



**PWGSC PROJECT #R.076190.002  
MARINE SEDIMENT SAMPLING PROGRAM  
LEONARDVILLE DFO-SCH  
LEONARDVILLE, NEW BRUNSWICK**

**DRAFT REPORT**

Submitted to:

**Public Works and Government Services Canada**  
Saint John, New Brunswick

Submitted by:

**Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited**  
Saint John, New Brunswick

August 2015

TE131446.3000



11 August 2015

TE131446.3000

Mr. Jason Keys  
Environmental Specialist  
Environmental Services  
Public Works and Government Services Canada  
189 Prince William Street  
Saint John, New Brunswick  
E2L 2B9

Dear Mr. Keys:

**Re: Marine Sediment Sampling Program at the Leonardville Fisheries and Oceans Small Craft Harbour, Leonardville, New Brunswick - Draft Report**

Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler), is pleased to provide Public Works and Government Services Canada the findings of a Marine Sediment Sampling Program undertaken at the Leonardville Fisheries and Oceans Canada - Small Craft Harbour in New Brunswick.

Amec Foster Wheeler appreciates the opportunity to provide services to your organization. Please do not hesitate to call if you have any questions regarding this, or any other matter.

Respectfully submitted,

**DRAFT**

**Chyann Kirby, B.Sc., PTech, EP  
Environmental Scientist**

Direct Tel.: 506.652.4530 (or 506.652.9497 ext. 226)

Fax: 506.652.9517

E-mail: chyann.kirby@amecfw.com

CD/tr

TE131446\_3000\_MSSP\_Leonardville\_DraftRpt\_11August2015\_cd\_tr.docx

Amec Foster Wheeler Environment & Infrastructure,  
a Division of Amec Foster Wheeler Americas Limited  
580 Main Street, Suite 105  
Hilyard Place Building B  
Saint John, New Brunswick E2K 1J5  
Tel +1 (506) 652-9497  
Fax +1 (506) 652-9517

[www.amecfw.com](http://www.amecfw.com)

## EXECUTIVE SUMMARY

Six sediment samples were collected within the Leonardville Fisheries and Oceans Canada (DFO) - Small Craft Harbour (SCH) in New Brunswick on 15 July 2015. The samples were submitted to AGAT Laboratories for detailed analyses. Results were compared to the *Canadian Environmental Protection Act* (CEPA) Disposal at Sea Lower Level Screening Criteria; Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health (1999a); Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Version 3.0 Risk-Based Screening Levels (RBSLs) (2012). Table ES1, below, reports the summarized guideline exceedance results of the sediment analysis for the field program. Figure ES1 (below) depicts the summarized substrate composition for the samples collected from the Leonardville DFO-SCH.

**Table ES1 Sediment Analysis Guideline Exceedance Table**

Guideline / Parameter	Sample ID					
	L-2	L-11	L-12	L-21	L-27	L-33
<b>CEPA Disposal at Sea – Lower Level Screening Criteria</b>						
PAHs <sup>1</sup>	•	-	-	-	-	-
Metals	-	-	-	-	-	-
PCBs <sup>2</sup>	-	-	-	-	-	-
<b>CCME Soil Quality Guidelines</b>						
PAHs (IACR)	•	-	•	•	-	•
Metals	•	•	•	•	-	•
PCBs	-	-	-	-	-	-
DDT <sup>3</sup>	-	-	-	-	-	-
<b>Atlantic RBCA Tier 1 Version 3.0 RBSLs and SESLs</b>						
BTEX <sup>4</sup>	-	-	-	-	-	-
TPH <sup>5</sup>	-	-	•	-	-	-

Notes:

“-” indicates no exceedance

“•” indicates exceedance

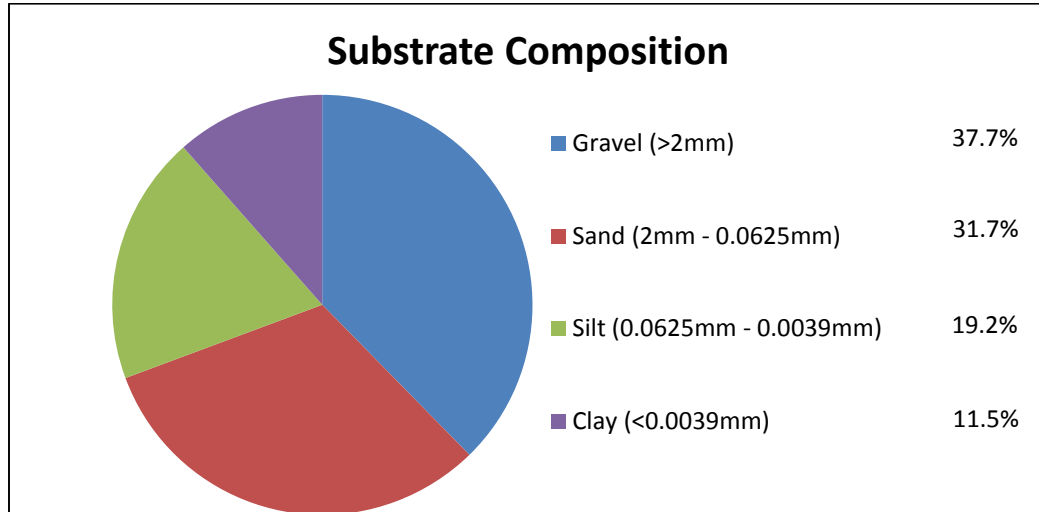
1 – PAH - polycyclic aromatic hydrocarbon

2 – PCB - polychlorinated biphenyl

3 – DDT - dichloro-diphenyl-trichloroethane

4 – BTEX - benzene, toluene, ethylbenzene, and xylene

5 – TPH - total petroleum hydrocarbons



**Figure ES1 Substrate Composition Averaged from Sampling Locations at the Leonardville DFO-SCH, New Brunswick**

Based on the results of the sediment analysis, two samples were selected to undergo Synthetic Precipitation Leachate Procedure (SPLP) for leachable PAHs and metals analysis, which was conducted as a requirement to determine if the material is suitable for disposal at New Brunswick landfills. Results from these samples were compared to the CCME Water Quality Guidelines (WQGs) for the Protection of Aquatic Life (1999b) and Health Canada Guidelines for Canadian Drinking Water Quality (GCDWQ, 2014). Table ES2, below, reports the summarized guideline exceedance results for the leachate analyses completed on these two sediment samples.

**Table ES2 Leachate Analysis Guideline Exceedance Table**

Guideline / Parameter	Sample ID	
	L-2	L-33
<b>CCME WQGs for the Protection of Aquatic Life</b>		
PAHs	•	•
Metals	•	•
<b>Health Canada GCDWQ</b>		
PAHs	•	-
Metals	•	•

Notes:  
 "•" indicates exceedance  
 "-" indicates no exceedance

## TABLE OF CONTENTS

	PAGE
<b>1.0 INTRODUCTION</b> .....	<b>1</b>
<b>2.0 SCOPE AND METHODOLOGY</b> .....	<b>1</b>
2.1 SITE PLAN .....	1
2.2 SAMPLE COLLECTION AND ANALYSIS.....	1
<b>3.0 ANALYTICAL RESULTS</b> .....	<b>3</b>
3.1 PAH CONCENTRATIONS .....	4
3.2 METAL CONCENTRATIONS.....	5
3.3 PETROLEUM HYDROCARBON CONCENTRATIONS.....	5
3.4 PCB CONCENTRATIONS .....	6
3.5 DDT CONCENTRATIONS .....	6
3.6 CARBON CONTENT .....	6
3.7 GRAIN SIZE DISTRIBUTION.....	6
<b>4.0 BENTHIC PHOTOGRAPH DESCRIPTION</b> .....	<b>7</b>
<b>5.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)</b> .....	<b>8</b>
<b>6.0 CONCLUSION</b> .....	<b>9</b>
<b>7.0 CLOSING</b> .....	<b>10</b>
<b>8.0 REFERENCES</b> .....	<b>11</b>

## TABLE OF CONTENTS (cont.)

### PAGE

### LIST OF TABLES

Table ES1	Sediment Analysis Guideline Exceedance Table.....	i
Table ES2	Leachate Analysis Guideline Exceedance Table.....	ii
Table 3.1	Dominant Sediment Types at Each Sample Location.....	7

### LIST OF FIGURES

Figure ES1	Substrate Composition Averaged from Sampling Locations at the Leonardville DFO-SCH, Nova Scotia.....	ii
Figure 2.1	Sampling Locations at the Leonardville DFO-SCH (23 January 2015) .....	2
Figure 3.1	Substrate Composition Averaged from Sampling Locations at the Leonardville DFO-SCH, Nova Scotia.....	6

### LIST OF APPENDICES

Appendix A	Photo Log	
Appendix B	Analytical Summary Tables	
Appendix C	Quality Assurance/Quality Control (QA/QC), Chain of Custody (COC), and Laboratory Certificates of Analyses	
Appendix D	Limitations	

## 1.0 INTRODUCTION

At the request of Public Works and Government Services Canada (PWGSC), six stations were sampled within the footprint of the proposed dredging area at the Leonardville Fisheries and Oceans (DFO) - Small Craft Harbour (SCH), Charlotte County, New Brunswick (NB) on 15 July 2015. The Marine Sediment Sampling Program (MSSP) was required to determine disposal options for the sediment intended to be dredged from this location.

## 2.0 SCOPE AND METHODOLOGY

### 2.1 Site Plan

The selection of sample stations followed guidance provided in the Environmental Protection Series: *Users Guide to the Application Form for Ocean Disposal* (Environment Canada, 1995), whereby a random approach was implemented for the location of sampling stations in the proposed dredging area of the SCH. The unstratified area was divided into square blocks where at least five times as many blocks as the number of stations required was used (minimum of 30 blocks). A random number generator software program was used to derive the sampling locations within this dredge area (Figure 2.1).

A detailed program design was prepared by Amec Foster Wheeler Environment & Infrastructure, a Division of Amec Foster Wheeler Americas Limited (Amec Foster Wheeler) and submitted to PWGSC on 10 July 2015 for review and approval prior to field program implementation. The field program was scheduled upon acceptance of the design.

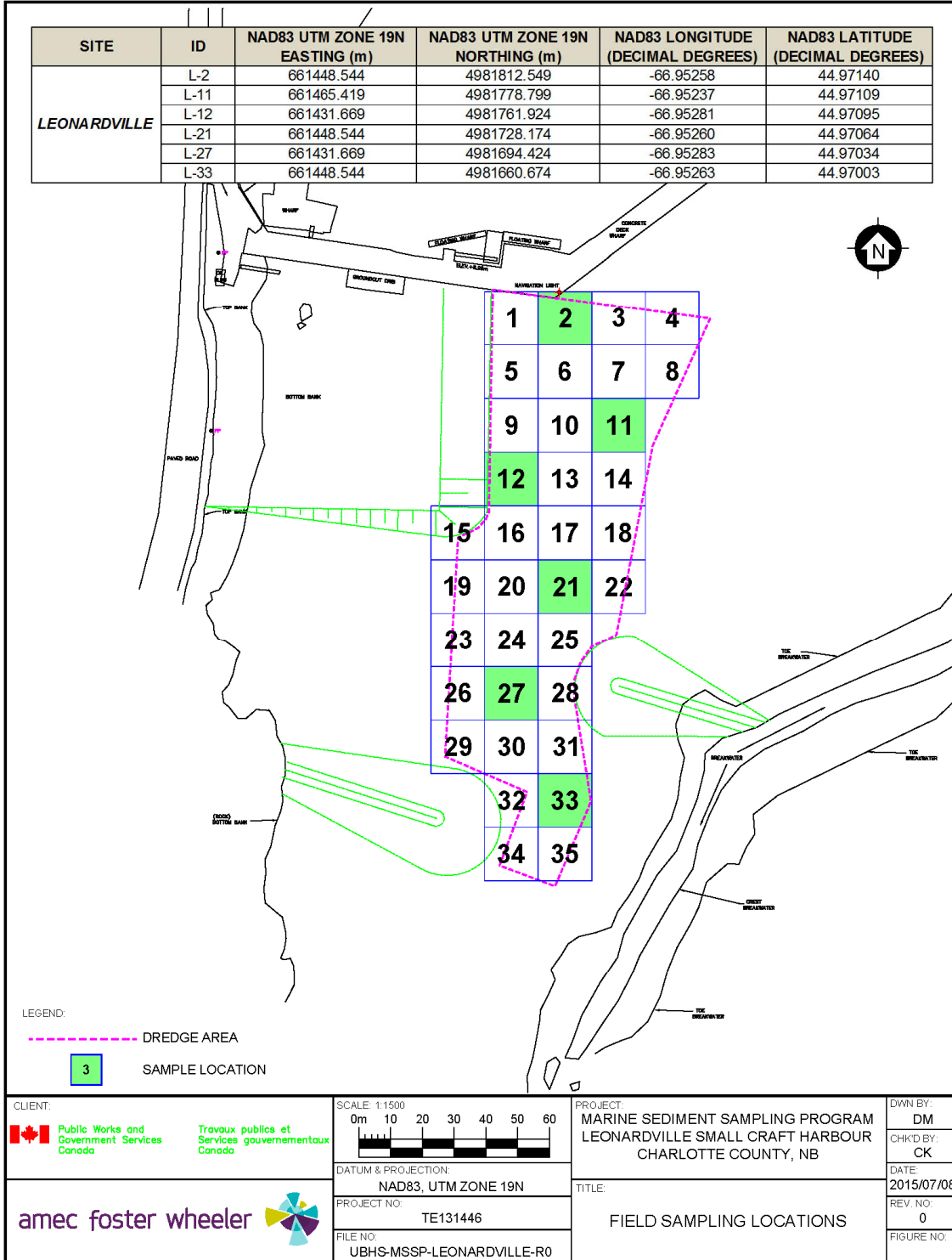
Sample collection, preparation, and analyses were conducted in accordance with Environment Canada's publication *Guidance Document on Collection and Preparation of Sediments for Physicochemical Characterization and Biological Testing* (1994). Diversified Divers Inc./Divers Quarters was retained to collect the sediment samples. The sample collection field program was completed in accordance with guidelines defined by provincial Occupational Health and Safety Standards.

### 2.2 Sample Collection and Analysis

The marine sediment samples were collected by divers at the selected sampling stations. A handheld Global Positioning System (GPS) was used to georeference the sampling location coordinates that were derived prior to field program initiation. Sample station coordinates are listed in Figure 2.1. Appendix A is comprised of a collection of photos taken of the sample locations during the field program.

Duplicate samples were collected from all stations to safeguard against loss or damage during transport. All samples were then stored in the laboratory-supplied jars and kept in a cooler on until the field program was completed. Upon completion of the field program, the samples were chilled and delivered to the laboratory for select chemical analyses. The duplicate sediment samples were refrigerated and stored at the Amec Foster Wheeler office in Saint John, New Brunswick.

**Figure 2.1 Sampling Locations at the Leonardville DFO-SCH**





AGAT Laboratories (AGAT) in Dartmouth, Nova Scotia, an accredited laboratory with the Canadian Association for Laboratory Accreditation (CALA) and ISO/IEC 17025 certified for all of the analyses required for this Project, was engaged to conduct the laboratory analyses. At the request of PWGSC, the samples were submitted for the typical ocean and land disposal suite of parameters which includes ICP 23 metals scan plus mercury, hexavalent chromium, tin, and low-level selenium; low-level polycyclic aromatic hydrocarbons (PAHs); total inorganic and total organic carbon (TIC/TOC); total polychlorinated biphenyls (PCBs); total dichloro-diphenyl-trichloroethane (DDT); low-level benzene, toluene, ethylbenzene, and xylene (BTEX); total petroleum hydrocarbons (TPHs), including a qualitative assessment for presence/absence of creosote; and grain size. Silica gel cleanup was completed for all samples analyzed for petroleum hydrocarbons, and a return to baseline at C32 was verified.

Based on the results of the sediment analysis, two samples were selected to undergo Synthetic Precipitation Leachate Procedure (SPLP) for leachable PAHs and metals analysis, which was conducted as a requirement to determine if the material is suitable for disposal at New Brunswick landfills.

### 3.0 ANALYTICAL RESULTS

The analytical results of the marine sediment samples collected and analyzed from the Leonardville DFO-SCH are summarized in Tables B.1 to B.7 (Appendix B) and discussed below. The complete set of analytical results, including laboratory Quality Assurance/Quality Control (QA/QC) and Certificates of Analyses for all parameters tested, are provided in Appendix C.

In order to facilitate the determination of all disposal options, the tabulated analytical sample results were compared to the following, where applicable:

- *Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations (formerly the Ocean Dumping Control Act) – Lower Level Screening Criteria.*
- Canadian Council of Ministers of the Environment (CCME) Sediment Quality Guidelines - Interim Sediment Quality Guidelines (ISQGs) and Marine and Estuarine Probable Effects Levels (PELs) (1999c).
- CCME Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications (1999a).
- Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Version 3.0 Risk-Based Screening Levels (RBSLs) and Sediment Ecological Screening Levels (SESLs) for the Protection of Freshwater and Marine Aquatic Life (2012).
- CCME Water Quality Guidelines (WQGs) (1999b).
- Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ) (2014).

Results as compared to the previously noted Guidelines, with the exception of the CCME Sediment Quality Guidelines (ISQGs and PELs), are discussed further in this Report.

### 3.1 PAH Concentrations

PAHs were detected in all six samples collected, with the exception of L-27.

#### CEPA Disposal at Sea Screening Criteria - Lower Level

One sample, L-2, had a total PAH concentration of 11 mg/kg, which exceeded the CEPA Disposal at Sea Lower Level Screening Criteria (Table B.1).

#### CCME SQGs - Human Health (Potable Water) and (Direct Contact)

Four of the six samples collected (L-2, L-12, L-21 and L-33) exceeded the CCME SQGs for the Protection of Human Health (Potable Water) for all land use scenarios for one to three individual PAH compounds as well as the Index of Additive Cancer Risk (IACR) (Table B.1).

Guidance provided in the CCME SQGs for the Protection of Environmental and Human Health (2008) indicates that for soil contaminated by coal tar or creosote mixtures, the calculated Benzo(a)pyrene total potency equivalent (TPE) concentration for soil samples should be multiplied by an uncertainty factor (UF) of 3 prior to comparison with the SQGs for the protection of human health (direct contact) to account for carcinogenic potential of alkylated and other PAHs present for which a Potency Equivalency Factors (PEF) does not currently exist, but which are likely to contribute to mixture carcinogenic potential.

Analytical review of the results by laboratory staff revealed that the presence of creosote was not observed in any of the six samples analyzed. No exceedances of the CCME SQGs for the Protection of Human Health (Direct Contact) for all land use applications were noted any of the six samples collected (Table B.1).

#### CCME SQGs - Environmental Health (Soil Contact), (Soil and Food Ingestion), and (Freshwater Life)

Four of the six samples collected (L-2, L-12, L-21 and L-33) had a level of one PAH compound, phenanthrene, which exceeded the CCME SQGs for the Protection of Environmental Health for Freshwater Life. There were no exceedances of the CCME SQGs for Protection of Environmental Health for Soil Contact or Soil and Food Ingestion for any land use scenario (Table B.1).

#### **Leachable PAHs Results**

Two samples (L-2 and L-33) were selected for SPLP leachable PAHs analysis based on noted guideline exceedances and discussions with PWGSC.

#### CCME WQGs for the Protection of Aquatic Life (Freshwater and Marine)

Both samples L-2 and L-33 exceeded CCME WQGs for the Protection of Aquatic Life (Freshwater) for two to four PAH compounds and both samples also exceeded marine water guidelines for pyrene (Table B.2).

Health Canada GCDWQ (Maximum Acceptable Concentration and Aesthetic Objective)

One of the two samples selected for leachable PAH analysis (L-2) exceeded Health Canada GCDWQ (Maximum Acceptable Concentration) for six individual PAH compounds (Table B.2).

### **3.2 Metal Concentrations**

CEPA Disposal at Sea Screening Criteria - Lower Level

No exceedances of the CEPA Disposal at Sea Lower Level Screening Criteria were noted in the six samples collected (Table B.3).

CCME SQGs

All but one of the six samples collected (L-27) exceeded the CCME SQGs for agricultural land use applications for either tin or both tin and arsenic (L-2) (Table B.3). One sample (L-2) had a level of arsenic which exceeded the CCME SQGs for all land use applications.

#### **Leachable Metals Results**

Two samples (L-2 and L-33) were submitted for SPLP metals leachate analysis based on noted guideline exceedances and discussions with PWGSC.

CCME WQGs for the Protection of Aquatic Life (Freshwater and Marine)

Both samples selected for SPLP analysis had levels of three elements in the leachate which exceeded CCME WQGs for the Protection of Aquatic Life (Freshwater). One of the two samples (L-2) had levels of arsenic and cadmium in the leachate which also exceeded marine water guidelines (Table B.4).

Health Canada GCDWQ (Maximum Acceptable Concentration and Aesthetic Objective)

Both samples selected for SPLP analysis had levels of arsenic in the leachate which exceeded Health Canada GCDWQ (Maximum Acceptable Concentration). One sample (L-2) also had a level of selenium in the leachate that exceeded the GCDWQ (Maximum Acceptable Concentration). Both sample leachates exceeded the GCDWQ (Aesthetic Objective) for sodium (Table B.4).

### **3.3 Petroleum Hydrocarbon Concentrations**

Modified TPH values reflect the sum of the individual carbon fractions that resembles gasoline, diesel #2, and lube oil. BTEX was not detected in any of the six samples collected. All six samples, with the exception of L-27, had detectable amounts of TPH present. All six samples reached baseline at C<sub>32</sub> (Table B.5).

No exceedances of the Atlantic RBCA Tier 1 Version 3.0 RBSLs or CCME SQGs were noted in any of the six samples collected (Table B.5). One sample (L-12) had a concentration of TPH which exceeded the SESLs for the Protection of Freshwater and Marine Aquatic Life for typical sediment.

### 3.4 PCB Concentrations

PCBs were not detected in any of the six samples collected at the Leonardville DFO-SCH and no exceedances of the CEPA Disposal at Sea Lower Level Screening Criteria or CCME SQGs for all land use applications were noted (Tables B.6).

### 3.5 DDT Concentrations

Total DDT refers to the sum of dichlorodiphenyldichloroethylene (DDE), dichlorodiphenyldichloroethane (DDD), and DDT. Neither DDE, DDD, nor DDT were detected in any of the six samples collected at the Leonardville DFO-SCH, and no exceedances of the CEPA Disposal at Sea Lower Level Screening Criteria or CCME SQGs for all land use applications were noted in any of the six samples collected (Table B.6).

### 3.6 Carbon Content

Samples collected from the Leonardville DFO-SCH showed total carbon content ranging from 1.57% to 3.00% (Table B.7). TOC was the predominant type in all six samples, ranging from 0.87% to 2.92%. TIC was not detected in half the samples (L-2, L-12 and L-33) and, where detected, ranged from 0.32% to 0.82%.

### 3.7 Grain Size Distribution

Sediment composition (Table B.7) is illustrated in Figure 3.1 and Table 3.1 below. Figure 3.1 illustrates the overall sediment composition from the samples collected from within the SCH, expressed as percentages to show the average grain size distributions. Table 3.1 breaks down the sediment composition at each sampling location.

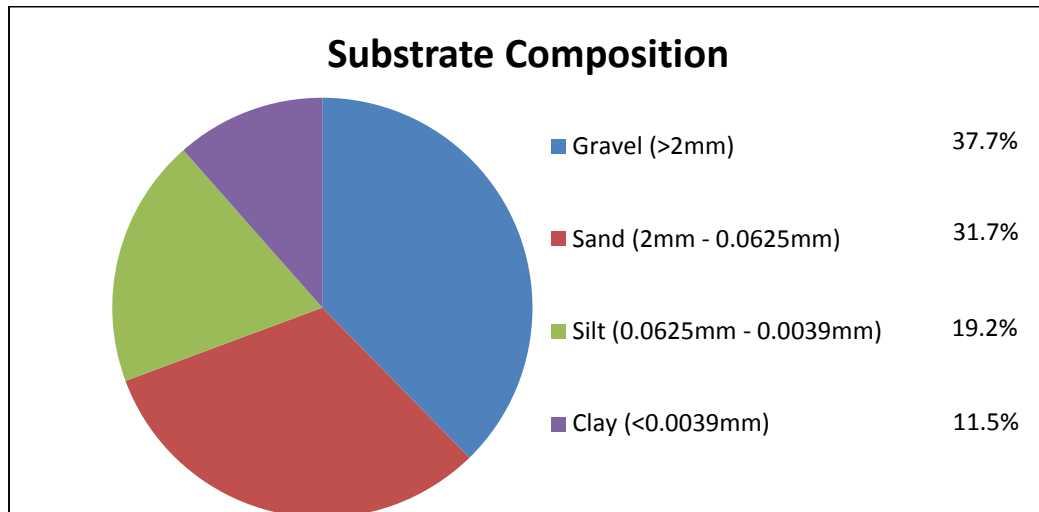


Figure 3.1 Substrate Composition Averaged from Sampling Locations at the Leonardville DFO-SCH, New Brunswick

**Table 3.1 Dominant Sediment Types at Each Sample Location**

Sample ID	Sediment Distribution			
	Primary Substrate	Secondary Substrate	Tertiary Substrate	Quaternary Substrate
L-2	Silt	Gravel	Clay	Sand
L-11	Gravel	Sand	Clay	Silt
L-12	Sand	Silt	Clay	Gravel
L-21	Sand	Gravel	Silt	Clay
L-27	Gravel	Sand	Clay	Silt
L-33	Sand	Gravel	Silt	Clay

Notes:  
 "-" indicates none detected.  
 "/" indicates equal amounts of substrate.

#### 4.0 BENTHIC PHOTOGRAPH DESCRIPTION

A series of underwater photographs were collected at each of the sampling locations that show the substrate and any flora and fauna at the site. Photographs are presented in Appendix A and characterization of the photographs collected at each of the sampling locations is provided below.

##### Sample Station L-2

The substrate appears to be a mix of silt and sand with lesser amounts of gravel and clay. No macroflora was identified but three green urchins (*Strongylocentrotus droebachiensis*) were observed. Shell hash (scallop shells) was plentiful.

##### Sample Station L-11

The substrate appears to be predominantly silt and sand however, after being collected, was found to have also have a large percentage of rock, cobble, and gravel. No macrofauna was identified but sugar kelp (*Laminaria saccharina*) were observed in approximately 20% of the photo. Shell hash was present but minimal.

##### Sample Station L-12

The substrate appears to be a mix of silt and sand with lesser amounts of gravel and clay. The photo was devoid of any macroflora or macrofauna.

##### Sample Station L-21

The substrate appears to be predominantly silt with lesser amounts of sand. One periwinkle (*Littorina* sp.) and a small piece of sea lettuce (*Ulva lactuca*) were observed.

##### Sample Station L-27

The substrate appears to be predominantly silt with lesser amounts of sand and gravel. The photos are devoid of fauna but there is approximately 25% cover of sugar kelp (*Laminaria saccharina*) and sea lettuce (*Ulva lactuca*).

### **Sample Station L-33**

The substrate appears to be a mix of sand and gravel with lesser amounts of cobble. There is approximately 20% cover of rockweed (*Ascophyllum nodosum*). No fauna was observed, however there was some shell hash.

## **5.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)**

All samples collected were labelled on site using a waterproof marker with the date, sample site identifier, and sample number. The samples were placed upright on ice inside a cooler for safe storage and transport, and were delivered to the laboratory following program completion. A copy of the Chain of Custody (COC) that accompanied the samples is provided in Appendix C. Additional samples were collected to safeguard against loss or damage during transport, and will be stored and refrigerated until the PWGSC Project Manager provides approval to dispose/destroy the samples.

Sample collection, preparation, and analyses followed guidance provided in the previously referenced Environment Canada document. Samples were analyzed by an accredited laboratory with CALA and/or ISO/IEC 17025 and are certified by the Standards Council of Canada (SCC) for each selected chemical analyses of this program. The complete set of analytical results, including laboratory QA/QC and Certificates of Analyses for all parameters tested, are provided in Appendix C.

The laboratory undertakes internal duplicate analyses for QA/QC purposes. Laboratory duplicate analyses were performed on all of the parameters analyzed for this program to meet internal QA/QC objectives for the Leonardville samples submitted. No discrepancies were noted by the laboratory for the analyses performed.

To assess the quality of the analytical data, a review of the internal laboratory QA/QC results was completed and included a review of laboratory duplicate analyses, method blanks, surrogates, spike samples, and QA/QC standards. This review did not reveal any information or discrepancies that may affect the analytical results of the Leonardville samples.

A Senior Amec Foster Wheeler Reviewer has reviewed this Report prior to its release. The limitations of this document are provided in Appendix D.

## 6.0 CONCLUSION

The analytical results of the six samples collected and analyzed from the Leonardville DFO-SCH indicate the following guideline exceedances:

### CEPA

- One sample (L-2) had a total PAH concentration of 11 mg/kg, which exceeded the CEPA Disposal at Sea Lower Level Screening Criteria.

### CCME SQGs

- Four of the six samples collected (L-2, L-12, L-21 and L-33) had PAHs in exceedance of the CCME SQGs for the Protection of Human Health (Potable Water) for all land use scenarios as well as the IACR.
- Four of the six samples collected (L-2, L-12, L-21 and L-33) had a level of one PAH compound, phenanthrene, which exceeded the CCME SQGs for the Protection of Environmental Health for Freshwater Life.
- Five of the six samples collected (L-2, L-11, L-12, L21 and L-33) exceeded the CCME SQGs for agricultural land use applications for one to two metals.
- One sample (L-2) had a level of arsenic which exceeded the CCME SQGs for all land use applications.

### SESLs

- One sample (L-12) had a concentration of TPH which exceeded the SESLs for the Protection of Freshwater and Marine Aquatic Life for typical sediment.

### CCME WQGs for the Protection of Aquatic Life

- Both samples selected for leachable PAHs analysis (L-2 and L-33, had two to four PAH compounds in the leachate which exceeded CCME WQGs for the Protection of Aquatic Life (both freshwater and marine).
- Both samples selected for leachable metals analysis, L-2 and L-33) had levels of three elements which exceeded CCME WQGs for the Protection of Aquatic Life (Freshwater). One of the two samples (L-2) had levels of two elements in the leachate which also exceeded the WQG for marine environment.

### Health Canada GCDWQs

- One of the two samples selected for leachable PAH analysis (L-2) exceeded Health Canada GCDWQ (Maximum Acceptable Concentration) for six PAH compounds.
- Both samples selected for leachable metals analysis had levels of arsenic in the leachate which exceeded Health Canada GCDWQ (Maximum Acceptable Concentration) as well as a level of sodium which exceeded the GCDWQ (Aesthetic Objective) for sodium. One sample (L-2) also had a level of selenium in the leachate that exceeded the GCDWQ (Maximum Acceptable Concentration).

## 7.0 CLOSING

This document has been prepared and reviewed by the following people:

**Prepared by:**

**DRAFT**

---

**Christa Dubreuil, B.Sc., EP**  
Intermediate Project Professional

**Reviewed by:**

**DRAFT**

---

**Kerry Higgins, B.Sc., EP**  
Senior Project Professional



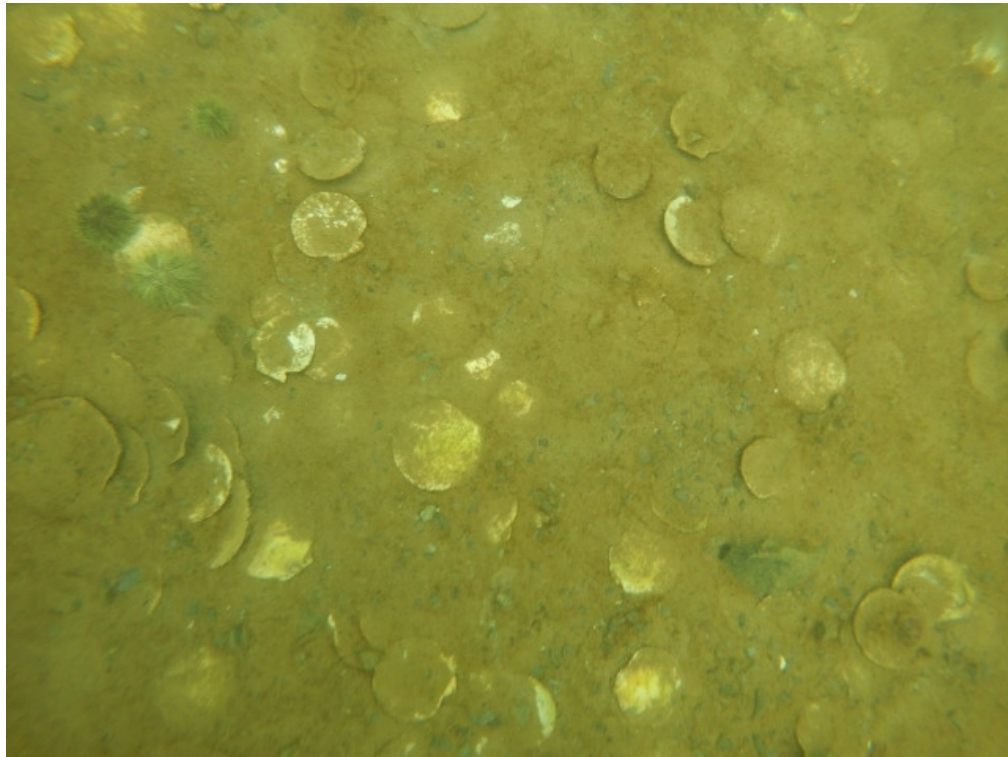
## 8.0 REFERENCES

- Atlantic Risk-Based Corrective Action (RBCA). 2012. Atlantic RBCA (Risk-Based Corrective Action), for Petroleum Impacted Sites in Atlantic Canada Tier I Version 3, User Guidance. Issued on, July 2012. Available online at: [http://www.atlanticrbc.com/data\\_eng/ATLANTIC\\_RBCA\\_User\\_Guidance\\_v3\\_July\\_2012doc\\_final.pdf](http://www.atlanticrbc.com/data_eng/ATLANTIC_RBCA_User_Guidance_v3_July_2012doc_final.pdf).
- Canadian Council of Ministers of the Environment (CCME). 1999a (updates). Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications. Available online at: <http://cegg-rcqe.ccme.ca/en/index.html#void>.
- Canadian Council of Ministers of the Environment (CCME). 1999b (updates). Canadian Water Quality Guidelines, 1999 with updates. Available on-line at: <http://cegg-rcqe.ccme.ca/en/index.html#void>.
- Canadian Council of Ministers of the Environment (CCME). 1999c (updates). CCME Sediment Quality Guidelines - Interim Sediment Quality Guidelines and Marine and Estuarine Probable Effects Levels. Available online at: <http://cegg-rcqe.ccme.ca/en/index.html#void>.
- Canadian Council of Ministers of the Environment (CCME). 2008. Canadian Soil Quality Guidelines Carcinogenic and other Polycyclic Aromatic Hydrocarbons (PAHS) (Environmental and Human Health Effects) Scientific Supporting Document, PN 1401, ISBN 978-1-896997-79-7 PDF. Available on-line at: [www.ccme.ca](http://www.ccme.ca).
- Environment Canada. 1994. Guidance document on collection and preparation of sediments for physicochemical characterization and biological testing. Environmental Protection Series. Report EPS 1/RM/29, December 1994.
- Environment Canada. 1995. User's Guide to the Application Form for Ocean Disposal. Report EPS 1/MA/1, December 1995.
- Health Canada. 2014. Guidelines for Canadian Drinking Water Quality – Summary Table. Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario. Available on-line at: [http://www.hc-sc.gc.ca/ewh-semt/alt\\_formats/pdf/pubs/water-eau/sum\\_guide-res\\_recom/sum\\_guide-res\\_recom-eng.pdf](http://www.hc-sc.gc.ca/ewh-semt/alt_formats/pdf/pubs/water-eau/sum_guide-res_recom/sum_guide-res_recom-eng.pdf).



**APPENDIX A**  
**Photo Log**

**Sample Station L-2**



**Sample L-2**



**Sample Station L-11**



**Sample L-11**



**Sample Station L-12**



**Sample L-12**



**Sample Station L-21**



**Sample L-21**



**Sample Station L-27**



**Sample L-27**



**Sample Station L-33**



**Sample L-33**







**APPENDIX B**  
**Analytical Summary Tables**

**Table B.1 PAH Results for Marine Sediments as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date						CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines						
			L-2	L-11	L-12	L-21	L-27	L-33		Interim Sediment Quality Guidelines		Probable Effects Levels		Human Health		Environmental Health				
			15-Jul-15							Freshwater	Marine	Freshwater	Marine	Potable Water	Direct Contact	Soil Contact		Soil and Food Ingestion	Freshwater Life	
			Agricultural, Residential/ Parkland, Commercial and Industrial Land Uses		Agricultural, Residential/ Parkland, Commercial and Industrial Land Uses		Agricultural and Residential/ Parkland Land Uses	Commercial and Industrial Land Uses		Agricultural and Residential/ Parkland Land Uses	Agricultural, Residential/ Parkland, Commercial/ Industrial Land Uses									
<b>Polycyclic Aromatic Hydrocarbon (PAH) Results</b>																				
1-Methylnaphthalene	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05												
2-Methylnaphthalene	0.02		<0.02	<0.02	<0.02	<0.02	<0.02	<0.02												
Acenaphthene	0.00671		<i>0.0488</i>	<0.00671	<0.00671	<i>0.00683</i>	<0.00671	<0.00671		0.00671	0.00671	0.0889	0.0889						21.5	0.28
Acenaphthylene	0.005		<i>0.212</i>	<0.005	<i>0.042</i>	<i>0.037</i>	<0.005	<i>0.019</i>		0.00587	0.00587	0.128	0.128							320
Anthracene	0.04		<i>0.28</i>	<0.04	<i>0.07</i>	<i>0.07</i>	<0.04	<i>0.05</i>		0.0469	0.0469	0.245	0.245		2.5	3.2			61.5	
Benzo(a)anthracene	0.01		<i>0.47</i>	<i>0.02</i>	<i>0.10</i>	<i>0.11</i>	<0.01	<i>0.08</i>		0.0371	0.0748	0.385	0.693	0.33					6.2	
Benzo(a)pyrene	0.01		<i>0.34</i>	<0.01	<i>0.05</i>	<i>0.07</i>	<0.01	<i>0.05</i>		0.0319	0.0888	0.782	0.763	0.37		20	72		0.6	8800
Benzo(b)fluoranthene	0.05		<i>1.07</i>	<0.05	<i>0.13</i>	<i>0.13</i>	<0.05	<i>0.07</i>											6.2	
Benzo(b+j)fluoranthene	0.1		<i>1.4</i>	<0.1	<i>0.3</i>	<i>0.2</i>	<0.1	<i>0.1</i>						0.16						
Benzo(g,h,i)perylene			<i>0.1</i>	<0.01	<0.01	<i>0.04</i>	<0.01	<i>0.02</i>						6.8						
Benzo(k)fluoranthene	0.01		<i>0.42</i>	<0.01	<i>0.07</i>	<i>0.08</i>	<0.01	<i>0.04</i>						0.034					6.2	
Chrysene	0.01		<i>1.52</i>	<i>0.04</i>	<i>0.28</i>	<i>0.26</i>	<0.01	<i>0.12</i>		0.0571	0.108	0.862	0.846	2.1					6.2	
Dibenz(a,h)anthracene	0.006		<i>0.013</i>	<0.006	<0.006	<0.006	<0.006	<0.006		0.00622	0.00622	0.135	0.135	0.23						
Fluoranthene	0.05		<i>4.52</i>	<0.05	<i>0.19</i>	<i>0.5</i>	<0.05	<i>0.22</i>		0.111	0.113	2.355	1.494		50	180			15.4	
Fluorene	0.02		<i>0.09</i>	<0.02	<i>0.02</i>	<i>0.02</i>	<0.02	<0.02		0.0212	0.0212	0.144	0.144						15.4	0.25
Indeno(1,2,3-cd)pyrene	0.01		<i>0.1</i>	<0.01	<0.01	<i>0.03</i>	<0.01	<i>0.02</i>						2.7						
Naphthalene	0.01		<i>&lt;0.01</i>	<0.01	<0.01	<0.01	<0.01	<0.01		0.0346	0.0346	0.391	0.391						8.8	0.013
Perylene	0.05		<i>0.1</i>	<0.05	<0.05	<0.05	<0.05	<0.05												
Phenanthrene	0.04		<i>1.8</i>	<0.04	<i>0.1</i>	<i>0.28</i>	<0.04	<i>0.17</i>		0.0419	0.0867	0.515	0.544						43	0.046
Pyrene	0.05		<i>2.76</i>	<0.05	<i>0.11</i>	<i>0.35</i>	<0.05	<i>0.17</i>		0.053	0.153	0.875	1.398						7.7	
Total PAH	0.5	<i>11</i>	<0.5	<i>1.1</i>	<i>1.6</i>	<0.5	<i>0.8</i>	2.5												
Index of Additive Cancer Risk (IACR)	Calculation	None	<i>24.3</i>	<i>0.57</i>	<i>4.52</i>	<i>4.28</i>	<i>0.51</i>	<i>2.26</i>					1							
Benzo(a)pyrene TPE (10 <sup>-5</sup> )	Calculation	mg/kg	0.6082	0.01645	0.10335	0.118	0.0146	0.0784											5.3	
Creosote or Coal Tar source suspected/ known?	yes/no		No	No	No	No	No	No												
Uncertainty Factor Applied	yes/no		No	No	No	No	No	No												
Benzo(a)pyrene TPE (10 <sup>-5</sup> ) with UF	Calculation	mg/kg	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable											5.3	

NOTE(S):  
 All results below the laboratory detection limit were divided by 2 prior to further calculations.  
 Total PAH calculation based on the sum of 16 individual PAH compounds (acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluorene, fluoranthene, ideno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene) as per guidance from Environment Canada, 2009.  
 Additive Cancer Risk (IACR) = ((Benz(a)anthracene)/0.33mg/kg) + ((Benzo(a)pyrene)/0.37mg/kg) + ((Benzo(b+j)fluoranthene)/0.16mg/kg) + ((Benzo(g,h,i)perylene)/6.8mg/kg) + ((Benzo(k)fluoranthene)/0.034mg/kg) + ((Chrysene)/2.1mg/kg) + ((Dibenz(a,h)anthracene)/0.23mg/kg) + ((Indeno(1,2,3-c,d)pyrene)/2.7mg/kg).  
 Total Potency Equivalent (TPE) based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10<sup>-5</sup>).  
 Benzo(a)pyrene TPE (10<sup>-5</sup>) = Sum of PAH concentration multiplied by their respective Benzo(a)pyrene Potency Equivalency Factors: ((Benz(a)anthracene)\*0.1) + ((Benzo(a)pyrene)\*1) + ((Benzo(b+j)fluoranthene)\*0.1) + ((Benzo(k)fluoranthene)\*0.1) + ((Benzo(g,h,i)perylene)\*0.01) + ((Chrysene)\*0.01) + ((Dibenz(a,h)anthracene)\*1) + ((Indeno(1,2,3-c,d)pyrene)\*0.1).  
 Benzo(a)pyrene TPE Uncertainty Factor = 3.  
 Light values indicate results below detection limit.  
 Yellow highlight indicates exceedance of CEPA Disposal at Sea Screening Criteria - Lower Level  
 Italicized values indicate exceedance of CCME Interim Sediment Quality Guideline and/or Probable Effects Levels for Freshwater and/or Marine Sediment.  
 Interrupted border values indicate exceedance of CCME SQG for the Protection of Human Health (Potable Water) for all land use applications.  
 Right justified values indicate exceedance of CCME Soil Quality Guideline for the Protection of Environmental Health (Freshwater Life) for all land use applications.

**Table B.2 PAH Results for Leachate Samples as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date		CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life		Health Canada Guidelines for Canadian Drinking Water Quality	
			L-2	L-33	Freshwater	Marine	Maximum Acceptable Concentration	Aesthetic Objective
			15-Jul-15					
<b>Leachable Polycyclic Aromatic Hydrocarbons (PAHs)</b>								
1-Methylnaphthalene	0.01	µg/L	0.01	<0.01				
2-Methylnaphthalene	0.01		0.03	0.01				
Acenaphthene	0.04		0.11	<0.04	5.8			
Acenaphthylene	0.04		<0.04	<0.04				
Anthracene	0.012		0.143	0.026	0.012			
Benzo(a)anthracene	0.018		2.69	<0.018	0.018		0.1*	
Benzo(a)pyrene	0.01		0.62	<0.01	0.015		0.01	
Benzo(b)fluoranthene	0.05		0.74	<0.05				
Benzo(b+j)fluoranthene	0.01		1.14	<0.01			0.01*	
Benzo(g,h,i)perylene	0.02		0.07	<0.02			1*	
Benzo(k)fluoranthene	0.04		0.77	<0.04			0.1*	
Chrysene	0.04		1.69	<0.04			1*	
Dibenzo(a,h)anthracene	0.01		0.04	<0.01			0.01*	
Fluoranthene	0.03		0.36	0.15	0.04			
Fluorene	0.01		0.08	0.02	3			
Indeno(1,2,3-cd)pyrene	0.04		0.09	<0.04			0.1*	
Naphthalene	0.01		<0.01	<0.01	1.1	1.4		
Perylene	0.05		0.09	<0.05				
Phenanthrene	0.02		0.33	0.06		0.4		
Pyrene	0.01		0.82	0.11		0.025		
Total PAH	2	8	<2					

NOTE(S):

\* denotes values based on Source Guidance Values for Groundwater (SGVG) which were obtained from the CCME Scientific

Light values indicate results below detection limit.

Yellow highlight indicates exceedance of Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater).

Interrupted border values indicate exceedance of Canadian Water Quality Guidelines for the Protection of Aquatic Life (Marine).

Italicized values indicate exceedance of Health Canada Guidelines for Canadian Drinking Water Quality (Maximum Acceptable Concentration and/or Aesthetic Objective).

**Table B.3 Metal Results for Marine Sediments as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date						CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines			
			L-2	L-11	L-12	L-21	L-27	L-33		Interim Sediment Quality Guidelines		Probable Effects Levels		Agricultural Land Use	Residential/Parkland Land Use	Commercial Land Use	Industrial Land Use
			15-Jul-15							Freshwater	Marine	Freshwater	Marine				
Aluminum	10	mg/kg	20100	18100	18600	19100	20000	18400									
Antimony	1		<1	<1	<1	<1	<1	<1						20	20	40	40
Arsenic	1		<u>14</u>	8	12	8	8	7		5.9	7.24	17.0	41.6	12	12	12	12
Barium	5		52	26	46	40	13	29						750	500	2000	2000
Beryllium	2		<2	<2	<2	<2	<2	<2						4	4	8	8
Boron (Total)	2		49	26	51	32	11	23									
Cadmium	0.3		0.3	<0.3	<0.3	<0.3	<0.3	<0.3	0.6	0.6	0.7	3.5	4.2	1.4	10	22	22
Chromium (Hexavalent)	0.4		< 0.4	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4						0.4	0.4	1.4	1.4
Chromium (Total)	2		26	25	24	23	31	25		37.3	52.3	90.0	160	64	64	87	87
Cobalt	1		8	8	8	7	10	7						40	50	300	300
Copper	2		49	14	20	13	16	14	81*	35.7	18.7	197	108	63	63	91	91
Iron	50		18900	18700	18500	17200	33400	18500									
Lead	0.5		44.5	17.1	32.5	27.3	7.9	25.1	66*	35.0	30.2	91.3	112	70	140	260	600
Manganese	2		242	260	238	255	359	283									
Mercury (Total)	0.05		< 0.05	0.06	< 0.05	< 0.05	< 0.05	< 0.05	0.75	0.17	0.13	0.486	0.7	6.6	6.6	24	50
Molybdenum	2		2	<2	<2	<2	<2	<2						5	10	40	40
Nickel	2		19	19	20	18	23	16						50	50	50	50
Selenium	1		1	<1	1	<1	<1	<1						1	1	2.9	2.9
Silver	0.5		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5						20	20	40	40
Strontium	5		41	29	33	30	39	19									
Thallium	0.1		0.1	0.1	<0.1	0.1	0.2	0.1						1	1	1	1
Tin	2	<u>6</u>	<u>13</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>6</u>						5	50	300	300	
Uranium	0.1	1.4	1.1	1.4	1.1	1.1	1.0						23	23	33	300	
Vanadium	2	33	34	34	31	35	32						130	130	130	130	
Zinc	5	88	60	79	59	51	58	160*	123	124	315	271	200	200	360	360	

NOTE(S):  
 \*Former Interim Rejection Limits (1991) which are not currently used to screen for ocean based disposal permitting but may be considered in terms of further investigation prior to issuance of an Ocean Disposal Permit (Victor Li, Environment Canada, pers. comm., June 2002).  
 Light values indicate results below detection limit.

*Italicized values indicate exceedance of CCME Interim Sediment Quality Guideline and/or Probable Effects Levels for Freshwater and/or Marine Sediment.*

Interrupted border values indicate exceedance of CCME Soil Quality Guideline for Agricultural land use applications.

Left justified values indicate exceedance of CCME Soil Quality Guideline for Residential/Parkland land use applications.

**Bold values indicate exceedance of CCME Soil Quality Guideline for Commercial land use applications.**

Underlined values indicate exceedance of CCME Soil Quality Guideline for Industrial land use applications.

**Table B.4 Metal Results for Leachate Samples as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date		CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life		Health Canada Guidelines for Canadian Drinking Water Quality	
			L-2	L-33	Freshwater	Marine	Maximum Acceptable Concentration	Aesthetic Objective
			15-Jul-15					
<b>General Chemistry</b>								
pH			7.62	7.95	6.5 - 9.0	7.0 - 8.7		6.5 - 8.5
Hardness (CaCO <sub>3</sub> )		mg/L	349	126				
Sodium	200000	µg/L	<i>833000</i>	<i>268000</i>				200000
<b>Leachable Metals</b>								
Aluminum	20	µg/L	90	180	5 - 100			
Antimony	6		< 6	< 6			6	
Arsenic	5		40	12	5	12.5	10	
Barium	20		< 20	< 20			1000	
Beryllium	50		< 50	< 50				
Boron	50		700	290	1500 - 29000		5000	
Cadmium	0.1		0.3	< 0.1	See Notes	0.12	5	
Chromium (Total)	20		< 20	< 20			50	
Cobalt	10		< 10	< 10				
Copper	2		2	2	See Notes			1000
Iron	200		< 200	< 200	300		300	
Lead	1		< 1	< 1	See Notes		10	
Manganese	20		30	< 20				50
Molybdenum	20		40	< 20	73			
Nickel	20		< 20	< 20	See Notes			
Selenium	1		69	18	1		50	
Silver	0.1		< 0.1	< 0.1	0.1			
Strontium	20		390	130				
Thallium	0.8		< 0.8	< 0.8	0.8			
Tin	20		< 20	< 20				
Uranium	1	< 1	< 1	15 - 33		20		
Vanadium	20	< 20	20					
Zinc	20	< 20	< 20	30			5000	

NOTE(S):

Aluminum: CCME CWQG for the Protection of Freshwater Aquatic Life= pH < 6.5 = 5 ug/L; pH ≥ 6.5 = 100 ug/L.

Boron: CCME CWQG for the Protection of Freshwater Aquatic Life = 29000 ug/L (short-term); 1500 ug/L (long-term).

Cadmium: CCME CWQG for the Protection of Aquatic Life = 1.0 ug/L (freshwater, short term); 0.09 ug/L (freshwater, long-term); 0.12 ug/L (marine, long-term)

Copper: CCME CWQG for the Protection of Freshwater Aquatic Life =  $e^{0.8545[\ln(\text{hardness})]-1.465} \times 0.2$  ug/L; minimum of 2 ug/L.

Lead: CCME CWQG for the Protection of Freshwater Aquatic Life =  $e^{1.273[\ln(\text{hardness})]-4.705}$  ug/L; minimum of 1 ug/L.

Nickel: CCME CWQG for the Protection of Freshwater Aquatic Life =  $e^{0.76[\ln(\text{hardness})]+1.06}$  ug/L; minimum of 25 ug/L.

Uranium: CCME CWQG for the Protection of Freshwater Aquatic Life = 33 ug/L (short-term); 15 ug/L (long-term).

Light values indicate results below detection limit.

**Yellow highlight indicates exceedance of Canadian Water Quality Guidelines for the Protection of Aquatic Life (Freshwater).**

**Interrupted border values indicate exceedance of Canadian Water Quality Guidelines for the Protection of Aquatic Life (Marine).**

**Italicized values indicate exceedance of Health Canada Guidelines for Canadian Drinking Water Quality (Maximum Acceptable Concentration and/or Aesthetic Objective).**

**Table B.5 BTEX/TPH Results for Marine Sediments as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Sample Identification	Date	Units	BTEX Concentrations				Petroleum Hydrocarbon Fraction Concentrations				MTBE	Reached Baseline at C32	Resemblance	FOC
			Benzene	Toluene	Ethylbenzene	Xylene	C <sub>6</sub> -C <sub>10</sub>	C <sub>10</sub> -C <sub>21</sub>	C <sub>21</sub> -C <sub>32</sub>	Modified TPH (Less BTEX)				
L-2	15-Jul-15	mg/kg	< 0.005	< 0.04	< 0.01	< 0.05	< 3	< 15	82	82	< 0.050	Y	Lube Oil Fraction	0.0281
L-11			< 0.005	< 0.04	< 0.01	< 0.05	< 3	< 15	46	46	< 0.050	Y	Lube Oil Fraction	0.0158
L-12			< 0.005	< 0.04	< 0.01	< 0.05	< 3	< 15	<b>108</b>	108	< 0.050	Y	Lube Oil Fraction	0.0292
L-21			< 0.005	< 0.04	< 0.01	< 0.05	< 3	<b>16</b>	53	69	< 0.050	Y	Lube Oil Fraction	0.0153
L-27			< 0.005	< 0.04	< 0.01	< 0.05	< 3	< 15	< 15	< 20	< 0.050	Y	No Resemblance	0.0087
L-33			< 0.005	< 0.04	< 0.01	< 0.05	< 3	< 15	<b>40</b>	40	< 0.050	Y	Lube Oil Fraction	0.0149
RD			0.005	0.04	0.01	0.05	3	15	15	20	0.050			
Guidelines			Benzene	Toluene	Ethylbenzene	Xylene	Gasoline	Diesel / No. 2 Fuel Oil	No. 6 Oil/ Lube Oil	Modified TPH (Less BTEX)	MTBE			
<b>Atlantic RBCA Tier I Version 3.0</b>														
<b>Risk-Based Screening Levels for Soil</b>														
Agricultural/ Residential Land Use	Potable	Coarse-Grained Soil	0.042	0.35	0.065	8.8	74	270	1100					
		Fine-Grained Soil	0.094	0.74	0.13	22	1900	4700	10000					
Commercial/ Industrial Land Use	Non-Potable	Coarse-Grained Soil	0.099	77	30	8.8	74	270	1100					
		Fine-Grained Soil	2.3	10000	9300	210	2100	8600	10000					
Residential Saturation	Potable	Coarse-Grained Soil	0.042	0.35	0.065	11	870	1800	10000					
		Fine-Grained Soil	0.094	0.74	0.13	22	1900	4700	10000					
Residential Saturation	Non-Potable	Coarse-Grained Soil	2.5	10000	10000	110	870	4000	10000					
		Fine-Grained Soil	33	10000	10000	10000	10000	10000	10000					
<b>Sediment Ecological Screening Levels for the Protection of Freshwater and Marine Aquatic Life</b>														
Sediment Type (based on standard FOC =)	Typical		1.2	1.4	1.2	1.3	15	25	43					
	Other		5.4	6.1	5	5.5	67	110	190					
Sediment Type (based on Average FOC = 0.02)	Typical		1.2	1.4	1.2	1.3	30	50	86					
	Other		5.4	6.1	5	5.5	134	220	380					
<b>CCME Soil Quality Guidelines</b>														
Agricultural, Residential/ Parkland, Commercial, and Industrial Land Uses	Surface	Coarse-Grained Soil	0.03	0.37	0.082	11.0								
		Fine-Grained Soil	0.0068	0.08	0.018	2.4								
	Subsoil	Coarse-Grained Soil	0.03	0.37	0.082	11.0								
		Fine-Grained Soil	0.0068	0.08	0.018	2.4								

NOTE(S):

Fraction of Organic Content (FOC) = g-carbon/g-soil

CCME Soil Quality Guidelines for benzene based on an incremental lifetime cancer risk (ILCR) of 1 in 100,000 (10<sup>-5</sup>).

Light values indicate results below detection limit.

**Bold values indicate exceedance of Atlantic RBCA Tier 1 Version 3.0 Sediment Ecological Screening Levels for the Protection of Freshwater and Marine Aquatic Life.**

**Table B.6 PCB and DDT Results for Marine Sediments as Compared to Federal Criteria - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date						CEPA Disposal at Sea Screening Criteria - Lower Level	CCME Sediment Quality Guidelines				CCME Soil Quality Guidelines			
			L-2	L-11	L-12	L-21	L-27	L-33		Interim Sediment Quality Guidelines		Marine and Estuarine Probable Effects Levels		Agricultural Land Use	Residential/Parkland Land Use	Commercial/Industrial Land Use	
			15-Jul-15							Freshwater	Marine	Freshwater	Marine				
<b>Polychlorinated Biphenyl (PCB) Results</b>																	
Aroclor 1016	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1221	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1232	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1242	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1248	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1254	0.0633		<0.0633	<0.0633	<0.0633	<0.0633	<0.0633	<0.0633		0.060	0.0633	0.340	0.709				
Aroclor 1260	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1262	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Aroclor 1268	0.1		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1									
Dieldrin	0.0007		< 0.0007	< 0.0007	< 0.0007	< 0.0007	< 0.0007	< 0.0007		0.00285	0.00071	0.00667	0.0043				
Total PCB Concentration	0.0215	< 0.0215	< 0.0215	< 0.0215	< 0.0215	< 0.0215	< 0.0215	0.1	0.0341	0.0215	0.277	0.189	0.5	1.3	33		
<b>Dichloro-Diphenyl-Trichloroethane (DDT) Results</b>																	
o,p-DDE		mg/kg	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
p,p-DDE			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
o,p-DDD			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
p,p-DDD			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
o,p-DDT			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
p,p-DDT			< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001									
o,p-DDT + p,p-DDT	1.0		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.00119	0.00119	0.00477	0.00477				
o,p-DDD + p,p-DDD	1.0		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.00354	0.00122	0.00851	0.00781				
o,p-DDE + p,p-DDE	1.0		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.00142	0.00207	0.00675	0.37400				
Total DDT (calculated)	1.0		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001						0.7	0.7	12	

NOTE(S):

Light values indicate results below detection limit.

**Table B.7 Grain Size and Carbon Content Results for Marine Sediments - Leonardville DFO-SCH, Charlotte County, New Brunswick**

Parameter	RDL	Units	Sample Identification and Date					
			L-2	L-11	L-12	L-21	L-27	L-33
			15-Jul-15					
<b>Grain Size Results</b>								
< PHI -4 (12.5 mm)	0.1	%	100	75.9	100	100	58.7	90.2
< PHI -3 (9.5 mm)	0.1		100	64.8	100	100	52	90.2
< PHI -2 (4.75 mm)	0.1		87.6	50.7	97.8	79.8	45.4	84.7
< PHI -1 (2 mm)	0.1		78.6	37.5	96.7	68.2	22.9	70.3
< PHI 0 (1 mm)	0.1		75.5	29.1	95.9	60.3	14.3	58.4
< PHI +1 (1/2 mm)	0.1		73.4	22.7	94.4	55.4	10.3	49.6
< PHI +2 (1/4 mm)	0.1		71.3	18.3	89.6	50	7	37.6
< PHI +3 (1/8 mm)	0.1		67	15.6	71.7	39.6	5.5	27.2
< PHI +4 (1/16 mm)	0.1		59.8	13.3	53.6	31	4.8	21
< PHI +5 (1/32 mm)	0.1		50.7	12.7	38.6	29.5	4.4	18.7
< PHI +6 (1/64 mm)	0.1		37.1	10.6	25.4	21.4	4.1	15.4
< PHI +7 (1/128 mm)	0.1		22.1	8.2	19	16.0	3.8	11.8
< PHI +8 (1/256 mm)	0.1		19.7	6.8	15.7	12.9	3.2	9.7
< PHI +9 (1/512 mm)	0.1		11.8	5.1	11.4	9.3	2.3	7.3
Gravel	1		21	63	3	32	77	30
Sand	1		19	24	43	37	18	49
Silt	1		40	6	38	18	2	11
Clay	1	20	7	16	13	3	10	
<b>Other</b>								
Total Organic Carbon (TOC)	0.15	%	2.81	1.58	2.92	1.53	0.87	1.49
Total Inorganic Carbon (TIC)	0.15	%	< 0.15	0.32	< 0.15	0.37	0.82	< 0.15
Total Carbon (TC)		%	2.89	1.90	3.00	1.90	1.69	1.57

NOTE(S):

All results below the laboratory detection limit were divided by 2 prior to further calculations.

Light values indicate results below detection limit.





**APPENDIX C**  
**QA/QC, COC, and Laboratory Certificates of Analyses**

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL  
580 MAIN STREET, SUITE 105  
SAINT JOHN, NB E2K1J5  
(506) 652-9497**

**ATTENTION TO: Chyann Kirby**

**PROJECT: TE131446.3000**

**AGAT WORK ORDER: 15X996778**

**SOIL ANALYSIS REVIEWED BY: Jason Coughtrey, Inorganics Supervisor**

**TRACE ORGANICS REVIEWED BY: Jennifer Patterson, Organics Supervisor**

**DATE REPORTED: Aug 06, 2015**

**PAGES (INCLUDING COVER): 31**

**VERSION\*: 4**

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

**\*NOTES**

VERSION 4: "Version "4" supersedes work order 15X996778, Version 3.0; Issued Aug 2, 2015"  
Updated report to include Organic and In-Organic Parameters, issued, August 2, 2015.  
V2: Partial report for Leachable parameters only, issued, July 27, 2015.

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



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Available Metals in Soil

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Aluminum	mg/kg	10	20100	18100	18600	19100	20000	18400	
Antimony	mg/kg	1	<1	<1	<1	<1	<1	<1	
Arsenic	mg/kg	1	14	8	12	8	8	7	
Barium	mg/kg	5	52	26	46	40	13	29	
Beryllium	mg/kg	2	<2	<2	<2	<2	<2	<2	
Boron	mg/kg	2	49	26	51	32	11	23	
Cadmium	mg/kg	0.3	0.3	<0.3	<0.3	<0.3	<0.3	<0.3	
Chromium	mg/kg	2	26	25	24	23	31	25	
Cobalt	mg/kg	1	8	8	8	7	10	7	
Copper	mg/kg	2	49	14	20	13	16	14	
Iron	mg/kg	50	18900	18700	18500	17200	33400	18500	
Lead	mg/kg	0.5	44.5	17.1	32.5	27.3	7.9	25.1	
Lithium	mg/kg	5	40	31	37	36	27	36	
Manganese	mg/kg	2	242	260	238	255	359	283	
Molybdenum	mg/kg	2	2	<2	<2	<2	<2	<2	
Nickel	mg/kg	2	19	19	20	18	23	16	
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	41	29	33	30	39	19	
Thallium	mg/kg	0.1	0.1	0.1	<0.1	0.1	0.2	0.1	
Tin	mg/kg	2	6	13	7	6	5	6	
Uranium	mg/kg	0.1	1.4	1.1	1.4	1.1	1.1	1.0	
Vanadium	mg/kg	2	33	34	34	31	35	32	
Zinc	mg/kg	5	88	60	79	59	51	58	

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard  
 6747287-6747359 Results are based on the dry weight of the sample.

Certified By:



# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

## AMEC - NB - Hexavalent Chromium in Soil

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		G / S	RDL	Soil	Soil	Soil	Soil	Soil	Soil
Chromium, Hexavalent	mg/kg	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4

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

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - SPLP Leachable Metals

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L33
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015
		G / S	RDL	6747287	6747359
Aluminum Leachate	mg/L		0.02	0.09	0.18
Antimony Leachate	mg/L		0.006	<0.006	<0.006
Arsenic Leachate	mg/L		0.005	0.040	0.012
Barium Leachate	mg/L		0.02	<0.02	<0.02
Beryllium Leachate	mg/L		0.05	<0.05	<0.05
Bismuth Leachate	mg/L		0.02	<0.02	<0.02
Boron Leachate	mg/L		0.05	0.70	0.29
Cadmium Leachate	mg/L		0.0001	0.0003	<0.0001
Chromium Leachate	mg/L		0.02	<0.02	<0.02
Cobalt Leachate	mg/L		0.01	<0.01	<0.01
Copper Leachate	mg/L		0.002	0.002	0.002
Iron Leachate	mg/L		0.2	<0.2	<0.2
Lead Leachate	mg/L		0.001	<0.001	<0.001
Lithium Leachate	mg/L		0.02	0.02	<0.02
Magnesium Leachate	mg/L		0.05	64.8	20.1
Manganese Leachate	mg/L		0.02	0.03	<0.02
Molybdenum Leachate	mg/L		0.02	0.04	<0.02
Nickel Leachate	mg/L		0.02	<0.02	<0.02
Selenium Leachate	mg/L		0.001	0.069	0.018
Silver Leachate	mg/L		0.0001	<0.0001	<0.0001
Sodium Leachate	mg/L		200	833	268
Strontium Leachate	mg/L		0.02	0.39	0.13
Thallium Leachate	mg/L		0.0008	<0.0008	<0.0008
Tin Leachate	mg/L		0.02	<0.02	<0.02
Uranium Leachate	mg/L		0.001	<0.001	<0.001
Vanadium Leachate	mg/L		0.02	<0.02	0.02
Zinc Leachate	mg/L		0.02	<0.02	<0.02
Initial pH	NA		NA	NA	NA
Final pH	NA		NA	7.62	7.95
% Moisture	%			60	35

Certified By:



# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

## AMEC - NB - SPLP Leachable Metals

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		G / S	RDL
		L-2	L33		
		SAMPLE TYPE:			
		Soil			
		DATE SAMPLED:			
		7/15/2015			
		7/15/2015			
Total Sample Mass	g			62.51	38.51
Hardness	mg/L	0.7		349	126

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

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - TOC/TIC

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Total Organic Carbon by Walkley Black	%		0.15	2.81	1.58	2.92	1.53	0.87	1.49
Total Inorganic Carbon, Calculated	%		0.15	<0.15	0.32	<0.15	0.37	0.82	<0.15

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

6747287-6747359 Total Carbon analysis performed by AGAT Burnaby.

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### Grain Size Analysis (Sieve & Pipette)

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Particle Size Distribution (<12.5mm, -4 PHI)	%		0.1	100	75.9	100	100	58.7	90.2
Particle Size Distribution (<9.5mm, -3 PHI)	%		0.1	100	64.8	100	100	52.0	90.2
Particle Size Distribution (<4.75mm, -2 PHI)	%		0.1	87.6	50.7	97.8	79.8	45.4	84.7
Particle Size Distribution (<2mm, -1 PHI)	%		0.1	78.6	37.5	96.7	68.2	22.9	70.3
Particle Size Distribution (<1mm, 0 PHI)	%		0.1	75.5	29.1	95.9	60.3	14.3	58.4
Particle Size Distribution (<1/2mm, 1 PHI)	%		0.1	73.4	22.7	94.4	55.4	10.3	49.6
Particle Size Distribution (<1/4mm, 2 PHI)	%		0.1	71.3	18.3	89.6	50.0	7.0	37.6
Particle Size Distribution (<1/8mm, 3 PHI)	%		0.1	67.0	15.6	71.7	39.6	5.5	27.2
Particle Size Distribution (<1/16mm, 4 PHI)	%		0.1	59.8	13.3	53.6	31.0	4.8	21.0
Particle Size Distribution (<1/32mm, 5 PHI)	%		0.1	50.7	12.7	38.6	29.5	4.4	18.7
Particle Size Distribution (<1/64mm, 6 PHI)	%		0.1	37.1	10.6	25.4	21.4	4.1	15.4
Particle Size Distribution (<1/128mm, 7 PHI)	%		0.1	22.1	8.2	19.0	16.0	3.8	11.8
Particle Size Distribution (<1/256mm, 8 PHI)	%		0.1	19.7	6.8	15.7	12.9	3.2	9.7
Particle Size Distribution (<1/512mm, 9 PHI)	%		0.1	11.8	5.1	11.4	9.3	2.3	7.3
Particle Size Distribution (Gravel)	%		1	21	63	3	32	77	30
Particle Size Distribution (Sand)	%		1	19	24	43	37	18	49
Particle Size Distribution (Silt)	%		1	40	6	38	18	2	11
Particle Size Distribution (Clay)	%		1	20	7	16	13	3	10
Particles >75um	%		1	38	86	42	67	95	77
Classification	Coarse/Fine			Fine	Coarse	Fine	Coarse	Coarse	Coarse

Certified By:





**AGAT** Laboratories

# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

## Grain Size Analysis (Sieve & Pipette)

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

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

Certified By:



# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

## Mercury Analysis in Soil

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Mercury	mg/kg			0.05	<0.05	0.06	<0.05	<0.05	<0.05

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard  
 6747287-6747359 Results are based on the dry weight of the soil.

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Atlantic RBCA Tier 1 Hydrocarbons - SPLP Leachate, EPH only

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

SAMPLE DESCRIPTION:		L12	
SAMPLE TYPE:		Soil	
DATE SAMPLED:		7/15/2015	
Parameter	Unit	G / S	RDL
>C10-C16 Hydrocarbons	mg/L	0.1	<0.1
>C16-C21 Hydrocarbons	mg/L	0.1	<0.1
>C21-C32 Hydrocarbons	mg/L	0.1	<0.1
Return to Baseline at C32			Y
Initial pH	NA	NA	4.01
Final pH	NA	NA	NA
% Moisture	%		63
Total Sample Mass	g		68
Surrogate	Unit	Acceptable Limits	
Isobutylbenzene - EPH	%	70-130	86
n-Dotriacontane - EPH	%	70-130	83

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

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Atlantic RBCA Tier 1 Hydrocarbons in Soil + Silica Gel + Creosote

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Methyl-t-Butyl-Ether (MTBE)	mg/Kg	0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Benzene	mg/kg	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Toluene	mg/kg	0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
Ethylbenzene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Xylene (Total)	mg/kg	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
C6-C10 (less BTEX)	mg/kg	3	<3	<3	<3	<3	<3	<3	<3
>C10-C21 Hydrocarbons	mg/kg	15	<15	<15	<15	16	<15	<15	<15
>C21-C32 Hydrocarbons	mg/kg	15	82	46	108	53	<15	40	40
Modified TPH (Tier 1)	mg/kg	20	82	46	108	69	<20	40	40
Resemblance Comment			LOF	LOF	LOF	LOF	NR	LOF	LOF
Creosote Comment			NR	NR	NR	NR	NR	NR	NR
Return to Baseline at C32			Y	Y	Y	Y	Y	Y	Y
% Moisture	%	1	60	28	63	42	25	35	35
Silica Gel Cleanup			y	y	y	y	y	y	y
Surrogate	Unit	Acceptable Limits							
Isobutylbenzene - EPH	%	60-140		76	79	63	N/A	103	64
Isobutylbenzene - VPH	%	60-140		71	74	69	76	69	76
n-Dotriacontane - EPH	%	60-140		94	95	67	101	121	129

Certified By:

*J. Patterson*



# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

**AMEC - NB - Atlantic RBCA Tier 1 Hydrocarbons in Soil + Silica Gel + Creosote**

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

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

6747287-6747343 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  
UC - Unidentified Compounds  
NR - No Resemblance  
NA - Not Applicable

6747347 EPH surrogate not available (NA) due to loss during silica gel cleanup.

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  
UC - Unidentified Compounds  
NR - No Resemblance  
NA - Not Applicable

6747355-6747359 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  
UC - Unidentified Compounds  
NR - No Resemblance  
NA - Not Applicable

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - DDT in Soil

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Dieldrin (Hfx 2012-03)	µg/kg		0.7	<0.7	<0.7	<0.7	<0.7	<0.7	<0.7
o,p'-DDD (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p'-DDE (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p'-DDT (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p,p'-DDD (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p,p'-DDE (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
p,p'-DDT (Hfx 2012-03)	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p'-DDT + p,p'-DDT	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p'-DDD + p,p'-DDD	ug/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
o,p'-DDE + p,p'-DDE	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total DDT	µg/kg		1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

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

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - PCB Arochlor

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Aroclor 1242	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg		0.0633	<0.0633	<0.0633	<0.0633	<0.0633	<0.0633	<0.0633
Aroclor 1260	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1016	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1262	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1268	mg/kg		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard  
 6747287-6747359 Results are based on the dry weight of the soil.

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Polycyclic Aromatic Hydrocarbons in SPLP Leachate

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L33
		G / S	RDL	6747287	6747359
1-Methylnaphthalene	ug/L		0.01	0.01	<0.01
2-Methylnaphthalene	ug/L		0.01	0.03	0.01
Acenaphthene	ug/L		0.04	0.11	<0.04
Acenaphthylene	ug/L		0.04	<0.04	<0.04
Anthracene	ug/L		0.012	0.143	0.026
Benzo(a)anthracene	ug/L		0.018	2.69	<0.018
Benzo(a)pyrene	ug/L		0.01	0.62	<0.01
Benzo(b)fluoranthene	ug/L		0.05	0.74	<0.05
Benzo(b+j)fluoranthene	µg/L		0.01	1.14	<0.01
Benzo(e)pyrene	ug/L		0.06	0.47	<0.06
Benzo(ghi)perylene	ug/L		0.02	0.07	<0.02
Benzo(k)fluoranthene	ug/L		0.04	0.77	<0.04
Chrysene	ug/L		0.04	1.69	<0.04
Dibenzo(a,h)anthracene	ug/L		0.01	0.04	<0.01
Fluoranthene	ug/L		0.03	0.36	0.15
Fluorene	ug/L		0.01	0.08	0.02
Indeno(1,2,3-cd)pyrene	ug/L		0.04	0.09	<0.04
Naphthalene	ug/L		0.01	<0.01	<0.01
Perylene	ug/L		0.05	0.09	<0.05
Phenanthrene	ug/L		0.02	0.33	0.06
Pyrene	ug/L		0.01	0.82	0.11
Total PAH	µg/L		2	8	<2
Initial pH	NA		NA	4.10	4.10
Final pH	NA		NA	8.01	7.93
Total Sample Mass	g			125	76.0
% Moisture	%			60	35
<b>Surrogate</b>	<b>Unit</b>	<b>Acceptable Limits</b>			
Nitrobenzene-d5	%	50-140		100	77
2-Fluorobiphenyl	%	50-140		83	70
Terphenyl-d14	%	50-140		57	52

Certified By:





**AGAT** Laboratories

# Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

**AMEC - NB - Polycyclic Aromatic Hydrocarbons in SPLP Leachate**

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

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

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Polycyclic Aromatic Hydrocarbons in Soil

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Parameter	Unit	SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015
		G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
1-Methylnaphthalene	mg/kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-Methylnaphthalene	mg/kg		0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	mg/kg		0.00671	0.0488	<0.00671	<0.00671	0.00683	<0.00671	<0.00671
Acenaphthylene	mg/kg		0.005	0.212	<0.005	0.042	0.037	<0.005	0.019
Acridine	mg/Kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	mg/kg		0.04	0.28	<0.04	0.07	0.07	<0.04	0.05
Benzo(a)anthracene	mg/kg		0.01	0.47	0.02	0.10	0.11	<0.01	0.08
Benzo(a)pyrene	mg/kg		0.01	0.34	<0.01	0.05	0.07	<0.01	0.05
Benzo(b)fluoranthene	mg/kg		0.05	1.07	<0.05	0.13	0.13	<0.05	0.07
Benzo(b+j)fluoranthene	mg/kg		0.1	1.4	<0.1	0.3	0.2	<0.1	0.1
Benzo(e)pyrene	mg/kg		0.05	0.62	<0.05	0.11	0.12	<0.05	0.07
Benzo(ghi)perylene	mg/kg		0.01	0.10	<0.01	<0.01	0.04	<0.01	0.02
Benzo(k)fluoranthene	mg/kg		0.01	0.42	<0.01	0.07	0.08	<0.01	0.04
Chrysene	mg/kg		0.01	1.52	0.04	0.28	0.26	<0.01	0.12
Dibenzo(a,h)anthracene	mg/kg		0.006	0.013	<0.006	<0.006	<0.006	<0.006	<0.006
Fluoranthene	mg/kg		0.05	4.52	<0.05	0.19	0.50	<0.05	0.22
Fluorene	mg/kg		0.02	0.09	<0.02	0.02	0.02	<0.02	<0.02
Indeno(1,2,3)pyrene	mg/kg		0.01	0.10	<0.01	<0.01	0.03	<0.01	0.02
Naphthalene	mg/kg		0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Perylene	mg/kg		0.05	0.10	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	mg/kg		0.04	1.80	<0.04	0.10	0.28	<0.04	0.17
Pyrene	mg/kg		0.05	2.76	<0.05	0.11	0.35	<0.05	0.17
Quinoline	mg/Kg		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total PAH	mg/Kg		0.5	11.0	<0.5	1.1	1.6	<0.5	0.8
% Moisture	%			60	28	63	42	25	35
<b>Surrogate</b>	<b>Unit</b>		<b>Acceptable Limits</b>						
Nitrobenzene-d5	%		50-140	84	87	73	78	84	78
2-Fluorobiphenyl	%		50-140	86	90	75	79	86	79
Terphenyl-d14	%		50-140	75	75	57	64	78	64

Certified By:

*J. Patterson*



**AGAT** Laboratories

## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

**AMEC - NB - Polycyclic Aromatic Hydrocarbons in Soil**

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard  
6747287-6747359 Results are based on the dry weight of the soil.

Certified By:



## Certificate of Analysis

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

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: AMEC EARTH AND ENVIRONMENTAL

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### AMEC - NB - Total Polychlorinated Biphenyls

DATE RECEIVED: 2015-07-17

DATE REPORTED: 2015-08-06

SAMPLE DESCRIPTION:		L-2	L11	L12	L21	L27	L33		
SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil		
DATE SAMPLED:		7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015	7/15/2015		
Parameter	Unit	G / S	RDL	6747287	6747339	6747343	6747347	6747355	6747359
Total Polychlorinated Biphenyls	mg/kg	0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215	<0.0215

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

6747287-6747359 Results are based on the dry weight of the soil.

Certified By:

## Quality Assurance

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

### Soil Analysis

RPT Date: Aug 06, 2015			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
<b>AMEC - NB - Available Metals in Soil</b>															
Aluminum	7202015		18400	19100	3.7%	< 10	120%	80%	120%	120%	80%	120%	105%	70%	130%
Antimony	7202015		< 1	< 1	0.0%	< 1	88%	80%	120%	103%	80%	120%	NA	70%	130%
Arsenic	7202015		7	7	0.0%	< 1	98%	80%	120%	96%	80%	120%	89%	70%	130%
Barium	7202015		29	34	15.9%	< 5	97%	80%	120%	101%	80%	120%	109%	70%	130%
Beryllium	7202015		< 2	< 2	0.0%	< 2	113%	80%	120%	114%	80%	120%	98%	70%	130%
Boron	7202015		23	24	4.3%	< 2	104%	80%	120%	101%	80%	120%	98%	70%	130%
Cadmium	7202015		< 0.3	< 0.3	0.0%	< 0.3	100%	80%	120%	99%	80%	120%	86%	70%	130%
Chromium	7202015		25	25	0.0%	< 2	110%	80%	120%	107%	80%	120%	81%	70%	130%
Cobalt	7202015		7	7	0.0%	< 1	108%	80%	120%	108%	80%	120%	71%	70%	130%
Copper	7202015		14	14	0.0%	< 2	111%	80%	120%	107%	80%	120%	74%	70%	130%
Iron	7202015		18500	18000	2.7%	< 50	109%	80%	120%	108%	80%	120%	89%	70%	130%
Lead	7202015		25.1	14.5	0.0%	< 0.5	107%	80%	120%	106%	80%	120%	92%	70%	130%
Lithium	7202015		36	35	2.8%	< 5	106%	70%	130%	107%	70%	130%	103%	70%	130%
Manganese	7202015		283	271	4.3%	< 2	115%	80%	120%	108%	80%	120%	86%	70%	130%
Molybdenum	7202015		< 2	< 2	0.0%	< 2	93%	80%	120%	94%	80%	120%	89%	70%	130%
Nickel	7202015		16	16	0.0%	< 2	109%	80%	120%	106%	80%	120%	74%	70%	130%
Selenium	7202015		< 1	< 1	0.0%	< 1	94%	80%	120%	81%	80%	120%	89%	70%	130%
Silver	7202015		< 0.5	< 0.5	0.0%	< 0.5	100%	80%	120%	104%	80%	120%	85%	70%	130%
Strontium	7202015		19	21	10.0%	< 5	101%	80%	120%	98%	80%	120%	95%	70%	130%
Thallium	7202015		0.1	< 0.1	0.0%	< 0.1	107%	80%	120%	103%	80%	120%	NA	70%	130%
Tin	7202015		6	7	15.4%	< 2	103%	80%	120%	100%	80%	120%	127%	70%	130%
Uranium	7202015		0.98	1.07	8.8%	< 0.1	101%	80%	120%	100%	80%	120%	92%	70%	130%
Vanadium	7202015		32	32	0.0%	< 2	107%	80%	120%	105%	80%	120%	93%	70%	130%
Zinc	7202015		58	57	1.7%	< 5	106%	80%	120%	108%	80%	120%	75%	70%	130%

**AMEC - NB - TOC/TIC**

Total Organic Carbon by Walkley Black	7060	3402	5.24	5.27	0.6%	< 0.15	91%	80%	120%	NA	80%	120%	100%	80%	120%
---------------------------------------	------	------	------	------	------	--------	-----	-----	------	----	-----	------	------	-----	------

**Mercury Analysis in Soil**

Mercury	1	6743415	< 0.05	< 0.05	0.0%	< 0.05	102%	70%	130%		70%	130%	91%	70%	130%
---------	---	---------	--------	--------	------	--------	------	-----	------	--	-----	------	-----	-----	------

**Soil Analysis - Total Organic Carbon (W-B Wet Oxidation)**

Total Organic Carbon	7060	3402	5.24	5.27	0.6%	< 0.15	91%	80%	120%				100%	80%	120%
----------------------	------	------	------	------	------	--------	-----	-----	------	--	--	--	------	-----	------

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

**AMEC - NB - SPLP Leachable Metals**

Aluminum Leachate	7312015		0.054	0.055	1.8%	< 0.02	120%	80%	120%	120%	80%	120%	114%	70%	130%
Antimony Leachate	7312015		< 0.006	< 0.006	0.0%	< 0.006	80%	80%	120%	89%	80%	120%	89%	70%	130%
Arsenic Leachate	7312015		0.060	0.061	1.7%	< 0.005	86%	80%	120%	85%	80%	120%	93%	70%	130%

## Quality Assurance

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

### Soil Analysis (Continued)

RPT Date: Aug 06, 2015			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
Barium Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	97%	80%	120%	92%	80%	120%	101%	70%	130%	
Beryllium Leachate	7312015		< 0.05	< 0.05	0.0%	< 0.05	104%	80%	120%	107%	80%	120%	111%	70%	130%	
Bismuth Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	108%	80%	120%	106%	80%	120%	83%	70%	130%	
Boron Leachate	7312015		0.99	0.97	2.0%	< 0.05	101%	80%	120%	104%	80%	120%	108%	70%	130%	
Cadmium Leachate	7312015		0.0002	0.0002	0.0%	< 0.0001	93%	80%	120%	86%	80%	120%	100%	70%	130%	
Chromium Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	115%	80%	120%	112%	80%	120%	103%	70%	130%	
Cobalt Leachate	7312015		< 0.01	< 0.01	0.0%	< 0.01	113%	80%	120%	109%	80%	120%	100%	70%	130%	
Copper Leachate	7312015		0.002	0.002	0.0%	< 0.002	120%	80%	120%	116%	80%	120%	98%	70%	130%	
Iron Leachate	7312015		< 0.2	< 0.2	0.0%	< 0.2	111%	80%	120%	114%	80%	120%	100%	70%	130%	
Lead Leachate	7312015		< 0.001	< 0.001	0.0%	< 0.001	104%	80%	120%	104%	80%	120%	90%	70%	130%	
Lithium Leachate	7312015		0.03	0.03	0.0%	< 0.02	109%	80%	120%	109%	80%	120%	109%	70%	130%	
Magnesium Leachate	7312015		80.4	77.3	3.9%	< 0.05	119%	80%	120%	116%	70%	130%	92%	70%	130%	
Manganese Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	117%	80%	120%	116%	80%	120%	99%	70%	130%	
Molybdenum Leachate	7312015		0.04	0.04	0.0%	< 0.02	99%	80%	120%	93%	80%	120%	101%	70%	130%	
Nickel Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	115%	80%	120%	113%	80%	120%	98%	70%	130%	
Selenium Leachate	7312015		0.0729	0.0787	7.7%	< 0.001	108%	80%	120%	99%	80%	120%	88%	70%	130%	
Silver Leachate	7312015		< 0.0001	< 0.0001	0.0%	< 0.0001	103%	80%	120%	98%	80%	120%	87%	70%	130%	
Sodium Leachate	7312015		986	966	2.0%	< 200	113%	80%	120%	110%	80%	120%	93%	70%	130%	
Strontium Leachate	7312015		0.561	0.571	1.8%	< 0.02	96%	80%	120%	95%	80%	120%	96%	70%	130%	
Thallium Leachate	7312015		< 0.0008	< 0.0008	0.0%	< 0.0008	101%	80%	120%	100%	80%	120%	96%	70%	130%	
Tin Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	97%	80%	120%	94%	80%	120%	97%	70%	130%	
Uranium Leachate	7312015		< 0.001	< 0.001	0.0%	< 0.001	83%	80%	120%	83%	80%	120%	90%	70%	130%	
Vanadium Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	109%	80%	120%	107%	80%	120%	97%	70%	130%	
Zinc Leachate	7312015		< 0.02	< 0.02	0.0%	< 0.02	102%	80%	120%	100%	80%	120%	99%	70%	130%	

**Certified By:**


## Quality Assurance

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

### Trace Organics Analysis

RPT Date: Aug 06, 2015			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE		MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

**AMEC - NB - Atlantic RBCA Tier 1 Hydrocarbons in Soil + Silica Gel + Creosote**

Methyl-t-Butyl-Ether (MTBE)	1	6723371	< 0.050	< 0.050	0.0%	< 0.050	72%	60%	140%	75%	60%	140%	69%	60%	140%
Benzene	1	6723371	< 0.005	< 0.005	0.0%	< 0.005	86%	60%	140%	82%	60%	140%	72%	30%	130%
Toluene	1	6723371	< 0.04	< 0.04	0.0%	< 0.04	80%	60%	140%	79%	60%	140%	68%	30%	130%
Ethylbenzene	1	6723371	< 0.01	< 0.01	0.0%	< 0.01	81%	60%	140%	81%	60%	140%	69%	30%	130%
Xylene (Total)	1	6723371	< 0.05	< 0.05	0.0%	< 0.05	94%	60%	140%	94%	60%	140%	81%	30%	130%
C6-C10 (less BTEX)	1	6723371	< 3	< 3	0.0%	< 3	98%	60%	140%	117%	60%	140%	116%	30%	130%
>C21-C32 Hydrocarbons	1	6749721	<15	<15	0.0%	< 15	100%	60%	140%	92%	60%	140%	99%	30%	130%

**AMEC - NB - PCB Arochlor**

Aroclor 1242	92	6743388	< 0.1	< 0.1	NA	< 0.1	128%	70%	130%	85%	70%	130%	80%	60%	140%
Aroclor 1254	92	6743388	< 0.0633	< 0.0633	NA	< 0.0633	113%	70%	130%	84%	70%	130%	80%	60%	140%
Aroclor 1260	92	6743388	< 0.1	< 0.1	NA	< 0.1	96%	70%	130%	74%	70%	130%	71%	60%	140%

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

**AMEC - NB - DDT in Soil**

Dieldrin (Hfx 2012-03)	1	6743371	< 0.7	< 0.7	0.0%	< 0.7	93%	60%	130%	97%	70%	130%	NA	60%	130%
o,p'-DDD (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	98%	60%	130%	105%	70%	130%	NA	60%	130%
o,p'-DDE (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	97%	60%	130%	99%	70%	130%	NA	60%	130%
o,p'-DDT (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	93%	60%	130%	93%	70%	130%	NA	60%	130%
p,p'-DDD (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	93%	60%	130%	91%	70%	130%	NA	60%	130%
p,p'-DDE (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	89%	60%	130%	93%	70%	130%	NA	60%	130%
p,p'-DDT (Hfx 2012-03)	1	6743371	< 1.0	< 1.0	0.0%	< 1.0	98%	60%	130%	96%	70%	130%	NA	60%	130%

**AMEC - NB - Polycyclic Aromatic Hydrocarbons in Soil**

1-Methylnaphthalene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	53%	50%	140%	90%	50%	140%	73%	50%	140%
2-Methylnaphthalene	1	6743380	< 0.02	< 0.02	0.0%	< 0.02	95%	50%	140%	91%	50%	140%	74%	50%	140%
Acenaphthene	1	6743380	< 0.00671	< 0.00671	0.0%	< 0.00671	92%	50%	140%	85%	50%	140%	70%	50%	140%
Acenaphthylene	1	6743380	< 0.005	< 0.005	0.0%	< 0.005	83%	50%	140%	77%	50%	140%	58%	50%	140%
Acridine	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	53%	50%	140%	56%	50%	140%	55%	50%	140%
Anthracene	1	6743380	< 0.04	< 0.04	0.0%	< 0.04	79%	50%	140%	69%	50%	140%	70%	50%	140%
Benzo(a)anthracene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	79%	50%	140%	68%	50%	140%	55%	50%	140%
Benzo(a)pyrene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	75%	50%	140%	105%	50%	140%	63%	50%	140%
Benzo(b)fluoranthene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	106%	50%	140%	89%	50%	140%	72%	50%	140%
Benzo(b+j)fluoranthene	1	6743380	< 0.1	< 0.1	0.0%	< 0.1	108%	50%	140%	93%	50%	140%	86%	50%	140%
Benzo(e)pyrene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	114%	50%	140%	97%	50%	140%	97%	50%	140%
Benzo(ghi)perylene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	71%	50%	140%	52%	50%	140%	81%	50%	140%
Benzo(k)fluoranthene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	74%	50%	140%	74%	50%	140%	72%	50%	140%
Chrysene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	85%	50%	140%	79%	50%	140%	75%	50%	140%
Dibenzo(a,h)anthracene	1	6743380	< 0.006	< 0.006	0.0%	< 0.006	76%	50%	140%	52%	50%	140%	80%	50%	140%
Fluoranthene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	87%	50%	140%	78%	50%	140%	59%	50%	140%

## Quality Assurance

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

### Trace Organics Analysis (Continued)

RPT Date: Aug 06, 2015			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits		
								Lower	Upper		Lower	Upper		Lower	Upper	
Fluorene	1	6743380	< 0.02	< 0.02	0.0%	< 0.02	85%	50%	140%	76%	50%	140%	58%	50%	140%	
Indeno(1,2,3)pyrene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	70%	50%	140%	68%	50%	140%	61%	50%	140%	
Naphthalene	1	6743380	< 0.01	< 0.01	0.0%	< 0.01	95%	50%	140%	90%	50%	140%	75%	50%	140%	
Perylene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	85%	50%	140%	80%	50%	140%	81%	50%	140%	
Phenanthrene	1	6743380	< 0.04	< 0.04	0.0%	< 0.04	95%	50%	140%	82%	50%	140%	69%	50%	140%	
Pyrene	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	85%	50%	140%	77%	50%	140%	58%	50%	140%	
Quinoline	1	6743380	< 0.05	< 0.05	0.0%	< 0.05	76%	50%	140%	94%	50%	140%	66%	50%	140%	
Terphenyl-d14	1	6743380	<	<	0.0%	<										

**AMEC - NB - Total Polychlorinated Biphenyls**

Total Polychlorinated Biphenyls	1	6743371	< 0.0215	< 0.0215	0.0%	< 0.0215	99%	70%	130%	100%	60%	130%	NA	60%	130%
---------------------------------	---	---------	----------	----------	------	----------	-----	-----	------	------	-----	------	----	-----	------

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

**AMEC NWT Polychlorinated Biphenyls Analysis in Soil**

Aroclor 1242	92	6743388	< 0.03	< 0.03	NA	< 0.03	128%	70%	130%	85%	70%	130%	80%	50%	150%
Aroclor 1254	92	6743388	< 0.03	< 0.03	NA	< 0.03	113%	70%	130%	84%	70%	130%	80%	50%	150%
Aroclor 1260	92	6743388	< 0.03	< 0.03	NA	< 0.03	96%	70%	130%	74%	70%	130%	71%	50%	150%

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

**AMEC - NB - Polycyclic Aromatic Hydrocarbons in SPLP Leachate**

1-Methylnaphthalene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	56%	50%	140%	102%	50%	140%	92%	50%	140%
2-Methylnaphthalene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	96%	50%	140%	103%	50%	140%	95%	50%	140%
Acenaphthene	1	6711559	< 0.04	< 0.04	0.0%	< 0.04	94%	50%	140%	104%	50%	140%	94%	50%	140%
Acenaphthylene	1	6711559	< 0.04	< 0.04	0.0%	< 0.04	87%	50%	140%	98%	50%	140%	86%	50%	140%
Anthracene	1	6711559	< 0.012	< 0.012	0.0%	< 0.012	75%	50%	140%	76%	50%	140%	81%	50%	140%
Benzo(a)anthracene	1	6711559	< 0.018	< 0.018	0.0%	< 0.018	81%	50%	140%	85%	50%	140%	78%	50%	140%
Benzo(a)pyrene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	118%	50%	140%	79%	50%	140%	125%	50%	140%
Benzo(b)fluoranthene	1	6711559	< 0.05	< 0.05	0.0%	< 0.05	118%	50%	140%	107%	50%	140%	101%	50%	140%
Benzo(b+j)fluoranthene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	101%	50%	140%	125%	50%	140%	130%	50%	140%
Benzo(e)pyrene	1	6711559	< 0.06	< 0.06	0.0%	< 0.06	108%	50%	140%	116%	50%	140%	115%	50%	140%
Benzo(ghi)perylene	1	6711559	< 0.02	< 0.02	0.0%	< 0.02	74%	50%	140%	125%	50%	140%	84%	50%	140%
Benzo(k)fluoranthene	1	6711559	< 0.04	< 0.04	0.0%	< 0.04	94%	50%	140%	95%	50%	140%	93%	50%	140%
Chrysene	1	6711559	< 0.04	< 0.04	0.0%	< 0.04	88%	50%	140%	99%	50%	140%	95%	50%	140%
Dibenzo(a,h)anthracene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	54%	50%	140%	65%	50%	140%	65%	50%	140%
Fluoranthene	1	6711559	< 0.03	< 0.03	0.0%	< 0.03	85%	50%	140%	94%	50%	140%	89%	50%	140%
Fluorene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	81%	50%	140%	80%	50%	140%	85%	50%	140%
Indeno(1,2,3-cd)pyrene	1	6711559	< 0.04	< 0.04	0.0%	< 0.04	114%	50%	140%	78%	50%	140%	69%	50%	140%
Naphthalene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	99%	50%	140%	110%	50%	140%	98%	50%	140%
Perylene	1	6711559	< 0.05	< 0.05	0.0%	< 0.05	81%	50%	140%	89%	50%	140%	85%	50%	140%
Phenanthrene	1	6711559	< 0.02	< 0.02	0.0%	< 0.02	97%	50%	140%	102%	50%	140%	98%	50%	140%
Pyrene	1	6711559	< 0.01	< 0.01	0.0%	< 0.01	83%	50%	140%	93%	50%	140%	88%	50%	140%



## Quality Assurance

**CLIENT NAME:** AMEC EARTH AND ENVIRONMENTAL  
**PROJECT:** TE131446.3000  
**SAMPLING SITE:**

**AGAT WORK ORDER:** 15X996778  
**ATTENTION TO:** Chyann Kirby  
**SAMPLED BY:**

### Trace Organics Analysis (Continued)

RPT Date: Aug 06, 2015			DUPLICATE				Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Measured Value		Acceptable Limits			Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper	Lower		Upper	Lower		Upper	

**AMEC - NB - Atlantic RBCA Tier 1 Hydrocarbons - SPLP Leachate, EPH only**

>C10-C16 Hydrocarbons	1	6801680	<0.05	<0.05	0	< 0.1	99%	70%	130%	114%	70%	130%	97%	70%	130%
>C16-C21 Hydrocarbons	1	6801680	<0.05	<0.05	0	< 0.1	105%	70%	130%	114%	70%	130%	97%	70%	130%
>C21-C32 Hydrocarbons	1	6801680	<0.01	<0.01	0	< 0.1	103%	70%	130%	114%	70%	130%	97%	70%	130%

Certified By: \_\_\_\_\_



## Method Summary

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Soil Analysis</b>			
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
Zinc	MET-121-6105 & MET-121-6103	EPA SW 846 6020A/3050B & SM 3125	ICP/MS
Chromium, Hexavalent	INOR-121-6029	SSSA 5;25 p. 683	SPECTROPHOTOMETER
Aluminum Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Antimony Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Arsenic Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS

## Method Summary

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Barium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Beryllium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Bismuth Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Boron Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Cadmium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Chromium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Cobalt Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Copper Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Iron Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Lead Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Lithium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Magnesium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Manganese Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Molybdenum Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Nickel Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Selenium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Silver Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Sodium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Strontium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Thallium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Tin Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Uranium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Vanadium Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Zinc Leachate	MET-121-6108, MET-121-6105	EPA SW-846 6020A/SM1325 In-house leachate	ICP-MS
Initial pH	MET-121-6108		pH METER
Final pH	MET-121-6108		pH METER
% Moisture			GRAVIMETRIC
Total Sample Mass			
Hardness		SM 2340B	CALCULATION
Total Organic Carbon by Walkley Black	SOIL 0480; SOIL 0110; SOIL 0120	NELSON 1996; SHEPPARD 2007	SPECTROPHOTOMETER
Total Inorganic Carbon, Calculated			CALCULATION



## Method Summary

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**

**AGAT WORK ORDER: 15X996778**

**PROJECT: TE131446.3000**

**ATTENTION TO: Chyann Kirby**

**SAMPLING SITE:**

**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Particle Size Distribution (<12.5mm, -4 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<9.5mm, -3 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<4.75mm, -2 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<2mm, -1 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1mm, 0 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/2mm, 1 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/4mm, 2 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/8mm, 3 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/16mm, 4 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/32mm, 5 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/64mm, 6 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/128mm, 7 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/256mm, 8 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (<1/512mm, 9 PHI)	INOR-121-6034	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (Gravel)	INOR-121-6031	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (Sand)	INOR-121-6031	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (Silt)	INOR-121-6031	ASTM D-422-63	SIEVE & PIPETTE
Particle Size Distribution (Clay)	INOR-121-6031	ASTM D-422-63	SIEVE & PIPETTE
Particles >75um	INOR-121-6031, INOR-121-6034	ASTM D-422-63	CALCULATED
Classification	INOR-121-6031, INOR-121-6031	Atlantic RBCA	CALCULATED
Mercury	INOR-121-6101 & INOR-121-6107	Based on EPA 245.5 & SM 3112B	CV/AA
Total Organic Carbon	SOIL 0480; SOIL 0110; SOIL 0120	NELSON 1996; SHEPPARD 2007	SPECTROPHOTOMETER

## Method Summary

CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL

AGAT WORK ORDER: 15X996778

PROJECT: TE131446.3000

ATTENTION TO: Chyann Kirby

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
<b>Trace Organics Analysis</b>			
>C10-C16 Hydrocarbons	VOL-120-5007/INOR-121-6039	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C16-C21 Hydrocarbons	VOL-120-5007/INOR-121-6039	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
>C21-C32 Hydrocarbons	VOL-120-5007/INOR-121-6039	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Return to Baseline at C32	VOL-120-5007/INOR-121-6039	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Isobutylbenzene - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
n-Dotriacontane - EPH	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Initial pH	MET-121-6108		
Final pH	MET-121-6108		
% Moisture			GRAVIMETRIC
Total Sample Mass			
Methyl-t-Butyl-Ether (MTBE)	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
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-C21 Hydrocarbons	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
>C21-C32 Hydrocarbons	VOL-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
Modified TPH (Tier 1)	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
Resemblance Comment	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS/FID
Creosote Comment			GC/FID
Return to Baseline at C32	ORG-120-5007	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/FID
% Moisture	LAB-131-4024	Topp, G.C. 1993. Soil Water Content. CSSS	GRAVIMETRIC
Silica Gel Cleanup			GC/FID
Isobutylbenzene - VPH	VOL-120-5013	Atlantic RBCA Guidelines for Laboratories Tier 1	GC/MS
Dieldrin (Hfx 2012-03)	ORG-120-5108		GC/ECD
o,p'-DDD (Hfx 2012-03)	ORG-120-5108		GC/ECD
o,p'-DDE (Hfx 2012-03)	ORG-120-5108		GC/ECD
o,p'-DDT (Hfx 2012-03)	ORG-120-5108		GC/ECD
p,p'-DDD (Hfx 2012-03)	ORG-120-5108		GC/ECD
p,p'-DDE (Hfx 2012-03)	ORG-120-5108		GC/ECD
p,p'-DDT (Hfx 2012-03)	ORG-120-5108		GC/ECD
o,p'-DDT + p,p'-DDT	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD

## Method Summary

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
o,p'-DDD + p,p'-DDD	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
o,p'-DDE + p,p'-DDE	ORG-120-5108	Based on EPA SW-846/6510 C-8080-8081 A	GC/ECD
Total DDT	Calculation	Calculation	GC/FID
Aroclor 1242	TO 0400	EPA 8082	GC/ECD
Aroclor 1248	TO 0400	EPA 8082	GC/ECD
Aroclor 1254	TO 0400	EPA 8082	GC/ECD
Aroclor 1260	TO 0400	EPA 8082	GC/ECD
Aroclor 1016	TO 0400	EPA 8082	GC/ECD
Aroclor 1221	TO 0400	EPA 8082	GC/ECD
Aroclor 1232	TO 0400	EPA 8082	GC/ECD
Aroclor 1262	TO 0400	EPA 8082	GC/ECD
Aroclor 1268	TO 0400	EPA 8082	GC/ECD
1-Methylnaphthalene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
2-Methylnaphthalene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Acenaphthene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Acenaphthylene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Anthracene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(a)anthracene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(a)pyrene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(b)fluoranthene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(b+j)fluoranthene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(e)pyrene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(ghi)perylene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Benzo(k)fluoranthene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Chrysene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Dibenzo(a,h)anthracene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Fluoranthene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Fluorene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Naphthalene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Perylene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Phenanthrene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS

## Method Summary

**CLIENT NAME: AMEC EARTH AND ENVIRONMENTAL**
**AGAT WORK ORDER: 15X996778**
**PROJECT: TE131446.3000**
**ATTENTION TO: Chyann Kirby**
**SAMPLING SITE:**
**SAMPLED BY:**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Pyrene	ORG-120-5104/INOR-121-6040	CGSB 164-GP-IMP/EPA SW846/3510/8270D/354	GC/MS
Total PAH			CALCULATION
Nitrobenzene-d5	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
2-Fluorobiphenyl	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Terphenyl-d14	ORG-120-5104	EPA SW846/3510/8270C	GC/MS
Initial pH	MET-121-6108-TCLP		
Final pH	MET-121-6108-TCLP		
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
Total PAH			
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
Total Polychlorinated Biphenyls	ORG-120-5106	EPA SW846/8081/8080	GC/ECD
Aroclor 1242	TO 0410	EPA 8082	GC/ECD
Aroclor 1254	TO 0410	EPA 8082	GC/ECD
Aroclor 1260	TO 0410	EPA 8082	GC/ECD
Total Polychlorinated Biphenyls	TO 0410	EPA 8082	GC/ECD
Decachlorobiphenyl	TO 0410	EPA 8082	GC/ECD



Unit 122 - 11 Morris Dr.  
Dartmouth, Nova Scotia  
B3B 1M2  
http://webearth.agatlabs.com

Phone: 902-468-8718  
Fax: 902-468-8924  
www.agatlabs.com

**Laboratory use Only**  
 Arrival Condition:  Good  Poor (complete 'notes')  
 Arrival Temperature: 30 AGAT Job Number: 15X996778  
 Notes: \_\_\_\_\_

Drinking Water Sample (y/n):   N   Reg. No. \_\_\_\_\_  
 Waterworks Number: \_\_\_\_\_

<b>Report To:</b> Company: Amec Foster Wheeler Contact: Chyann Kirby Address: 580 Main Street, Suite 105, Hilyard Place, Building B, Saint John, New Brunswick, F2K 1T5 Phone: 506-652-4530 FAX: 506-652-9517 PO#: _____ AGAT Quotation: 15-1771 Client Project #: TE131446.3000		<b>Report Information</b> 1. Name: Chyann Kirby Email: chyann.kirby@amecflw.com 2. Name: Christa Dubreuil Email: christa.dubreuil@amecflw.com		<b>Report Format</b> <input type="checkbox"/> Single PDF sample per page <input type="checkbox"/> Multiple PDF samples per page <input type="checkbox"/> Excel Format Included		<b>Turnaround Time (TAT) Business Days</b> <b>Regular TAT:</b> <input checked="" type="checkbox"/> 5 - 7 days <b>Rush TAT:</b> <input type="checkbox"/> 1 day <input type="checkbox"/> 2 days <input type="checkbox"/> 3 - 4 days Date Required: _____ Time Required: _____	
<b>Invoice to:</b> Same (Y/N) - Circle		<b>Regulatory Requirements (Check):</b> <input type="checkbox"/> List Guidelines on Report <input checked="" type="checkbox"/> Do Not List Guidelines on Report <input type="checkbox"/> PIRI Site Info (check all that apply): <input type="checkbox"/> Tier 1 <input type="checkbox"/> Res. <input type="checkbox"/> Pot. <input type="checkbox"/> Coarse <input type="checkbox"/> Tier 2 <input type="checkbox"/> Com <input type="checkbox"/> N/Pot. <input type="checkbox"/> Fine <input type="checkbox"/> Gas <input type="checkbox"/> Fuel <input type="checkbox"/> Lube <input type="checkbox"/> CCME <input type="checkbox"/> CDWQ <input type="checkbox"/> Ind <input type="checkbox"/> NSDFOSP <input type="checkbox"/> Com <input type="checkbox"/> HRM 101 <input type="checkbox"/> Res/P Storm Water <input type="checkbox"/> Ag <input type="checkbox"/> HRM 101 <input type="checkbox"/> FWAL Waste Water <input type="checkbox"/> Sediment <input type="checkbox"/> Other					

SAMPLE IDENTIFICATION	DATE / TIME SAMPLED	SAMPLE MATRIX	# OF CONTAINERS	COMMENTS - site/sample info, sample containment	Field Filtered/ Preserved	Standard Water Analysis +MS	Available Metals (w Sn Se-LL)	Hexavalent Chromium	Mercury	PSA - Sieve & Pipette	TOC	TC	DDT	Silica Gel Cleanup	TPH/BTEX (PIR) Tier 1	Total PAH	Total PCBs (Calculation)	PCB Arochlors-1242,1248,1254,1260 (Misc)	PCB Phoclorins-1016,1221,1232,1262,1263 (Cal)	Zero Headspace Extract for Potential Leachate Analysis (Perform Extract on July 21, 2015)	Lab Sample #
L-2	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L-11	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L-12	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L-21	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L-27	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
L-33	15-Jul-15	sed./sol	4 x 500 ml	Sediment		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	

Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Special Instructions
Chyann Kirby (Amec Foster Wheeler) <i>Chyann Kirby</i>	16-Jul-15 1:00pm	<i>Trace Dorell</i>	17 July	Please include a qualitative comment regarding the presence of creosote in samples as well as provide the results in GIS-ready format.
Sample Relinquished By (print name & sign)	Date/Time	Samples Received By (print name and sign)	Date/Time	Page 1 of 1
		<i>Trace Dorell</i>	18/05	





## **APPENDIX D**

### **Limitations**

## LIMITATIONS

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
  1. The Standard Terms and Conditions which form a part of our Professional Services Contract.
  2. The Scope of Services.
  3. Time and Budgetary limitations as described in our Contract.
  4. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The information presented in this report is based on sampling techniques which are considered industry-standard for this type of assessment (i.e., samples collected by divers using standard procedures commonly accepted by PWGSC).
4. The sediment characteristics at the Site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the analytical reporting.
5. No request for information about the site history or operating practices within the site boundaries has been included in the scope of work for this project.
6. Sample collection and testing was carried out in accordance with the terms of our contract. Other substances, or different quantities of substances testing for, may be present on Site and may be revealed by different or other testing not provided for in our contract.
7. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. Amec Foster Wheeler accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.