Public Works and Government Services Canada

Travaux publics et Services gouvernementaux Canada

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Halifax
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SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

Vendor/Firm Name and Address
Raison sociale et adresse du fournisseur/de l'entrepreneur

Issuing Office - Bureau de distribution

Real Property Contracting
1713 Bedford Row
P.O. Box 2247/C.P.2247
Halifax, N.S./Halifax, (N.E.)
B3J 3C9
Halifax

Title - Sujet Lead Paint Abatement	
Solicitation No. - N° de l'invitation E0225-141170/A	**Amendment No. - N° modif.** 001
Client Reference No. - N° de référence du client E0225-14-1170	**Date** 2013-10-02
GETS Reference No. - N° de référence de SEAG PW-$PWA-123-5015	
File No. - N° de dossier PWA-3-70056 (123)	**CCC No./N° CCC - FMS No./N° VME**
Solicitation Closes - L'invitation prend fin **at - à 02:00 PM** **on - le 2013-10-17**	**Time Zone** **Fuseau horaire** Atlantic Daylight Saving Time ADT
F.O.B. - F.A.B. **Plant-Usine:** ☐ **Destination:** ☑ **Other-Autre:** ☐	
Address Enquiries to: - Adresser toutes questions à: Lockyer (PWA), Jeff	**Buyer Id - Id de l'acheteur** pwa123
Telephone No. - N° de téléphone (902) 496-5636 ( )	**FAX No. - N° de FAX** (902) 496-5016
Destination - of Goods, Services, and Construction: **Destination - des biens, services et construction:**	

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Delivery Required - Livraison exigée	**Delivery Offered - Livraison proposée**
Vendor/Firm Name and Address **Raison sociale et adresse du fournisseur/de l'entrepreneur** **Telephone No. - N° de téléphone** **Facsimile No. - N° de télécopieur**	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) **Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)** **Signature** **Date**	

Canada

La modification no 001 à la demande de soumissions est apportée pour les raisons suivantes:

**** Remarque: En raison de la nature technique de cette modification, il sera fourni en anglais seulement.**

Amendment 001 is being created to answer the following question from a potential bidder:

Question 1

Is there lead leachate soil data available for this site?

Answer 1

Please see attached in which contains the RAP with the paint and soil info in it.

***All other terms and conditions remain the same.**

September 11, 2013

Ms. Marcia Johannesen, B.Sc., M.A.Sc. (Env. Eng.)
Environmental Officer
Public Works and Government Services Canada
1045 Main Street
Moncton, New Brunswick
E1C 1H1

Dear Ms. Johannesen:

Re: Updated Risk Management Plan
Devil's Island Former Minor Shore Light, Halifax County, Nova Scotia

1.0 INTRODUCTION

AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC), was commissioned by Public Works and Government Services Canada (PWGSC), on behalf of Fisheries and Oceans Canada (DFO), to update a previous Risk Management Plan (RMP) prepared for the Devil's Island Former Minor Shore Light (DFRP#02878) by Dillon Consulting Limited (Dillon) in March 2013. The Devil's Island Former Minor Shore Light property is located on Devil's Island in Halifax County, Nova Scotia (NS).

2.0 SITE BACKGROUND

2.1 Site Description and History

The subject property is located on the southern end of Devil's Island, at the eastern edge of the mouth of Halifax Harbour, in Halifax County, Nova Scotia. According to Service Nova Scotia and Municipal Relations' Property Online, the subject property is legally described as PID No. 40020125. Service Nova Scotia and Municipal Relations' Property Online indicates that the subject property is owned by Transport Canada and occupies 0.36 hectares of land area. The DFRP information indicates that the property is Crown owned with DFO as custodian, and the land area is 4.41 hectares. The property boundaries presented in Figure 1 are generally consistent with the provincial land area, and those presented in the Risk Management Plan (Dillon, 2013). It is possible the DFRP land area includes the parcel of land to the south, on which the current minor shore light (MSL) is located.

The island is uninhabited. The first permanent settlement on this 12 hectare island was established in 1830, and by 1850 there were three houses and a school. By 1901 the settlement had grown to 18 houses. Most of the residents were moved to the mainland during World War II. Until the 1950s, the island was also the base for a rescue lifeboat, which saved the crews of many vessels stranded on the shoals approaching Halifax Harbour. The last permanent resident moved off in 2000.

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The Devil's Island former MSL consists of a three storey octagonal wood structure, approximately 6.5 m in diameter and supported by granite pillars underneath raising it above ground level. The former MSL is in a state of significant disrepair and represents an ongoing source of contamination in soil. Recently, a 6.6 m high square skeleton tower with red, white, and red rectangular daymark with a red triangle in the centre (LL No. 545) has been erected to replace the former MSL structure (Dillon, 2013). The new structure is located on the adjacent property (PID No. 40020067) southwest of the subject property.

The subject property is covered mainly by mixed grasses, with some scattered small shrubs and exposed bedrock and gravel shoreline. A small lagoon (or water-filled depression) was noted during a site visit (Dillon, 2013) on the adjacent property to the west of the subject property, near the former boat docking area on the western shoreline. No additional lagoons, ponded water or watercourses were observed on the subject property by Dillon, or in the previous Phase II ESA (JWEL, 2008). Storm water is anticipated to drain via infiltration or overland flow toward the small lagoon or the Atlantic Ocean.

2.2 Current Land Use

Currently, the Devil's Island former MSL property is an inactive navigational aid site with the former minor shore light as the only structure present. Land use is not anticipated to change in the foreseeable future.

2.3 Previous Investigations

The Human Health and Ecological Risk Assessment (HHERA) and RMP prepared by Dillon (2013) identified the following reports completed for the Devil's Island former MSL:

- Phase II Environmental Site Assessment, Devil's Island Minor Shore Light (LL #: 545, DFRP #: 2878, RPIS #: MC 00145), Halifax County, Nova Scotia, prepared by JWEL, March 2008.

The Dillon HHERA summarizes the main findings of this previous report. For this update, the only report provided for review was the Dillon HHERA completed in March 2013. A summary of the main results is presented below.

2.3.1 Site Exposure Scenario

The subject property is on federal land and; therefore, the appropriate guidelines for metals in soil are the Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines (SQG) for the Protection of Environmental and Human Health. The CCME SQG are developed on the basis of land use and are protective of both human health and ecological receptors. Based on the use of the subject property, the CCME SQG for commercial land use are the most appropriate guidelines for evaluating metal concentrations at the subject property.

The island is uninhabited and accessible only by boat. Dillon's assessment of this site indicated that a DFO Recreational surface soil criteria (SSC) is most appropriate for the subject property. The Recreational site exposure category is based on the site being publicly accessible and potentially attracting recreational visitors or tourists.

2.3.2 Soil Conditions

The results of the previous phased assessments identified lead in soil at concentrations that exceeded the DFO Recreational SSC. Therefore, an HHERA was completed for the subject property in 2013. The results of the HHRA indicated that the soil exposure point concentration (EPC) for lead was greater than the site-specific target level (SSTL) generated for toddlers, indicating that unacceptable risks cannot be discounted for toddler visitors to the site as a result of exposure to lead in soil. Unacceptable human health risks were not predicted for a visiting adult or a DFO worker.

The results of the ERA (Dillon, 2013) identified antimony, barium, copper, lead, manganese, mercury, selenium, and zinc in soil at concentrations that exceeded the applicable ecological criteria (SQG_E). The ERA concluded that chemicals present in subject property soil do not likely pose an ecological concern to terrestrial vegetation or soil invertebrates, despite the fact that some parameters exceed their respective SQG_E (developed for these receptor groups) in some soil samples. Subject property observations did not suggest that the soil concentrations of metals are limiting the presence, growth, or ability to reproduce for these receptors. Thus, the potential for community level adverse effects on these receptors appears to be low to negligible, and there did not appear to be any need for corrective action on the subject property in relation to the health or abundance of terrestrial vegetation or soil invertebrates.

One sample (SS3A) collected to the north of the MSL as part of the Phase II ESA (Jacques Whitford, 2008) exceeded the CCME commercial SQGs and the DFO Recreational Soil Screening Criteria (SSCs). Based on the soil results, the sample was submitted for leachate analysis. The lead leachate results (1.3 mg/L) were less than the Nova Scotia Department of the Environment and Labour (NSDEL) leachate criteria for lead (5 mg/L). Materials with a total lead concentration exceeding 1,000 mg/kg, but under the leachate regulatory limit of 5 mg/L can be disposed of at an approved provincial sanitary landfill. However, these materials cannot be disposed of at a C&D waste disposal site.

2.3.3 Lead Based Paint

A summary of the paint sampling program results is provided in Table 2.1 below.

Table 2.1 Summary of Lead in Paint at Devil's Island Former MSL.

Building	Reference	Location	Substrate	Paint Color	Area	Paint Concentration (mg/kg)	Leachate Concentration (mg/L)
Light House (including extension)	Jacques Whitford (21-Sep-07)	Exterior Wall	Wood	White	226 m^2	**32,000**	**6.2**
Light House	Dillon (22-Feb-13)	Under Stairwell	Wood (stairs) and fibreglass (roof)	Red	25 m^2	**2,200**	NA

Notes:
Guidelines for Disposal of Contaminated Solids in Landfills (NS Environment and Labour, 1992):
Total Lead = 1000 ppm, Leachable Lead = 5 mg/L (based on Transportation of Dangerous Goods regulations)
BOLD values exceed the applicable provincial guideline.

Paint samples (white) collected from the exterior wooden shingles of the former MSL structure wall exceeded the Guidelines for Disposal of Contaminated Solids in Landfills (NS Environment and Labour, 1992) for lead (1000 mg/kg). The sample was then submitted for leachate analysis. The concentration in leachate (6.2 mg/L) exceeded the limit of 5 mg/L based on Transportation of Dangerous Goods regulations. Since the material has a lead leachate concentration above 5 mg/L, it is considered "lead leachate toxic" and must be disposed of at an approved facility. There are currently no facilities in Nova Scotia capable of accepting lead leachate toxic materials and out-of province disposal is required.

During the Dillon (2013) site visit, red paint was noted under the stairwell of the former MSL, and as such was analyzed for lead content. The red paint was found to contain elevated lead concentrations exceeding the Guidelines for Disposal of Contaminated Solids in Landfills (NS Environment and Labour, 1992), but was not submitted for leachate analysis.

3.0 RE-EVALUATION OF ENVIRONMENTAL CONDITIONS

Recommendations for remedial action in the Dillon (2013) report were based on potential risk to toddlers based on a conceptual site model (CSM) in which the same toddler is at the former minor shore light two days/week. AMEC does not concur with this CSM on the basis it seems highly conservative, given the site characteristics (uninhabited island 1 km off-shore). It is unlikely that an adult would visit Devil's Island (and specifically the shore light) more than a few times per year and also unlikely that they would bring a 1-4 year old child with them. AMEC has re-evaluated the human health CSM and reduced the assumed exposure frequency for the toddler age group from two days per week to one day per week (the lowest frequency allowed by Health Canada for lead, a developmental toxicant). A final soil lead SSTL calculation is presented below. AMEC generally concurred with the overall conclusions of the ERA completed by Dillon (2013).

3.1 Site-Specific Target Levels

SSTLs can be calculated according to the risk characterization equation presented below:

$$\text{SSTL Toddler} = \frac{(\text{TDI} - \text{EDI}) \times \text{THQ} \times \text{BW}}{(AF_{gut} \times \text{SIR} \times ET_{ing}) + (AF_{lung} \times IR_{soil} \times ET_{inh}) + (AF_{skin} \times \text{SDR} \times ET_{derm})} + \text{BSC}$$

Where:

	SSTL	=	site-specific target level (mg/kg)
	TDI	=	tolerable daily intake (mg/kg – bw/day)
	EDI	=	estimated daily intake (mg/kg – bw/day)
	THQ	=	target hazard quotient (1; unitless)
	BW	=	body weight (kg)
	AF_{gut}	=	absorption factor for gut (unitless)
	SIR	=	soil ingestion rate (kg/day)
	ET_{ing}	=	exposure term for soil ingestion pathway (unitless)
	AF_{lung}	=	absorption factor for lung (unitless)
	IR_{soil}	=	soil inhalation rate (kg/day)
	ET_{inh}	=	exposure term for soil inhalation pathway (unitless)
	AF_{skin}	=	absorption factor skin (unitless)
	SDR	=	soil dermal contact rate (kg/day)
	ET_{derm}	=	exposure term for soil dermal contact pathway (unitless)
	BSC	=	background soil concentration (mg/kg)

The important characteristics of the receptors (including body weight (BW), exposure duration, *etc*.) considered in the SSTL are presented in Table 1 below.

Table 1 Summary of Receptor Characteristics

Characteristic		Toddler
Exposure	ET1 (hours per day exposed per 24 h/d)	2
	ET2 (days per week exposed per 7 d/wk)	1
	ET3 (weeks per year exposed per 52 wk/yr)	52
BW	Body Weight (kg)	16.5
IR_{soil}	Soil Ingestion Rate (g/d)	0.08
IR_{air}	Inhalation Rate (m^3/d)	8.3
SA_H	Skin Surface Area – Hands (cm^2)	430
SA_O	Skin Surface Area – Other (cm^2)	2580
AF_H	Adherence Factor – Hands (mg/cm^2)	0.1
AF_O	Adherence Factor – Other (mg/cm^2)	0.01

Notes:
ET3 – As per Health Canada (2010a), developmental toxicants were assessed assuming the hours per day, and days per week, but were not amortized as weeks per year as they present a risk of harm that may not be related to either frequency or duration of exposure.

Based on the above, the soil SSTL for lead is calculated as 2,800 mg/kg.

3.2 Exposure Point Concentrations

As impacts have been identified at concentrations exceeding the applicable SSTL, human receptors at the site could be exposed to the identified metal impacts in surface soil. Further risk assessment and possibly risk management is required. Subsequent risk management uses exposure point concentrations (EPCs) to represent contaminant concentrations. The EPC is an estimate of a reasonable upper limit value for the average chemical concentration in the soil and is represented by Upper Confidence Limits on the Mean (UCLM; 95% or above) calculated from ProUCL version 4.1.01 using data from the site.

The EPC for lead has been re-calculated and is consistent with that calculated by Dillon (2013) (6,230 mg/kg):

- Revised lead EPC = 6,226 mg/kg

Data used in ProUCL to calculate EPCs, and the results of the statistical analyses, are provided in Appendix A. In the case of laboratory or field duplicate samples, the sample with the highest concentration was used in the calculation of the EPC to ensure conservativeness in the assessment.

3.3 Contaminant Distribution

At light stations and related sites in Atlantic Canada, it is common to find that contaminant impacts on soil quality are strongest in the immediate vicinity of buildings and other site infrastructure, due to the weathering of paint from structures, the leakage or spillage of fuels, or historical waste disposal practices. This pattern is evident at the Devil's Island former Minor Shore Light where the highest soil lead concentrations are associated with the former MSL. Sample locations with lead concentrations exceeding the revised SSTL are restricted to the drip line of the light tower and consist of: SS3, SS6, and SS9.

4.0 RISK MANAGEMENT PLAN

There are two potential environmental concerns that should be addressed as part of the risk management plan for this site:

- Lead based paint on the former MSL in a state of significant disrepair represents an ongoing source of contamination in soil; and

- Soil lead concentrations on-site that exceed the SSTL.

A proposed risk management plan for both issues and a brief overview of logistical considerations and are provided herein.

4.1 Lead-Based Paint

The RMP prepared by Dillon (2013) did not make explicit recommendations with respect to dealing with elevated concentrations of lead in paint on the exterior and interior of the structure, with the exception of re-testing samples to confirm disposal options in the event rehabilitation or demolition is considered. As previously discussed, the former MSL is in significant disrepair. Soil remediation without paint remediation will result in re-contamination of the soil as the structure continues to deteriorate. Given that the light has been replaced by one on the adjacent property, the most practical option may be to demolish the structure rather than try to rehabilitate it (it is unlikely that paint scraping and re-encapsulation could be completed without structural repair); however, PWGSC has indicated that this is not a viable option for this site, given the historic nature of the building.

Based on the results of the lead paint analysis (Table 2.1), paint removed from the exterior wooden shingles of the former MSL structure cannot be disposed of at a licensed landfill within NS and will have to be transported out-of province for disposal.

4.2 Lead in Soil

Elevated concentrations (>SSTL) for lead are most likely related to flaking of lead based paint from the former MSL. To assess the potential benefits of undertaking risk management or remedial action in the immediate vicinity of the former MSL, the soil lead EPC has been recalculated, excluding the following samples, as illustrated on Figure 1, Appendix B:

- Impacted area within the dripline of the former MSL: SS3, SS6, SS9, and SS12.

The concentration of lead in soil at SS12 (dripline sample on the western side of the former MSL) did not exceed the revised SSTL. However, this sample has been excluded from the revised EPC calculation and it is recommended that remedial action undertaken should extend around the entire dripline of the former MSL.

The revised HHRA results are presented in Table 2 below.

Table 2 Revised Human Health Risk Assessment Results

Chemical	Maximum Concentration (mg/kg)	EPC (mg/kg)	SSTL (mg/kg)	Comment
			Site Visitor	
Lead	2,400	1,862	2,800	EPC does not exceed the SSTL.

As indicated, no unacceptable risks remain for site visitors assuming that the areas noted above and indicated on Figure 1 are risk managed and/or remediated. Based on the proposed remediated areas, no concentrations exceeding the revised SSTL (2,800 mg/kg) will be

remaining on-site, therefore overall risks associated with average exposure will be within acceptable limits. Risk management options are discussed below.

4.2.1 Risk Management Options

The risk management option presented below is considered logistically feasible but final selection of a preferred option will depend on DFO priorities in terms of practicality, economics, aesthetics, and other factors.

4.2.1.1 Capping

The risk management at the former MSL includes the encapsulation of the area requiring risk management with geosynthetic liner secured with soil excavated from an on-site borrow pit, which could be excavated in the vicinity of samples SS18 and SS19 (i.e., areas of the site with sufficient soil volumes and soil lead concentrations lower than the SSTL). Dillon provided performance considerations for a liner/soil cover in their risk management plan. The main considerations identified by Dillon are summarized as follows:

- The geosynthetic should be woven/permeable to rain water and UV resistant;
- The leading edges of the geosynthetic should be embedded at least 150mm (6”) into the ground;
- 100% of the surface of the geosynthetic should be covered with at least 150mm of soil to provide UV protection, erosion protection, and ballast;
- Seams in the geosynthetic liner will have a 500mm overlap;
- Soil shall be free of rocks or objects that may penetrate the underlying geosynthetic liner;
- Exposed soil shall be rolled/compacted and seeded with grass to stabilize it and prevent erosion. Temporary sediment control structures such as silt fencing, mulch, and hay bales may be required until the grass cover is established; and
- Based on the above performance criteria, a Terrafix® 800R or equivalent is recommended.

Because the foundation of the former MSL is elevated on blocks, additional considerations are as follows:

- Care should be taken to avoid ponding of water, especially beneath the former MSL as a result of the capping; and
- Because the borrow pit will not be backfilled, it should not exceed 30 cm in depth to avoid creating a tripping/falling hazard.

4.2.2 Site Logistical Issues

Dillon provided detailed discussion of logistical issues that may affect any remediation option at the site in their RMP dated March 2013. Logistical issues may include:

- The easiest logistical method to travel to the site is via helicopter. There is a flat area near the former MSL that serves a suitable landing spot.
- Dillon reported that it may be possible to land a boat or barge with light equipment (i.e., skid steer, mini excavators etc.) on the island during high tide. The western and northern shores of the island appeared to offer the most promising landing spots by sea.
- Due to site access constraints for mobile equipment, soil will likely need to be excavated manually with spades and transported to encapsulation area with wheelbarrows.
- When mobilizing equipment on and off the site and when conducting remedial activities, contractors should remain within the property boundaries. Permission from the adjacent property owners is required prior to traveling any mobile equipment across their land. Burrow pits outside the of subject property are not recommended.
- The site is relatively flat and covered by grass and small shrubs. There are no large trees on the island to impede equipment movement. Evidence of soft soils was observed on the island, however if travel to and from the site is conducted within the property boundaries, the disturbance of areas with soft soils would be avoided.
- Soil conditions on the property vary from exposed bedrock to >0.5m depth. Ground disturbance within 30m of the ordinary high water mark may require environmental permitting, and therefore should be avoided.
- Mobile equipment should not operate in the intertidal zone.

5.0 CLOSURE

This report was prepared for the exclusive use of Public Works and Government Services Canada and Fisheries and Oceans Canada, and is intended to provide an updated risk management plan for the Site. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of the third party. Should additional parties require reliance on this report, written authorization from AMEC will be required. With respect to third parties, AMEC has no liability or responsibility for losses of any kind whatsoever, including direct or consequential financial effects on transactions or property values, or requirements for follow-up actions and costs.

The report is based solely on a review of historical information and data obtained by AMEC as described in this report, and discussion with a representative of the owner/occupant, as reported herein. Except as otherwise maybe specified, AMEC disclaims any obligation to update this report for events taking place, or with respect to information that becomes available to AMEC after the time during which AMEC conducted the review.

In evaluating the property, AMEC has relied in good faith on information provided by other individuals noted in this report. AMEC has assumed that the information provided is factual and accurate. In addition, the findings in this report are based, to a large degree, upon information provided by the current owner/occupant. AMEC accepts no responsibility for any deficiency,

misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or fraudulent acts of persons interviewed or contacted.

AMEC makes no other representations whatsoever, including those concerning the legal significance of its findings, or as to other legal matters touched on in this report, including, but not limited to, ownership of any property, or the application of any law to the facts set forth herein. With respect to regulatory compliance issues, regulatory statutes are subject to interpretation and change. Such interpretations and regulatory changes should be reviewed with legal counsel.

This report was written by Erin Smith, P.Eng., P.Geo., and reviewed by Lynn Pilgrim, P.Geo. We trust that our submission meets your present requirement. Please do not hesitate to contact us if you have any questions regarding the above.

Regards,

AMEC Earth & Environmental
A division of AMEC Americas Limited

Prepared by:

Erin L. Smith, P.Eng., P.Geo.
Senior Project Professional

Reviewed by:

Lynn Pilgrim, P.Geo.
Senior Project Team Contact

Attachments

APPENDIX A

SOIL LEAD DATA

Table A1: Historical Lead Concentrations Used for Statictical Analysis

Sample ID	Lead Concentration (mg/kg)
SS1A	1600
SS2A	1900
SS3A*	6200
SS5A	2400
SS6A*	31000
SS8A	2100
SS9A*	6300
SS10A	1500
SS11A	140
SS12A	2600
SS13A	200
SS14A	250
SS15A	36
SS16A	110
SS17A	480
SS18A	430
SS19A	120
SS20A	1300
SS21A	2200

* Concentrations not included in the re-calculated EPC

General UCL Statistics for Full Data Sets

User Selected Options

From File	P:\PROJECTS\TE131400_PWGSC_SO_EA_CEAA_NB_PEI\TE131402_Peer Review Services_3Sites\Previous Repor
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Number of Valid Observations	16	Number of Distinct Observations	16
Number of Missing Values	3		

Raw Statistics

Minimum	36
Maximum	2600
Mean	1085
Geometric Mean	568
Median	890
SD	952.1
Std. Error of Mean	238
Coefficient of Variation	0.877
Skewness	0.294

Log-transformed Statistics

Minimum of Log Data	3.584
Maximum of Log Data	7.863
Mean of log Data	6.342
SD of log Data	1.382

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.858
Shapiro Wilk Critical Value	0.887

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	1503

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1496
95% Modified-t UCL (Johnson-1978)	1506

Gamma Distribution Test

k star (bias corrected)	0.775
Theta Star	1401
MLE of Mean	1085
MLE of Standard Deviation	1233
nu star	24.8
Approximate Chi Square Value (.05)	14.46
Adjusted Level of Significance	0.0335
Adjusted Chi Square Value	13.56
Anderson-Darling Test Statistic	0.761
Anderson-Darling 5% Critical Value	0.768
Kolmogorov-Smirnov Test Statistic	0.201
Kolmogorov-Smirnov 5% Critical Value	0.222

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL (Use when n >= 40)	1862
95% Adjusted Gamma UCL (Use when n < 40)	1984

Potential UCL to Use

Use 95% Approximate Gamma UCL 1862

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.888
Shapiro Wilk Critical Value	0.887

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	4850
95% Chebyshev (MVUE) UCL	3629
97.5% Chebyshev (MVUE) UCL	4623
99% Chebyshev (MVUE) UCL	6575

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

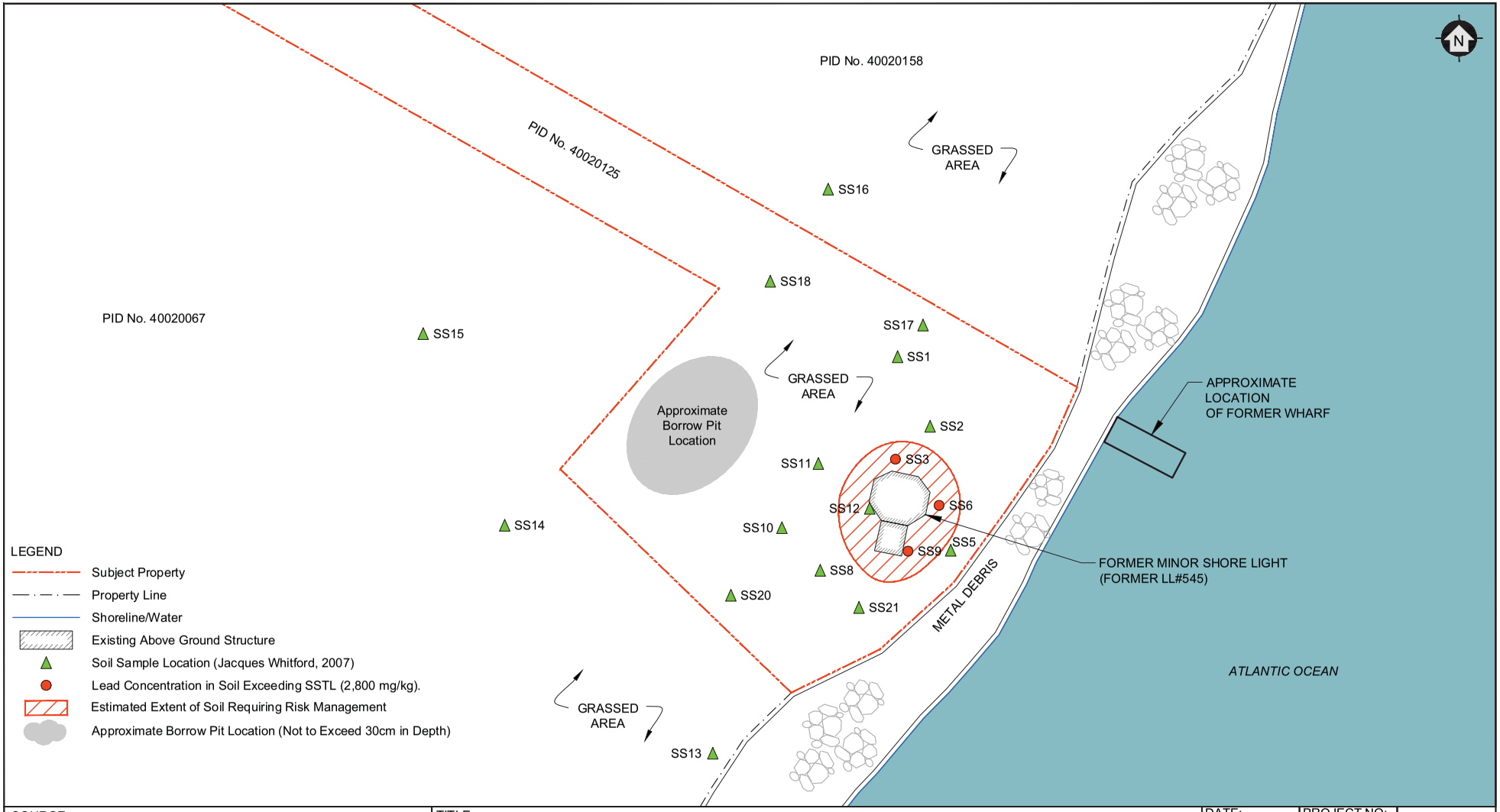
Nonparametric Statistics

95% CLT UCL	1477
95% Jackknife UCL	1503
95% Standard Bootstrap UCL	1461
95% Bootstrap-t UCL	1486
95% Hall's Bootstrap UCL	1466
95% Percentile Bootstrap UCL	1475
95% BCA Bootstrap UCL	1473
95% Chebyshev(Mean, Sd) UCL	2123
97.5% Chebyshev(Mean, Sd) UCL	2572
99% Chebyshev(Mean, Sd) UCL	3454

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

APPENDIX B

FIGURE



SOURCE:
Property Boundaries are based on Service NS Land Registration Records, and Dillon Job No. 13-7403-3000 Drawing 8, Dated March 2013.
Infrastructure locations are approximate only.

0m 4 8 12 16
1 : 400

TITLE:
Soil Areas Requiring Risk Management

Risk Management/Remedial Action Plan
Devils Island Light Station, Halifax County, NS
(LL# Former 545, DFRP# 02878, RPIS# MC00145)

CLIENT:
PWGSC for Fisheries and Oceans Canada

DATE: Sept 2013	PROJECT NO: TE131402.1000
DWN BY: DS	PROJECTION: UTM Zone 20
CHK'D BY: LP	DATUM: NAD83
REV. NO.: N/A	SCALE: AS SHOWN

amec

DRAWING No. 1