Edwards Pond Enhancements - Detailed Design

Design Study: Geotechnical Investigation for Outlet Control Structure

Draft Report

SENES Project 340570-11a

Stantec Project 121612372.200

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1.0 Introduction

Further to the SENES Team's[1] proposal submission for completing a geotechnical investigation in support of development of detailed design activities for Edwards Pond enhancements, (Proposal No. 550185-005a, dated 15 August 2010), and subsequent approval to proceed provided by Public Works and Government Services Canada (PWGSC) on August 16, 2010, Stantec Consulting Ltd. (Stantec) has completed a geotechnical investigation at the location of a future outlet structure for Edwards Pond.

Please find herein a summary of our investigative methodology, findings and geotechnical design and construction recommendations pertinent to the proposed development.

1.1 BACKGROUND AND SITE DESCRIPTION

Edwards Pond is located in Sydney Mines, Nova Scotia, and is situated to the southeast of the former Princess Mine Site, across Pitt Street. The pond has historically received ARD runoff and coal fines from the Princess Mine Site, and continues to receive site drainage via a ditch that drains southeasterly from the east end of the Princess site and below Pitt Street, where it is received at the west side of Edwards Pond. A sand embankment (hereafter referred to as the "east berm") is located at the east end of Edwards Pond, that separates the pond from the Atlantic Ocean. There is an existing drainage channel through the east berm that discharges from Edwards Pond to the Atlantic Ocean.

As part of the Enterprise Cape Breton Corporation (ECBC) Mine Reclamation Program, conceptual options for enhancement of Edwards Pond to improve perimeter vegetation growth and recreational appeal have been developed. The option for pond enhancements that has been selected for detailed design requires raising the current pond elevation to reduce the exposed unvegetated "beach" areas around the perimeter of the pond, in conjunction with removal of a narrow strip of exposed beach materials and replacement with soils more suitable to sustain vegetation growth.

For implementation of this design, a new control structure at the existing pond outlet channel will be required. A concrete box inlet structure founded on shallow footing foundations is being considered for this purpose. An ATV bridge will be constructed across the control structure, and the north and south approaches to the bridge will consist of concrete boxes filled with well graded 80 mm minus gravel. Consideration is also being given to re-using beach materials excavated from the pond perimeter to raise a segment of the east berm and for use as a backfill around the control structure.

[1] (SENES Consultants Limited (SENES), Decommissioning Consulting Services Limited (DCS), Stantec Consulting Ltd. (Stantec) and ADI Limited (ADI).

Figure 1 (below) provides an aerial photo depiction of the Edwards Pond site, and identifies the features described herein. A preliminary conceptual design drawing (Drawing C2) of the proposed control structure is provided in Appendix A.

Figure 1 - Edwards Pond: General Location and Features (Air Photo May 2010)

1.2 OBJECTIVES AND WORK SCOPE

The primary objective of this geotechnical investigation was to identify subsurface soil and groundwater conditions at the location of the proposed control structure, and provide geotechnical design and construction recommendations for foundations. Secondary objectives included characterizing and assessing existing Edwards Pond beach materials that will be removed for re-use as part of construction enhancements to raise low areas of the existing berm. In addition to these objectives, characterization of the existing beach materials for the purpose of supporting vegetation growth was also completed.

The scope of work for this investigation included:

- Drilling four (4) boreholes to identify subsurface soil and groundwater conditions;

- Conducting geotechnical testing of selected soil samples at the control structure and east berm areas;
- Geotechnical and chemistry testing of Edwards Pond beach materials;
- Nutrient assessment of Edwards Pond beach materials; and
- Preparation of this report.

2.0 Investigative Methodology

2.1 FIELD INVESTIGATION

Four (4) boreholes were drilled along the Edwards Pond east boundary between August 20th to 21st, 2010, and were generally located as follows:

- Two (2) boreholes were drilled at opposite sides of the existing drainage channel to assess subsurface characterizations at the proposed control structure location (Boreholes PRSS-10BH-01 and PRSS-10BH-02).

- Two (2) boreholes were drilled along a segment of the east berm at the south side of the existing drainage channel, that will be raised as part of future construction (Boreholes PRSS-10BH-03 and PRSS-10BH-04).

Boreholes were drilled using a track mounted CME 55 drill and utilizing hollow stem augers. Soil samples were collected at continuous 0.6 m intervals using a split spoon sampler. Standard Penetration Testing was also conducted at the continuous sampling intervals at all borehole locations. Subsurface soil and groundwater conditions encountered were logged by Stantec geotechnical field personnel using split spoon samples recovered, and supplemented with observations of drill response and cuttings. As-drilled borehole locations were geodetically surveyed by ADI Limited, and the surveyed locations are provided on Drawing 1 (Appendix A).

At the time of the field drilling, three (3) bulk samples of surficial beach material were collected (PRSS-10SS-01 to PRSS-10SS-03). These samples were located on the exposed beach area at the eastern side of Edwards Pond. Sample locations were surveyed using a recreational grade GPS, and the approximate sample locations are shown on Figure 1 included in Appendix A.

2.2 LABORATORY INVESTIGATION

Selected soil samples from the borehole drilling and bulk samples collected from the beach material were submitted to the Stantec geotechnical laboratory in Sydney for physical property testing, including grain size analysis and moisture contents. Selected samples from the beach material were submitted to Maxxam Analytics and SGS Canada laboratories for chemical analysis, including available metals and acid base accounting (ABA). In addition, samples of the beach material were submitted to Nova Scotia Agricultural college for nutrient assessment. Table 1 provides a summary of physical properties testing and chemical analysis completed as part of this investigation.

Table1: Laboratory Testing Summary

Sample ID	Soil Physical Properties Testing		Soil Chemical Analysis		
	Grain Size Analysis	Moisture Content	Available Metals	ABA	Soil Nutrients
PRSS-10BH-01-03		√			
PRSS-10BH-01-05	√	√			
PRSS-10BH-01-10	√	√			
PRSS-10BH-02-04		√			
PRSS-10BH-02-06	√	√			
PRSS-10BH-02-11		√			
PRSS-10BH-03-02		√			
PRSS-10BH-03-04		√			
PRSS-10BH-03-06		√			
PRSS-10BH-04-02		√			
PRSS-10BH-04-04		√			
PRSS-10BH-04-06		√			
PRSS-10SS-01	√	√	√	√	√
PRSS-10SS-02	√	√	√	√	√
PRSS-10SS-03	√	√	√	√	√
Totals	6	15	3	3	3

3.0 Summary of Findings

3.1 SUBSURFACE CONDITIONS

3.1.1 East Berm

Subsurface conditions encountered at the borehole locations drilled along the existing east berm can generally be described as follows:

- UPPER SAND: Loose to compact sand with trace of silt and gravel, extending to depths ranging from 3.0 to 4.2 m; transitioning to,
- LOWER SAND: Very loose to compact sand with stratified silty and clayey layers, extending to depths ranging from 6.8 to 7.2 m; underlain by,
- CLAY: Stiff to hard clay, encountered at depths ranging from 6.8 to 7.2 m and extending to termination depths of the boreholes.

In addition to the generalized stratigraphy above, the following subsurface features were noted at some borehole locations:

- A very loose to loose coal layer was encountered at Borehole PRSS-10BH-01, separating the upper and lower sand layers.
- An organic peat layer was encountered at Borehole PRSS-10BH-02, separating the lower sand and clay layers.
- Water was encountered at borehole locations in the upper sand layer, at depths ranging from 1.5 to 2.4 m (Elevation 0 to +0.7 m). However, it should be noted that the water level is expected to be greatly influenced by tidal action, and vary considerably with tide changes. Chart datum correlations to geodetic elevation completed by ADI Limited indicate that the mean high water and low water geodetic elevations range from -0.2 to +0.7 m, respectively, and large tide high and low water range from -0.4 to +1.0 m.

Table 2 provides a generalized stratigraphic summary of soil conditions encountered along the east berm. Detailed descriptions are provided on the borehole logs (Attachment B).

Table 2: Subsurface Soil Summary

Borehole ID	Location Coordinates (ATS 77 UTM Z4)		Surface Elevation (m)	Upper Sand	Coal Layer	Lower Sand	Peat	Clay
	Northing	Easting		Depth in meters (From - To)	Depth in meters (From - To)	Depth in meters (From - To)	Depth in meters (From - To)	Depth in meters (From - To)
PRSS-10BH-01	5124134.866	4599262.874	2.20	0 - 3.0	3.0 - 4.3	4.3 - 7.2	Not Encountered	7.2 - 7.8+
PRSS-10BH-02	5124116.127	4599242.946	1.49	0 - 3.0	Not Encountered	3.0 - 5.9	5.9 - 6.8	6.8 - 7.3+
PRSS-10BH-03	5124072.136	4599249.760	2.24	0 - 4.2	Not Encountered	4.2 - 7.0	Not Encountered	7.0 - 7.9+
PRSS-10BH-04	5124001.119	4599265.407	3.15	0 - 2.4	Not Encountered	2.4 - 6.8	Not Encountered	6.8 - 7.9+

Two samples of the upper sand and one sample of the lower sand soils encountered at the east berm were submitted for grain size analysis, and gradation curves are provided in Appendix C. Eleven moisture contents were completed for samples of the upper and lower sands, and the moisture content results are provided on the borehole logs (Appendix B). A summary of results is provided below:

- Upper Sand: For two samples of the upper sand tested, the gradation analyses showed 2 to 4 percent gravel sizes, 88 to 92% sand sizes and 4 to 10 percent fines (silt/clay). Moisture contents in the upper sand ranged from 8 to 22 percent.

- Lower Sand: A single gradation analysis test showed 7 percent gravel, 83 percent sand and 10 percent fines. Moisture contents in the lower sand zone ranged from 28 to 30 percent.

While the gradation results discussed above are similar for the Upper and Lower sands, the lower sands were visually observed to have stratified lenses of more silty clayey sand soils. This is evident from the higher moisture contents identified in this zone.

3.1.2 East Pond Beach

The three bulk samples of unvegetated surficial sands exposed along the east beach of Edwards Pond were collected by manual methods. All three samples were submitted for geotechnical analysis for grain size analysis and moisture contents. The gradation results are provided in Appendix C. Moisture contents are plotted on the borehole logs in Appendix B. A summary of these results is provided below:

- PRSS-10SS-01 and PRSS-10SS-03: Gradation results were similar with 1% Gravel, 68 to 71 percent sand and 27 to 30 percent fines (silt and clay). Sand Moisture content for both samples was determined to be 17 percent

- PRSS-10SS-02: Gradation results indicated 1 percent gravel, 36 percent sand and 63 percent fines, with moisture content of 34%.

Based on the results above, this material shows considerable variations in composition and can be characterized as ranging from a silty sand with trace gravel to sandy silt with trace gravel.

3.2 CHEMICAL CHARACTERIZATION – EAST BEACH SOILS

The three samples collected from the east beach were submitted for chemical analysis, which included available metals (completed by Maxxam Analytics laboratory in Sydney, NS) and acid base accounting (submitted to SGS Canada laboratory in Lakefield, ON). Samples were also submitted to the Nova Scotia Agricultural College for soil nutrient assessment. Analytical certificates are provided in Appendix D, and the results are discussed below.

3.2.1 Available Metals

The available metals concentrations are summarized in Table 3, and have been compared to the ROAC Committee secondary screening criteria developed for the Enterprise Cape Breton Development Corporation Mine Reclamation Program, using the lowest criteria of either human health or ecological receptors and considering future recreational land use. For arsenic exceedances, the general accepted urban background concentrations for arsenic in soils has been used as tertiary screening where exceedances of the ROAC secondary screening criteria were identified.

Based on the comparison of test results to screening criteria, the following exceedances of the screening criteria were identified for the soils analyzed.

- Arsenic concentrations exceeded the secondary screening criteria (18 mg/kg) for all samples analyzed, with concentrations ranging from 69 to 85 mg/kg. For PRSS-10SS-01, the arsenic concentration (85 mg/kg) also exceeded the urban background concentrations. For PRSS-10SS-03, the urban background concentration was also marginally exceeded with a concentration of 74 mg/kg determined. However, a laboratory QC duplicate analysis for this sample yielded a concentration marginally below the urban background concentration, at 71 mg/kg. An average concentration of the arsenic concentrations at all four of the samples also exceeded the secondary and tertiary screening criteria.

- For the sample collected at PRSS-10SS-01, the selenium concentration (10 mg/kg) exceeded the secondary screening criteria (3.6 mg/kg). Other samples were below the reported detection limits, however, as noted below, the detection limits for selenium were elevated above the screening criteria.

- Due to interfering compounds in the sample matrix, the results were outside the acceptable QA/QC limits. Samples were diluted 10 fold and re-analyzed, which resulted in a elevation of reportable detection limits (RDLs) by a factor of 10. Attempts for analysis at lesser dilutions did not yield results within acceptable QA/QC limits. At this

sample dilution, RDLs for beryllium, boron, selenium, thallium and zinc were greater than the secondary screening criteria, and as such exccedances of screening criteria for these compounds cannot conclusively be determined.

Table 3: Analytical Testing Summary (Available Metals)

Parameter	ROAC Secondary Screening Criteria (Recreational Land Use) (1)	RDL (3)	Sample ID:	PRSS-10SS-01	PRSS-10SS-02	PRSS-10SS-03	PRSS-10SS-03 (Lab Dup)
			Date Sampled:	8/20/2010	8/20/2010	8/28/2010	8/28/2010
AVAILABLE METALS							
Aluminum (Al)	-	800	mg/kg	980	910	1300	1300
Antimony (Sb)	10.9	10	mg/kg	ND	ND	ND	ND
Arsenic (As)	18/72 (2)	10	mg/kg	**85**	69	**74**	71
Barium (Ba)	-	100	mg/kg	ND	ND	ND	ND
Beryllium (Be)	4	10	mg/kg	***ND***	***ND***	***ND***	***ND***
Boron (B)	7.0 (2)	70	mg/kg	***ND***	***ND***	***ND***	***ND***
Cadmium (Cd)	12	2	mg/kg	ND	ND	ND	ND
Calcium (Ca)	-	3000	mg/kg	ND	ND	ND	ND
Chromium (Cr)	80	10	mg/kg	ND	ND	ND	ND
Cobalt (Co)	-	10	mg/kg	ND	ND	ND	ND
Copper (Cu)	140	100	mg/kg	ND	ND	ND	ND
Iron (Fe)	-	300	mg/kg	340000	390000	250000	230000
Lead (Pb)	200	10	mg/kg	28	34	46	42
Lithium (Li)	-	10	mg/kg	ND	ND	ND	ND
Magnesium (Mg)	-	800	mg/kg	ND	ND	ND	ND
Manganese (Mn)	2445	100	mg/kg	130	110	120	120
Mercury (Hg)	5.7	1	mg/kg	ND	ND	ND	ND
Molybdenum (Mo)	40	10	mg/kg	ND	ND	ND	ND
Nickel (Ni)	100	20	mg/kg	ND	ND	ND	ND
Phosphorus (P)	-	200	mg/kg	760	540	670	670
Potassium (K)	-	4000	mg/kg	5800	8000	9700	9400
Selenium (Se)	3.6	6	mg/kg	**10**	***ND***	***ND***	***ND***
Silver (Ag)	15.5	10	mg/kg	ND	ND	ND	ND
Sodium (Na)	-	4000	mg/kg	ND	ND	ND	ND
Strontium (Sr)	670	20	mg/kg	32	42	43	42
Thallium (Tl)	0.6	7	mg/kg	***ND***	***ND***	***ND***	***ND***
Tin (Sn)	-	100	mg/kg	ND	ND	ND	ND
Titanium (Ti)	-	10	mg/kg	49	39	82	81
Uranium (U)	-	10	mg/kg	ND	ND	ND	ND
Vanadium (V)	174	10	mg/kg	10	ND	14	14
Zinc (Zn)	400	500	mg/kg	***ND***	***ND***	***ND***	***ND***

NOTES:

(1) Cape Breton Development Corporation Mine Closure Program - Risk Assessment Framework Draft Screening Criteria, Dated June 24, 2008.

(2) JDAC = Background Surface Soil Concentrations Urban Reference Area Final Report Human Health Risk Assessment North of Coke Ovens (NOCO) Area , Sydney Nova Scotia (JDAC Environment Limited, Dated November 26, 2001).

(3) RDLs were raised by a factor of 10 by analytcal laboratroy due to sample dilution for interfering compounds.

(4) Exceeds Secondary Soil Screening Criteria & Urban Background Concentrations.

(5) RDL Exceeds Screening Criteria.

(4) ND = Not Detected

(5) RDL = Reportable Detection Limit

3.2.2 ARD Potential

The ABA results for the three bulk samples collected from the east beach of Edwards Pond, are similar to that of Edwards Pond sediments identified from previous investigations. The beach material is considered to be potentially acid generating, based on the following:

- The paste pH of all samples were determined to be acidic (i.e. less than 4).

- There is some Acid Potential (AP), ranging from 1.25 to 2.5, but no Neutralization Potential (NP), which ranges from -10.5 to -17.1.

- The NP/AP ratio ranges from -13 to -19.

While the samples do indicated ARD generating potential, it is notable that the percent sulphide present to total sulphur is relatively low, ranging from 2 to 5%, suggesting that most of the sulphides have already oxidized.

3.2.3 Nutrient Assessment

From the soil nutrient assessment completed for the three samples of the east beach material, the following soil amendments were recommended to support vegetation growth:

- Lime: 33 to 43 kg per 100 m^2.
- Nitrogen (N): 65 kg/ha.
- Phosphorus Pentoxide (P2O5): 120 kg/ha
- Potassium Oxide (K2O): 100 kg/ha

4.0 Recommendations

4.1 CONTROL STRUCTURE FOUNDATIONS

The design elevation for footings is expected to be 0 to -0.5. Soils encountered at these depths are expected to provide marginal foundation bearing support conditions based on the following:

- The proposed footing elevation (-0.5 m) is below the mean and large low tide elevations (-0.2 and -0.4 m, respectively), and as such the bearing soils will remain in a saturated condition.
- Average Standard Penetration Testing (SPT) N values in the sand and coal layers below footing elevation ranged from 3 to 6, at the north and south sides of the control structure respectively. This is reflective of a very loose to loose condition.
- The foundation materials are considered easily prone to disturbance, and can be loosed considerably from excavation to the design elevation.
- Implementation of conventional methods for improvement of bearing soil conditions (such as excavation and replacement with structural fill) are considered problematic. Excavation below water are anticipated to have high flow conditions and flowing sand may be encountered, making dewatering and advancing excavations below water problematic.

To improve bearing soil conditions, it is recommended that a 150 mm minus rip rap be “pushed” into the foundation bearing soils to improve bearing conditions. This will help stabilize the bearing surface. Sufficient quantity of rip rap should be pushed into the bearing soils until noticeable resistance is realized, and then covered with a non-woven geotextile. A minimum of 100 mm of a 50 mm minus clear stone should be placed over the sand impregnated with rip rap to create a level bearing surface. Qualified geotechnical personnel should monitor construction activities of bearing soil improvements described above.

For bearing soils prepared as described above, an allowable bearing capacity of 70 kPa is recommended for design. This bearing capacity assumes a factor of safety of 3, and a minimum footing width of 0.6 m.

Theoretical total settlements for footings designed and constructed as above are expected to be less than 25 mm, provided the improvements described above can be successfully and uniformly implemented. However, due to anticipated construction difficulties for preparation of the bearing soils, the design of the control structure should consider potential settlements in the order of 100 mm. If settlements of this magnitude cannot be tolerated, then a deep foundation alternative should be considered.

To mitigate uplift of foundations from frost action, the footings should have a minimum burial depth of 1.2 m.

4.2 LATERAL EARTH PRESSURES

It is understood that the concrete box structures that will form the ATV bridge approaches will be backfilled inside and outside the concrete walls. Only a small wedge of the east and west walls of this structure will extend above grade (less than 2 m above the weir invert) and effectively act to retain the gravel fill inside the structure. As such, it is understood that long term lateral earth pressures are not a significant concern. However, to minimize soil lateral earth pressures and pressures induced by compaction during filling inside the approach structures, fill inside and outside the structure should be brought up in uniform lifts.

4.3 REUSE OF EXCAVATED BEACH MATERIAL

The elevation at the top of the east berm along the segment to be raised currently ranges from around 1.8 to 2.8 m. It is understood that the planned future enhancements will require this segment be raised to an elevation of around 3.0 m.

The existing Edwards Pond beach material is considered marginally suited for re-use in raising the east berm and as a backfill around the control structure for the following reasons:

- The material showed considerable variability in gradation and moisture content. The finer material with high moisture content is considered unsuitable for fill placement to raise the berms or backfill around the control structure, and should be placed in the proposed disposal area behind the rip-rap berms.

- Due to the variations in materials, careful attention would have to be given to selection and rejection of these materials during construction.

- The material was determined to have metals exceedances of the screening criteria for recreational land use, and is considered to have ARD generating potential.

Based on the above, it is suggested that all the excavated beach material be placed at the planned on-site disposal areas at the northwest side of the pond, which are planned to be capped with imported cover soil material. However, it is noted that this would result in increased construction costs for importing suitable fill materials.

If from a design perspective, relocation of all the beach material to the disposal area is not preferable or feasible and the beach materials are to be re-used for raising the east berm and/or backfill around the control structure, the following recommendations are provided:

- Full time monitoring of the excavation for removal of the beach material should be undertaken by a qualified geotechnical personnel, to selectively determine which

materials would be suitable for re-use in construction and which materials should be directed to the capping area.

- A suitable cover soil of minimum 0.5 m thickness, meeting the environmental screening requirements for recreational land use, should be used to cover the beach materials in order to limit exposure of future users of the site.

5.0 Closure

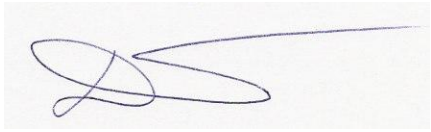
Use of this report is subject to the Statement of General Conditions provided in Appendix E. It is the responsibility of SENES Consultants Ltd., who is identified as “the Client” within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec Consulting Ltd. should any of these be not satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

This report was prepared by Dwayne Druggett, P.Eng. and was reviewed by Arun Valsangkar, Ph.D, P.Eng., FCSCE, FEIC. Should you have any questions, please do not hesitate to contact the undersigned.

Respectfully submitted,

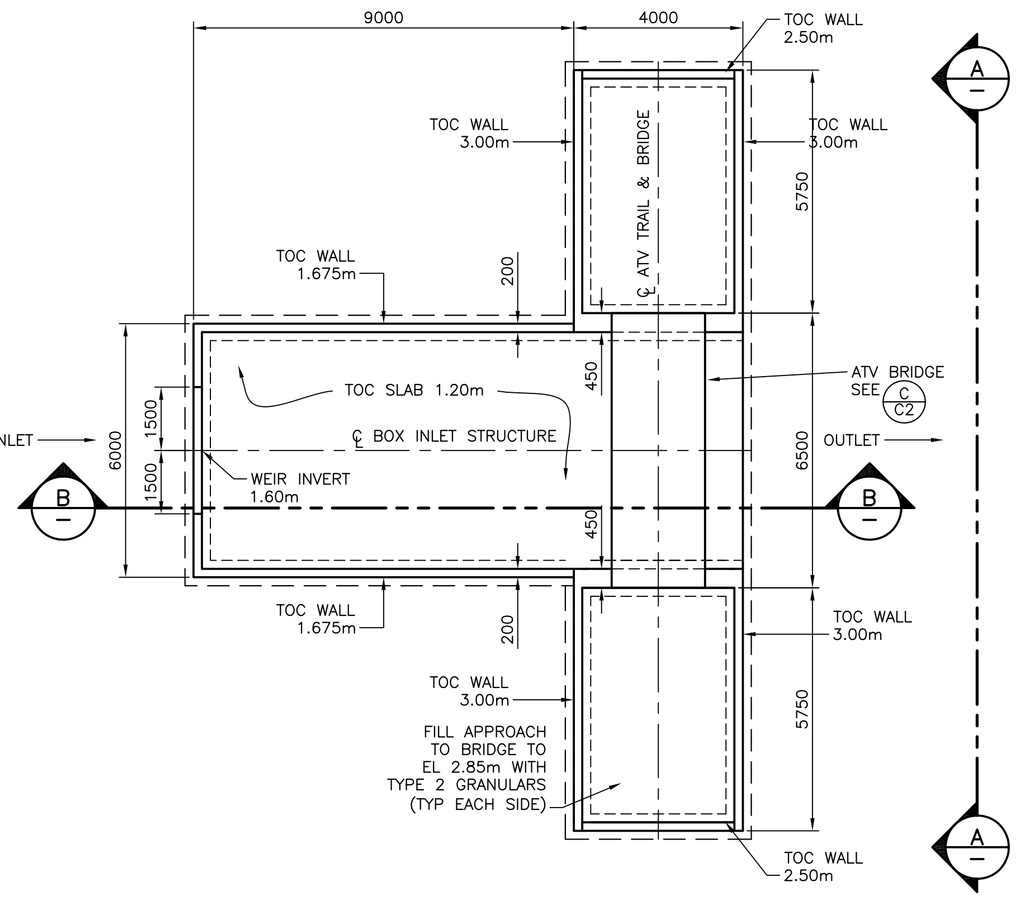
Stantec Consulting Ltd.



Dwayne J. Druggett, P.Eng.
Associate Geotechnical Engineer

APPENDIX A

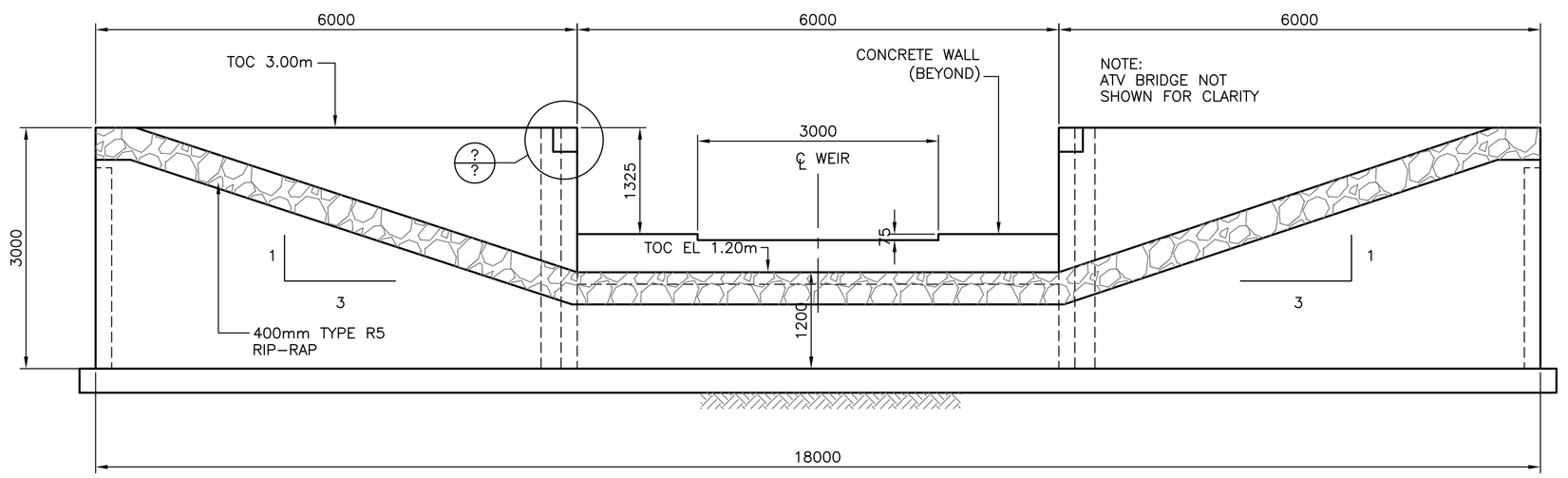
Drawings and Figures



PLAN VIEW

SCALE/ÉCHELLE: 1:100

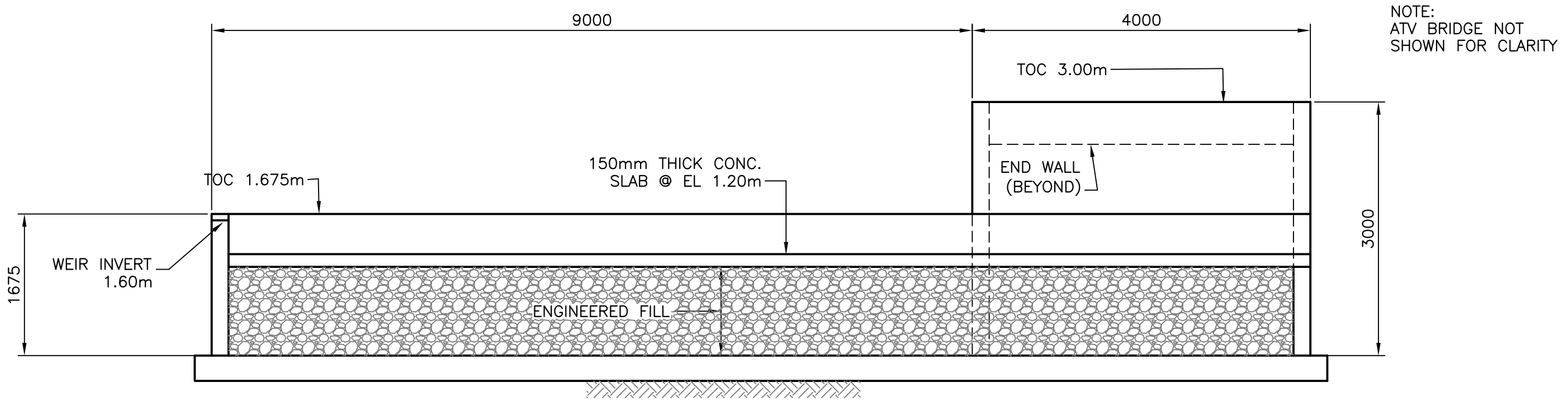
0m 1m 2m 3m 4m 5m 6m 7m 8m 9m 10m



SECTION A

SCALE/ÉCHELLE: 1:50

0m 1m 2m 3m 4m 5m



SECTION B

SCALE/ÉCHELLE: 1:50

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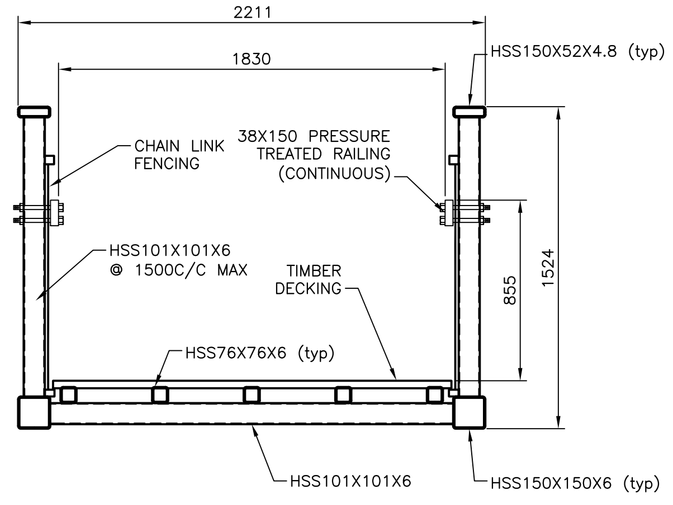
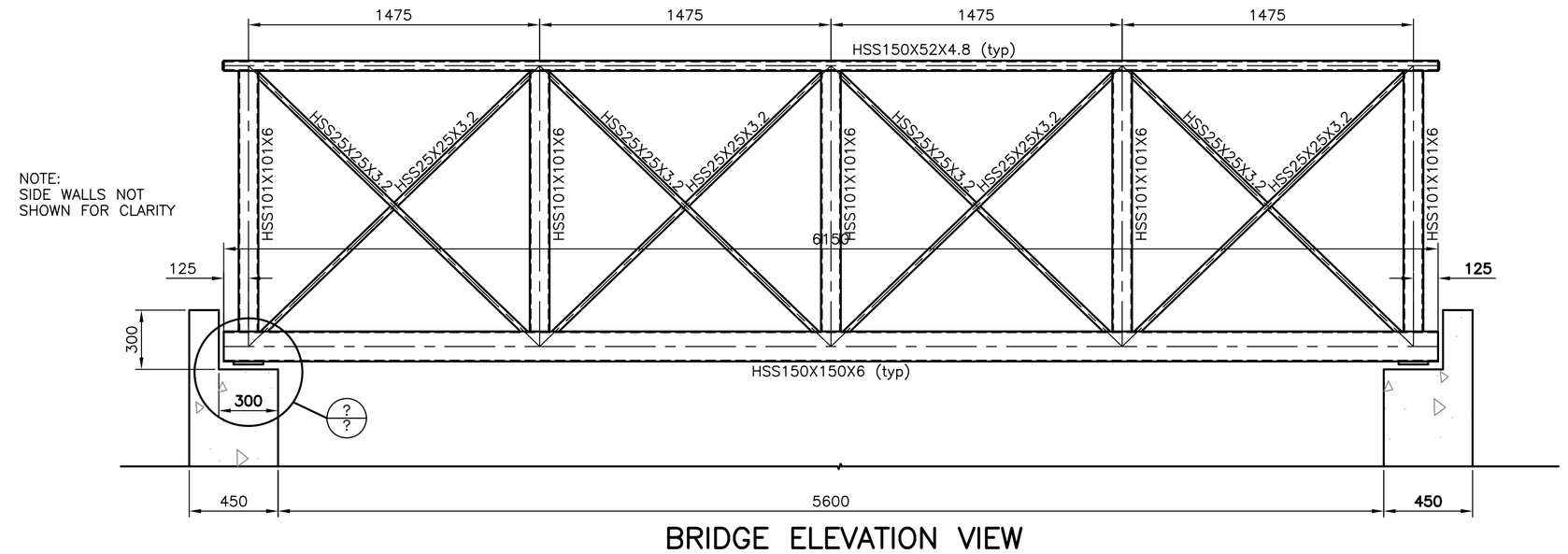


TYPICAL BRIDGE SECTION C2

SCALE/ÉCHELLE: 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

NOTE: SIDE WALLS NOT SHOWN FOR CLARITY



BRIDGE ELEVATION VIEW

SCALE/ÉCHELLE: 1:20

0mm 500mm 1000mm 1500mm 2000mm 2500mm

PRELIMINARY

Public Works and Government Services Canada / Travaux Publics et Services gouvernementaux Canada

ADI Limited
A Trow Global Company

Stantec

revisions		date

project / projet

EDWARDS POND ENHANCEMENT PROJECT

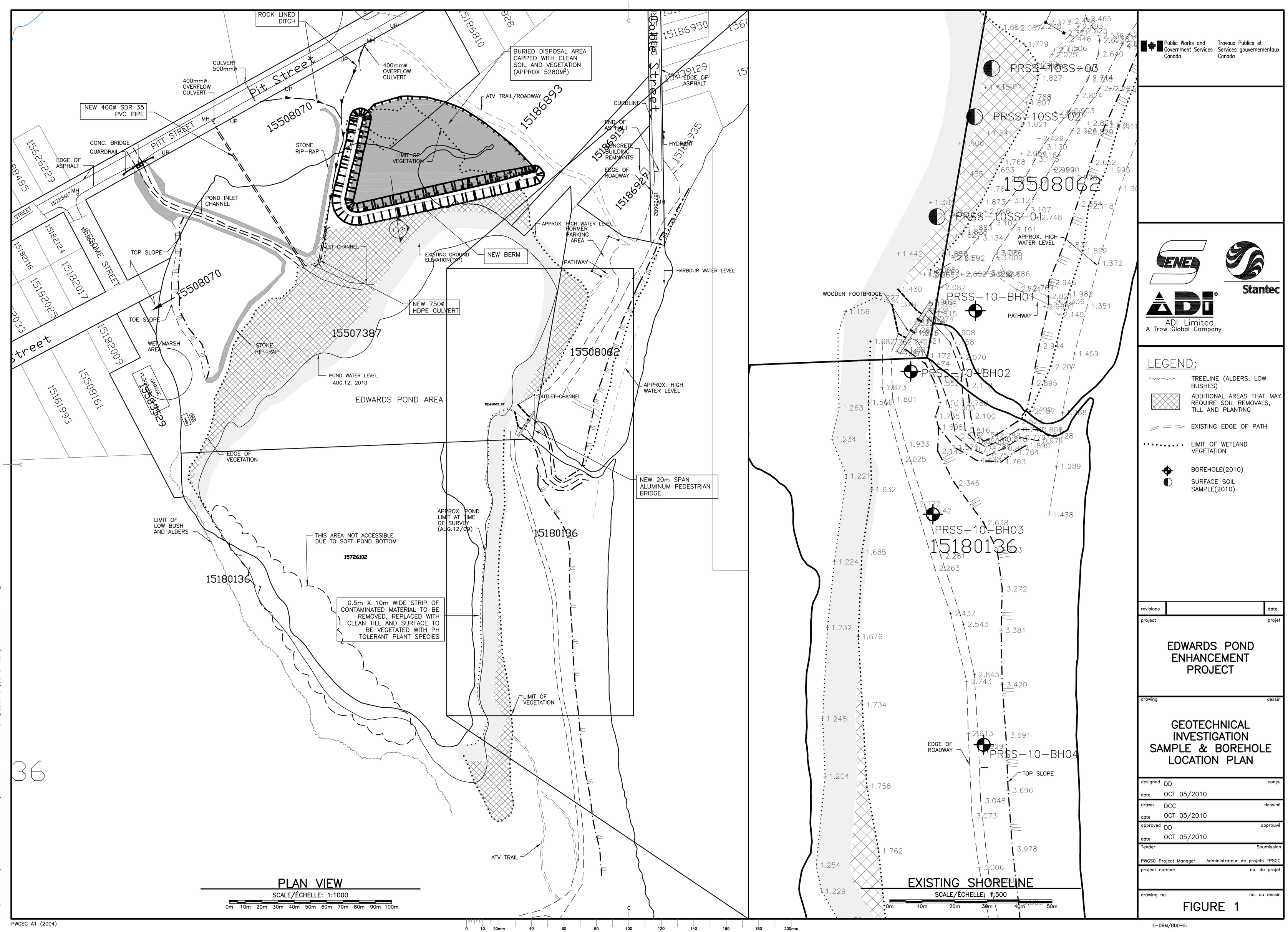
drawing / dessin

NEW CONCRETE WEIR PLAN, SECTIONS & DETAILS

designed	BJG	conçu
date	OCT 13/2010	
drawn	BDP	dessiné
date	OCT 13/2010	
approved	BJG	approuvé
date	OCT 13/2010	
Tender		Soumission
PWGSC Project Manager		Administrateur de projets TPSGC
project number		no. du projet
drawing no.	C2	no. du dessin

PWGSC A1 (2004)

E-DRM/GDD-E:



Public Works and Government Services Canada
Travaux Publics et Services gouvernementaux Canada

ENEL
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ADI Limited
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LEGEND:

- TREELINE (ALDERS, LOW BUSHES)
- ADDITIONAL AREAS THAT MAY REQUIRE SOIL REMOVALS, TILL AND PLANTING
- EXISTING EDGE OF PATH
- LIMIT OF WETLAND VEGETATION
- BOREHOLE(2010)
- SURFACE SOIL SAMPLE(2010)

revisions		date

project / projet

EDWARDS POND ENHANCEMENT PROJECT

drawing / dessin

GEOTECHNICAL INVESTIGATION SAMPLE & BOREHOLE LOCATION PLAN

designed	DD	conçu
date	OCT 05/2010	
drawn	DCC	dessiné
date	OCT 05/2010	
approved	DD	approuvé
date	OCT 05/2010	
Tender		Soumission
PWGSC Project Manager		Administrateur de projets TPSGC
project number		no. du projet
drawing no.		no. du dessin

FIGURE 1

E-DRM/GDD-E:

PWGSC A1 (2004)

E:\60640015\EDWARDS POND TOPO\EDWARDS POND TOPO\dwg\EDWARDS POND TOPO 3D.dwg

APPENDIX B

Borehole Logs

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Topsoil	-	mixture of soil and humus capable of supporting vegetative growth
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	-	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure
Varved	-	composed of regular alternating layers of silt and clay
Stratified	-	composed of alternating successions of different soil types, e.g. silt and sand
Layer	-	> 75 mm in thickness
Seam	-	2 mm to 75 mm in thickness
Parting	-	< 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488). The classification excludes particles larger than 76 mm (3 inches). The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 76 mm, visible organic matter, construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test N-Value (also known as N-Index). A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests.

Consistency	Undrained Shear Strength	
	kips/sq.ft.	kPa
Very Soft	<0.25	<12.5
Soft	0.25 - 0.5	12.5 - 25
Firm	0.5 - 1.0	25 - 50
Stiff	1.0 - 2.0	50 – 100
Very Stiff	2.0 - 4.0	100 - 200
Hard	>4.0	>200

ROCK DESCRIPTION

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor, Crushed, Very Severely Fractured*
25-50	*Poor, Shattered and Very Seamy or Blocky, Severely Fractured*
50-75	*Fair, Blocky and Seamy, Fractured*
75-90	*Good, Massive, Moderately Jointed or Sound*
90-100	*Excellent, Intact, Very Sound*

Rock quality classification is based on a modified core recovery percentage (RQD) in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on NW core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from *in situ* fractures. The terminology describing rock mass quality based on RQD is subjective and is underlain by the presumption that sound strong rock is of higher engineering value than fractured weak rock.

Terminology describing rock mass:

Spacing (mm)	Joint Classification	Bedding, Laminations, Bands
> 6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Unconfined Compressive Strength (MPa)
Extremely Weak	< 1
Very Weak	1 – 5
Weak	5 – 25
Medium Strong	25 – 50
Strong	50 – 100
Very Strong	100 – 250
Extremely Strong	> 250

Terminology describing rock weathering:

Term	Description
Fresh	No visible signs of rock weathering. Slight discolouration along major discontinuities
Slightly Weathered	Discolouration indicates weathering of rock on discontinuity surfaces. All the rock material may be discoloured.
Moderately Weathered	Less than half the rock is decomposed and/or disintegrated into soil.
Highly Weathered	More than half the rock is decomposed and/or disintegrated into soil.
Completely Weathered	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
WS	Wash sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to A size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (305 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

Stantec

BOREHOLE RECORD

PRSS-10BH-01

CLIENT **SENES** PROJECT No. **121612372**

LOCATION **Edwards Pond, Sydney Mines, NS** BH SIZE **150**

DATES: BORING **2010/08/20 2010/08/20** WATER LEVEL **Tidal** DATUM **Geodetic**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0	2.20	Very loose to compact, light brown SAND, trace fines and gravel			SS	01	250	4	
					SS	02	400	13	
1		... traces of coal, wet below 1.5 m.			SS	03	450	6	
					SS	04	300	5	
2					SS	05	200	3	GSA
	-0.80	Very loose to loose COAL, some gravel and trace sand, wet			SS	06	425	2	
3					SS	07	300	6	
	-2.10	Very loose to loose, grey SAND with stratified silty/clayey sand layers, traces of gravel and coal throughout, wet			SS	08	350	3	
4					SS	09	600	5	
					SS	10	600	2	GSA
5					SS	11	525	2	
					SS	12	600	14	
6	-5.00	Stiff to hard, greyish brown CLAY, trace of sandstone fragments			SS	13	500	40	
	-5.60	... more frequent sandstone fragments below 7.8 m							
7		End of Borehole at 7.8 m (Inferred Bedrock)							
8									
9									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

App'd Oct 18 2010 9:46:2

MBH 10/18/10

Stantec

BOREHOLE RECORD

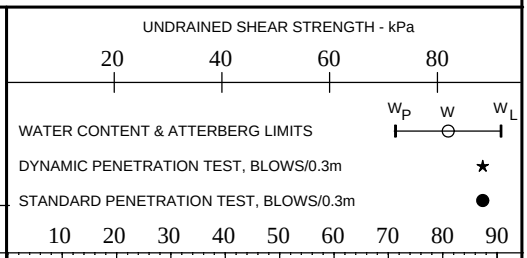
PRSS-10BH-02

CLIENT **SENES** PROJECT No. **121612372**

LOCATION **Edwards Pond, Sydney Mines, NS** BH SIZE **150**

DATES: BORING **2010/08/20 2010/08/20** WATER LEVEL **Tidal** DATUM **Geodetic**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
	1.49								
0	1.47	Grass and Organics							
		Loose to comapct, light brown to light grey SAND, trace of gravel, fines and coal			SS	01	150	2	
1					SS	02	250	9	
		... wet below 1.5 m			SS	03	250	12	
2					SS	04	400	11	
					SS	05	600	18	
3	-1.81								
		Very loose to loose, brownish grey SAND with some soft silty clay stratifications, wet			SS	06	600	2	GSA
4					SS	07	600	10	
					SS	08	325	1	
5					SS	09	600	4	
	-4.41				SS	10	150	4	
6		Brown PEAT			SS	11	350	1	
	-5.31								
7		Very stiff, greyish brown CLAY			SS	12	600	18	
	-5.81								
		End of Borehole at 7.3 m.							
8									
9									



App'd Oct 18 2010 9:46:3

MBH 10/18/10

Stantec

BOREHOLE RECORD

PRSS-10BH-03

CLIENT **SENES** PROJECT No. **121612372**

LOCATION **Edwards Pond, Sydney Mines, NS** BH SIZE **150**

DATES: BORING **2010/08/20 2010/08/20** WATER LEVEL **Tidal** DATUM **Geodetic**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
0	2.24	Loose to compact, light brown SAND, trace of gravel, fines and coal			SS	01	450	5	
1					SS	02	225	10	
		... wet, light grey below 1.5 m.			SS	03	225	8	
2					SS	04	450	4	
					SS	05	600	9	
3					SS	06	600	5	
4	-1.96				SS	07	600	7	
		Very loose to loose, greyish brown SAND with some silty sand and silty clay stratifications			SS	08	600	7	
5					SS	09	600	5	
					SS	10	600	4	
6					SS	11	300	2	
7	-4.76				SS	12	600	14	
		Stiff to very stiff, greyish brown CLAY			SS	13	600	11	
	-5.66								
8		End of Borehole at 7.9 m.							
9									

UNDRAINED SHEAR STRENGTH - kPa
20 40 60 80
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
DYNAMIC PENETRATION TEST, BLOWS/0.3m ★
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

App'd Oct 18 2010 9:46:4

MBH 10/18/10

Stantec

BOREHOLE RECORD

PRSS-10BH-04

CLIENT **SENES** PROJECT No. **121612372**

LOCATION **Edwards Pond, Sydney Mines, NS** BH SIZE **150**

DATES: BORING **2010/08/21 2010/08/21** WATER LEVEL **Tidal** DATUM **Geodetic**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR-RQD %	OTHER TESTS
	3.15								
0		Very loose to compact, light brown SAND, trace gravel, fines, coal and organic matter			SS	01	350	5	
1					SS	02	475	9	
					SS	03	600	7	
2					SS	04	600	14	
		... wet below 2.4 m.			SS	05	450	12	
3					SS	06	250	2	
	-0.35								
		Very loose to compact, grey SAND with some silt and clay stratifications, wet			SS	07	600	9	
4					SS	08	225	11	
					SS	09	375	12	
5					SS	10	600	7	
					SS	11	600	3	
6									
	-3.65								
		Stiff to hard, dark grey CLAY			SS	12	600	13	
7					SS	13	600	30	
	-4.75								
8		End of Borehole at 7.9 m.							
9									

UNDRAINED SHEAR STRENGTH - kPa

20 40 60 80

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

DYNAMIC PENETRATION TEST, BLOWS/0.3m ★

STANDARD PENETRATION TEST, BLOWS/0.3m ●

10 20 30 40 50 60 70 80 90

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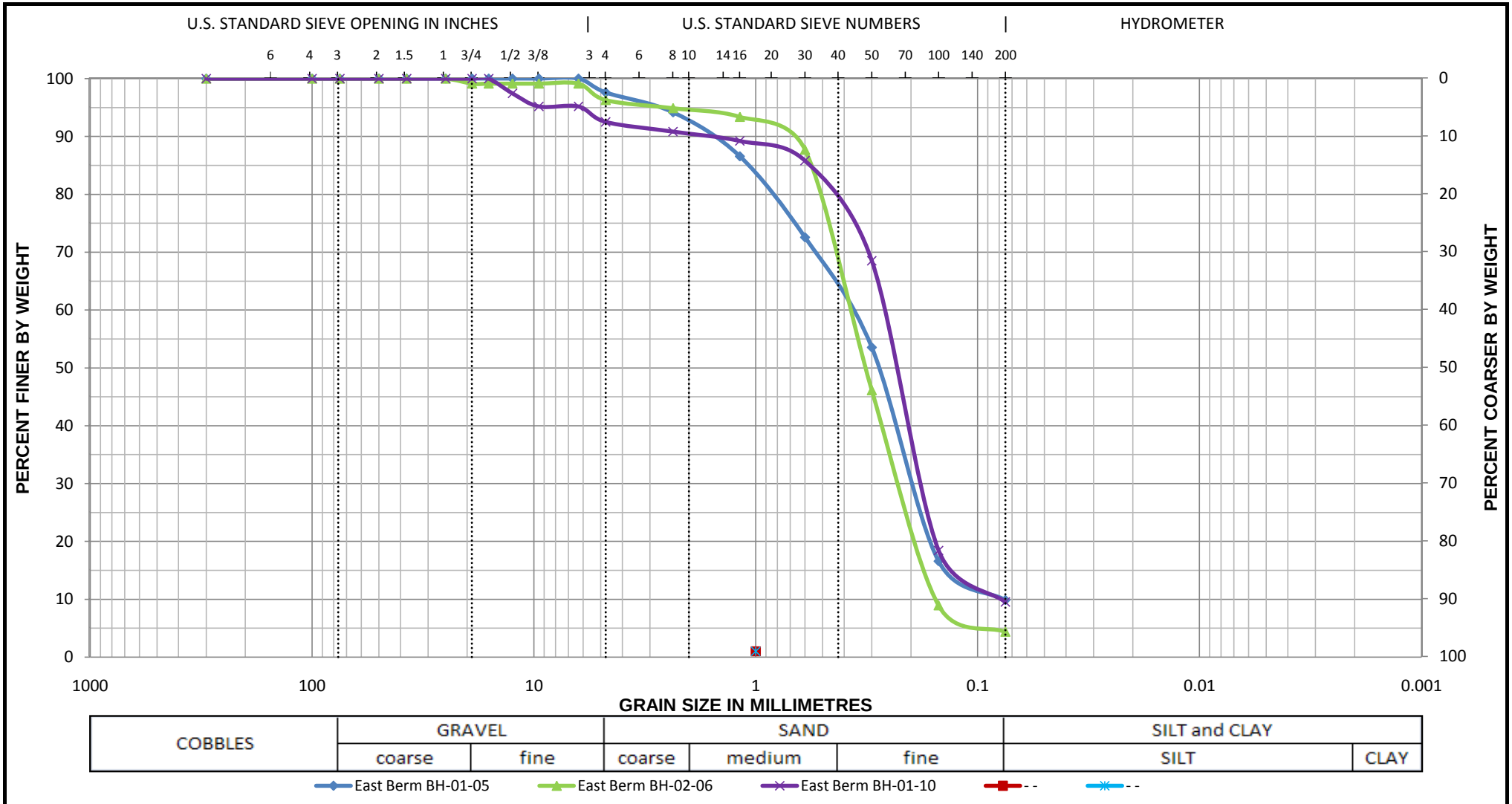
APPENDIX C

Grain Size Analysis Curves



UNIFIED CLASSIFICATION SYSTEM

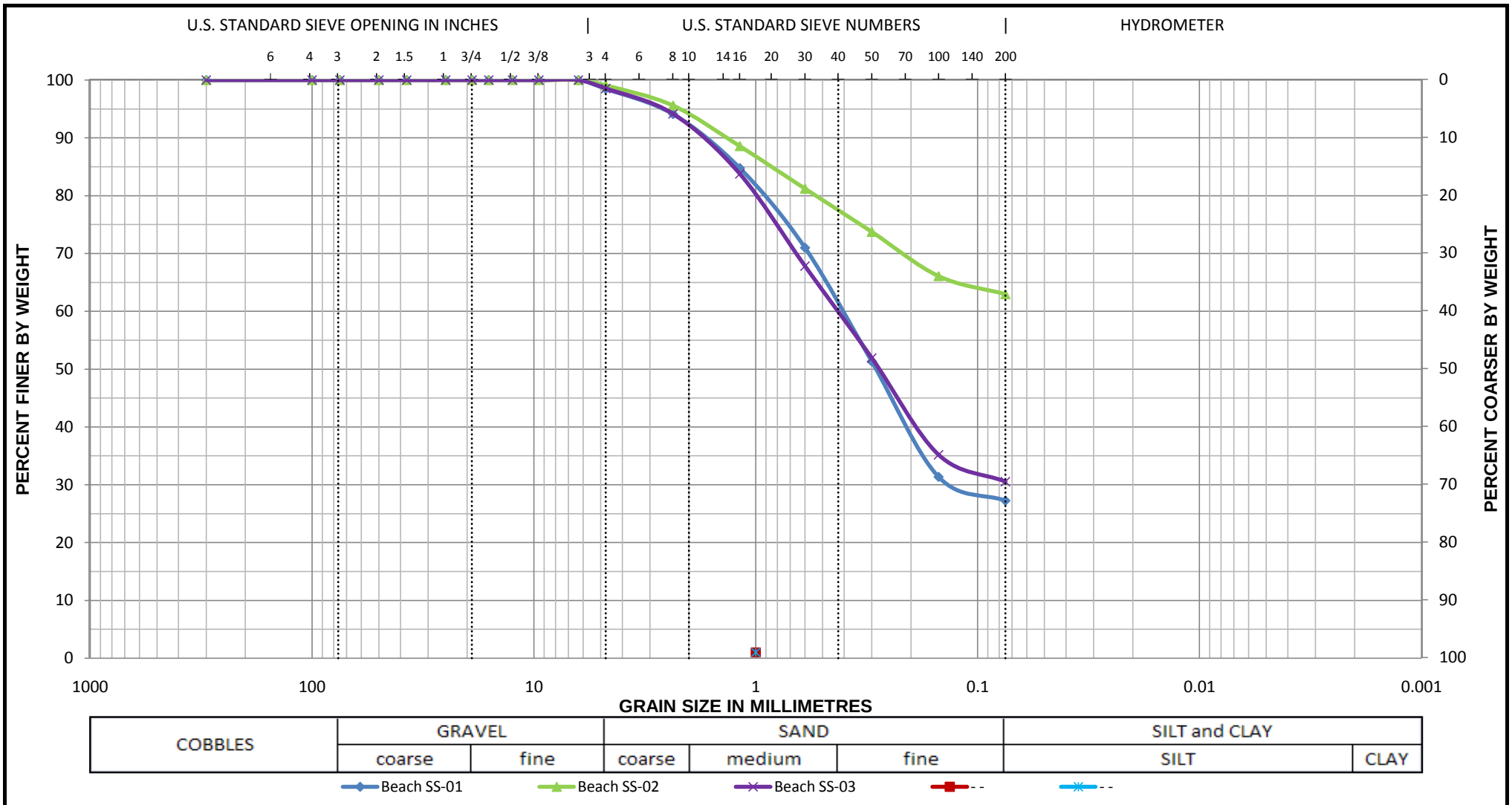
Source	Sample	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
East Berm	BH-01-05	Poorly graded SAND with silty clay (SP-SC)	24.6				2.4	87.7		9.9
East Berm	BH-02-06	Poorly graded SAND (SP)	29.3				3.7	91.9		4.4
East Berm	BH-01-10	Poorly graded SAND with silty clay (SP-SC)	34.7				7.5	83.0		9.5
-	-									
-	-									

Stantec

Project:	**Edwards Pond Enhancements**
Job No.:	**121612372**
Client:	**SENES Consultants Limited**
Location:	**Sydney Mines, Nova Scotia**
Date:	**August 27, 2010**

Notes:

GRADATION CURVES



UNIFIED CLASSIFICATION SYSTEM

Source	Sample	Description	W%	W_L	W_P	I_P	%Gravel	%Sand	%Silt	%Clay
Beach	SS-01	Silty, clayey SAND (SC-SM)	17.3				1.5	71.2		27.3
Beach	SS-02	Sandy SILT (ML)	34.4				0.9	36.1		63.0
Beach	SS-03	Silty, clayey SAND (SC-SM)	16.7				1.5	68.0		30.5
-	-									
-	-									

Stantec

Project:	**Edwards Pond Enhancements**
Job No.:	**121612372**
Client:	**SENES Consultants Limited**
Location:	**Sydney Mines, Nova Scotia**
Date:	**August 27, 2010**

Notes:

GRADATION CURVES

APPENDIX D

Analytical Certificates

Your Project #: 1216 12372
Site: EDWARDS POND
Your C.O.C. #: B131790

Attention: Dwayne Druggett
Stantec Consulting Ltd.
Sydney - Standing Offer
PO Box 1231
Sydney, NS
B1P 6J9

Report Date: 2010/09/02

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B0B6304
Received: 2010/08/25, 16:24

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Elements by ICPMS in soil	3	N/A	2010/09/01	ATL SOP-00161 R6, 00162 R5	Based on EPA6020

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

Encryption Key

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

TRACY MACLEOD-FLOYD,
Email: Tracy.MacLeod.Reports@maxxamanalytics.com
Phone# (902) 567 1255

==========

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

Total cover pages: 1

This document is in electronic format, hard copy is available on request.

Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

ELEMENTS BY ICP/MS (SOIL)

Maxxam ID		GY1062	GY1063	GY1064	GY1064		
Sampling Date		2010/08/23	2010/08/23	2010/08/23	2010/08/23		
COC Number		B131790	B131790	B131790	B131790		
	Units	**PRSS-10SS-01**	**PRSS-10SS-02**	**PRSS-10SS-03**	**PRSS-10SS-03 Lab-Dup**	**RDL**	**QC Batch**
Metals							
Available Aluminum (Al)	mg/kg	980	910	1300	1300	800	2251600
Available Antimony (Sb)	mg/kg	ND	ND	ND	ND	10	2251600
Available Arsenic (As)	mg/kg	85	69	74	71	10	2251600
Available Barium (Ba)	mg/kg	ND	ND	ND	ND	100	2251600
Available Beryllium (Be)	mg/kg	ND	ND	ND	ND	10	2251600
Available Boron (B)	mg/kg	ND	ND	ND	ND	70	2251600
Available Cadmium (Cd)	mg/kg	ND	ND	ND	ND	2	2251600
Available Calcium (Ca)	mg/kg	ND	ND	ND	ND	3000	2251600
Available Chromium (Cr)	mg/kg	ND	ND	ND	ND	10	2251600
Available Cobalt (Co)	mg/kg	ND	ND	ND	ND	10	2251600
Available Copper (Cu)	mg/kg	ND	ND	ND	ND	100	2251600
Available Iron (Fe)	mg/kg	340000	390000	250000	230000	300	2251600
Available Lead (Pb)	mg/kg	28	34	46	42	10	2251600
Available Lithium (Li)	mg/kg	ND	ND	ND	ND	10	2251600
Available Magnesium (Mg)	mg/kg	ND	ND	ND	ND	800	2251600
Available Manganese (Mn)	mg/kg	130	110	120	120	100	2251600
Available Mercury (Hg)	mg/kg	ND	ND	ND	ND	1	2251600
Available Molybdenum (Mo)	mg/kg	ND	ND	ND	ND	10	2251600
Available Nickel (Ni)	mg/kg	ND	ND	ND	ND	20	2251600
Available Phosphorus (P)	mg/kg	760	540	670	670	200	2251600
Available Potassium (K)	mg/kg	5800	8000	9700	9400	4000	2251600
Available Selenium (Se)	mg/kg	10	ND	ND	ND	6	2251600
Available Silver (Ag)	mg/kg	ND	ND	ND	ND	10	2251600
Available Sodium (Na)	mg/kg	ND	ND	ND	ND	4000	2251600
Available Strontium (Sr)	mg/kg	32	42	43	42	20	2251600
Available Thallium (Tl)	mg/kg	ND	ND	ND	ND	7	2251600
Available Tin (Sn)	mg/kg	ND	ND	ND	ND	100	2251600
Available Titanium (Ti)	mg/kg	49	39	82	81	10	2251600
Available Uranium (U)	mg/kg	ND	ND	ND	ND	10	2251600
Available Vanadium (V)	mg/kg	10	ND	14	14	10	2251600

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 90 Esplanade St, Sydney, Nova Scotia Canada B1P 1A1 Tel: 902 567 1255 Toll Free: 888 535 7770 Fax: 902 5396504 www.maxxamanalytics.com

Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

ELEMENTS BY ICP/MS (SOIL)

Maxxam ID		GY1062	GY1063	GY1064	GY1064		
Sampling Date		2010/08/23	2010/08/23	2010/08/23	2010/08/23		
COC Number		B131790	B131790	B131790	B131790		
	Units	**PRSS-10SS-01**	**PRSS-10SS-02**	**PRSS-10SS-03**	**PRSS-10SS-03 Lab-Dup**	**RDL**	**QC Batch**
Available Zinc (Zn)	mg/kg	ND	ND	ND	ND	500	2251600

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Analytics International Corporation o/a Maxxam Analytics 90 Esplanade St, Sydney, Nova Scotia Canada B1P 1A1 Tel: 902 567 1255 Toll Free: 888 535 7770 Fax: 902 5396504 www.maxxamanalytics.com

Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

GENERAL COMMENTS

Sample GY1062-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

Sample GY1063-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

Sample GY1064-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics 90 Esplanade St, Sydney, Nova Scotia Canada B1P 1A1 Tel: 902 567 1255 Toll Free: 888 535 7770 Fax: 902 5396504 www.maxxamanalytics.com

Stantec Consulting Ltd.
Attention: Dwayne Druggett
Client Project #: 1216 12372
P.O. #:
Project name: EDWARDS POND

Quality Assurance Report

Maxxam Job Number: KB0B6304

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2251600	MBU	Matrix Spike [GY1064-01]	Available Antimony (Sb)	2010/09/01		101	%	75 - 125
			Available Arsenic (As)	2010/09/01		105	%	75 - 125
			Available Barium (Ba)	2010/09/01		87	%	75 - 125
			Available Beryllium (Be)	2010/09/01		97	%	75 - 125
			Available Boron (B)	2010/09/01		96	%	75 - 125
			Available Cadmium (Cd)	2010/09/01		113	%	75 - 125
			Available Calcium (Ca)	2010/09/01		114	%	75 - 125
			Available Cobalt (Co)	2010/09/01		120	%	75 - 125
			Available Copper (Cu)	2010/09/01		114	%	75 - 125
			Available Lead (Pb)	2010/09/01		117	%	75 - 125
			Available Lithium (Li)	2010/09/01		112	%	75 - 125
			Available Magnesium (Mg)	2010/09/01		115	%	75 - 125
			Available Molybdenum (Mo)	2010/09/01		114	%	75 - 125
			Available Nickel (Ni)	2010/09/01		119	%	75 - 125
			Available Phosphorus (P)	2010/09/01		98	%	75 - 125
			Available Potassium (K)	2010/09/01		97	%	75 - 125
			Available Selenium (Se)	2010/09/01		118	%	75 - 125
			Available Silver (Ag)	2010/09/01		108	%	75 - 125
			Available Sodium (Na)	2010/09/01		97	%	75 - 125
			Available Strontium (Sr)	2010/09/01		121	%	75 - 125
			Available Thallium (Tl)	2010/09/01		112	%	75 - 125
			Available Tin (Sn)	2010/09/01		110	%	75 - 125
			Available Titanium (Ti)	2010/09/01		108	%	75 - 125
			Available Uranium (U)	2010/09/01		114	%	75 - 125
			Available Vanadium (V)	2010/09/01		113	%	75 - 125
			Available Zinc (Zn)	2010/09/01		116	%	75 - 125
		QC Standard	Available Aluminum (Al)	2010/08/31		96	%	75 - 125
			Available Arsenic (As)	2010/08/31		119	%	75 - 125
			Available Barium (Ba)	2010/08/31		100	%	75 - 125
			Available Calcium (Ca)	2010/08/31		115	%	75 - 125
			Available Chromium (Cr)	2010/08/31		98	%	75 - 125
			Available Cobalt (Co)	2010/08/31		113	%	75 - 125
			Available Copper (Cu)	2010/08/31		110	%	75 - 125
			Available Iron (Fe)	2010/08/31		117	%	75 - 125
			Available Lead (Pb)	2010/08/31		109	%	75 - 125
			Available Lithium (Li)	2010/08/31		103	%	75 - 125
			Available Magnesium (Mg)	2010/08/31		106	%	75 - 125
			Available Manganese (Mn)	2010/08/31		115	%	75 - 125
			Available Mercury (Hg)	2010/08/31		97	%	75 - 125
			Available Nickel (Ni)	2010/08/31		117	%	75 - 125
			Available Potassium (K)	2010/08/31		91	%	75 - 125
			Available Sodium (Na)	2010/08/31		82	%	75 - 125
			Available Strontium (Sr)	2010/08/31		119	%	75 - 125
			Available Titanium (Ti)	2010/08/31		109	%	75 - 125
			Available Vanadium (V)	2010/08/31		114	%	75 - 125
			Available Zinc (Zn)	2010/08/31		114	%	75 - 125
		Spiked Blank	Available Aluminum (Al)	2010/08/31		116	%	75 - 125
			Available Antimony (Sb)	2010/08/31		103	%	75 - 125
			Available Arsenic (As)	2010/08/31		95	%	75 - 125
			Available Barium (Ba)	2010/08/31		110	%	75 - 125
			Available Beryllium (Be)	2010/08/31		119	%	75 - 125
			Available Boron (B)	2010/08/31		119	%	75 - 125
			Available Cadmium (Cd)	2010/08/31		108	%	75 - 125
			Available Calcium (Ca)	2010/08/31		101	%	75 - 125

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Stantec Consulting Ltd.
Attention: Dwayne Druggett
Client Project #: 1216 12372
P.O. #:
Project name: EDWARDS POND

Quality Assurance Report (Continued)

Maxxam Job Number: KB0B6304

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2251600	MBU	Spiked Blank	Available Chromium (Cr)	2010/08/31		109	%	75 - 125
			Available Cobalt (Co)	2010/08/31		107	%	75 - 125
			Available Copper (Cu)	2010/08/31		102	%	75 - 125
			Available Iron (Fe)	2010/08/31		107	%	75 - 125
			Available Lead (Pb)	2010/08/31		102	%	75 - 125
			Available Lithium (Li)	2010/08/31		116	%	75 - 125
			Available Magnesium (Mg)	2010/08/31		105	%	75 - 125
			Available Manganese (Mn)	2010/08/31		108	%	75 - 125
			Available Mercury (Hg)	2010/08/31		82	%	75 - 125
			Available Molybdenum (Mo)	2010/08/31		108	%	75 - 125
			Available Nickel (Ni)	2010/08/31		103	%	75 - 125
			Available Phosphorus (P)	2010/08/31		121	%	75 - 125
			Available Potassium (K)	2010/08/31		109	%	75 - 125
			Available Selenium (Se)	2010/08/31		103	%	75 - 125
			Available Silver (Ag)	2010/08/31		103	%	75 - 125
			Available Sodium (Na)	2010/08/31		111	%	75 - 125
			Available Strontium (Sr)	2010/08/31		107	%	75 - 125
			Available Thallium (Tl)	2010/08/31		97	%	75 - 125
			Available Tin (Sn)	2010/08/31		107	%	75 - 125
			Available Titanium (Ti)	2010/08/31		105	%	75 - 125
			Available Uranium (U)	2010/08/31		99	%	75 - 125
			Available Vanadium (V)	2010/08/31		108	%	75 - 125
			Available Zinc (Zn)	2010/08/31		99	%	75 - 125
		Method Blank	Available Aluminum (Al)	2010/08/31	ND, RDL=80		mg/kg	
			Available Antimony (Sb)	2010/08/31	ND, RDL=1		mg/kg	
			Available Arsenic (As)	2010/08/31	ND, RDL=1		mg/kg	
			Available Barium (Ba)	2010/08/31	ND, RDL=10		mg/kg	
			Available Beryllium (Be)	2010/08/31	ND, RDL=1		mg/kg	
			Available Boron (B)	2010/08/31	ND, RDL=7		mg/kg	
			Available Cadmium (Cd)	2010/08/31	ND, RDL=0.2		mg/kg	
			Available Calcium (Ca)	2010/08/31	ND, RDL=300		mg/kg	
			Available Chromium (Cr)	2010/08/31	ND, RDL=1		mg/kg	
			Available Cobalt (Co)	2010/08/31	ND, RDL=1		mg/kg	
			Available Copper (Cu)	2010/08/31	ND, RDL=10		mg/kg	
			Available Iron (Fe)	2010/08/31	ND, RDL=30		mg/kg	
			Available Lead (Pb)	2010/08/31	ND, RDL=1		mg/kg	
			Available Lithium (Li)	2010/08/31	ND, RDL=1		mg/kg	
			Available Magnesium (Mg)	2010/08/31	ND, RDL=80		mg/kg	
			Available Manganese (Mn)	2010/08/31	ND, RDL=10		mg/kg	
			Available Mercury (Hg)	2010/08/31	ND, RDL=0.1		mg/kg	
			Available Molybdenum (Mo)	2010/08/31	ND, RDL=1		mg/kg	
			Available Nickel (Ni)	2010/08/31	ND, RDL=2		mg/kg	
			Available Phosphorus (P)	2010/08/31	ND, RDL=20		mg/kg	
			Available Potassium (K)	2010/08/31	ND, RDL=400		mg/kg	
			Available Selenium (Se)	2010/08/31	ND, RDL=0.6		mg/kg	
			Available Silver (Ag)	2010/08/31	ND, RDL=1		mg/kg	
			Available Sodium (Na)	2010/08/31	ND, RDL=400		mg/kg	
			Available Strontium (Sr)	2010/08/31	ND, RDL=2		mg/kg	
			Available Thallium (Tl)	2010/08/31	ND, RDL=0.7		mg/kg	
			Available Tin (Sn)	2010/08/31	ND, RDL=10		mg/kg	
			Available Titanium (Ti)	2010/08/31	ND, RDL=1		mg/kg	
			Available Uranium (U)	2010/08/31	ND, RDL=1		mg/kg	
			Available Vanadium (V)	2010/08/31	ND, RDL=1		mg/kg	
			Available Zinc (Zn)	2010/08/31	ND, RDL=50		mg/kg	
		RPD [GY1064-01]	Available Aluminum (Al)	2010/09/01	NC		%	35

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Stantec Consulting Ltd.
Attention: Dwayne Druggett
Client Project #: 1216 12372
P.O. #:
Project name: EDWARDS POND

Quality Assurance Report (Continued)

Maxxam Job Number: KB0B6304

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2251600	MBU	RPD [GY1064-01]	Available Antimony (Sb)	2010/09/01	NC		%	35
			Available Arsenic (As)	2010/09/01	4.0		%	35
			Available Barium (Ba)	2010/09/01	NC		%	35
			Available Beryllium (Be)	2010/09/01	NC		%	35
			Available Boron (B)	2010/09/01	NC		%	35
			Available Cadmium (Cd)	2010/09/01	NC		%	35
			Available Calcium (Ca)	2010/09/01	NC		%	35
			Available Chromium (Cr)	2010/09/01	NC		%	35
			Available Cobalt (Co)	2010/09/01	NC		%	35
			Available Copper (Cu)	2010/09/01	NC		%	35
			Available Iron (Fe)	2010/09/01	4.5		%	35
			Available Lead (Pb)	2010/09/01	NC		%	35
			Available Lithium (Li)	2010/09/01	NC		%	35
			Available Magnesium (Mg)	2010/09/01	NC		%	35
			Available Manganese (Mn)	2010/09/01	NC		%	35
			Available Mercury (Hg)	2010/09/01	NC		%	35
			Available Molybdenum (Mo)	2010/09/01	NC		%	35
			Available Nickel (Ni)	2010/09/01	NC		%	35
			Available Phosphorus (P)	2010/09/01	NC		%	35
			Available Potassium (K)	2010/09/01	NC		%	35
			Available Selenium (Se)	2010/09/01	NC		%	35
			Available Silver (Ag)	2010/09/01	NC		%	35
			Available Sodium (Na)	2010/09/01	NC		%	35
			Available Strontium (Sr)	2010/09/01	NC		%	35
			Available Thallium (Tl)	2010/09/01	NC		%	35
			Available Tin (Sn)	2010/09/01	NC		%	35
			Available Titanium (Ti)	2010/09/01	1		%	35
			Available Uranium (U)	2010/09/01	NC		%	35
			Available Vanadium (V)	2010/09/01	NC		%	35
			Available Zinc (Zn)	2010/09/01	NC		%	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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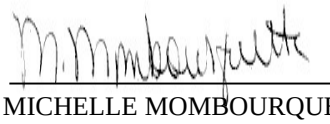
Validation Signature Page

Maxxam Job #: B0B6304

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



MICHELLE MOMBOURQUETTE, Laboratory Manager

==========

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Your Project #: 1216 12372
Site: EDWARDS POND
Your C.O.C. #: B131790

Attention: Dwayne Druggett
Stantec Consulting Ltd.
Sydney - Standing Offer
PO Box 1231
Sydney, NS
B1P 6J9

Report Date: 2010/09/02

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B0B6304
Received: 2010/08/25, 16:24

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Elements by ICPMS in soil	3	N/A	2010/09/01	ATL SOP-00161 R6, 00162 R5	Based on EPA6020

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
* Results relate only to the items tested.

Encryption Key

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

TRACY MACLEOD-FLOYD,
Email: Tracy.MacLeod.Reports@maxxamanalytics.com
Phone# (902) 567 1255

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Total cover pages: 1

This document is in electronic format, hard copy is available on request.

Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

ELEMENTS BY ICP/MS (SOIL)

Maxxam ID		GY1062	GY1063	GY1064	GY1064		
Sampling Date		2010/08/23	2010/08/23	2010/08/23	2010/08/23		
	Units	**PRSS-10SS-01**	**PRSS-10SS-02**	**PRSS-10SS-03**	**PRSS-10SS-03 Lab-Dup**	**RDL**	**QC Batch**
Metals							
Available Aluminum (Al)	mg/kg	980	910	1300	1300	800	2251600
Available Antimony (Sb)	mg/kg	ND	ND	ND	ND	10	2251600
Available Arsenic (As)	mg/kg	85	69	74	71	10	2251600
Available Barium (Ba)	mg/kg	ND	ND	ND	ND	100	2251600
Available Beryllium (Be)	mg/kg	ND	ND	ND	ND	10	2251600
Available Boron (B)	mg/kg	ND	ND	ND	ND	70	2251600
Available Cadmium (Cd)	mg/kg	ND	ND	ND	ND	2	2251600
Available Calcium (Ca)	mg/kg	ND	ND	ND	ND	3000	2251600
Available Chromium (Cr)	mg/kg	ND	ND	ND	ND	10	2251600
Available Cobalt (Co)	mg/kg	ND	ND	ND	ND	10	2251600
Available Copper (Cu)	mg/kg	ND	ND	ND	ND	100	2251600
Available Iron (Fe)	mg/kg	340000	390000	250000	230000	300	2251600
Available Lead (Pb)	mg/kg	28	34	46	42	10	2251600
Available Lithium (Li)	mg/kg	ND	ND	ND	ND	10	2251600
Available Magnesium (Mg)	mg/kg	ND	ND	ND	ND	800	2251600
Available Manganese (Mn)	mg/kg	130	110	120	120	100	2251600
Available Mercury (Hg)	mg/kg	ND	ND	ND	ND	1	2251600
Available Molybdenum (Mo)	mg/kg	ND	ND	ND	ND	10	2251600
Available Nickel (Ni)	mg/kg	ND	ND	ND	ND	20	2251600
Available Phosphorus (P)	mg/kg	760	540	670	670	200	2251600
Available Potassium (K)	mg/kg	5800	8000	9700	9400	4000	2251600
Available Selenium (Se)	mg/kg	10	ND	ND	ND	6	2251600
Available Silver (Ag)	mg/kg	ND	ND	ND	ND	10	2251600
Available Sodium (Na)	mg/kg	ND	ND	ND	ND	4000	2251600
Available Strontium (Sr)	mg/kg	32	42	43	42	20	2251600
Available Thallium (Tl)	mg/kg	ND	ND	ND	ND	7	2251600
Available Tin (Sn)	mg/kg	ND	ND	ND	ND	100	2251600
Available Titanium (Ti)	mg/kg	49	39	82	81	10	2251600
Available Uranium (U)	mg/kg	ND	ND	ND	ND	10	2251600
Available Vanadium (V)	mg/kg	10	ND	14	14	10	2251600
Available Zinc (Zn)	mg/kg	ND	ND	ND	ND	500	2251600

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

GENERAL COMMENTS

Sample GY1062-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

Sample GY1063-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

Sample GY1064-01: Reporting limits for ICP-MS metals elevated due to dilution for interfering compounds.

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Maxxam Job #: B0B6304
Report Date: 2010/09/02

Stantec Consulting Ltd.
Client Project #: 1216 12372
Project name: EDWARDS POND

QUALITY ASSURANCE REPORT

			Matrix Spike		Spiked Blank		Method Blank		RPD		QC Standard	
QC Batch	Parameter	Date	% Recovery	QC Limits	% Recovery	QC Limits	Value	Units	Value (%)	QC Limits	% Recovery	QC Limits
2251600	Available Antimony (Sb)	2010/09/01	101	75 - 125	103	75 - 125	ND, RDL=1	mg/kg	NC	35		
2251600	Available Arsenic (As)	2010/09/01	105	75 - 125	95	75 - 125	ND, RDL=1	mg/kg	4.0	35	119	75 - 125
2251600	Available Barium (Ba)	2010/09/01	87	75 - 125	110	75 - 125	ND, RDL=10	mg/kg	NC	35	100	75 - 125
2251600	Available Beryllium (Be)	2010/09/01	97	75 - 125	119	75 - 125	ND, RDL=1	mg/kg	NC	35		
2251600	Available Boron (B)	2010/09/01	96	75 - 125	119	75 - 125	ND, RDL=7	mg/kg	NC	35		
2251600	Available Cadmium (Cd)	2010/09/01	113	75 - 125	108	75 - 125	ND, RDL=0.2	mg/kg	NC	35		
2251600	Available Calcium (Ca)	2010/09/01	114	75 - 125	101	75 - 125	ND, RDL=300	mg/kg	NC	35	115	75 - 125
2251600	Available Cobalt (Co)	2010/09/01	120	75 - 125	107	75 - 125	ND, RDL=1	mg/kg	NC	35	113	75 - 125
2251600	Available Copper (Cu)	2010/09/01	114	75 - 125	102	75 - 125	ND, RDL=10	mg/kg	NC	35	110	75 - 125
2251600	Available Lead (Pb)	2010/09/01	117	75 - 125	102	75 - 125	ND, RDL=1	mg/kg	NC	35	109	75 - 125
2251600	Available Lithium (Li)	2010/09/01	112	75 - 125	116	75 - 125	ND, RDL=1	mg/kg	NC	35	103	75 - 125
2251600	Available Magnesium (Mg)	2010/09/01	115	75 - 125	105	75 - 125	ND, RDL=80	mg/kg	NC	35	106	75 - 125
2251600	Available Molybdenum (Mo)	2010/09/01	114	75 - 125	108	75 - 125	ND, RDL=1	mg/kg	NC	35		
2251600	Available Nickel (Ni)	2010/09/01	119	75 - 125	103	75 - 125	ND, RDL=2	mg/kg	NC	35	117	75 - 125
2251600	Available Phosphorus (P)	2010/09/01	98	75 - 125	121	75 - 125	ND, RDL=20	mg/kg	NC	35		
2251600	Available Potassium (K)	2010/09/01	97	75 - 125	109	75 - 125	ND, RDL=400	mg/kg	NC	35	91	75 - 125
2251600	Available Selenium (Se)	2010/09/01	118	75 - 125	103	75 - 125	ND, RDL=0.6	mg/kg	NC	35		
2251600	Available Silver (Ag)	2010/09/01	108	75 - 125	103	75 - 125	ND, RDL=1	mg/kg	NC	35		
2251600	Available Sodium (Na)	2010/09/01	97	75 - 125	111	75 - 125	ND, RDL=400	mg/kg	NC	35	82	75 - 125
2251600	Available Strontium (Sr)	2010/09/01	121	75 - 125	107	75 - 125	ND, RDL=2	mg/kg	NC	35	119	75 - 125
2251600	Available Thallium (Tl)	2010/09/01	112	75 - 125	97	75 - 125	ND, RDL=0.7	mg/kg	NC	35		
2251600	Available Tin (Sn)	2010/09/01	110	75 - 125	107	75 - 125	ND, RDL=10	mg/kg	NC	35		
2251600	Available Titanium (Ti)	2010/09/01	108	75 - 125	105	75 - 125	ND, RDL=1	mg/kg	1	35	109	75 - 125
2251600	Available Uranium (U)	2010/09/01	114	75 - 125	99	75 - 125	ND, RDL=1	mg/kg	NC	35		
2251600	Available Vanadium (V)	2010/09/01	113	75 - 125	108	75 - 125	ND, RDL=1	mg/kg	NC	35	114	75 - 125
2251600	Available Zinc (Zn)	2010/09/01	116	75 - 125	99	75 - 125	ND, RDL=50	mg/kg	NC	35	114	75 - 125
2251600	Available Aluminum (Al)	2010/09/01			116	75 - 125	ND, RDL=80	mg/kg	NC	35	96	75 - 125
2251600	Available Chromium (Cr)	2010/09/01			109	75 - 125	ND, RDL=1	mg/kg	NC	35	98	75 - 125
2251600	Available Iron (Fe)	2010/09/01			107	75 - 125	ND, RDL=30	mg/kg	4.5	35	117	75 - 125
2251600	Available Manganese (Mn)	2010/09/01			108	75 - 125	ND, RDL=10	mg/kg	NC	35	115	75 - 125
2251600	Available Mercury (Hg)	2010/09/01			82	75 - 125	ND, RDL=0.1	mg/kg	NC	35	97	75 - 125

N/A = Not Applicable
RDL = Reportable Detection Limit
RPD = Relative Percent Difference
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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Validation Signature Page

Maxxam Job #: B0B6304

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

MICHELLE MOMBOURQUETTE, Laboratory Manager

==========

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MAXXAM Chain of Custody Record

COC #: B 131790 Page ____ of ____

This column for lab use only:
Client Code: 10949
Maxxam Job #: B086304

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp
			14	14	15	

Integrity: YES NO
Integrity / Checklist by: NW
Labelled by:
Location / Bin #:

INVOICE INFORMATION:
Company Name: Stantec
Contact Name:
Address: Dartmouth
Postal Code:
Email:
Ph: Fax:

REPORT INFORMATION (if differs from invoice):
Company Name: Stantec
Contact Name: Dwayne Druggett
Address: 207-200 Churchill Dr.
Membertou, NS
Postal Code: B1S 0H1
Email: dwayne.druggett@stantec.com
Ph: 564-1855 Fax: 564 8756

PO #:
Project # / Phase #: 121612372
Project Name / Site Location: EDWARDS POND.
Quote:
Site #:
Task Order #:
Sampled by: K. MacLeod

TURNAROUND TIME
Standard ☑
10 day ☐
If RUSH Specify Date:
Pre-schedule rush work
Charge for # Jars used but not submitted

Guideline Requirements / Detection Limits / Special Instructions

*Specify Matrix: Surface/Salt/Ground/Tapwater/Sewage/Effluent/Potable/NonPotable/Tissue/Soil/Sludge/Metal/Seawater

	Field Sample Identification	Matrix*	Date/Time Sampled	# & type of bottles	Field Filtered & Preserved	Lab Filtration Required	RCAP-30 Choose Total or Diss Metals	RCAP-MS Choose Total or Diss Metals	Metals Water: Total Digest (Default Method) for well water; surface water	Metals Water: Dissolved for ground water	Metals Water: Mercury	Metals Soil: Metals & Mercury (Default Available Digest Method)	Metals Soil: Metals Total Digest - for Ocean sediments (HNO3/HF/HCLO4)	Metals Soil: Mercury Low level by Cold Vapour AA	Metals Soil: Selenium (low level) Req'd for CCME Residential/ Parklands, Agricultural	Metals Soil: Hot Water soluble Boron required for CCME Agricultural	Hydrocarbons: RBCA Hydrocarbons (BTEX, C6-C32)	Hydrocarbons: Hydrocarbons Soil (Potable), NS Fuel Oil Soil Policy Low Level BTEX, C6-C32	Hydrocarbons: NB Potable Water BTEX, VPH, Low level T.E.H.	Hydrocarbons: TPH Fractionation	Hydrocarbons: PAH's	Hydrocarbons: PAH's with Acridine, Quinoline
1	PRSS-1055-01	Soil	Aug 23/10	1-250								✓										
2	PRSS-1055-02	1	✓	1								✓										
3	PRSS-1055-03	1	1	1								✓										
4																						
5																						
6																						
7																						
8																						
9																						
10																						

RELINQUISHED BY: (Signature/Print) Blair MacVicar Date: Aug 26-10 Time:

RECEIVED BY: (Signature/Print) Natalie White Date: Aug 25/10 Time: 4:05

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Friday, September 10, 2010

Stantec
Attn : Dwayne Druggett

222 George St. PO Box 1231
Sydney, Nova Scotia
B1P 1T1,

Phone: 902-564-1855
Fax:902-564-8756

Date Rec. : 30 August 2010
LR Report: **CA13403-AUG10**
Reference: Project # 121612372

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: PRSS-10SS-01	6: PRSS-10SS-02	7: PRSS-10SS-03
Sample Date & Time			23-Aug-10	23-Aug-10	23-Aug-10
Paste pH [units]	08-Sep-10	14:19	3.47	3.46	3.64
Fizz Rate [---]	08-Sep-10	14:19	1	1	1
Sample [weight(g)]	08-Sep-10	14:19	1.98	1.99	2.02
HCl added [mL]	08-Sep-10	14:19	20.0	20.0	20.0
HCl [Normality]	08-Sep-10	14:19	0.10	0.10	0.10
NaOH [Normality]	08-Sep-10	14:19	0.10	0.10	0.10
NaOH to [pH=8.3 mL]	08-Sep-10	14:19	26.79	26.74	24.22
Final pH [units]	08-Sep-10	14:19	1.12	1.18	1.16
NP [t CaCO3/1000t]	08-Sep-10	14:19	-17.100	-16.900	-10.500
AP [t CaCO3/1000 t]	08-Sep-10	14:19	1.89	1.25	2.50
Net NP [t CaCO3/1000 t]	08-Sep-10	14:19	-19.0	-18.2	-13.0
NP/AP [ratio]	08-Sep-10	14:19	-9.05	-13.5	-4.20
Total Sulphur [%]	03-Sep-10	08:51	1.83	1.91	1.50
Sulphide [%]	03-Sep-10	11:33	0.06	0.04	0.08
Sulphate [%]	10-Sep-10	11:18	5.4	6.5	4.7
Total Carbon [%]	03-Sep-10	08:51	4.14	5.52	9.40
Carbonate (CO3) [%]	03-Sep-10	11:34	0.810	1.05	2.81

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LR Report : **CA13403-AUG10**

*NP (Neutralization Potential)

$$= \frac{50 \times (\text{N of HCL} \times \text{Total HCL added} - \text{N NaOH} \times \text{NaOH added})}{\text{Weight of Sample}}$$

*AP (Acid Potential) = % Sulphide Sulphur x 31.25
*Net NP (Net Neutralization Potential) = NP-AP
NP/AP Ratio = NP/AP
*Results expressed as tonnes CaCO3 equivalent/1000 tonnes of material
Samples with a % Sulphide value of <0.01 will be calculated using a 0.01 value.

Brian Graham B.Sc.
Project Specialist
Environmental Services, Analytical

OnLine LIMS

NOVA SCOTIA
Agriculture

Soil Test Report

PO Box 550
Truro, Nova Scotia
Canada
B2N 5E3

*URL*http://www.gov.ns.ca/nsaf/
Tel: 902-893-6565
*Fax:*902-893-4193

STANTEC CONSULTING LIMITED
FAX: 564-8756
207-200 CHURCHHILL DRIVE
MEMBERTOU, NS
B1S 2M9

Client Number: 20471
Accession: 91628
Samples Reported: 9/ 2/2010
Samples Received: 8/27/2010

Lab #	1		2		3			
Sample ID	PRSS-1055-01		PRSS-1055-02		PRSS-1055-03			
Field Size (ha)								
Manure Code								
Sod Code								
Crop to be Grown	MEDIUM TURF		MEDIUM TURF		MEDIUM TURF			
	Analysis	Rating	Analysis	Rating	Analysis	Rating	Analysis	Rating
pH	3.2		2.9		3.1			
Organic Matter (%)	8.1		9.0		9.9			
P2O5 (kg/ha)	<= 5	L-	<= 5	L-	<= 5	L-		
K2O (kg/ha)	161	L+	191	M-	173	L+		
Ca (kg/ha)	325	L-	339	L-	379	L-		
Mg (kg/ha)	92	M-	142	M-	92	M-		
Na (kg/ha)	184		282		125			
Sulfur (kg/ha)	2274		2466		2120			
Al (ppm)	43.00		65.51		45.41			
Fe (ppm)	457		543		519			
Mn (ppm)	7		10		9			
Cu (ppm)	0.16		0.17		0.21			
Zn (ppm)	<= 0.2		<= 0.2		<= 0.2			
B (ppm)	<= 0.50		<= 0.50		<= 0.50			
Nitrate - N (ppm)								
% Nitrogen								
Salt (mhos x 10^3)								
CEC (meq/100gm)	20.2		23.2		18.3			
Base Sat. K (%)	0.8		0.9		1.0			
Ca (%)	4.0		3.7		5.2			
Mg (%)	1.9		2.5		2.1			
Na (%)	2.0		2.6		1.5			
H (%)	91.3		90.3		90.2			
Lime Required (t/ha)	6.0	6.5	6.0	6.5	6.0	6.5	6.0	6.5
		38		43		33		
Required Nutrient (kg/ha)	N P2O5 K2O		N P2O5 K2O		N P2O5 K2O		N P2O5 K2O	
	65 120 100		65 120 90		65 120 100			

Result(s) relate only to sample(s) tested

(1) Sample sent to an accreditated lab for analysis
1 kg/ha = 0.89 lb/ac 1 tonne/ha = 0.45 ton/ac
To convert kg/ha to ppm divide by 2
L = Low M = Medium H = High E = Excessive

Copies To:

Analysis Approved By:
Michelle Sparrow, TLOS

APPENDIX E

Statement of General Limitations

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of our Client (SENES Consultants Limited (SENES)) and their Client (Public Works and Government Services Canada (PWGSC) and Enterprise Cape Breton Corporation (ECBCC)). This report may not be used by any third party without the express written consent of Stantec Consulting Ltd. (Stantec) and SENES. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described in the report, based on information provided by PWGSC and ECBC. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by SENES/PWGSC/CBDC to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.