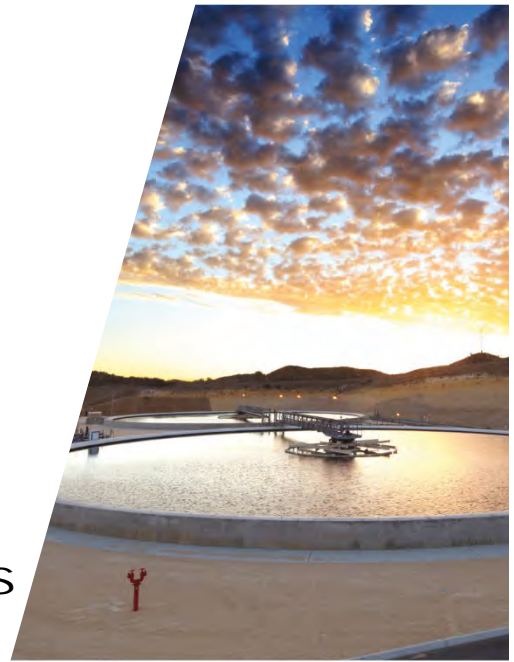




# NORM and Hazardous Materials Survey Report

Brunswick Smelter  
Belledune, New Brunswick

Glencore Canada Corporation





## Executive Summary

GHD was retained by Glencore Canada Corporation (Glencore) to conduct a Naturally Occurring Radioactive Materials (NORM) survey for the Fertilizer Plant area of the Brunswick Smelter facility, specifically the Diammonium Phosphate Plant and the Phosphoric Acid Plant buildings (DAP and PAP buildings), located in Belledune, New Brunswick. The Brunswick Smelter includes the Smelter Area, the Material Handling West (MHW) Area and the Fertilizer Plant. For the purpose of this report, the term “Site” will refer to the wider Glencore Smelter complex and associated assets but the report focusses on the Fertilizer Plant area, specifically the DAP and PAP buildings.

The initial NORM characterization study completed for this area of the Brunswick Smelter in 2006 identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or disposal requirements. However, a supplemental assessment program completed in 2008 identified concentrations of NORM in soil adjacent to the DAP and PAP buildings that were below applicable guidelines indicating additional soil management or remediation may not be required. As such, the purpose of the 2019 characterization survey is to provide Glencore with updated information on current concentrations of NORM inside the DAP and PAP buildings as well as in soil and groundwater adjacent to these buildings. The characterization study is also intended to quantify NORM impacted material that will require specific remedial planning as part of future facility closure activities.

In addition to the NORM survey, GHD was also retained to complete a hazardous materials inventory for the Fertilizer Plant. The DAP and PAP buildings ceased operations in the 1990s and available information on the presence of other hazardous materials (non-NORM) is limited to potential asbestos containing materials (ACM).

GHD completed the NORM and Hazardous Materials Survey work between September 16 and 19, 2019. The work was completed at the Site as part of the “Closure Plan - Prefeasibility Study 2019 Update” and consisted of the following:

- The completion of a non-intrusive NORM screening survey of the DAP and PAP buildings and surrounding soil areas to validate previous findings and identify areas of the buildings (and surrounding soil) that potentially contain NORM levels above applicable guidelines.
- Based on the findings of the non-intrusive survey, the collection of representative building material samples, surface soil samples, feedstock samples (remaining in equipment vessels) and groundwater samples for quantitative laboratory analysis of gamma spectrometry as well as other parameters.
- The completion of a hazardous materials inventory of the DAP and PAP buildings including the collection of bulk samples for laboratory analysis.

The results of the NORM and Hazardous Materials Survey are summarized as follows:

### **NORM**

- The gamma readings recorded in the PAP and DAP buildings and surrounding soil areas were generally consistent with background soil conditions in the area (0.05  $\mu\text{Sv/h}$ ) or within 2 to 4 times background conditions (0.1 to 0.2  $\mu\text{Sv/hr}$ ) which is similar to the 2006 findings. These results indicate the remaining structures and equipment within the historical PAP or DAP



operation areas will likely not warrant NORM mitigation during demolition of these former units. Note GHD was unable to perform NORM screening surveys on the filter pans located on the 4<sup>th</sup> floor of the historical PAP building due to inaccessibility during the 2019 Site visit. As such, current data regarding NORM associated with this specific equipment is not available.

- Although the non-intrusive NORM screening survey did not identify elevated gamma readings in the PAP building, residual bulk product samples collected from the PAP building (19BP-1 (Filtrate Sump) and 19BP-2 (PAP building Conveyor Feeding Mill) had concentrations of diffuse NORM exceeding applicable Canadian NORM guidelines. As such, this residual bulk product remaining in the PAP building would require removal and disposal at an approved facility as part of future building decommissioning activities. Approximately 6 m<sup>3</sup> of residual bulk product is estimated that will require removal and disposal as NORM.
- The non-intrusive NORM screening survey conducted on the Gypsum Line piping being stored in the Smelter Area identified NORM measurements consistent with background conditions. However, a bulk sample of residual gypsum accumulated in the annular space between the plastic inner sleeve and the outer wood sheath had NORM concentrations exceeding applicable Canadian NORM guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. As such, the former gypsum piping being stockpiled in the Smelter Area will likely require cleaning or disposal at an approved facility as part of future Site closure activities. There is approximately 225 metres of 0.6 metre diameter piping currently being stored at the Site that has the potential to be impacted with NORM. The volume of residual gypsum accumulated in the annular space between the inner plastic sleeve and the outer wood sheath is estimated to be <0.1 m<sup>3</sup>.
- The majority of materials and equipment found within the Scrap Yard were identified to have NORM measurements above the NORM Management (Dose Management) Threshold and will likely require management (cleaning and recycling or off-Site disposal, whichever is most cost-effective) as part of future Site closure activities. Approximately 145 m<sup>3</sup> of NORM impacted materials and equipment is located in the Scrap Yard.
- Soil samples collected from various areas of the Fertilizer Plant, including the Scrap Yard, had NORM concentrations below applicable Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. These results confirmed the findings of the 2019 non-intrusive NORM screening survey as well as soil samples collected in 2008 and indicate that remediation of soils specific to NORM are likely not required as part of future Site closure activities. Note soil samples were not collected from areas directly beneath equipment or piping and these areas may require additional assessment at the time of facility closure (following removal of the equipment or piping).
- The non-intrusive NORM survey measurements recorded from the DAP building were generally consistent with the established background conditions for this area (0.05 µSv/h). One measurement was not considered consistent with the absolute value of the background for the area (the measurement recorded from the historical reactor area, 0.11 µSv/hr). However, this measurement is within the applicable NORM Management (Dose Management) Threshold of 0.5 µSv/hr above background and is protective of human health and the environment.
- Results of the leachate testing indicated that residual NORM levels identified in soil and residual bulk product samples at the Site are not leachable.



- Groundwater samples collected from the Fertilizer Plant area did not contain detectable concentrations of NORM indicating groundwater in the area has not been impacted with NORM and does not require additional evaluation or remediation as part of future Site closure activities.

#### ***Metals/Petroleum Hydrocarbons***

- Concentrations of metals in soil and groundwater in several areas of the Fertilizer Plant area exceeded applicable screening guidelines. This data has been incorporated into the “Hydrogeological Study and Data Gap Assessment” also being completed by GHD in support of the “Closure Plan - Prefeasibility Study 2019 Update”.
- The soil samples collected from the Fertilizer Plant had leachate concentrations of several metals exceeding the leachate screening level. This data has been incorporated into the “Hydrogeological Study and Data Gap Assessment” also being completed by GHD in support of the “Closure Plan - Prefeasibility Study 2019 Update”.
- The majority of residual bulk product samples collected from the Site had metal concentrations above the Screening guidelines but only three samples (19BP-1, 19BP-4 and 19BP-7) had metal concentrations above risk-based values for protection of human health (industrial or commercial utility worker). In addition, the residual bulk product samples collected from the Site had leachate concentrations below applicable screening levels. It is noted that bulk product sample 19BP-2 (PAP Conveyor Feeding Mill) had a pH value of 1.5 and would be considered highly acidic. As indicated above, this sample also contained elevated concentrations of NORM.
- The three residual bulk product samples collected from the DAP and PAP buildings (19BP-1, 19BP-3 and 19BP-6) had detectable concentrations of petroleum hydrocarbons and, therefore, will require disposal at a facility licensed to accept hydrocarbon impacted materials. For residual bulk product sample 19BP-1 (Filtrate Sump), this sample also contained elevated concentrations of NORM and metals (lead) and would be considered mixed waste.

#### ***Other Hazardous Building Materials***

- Potentially hazardous materials such as PCB containing equipment and light ballasts, mercury switches or mercury containing devices, and ozone depleting substances were not identified in the Fertilizer Plant area during the 2019 survey excluding potential ACM.
- Four of ten asbestos samples collected from the DAP and PAP buildings were identified to have asbestos content of more than 1% and are considered to be friable. Approximately 15 m<sup>3</sup> of friable pipe, tank and cable tray insulation was observed in the DAP and PAP buildings as part of the 2019 survey that would require abatement prior to future building demolition activities.
- The concrete samples collected from the two transformer pads in the Fertilizer Plant area did not contain detectable concentrations of PCBs and do not require specific handling or disposal requirements as part of future Site closure activities.





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## List of Acronyms

ACM	Asbestos Containing Materials
BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
BV	Bureau Veritas
C&D	Construction and Demolition
CCME	Canadian Council of Ministers of the Environment
CEPA	Canadian Environmental Protection Act
CN	Canadian National Railway
CRA	Conestoga-Rovers & Associates
DAP	Di-Ammonium Phosphate Plant
EQS	Environmental Quality Standards
GHD	GHD Limited
Glencore	Glencore Canada Corporation
ICP	Inductively Coupled Plasma
IEM	Integrated Environmental Management
kg	Kilograms
m	Metre
m <sup>2</sup>	Meter Square
m <sup>3</sup>	Meter Cubed
MAP	Monoammonium Phosphate
Maxxam	Maxxam Analytics Inc.
mg	milligram
MHW Area	Material Handling West Area
mSv	milliSieverts
mTPH	Modified Total Petroleum Hydrocarbons
NBDELG	New Brunswick Department of Environment and Local Government
NORM	Naturally Occurring Radioactive Materials
NSE	Nova Scotia Environment
PAP	Phosphoric Acid Plant
PCB	Polychlorinated Biphenyls
PLM	Polarized-Light Microscopy
QA/QC	Quality Assurance / Quality Control
RBCA	Risk Based Corrective Action
RBSLs	Risk Based Screening Levels





## List of Acronyms

Smelter	Brunswick Smelter Complex, Belledune, NB
SNC	SNC-Lavalin
SQGs	Soil Quality Guidelines
SSTLs	Site Specific Target levels
TCLP	Toxicity Characteristic Leaching Procedure
UCLM	Upper Confidence Limit of the Mean
USEPA	United States Environmental Protection Agency



# 1. Introduction

GHD was retained by Glencore Canada Corporation (Glencore) to conduct a Naturally Occurring Radioactive Materials (NORM) survey for the Fertilizer Plant area of the Brunswick Smelter facility, specifically the Diammonium Phosphate Plant and the Phosphoric Acid Plant buildings (DAP and PAP buildings), located in Belledune, New Brunswick (Site). The Brunswick Smelter includes the Smelter Area, the Material Handling West (MHW) Area and the Fertilizer Plant. For the purpose of this report, the term "Site" will refer to the wider Glencore Smelter complex and associated assets but the report focusses on the Fertilizer Plant area, specifically the DAP and PAP buildings. A Site location map, a property map and a 2018 aerial image of the Fertilizer Plant area are attached as Figures 1, 2 and 3, respectively.

The initial NORM characterization study completed for this area of the Brunswick Smelter in 2006 by Integrated Environmental Management (IEM)<sup>1</sup> identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or disposal requirements. However, a supplemental assessment program completed in 2008 by Conestoga-Rovers & Associates (CRA) on behalf of SNC-Lavalin (SNC) identified concentrations of NORM in soil adjacent to the DAP and PAP buildings that were below applicable guidelines indicating additional soil management or remediation may not be required (SNC, 2008). As such, the purpose of the 2019 characterization survey is to provide Glencore with updated information on current concentrations of NORM inside the DAP and PAP buildings as well as in soil and groundwater adjacent to these buildings. The characterization study is also intended to quantify NORM impacted material that will require specific remedial planning as part of future facility closure activities.

In addition to the NORM survey, GHD was also retained to complete a hazardous materials inventory for the Fertilizer Plant area. The DAP and PAP buildings ceased operations in the 1990s and available information on the presence of other hazardous materials (non-NORM) is limited to potential asbestos containing materials (ACM). During existing conditions surveys completed by GHD in July 2019, the DAP and PAP buildings were identified to contain several tanks, vessels and piping that contain residual product from unknown sources.

The NORM and hazardous materials survey for the DAP and PAP buildings was completed as part of the decommissioning and closure cost forecasting study ("Decommissioning Study") currently being completed by GHD for the Smelter and referred to as the "Closure Plan - Prefeasibility Study 2019 Update". The volumes of hazardous materials potentially requiring abatement is required for development of the DAP and PAP Closure Feasibility study and associated decommissioning technical specifications that are also currently being prepared by GHD. The NORM and Hazardous Materials Survey specific to the Fertilizer Plant area of the Site was completed in conjunction with a "Hydrogeological Study and Data Gap Assessment" also being completed by GHD in support of the Decommissioning Study.

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<sup>1</sup> Conestoga-Rovers & Associates, Pre-remediation Survey of the Falconbridge Ltd. DAP Facility, August 24, 2006



## 1.1 Site Description

Glencore has been operating the Brunswick Smelter complex in Belledune, New Brunswick (Smelter) since 1966. The Fertilizer Plant area was constructed in 1967 and operated until approximately 1995. It originally produced monoammonium phosphate (MAP) fertilizer but later production switched to DAP fertilizer. The phosphate rock used to feed the process was mined in the southeastern and western United States, and in the African countries of Togo and Morocco. It contained oxides of phosphorus and calcium, with trace amounts of NORM impurities such as Uranium-238 (U-238) and Thorium-232 (Th-232), along with their various progeny (i.e., Ra-226).

The two primary buildings associated with the Fertilizer Plant are the DAP and PAP buildings as shown on Figure 3. These buildings are not currently being used as part of Site operations excluding the storage of equipment on the ground level of the DAP building. Several areas of these buildings, specifically the PAP building, are also severely deteriorated and not accessible for safety reasons. In addition, the electrical supply to the PAP building has been disconnected.

Bulk product associated with the Fertilizer Plant operation was reportedly historically stored immediately east of the PAP building and referred to as the Lay Down Area. This area is still reportedly used for the storage of bulk product as part of the MHW operation. In addition, equipment historically used in the Fertilizer Plant operation but removed from the DAP and PAP buildings are currently being stored in a fenced area directly southeast of the PAP building referred to as Scrap Yard. The specific areas of the Fertilizer Plant area associated with this study are shown on Figure 3.

## 1.2 Objectives

The objectives of the work program were:

- Obtain current NORM screening measurements on building surfaces and equipment of the DAP and PAP buildings.
- Obtain current NORM quantitative concentration data from soil samples collected in proximity to the historical DAP and PAP operations.
- Compare the current NORM measurements and analytical data to the historical information obtained in 2006 and 2008 and identify significant changes.
- To quantify the volume of feedstock and by-products remaining in equipment vessels and piping in the DAP and PAP buildings that have concentrations of NORM or other chemicals (e.g., acids) exceeding applicable guidelines and will require specific mitigation/management as part of future building decommissioning activities.
- To quantify the volume of soil, if any, in proximity to the historical DAP and PAP operations with concentrations of NORM requiring specific mitigation or management as part of future building decommissioning activities.
- To quantify the approximate surface area of building materials such as structural steel and concrete as well as equipment remaining in the DAP and PAP buildings that will require specific cleaning due to the presence of NORM, prior to being recycled or will require specific mitigation/management as part of future building decommissioning activities.



- To quantify the volume of hazardous materials such as ACM, polychlorinated biphenyls (PCBs), and mercury (among others) in the DAP and PAP buildings that will require specific handling and disposal as part of future building decommissioning activities.

### 1.3 Scope of Work

The scope of work required to meet the study objectives is summarized as follows:

- Review the previous environmental reports that have been completed specifically for the DAP and PAP buildings.
- Complete a non-intrusive NORM screening survey of the DAP and PAP buildings and surrounding soil areas to validate previous findings and identify areas of the buildings (and surrounding soil) that potentially contain NORM levels above applicable guidelines.
- Based on the findings of the non-intrusive survey, collect representative building material samples, surface soil samples and/or feedstock samples (remaining in equipment vessels) for quantitative laboratory analysis of gamma spectrometry as well as possible leachate testing.
- Collect representative groundwater samples from existing wells located in the Fertilizer Plant area for gamma spectrometry.
- Determine the quantity of soil/residual feedstock as well as building/equipment surfaces remaining in the Fertilizer Plant area that will require specific management pursuant to the applicable NORM management guidelines as part of future decommissioning/demolition activities.
- Determine if groundwater surrounding the Fertilizer Plant area has NORM concentrations above applicable guidelines and establish the groundwater flow pattern affecting the plume, including preferential pathways such as buried utilities as well as potential receptors.
- Complete a hazardous materials inventory of the DAP and PAP buildings including the collection of bulk samples (if accessible) for laboratory analysis.
- Determine the quantity of residual product remaining in tanks/vessels/piping of the DAP and PAP buildings as well as the type of product.
- Prepare draft and final reports on the study findings.

## 2. Regulations and Guidance

The analytical data collected during the NORM and hazardous materials survey program will be compared to applicable guidelines to define areas of the Fertilizer Plant that will require specific remediation, abatement or cleaning prior to future building decommissioning and demolition activities. The guidelines selected are those used in standard industry practice in Atlantic Canada, which are most appropriate for the current and intended future land use of the Site.

The NORM screening survey (non-intrusive) and quantitative NORM analyses from sampling (intrusive) will be guided by the Canadian Guidelines for the Management of NORM, 2013, ISBN: 978 1 100 23019 1, Cat. No.: H129 34/2013E PDF 130465; (hereafter referred to as the Canadian NORM Guidelines) that provide guidelines for NORM contamination on surfaces as well as diffuse





NORM concentrations in soil, groundwater and air that may be released unconditionally (i.e., without regard for radiological ramifications).

The New Brunswick Guideline for the Management of Contaminated Sites does not provide guidelines for non-petroleum contaminants in soil or groundwater. However, the New Brunswick Department of Environment and Local Government (NBDELG) typically recommend applying the Canadian Council of Ministers of the Environment (CCME) guidelines and/or the Nova Scotia Environment (NSE) Tier I Environmental Quality Standards (EQS) for screening non-petroleum hydrocarbon contaminants in soil and groundwater. The NSE EQS were adopted from CCME, where available, and are based on multiple pathway analysis considering both human and ecological health. The NSE Tier I EQS also include screening values from other jurisdictions for parameters that do not have CCME guidelines.

The various guidelines used in this study are further described below.

## 2.1 Naturally Occurring Radioactive Material

The Canadian NORM Guidelines provide three NORM Classification Levels for evaluation of potential NORM containing material. These levels are as follows:

- **Investigation Threshold** - The lowest threshold and considered protective of human health is radiation dose basis for control of NORM at 0.3 milliSieverts (mSv) per year. NORM measurements equal or below this threshold allow unrestricted use of the assessed site. The occupational dose-rate that will give an incremental gamma radiation dose of 0.3 mSv/year is 0.15  $\mu$ Sv/hour (h). The gamma Investigation Threshold is an incremental dose-rate above off-site background of 0.15  $\mu$ Sv/h.
- **NORM Management (Dose Management) Threshold** - Radiation dose assessment implemented if the Investigation Threshold is exceeded. The assessed site can be classified for unrestricted use or require NORM management controls depending on findings from the radiation dose assessment. An assessed incremental dose of 1 mSv/year or 0.5  $\mu$ Sv/h to a worker is adopted as the Dose Management Threshold.
- **Radiation Management Threshold** - The radiation management threshold is 5 mSv/year and Exceeding this threshold requires implementation of a radiation protection management program.

Establishment of the Investigation Threshold includes accounting for background (natural surface) NORM for a given site. As such, establishment of the background NORM incremental dose-rate for a given site is the initial step of a NORM assessment per the Canadian NORM Guidelines. This is accomplished through NORM assessments of areas in close proximity to a given site but external to active or legacy production or storage operations.

The Canadian NORM Guidelines provide the following absolute incremental dose-rate as the Dose Management Threshold:

- Derived Working Limit Occupational dose-rate: 0.5  $\mu$ Sv/hr (Section 4.1.2 Dose Management Threshold, the Canadian Guidelines for the Management of NORM, 2013).



Site-specific measurements above 0.5  $\mu\text{Sv/hr}$  triggers the requirement to perform NORM dose management evaluations for protection of human health. This value was used as part of the non-intrusive survey to guide collection of soil, bulk product or building materials sampling through intrusive methods for laboratory analysis.

## 2.2 Soils

### **Parameters: NORM**

*Guideline:* Canadian NORM Guidelines

*Rationale:* The Canadian NORM Guidelines lists the concentration of diffuse NORM in solids (radioactive isotopes of uranium, radium, etc.) that may be released unconditionally (i.e., without regard for radiological ramifications). The Canadian NORM guidelines for diffuse NORM in liquids were also applied to soil samples submitted for NORM leachate analysis to determine potential disposal requirements (if applicable).

### **Parameters: Metals and PCBs**

*Guideline:* Analytical results for select metals (arsenic, cadmium, copper, lead, silver, thallium and zinc) typically associated with the ore concentrate being processed at the Site, are compared to the risk-based Site Specific Target Levels (SSTLs) that were previously developed in relation to the rail transport of ore concentrate to the Smelter from the Brunswick Mine for the Protection of Human Health for an Industrial Worker (CRA, 2013).

For metals other than those listed above and PCBs, the main criteria referenced are the CCME SQG using the associated CCME Factsheets (accessed online, October 2019) and the NSE EQS. The criteria for Industrial Land Use, based on the most conservative applicable human health pathway were applied.

*Rationale:* The risk based SSTLs for an industrial worker, previously calculated during assessment, remediation and closure of the CN rail line properties over which ore concentration was transported to the Site from the Brunswick Mine, were used as the primary screening values for typical ore related metals to demonstrate the likely expected areas on-Site that would require remedial action planning work as part of the "Closure Plan - Prefeasibility Study 2019 Update". It is also noted that a review of these SSTLs was completed with Glencore as part of the regulatory site closure work completed by GHD in 2018, on behalf of CN, for the CN rail line bordering the Site properties owned by Glencore.

As the science for risk assessment is evolving, the SSTLs presented in this report are being used specifically for environmental closure cost estimation items in the Closure Plan - Prefeasibility Study 2019 Update, and that Brunswick Smelter specific SSTLs would be required as part of a remedial action plan.

The CCME SQGs were used as the primary screening values for other metals and PCBs, in the absence of SSTLs, as these standards are based on multiple pathway analysis considering human exposure pathways including soil ingestion/dermal



contact, particulate inhalation and off-site migration. The NSE Tier I EQS standards are also based on multiple pathway analysis considering human health, but do not include the particulate inhalation or off-site migration check.

**Parameters: Leachable Metals**

*Guideline:* Leachable metals in soil concentrations were compared to screening levels provided in the Canadian Environmental Protection Act (CEPA), Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, Current to July 1, 2019.

*Rationale:* The CEPA leachate screening levels were used as the primary screening values for metals in leachate, as these standards are used to determine if the soil would be considered a hazardous waste under the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations, to evaluate disposal options. The leachate screening levels can also give an indication as to how likely the metal in soil is to leach from soil to groundwater.

### 2.3 Residual Bulk Products

The same screening guidelines for NORM and metals as discussed above for soil are also applied to residual bulk products for screening purposes. However, several bulk product samples were also analyzed for petroleum hydrocarbons. The guidelines used to screen petroleum hydrocarbon concentrations in residual bulk products is summarized below.

**Parameters: Petroleum Hydrocarbons (BTEX/mTPH)**

*Guideline:* RBCA Tier 1, Atlantic RBCA for Petroleum Impacted Sites in Atlantic Canada, Version 3, User Guidance, Appendix 3 – Table 4a: Tier I Risk-Based Screening Level (RBSL), July 2012, revised January 2015. Industrial Receptor, non-potable groundwater use, coarse-grained soil type for the protection of human health.

*Rationale:* The Tier I RBSL are based on multiple pathway analyses considering human health in an industrial setting. This is the standard guideline for petroleum hydrocarbons used throughout Atlantic Canada.

### 2.4 Groundwater

**Parameters: NORM**

*Guideline:* Canadian NORM Guidelines

*Rationale:* The Canadian NORM Guidelines lists the concentration of diffuse NORM in liquids (radioactive isotopes of uranium, radium, etc.) that may be released unconditionally (i.e., without regard for radiological ramifications).



**Parameters: Metals**

*Guideline:* NSE Pathway Specific Standards (PSS) for Groundwater – Groundwater Discharging to Surface Water, >10 metres from surface water body marine discharge to marine water (April 2014).

*Rationale:* The NSE PSS for Groundwater Discharge to Surface Water, Discharge to Marine Water are used for screening purposes where groundwater is potentially discharging to a marine aquatic environment, in order to evaluate potential effects to nearby marine aquatic life. The NSE PSS for Groundwater Discharge to Surface Water >10 m from a Marine Surface Water Body are applied to boundary groundwater sampling locations at 10 m or greater from Chaleur Bay.

## 2.5 Concrete

**Parameters: PCBs**

*Guideline:* NSE Tier 1 EQS for soil at a Non-Potable Site – coarse grained soil type, for commercial land use (July 6, 2013).

*Rationale:* As there are no guidelines specific to allowable limits of PCB in concrete, the soil quality guideline for PCB was used as a screening tool. As noted above the Province of NB does not have environmental guidelines specific to PCBs. The NSE EQS were used for screening purposes as these standards were adopted from CCME.

## 2.6 Asbestos

**Parameters: Percent Asbestos and Friability**

*Guideline:* A Code of Practice for Working with Materials Containing Asbestos in New Brunswick (1992).

*Rationale:* Asbestos found within the Glencore Smelter Site were compared to The Code of Practice for Working with Materials Containing Asbestos in New Brunswick. This Code of Practice was developed to provide safe handling procedures to minimize exposure to asbestos-containing materials.

# 3. Records Review

## *Previous Studies*

As indicated in Section 1, a NORM characterization study (screening and quantitative analysis) was completed for the Fertilizer Plant area of the Site in 2006 by IEM on behalf of CRA. This survey identified several building surfaces and adjacent soil areas that contained NORM concentrations above acceptable guidelines that would require specific remediation and/or disposal requirements as outlined below:





- Approximately 50% of the PAP Building contained process material dust that exhibited residual NORM above surface contamination limits indicating remediation may be required before unrestricted use or demolition.
- The Lay-down Area adjacent to the PAP Building exhibited non-uniform levels of residual NORM in soil.
- The Scrap Yard area contained former process equipment/materials that contained residual levels of NORM.

Although the PAP building and associated exterior areas were identified to contain residual levels of NORM, the DAP building was identified to contain insignificant levels of residual NORM excluding a small surface soil area near the northeast corner of the building.

Following completion of the non-intrusive NORM survey, soil samples were collected from selected areas of the Fertilizer Plant in 2008 for gamma spectroscopy analysis. The analytical results identified concentrations of diffuse NORM in the soil samples that were below the Canadian NORM Guidelines that may be released unconditionally (i.e., without regard for radiological ramifications). Based on the analytical results obtained during the 2008 supplemental sampling program, additional soil management or remediation may not be required (SNC-Lavalin, 2008). The locations of the soil samples collected in 2008 are shown on Figure 4.

Groundwater samples were also collected from seven monitor wells located in Fertilizer Plant area in 2008 for gamma spectroscopy analysis (08GW-79, 08GW-80, 08GW-92 to 08GW-95 and 08GW-98). Results of the laboratory analysis indicated the concentrations of NORM in the groundwater samples were below current Canadian NORM guidelines. However, the laboratory analysis noted the samples did not meet required preservation standards at the time of analysis (pH <2) and the results may not accurately reflect the concentration of NORM at the time of sampling (SNC-Lavalin, 2008). The historical groundwater sample locations are shown on Figure 5.

### ***Operational Review***

Prior to the mobilization of field staff to the Site, GHD contacted Glencore representatives to review historic development and operational information specific to the Fertilizer Plant. The purpose of the historic review was to confirm the potential presence of residual NORM-bearing materials in subsurface soils that might escape surface gamma walkover surveys based on the presence of clean cover materials (i.e., buried NORM sources). Limited additional information was available on the historic operation of the Fertilizer Plant but Site staff did note that the Lay-down Area continues to be used for stockpiling various bulk materials. The movement of equipment and stockpiling of materials in the Lay-down Area has likely significantly disturbed surface soil conditions since completion of the 2006 and 2008 sampling programs.

In addition, Glencore representatives indicated that the former aboveground Gypsum Line that extended from the Fertilizer Plant to the Port of Belledune was decommissioned and the abandoned line is now being stored on Belledune Point in the Smelter Area (see Figure 3). As part of the 2019 investigation, GHD staff investigated the current storage location of the former Gypsum Line that was constructed of 0.6 metre diameter plastic piping (sleeve) with an outer wooden sheathing. Approximately 25 pieces of the former Gypsum Line averaging approximately 10 metres in length were observed in the storage area. Residual gypsum product was not observed to be present in the



line but small accumulations of gypsum was observed in the annulus between the inner plastic sleeve and the outer wood sheathing (See photos in Appendix A).

Based on the findings of the records review, the 2019 NORM survey was focused primarily on the PAP building and associated exterior areas but also included the current Gypsum Line storage area and the DAP building to validate the 2006 findings.

## 4. Field Investigation Methodology

### 4.1 NORM Survey

Between September 16 and 19, 2019, GHD completed a non-intrusive, NORM screening survey of the DAP and PAP building surfaces, equipment and surrounding land surface using a gamma measurement instrument (Ludlum calibrated to a 44-9 probe). The purpose of this task was to identify any land areas, building surfaces, or equipment/materials that exhibit gamma radiation levels that exceed established regulatory guidance thresholds. As previously indicated, the survey results obtained during the 2006 survey completed by IEM along with findings from the records review formed the basis for selecting the 2019 survey locations. The former Gypsum Line piping currently being stored in the Smelter Area was also included in the non-intrusive NORM survey.

#### **Background**

As indicated in Section 2.1, the Investigation Threshold protocol included in the Canadian NORM Guidelines includes accounting for background (natural surface) NORM for a given site. As such, establishment of the background NORM incremental dose-rate for a given site is the initial step of a NORM assessment per the Canadian NORM Guidelines. The Site-specific NORM background for the Site was established through the following non-intrusive (passive) survey:

- 1) Establish background locations as presented on Figure 6 are applicable for the Site (no known source of NORM material from historical facility operations).
- 2) Perform a non-intrusive, serpentine survey in a southwest to northeast orientation, within each background location using the gamma measurement instrument.
- 3) GHD recorded the gamma measurements in  $\mu\text{Sv/hr}$  from the survey at 12 locations. The background gamma measurements recorded ranged from 0.03  $\mu\text{Sv/hr}$  to 0.06  $\mu\text{Sv/hr}$ . The survey results are further discussed in Section 5 and the background gamma measurements are presented in Table 1.
- 4) The 95% upper confidence limit of the mean (UCLM) from the data collected from each of the two background locations was calculated using the United States Environmental Protection Agency (USEPA) ProUCL (Version 5.1) statistical software. The UCLM calculated using the background data set was 0.05  $\mu\text{Sv/hr}$  and this value was considered to be representative of background radiological conditions in the area (see Section 5).

#### **Site Investigation**

Following the establishment of background conditions at the Site, GHD completed a non-intrusive survey of the building surfaces and equipment remaining in the DAP and PAP buildings. As



previously indicated, the 2006 survey indicated that the DAP building generally had NORM levels below applicable guidelines. As such, the 2019 survey was focused on the PAP building in an effort to refine the quantities of materials in the building that will require special handling and remediation/disposal during future demolition activities. The equipment survey also included equipment previously removed from the DAP and PAP buildings and currently being stored in the fenced Scrap Yard area located approximately 150 meters southeast of the PAP building as well as the former Gypsum Line that is now stored in the Smelter Area (see Figure 3). The ground surface in the vicinity of the DAP and PAP buildings as well as the Gypsum Line piping was also included in the non-intrusive NORM survey with a specific focus on the Lay-down and Scrap Yard areas that were previously identified to contain non-uniform concentrations of NORM.

The non-intrusive NORM survey of the equipment, building materials and surrounding land surface was completed using a gamma measurement instrument (Ludlum with 44-9 probe). Accessible internal surfaces within the DAP and PAP buildings were scanned with the gamma detector held in close proximity to the surface (i.e., 10 to 15 centimeters from surface) and moved over the area at a rate of 2.5 to 5.5 centimeters per second. Areas of the floor, walls, ledges and equipment surfaces were also surveyed in this manner. The land areas were surveyed by traversing the surface to be monitored while moving the detector in a serpentine pattern in close proximity to the ground (i.e., approximately 15 centimeters from the soil surface). Specific to the Gypsum Line piping, the wood exterior, plastic interior (sleeve) piping as well as any residual gypsum/residue observed in the piping was surveyed to the extent possible with the Ludlum instrument.

Measurements in  $\mu\text{Sv/hr}$  were recorded during the survey and areas where the device alarm is triggered, if any, were noted. Photographs of the equipment and vessel identification number (if available) were also recorded. Building floor plans were obtained from Glencore and were used to build databases to show areas with NORM levels exceeding the Dose Management Threshold along with a corresponding photograph. For equipment/materials, an estimate of the extent of surface contamination was also recorded as practical, including drawings and/or photographs for necessary details. GPS coordinates for the land surface triggers (soil areas) were recorded and used to develop Site plans showing soil areas that exceed the Dose Management Threshold. The land areas with exceedances were delineated to the extent possible in an effort to estimate surface extents of relatively large areas ( $>25 \text{ m}^2$ ). Results of the non-intrusive survey are further discussed in Section 5 and photographs of the areas investigated are provided in Appendix A.

## 4.2 Soil Sample Collection

Results of the non-intrusive NORM soil survey were utilized to identify ground surface areas requiring further evaluation with respect to evaluating concentrations of NORM in soil through laboratory analysis. GHD collected soil samples from areas of the Fertilizer Plant with NORM levels exceeding the Dose Management Threshold ( $0.5 \mu\text{Sv/hr}$  plus background) identified during non-intrusive survey completed in 2019 as well as the areas previously identified to contain residual NORM levels exceeding applicable guidelines in 2006. GHD used a stainless steel hand auger, trowel and pickaxe to collect shallow soil samples (0 to 15 centimeters below ground surface) from designated areas for potential laboratory analysis.



Collected samples were placed in a double lined Ziploc bag and jars labeled accordingly. As the non-intrusive NORM survey identified a relatively small area of NORM impacted soil (see Section 5), the surface soil sample collection was limited to single “grab” samples at various locations.

Shallow subsurface soil sampling was also completed to delineate the vertical extent of potential exceedances in soils. Shallow subsurface soil sampling was performed beneath each surface soil sampling location, and at several locations identified during the historical review as having the potential presence of residual NORM bearing materials in subsurface soils (e.g., the Lay-down Area).

The subsurface samples were collected as follows:

- a. If soils were conducive, a hand auger was used to collect subsurface soils in 15 cm intervals to target depth.
- b. Otherwise, a 0.6 m long split spoon soil sampler was advanced to targeted depths using a geotechnical drill rig and the soils extracted from the split spoon at approximately 0.3 m intervals.
- c. Each soil sample collected was screened on-Site using the gamma measurement instrument (Ludlum with 44-9 probe) prior to being placed in sample containers for potential laboratory analysis of gamma spectroscopy.
- d. If on-Site screening indicated that elevated NORM levels were present at the target depth, additional sampling depths was completed to identify clean bottom (to the extent possible).

To avoid the risk of cross-contamination, all equipment was washed and rinsed thoroughly between sampling locations.

Selected soil samples were submitted to Bureau Veritas (BV) laboratories in Bedford, NS (formerly Maxxam) for gamma spectroscopy analysis. Select soil samples were also analyzed for leachable NORM analysis, available metals and leachable metals to determine if the material may also be classified as mixed waste.

Table 2 outlines the soil samples collected for potential laboratory analysis, the sample depth and the associated gamma measurement. The non-intrusive survey locations as well as the soil sample locations collected for potential laboratory analysis are also shown on Figures 7A and 7B.

### 4.3 Residual Bulk Product Sample Collection

During an existing conditions evaluation completed for the DAP and PAP in July 2019, several vessels located in the DAP and PAP buildings were identified to contain residual feedstock or associated by-product material. Based on the results of the non-intrusive survey, a total of five bulk samples of residual product remaining in accessible vessels were collected from the PAP building for submission to BV for analysis of NORM by gamma spectrometry. Samples of soil-type media including sludge, fine debris, etc. (19BP-1, 19BP-2, 19BP-3, and 19BP-10) were collected to be representative of the media remaining in vessels, screened using the gamma measurement instrument (Ludlum with 44-9 probe) and managed for laboratory analysis consistent with the subsequent steps. Each sample collected was screened to the extent practical using appropriate on-Site preparation methods. One sample of residual product on the north conveyor of the DAP building (19BP-5) was also submitted for NORM analysis to confirm this building does not contain residual levels of NORM. In addition, a sample of the residual gypsum obtained from the former Gypsum Line piping being stored at the Smelter Area was also collected for NORM analysis





(19SP-8). The residual gypsum product remaining in the piping was limited to small amounts accumulated in the annular space between the inner plastic sleeve and the outer wood sheathing.

Specific samples were selected from sample sets collected by hand, or from specific depth profiles at highest gamma measurement depth interval and placed in a sample container for laboratory analysis. The laboratory results will be used to determine if the residual product or building materials requires special handling, cleaning and/or disposal as NORM impacted material related to future building decommissioning activities. Select samples were also submitted for NORM leachate analysis. Determining the leachate potential for the NORM impacted material will form the basis of determining future regulatory disposal requirements for the impacted material.

A total of 10 samples of the residual product remaining in equipment vessels of the DAP and PAP buildings were submitted to BV for analysis of available metals, leachable metals and/or other chemical parameters (pH, phosphate, sulfur, etc.) to determine if the material may also be classified as hazardous waste and/or mixed waste (19BP-1 to 19BP-10). It is noted that one of the ten bulk product samples submitted for metal analysis (19BP-3) was identified by the laboratory to contain elevated concentrations of petroleum hydrocarbons and as such, the metals analysis could not be completed on this specific sample. Based on the laboratory comments, three residual bulk product samples (19BP-1, 19BP-3 and 19BP-6) were also analyzed for petroleum hydrocarbons.

Table 3 outlines the residual bulk samples collected for potential laboratory analysis and the associated gamma measurement. The locations of residual bulk product samples collected from the DAP and PAP buildings for laboratory analysis are also shown on Figures 8A to 8D and Figure 9.

#### 4.4 Groundwater Sample Collection

Based on a review of previous reports provided by Glencore, approximately ten shallow groundwater wells were previously constructed in the Fertilizer Plant area during an assessment program completed in 2008 (SNC-Lavalin, 2008). Several of these wells were sampled for NORM in 2008 but the quality of the analytical results was noted to be questionable based on a change in water chemistry (rise in pH) that occurred during sample shipment to the laboratory. As such, GHD recommended re-sampling groundwater from existing and/or newly installed monitor wells located in the Fertilizer Plant as part of the 2019 survey activities.

A total of 6 groundwater samples were collected from monitor wells (19GW-118, 19GW-120, 19GW-122, 19GW-124, 08GW-95, and 09GW-102) located in the Fertilizer Plant area on September 23, 2019 (Figure 10). The monitor wells were purged prior to sampling to provide samples that are representative of formation waters. Following purging, the water samples were placed into laboratory supplied bottles for analysis of NORM by gamma spectrometry and dissolved metals by BV laboratories. All sample sets were collected in as short a time period as possible, preserved as required and stored on ice during shipment in coolers to the laboratory in accordance with laboratory requirements. This precaution ensured that the samples collected were representative and comparable for data interpretation purposes. To the extent possible, the groundwater sampling program for NORM was completed in coordination with a concurrent Site-wide hydrogeological evaluation also being completed by GHD.



## 4.5 Hazardous Materials Inventory and Sample Collection

### *Asbestos*

Available inventories of potential hazardous building materials associated with the DAP and PAP building are generally limited to the identification of potential ACM. The purpose of the hazardous materials inventory was to confirm that the available ACM inventory accurately characterizes and quantifies potential ACM remaining in DAP and PAP buildings. Asbestos is a group of fibrous minerals that occur naturally in soil and rock. Asbestos fibres were formerly used (primarily for their insulating and fireproofing properties) in roofing shingles, ceiling tiles, floor tiles, drywall mastic, asbestos cement products, gaskets, insulation, paper products, and other building and insulating products.

Regulatory control of asbestos in the workplace is the responsibility of the Worksafe New Brunswick under the provisions of the Occupational Health and Safety Act. For the purposes of managing worker exposure during building maintenance, renovation and demolition, the Regulation 92 106 (“Code of Practice for Working With Materials Containing Asbestos in New Brunswick”) defines an asbestos containing material (ACM) as a material which contains 1% or more by volume of asbestos. The Regulation has established procedures for safe monitoring and abatement as well as the specific responsibilities of owners, employers, and employees.

As part of the 2019 investigation, GHD collected a total of six samples of suspect asbestos-containing building materials, including insulation, pipe fittings, roof parge and tank insulation in the PAP building (19ACM-1 to 19ACM-6). Three additional suspected asbestos-containing building materials were also sampled in the DAP building (19ACM-7 to 19ACM-9) as well as insulation on an inactive storage tank located adjacent to the fenced Scrap Yard area (19ACM-10). The samples were collected using small hand tools such as utilities knives or similar cutting device. The samples were placed in samples bags, sealed and labeled. The samples were submitted under chain-of-custody protocol to BV for analysis by polarized-light microscopy (PLM) using Method SOP AQS 16 (based on National Institute for Occupational Safety & Health Method 9002).

It is also noted that there were areas of the PAP building that could not be surveyed due to building access restrictions. The locations of the ACM samples collected as part of the 2019 survey are shown on Figures 8A to 8D and Figure 9.

### *Other Hazardous Materials*

Other potentially hazardous materials such as PCB containing equipment and light ballasts, mercury switches or mercury containing devices, and ozone depleting substances were not identified in the Fertilizer Plant area during the 2019 survey. However, the existing conditions survey completed at the Site in July 2019 identified two wet transformers located on concrete pads on the exterior to the DAP building (see Figure 11). Given the age of these transformers (likely installed during construction of the DAP building in the 1960s), there is the potential these transformers formerly contained PCB oils (Glencore representatives previously indicated the transformers are currently PCB free). To ensure historical leaks or spills associated with these transformers have not impacted the concrete pads, a total of two concrete core samples (one from each foundation) were collected for PCB analysis. The concrete samples were collected from areas of visible surface staining or as



close as possible to the drain spigots on the transformers (worst-case scenario). The samples of the concrete transformer pads were collected by advancing a 50 mm diameter diamond tip core saw to a depth of approximately 50 mm into the concrete surface. The concrete core samples were then placed in laboratory-supplied jars for delivery to BV for PCB analysis.

## 5. Analytical Results

### 5.1 Analytical Program

Selected soil and residual product samples were analyzed for the following:

1. NORM radionuclides using gamma spectroscopy
2. Metals scan (including mercury) by an Inductively Coupled Plasma (ICP) method
3. Metals and NORM leachate by Toxicity Characteristic Leachate Procedure (TCLP) method (or similar)
4. Specified chemical parameters (pH, phosphorous, sulfur, etc.)

Selected groundwater samples were analyzed for:

1. NORM radionuclides using gamma spectroscopy
2. Metals scan (including Hg) by an ICP method

Selected bulk building materials and/or transformer concrete pad samples were analyzed for:

1. Asbestos containing material by Polarized Light Microscopy (PLM)
2. Polychlorinated Biphenyls (PCB)

A field duplicate and trip blank sample of the soil and groundwater sample sets were analyzed for the appropriate parameters. Laboratory quality assurance / quality control (QA/QC) data is also included in the report.

### 5.2 NORM Survey Results

#### 5.2.1 PAP Building

Various areas and equipment within PAP building and surrounding soil areas were previously identified to contain NORM levels above applicable guidelines. As such, the PAP building, equipment and surrounding soil areas (Lay-down Area) were re-surveyed in 2019 for gamma radiation using a Ludlum 2241 with 44-9 probe and the results were compared to the Canadian NORM Guidelines. The 2019 survey included scanning surfaces and equipment on all four floors of the PAP building but some areas of the building were inaccessible due to deterioration of the building and unsafe work conditions. Surficial and sub-surface soils surrounding the PAP building were also surveyed at numerous locations as shown on Figure 7A. The purpose of the survey was to determine the current radiation levels in residual bulk products, equipment, structures and soil associated with the PAP building.



Overall, the gamma readings recorded from the PAP building and surrounding soil areas were generally consistent with background soil conditions in area ( $0.05 \mu\text{Sv/h}$ ) or within 2 to 4 times background conditions ( $0.1$  to  $0.2 \mu\text{Sv/hr}$ ) which is similar to the 2006 findings (CRA, 2006). In addition, all of the readings collected from the PAP building and surrounding soil areas were found to be well below the NORM Management (Dose Management) Threshold of  $0.5 \mu\text{Sv/hr}$ .

As previously indicated, several areas of the PAP building were not accessible due to structural integrity issues, specifically the filter pan area on the fourth floor of the PAP building. The filter pan enclosure had a gamma reading of  $0.1 \mu\text{Sv/hr}$  at 1 metre distance from the equipment. However, the filter pans in the Scrap Yard area had gamma readings well above the NORM Management Threshold (see Section 5.2.3). As such, it is reasonable to assume that the filter pans on the fourth floor of the PAP building may have radiation levels greater than the readings recorded during the 2019 investigation.

The NORM survey results for the PAP building are presented in Tables 2 to 4 and the survey locations are presented on Figures 8A to 8D.

### 5.2.2 DAP Building

The DAP building surfaces, DAP equipment, residual bulk product and soil areas surrounding the DAP building to the north were surveyed using a Ludlum 2241 with 44-9 probe as described above for the PAP building. The gamma radiation readings collected from the DAP building were generally consistent with background soil conditions identified in the area ( $0.05 \mu\text{Sv/h}$ ). The only reading above background levels was identified for a piece of equipment identified as the “reactor” located on the ground floor of the building. The gamma radiation reading for this piece of equipment was measured at  $0.11 \mu\text{Sv/hr}$  which is well below the NORM Management (Dose Management) Threshold of  $0.5 \mu\text{Sv/hr}$ . The survey results obtained in 2019 are similar to the findings reported in the 2006 survey.

The NORM survey results for the DAP building are presented in Tables 2 to 4 and the survey locations are presented on Figure 9.

### 5.2.3 Scrap Yard

Equipment stored in the Scrap Yard and surrounding soils were surveyed using a Ludlum 2241 with 44-9 probe to determine if this area of the Fertilizer Plant contained gamma radiation levels above the Canadian NORM Guidelines.

The majority of the scrap material and equipment surveyed in the Scrap Yard was found to have NORM readings above background levels and numerous pieces of equipment had readings greater than the NORM Management (Dose Management) Threshold of  $0.5 \mu\text{Sv/hr}$ . The material and equipment with readings exceeding the NORM Management (Dose Management) Threshold included the following:

- Rubber lined pans –  $2.50 \mu\text{Sv/hr}$
- 3 steel boxes with filter cloths –  $3.00 \mu\text{Sv/hr}$
- Filter pans on the east wall –  $7.00 \mu\text{Sv/hr}$
- 24 filter pans –  $7.00 \mu\text{Sv/hr}$



- Gypsum piping – 1.00  $\mu\text{Sv/hr}$
- Filtrate tank – 4.00  $\mu\text{Sv/hr}$
- Dump boxes with filter cloths – 1.00  $\mu\text{Sv/hr}$

Approximately 145 m<sup>3</sup> of NORM impacted materials and equipment is located in the Scrap Yard that exceeds the NORM Management (Dose Management) Threshold and will likely require remediation (cleaning) prior to being recycled or will require disposal at an approved facility as part of future Site closure activities.

Although equipment being stored in the Scrap Yard area was identified to contain elevated gamma measurements, soil in the area generally had gamma radiation readings similar to background soil conditions in area (0.05  $\mu\text{Sv/h}$ ) or within 2 to 4 times background conditions (0.1 to 0.2  $\mu\text{Sv/hr}$ ).

The NORM survey results for the Scrap Yard are presented in Tables 2 and 4 and the survey results specific to the Scrap Yard are presented on Figure 12.

#### 5.2.4 Former Gypsum Line Piping

The former Gypsum Line piping currently stored north of the rail line in the Smelter Area (Figure 7B) and surrounding soils were surveyed using a Ludlum 2241 with 44-9 probe to determine if this piping contained gamma radiation levels above the Canadian NORM Guidelines.

The former Gypsum Line piping (interior plastic sleeve and outer wood sheathing) and surrounding soils were identified to contain NORM readings similar to background levels.

The NORM survey results for the former Gypsum Line piping are presented in Table 4.

### 5.3 Soils

#### 5.3.1 NORM

A total of 19 soil samples (plus duplicates) collected from the Fertilizer Plant area were submitted to BV for NORM analysis to confirm the findings of the non-intrusive survey. Analytical results were compared to the guidelines presented in Section 5 of the Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources.

The soil samples collected from various areas surrounding the DAP and PAP buildings as well as the Scrap Yard area contained concentrations of NORM (various radioactive isotopes of lead, potassium uranium, radium, and thorium) below the Canadian NORM Guidelines.

However, it is noted that soil samples were not collected from areas directly beneath equipment or piping with elevated NORM concentrations and these areas will require additional assessment at the time of facility closure.

The soil NORM analytical results are presented in Table 5 and the laboratory certificates are included in Appendix B.



### 5.3.2 NORM Leachate

A total of six soil samples collected from the Fertilizer Plant area were also submitted to BV for NORM leachate analysis. Analytical results were compared to the guidelines presented in Section 5 of the Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources (aqueous). The purpose of the analysis was to determine residual concentrations of NORM in soil are leachable which could affect disposal options of the impacted material (if present).

Detectable concentrations of NORM were not identified in the leachate samples extracted from the six soil samples submitted for analysis and the laboratory detection limits were below the Canadian NORM Guidelines for unconditional derived release limits for aqueous diffuse NORM sources.

The NORM leachate analytical results for soil are presented in Table 6 and the laboratory certificates are in Appendix B.

### 5.3.3 Chemistry and Metals

A total of nine soil samples collected from the Fertilizer Plant area were submitted for metal and select chemistry analysis. Analytical results were compared to the Nova Scotia Tier I EQS (Industrial land use, coarse soil type) as well as the risk-based SSTLs previously developed for protection of Human Health (Industrial Worker & Utility Worker).

The soil samples collected from the Site had concentrations of several metals exceeding the NSE Tier I EQS. In particular, the concentrations of arsenic, iron, lead, and/or thallium in all the samples collected exceeded the NSE Tier I EQS for industrial land use. Other metal parameters exceeding applicable NSE Tier I EQS for industrial land use were limited to the following:

- Antimony at locations 19SP-3 (0.15-0.3m), 19SP-5 (0 – 0.15m), 19SP-5 (0.15 – 0.30m), and 19SP-11 (0 – 0.15m)
- Uranium at location 19SP-3 (0.15-0.3m)
- Vanadium at location 19SP-1 (as well as pH)

All soil samples collected and analyzed from the Site contained concentrations of lead exceeding the risk-based SSTL for protection of human health (Industrial and/ or Utility Worker). Other chemistry and metal parameters that exceeded the applicable Risk Based Target Levels for protection of human health were limited to the following:

- Arsenic at locations 19SP-3 (0.15-0.3m), 19SP-5 (0–0.15m), and 19SP-5 (0.15 – 0.30m)
- Cadmium at location 19SP-5 (0–0.15m) (Utility Worker exposure only)
- Thallium at locations 19SP-3 (0.15-0.3m), 19SP-5 (0–0.15m), and 19SP-5 (0.15 – 0.30m)

The soil analytical results are also included and further discussed in the “Hydrogeological Study and Data Gap Assessment” report (GHD, 2019).

The soil chemistry and metal analytical results are presented in Table 7 and the laboratory certificates are included in Appendix B.



#### 5.3.4 Metal Leachate

A total of five soil samples from the Fertilizer Plant area were submitted for metal leachate analysis and compared to the CEPA leachate screening levels to determine if the soil would be considered a hazardous waste under the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.

The 2019 soil leachate concentrations for selected metals associated with historical Site operations are summarized as follows:

- Arsenic: Concentrations ranged from 26 to 280 µg/L and were below the CEPA leachate screening level (2,500 µg/L)
- Cadmium: Concentrations ranged from 22 to 1500 µg/L with one of the five samples exceeding the CEPA leachate screening level (500 µg/L)
- Lead: Concentrations ranged from 3,900 to 460,000 µg/L with four of the five samples exceeding the CEPA leachate screening level (5,000 µg/L)
- Thallium: Concentrations ranged from <1 to 45 µg/L but a CEPA leachate screening value is not available
- Zinc: Concentrations ranged from 1,000 to 35,000 µg/L but a CEPA leachate screening value is not available

In addition to screening for hazardous waste considerations, the leachate screening levels can also give an indication as to how likely the metal in soil is to leach from soil to groundwater. The soil leachate results are included and further discussed in the “Hydrogeological Study and Data Gap Assessment” report (GHD, 2019).

The soil metal leachate analytical results are presented in Table 8 and the laboratory certificates are included in Appendix B

### 5.4 Residual Bulk Product

#### 5.4.1 NORM

A total of three residual bulk product samples and one concrete sample collected from the PAP building were submitted to BV for NORM analysis to confirm the findings of the non-intrusive survey. One bulk product sample collected from the DAP building was also submitted for NORM analysis to confirm previous findings that this building does not contain residual products impacted with NORM. As indicated in Section 4.3, a sample of the residual gypsum obtained from the former Gypsum Line piping being stored north of the rail line at the Smelter Area was also collected for NORM analysis (19SP-8). Analytical results were compared to the guidelines presented in Section 5 of the Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources.

Samples collected from the Filtrate Sump (19BP-1) and the Conveyor Feeding Mill (19BP-2) as well as the former Gypsum Line (19BP-8) contain residual concentrations of radionuclides exceeding the Canadian NORM Guidelines for Unconditional Derived Release Limits. As such, these residual bulk product materials and potentially the holding vessel would require disposal at an approved facility prior to the decommissioning and demolition of the PAP building. Approximately 6 m<sup>3</sup> of residual





bulk product remaining in the PAP building is estimated that will require removal and disposal as NORM. The volume of residual gypsum associated with the former Gypsum Line piping is limited to material accumulated in the annular space between the inner plastic sleeve and the outer wood sheath of the former gypsum piping (<0.1 m<sup>3</sup>). However, based on the presence of residual NORM impacted gypsum, it is anticipated that all the Gypsum Line piping being stored in the Smelter Area (approximately 225 metres) would require cleaning prior to disposal at a local landfill or construction and demolition debris (C&D) site.

The radionuclides exceeding the Canadian NORM Guidelines were limited to the following:

- Lead 210 at sample points 19BP-1 (PAP Filtrate Sump), 19BP-2 (PAP Conveyor Feeding Mill) and 19BP-8 (former Gypsum Line)
- Radium 226 at sample points 19BP-1 (PAP Filtrate Sump), 19BP-2 (PAP Conveyor Feeding Mill) and 19BP-8 (former Gypsum Line)

The residual bulk product NORM analytical results are presented in Table 9 and the laboratory certificates are included in Appendix B.

#### 5.4.2 NORM Leachate

A total of four residual bulk product samples collected from the DAP and PAP buildings were submitted to BV for NORM leachate analysis. A residual bulk sample of gypsum collected from the former Gypsum Line piping stored at the Smelter Area was also submitted for NORM leachate analysis. Analytical results were compared to the guidelines presented in Section 5 of the Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources (aqueous). The purpose of the analysis was to determine residual concentrations of NORM in residual bulk product are leachable which could affect disposal options of the impacted material (if present).

Detectable concentrations of NORM were not identified in the leachate samples extracted from the six residual bulk product samples submitted for analysis and the laboratory detection limits were below the Canadian NORM Guidelines for unconditional derived release limits for aqueous diffuse NORM sources.

The NORM leachate analytical results for residual bulk products are presented in Table 10 and the laboratory certificates are in Appendix B.

#### 5.4.3 Chemistry and Metals

A total of nine residual bulk product samples were submitted for metal and selected chemistry analysis. One additional residual bulk product sample (19BP-3) as also submitted for metals analysis but the laboratory could not complete the analysis due to interference from elevated hydrocarbon concentrations in the sample. This sample was subsequently submitted for petroleum hydrocarbon analysis (see Section 5.4.5).

Analytical results obtained from the nine bulk samples were compared to the NSE Tier I EQS (commercial land use, coarse soil type) as well as the risk based SSTLs previously developed for protection of human health (Industrial Worker & Utility Worker). The above noted guidelines were only used for comparison purposes and guidelines for bulk product samples are not available from the NSE or CCME and the bulk product samples were collected characterization purposes only.



The majority of residual bulk product samples collected from the Site had metal concentrations below the NSE Tier I EQS. Metal parameters exceeding applicable NSE Tier I EQS were limited to the following:

- Arsenic and lead at sample points 19BP-1 (PAP Filtrate Sump), 19BP-4 (DAP Overflow Tank), and 19BP-7 DAP (Floor 2 West Conveyor)
- Chromium and iron at sample point 19BP-4 (DAP Overflow Tank)
- Thallium, uranium and/or vanadium at sample points 19BP-1 (PAP Filtrate Sump), 19BP-2 (PAP Conveyor Feeding Mill), 19BP-4 (DAP Overflow Tank), 19BP-5 (DAP – North Conveyor), 19BP-6 (DAP – Overflow Tank), 19BP-7 (DAP – Floor 2 West Conveyor), 19BP-8 (DAP – Phosphoric Acid Line) and 19BP-9 (PAP – Concrete), respectively

It is also noted that several of the bulk product samples also contained pH values below the NSE Tier I EQS values. In particular, samples 19BP-4 (DAP Overflow Tank), 19BP-6 (DAP – Overflow Tank), 19BP-7 (DAP – Floor 2 West Conveyor), 19BP-8 (DAP – Phosphoric Acid Line) and 19BP-9 (PAP – Concrete) had pH values ranging between 4 and 6. Bulk product sample 19BP-2 (PAP Conveyor Feeding Mill) had a pH value of 1.5 and would be considered highly acidic.

Bulk product samples collected from 19BP-4 (DAP Overflow Tank), 19BP-6 (DAP – Overflow Tank), and 19BP-8 (DAP – Phosphoric Acid Line) also contained elevated concentrations of orthophosphate ranging from 370 to 2,300 mg/kg.

The residual bulk product samples collected and analyzed from the Site were also compared to the risk-based SSTLs for protection of human health (Industrial and/ or Utility Worker) for comparison purposes only. The chemistry and metal parameters that exceeded the applicable risk-based SSTLs for protection of human health were limited to the following:

- Thallium at location 19BP-1(PAP Filtrate Sump) for Industrial/Utility Worker only
- Lead locations 19BP-1 (PAP Filtrate Sump), 19BP-4 (DAP Overflow Tank), and 19BP-7 (DAP – Floor 2 West Conveyor) for Industrial and/or Utility Worker

The residual bulk product chemistry and metal analytical results are presented in Table 11 and the laboratory certificates are included in Appendix B.

#### 5.4.4 Metal Leachate

A total of five residual bulk product samples collected from the DAP and PAP buildings were submitted for metal leachate analysis and compared to the CEPA leachate screening levels to determine if the residual bulk product would be considered a hazardous waste under the Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations.

The residual bulk product samples collected from the Site had leachate concentrations below applicable CEPA screening levels.

The residual bulk product metal leachate analytical results are presented in Table 12 and the laboratory certificates are included in Appendix B.



#### 5.4.5 Petroleum Hydrocarbons

A total of three residual bulk product samples were submitted for petroleum hydrocarbon (BTEX, mTPH) analysis. The residual bulk product samples had concentrations of BTEX within the applicable Tier I RBSLs (for an industrial site with non-potable water use and coarse grained soil). However, the three bulk product samples contained detectable concentrations of mTPH with 1,500 mg/kg detected in 19BP-1 (PAP Filtrate Sump), 180,000 mg/kg in 19BP-3 (PAP – Floor 2.5 Mixing Tank) and 9,700 mg/kg in 19BP-6 (DAP – Overflow Tank). The mTPH concentrations in samples 19BP-3 and 19BP-6 exceed the Tier I RBSLs for an industrial site with non-potable water use and coarse grained soil.

The residual bulk product analytical data is present in Table 13 and the laboratory certificates of analyses are included in Appendix B.

### 5.5 Groundwater

#### 5.5.1 NORM

A total of six groundwater samples were collected from the Fertilizer Plant area and submitted to BV for NORM analysis. Analytical results were compared to the guidelines presented in Section 5 of the Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources (aqueous).

The groundwater samples collected did not contain detectable concentrations of NORM and the laboratory detection limits were below the Canadian NORM Guidelines for unconditional derived release limits for aqueous diffuse NORM sources.

The groundwater NORM analytical results are presented in Table 14 and the laboratory certificates of analysis are included in Appendix B.

#### 5.5.2 Metals

A total of six groundwater samples were collected from the Fertilizer Plant area and submitted to BV for metals analysis. It is noted that there are no NSE Tier I EQS for the protection of human health for metals at non-potable sites as the human exposure pathway is considered incomplete. For comparison purposes, the groundwater samples collected from the Fertilizer Plant area were screened against NSE PSS for groundwater discharge to marine water at a distance >10 m.

The majority of groundwater samples collected had metal concentrations below NSE PSS for groundwater discharge to marine waters excluding the following:

- Cadmium at sample locations 08GW-95, 19GW-118, and 19GW-120
- Copper, mercury and nickel at sample location 19GW-120
- Lead at sample location 08GW-95
- Zinc at sample locations 08GW-95, 19GW-118, 19GW-120, and 19GW-122

The groundwater metal results are also included and further discussed in the “Hydrogeological and Data Gap Assessment” report (GHD, 2019).



The groundwater metal analytical results are presented in Table 15 and the laboratory certificates of analysis are included in Appendix B.

## 5.6 Hazardous Building Materials

### 5.6.1 Asbestos

Between September 16 and 19, 2019 a total of ten samples of suspect asbestos containing building materials were collected throughout the DAP and PAP Buildings. The samples included various pipe wraps and insulations, fittings, tank insulation and concrete parge.

Four of the ten samples were found to contain asbestos content over 1% by volume. Three of the samples identified to contain asbestos (19ACM-1, 19ACM-2 and 19ACM-5) were collected from pipe insulation or tank insulation from the PAP building and considered to be friable. The fourth sample identified to contain asbestos (19ACM-8) was collected from cable tray insulation in the DAP building and was also identified to be friable. Approximately 15 m<sup>3</sup> of friable pipe, tank and cable tray insulation was observed in the DAP and PAP buildings as part of the 2019 survey that would require abatement prior to future building demolition activities. Friable ACM such as insulation and mechanical pipe wrap must be disposed of at a licensed municipal landfill.

The asbestos analytical results along with the approximate quantity of ACM is presented in Table 16 and the laboratory certificates of asbestos analysis are included in Appendix B.

### 5.6.2 PCBs

A total of two concrete samples were collected from the transformer pads south of the DAP Building as illustrated in Figure 11 and submitted for PCB analysis. The concrete samples did not contain detectable concentrations of PCBs and the laboratory detection limits (0.5 mg/kg) were well below the NSE Tier I EQS for an industrial site with non-potable water use and coarse grained soil.

The PCB analytical results are presented in Table 17 and the laboratory certificates of analysis are included in Appendix B.

## 6. Conclusions

The NORM and Hazardous Materials Survey was completed at the Brunswick Smelter to investigate potential sources of radioactivity and other sources of environmental impairment to supplement the GHD Closure Plan – Prefeasibility Study 2019 Update. The information presented in this report facilitates identifying technically sound, implementable, regulatory compliant management approaches for demolition of the historical DAP and PAP operations addressed in the Closure Plan – Prefeasibility Study 2019 Update.

The NORM and Hazardous Materials Survey consisted of the following:

- Current NORM levels on building surfaces and equipment of the DAP and PAP buildings and scrap yard were determined as well as the surrounding soil compared to the 2006 and 2008 study findings.



- Determining the volume of feedstock and by-products remaining in equipment vessels and piping in the DAP and PAP buildings that have concentrations of NORM or other chemicals (e.g., acids) exceeding applicable guidelines that would require specific mitigation/management as part of future building decommissioning activities.
- Determining the volume of soil surrounding the buildings and scrap yard that have concentrations of NORM exceeding applicable guidelines (if any) that would require specific mitigation/management as part of future building decommissioning activities.
- Determining the approximate surface area of NORM impacted building materials such as structural steel and concrete as well as equipment remaining in the DAP and PAP buildings that would require specific cleaning prior to being recycled or would require specific mitigation/management as part of future building decommissioning activities.
- Quantification of the volume of hazardous materials such ACM, PCBs, and mercury (among others) in the DAP and PAP buildings that will require specific handling and disposal as part of future building decommissioning activities.

The results of the NORM and Hazardous Materials Survey are summarized as follows:

#### ***NORM***

- The gamma readings recorded in the PAP and DAP buildings and surrounding soil areas were generally consistent with background soil conditions in the area (0.05  $\mu\text{Sv/h}$ ) or within 2 to 4 times background conditions (0.1 to 0.2  $\mu\text{Sv/hr}$ ) which is similar to the 2006 findings. These results indicate the remaining structures and equipment within the historical PAP or DAP operation areas will likely not warrant NORM mitigation during demolition of these former units. Note GHD was unable to perform NORM screening surveys on the filter pans located on the 4<sup>th</sup> floor of the historical PAP building due to inaccessibility during the 2019 Site visit. As such, current data regarding NORM associated with this specific equipment is not available.
- Although the non-intrusive NORM screening survey did not identify elevated gamma readings in the PAP building, residual bulk product samples collected from the PAP building (19BP-1 (Filtrate Sump) and 19BP-2 (PAP building Conveyor Feeding Mill) had concentrations of diffuse NORM exceeding applicable Canadian NORM guidelines. As such, this residual bulk product remaining in the PAP building would require removal and disposal at an approved facility as part of future building decommissioning activities. Approximately 6 m<sup>3</sup> of residual bulk product is estimated that will require removal and disposal as NORM.
- The non-intrusive NORM screening survey conducted on the Gypsum Line piping being stored in the Smelter Area identified NORM measurements consistent with background conditions. However, a bulk sample of residual gypsum accumulated in the annular space between the plastic inner sleeve and the outer wood sheath had NORM concentrations exceeding applicable Canadian NORM guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. As such, the former gypsum piping being stockpiled in the Smelter Area will likely require cleaning or disposal at an approved facility as part of future Site closure activities. There is approximately 225 metres of 0.6 metre diameter piping currently being stored at the Site that has the potential to be impacted with NORM. The volume of residual gypsum accumulated in the annular space between the inner plastic sleeve and the outer wood sheath is estimated to be <0.1 m<sup>3</sup>.



- The majority of materials and equipment found within the Scrap Yard were identified to have NORM measurements above the NORM Management (Dose Management) Threshold and will likely require management (cleaning and recycling or off-Site disposal, whichever is most cost-effective) as part of future Site closure activities. Approximately 145 m<sup>3</sup> of NORM impacted materials and equipment is located in the Scrap Yard.
- Soil samples collected from various areas of the Fertilizer Plant, including the Scrap Yard, had NORM concentrations below applicable Canadian NORM Guidelines for Unconditional Derived Release Limits of Diffuse NORM Sources. These results confirmed the findings of the 2019 non-intrusive NORM screening survey as well as soil samples collected in 2008 and indicate that remediation of soils specific to NORM are likely not required as part of future Site closure activities. Note soil samples were not collected from areas directly beneath equipment or piping and these areas may require additional assessment at the time of facility closure (following removal of the equipment or piping).
- The non-intrusive NORM survey measurements recorded from the DAP building were generally consistent with the established background conditions for this area (0.05 µSv/h). One measurement was not considered consistent with the absolute value of the background for the area (the measurement recorded from the historical reactor area, 0.11 µSv/hr). However, this measurement is within the applicable NORM Management (Dose Management) Threshold of 0.5 µSv/hr above background and is protective of human health and the environment.
- Results of the leachate testing indicated that residual NORM levels identified in soil and residual bulk product samples at the Site are not leachable.
- Groundwater samples collected from the Fertilizer Plant area did not contain detectable concentrations of NORM indicating groundwater in the area has not been impacted with NORM and does not require additional evaluation or remediation as part of future Site closure activities.

#### ***Metals/Petroleum Hydrocarbons***

- Concentrations of metals in soil and groundwater in several areas of the Fertilizer Plant area exceeded NSE Tier I EQS, risk-based SSTLs and/or NSE PSS. This data has been incorporated into the “Hydrogeological Study and Data Gap Assessment” also being completed by GHD in support of the “Closure Plan - Prefeasibility Study 2019 Update”.
- The soil samples collected from the Fertilizer Plant had leachate concentrations of several metals exceeding the CEPA leachate screening level. This data has been incorporated into the “Hydrogeological Study and Data Gap Assessment” also being completed by GHD in support of the “Closure Plan - Prefeasibility Study 2019 Update”.
- The majority of residual bulk product samples collected from the Site had metal concentrations above the NSE Tier I EQS but only three samples (19BP-1, 19BP-4 and 19BP-7) had metal concentrations above risk-based SSTLs for protection of human health (industrial or commercial utility worker). In addition, the residual bulk product samples collected from the Site had leachate concentrations below applicable CEPA screening levels. It is noted that bulk product sample 19BP-2 (PAP Conveyor Feeding Mill) had a pH value of 1.5 and would be considered highly acidic. As indicated above, this sample also contained elevated concentrations of NORM.
- The three residual bulk product samples collected from the DAP and PAP buildings (19BP-1, 19BP-3 and 19BP-6) had detectable concentrations of petroleum hydrocarbons and, therefore,





will require disposal at a facility licensed to accept hydrocarbon impacted materials. For residual bulk product sample 19BP-1 (Filtrate Sump), this sample also contained elevated concentrations of NORM and metals (lead) and would be considered mixed waste.

#### *Other Hazardous Building Materials*

- Potentially hazardous materials such as PCB containing equipment and light ballasts, mercury switches or mercury containing devices, and ozone depleting substances were not identified in the Fertilizer Plant area during the 2019 survey excluding potential ACM.
- Four of ten asbestos samples collected from the DAP and PAP buildings were identified to have asbestos content of more than 1% and are considered to be friable. Approximately 15 m<sup>3</sup> of friable pipe, tank and cable tray insulation was observed in the DAP and PAP buildings as part of the 2019 survey that would require abatement prior to future building demolition activities.
- The concrete samples collected from the two transformer pads in the Fertilizer Plant area did not contain detectable concentrations of PCBs and do not require specific handling or disposal requirements as part of future Site closure activities.

## 7. Limitations

This report has been prepared, and the work referred to in this report has been undertaken, by GHD for Glencore Canada Corporation (Glencore). It is intended for the sole and exclusive use of Glencore, its affiliated companies and partners and their respective insurers, agents, employees and advisors (collectively, "Glencore"). Any use, reliance on, or decision made by any person other than Glencore based on this report is the sole responsibility of such other person. Glencore and GHD 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.

The investigation undertaken by GHD with respect to this report and any conclusions or recommendations made in this report reflect GHD's judgement 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 this Site and it is based, in part, upon visual observation of the Site, surface and sub-surface 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, sub-surface 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. 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 Glencore, 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 Glencore. Nothing in this report is intended to constitute or provide a legal opinion.

## 8. Closure

All of which is respectfully submitted,

GHD

A handwritten signature in blue ink that reads 'Troy Small'.

Troy Small, M.Sc., CE

A handwritten signature in blue ink that reads 'Cody Ross'.

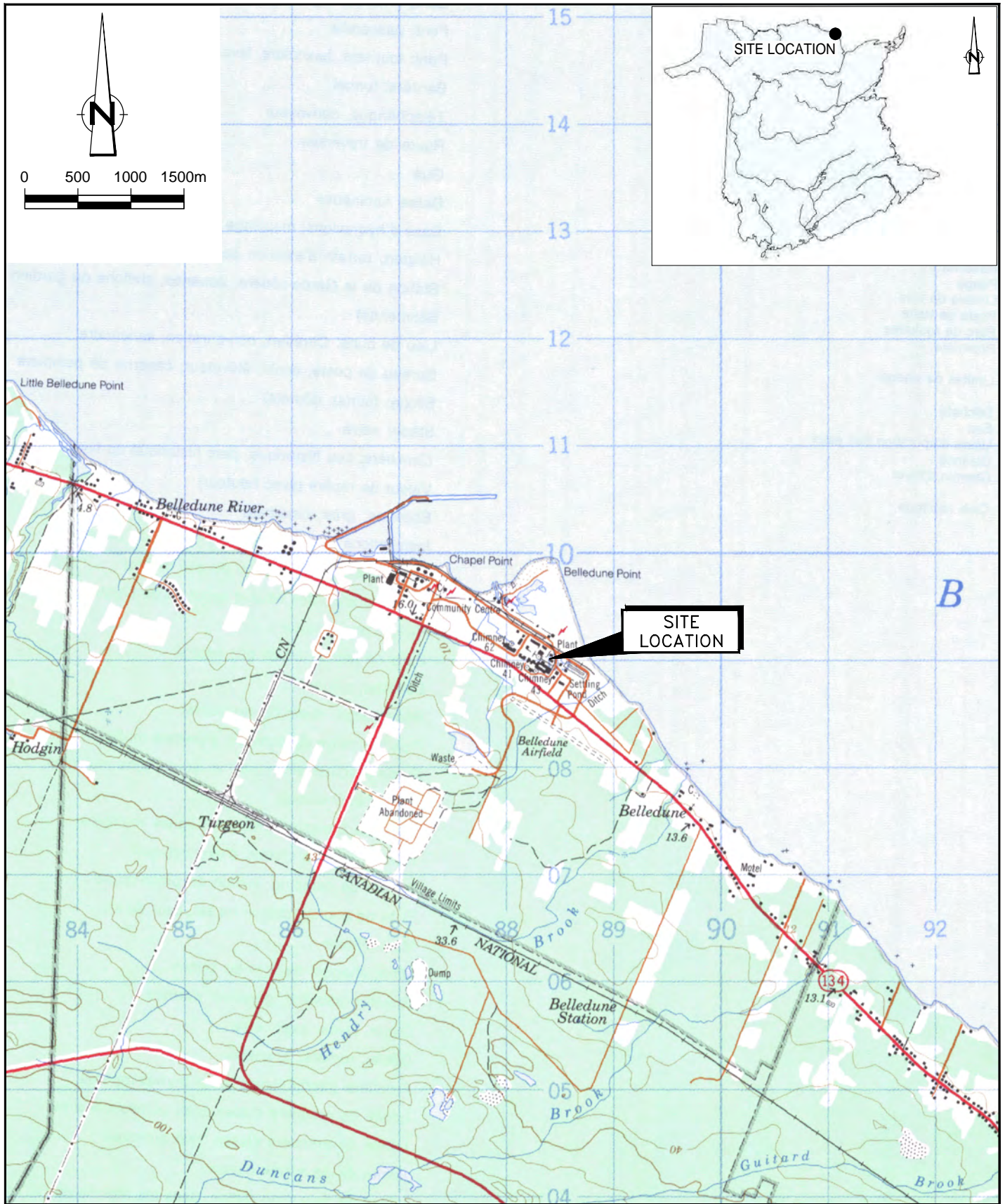
Cody Ross, B.Sc.

This report was reviewed by Frank Edwards, P. Eng. of GHD.



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 BRUNSWICK SMELTER, BELLEDUNE, NEW BRUNSWICK  
 NORM AND HAZARDOUS MATERIALS SURVEY

11198639-01(003)

Jan 6, 2020

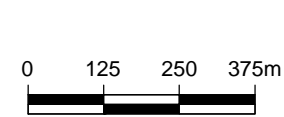
SITE LOCATION

FIGURE 1





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- - - - - SMELTER AREA
- - - - - FERTILIZER PLANT
- - - - - MATERIALS HANDLING WEST AREA



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 NORM AND HAZARDOUS MATERIALS SURVEY

PROPERTY PLAN

11198639-01(003)

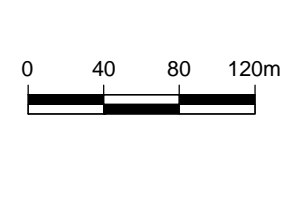
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FIGURE 2





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



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 NORM AND HAZARDOUS MATERIALS SURVEY

11198639-01(003)

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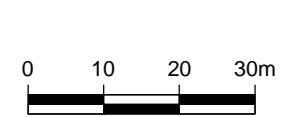
FERTILIZER PLANT AREA

FIGURE 3





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018. & Summary of NORM Characterization Work, SNC LAVALIN 2008, 020120-0000-4EDD-004-00



**LEGEND:**

SOIL AREAS PREVIOUSLY SAMPLED FOR NORM (SNC LAVALIN 2008)



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 NORM AND HAZARDOUS MATERIALS SURVEY

2008 SOIL SAMPLE LOCATIONS

11198639-01

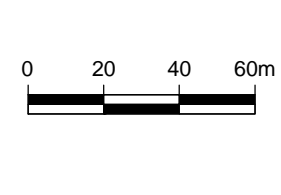
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FIGURE 4





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- CURRENT GROUND WATER SAMPLING LOCATIONS IN FERTILIZER PLANT AREA
- ⊗ HISTORICAL GROUND WATER SAMPLES, LOCATIONS DESTROYED
- WELLS SAMPLED IN 2008



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2008 GROUNDWATER SAMPLING LOCATIONS

11198639-01(003)

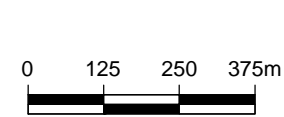
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FIGURE 5





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**



PROPOSED NORM BACKGROUND ESTABLISHMENT AREA



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NORM BACKGROUND ESTABLISHMENT AREAS

11198639-01(003)

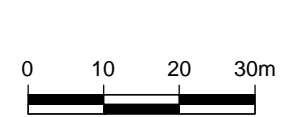
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FIGURE 6







Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

-  SOIL SAMPLE LOCATION
-  AREA SCANNED FOR NORM



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2019 SOIL SAMPLE AND NORM SURVEY LOCATIONS

11198639-01(003)

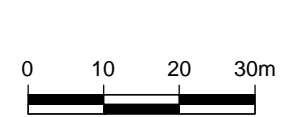
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FIGURE 7A





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



LEGEND:

■ AREA SCANNED FOR NORM



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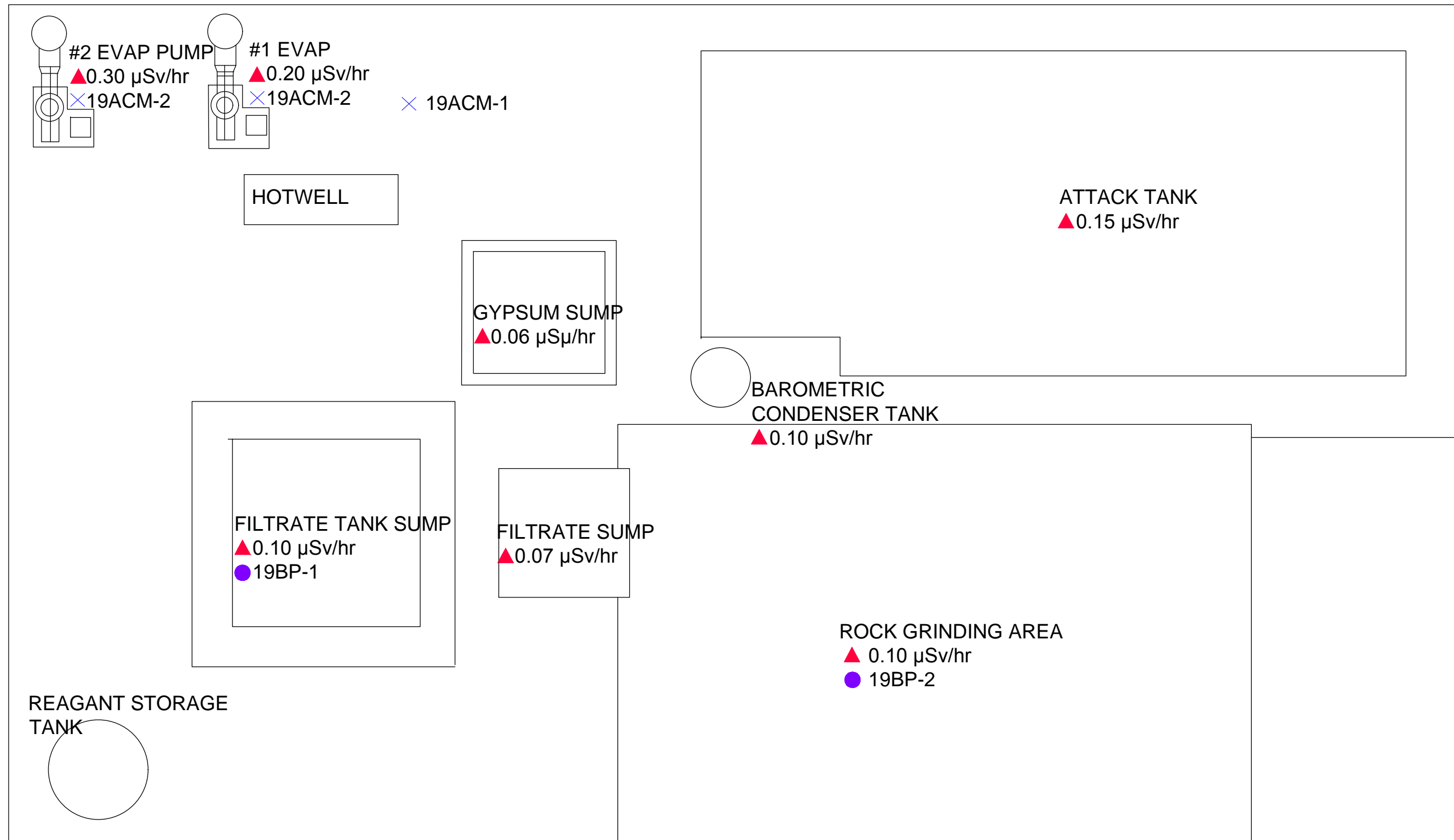
11198639-01(003)

Jan 6, 2020

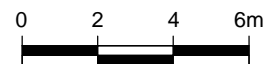
NORM SURVEY LOCATION - GYPSUM LINE PIPING STORAGE AREA

FIGURE 7B





Source:WELLMAN LORD INC DWG3499-02-006 1966



LEGEND:

- \* ONLY READINGS ABOVE BACKGROUND ARE PROVIDED ON FIGURE
- ▲ NORM SURVEY READING
- BULK SAMPLE LOCATION
- × ACM SAMPLE LOCATION



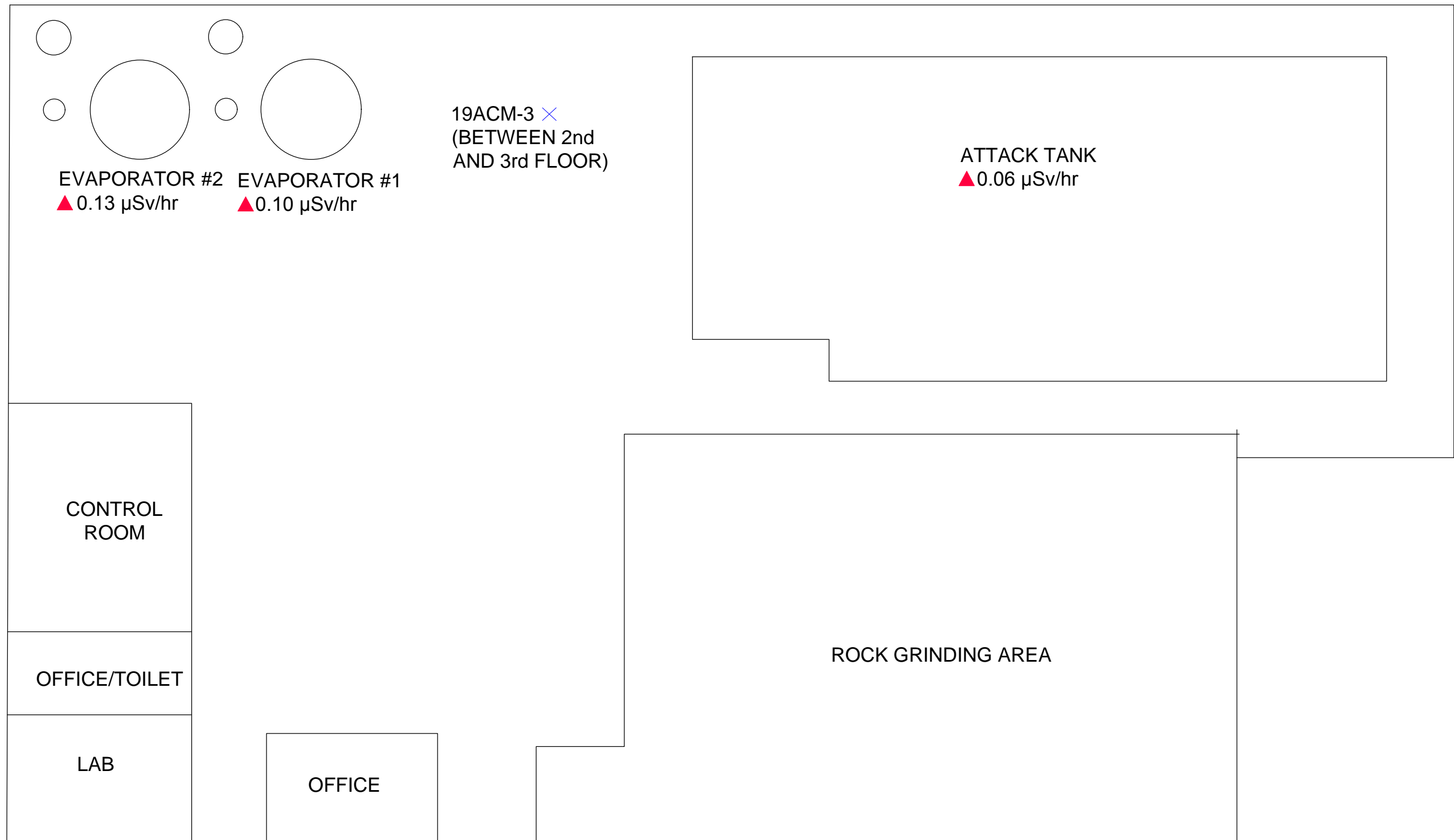
GLENCORE CANADA CORPORATION  
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 NORM AND HAZARDOUS MATERIALS SURVEY

PAP BUILDING - MAIN FLOOR

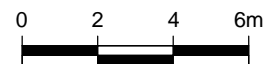
11198639-01(003)

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FIGURE 8A



Source: WELLMAN LORD INC DWG 3499-02A-007 1966



LEGEND:

- \* ONLY READINGS ABOVE BACKGROUND ARE PROVIDED ON FIGURE
- ▲ NORM SURVEY READING
- BULK SAMPLE LOCATION
- × ACM SAMPLE LOCATION

NOTE: RESIDUAL BULK PRODUCT SAMPLE LOCATION 19BP-3 COLLECTED FROM MIXING TANK ON FLOOR 2.5 AND NOT SHOWN ON FIGURE



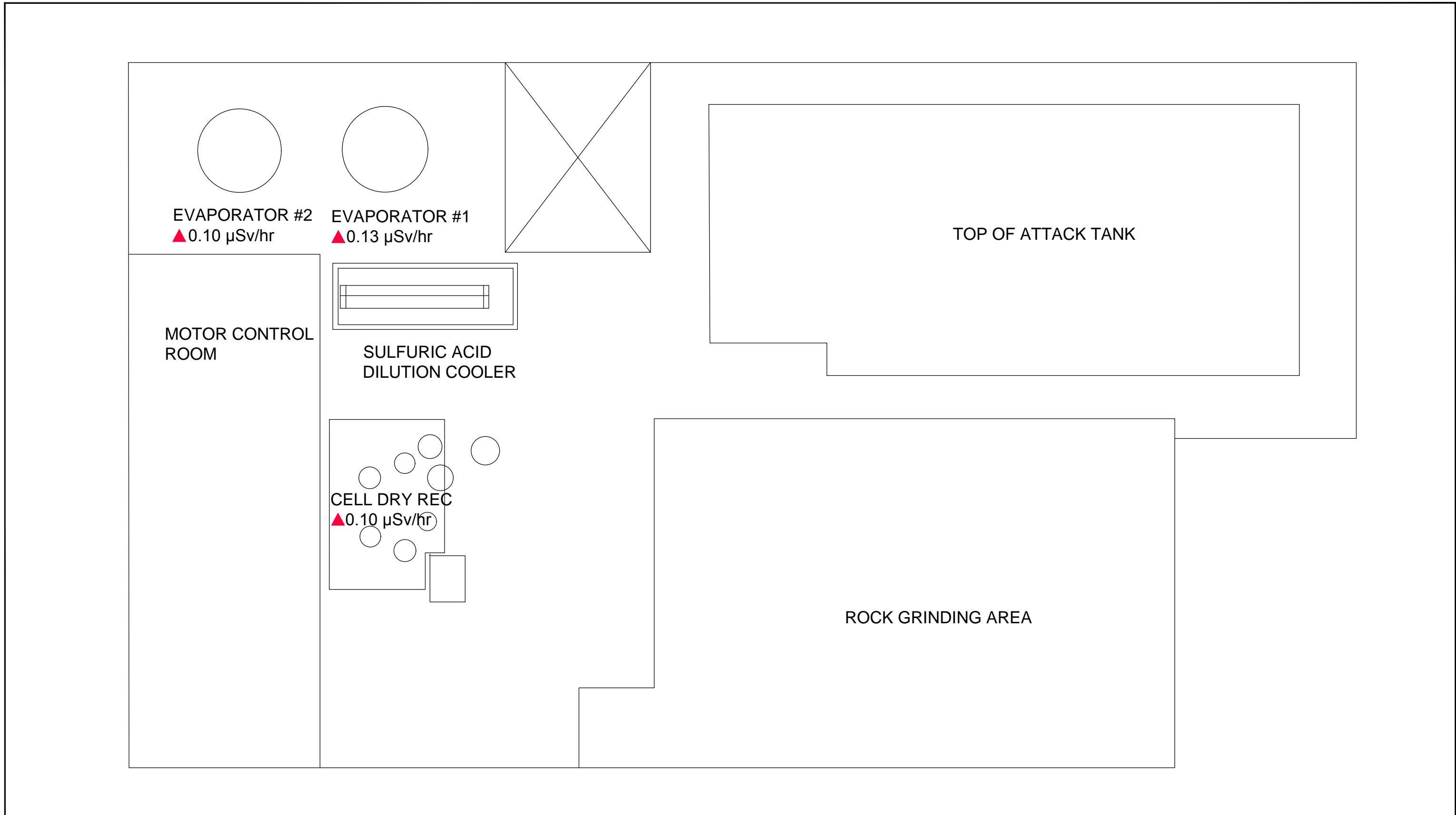
GLENCORE CANADA CORPORATION  
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NORM AND HAZARDOUS MATERIALS SURVEY

PAP BUILDING - 2ND FLOOR

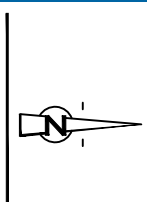
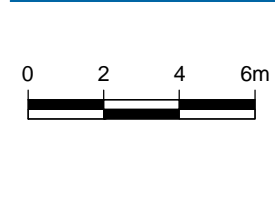
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Jan 6, 2020

FIGURE 8B



Source: WELLMAN LORD INC DWG3499-02-008 1966



LEGEND:  
 \* ONLY READINGS ABOVE BACKGROUND ARE PROVIDED ON FIGURE  
 ▲ NORM SURVEY READING  
 ● BULK SAMPLE LOCATION  
 × ACM SAMPLE LOCATION



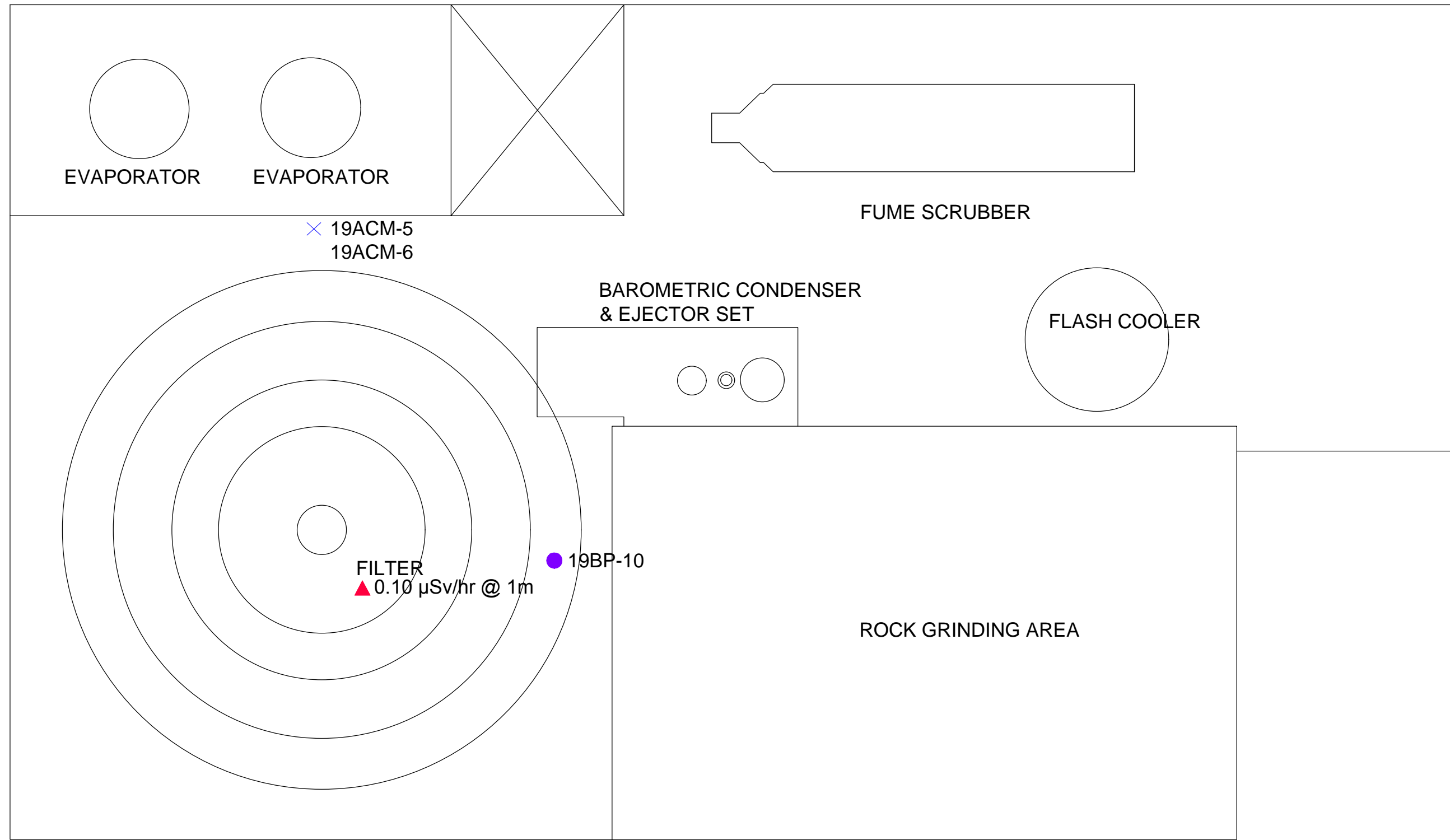
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 BELLEDUNE, NEW BRUNSWICK  
 NORM AND HAZARDOUS MATERIALS SURVEY

PAP BUILDING - 3RD FLOOR

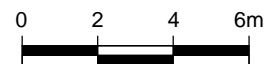
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FIGURE 8C



Source: WELLMAN LORD INC DWG3499-02-009 1966



LEGEND:

- \* ONLY READINGS ABOVE BACKGROUND ARE PROVIDED ON FIGURE
- ▲ NORM SURVEY READING
- BULK SAMPLE LOCATION
- × ACM SAMPLE LOCATION

NOTE: 19ACM-4 COLLECTED FROM ROOF DEBRIS (ROOF PARGE)  
AND NOT SHOWN ON FIGURE



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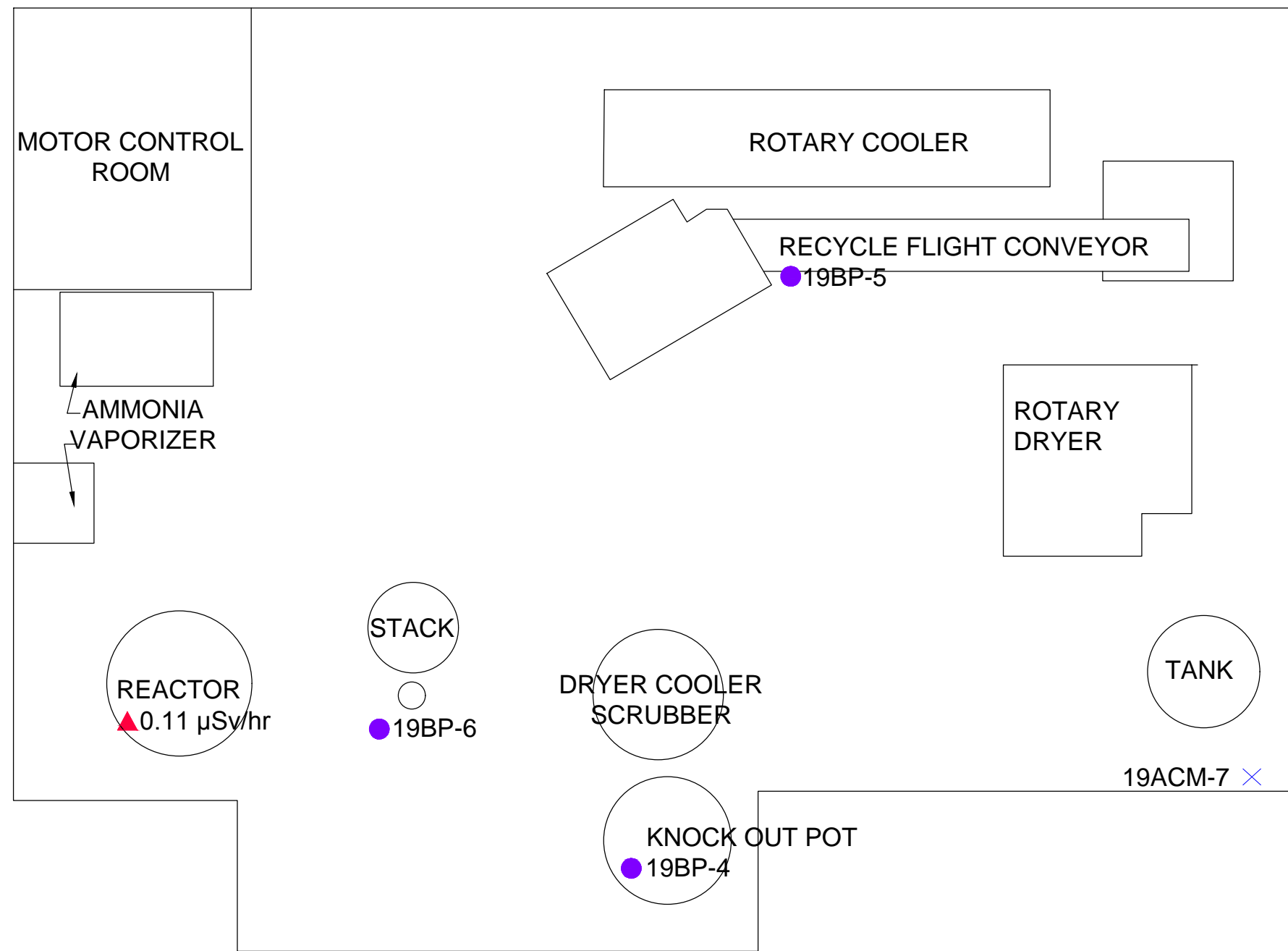
PAP BUILDING - 4TH FLOOR

11198639-01(003)

Jan 6, 2020

FIGURE 8D





Source: WELLMAN LORD INC DWG 8060-71-4010



LEGEND:

- \* ONLY READINGS ABOVE BACKGROUND ARE PROVIDED ON FIGURE
- ▲ NORM SURVEY READING
- BULK SAMPLE LOCATION
- X ACM SAMPLE LOCATION

NOTE: ACM SAMPLES 19ACM-8 & 19ACM-9 AND RESIDENTIAL BULK PRODUCT SAMPLES 19BP-7 & 19BP-9 COLLECTED FROM SECOND FLOOR AND NOT SHOWN ON FIGURE



GLENCORE CANADA CORPORATION  
BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

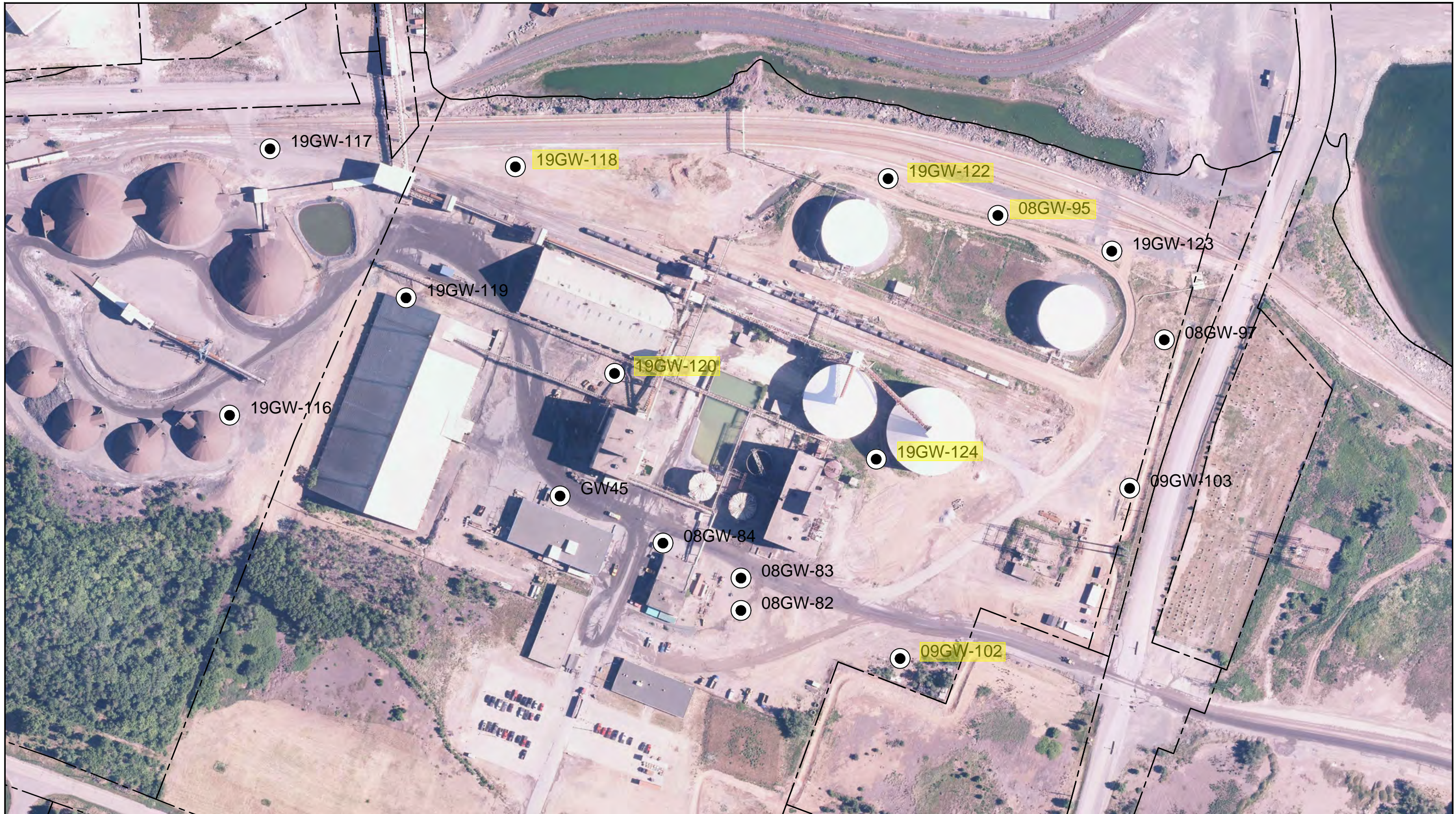
DAP BUILDING - 1ST FLOOR

11198639-01(003)

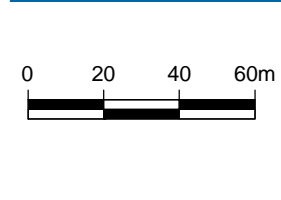
Jan 6, 2020

FIGURE 9





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

- CURRENT GROUND WATER SAMPLING LOCATIONS IN FERTILIZER PLANT AREA
- WELLS SAMPLED IN 2019 AS PART OF THE NORM SURVEY



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 NORM AND HAZARDOUS MATERIALS SURVEY

2019 GROUNDWATER SAMPLING LOCATIONS

11198639-01(003)

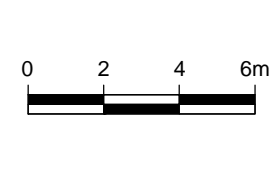
Jan 6, 2020

FIGURE 10





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



**LEGEND:**

 CONCRETE CORE SAMPLES



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 NORM AND HAZARDOUS MATERIALS SURVEY

CONCRETE SAMPLE LOCATIONS

11198639-01(003)

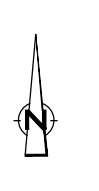
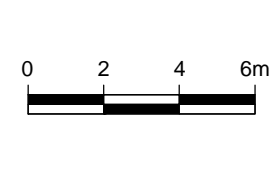
Jan 6, 2020

FIGURE 11





Source: High Resolution Aerial Imagery from New Brunswick Dept of Natural Resources, Acquisition Date: 2018.



LEGEND:



GLENCORE CANADA CORPORATION  
 BELLEDUNE, NEW BRUNSWICK  
 NORM AND HAZARDOUS MATERIALS SURVEY

SCRAP YARD NORM READINGS

11198639-01(003)  
 Jan 6, 2020

FIGURE 12

**Table 1  
Background Soil Conditions - NORM  
Brunswick Smelter  
Belledune, NB**

Survey Area	Background Reading ( $\mu\text{Sv/hr}$ )
<b>East Location</b>	
1	0.05
2	0.05
3	0.05
4	0.03
5	0.03
6	0.05
<b>South Location</b>	
1	0.05
2	0.05
3	0.05
4	0.04
5	0.06
6	0.05
<b>95% Upper Confidence Limit of the Mean – 0.05 <math>\mu\text{Sv/hr}</math></b>	

**Table 2**  
**Soil Survey Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

Sample ID	Sample Depth (m)	Gamma Reading ( $\mu\text{Sv/hr}$ )	Method of Collection/Comments (hand auger unless otherwise noted)
19SP-1	Surface	0.04	
	0.15	0.05	
	Bedrock	0.05	
19SP-2	Surface	0.05	
	0.15	0.05	
19SP-3	Surface	0.04	
	0.15	0.04	
	Bedrock	0.04	
19SP-4	Surface	0.04	
	0.15	0.04	
19SP-5	Surface	0.05	
	0.15	0.05	
	0.3	0.05	
19SP-6	Surface	0.05	
	0.15	0.05	
19SP-9	Surface	0.05	Completed by drill team with geotech drill and split spoon
	0.3	0.05	
	0.6	0.05	
	0.9	0.05	
	1.2	0.05	Bedrock at 1.2m
19SP-10	Surface	0.04	
	0.15	0.04	
19SP-11	Surface	0.04	Completed by drill team with geotech drill and split spoon
	0.3	0.04	
	0.6	0.04	
	0.9	0.04	
	1.2	0.04	
	1.5	0.04	Bedrock at 1.5m
19SP-12	Surface	0.2	
	0.15	0.1	
	0.3	0.05	
19SP-30	Surface	0.05	
	0.15	0.05	
19SP-31	Surface	0.18	Readings could be influenced by filter bins 1m to the west
	0.15	0.04	
19SP-32	Surface	0.2	Readings could be influenced by filter pans 1m to the west
	0.15	0.05	

**Table 3**  
**Residual Bulk Product - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

Sample ID	Location	Volume Remaining	Gamma Reading	Comments
		(m <sup>3</sup> )	( $\mu$ Sv/hr)	
19BP-1	PAP – Filtrate Sump	0.94	0.07	
19BP-2	PAP – Conveyor Feeding Mill	5	0.05	
19BP-3	PAP – Floor 2.5 Mixing Tank	0.01	0.06	
19BP-4	DAP – Overflow Tank, Dryer Cooler Knockout Pot	0.14	0.09	
19BP-5	DAP – North Conveyor	0.42	0.05	
19BP-6	DAP – Overflow Tank in Water	0.02	0.04	2 tanks, volume is combined
19BP-7	DAP – Floor 2 West Conveyor	2.63	0.05	
19BP-8	Former Gypsum Line piping stockpiled in Smelter Area	<0.1	0.06	Approximately 25 pipes in 10 metre lengths. Product limited to minor amount of residual gypsum trapped in annular space between plastic sleeve and outer wood sheathing.
19BP-9	DAP – Phosphoric Acid Line	0.3	0.05	
19BP-10	PAP - Concrete	2.5	0.05	



**Table 4**  
**Building Survey Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

Survey Area	Equipment/Tank/Vessel	Maximum Measured Exposure Rate (15 cm distance unless otherwise noted)	Quantity	Dimensions	Volume	Comments
		µSv/hr	#	m	m <sup>3</sup>	
<b>Scrap Yard</b>						
Fenced in Area	40' Rubberlined Pans	2.50	4	3 x 1.2x 0.3	4.32	
	3 Steel Boxes w/ filter cloths	3.00	3	0.9 x 0.9 x 1.0	2.43	Radiation from these boxes may have affected the soil readings outside of the fence.
	Filter Pans on East Wall	7.00	4	3 x 1.2 x 0.3	4.32	
	24 Filter Pans	7.00	24	3 x 1.2 x 0.3	25.92	Radiation from these filter pans may have affected the soil readings outside of the fence.
	Gypsum Piping	1.00	3	0.5 x 3.0	2.36	
	Filtrate Tank	4.00	1	5 x 2.5 x 1.2	15	In a dump box with miscellaneous material.
	Flash Cooler Ducts	0.50	1	5 x 5 x 1.2	30	
	Concrete Debris	0.40	3	0.5 x 1.0	0.8	
	Dump Boxes with Filter Cloths	1.00		10 x 5 x 1.2	60	Unable to determine # of boxes however they ran from approximately 2m off the west wall until the 24 filter pans on the east side of the waste yard.
	Soil	0.2 (Avg)			est. 89.5	
	Tank outside of Scrap Yard	0.05				
<b>PAP Building</b>						
Ground Floor	Attack Tank	0.15				
	Gypsum Sump	0.06				
	Evap #1	0.20				
	Evap #2	0.30				
	Feed Conveyor	0.10				
	Bag House Fan	0.20				
	Filtrate Sump	0.07				
	Filtrate Tank Sump	0.10				
2nd Floor	Top of Attack Tank	0.06				
	Evap #1	0.10				
	Evap #2	0.13				
	Barometric Condenser Seal Tank	0.10				
3rd Floor	Evap #1	0.10				
	Evap #2	0.13				
	Elevated Platform	0.1				
4th Floor	Filter Pan Enclosure	0.10 @ 1m				May read higher, was unable to get closer than 1m due to unsafe structural conditions.
<b>DAP Building</b>						
Main Floor	Reactor	0.11				Reactor readings were background on outside, elevated readings came from inside reactor.
<b>Smelter Area</b>						
Gypsum Line Storage Area	Gypsum Line piping (interior plastic sleeve, exterior wood sheathing and gypsum residue)	0.05 to 0.06				Multiple readings collected from interior and exterior of former Gypsum Line piping material stockpiled in Smelter Area. All readings recorded were approximately equal to background.

**Table 5**  
**Soil Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	2013 Canadian Guidelines for the Management of NORM, Unconditional Derived Release Limits - Diffuse NORM Sources (Solids)	19SP-1	19SP-1	19SP-1	19SP-3	19SP-3	19SP-5	19SP-5	19SP-2	19SP-4	19SP-6	19SP-10	19SP-9	
			0-0.15M	0-0.15M Lab-Dup	0-0.15-0.30M	0-0.15M	0.15-0.3M	0-0.15M	0.15-0.3M	0-0.15M	0-0.15M	0-0.15M	0-0.15M	0-0.15M	0-0.15M
			9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Lead-210	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	130	<100	<100	
Potassium-40	Bq/kg	17000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	
Radium-226	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	200	<100	<100	
Radium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
Thorium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	
Thorium-230	Bq/kg	10000	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	70	<800	
Thorium-234	Bq/kg	N/A	<50	<50	<50	<50	150	<50	<50	<50	50	120	<50	<50	
Uranium-235	Bq/kg	N/A	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines

**Table 5**  
**Soil Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	2013 Canadian Guidelines for the Management of NORM, Unconditional Derived Release Limits - Diffuse NORM Sources (Solids)	19SP-11	19SP-11	19SP-12	19SP-12	19SP-31	19SP-31	19SP-32	19SP-32	SOIL QA/QC-4	SOIL QA/QC-5	19SP-10
			0-0.15M	1.2-1.8M	0-0.15M	0.15-0.3M	0-0.15M	0.15-0.3M	0-0.15M	0.15-0.3M			0.15-0.3M
			9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Lead-210	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Potassium-40	Bq/kg	17000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Radium-226	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	110	<100	140
Radium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Thorium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Thorium-230	Bq/kg	10000	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800	<800
Thorium-234	Bq/kg	N/A	<50	<50	<50	<50	<50	<50	<50	<50	280	<50	400
Uranium-235	Bq/kg	N/A	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines

**Table 6**  
**Soil Leachate Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	2013 Canadian Guidelines for the Management of NORM, Unconditional Derived Release Limits - Diffuse NORM Sources (Aqueous)	19SP-5 0-0.15M	19SP-2 0-0.15M	19SP-4 0-0.15M	19SP-12 0-0.15M	19SP-31 0-0.15M	19SP-32 0-0.15M
			9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Lead-210	Bq/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead-212	Bq/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Radium-226	Bq/L	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-228	Bq/L	5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thorium-230	Bq/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thorium-234	Bq/L	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium-235	Bq/L	N/A	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines

Table 7  
Soil Analytical Results - Metals  
Brunswick Smelter  
Belledune, NB

Metals	Units	NSE Tier 1 EQS - Non-Potable, Coarse, Industrial <sup>1</sup>	Risk Based Target Levels for Protection of Human Health - Industrial Worker <sup>2</sup>	Risk Based Target Levels for Protection of Human Health - Commercial/Utility Worker <sup>2</sup>	Sample ID	19SP-1	19SP-1	19SP-3	19SP-3	19SP-3 Lab-Dup	19SP-5	19SP-5	19SP-9	19SP-11	19SP-11		
					Sample Depth (m)	0-0.15M	0.15-0.30M	0-0.15M	0.15-0.3M	0.15-0.3M	0-0.15M	0.15-0.3M	0-0.15M	0.15-0.3M	0-0.15M	0-0.15M	1.2-1.8M
					Sample Date	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	
Aluminum	mg/kg	198,000				50000	25000	25000	24000	23000	24000	30000	18000	29000	20000		
Antimony	mg/kg	63				28	53	42	<b>320</b>	<b>310</b>	<b>1100</b>	<b>430</b>	24	<b>100</b>	17		
Arsenic	mg/kg	31	295	130		<b>67</b>	<b>130</b>	<b>90</b>	<b>640</b>	<b>590</b>	<b>1400</b>	<b>620</b>	<b>53</b>	<b>170</b>	<b>50</b>		
Barium	mg/kg	140,000				120	91	94	190	200	220	290	90	100	69		
Beryllium	mg/kg	320				<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		
Bismuth	mg/kg	NG				9.1	21	18	100	120	200	120	6.7	21	4.1		
Boron	mg/kg	24,000				<50	<50	<50	<50	<50	<50	<50	<50	<50	<50		
Cadmium	mg/kg	192 (3)	1,505	95		18	35	23	54	58	<b>180</b>	74	24	19	3.4		
Chromium	mg/kg	6,700				300	92	57	88	92	100	79	42	59	40		
Cobalt	mg/kg	250				41	20	18	15	15	32	32	15	18	13		
Copper	mg/kg	16000 (3)	104,983	67,096		210	250	220	900	880	9300	2500	86	310	120		
Iron	mg/kg	144,000				<b>69000</b>	<b>42000</b>	<b>42000</b>	<b>53000</b>	<b>51000</b>	<b>63000</b>	<b>71000</b>	<b>35000</b>	<b>44000</b>	33000		
Lead	mg/kg	740 (3)	3,567	656		<b>3000</b>	<b>5000</b>	<b>4100</b>	<b>27000</b>	<b>27000</b>	<b>48000</b>	<b>28000</b>	<b>1600</b>	<b>6600</b>	<b>1300</b>		
Lithium	mg/kg	NG				42	25	26	21	21	24	31	22	26	21		
Manganese	mg/kg	NG				1500	1100	970	870	830	2000	2000	990	920	650		
Mercury	mg/kg	24				1.3	1.2	0.33	1.9	2.1	5.2	2.7	0.14	0.51	0.13		
Molybdenum	mg/kg	1,200				<2.0	<2.0	<2.0	8.3	8.8	16	8.0	<2.0	2.2	<2.0		
Nickel	mg/kg	2,200				120	54	47	41	42	85	56	43	52	40		
Rubidium	mg/kg	NG				<2.0	8.2	12	13	13	9.5	4.9	7.6	11	9.6		
Selenium	mg/kg	125				5.4	3.8	1.9	17	18	100	34	1.5	4.4	<1.0		
Silver	mg/kg	490	7,526	3,920		13	23	17	91	89	82	85	9.9	39	6.8		
Strontium	mg/kg	9,400				76	63	43	100	100	160	98	17	32	14		
Thallium	mg/kg	1	22	12		<b>1.8</b>	<b>7.5</b>	<b>5.0</b>	<b>26</b>	<b>26</b>	<b>36</b>	<b>22</b>	<b>1.2</b>	<b>4.2</b>	0.80		
Tin	mg/kg	9,400				4.3	12	10	170	170	310	140	4.2	26	5.8		
Uranium	mg/kg	33				0.20	2.8	4.5	<b>38</b>	<b>38</b>	5.0	2.5	0.74	4.9	1.3		
Vanadium	mg/kg	160				<b>220</b>	98	89	98	100	99	160	63	80	56		
Zinc	mg/kg	47,000	466,418	337,534		870	1400	1500	4900	5100	9600	4500	350	1600	310		
pH		6-8 (3)				<b>8.25</b>	7.43	6.68	<b>5.96</b>		6.86	7.01	7.55	6.56	6.48		
Orthophosphate	mg/kg																

## Notes:

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for Soil at a Non-Potable Site - Coarse Soil Type, Industrial Land Use (July 6, 2013)

<sup>2</sup> Risk Based Target Level for Protection of Human Health assuming Industrial Worker and/or Construction/Utility Worker

<sup>3</sup> Canadian Council of Ministers of the Environment Soil Quality Guideline for Industrial Land Use based on most conservative pathway (Direct Ingestion or Off-Site Migration) (CCME Factsheets accessed October 2019)

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

NG - No Guideline

**BOLD/UNDERLINE** - Exceeds Industrial criteria

**SHADING** - Exceeds Risk Based Target levels where applicable (Industrial Worker and/or Construction/Utility Worker)

**Table 8**  
**Soil Leachate Analytical Results - Metals**  
**Brunswick Smelter**  
**Belledune, NB**

Metals	Units	CEPA Leachate Guideline (1)	Sample ID	19SP-1	19SP-3	19SP-5	19SP-9	19SP-11
			Sample Depth (m)	0.15-0.30M	0.15-0.3M	0-0.15M	0-0.15M	1.2-1.8M
			Sample Date	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Aluminum	µg/L	NG		110	1700	1400	750	1300
Antimony	µg/L	NG		90	330	500	98	49
Arsenic	µg/L	2500		42	180	280	48	26
Barium	µg/L	NG		180	74	310	550	470
Beryllium	µg/L	NG		<20	<20	<20	<20	<20
Boron	µg/L	500,000		<500	<500	<500	<500	<500
Cadmium	µg/L	500		200	280	1500	270	22.0
Chromium	µg/L	NG		<20	<20	<20	<20	<20
Cobalt	µg/L	NG		<10	<10	28	<10	<10
Copper	µg/L	NG		130	1300	19000	570	130
Iron	µg/L	NG		<500	<500	<500	<500	<500
Lead	µg/L	5,000		3900	7000	460000	20000	4100
Lithium	µg/L	NG		<20	<20	<20	<20	<20
Manganese	µg/L	NG		2900	2800	6100	1400	560
Molybdenum	µg/L	NG		<20	<20	<20	<20	<20
Nickel	µg/L	NG		<20	27	67	<20	<20
Selenium	µg/L	1000		<10	<10	<10	<10	<10
Silver	µg/L	NG		<5.0	<5.0	<5.0	<5.0	<5.0
Strontium	µg/L	NG		490	440	440	99	95
Thallium	µg/L	NG		4.7	4.9	45	1.2	<1.0
Tin	µg/L	NG		<20	<20	<20	<20	<20
Uranium	µg/L	10,000		<1.0	3.9	4.3	1.1	1.8
Vanadium	µg/L	NG		<20	<20	<20	<20	<20
Zinc	µg/L	NG		4200	12000	35000	2100	1000

**Notes:**

<sup>1</sup> Canadian Environmental Protection Act (CEPA), Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

NG - No Guideline

**Shading** CEPA Leachate Screening Levels

**Table 9**  
**Bulk Product Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	2013 Canadian Guidelines for the Management of NORM, Unconditional Derived Release Limits - Diffuse NORM Sources (Solids)	19BP-1	19BP-2	19BP-3	19BP-5	19BP-5 Lab-Dup	19BP-8	19BP-10
			9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/19/2019	9/19/2019
Lead-210	Bq/kg	300	<b>900</b>	<b>1150</b>	<100	170	220	<b>570</b>	<100
Potassium-40	Bq/kg	17000	<1000	<1000	3900	<1000	<1000	<1000	<1000
Radium-226	Bq/kg	300	<b>1650</b>	<b>1740</b>	110	280	200	<b>640</b>	<100
Radium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100
Thorium-228	Bq/kg	300	<100	<100	<100	<100	<100	<100	<100
Thorium-230	Bq/kg	10000	<800	1300	<800	2300	2400	<800	<800
Thorium-234	Bq/kg	N/A	70	1420	90	2070	1980	<50	<50
Uranium-235	Bq/kg	N/A	<100	<100	<100	100	<100	<100	<100

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines



**Table 10**  
**Bulk Product Leachate Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	2013 Canadian Guidelines for the Management of NORM, Unconditional Derived Release Limits - Diffuse NORM Sources (Aqueous)	19BP-1	19BP-2	19BP-3	19BP-5	19BP-8	19BP-10
			9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Lead-210	Bq/L	1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead-212	Bq/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Radium-226	Bq/L	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-228	Bq/L	5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thorium-230	Bq/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thorium-234	Bq/L	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium-235	Bq/L	N/A	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines

**Table 11**  
**Bulk Product Analytical Results - Metals**  
**Brunswick Smelter**  
**Belledune, NB**

Metals	Units	NSE Tier 1 EQS - Non-Potable, Coarse, Industrial <sup>1</sup>	Risk Based Target Levels for Protection of Human Health - Industrial Worker <sup>2</sup>	Risk Based Target Levels for Protection of Human Health - Commercial/Utility Worker <sup>2</sup>	Sample ID	19BP-1	19BP-2	19BP-2 Lab-Dup	19BP-4	19BP-5	19BP-6	19BP-7	19BP-8	19BP-9	19BP-10
					Sample Depth (m)										
					Sample Date	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/19/2019	9/18/2019	9/19/2019
Aluminum	mg/kg	198,000				19000	17000		15000	7000	43000	7300	1200	5900	16000
Antimony	mg/kg	63				28	13		48	6.8	13	26	8.0	5.3	3.1
Arsenic	mg/kg	31	295	130		<b>74</b>	4.8		<b>45</b>	23	19	<b>45</b>	28	10	16
Barium	mg/kg	140,000				380	110		300	11	150	18	29	<5.0	130
Beryllium	mg/kg	320				<2.0	2.8		2.9	2.1	3.9	3.9	<2.0	2.0	<2.0
Bismuth	mg/kg	NG				12	<2.0		5.5	<2.0	<2.0	4.3	<2.0	<2.0	<2.0
Boron	mg/kg	24,000				<50	<50		<50	<50	<50	<50	<50	<50	<50
Cadmium	mg/kg	192 (3)	1,505	95		46	7.9		18	9.4	37	26	4.9	3.4	2.1
Chromium	mg/kg	6,700				150	72		<b>8500</b>	100	2800	170	2.7	85	51
Cobalt	mg/kg	250				7.6	3.6		5.2	5.7	11	11	3.7	3.2	12
Copper	mg/kg	16000 (3)	104,983	67,096		230	12		170	26	170	79	41	13	46
Iron	mg/kg	144,000				31000	7700		<b>210000</b>	22000	99000	39000	1300	19000	54000
Lead	mg/kg	740 (3)	3,567	656		<b>4200</b>	84		<b>1700</b>	180	410	<b>1400</b>	250	150	73
Lithium	mg/kg	NG				6.7	2.9		<2.0	2.3	13	3.4	<2.0	<2.0	19
Manganese	mg/kg	NG				890	180		420	350	650	640	30	180	810
Mercury	mg/kg	24				1.8	0.16		4.5	0.24	9.6	0.34	0.40	<0.10	<0.10
Molybdenum	mg/kg	1,200				7.6	5.2		26	16	14	16	<2.0	7.5	2.3
Nickel	mg/kg	2,200				35	14		50	33	110	46	14	17	43
Rubidium	mg/kg	NG				19	5.6		7.7	8.7	11	8.8	<2.0	9.8	8.1
Selenium	mg/kg	125				4.1	<1.0		5.4	<1.0	2.9	1.5	2.1	<1.0	<1.0
Silver	mg/kg	490	7,526	3,920		21	0.71		12	1.7	3.8	7.4	2.9	1.0	<0.50
Strontium	mg/kg	9,400				460	1200		120	68	350	71	380	33	190
Thallium	mg/kg	1	22	12		<b>15</b>	0.58		<b>3.7</b>	<b>1.2</b>	<b>1.3</b>	<b>2.8</b>	<b>1.3</b>	0.92	0.27
Tin	mg/kg	9,400				19	<1.0		15	1.3	4.1	6.0	5.6	1.6	3.4
Uranium	mg/kg	33				21	<b>140</b>		<b>170</b>	<b>170</b>	<b>300</b>	<b>160</b>	6.8	<b>37</b>	2.9
Vanadium	mg/kg	160				50	120		<b>1200</b>	<b>190</b>	<b>1400</b>	<b>210</b>	2.4	<b>180</b>	44
Zinc	mg/kg	47,000	466,418	337,534		4200	100		1500	160	1800	950	200	150	130
pH		6-8 (3)				6.3	<b>1.5</b>	7.62	<b>5.77</b>	6.19	<b>5.07</b>	<b>4.52</b>	<b>5.47</b>	<b>4.03</b>	
Orthophosphate	mg/kg					6.98	7.53	1.9	370	0.066	1300	<0.050	2300	<0.050	

**Notes:**

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for Soil at a Non-Potable Site - Coarse Soil Type, Industrial Land Use (July 6, 2013)

<sup>2</sup> Risk Based Target Level for Protection of Human Health assuming Industrial Worker and/or Construction/Utility Worker

<sup>3</sup> Canadian Council of Ministers of the Environment Soil Quality Guideline for Industrial Land Use based on most conservative pathway (Direct Ingestion or Off-Site Migration) (CCME Factsheets accessed October 2019)

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

NG - No Guideline

**BOLD/UNDERLINE** - Exceeds Industrial criteria

**SHADING** - Exceeds Risk Based Target Levels where applicable (Industrial Worker and/or Construction/Utility Worker)

**Table 12**  
**Bulk Product Leachate Analytical Results - Metals**  
**Brunswick Smelter**  
**Belledune, NB**

Metals	Units	CEPA Leachate Guideline (1)	Sample ID	19BP-1	19BP-4	19BP-5	19BP-7	19BP-9
			Sample Depth (m)					
			Sample Date	9/18/2019	9/18/2019	9/18/2019	9/18/2019	9/18/2019
Aluminum	µg/L	NG		760	19000	39000	14000	300
Antimony	µg/L	NG		29	51	21	53	24
Arsenic	µg/L	2500		37	85	880	1300	240
Barium	µg/L	NG		180	<50	<50	<50	<50
Beryllium	µg/L	NG		<20	<20	<20	23	71
Boron	µg/L	500,000		<500	<500	530	1000	1200
Cadmium	µg/L	NG		140	7.4	31	64	160
Chromium	µg/L	NG		<20	27	64	83	310
Cobalt	µg/L	NG		<10	<10	29	32	160
Copper	µg/L	NG		100	73	290	520	160
Iron	µg/L	NG		<500	<500	<500	<500	610
Lead	µg/L	5,000		210	8.7	12	29	19
Lithium	µg/L	NG		<20	<20	<20	38	44
Manganese	µg/L	NG		380	340	140	2000	8700
Molybdenum	µg/L	NG		<20	<20	41	<20	150
Nickel	µg/L	NG		48	230	420	480	780
Selenium	µg/L	1000		<10	12	15	24	17
Silver	µg/L	NG		<5.0	<5.0	<5.0	<5.0	<5.0
Strontium	µg/L	NG		2600	63	<50	<50	1100
Thallium	µg/L	NG		9.8	<1.0	16	21	16
Tin	µg/L	NG		<20	<20	<20	<20	<20
Uranium	µg/L	10,000		2.3	5.1	280	96	970
Vanadium	µg/L	NG		<20	230	180	85	710
Zinc	µg/L	NG		15000	230	140	450	1900

**Notes:**

<sup>1</sup> Canadian Environmental Protection Act (CEPA), Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

NG - No Guideline

**Shading** CEPA Leachate Screening Levels

**Table 13**  
**Bulk Product Analytical Results - Petroleum Hydrocarbons**  
**Brunswick Smelter**  
**Belledune, NB**

Petroleum Hydrocarbons	Benzene	Toluene	Ethylbenzene	Total Xylenes	F1	F2	F3		mTPH	Hydrocarbon Resemblance	
					C <sub>6</sub> - C <sub>10</sub> (less BTEX)	>C <sub>10</sub> -C <sub>16</sub>	>C <sub>16</sub> -C <sub>21</sub>	>C <sub>21</sub> -<C <sub>32</sub>			
Atlantic RBCA Tier I RBSLs - Industrial, Non-Potable, Coarse Grained <sup>1</sup>	2.5	10,000	10,000	110	NG	NG	NG	NG	870	Gasoline	
									4,000	Diesel/No. 2 Fuel Oil	
									10,000	No. 6 Oil/Lube Oil	
<b>Sample ID</b>	<b>Sample Date</b>										
19BP-1	9/18/2019	<0.025	<0.050	<0.025	<0.050	<2.5	<100	<100	1,500	1,500	Lube oil fraction.
19BP-1 Lab-Dup	9/18/2019	<0.025	<0.050	<0.025	<0.050	<2.5					
19BP-3	9/18/2019	<0.025	<0.050	<0.025	<0.050	<2.5	3800	10,000	77,000	180,000	One product in fuel / lube range. Unidentified compound(s) in fuel / lube range.
19BP-6	9/18/2019	<0.025	<0.050	<0.025	<0.050	<2.5	<100	3,500	6,200	9,700	One product in fuel / lube range.

**Notes:**

<sup>1</sup> Atlantic Risk-Based Corrective Action (RBCA) Tier I Risk-Based Screening Levels (RBSLs) for Soil - Industrial Land Use, Non-Potable Groundwater Use, Coarse-Grained Soil Type (July 2012, revised January 2015)

Results for all parameters are reports in milligrams per kilogram (mg/kg)

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

NG - No Guideline

m - Metres

mTPH - Modified Total Petroleum Hydrocarbons

SHADING - Exceeds industrial criteria

**Table 14**  
**Groundwater Analytical Results - NORM**  
**Brunswick Smelter**  
**Belledune, NB**

RADIONUCLIDE	UNITS	Canadian NORM Guidelines Section 5	08GW-95	09GW-102	19GW-118	19GW-120	19GW-122	19GW-124	QA/QC-1
			9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019
Lead-210	Bq/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Lead-212	Bq/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Radium-226	Bq/L	5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Radium-228	Bq/L	5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Thorium-230	Bq/L	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Thorium-234	Bq/L	N/A	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Uranium-235	Bq/L	N/A	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50

**Notes:**

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch

N/A = Not Applicable

**BOLD/UNDERLINE** - Exceeds Canadian NORM Guidelines

**Table 15**  
**Groundwater Analytical Results - Metals**  
**Brunswick Smelter**  
**Belledune, NB**

Metals	Units	NSE Tier 1 EQS - Non-Potable, Coarse, Commercial <sup>1</sup>	NSE PSS - Discharge to Surface Water - >10 m from Marine Surface Water Body <sup>2</sup>	Sample ID	08GW-95	08GW-95 Lab-Dup	09GW-102	19GW-118	19GW-120	19GW-122	19GW-124	QA/QC-1
				Sample Date	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019	9/23/2019
Aluminum	µg/L	NG	NG		16	15	13	<10	89	<10	<10	<10
Antimony	µg/L	NG	5,000		14.0	13.8	<0.50	40.1	2.29	17.6	11.2	34.9
Arsenic	µg/L	NG	125		5.76	5.38	1.34	28.5	66.0	3.30	8.77	28.1
Barium	µg/L	NG	5,000		30.2	30.1	77.7	2.2	3.8	5.8	45.2	2.7
Beryllium	µg/L	NG	1,000		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Bismuth	µg/L	NG	NG		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Boron	µg/L	NG	12,000		<50	50	<50	129	225	<50	185	133
Cadmium	µg/L	NG	1.2		26.7	26.1	0.284	156	108	0.850	0.984	121
Calcium	mg/L	NG	NG		135		71.1	160	447	248	87.1	161
Chromium	µg/L	NG	NG		<0.50	<0.50	<0.50	0.73	<0.50	<0.50	<0.50	0.73
Cobalt	µg/L	NG	NG		0.33	0.30	<0.10	2.63	368	3.49	<0.10	2.81
Copper	µg/L	NG	20		11.7	11.9	0.97	3.57	30.2	<0.50	2.48	4.25
Iron	µg/L	NG	NG		8.9	8.6	<2.0	<2.0	5.2	89.2	<2.0	<2.0
Lead	µg/L	NG	20		115	114	13.9	8.35	4.35	0.41	7.33	7.20
Lithium	µg/L	NG	NG		<20	<20	<20	<20	382	<20	<20	<20
Magnesium	mg/L	NG	NG		15.7	---	4.6	13.3	193	22.3	6.5	13.1
Manganese	µg/L	NG	NG		418	413	0.66	2940	47600	2610	165	2980
Mercury	µg/L	NG	0.16		<0.013	<0.013	<0.013	<0.013	0.19	<0.013	<0.013	<0.013
Molybdenum	µg/L	NG	NG		<1.0	<1.0	<1.0	<1.0	4.3	2.2	3.1	<1.0
Nickel	µg/L	NG	83		4.69	5.30	<0.20	34.8	1210	9.21	1.35	33.7
Phosphorus	µg/L	NG	NG		268	290	<50	18500	184000	<50	1550	19800
Potassium	mg/L	NG	NG		5.4		<1.0	3.4	3.2	2.8	3.6	3.5
Selenium	µg/L	NG	20		15.0	14.4	1.71	16.3	12.5	<0.50	6.52	16.3
Silicon	µg/L	NG	NG		6680	6690	3630	8250	57400	8410	4580	8160
Silver	µg/L	NG	15		<0.050	<0.050	<0.050	<0.050	0.209	<0.050	<0.050	<0.050
Sodium	mg/L	NG	NG		145	139	11.8	102	231	79.9	246	101
Strontium	µg/L	NG	NG		190	187	121	185	69	277	134	181
Sulphur	mg/L	NG	NG		93	---	46	134	344	188	80	132
Thallium	µg/L	NG	213		20.8	20.9	<0.10	1.61	0.37	0.11	0.38	1.29
Tin	µg/L	NG	NG		<1.0	<1.0	1.6	2.4	<1.0	1.3	<1.0	<1.0
Titanium	µg/L	NG	NG		<10	<10	<10	<10	14	<10	<10	<10
Uranium	µg/L	NG	1,000		0.091	0.080	0.120	<0.050	<0.050	0.089	0.764	<0.050
Vanadium	µg/L	NG	500		<10	<10	<10	15	21	<10	<10	16
Zinc	µg/L	NG	100		814	828	6.7	4120	14100	539	21.0	3730
pH <sup>3</sup>	µg/L	NG	7-8.7		6.94		7.39	6.91	5.75	7.00	7.52	6.95

**Notes:**

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for Groundwater - Non-Potable Groundwater, Coarse-Grained Soil, Commercial Land Use (July 6, 2013)

<sup>2</sup> Nova Scotia Environment (NSE) Pathway Specific Standards (PSS) for Groundwater - Groundwater Discharging to Surface Water, >10 metres from Surface Water Body, Discharge to Marine Water (April 2014)

<sup>3</sup> Canadian Council of Ministers of the Environment Guideline for the Protection of Marine Aquatic Life

Lab Dup - Laboratory Duplicate

NG - No Guideline

**BOLD/UNDERLINE** - Exceeds Industrial criteria

**SHADING** - Exceeds NSE PSS

**Table 16**  
**Asbestos Containing Materials Analytical Results**  
**Brunswick Smelter**  
**Belledune, NB**

Sample ID	Location	Description	Asbestos Content %	Approximate Volume (m <sup>3</sup> )	Friability
<b>PAP Building</b>					
19ACM-1	Main to 3rd Floor	Pipe Wrap Insulation	12	>1.0	High
19ACM-2	Main to 3rd Floor	Evaporator Tank Insulation	55	11.55	High
19ACM-3	Platform between 2nd and 3rd Floor	Pipe Fitting	ND	NA	Low
19ACM-4	Debris from Roof	Roof Parge	ND	NA	Low
19ACM-5	4th Floor Isolated Line	Pipe Insulation	85	>1.0	High
19ACM-6	4th Floor Isolated Line	Pipe Insulation Mag Block	ND	NA	High
<b>DAP Building</b>					
19ACM-7	Main to 2nd Floor	Pipe Fitting	ND	NA	High
19ACM-8	2nd Floor Burner Room	Cable Tray insulation	12	>1.0	High
19ACM-9	2nd Floor	Pipe Fitting	ND	NA	High
<b>Outside of Waste Yard</b>					
19ACM-10	Tank Outside Scrap Yard	Tank Insulation	ND	NA	High

**Table 17**  
**Concrete Analytical Results - Polychlorinated Biphenyls (PCBs)**  
**Brunswick Smelter**  
**Belledune, NB**

PCBs	Units	NSE Tier 1 EQS - Non-Potable, Coarse, Industrial <sup>1</sup>	Sample ID	19-CONCRETE-1	19-CONCRETE-2	19-CONCRETE-2 Lab-Dup
			Sample Date	9/18/2019	9/18/2019	9/18/2019
Aroclor 1016	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1221	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1232	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1248	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1242	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1254	µg/g	NG		<0.50	<0.50	<0.50
Aroclor 1260	µg/g	NG		<0.50	<0.50	<0.50
Calculated Total PCB	µg/g	33		<0.50	<0.50	

**Notes:**

<sup>1</sup> Nova Scotia Environment (NSE) Tier 1 Environmental Quality Standards (EQS) for Soil at a Non-Potable Site - Coarse Soil Type, Industrial Land Use (July 6, 2013)

"-" - Not Applicable/Not Analyzed

Lab Dup - Laboratory Duplicate

PCB - Polychlorinated Biphenyls

NG - No Guideline

**BOLD/UNDERLINE** - Exceeds Industrial criteria



# Appendix A Photograph Log



PHOTO 1 - FILTER PANS ALONG THE EAST WALL IN SCRAP YARD



PHOTO 2 - BINS WITH FILTER CLOTHS ALONG THE EAST WALL OF SCRAP YARD



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

PHOTOGRAPHIC LOG

11198639-06

Oct 31, 2019

FIGURE P1



PHOTO 3 - GYPSUM PIPING IN SCRAP YARD



PHOTO 4 - 24 FILTER PANS IN THE SOUTHEAST CORNER OF SCRAP YARD



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

11198639-06

Oct 31, 2019

PHOTOGRAPHIC LOG

FIGURE P2





PHOTO 5 - BINS ALONG THE SOUTH EDGE OF THE SCRAP YARD



PHOTO 6 - FILTRATE TANK IN DUMP BOX



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

PHOTOGRAPHIC LOG

11198639-06

Oct 31, 2019

FIGURE P3



PHOTO 7 - FILTRATE TANK IN PAP BUILDING



PHOTO 8 - EVAPORATOR PIPING ON MAIN FLOOR IN PAP BUILDING



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

11198639-06

Oct 31, 2019

PHOTOGRAPHIC LOG

FIGURE P4





PHOTO 9 - BALL MILL IN PAP BUILDING



PHOTO 10 - 3RD FLOOR OF THE PAP BUILDING DIRECTLY UNDER FILTER PANS WITH SUSPECTED ELEVATED NORM READINGS



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

PHOTOGRAPHIC LOG

11198639-06

Oct 31, 2019

FIGURE P5



PHOTO 11 - EVAPORATOR TANKS ON THE 3RD FLOOR OF PAP BUILDING



PHOTO 12 - TOP FLOOR OF PAP BUILDING WITH EVAPORATOR TANKS RIGHT AND FILTER PANS LEFT



GLENCORE CANADA CORPORATION  
BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

11198639-06

Oct 31, 2019

PHOTOGRAPHIC LOG

FIGURE P6





PHOTO 13 - HOUSING FOR PAN FILTERS ON TOP FLOOR OF PAP BUILDING, LOCATION OF 19ACM-4



PHOTO 14 - BAROMETRIC CONDENSOR AND EJECTOR SET ON THE 4TH FLOOR OF PAP BUILDING



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BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

PHOTOGRAPHIC LOG

11198639-06

Oct 31, 2019

FIGURE P7





PHOTO 15 - FUME SCRUBBER ON THE 4TH FLOOR OF THE PAP BUILDING



PHOTO 16 - MAIN FLOOR OF THE DAP BUILDING



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BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

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FIGURE P8



PHOTO 17 - TANK IN NORTHEAST CORNER OF DAP BUILDING ON MAIN FLOOR



PHOTO 18 - 2ND FLOOR OF THE DAP BUILDING, CONVEYOR ON LEFT AND DRYER ON RIGHT



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FIGURE P9





PHOTO 19 - 3RD FLOOR OF THE DAP BUILDING



PHOTO 20 - CONVEYORS ON THE 4TH FLOOR OF THE DAP BUILDING



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FIGURE P10



PHOTO 21 - GYPSUM LINE STOCKPILED ON THE NORTH SIDE OF THE SMELTER AREA. APPROXIMATELY 25 SECTIONS OF PIPING THAT ARE 30 FEET IN LENGTH



PHOTO 22 - CONCRETE PAD AND TRANSFORMERS OUTSIDE OF THE DAP BUILDING



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BELLEDUNE SMELTER, BELLEDUNE, NEW BRUNSWICK  
NORM AND HAZARDOUS MATERIALS SURVEY

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PHOTOGRAPHIC LOG

FIGURE P11





PHOTO 23 - LOCATION OF ACM SAMPLE 19ACM-1



PHOTO 24 - LOCATION OF ACM SAMPLE 19ACM-2



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FIGURE P12



PHOTO 25 - LOCATION OF ACM SAMPLE 19ACM-3



PHOTO 26 - LOCATION OF ACM SAMPLES 19ACM-5 AND 19ACM-6



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FIGURE P13



PHOTO 27 - LOCATION OF ACM SAMPLE 19ACM-7



PHOTO 28 - LOCATION OF ACM SAMPLE 19ACM-8



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NORM AND HAZARDOUS MATERIALS SURVEY

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FIGURE P14





PHOTO 29 - LOCATION OF ACM SAMPLE 19ACM-9



PHOTO 30 - LOCATION OF ACM SAMPLE 19ACM-10



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NORM AND HAZARDOUS MATERIALS SURVEY

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PHOTOGRAPHIC LOG

FIGURE P15



# Appendix B

## Laboratory Certificates



Your P.O. #: 73517254  
 Your Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your C.O.C. #: D 34709, D 34684, D34691

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/24**  
 Report #: R5934513  
 Version: 5 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q8613**  
**Received: 2019/09/25, 09:58**

Sample Matrix: Soil  
 # Samples Received: 22

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
Metals Leach TCLP/CGSB extraction	3	2019/10/16	2019/10/17	ATL SOP 00058	EPA 6020B R2 m
Metals Leach TCLP/CGSB extraction	1	2019/10/17	2019/10/18	ATL SOP 00058	EPA 6020B R2 m
Metals Leach TCLP/CGSB extraction	1	2019/10/18	2019/10/21	ATL SOP 00058	EPA 6020B R2 m
Metals Solids Acid Extr. ICPMS	9	2019/09/27	2019/10/01	ATL SOP 00058	EPA 6020B R2 m
pH (5:1 DI Water Extract)	9	2019/09/30	2019/10/01	ATL SOP 00003	SM 23 4500-H+ B m
NORM Group Analysis (1)	2	N/A	2019/10/04	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	15	N/A	2019/10/05	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	5	N/A	2019/10/06	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/09	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/10	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	2	N/A	2019/10/11	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/17	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/22	BQL SOP-00007	Gamma Spectrometry
TCLP Inorganic extraction - pH	5	N/A	2019/09/27	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - pH	1	N/A	2019/10/01	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - pH	3	N/A	2019/10/16	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - pH	1	N/A	2019/10/17	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	5	N/A	2019/09/27	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	1	N/A	2019/10/01	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	3	N/A	2019/10/16	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	1	N/A	2019/10/17	ATL SOP 00035	EPA 1311 m

**Remarks:**

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied.



Your P.O. #: 73517254  
Your Project #: 11198639-06  
Site Location: BELLEDUNE  
Your C.O.C. #: D 34709, D 34684, D34691

**Attention: Troy Small**

GHD Limited  
466 Hodgson Rd  
Fredericton, NB  
CANADA E3C 2G5

**Report Date: 2019/10/24**  
Report #: R5934513  
Version: 5 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q8613**

**Received: 2019/09/25, 09:58**

BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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. When sampling is not conducted by BV Labs, results relate to the supplied 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 Bureau Veritas Laboratories Kitimat

Encryption Key



Bureau Veritas Laboratories  
24 Oct 2019 15:46:41

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Heather Macumber, Senior Project Manager

Email: Heather.MACUMBER@bvlabs.com

Phone# (902)420-0203 Ext:226

=====

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





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VERITAS

BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWI778			KWI778			KWI779		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34709			D 34709			D 34709		
	UNITS	19SP-1 0-0.15M	RDL	QC Batch	19SP-1 0-0.15M Lab-Dup	RDL	QC Batch	19SP-1 0-0.15-0.30M	RDL	QC Batch

Inorganics										
Soluble (5:1) pH	pH	8.25	N/A	6362631				7.43	N/A	6362631
Sample Weight (as received)	g							100	N/A	6388164
Initial pH	N/A							4.8		6388165
Final pH	N/A							5.9		6388165

RADIONUCLIDE										
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434	<0.80	0.80	6368434
Thorium-234	Bq/g	<0.050	0.050	6368434	<0.050	0.050	6368434	<0.050	0.050	6368434
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 Lab-Dup = Laboratory Initiated Duplicate  
 N/A = Not Applicable



BUREAU  
VERITAS

BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWI780			KWI781			KWI782		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34709			D 34709			D 34709		
	UNITS	19SP-3 0-0.15M	RDL	QC Batch	19SP-3 0.15-0.3M	RDL	QC Batch	19SP-5 0-0.15M	RDL	QC Batch

Inorganics										
Soluble (5:1) pH	pH	6.68	N/A	6362631	5.96	N/A	6362631	6.86	N/A	6362631
Sample Weight (as received)	g				100	N/A	6388164	100	N/A	6356111
Initial pH	N/A				4.8		6388165	4.9		6356112
Final pH	N/A				5.4		6388165	5.3		6356112

RADIONUCLIDE										
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Lead-210	Bq/L							<1.0	1.0	6370557
Lead-212	Bq/L							<0.10	0.10	6370557
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-226	Bq/L							<1.0	1.0	6370557
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-228	Bq/L							<0.50	0.50	6370557
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434	<0.80	0.80	6368434
Thorium-230	Bq/L							<5.0	5.0	6370557
Thorium-234	Bq/g	<0.050	0.050	6368434	0.150	0.050	6368434	<0.050	0.050	6368434
Thorium-234	Bq/L							<1.0	1.0	6370557
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Uranium-235	Bq/L							<0.50	0.50	6370557

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 N/A = Not Applicable



**RESULTS OF ANALYSES OF SOIL**

BV Labs ID		KWI783			KWI784			KWI784	
Sampling Date		2019/09/18			2019/09/18			2019/09/18	
COC Number		D 34709			D 34709			D 34709	
	UNITS	19SP-5 0.15-0.3M	RDL	QC Batch	19SP-2 0-0.15M	RDL	QC Batch	19SP-2 0-0.15M Lab-Dup	QC Batch
<b>Inorganics</b>									
Soluble (5:1) pH	pH	7.01	N/A	6362631					
Sample Weight (as received)	g				100	N/A	6356111	100	6356111
Initial pH	N/A				4.8		6356112	4.9	6356112
Final pH	N/A				5.9		6356112	6.0	6356112
<b>RADIONUCLIDE</b>									
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434		
Lead-210	Bq/L				<1.0	1.0	6370557		
Lead-212	Bq/L				<0.10	0.10	6370557		
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434		
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434		
Radium-226	Bq/L				<1.0	1.0	6370557		
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434		
Radium-228	Bq/L				<0.50	0.50	6370557		
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434		
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434		
Thorium-230	Bq/L				<5.0	5.0	6370557		
Thorium-234	Bq/g	<0.050	0.050	6368434	<0.050	0.050	6368434		
Thorium-234	Bq/L				<1.0	1.0	6370557		
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434		
Uranium-235	Bq/L				<0.50	0.50	6370557		
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable									





BV Labs Job #: B9Q8613  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254

**RESULTS OF ANALYSES OF SOIL**

<b>BV Labs ID</b>		KWI785			KWI786	KWI787		
<b>Sampling Date</b>		2019/09/18			2019/09/18	2019/09/18		
<b>COC Number</b>		D 34709			D 34709	D 34709		
	<b>UNITS</b>	<b>19SP-4 0-0.15M</b>	<b>RDL</b>	<b>QC Batch</b>	<b>19SP-6 0-0.15M</b>	<b>19SP-10 0-0.15M</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Inorganics</b>								
Sample Weight (as received)	g	100	N/A	6362110				
Initial pH	N/A	4.9		6362115				
Final pH	N/A	5.5		6362115				

<b>RADIONUCLIDE</b>								
Lead-210	Bq/g	<0.10	0.10	6368434	0.13	<0.10	0.10	6368434
Lead-210	Bq/L	<1.0	1.0	6370557				
Lead-212	Bq/L	<0.10	0.10	6370557				
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	0.20	<0.10	0.10	6368434
Radium-226	Bq/L	<1.0	1.0	6370557				
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	<0.10	0.10	6368434
Radium-228	Bq/L	<0.50	0.50	6370557				
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	<0.80	0.80	6368434
Thorium-230	Bq/L	<5.0	5.0	6370557				
Thorium-234	Bq/g	0.050	0.050	6368434	0.120	0.070	0.050	6368434
Thorium-234	Bq/L	<1.0	1.0	6370557				
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	<0.10	0.10	6368434
Uranium-235	Bq/L	<0.50	0.50	6370557				

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 N/A = Not Applicable



BV Labs Job #: B9Q8613  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254

**RESULTS OF ANALYSES OF SOIL**

<b>BV Labs ID</b>		KWI974			KWI975			KWI976		
<b>Sampling Date</b>		2019/09/18			2019/09/18			2019/09/18		
<b>COC Number</b>		D 34684			D 34684			D 34684		
	<b>UNITS</b>	<b>19SP-9 0-0.15M</b>	<b>RDL</b>	<b>QC Batch</b>	<b>19SP-11 0-0.15M</b>	<b>RDL</b>	<b>QC Batch</b>	<b>19SP-11 1.2-1.8M</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Inorganics</b>										
Soluble (5:1) pH	pH	7.55	N/A	6362631	6.56	N/A	6362631	6.48	N/A	6362631
Sample Weight (as received)	g	100	N/A	6388164				91	N/A	6391323
Initial pH	N/A	4.9		6388165				4.9		6391325
Final pH	N/A	4.8		6388165				4.9		6391325

<b>RADIONUCLIDE</b>										
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434	<0.80	0.80	6368434
Thorium-234	Bq/g	<0.050	0.050	6368434	<0.050	0.050	6368434	<0.050	0.050	6368434
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 N/A = Not Applicable



BUREAU  
VERITAS

BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWI977			KWI978			KWI979		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34684			D 34684			D 34684		
	UNITS	19SP-12 0-0.15M	RDL	QC Batch	19SP-12 0.15-0.3M	RDL	QC Batch	19SP-31 0-0.15M	RDL	QC Batch

Inorganics										
Sample Weight (as received)	g	100	N/A	6356111				100	N/A	6356111
Initial pH	N/A	4.8		6356112				4.8		6356112
Final pH	N/A	5.0		6356112				5.0		6356112

RADIONUCLIDE										
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Lead-210	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	0.10	6370557				<0.10	0.10	6370557
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-226	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-228	Bq/L	<0.50	0.50	6370557				<0.50	0.50	6370557
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434	<0.80	0.80	6368434
Thorium-230	Bq/L	<5.0	5.0	6370557				<5.0	5.0	6370557
Thorium-234	Bq/g	<0.050	0.050	6368434	<0.050	0.050	6368434	<0.050	0.050	6368434
Thorium-234	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Uranium-235	Bq/L	<0.50	0.50	6370557				<0.50	0.50	6370557

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 N/A = Not Applicable





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BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

### RESULTS OF ANALYSES OF SOIL

<b>BV Labs ID</b>		KWI980			KWI981			KWI982		
<b>Sampling Date</b>		2019/09/18			2019/09/18			2019/09/18		
<b>COC Number</b>		D 34684			D 34684			D 34684		
	<b>UNITS</b>	<b>19SP-31 0.15-0.3M</b>	<b>RDL</b>	<b>QC Batch</b>	<b>19SP-32 0-0.15M</b>	<b>RDL</b>	<b>QC Batch</b>	<b>19SP-32 0.15-0.3M</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Inorganics</b>										
Sample Weight (as received)	g				100	N/A	6356111			
Initial pH	N/A				4.8		6356112			
Final pH	N/A				4.9		6356112			

<b>RADIONUCLIDE</b>										
Lead-210	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Lead-210	Bq/L				<1.0	1.0	6370557			
Lead-212	Bq/L				<0.10	0.10	6370557			
Potassium-40	Bq/g	<1.0	1.0	6368434	<1.0	1.0	6368434	<1.0	1.0	6368434
Radium-226	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-226	Bq/L				<1.0	1.0	6370557			
Radium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Radium-228	Bq/L				<0.50	0.50	6370557			
Thorium-228	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Thorium-230	Bq/g	<0.80	0.80	6368434	<0.80	0.80	6368434	<0.80	0.80	6368434
Thorium-230	Bq/L				<5.0	5.0	6370557			
Thorium-234	Bq/g	<0.050	0.050	6368434	<0.050	0.050	6368434	<0.050	0.050	6368434
Thorium-234	Bq/L				<1.0	1.0	6370557			
Uranium-235	Bq/g	<0.10	0.10	6368434	<0.10	0.10	6368434	<0.10	0.10	6368434
Uranium-235	Bq/L				<0.50	0.50	6370557			

RDL = Reportable Detection Limit  
 QC Batch = Quality Control Batch  
 N/A = Not Applicable



BV Labs Job #: B9Q8613  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254

**RESULTS OF ANALYSES OF SOIL**

BV Labs ID		KWI983	KWJ003	KWJ004		
Sampling Date		2019/09/18	2019/09/18	2019/09/18		
COC Number		D 34684	D34691	D34691		
	UNITS	SOIL QA/QC-4	SOIL QA/QC-5	19SP-10 0.15-0.3M	RDL	QC Batch
<b>RADIONUCLIDE</b>						
Lead-210	Bq/g	<0.10	<0.10	<0.10	0.10	6368435
Potassium-40	Bq/g	<1.0	<1.0	<1.0	1.0	6368435
Radium-226	Bq/g	0.11	<0.10	0.14	0.10	6368435
Radium-228	Bq/g	<0.10	<0.10	<0.10	0.10	6368435
Thorium-228	Bq/g	<0.10	<0.10	<0.10	0.10	6368435
Thorium-230	Bq/g	<0.80	<0.80	<0.80	0.80	6368435
Thorium-234	Bq/g	0.280	<0.050	0.400	0.050	6368435
Uranium-235	Bq/g	<0.10	<0.10	<0.10	0.10	6368435
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



**ELEMENTS BY ICP/MS (SOIL)**

BV Labs ID		KWI779	KWI781			KWI782		
Sampling Date		2019/09/18	2019/09/18			2019/09/18		
COC Number		D 34709	D 34709			D 34709		
	UNITS	19SP-1 0-0.15-0.30M	19SP-3 0.15-0.3M	RDL	QC Batch	19SP-5 0-0.15M	RDL	QC Batch
<b>Metals</b>								
Leachable Aluminum (Al)	ug/L	110	1700	100	6388780	1400	100	6393264
Leachable Antimony (Sb)	ug/L	90	330	20	6388780	500	20	6393264
Leachable Arsenic (As)	ug/L	42	180	20	6388780	280	20	6393264
Leachable Barium (Ba)	ug/L	180	74	50	6388780	310	50	6393264
Leachable Beryllium (Be)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Boron (B)	ug/L	<500	<500	500	6388780	<500	500	6393264
Leachable Cadmium (Cd)	ug/L	200	280	3.0	6388780	1500	3.0	6393264
Leachable Calcium (Ca)	ug/L	650000	380000	1000	6388780	310000	1000	6393264
Leachable Chromium (Cr)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Cobalt (Co)	ug/L	<10	<10	10	6388780	28	10	6393264
Leachable Copper (Cu)	ug/L	130	1300	20	6388780	19000	20	6393264
Leachable Iron (Fe)	ug/L	<500	<500	500	6388780	<500	500	6393264
Leachable Lead (Pb)	ug/L	3900	7000	5.0	6388780	460000	50	6393264
Leachable Lithium (Li)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Magnesium (Mg)	ug/L	6500	5500	1000	6388780	4500	1000	6393264
Leachable Manganese (Mn)	ug/L	2900	2800	20	6388780	6100	20	6393264
Leachable Molybdenum (Mo)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Nickel (Ni)	ug/L	<20	27	20	6388780	67	20	6393264
Leachable Potassium (K)	ug/L	2400	2300	1000	6388780	2700	1000	6393264
Leachable Selenium (Se)	ug/L	<10	<10	10	6388780	<10	10	6393264
Leachable Silver (Ag)	ug/L	<5.0	<5.0	5.0	6388780	<5.0	5.0	6393264
Leachable Strontium (Sr)	ug/L	490	440	50	6388780	440	50	6393264
Leachable Thallium (Tl)	ug/L	4.7	4.9	1.0	6388780	45	1.0	6393264
Leachable Tin (Sn)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Uranium (U)	ug/L	<1.0	3.9	1.0	6388780	4.3	1.0	6393264
Leachable Vanadium (V)	ug/L	<20	<20	20	6388780	<20	20	6393264
Leachable Zinc (Zn)	ug/L	4200	12000	50	6388780	35000	50	6393264
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								





**ELEMENTS BY ICP/MS (SOIL)**

BV Labs ID		KWI974		KWI976		
Sampling Date		2019/09/18		2019/09/18		
COC Number		D 34684		D 34684		
	UNITS	19SP-9 0-0.15M	QC Batch	19SP-11 1.2-1.8M	RDL	QC Batch
<b>Metals</b>						
Leachable Aluminum (Al)	ug/L	750	6388780	1300	100	6391070
Leachable Antimony (Sb)	ug/L	98	6388780	49	20	6391070
Leachable Arsenic (As)	ug/L	48	6388780	26	20	6391070
Leachable Barium (Ba)	ug/L	550	6388780	470	50	6391070
Leachable Beryllium (Be)	ug/L	<20	6388780	<20	20	6391070
Leachable Boron (B)	ug/L	<500	6388780	<500	500	6391070
Leachable Cadmium (Cd)	ug/L	270	6388780	22	3.0	6391070
Leachable Calcium (Ca)	ug/L	51000	6388780	34000	1000	6391070
Leachable Chromium (Cr)	ug/L	<20	6388780	<20	20	6391070
Leachable Cobalt (Co)	ug/L	<10	6388780	<10	10	6391070
Leachable Copper (Cu)	ug/L	570	6388780	130	20	6391070
Leachable Iron (Fe)	ug/L	<500	6388780	<500	500	6391070
Leachable Lead (Pb)	ug/L	20000	6388780	4100	5.0	6391070
Leachable Lithium (Li)	ug/L	<20	6388780	<20	20	6391070
Leachable Magnesium (Mg)	ug/L	3100	6388780	5800	1000	6391070
Leachable Manganese (Mn)	ug/L	1400	6388780	560	20	6391070
Leachable Molybdenum (Mo)	ug/L	<20	6388780	<20	20	6391070
Leachable Nickel (Ni)	ug/L	<20	6388780	<20	20	6391070
Leachable Potassium (K)	ug/L	3200	6388780	3200	1000	6391070
Leachable Selenium (Se)	ug/L	<10	6388780	<10	10	6391070
Leachable Silver (Ag)	ug/L	<5.0	6388780	<5.0	5.0	6391070
Leachable Strontium (Sr)	ug/L	99	6388780	95	50	6391070
Leachable Thallium (Tl)	ug/L	1.2	6388780	<1.0	1.0	6391070
Leachable Tin (Sn)	ug/L	<20	6388780	<20	20	6391070
Leachable Uranium (U)	ug/L	1.1	6388780	1.8	1.0	6391070
Leachable Vanadium (V)	ug/L	<20	6388780	<20	20	6391070
Leachable Zinc (Zn)	ug/L	2100	6388780	1000	50	6391070
RDL = Reportable Detection Limit						
QC Batch = Quality Control Batch						



**ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)**

BV Labs ID		KWI778	KWI779	KWI780		KWI781		
Sampling Date		2019/09/18	2019/09/18	2019/09/18		2019/09/18		
COC Number		D 34709	D 34709	D 34709		D 34709		
	UNITS	19SP-1 0-0.15M	19SP-1 0-0.15-0.30M	19SP-3 0-0.15M	RDL	19SP-3 0.15-0.3M	RDL	QC Batch

Metals								
Acid Extractable Aluminum (Al)	mg/kg	50000	25000	25000	10	24000	10	6356323
Acid Extractable Antimony (Sb)	mg/kg	28	53	42	2.0	320	20	6356323
Acid Extractable Arsenic (As)	mg/kg	67	130	90	2.0	640	20	6356323
Acid Extractable Barium (Ba)	mg/kg	120	91	94	5.0	190	5.0	6356323
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	<2.0	2.0	<2.0	2.0	6356323
Acid Extractable Bismuth (Bi)	mg/kg	9.1	21	18	2.0	100	2.0	6356323
Acid Extractable Boron (B)	mg/kg	<50	<50	<50	50	<50	50	6356323
Acid Extractable Cadmium (Cd)	mg/kg	18	35	23	0.30	54	0.30	6356323
Acid Extractable Chromium (Cr)	mg/kg	300	92	57	2.0	88	2.0	6356323
Acid Extractable Cobalt (Co)	mg/kg	41	20	18	1.0	15	1.0	6356323
Acid Extractable Copper (Cu)	mg/kg	210	250	220	2.0	900	2.0	6356323
Acid Extractable Iron (Fe)	mg/kg	69000	42000	42000	50	53000	50	6356323
Acid Extractable Lead (Pb)	mg/kg	3000	5000	4100	0.50	27000	5.0	6356323
Acid Extractable Lithium (Li)	mg/kg	42	25	26	2.0	21	2.0	6356323
Acid Extractable Manganese (Mn)	mg/kg	1500	1100	970	2.0	870	2.0	6356323
Acid Extractable Mercury (Hg)	mg/kg	1.3	1.2	0.33	0.10	1.9	0.10	6356323
Acid Extractable Molybdenum (Mo)	mg/kg	<2.0	<2.0	<2.0	2.0	8.3	2.0	6356323
Acid Extractable Nickel (Ni)	mg/kg	120	54	47	2.0	41	2.0	6356323
Acid Extractable Rubidium (Rb)	mg/kg	<2.0	8.2	12	2.0	13	2.0	6356323
Acid Extractable Selenium (Se)	mg/kg	5.4	3.8	1.9	1.0	17	1.0	6356323
Acid Extractable Silver (Ag)	mg/kg	13	23	17	0.50	91	5.0	6356323
Acid Extractable Strontium (Sr)	mg/kg	76	63	43	5.0	100	5.0	6356323
Acid Extractable Thallium (Tl)	mg/kg	1.8	7.5	5.0	0.10	26	0.10	6356323
Acid Extractable Tin (Sn)	mg/kg	4.3	12	10	1.0	170	1.0	6356323
Acid Extractable Uranium (U)	mg/kg	0.20	2.8	4.5	0.10	38	0.10	6356323
Acid Extractable Vanadium (V)	mg/kg	220	98	89	2.0	98	2.0	6356323
Acid Extractable Zinc (Zn)	mg/kg	870	1400	1500	5.0	4900	5.0	6356323

RDL = Reportable Detection Limit

QC Batch = Quality Control Batch



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BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

**ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)**

BV Labs ID		KWI781		KWI782		KWI783		KWI974		
Sampling Date		2019/09/18		2019/09/18		2019/09/18		2019/09/18		
COC Number		D 34709		D 34709		D 34709		D 34684		
	UNITS	19SP-3 0.15-0.3M Lab-Dup	RDL	19SP-5 0-0.15M	RDL	19SP-5 0.15-0.3M	RDL	19SP-9 0-0.15M	RDL	QC Batch

Metals										
Acid Extractable Aluminum (Al)	mg/kg	23000	10	24000	10	30000	10	18000	10	6356323
Acid Extractable Antimony (Sb)	mg/kg	310	20	1100	20	430	20	24	2.0	6356323
Acid Extractable Arsenic (As)	mg/kg	590	20	1400	20	620	20	53	2.0	6356323
Acid Extractable Barium (Ba)	mg/kg	200	5.0	220	5.0	290	5.0	90	5.0	6356323
Acid Extractable Beryllium (Be)	mg/kg	<2.0	2.0	<2.0	2.0	<2.0	2.0	<2.0	2.0	6356323
Acid Extractable Bismuth (Bi)	mg/kg	120	2.0	200	20	120	2.0	6.7	2.0	6356323
Acid Extractable Boron (B)	mg/kg	<50	50	<50	50	<50	50	<50	50	6356323
Acid Extractable Cadmium (Cd)	mg/kg	58	0.30	180	0.30	74	0.30	24	0.30	6356323
Acid Extractable Chromium (Cr)	mg/kg	92	2.0	100	2.0	79	2.0	42	2.0	6356323
Acid Extractable Cobalt (Co)	mg/kg	15	1.0	32	1.0	32	1.0	15	1.0	6356323
Acid Extractable Copper (Cu)	mg/kg	880	2.0	9300	20	2500	2.0	86	2.0	6356323
Acid Extractable Iron (Fe)	mg/kg	51000	50	63000	50	71000	50	35000	50	6356323
Acid Extractable Lead (Pb)	mg/kg	27000	5.0	48000	5.0	28000	5.0	1600	0.50	6356323
Acid Extractable Lithium (Li)	mg/kg	21	2.0	24	2.0	31	2.0	22	2.0	6356323
Acid Extractable Manganese (Mn)	mg/kg	830	2.0	2000	2.0	2000	2.0	990	2.0	6356323
Acid Extractable Mercury (Hg)	mg/kg	2.1	0.10	5.2	0.10	2.7	0.10	0.14	0.10	6356323
Acid Extractable Molybdenum (Mo)	mg/kg	8.8	2.0	16	2.0	8.0	2.0	<2.0	2.0	6356323
Acid Extractable Nickel (Ni)	mg/kg	42	2.0	85	2.0	56	2.0	43	2.0	6356323
Acid Extractable Rubidium (Rb)	mg/kg	13	2.0	9.5	2.0	4.9	2.0	7.6	2.0	6356323
Acid Extractable Selenium (Se)	mg/kg	18	1.0	100	1.0	34	1.0	1.5	1.0	6356323
Acid Extractable Silver (Ag)	mg/kg	89	5.0	82	5.0	85	5.0	9.9	0.50	6356323
Acid Extractable Strontium (Sr)	mg/kg	100	5.0	160	5.0	98	5.0	17	5.0	6356323
Acid Extractable Thallium (Tl)	mg/kg	26	0.10	36	0.10	22	0.10	1.2	0.10	6356323
Acid Extractable Tin (Sn)	mg/kg	170	1.0	310	1.0	140	1.0	4.2	1.0	6356323
Acid Extractable Uranium (U)	mg/kg	38	0.10	5.0	0.10	2.5	0.10	0.74	0.10	6356323
Acid Extractable Vanadium (V)	mg/kg	100	2.0	99	2.0	160	2.0	63	2.0	6356323
Acid Extractable Zinc (Zn)	mg/kg	5100	5.0	9600	5.0	4500	5.0	350	5.0	6356323

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





**ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)**

BV Labs ID		KWI975	KWI976		
Sampling Date		2019/09/18	2019/09/18		
COC Number		D 34684	D 34684		
	UNITS	19SP-11 0-0.15M	19SP-11 1.2-1.8M	RDL	QC Batch
<b>Metals</b>					
Acid Extractable Aluminum (Al)	mg/kg	29000	20000	10	6356323
Acid Extractable Antimony (Sb)	mg/kg	100	17	2.0	6356323
Acid Extractable Arsenic (As)	mg/kg	170	50	2.0	6356323
Acid Extractable Barium (Ba)	mg/kg	100	69	5.0	6356323
Acid Extractable Beryllium (Be)	mg/kg	<2.0	<2.0	2.0	6356323
Acid Extractable Bismuth (Bi)	mg/kg	21	4.1	2.0	6356323
Acid Extractable Boron (B)	mg/kg	<50	<50	50	6356323
Acid Extractable Cadmium (Cd)	mg/kg	19	3.4	0.30	6356323
Acid Extractable Chromium (Cr)	mg/kg	59	40	2.0	6356323
Acid Extractable Cobalt (Co)	mg/kg	18	13	1.0	6356323
Acid Extractable Copper (Cu)	mg/kg	310	120	2.0	6356323
Acid Extractable Iron (Fe)	mg/kg	44000	33000	50	6356323
Acid Extractable Lead (Pb)	mg/kg	6600	1300	0.50	6356323
Acid Extractable Lithium (Li)	mg/kg	26	21	2.0	6356323
Acid Extractable Manganese (Mn)	mg/kg	920	650	2.0	6356323
Acid Extractable Mercury (Hg)	mg/kg	0.51	0.13	0.10	6356323
Acid Extractable Molybdenum (Mo)	mg/kg	2.2	<2.0	2.0	6356323
Acid Extractable Nickel (Ni)	mg/kg	52	40	2.0	6356323
Acid Extractable Rubidium (Rb)	mg/kg	11	9.6	2.0	6356323
Acid Extractable Selenium (Se)	mg/kg	4.4	<1.0	1.0	6356323
Acid Extractable Silver (Ag)	mg/kg	39	6.8	0.50	6356323
Acid Extractable Strontium (Sr)	mg/kg	32	14	5.0	6356323
Acid Extractable Thallium (Tl)	mg/kg	4.2	0.80	0.10	6356323
Acid Extractable Tin (Sn)	mg/kg	26	5.8	1.0	6356323
Acid Extractable Uranium (U)	mg/kg	4.9	1.3	0.10	6356323
Acid Extractable Vanadium (V)	mg/kg	80	56	2.0	6356323
Acid Extractable Zinc (Zn)	mg/kg	1600	310	5.0	6356323
RDL = Reportable Detection Limit					
QC Batch = Quality Control Batch					



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BV Labs Job #: B9Q8613

Report Date: 2019/10/24

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE

Your P.O. #: 73517254

## GENERAL COMMENTS

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

Package 1	15.0°C
Package 2	3.7°C
Package 3	16.0°C
Package 4	16.0°C
Package 5	15.7°C
Package 6	16.7°C

Revised Report - TCLP + Metals analysis added to the below listed samples as per requested from Rob T. HWS Oct 11/19

19SP-1 0.15-0.3m (KWI779)

19SP-3 0.15-0.3m (KWI781)

19SP-5 0-0.15m (KWI782)

19SP-9 0-0.15m (KWI974)

19SP-11 1.2-1.8m (KWI976)

Sample KWI976 [19SP-11 1.2-1.8M] : The minimum weight of 100g for the standard TCLP extraction, as per Reference Method EPA 1311 R1992, could not be achieved due to insufficient sample. Client consent has been received to proceed using the modified TCLP method. The uncertainty of the analysis may be increased, and the reported results may not be suitable for compliance purposes.

**Results relate only to the items tested.**



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BV Labs Job #: B9Q8613  
Report Date: 2019/10/24

### QUALITY ASSURANCE REPORT

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6356111	Sample Weight (as received)	2019/09/27					NA	g	0.077 (2)	N/A		
6356323	Acid Extractable Aluminum (Al)	2019/10/01					<10	mg/kg	2.0 (4)	35		
6356323	Acid Extractable Antimony (Sb)	2019/10/01	NC (3)	75 - 125	108	75 - 125	<2.0	mg/kg	1.6 (4)	35		
6356323	Acid Extractable Arsenic (As)	2019/10/01	NC (3)	75 - 125	105	75 - 125	<2.0	mg/kg	6.6 (4)	35		
6356323	Acid Extractable Barium (Ba)	2019/10/01	NC (3)	75 - 125	104	75 - 125	<5.0	mg/kg	7.1 (4)	35		
6356323	Acid Extractable Beryllium (Be)	2019/10/01	107 (3)	75 - 125	100	75 - 125	<2.0	mg/kg	NC (4)	35		
6356323	Acid Extractable Bismuth (Bi)	2019/10/01	NC (3)	75 - 125	106	75 - 125	<2.0	mg/kg	17 (4)	35		
6356323	Acid Extractable Boron (B)	2019/10/01	97 (3)	75 - 125	99	75 - 125	<50	mg/kg	NC (4)	35		
6356323	Acid Extractable Cadmium (Cd)	2019/10/01	NC (3)	75 - 125	100	75 - 125	<0.30	mg/kg	7.4 (4)	35		
6356323	Acid Extractable Chromium (Cr)	2019/10/01	NC (3)	75 - 125	104	75 - 125	<2.0	mg/kg	4.0 (4)	35		
6356323	Acid Extractable Cobalt (Co)	2019/10/01	107 (3)	75 - 125	103	75 - 125	<1.0	mg/kg	1.5 (4)	35		
6356323	Acid Extractable Copper (Cu)	2019/10/01	NC (3)	75 - 125	100	75 - 125	<2.0	mg/kg	2.8 (4)	35		
6356323	Acid Extractable Iron (Fe)	2019/10/01					<50	mg/kg	2.1 (4)	35		
6356323	Acid Extractable Lead (Pb)	2019/10/01	NC (3)	75 - 125	105	75 - 125	<0.50	mg/kg	1.8 (4)	35		
6356323	Acid Extractable Lithium (Li)	2019/10/01	110 (3)	75 - 125	103	75 - 125	<2.0	mg/kg	0.14 (4)	35		
6356323	Acid Extractable Manganese (Mn)	2019/10/01	NC (3)	75 - 125	105	75 - 125	<2.0	mg/kg	5.4 (4)	35		
6356323	Acid Extractable Mercury (Hg)	2019/10/01	99 (3)	75 - 125	102	75 - 125	<0.10	mg/kg	6.3 (4)	35		
6356323	Acid Extractable Molybdenum (Mo)	2019/10/01	NC (3)	75 - 125	104	75 - 125	<2.0	mg/kg	4.8 (4)	35		
6356323	Acid Extractable Nickel (Ni)	2019/10/01	108 (3)	75 - 125	105	75 - 125	<2.0	mg/kg	1.2 (4)	35		
6356323	Acid Extractable Rubidium (Rb)	2019/10/01	102 (3)	75 - 125	103	75 - 125	<2.0	mg/kg	3.4 (4)	35		
6356323	Acid Extractable Selenium (Se)	2019/10/01	101 (3)	75 - 125	107	75 - 125	<1.0	mg/kg	5.9 (4)	35		
6356323	Acid Extractable Silver (Ag)	2019/10/01	NC (3)	75 - 125	101	75 - 125	<0.50	mg/kg	2.2 (4)	35		
6356323	Acid Extractable Strontium (Sr)	2019/10/01	NC (3)	75 - 125	107	75 - 125	<5.0	mg/kg	2.3 (4)	35		
6356323	Acid Extractable Thallium (Tl)	2019/10/01	NC (3)	75 - 125	106	75 - 125	<0.10	mg/kg	1.3 (4)	35		
6356323	Acid Extractable Tin (Sn)	2019/10/01	NC (3)	75 - 125	110	75 - 125	<1.0	mg/kg	3.7 (4)	35		
6356323	Acid Extractable Uranium (U)	2019/10/01	107 (3)	75 - 125	113	75 - 125	<0.10	mg/kg	0.29 (4)	35		
6356323	Acid Extractable Vanadium (V)	2019/10/01	NC (3)	75 - 125	106	75 - 125	<2.0	mg/kg	4.4 (4)	35		
6356323	Acid Extractable Zinc (Zn)	2019/10/01	NC (3)	75 - 125	104	75 - 125	<5.0	mg/kg	3.1 (4)	35		
6362110	Sample Weight (as received)	2019/10/01					NA	g	0.052 (1)	N/A		
6362631	Soluble (5:1) pH	2019/10/01							0.70 (1)	N/A		
6368434	Lead-210	2019/10/04					<0.10	Bq/g	NC (5)	N/A	102	74 - 126
6368434	Potassium-40	2019/10/04					<1.0	Bq/g	NC (5)	N/A	90	74 - 126





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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6368434	Radium-226	2019/10/04					<0.10	Bq/g	NC (5)	N/A	88	74 - 126
6368434	Radium-228	2019/10/04					<0.10	Bq/g	NC (5)	N/A	99	74 - 126
6368434	Thorium-228	2019/10/04					<0.10	Bq/g	NC (5)	N/A	100	74 - 126
6368434	Thorium-230	2019/10/04					<0.80	Bq/g	NC (5)	N/A	104	74 - 126
6368434	Thorium-234	2019/10/04					<0.050	Bq/g	NC (5)	N/A	106	74 - 126
6368434	Uranium-235	2019/10/04					<0.10	Bq/g	NC (5)	N/A	96	74 - 126
6368435	Lead-210	2019/10/05					<0.10	Bq/g	NC (1)	N/A	103	74 - 126
6368435	Potassium-40	2019/10/05					<1.0	Bq/g	NC (1)	N/A	100	74 - 126
6368435	Radium-226	2019/10/05					<0.10	Bq/g	NC (1)	N/A	97	74 - 126
6368435	Radium-228	2019/10/05					<0.10	Bq/g	NC (1)	N/A	100	74 - 126
6368435	Thorium-228	2019/10/05					<0.10	Bq/g	NC (1)	N/A	103	74 - 126
6368435	Thorium-230	2019/10/05					<0.80	Bq/g	NC (1)	N/A	94	74 - 126
6368435	Thorium-234	2019/10/05					<0.050	Bq/g	NC (1)	N/A	102	74 - 126
6368435	Uranium-235	2019/10/05					<0.10	Bq/g	NC (1)	N/A	105	74 - 126
6370557	Lead-210	2019/10/08					<1.0	Bq/L			93	74 - 126
6370557	Lead-212	2019/10/08					<0.10	Bq/L			105	N/A
6370557	Radium-226	2019/10/08					<1.0	Bq/L			96	74 - 126
6370557	Radium-228	2019/10/08					<0.50	Bq/L			104	74 - 126
6370557	Thorium-230	2019/10/08					<5.0	Bq/L			107	74 - 126
6370557	Thorium-234	2019/10/08					<1.0	Bq/L			100	74 - 126
6370557	Uranium-235	2019/10/08					<0.50	Bq/L			108	74 - 126
6388164	Sample Weight (as received)	2019/10/16					NA	g	0.076 (1)	N/A		
6388780	Leachable Aluminum (Al)	2019/10/18					<100	ug/L	18 (1)	35		
6388780	Leachable Antimony (Sb)	2019/10/18	104	75 - 125	101	75 - 125	<20	ug/L	11 (1)	35		
6388780	Leachable Arsenic (As)	2019/10/18	102	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Barium (Ba)	2019/10/18	100	75 - 125	98	75 - 125	<50	ug/L	5.4 (1)	35		
6388780	Leachable Beryllium (Be)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Boron (B)	2019/10/18	97	75 - 125	99	75 - 125	<500	ug/L	NC (1)	35		
6388780	Leachable Cadmium (Cd)	2019/10/18	97	75 - 125	97	75 - 125	<3.0	ug/L	18 (1)	35		
6388780	Leachable Calcium (Ca)	2019/10/18					<1000	ug/L	26 (1)	35		
6388780	Leachable Chromium (Cr)	2019/10/18	100	75 - 125	99	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Cobalt (Co)	2019/10/18	100	75 - 125	99	75 - 125	<10	ug/L	NC (1)	35		



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6388780	Leachable Copper (Cu)	2019/10/18	97	75 - 125	97	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Iron (Fe)	2019/10/18					<500	ug/L	30 (1)	35		
6388780	Leachable Lead (Pb)	2019/10/18	NC	75 - 125	97	75 - 125	<5.0	ug/L	20 (1)	35		
6388780	Leachable Lithium (Li)	2019/10/18	106	75 - 125	104	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Magnesium (Mg)	2019/10/18					<1000	ug/L	2.2 (1)	35		
6388780	Leachable Manganese (Mn)	2019/10/18	101	75 - 125	100	75 - 125	<20	ug/L	6.9 (1)	35		
6388780	Leachable Molybdenum (Mo)	2019/10/18	103	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Nickel (Ni)	2019/10/18	99	75 - 125	98	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Potassium (K)	2019/10/18					<1000	ug/L	4.1 (1)	35		
6388780	Leachable Selenium (Se)	2019/10/18	102	75 - 125	102	75 - 125	<10	ug/L	NC (1)	35		
6388780	Leachable Silver (Ag)	2019/10/18	95	75 - 125	95	75 - 125	<5.0	ug/L	NC (1)	35		
6388780	Leachable Strontium (Sr)	2019/10/18	102	75 - 125	101	75 - 125	<50	ug/L	17 (1)	35		
6388780	Leachable Thallium (Tl)	2019/10/18	97	75 - 125	95	75 - 125	<1.0	ug/L	11 (1)	35		
6388780	Leachable Tin (Sn)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Uranium (U)	2019/10/18	107	75 - 125	105	75 - 125	<1.0	ug/L	11 (1)	35		
6388780	Leachable Vanadium (V)	2019/10/18	101	75 - 125	101	75 - 125	<20	ug/L	NC (1)	35		
6388780	Leachable Zinc (Zn)	2019/10/18	NC	75 - 125	99	75 - 125	<50	ug/L	35 (1)	35		
6391070	Leachable Aluminum (Al)	2019/10/18					<100	ug/L				
6391070	Leachable Antimony (Sb)	2019/10/18	103	75 - 125	102	75 - 125	<20	ug/L				
6391070	Leachable Arsenic (As)	2019/10/18	101	75 - 125	100	75 - 125	<20	ug/L				
6391070	Leachable Barium (Ba)	2019/10/18	98	75 - 125	98	75 - 125	<50	ug/L				
6391070	Leachable Beryllium (Be)	2019/10/18	100	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Boron (B)	2019/10/18	97	75 - 125	96	75 - 125	<500	ug/L				
6391070	Leachable Cadmium (Cd)	2019/10/18	96	75 - 125	96	75 - 125	<3.0	ug/L				
6391070	Leachable Calcium (Ca)	2019/10/18					<1000	ug/L				
6391070	Leachable Chromium (Cr)	2019/10/18	97	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Cobalt (Co)	2019/10/18	98	75 - 125	98	75 - 125	<10	ug/L				
6391070	Leachable Copper (Cu)	2019/10/18	95	75 - 125	95	75 - 125	<20	ug/L				
6391070	Leachable Iron (Fe)	2019/10/18					<500	ug/L				
6391070	Leachable Lead (Pb)	2019/10/18	103	75 - 125	96	75 - 125	<5.0	ug/L				
6391070	Leachable Lithium (Li)	2019/10/18	104	75 - 125	103	75 - 125	<20	ug/L				
6391070	Leachable Magnesium (Mg)	2019/10/18					<1000	ug/L				



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6391070	Leachable Manganese (Mn)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Molybdenum (Mo)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Nickel (Ni)	2019/10/18	98	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Potassium (K)	2019/10/18					<1000	ug/L				
6391070	Leachable Selenium (Se)	2019/10/18	100	75 - 125	99	75 - 125	<10	ug/L				
6391070	Leachable Silver (Ag)	2019/10/18	93	75 - 125	94	75 - 125	<5.0	ug/L				
6391070	Leachable Strontium (Sr)	2019/10/18	101	75 - 125	101	75 - 125	<50	ug/L				
6391070	Leachable Thallium (Tl)	2019/10/18	97	75 - 125	94	75 - 125	<1.0	ug/L				
6391070	Leachable Tin (Sn)	2019/10/18	103	75 - 125	101	75 - 125	<20	ug/L				
6391070	Leachable Uranium (U)	2019/10/18	108	75 - 125	104	75 - 125	<1.0	ug/L				
6391070	Leachable Vanadium (V)	2019/10/18	100	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Zinc (Zn)	2019/10/18	NC	75 - 125	100	75 - 125	<50	ug/L				
6391323	Sample Weight (as received)	2019/10/17					NA	g				
6393264	Leachable Aluminum (Al)	2019/10/22					<100	ug/L	5.4 (1)	35		
6393264	Leachable Antimony (Sb)	2019/10/22	NC	75 - 125	99	75 - 125	<20	ug/L	27 (1)	35		
6393264	Leachable Arsenic (As)	2019/10/22	98	75 - 125	99	75 - 125	<20	ug/L	116 (6,1)	35		
6393264	Leachable Barium (Ba)	2019/10/22	99	75 - 125	98	75 - 125	<50	ug/L	14 (1)	35		
6393264	Leachable Beryllium (Be)	2019/10/22	104	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Boron (B)	2019/10/22	100	75 - 125	101	75 - 125	<500	ug/L	3.7 (1)	35		
6393264	Leachable Cadmium (Cd)	2019/10/22	NC	75 - 125	95	75 - 125	<3.0	ug/L	155 (6,1)	35		
6393264	Leachable Calcium (Ca)	2019/10/22					<1000	ug/L	4.5 (1)	35		
6393264	Leachable Chromium (Cr)	2019/10/22	99	75 - 125	98	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Cobalt (Co)	2019/10/22	99	75 - 125	98	75 - 125	<10	ug/L	3.2 (1)	35		
6393264	Leachable Copper (Cu)	2019/10/22	NC	75 - 125	96	75 - 125	<20	ug/L	1.4 (1)	35		
6393264	Leachable Iron (Fe)	2019/10/22					<500	ug/L	NC (1)	35		
6393264	Leachable Lead (Pb)	2019/10/22	NC	75 - 125	98	75 - 125	<5.0	ug/L	22 (1)	35		
6393264	Leachable Lithium (Li)	2019/10/22	107	75 - 125	110	75 - 125	<20	ug/L	8.2 (1)	35		
6393264	Leachable Magnesium (Mg)	2019/10/22					<1000	ug/L	4.9 (1)	35		
6393264	Leachable Manganese (Mn)	2019/10/22	NC	75 - 125	100	75 - 125	<20	ug/L	3.2 (1)	35		
6393264	Leachable Molybdenum (Mo)	2019/10/22	104	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Nickel (Ni)	2019/10/22	100	75 - 125	99	75 - 125	<20	ug/L	9.9 (1)	35		
6393264	Leachable Potassium (K)	2019/10/22					<1000	ug/L	9.3 (1)	35		





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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6393264	Leachable Selenium (Se)	2019/10/22	101	75 - 125	98	75 - 125	<10	ug/L	1.5 (1)	35		
6393264	Leachable Silver (Ag)	2019/10/22	94	75 - 125	94	75 - 125	<5.0	ug/L	NC (1)	35		
6393264	Leachable Strontium (Sr)	2019/10/22	100	75 - 125	99	75 - 125	<50	ug/L	0.94 (1)	35		
6393264	Leachable Thallium (Tl)	2019/10/22	99	75 - 125	96	75 - 125	<1.0	ug/L	3.4 (1)	35		
6393264	Leachable Tin (Sn)	2019/10/22	99	75 - 125	97	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Uranium (U)	2019/10/22	104	75 - 125	102	75 - 125	<1.0	ug/L	NC (1)	35		
6393264	Leachable Vanadium (V)	2019/10/22	104	75 - 125	100	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Zinc (Zn)	2019/10/22	NC	75 - 125	101	75 - 125	<50	ug/L	37 (6,1)	35		

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.

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) Duplicate Parent ID

(2) Duplicate Parent ID [KWI784-03]

(3) Matrix Spike Parent ID [KWI781-01]

(4) Duplicate Parent ID [KWI781-01]

(5) Duplicate Parent ID [KWI778-02]

(6) Poor RPD due to sample inhomogeneity. Insufficient sample for re-extraction and re-analysis.



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BV Labs Job #: B9Q8613

Report Date: 2019/10/24

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE

Your P.O. #: 73517254

### VALIDATION SIGNATURE PAGE

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

Eric Dearman, Scientific Specialist

Kurt Headrick, Ph.D., C. Chem., Laboratory Manager

Mike MacGillivray, Scientific Specialist (Inorganics)

Robert Allen, Scientific Specialist

Steven Simpson, Lab Director

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.







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CHAIN OF CUSTODY RECORD

COC #: **D34684** Page **2** of **3**

Invoice Information	Report Information (if differs from invoice)	Project Information (where applicable)	Turnaround Time (TAT) Required
Company Name: <b>GHD</b>	Company Name: <b>[Crossed out]</b>	Quotation #: <b>[Blank]</b>	<input checked="" type="checkbox"/> Regular TAT (5 business days) Most analyses
Contact Name: <b>Troy Small / Cherie Babineau</b>	Contact Name: <b>[Crossed out]</b>	P.O. #: <b>73517254</b>	PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address: <b>4666 Hodgson Rd. F'ton, NB Postal Code: E3C 2G5</b>	Address: <b>[Crossed out]</b>	Project #: <b>11198639-06</b>	IF RUSH please specify date (Surcharges will be applied)
Phone: <b>[Blank]</b> Fax: <b>[Blank]</b>	Phone: <b>[Crossed out]</b> Fax: <b>[Crossed out]</b>	Site Location: <b>Belledune</b>	DATE REQUIRED: <b>[Blank]</b>
Email: <b>troy.small@ghd.com / cherie.babineau@ghd.com</b>	Email: <b>[Crossed out]</b>	Site #: <b>[Blank]</b>	
		Sampled By: <b>Cody Ross / JR Wall</b>	

Laboratory Use Only			Analysis Requested															Regulatory Requirements (Specify)
CUSTODY SEAL	COOLER TEMPERATURES	COOLER TEMPERATURES																
Present	Intact																	Shipped from FREDTON
	<b>ACTR</b>																	
COOLING MEDIA PRESENT Y / N																		COMMENTS
SAMPLES MUST BE KEPT COOL (<10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM																		

SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS (Total Metals) Well / Surface water	RCAP-MS (Dissolved Metals) Ground waters	Metals (Water)		Metals (Soil)		Mercury (CIRCLE) TOTAL / DISSOLVED	Metals & Mercury (Default Method) for well water & surface water	Dissolved for ground water	Mercury (CIRCLE) TOTAL / DISSOLVED	Metals & Mercury (Default Method) Available Diges: (HNO3/HF/HClO4)	Mercury Total Digest (or Clean Sediments) (HNO3/HF/HClO4)	Mercury Low level by Cold Vapor AA	Hot Water Soluble Boron (Required for COC: Agriculture/ Landfill)	RBGA Hydrocarbons (BTEX, C6-C12)	Hydrocarbons Soil (Nonchlor. MS Fuel Oil Spill Policy Low Level) (BTEX, C6-C12)	CCME Hydrocarbons (CWS-PHC F1/BTEX, F2-F4)	NH Potable Water (BTEX, VPH, Low level T.E.H)	PAHs (Default for water/soil)	PAHs (RWAF, CCME sediment)	PCB	VOCs	Total Coliform/E.coli (Presence/Absence)	Total Coliform/E.coli (Count)	HOLD FOR METAL ANALYZE		
									Total Digest (Default Method) for well water & surface water	Dissolved for ground water																							
1 19SP-9 0-0.15m	19/09/18		Soil	2									X																		X	pH, NORM	
2 19SP-11 0-0.15m				2									X																		X	pH, NORM	
3 19SP-11 1.2-1.8m				2									X																		X	pH, NORM	
4 19SP-12 0-0.15m				4																													NORM, NORM Leachate
5 19SP-12 0.15-0.3m				1																													NORM
6 19SP-31 0-0.15m				4																													NORM, NORM Leachate
7 19SP-31 0.15-0.3m				1																													NORM
8 19SP-32 0-0.15m				4																													NORM, NORM Leachate
9 19SP-32 0.15-0.3m				1																													NORM
10 19SP-32 QA/QC-4				2																													NORM

REINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #
<b>Troy Small</b>	<b>2019/09/23</b>	<b>3:00pm</b>	<b>[Signature]</b>			<b>B908613</b>

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CHAIN OF CUSTODY RECORD

COC #: **D34691** Page **3** of **3**

Invoice Information				Report Information (if differs from invoice)				Project Information (where applicable)				Turnaround Time (TAT) Required					
Company Name: <u>G&amp;HD</u>				Company Name: <u>[X]</u>				Quotation #: <u>73517254</u>				<input checked="" type="checkbox"/> Regular TAT (5 business days) Most					
Contact Name: <u>Troy Small / Cherie Robineau</u>				Contact Name: <u>[X]</u>				P.O. #: <u>1198639-06</u>				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS					
Address: <u>466 Hodgson Road</u>				Address: <u>[X]</u>				Project #: <u>Belledune</u>				IF RUSH please specify date (Surcharges will be applied)					
City: <u>Fredericton, NB</u> Postal Code: <u>E3C 2G5</u>				Postal Code: <u>[X]</u>				Site Location: <u>Belledune</u>				DATE REQUIRED:					
Phone: <u>[X]</u> Fax: <u>[X]</u>				Phone: <u>[X]</u> Fax: <u>[X]</u>				Site #: <u>[X]</u>									
Email: <u>troy.small@ghd.com</u>				Email: <u>[X]</u>				Sampled By: <u>Cody Ross / JR Wall</u>									
Email: <u>cherie.robineau@gndi.com</u>				Email: <u>[X]</u>													
Laboratory Use Only						Analysis Requested											
CUSTODY SEAL		COOLER TEMPERATURES		COOLER TEMPERATURES		FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS [Total Metals] Well / Surface water	RCAP-MS [Dissolved Metals] Ground waters	Metals (Water)		Metals (Soil)		Regulatory Requirements (Specify)			
Present	Intact	ACTR								Total Digest (Default Method) for well water & surface water	Dissolved for ground water	Mercury [CIRCLE] TOTAL / DISSOLVED	Metals & Mercury		Default Acid Extractable (Available) Digest	Mercury Total Digest for Ocean Sediments (HNO <sub>3</sub> /HF/HClO <sub>4</sub> )	COMMENTS
										Total Digest (Default Method) for well water & surface water	Dissolved for ground water	Mercury [CIRCLE] TOTAL / DISSOLVED	Mercury low level by Cold Vaporize AA		Hot Water Soluble Boron (residue for CCME Ag/culture/Landfill)	RBCA Hydrocarbons (BTEX, CE-C13)	
COOLING MEDIA PRESENT Y / N						SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM											
SAMPLE IDENTIFICATION				DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED										
1	Soil QA/QC -5			19/09/18		Soil	2										
2	19SP-10 0.15-0.3			19/09/18		Soil	2										
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	
RELINQUISHED BY: (Signature/Print)				DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)				DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #					
<u>Troy Small</u>				2019/09/19	3:00	<u>[Signature]</u>						B908613					
<u>Troy Small</u>																	

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](http://www.maxxam.ca/terms).

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Your P.O. #: 73517254  
 Your Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your C.O.C. #: D 34708

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/24**  
 Report #: R5934512  
 Version: 6 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9383**

**Received: 2019/09/25, 09:58**

Sample Matrix: Soil  
 # Samples Received: 10

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
TEH in Soil (PIRI) (2)	1	2019/10/09	2019/10/09	ATL SOP 00111	Atl. RBCA v3.1 m
TEH in Soil (PIRI) (2)	2	2019/10/09	2019/10/10	ATL SOP 00111	Atl. RBCA v3.1 m
Metals Leach TCLP/CGSB extraction	1	2019/10/17	2019/10/18	ATL SOP 00058	EPA 6020B R2 m
Metals Leach TCLP/CGSB extraction	4	2019/10/18	2019/10/18	ATL SOP 00058	EPA 6020B R2 m
Metals Solids Acid Extr. ICPMS	4	2019/09/27	2019/09/28	ATL SOP 00058	EPA 6020B R2 m
Metals Solids Acid Extr. ICPMS	2	2019/09/27	2019/09/30	ATL SOP 00058	EPA 6020B R2 m
Metals Solids Acid Extr. ICPMS	2	2019/09/27	2019/10/02	ATL SOP 00058	EPA 6020B R2 m
Metals Solids Acid Extr. ICPMS	1	2019/09/27	2019/10/04	ATL SOP 00058	EPA 6020B R2 m
Moisture	3	N/A	2019/10/10	ATL SOP 00001	OMOE Handbook 1983 m
pH (5:1 DI Water Extract)	8	2019/09/30	2019/10/01	ATL SOP 00003	SM 23 4500-H+ B m
Phosphorus - ortho by auto Colourimetry	8	2019/09/30	2019/10/02	ATL SOP 00021	SM 23 4500-P E m
VPH in Soil (PIRI) (3)	3	2019/10/09	2019/10/09	ATL SOP 00119	Atl. RBCA v3.1 m
NORM Group Analysis (1)	4	N/A	2019/10/05	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/06	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/15	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/23	BQL SOP-00007	Gamma Spectrometry
TCLP Inorganic extraction - pH	1	N/A	2019/10/01	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - pH	1	N/A	2019/10/17	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - pH	2	N/A	2019/10/18	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	1	N/A	2019/10/01	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	1	N/A	2019/10/17	ATL SOP 00035	EPA 1311 m
TCLP Inorganic extraction - Weight	2	N/A	2019/10/18	ATL SOP 00035	EPA 1311 m
ModTPH (T1) Calc. for Soil	3	N/A	2019/10/10	N/A	Atl. RBCA v3.1 m

Sample Matrix: Water  
 # Samples Received: 5

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
NORM Group Analysis (1)	1	N/A	2019/10/12	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	2	N/A	2019/10/13	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/14	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (1)	1	N/A	2019/10/15	BQL SOP-00007	Gamma Spectrometry
TCLP Inorganic extraction - pH	5	N/A	2019/09/27	ATL SOP 00035	EPA 1311 m





Your P.O. #: 73517254  
 Your Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your C.O.C. #: D 34708

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/24**  
 Report #: R5934512  
 Version: 6 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9383**

**Received: 2019/09/25, 09:58**

Sample Matrix: Water  
 # Samples Received: 5

<b>Analyses</b>	<b>Quantity</b>	<b>Date Extracted</b>	<b>Date Analyzed</b>	<b>Laboratory Method</b>	<b>Reference</b>
TCLP Inorganic extraction - Weight	5	N/A	2019/09/27	ATL SOP 00035	EPA 1311 m

**Remarks:**

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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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 Bureau Veritas Laboratories Kitimat
- (2) Soils are reported on a dry weight basis unless otherwise specified.
- (3) Sample(s) were not field preserved for VPH when received at the laboratory. Analytical results for VPH parameters should be regarded as minimum values.



Your P.O. #: 73517254  
Your Project #: 11198639-06  
Site Location: BELLEDUNE  
Your C.O.C. #: D 34708

**Attention: Troy Small**

GHD Limited  
466 Hodgson Rd  
Fredericton , NB  
CANADA E3C 2G5

**Report Date: 2019/10/24**  
Report #: R5934512  
Version: 6 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9383**

**Received: 2019/09/25, 09:58**

Encryption Key



Bureau Veritas Laboratories  
24 Oct 2019 15:45:06

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Heather Macumber, Senior Project Manager  
Email: Heather.MACUMBER@bvlab.com  
Phone# (902)420-0203 Ext:226

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BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWN283			KWN283			KWN284		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34708			D 34708			D 34708		
	UNITS	19BP-1	RDL	QC Batch	19BP-1 Lab-Dup	RDL	QC Batch	19BP-2	RDL	QC Batch
<b>Inorganics</b>										
Moisture	%	54	1.0	6377316	54	1.0	6377316			
Orthophosphate (P)	mg/kg	6.3	2.5	6361799				1.5	0.050	6361799
Soluble (5:1) pH	pH	6.98	N/A	6362637				7.53	N/A	6362637
<b>RADIONUCLIDE</b>										
Lead-210	Bq/g	0.90	0.10	6368435				1.15	0.10	6368435
Potassium-40	Bq/g	<1.0	1.0	6368435				<1.0	1.0	6368435
Radium-226	Bq/g	1.65	0.10	6368435				1.74	0.10	6368435
Radium-228	Bq/g	<0.10	0.10	6368435				<0.10	0.10	6368435
Thorium-228	Bq/g	<0.10	0.10	6368435				<0.10	0.10	6368435
Thorium-230	Bq/g	<0.80	0.80	6368435				1.30	0.80	6368435
Thorium-234	Bq/g	0.070	0.050	6368435				1.42	0.050	6368435
Uranium-235	Bq/g	<0.10	0.10	6368435				<0.10	0.10	6368435
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable										





BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWN284			KWN285			KWN286		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34708			D 34708			D 34708		
	UNITS	19BP-2 Lab-Dup	RDL	QC Batch	19BP-3	RDL	QC Batch	19BP-4	RDL	QC Batch
<b>Inorganics</b>										
Moisture	%				12 (1)	1.0	6377316			
Orthophosphate (P)	mg/kg	1.9	0.050	6361799				370	25	6361799
Soluble (5:1) pH	pH	7.62	N/A	6362637				5.77	N/A	6362637
Sample Weight (as received)	g							100	N/A	6391323
Initial pH	N/A							4.8		6391325
Final pH	N/A							5.0		6391325
<b>RADIONUCLIDE</b>										
Lead-210	Bq/g				<0.10	0.10	6368435			
Potassium-40	Bq/g				3.9	1.0	6368435			
Radium-226	Bq/g				0.11	0.10	6368435			
Radium-228	Bq/g				<0.10	0.10	6368435			
Thorium-228	Bq/g				<0.10	0.10	6368435			
Thorium-230	Bq/g				<0.80	0.80	6368435			
Thorium-234	Bq/g				0.090	0.050	6368435			
Uranium-235	Bq/g				<0.10	0.10	6368435			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Based on physical appearance, sample contains oil.										



BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

**RESULTS OF ANALYSES OF SOIL**

BV Labs ID		KWN287			KWN287			KWN288		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34708			D 34708			D 34708		
	UNITS	19BP-5	RDL	QC Batch	19BP-5 Lab-Dup	RDL	QC Batch	19BP-6	RDL	QC Batch
<b>Inorganics</b>										
Moisture	%							18	1.0	6377316
Orthophosphate (P)	mg/kg	0.066	0.050	6361799				1300	50	6361799
Soluble (5:1) pH	pH	6.19	N/A	6362637				5.07	N/A	6362637
<b>RADIONUCLIDE</b>										
Lead-210	Bq/g	0.17	0.10	6368435	0.22	0.10	6368435			
Potassium-40	Bq/g	<1.0	1.0	6368435	<1.0	1.0	6368435			
Radium-226	Bq/g	0.28	0.10	6368435	0.20	0.10	6368435			
Radium-228	Bq/g	<0.10	0.10	6368435	<0.10	0.10	6368435			
Thorium-228	Bq/g	<0.10	0.10	6368435	<0.10	0.10	6368435			
Thorium-230	Bq/g	2.30	0.80	6368435	2.40	0.80	6368435			
Thorium-234	Bq/g	2.07	0.050	6368435	1.98	0.050	6368435			
Uranium-235	Bq/g	0.10	0.10	6368435	<0.10	0.10	6368435			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable										



BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### RESULTS OF ANALYSES OF SOIL

BV Labs ID		KWN289			KWN290			KWN291		
Sampling Date		2019/09/18			2019/09/19			2019/09/18		
COC Number		D 34708			D 34708			D 34708		
	UNITS	19BP-7	RDL	QC Batch	19BP-8	RDL	QC Batch	19BP-9	RDL	QC Batch
<b>Inorganics</b>										
Orthophosphate (P)	mg/kg	<0.050	0.050	6361799	2300	75	6361799	<0.050	0.050	6361799
Soluble (5:1) pH	pH	4.52	N/A	6362637	5.47	N/A	6362637	4.03	N/A	6362637
Sample Weight (as received)	g	100	N/A	6393098				100	N/A	6393098
Initial pH	N/A	4.9		6393100				4.6		6393100
Final pH	N/A	4.8		6393100				4.2		6393100
<b>RADIONUCLIDE</b>										
Lead-210	Bq/g				0.57	0.10	6368435			
Potassium-40	Bq/g				<1.0	1.0	6368435			
Radium-226	Bq/g				0.64	0.10	6368435			
Radium-228	Bq/g				<0.10	0.10	6368435			
Thorium-228	Bq/g				<0.10	0.10	6368435			
Thorium-230	Bq/g				<0.80	0.80	6368435			
Thorium-234	Bq/g				<0.050	0.050	6368435			
Uranium-235	Bq/g				<0.10	0.10	6368435			
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable										





**RESULTS OF ANALYSES OF SOIL**

BV Labs ID		KWN292		
Sampling Date		2019/09/19		
COC Number		D 34708		
	UNITS	19BP-10	RDL	QC Batch
<b>Inorganics</b>				
Sample Weight (as received)	g	100	N/A	6362110
Initial pH	N/A	4.9		6362115
Final pH	N/A	8.3		6362115
<b>RADIONUCLIDE</b>				
Lead-210	Bq/g	<0.10	0.10	6368435
Lead-210	Bq/L	<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	0.10	6370557
Potassium-40	Bq/g	<1.0	1.0	6368435
Radium-226	Bq/g	<0.10	0.10	6368435
Radium-226	Bq/L	<1.0	1.0	6370557
Radium-228	Bq/g	<0.10	0.10	6368435
Radium-228	Bq/L	<0.50	0.50	6370557
Thorium-228	Bq/g	<0.10	0.10	6368435
Thorium-230	Bq/g	<0.80	0.80	6368435
Thorium-230	Bq/L	<5.0	5.0	6370557
Thorium-234	Bq/g	<0.050	0.050	6368435
Thorium-234	Bq/L	<1.0	1.0	6370557
Uranium-235	Bq/g	<0.10	0.10	6368435
Uranium-235	Bq/L	<0.50	0.50	6370557
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable				



BUREAU  
VERITAS

BV Labs Job #: B9Q9383  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

### ELEMENTS BY ICP/MS (SOIL)

BV Labs ID		KWN283		KWN286		KWN287		KWN289		
Sampling Date		2019/09/18		2019/09/18		2019/09/18		2019/09/18		
COC Number		D 34708		D 34708		D 34708		D 34708		
	UNITS	19BP-1	QC Batch	19BP-4	QC Batch	19BP-5	QC Batch	19BP-7	RDL	QC Batch
<b>Metals</b>										
Leachable Aluminum (Al)	ug/L	760	6393264	19000	6391070	39000	6393275	14000	100	6393264
Leachable Antimony (Sb)	ug/L	29	6393264	51	6391070	21	6393275	53	20	6393264
Leachable Arsenic (As)	ug/L	37	6393264	85	6391070	880	6393275	1300	20	6393264
Leachable Barium (Ba)	ug/L	180	6393264	<50	6391070	<50	6393275	<50	50	6393264
Leachable Beryllium (Be)	ug/L	<20	6393264	<20	6391070	<20	6393275	23	20	6393264
Leachable Boron (B)	ug/L	<500	6393264	<500	6391070	530	6393275	1000	500	6393264
Leachable Cadmium (Cd)	ug/L	140	6393264	7.4	6391070	31	6393275	64	3.0	6393264
Leachable Calcium (Ca)	ug/L	550000	6393264	53000	6391070	1100	6393275	9700	1000	6393264
Leachable Chromium (Cr)	ug/L	<20	6393264	27	6391070	64	6393275	83	20	6393264
Leachable Cobalt (Co)	ug/L	<10	6393264	<10	6391070	29	6393275	32	10	6393264
Leachable Copper (Cu)	ug/L	100	6393264	73	6391070	290	6393275	520	20	6393264
Leachable Iron (Fe)	ug/L	<500	6393264	<500	6391070	<500	6393275	<500	500	6393264
Leachable Lead (Pb)	ug/L	210	6393264	8.7	6391070	12	6393275	29	5.0	6393264
Leachable Lithium (Li)	ug/L	<20	6393264	<20	6391070	<20	6393275	38	20	6393264
Leachable Magnesium (Mg)	ug/L	7300	6393264	43000	6391070	<1000	6393275	2900	1000	6393264
Leachable Manganese (Mn)	ug/L	380	6393264	340	6391070	140	6393275	2000	20	6393264
Leachable Molybdenum (Mo)	ug/L	<20	6393264	<20	6391070	41	6393275	<20	20	6393264
Leachable Nickel (Ni)	ug/L	48	6393264	230	6391070	420	6393275	480	20	6393264
Leachable Potassium (K)	ug/L	5900	6393264	2600	6391070	14000	6393275	15000	1000	6393264
Leachable Selenium (Se)	ug/L	<10	6393264	12	6391070	15	6393275	24	10	6393264
Leachable Silver (Ag)	ug/L	<5.0	6393264	<5.0	6391070	<5.0	6393275	<5.0	5.0	6393264
Leachable Strontium (Sr)	ug/L	2600	6393264	63	6391070	<50	6393275	<50	50	6393264
Leachable Thallium (Tl)	ug/L	9.8	6393264	<1.0	6391070	16	6393275	21	1.0	6393264
Leachable Tin (Sn)	ug/L	<20	6393264	<20	6391070	<20	6393275	<20	20	6393264
Leachable Uranium (U)	ug/L	2.3	6393264	5.1	6391070	280	6393275	96	1.0	6393264
Leachable Vanadium (V)	ug/L	<20	6393264	230	6391070	180	6393275	85	20	6393264
Leachable Zinc (Zn)	ug/L	15000	6393264	230	6391070	140	6393275	450	50	6393264
RDL = Reportable Detection Limit QC Batch = Quality Control Batch										



BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

**ELEMENTS BY ICP/MS (SOIL)**

BV Labs ID		KWN291		
Sampling Date		2019/09/18		
COC Number		D 34708		
	UNITS	19BP-9	RDL	QC Batch
<b>Metals</b>				
Leachable Aluminum (Al)	ug/L	300	100	6393264
Leachable Antimony (Sb)	ug/L	24	20	6393264
Leachable Arsenic (As)	ug/L	240	20	6393264
Leachable Barium (Ba)	ug/L	<50	50	6393264
Leachable Beryllium (Be)	ug/L	71	20	6393264
Leachable Boron (B)	ug/L	1200	500	6393264
Leachable Cadmium (Cd)	ug/L	160	3.0	6393264
Leachable Calcium (Ca)	ug/L	290000	1000	6393264
Leachable Chromium (Cr)	ug/L	310	20	6393264
Leachable Cobalt (Co)	ug/L	160	10	6393264
Leachable Copper (Cu)	ug/L	160	20	6393264
Leachable Iron (Fe)	ug/L	610	500	6393264
Leachable Lead (Pb)	ug/L	19	5.0	6393264
Leachable Lithium (Li)	ug/L	44	20	6393264
Leachable Magnesium (Mg)	ug/L	9000	1000	6393264
Leachable Manganese (Mn)	ug/L	8700	20	6393264
Leachable Molybdenum (Mo)	ug/L	150	20	6393264
Leachable Nickel (Ni)	ug/L	780	20	6393264
Leachable Potassium (K)	ug/L	31000	1000	6393264
Leachable Selenium (Se)	ug/L	17	10	6393264
Leachable Silver (Ag)	ug/L	<5.0	5.0	6393264
Leachable Strontium (Sr)	ug/L	1100	50	6393264
Leachable Thallium (Tl)	ug/L	16	1.0	6393264
Leachable Tin (Sn)	ug/L	<20	20	6393264
Leachable Uranium (U)	ug/L	970	1.0	6393264
Leachable Vanadium (V)	ug/L	710	20	6393264
Leachable Zinc (Zn)	ug/L	1900	50	6393264
RDL = Reportable Detection Limit QC Batch = Quality Control Batch				





BUREAU  
VERITAS

BV Labs Job #: B9Q9383  
Report Date: 2019/10/24

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

### ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)

BV Labs ID		KWN283	KWN284		KWN286		KWN287		KWN288		
Sampling Date		2019/09/18	2019/09/18		2019/09/18		2019/09/18		2019/09/18		
COC Number		D 34708	D 34708		D 34708		D 34708		D 34708		
	UNITS	19BP-1	19BP-2	RDL	19BP-4	RDL	19BP-5	RDL	19BP-6	RDL	QC Batch
<b>Metals</b>											
Acid Extractable Aluminum (Al)	mg/kg	19000	17000	10	15000	10	7000	10	43000	10	6356132
Acid Extractable Antimony (Sb)	mg/kg	28	13	2.0	48	2.0	6.8	2.0	13	2.0	6356132
Acid Extractable Arsenic (As)	mg/kg	74	4.8	2.0	45	2.0	23	2.0	19	2.0	6356132
Acid Extractable Barium (Ba)	mg/kg	380	110	5.0	300	5.0	11	5.0	150	5.0	6356132
Acid Extractable Beryllium (Be)	mg/kg	<2.0	2.8	2.0	2.9	2.0	2.1	2.0	3.9	2.0	6356132
Acid Extractable Bismuth (Bi)	mg/kg	12	<2.0	2.0	5.5	2.0	<2.0	2.0	<2.0	2.0	6356132
Acid Extractable Boron (B)	mg/kg	<50	<50	50	<50	50	<50	50	<50	50	6356132
Acid Extractable Cadmium (Cd)	mg/kg	46	7.9	0.30	18	0.30	9.4	0.30	37	0.30	6356132
Acid Extractable Chromium (Cr)	mg/kg	150	72	2.0	8500	200	100	2.0	2800	20	6356132
Acid Extractable Cobalt (Co)	mg/kg	7.6	3.6	1.0	5.2	1.0	5.7	1.0	11	1.0	6356132
Acid Extractable Copper (Cu)	mg/kg	230	12	2.0	170	2.0	26	2.0	170	2.0	6356132
Acid Extractable Iron (Fe)	mg/kg	31000	7700	50	210000	500	22000	50	99000	500	6356132
Acid Extractable Lead (Pb)	mg/kg	4200	84	0.50	1700	0.50	180	0.50	410	0.50	6356132
Acid Extractable Lithium (Li)	mg/kg	6.7	2.9	2.0	<2.0	2.0	2.3	2.0	13	2.0	6356132
Acid Extractable Manganese (Mn)	mg/kg	890	180	2.0	420	2.0	350	2.0	650	2.0	6356132
Acid Extractable Mercury (Hg)	mg/kg	1.8	0.16	0.10	4.5	0.10	0.24	0.10	9.6	0.10	6356132
Acid Extractable Molybdenum (Mo)	mg/kg	7.6	5.2	2.0	26	2.0	16	2.0	14	2.0	6356132
Acid Extractable Nickel (Ni)	mg/kg	35	14	2.0	50	2.0	33	2.0	110	2.0	6356132
Acid Extractable Rubidium (Rb)	mg/kg	19	5.6	2.0	7.7	2.0	8.7	2.0	11	2.0	6356132
Acid Extractable Selenium (Se)	mg/kg	4.1	<1.0	1.0	5.4	1.0	<1.0	1.0	2.9	1.0	6356132
Acid Extractable Silver (Ag)	mg/kg	21	0.71	0.50	12	0.50	1.7	0.50	3.8	0.50	6356132
Acid Extractable Strontium (Sr)	mg/kg	460	1200	5.0	120	5.0	68	5.0	350	5.0	6356132
Acid Extractable Thallium (Tl)	mg/kg	15	0.58	0.10	3.7	0.10	1.2	0.10	1.3	0.10	6356132
Acid Extractable Tin (Sn)	mg/kg	19	<1.0	1.0	15	1.0	1.3	1.0	4.1	1.0	6356132
Acid Extractable Uranium (U)	mg/kg	21	140	0.10	170	0.10	170	0.10	300	0.10	6356132
Acid Extractable Vanadium (V)	mg/kg	50	120	2.0	1200	2.0	190	2.0	1400	2.0	6356132
Acid Extractable Zinc (Zn)	mg/kg	4200	100	5.0	1500	5.0	160	5.0	1800	5.0	6356132
RDL = Reportable Detection Limit QC Batch = Quality Control Batch											



**ELEMENTS BY ATOMIC SPECTROSCOPY (SOIL)**

BV Labs ID		KWN289		KWN290	KWN291	KWN292		
Sampling Date		2019/09/18		2019/09/19	2019/09/18	2019/09/19		
COC Number		D 34708		D 34708	D 34708	D 34708		
	UNITS	19BP-7	QC Batch	19BP-8	19BP-9	19BP-10	RDL	QC Batch
<b>Metals</b>								
Acid Extractable Aluminum (Al)	mg/kg	7300	6356132	1200	5900	16000	10	6356395
Acid Extractable Antimony (Sb)	mg/kg	26	6356132	8.0	5.3	3.1	2.0	6356395
Acid Extractable Arsenic (As)	mg/kg	45	6356132	28	10	16	2.0	6356395
Acid Extractable Barium (Ba)	mg/kg	18	6356132	29	<5.0	130	5.0	6356395
Acid Extractable Beryllium (Be)	mg/kg	3.9	6356132	<2.0	2.0	<2.0	2.0	6356395
Acid Extractable Bismuth (Bi)	mg/kg	4.3	6356132	<2.0	<2.0	<2.0	2.0	6356395
Acid Extractable Boron (B)	mg/kg	<50	6356132	<50	<50	<50	50	6356395
Acid Extractable Cadmium (Cd)	mg/kg	26	6356132	4.9	3.4	2.1	0.30	6356395
Acid Extractable Chromium (Cr)	mg/kg	170	6356132	2.7	85	51	2.0	6356395
Acid Extractable Cobalt (Co)	mg/kg	11	6356132	3.7	3.2	12	1.0	6356395
Acid Extractable Copper (Cu)	mg/kg	79	6356132	41	13	46	2.0	6356395
Acid Extractable Iron (Fe)	mg/kg	39000	6356132	1300	19000	54000	50	6356395
Acid Extractable Lead (Pb)	mg/kg	1400	6356132	250	150	73	0.50	6356395
Acid Extractable Lithium (Li)	mg/kg	3.4	6356132	<2.0	<2.0	19	2.0	6356395
Acid Extractable Manganese (Mn)	mg/kg	640	6356132	30	180	810	2.0	6356395
Acid Extractable Mercury (Hg)	mg/kg	0.34	6356132	0.40	<0.10	<0.10	0.10	6356395
Acid Extractable Molybdenum (Mo)	mg/kg	16	6356132	<2.0	7.5	2.3	2.0	6356395
Acid Extractable Nickel (Ni)	mg/kg	46	6356132	14	17	43	2.0	6356395
Acid Extractable Rubidium (Rb)	mg/kg	8.8	6356132	<2.0	9.8	8.1	2.0	6356395
Acid Extractable Selenium (Se)	mg/kg	1.5	6356132	2.1	<1.0	<1.0	1.0	6356395
Acid Extractable Silver (Ag)	mg/kg	7.4	6356132	2.9	1.0	<0.50	0.50	6356395
Acid Extractable Strontium (Sr)	mg/kg	71	6356132	380	33	190	5.0	6356395
Acid Extractable Thallium (Tl)	mg/kg	2.8	6356132	1.3	0.92	0.27	0.10	6356395
Acid Extractable Tin (Sn)	mg/kg	6.0	6356132	5.6	1.6	3.4	1.0	6356395
Acid Extractable Uranium (U)	mg/kg	160	6356132	6.8	37	2.9	0.10	6356395
Acid Extractable Vanadium (V)	mg/kg	210	6356132	2.4	180	44	2.0	6356395
Acid Extractable Zinc (Zn)	mg/kg	950	6356132	200	150	130	5.0	6356395
RDL = Reportable Detection Limit QC Batch = Quality Control Batch								



### ATLANTIC RBCA HYDROCARBONS (SOIL)

BV Labs ID		KWN283			KWN283			KWN285		
Sampling Date		2019/09/18			2019/09/18			2019/09/18		
COC Number		D 34708			D 34708			D 34708		
	UNITS	19BP-1	RDL	QC Batch	19BP-1 Lab-Dup	RDL	QC Batch	19BP-3	RDL	QC Batch
<b>Petroleum Hydrocarbons</b>										
Benzene	mg/kg	<0.025	0.025	6377518	<0.025	0.025	6377518	<0.025	0.025	6377518
Toluene	mg/kg	<0.050	0.050	6377518	<0.050	0.050	6377518	<0.050	0.050	6377518
Ethylbenzene	mg/kg	<0.025	0.025	6377518	<0.025	0.025	6377518	<0.025	0.025	6377518
Total Xylenes	mg/kg	<0.050	0.050	6377518	<0.050	0.050	6377518	<0.050	0.050	6377518
C6 - C10 (less BTEX)	mg/kg	<2.5	2.5	6377518	<2.5	2.5	6377518	<2.5	2.5	6377518
>C10-C16 Hydrocarbons	mg/kg	<100	100	6377476				3800	2500	6377476
>C16-C21 Hydrocarbons	mg/kg	<100	100	6377476				100000	2500	6377476
>C21-<C32 Hydrocarbons	mg/kg	1500	150	6377476				77000	3800	6377476
Modified TPH (Tier1)	mg/kg	1500	150	6375695				180000	3800	6375695
Reached Baseline at C32	mg/kg	No	N/A	6377476				Yes	N/A	6377476
Hydrocarbon Resemblance	mg/kg	COMMENT (1)	N/A	6377476				COMMENT (2)	N/A	6377476
<b>Surrogate Recovery (%)</b>										
Isobutylbenzene - Extractable	%	107		6377476				124		6377476
n-Dotriacontane - Extractable	%	129 (3)		6377476				102 (4)		6377476
Isobutylbenzene - Volatile	%	108		6377518	109		6377518	5.3 (5)		6377518
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable (1) Lube oil fraction. (2) One product in fuel / lube range. Unidentified compound(s) in fuel / lube range. (3) Elevated TEH RDL(s) due to matrix interference. (4) Elevated TEH RDL(s) due to sample dilution. (5) VPH surrogate not within acceptance limits. Insufficient sample to repeat.										





**ATLANTIC RBCA HYDROCARBONS (SOIL)**

<b>BV Labs ID</b>		KWN288		
<b>Sampling Date</b>		2019/09/18		
<b>COC Number</b>		D 34708		
	<b>UNITS</b>	<b>19BP-6</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Petroleum Hydrocarbons</b>				
Benzene	mg/kg	<0.025	0.025	6377518
Toluene	mg/kg	<0.050	0.050	6377518
Ethylbenzene	mg/kg	<0.025	0.025	6377518
Total Xylenes	mg/kg	<0.050	0.050	6377518
C6 - C10 (less BTEX)	mg/kg	<2.5	2.5	6377518
>C10-C16 Hydrocarbons	mg/kg	<100	100	6377476
>C16-C21 Hydrocarbons	mg/kg	3500	100	6377476
>C21-<C32 Hydrocarbons	mg/kg	6200	150	6377476
Modified TPH (Tier1)	mg/kg	9700	150	6375695
Reached Baseline at C32	mg/kg	Yes	N/A	6377476
Hydrocarbon Resemblance	mg/kg	COMMENT (1)	N/A	6377476
<b>Surrogate Recovery (%)</b>				
Isobutylbenzene - Extractable	%	112		6377476
n-Dotriacontane - Extractable	%	74 (2)		6377476
Isobutylbenzene - Volatile	%	67		6377518
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable (1) One product in fuel / lube range. (2) Elevated TEH RDL(s) due to sample dilution.				



BV Labs Job #: B9Q9383  
 Report Date: 2019/10/24

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### RESULTS OF ANALYSES OF WATER

BV Labs ID		KWN283	KWN284	KWN285	KWN287	KWN290		
Sampling Date		2019/09/18	2019/09/18	2019/09/18	2019/09/18	2019/09/19		
COC Number		D 34708	D 34708	D 34708	D 34708	D 34708		
	UNITS	19BP-1	19BP-2	19BP-3	19BP-5	19BP-8	RDL	QC Batch
<b>Inorganics</b>								
Sample Weight (as received)	g	100	100	100	100	100	N/A	6356111
Initial pH	N/A	4.8	4.8	4.7	4.1	4.8		6356112
Final pH	N/A	5.7	5.0	4.9	5.1	4.9		6356112
<b>RADIONUCLIDE</b>								
Lead-210	Bq/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	6370557
Radium-226	Bq/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6370557
Radium-228	Bq/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6370557
Thorium-230	Bq/L	<5.0	<5.0	<5.0	<5.0	<5.0	5.0	6370557
Thorium-234	Bq/L	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	6370557
Uranium-235	Bq/L	<0.50	<0.50	<0.50	<0.50	<0.50	0.50	6370557
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable								



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BV Labs Job #: B9Q9383

Report Date: 2019/10/24

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE

Your P.O. #: 73517254

Sampler Initials: JR

### GENERAL COMMENTS

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

Package 1	15.0°C
Package 2	3.7°C
Package 3	16.0°C
Package 4	16.0°C
Package 5	15.7°C
Package 6	16.7°C

Samples 19BP-3, 19BP-1 and 19BP-6 analyzed past the recommended hold time for TPH/BTEX.

Revised Report: TCLP + Metals added to the below listed samples as per request from Rob T. HWS Oct 11/19

19BP-1 (KWN283)

19BP-4 (KWN286)

19BP-5 (KWN287)

19BP-7 (KWN289)

19BP-9 (KWN291)

**Results relate only to the items tested.**





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BV Labs Job #: B9Q9383  
Report Date: 2019/10/24

### QUALITY ASSURANCE REPORT

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6377476	Isobutylbenzene - Extractable	2019/10/09	98	60 - 130	98	60 - 130	92	%				
6377476	n-Dotriacontane - Extractable	2019/10/09	88	60 - 130	103	60 - 130	98	%				
6377518	Isobutylbenzene - Volatile	2019/10/09	104 (7)	60 - 130	95	60 - 130	99	%				
6356111	Sample Weight (as received)	2019/09/27					NA	g	0.077 (1)	N/A		
6356132	Acid Extractable Aluminum (Al)	2019/09/27					<10	mg/kg	5.5 (1)	35		
6356132	Acid Extractable Antimony (Sb)	2019/09/27	101	75 - 125	103	75 - 125	<2.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Arsenic (As)	2019/09/27	103	75 - 125	104	75 - 125	<2.0	mg/kg	5.1 (1)	35		
6356132	Acid Extractable Barium (Ba)	2019/09/27	108	75 - 125	102	75 - 125	<5.0	mg/kg	9.4 (1)	35		
6356132	Acid Extractable Beryllium (Be)	2019/09/27	109	75 - 125	105	75 - 125	<2.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Bismuth (Bi)	2019/09/27	102	75 - 125	99	75 - 125	<2.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Boron (B)	2019/09/27	95	75 - 125	116	75 - 125	<50	mg/kg	NC (1)	35		
6356132	Acid Extractable Cadmium (Cd)	2019/09/27	102	75 - 125	99	75 - 125	<0.30	mg/kg	NC (1)	35		
6356132	Acid Extractable Chromium (Cr)	2019/09/27	105	75 - 125	102	75 - 125	<2.0	mg/kg	3.8 (1)	35		
6356132	Acid Extractable Cobalt (Co)	2019/09/27	105	75 - 125	103	75 - 125	<1.0	mg/kg	0.99 (1)	35		
6356132	Acid Extractable Copper (Cu)	2019/09/27	106	75 - 125	104	75 - 125	<2.0	mg/kg	4.7 (1)	35		
6356132	Acid Extractable Iron (Fe)	2019/09/27					<50	mg/kg	2.7 (1)	35		
6356132	Acid Extractable Lead (Pb)	2019/09/27	103	75 - 125	101	75 - 125	<0.50	mg/kg	4.9 (1)	35		
6356132	Acid Extractable Lithium (Li)	2019/09/27	117	75 - 125	107	75 - 125	<2.0	mg/kg	7.4 (1)	35		
6356132	Acid Extractable Manganese (Mn)	2019/09/27	NC	75 - 125	104	75 - 125	<2.0	mg/kg	3.2 (1)	35		
6356132	Acid Extractable Mercury (Hg)	2019/09/27	97	75 - 125	97	75 - 125	<0.10	mg/kg	NC (1)	35		
6356132	Acid Extractable Molybdenum (Mo)	2019/09/27	111	75 - 125	103	75 - 125	<2.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Nickel (Ni)	2019/09/27	105	75 - 125	105	75 - 125	<2.0	mg/kg	1.7 (1)	35		
6356132	Acid Extractable Rubidium (Rb)	2019/09/27	100	75 - 125	102	75 - 125	<2.0	mg/kg	5.8 (1)	35		
6356132	Acid Extractable Selenium (Se)	2019/09/27	103	75 - 125	106	75 - 125	<1.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Silver (Ag)	2019/09/27	104	75 - 125	102	75 - 125	<0.50	mg/kg	NC (1)	35		
6356132	Acid Extractable Strontium (Sr)	2019/09/27	109	75 - 125	102	75 - 125	<5.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Thallium (Tl)	2019/09/27	103	75 - 125	101	75 - 125	<0.10	mg/kg	NC (1)	35		
6356132	Acid Extractable Tin (Sn)	2019/09/27	105	75 - 125	108	75 - 125	<1.0	mg/kg	NC (1)	35		
6356132	Acid Extractable Uranium (U)	2019/09/27	109	75 - 125	106	75 - 125	<0.10	mg/kg	3.9 (1)	35		
6356132	Acid Extractable Vanadium (V)	2019/09/27	108	75 - 125	105	75 - 125	<2.0	mg/kg	2.7 (1)	35		
6356132	Acid Extractable Zinc (Zn)	2019/09/27	101	75 - 125	98	75 - 125	<5.0	mg/kg	1.1 (1)	35		



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6356395	Acid Extractable Aluminum (Al)	2019/10/02					<10	mg/kg				
6356395	Acid Extractable Antimony (Sb)	2019/10/02	NC	75 - 125	114	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Arsenic (As)	2019/10/02	NC	75 - 125	107	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Barium (Ba)	2019/10/02	NC	75 - 125	110	75 - 125	<5.0	mg/kg				
6356395	Acid Extractable Beryllium (Be)	2019/10/02	104	75 - 125	104	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Bismuth (Bi)	2019/10/02	NC	75 - 125	108	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Boron (B)	2019/10/02	90	75 - 125	96	75 - 125	<50	mg/kg				
6356395	Acid Extractable Cadmium (Cd)	2019/10/02	109	75 - 125	101	75 - 125	<0.30	mg/kg				
6356395	Acid Extractable Chromium (Cr)	2019/10/02	NC	75 - 125	106	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Cobalt (Co)	2019/10/02	104	75 - 125	108	75 - 125	<1.0	mg/kg				
6356395	Acid Extractable Copper (Cu)	2019/10/02	NC	75 - 125	104	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Iron (Fe)	2019/10/02					<50	mg/kg				
6356395	Acid Extractable Lead (Pb)	2019/10/02	NC	75 - 125	108	75 - 125	<0.50	mg/kg				
6356395	Acid Extractable Lithium (Li)	2019/10/02	107	75 - 125	109	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Manganese (Mn)	2019/10/02	NC	75 - 125	106	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Mercury (Hg)	2019/10/02	104	75 - 125	105	75 - 125	<0.10	mg/kg				
6356395	Acid Extractable Molybdenum (Mo)	2019/10/02	137 (2)	75 - 125	113	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Nickel (Ni)	2019/10/02	103	75 - 125	107	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Rubidium (Rb)	2019/10/02	99	75 - 125	106	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Selenium (Se)	2019/10/02	102	75 - 125	102	75 - 125	<1.0	mg/kg				
6356395	Acid Extractable Silver (Ag)	2019/10/02	NC	75 - 125	107	75 - 125	<0.50	mg/kg				
6356395	Acid Extractable Strontium (Sr)	2019/10/02	115	75 - 125	109	75 - 125	<5.0	mg/kg				
6356395	Acid Extractable Thallium (Tl)	2019/10/02	129 (2)	75 - 125	109	75 - 125	<0.10	mg/kg				
6356395	Acid Extractable Tin (Sn)	2019/10/02	NC	75 - 125	106	75 - 125	<1.0	mg/kg				
6356395	Acid Extractable Uranium (U)	2019/10/02	113	75 - 125	115	75 - 125	<0.10	mg/kg				
6356395	Acid Extractable Vanadium (V)	2019/10/02	NC	75 - 125	110	75 - 125	<2.0	mg/kg				
6356395	Acid Extractable Zinc (Zn)	2019/10/02	NC	75 - 125	104	75 - 125	<5.0	mg/kg				
6361799	Orthophosphate (P)	2019/10/02	85 (3)	80 - 120	96	80 - 120	<0.050	mg/kg	20 (4)	25		
6362110	Sample Weight (as received)	2019/10/01					NA	g	0.052 (1)	N/A		
6362637	Soluble (5:1) pH	2019/10/01							1.2 (4)	N/A		
6368435	Lead-210	2019/10/05					<0.10	Bq/g	NC (5)	N/A	103	74 - 126



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6368435	Potassium-40	2019/10/05					<1.0	Bq/g	NC (5)	N/A	100	74 - 126
6368435	Radium-226	2019/10/05					<0.10	Bq/g	NC (5)	N/A	97	74 - 126
6368435	Radium-228	2019/10/05					<0.10	Bq/g	NC (5)	N/A	100	74 - 126
6368435	Thorium-228	2019/10/05					<0.10	Bq/g	NC (5)	N/A	103	74 - 126
6368435	Thorium-230	2019/10/05					<0.80	Bq/g	NC (5)	N/A	94	74 - 126
6368435	Thorium-234	2019/10/05					<0.050	Bq/g	NC (5)	N/A	102	74 - 126
6368435	Uranium-235	2019/10/05					<0.10	Bq/g	NC (5)	N/A	105	74 - 126
6370557	Lead-210	2019/10/08					<1.0	Bq/L			93	74 - 126
6370557	Lead-212	2019/10/08					<0.10	Bq/L			105	N/A
6370557	Radium-226	2019/10/08					<1.0	Bq/L			96	74 - 126
6370557	Radium-228	2019/10/08					<0.50	Bq/L			104	74 - 126
6370557	Thorium-230	2019/10/08					<5.0	Bq/L			107	74 - 126
6370557	Thorium-234	2019/10/08					<1.0	Bq/L			100	74 - 126
6370557	Uranium-235	2019/10/08					<0.50	Bq/L			108	74 - 126
6377316	Moisture	2019/10/10							0.37 (6)	25		
6377476	>C10-C16 Hydrocarbons	2019/10/09	88	30 - 130	87	60 - 130	<10	mg/kg	NC (1)	50		
6377476	>C16-C21 Hydrocarbons	2019/10/09	83	30 - 130	84	60 - 130	<10	mg/kg	NC (1)	50		
6377476	>C21-<C32 Hydrocarbons	2019/10/09	99	30 - 130	106	60 - 130	<15	mg/kg	13 (1)	50		
6377518	Benzene	2019/10/09	87 (7)	60 - 130	93	60 - 140	<0.025	mg/kg	NC (6)	50		
6377518	C6 - C10 (less BTEX)	2019/10/09					<2.5	mg/kg	NC (6)	50		
6377518	Ethylbenzene	2019/10/09	94 (7)	60 - 130	96	60 - 140	<0.025	mg/kg	NC (6)	50		
6377518	Toluene	2019/10/09	89 (7)	60 - 130	93	60 - 140	<0.050	mg/kg	NC (6)	50		
6377518	Total Xylenes	2019/10/09	90 (7)	60 - 130	91	60 - 140	<0.050	mg/kg	NC (6)	50		
6391070	Leachable Aluminum (Al)	2019/10/18					<100	ug/L				
6391070	Leachable Antimony (Sb)	2019/10/18	103	75 - 125	102	75 - 125	<20	ug/L				
6391070	Leachable Arsenic (As)	2019/10/18	101	75 - 125	100	75 - 125	<20	ug/L				
6391070	Leachable Barium (Ba)	2019/10/18	98	75 - 125	98	75 - 125	<50	ug/L				
6391070	Leachable Beryllium (Be)	2019/10/18	100	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Boron (B)	2019/10/18	97	75 - 125	96	75 - 125	<500	ug/L				
6391070	Leachable Cadmium (Cd)	2019/10/18	96	75 - 125	96	75 - 125	<3.0	ug/L				
6391070	Leachable Calcium (Ca)	2019/10/18					<1000	ug/L				





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**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE  
 Your P.O. #: 73517254  
 Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6391070	Leachable Chromium (Cr)	2019/10/18	97	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Cobalt (Co)	2019/10/18	98	75 - 125	98	75 - 125	<10	ug/L				
6391070	Leachable Copper (Cu)	2019/10/18	95	75 - 125	95	75 - 125	<20	ug/L				
6391070	Leachable Iron (Fe)	2019/10/18					<500	ug/L				
6391070	Leachable Lead (Pb)	2019/10/18	103	75 - 125	96	75 - 125	<5.0	ug/L				
6391070	Leachable Lithium (Li)	2019/10/18	104	75 - 125	103	75 - 125	<20	ug/L				
6391070	Leachable Magnesium (Mg)	2019/10/18					<1000	ug/L				
6391070	Leachable Manganese (Mn)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Molybdenum (Mo)	2019/10/18	101	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Nickel (Ni)	2019/10/18	98	75 - 125	97	75 - 125	<20	ug/L				
6391070	Leachable Potassium (K)	2019/10/18					<1000	ug/L				
6391070	Leachable Selenium (Se)	2019/10/18	100	75 - 125	99	75 - 125	<10	ug/L				
6391070	Leachable Silver (Ag)	2019/10/18	93	75 - 125	94	75 - 125	<5.0	ug/L				
6391070	Leachable Strontium (Sr)	2019/10/18	101	75 - 125	101	75 - 125	<50	ug/L				
6391070	Leachable Thallium (Tl)	2019/10/18	97	75 - 125	94	75 - 125	<1.0	ug/L				
6391070	Leachable Tin (Sn)	2019/10/18	103	75 - 125	101	75 - 125	<20	ug/L				
6391070	Leachable Uranium (U)	2019/10/18	108	75 - 125	104	75 - 125	<1.0	ug/L				
6391070	Leachable Vanadium (V)	2019/10/18	100	75 - 125	99	75 - 125	<20	ug/L				
6391070	Leachable Zinc (Zn)	2019/10/18	NC	75 - 125	100	75 - 125	<50	ug/L				
6391323	Sample Weight (as received)	2019/10/17					NA	g				
6393098	Sample Weight (as received)	2019/10/18					NA	g	0.044 (1)	N/A		
6393264	Leachable Aluminum (Al)	2019/10/22					<100	ug/L	5.4 (1)	35		
6393264	Leachable Antimony (Sb)	2019/10/22	NC	75 - 125	99	75 - 125	<20	ug/L	27 (1)	35		
6393264	Leachable Arsenic (As)	2019/10/22	98	75 - 125	99	75 - 125	<20	ug/L	116 (8,1)	35		
6393264	Leachable Barium (Ba)	2019/10/22	99	75 - 125	98	75 - 125	<50	ug/L	14 (1)	35		
6393264	Leachable Beryllium (Be)	2019/10/22	104	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Boron (B)	2019/10/22	100	75 - 125	101	75 - 125	<500	ug/L	3.7 (1)	35		
6393264	Leachable Cadmium (Cd)	2019/10/22	NC	75 - 125	95	75 - 125	<3.0	ug/L	155 (8,1)	35		
6393264	Leachable Calcium (Ca)	2019/10/22					<1000	ug/L	4.5 (1)	35		
6393264	Leachable Chromium (Cr)	2019/10/22	99	75 - 125	98	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Cobalt (Co)	2019/10/22	99	75 - 125	98	75 - 125	<10	ug/L	3.2 (1)	35		



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6393264	Leachable Copper (Cu)	2019/10/22	NC	75 - 125	96	75 - 125	<20	ug/L	1.4 (1)	35		
6393264	Leachable Iron (Fe)	2019/10/22					<500	ug/L	NC (1)	35		
6393264	Leachable Lead (Pb)	2019/10/22	NC	75 - 125	98	75 - 125	<5.0	ug/L	22 (1)	35		
6393264	Leachable Lithium (Li)	2019/10/22	107	75 - 125	110	75 - 125	<20	ug/L	8.2 (1)	35		
6393264	Leachable Magnesium (Mg)	2019/10/22					<1000	ug/L	4.9 (1)	35		
6393264	Leachable Manganese (Mn)	2019/10/22	NC	75 - 125	100	75 - 125	<20	ug/L	3.2 (1)	35		
6393264	Leachable Molybdenum (Mo)	2019/10/22	104	75 - 125	102	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Nickel (Ni)	2019/10/22	100	75 - 125	99	75 - 125	<20	ug/L	9.9 (1)	35		
6393264	Leachable Potassium (K)	2019/10/22					<1000	ug/L	9.3 (1)	35		
6393264	Leachable Selenium (Se)	2019/10/22	101	75 - 125	98	75 - 125	<10	ug/L	1.5 (1)	35		
6393264	Leachable Silver (Ag)	2019/10/22	94	75 - 125	94	75 - 125	<5.0	ug/L	NC (1)	35		
6393264	Leachable Strontium (Sr)	2019/10/22	100	75 - 125	99	75 - 125	<50	ug/L	0.94 (1)	35		
6393264	Leachable Thallium (Tl)	2019/10/22	99	75 - 125	96	75 - 125	<1.0	ug/L	3.4 (1)	35		
6393264	Leachable Tin (Sn)	2019/10/22	99	75 - 125	97	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Uranium (U)	2019/10/22	104	75 - 125	102	75 - 125	<1.0	ug/L	NC (1)	35		
6393264	Leachable Vanadium (V)	2019/10/22	104	75 - 125	100	75 - 125	<20	ug/L	NC (1)	35		
6393264	Leachable Zinc (Zn)	2019/10/22	NC	75 - 125	101	75 - 125	<50	ug/L	37 (8,1)	35		
6393275	Leachable Aluminum (Al)	2019/10/18					<100	ug/L				
6393275	Leachable Antimony (Sb)	2019/10/18	107 (9)	75 - 125	91	75 - 125	<20	ug/L				
6393275	Leachable Arsenic (As)	2019/10/18	104 (9)	75 - 125	98	75 - 125	<20	ug/L				
6393275	Leachable Barium (Ba)	2019/10/18	107 (9)	75 - 125	97	75 - 125	<50	ug/L				
6393275	Leachable Beryllium (Be)	2019/10/18	113 (9)	75 - 125	100	75 - 125	<20	ug/L				
6393275	Leachable Boron (B)	2019/10/18	120 (9)	75 - 125	108	75 - 125	<500	ug/L				
6393275	Leachable Cadmium (Cd)	2019/10/18	111 (9)	75 - 125	96	75 - 125	<3.0	ug/L				
6393275	Leachable Calcium (Ca)	2019/10/18					<1000	ug/L				
6393275	Leachable Chromium (Cr)	2019/10/18	110 (9)	75 - 125	99	75 - 125	<20	ug/L				
6393275	Leachable Cobalt (Co)	2019/10/18	113 (9)	75 - 125	101	75 - 125	<10	ug/L				
6393275	Leachable Copper (Cu)	2019/10/18	109 (9)	75 - 125	99	75 - 125	<20	ug/L				
6393275	Leachable Iron (Fe)	2019/10/18					<500	ug/L				
6393275	Leachable Lead (Pb)	2019/10/18	107 (9)	75 - 125	96	75 - 125	<5.0	ug/L				
6393275	Leachable Lithium (Li)	2019/10/18	112 (9)	75 - 125	104	75 - 125	<20	ug/L				



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6393275	Leachable Magnesium (Mg)	2019/10/18					<1000	ug/L				
6393275	Leachable Manganese (Mn)	2019/10/18	107 (9)	75 - 125	97	75 - 125	<20	ug/L				
6393275	Leachable Molybdenum (Mo)	2019/10/18	110 (9)	75 - 125	98	75 - 125	<20	ug/L				
6393275	Leachable Nickel (Ni)	2019/10/18	111 (9)	75 - 125	102	75 - 125	<20	ug/L				
6393275	Leachable Potassium (K)	2019/10/18					<1000	ug/L				
6393275	Leachable Selenium (Se)	2019/10/18	114 (9)	75 - 125	107	75 - 125	<10	ug/L				
6393275	Leachable Silver (Ag)	2019/10/18	106 (9)	75 - 125	94	75 - 125	<5.0	ug/L				
6393275	Leachable Strontium (Sr)	2019/10/18	105 (9)	75 - 125	93	75 - 125	<50	ug/L				
6393275	Leachable Thallium (Tl)	2019/10/18	106 (9)	75 - 125	95	75 - 125	<1.0	ug/L				
6393275	Leachable Tin (Sn)	2019/10/18	106 (9)	75 - 125	94	75 - 125	<20	ug/L				
6393275	Leachable Uranium (U)	2019/10/18	108 (9)	75 - 125	98	75 - 125	<1.0	ug/L				
6393275	Leachable Vanadium (V)	2019/10/18	111 (9)	75 - 125	102	75 - 125	<20	ug/L				



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### QUALITY ASSURANCE REPORT(CONT'D)

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6393275	Leachable Zinc (Zn)	2019/10/18	106 (9)	75 - 125	101	75 - 125	<50	ug/L				

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).

(1) Duplicate Parent ID

(2) Matrix Spike exceeds acceptance limits, sample inhomogeneity suspected.

(3) Matrix Spike Parent ID [KWN284-01]

(4) Duplicate Parent ID [KWN284-01]

(5) Duplicate Parent ID [KWN287-02]

(6) Duplicate Parent ID [KWN283-04]

(7) Matrix Spike Parent ID [KWN283-04]

(8) Poor RPD due to sample inhomogeneity. Insufficient sample for re-extraction and re-analysis.

(9) Matrix Spike Parent ID [KWN287-01]





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BV Labs Job #: B9Q9383

Report Date: 2019/10/24

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE

Your P.O. #: 73517254

Sampler Initials: JR

### VALIDATION SIGNATURE PAGE

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

Eric Dearman, Scientific Specialist

Mike MacGillivray, Scientific Specialist (Inorganics)

Robert Allen, Scientific Specialist

Rosemarie MacDonald, Scientific Specialist (Organics)

Steven Simpson, Lab Director

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





Your P.O. #: 73517186  
 Your Project #: 11198639-04  
 Site Location: BELLEDENE SMETTER  
 Your C.O.C. #: D34696

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/22**  
 Report #: R5930968  
 Version: 4 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9518**

**Received: 2019/09/24, 09:59**

Sample Matrix: Water  
 # Samples Received: 7

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
Mercury - Dissolved (CVAA,LL)	7	2019/09/27	2019/09/30	ATL SOP 00026	EPA 245.1 R3 m
ICP-OES Dissolved Metals in Water (1)	7	N/A	2019/10/03	BBY7SOP-00018	EPA 6010d m
Na, K, Ca, Mg, S by CRC ICPMS (diss.) (1)	7	N/A	2019/10/01	BBY WI-00033	Auto Calc
Elements by ICPMS (dissolved) - Seawater (1)	7	N/A	2019/10/01	BBY7SOP-00002	BCMOE BCLM Nov 2015
pH (3)	4	N/A	2019/09/27	ATL SOP 00003	SM 23 4500-H+ B m
pH (3)	2	N/A	2019/10/01	ATL SOP 00003	SM 23 4500-H+ B m
pH (3)	1	N/A	2019/10/02	ATL SOP 00003	SM 23 4500-H+ B m
NORM Group Analysis (2)	2	N/A	2019/10/17	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (2)	2	N/A	2019/10/18	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (2)	2	N/A	2019/10/19	BQL SOP-00007	Gamma Spectrometry
NORM Group Analysis (2)	1	N/A	2019/10/20	BQL SOP-00007	Gamma Spectrometry
Salinity (4)	7	N/A	2019/10/01		SM 22 2520B
Total Suspended Solids	7	2019/09/30	2019/10/01	ATL SOP 00007	SM 23 2540D m

**Remarks:**

Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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. When sampling is not conducted by BV Labs, results relate to the supplied 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.



Your P.O. #: 73517186  
Your Project #: 11198639-04  
Site Location: BELLEDENE SMETTER  
Your C.O.C. #: D34696

**Attention: Troy Small**

GHD Limited  
466 Hodgson Rd  
Fredericton , NB  
CANADA E3C 2G5

**Report Date: 2019/10/22**  
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**CERTIFICATE OF ANALYSIS**

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**Received: 2019/09/24, 09:59**

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

- (1) This test was performed by Bedford to Burnaby - Offsite
- (2) This test was performed by Bureau Veritas Laboratories Kitimat
- (3) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.
- (4) Non-accredited test method

Encryption Key

Melissa DiPinto  
Project Manager  
22 Oct 2019 12:33:12

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Heather Macumber, Senior Project Manager  
Email: Heather.MACUMBER@bvlabs.com  
Phone# (902)420-0203 Ext:226

=====  
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.





### RESULTS OF ANALYSES OF WATER

BV Labs ID		KWN916			KWN916			KWN917		
Sampling Date		2019/09/23			2019/09/23			2019/09/23		
COC Number		D34696			D34696			D34696		
	UNITS	08GW-95	RDL	QC Batch	08GW-95 Lab-Dup	RDL	QC Batch	09GW-102	RDL	QC Batch
<b>Inorganics</b>										
pH	pH	6.94	N/A	6356971				7.39	N/A	6363133
Salinity	N/A	<2.0	2.0	6359774				<2.0	2.0	6359774
Total Suspended Solids	mg/L	170	10	6359835				30	2.0	6359835
<b>Metals</b>										
Dissolved Aluminum (Al)	ug/L	16	10	6369100	15	10	6369100	13	10	6369100
Dissolved Antimony (Sb)	ug/L	14.0	0.50	6369100	13.8	0.50	6369100	<0.50	0.50	6369100
Dissolved Arsenic (As)	ug/L	5.76	0.50	6369100	5.38	0.50	6369100	1.34	0.50	6369100
Dissolved Barium (Ba)	ug/L	30.2	1.0	6369100	30.1	1.0	6369100	77.7	1.0	6369100
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Boron (B)	ug/L	<50	50	6369100	50	50	6369100	<50	50	6369100
Dissolved Cadmium (Cd)	ug/L	26.7	0.050	6369100	26.1	0.050	6369100	0.284	0.050	6369100
Dissolved Chromium (Cr)	ug/L	<0.50	0.50	6369100	<0.50	0.50	6369100	<0.50	0.50	6369100
Dissolved Cobalt (Co)	ug/L	0.33	0.10	6369100	0.30	0.10	6369100	<0.10	0.10	6369100
Dissolved Copper (Cu)	ug/L	11.7	0.50	6369100	11.9	0.50	6369100	0.97	0.50	6369100
Dissolved Iron (Fe)	ug/L	8.9	2.0	6369100	8.6	2.0	6369100	<2.0	2.0	6369100
Dissolved Lead (Pb)	ug/L	115	0.10	6369100	114	0.10	6369100	13.9	0.10	6369100
Dissolved Lithium (Li)	ug/L	<20	20	6369100	<20	20	6369100	<20	20	6369100
Dissolved Manganese (Mn)	ug/L	418	0.50	6369100	413	0.50	6369100	0.66	0.50	6369100
Dissolved Molybdenum (Mo)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Nickel (Ni)	ug/L	4.69	0.20	6369100	5.30	0.20	6369100	<0.20	0.20	6369100
Dissolved Phosphorus (P)	ug/L	268	50	6369100	290	50	6369100	<50	50	6369100
Dissolved Selenium (Se)	ug/L	15.0	0.50	6369100	14.4	0.50	6369100	1.71	0.50	6369100
Dissolved Silicon (Si)	ug/L	6680	1000	6369100	6690	1000	6369100	3630	1000	6369100
Dissolved Silver (Ag)	ug/L	<0.050	0.050	6369100	<0.050	0.050	6369100	<0.050	0.050	6369100
Dissolved Strontium (Sr)	ug/L	190	10	6369100	187	10	6369100	121	10	6369100
Dissolved Thallium (Tl)	ug/L	20.8	0.10	6369100	20.9	0.10	6369100	<0.10	0.10	6369100
Dissolved Tin (Sn)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	1.6	1.0	6369100
Dissolved Titanium (Ti)	ug/L	<10	10	6369100	<10	10	6369100	<10	10	6369100
Dissolved Uranium (U)	ug/L	0.091	0.050	6369100	0.080	0.050	6369100	0.120	0.050	6369100
Dissolved Vanadium (V)	ug/L	<10	10	6369100	<10	10	6369100	<10	10	6369100
Dissolved Zinc (Zn)	ug/L	814	1.0	6369100	828	1.0	6369100	6.7	1.0	6369100
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate N/A = Not Applicable										



BV Labs Job #: B9Q9518  
 Report Date: 2019/10/22

GHD Limited  
 Client Project #: 11198639-04  
 Site Location: BELLEDENE SMETTER  
 Your P.O. #: 73517186  
 Sampler Initials: MT

### RESULTS OF ANALYSES OF WATER

BV Labs ID		KWN916			KWN916			KWN917		
Sampling Date		2019/09/23			2019/09/23			2019/09/23		
COC Number		D34696			D34696			D34696		
	UNITS	08GW-95	RDL	QC Batch	08GW-95 Lab-Dup	RDL	QC Batch	09GW-102	RDL	QC Batch
Dissolved Calcium (Ca)	mg/L	135	1.0	6369101				71.1	1.0	6369101
Dissolved Magnesium (Mg)	mg/L	15.7	1.0	6369101				4.6	1.0	6369101
Dissolved Potassium (K)	mg/L	5.4	1.0	6369101				<1.0	1.0	6369101
Dissolved Sodium (Na)	mg/L	145	1.0	6369102	139	1.0	6369102	11.8	1.0	6369102
Dissolved Sulphur (S)	mg/L	93	20	6369101				46	20	6369101
<b>RADIONUCLIDE</b>										
Lead-210	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	0.10	6370557				<0.10	0.10	6370557
Radium-226	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Radium-228	Bq/L	<0.50	0.50	6370557				<0.50	0.50	6370557
Thorium-230	Bq/L	<5.0	5.0	6370557				<5.0	5.0	6370557
Thorium-234	Bq/L	<1.0	1.0	6370557				<1.0	1.0	6370557
Uranium-235	Bq/L	<0.50	0.50	6370557				<0.50	0.50	6370557
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										



**RESULTS OF ANALYSES OF WATER**

BV Labs ID		KWN918			KWN919			KWN920		
Sampling Date		2019/09/23			2019/09/23			2019/09/23		
COC Number		D34696			D34696			D34696		
	UNITS	19GW-118	RDL	QC Batch	19GW-120	RDL	QC Batch	19GW-122	RDL	QC Batch
<b>Inorganics</b>										
pH	pH	6.91	N/A	6356971	5.75	N/A	6364217	7.00	N/A	6356963
Salinity	N/A	<2.0	2.0	6359774	2.9	2.0	6359774	<2.0	2.0	6359774
Total Suspended Solids	mg/L	11	1.0	6359835	240	5.0	6359835	310	10	6359835
<b>Metals</b>										
Dissolved Aluminum (Al)	ug/L	<10	10	6369100	89	10	6369100	<10	10	6369100
Dissolved Antimony (Sb)	ug/L	40.1	0.50	6369100	2.29	0.50	6369100	17.6	0.50	6369100
Dissolved Arsenic (As)	ug/L	28.5	0.50	6369100	66.0	0.50	6369100	3.30	0.50	6369100
Dissolved Barium (Ba)	ug/L	2.2	1.0	6369100	3.8	1.0	6369100	5.8	1.0	6369100
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Boron (B)	ug/L	129	50	6369100	225	50	6369100	<50	50	6369100
Dissolved Cadmium (Cd)	ug/L	156	0.050	6369100	108	0.050	6369100	0.850	0.050	6369100
Dissolved Chromium (Cr)	ug/L	0.73	0.50	6369100	<0.50	0.50	6369100	<0.50	0.50	6369100
Dissolved Cobalt (Co)	ug/L	2.63	0.10	6369100	368	0.10	6369100	3.49	0.10	6369100
Dissolved Copper (Cu)	ug/L	3.57	0.50	6369100	30.2	0.50	6369100	<0.50	0.50	6369100
Dissolved Iron (Fe)	ug/L	<2.0	2.0	6369100	5.2	2.0	6369100	89.2	2.0	6369100
Dissolved Lead (Pb)	ug/L	8.35	0.10	6369100	4.35	0.10	6369100	0.41	0.10	6369100
Dissolved Lithium (Li)	ug/L	<20	20	6369100	382	20	6369100	<20	20	6369100
Dissolved Manganese (Mn)	ug/L	2940	0.50	6369100	47600	0.50	6369100	2610	0.50	6369100
Dissolved Molybdenum (Mo)	ug/L	<1.0	1.0	6369100	4.3	1.0	6369100	2.2	1.0	6369100
Dissolved Nickel (Ni)	ug/L	34.8	0.20	6369100	1210	0.20	6369100	9.21	0.20	6369100
Dissolved Phosphorus (P)	ug/L	18500	50	6369100	184000	50	6369100	<50	50	6369100
Dissolved Selenium (Se)	ug/L	16.3	0.50	6369100	12.5	0.50	6369100	<0.50	0.50	6369100
Dissolved Silicon (Si)	ug/L	8250	1000	6369100	57400	1000	6369100	8410	1000	6369100
Dissolved Silver (Ag)	ug/L	<0.050	0.050	6369100	0.209	0.050	6369100	<0.050	0.050	6369100
Dissolved Strontium (Sr)	ug/L	185	10	6369100	69	10	6369100	277	10	6369100
Dissolved Thallium (Tl)	ug/L	1.61	0.10	6369100	0.37	0.10	6369100	0.11	0.10	6369100
Dissolved Tin (Sn)	ug/L	2.4	1.0	6369100	<1.0	1.0	6369100	1.3	1.0	6369100
Dissolved Titanium (Ti)	ug/L	<10	10	6369100	14	10	6369100	<10	10	6369100
Dissolved Uranium (U)	ug/L	<0.050	0.050	6369100	<0.050	0.050	6369100	0.089	0.050	6369100
Dissolved Vanadium (V)	ug/L	15	10	6369100	21	10	6369100	<10	10	6369100
Dissolved Zinc (Zn)	ug/L	4120	1.0	6369100	14100	1.0	6369100	539	1.0	6369100
Dissolved Calcium (Ca)	mg/L	160	1.0	6369101	447	1.0	6369101	248	1.0	6369101
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
N/A = Not Applicable										



BV Labs Job #: B9Q9518  
 Report Date: 2019/10/22

GHD Limited  
 Client Project #: 11198639-04  
 Site Location: BELLEDENE SMETTER  
 Your P.O. #: 73517186  
 Sampler Initials: MT

### RESULTS OF ANALYSES OF WATER

BV Labs ID		KWN918			KWN919			KWN920		
Sampling Date		2019/09/23			2019/09/23			2019/09/23		
COC Number		D34696			D34696			D34696		
	UNITS	19GW-118	RDL	QC Batch	19GW-120	RDL	QC Batch	19GW-122	RDL	QC Batch
Dissolved Magnesium (Mg)	mg/L	13.3	1.0	6369101	193	1.0	6369101	22.3	1.0	6369101
Dissolved Potassium (K)	mg/L	3.4	1.0	6369101	3.2	1.0	6369101	2.8	1.0	6369101
Dissolved Sodium (Na)	mg/L	102	1.0	6369102	231	1.0	6369102	79.9	1.0	6369102
Dissolved Sulphur (S)	mg/L	134	20	6369101	344	20	6369101	188	20	6369101
<b>RADIONUCLIDE</b>										
Lead-210	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557	<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	0.10	6370557	<0.10	0.10	6370557	<0.10	0.10	6370557
Radium-226	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557	<1.0	1.0	6370557
Radium-228	Bq/L	<0.50	0.50	6370557	<0.50	0.50	6370557	<0.50	0.50	6370557
Thorium-230	Bq/L	<5.0	5.0	6370557	<5.0	5.0	6370557	<5.0	5.0	6370557
Thorium-234	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557	<1.0	1.0	6370557
Uranium-235	Bq/L	<0.50	0.50	6370557	<0.50	0.50	6370557	<0.50	0.50	6370557
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										





### RESULTS OF ANALYSES OF WATER

BV Labs ID		KWN921			KWN922		
Sampling Date		2019/09/23			2019/09/23		
COC Number		D34696			D34696		
	UNITS	19GW-124	RDL	QC Batch	QA/QC-1	RDL	QC Batch
<b>Inorganics</b>							
pH	pH	7.52	N/A	6363133	6.95	N/A	6356963
Salinity	N/A	<2.0	2.0	6359774	<2.0	2.0	6359774
Total Suspended Solids	mg/L	2100	50	6359835	12	1.0	6359835
<b>Metals</b>							
Dissolved Aluminum (Al)	ug/L	<10	10	6369100	<10	10	6369100
Dissolved Antimony (Sb)	ug/L	11.2	0.50	6369100	34.9	0.50	6369100
Dissolved Arsenic (As)	ug/L	8.77	0.50	6369100	28.1	0.50	6369100
Dissolved Barium (Ba)	ug/L	45.2	1.0	6369100	2.7	1.0	6369100
Dissolved Beryllium (Be)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Bismuth (Bi)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Boron (B)	ug/L	185	50	6369100	133	50	6369100
Dissolved Cadmium (Cd)	ug/L	0.984	0.050	6369100	121	0.050	6369100
Dissolved Chromium (Cr)	ug/L	<0.50	0.50	6369100	0.73	0.50	6369100
Dissolved Cobalt (Co)	ug/L	<0.10	0.10	6369100	2.81	0.10	6369100
Dissolved Copper (Cu)	ug/L	2.48	0.50	6369100	4.25	0.50	6369100
Dissolved Iron (Fe)	ug/L	<2.0	2.0	6369100	<2.0	2.0	6369100
Dissolved Lead (Pb)	ug/L	7.33	0.10	6369100	7.20	0.10	6369100
Dissolved Lithium (Li)	ug/L	<20	20	6369100	<20	20	6369100
Dissolved Manganese (Mn)	ug/L	165	0.50	6369100	2980	0.50	6369100
Dissolved Molybdenum (Mo)	ug/L	3.1	1.0	6369100	<1.0	1.0	6369100
Dissolved Nickel (Ni)	ug/L	1.35	0.20	6369100	33.7	0.20	6369100
Dissolved Phosphorus (P)	ug/L	1550	50	6369100	19800	50	6369100
Dissolved Selenium (Se)	ug/L	6.52	0.50	6369100	16.3	0.50	6369100
Dissolved Silicon (Si)	ug/L	4580	1000	6369100	8160	1000	6369100
Dissolved Silver (Ag)	ug/L	<0.050	0.050	6369100	<0.050	0.050	6369100
Dissolved Strontium (Sr)	ug/L	134	10	6369100	181	10	6369100
Dissolved Thallium (Tl)	ug/L	0.38	0.10	6369100	1.29	0.10	6369100
Dissolved Tin (Sn)	ug/L	<1.0	1.0	6369100	<1.0	1.0	6369100
Dissolved Titanium (Ti)	ug/L	<10	10	6369100	<10	10	6369100
Dissolved Uranium (U)	ug/L	0.764	0.050	6369100	<0.050	0.050	6369100
Dissolved Vanadium (V)	ug/L	<10	10	6369100	16	10	6369100
Dissolved Zinc (Zn)	ug/L	21.0	1.0	6369100	3730	1.0	6369100
Dissolved Calcium (Ca)	mg/L	87.1	1.0	6369101	161	1.0	6369101
RDL = Reportable Detection Limit QC Batch = Quality Control Batch N/A = Not Applicable							



BV Labs Job #: B9Q9518  
 Report Date: 2019/10/22

GHD Limited  
 Client Project #: 11198639-04  
 Site Location: BELLEDENE SMETTER  
 Your P.O. #: 73517186  
 Sampler Initials: MT

**RESULTS OF ANALYSES OF WATER**

BV Labs ID		KWN921			KWN922		
Sampling Date		2019/09/23			2019/09/23		
COC Number		D34696			D34696		
	UNITS	19GW-124	RDL	QC Batch	QA/QC-1	RDL	QC Batch
Dissolved Magnesium (Mg)	mg/L	6.5	1.0	6369101	13.1	1.0	6369101
Dissolved Potassium (K)	mg/L	3.6	1.0	6369101	3.5	1.0	6369101
Dissolved Sodium (Na)	mg/L	246	1.0	6369102	101	1.0	6369102
Dissolved Sulphur (S)	mg/L	80	20	6369101	132	20	6369101
<b>RADIONUCLIDE</b>							
Lead-210	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557
Lead-212	Bq/L	<0.10	0.10	6370557	<0.10	0.10	6370557
Radium-226	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557
Radium-228	Bq/L	<0.50	0.50	6370557	<0.50	0.50	6370557
Thorium-230	Bq/L	<5.0	5.0	6370557	<5.0	5.0	6370557
Thorium-234	Bq/L	<1.0	1.0	6370557	<1.0	1.0	6370557
Uranium-235	Bq/L	<0.50	0.50	6370557	<0.50	0.50	6370557
RDL = Reportable Detection Limit QC Batch = Quality Control Batch							



BUREAU  
VERITAS

BV Labs Job #: B9Q9518

Report Date: 2019/10/22

GHD Limited

Client Project #: 11198639-04

Site Location: BELLEDENE SMETTER

Your P.O. #: 73517186

Sampler Initials: MT

### MERCURY BY COLD VAPOUR AA (WATER)

<b>BV Labs ID</b>		KWN916	KWN916	KWN917	KWN918	KWN919	KWN920	KWN921		
<b>Sampling Date</b>		2019/09/23	2019/09/23	2019/09/23	2019/09/23	2019/09/23	2019/09/23	2019/09/23		
<b>COC Number</b>		D34696	D34696	D34696	D34696	D34696	D34696	D34696		
	<b>UNITS</b>	<b>08GW-95</b>	<b>08GW-95 Lab-Dup</b>	<b>09GW-102</b>	<b>19GW-118</b>	<b>19GW-120</b>	<b>19GW-122</b>	<b>19GW-124</b>	<b>RDL</b>	<b>QC Batch</b>

<b>Metals</b>										
Dissolved Mercury (Hg)	ug/L	<0.013	<0.013	<0.013	<0.013	0.19	<0.013	<0.013	0.013	6356457
RDL = Reportable Detection Limit										
QC Batch = Quality Control Batch										
Lab-Dup = Laboratory Initiated Duplicate										

<b>BV Labs ID</b>		KWN922		
<b>Sampling Date</b>		2019/09/23		
<b>COC Number</b>		D34696		
	<b>UNITS</b>	<b>QA/QC-1</b>	<b>RDL</b>	<b>QC Batch</b>
<b>Metals</b>				
Dissolved Mercury (Hg)	ug/L	<0.013	0.013	6356457
RDL = Reportable Detection Limit				
QC Batch = Quality Control Batch				



BUREAU  
VERITAS

BV Labs Job #: B9Q9518

Report Date: 2019/10/22

GHD Limited

Client Project #: 11198639-04

Site Location: BELLEDENE SMETTER

Your P.O. #: 73517186

Sampler Initials: MT

### GENERAL COMMENTS

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

Package 1	8.7°C
-----------	-------

**Results relate only to the items tested.**





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VERITAS

BV Labs Job #: B9Q9518  
Report Date: 2019/10/22

### QUALITY ASSURANCE REPORT

GHD Limited  
Client Project #: 11198639-04  
Site Location: BELLEDENE SMETTER  
Your P.O. #: 73517186  
Sampler Initials: MT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6356457	Dissolved Mercury (Hg)	2019/09/30	100 (1)	80 - 120	101	80 - 120	<0.013	ug/L	NC (2)	20		
6356963	pH	2019/09/27							0.98 (3)	N/A	101	97 - 103
6356971	pH	2019/09/27							0.40 (3)	N/A	101	97 - 103
6359774	Salinity	2019/10/01					<2.0	N/A	NC (3)	25	101	80 - 120
6359835	Total Suspended Solids	2019/10/01					<1.0	mg/L	3.6 (3)	20	97	N/A
6363133	pH	2019/10/01							1.2 (3)	N/A	100	97 - 103
6364217	pH	2019/10/02							0.16 (3)	N/A	100	97 - 103
6369100	Dissolved Aluminum (Al)	2019/10/01	101 (4)	80 - 135	100	80 - 120	<10	ug/L	3.1 (5)	25		
6369100	Dissolved Antimony (Sb)	2019/10/01	NC (4)	80 - 120	98	80 - 120	<0.50	ug/L	2.0 (5)	25		
6369100	Dissolved Arsenic (As)	2019/10/01	98 (4)	80 - 120	100	80 - 120	<0.50	ug/L	6.8 (5)	25		
6369100	Dissolved Barium (Ba)	2019/10/01	98 (4)	80 - 120	98	80 - 120	<1.0	ug/L	0.27 (5)	25		
6369100	Dissolved Beryllium (Be)	2019/10/01	105 (4)	80 - 120	102	80 - 120	<1.0	ug/L	NC (5)	25		
6369100	Dissolved Bismuth (Bi)	2019/10/01	108 (4)	80 - 120	102	80 - 120	<1.0	ug/L	NC (5)	25		
6369100	Dissolved Boron (B)	2019/10/01	101 (4)	80 - 120	99	80 - 120	<50	ug/L	0.82 (5)	25		
6369100	Dissolved Cadmium (Cd)	2019/10/01	103 (4)	80 - 120	101	80 - 120	<0.050	ug/L	2.2 (5)	25		
6369100	Dissolved Chromium (Cr)	2019/10/01	102 (4)	80 - 120	99	80 - 120	<0.50	ug/L	NC (5)	25		
6369100	Dissolved Cobalt (Co)	2019/10/01	103 (4)	80 - 120	98	80 - 120	<0.10	ug/L	8.2 (5)	25		
6369100	Dissolved Copper (Cu)	2019/10/01	111 (4)	80 - 120	102	80 - 120	<0.50	ug/L	1.3 (5)	25		
6369100	Dissolved Iron (Fe)	2019/10/01	102 (4)	80 - 135	98	80 - 120	<10	ug/L	3.6 (5)	25		
6369100	Dissolved Lead (Pb)	2019/10/01	NC (4)	80 - 120	97	80 - 120	<0.10	ug/L	0.36 (5)	25		
6369100	Dissolved Lithium (Li)	2019/10/01	107 (4)	80 - 120	104	80 - 120	<20	ug/L	NC (5)	25		
6369100	Dissolved Manganese (Mn)	2019/10/01	NC (4)	80 - 120	100	80 - 120	<0.50	ug/L	1.1 (5)	25		
6369100	Dissolved Molybdenum (Mo)	2019/10/01	94 (4)	80 - 120	101	80 - 120	<1.0	ug/L	NC (5)	25		
6369100	Dissolved Nickel (Ni)	2019/10/01	108 (4)	80 - 120	100	80 - 120	<0.20	ug/L	12 (5)	25		
6369100	Dissolved Phosphorus (P)	2019/10/01					<50	ug/L	8.1 (5)	25		
6369100	Dissolved Selenium (Se)	2019/10/01	102 (4)	80 - 120	102	80 - 120	<0.50	ug/L	3.9 (5)	25		
6369100	Dissolved Silicon (Si)	2019/10/01					<1000	ug/L	0.046 (5)	25		
6369100	Dissolved Silver (Ag)	2019/10/01	102 (4)	80 - 120	100	80 - 120	<0.050	ug/L	NC (5)	25		
6369100	Dissolved Strontium (Sr)	2019/10/01	NC (4)	80 - 120	90	80 - 120	<10	ug/L	1.7 (5)	25		
6369100	Dissolved Thallium (Tl)	2019/10/01	NC (4)	80 - 120	97	80 - 120	<0.10	ug/L	0.64 (5)	25		
6369100	Dissolved Tin (Sn)	2019/10/01	96 (4)	80 - 120	101	80 - 120	<1.0	ug/L	NC (5)	25		



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BV Labs Job #: B9Q9518  
Report Date: 2019/10/22

**QUALITY ASSURANCE REPORT(CONT'D)**

GHD Limited  
Client Project #: 11198639-04  
Site Location: BELLEDENE SMETTER  
Your P.O. #: 73517186  
Sampler Initials: MT

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD		QC Standard	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits	% Recovery	QC Limits
6369100	Dissolved Titanium (Ti)	2019/10/01	96 (4)	80 - 120	102	80 - 120	<10	ug/L	NC (5)	25		
6369100	Dissolved Uranium (U)	2019/10/01	97 (4)	80 - 120	97	80 - 120	<0.050	ug/L	13 (5)	25		
6369100	Dissolved Vanadium (V)	2019/10/01	98 (4)	80 - 120	99	80 - 120	<10	ug/L	NC (5)	25		
6369100	Dissolved Zinc (Zn)	2019/10/01	NC (4)	80 - 120	108	80 - 120	<5.0	ug/L	1.6 (5)	25		
6369102	Dissolved Sodium (Na)	2019/10/03	NC (4)	80 - 120	100	80 - 120	<0.10	mg/L	4.0 (5)	20		
6370557	Lead-210	2019/10/08					<1.0	Bq/L			93	74 - 126
6370557	Lead-212	2019/10/08					<0.10	Bq/L			105	N/A
6370557	Radium-226	2019/10/08					<1.0	Bq/L			96	74 - 126
6370557	Radium-228	2019/10/08					<0.50	Bq/L			104	74 - 126
6370557	Thorium-230	2019/10/08					<5.0	Bq/L			107	74 - 126
6370557	Thorium-234	2019/10/08					<1.0	Bq/L			100	74 - 126
6370557	Uranium-235	2019/10/08					<0.50	Bq/L			108	74 - 126

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.

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) Matrix Spike Parent ID [KWN917-05]
- (2) Duplicate Parent ID [KWN916-05]
- (3) Duplicate Parent ID
- (4) Matrix Spike Parent ID [KWN916-04]
- (5) Duplicate Parent ID [KWN916-04]



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VERITAS

BV Labs Job #: B9Q9518

Report Date: 2019/10/22

GHD Limited

Client Project #: 11198639-04

Site Location: BELLEDENE SMETTER

Your P.O. #: 73517186

Sampler Initials: MT

### VALIDATION SIGNATURE PAGE

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

Colleen Acker, Scientific Service Specialist

Mike MacGillivray, Scientific Specialist (Inorganics)

Rob Reinert, B.Sc., Scientific Specialist

Steven Simpson, Lab Director

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



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ATL FCD 00149 / 22

CHAIN OF CUSTODY RECORD

COC #: **D34696** Page **1** of **1**

Invoice Information				Report Information (if differs from invoice)				Project Information (where applicable)				Turnaround Time (TAT) Required			
Company Name: <b>GHD</b>				Company Name: <del>XXXXXXXXXX</del>				Quotation #: <b>73517186</b>				<input checked="" type="checkbox"/> Regular TAT (5 business days) Most			
Contact Name: <b>Troy Small, Charie Babine</b>				Contact Name: <del>XXXXXXXXXX</del>				P.O. #: <b>11198639-4</b>				PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS			
Address: <b>466 Hodgson Road, Fredericton, NB</b>				Address: <del>XXXXXXXXXX</del>				Project #: <b>Bellefleur Smelter</b>				IF RUSH please specify date (Surcharges will be applied)			
Postal Code: <b>E3C 2G5</b>				Postal Code: <del>XXXXXXXXXX</del>				Site Location: <b>Bellefleur Smelter</b>				DATE REQUIRED:			
Phone: _____ Fax: _____				Phone: _____ Fax: _____				Site #: _____							
Email: <b>troy.small@ghd.com charie.babine@ghd.com</b>				Email: <del>XXXXXXXXXX</del>				Sampled By: <b>MARIE Theriault</b>							
Laboratory Use Only								Analysis Requested							
CUSTODY SEAL		COOLER TEMPERATURES		COOLER TEMPERATURES										Regulatory Requirements (Specify)	
Present	Intact	9, 8, 9													
COOLING MEDIA PRESENT Y / N															
SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM															
SAMPLE IDENTIFICATION		DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	RCAP-MS (Total Metals) Well / Surface water	RCAP-MS (Dissolved Metals) Ground waters	Total Digest (Default Method) for well water & surface water	Dissolved for ground water	Mercury (CIRCLE) TOTAL / DISSOLVED	Metals (Water)	Metals (Soil)	Regulatory Requirements (Specify)
1	08GW-95	19/09/23	/	GW	5	Y	N						X	X	PH, TSS, SALINITY-NORM
2	09GW-102	19/09/23	/	GW	5	Y	N						X	X	" " " "
3	19GW-118	19/09/23	/	GW	5	Y	N						X	X	" " " "
4	19GW-120	19/09/23	/	GW	5	Y	N						X	X	" " " "
5	19GW-122	19/09/23	/	GW	5	Y	N						X	X	" " " "
6	19GW-124	19/09/23	/	GW	5	Y	N						X	X	" " " "
7	QA/QC-1	19/09/23	/	GW	5	Y	N						X	X	" " " "
8															
9															
10															
RELINQUISHED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)		DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #							
<i>[Signature]</i>		19/09/23	5:03	<i>[Signature]</i>				B9Q9518							

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](http://www.maxxam.ca/terms)

White: Maxxam

Pink: Client







Your P.O. #: 73517254  
 Your Project #: 11198639-06  
 Site Location: BELLEDUNE SMELTER  
 Your C.O.C. #: D34692

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/02**  
 Report #: R5904731  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9R0928**  
**Received: 2019/09/25, 09:58**

Sample Matrix: Solid  
 # Samples Received: 10

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Asbestos by PLM - 0.5 RDL (1, 2)	10	N/A	N/A	COR3SOP-00002	EPA 600R-93/116

**Remarks:**  
 Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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. When sampling is not conducted by BV Labs, results relate to the supplied samples tested. This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Bureau Veritas Laboratories' Asbestos Laboratory is accredited by NVLAP for bulk asbestos analysis by polarized light microscopy, NVLAP Code 600163-0.

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Bureau Veritas Laboratories' scope of accreditation includes EPA-600/M4-82-020: "Interim Method for the Determination of Asbestos in Bulk Insulation Samples" and EPA-600/R-93/116: "Method for the Determination of Asbestos in Bulk Building Materials".

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 Bureau Veritas Laboratories Mississauga
- (2) P.O.B. - Percent of Bulk

When Asbestos data is reported with other data, this report contains data that are not covered by the NVLAP accreditation.



Your P.O. #: 73517254  
Your Project #: 11198639-06  
Site Location: BELLEDUNE SMELTER  
Your C.O.C. #: D34692

**Attention: Troy Small**

GHD Limited  
466 Hodgson Rd  
Fredericton , NB  
CANADA E3C 2G5

**Report Date: 2019/10/02**  
Report #: R5904731  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9R0928**

**Received: 2019/09/25, 09:58**

Encryption Key



Bureau Veritas Laboratories  
02 Oct 2019 16:12:48

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Heather Macumber, Senior Project Manager  
Email: Heather.MACUMBER@bvlabs.com  
Phone# (902)420-0203 Ext:226

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This report has been generated and distributed using a secure automated process.  
BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



BV Labs Job #: B9R0928  
 Report Date: 2019/10/02

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE SMELTER  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### Asbestos Analytical Results

EPA/600R-93/116 by Polarized Light Microscopy

<b>19ACM-1</b>						
BV Labs ID: KWV424		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	50	Homogeneous beige fibrous material	Not Detected		Fibrous Glass 75%	Perlite Non-Fibrous
Layer 2	50	Homogeneous grey cementitious material	<b>Chrysotile</b>	12%		Non-Fibrous

<b>19ACM-2</b>						
BV Labs ID: KWV425		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	100	Homogeneous grey cementitious material	<b>Chrysotile</b>	55%		Non-Fibrous

<b>19ACM-3</b>						
BV Labs ID: KWV426		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	100	Homogeneous beige rubbery material	Not Detected			Non-Fibrous
		<b>Comment:</b> fibrous glass present.				

The limit of quantitation is 0.50%, although asbestos may be qualitatively detected at concentrations less than 0.50%. Samples for which asbestos is detected at <0.50% are reported as trace, "<0.50%". "Not Detected" indicates that no asbestos fibres were observed.

Calibrated Visual Estimate (%)  
 Date Format : yyyy/mm/dd





BV Labs Job #: B9R0928  
 Report Date: 2019/10/02

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE SMELTER  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### Asbestos Analytical Results

EPA/600R-93/116 by Polarized Light Microscopy

<b>19ACM-4</b>						
BV Labs ID: KVV427						
		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>	<u>Other Fibres</u>	<u>Particulate</u>	
Layer 1	100	Homogeneous grey cementitious material	Not Detected		Non-Fibrous	

<b>19ACM-5</b>						
BV Labs ID: KVV428						
		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>	<u>Other Fibres</u>	<u>Particulate</u>	
Layer 1	100	Homogeneous beige fibrous material	<b>Amosite</b> 85%		Non-Fibrous	

<b>19ACM-6</b>						
BV Labs ID: KVV429						
		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>	<u>Other Fibres</u>	<u>Particulate</u>	
Layer 1	100	Homogeneous white insulation	Not Detected	Cellulose 15% Glass Fibres 5%	Non-Fibrous	

<b>19ACM-7</b>						
BV Labs ID: KVV430						
		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>	<u>Other Fibres</u>	<u>Particulate</u>	
Layer 1	100	Homogeneous beige cementitious material	Not Detected	Fibrous Glass 15%	Non-Fibrous	

The limit of quantitation is 0.50%, although asbestos may be qualitatively detected at concentrations less than 0.50%. Samples for which asbestos is detected at <0.50% are reported as trace, "<0.50%". "Not Detected" indicates that no asbestos fibres were observed.

Calibrated Visual Estimate (%)  
 Date Format : yyyy/mm/dd



BV Labs Job #: B9R0928  
 Report Date: 2019/10/02

GHD Limited  
 Client Project #: 11198639-06  
 Site Location: BELLEDUNE SMELTER  
 Your P.O. #: 73517254  
 Sampler Initials: JR

### Asbestos Analytical Results

EPA/600R-93/116 by Polarized Light Microscopy

<b>19ACM-8</b>						
BV Labs ID: KWV431		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	100	Homogeneous white insulation	<b>Chrysotile</b>	12%		Non-Fibrous

<b>19ACM-9</b>						
BV Labs ID: KWV432		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	100	Homogeneous grey cementitious material	Not Detected		Fibrous Glass 10%	Non-Fibrous

<b>19ACM-10</b>						
BV Labs ID: KWV433		Date Analyzed: 2019/10/02				
	<u>P.O.B</u>	<u>Sample Morphology</u>	<u>Asbestos</u>		<u>Other Fibres</u>	<u>Particulate</u>
Layer 1	100	Homogeneous yellow foam	Not Detected			Foam Non-Fibrous

The limit of quantitation is 0.50%, although asbestos may be qualitatively detected at concentrations less than 0.50%. Samples for which asbestos is detected at <0.50% are reported as trace, "<0.50%". "Not Detected" indicates that no asbestos fibres were observed.

Calibrated Visual Estimate (%)  
 Date Format : yyyy/mm/dd



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VERITAS

BV Labs Job #: B9R0928

Report Date: 2019/10/02

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE SMELTER

Your P.O. #: 73517254

Sampler Initials: JR

### GENERAL COMMENTS

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

Package 1	15.0°C
Package 2	3.7°C
Package 3	16.0°C
Package 4	16.0°C
Package 5	15.7°C
Package 6	16.7°C

**Results relate only to the items tested.**



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VERITAS

BV Labs Job #: B9R0928

Report Date: 2019/10/02

GHD Limited

Client Project #: 11198639-06

Site Location: BELLEDUNE SMELTER

Your P.O. #: 73517254

Sampler Initials: JR

### VALIDATION SIGNATURE PAGE

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

A handwritten signature in black ink, appearing to read 'Banu Gurgun-Keough', written over a horizontal line.

Banu Gurgun-Keough, Supervisor

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CHAIN OF CUSTODY RECORD

COC #: **D34692** Page 1 of 1

<b>Invoice Information</b> Company Name: <u>GHD</u> Contact Name: <u>Tray Small - Charcie Babineau</u> Address: <u>466 Hodgson Rd</u> <u>Fredericton</u> Postal Code: <u>E3C 2G5</u> Phone: _____ Fax: _____ Email: <u>tray.small@ghd.com</u>		<b>Report Information (if differs from invoice)</b> Company Name: _____ Address: _____ Postal Code: _____ Phone: _____ Fax: _____ Email: <u>Charcie.Babineau@ghd.com</u>		<b>Project Information (where applicable)</b> Quotation #: _____ P.O. #: <u>73517254</u> Project #: <u>11198639-06</u> Site Location: <u>Bellefleur Smelter</u> Site #: _____ Sampled By: <u>JR - Cody</u>		<b>Turnaround Time (TAT) Required</b> <input checked="" type="checkbox"/> Regular TAT (5 business days) Most analyses PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS IF RUSH please specify date (Surcharges will be applied) DATE REQUIRED: _____	
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<b>Laboratory Use Only</b> CUSTODY SEAL: Present <input type="checkbox"/> Intact <input type="checkbox"/> COOLER TEMPERATURES: _____ COOLING MEDIA PRESENT Y / N: _____ SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM			<b>Analysis Requested</b> Metals (Water): _____ Metals (Soil): _____ PCBs: _____ VOCs: _____ Total Coliform/Leak Presence/Absence: _____ Total Coliform/Leak Count: _____ PLM For ACM: _____ HODD - DO NOT ANALYZE: _____ REGULATORY REQUIREMENTS (Specify): Shipped from FREDTON									
--	--	--	---	--	--	--	--	--	--	--	--	--

SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	NO. OF CONTAINERS SUBMITTED	FIELD FILTERED & PRESERVED	LAB FILTRATION REQUIRED	PCAP-MS (Total Metals) Well / Surface water	PCAP-MS (Dissolved Metals) Ground waters	Total Digest (Default Method) for well water & surface water	Dissolved for ground water	Mercury (CIRCLE) TOTAL / DISSOLVED	Metals & Mercury Default Acid Extractable (Available) Digest	Metals Total Digest for Ocean Sediment (HNO3)/H2O2/PCO4	Mercury low level by Cold Vapour AA	Hot Water Soluble Boron (required for COCAG Agricultural/Landfill)	RBGA Hydrocarbons (BTEX, C6-C11)	Hydrocarbons Soil (Total), NS Fuel Oil Spill Policy LOW Level BTEX, C6-C12	CONE Hydrocarbons (CVS-PHC F-1/BTEX F-1-F4)	NS Petroleum Water BTEX, VPM, Low Level T.E.H	PAHs (Default for water/soil)	PAHs (FWA), (CCME Sediment)	PCBs	VOCs	Total Coliform/Leak Presence/Absence	Total Coliform/Leak Count	PLM For ACM	HODD - DO NOT ANALYZE	COMMENTS	
																												1	19ACM-1
2	19ACM-2	2019/09/17	/	1																									PLM for ACM
3	19ACM-3	2019/09/17	/	1																									PLM for ACM
4	19ACM-4	2019/09/17	/	1																									PLM for ACM
5	19ACM-5	2019/09/17	/	1																									PLM for ACM
6	19ACM-6	2019/09/17	/	1																									PLM for ACM
7	19ACM-7	2019/09/17	/	1																									PLM for ACM
8	19ACM-8	2019/09/17	/	1																									PLM for ACM
9	19ACM-9	2019/09/17	/	1																									PLM for ACM
10	19ACM-10	2019/09/17	/	1																									PLM for ACM

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	MAXXAM JOB #
<u>Maria Ther.ault</u>	2019/09/21	9:47AM	<u>G.P. Smith</u>			<b>B9R0928</b>

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.

White: Maxxam

Pink: Client



Your P.O. #: 73517254  
 Your Project #: 11198639-06  
 Site Location: BELLEDUNE SMELTER  
 Your C.O.C. #: D 34695

**Attention: Troy Small**

GHD Limited  
 466 Hodgson Rd  
 Fredericton, NB  
 CANADA E3C 2G5

**Report Date: 2019/10/01**  
 Report #: R5902950  
 Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9381**  
**Received: 2019/09/25, 09:58**

Sample Matrix: Rock  
 # Samples Received: 2

Analyses	Quantity	Date	Date	Laboratory Method	Reference
		Extracted	Analyzed		
PCBs in Solid by GC/ECD (1)	2	2019/09/27	2019/10/01	ATL SOP 00105	EPA 8082A m
PCB Aroclor sum (solid)	2	N/A	2019/10/01	N/A	Auto Calc.

**Remarks:**  
 Bureau Veritas Laboratories are accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by BV Labs are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in BV Labs profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and BV Labs 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. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

BV Labs liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. BV Labs 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 BV Labs, unless otherwise agreed in writing. BV Labs is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

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. When sampling is not conducted by BV Labs, results relate to the supplied samples tested.

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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) Samples were analyzed for PCB using an accredited standard procedure modified for a non-standard matrix. Best laboratory practice and all routine QC procedures were employed. The accreditation does not extend to the matrix analyzed.



Your P.O. #: 73517254  
Your Project #: 11198639-06  
Site Location: BELLEDUNE SMELTER  
Your C.O.C. #: D 34695

**Attention: Troy Small**

GHD Limited  
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CANADA E3C 2G5

**Report Date: 2019/10/01**  
Report #: R5902950  
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**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: B9Q9381**

**Received: 2019/09/25, 09:58**

Encryption Key

Melissa DiPinto  
Project Manager  
01 Oct 2019 13:06:56

Please direct all questions regarding this Certificate of Analysis to your Project Manager.  
Heather Macumber, Senior Project Manager  
Email: Heather.MACUMBER@bvlabs.com  
Phone# (902)420-0203 Ext:226

=====  
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VERITAS

BV Labs Job #: B9Q9381  
Report Date: 2019/10/01

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE SMELTER  
Your P.O. #: 73517254  
Sampler Initials: JR

**POLYCHLORINATED BIPHENYLS BY GC-ECD (ROCK)**

BV Labs ID		KWN281	KWN282			KWN282		
Sampling Date		2019/09/18	2019/09/18			2019/09/18		
COC Number		D 34695	D 34695			D 34695		
	UNITS	19-CONCRETE-1	19-CONCRETE-2	RDL	QC Batch	19-CONCRETE-2 Lab-Dup	RDL	QC Batch
<b>PCBs</b>								
Aroclor 1016	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1221	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1232	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1248	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1242	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1254	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Aroclor 1260	mg/kg	<0.50	<0.50	0.50	6356857	<0.50	0.50	6356857
Calculated Total PCB	mg/kg	<0.50	<0.50	0.50	6353740			
<b>Surrogate Recovery (%)</b>								
Decachlorobiphenyl	%	94	94		6356857	92		6356857
RDL = Reportable Detection Limit QC Batch = Quality Control Batch Lab-Dup = Laboratory Initiated Duplicate								





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BV Labs Job #: B9Q9381

Report Date: 2019/10/01

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Site Location: BELLEDUNE SMELTER

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### GENERAL COMMENTS

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

Package 1	15.0°C
Package 2	3.7°C
Package 3	16.0°C
Package 4	16.0°C
Package 5	15.7°C
Package 6	16.7°C

**Results relate only to the items tested.**



BUREAU  
VERITAS

BV Labs Job #: B9Q9381  
Report Date: 2019/10/01

### QUALITY ASSURANCE REPORT

GHD Limited  
Client Project #: 11198639-06  
Site Location: BELLEDUNE SMELTER  
Your P.O. #: 73517254  
Sampler Initials: JR

QC Batch	Parameter	Date	Matrix Spike		SPIKED BLANK		Method Blank		RPD	
			% Recovery	QC Limits	% Recovery	QC Limits	Value	UNITS	Value (%)	QC Limits
6356857	Decachlorobiphenyl	2019/10/01	92 (1)	30 - 130	94	30 - 130	91	%		
6356857	Aroclor 1016	2019/10/01					<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1221	2019/10/01					<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1232	2019/10/01					<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1242	2019/10/01					<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1248	2019/10/01					<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1254	2019/10/01	101 (1)	30 - 130	98	30 - 130	<0.50	mg/kg	NC (2)	50
6356857	Aroclor 1260	2019/10/01					<0.50	mg/kg	NC (2)	50

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

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

Spiked Blank: A blank matrix 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 (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) Matrix Spike Parent ID [KWN282-01]

(2) Duplicate Parent ID [KWN282-01]



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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).

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Rosemarie MacDonald, Scientific Specialist (Organics)

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## about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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