☎ 877.635.1566 ✉ fundy@fundyeng.com www.fundyeng.com

Bio-Resources | Building Systems | Environmental | Geotechnical | Project Management

GEOTECHNICAL INVESTIGATION REPORT

BRIDGE STRUCTURE Q2-021

Route 258
New Glasgow
Prince Edward Island

Prepared for:

Prince Edward Island Department of
Transportation, Infrastructure, & Energy
PO Box 2000
Charlottetown, PE
C1A 7N8

Attn: Mr. Neil Lawless, *P.Eng.*

September 2019

Project No: 13982

FUNDY Engineering

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SAINT JOHN CHARLOTTETOWN HALIFAX

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PROFESSIONAL SEAL:

THE ASSOCIATION OF PROFEESIONAL ENGINEERS OF THE PROVINCE OF PRINCE EDWARD ISLAND
VALID FOR THE YEAR 2019

G. Alex Mouland
No. 1730

DATE: Sept. 24, 2019

LICENSED PROFESSIONAL ENGINEER
PROVINCE OF PRINCE EDWARD ISLAND

EXECUTIVE SUMMARY

Fundy Engineering & Consulting Ltd. (Fundy Engineering) was retained by the Prince Edward Island Department of Transportation, Infrastructure, & Energy (PEIDTIE) to undertake a geotechnical investigation at a bridge structure in New Glasgow, Prince Edward Island (PE). The site is identified as Bridge Structure Q2-021 and is located on Route 258 between Route 224 (New Glasgow Road) and Route 6 (Rustico Road). The existing structure at this location is a 2.5 m diameter corrugated steel pipe (CSP) culvert and the road surface to channel bottom depth is approximately 4.5 m.

The purpose of this geotechnical investigation was to obtain detailed information on the soil and bedrock conditions at the site and to provide recommendations for the foundation design of the proposed structure. This investigation consisted of four (4) boreholes in the proposed location of the new structure as instructed by PEIDTIE.

It is our understanding the existing CSP culvert will be removed and replaced with a 1.8 m diameter circular High-Density Poly-Ethylene (HDPE) highway culvert. The replacement culvert will be in the same location with the same alignment as existing, with an inlet invert elevation of 7.3 m, an outlet invert elevation of 6.4 m, and the road elevation will remain at 11.9 m. The bearing surface for the replacement structure's foundations will be Class A Gravel Fill founded on Till or Bedrock. The Reddish Brown Silty Sand and Gravel Till and/or Sandstone material are acceptable for use as a bearing stratum to support either a HDPE pipe culvert or a precast concrete box culvert. An allowable bearing capacity of 150 kPa may be used for foundation materials supported by the bearing materials.

At the request of PEIDTIE, six soil samples were submitted to AGAT Laboratories for analysis of petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs) and available metals (including mercury). An anion scan was also completed on all samples. Based on the analytical results, no parameters exceeded the applicable guideline values.

While every effort has been made to determine the geotechnical concerns pertaining to Bridge Structure Q2-021 in New Glasgow, PE, the discovery or development of additional geotechnical concerns cannot be precluded. Further investigation may reveal additional information that may influence the recommendations included herein. Should such information be discovered, Fundy Engineering should be notified so that any required amendments to our recommendations can be made.

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1.0 INTRODUCTION

Fundy Engineering was retained by the Prince Edward Island Department of Transportation, Infrastructure, & Energy (PEIDTIE) to undertake a geotechnical investigation at a bridge structure in New Glasgow, Prince Edward Island (PE). The site is identified as Bridge Structure Q2-021 and is located on Route 258 between Route 224 (New Glasgow Road) and Route 6 (Rustico Road), as shown in Figure 1. The existing structure at this location is a 2.5 m diameter corrugated steel pipe (CSP) culvert. The purpose of this geotechnical investigation was to obtain detailed information on the soil and bedrock conditions at the site and to provide recommendations for the foundation design for the construction of a new culvert structure. This investigation consisted of four (4) boreholes in the proposed location of the new structure as instructed by PEIDTIE.

1.1 SCOPE OF WORK COMPLETED

This following scope of work was performed by Fundy Engineering as part of this geotechnical investigation:

- Four (4) boreholes were drilled adjacent to the existing structure (Bridge Structure Q2-021). At the request of PEIDTIE, two boreholes were extended on the northeast side (Anglo Rustico approach) and two boreholes were on the southwest side (New Glasgow approach) of the existing structure.
- Representative soil samples were generally collected at 0.6 m intervals via a split spoon sampler. Approximately 3.0 m of bedrock was cored from two of the four boreholes to determine its structural properties and geological characteristics.
- Six (6) soil samples from various boreholes and depths (as requested by PEIDTIE) were collected and sent for laboratory analysis. These samples were analyzed for petroleum hydrocarbons (PHCs), polycyclic aromatic hydrocarbons (PAHs), available metals (including mercury) and an anion scan.
- A complete geotechnical report which includes factual findings, data collected over the course of the investigation and recommendations pertaining to the foundations for the culvert replacement structure and associated earthworks.

1.2 LIMITATIONS

The observations made and facts presented in this report are based on site visits carried out in September 2019. While every effort has been made to determine the geotechnical concerns pertaining to Bridge Structure Q2-021 in New Glasgow, PE, the discovery or development of additional geotechnical concerns cannot be precluded. Further investigation may reveal additional information that may influence the recommendations included herein. Should such information be revealed, Fundy Engineering should be notified in a timely fashion so that any required amendments to our recommendations can be made.

These results are reported confidentially to the client, who is advised to take appropriate action to rectify any areas of concern. No professional responsibility is assumed for the use or interpretation of these findings by others.

Figure 1. Project location map showing bridge structure Q2-021 located in New Glasgow, PE.

2.0 BACKGROUND

2.1 SITE DESCRIPTION AND LOCATION

Bridge Structure Q2-021 is located on Route 258 in New Glasgow, PE. The existing structure at this location is a 2.5 m diameter CSP culvert that conveys water below the roadway for a tributary to Hunter River, as shown in Figure 2. The proposed replacement structure is a 1.8 m diameter HDPE culvert to be situated in place of the existing culvert. The current roadway is located approximately 4.5 m above the channel's bottom.

Figure 2. Photograph of bridge structure Q2-021 (downstream side).

2.2 GEOTECHNICAL SETTING & TOPOGRAPHY

The bedrock geology of Prince Edward Island consists of relatively flat lying sedimentary deposits commonly referred to as the PEI Redbeds; a part of the Pictou Group that makes up a section of the Maritime Plane and lies within the Appalachian Mountain System. The PEI Redbeds can be broken down into four cyclic sequences generally comprised of conglomerate, sandstone and siltstone, from the Late Pennsylvanian to Early Permian ages (*i.e.,* formed 286 million years ago to 320 million years ago) which fine upward (*i.e.,* conglomerate at the base and siltstone at the top), with the oldest deposits found along the south shore of the island and the youngest found along the north shore. The PEI Redbeds generally dip 1 – 3 degrees towards the northeast. Bedrock in Prince Edward Island is generally covered by a thin drift of Ground Moraine or Basal Till with occurrences of Residual, Ablation Till, and minor Glaciofluvial and Marine Deposits. Basal Till, which covers approximately 75% of the province, are often local in origin and can generally be described as reddish brown, strongly acidic, and compact to dense soils further defined by their clay and silt content (Soils of Prince Edward Island. 1988. Agriculture Canada Research Branch).

An initial review of available soils information for the area revealed that the natural surficial deposits identified in the vicinity of the bridge structure comprise of clay-sand phase till (Surficial Deposits of Prince Edward Island. 1973. Geological Survey of Canada. Map 1366A).

The roadway is relatively level over the existing bridge structure with minor grading to direct surface water towards either side of the roadway. The general topography of the area surrounding the bridge structure slopes down to the northwest towards Hunter River (Figure 3).

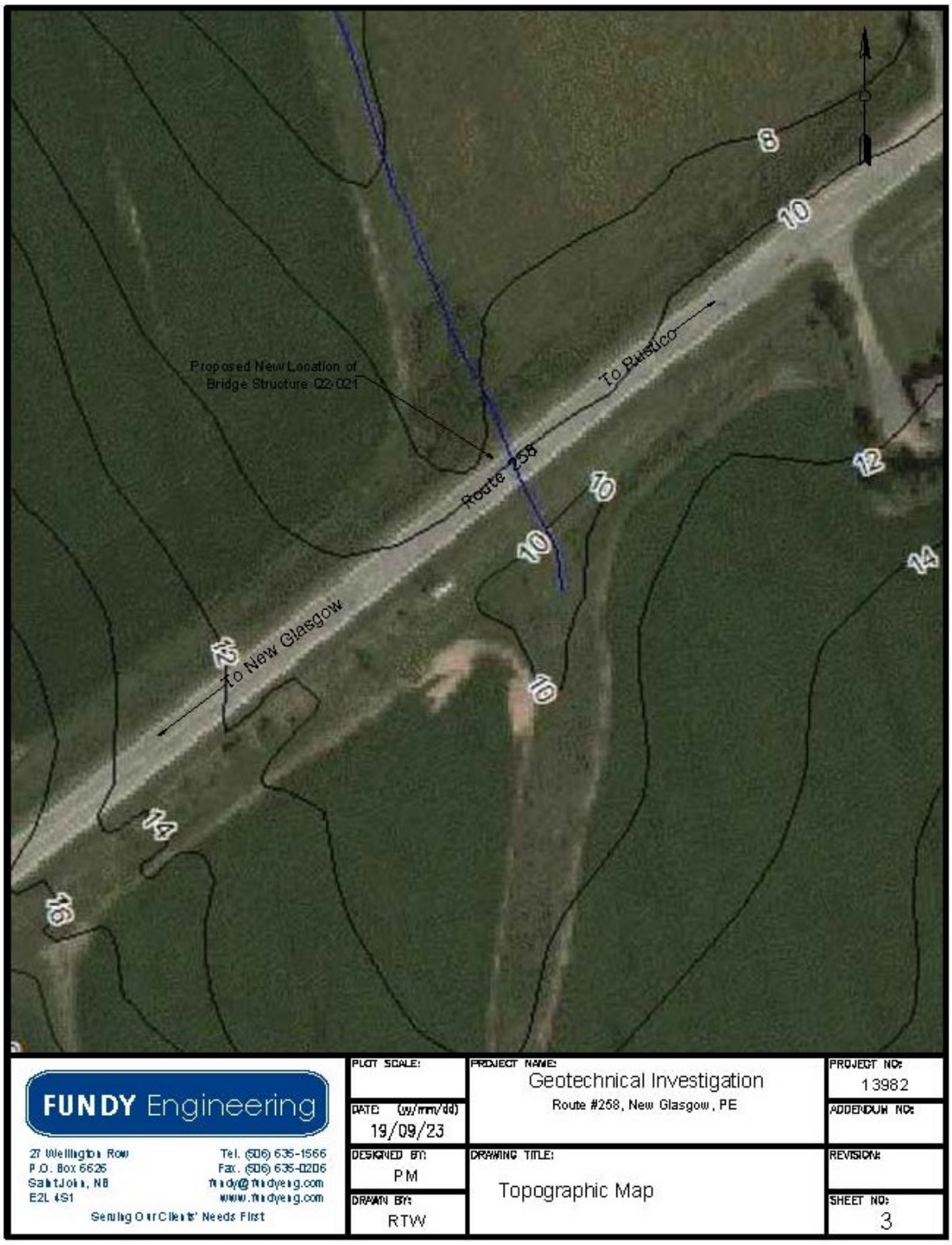


Figure 3. Aerial photograph with 2 m contour lines depicting the topography of the area.

3.0 SITE WORK COMPLETED

3.1 BOREHOLE INVESTIGATION

A geotechnical borehole investigation was completed at Bridge Structure Q2-021 to collect information pertaining to the soils and bedrock in the project area. On September 4 and 5, 2019, four (4) boreholes were drilled to obtain such information using a track-mounted drill rig provided by Lantech Drilling Services under the direction of Rob Haineault, *P.Eng.*, and Patrick MacDonald, *EIT*, of Fundy Engineering. Split spoon samples of the overburden soils were generally collected in 0.6 m intervals to obtain an understanding of the soil depths and stratigraphy. Approximately 3.0 m of bedrock was cored in boreholes BH2 and BH3 to determine its structural characteristics and geotechnical properties. Two boreholes were drilled on each side of the existing structure, all of which were approximately 2.0 m from the back of the existing structure, as depicted in Figure 4.

3.2 SOILS

Soils encountered can generally be described as Compact Reddish Brown Silty Sand and Gravel/Sandstone Fill overlying Loose Brown to Reddish Brown Silty Sand with Organics which overlays Compact Reddish Brown Silty Sand and Gravel Till. Reddish Brown Sandstone was identified below the Till layer in boreholes that were drilled for rock core samples. Asphalt and Reddish Brown Sand & Gravel Fill associated with roadway construction were identified at the surface in all of the boreholes. A summary of the findings of the borehole investigation is included in Table 1. Further details of the soils encountered in this geotechnical investigation can be found in the borehole logs that are appended to this report (Appendix II).

Table 1-Summary of the investigation with critical depths.

Borehole (Location from Existing Structure)	Compact Reddish Brown Silty Sand and Gravel Till (m)	Inferred Bedrock Surface (m)	Groundwater (m)
BH1 (2 m southwest of existing structure)	5.49	N/A	5.49
BH2 (2 m northeast of existing structure)	4.27	13.7	5.49
BH3 (2 m southwest of existing structure)	5.49	13.7	5.49
BH4 (2 m northeast of existing structure)	4.27	N/A	N/A

3.3 BEDROCK

Bedrock was identified as Very Poor to Excellent Reddish Brown Sandstone. Recoveries ranged from 60-69% and 93-97% for the bedrock core samples from boreholes BH2 and BH3, respectively. The rock quality designation (RQD) values ranged from 0-22% (BH2) and 75-91% (BH3).

3.4 GROUNDWATER

Groundwater was identified at a depth of 5.49 m in boreholes BH1 to BH3 and was not encountered in BH4 (although the last soil sample collected from BH4 was moist, likely indicating nearby groundwater). Note that tidal effects, seasonal conditions, and precipitation events will have some effects on these measured depths and hence these depths do not represent a referenced high water mark or regional groundwater table elevation.

Figure 4. Site plan of bridge structure Q2-021 showing the borehole locations.

4.0 CHEMICAL ANALYSIS

A total of six (6) soil samples were collected from various depths in each of the boreholes as requested by PEIDTIE, and sent to AGAT Laboratories in Dartmouth, NS, for analysis of PHC and PAH parameters and available metals (including mercury). An anion scan was also completed for each sample. All laboratory certificates have been included in Appendix III.

4.1 PETROLEUM HYDROCARBONS

Based on the sample analyses, all of the soil samples were found to have PHC concentrations that were below the allowable Atlantic Risk Based Corrective Action (RBCA) Tier I criteria for a residential and commercial property with coarse-grained soils and a potable water source. The soil sample analytical results and the evaluation criteria for both residential and commercial sites are shown below in Table 2.

Table 2. Summary of the PHC analytical results.

Sample ID	Depth (m)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylene (mg/kg)	TPH (mg/kg)	Resemblance
BH1-1	**3.66**	<0.03	<0.04	<0.03	<0.05	<20	Lube Range
BH1-2	**5.49**	<0.03	<0.04	<0.03	<0.05	<20	No Resemblance
BH2	**1.83**	<0.03	<0.04	<0.03	<0.05	<20	No Resemblance
BH3	**1.83**	<0.03	<0.04	<0.03	<0.05	<20	No Resemblance
BH4-1	**3.66**	<0.03	<0.04	<0.03	<0.05	<20	No Resemblance
BH4-2	**5.49**	<0.03	<0.04	<0.03	<0.05	<20	No Resemblance
Atlantic RBCA Tier I Criteria	Residential, Potable	**0.042**	**0.35**	**0.043**	**0.73**	**1,100**	
	Commercial, Potable	**0.042**	**0.35**	**0.043**	**0.73**	**10,000**	

4.2 POLYCYCLIC AROMATIC HYDROCARBONS

All of the soil samples analyzed in this investigation were found to have PAH concentrations below the recommended Canadian Council of Ministers of the Environment (CCME) Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health criteria for a residential property. The results of this analysis are included below in Tables 3 and 4 with the relevant CCME guidelines.

Table 3. Summary of the PAH analytical results (carcinogenic) for human health criteria (dermal contact).

Sample ID	BH1-1	BH1-2	BH2	BH3	BH4-1	BH4-2	CCME Canadian Soil Quality Guidelines
Depth (m)	3.66	5.49	1.83	1.83	3.66	5.49	
Benzo(a)anthracene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Benzo(a)pyrene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Benzo(b, b+j)fluoranthene	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	-
Benzo(ghi)perylene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Benzo(k)fluoranthene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Chrysene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
Dibenzo(a,h)anthracene (mg/kg)	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	-
Indeno(1,2,3)pyrene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-
B[a]P TPE Concentration	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	5.3

Table 4. Summary of the PAH analytical results for environmental health criteria (non-carcinogenic effects).

Sample ID	BH1-1	BH1-2	BH2	BH3	BH4-1	BH4-2	CCME Canadian Soil Quality Guidelines	
Depth (m)	3.66	5.49	1.83	1.83	3.66	5.49	Residential	Commercial
Anthracene (mg/kg)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	2.5	32
Benzo(a)anthracene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	20	72
Benzo(a)pyrene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	50	180
Benzo(b)flouroanthene (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.013	0.013
Benzo(b+j)fluoranthene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	10
Benzo(k)fluoranthene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.046	0.046
Dibenzo(a,h)anthracene (mg/kg)	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	0.1	10
Fluoranthene (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	10

Indeno(1,2,3)pyrene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	10
Naphthalene (mg/kg)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.1	10
Phenanthrene (mg/kg)	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.1	10
Pyrene (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	10

4.3 TRACE METALS

All of the soil samples analyzed in this investigation were found to have trace metals concentrations that are below the CCME Canadian Soil Quality Guidelines for the Protection of the Environment and Human Health. The results from the analysis are shown below in Table 5 with the evaluation criteria for both residential and commercial properties.

Table 5. Summary of the metal analytical results (units in mg/kg).

Sample ID	BH1-1	BH1-2	BH2	BH3	BH4-1	BH4-2	CCME Canadian Soil Quality Guidelines	
Depth (m)	3.66	5.49	1.83	1.83	3.66	5.49	Residential (mg/kg)	Commercial (mg/kg)
Aluminum	4780	5950	5580	6160	4860	6270	NRL*	NRL
Antimony	<1	<1	<1	<1	<1	<1	20	40
Arsenic	5	9	6	6	5	4	12	12
Barium	23	75	35	34	26	45	500	2000
Beryllium	<2	<2	<2	<2	<2	<2	4	8
Boron	3	3	4	5	3	4	NRL	NRL
Cadmium	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	10	22
Chromium	20	24	24	28	25	21	64	87
Cobalt	8	8	1	1	9	9	50	300
Copper	14	7	13	16	12	12	63	91
Iron	7720	14100	8220	9380	7230	9760	NRL	NRL
Lead	8.4	5.1	8.4	9.8	8.1	7.6	140	260
Lithium	28	17	36	38	31	30	NRL	NRL
Manganese	225	432	262	286	240	340	NRL	NRL

Mercury	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	**6.6**	**24**
Molybdenum	<2	<2	<2	<2	<2	<2	**10**	**40**
Nickel	18	18	25	26	21	22	**45**	**89**
Selenium	<1	<1	<1	<1	<1	<1	**1**	**2.9**
Silver	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**20**	**40**
Strontium	6	10	7	8	8	9	**NRL**	**NRL**
Thallium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**1**	**1**
Tin	3	3	<2	3	3	3	**50**	**300**
Uranium	0.6	1.7	0.8	0.9	0.7	0.6	**23**	**33**
Vanadium	21	36	26	29	23	20	**130**	**130**
Zinc	40	30	48	52	41	42	**250**	**410**

*NRL - No Recommended Level

4.4 ANION SCAN

At the request of the client, an anion scan was completed on all six samples collected as shown in Table 6.

Table 6. Summary of results for the anion scan.

Sample ID	BH1-1	BH1-2	BH2	BH3	BH4-1	BH4-2
Depth (m)	**3.66**	**5.49**	**1.83**	**1.83**	**3.66**	**5.49**
Bromide (ug/g)	<1	<1	<1	<1	<1	<1
Chloride (ug/g)	12	89	5	6	13	6
Fluoride (ug/g)	<1	<1	<1	<1	<1	<1
Nitrate (ug/g)	<1	<1	<1	<1	<1	<1
Nitrite (ug/g)	<1	<1	<1	<1	<1	<1
Phosphate (ug/g)	<2	<2	<2	<2	<2	<2
Sulphate (ug/g)	6	5	9	7	5	2

5.0 RECOMMENDATIONS

5.1 GENERAL

It is our understanding that the existing structure will be removed and replaced with a 1.8 m diameter HDPE highway culvert. The replacement culvert will be in the same location with the same alignment as existing, with an inlet invert elevation of 7.3 m, an outlet invert elevation of 6.4 m, and road elevation of 11.9 m. The following recommendations have been developed for the foundation design and earthworks for the re-construction of Bridge Structure Q2-021.

5.2 IN-SITU BEARING MATERIALS

The Reddish Brown Silty Sand and Gravel Till and/or the Sandstone material are acceptable for use as a bearing stratum to support either a HDPE pipe culvert or a precast concrete box culvert. A minimum of 450 mm of Class A Gravel is recommended to be placed on the above noted insitu bearing soils to the underside of the culvert structure. An allowable bearing capacity of 150 kPa may be used for foundation design for footings supported by the undisturbed Till material.

It is anticipated that maximum total and differential settlements under the proposed loads would be less than 25 mm and 15 mm, respectively. The allowable bearing capacity provided is based on the HDPE or concrete box culvert having a minimum width of 600 mm.

Once the site is excavated to subgrade depth, the bearing surface should be inspected by a Geotechnical Engineer.

Pumping of groundwater from the project area will be required to allow for the excavation and inspection of the subgrade surface.

5.3 BACKFILLING

Once the footings and replacement structure have been installed, the excavation should be backfilled with Structural Fill consisting of an approved material which is free from Organics and deleterious materials. Fill material meeting the current PEIDTIE specifications for Select Borrow would be acceptable as backfill material. Drainage gravel may be required for use as backfill if the water elevation in the stream cannot be controlled and maintained until the prescribed Structural Fills have been placed.

Filter fabric or an alternative means of filtration should be used in all areas where drainage gravel transitions to surrounding soils to prevent the migration of fines into the void space of the drainage gravel.

All Structural Fill placed as backfill is to be compacted in lifts to 98% of its Standard Proctor Density at optimum moisture content to an elevation that will enable roadway construction as prescribed below. During the backfilling of the replacement structure, both sides of the structure should be backfilled in subsequent lifts, as opposed to backfilling the structure one side at a time. The lift thickness must be compatible with the compaction equipment used. A maximum lift thickness of 300 mm is recommended for Structural Fill material placed as backfill.

It is recommended that the placement of Structural Fills be monitored by a Geotechnical Engineer.

All backfilled areas should be protected from scour with rip rap.

5.4 ROADWAY RE-CONSTRUCTION

All approaches constructed on existing soils will require the placement of Structural Fill as prescribed below. The bearing surfaces (*i.e.*, existing or placed Fill Materials) below the bridge approaches should be inspected and proof rolled under the direction of a geotechnical engineer prior to proceeding with the placement of roadway granular sub-base and base layers. Any suspect (*i.e.,* soft, saturated, or deformable) areas are to be removed and replaced to the sub-grade level with an approved Structural Fill, compacted to a minimum of 100% of its Standard Proctor maximum dry density at optimum moisture content. An effort should be made to control surface water and direct it away from the approach subgrade materials prior to the placement of roadway granular sub-base and base materials. The following specifications are recommended for the re-construction of the roadway cross section:

Specifications for Roadway Re-Construction

Asphalt B Seal	50 mm
Asphalt A Base	100 mm
Granular Base - Class A Gravel	300 mm
Granular Sub-Base - Select Borrow	450 mm

The above materials should comply with the present PEIDTIE specifications. The granular sub-base and base layers should be compacted to 100% of their Standard Proctor maximum dry densities. It is recommended that the granular sub-base and base materials be placed in lifts no larger than 300 mm thick. Asphalt A Base should be placed and compacted in two lifts.

5.5 SEDIMENT CONTROL

Sediment control is recommended around the area where excavations and construction activities are to occur to prevent fine soil particles from exiting the project area, as this may have a negative impact on the surrounding aquatic habitat.

5.6 SEISMIC SITE CLASSIFICATION

Based on Table 4.1.8.4.A Site Classification for Seismic Site Response in the 2015 edition of the National Building Code of Canada and a review of the soil and bedrock information, the Site Classification for the project area is "D".

6.0 CONCLUSIONS AND CLOSING REMARKS

The purpose of this geotechnical investigation was to determine the properties of the soils and bedrock within the project area and to provide geotechnical design parameters to facilitate the foundation design for the replacement of Bridge Structure Q2-021 located on Route 258 in New Glasgow, PE. The geotechnical investigation consisted of four (4) boreholes placed adjacent to the existing culvert structure. It is our understanding that the existing structure will be removed and replaced with a 1.8 m diameter HDPE highway culvert.

The Reddish Brown Silty Sand and Gravel Till and/or Sandstone material are acceptable for use as a bearing stratum to support either a HDPE pipe culvert or a precast concrete box culvert. An allowable bearing capacity of 150 kPa may be used for foundation design for footings supported by the undisturbed material.

Once the footings and replacement structure have been installed, the excavation should be backfilled with Structural Fill consisting of an approved material which is free from Organics and deleterious materials. Fill material meeting the current PEIDTIE specifications for Select Borrow would be acceptable as backfill material. Drainage gravel may be required for use as backfill if the water elevation in the stream cannot be controlled and maintained until the prescribed Structural Fills have been placed.

We trust this is sufficient for your present needs, please feel free to contact the undersigned for any additional information or clarification that may be required. This report has been prepared by Patrick MacDonald, *EIT,* and reviewed by Alex Mouland, *P.Eng., PMP*.

Sincerely,
Fundy Engineering & Consulting Ltd.

Mr. Alex Mouland, *P.Eng., PMP*
Fundy Engineering &Consulting Ltd.

APPENDIX I

SYMBOLS AND TERMS

FUNDY ENGINEERING SYMBOLS AND TERMS
Borehole, Test Pit, and Monitoring Well Logs

SOIL DESCRIPTION

Behavioural properties (i.e. plasticity, permeability) take precedence over particle gradation in describing soils.

Terminology describing soil structure:

Desiccated.....having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured..... having cracks, and hence a blocky structure
Varved..... .....composed of regular alternating layers of silt and clay
Stratified.....composed of alternating layers of different soil types, e.g. silt and sand or silt and clay
Well Graded.....having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded.....predominantly of one grain size

Terminology used for describing soil strata based upon the proportion of individual particle sizes present:

Trace, or occasional.....less than 10%
Some.....10-20%
Adjective (e.g. silty or sandy).....20-35%
And (e.g. silt or sand.....35-50%

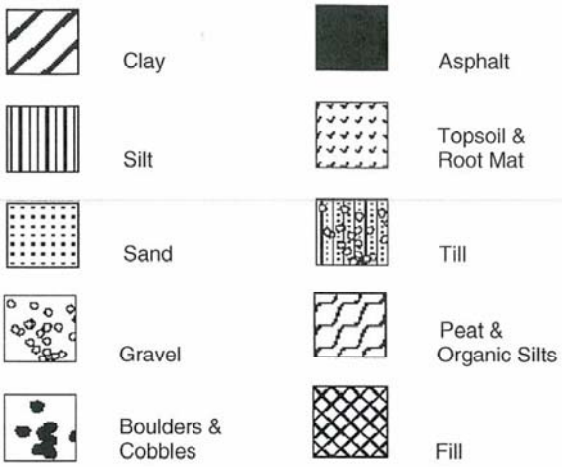
The standard terminology to describe cohesionless soils includes the relative density, as determined by laboratory test or by the Standard Penetration Test 'N' - value: the number of blows of 140 pound (64kg) hammer falling 30 inches (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil.

RELATIVE DENSITY	N' VALUE	RELATIVE DENSITY %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

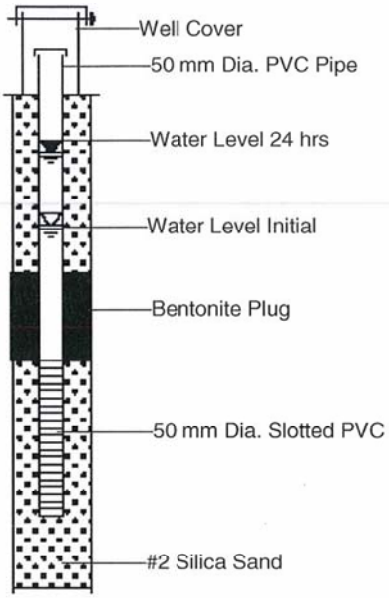
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by insitu vane tests, penetrometer test, unconfined compression tests, or occasionally by standard penetration tests.

CONSISTENCY	UNDRAINED SHEAR STRENGTH		'N' VALUE
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25-0.5	12.5-25	2-4
Firm	0.5-1.0	25-50	4-8
Stiff	1.0-2.0	50-100	8-15
Very Stiff	2.0-4.0	100-200	15-30
Hard	>4.0	>200	>30

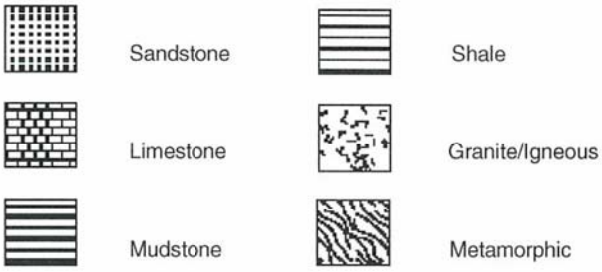
SOILS GRAPHIC LEGEND



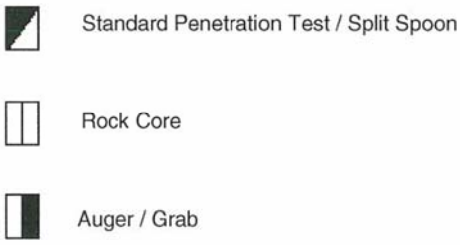
MONITORING WELL SCHEMATIC



BEDROCK GRAPHIC LEGEND



SAMPLER SYMBOLS



LABORATORY TESTS

MC	Moisture Content	P	Field Permeability	CD	Consolidation Drained Triaxial
SG	Specific Gravity	PF	Permeability Falling Head	CU	Consolidation Undrained Triaxial
HA	Hydrometer Analysis	PC	Permeability Constant Head	UU	Unconsolidated Undrained Triaxial
SA	Sieve Analysis	PR	Proctor	DS	Direct Shear

BEDROCK DESCRIPTION

The description of bedrock is based on the rock quality designation (RQD).

The classification is based on a modified core recovery percentage in which all pieces of sound core over 100mm long are expressed as a percentage of total recovery. The small pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. In most cases RQD is measured on NXL core.

RQD	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

FUNDY Engineering

APPENDIX II

BOREHOLE LOGS

FUNDY Engineering

BOREHOLE LOG
No. BH-1

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982
CLIENT: Department of Transportation, Infrastructure and Energy
PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 12.009 m Geodetic
DRILLING CONTRACTOR: Lantech Drilling Services
LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland
DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 4, 2019
DEPTH TO - WATER> INITIAL: ▽ 5.49 m **AFTER 24 HOURS:** ▽ **CAVING>**

Depth (meters)	Depth (feet)	Description	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
0	0	Asphalt								
		11.909								
		Compact Asphalt over Reddish Brown Silty Sand and Gravel Fill				25	--13-11-9 (24)			
		11.399								
0.75	3	Compact to Very Loose Reddish Brown Silty Sand and Gravel Fill with Sandstone				31	11-12-10-8 (22)			
1.5						61	8-6-7-11 (13)			
	6	10.179								
		Compact Reddish Brown Silty Sand and Gravel Till with Trace Brown Sandstone				61	13-12-15-12 (27)			
2.25										
	9					61	9-9-6-7 (15)			
3						25	7-2-1-3 (3)			
3.75	12									
		8.059				8	6-12-7-6 (19)			
		Very Poor Brown Mudstone								
		7.979								
4.5	15	Compact to Loose Reddish Brown Silty Sand Till with Gravel (Moist)				14	3-2-3-4 (5)			
		7.539								
		Loose to Compact Brown Silty Sand with Organics				20	4-6-7-11 (13)			
5.25	18	▽ 6.519								
		Compact Reddish Brown Silty Sand Till with Gravel				61	5-12-12-12 (24)			
6										
		Boring terminated at 6.1 m.								

TEST RESULTS SUMMARY

Bedrock Core Recovery (%) ⌖
RQD (%) ▲
Plastic Limit ⊢ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

BOREHOLE LOG
No. BH-2

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982
CLIENT: Department of Transportation, Infrastructure and Energy
PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 11.822 m Geodetic
DRILLING CONTRACTOR: Lantech Drilling Services
LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland
DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 4, 2019
DEPTH TO - WATER> INITIAL: ▽ 5.49 m **AFTER 24 HOURS:** ▽ **CAVING>**

Depth (meters)	Depth (feet)	Description	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
0	0	Asphalt								
		11.722								
		Compact Asphalt over Reddish Brown Sandy Gravel Fill				30	--12-14-8 (26)			
		11.212								
1	4	Compact to Dense Reddish Brown Silty Sand and Sandstone Fill				43	7-10-14-14 (24)			
						61	7-8-9-12 (17)			
2	8					61	12-17-13-11 (30)			
						30	8-8-7-6 (15)			
3		8.772								
	12	Loose to Very Loose Brown Silty Sand and Gravel with Trace Organics (Moist)				52	4-3-3-4 (6)			
4						61	3-2-2-2 (4)			
		7.552								
		Compact Reddish Brown Silty Sand and Gravel Till				61	5-11-11-7 (22)			
5	16	▽				45	5-7-5-7 (12)			
						45	5-14-12-17 (26)			
6		5.882								
	20	Compact Reddish Brown Silty Sand Till with Reddish Brown Sandstone				55	7-14-10-12 (24)			
7						61	12-11-13-19 (24)			
	24									
8						49	6-6-11-10 (17)			

TEST RESULTS SUMMARY

Bedrock Core Recovery (%) ⌖
RQD (%) ▲
Plastic Limit ⊢ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

BOREHOLE LOG
No. BH-2

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982

CLIENT: Department of Transportation, Infrastructure and Energy

PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 11.822 m Geodetic

DRILLING CONTRACTOR: Lantech Drilling Services

LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland

DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 4, 2019

DEPTH TO - WATER> INITIAL: ▽ 5.49 m **AFTER 24 HOURS:** ▽ **CAVING>**

Depth (meters)	Depth (feet)	Description	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
9	28					50	10-13-15-17 (28)			
	32					58	5-19-24-23 (43)			
10										
11	36					48	8-9-11-14 (20)			
12	40					39	7-14-30-34 (44)			
13	44									
		-1.888 Very Poor Reddish Brown Sandstone				0				
14						90		22		
15	48									
		-3.418 Very Poor Reddish Brown Sandstone				103		0		
16	52									
		Boring terminated at 16.76 m.								

TEST RESULTS SUMMARY

Bedrock Core Recovery (%) ⌖
RQD (%) ▲
Plastic Limit ⊢ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

BOREHOLE LOG
No. BH-3

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982
CLIENT: Department of Transportation, Infrastructure and Energy
PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 11.960 m Geodetic
DRILLING CONTRACTOR: Lantech Drilling Services
LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland
DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 5, 2019
DEPTH TO - WATER> INITIAL: ▽ 5.49 m **AFTER 24 HOURS:** ▽ **CAVING>**

Depth (meters)	Depth (feet)	Description	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
0	0	Asphalt								
		11.860								
		Compact Grey Asphalt and Gravel Fill				8	--13-13-12 (26)			
		11.780								
1	4	Compact Reddish Brown Silty Sand Fill with Gravel				46	8-11-10-10 (21)			
						37	8-10-11-7 (21)			
2						61	11-11-14-14 (25)			
	8	9.520								
		Compact Reddish Brown Silty Sand Fill with Gravel and Trace Organics				44	7-8-6-6 (14)			
3		8.910								
		Loose Reddish Brown Silty Sand with Sandstone (Moist)				25	3-2-2-3 (4)			
	12	8.300								
4		Very Loose to Compact Reddish Brown Silty Sand with Trace Gravel				35	2-1-2-1 (3)			
						23	2-1-2-3 (3)			
5	16					35	4-5-8-4 (13)			
		▽				61	7-8-12-12 (20)			
6	20	5.860								
		Compact Reddish Brown Silty Sand and Gravel Till				52	6-7-12-12 (19)			
7	24									
8						47	11-8-7-10 (15)			

TEST RESULTS SUMMARY

Bedrock Core Recovery (%) ⌖
RQD (%) ▲
Plastic Limit ⊢ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

BOREHOLE LOG
No. BH-3

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982

CLIENT: Department of Transportation, Infrastructure and Energy

PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 11.960 m Geodetic

DRILLING CONTRACTOR: Lantech Drilling Services

LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland

DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 5, 2019

DEPTH TO - WATER> INITIAL: ▽ 5.49 m **AFTER 24 HOURS:** ▽ **CAVING>**

Depth (meters)	Depth (feet)	Description	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
9	28									
						20	8-9-9-9 (18)			
10	32									
		1.290								
11	36	Compact Reddish Brown Silty Sand and Gravel Till with Reddish Brown Sandstone				29	7-8-11-11 (19)			
12	40	**-0.230**								
		Compact to Very Dense Reddish Brown Silty Sand and Gravel Till with Trace Grey Sandstone				37	7-9-12-13 (21)			
13	44									
		-1.750								
14		Excellent Reddish Brown Sandstone				140		91.2		
	48									
15		**-3.280**								
		Fair Reddish Brown Sandstone				146		74.8		
16	52									
		Boring terminated at 16.76 m.								

TEST RESULTS SUMMARY

Bedrock Core Recovery (%) ⌖
RQD (%) ▲
Plastic Limit ⊢ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

FUNDY Engineering

BOREHOLE LOG
No. BH-4

PROJECT: New Glasgow Bridge Q2-021 **PROJECT NO.:** 13982

CLIENT: Department of Transportation, Infrastructure and Energy

PROJECT LOCATION: Route 258, New Glasgow, PE **ELEVATION:** 11.799 Geodetic

DRILLING CONTRACTOR: Lantech Drilling Services

LOGGED BY: Patrick MacDonald **CHECKED BY:** Al Mouland

DRILLING METHOD: Track-mounted Drill **DATE:** Sept. 5, 2019

DEPTH TO - WATER> INITIAL: N/A **AFTER 24 HOURS:** **CAVING>**

Depth (meters)	Depth (feet)	Description	Elevation	Graphic	Sample Type	Sample No.	Sample Rec. (cm)	Blow Counts (N value)	RQD (%)	Bedrock Compressive Strength (MPa)	% < #200
0	0	Asphalt									
		Compact Asphalt over Reddish Brown Sand and Gravel Fill with Trace Silt	11.699				37	--12-9-8 (21)			
0.75	3	Compact Reddish Brown Silty Sand Fill with Gravel	11.189				43	8-9-9-12 (18)			
1.5	6						42	12-13-12-12 (25)			
		Dense Reddish Brown Sand and Asphalt	9.969				11	16-19-12-12 (31)			
2.25	9	Dense to Compact Reddish Brown Silty Sand with Gravel	9.859				47	10-10-10-8 (20)			
3	12	Loose Reddish Brown Silty Sand with Reddish Brown Sandstone	8.749				28	9-4-3-1 (7)			
3.75		Loose Brownish Grey Silty Sand with Organics	8.139				27	2-2-3-2 (5)			
	15	Compact Reddish Brown Silty Sand with Gravel	7.529				42	7-14-13-17 (27)			
4.5		Compact Reddish Brown Silty Sand Till with Gravel (Moist)	6.719				27	8-10-8-11 (18)			
5.25	18						13	8-11-14-16 (25)			
6		Boring terminated at 6.1 m.									

TEST RESULTS SUMMARY

Bedrock Core Recovery (%)
RQD (%) ▲
Plastic Limit ⊢——⊣ Liquid Limit
Water Content - ●
SPT N Values - ■

20 40 60 80

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

APPENDIX III

LABORATORY CERTIFICATES

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

CLIENT NAME: FUNDY ENGINEERING
PO Box 25083
HALIFAX, NS B3M4H4
(902) 492-1550

ATTENTION TO: Rob Haineault

PROJECT: 13982

AGAT WORK ORDER: 19X514406

SOIL ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor

TRACE ORGANICS REVIEWED BY: Amy Hunter, Trace Organics Supervisor, B.Sc.

DATE REPORTED: Sep 18, 2019

PAGES (INCLUDING COVER): 17

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (902) 468-8718

*NOTES

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

AGAT Laboratories
11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Anions (Soil)

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

		SAMPLE DESCRIPTION:		13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL	502563	502568	502569	502570	502571	502572
Bromide (2:1)	µg/g		1	<1	<1	<1	<1	<1	<1
Chloride (2:1)	µg/g		2	12	89	5	6	13	6
Fluoride (2:1)	µg/g		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nitrate as N (2:1)	µg/g		1	<1	<1	<1	<1	<1	<1
Nitrite as N (2:1)	µg/g		1	<1	<1	<1	<1	<1	<1
Phosphate as P (2;1)	µg/g		2	<2	<2	<2	<2	<2	<2
Sulphate (2:1)	µg/g		2	6	5	9	7	5	2

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

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Available Metals in Soil

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

SAMPLE DESCRIPTION:				13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL	502563	502568	502569	502570	502571	502572
Aluminum	mg/kg		10	4780	5950	5580	6160	4860	6270
Antimony	mg/kg		1	<1	<1	<1	<1	<1	<1
Arsenic	mg/kg		1	5	9	6	6	5	4
Barium	mg/kg		5	23	75	35	34	26	45
Beryllium	mg/kg		2	<2	<2	<2	<2	<2	<2
Boron	mg/kg		2	3	3	4	5	3	4
Cadmium	mg/kg		0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Chromium	mg/kg		2	20	24	24	28	25	21
Cobalt	mg/kg		1	8	8	11	11	9	9
Copper	mg/kg		2	14	7	13	16	12	12
Iron	mg/kg		50	7720	14100	8220	9380	7230	9760
Lead	mg/kg		0.5	8.4	5.1	8.4	9.8	8.1	7.6
Lithium	mg/kg		5	28	17	36	38	31	30
Manganese	mg/kg		2	225	432	262	286	240	340
Molybdenum	mg/kg		2	<2	<2	<2	<2	<2	<2
Nickel	mg/kg		2	18	18	25	26	21	22
Selenium	mg/kg		1	<1	<1	<1	<1	<1	<1
Silver	mg/kg		0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Strontium	mg/kg		5	6	10	7	8	8	9
Thallium	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	mg/kg		2	4	4	5	5	4	4
Uranium	mg/kg		0.1	0.6	1.7	0.8	0.9	0.7	0.6
Vanadium	mg/kg		2	21	36	26	29	23	20
Zinc	mg/kg		5	40	30	48	52	41	42

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

502563-502572 Results are based on the dry weight of the sample.

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Mercury in Soil - CVAAS

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

				SAMPLE DESCRIPTION:	13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
				SAMPLE TYPE:	Soil	Soil	Soil	Soil	Soil	Soil
				DATE SAMPLED:	2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL		502563	502568	502569	502570	502571	502572
Mercury	µg/g		0.01		0.02	<0.01	<0.01	<0.01	<0.01	<0.01

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

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Atlantic RBCA Tier 1 Hydrocarbons in Soil (Version 3.1) - Field Preserved

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

SAMPLE DESCRIPTION:				13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL	502563	502568	502569	502570	502571	502572
Benzene	mg/kg		0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Toluene	mg/kg		0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	mg/kg		0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Xylene (Total)	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C6-C10 (less BTEX)	mg/kg		3	<3	<3	10	<3	<3	<3
>C10-C16 Hydrocarbons	mg/kg		15	<15	<15	<15	<15	<15	<15
>C16-C21 Hydrocarbons	mg/kg		15	<15	<15	<15	<15	<15	<15
>C21-C32 Hydrocarbons	mg/kg		15	15	<15	<15	<15	<15	<15
Modified TPH (Tier 1)	mg/kg		20	<20	<20	<20	<20	<20	<20
Resemblance Comment				LR	NR	NR	NR	NR	NR
Return to Baseline at C32				Y	Y	Y	Y	Y	Y
Surrogate	Unit	Acceptable Limits							
Isobutylbenzene - EPH	%	60-140		121	106	117	110	111	101
Isobutylbenzene - VPH	%	60-140		108	112	108	112	114	103
n-Dotriacontane - EPH	%	60-140		136	118	126	118	130	118

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

502563-502572 Results are based on the dry weight of the soil.

Resemblance Comment Key:
GF - Gasoline Fraction
WGF - Weathered Gasoline Fraction
GR - Product in Gasoline Range
FOF - Fuel Oil Fraction
WFOF - Weathered Fuel Oil Fraction
FR - Product in Fuel Oil Range
LOF - Lube Oil Fraction
LR - Lube Range
UC - Unidentified Compounds
NR - No Resemblance
NA - Not Applicable

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

AGAT Laboratories
11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Moisture

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

SAMPLE DESCRIPTION:				13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL	502563	502568	502569	502570	502571	502572
% Moisture	%		0	14	16	12	11	19	17

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

Analysis performed at AGAT Halifax (unless marked by *)

Certified By:

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Soil

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

SAMPLE DESCRIPTION:				13982 BH1 12'	13982 BH1 18'	13982 BH2	13982 BH3	13982 BH4 12'	13982 BH4 18'
SAMPLE TYPE:				Soil	Soil	Soil	Soil	Soil	Soil
DATE SAMPLED:				2019-09-04	2019-09-04	2019-09-04	2019-09-05	2019-09-05	2019-09-05
Parameter	Unit	G / S	RDL	502563	502568	502569	502570	502571	502572
1-Methylnaphthalene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg		0.00671	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671	<0.00671
Acenaphthylene	mg/kg		0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Acridine	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg		0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Benzo(a)anthracene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b+j)fluoranthene	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(e)pyrene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(ghi)perylene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenzo(a,h)anthracene	mg/kg		0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3)pyrene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg		0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Pyrene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Quinoline	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits							
Nitrobenzene-d5	%	50-140		89	101	103	105	98	96
2-Fluorobiphenyl	%	50-140		122	140	140	114	136	134
Terphenyl-d14	%	50-140		89	105	112	106	101	100

Certified By:

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CANADA B3B 1M2
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Certificate of Analysis

AGAT WORK ORDER: 19X514406

PROJECT: 13982

CLIENT NAME: FUNDY ENGINEERING

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Polycyclic Aromatic Hydrocarbons in Soil

DATE RECEIVED: 2019-09-05

DATE REPORTED: 2019-09-18

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

502563-502572 Results are based on the dry weight of the soil.

Benzo(b)fluoranthene may include contributions from benzo(j)fluoranthene, if also present in the sample.

Analysis performed at AGAT Halifax (unless marked by *)

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Quality Assurance

CLIENT NAME: FUNDY ENGINEERING
AGAT WORK ORDER: 19X514406
PROJECT: 13982
ATTENTION TO: Rob Haineault
SAMPLING SITE:
SAMPLED BY:

Soil Analysis

RPT Date: Sep 18, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Available Metals in Soil															
Aluminum	502570		6160	5140	18.1%	< 10	120%	80%	120%	120%	80%	120%	NA	70%	130%
Antimony	502570		<1	<1	NA	< 1	80%	80%	120%	120%	80%	120%	NA	70%	130%
Arsenic	502570		6	5	18.2%	< 1	120%	80%	120%	120%	80%	120%	NA	70%	130%
Barium	502570		34	30	12.5%	< 5	113%	80%	120%	120%	80%	120%	NA	70%	130%
Beryllium	502570		<2	<2	NA	< 2	120%	80%	120%	120%	80%	120%	126%	70%	130%
Boron	502570		5	3	NA	< 2	120%	80%	120%	120%	80%	120%	125%	70%	130%
Cadmium	502570		<0.3	<0.3	NA	< 0.3	113%	80%	120%	120%	80%	120%	123%	70%	130%
Chromium	502570		28	23	19.6%	< 2	120%	80%	120%	120%	80%	120%	NA	70%	130%
Cobalt	502570		11	10	9.5%	< 1	120%	80%	120%	120%	80%	120%	NA	70%	130%
Copper	502570		16	12	28.6%	< 2	120%	80%	120%	120%	80%	120%	NA	70%	130%
Iron	502570		9380	7890	17.3%	< 50	120%	80%	120%	120%	80%	120%	NA	70%	130%
Lead	502570		9.8	8.4	15.4%	< 0.5	120%	80%	120%	120%	80%	120%	NA	70%	130%
Lithium	502570		38	34	11.1%	< 5	117%	70%	130%	120%	70%	130%	NA	70%	130%
Manganese	502570		286	233	20.4%	< 2	120%	80%	120%	120%	80%	120%	NA	70%	130%
Molybdenum	502570		<2	<2	NA	< 2	120%	80%	120%	120%	80%	120%	NA	70%	130%
Nickel	502570		26	23	12.2%	< 2	120%	80%	120%	120%	80%	120%	NA	70%	130%
Selenium	502570		<1	<1	NA	< 1	120%	80%	120%	120%	80%	120%	107%	70%	130%
Silver	502570		<0.5	<0.5	NA	< 0.5	120%	80%	120%	120%	80%	120%	NA	70%	130%
Strontium	502570		8	8	NA	< 5	120%	80%	120%	120%	80%	120%	NA	70%	130%
Thallium	502570		<0.1	<0.1	NA	< 0.1	120%	80%	120%	120%	80%	120%	84%	70%	130%
Tin	502570		5	4	NA	< 2	111%	80%	120%	120%	80%	120%	NA	70%	130%
Uranium	502570		0.9	0.7	25.0%	< 0.1	120%	80%	120%	120%	80%	120%	NA	70%	130%
Vanadium	502570		29	25	14.8%	< 2	118%	80%	120%	120%	80%	120%	NA	70%	130%
Zinc	502570		52	45	14.4%	< 5	120%	80%	120%	120%	80%	120%	NA	70%	130%
Anions (Soil)															
Bromide (2:1)	502563	502563	<1	<1	NA	< 1	110%	70%	130%	103%	70%	130%	89%	70%	130%
Chloride (2:1)	502563	502563	12	11	7.3%	< 2	94%	70%	130%	108%	70%	130%	103%	70%	130%
Fluoride (2:1)	502563	502563	<1.0	<1.0	NA	< 1.0	108%	70%	130%	106%	70%	130%	101%	70%	130%
Nitrate as N (2:1)	502563	502563	<1	<1	NA	< 1	92%	70%	130%	109%	70%	130%	104%	70%	130%
Nitrite as N (2:1)	502563	502563	<1	<1	NA	< 1				91%	70%	130%	104%	70%	130%
Phosphate as P (2;1)	502563	502563	<2	<2	NA	< 2	100%	70%	130%	98%	70%	130%	111%	70%	130%
Sulphate (2:1)	502563	502563	6	5	NA	< 2	94%	70%	130%	108%	70%	130%	108%	70%	130%
Mercury in Soil - CVAAS															
Mercury	502622		0.06	0.05	12.1%	< 0.01	102%	90%	110%	103%	90%	110%	105%	80%	120%

Comments: If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
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FAX (902)468-8924
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Quality Assurance

CLIENT NAME: FUNDY ENGINEERING

AGAT WORK ORDER: 19X514406

PROJECT: 13982

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Sep 18, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

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Quality Assurance

CLIENT NAME: FUNDY ENGINEERING
AGAT WORK ORDER: 19X514406
PROJECT: 13982
ATTENTION TO: Rob Haineault
SAMPLING SITE:
SAMPLED BY:

Trace Organics Analysis

RPT Date: Sep 18, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Polycyclic Aromatic Hydrocarbons in Soil															
1-Methylnaphthalene	1	502618	< 0.05	< 0.05	NA	< 0.05	120%	50%	140%	131%	50%	140%	NA	50%	140%
2-Methylnaphthalene	1	502618	< 0.01	< 0.01	NA	< 0.01	112%	50%	140%	109%	50%	140%	NA	50%	140%
Acenaphthene	1	502618	< 0.00671	< 0.00671	NA	< 0.00671	131%	50%	140%	100%	50%	140%	NA	50%	140%
Acenaphthylene	1	502618	< 0.004	< 0.004	NA	< 0.004	115%	50%	140%	89%	50%	140%	NA	50%	140%
Acridine	1	502618	< 0.05	< 0.05	NA	< 0.05	94%	50%	140%	90%	50%	140%	NA	50%	140%
Anthracene	1	502618	< 0.03	< 0.03	NA	< 0.03	74%	50%	140%	91%	50%	140%	NA	50%	140%
Benzo(a)anthracene	1	502618	< 0.01	< 0.01	NA	< 0.01	83%	50%	140%	104%	50%	140%	NA	50%	140%
Benzo(a)pyrene	1	502618	< 0.01	< 0.01	NA	< 0.01	108%	50%	140%	106%	50%	140%	NA	50%	140%
Benzo(b)fluoranthene	1	502618	< 0.05	< 0.05	NA	< 0.05	93%	50%	140%	121%	50%	140%	NA	50%	140%
Benzo(b+j)fluoranthene	1	502618	< 0.1	< 0.1	NA	< 0.1	100%	50%	140%	132%	50%	140%	NA	50%	140%
Benzo(e)pyrene	1	502618	< 0.05	< 0.05	NA	< 0.05	56%	50%	140%	115%	50%	140%	NA	50%	140%
Benzo(ghi)perylene	1	502618	< 0.01	< 0.01	NA	< 0.01	131%	50%	140%	102%	50%	140%	NA	50%	140%
Benzo(k)fluoranthene	1	502618	< 0.01	< 0.01	NA	< 0.01	96%	50%	140%	108%	50%	140%	NA	50%	140%
Chrysene	1	502618	< 0.01	< 0.01	NA	< 0.01	99%	50%	140%	98%	50%	140%	NA	50%	140%
Dibenzo(a,h)anthracene	1	502618	< 0.006	< 0.006	NA	< 0.006	83%	50%	140%	116%	50%	140%	NA	50%	140%
Fluoranthene	1	502618	< 0.05	< 0.05	NA	< 0.05	79%	50%	140%	108%	50%	140%	NA	50%	140%
Fluorene	1	502618	< 0.01	< 0.01	NA	< 0.01	116%	50%	140%	84%	50%	140%	NA	50%	140%
Indeno(1,2,3)pyrene	1	502618	< 0.01	< 0.01	NA	< 0.01	91%	50%	140%	111%	50%	140%	NA	50%	140%
Naphthalene	1	502618	< 0.01	< 0.01	NA	< 0.01	127%	50%	140%	135%	50%	140%	NA	50%	140%
Perylene	1	502618	< 0.05	< 0.05	NA	< 0.05	101%	50%	140%	111%	50%	140%	NA	50%	140%
Phenanthrene	1	502618	< 0.03	< 0.03	NA	< 0.03	117%	50%	140%	117%	50%	140%	NA	50%	140%
Pyrene	1	502618	< 0.05	< 0.05	NA	< 0.05	76%	50%	140%	108%	50%	140%	NA	50%	140%
Quinoline	1	502618	< 0.05	< 0.05	NA	< 0.05	99%	50%	140%	93%	50%	140%	NA	50%	140%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

Atlantic RBCA Tier 1 Hydrocarbons in Soil (Version 3.1) - Field Preserved															
Benzene	1	504021	< 0.03	< 0.03	NA	< 0.03	110%	60%	140%	106%	60%	140%			
Toluene	1	504021	< 0.04	< 0.04	NA	< 0.04	115%	60%	140%	104%	60%	140%			
Ethylbenzene	1	504021	< 0.03	< 0.03	NA	< 0.03	123%	60%	140%	109%	60%	140%			
Xylene (Total)	1	504021	< 0.05	< 0.05	NA	< 0.05	125%	60%	140%	112%	60%	140%			
C6-C10 (less BTEX)	1	504021	< 3	< 3	NA	< 3	93%	60%	140%	109%	60%	140%	119%	30%	130%
>C10-C16 Hydrocarbons	1	515851	30	36	NA	< 15	98%	60%	140%	82%	60%	140%	110%	30%	130%
>C16-C21 Hydrocarbons	1	515851	34	49	NA	< 15	96%	60%	140%	82%	60%	140%	110%	30%	130%
>C21-C32 Hydrocarbons	1	515851	61	68	NA	< 15	110%	60%	140%	82%	60%	140%	110%	30%	130%

Comments: If Matrix spike value is NA, the spiked analyte concentration was lower than that of the matrix contribution.
If RPD value is NA, the results of the duplicates are less than 5x the RDL and the RPD will not be calculated.

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Dartmouth, Nova Scotia
CANADA B3B 1M2
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Quality Assurance

CLIENT NAME: FUNDY ENGINEERING

AGAT WORK ORDER: 19X514406

PROJECT: 13982

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis (Continued)

RPT Date: Sep 18, 2019			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

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CANADA B3B 1M2
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Method Summary

CLIENT NAME: FUNDY ENGINEERING

AGAT WORK ORDER: 19X514406

PROJECT: 13982

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Bromide (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Fluoride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Nitrate as N (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Nitrite as N (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Phosphate as P (2;1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Aluminum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Antimony	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Arsenic	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Barium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Beryllium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Boron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cadmium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Chromium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Cobalt	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Copper	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Iron	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Lead	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP-MS
Lithium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP-MS
Manganese	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Molybdenum	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Nickel	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Selenium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Silver	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Strontium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Thallium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Tin	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Uranium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Vanadium	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS

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Method Summary

CLIENT NAME: FUNDY ENGINEERING

AGAT WORK ORDER: 19X514406

PROJECT: 13982

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Zinc	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Mercury	MET-93-6101	EPA SW-846 7471B & 245.5	CVAAS

AGAT Laboratories

11 Morris Drive, Unit 122
Dartmouth, Nova Scotia
CANADA B3B 1M2
TEL (902)468-8718
FAX (902)468-8924
http://www.agatlabs.com

Method Summary

CLIENT NAME: FUNDY ENGINEERING

AGAT WORK ORDER: 19X514406

PROJECT: 13982

ATTENTION TO: Rob Haineault

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Toluene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Ethylbenzene	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Xylene (Total)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
C6-C10 (less BTEX)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C10-C16 Hydrocarbons	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C16-C21 Hydrocarbons	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C21-C32 Hydrocarbons	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Modified TPH (Tier 1)	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	CALCULATION
Resemblance Comment	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
Return to Baseline at C32	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Isobutylbenzene - EPH	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Isobutylbenzene - VPH	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
n-Dotriacontane - EPH	ORG-120-5101	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
% Moisture		Calculation	GRAVIMETRIC
1-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Methylnaphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acenaphthylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Acridine	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(a)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(b+j)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(e)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(ghi)perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Benzo(k)fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Chrysene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluoranthene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Fluorene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Indeno(1,2,3)pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Naphthalene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Perylene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Phenanthrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Pyrene	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Quinoline	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS

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SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3541/3510/8270C	GC/MS

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Chain of Custody Record

Laboratory Use Only
Arrival Condition: ☐ Good ☐ Poor (see notes)
Arrival Temperature: 14.6, 13.7, 16.2
Hold Time:
AGAT Job Number: 19x5144006
Notes:

Report Information
Company: Fundy Engineering
Contact: Rob Haineault
Address:
Phone: Fax:
Client Project #:
AGAT Quotation: 13982
Please Note: If quotation number is not provided client will be billed full price for analysis.

Report Information (Please print):
1. Name:
Email: robhaineault@fundyeng.com
2. Name:
Email:

Report Format
☐ Single Sample per page
☑ Multiple Samples per page
☑ Excel Format Included
☐ Export

Turnaround Time Required (TAT)
Regular TAT ☑ 5 to 7 working days
Rush TAT ☐ Same day ☐ 1 day ☐ 2 days ☐ 3 days
Date Required:

Invoice To Same Yes ☑ / No ☐
Company:
Contact:
Address:
Phone: Fax:
PO/Credit Card#:

Regulatory Requirements (Check):
☐ List Guidelines on Report ☐ Do not list Guidelines on Report
☐ PIRI
☐ Tier 1 ☐ Res ☐ Pot ☐ Coarse
☐ Tier 2 ☐ Com ☐ N/Pot ☐ Fine
☐ Gas ☐ Fuel ☐ Lube
☐ CCME ☐ CDWQ
☐ Industrial ☐ NSEQS-Cont Sites
☐ Commercial ☐ HRM 101
☐ Res/Park ☐ Storm Water
☐ Agricultural ☐ Waste Water
☐ FWAL
☐ Sediment ☐ Other

Drinking Water Sample: ☐ Yes ☐ No **Salt Water Sample** ☐ Yes ☐ No
Reg. No.:

Sample Identification	Date/Time Sampled	Sample Matrix	# Containers	Comments – Site/Sample Info. Sample Containment
13982 BH1 12'	Sep. 4	Soil	6	
" BH1 18'	"	"	"	
" BH2	"	"	4	
" BH3	Sep. 5	"	"	
" BH4 12'	"	"	"	
" BH4 18'	"	"	"	

Field Filtered/Preserved	Standard Water Analysis	Metals: ☐ Total ☐ Diss ☐ Available	Mercury	☐ BOD ☐ CBOD	pH	☐ TSS ☐ TDS ☐ VSS	TKN	Total Phosphorus	Phenols	Tier 1: TPH/BTEX (PIRI) ☐ low level	Tier 2: TPH/BTEX Fractionation	CCME-CWS TPH/BTEX	VOC	THM	HAA	PAH	PCB	TC + EC ☐ P/A ☐ MPN ☐ MF	☐ HPC ☐ Pseudomonas	Fecal Coliform ☐ MPN ☐ MF	Other: Anion	Other:	Hazardous (Y/N)
		✓	✓							✓						✓					✓		
		✓	✓							✓						✓					✓		
		✓	✓							✓						✓					✓		
		✓	✓							✓						✓					✓		
		✓	✓							✓						✓					✓		
		✓	✓							✓						✓					✓		

Samples Relinquished By (Print Name)	Date/Time	Samples Received By (Print Name)	Date/Time
Rob Haineault	Sep. 5		Sept. 5
Samples Relinquished By (Sign)	Date/Time	Samples Received By (Sign)	Date/Time
	5:52pm		17:54

Pink Copy - Client
Yellow Copy - AGAT
White Copy- AGAT

Page ☐ of ☐
N°: 064051

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27 Wellington Row
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Clyde River, PE C0A 1H1

902.675.4885

HALIFAX OFFICE
PO Box 25083
Halifax, NS
B3M 4H4

902.492.1550