert limit exceeded
RDL	Reportable Detection Limit
nc	Not calculable

Table 3
Groundwater and Surface Water Analytical Results
Metals

Sample Date				2017-07-25	2017-07-25	2017-07-25	2017-07-25			2017-07-25
Sample ID	**Units**	**RDL**	**CCME[1]**	**MW-1**	**SW-1**	**SW-2**	**SW-3**	**DUP-1 (Duplicate of SW-3)**	**% RPD**	**SW-B (Lab: SW-8)**
Sampling Company				Arcadis	Arcadis	Arcadis	Arcadis			Arcadis
Laboratory				Maxxam	Maxxam	Maxxam	Maxxam			Maxxam
Inorganics										
Total Metals by ICPMS										
Total Aluminum (Al)	µg/L	3.0	n/v	8700	6.2	12.7	3.7	3.8	2.7%	8.7
Total Antimony (Sb)	µg/L	0.50	n/v	<5.0	<0.50	<0.50	<0.50	<0.50	nc	<0.50
Total Arsenic (As)	µg/L	0.10	5 / 12.5	3.5	0.12	0.27	0.31	0.28	9.7%	0.48
Total Barium (Ba)	µg/L	1.0	n/v	164	5.1	8.3	14.9	14.7	1.3%	13.7
Total Beryllium (Be)	µg/L	0.10	n/v	1.8	<0.10	<0.10	<0.10	<0.10	nc	<0.10
Total Bismuth (Bi)	µg/L	1.0	n/v	<10	<1.0	<1.0	<1.0	<1.0	nc	<1.0
Total Boron (B)	µg/L	50	1500.0	<500	<50	<50	<50	<50	nc	<50
Total Cadmium (Cd)	µg/L	0.010	0.09 / 0.12	**2.37**	0.013	<0.010	0.010	0.011	10.0%	0.013
Total Chromium (Cr)	µg/L	1.0	1 / 1.5	**16**	<1.0	<1.0	<1.0	<1.0	nc	<1.0
Total Cobalt (Co)	µg/L	0.20	n/v	10.3	<0.20	<0.20	<0.20	<0.20	nc	<0.20
Total Copper (Cu)	µg/L	0.50	n/v	22.3	<0.50	<0.50	0.77	0.71	7.8%	0.90
Total Iron (Fe)	µg/L	10	300.0	**9990**	<10	28	<10	<10	nc	19
Total Lead (Pb)	µg/L	0.20	n/v	144	<0.20	4.89	11.8	11.8	0.0%	15.2
Total Lithium (Li)	µg/L	2.0	n/v	<20	<2.0	<2.0	<2.0	<2.0	nc	<2.0
Total Manganese (Mn)	µg/L	1.0	n/v	1850	<1.0	15.7	4.2	4.5	7.1%	7.0
Total Molybdenum (Mo)	µg/L	1.0	73.0	<10	<1.0	<1.0	<1.0	<1.0	nc	<1.0
Total Nickel (Ni)	µg/L	1.0	n/v	18	<1.0	<1.0	1.2	1.1	8.3%	1.3
Total Selenium (Se)	µg/L	0.10	1.0	<1.0	<0.10	<0.10	0.12	0.12	0.0%	0.11
Total Silicon (Si)	µg/L	100	n/v	8680	338	482	615	567	7.8%	660
Total Silver (Ag)	µg/L	0.020	0.25 / 7.5	**0.50**	<0.020	<0.020	<0.020	<0.020	nc	<0.020
Total Strontium (Sr)	µg/L	1.0	n/v	973	60.3	93.6	153	148	3.3%	135
Total Thallium (Tl)	µg/L	0.010	0.8	0.26	<0.010	<0.010	<0.010	<0.010	nc	0.010
Total Tin (Sn)	µg/L	5.0	n/v	<50	<5.0	<5.0	<5.0	<5.0	nc	<5.0
Total Titanium (Ti)	µg/L	5.0	n/v	77	<5.0	<5.0	<5.0	<5.0	nc	<5.0
Total Uranium (U)	µg/L	0.10	15.0	3.4	0.10	0.31	0.41	0.41	0.0%	0.47
Total Vanadium (V)	µg/L	5.0	n/v	<50	<5.0	<5.0	<5.0	<5.0	nc	<5.0
Total Zinc (Zn)	µg/L	5.0	30.0	**297**	<5.0	<5.0	<5.0	<5.0	nc	<5.0
Total Zirconium (Zr)	µg/L	0.10	n/v	<1.0	<0.10	<0.10	<0.10	<0.10	nc	<0.10
Total Calcium (Ca)	µg/L	0.050	n/v	2430	34.6	38.2	56.2	53.1	5.5%	50.8
Total Magnesium (Mg)	µg/L	0.050	n/v	1070	12.7	11.6	12.5	12.2	2.4%	12.9
Total Potassium (K)	µg/L	0.050	n/v	3.36	0.467	1.00	1.54	1.51	1.9%	2.58
Total Sodium (Na)	µg/L	0.050	n/v	7.42	6.41	6.12	6.22	5.92	4.8%	6.30
Total Sulphur (S)	µg/L	3.0	n/v	<30	<3.0	<3.0	<3.0	<3.0	nc	<3.0

Notes:

[1] CCME Water Quality Guidelines for the Protection of Aquatic Life, (Freshwater/Marine)

6.5 **Concentration exceeds the CCME guideline**
* standard dependent on pH
** standard dependent on hardness
n/v No standard/guideline value.
\- Parameter not analyzed / not available.
n/a Not applicable.
RPD Relative Percent Difference
ITALICS RPD alert limit exceeded
RDL Reportable Detection Limit
nc Not calculable

Table 4
Groundwater and Surface Water Analytical Results
Miscellaneous Parameters

Sample Date					2017-07-25	2017-07-25	2017-07-25	2017-07-25	2017-07-25		2017-07-25
Sample ID	Units	RDL	CCME[1]	NWB License[2]	MW-1	SW-1	SW-2	SW-3	DUP-1 (Duplicate of SW-3)	% RPD	SW-B
Sampling Company					Arcadis	Arcadis	Arcadis	Arcadis	Arcadis		Arcadis
Laboratory					Maxxam	Maxxam	Maxxam	Maxxam	Maxxam		Maxxam
Hardness (CaCO3)	mg/L	0.50	n/v	n/v	10500	139	143	192	192	0.0%	180
Calculated Parameters											
Bicarbonate Alkalinity (calc. as CaCO3)	mg/L	1.0	n/v	n/v	130	130	140	180	180	0.0%	160
Carbonate Alkalinity (calc. as CaCO3)	mg/L	1.0	n/v	n/v	1.9	2.6	2.0	3.3	3.8	14.1%	2.8
Inorganics											
Total Ammonia-N	mg/L	0.050	temp and pH dependant	n/v	<0.050	<0.050	<0.050	<0.050	<0.050	nc	0.34
Conductivity	umho/cm	1.0	n/v	n/v	270	260	280	340	340	0.0%	330
pH	pH		6.5-9.0	6.0-9.0	8.19	8.34	8.20	8.30	8.36	0.7%	8.28
Phenols-4AAP	mg/L	0.0010	0.004	n/v	<0.0010	<0.0010	0.0026	<0.010	<0.010	nc	**0.0056**
Total Suspended Solids	mg/L	10	background dependent	n/v	4800	<10	<10	<10	<10	nc	<10
Dissolved Sulphate (SO4)	mg/L	1.0	n/v	n/v	3.4	3.5	3.6	3.2	3.4	6.1%	4.2
Alkalinity (Total as CaCO3)	mg/L	1.0	n/v	n/v	130	130	140	180	180	0.0%	160
Dissolved Chloride (Cl)	mg/L	1.0	640 (short) 120 (long)	n/v	12	7.4	4.9	6.7	6.9	2.9%	7.3
Nitrite (N)	mg/L	0.010	n/v	n/v	<0.010	<0.010	<0.010	<0.010	<0.010	nc	0.010
Nitrate (N)	mg/L	0.10	n/v	n/v	0.19	0.17	0.11	0.37	0.36	2.7%	1.45
Nitrate + Nitrite (N)	mg/L	0.10	n/v	n/v	0.19	0.17	0.11	0.37	0.36	2.7%	1.46
Petroleum Hydrocarbon											
Total Oil and grease	mg/L	0.50	n/v	5.0	<0.50	<0.50	<0.50	<0.50	<0.50	nc	<0.50

Notes:

[1] CCME Water Quality Guidelines for the Protection of Aquatic Life, (Freshwater/Marine)

6.5 **Concentration exceeds the CCME guideline**

* standard dependent on pH

** standard dependent on hardness

n/v No standard/guideline value.

\- Parameter not analyzed / not available.

n/a Not applicable.

RPD Relative Percent Difference

ITALICS RPD alert limit exceeded

RDL Reportable Detection Limit

nc Not calculable

APPENDIX A

Maxxam's Approval Letter of the 2017 Arcadis Sampling Plan

maxxam.ca
MAXXAM ANALYTICS
32 Colonnade Road North, Unit 1000
Nepean, ON K2E 7J6
Office 613 274 0573
Toll Free 877 480 7272
Fax 613 274 0574

June 20th, 2017

To whom it may concern,

Founded over 40 years ago, Maxxam is the Canadian market leader in analytical services and solutions to the energy, environmental, food and DNA industries and a member of the Bureau Veritas Group of companies – a world leader in testing, inspection and certification services. We support critical decisions made by our customers through the application of rigorous science and are committed to success with responsibility.

Maxxam's laboratories function as a tight network operating under a single Quality System – they work together to ensure customer requirements are met. Our laboratories are accredited to ISO/IEC 17025 "General Requirements for the Competence of Testing and Calibration Laboratories", which is the global standard for laboratory quality management programs. All of Maxxam's facilities are ASTM, CALA and/or SCC certified and recognized testing facilities by provincial and federal governments.

The full scope of current accredited parameters can be found at: http://maxxam.ca/about-maxxam/quality/accreditation-certification

All groundwater sample analyses conducted during the Resolute Bay Airport Land Treatment Units Environmental Monitoring Program for 2017 will be conducted by Maxxam, who is accredited according to ISO/IEC Standard 17025. Maxxam confirms that all of the samples analyzed during the sampling plan required under the Nunavut Water Board Licence 1BR-RLF1520 will be completed to this standard.

For further questions please contact the undersigned.

Sincerely,

Julie Clement
Technical Account Manager - Environmental Services
jclement@maxxam.ca
613-868-6079

APPENDIX B

Site Photographs

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 1

Date: July 25, 2017

Description:
View of LTU 1, east portion

Location:
From south end of LTU 1 looking northeast

Photo: 2

Date:
July 25, 2017

Description:
LTU 1 center portion

Location:
From south of LTU1 looking north

Photo: 3

Date:
July 25, 2017

Description:
LTU 1 west portion

Location:
South end of LTU 1 looking north

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 4

Date: July 24, 2017

Description:
LTU 2, east portion

Location:
From south end of LTU 2 looking northeast

Photo: 5

Date:
July 24, 2017
Description:
LTU 2 center portion
Location:
From south of LTU 2 looking north

Photo: 6

Date:
July 24, 2017
Description:
LTU 2 west portion and to the west SW-2 surface water sample location can also be seen. Area of green vegetation can be seen both inside and outside the LTU in this photo.
Location:
South end of LTU 2 looking north

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 7

Date: July 24, 2017

Description:
MW-1

Location:
Near east side of LTU 1, looking west

Photo: 8

Date:
July 25, 2017

Description:
MW-2

Location:
Adjacent west of LTU2, looking north

Photo: 9

Date:
July 24, 2017

Description:
MW-3 (tilted, possibly heaved)

Location:
Adjacent west of LTU2, looking north

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

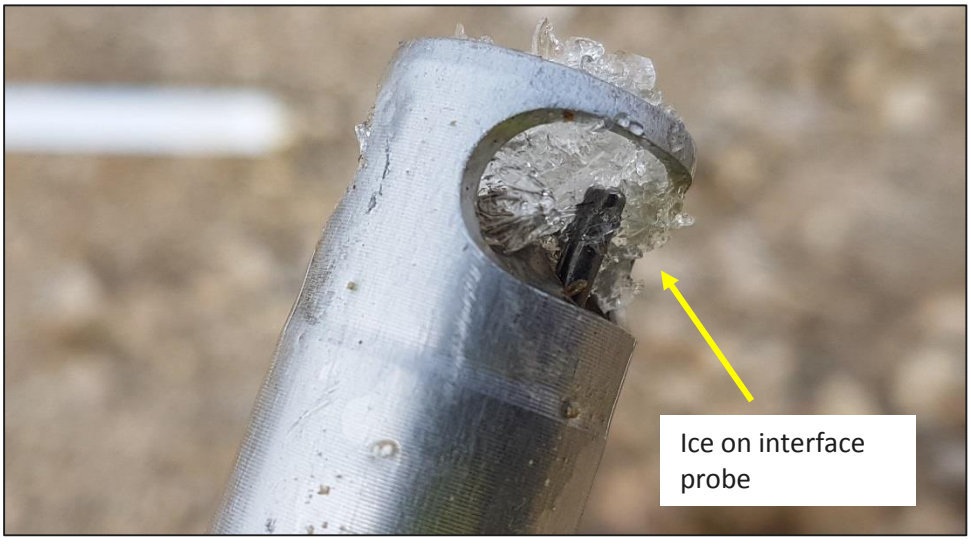

Photo: 10

Date: July 24, 2017

Description:
Ice on Interface probe, example of frozen condition vs. dry condition observation

Location:
From MW-3

Photo: 11

Date:
July 24, 2017

Description:
MW-4 (Also note grey-brown soil/rocky surface around this area)

Location:
North of LTU 2, view looking north

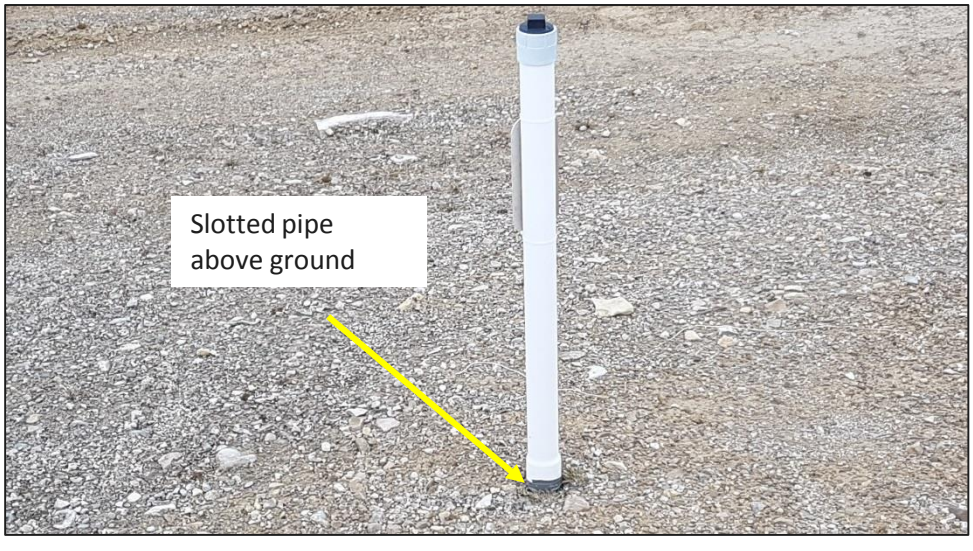

Photo: 12

Date:
July 24, 2017

Description:
MW-4, example of PVC screen above ground

Location:
North of LTU 2, view looking southwest towards ground

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 13

Date: July 24, 2017

Description:
MW-5

Location:
South of southwest corner of LTU 2, view looking north

Photo: 14

Date:
July 24, 2017

Description:
MW-6

Location:
South of southeast corner of LTU 2

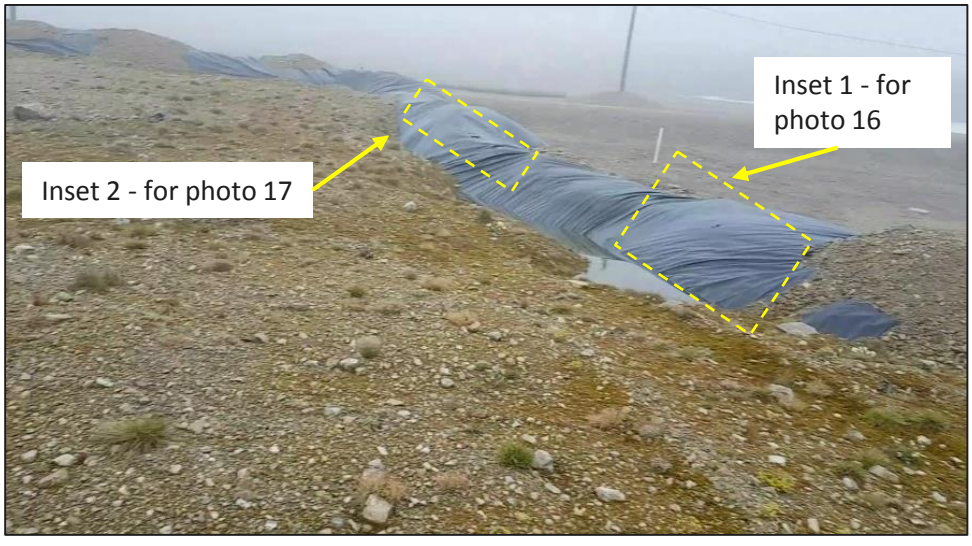

Photo: 15

Date:
July 25, 2017

Description:
LTU 2 south boundary, inset for photo 16 and 17 (MW 6 can be seen outside LTU 2 in background)

Location:
LTU southwest corner looking east along south wall

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

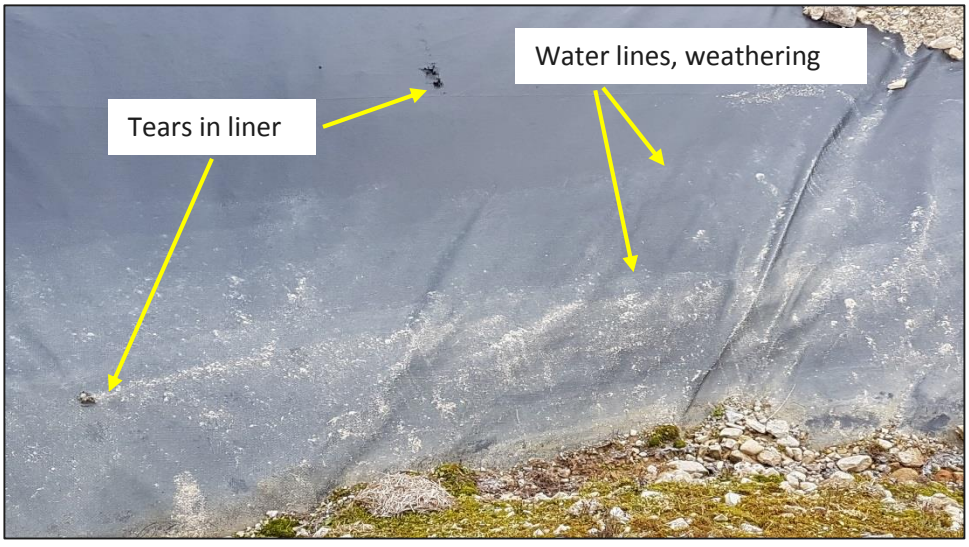

Photo: 16

Date: July 24, 2017

Description:
Close-up minor tearing, weathering where water collects

Location:
LTU 2 southwest wall – Inset 1 view looking south

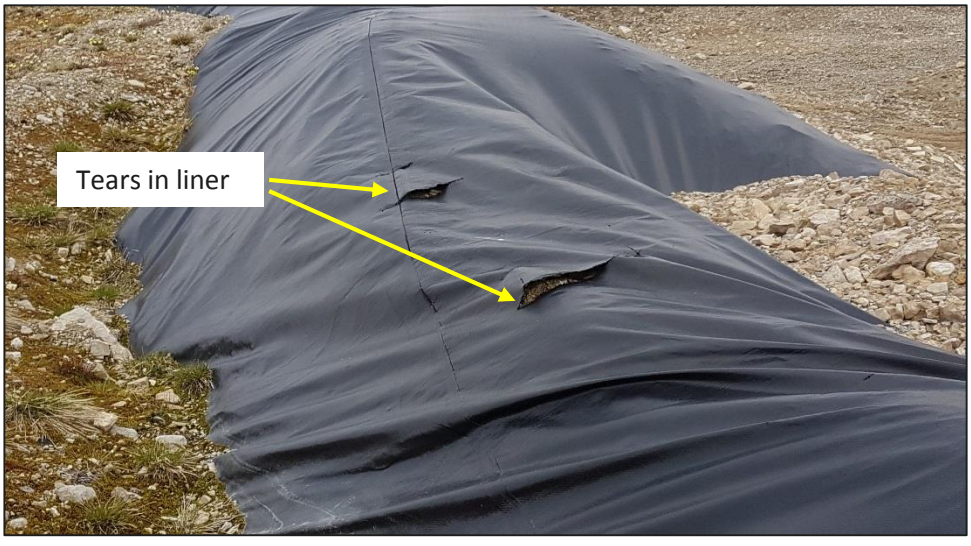

Photo: 17

Date:
July 24, 2017

Description:
Tears in liner

Location:
LTU 2 south wall, center portion - Inset 2, view looking east

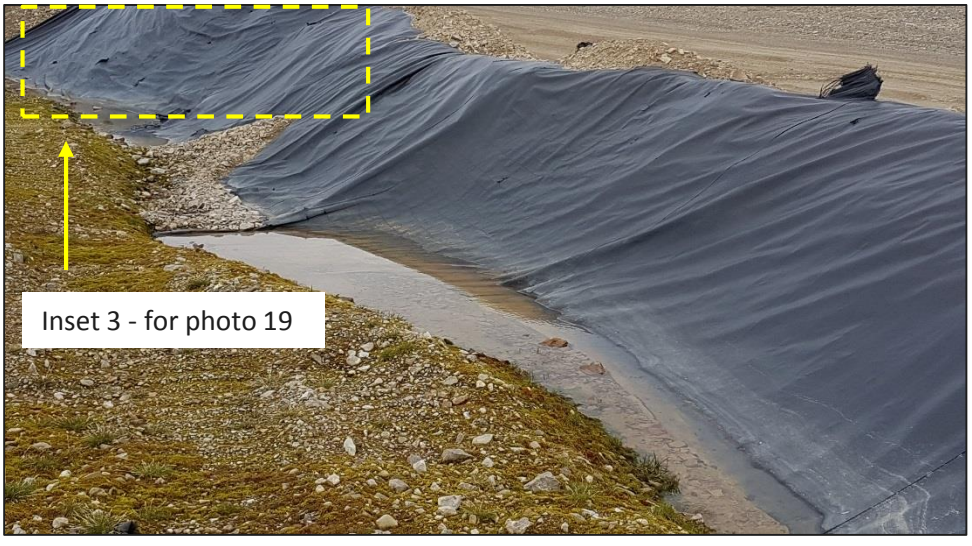

Photo: 18

Date:
July 24, 2017

Description:
LTU 2 east wall, north portion, Inset 3 for photo 19

Location:
View looking northwest, along north portion of LTU 2 east wall

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

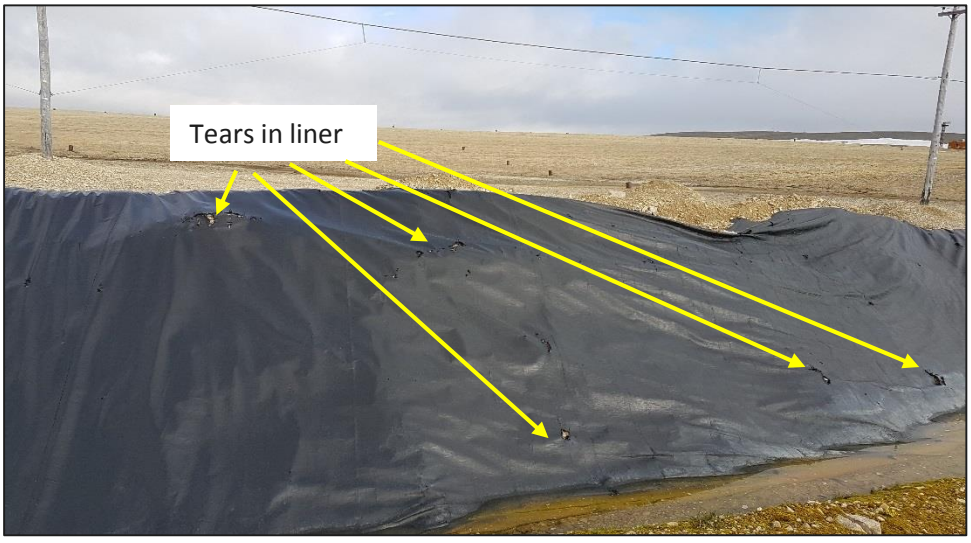

Photo: 19

Date: July 24, 2017

Description:
Tears in liner, Inset 3 close-up

Location:
LTU 2 east wall north portion, view looking east

Photo: 20

Date:
July 27, 2017

Description:
LTU 2 north wall (inside LTU 2), most liner buried, visible liner in good condition

Location:
View from northeast corner of LTU 2 looking northeast

Photo: 21

Date:
July 27, 2017

Description:
LTU 2 northwest corner of liner, good condition (interior of LTU 2 is shown)

Location:
View from center portion of north wall, looking west

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 22

Date:
July 25, 2017

Description:
Tears in liner, LTU 2 west wall liner (SW2 location shown on far left side of photo)

Location:
West wall of LTU 2, central portion, looking north

Photo: 23

Date:
July 25, 2017

Description:
LTU 2 west wall, Inset 4 for photo 24 (right side of photo shows interior of LTU 2 and top left side shows exterior of LTU 2.

Location:
LTU 2 west wall, south central portion, looking north

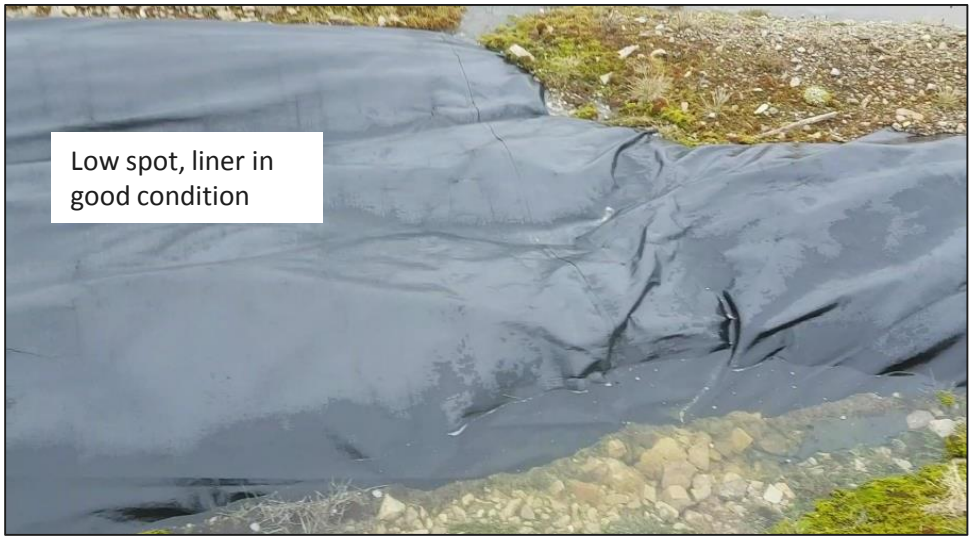

Photo: 24

Date:
July 25, 2017

Description:
LTU 2 low spot, close-up of Inset 4

Location:
LTU 2 west wall south central portion, looking west towards liner

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 25

Date: July 27, 2017

Description:
LTU 1, east wall liner section

Location:
East wall of LTU 1 south portion, view looking northeast

Photo: 26

Date:
July 27, 2017

Description:
Minor tears in liner, generally good condition

Location:
East wall, south portion of LTU 1, close-up

Photo: 27

Date:
July 27, 2017

Description:
North wall of LTU 1, east end portion, good condition

Location:
Northeast corner of LTU 1, view looking north

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 28

Date: July 27, 2017

Description:
LTU 1 north wall, center and west portion, good condition

Location:
North end, middle of LTU 1, view along north wall, looking northwest

Photo: 29

Date:
July 27, 2017

Description:
Separate LTU 1 berm, west wall, good condition

Location:
View looking south

Photo: 30

Date:
July 24, 2017

Description:
West-most separate LTU 1 berm, liner in good condition

Location:
Southwest corner of LTU1 looking north

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

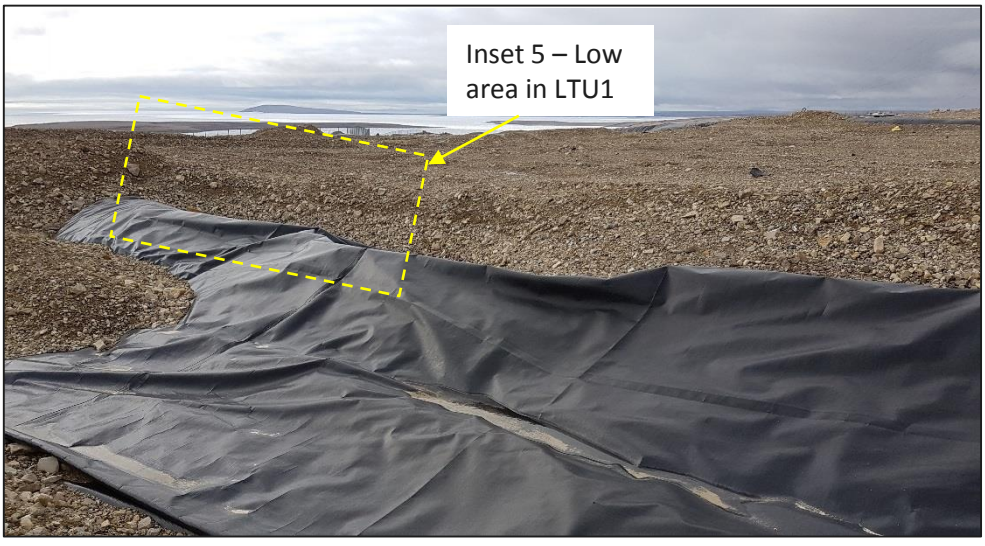

Photo: 31

Date: July 27, 2017

Description:
South wall of LTU 1, center east portion, east of access point. Inset 5 for photo 32, low spot in liner wall

Location:
Standing on exterior of LTU 1 looking northwest

Photo: 32

Date:
July 27, 2017

Description:
Inset 5, from interior of LTU 1, low spot, liner in good condition

Location:
South wall of LTU 1, east center portion, view looking southwest towards liner

Photo: 33

Date:
July 25, 2017

Description:
SW 1 sampling location

Location:
North of LTU 1, view along north wall from exterior of LTU1 northwest corner, view looking east

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 34

Date: July 24, 2017

Description:
SW2 sampling location

Location:
From LTU2 west wall, south centre portion view looking southwest

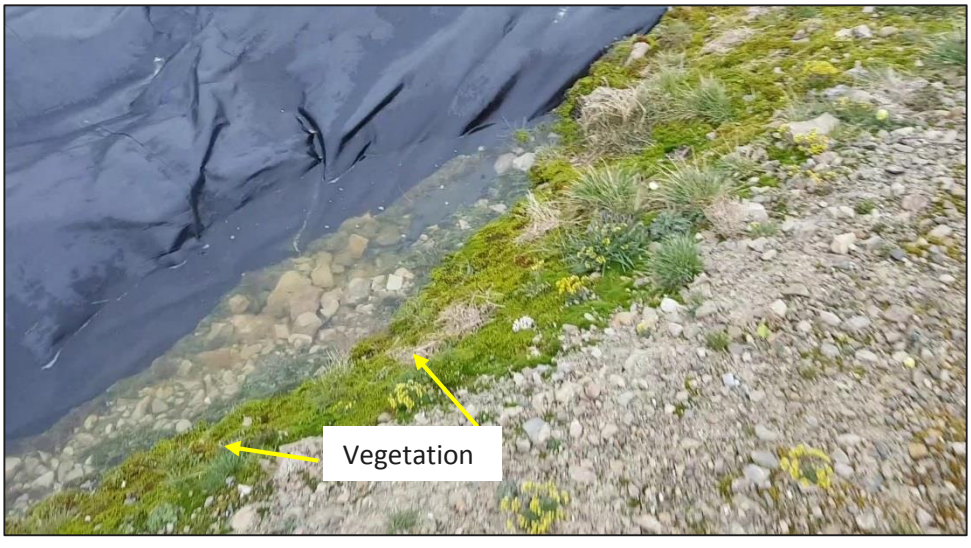

Photo: 35

Date:
July 25, 2017

Description:
Growth area at LTU2 ditch

Location:
Near LTU 2 low spot and SW 2, looking northwest towards ground.

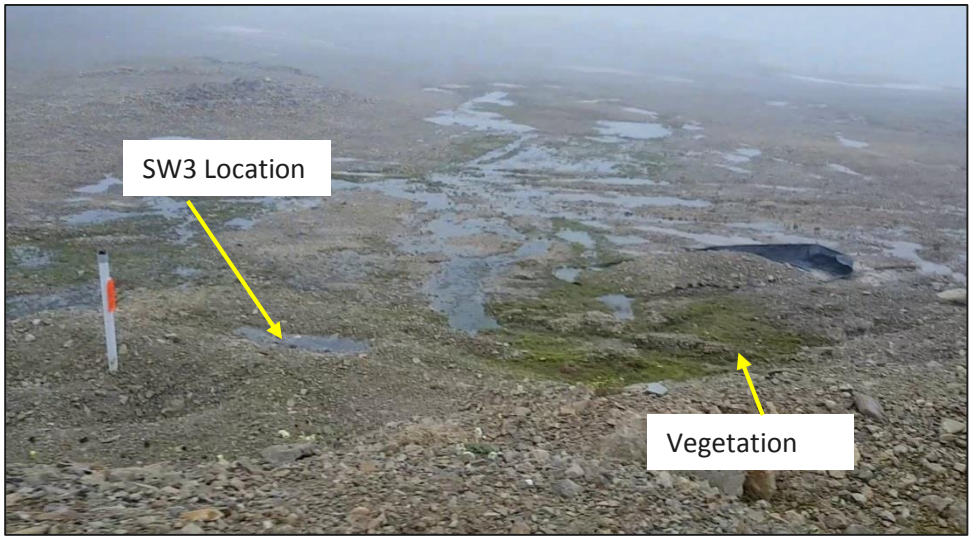

Photo: 36

Date:
July 25, 2017

Description:
SW 3 sampling location, and vegetation following site drainage

Location:
North of LTU 2, view toward ground

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 37

Date: July 24, 2017

Description:
Close-up near SW3, water and vegetation

Location:
Towards ground at SW3

Photo: 38

Date:
July 25, 2017

Description:
Drainage north of LTU 1, from north to south

Location:
Standing at northwest corner of LTU 1 exterior, looking east

Photo: 39

Date:
July 25, 2017

Description:
LTU 1 interior draining

Location:
South end of LTU 1, center east portion

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 40

Date: July 24, 2017

Description:
LTU 2 interior drainage north to south and to center from outsides

Location:
South east end of LTU 2, view looking north

Photo: 41

Date:
July 25, 2017

Description:
Drainage to ditch in LTU 2, and site drainage from north to south. Right side of phot shows interior of LTU 2 and left side shows exterior.

Location:
Standing south center of LTU2 at west wall, view looking northwest

Photo: 42

Date:
July 25, 2017

Description
Site drainage from north to south

Location:
Standing at center portion of LTU 2 west wall, view looking south

Project Photographs

2017 Environmental Monitoring Resolute Bay Airport, Land Treatment Unit
Resolute, NU

Photo: 43

Date: July 25, 2017

Description:
Drainage south of site, south of MW5 and LTU2

Location:
Standing on southeast corner of LTU 2 looking down, and south

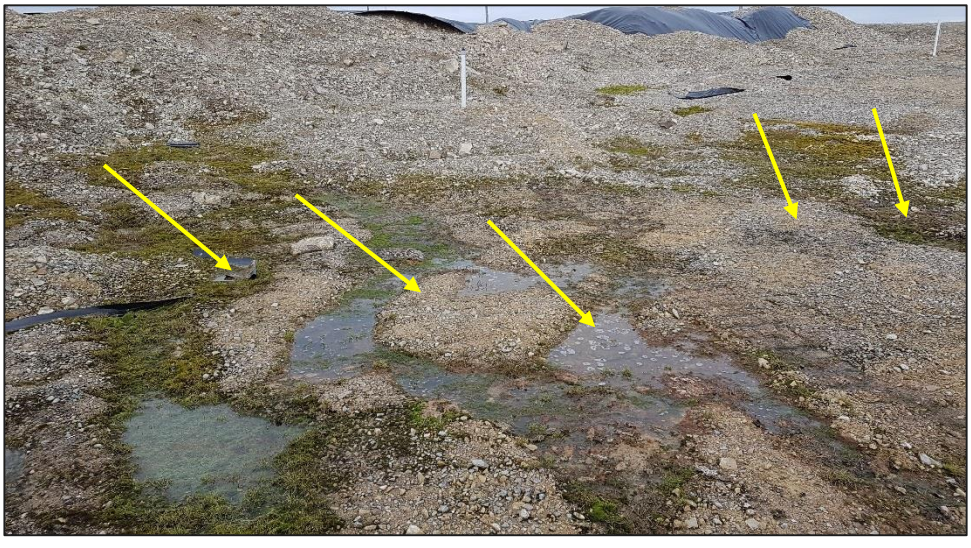

Photo: 44

Date:
July 24, 2017

Description:
Drainage at south of site, south of MW5, alternate view

Location:
View looking northeast towards MW5 and LTU 2

Photo: 45

Date:
July 27, 2017

Description:
PSPC storage units south of site, all accounted for and in good condition

Location:
Approx. 150m southwest of airport LTUs, view looking east

APPENDIX C

Analytical Laboratory Certificates of Analysis

Maxxam
A Bureau Veritas Group Company

Your P.O. #: 100463-003
Your Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your C.O.C. #: 620455-01-02, 620455-01-01

Attention:Maurenia Lynds

ARCADIS Canada Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2017/08/25
Report #: R4675076
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7G4522
Received: 2017/08/01, 10:40

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Alkalinity (1)	6	N/A	2017/08/05	CAM SOP-00448	SM 22 2320 B m
Carbonate, Bicarbonate and Hydroxide (1)	6	N/A	2017/08/08	CAM SOP-00102	APHA 4500-CO2 D
Chloride by Automated Colourimetry (1)	3	N/A	2017/08/04	CAM SOP-00463	EPA 325.2 m
Chloride by Automated Colourimetry (1)	3	N/A	2017/08/08	CAM SOP-00463	EPA 325.2 m
Conductivity (1)	6	N/A	2017/08/05	CAM SOP-00414	SM 22 2510 m
Petroleum Hydro. CCME F1 & BTEX in Water	6	N/A	2017/08/03	OTT SOP-00002	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water (3)	6	2017/08/03	2017/08/03	OTT SOP-00001	CCME Hydrocarbons
Total Ammonia-N (1)	6	N/A	2017/08/09	CAM SOP-00441	EPA GS I-2522-90 m
Nitrate (NO3) and Nitrite (NO2) in Water (1, 4)	6	N/A	2017/08/09	CAM SOP-00440	SM 22 4500-NO3I/NO2B
Total Oil and Grease (1)	6	2017/08/04	2017/08/05	CAM SOP-00326	EPA1664B m,SM5520A m
PAH Compounds in Water by GC/MS (SIM)	6	2017/08/04	2017/08/04	OTT SOP-00011	EPA 8270D/3510C m
pH (1)	6	N/A	2017/08/05	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP) (1)	6	N/A	2017/08/04	CAM SOP-00444	OMOE E3179 m
Sulphate by Automated Colourimetry (1)	3	N/A	2017/08/04	CAM SOP-00464	EPA 375.4 m
Sulphate by Automated Colourimetry (1)	3	N/A	2017/08/08	CAM SOP-00464	EPA 375.4 m
Total Suspended Solids (1)	6	2017/08/03	2017/08/03	CAM SOP-00428	SM 22 2540D m
Hardness Total (calculated as CaCO3) (2)	6	N/A	N/A	BBY WI-00033	Auto Calc

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

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Maxxam
A Bureau Veritas Group Company

Your P.O. #: 100463-003
Your Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your C.O.C. #: 620455-01-02, 620455-01-01

Attention:Maurenia Lynds

ARCADIS Canada Inc
329 Churchill Ave N
Suite 200
Ottawa, ON
K1Z 5B8

Report Date: 2017/08/25
Report #: R4675076
Version: 2 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B7G4522
Received: 2017/08/01, 10:40

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

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

(1) This test was performed by Maxxam Analytics Mississauga
(2) This test was performed by Campo to Burnaby Subcontract
(3) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.
(4) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Alison Cameron, Project Manager
Email: ACameron@maxxam.ca
Phone# (613) 274-0573
==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

CCME PETROLEUM HYDROCARBONS IN WATER (WATER)

Maxxam ID		EWC394	EWC395	EWC396	EWC397	EWC398	EWC399		
Sampling Date		2017/07/25 09:00	2017/07/25 09:45	2017/07/25 13:00	2017/07/25 14:15	2017/07/25 15:00	2017/07/25		
COC Number		620455-01-01	620455-01-01	620455-01-01	620455-01-01	620455-01-01	620455-01-01		
	UNITS	**MW-1**	**SW-1**	**SW-2**	**SW-3**	**SW-B**	**DUP-1**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons									
Benzene	ug/L	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5103736
Toluene	ug/L	3.0	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5103736
Ethylbenzene	ug/L	0.36	<0.20	<0.20	<0.20	<0.20	<0.20	0.20	5103736
o-Xylene	ug/L	1.2	<0.20	0.71	<0.20	<0.20	<0.20	0.20	5103736
p+m-Xylene	ug/L	2.1	<0.40	<0.40	<0.40	<0.40	<0.40	0.40	5103736
Total Xylenes	ug/L	3.3	<0.40	0.71	<0.40	<0.40	<0.40	0.40	5103736
F1 (C6-C10)	ug/L	<25	<25	<25	<25	<25	<25	25	5103736
F1 (C6-C10) - BTEX	ug/L	<25	<25	<25	<25	<25	<25	25	5103736
F2-F4 Hydrocarbons									
F2 (C10-C16 Hydrocarbons)	ug/L	<100	<100	<100	<100	<100	<100	100	5104645
F3 (C16-C34 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	<200	200	5104645
F4 (C34-C50 Hydrocarbons)	ug/L	<200	<200	<200	<200	<200	<200	200	5104645
Reached Baseline at C50	ug/L	Yes	Yes	Yes	Yes	Yes	Yes		5104645
Surrogate Recovery (%)									
1,4-Difluorobenzene	%	92	91	95	92	91	91		5103736
4-Bromofluorobenzene	%	102	109	103	100	107	108		5103736
D10-Ethylbenzene	%	117	112	120	109	116	118		5103736
D4-1,2-Dichloroethane	%	96	97	94	99	99	103		5103736
o-Terphenyl	%	98	95	98	96	100	100		5104645

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Maxxam ID		EWC394			EWC395		EWC396		
Sampling Date		2017/07/25 09:00			2017/07/25 09:45		2017/07/25 13:00		
COC Number		620455-01-01			620455-01-01		620455-01-01		
	UNITS	**MW-1**	**RDL**	**QC Batch**	**SW-1**	**QC Batch**	**SW-2**	**RDL**	**QC Batch**
Calculated Parameters									
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	130	1.0	5101629	130	5101629	140	1.0	5101629
Carb. Alkalinity (calc. as CaCO3)	mg/L	1.9	1.0	5101629	2.6	5101629	2.0	1.0	5101629
Inorganics									
Total Ammonia-N	mg/L	<0.050	0.050	5106008	<0.050	5106008	<0.050	0.050	5106008
Conductivity	umho/cm	270	1.0	5106183	260	5106183	280	1.0	5106183
pH	pH	8.19		5106193	8.34	5106193	8.20		5106193
Phenols-4AAP	mg/L	<0.0010	0.0010	5106130	<0.0010	5106130	0.0026	0.0010	5106130
Total Suspended Solids	mg/L	4800	50	5104887	<10	5104887	<10	10	5104887
Dissolved Sulphate (SO4)	mg/L	3.4	1.0	5106069	3.5	5105203	3.6	1.0	5106069
Alkalinity (Total as CaCO3)	mg/L	130	1.0	5106176	130	5106176	140	1.0	5106176
Dissolved Chloride (Cl)	mg/L	12	1.0	5106066	7.4	5105193	4.9	1.0	5106066
Nitrite (N)	mg/L	<0.010	0.010	5105126	<0.010	5105126	<0.010	0.010	5105126
Nitrate (N)	mg/L	0.19	0.10	5105126	0.17	5105126	0.11	0.10	5105126
Nitrate + Nitrite (N)	mg/L	0.19	0.10	5105126	0.17	5105126	0.11	0.10	5105126
Petroleum Hydrocarbons									
Total Oil & Grease	mg/L	<0.50	0.50	5105679	<0.50	5105679	<0.50	0.50	5105679

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Maxxam ID		EWC396			EWC397			EWC398		
Sampling Date		2017/07/25 13:00			2017/07/25 14:15			2017/07/25 15:00		
COC Number		620455-01-01			620455-01-01			620455-01-01		
	UNITS	**SW-2 Lab-Dup**	**RDL**	**QC Batch**	**SW-3**	**RDL**	**QC Batch**	**SW-B**	**RDL**	**QC Batch**
Calculated Parameters										
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		1.0	5101629	180	1.0	5101629	160	1.0	5101629
Carb. Alkalinity (calc. as CaCO3)	mg/L		1.0	5101629	3.3	1.0	5101629	2.8	1.0	5101629
Inorganics										
Total Ammonia-N	mg/L		0.050	5106008	<0.050	0.050	5106008	0.34	0.050	5106008
Conductivity	umho/cm		1.0	5106183	340	1.0	5106183	330	1.0	5106183
pH	pH			5106193	8.30		5106193	8.28		5106193
Phenols-4AAP	mg/L		0.0010	5106130	<0.010 (1)	0.010	5106130	0.0056	0.0020	5106130
Total Suspended Solids	mg/L		10	5104887	<10	10	5104887	<10	10	5104887
Dissolved Sulphate (SO4)	mg/L		1.0	5106069	3.2	1.0	5105203	4.2	1.0	5106069
Alkalinity (Total as CaCO3)	mg/L		1.0	5106176	180	1.0	5106176	160	1.0	5106176
Dissolved Chloride (Cl)	mg/L		1.0	5106066	6.7	1.0	5105193	7.3	1.0	5106066
Nitrite (N)	mg/L	<0.010	0.010	5105126	<0.010	0.010	5105126	0.010	0.010	5105126
Nitrate (N)	mg/L	0.20	0.10	5105126	0.37	0.10	5105126	1.45	0.10	5105126
Nitrate + Nitrite (N)	mg/L	0.20	0.10	5105126	0.37	0.10	5105126	1.46	0.10	5105126
Petroleum Hydrocarbons										
Total Oil & Grease	mg/L		0.50	5105679	<0.50	0.50	5105679	<0.50	0.50	5105679

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Detection limit was raised due to matrix interferences.

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

RESULTS OF ANALYSES OF WATER

Maxxam ID		EWC398			EWC399		
Sampling Date		2017/07/25 15:00			2017/07/25		
COC Number		620455-01-01			620455-01-01		
	UNITS	**SW-B Lab-Dup**	**RDL**	**QC Batch**	**DUP-1**	**RDL**	**QC Batch**
Calculated Parameters							
Bicarb. Alkalinity (calc. as CaCO3)	mg/L		1.0	5101629	180	1.0	5101629
Carb. Alkalinity (calc. as CaCO3)	mg/L		1.0	5101629	3.8	1.0	5101629
Inorganics							
Total Ammonia-N	mg/L	0.33	0.050	5106008	<0.050	0.050	5106008
Conductivity	umho/cm		1.0	5106183	340	1.0	5106183
pH	pH			5106193	8.36		5106193
Phenols-4AAP	mg/L		0.0020	5106130	<0.010 (1)	0.010	5106130
Total Suspended Solids	mg/L		10	5104887	<10	10	5104887
Dissolved Sulphate (SO4)	mg/L		1.0	5106069	3.4	1.0	5105203
Alkalinity (Total as CaCO3)	mg/L		1.0	5106176	180	1.0	5106176
Dissolved Chloride (Cl)	mg/L		1.0	5106066	6.9	1.0	5105193
Nitrite (N)	mg/L		0.010	5105126	<0.010	0.010	5105126
Nitrate (N)	mg/L		0.10	5105126	0.36	0.10	5105126
Nitrate + Nitrite (N)	mg/L		0.10	5105126	0.36	0.10	5105126
Petroleum Hydrocarbons							
Total Oil & Grease	mg/L		0.50	5105679	<0.50	0.50	5105679

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate
(1) Detection limit was raised due to matrix interferences.

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		EWC394	EWC394	EWC395	EWC396	EWC397	EWC398		
Sampling Date		2017/07/25 09:00	2017/07/25 09:00	2017/07/25 09:45	2017/07/25 13:00	2017/07/25 14:15	2017/07/25 15:00		
COC Number		620455-01-01	620455-01-01	620455-01-01	620455-01-01	620455-01-01	620455-01-01		
	UNITS	**MW-1**	**MW-1 Lab-Dup**	**SW-1**	**SW-2**	**SW-3**	**SW-B**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons									
Acenaphthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Acenaphthylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Benzo(a)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Benzo(a)pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Benzo(b/j)fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Benzo(g,h,i)perylene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Benzo(k)fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Chrysene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Dibenz(a,h)anthracene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Fluoranthene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Fluorene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
1-Methylnaphthalene	ug/L	0.050	0.045	<0.010	0.060	0.015	<0.010	0.010	5105687
2-Methylnaphthalene	ug/L	0.040	0.035	<0.010	0.045	0.045	0.025	0.010	5105687
Naphthalene	ug/L	0.050	0.060	<0.010	0.055	0.025	<0.010	0.010	5105687
Phenanthrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Pyrene	ug/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	5105687
Surrogate Recovery (%)									
D10-Anthracene	%	107	115	108	112	108	111		5105687
D14-Terphenyl (FS)	%	106	114	108	113	105	111		5105687
D8-Acenaphthylene	%	103	110	104	105	107	106		5105687

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Lab-Dup = Laboratory Initiated Duplicate

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID		EWC399		
Sampling Date		2017/07/25		
COC Number		620455-01-01		
	UNITS	**DUP-1**	**RDL**	**QC Batch**
Polyaromatic Hydrocarbons				
Acenaphthene	ug/L	<0.010	0.010	5105687
Acenaphthylene	ug/L	<0.010	0.010	5105687
Anthracene	ug/L	<0.010	0.010	5105687
Benzo(a)anthracene	ug/L	<0.010	0.010	5105687
Benzo(a)pyrene	ug/L	<0.010	0.010	5105687
Benzo(b/j)fluoranthene	ug/L	<0.010	0.010	5105687
Benzo(g,h,i)perylene	ug/L	<0.010	0.010	5105687
Benzo(k)fluoranthene	ug/L	<0.010	0.010	5105687
Chrysene	ug/L	<0.010	0.010	5105687
Dibenz(a,h)anthracene	ug/L	<0.010	0.010	5105687
Fluoranthene	ug/L	<0.010	0.010	5105687
Fluorene	ug/L	<0.010	0.010	5105687
Indeno(1,2,3-cd)pyrene	ug/L	<0.010	0.010	5105687
1-Methylnaphthalene	ug/L	0.025	0.010	5105687
2-Methylnaphthalene	ug/L	0.025	0.010	5105687
Naphthalene	ug/L	0.015	0.010	5105687
Phenanthrene	ug/L	<0.010	0.010	5105687
Pyrene	ug/L	<0.010	0.010	5105687
Surrogate Recovery (%)				
D10-Anthracene	%	109		5105687
D14-Terphenyl (FS)	%	106		5105687
D8-Acenaphthylene	%	99		5105687

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

TEST SUMMARY

Maxxam ID: EWC394
Sample ID: MW-1
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5106066	N/A	2017/08/08	Alina Dobreanu
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5106069	N/A	2017/08/08	Alina Dobreanu
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

Maxxam ID: EWC394 Dup
Sample ID: MW-1
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici

Maxxam ID: EWC395
Sample ID: SW-1
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5105193	N/A	2017/08/04	Deonarine Ramnarine
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5105203	N/A	2017/08/04	Deonarine Ramnarine
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

TEST SUMMARY

Maxxam ID: EWC396
Sample ID: SW-2
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5106066	N/A	2017/08/08	Alina Dobreanu
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5106069	N/A	2017/08/08	Alina Dobreanu
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

Maxxam ID: EWC396 Dup
Sample ID: SW-2
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal

Maxxam ID: EWC397
Sample ID: SW-3
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5105193	N/A	2017/08/04	Deonarine Ramnarine
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5105203	N/A	2017/08/04	Deonarine Ramnarine
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

TEST SUMMARY

Maxxam ID: EWC398
Sample ID: SW-B
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5106066	N/A	2017/08/08	Alina Dobreanu
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5106069	N/A	2017/08/08	Alina Dobreanu
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

Maxxam ID: EWC398 Dup
Sample ID: SW-B
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware

Maxxam ID: EWC399
Sample ID: DUP-1
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/01

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Alkalinity	AT	5106176	N/A	2017/08/05	Surinder Rai
Carbonate, Bicarbonate and Hydroxide	CALC	5101629	N/A	2017/08/08	Automated Statchk
Chloride by Automated Colourimetry	KONE	5105193	N/A	2017/08/04	Deonarine Ramnarine
Conductivity	AT	5106183	N/A	2017/08/05	Surinder Rai
Petroleum Hydro. CCME F1 & BTEX in Water	HSGC/MSFD	5103736	N/A	2017/08/03	Lyndsey Hart
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	5104645	2017/08/03	2017/08/03	Arezoo Habibagahi
Total Ammonia-N	LACH/NH4	5106008	N/A	2017/08/09	Charles Opoku-Ware
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	5105126	N/A	2017/08/09	Chandra Nandlal
Total Oil and Grease	BAL	5105679	2017/08/04	2017/08/05	Amjad Mir
PAH Compounds in Water by GC/MS (SIM)	GC/MS	5105687	2017/08/04	2017/08/04	Liliana Gaburici
pH	AT	5106193	N/A	2017/08/05	Surinder Rai
Phenols (4AAP)	TECH/PHEN	5106130	N/A	2017/08/04	Zahid Soikot
Sulphate by Automated Colourimetry	KONE	5105203	N/A	2017/08/04	Deonarine Ramnarine
Total Suspended Solids	BAL	5104887	2017/08/03	2017/08/03	Xue Zheng Li(Scott)
Hardness Total (calculated as CaCO3)	CALC	5134346	N/A		Fatemeh Habibagahi

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.7°C
Package 2	3.3°C

Sample EWC394 [MW-1] : Kindly refer to the attached sediment sheet for a description for the presence of visible particulate/sediment.

Results relate only to the items tested.

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

QUALITY ASSURANCE REPORT

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5103736	1,4-Difluorobenzene	2017/08/03	97	70 - 130	90	70 - 130	99	%				
5103736	4-Bromofluorobenzene	2017/08/03	109	70 - 130	99	70 - 130	107	%				
5103736	D10-Ethylbenzene	2017/08/03	124	70 - 130	118	70 - 130	120	%				
5103736	D4-1,2-Dichloroethane	2017/08/03	110	70 - 130	96	70 - 130	104	%				
5104645	o-Terphenyl	2017/08/03	98	30 - 130	103	30 - 130	97	%				
5105687	D10-Anthracene	2017/08/04	111	50 - 130	109	50 - 130	111	%				
5105687	D14-Terphenyl (FS)	2017/08/04	112	50 - 130	112	50 - 130	113	%				
5105687	D8-Acenaphthylene	2017/08/04	104	50 - 130	101	50 - 130	103	%				
5103736	Benzene	2017/08/03	94	70 - 130	85	70 - 130	<0.20	ug/L	NC	40		
5103736	Ethylbenzene	2017/08/03	106	70 - 130	93	70 - 130	<0.20	ug/L	NC	40		
5103736	F1 (C6-C10) - BTEX	2017/08/03					<25	ug/L	NC	40		
5103736	F1 (C6-C10)	2017/08/03	102	70 - 130	101	70 - 130	<25	ug/L	NC	40		
5103736	o-Xylene	2017/08/03	114	70 - 130	100	70 - 130	<0.20	ug/L	NC	40		
5103736	p+m-Xylene	2017/08/03	127	70 - 130	111	70 - 130	<0.40	ug/L	NC	40		
5103736	Toluene	2017/08/03	115	70 - 130	95	70 - 130	<0.20	ug/L	NC	40		
5103736	Total Xylenes	2017/08/03					<0.40	ug/L	NC	40		
5104645	F2 (C10-C16 Hydrocarbons)	2017/08/03	100	50 - 130	102	80 - 120	<100	ug/L	NC	50		
5104645	F3 (C16-C34 Hydrocarbons)	2017/08/03	100	50 - 130	102	80 - 120	<200	ug/L	NC	50		
5104645	F4 (C34-C50 Hydrocarbons)	2017/08/03	100	50 - 130	102	80 - 120	<200	ug/L	NC	50		
5104887	Total Suspended Solids	2017/08/03					<10	mg/L	NC	25	101	85 - 115
5105126	Nitrate (N)	2017/08/09	120	80 - 120	106	80 - 120	<0.10	mg/L	NC	20		
5105126	Nitrite (N)	2017/08/09	98	80 - 120	93	80 - 120	<0.010	mg/L	NC	20		
5105193	Dissolved Chloride (Cl)	2017/08/04	NC	80 - 120	104	80 - 120	<1.0	mg/L	1.3	20		
5105203	Dissolved Sulphate (SO4)	2017/08/04	NC	75 - 125	102	80 - 120	<1.0	mg/L	4.6	20		
5105679	Total Oil & Grease	2017/08/05			101	85 - 115	<0.50	mg/L	3.1	25		
5105687	1-Methylnaphthalene	2017/08/04	107	50 - 130	98	50 - 130	<0.010	ug/L	11	30		
5105687	2-Methylnaphthalene	2017/08/04	102	50 - 130	96	50 - 130	<0.010	ug/L	13	30		
5105687	Acenaphthene	2017/08/04	113	50 - 130	103	50 - 130	<0.010	ug/L	NC	30		
5105687	Acenaphthylene	2017/08/04	104	50 - 130	96	50 - 130	<0.010	ug/L	NC	30		
5105687	Anthracene	2017/08/04	109	50 - 130	103	50 - 130	<0.010	ug/L	NC	30		

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

QUALITY ASSURANCE REPORT(CONT'D)

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5105687	Benzo(a)anthracene	2017/08/04	107	50 - 130	101	50 - 130	<0.010	ug/L	NC	30		
5105687	Benzo(a)pyrene	2017/08/04	86	50 - 130	89	50 - 130	<0.010	ug/L	NC	30		
5105687	Benzo(b/j)fluoranthene	2017/08/04	112	50 - 130	102	50 - 130	<0.010	ug/L	NC	30		
5105687	Benzo(g,h,i)perylene	2017/08/04	88	50 - 130	82	50 - 130	<0.010	ug/L	NC	30		
5105687	Benzo(k)fluoranthene	2017/08/04	107	50 - 130	98	50 - 130	<0.010	ug/L	NC	30		
5105687	Chrysene	2017/08/04	105	50 - 130	100	50 - 130	<0.010	ug/L	NC	30		
5105687	Dibenz(a,h)anthracene	2017/08/04	104	50 - 130	107	50 - 130	<0.010	ug/L	NC	30		
5105687	Fluoranthene	2017/08/04	109	50 - 130	102	50 - 130	<0.010	ug/L	NC	30		
5105687	Fluorene	2017/08/04	121	50 - 130	104	50 - 130	<0.010	ug/L	NC	30		
5105687	Indeno(1,2,3-cd)pyrene	2017/08/04	102	50 - 130	105	50 - 130	<0.010	ug/L	NC	30		
5105687	Naphthalene	2017/08/04	95	50 - 130	89	50 - 130	<0.010	ug/L	18	30		
5105687	Phenanthrene	2017/08/04	109	50 - 130	102	50 - 130	<0.010	ug/L	NC	30		
5105687	Pyrene	2017/08/04	106	50 - 130	100	50 - 130	<0.010	ug/L	NC	30		
5106008	Total Ammonia-N	2017/08/09	100	80 - 120	102	85 - 115	<0.050	mg/L	4.5	20		
5106066	Dissolved Chloride (Cl)	2017/08/08	NC	80 - 120	103	80 - 120	<1.0	mg/L	0.33	20		
5106069	Dissolved Sulphate (SO4)	2017/08/08	NC	75 - 125	102	80 - 120	<1.0	mg/L	0.83	20		
5106130	Phenols-4AAP	2017/08/04	114	80 - 120	104	85 - 115	<0.0010	mg/L	13	20		
5106176	Alkalinity (Total as CaCO3)	2017/08/04			96	85 - 115	<1.0	mg/L	2.2	20		
5106183	Conductivity	2017/08/04			100	85 - 115	<1.0	umho/cm	0.64	25		

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

QUALITY ASSURANCE REPORT(CONT'D)

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

			Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
5106193	pH	2017/08/04			101	98 - 103			0.48	N/A		

N/A = Not Applicable

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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Maxxam Job #: B7G4522
Report Date: 2017/08/25

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Site Location: RESOLUTE AIRPORT LTUS
Your P.O. #: 100463-003
Sampler Initials: KC

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Paul Rubinato, Analyst, Maxxam Analytics

Steve Roberts, Ottawa Lab Manager

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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01-Aug-17 10:40

Alison Cameron

B7G4522

KIV OTT-001

CAM FCD-01013/4

Presence of Visible Particulate/Sediment

When there is >1cm of visible particulate/sediment, the amount will be recorded in the field below

Bottle Types

	Sample ID	All	Inorganics					Organics											Hydrocarbons							Volatiles				Other
			CrVI	CN	General	Hg	Metals (Diss.)	Organic 1 of 2	Organic 2 of 2	PCB 1 of 2	PCB 2 of 2	Pest/ Herb 1 of 2	Pest/ Herb 2 of 2	SVOC/ ABN 1 of 2	SVOC/ ABN 2 of 2	PAH 1 of 2	PAH 2 of 2	Dioxin /Furan	F1 Vial 1	F1 Vial 2	F1 Vial 3	F1 Vial 4	F2-F4 1 of 2	F2-F4 2 of 2	F4G	VOC Vial 1	VOC Vial 2	VOC Vial 3	VOC Vial 4	0/4
1	MW-1				TS														TS	TS										TS
2																														
3																														
4																														
5																														
6																														
7																														
8																														
9																														
##																														

Comments:

Legend:	
P	Suspended Particulate
TP	Trace Settled Particulate (just covers bottom of container or less)
TS	Trace Settled Sediment (just covers bottom of container or less)
S	Sediment greater than (>) Trace, but less than (<) 1 cm

Recorded By: (signature/print)	Kam. Jayasekara by

Maxxam
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Maxxam Analytics International Corporation o/a Maxxam Analytics
6740 Campobello Road, Mississauga, Ontario Canada L5N 2L8 Tel:(905) 817-5700 Toll-free:800-563-6266 Fax:(905) 817-5777 www.maxxam.ca

CHAIN OF CUSTODY RECORD

Page 1 of 1

INVOICE TO:	REPORT TO:	PROJECT INFORMATION:	Laboratory Use Only:
Company Name: #10988 ARCADIS Canada Inc	Company Name: Arcadis Canada, Inc.	Quotation #: B54416	Maxxam Job #: / Bottle Order #: 620455
Attention: Invoices Attention	Attention: Maurenia Lynds	P.O. #: 100463-003	
Address: 329 Churchill Ave N Suite 200, Ottawa ON K1Z 5B8	Address:	Project: RESOLUTE ~~SOIL~~ GW/SW	COC #: C#620455-01-02
Tel: (613) 721-0555 x Fax: (613) 721-0029 x	Tel: Fax:	Project Name: Resolute Airport LTUs	Project Manager: Alison Cameron
Email: invoicesottawa@arcadis.com, barb.adelman@arcadis-c	Email: maurenia.lynds@arcadis.com	Site #:	
		Sampled By: Keith Coulthart	

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153 (2011): ☐ Table 1 ☐ Res/Park ☐ Medium/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ For RSC ☐ Table ___

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ Reg 558 ☐ Storm Sewer Bylaw ☐ MISA Municipality ☐ PWQO ☒ Other Nunavut Water Board

Special Instructions: * Refer to Maxxam Quote: B54416

Include Criteria on Certificate of Analysis (Y/N)? ____

ANALYSIS REQUESTED (PLEASE BE SPECIFIC)

#	Sample Barcode Label	Sample (Location) Identification	Date Sampled	Time Sampled	Matrix	Field Filtered (please circle): Metals / Hg / Cr VI	Total Oil and Grease Water	Phenols water	F1-BTEX	PHC F2-F4	General Chemistry	PAHs	Metals	# of Bottles	Comments
1		MW-1	25 July	9:00am	GW		X	X	X	X	X	X	X	10	
2		SW-1	↓	9:45am	SW		↓	↓	↓	↓	↓	↓	↓	10	
3		SW-2	↓	1:00pm	↓		↓	↓	↓	↓	↓	↓	↓	10	
4		SW-3	↓	2:15pm	↓		↓	↓	↓	↓	↓	↓	↓	10	
5		SW-B	↓	3:00pm	↓		↓	↓	↓	↓	↓	↓	↓	10	
6		DUP-1	↓	—	↓		↓	↓	↓	↓	↓	↓	↓	10	RECEIVED IN OTTAWA
7															
8															
9															
10															ON Ice

01-Aug-17 10:40
Alison Cameron
B7G4522
KIY OTT-001

Turnaround Time (TAT) Required:
Please provide advance notice for rush projects
Regular (Standard) TAT: ☒
(will be applied if Rush TAT is not specified):
Standard TAT = 5-7 Working days for most tests.
Please note: Standard TAT for certain tests such as BOD and Dioxins/Furans are > 5 days - contact your Project Manager for details.
Job Specific Rush TAT (if applies to entire submission)
Date Required: ____ Time Required: ____
Rush Confirmation Number: ____ (call lab for #)

* RELINQUISHED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	RECEIVED BY: (Signature/Print)	Date: (YY/MM/DD)	Time	# jars used and not submitted
[signature] Keith Coulthart	17/08/01	10:40am	[signature] Jayrem	2017/08/01	10.40	

Laboratory Use Only: Time Sensitive | Temperature (°C) on Recei 4,6,4 / 3,4,3 | Custody Seal Present: Yes ✗ | Intact: Yes ✗ | No

* UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO MAXXAM'S STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS WHICH ARE AVAILABLE FOR VIEWING AT WWW.MAXXAM.CA/TERMS.

* IT IS THE RESPONSIBILITY OF THE RELINQUISHER TO ENSURE THE ACCURACY OF THE CHAIN OF CUSTODY RECORD. AN INCOMPLETE CHAIN OF CUSTODY MAY RESULT IN ANALYTICAL TAT DELAYS.

** SAMPLE CONTAINER, PRESERVATION, HOLD TIME AND PACKAGE INFORMATION CAN BE VIEWED AT HTTP://MAXXAM.CA/WP-CONTENT/UPLOADS/ONTARIO-COC.PDF.

SAMPLES MUST BE KEPT COOL (< 10° C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

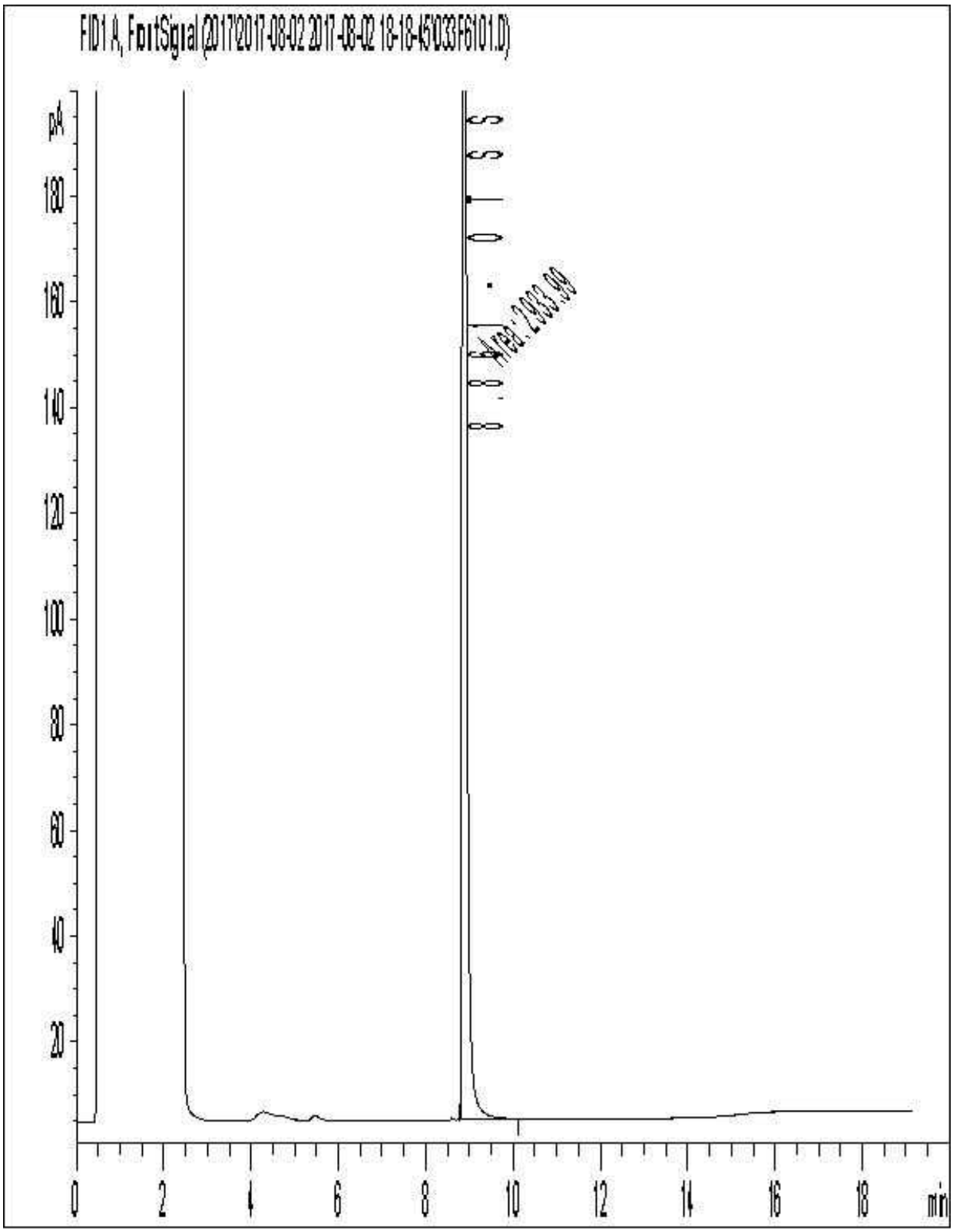
White: Maxxam Yellow: Client

Maxxam Analytics International Corporation o/a Maxxam Analytics

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC394

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: MW-1

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

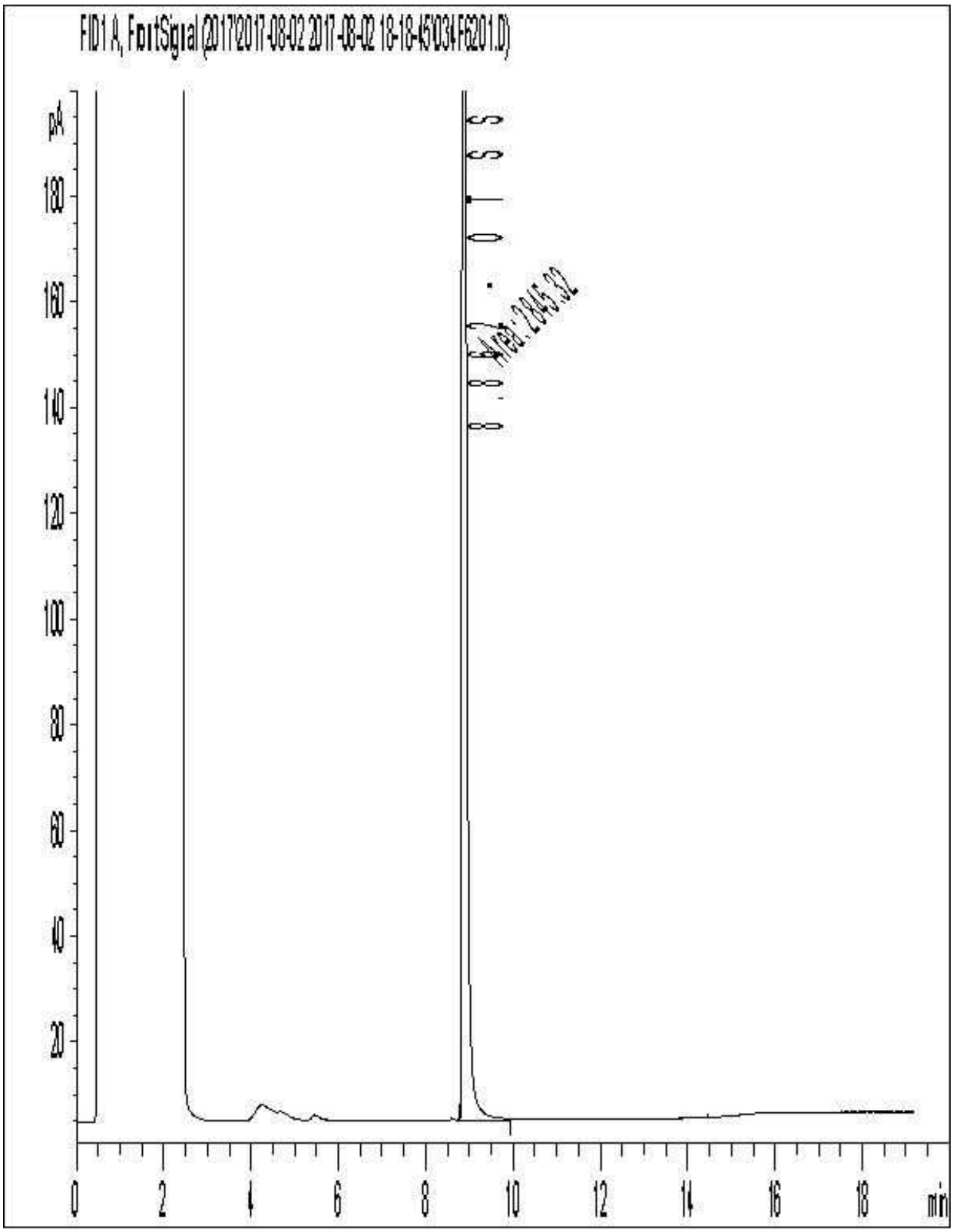


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC395

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: SW-1

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

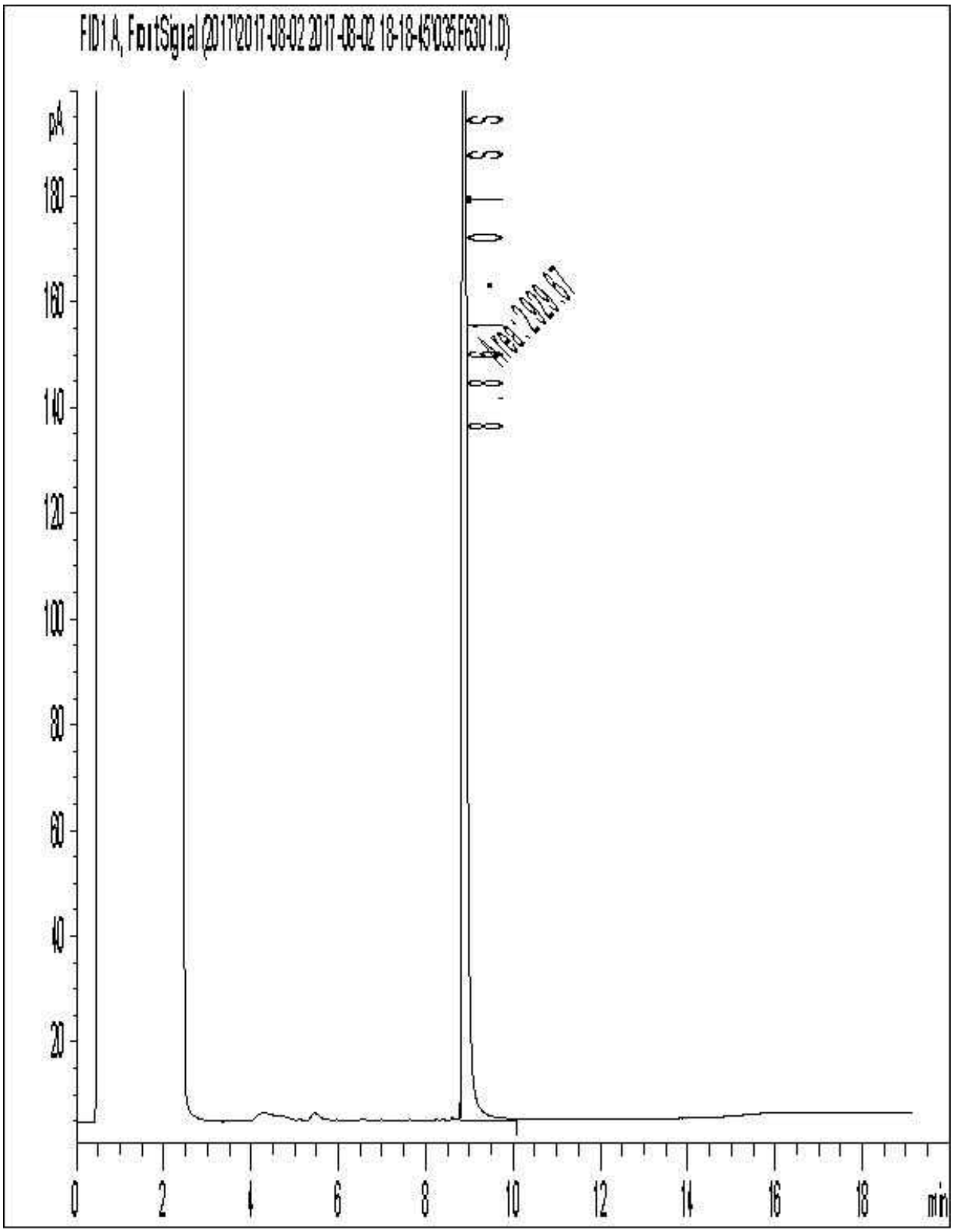


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC396

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: SW-2

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

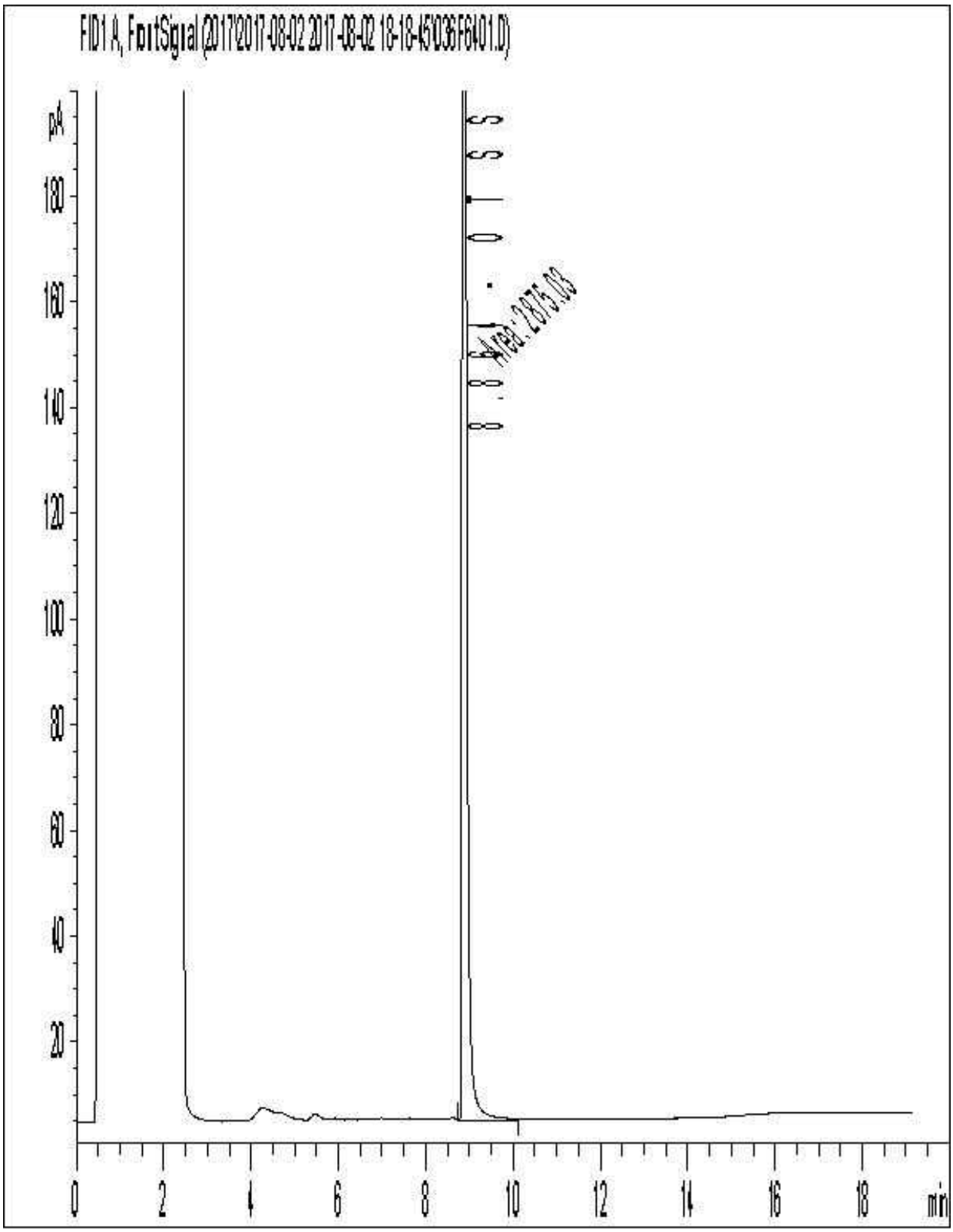


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC397

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: SW-3

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

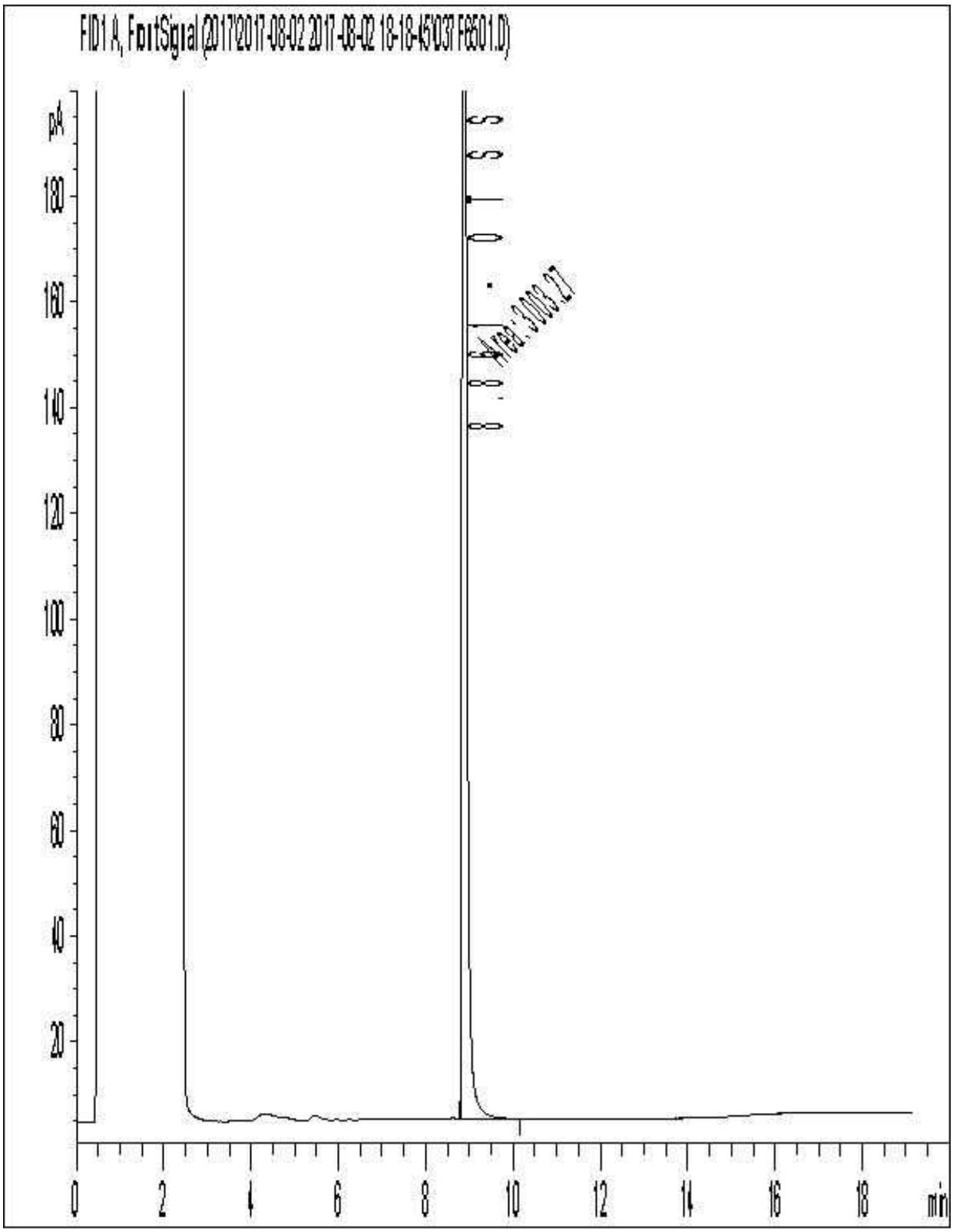


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC398

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: SW-B

Petroleum Hydrocarbons F2-F4 in Water Chromatogram

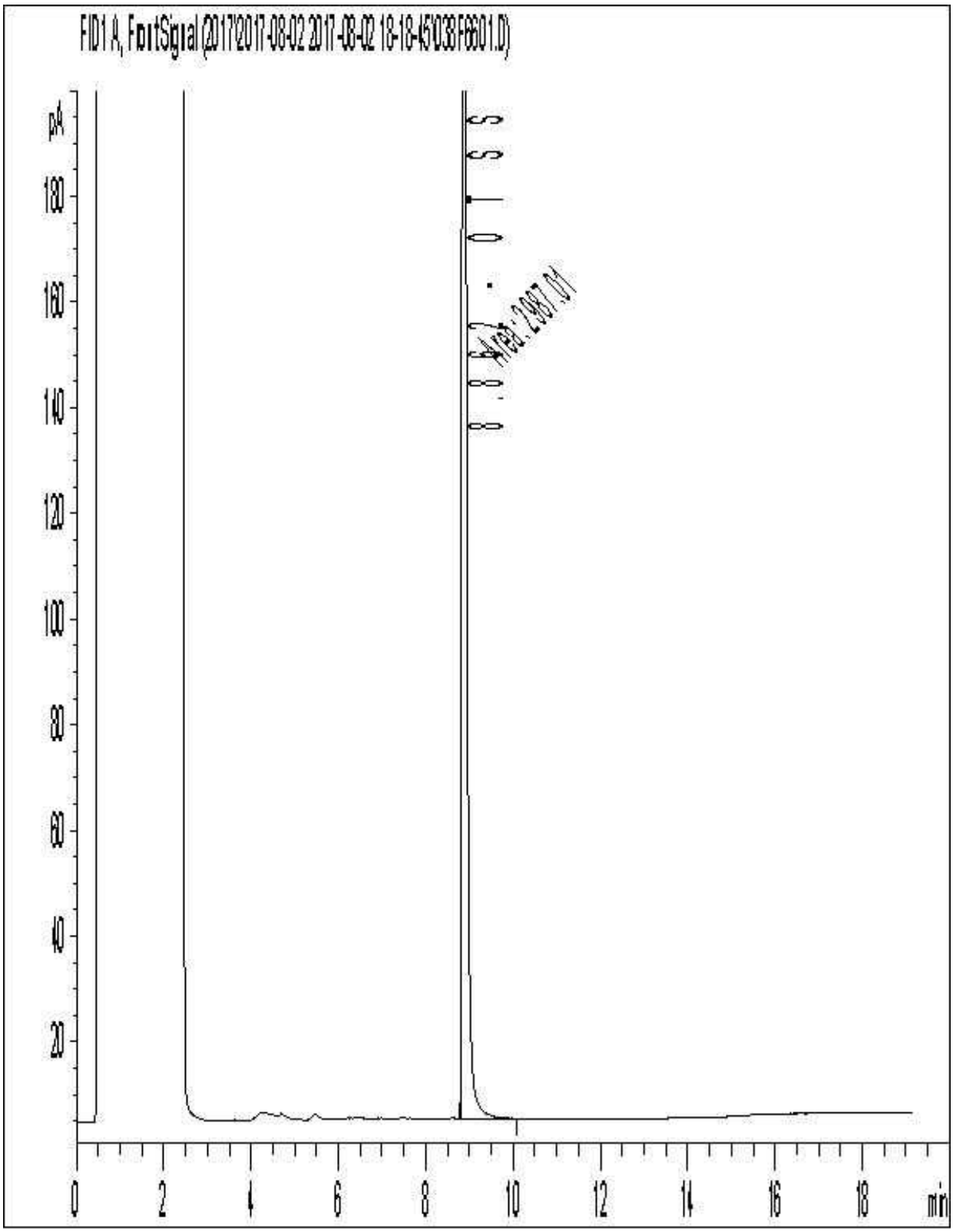


Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam Job #: B7G4522
Report Date: 2017/08/25
Maxxam Sample: EWC399

ARCADIS Canada Inc
Client Project #: RESOLUTE GW/SW
Project name: RESOLUTE AIRPORT LTUS
Client ID: DUP-1

Petroleum Hydrocarbons F2-F4 in Water Chromatogram



Note: This information is provided for reference purposes only. Should detailed chemist interpretation or fingerprinting be required, please contact the laboratory.

Maxxam
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Success Through Science®

Your P.O. #: 100463-003
Your Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your C.O.C. #: B7G4522-M058-01-01

Attention:ALISON CAMERON

MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/08/24
Report #: R2433422
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B771117
Received: 2017/08/03, 08:40

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Hardness Total (calculated as CaCO3)	1	N/A	2017/08/23	BBY WI-00033	Auto Calc
Hardness Total (calculated as CaCO3)	5	N/A	2017/08/24	BBY WI-00033	Auto Calc
Na, K, Ca, Mg, S by CRC ICPMS (total)	1	2017/08/22	2017/08/23	BBY7SOP-00002	EPA 6020B R2 m
Na, K, Ca, Mg, S by CRC ICPMS (total)	5	2017/08/22	2017/08/24	BBY7SOP-00002	EPA 6020B R2 m
Elements by CRC ICPMS (total)	6	2017/08/23	2017/08/23	BBY7SOP-00003,	BCLM2005,EPA6020bR2m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Your P.O. #: 100463-003
Your Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your C.O.C. #: B7G4522-M058-01-01

Attention:ALISON CAMERON

MAXXAM ANALYTICS
CAMPOBELLO
6740 CAMPOBELLO ROAD
MISSISSAUGA, ON
CANADA L5N 2L8

Report Date: 2017/08/24
Report #: R2433422
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B771117
Received: 2017/08/03, 08:40

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Amandeep Nagra, Account Specialist
Email: ANagra@maxxam.ca
Phone# (604)639-2602
==========
This report has been generated and distributed using a secure automated process.
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		RU2033			RU2034		
Sampling Date		2017/07/25 09:00			2017/07/25 09:45		
COC Number		B7G4522-M058-01-01			B7G4522-M058-01-01		
	UNITS	MW-1 (EWC394)	RDL	QC Batch	SW-1 (EWC395)	RDL	QC Batch
Calculated Parameters							
Total Hardness (CaCO3)	mg/L	10500	0.50	8734171	139	0.50	8734171
Total Metals by ICPMS							
Total Aluminum (Al)	ug/L	8700	30	8735687	6.2	3.0	8735712
Total Antimony (Sb)	ug/L	<5.0	5.0	8735687	<0.50	0.50	8735712
Total Arsenic (As)	ug/L	3.5	1.0	8735687	0.12	0.10	8735712
Total Barium (Ba)	ug/L	164	10	8735687	5.1	1.0	8735712
Total Beryllium (Be)	ug/L	1.8	1.0	8735687	<0.10	0.10	8735712
Total Bismuth (Bi)	ug/L	<10	10	8735687	<1.0	1.0	8735712
Total Boron (B)	ug/L	<500	500	8735687	<50	50	8735712
Total Cadmium (Cd)	ug/L	2.37	0.10	8735687	0.013	0.010	8735712
Total Chromium (Cr)	ug/L	16	10	8735687	<1.0	1.0	8735712
Total Cobalt (Co)	ug/L	10.3	2.0	8735687	<0.20	0.20	8735712
Total Copper (Cu)	ug/L	22.3	5.0	8735687	<0.50	0.50	8735712
Total Iron (Fe)	ug/L	9990	100	8735687	<10	10	8735712
Total Lead (Pb)	ug/L	144	2.0	8735687	<0.20	0.20	8735712
Total Lithium (Li)	ug/L	<20	20	8735687	<2.0	2.0	8735712
Total Manganese (Mn)	ug/L	1850	10	8735687	<1.0	1.0	8735712
Total Molybdenum (Mo)	ug/L	<10	10	8735687	<1.0	1.0	8735712
Total Nickel (Ni)	ug/L	18	10	8735687	<1.0	1.0	8735712
Total Selenium (Se)	ug/L	<1.0	1.0	8735687	<0.10	0.10	8735712
Total Silicon (Si)	ug/L	8680	1000	8735687	338	100	8735712
Total Silver (Ag)	ug/L	0.50	0.20	8735687	<0.020	0.020	8735712
Total Strontium (Sr)	ug/L	973	10	8735687	60.3	1.0	8735712
Total Thallium (Tl)	ug/L	0.26	0.10	8735687	<0.010	0.010	8735712
Total Tin (Sn)	ug/L	<50	50	8735687	<5.0	5.0	8735712
Total Titanium (Ti)	ug/L	77	50	8735687	<5.0	5.0	8735712
Total Uranium (U)	ug/L	3.4	1.0	8735687	0.10	0.10	8735712
Total Vanadium (V)	ug/L	<50	50	8735687	<5.0	5.0	8735712
Total Zinc (Zn)	ug/L	297	50	8735687	<5.0	5.0	8735712
Total Zirconium (Zr)	ug/L	<1.0	1.0	8735687	<0.10	0.10	8735712
RDL = Reportable Detection Limit							

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Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		RU2033			RU2034		
Sampling Date		2017/07/25 09:00			2017/07/25 09:45		
COC Number		B7G4522-M058-01-01			B7G4522-M058-01-01		
	UNITS	**MW-1 (EWC394)**	**RDL**	**QC Batch**	**SW-1 (EWC395)**	**RDL**	**QC Batch**
Total Calcium (Ca)	mg/L	2430	0.50	8734174	34.6	0.050	8734174
Total Magnesium (Mg)	mg/L	1070	0.50	8734174	12.7	0.050	8734174
Total Potassium (K)	mg/L	3.36	0.50	8734174	0.467	0.050	8734174
Total Sodium (Na)	mg/L	7.42	0.50	8734174	6.41	0.050	8734174
Total Sulphur (S)	mg/L	<30	30	8734174	<3.0	3.0	8734174
RDL = Reportable Detection Limit							

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Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		RU2035	RU2036	RU2037	RU2038		
Sampling Date		2017/07/25 13:00	2017/07/25 14:15	2017/07/25 15:00	2017/07/25		
COC Number		B7G4522-M058-01-01	B7G4522-M058-01-01	B7G4522-M058-01-01	B7G4522-M058-01-01		
	UNITS	SW-2 (EWC396)	SW-3 (EWC397)	SW-8 (EWC398)	DUP-1 (EWC399)	RDL	QC Batch
Calculated Parameters							
Total Hardness (CaCO3)	mg/L	143	192	180	183	0.50	8734171
Total Metals by ICPMS							
Total Aluminum (Al)	ug/L	12.7	3.7	8.7	3.8	3.0	8735687
Total Antimony (Sb)	ug/L	<0.50	<0.50	<0.50	<0.50	0.50	8735687
Total Arsenic (As)	ug/L	0.27	0.31	0.48	0.28	0.10	8735687
Total Barium (Ba)	ug/L	8.3	14.9	13.7	14.7	1.0	8735687
Total Beryllium (Be)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	8735687
Total Bismuth (Bi)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	8735687
Total Boron (B)	ug/L	<50	<50	<50	<50	50	8735687
Total Cadmium (Cd)	ug/L	<0.010	0.010	0.013	0.011	0.010	8735687
Total Chromium (Cr)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	8735687
Total Cobalt (Co)	ug/L	<0.20	<0.20	<0.20	<0.20	0.20	8735687
Total Copper (Cu)	ug/L	<0.50	0.77	0.90	0.71	0.50	8735687
Total Iron (Fe)	ug/L	28	<10	19	<10	10	8735687
Total Lead (Pb)	ug/L	4.89	11.8	15.2	11.8	0.20	8735687
Total Lithium (Li)	ug/L	<2.0	<2.0	<2.0	<2.0	2.0	8735687
Total Manganese (Mn)	ug/L	15.7	4.2	7.0	4.5	1.0	8735687
Total Molybdenum (Mo)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	8735687
Total Nickel (Ni)	ug/L	<1.0	1.2	1.3	1.1	1.0	8735687
Total Selenium (Se)	ug/L	<0.10	0.12	0.11	0.12	0.10	8735687
Total Silicon (Si)	ug/L	482	615	660	567	100	8735687
Total Silver (Ag)	ug/L	<0.020	<0.020	<0.020	<0.020	0.020	8735687
Total Strontium (Sr)	ug/L	93.6	153	135	148	1.0	8735687
Total Thallium (Tl)	ug/L	<0.010	<0.010	0.010	<0.010	0.010	8735687
Total Tin (Sn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	8735687
Total Titanium (Ti)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	8735687
Total Uranium (U)	ug/L	0.31	0.41	0.47	0.41	0.10	8735687
Total Vanadium (V)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	8735687
Total Zinc (Zn)	ug/L	<5.0	<5.0	<5.0	<5.0	5.0	8735687
Total Zirconium (Zr)	ug/L	<0.10	<0.10	<0.10	<0.10	0.10	8735687

RDL = Reportable Detection Limit

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Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

CCME TOTAL METALS IN WATER (WATER)

Maxxam ID		RU2035	RU2036	RU2037	RU2038		
Sampling Date		2017/07/25 13:00	2017/07/25 14:15	2017/07/25 15:00	2017/07/25		
COC Number		B7G4522-M058-01-01	B7G4522-M058-01-01	B7G4522-M058-01-01	B7G4522-M058-01-01		
	UNITS	SW-2 (EWC396)	SW-3 (EWC397)	SW-8 (EWC398)	DUP-1 (EWC399)	RDL	QC Batch
Total Calcium (Ca)	mg/L	38.2	56.2	50.8	53.1	0.050	8734174
Total Magnesium (Mg)	mg/L	11.6	12.5	12.9	12.2	0.050	8734174
Total Potassium (K)	mg/L	1.00	1.54	2.58	1.51	0.050	8734174
Total Sodium (Na)	mg/L	6.12	6.22	6.30	5.92	0.050	8734174
Total Sulphur (S)	mg/L	<3.0	<3.0	<3.0	<3.0	3.0	8734174
RDL = Reportable Detection Limit							

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Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

TEST SUMMARY

Maxxam ID: RU2033 **Collected:** 2017/07/25
Sample ID: MW-1 (EWC394) **Shipped:**
Matrix: Water **Received:** 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/24	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/24	2017/08/24	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735687	2017/08/23	2017/08/23	Jeffrey Laporte

Maxxam ID: RU2034 **Collected:** 2017/07/25
Sample ID: SW-1 (EWC395) **Shipped:**
Matrix: Water **Received:** 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/23	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/23	2017/08/23	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735712	2017/08/23	2017/08/23	Jeffrey Laporte

Maxxam ID: RU2035 **Collected:** 2017/07/25
Sample ID: SW-2 (EWC396) **Shipped:**
Matrix: Water **Received:** 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/24	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/24	2017/08/24	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735687	2017/08/23	2017/08/23	Jeffrey Laporte

Maxxam ID: RU2036 **Collected:** 2017/07/25
Sample ID: SW-3 (EWC397) **Shipped:**
Matrix: Water **Received:** 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/24	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/24	2017/08/24	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735687	2017/08/23	2017/08/23	Jeffrey Laporte

Maxxam ID: RU2037 **Collected:** 2017/07/25
Sample ID: SW-8 (EWC398) **Shipped:**
Matrix: Water **Received:** 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/24	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/24	2017/08/24	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735687	2017/08/23	2017/08/23	Jeffrey Laporte

Maxxam Analytics International Corporation o/a Maxxam Analytics Burnaby: 4606 Canada Way V5G 1K5 Telephone(604) 734-7276 Fax(604) 731-2386

Maxxam Job #: B771117
Report Date: 2017/08/24

MAXXAM ANALYTICS
Client Project #: MB7G4522
Site Location: RESOLUTE GW/SW
Your P.O. #: 100463-003
Sampler Initials: KC

TEST SUMMARY

Maxxam ID: RU2038
Sample ID: DUP-1 (EWC399)
Matrix: Water

Collected: 2017/07/25
Shipped:
Received: 2017/08/03

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Hardness Total (calculated as CaCO3)	CALC	8734171	N/A	2017/08/24	Automated Statchk
Na, K, Ca, Mg, S by CRC ICPMS (total)	ICP/CRCM	8734174	2017/08/24	2017/08/24	Automated Statchk
Elements by CRC ICPMS (total)	ICP/CRCM	8735687	2017/08/23	2017/08/23	Jeffrey Laporte

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GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	4.3°C

CCME TOTAL METALS IN WATER (WATER) Comments

Matrix Spike Elements by CRC ICPMS (total): RDL raised due to sample matrix interference.
Sample RU2033 [MW-1 (EWC394)] Elements by CRC ICPMS (total): RDL raised due to sample matrix interference.
Matrix Spike Elements by CRC ICPMS (total): RDL raised due to sample matrix interference.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

MAXXAM ANALYTICS
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			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8735687	Total Aluminum (Al)	2017/08/23	NC	80 - 120	122 (1)	80 - 120	<3.0	ug/L	1.1 (2)	20
8735687	Total Antimony (Sb)	2017/08/23	93	80 - 120	106	80 - 120	<0.50	ug/L	NC (2)	20
8735687	Total Arsenic (As)	2017/08/23	102	80 - 120	109	80 - 120	<0.10	ug/L	NC (2)	20
8735687	Total Barium (Ba)	2017/08/23	NC	80 - 120	105	80 - 120	<1.0	ug/L	1.7 (2)	20
8735687	Total Beryllium (Be)	2017/08/23	107	80 - 120	111	80 - 120	<0.10	ug/L	NC (2)	20
8735687	Total Bismuth (Bi)	2017/08/23	92	80 - 120	109	80 - 120	<1.0	ug/L	NC (2)	20
8735687	Total Boron (B)	2017/08/23	NC	80 - 120	120	80 - 120	<50	ug/L	0.10 (2)	20
8735687	Total Cadmium (Cd)	2017/08/23	98	80 - 120	108	80 - 120	<0.010	ug/L	NC (2)	20
8735687	Total Chromium (Cr)	2017/08/23	99	80 - 120	104	80 - 120	<1.0	ug/L	NC (2)	20
8735687	Total Cobalt (Co)	2017/08/23	91	80 - 120	100	80 - 120	<0.20	ug/L	NC (2)	20
8735687	Total Copper (Cu)	2017/08/23	NC	80 - 120	101	80 - 120	<0.50	ug/L	2.9 (2)	20
8735687	Total Iron (Fe)	2017/08/23	NC	80 - 120	119	80 - 120	<10	ug/L	0.66 (2)	20
8735687	Total Lead (Pb)	2017/08/23	96	80 - 120	106	80 - 120	<0.20	ug/L	1.4 (2)	20
8735687	Total Lithium (Li)	2017/08/23	NC	80 - 120	109	80 - 120	<2.0	ug/L	1.7 (2)	20
8735687	Total Manganese (Mn)	2017/08/23	NC	80 - 120	107	80 - 120	<1.0	ug/L	2.0 (2)	20
8735687	Total Molybdenum (Mo)	2017/08/23	100	80 - 120	107	80 - 120	<1.0	ug/L	NC (2)	20
8735687	Total Nickel (Ni)	2017/08/23	90	80 - 120	102	80 - 120	<1.0	ug/L	NC (2)	20
8735687	Total Selenium (Se)	2017/08/23	101	80 - 120	111	80 - 120	<0.10	ug/L	NC (2)	20
8735687	Total Silicon (Si)	2017/08/23					<100	ug/L	3.4 (2)	20
8735687	Total Silver (Ag)	2017/08/23	106	80 - 120	113	80 - 120	<0.020	ug/L	NC (2)	20
8735687	Total Strontium (Sr)	2017/08/23	NC	80 - 120	101	80 - 120	<1.0	ug/L	0.58 (2)	20
8735687	Total Thallium (Tl)	2017/08/23	96	80 - 120	108	80 - 120	<0.010	ug/L	NC (2)	20
8735687	Total Tin (Sn)	2017/08/23	112	80 - 120	103	80 - 120	<5.0	ug/L	NC (2)	20
8735687	Total Titanium (Ti)	2017/08/23	78 (1)	80 - 120	112	80 - 120	<5.0	ug/L	NC (2)	20
8735687	Total Uranium (U)	2017/08/23	103	80 - 120	108	80 - 120	<0.10	ug/L	NC (2)	20
8735687	Total Vanadium (V)	2017/08/23	97	80 - 120	102	80 - 120	<5.0	ug/L	NC (2)	20
8735687	Total Zinc (Zn)	2017/08/23	NC	80 - 120	106	80 - 120	<5.0	ug/L	6.3 (2)	20
8735687	Total Zirconium (Zr)	2017/08/23					<0.10	ug/L	NC (2)	20
8735712	Total Aluminum (Al)	2017/08/23	NC	80 - 120	113	80 - 120	<3.0	ug/L	3.8 (2)	20
8735712	Total Antimony (Sb)	2017/08/23	96	80 - 120	102	80 - 120	<0.50	ug/L		

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			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8735712	Total Arsenic (As)	2017/08/23	99	80 - 120	103	80 - 120	<0.10	ug/L	3.1 (2)	20
8735712	Total Barium (Ba)	2017/08/23	NC	80 - 120	102	80 - 120	<1.0	ug/L		
8735712	Total Beryllium (Be)	2017/08/23	103	80 - 120	103	80 - 120	<0.10	ug/L		
8735712	Total Bismuth (Bi)	2017/08/23	95	80 - 120	104	80 - 120	<1.0	ug/L		
8735712	Total Boron (B)	2017/08/23	105	80 - 120	108	80 - 120	<50	ug/L	NC (2)	20
8735712	Total Cadmium (Cd)	2017/08/23	101	80 - 120	102	80 - 120	<0.010	ug/L	NC (2)	20
8735712	Total Chromium (Cr)	2017/08/23	91	80 - 120	95	80 - 120	<1.0	ug/L	1.8 (2)	20
8735712	Total Cobalt (Co)	2017/08/23	92	80 - 120	96	80 - 120	<0.20	ug/L	NC (2)	20
8735712	Total Copper (Cu)	2017/08/23	87	80 - 120	94	80 - 120	<0.50	ug/L	1.1 (2)	20
8735712	Total Iron (Fe)	2017/08/23	NC	80 - 120	115	80 - 120	<10	ug/L	2.4 (2)	20
8735712	Total Lead (Pb)	2017/08/23	96	80 - 120	101	80 - 120	<0.20	ug/L	NC (2)	20
8735712	Total Lithium (Li)	2017/08/23	NC	80 - 120	103	80 - 120	<2.0	ug/L		
8735712	Total Manganese (Mn)	2017/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L	0.81 (2)	20
8735712	Total Molybdenum (Mo)	2017/08/23	NC	80 - 120	103	80 - 120	<1.0	ug/L	NC (2)	20
8735712	Total Nickel (Ni)	2017/08/23	93	80 - 120	97	80 - 120	<1.0	ug/L	NC (2)	20
8735712	Total Selenium (Se)	2017/08/23	110	80 - 120	109	80 - 120	<0.10	ug/L	8.5 (2)	20
8735712	Total Silicon (Si)	2017/08/23					<100	ug/L		
8735712	Total Silver (Ag)	2017/08/23	103	80 - 120	111	80 - 120	<0.020	ug/L	NC (2)	20
8735712	Total Strontium (Sr)	2017/08/23	NC	80 - 120	98	80 - 120	<1.0	ug/L		
8735712	Total Thallium (Tl)	2017/08/23	96	80 - 120	102	80 - 120	<0.010	ug/L		
8735712	Total Tin (Sn)	2017/08/23	98	80 - 120	98	80 - 120	<5.0	ug/L		
8735712	Total Titanium (Ti)	2017/08/23	125 (1)	80 - 120	95	80 - 120	<5.0	ug/L		
8735712	Total Uranium (U)	2017/08/23	97	80 - 120	101	80 - 120	<0.10	ug/L		
8735712	Total Vanadium (V)	2017/08/23	96	80 - 120	95	80 - 120	<5.0	ug/L		
8735712	Total Zinc (Zn)	2017/08/23	NC	80 - 120	97	80 - 120	<5.0	ug/L	NC (2)	20

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QUALITY ASSURANCE REPORT(CONT'D)

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Site Location: RESOLUTE GW/SW
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Sampler Initials: KC

			Matrix Spike		Spiked Blank		Method Blank		RPD	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
8735712	Total Zirconium (Zr)	2017/08/23					<0.10	ug/L		

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spike amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than the native sample concentration)

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

(2) Duplicate Parent ID

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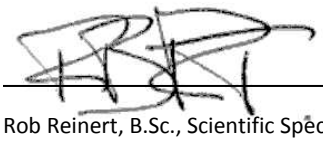
VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Rob Reinert, B.Sc., Scientific Specialist

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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