

Geotechnical Data Report, Core Area Wastewater Treatment Program

Report Context

The CRD has been planning wastewater treatment for the Core Area for over 30 years. During this time a significant number of reports have been prepared and/or reviewed to assess options and provide information to further planning.

In May 2016 a Project Board was established to define and implement wastewater treatment for the Core Area. The Project Board heard delegations and presentations from the public, industry professionals, and a CRD Director. The Project Board Chair and Vice Chair also met with staff from the CRD, all of the Core Area municipalities, and with Esquimalt and Songhees Nations representatives. The Project Board reviewed the previous technical work and extensive public commentary and developed a methodology to review and evaluate all options. This methodology included evaluation of a large number of options to identify a short list that best addressed the Project goals.

In September 2016 the Project Board presented its recommendation for wastewater treatment and on September 14, 2016 the CRD Board approved the Wastewater Treatment Project (the Project).

A significant number of the reports that have been prepared and/or reviewed still serve as useful background information, but not all of the reports are applicable to the Project. To respond to several recent public inquiries regarding topics of interest, the CRD has prepared a synopsis of reports along with a summary of the applicability of the report to the Project. The document summary is available here:

<https://www.crd.bc.ca/docs/default-source/wastewater-planning-2014/2017-05-30-summary-of-documents-related-to-topics-of-interest.pdf>. The document summary does not provide a comprehensive list of reports completed as part of wastewater treatment planning for the Core Area, it is a compilation of a number of reports related to key topics of interest: odour; seabed pipeline; bluffs and shoreline; geotechnical; and noise.

Purpose of this Report

This report was a Geotechnical Data Report that was provided to all bidders for the McLoughlin Point Wastewater Treatment Plant. The report provided the results of test drilling at a number of boreholes drilled on the McLoughlin site and in Victoria Harbour. The report included a compilation of borehole data completed by Stantec and by Golder Associates as part of the McLoughlin site remediation. The report identified issues that would have to be addressed by the successful proponent for the McLoughlin Point Wastewater Treatment Plant.



Applicability to Project

This report is applicable to the Project. The report provides relevant information with respect to the current geotechnical conditions for the McLoughlin Site and the Victoria Harbour Crossing. The design-build contractor, Harbour Resource Partners (HRP) will consider the findings in this report as they finalize the design of the McLoughlin Point Wastewater Treatment Plant and the Victoria Harbour Crossing. HRP has engaged a geotechnical engineer to provide further geotechnical design information for the design of the McLoughlin plant foundations and the Victoria Harbour Crossing.

GEOTECHNICAL DATA REPORT

Core Area Wastewater Treatment
Program

FINAL



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TABLE OF CONTENTS

1	INTRODUCTION	1
2	PROJECT DESCRIPTION	2
3	SITE DESCRIPTION	3
4	EXISTING INFORMATION.....	4
5	STANTEC SUBSURFACE INVESTIGATION.....	6
	5.1 General.....	6
	5.2 McLoughlin Point.....	6
	5.3 Ogden Point	7
	5.4 Victoria Harbour Crossing	7
	5.4.1 Detailed Geotechnical Logging with Q-Method.....	8
6	LABORATORY SOIL AND ROCK TESTING	10
	6.1 Water Content Determination (Soil).....	10
	6.2 Atterberg Limits (Soil).....	10
	6.3 Field Point Load Testing (Rock).....	10
	6.4 Laboratory Strength and Density Testing	11
7	SUBSURFACE CONDITIONS	12
	7.1 Surficial Geology	12
	7.2 McLoughlin Point Soil and Bedrock Conditions	12
	7.2.1 Fill.....	12
	7.2.2 Silt and Clay	13
	7.2.3 Silty Sand to Sand	14
	7.2.4 Bedrock	14
	7.2.4.1 Intact Rock Properties.....	14
	7.2.4.2 Rock Mass Characteristics.....	15
	7.2.5 Groundwater Conditions.....	16
	7.3 Ogden Point Soil and Bedrock Conditions.....	16
	7.3.1 Fill.....	17
	7.3.2 Silt and Clay	17
	7.3.3 Sand	17
	7.3.4 Bedrock	17
	7.3.5 Groundwater Conditions.....	17
	7.4 Victoria Harbour Crossing Soil and Bedrock Conditions	17
	7.4.1 Silty Sand/Sand	18
	7.4.2 Silt and Clay	18

	7.4.3	Bedrock	18
	7.4.3.1	Intact Rock Properties.....	18
	7.4.3.2	Rock Mass Characteristics.....	19
8	DISCUSSION		22
9	CLOSURE		24

List of Tables

Table 1:	Summary of Atterberg Limits Tests for Silt and Clay, ASTM D 4318	13
Table 2:	Summary of Intact Strength and Density Parameters, McLoughlin Point	15
Table 3:	Summary of RQD Values, McLoughlin Point.....	15
Table 4:	Summary of RMR Values, McLoughlin Point	16
Table 5:	Summary of Intact Strength and Density Parameters, Victoria Harbour Crossing.....	18
Table 6:	Summary of RQD Values, Victoria Harbour Crossing	19
Table 7:	Summary of Q-Values, Victoria Harbour Crossing	21

List of Appendices

Appendix A:	.....	Drawings
Appendix B:	.....	Borehole and Test Pit Logs
Appendix C:	.....	CPT Results
Appendix D:	.....	Laboratory Test Results
Appendix E:	.....	Rock Core Photos
Appendix F:	.....	Drawing and Test Hole Logs from Stage 2 PSI by Golder Associates
Appendix G:	Remedial Site Works Drawings by Golder Associates
Appendix H:	Frontier Geoscience Report

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1 INTRODUCTION

Stantec Consulting Ltd. (Stantec) has prepared this geotechnical report to present the subsurface conditions at McLoughlin Point, Ogden Point and the Victoria Harbour Crossing as part of the Capital Regional District (CRD) Core Area Wastewater Treatment Program. A wastewater treatment plant and marine outfall are proposed at the McLoughlin Point site. An approximately 880 m long submarine forcemain is also proposed for the Victoria Harbour Crossing, extending from McLoughlin Point to Ogden Point. The McLoughlin Point site is located at the south end of Victoria View Road in Esquimalt, BC. The Ogden Point site is located off Dallas Road, northwest of the intersection between St. Lawrence Street and Niagra Street in Victoria, BC.

The purpose of this report is to provide subsurface information about the soil, bedrock and groundwater conditions at the sites to support procurement of this design-build project. The scope of work for this geotechnical assessment consisted of a review of existing documentation for the sites, a subsurface investigation, laboratory testing (soil and rock) and preparation of this report. This report is issued pursuant to the draft Geotechnical Data Report and incorporates the findings of a bedrock laboratory testing program that were not available at the time of the draft report. The scope of this report is limited to the geotechnical aspects of the proposed development, and does not address soil and groundwater contamination at the sites or the remedial work previously conducted at the McLoughlin Point Site.

2 PROJECT DESCRIPTION

The proposed McLoughlin Wastewater Treatment Plant, Marine Outfall and Victoria Harbour Sub-marine Crossing will comprise a portion of the CRD's Core Area Wastewater Treatment Program, which will service the Greater Victoria Core Area. The treatment plant will provide secondary-level treatment for wastewater, which will be discharged through a new marine outfall at McLoughlin Point. The Victoria Harbour Crossing will involve the installation of a sub-marine forcemain from McLoughlin Point to Ogden Point using a trenchless construction technology such as horizontal directional drilling (HDD).

Based on the indicative design, and as shown on Drawing 1 in **Appendix A**, the wastewater treatment facility at McLoughlin Point includes a chemical building, high-rate primary clarifiers, biological aerated filters, a sludge storage tank, an odour control room, a mechanical room, a dirty wash water tank, a heat recovery room, a blower and pump station, a clean wash water tank and an electrical room. An operations and maintenance building is situated to the east of the main facility, and a standby generator and transformer occupies the southern end of the site. The marine outfall discharges treated wastewater at the southeast corner of the site. Based on preliminary section drawings for the facility, the high-rate primary clarifiers, biological aerated filters, sludge storage tank and wash water storage tanks extend below the existing site grades, with some portions of the structure being as deep as Elev. -4.15 m Geodetic.

In addition to the wastewater treatment plant and associated structures, the development at McLoughlin point includes an access road encircling the wastewater treatment facility with parking stalls being situated alongside the roadway. A new retaining wall will be constructed around the shoreline of the site, connecting to an existing retaining wall along the east side of the property, to accommodate the eastern portions of the access road and parking areas. The remaining site areas are redesigned as green areas.

The entry point for the sub-marine forcemain Crossing will be located at the McLoughlin Point site and will exit at the Ogden Point site. Based on the preliminary design, the alignment of this forcemain will require an 8 m diameter entry pit of approximately 3 m depth and a 5 m diameter exit pit of approximately 3 m depth.

Based on preliminary design, the sub-marine forcemain may be installed up to 40 m below the sea floor and founded within the underlying bedrock. The sub-marine forcemain will be approximately 880 m long.

3 SITE DESCRIPTION

As shown on Drawing 1 in **Appendix A**, the site of the proposed wastewater treatment plant and marine outfall is located at the south end of Victoria View Road in Esquimalt, BC. The site is irregular in shape and is bounded by Victoria Harbour to the south and east, by Victoria View Road to the west and by a recreational boating facility to the north. The dimensions of the site are approximately 180 m in the north-south direction and 100 m in the east-west direction at the widest point. The site was formerly occupied by a bulk fuel storage and distribution terminal (operated by Imperial Oil), which has since been demolished. Access to the site is through one of two fences along Victoria View Road.

The terrain at McLoughlin Point is generally flat, except along the shoreline and at the bedrock outcrops present in the eastern portion of the property. The elevation of the site typically ranges from approximately Elev. 6.5 m Geodetic in the northwest corner of the property to Elev. 3.5 m Geodetic in the southeast corner, with an elevation rise to approximately Elev. 9 m occurring at the bedrock outcrops. The site is mostly gravel-covered, although asphalt pavement is present along the western side of the property and a grass-covered area is situated in the northwest corner. The gravel cover was observed to be thin within the central portion of the site, and the underlying silty material was found to be soft. Occasional concrete walls (remnants of old buildings) remain across some portions of the site, and an existing concrete retaining wall up to approximately 4 m in height is present on the eastern side of the property.

As shown on Drawing 2 in **Appendix A**, the Ogden Point site is rectangular in shape and is approximately 50 m wide in the east-west direction and 70 m long in the north-south direction. The site is undeveloped except for a small, one-storey structure located at the east end of the site near Dallas Road. There is a boat launch with a concrete ramp at the northwest corner of the property. The site is asphalt paved along the east end, and the remaining areas are gravel covered. The site gently slopes from east to west, and the grades range from approximately Elev. 3.6 m Geodetic at the east end down to Elev. -1.5 m Geodetic at the west end of the boat launch.

4 EXISTING INFORMATION

In preparation of this factual report, Stantec has reviewed documentation of past site investigation and environmental remediation works completed at the McLoughlin Point site. Relevant documentation of these past works includes the following:

- “Limited Stage 2 Preliminary Site Investigation: Former Imperial Oil Limited Agency and Terminal Facility, 337-343 Victoria View Road, Esquimalt, BC (SAP No. 88002302)”, dated May 19, 2011, by Golder Associates.
- “Confirmation of Soil Excavation Report: 337 – 343 Victoria View Road, Esquimalt, BC (SAP No. 88002302)”, dated December 20, 2011, by Golder Associates.
- “Confirmation of Remedial Soil Excavation: Former Distribution Terminal and Agency Site, 337-343 Victoria View Road, Esquimalt, BC (SAP 88002302 / Site ID 300544)”, dated January 16, 2013, by Golder Associates.
- “Submarine Pipeline Crossing CRD Wastewater Treatment Program – Alignment Evaluation”, dated November 15, 2010, by Stantec Consulting Ltd.

The Stage 2 Preliminary Site Investigation (PSI) by Golder Associates included a subsurface investigation consisting of 40 mechanically excavated test pits and 38 auger holes across the site. The test pits were advanced to a maximum depth of 5 m or until refusal on bedrock, and the auger holes were advanced to a maximum depth of 16.5 m or until refusal on bedrock. Of the 38 auger holes, 35 were equipped with monitoring well installations. The test hole location plan and test hole logs from the Stage 2 PSI report by Golder Associates are provided in **Appendix F**. Based on the findings of the Stage 2 PSI by Golder Associates, remedial work was carried out in 2011 and 2012, and included excavation and replacement of contaminated soils in the identified areas of environmental concern.

The remedial work in 2011 involved excavation of contaminated soils from an approximately 60 m east-west by 25 m north-south area in the southern portion of the site. The depth of excavation was typically in the range of 1 to 4 m. The western half of the excavation extended into the native silt and clay soils, while the eastern half extended to the depth of bedrock. The excavation was backfilled mostly with imported fill materials, although excavated sand and gravel material was also used as backfill at lower elevations in the eastern portion of the excavation. Imported silt material was used as backfill at lower elevations in some portions of the excavation. Seventy five (75) millimeter minus crushed gravel was used as backfill for the remainder of the excavation and as surficial cover overtop the imported silt and excavated sand and gravel backfill materials

The remedial work in 2012 involved excavation of contaminated soils from three additional areas: a 25 m east-west by 30 m north-south area to the southwest of the bedrock outcrops, a 25 m east-west by 43 m north-south area in the central portion of the site to the west of the bedrock outcrops, and a 20 m east-west by 36 m north-south area in the northeast corner of the site. The excavation depths in these areas typically ranged from 1 to 2.5 m below the ground surface. Excavation in the area to the southeast of the bedrock outcrops exposed the underlying bedrock. The eastern side of

the excavation in the central portion of the site exposed the underlying bedrock, while the remainder of the excavation extended into the native silt and clay soils. The excavation in the northeast corner of the site extended mostly into the native silt and clay soils, although bedrock was exposed at the southeast corner of the excavation. The excavations were backfilled with an assortment of fill materials, including blast-rock, excavated sand and gravel material and 75 to 150 mm clear stone, in addition to imported silty material, fine sand, 75 mm minus crushed gravel and 19 mm minus crushed gravel.

As a result of the remedial work completed at the site, the existing soil conditions at the site differ from those described on the test hole logs in the Stage 2 PSI report by Golder Associates (included in **Appendix F**). Drawings by Golder Associates showing the extents of the remedial work and describing the nature of backfill materials are provided in **Appendix G**.

An Alignment Evaluation report completed by Stantec for the sub-marine crossing included a geophysical survey of Victoria Harbour, which was completed by Frontier Geoscience. The survey data was used to determine the depth to the sea floor and the depth to bedrock. Details of the geophysical survey are presented in Frontier's report enclosed in **Appendix H**.

5 STANTEC SUBSURFACE INVESTIGATION

5.1 General

The Stantec subsurface investigations were completed in three (3) stages and were continuously monitored by a Stantec field representative, who positioned the test holes, selected the sample locations, classified the soil and rock encountered, kept a detailed record of each borehole, and observed and recorded pertinent site features. Representative soil samples and rock core were returned to the Stantec laboratory in Burnaby. Laboratory soil testing consisted of detailed visual classification of the soil, moisture content measurement and Atterberg Limits testing. Laboratory examination of the rock cores included detailed characterization of the rock and fracture properties.

5.2 McLoughlin Point

Stantec completed a site investigation for the proposed wastewater treatment plant from December 13 to 18, 2012 to characterize the soil, bedrock and groundwater conditions at the site, and to record pertinent site features. The subsurface investigation consisted of three (3) Cone Penetration Tests (CPTs), ten (10) mud rotary boreholes with Standard Penetration Tests (SPTs) and diamond-bit rock coring, and six (6) mechanically excavated test pits. The test hole locations were selected to provide adequate coverage of the site area and to supplement the test hole information previously acquired by Golder Associates in their Stage 2 PSI. The test hole locations from the Stantec investigation are shown on Drawing 1 in **Appendix A**.

The CPTs were advanced to depths ranging from 10.3 to 13.7 m below the ground surface with a track-mounted rig. The CPT involves hydraulically pushing a stainless steel cone into the ground at a constant rate of penetration. The cone device consists of transducers and sensors mounted on the cone tip and friction sleeve (shaft of the cone) to measure end-bearing resistance at the tip, frictional resistance along the sleeve and pore water pressure. The electronic readings from the transducers and sensors were recorded at 25 mm depth intervals. The CPT results can be used to obtain a detailed stratigraphic log, information about groundwater conditions and indication of soil properties/parameters. The full depths of the CPT holes were grouted in accordance with the *Groundwater Protection Regulation of the BC Water Act*.

The mud rotary boreholes with rock coring were advanced to depths of 7.0 to 19.8 m below the existing site grades with the same track-mounted drill rig. The total length of mud rotary drilling ranged from 1.6 to 14.6 m, while the total length of rock coring ranged from 1.5 to 18.2 m. SPTs were typically conducted at 1.5 m intervals within the overburden soils in order to obtain representative samples and evaluate the consistency and compactness condition of these soils. Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation of the BC Water Act*.

Select rock cores from the McLoughlin Point investigation were logged by a geological engineer to establish Rock Mass Rating (RMR) characterization in support of proposed bedrock excavations in the following areas: proposed structures with below grade storage tanks and the proposed entry pit

for the sub-marine forcemain (Boreholes BH12-05, BH12-06 and BH12-09). RMR is a geomechanical classification system widely used to quantify rock mass quality and can be empirically correlated to excavation performance and support requirements. It is based on the following parameters: intact rock strength, rock quality designation (RQD), joint spacing, joint condition and groundwater conditions. The RMR classification system applied to the McLoughlin Point cores was RMR (1974)¹.

The mechanically excavated test pits extended to depths in the range of 0.1 to 3.4 m below the ground surface. The shallower test pits are indicative of areas in which refusal was encountered on near-surface bedrock.

High Resolution Core Photography

Detailed photographs of the McLoughlin Point core were taken with a Nikon D5100 digital SLR (single lens reflex) 10.2 megapixel camera. Core logging and photography were completed at Stantec's Sidney, BC warehouse facilities. Core photograph summaries are provided in **Appendix E**.

5.3 Ogden Point

The site investigation at the Ogden Point site was completed from February 5 to 6, 2013 to characterize the soil, bedrock and groundwater conditions at the site, and to record pertinent site features. The site investigation consisted of 2 mud rotary boreholes (BH13-1 and BH13-2) with Standard Penetration Tests (SPTs) and diamond-bit rock coring. The approximate locations of the boreholes are shown on Drawing 2 in **Appendix A**. The locations of the boreholes were selected based on the preliminary alignment of the proposed sub-marine forcemain in order to obtain subsurface information in the vicinity of the forcemain and receiving pit.

Boreholes BH13-1 and BH13-2 were advanced to depths of 17.8 and 20.4 m below the existing site grades, respectively. The total length of mud rotary drilling was 15 m for borehole BH13-1 and 19.4 m for borehole BH13-2. The total length of rock coring was 2.8 m for borehole BH13-1 and 1.0 m for borehole BH13-2. SPTs were typically conducted at 1.5 m intervals within the overburden soils in order to obtain representative samples and evaluate the consistency and compactness condition of these soils. Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation* of the *BC Water Act*.

5.4 Victoria Harbour Crossing

A marine geotechnical investigation of the Victoria Harbour Crossing was carried out by Stantec between January 25 to February 2, 2013. The geotechnical investigation consisted of four (4) mud-rotary boreholes (MBH13-1 to MBH13-4) with SPT's and diamond-bit rock coring. The approximate locations of the marine boreholes are shown on Drawings 3-1 to 3-3 in **Appendix A**.

¹ Barton N., Lien R. and Lunde J. (1974): Engineering classification of rock masses for the design of rock support. *Rock Mechanics* 6, 1974, pp. 189-236.

The marine geotechnical investigation was carried out from a spud barge subcontracted from Spectrum Marine Services. The spud barge was approximately 30 m in length and 10 m wide and was equipped with two steel vertical spuds of approximately 22 m length, located on the starboard side. Maneuvering of the barge was achieved using a self-propelled tug boat. The boreholes were located using a hand held GPS unit. Once in position, the barge location was fixed using the two vertical spuds. Stantec site supervision was provided by three geotechnical staff across two twelve hour shift patterns to allow 24 hour fieldwork to be carried out.

All four (4) of the marine boreholes were advanced to 50 m below the seafloor and terminated within the underlying bedrock. SPTs were typically conducted at 3 m intervals within the overburden soils in order to get a general description of the soil strata. The primary focus of the marine boreholes was to obtain information of the bedrock zones within proximity of the proposed submarine pipeline alignment. It should be noted that two (2) attempts were required to complete borehole MBH13-3. During the first attempt, the borehole was advanced to a depth of 22 m, but was terminated early due to mechanical problems with the drill-rig. Following repairs to the drill-rig, the barge and drill-rig were repositioned near the original MBH13-3 location (shown as MBH13-3A on Drawing 3-2) and was successfully completed on the second attempt.

Upon completion of each borehole, the full depths of the holes were grouted in accordance with the *Groundwater Protection Regulation of the BC Water Act*.

5.4.1 Detailed Geotechnical Logging with Q-Method

The rock cores of the Victoria Harbour Crossing were logged by a geological engineer according to the Q-method.

The Q-Method is a rock mass classification system that can be related to stability in underground openings. It was originally developed at the Norwegian Geotechnical Institute (NGI) between 1971-1974 (Barton et. al. 1974)¹ and has been further refined using thousands of case studies from existing excavations. Based on six rock mass parameters, a Q-value for any rock mass may be calculated.

$$Q = RQD/J_n \times J_r/J_a \times J_w/SRF$$

$$\text{Where: } J_w/SRF = 1$$

Guidelines for the determination of each parameter are given within the system methodology. To summarize:

- RQD/J_n: Defines the block size within the rockmass. RQD is calculated for each geotechnical interval. Joint set number (J_n) is a value that represents the number of natural joint sets present within the interval.
- J_r/J_a: Defines the strength of joints within the rockmass. Joint roughness (J_r) is assigned a value per interval based on the degree of asperities along the joint planes. Joint alteration (J_a) is assigned a value per interval based on the degree of joint wall mineralization or coating.

- Jw/SRF: Defines the state of stress in a rockmass. For preliminary assessment of Q, a value of unity (1) was assigned to the last term of the formula where Jw represents the Joint Water Reduction Factor and SRF represents the Stress Reduction Factor. This is a common practice for preparation of the factual investigation report, as the tunnel designer selects Jw and SRF based on other considerations, such as tunnel alignment and geological stress history of the area, for example.

High Resolution Core Photography

Detailed photographs of the Victoria Harbour Crossing cores were taken with a Nikon D5100 digital SLR (single lens reflex) 10.2 megapixel camera. Core logging and photography were completed at Stantec's Sidney, BC warehouse facilities. Core photograph summaries are provided in **Appendix E**.

6 LABORATORY SOIL AND ROCK TESTING

The primary objectives of the laboratory testing program were to aid in the visual classification of the soil and rock core samples and to measure pertinent engineering properties of soil/rock to facilitate design of the proposed facilities. In general, geotechnical laboratory testing was performed in accordance with applicable American Society for Testing Materials (ASTM) test procedures. Details of the laboratory test results are enclosed in **Appendix D**.

It should be noted that bedrock samples from the McLoughlin Point and Victoria Harbour Crossing subsurface investigations were subjected to further field and laboratory strength testing as described below.

6.1 Water Content Determination (Soil)

Water (or moisture) contents (w) were determined from measured total and dry weights of both undisturbed and disturbed specimens cut from the recovered soil samples. Measurements were performed in accordance with the procedures described in ASTM D 2216.

6.2 Atterberg Limits (Soil)

An index soil test called Atterberg Limits is used to describe the plastic limit and liquid limit of a soil. As water is added to a dry soil, the soil changes from a solid to a semi-solid, then to a plastic, and finally to a liquid. The moisture content in the soil at the threshold between semi-solid and plastic state is called the plastic limit. The moisture content in the soil at the threshold between plastic and liquid state is called the liquid limit. Subtracting the plastic limit from the liquid limit yields the plasticity index.

The Atterberg Limits tests were performed on selected soil samples using the multipoint test method. The liquid (LL) and plastic (PL) limits are determined using the test procedures described in ASTM D4318. The plasticity index, PI , is defined as:

- $PI\% = LL\% - PL\%$

The liquidity index, LI , is defined as:

- $LI = (w\% - PL\%) / PI\%$

In general, Atterberg Limits were performed on samples that were tested for strength or deformation characteristics.

6.3 Field Point Load Testing (Rock)

Concurrently with detailed core logging, representative core samples were subjected to field point load strength testing. A RocTest Point Load Tester (Model PIL-7) was used to measure the point load strength index for rock samples. The samples were selected from the McLoughlin Point and Victoria Harbour Crossing borehole locations. The tests were performed diametrically in accordance with ASTM D5731.

6.4 Laboratory Strength and Density Testing

Representative samples of rock core were selected to measure the uniaxial compressive strength (UCS) of the intact rock core specimens. UCS Samples were prepared and tested in accordance with ASTM D 2938-95 (2002) and D 4543-04. On each UCS samples, bulk density was determined. Indirect (Brazilian) strength testing was conducted on select rock core samples in accordance with ASTM D 3967.

7 SUBSURFACE CONDITIONS

7.1 Surficial Geology

Based on *Quaternary Geological Map of Greater Victoria* (Monohan and Levson, 2000)², the McLoughlin Point site is situated in a region consisting primarily of shallow soils over bedrock. Overburden soils typically include less than 5 metres of Victoria Clay overlying thin, older Pleistocene deposits or bedrock. Scattered outcrops occur throughout the unit, and bedrock is commonly found within a few metres of the ground surface. The thickness of the older Pleistocene deposits is less than a few metres in most areas, but locally up to approximately 10 m.

The Ogden Point site is situated in an area of thick anthropogenic fills overlying the grey facies of Victoria Clay, which typically exceeds 3 m in thickness. The thickness of the grey clay facies is commonly greater than 10 m and locally exceeds 20 m. The grey clay facies is typically overlain by the brown clay facies, which is generally 2 to 5 m thick. The thickness of older Pleistocene deposits underlying the Victoria clay is generally less than a few metres.

The results of the geotechnical investigations at McLoughlin Point and Ogden Point are in general agreement with the surficial geology for the region.

7.2 McLoughlin Point Soil and Bedrock Conditions

Based on the results of the Stantec site investigation and our review of the documentation produced by Golder Associates for the past site investigation and remedial work, the majority of the site is covered by existing fill materials. The fill materials are directly underlain by bedrock at shallow depth throughout much of the eastern portion of the property, in which some bedrock outcrops are also present. In the western and northern parts of the property, the fill materials are underlain by native silt and clay soils of variable thickness. In some areas, the native silt and clay soils were found to be directly underlain by granodiorite bedrock; whereas in others, they were underlain by granular soils which were, in turn, underlain by bedrock.

Additional details regarding the soil, bedrock and groundwater conditions at the site are provided below. The detailed borehole and test pit logs are presented in **Appendix B**, CPT results are presented in **Appendix C**, and field strength and laboratory testing results are presented in **Appendix D**.

7.2.1 Fill

The majority of the site is covered by surficial fill materials with the exception being the area of the bedrock outcrops in the eastern portion of the property. Based on the test hole information acquired by Stantec and Golder Associates and documentation of the environmental remediation work

² Quaternary Geological Map of Greater Victoria, Trim Sheets (92B.043, 044, 053 & 054)

completed at the site, the fill extends to a depth of up to 4 m below the ground surface. The composition of fill material is variable across the site. The fill encountered in the investigation by Golder Associates consisted predominantly of granular material ranging from sand with a trace of gravel to sand and gravel. Occasional zones of silty material were also encountered within the fill, and other areas contained cobble and debris inclusions.

Much of the existing fill materials were excavated from the site as part of the environmental remediation work completed in 2011 and 2012. The excavations were backfilled with an assortment of fill materials, including imported silty material, fine sand, 75 mm minus crushed gravel and 19 mm minus crushed gravel. Where placed, the imported silt fill was typically covered with a surficial layer of gravel. Existing on-site blast-rock, excavated sand and gravel, and 75 to 150 mm clear stone were also used as backfill in portions of the 2012 excavations. Records of the nature and variability of the fill materials used to backfill the excavations completed during the site remediation are generally consistent with the findings of the Stantec site investigation.

7.2.2 Silt and Clay

In the western and northern portions of the site, the fill materials are underlain by a deposit of silt and clay with a trace of sand and occasional gravel inclusions. Based on the test holes completed during the site investigations by Stantec and Golder Associates, the deposit of silt and clay extends to a maximum depth of approximately 14.6 m below the ground surface. In some areas, the lower portions of the deposit are described as sandy silt with some clay and a trace to some gravel. The silt and clay soils are generally light brown in colour near the ground surface, becoming grey with depth. The results of Atterberg Limit testing conducted on selected samples from the silt and clay deposit generally categorizes the soil as high plasticity clay under the Unified Soil Classification System. The CPT results indicate that the silt and clay soils are very stiff to hard (i.e., overconsolidated) within 4 to 5 m of the ground surface, becoming stiff below. Measured moisture contents of the silt and clay soil samples ranged from 22% to 43%, except in the lower sandy portions of the deposit where measured moisture contents were in the range of 13% to 16%. A summary of the Atterberg Limits tests for the silt and clay samples are shown in Table 1. The graphic results are presented in **Appendix D**.

Table 1: Summary of Atterberg Limits Tests for Silt and Clay, ASTM D 4318

Borehole No. (Sample Depth)	Liquid Limit %	Plastic Limit %	Plasticity Index %	Natural Water Content %
BH12-1 (3.3 m)	50	21	29	29
BH12-2 (4.8 m)	48	25	23	33
BH12-3 (4.8 m)	57	18	39	41
BH12-4 (4.8 m)	54	19	35	36
BH12-7 (4.8 m)	59	18	41	36

7.2.3 Silty Sand to Sand

The silt and clay soils are underlain in some areas by a deposit of granular soil. The maximum thickness of granular soil encountered in the Stantec investigation was 1.7 m, although up to 6.1 m of granular soil was encountered in boreholes completed by Golder Associates. The granular deposits consist primarily of sand, with some zones containing a trace to some silt and others being described as silty. The deposit typically contains a trace to some gravel, although some portions are described as gravelly. The thickest regions of granular soil beneath the silt and clay deposit occur within the northwest portion of the property.

7.2.4 Bedrock

The overburden soils across the site are underlain by bedrock consisting predominantly of granodiorite intruded by occasional andesite dykes. In proximity to the andesite intrusions, alteration of the granodiorite was observed and is noted herein as “altered granodiorite”. The bedrock is described as moderately jointed to intact in some areas, but very severely fractured to severely fractured in zones, as illustrated on the attached borehole records (see **Appendix B**). The rock is typically medium strong to strong and slightly weathered. Discrete zones of moderate weathering were observed and correspond to zones of low RQD.

Each of the boreholes in the Stantec investigation was terminated within the bedrock formation. The test pits were each terminated upon refusal at the bedrock surface, except TP12-1 which was terminated within the deposit of silt and clay.

Further bedrock characterization was completed on BH12-5, BH12-6 and BH12-9 in support of proposed site infrastructure that may require significant bedrock excavation. The details are provided below in Sections 7.2.4.1 and 7.2.4.2.

7.2.4.1 Intact Rock Properties

The intact strength of the bedrock has been determined using unconfined compression tests, indirect (Brazilian) tensile strength tests and field point load tests. The laboratory bedrock testing report and a summary of point load strength data are provided in **Appendix D**.

Four (4) unconfined compression tests were carried out on samples of the bedrock core and two (2) indirect (Brazilian) tensile strength test were conducted. Point load tests were performed diametrically on samples of the bedrock core and are reported as values of the Point Load Index corrected to a standard 50 mm diameter specimen, $I_{s(50)}$, in Table D-1, **Appendix D**. To summarize, the following mean parameters are provided in Table 2:

Table 2: Summary of Intact Strength and Density Parameters, McLoughlin Point

Intact Strength Parameter	Granodiorite	Altered Granodiorite ²
Point Load $I_{s(50)}$ (MPa)	6.9	5.0
Dry Density(kg/m ³)	2,630	2,663
UCS (MPa) ¹	110	153
Indirect Tensile Strength (MPa)	8.4	13.2

Note:

1. Average of valid test results: i.e., excludes tests that failed along foliation.
2. Lithology in attached laboratory reports incorrect: specimens noted as gneiss are equivalent to altered granodiorite.

Average point load strength indices (I_{s50}) range from 6.9 to 5.0 for the granodiorite and altered granodiorite, respectively. Estimated uniaxial compressive strength can be obtained from these data by utilizing a conversion factor, K. K is an index to strength conversion factor that depends on site-specific correlation between UCS and I_s for a particular specimen size. To accurately determine K, a robust site-specific database is required and is not available for the McLoughlin Point bedrock. In lieu of a site-specific factor, ASTM D5731 dictates generalized K values for specific core diameter. For NQ sized core, a conversion factor, K, of 21 is provided.

Average laboratory UCS values range from 110 MPa to 153 MPa in the granodiorite and altered granodiorite, respectively. Based on the field and laboratory testing results, both the granodiorite and altered granodiorite in the McLoughlin Point area may be classified as very strong (100 – 250 MPa).

7.2.4.2 Rock Mass Characteristics

An explanation of the rock mass quality descriptors is presented in the Borehole Symbols and Terms in **Appendix B**.

Rock Quality Designation (RQD)

RQD values were obtained for all drill holes, and are plotted on the Borehole Records in **Appendix B**. RQD values for each lithological unit in drill holes BH12-5, BH12-6 and BH12-9, based on the recovered core, are summarized in Table 3.

Table 3: Summary of RQD Values, McLoughlin Point

Rock Type	Average RQD (%)	Standard Deviation (%)
Granodiorite	67	26
Altered Granodiorite	68	32
All Rock Types	68	28

Based on the average RQD values from these three boreholes, the rock mass at McLoughlin Point may be described as fair quality, fractured, or blocky. It should be noted, however, that low RQD values (< 50%) representing severely fractured rock mass were observed at discrete intervals.

Rock Mass Rating (RMR)

RMR values were obtained for all core runs in boreholes BH12-5, BH12-6 and BH12-9 and are plotted on the Borehole Records in **Appendix B**.

Table 4: Summary of RMR Values, McLoughlin Point

Rock Type	Average RMR	Standard Deviation
Granodiorite	61	15
Altered Granodiorite	62	14
All Rock Types	61	14

Based on an RMR rating of 61, the overall rock mass may be classified as good quality rockmass. No significant variation in the two lithologies was noted with respect to RMR.

Surface Characteristics of Structural Discontinuities

Based on the detailed core logging, discontinuities of all sets have general surficial characteristics that range from rough and undulating to smooth and undulating. In general, joint surfaces were partially stained or partially coated. Local occurrences of silty joint infill < 5mm were observed more frequently near the bedrock surface and in discrete zones of higher weathering, as noted on the Borehole Records.

7.2.5 Groundwater Conditions

The monitoring well records from the Stage 2 PSI by Golder Associates indicate that, where encountered, the groundwater table was in the range of 0.95 to 5.06 m below the existing ground surface at the site (i.e., between Elev. 0.35 m and Elev. 4.76 m Geodetic). Due to the proximity of the site to the ocean, it is anticipated that the groundwater table elevation will be strongly influenced by tidal fluctuations. Due to the granular nature of the fill throughout much of the site, it is expected that perched groundwater zones will be present within the fill materials overtop the relatively impermeable silt, clay and bedrock surfaces. Evidence of the perched groundwater was observed during the excavation of test pit TP12-6. Heavy seepage was encountered within the fill at a depth of approximately 1.5 m below grade.

7.3 Ogden Point Soil and Bedrock Conditions

In general, the soil conditions at the Ogden Point site consist of existing fill underlain by a deposit of silt and clay, which is in turn underlain by sand. The overburden soils are underlain by granodiorite bedrock. A summary of the soil conditions encountered in the Stantec subsurface investigation is provided below, and details are presented on the borehole logs enclosed in **Appendix B**.

7.3.1 Fill

The fills encountered at the site consisted primarily of granular soils, varying from gravelly sand or sand and gravel to silty sand. The thicknesses of fill encountered in boreholes BH13-1 and BH13-2 were 5.2 m and 4.4 m, respectively. Traces of asphalt, concrete and organics were encountered throughout the fill layer. A 450 mm thick concrete slab was encountered in borehole BH13-2 at approximately 4 m depth. Based on the recorded SPT blow counts, the compactness condition of the fill is variable, but generally loose to compact.

7.3.2 Silt and Clay

The deposit of silt and clay extended to depths of approximately 13 m and 17 m in boreholes BH13-1 and BH13-2, respectively. The silt and clay soil is stiff to very stiff in the upper portions of the deposit, and transitions to a soft to firm consistency with depth. This deposit is typically light brown in colour within its upper portions, becoming grey with depth. Measured moisture contents of the silt and clay soil samples ranged from 27% to 56%.

7.3.3 Sand

The silt and clay soils were underlain by a deposit of sand, which extended to depths of 15 and 19.4 m at boreholes BH13-1 and BH13-2, respectively. The sand contains variable amounts of silt and some gravel. Based on the recorded SPT blow counts, the sand is compact to very dense.

7.3.4 Bedrock

The bedrock encountered in the boreholes at Ogden Point consists mostly of fractured to moderately jointed, medium strong, slightly weathered, grey granodiorite with occasional andesite dykes. Both of the boreholes in the Stantec investigation were terminated within the bedrock formation.

As the currently proposed site works in the Ogden Point area do not include significant bedrock excavation, detailed rock core logging was not conducted for these boreholes.

7.3.5 Groundwater Conditions

Due to the proximity of the site to the ocean, it is anticipated that the groundwater table elevation will be strongly influenced by tidal fluctuations. Standpipe piezometers were not installed at the Ogden Point site.

7.4 Victoria Harbour Crossing Soil and Bedrock Conditions

In general, the soil conditions below the sea floor within the Victoria Harbour Crossing consists primarily of very loose sediments consisting of silty sand underlain by compact sand, firm to stiff silt and clay and bedrock.

Results of the geophysical survey indicate the bedrock surface is approximately 15 to 30 m below the seafloor through the central portion of the channel, which is in general agreement with bedrock depths encountered the marine drilling investigation.

7.4.1 Silty Sand/Sand

The loose sediments along the seafloor consisted of silty sand and ranged from approximately 1.5 to 1.8 m thick. A thicker deposit of compact sand 7.1 to 13.7 m thick was encountered below the looser silty sand.

7.4.2 Silt and Clay

Below the sand unit is a layer of silt and clay. The silt and clay encountered in the boreholes ranged from approximately 6.6 to 18.8 m thick. The silt and clay is generally firm to stiff.

7.4.3 Bedrock

Bedrock was encountered underlying seabed sediments at elevations ranging from -18.8 m (MHB13-4) to -41.8 m (MBH13-1). The bedrock encountered in the four (4) boreholes consisted primarily of grey granodiorite occasionally intruded by dark grey andesite dykes that ranged in apparent thickness from approximately 0.2 m to 3.0 m. In proximity to the andesite intrusions, alteration of the granodiorite was observed and is noted herein as “altered granodiorite”. In these zones of alteration, micro-veins and disseminated sulphides were more frequent.

Weathering was noted at the surface of the bedrock extending several metres below the bedrock soil interface. In this zone, the rock is described as slightly weathered (W2) to moderately weathered (W3). Further discrete zones of moderately (W3) to highly weathered (W4) bedrock were observed to depths up to 50 m below the bedrock surface (MBH13-4).

7.4.3.1 Intact Rock Properties

The intact strength of the bedrock has been determined using unconfined compression tests, indirect (Brazilian) tensile strength tests and field point load tests. The laboratory bedrock testing report and a summary of point load strength data are provided in Appendix D.

Eight (8) unconfined compression tests were carried out on samples of the bedrock core and four (4) indirect (Brazilian) tensile strength tests were conducted. Point load tests were performed diametrically on samples of the bedrock core and are reported as values of the Point Load Index corrected to a standard 50 mm diameter specimen, $I_{s(50)}$, in Table D-2, **Appendix D**. To summarize, the following mean parameters are provided:

Table 5: Summary of Intact Strength and Density Parameters, Victoria Harbour Crossing

Intact Strength Parameter	Granodiorite	Altered Granodiorite ²
Point Load $I_{s(50)}$ (MPa)	3.7	4.2
Total Unit Weight (kN/m ³)	2,630	2,589
UCS (MPa) ¹	91	57
Indirect Tensile Strength (MPa)	9.5	3.3

Note: 1. Average of valid test results: i.e., excludes tests that failed along foliation, excludes outliers.

2. Lithology in attached laboratory reports incorrect: specimens noted as gneiss are equivalent to altered granodiorite

Average point load strength indices (I_{s50}) range from 3.7 to 4.2 for the granodiorite and altered granodiorite, respectively. Estimated uniaxial compressive strength can be obtained from these data by utilizing a conversion factor, K. K is an index to strength conversion factor that depends on site-specific correlation between UCS and I_s for a particular specimen size. To accurately determine K, a robust site-specific database is required and is not available for the Victoria Harbour bedrock. In lieu of a site-specific factor, ASTM D5731 dictates generalized K values for specific core diameter. For NQ sized core, a conversion factor, K, of 24.5 is provided.

Average laboratory UCS values range from 91 MPa to 57 MPa in the granodiorite and altered granodiorite, respectively. Based on the laboratory testing results, both the granodiorite and altered granodiorite in the area of the Victoria Harbour Crossing may be classified as strong (50 – 100 MPa).

7.4.3.2 Rock Mass Characteristics

An explanation of the rock mass quality descriptors is presented in the Borehole Symbols and Terms in **Appendix B**.

Rock Quality Designation (RQD)

RQD values were determined for all boreholes, and are plotted on the Borehole Records provided in Appendix B. RQD values for each borehole are summarized in Table 5, below.

Table 6: Summary of RQD Values, Victoria Harbour Crossing

Rock Type	Average RQD (%)	Standard Deviation (%)
Granodiorite	69	26
Altered Granodiorite	58	30
Andesite	12	20
All Rock Types	62	30

Based on the average RQD values from these three boreholes, the granodiorite and altered granodiorite rock mass at the Victoria Harbour Crossing may be described as fair quality, fractured, or blocky. It should be noted, however, that low RQD values (< 50%) representing severely fractured rock mass were observed at discrete intervals as indicated on the attached Borehole Records.

Andesite dykes were observed in the Victoria Harbour Crossing core in sufficient thickness to estimate an average RQD of 12%. Based on this value, the andesite may be described as very severely fractured.

Rock Mass Quality (Q-Value)

The Victoria Harbour Crossing rock core was logged according to the Q-Method. For preliminary assessment of Q, and as noted previously, a value of unity (1) was assigned to the last term of the formula, where J_w represents the Joint Water Reduction Factor and SRF, Stress Reduction Factor.

The rock mass quality is classified across all boreholes as 'very poor' to 'very good' with Q-values ranging from 0.4 to 100.0, with an average of 30.5 ('very good'). By rock type, the Q values can be summarized as follows:

Table 7: Summary of Q-Values, Victoria Harbour Crossing

Rock Type	Average Q-Value	Standard Deviation
Granodiorite	35.0	27.6
Altered Granodiorite	27.5	25.8
Andesite	3.0	4.6
All Rock Types	30.5	27.2

Surface Characteristics of Structural Discontinuities

Based on the detailed core logging, discontinuities of all sets in have general surficial characteristics that range from rough and undulating to smooth and undulating. In general, joint surfaces were partially stained or partially coated. Local occurrences of silty joint infill < 5mm were observed more frequently near the bedrock surface and in discrete zones of higher weathering, as noted on the Borehole Records.

8 DISCUSSION

Based on our review of existing documentation for past site works, and on the results of the Stantec subsurface investigations and laboratory testing, Stantec considers that the following geotechnical issues are relevant to the design and construction of the wastewater treatment plant and sub-marine forcemain.

- A variety of predominantly granular fill materials are present across the McLoughlin Point site, including existing fills from the previous site development and imported fills placed during the environmental remediation work completed in 2011 and 2012. It is expected that the majority of the existing fill material was placed and compacted as engineered fill; however, as Stantec was not on-site at the time that these fills were placed, we cannot comment on their compaction.
- It is anticipated that most excavations on the McLoughlin Point site will encounter fill materials. The nature and variability of fill materials at the site suggests that steep cuts within these materials are unlikely to remain stable, particularly in areas containing perched groundwater. Accordingly, it is expected that sloping or shoring measures will be required for excavation through the existing fill materials.
- Construction of below-grade facilities at the McLoughlin Point site is anticipated to require excavation into bedrock within some areas. As the bedrock at the site consists predominantly of strong granodiorite, it is expected that drill and blast techniques will be required for excavation into the bedrock. Further geotechnical characterization of the rockmass and, in particular, geological structure is recommended prior to the design of these excavations. Rockmass support may be required.
- Based on the design foundation depths for some of the proposed structures, it is anticipated that excavation will extend below the depth of the water table. Accordingly, ingress of water from granular soil zones and open fracture networks within the bedrock should be expected. Ingress of water is also likely to occur through zones of granular fill materials containing perched groundwater.
- Although the silt and clay soils at the site are overconsolidated, construction of heavily loaded structures above these soils could result in settlement, particularly due to compression/consolidation in the more lightly overconsolidated zones at depth.
- The potential for earthquake-induced liquefaction of the granular soil deposits underlying the silt and clay soils should be addressed. Structures founded in these areas may experience post-liquefaction differential settlements in the event of the design earthquake.
- For the exit pit at Ogden Point, consideration should be given to the thickness of the existing fill and the depth of bedrock. Similarly to McLoughlin Point, deep excavations in the variable fills are unlikely to remain stable. Based on the anticipated depths of excavation and the close proximity to the ocean, groundwater seepage will likely be a construction issue.

- Advancement of the sub-marine forcemain along the Victoria Harbour Crossing will require further understanding of the bedrock geotechnical conditions along its alignment. Zones of very poor quality (Q-method classification) and very severely to severely fractured rock (RQD classification) were encountered at varying depths. It is likely that the forcemain bore may encounter these zones and may warrant stabilizing measures such as grouting or the advancement of a supporting liner.
- Particular attention to the subsurface quality in zones where the Victoria Harbour Crossing alignment nears the bedrock surface will be warranted. Generally, the rockmass within several metres of this interface is more highly fractured and weathered than bedrock at depth. Stabilization measures for the forcemain bore may be required.
- The occurrence of sulphide mineralization was noted in the bedrock at all areas of the site and more frequently in the altered granodiorite rock mass. The mineralization was noted on fracture surfaces and disseminated through the rockmass in areas. As a result, consideration must be given to waste rock management during site development as acid rock drainage may be a concern.

9 CLOSURE

This report was prepared for the exclusive use of the CRD and their agents for specific application to the development of the subject site. Any use of this report or the material contained herein by third parties, or for other than the intended purpose, should be first approved in writing by Stantec. The report and any interpretations or conclusions contained herein are based on the site conditions encountered by Stantec at the time of our site investigation and at the specific testing and sampling locations. Any interpretation or extrapolation thereof by others is done so at the risk of the user.

This report was prepared by Chris Longley, EIT, Maureen Matthew, M.Sc., P.Geo., Ben Huynh, P.Eng. and reviewed by Henrik Kristiansen, M.A.Sc., P.Eng. We trust that this report meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Respectfully submitted,
Stantec Consulting Ltd.

Reviewed by:

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Engineer-in-Training

Original signed by:

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Principal

Original signed by:

Maureen Matthew, M.Sc., P.Geo
Engineering Geologist

Original signed by:

Ben Huynh, P.Eng.
Geotechnical Engineer

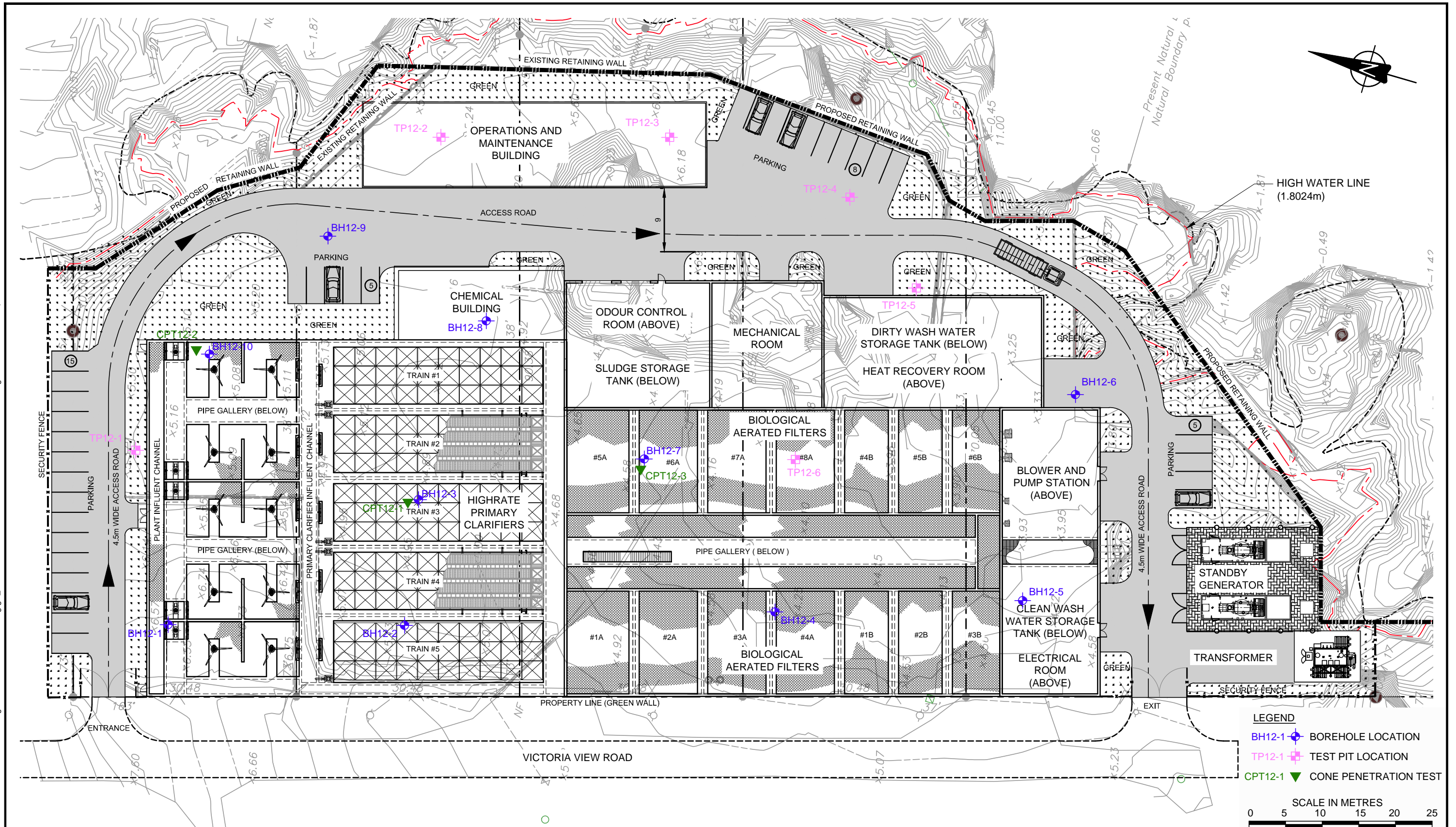
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APPENDIX A

Drawings

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LEGEND

- BH12-1 BOREHOLE LOCATION
- TP12-1 TEST PIT LOCATION
- CPT12-1 CONE PENETRATION TEST

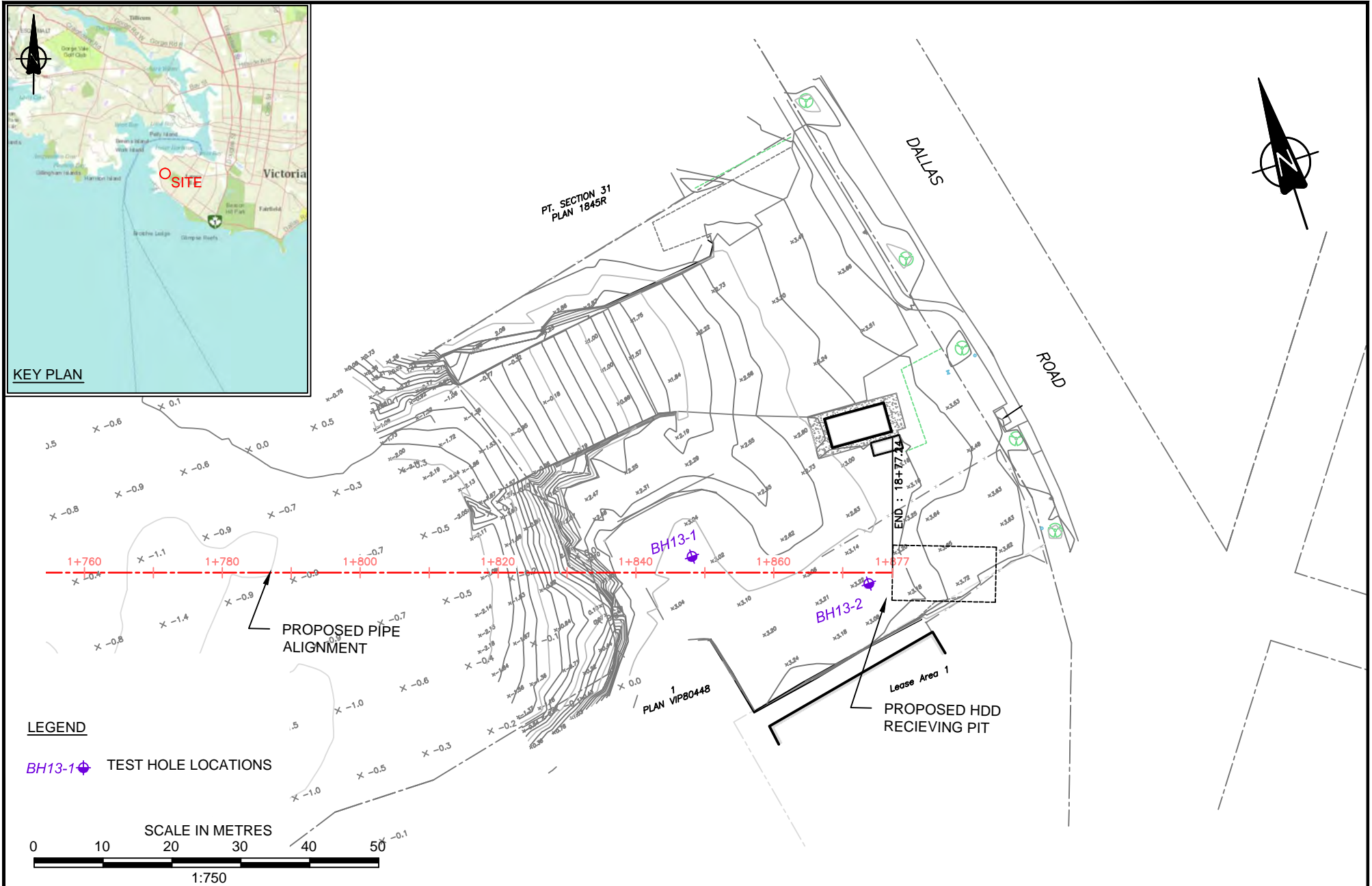
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NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

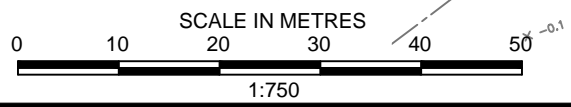
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	Date:	07-Dec-12						ESQUIMALT, BC	
	Dwn. By:	NP							
App'd By:	BH								

Stantec © 2013



LEGEND

BH13-1 TEST HOLE LOCATIONS



TEST HOLE LOCATION PLAN

CORE AREA WASTEWATER TREATMENT PROGRAM

OGDEN POINT, VICTORIA, BC

Client: CAPITAL REGIONAL DISTRICT

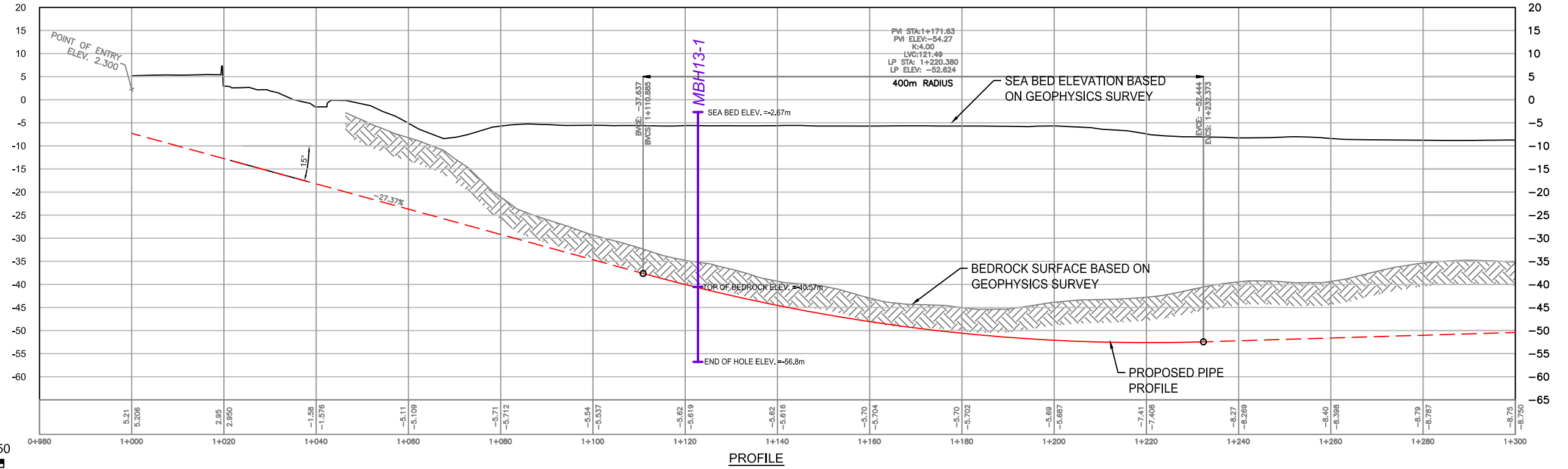
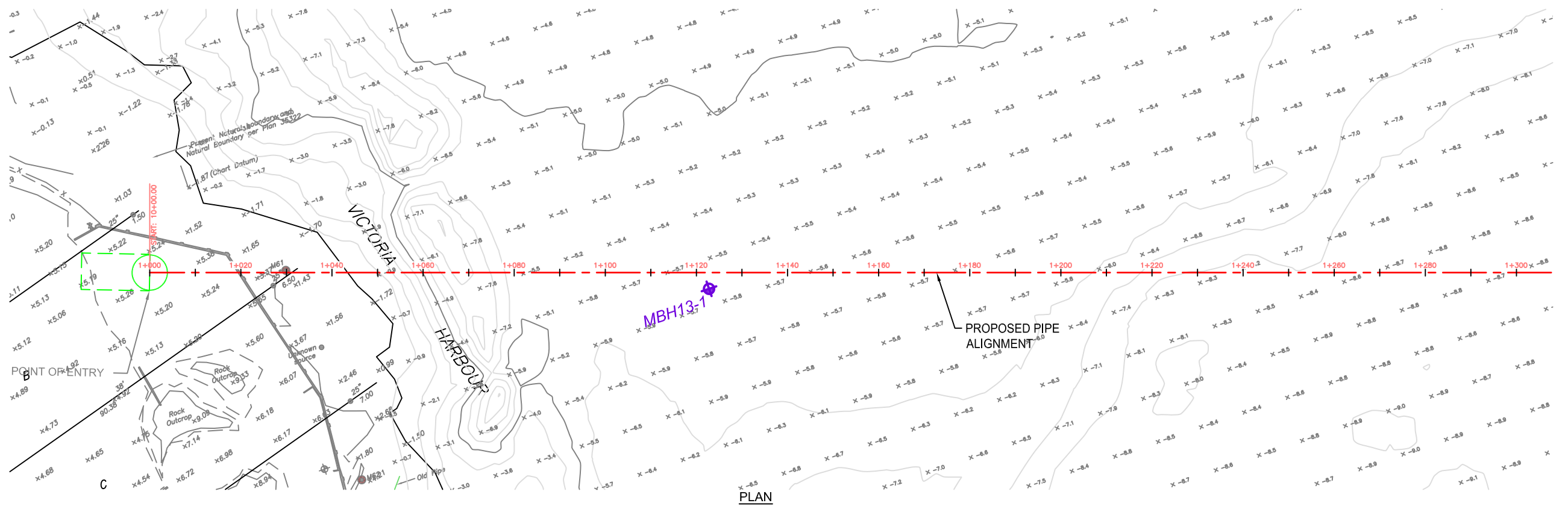
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Dwg. No.:

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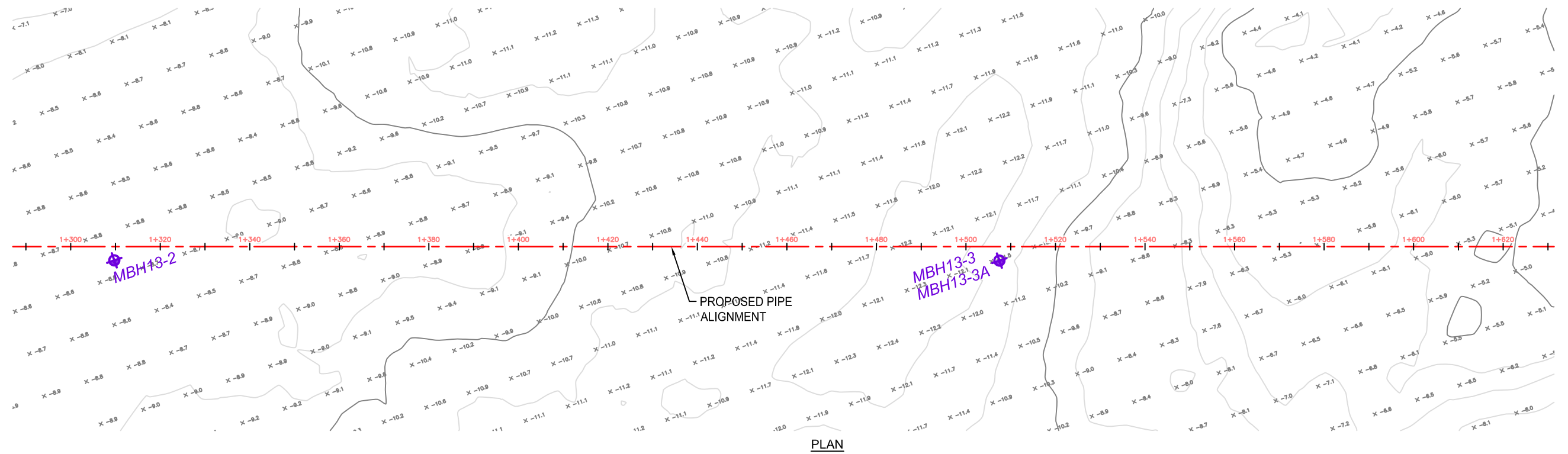


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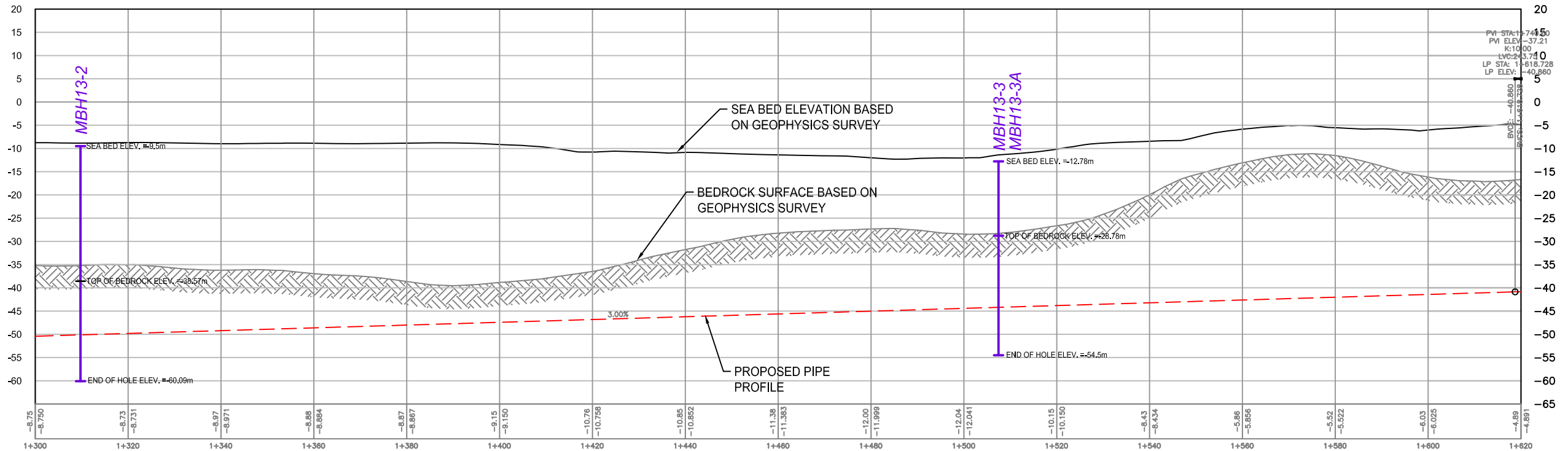
NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

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	Dwn. By:	SS								
App'd By:	CL									

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PLAN



PROFILE

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MBH13-2 TEST HOLE LOCATIONS

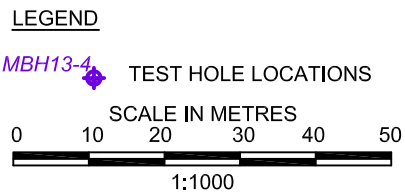
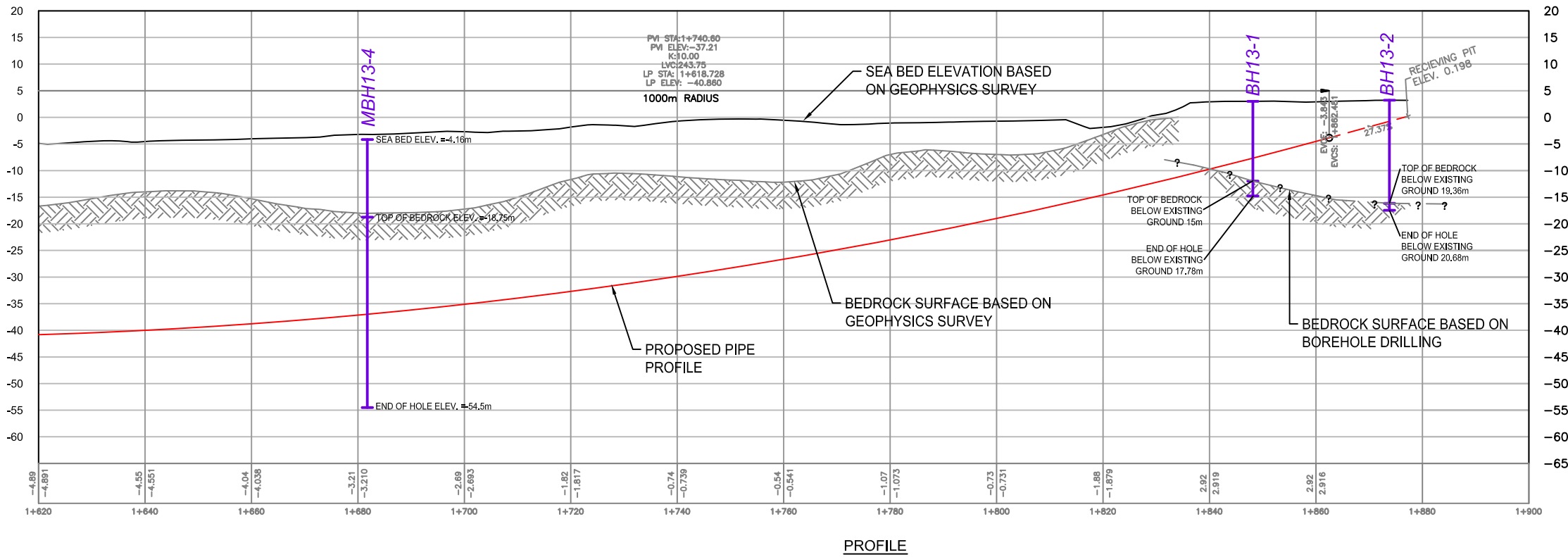
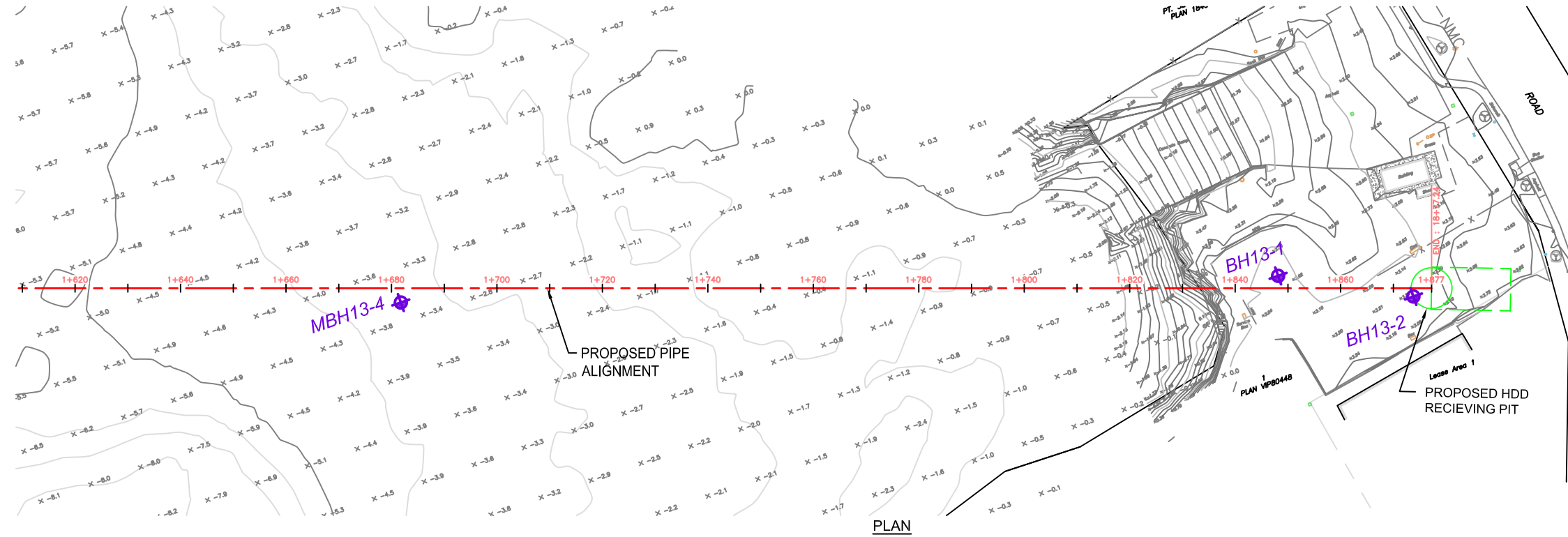
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NOTE: THIS DRAWING ILLUSTRATES SUPPORTING INFORMATION SPECIFIC TO A STANTEC REPORT AND MUST NOT BE USED FOR OTHER PURPOSES.

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APPENDIX B

Borehole and Test Pit Logs

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

<i>Rootmat</i>	- Vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
<i>Topsoil</i>	- mixture of soil and humus capable of supporting vegetative growth
<i>Peat</i>	- mixture of visible and invisible fragments of decayed organic matter
<i>Till</i>	- unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

<i>Homogeneous</i>	- same color and consistency throughout
<i>Desiccated</i>	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	- having cracks, and hence a blocky structure
<i>Varved</i>	- composed of regular alternating layers of silt and clay
<i>Stratified</i>	- composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	- > 75 mm in thickness
<i>Seam</i>	- 2 mm to 75 mm in thickness
<i>Parting</i>	- < 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, and construction debris) is based upon the proportion of these materials present:

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	> 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) in accordance with ASTM D1586. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
<i>Very Loose</i>	<4
<i>Loose</i>	4-10
<i>Compact</i>	10-30
<i>Dense</i>	30-50
<i>Very Dense</i>	>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		Approximate SPT N-Value
	kips/sq.ft.	kPa	
<i>Very Soft</i>	<0.25	<12.5	<2
<i>Soft</i>	0.25 - 0.5	12.5 - 25	2-4
<i>Firm</i>	0.5 - 1.0	25 - 50	4-8
<i>Stiff</i>	1.0 - 2.0	50 - 100	8-15
<i>Very Stiff</i>	2.0 - 4.0	100 - 200	15-30
<i>Hard</i>	>4.0	>200	>30

ROCK DESCRIPTION

Terminology describing rock quality:

RQD	Rock Mass Quality		
0-25	<i>Very Poor Quality</i>	<i>Very Severely Fractured</i>	<i>Crushed</i>
25-50	<i>Poor Quality</i>	<i>Severely Fractured</i>	<i>Shattered or Very Blocky</i>
50-75	<i>Fair Quality</i>	<i>Fractured</i>	<i>Blocky</i>
75-90	<i>Good Quality</i>	<i>Moderately Jointed</i>	<i>Sound</i>
90-100	<i>Excellent Quality</i>	<i>Intact</i>	<i>Very Sound</i>

The RQD denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD determined in accordance with ASTM D6032.

Terminology describing rock with respect to discontinuity spacing:

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

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
<i>Extremely Weak</i>	R0	< 1
<i>Very Weak</i>	R1	1 – 5
<i>Weak</i>	R2	5 – 25
<i>Medium Strong</i>	R3	25 – 50
<i>Strong</i>	R4	50 – 100
<i>Very Strong</i>	R5	100 – 250
<i>Extremely Strong</i>	R6	> 250

Terminology describing rock weathering:

Term	Symbol	Description
<i>Fresh</i>	W1	No visible signs of rock weathering. Slight discolouration along major discontinuities
<i>Slightly</i>	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discoloured.
<i>Moderately</i>	W3	Less than half the rock is decomposed and/or disintegrated into soil.
<i>Highly</i>	W4	More than half the rock is decomposed and/or disintegrated into soil.
<i>Completely</i>	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
<i>Residual Soil</i>	W6	All the rock converted to soil. Structure and fabric destroyed.

Solid Core Recovery (SCR):

Solid core recovery is defined as the cumulative length of all solid core in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis (i.e. length of core run excluding broken, crushed or rubble zones)

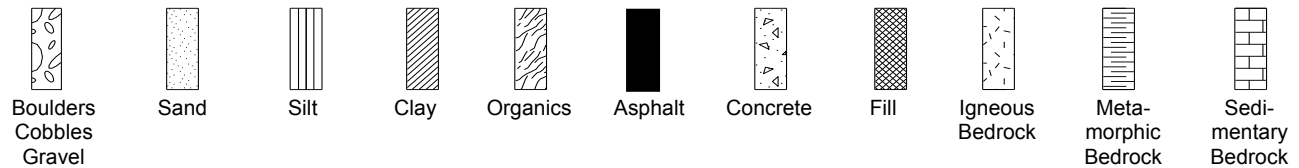
Fracture Index (FI):

Fracture Index is defined as the number of naturally occurring fractures occurring per given length of core. The Fracture Index is reported as a simple count of fractures.



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
HQ, NQ, BQ, etc.	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 (or total core recovery - TCR) 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 (762 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. In accordance with ASTM D1586, the N-value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (152 to 457 mm). However, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (305 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the total number of blows are reported over sampler penetration in millimeters (e.g., 50/75).

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

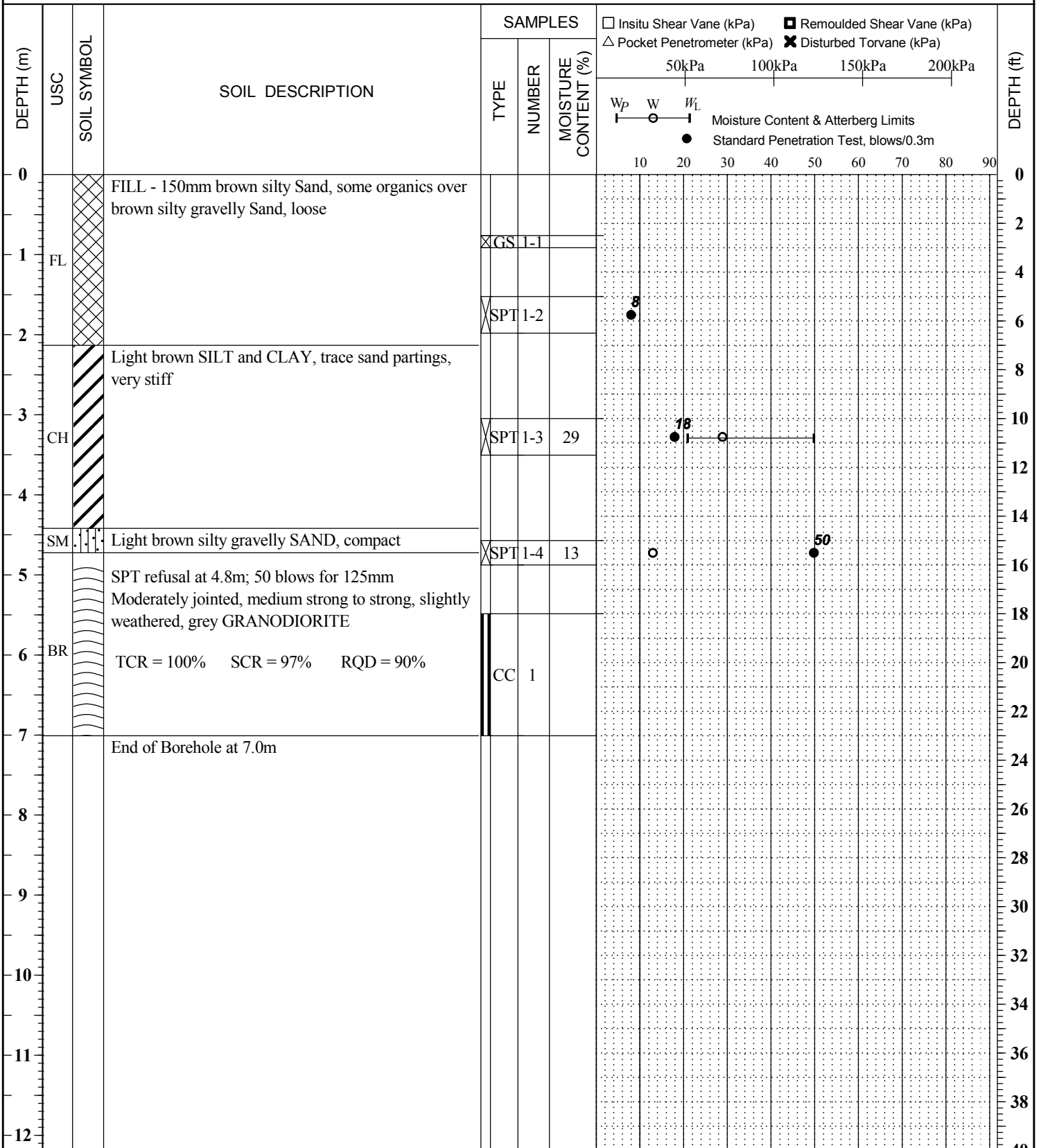
S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined 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

BOREHOLE RECORD

BH12-01

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363184
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~6.5m EASTING 470559
 DRILLING DATE Dec 18, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

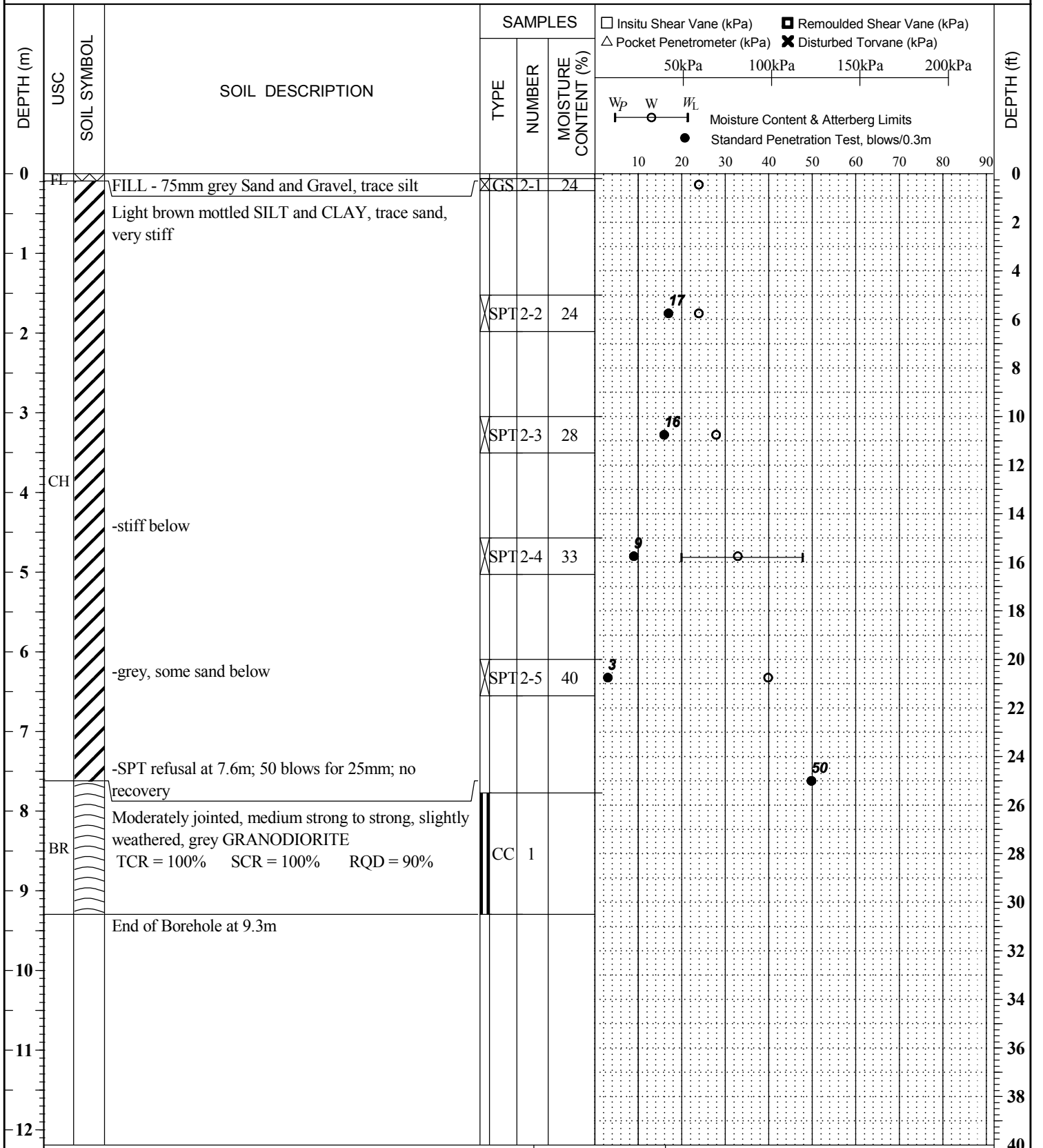
Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-02

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363159
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.1m EASTING 470573
 DRILLING DATE Dec 13, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

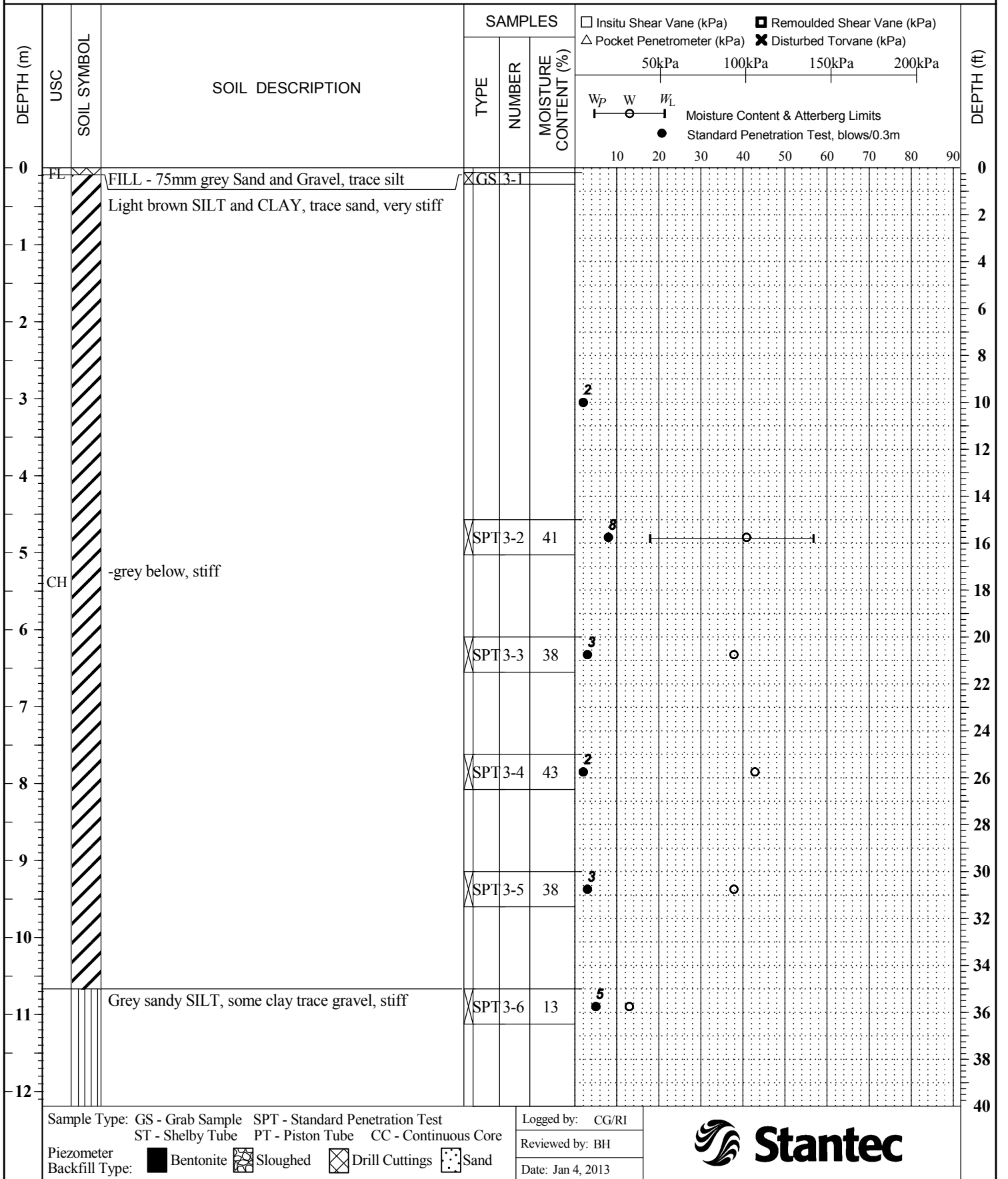
Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-03

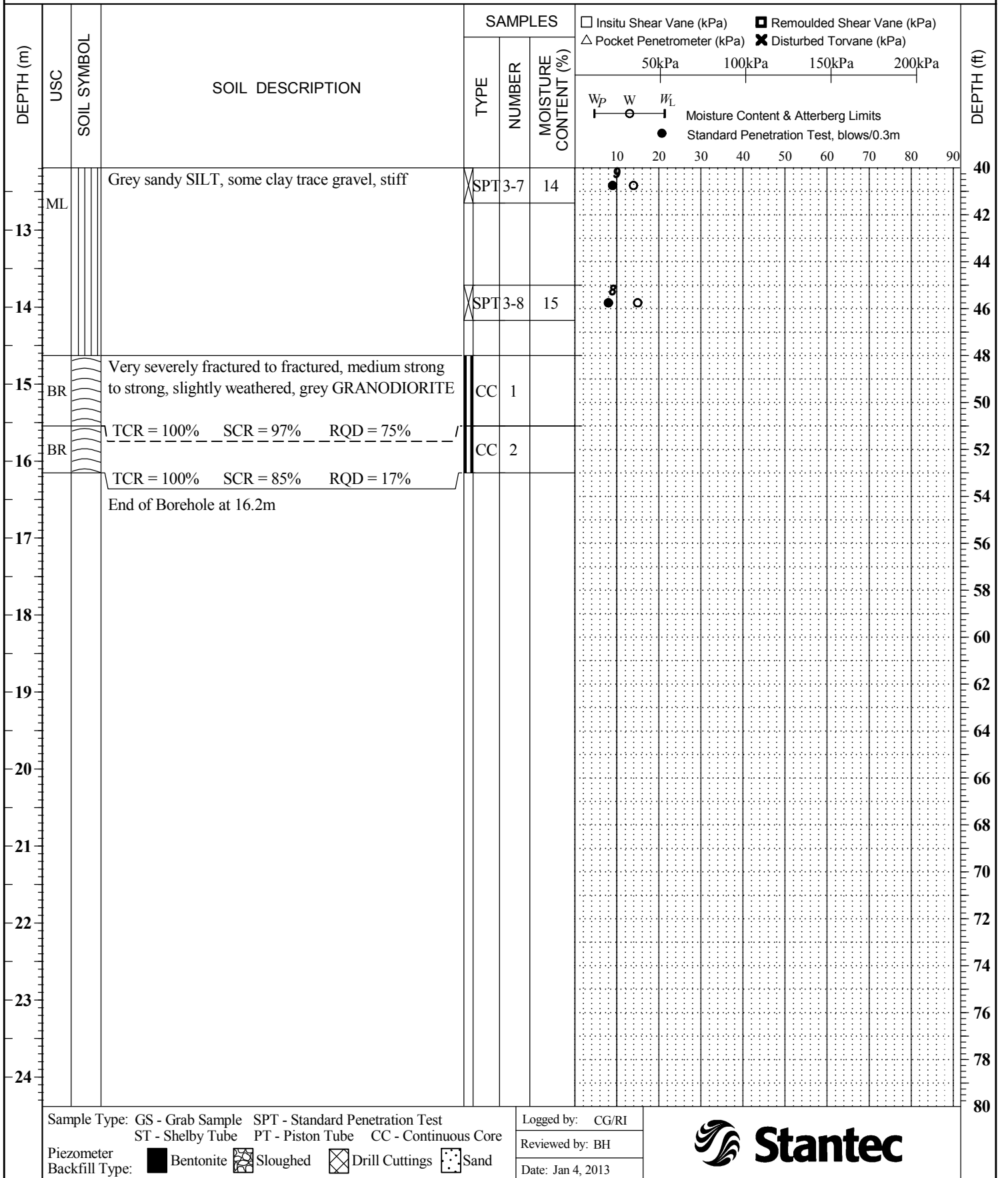
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363157
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.0m EASTING 470585
 DRILLING DATE Dec 13, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



BOREHOLE RECORD

BH12-03 cont'd

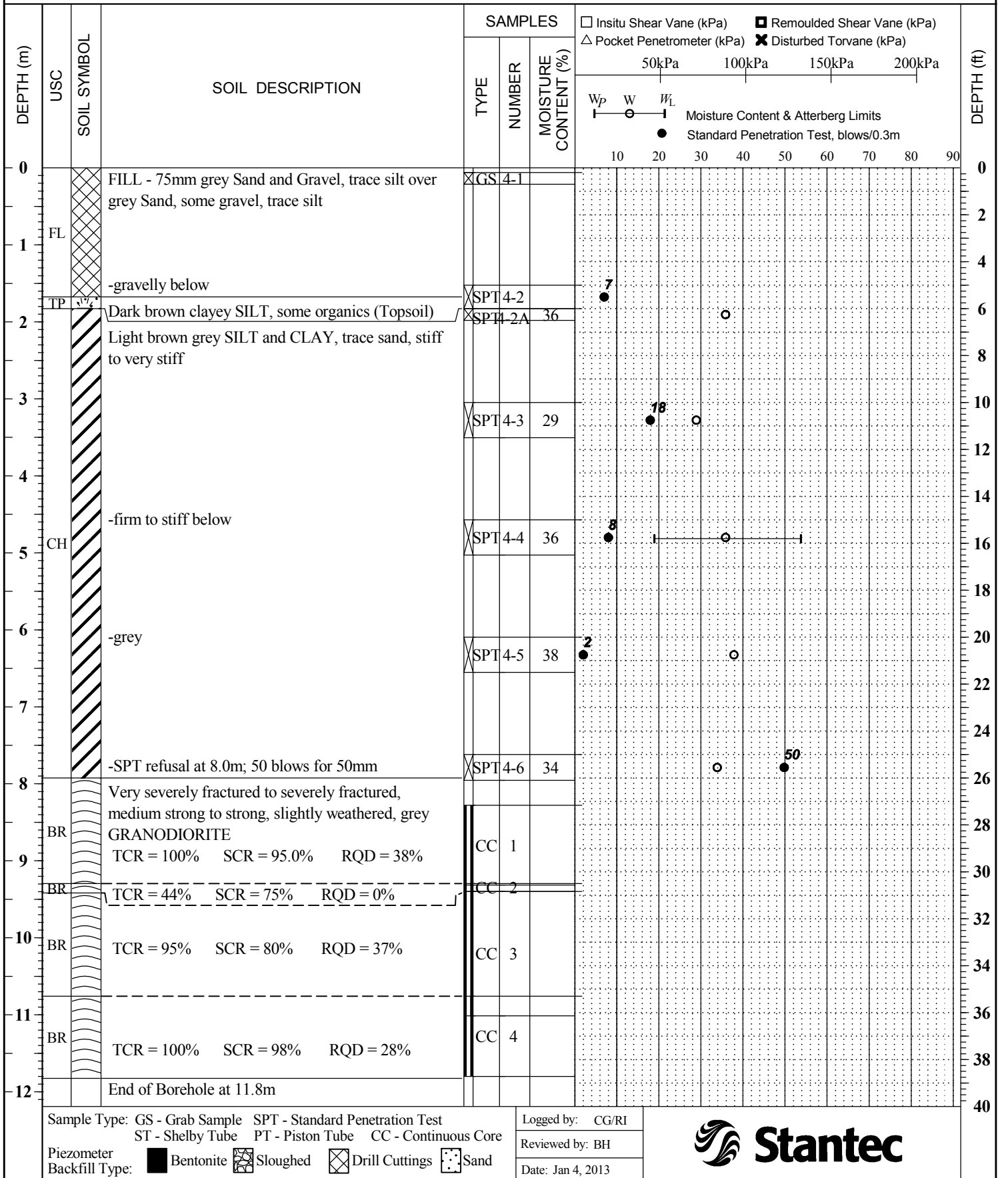
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363157
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.0m EASTING 470585
 DRILLING DATE Dec 13, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



BOREHOLE RECORD

BH12-04

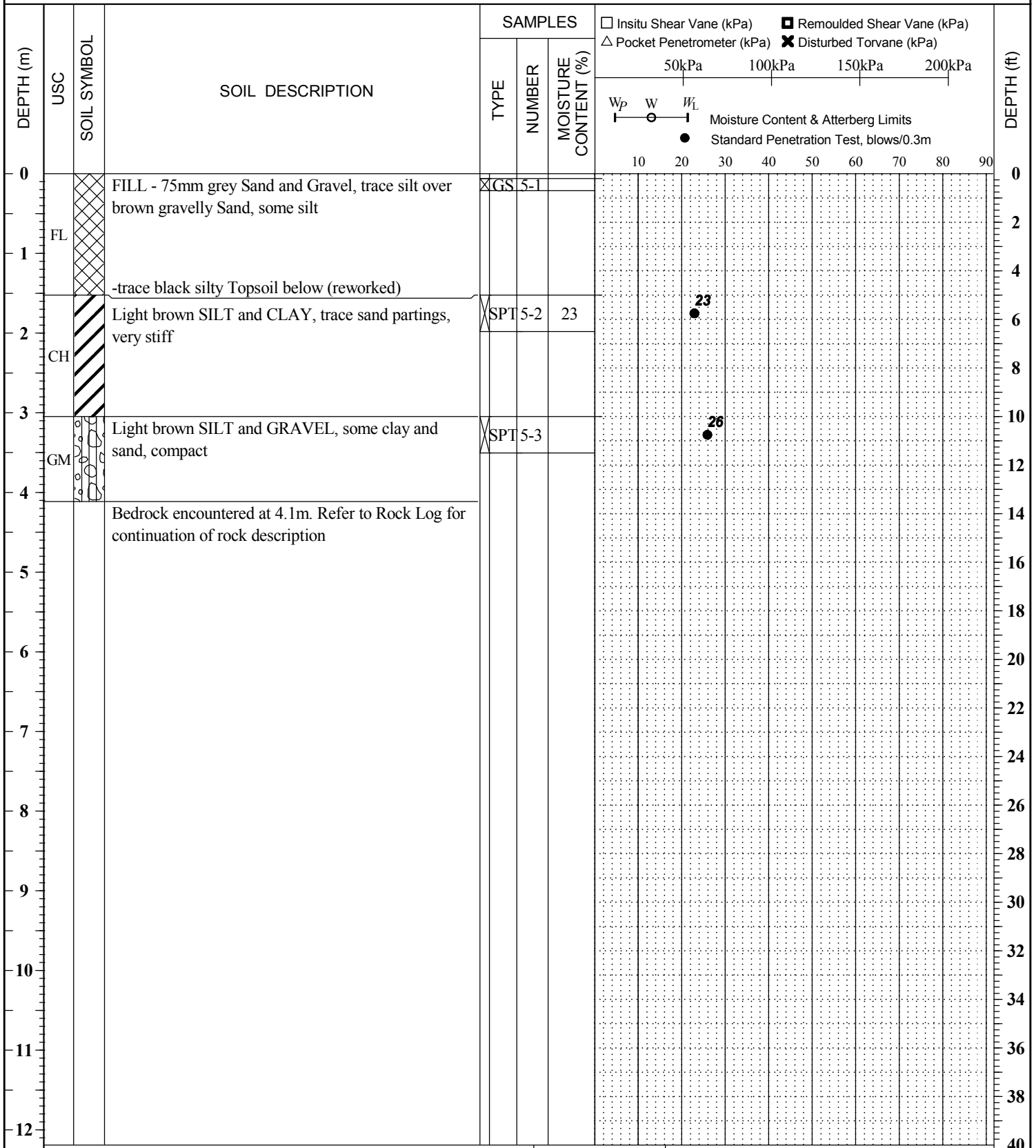
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363113
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~4.3m EASTING 470588
 DRILLING DATE Dec 16, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



BOREHOLE RECORD

BH12-05

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363080
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~4.2m EASTING 470597
 DRILLING DATE Dec 18, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013





BOREHOLE RECORD

BH12-05

PROJECT Core Area Wastewater Treatment Program PROJECT No. 111700431
 CLIENT CAPITAL REGIONAL DISTRICT DATUM Geodetic NORTHING 5363080
 LOCATION McLoughlin Point ELEVATION 4.2m EASTING 470597
 DRILLING DATE 12/18/2012 to DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										RMR76-VALUE	OTHER TESTS	DEPTH (ft)		
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J ₁	J ₂				J ₃	TYPE AND SURFACE DESCRIPTION
0	4.2																	0	
1																		1	
2																		2	
3																		3	
4																		4	
5																		5	
6																		6	
7																		7	
8																		8	
9																		9	
10																		10	
11																		11	
12																		12	
13	0.1	Bedrock encountered at 4.1 m. Refer to Soil Log for overburden description.																13	
14		Fractured to moderately jointed, slightly to moderately weathered, weak to strong, greenish grey ALTERED GRANODIORITE - Sulphide mineralization observed on fracture surfaces	-	NQ 1														14	
15				NQ 2															15
16				NQ 3A															16
17				NQ 3B															17
18				NQ 4															18
19		Intact, fresh, strong, greenish grey ALTERED GRANODIORITE	-	NQ 5														19	
20																		20	
21																			21
22																		22	
23																		23	
24																		24	
25																		25	
26																		26	
27																		27	
28																		28	
29																		29	
30																		30	
31																		31	
32																		32	
33																		33	
34																		34	
35		End of Borehole BH12-05 at 10.49 m																35	
36																		36	
37																		37	
38																		38	
39																		39	
40																		40	

BOREHOLE RECORD

BH12-06

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363083
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~3.1m EASTING 470627
 DRILLING DATE Dec 17, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0		X	FILL - 75mm grey Sand and Gravel, trace silt over grey silty sandy Gravel	X	GS 6-1						0
1		X	-SPT refusal at 1.7m; 50 blows for 150mm	X	SPT 6-2						2
2			Bedrock encountered at 1.7m. Refer to Rock Log for continuation of rock description								4
3											6
4											8
5											10
6											12
7											14
8											16
9											18
10											20
11											22
12											24
											26
											28
											30
											32
											34
											36
											38
											40

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-06

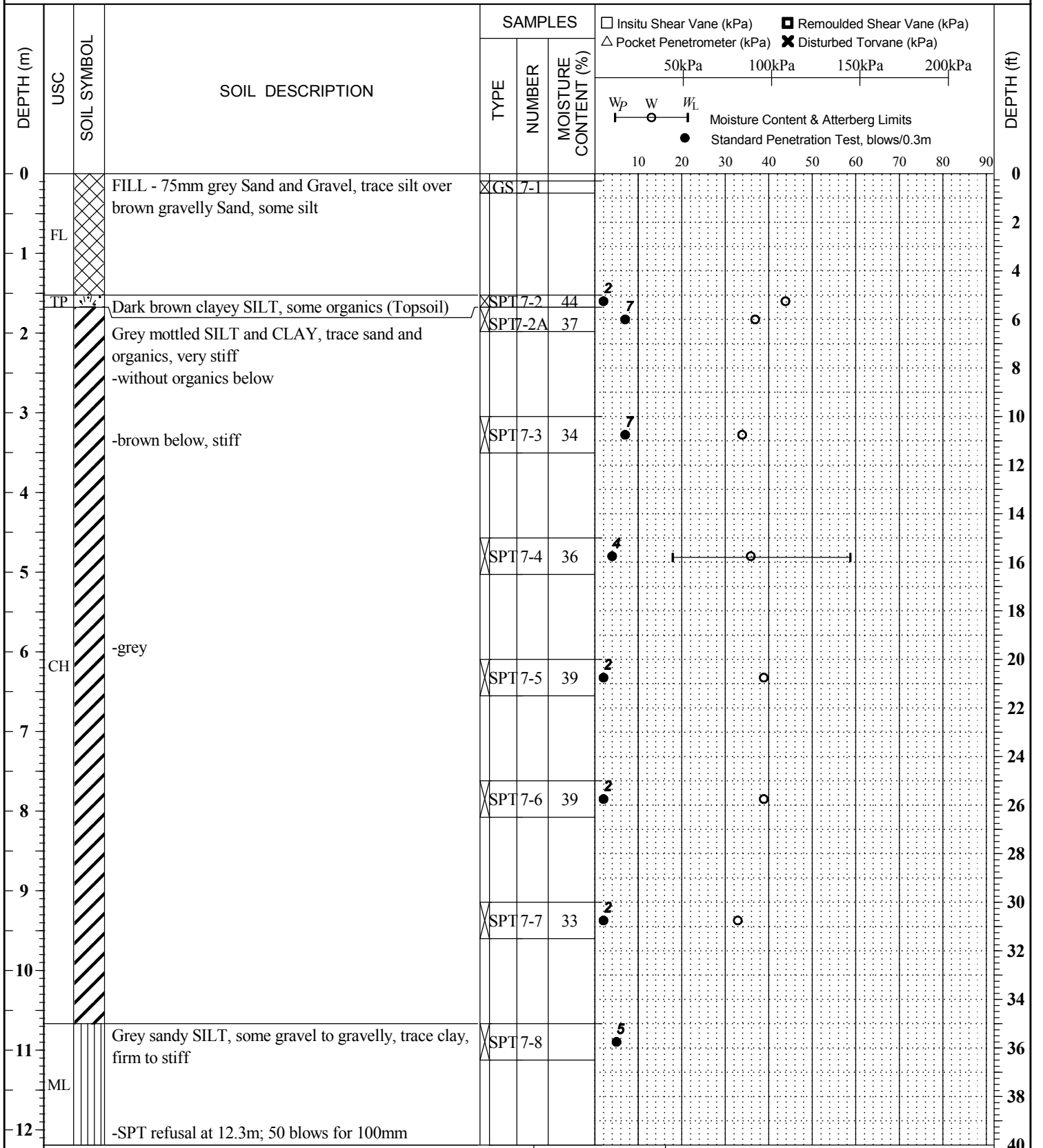
PROJECT Core Area Wastewater Treatment Program PROJECT No. 111700431
 CLIENT CAPITAL REGIONAL DISTRICT DATUM Geodetic NORTHING 5363083
 LOCATION McLoughlin Point ELEVATION 3.1m EASTING 470627
 DRILLING DATE 12/17/2012 to DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										RMR76-VALUE	OTHER TESTS	DEPTH (ft)		
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J1	Jr				Ja	TYPE AND SURFACE DESCRIPTION
0	3.1																	0	
1		Bedrock encountered at 1.7 m. Refer to Soil Log for overburden description.																1	
2	1.4	Severely to very severely fractured, slightly to moderately weathered, medium strong, grey GRANODIORITE - Iron staining observed on fracture surfaces	RC 1A															2	
3				RC 1B															3
4	-0.1	Intact, slightly weathered, medium strong, grey GRANODIORITE	RC 2															4	
5				RC 3															5
6																			6
7	-3.2	Severely fractured to intact, slightly weathered, medium strong, grey GRANODIORITE - Andesite dykes observed	RC 4															7	
8				RC 5															8
9				RC 6															9
10	-7.4	End of Borehole BH12-06 at 10.52 m																10	
11																		11	
12																		12	

BOREHOLE RECORD

BH12-07

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363129
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~4.5m EASTING 470603
 DRILLING DATE Dec 16, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-07 cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363129
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~4.5m EASTING 470603
 DRILLING DATE Dec 16, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			TEST RESULTS				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
13	BR		Severely fractured, medium strong to strong, slightly weathered, grey GRANODIORITE TCR = 83% SCR = 85% RQD = 30%	SPT	7-9						40
13.7			End of Borehole at 13.7m	CC	1						44
14											46
15											50
16											52
17											56
18											58
19											60
20											62
21											64
22											66
23											68
24											70

Insitu Shear Vane (kPa) Remoulded Shear Vane (kPa)
 Pocket Penetrometer (kPa) Disturbed Torvane (kPa)

50kPa 100kPa 150kPa 200kPa

W_p W W_L

Moisture Content & Atterberg Limits

● Standard Penetration Test, blows/0.3m

10 20 30 40 50 60 70 80 90

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

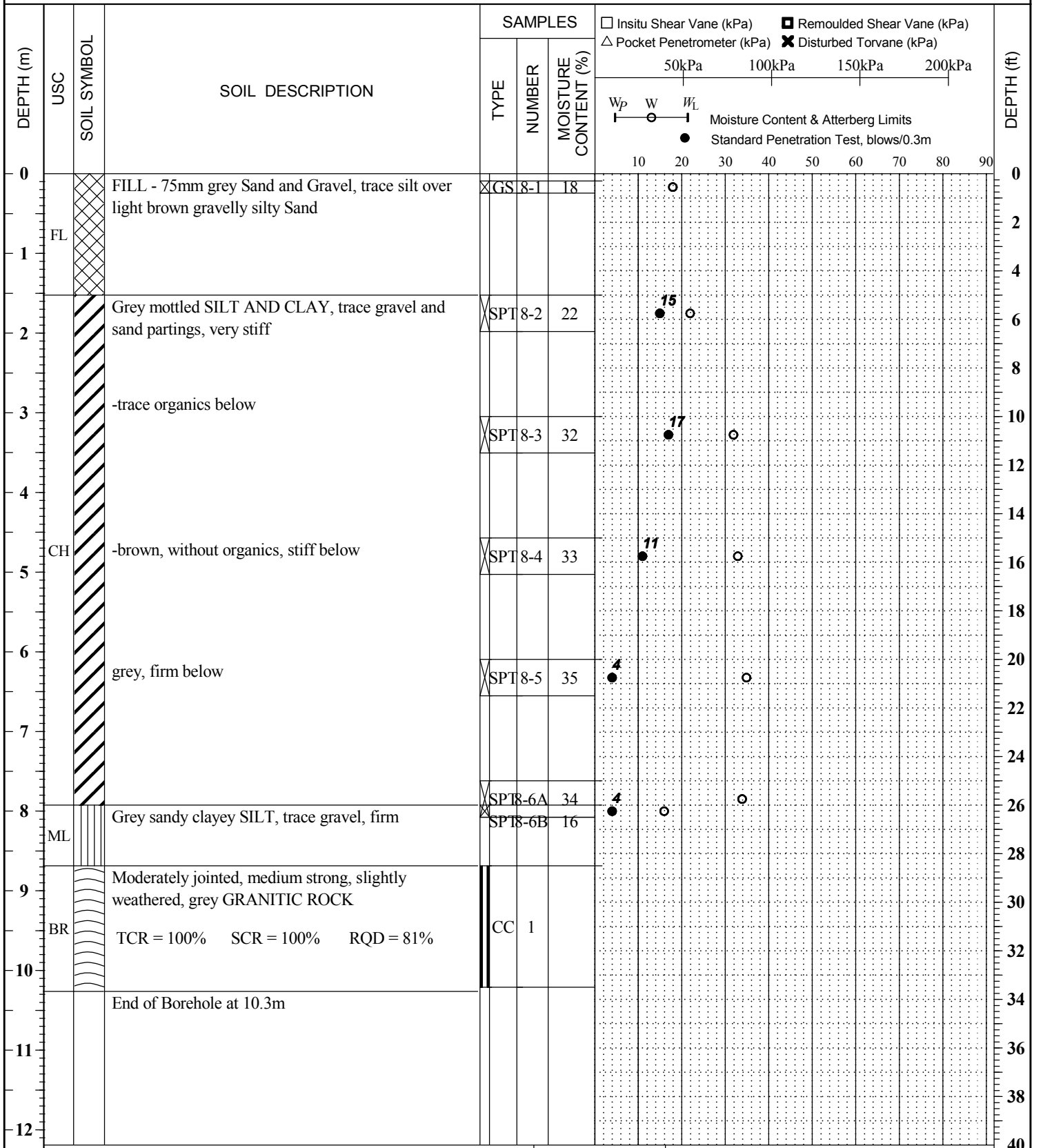
Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-08

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363159
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.0m EASTING 470613
 DRILLING DATE Dec 17, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: ■ Bentonite ▨ Sloughed ▩ Drill Cuttings □ Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-09

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363182
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.2m EASTING 470621
 DRILLING DATE Dec 15 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0			FILL - brown gravelly sandy Silt, some clay								0
1	FL	X	-SPT refusal at 1.6m; 50 blows for 75mm								2
2			Bedrock encountered at 1.6m. Refer to Rock Log for continuation of rock description								4
				SPT 9-1	16	○				● 50	6
3											10
4											12
5											16
6											18
7											20
8											22
9											24
10											26
11											28
12											30
											32
											34
											36
											38
											40

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013





BOREHOLE RECORD

BH12-09

PROJECT Core Area Wastewater Treatment Program PROJECT No. 111700431
 CLIENT CAPITAL REGIONAL DISTRICT DATUM Geodetic NORTHING 5363182
 LOCATION McLoughlin Point ELEVATION 5.2m EASTING 470621
 DRILLING DATE 12/15/2012 to DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.										DISCONTINUITY DATA										RMR76-VALUE	OTHER TESTS	DEPTH (ft)
				STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FX-FRACTURE	J-JOINT	CL-CLEAVAGE	VN-VEIN	B-BEDDING	F-FAULT	FOL-FOLIATION	RZ-BROKEN CORE / RUBBLE ZONE	UN-UNDULATING	CL-CLEAN	PC-PARTIALLY COATED								
0	5.2																								0	
1																									1	
2																									2	
3																									3	
4																									4	
5																									5	
6																									6	
7																									7	
8																									8	
9																									9	
10																									10	
11																									11	
12																									12	



BOREHOLE RECORD

BH12-09

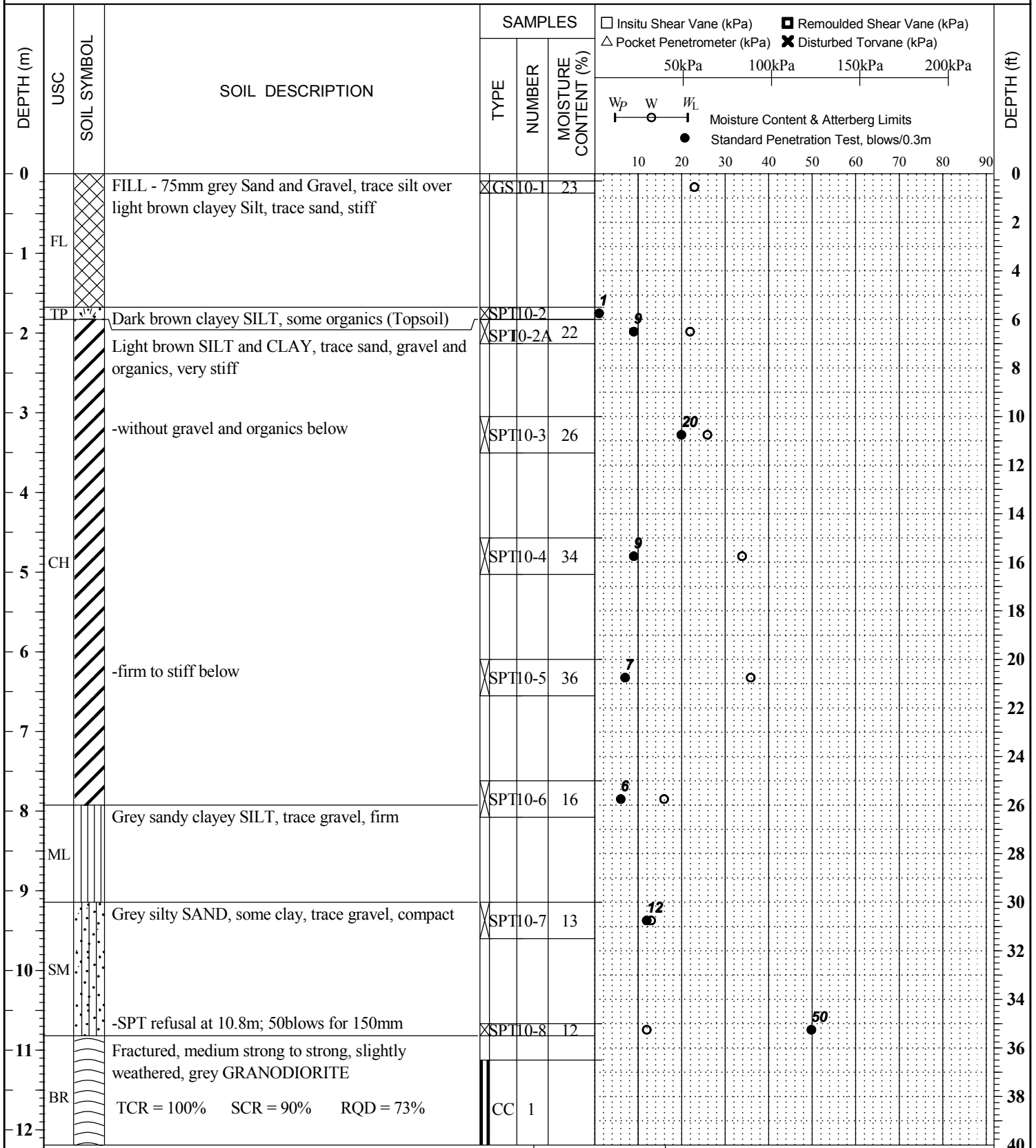
PROJECT Core Area Wastewater Treatment Program PROJECT No. 111700431
 CLIENT CAPITAL REGIONAL DISTRICT DATUM Geodetic NORTHING 5363182
 LOCATION McLoughlin Point ELEVATION 5.2m EASTING 470621
 DRILLING DATE 12/15/2012 to DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITIES				DISCONTINUITY DATA				RMR76-VALUE	OTHER TESTS	DEPTH (ft)		
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS				J ₁	J ₂	J_{3}	TYPE AND SURFACE DESCRIPTION
5.2																	
13		Severely fractured, highly weathered, very weak to weak, grey GRANODIORITE - Iron staining observed on fracture surfaces (<i>continued...</i>)		RC 8												67	41
14		Moderately jointed to intact, slightly weathered to fresh, medium strong to strong, greenish grey ALTERED GRANODIORITE - Frequent microdefects/veins		RC 9												67	42
15				RC 10												71	43
16				RC 11A												74	44
17				RC 11B												42	45
18				RC 12												42	46
19				RC 13												74	47
20		End of Borehole BH12-09 at 19.81 m															48
21																	49
22																	50
23																	51
24																	52

BOREHOLE RECORD

BH12-10

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363189
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.2m EASTING 470601
 DRILLING DATE Dec 14, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



BOREHOLE RECORD

BH12-10 cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5363189
 LOCATION McLoughlin Point, Esquimalt, B.C. ELEVATION ~5.2m EASTING 470601
 DRILLING DATE Dec 14, 2012 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Rock Coring

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			TEST RESULTS				DEPTH (ft)	
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa		
12.8	BR		Fractured, medium strong to strong, slightly weathered, grey GRANODIORITE TCR = 100% SCR = 94% RQD = 50%	CC	2							42
			End of Borehole at 12.8m									
13												44
14												46
15												48
16												50
17												52
18												54
19												56
20												58
21												60
22												62
23												64
24												66
												68
												70
												72
												74
												76
												78
												80

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CG/RI
 Reviewed by: BH
 Date: Jan 4, 2013



TEST PIT RECORD

TP12-1

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 5.2m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input checked="" type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)			
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa				
0		X	FILL - 75mm of grey Sand and Gravel, trace silt over light brown clayey Silt, trace sand	X	GS	1	26							0
		X	FILL - grey sandy Gravel, trace silt	X	GS	2								2
1		X	100mm of black clayey Silt , some organics (Topsoil)	X	GS	3	30							4
		X	Grey/light brown clayey SILT, trace sand and gravel, very stiff to hard	X	GS	4	31							6
2		X												8
3		X		X	GS	5	25							10
4			End of Test Pit at 3.4m Easting: 470586 Northing: 5363198											12
														14

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



TEST PIT RECORD

TP12-2

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 5.3m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0		X	FILL - 150mm of grey Sand and Gravel, trace silt over light brown sandy clayey Silt, some gravel	GS	1	19					0
	FL	X									
	FL	X	FILL - brown Sand and Gravel, some cobbles, trace silt	GS	2						2
1		W	BEDROCK (weathered)								4
	BR	W									
			End of Test Pit at 1.2m Easting: 470639 Northing: 5363170								6
2											8
3											10
4											12
											14

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



TEST PIT RECORD

TP12-3

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 6.2m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="triangle-up"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)	
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa		
0		FL	FILL - grey/brown clayey Silt, trace sand and gravel	GS	1	24	○					0
1			End of Test Pit at 0.6m Bedrock encountered Easting: 470648 Northing: 5363140									2
2												4
3												6
4												8
												10
												12
												14

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



TEST PIT RECORD

TP12-4

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 5.3m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0		X	FILL - grey/brown clayey Silt, trace sand and gravel								0
1	FL	X	-heavy seepage at 1.1m	GS	1	25					2
2			End of Test Pit at 1.2m Bedrock encountered Easting: 470647 Northing: 5363114								4
3											6
4											8
											10
											12
											14

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



TEST PIT RECORD

TP12-5

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 5.1m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0		FL	FILL - brown Sand and Gravel, some silt and clay								0
			End of Test Pit at 0.1m Bedrock encountered Easting: 470637 Northing: 5363101								
1											2
2											4
3											6
4											8
											10
											12
											14

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



TEST PIT RECORD

TP12-6

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic
 LOCATION McLoughlin Point, Esquimalt, BC ELEVATION 4.2m (est.)
 EXCAVATION DATE Dec 18, 2012 CONTRACTOR Don Mann Excavating Ltd EXCAVATION METHOD Test Pitting

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
0		X	FILL - grey/brown Sand and Gravel, some silt	X	GS 1					0	
1		FL								2	
2		FL	FILL - grey/light brown clayey Silt, some sand, mixed with black clayey Silt, some organics - test pit full of water due to heavy seepage at 1.5 m	X	GS 2	33		○		4	
3		FL								6	
4			End of Test Pit at 3.0m Inferred Bedrock from Resistance of Excavator Bucket Easting: 470610 Northing: 5363111							10	
										12	
										14	

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

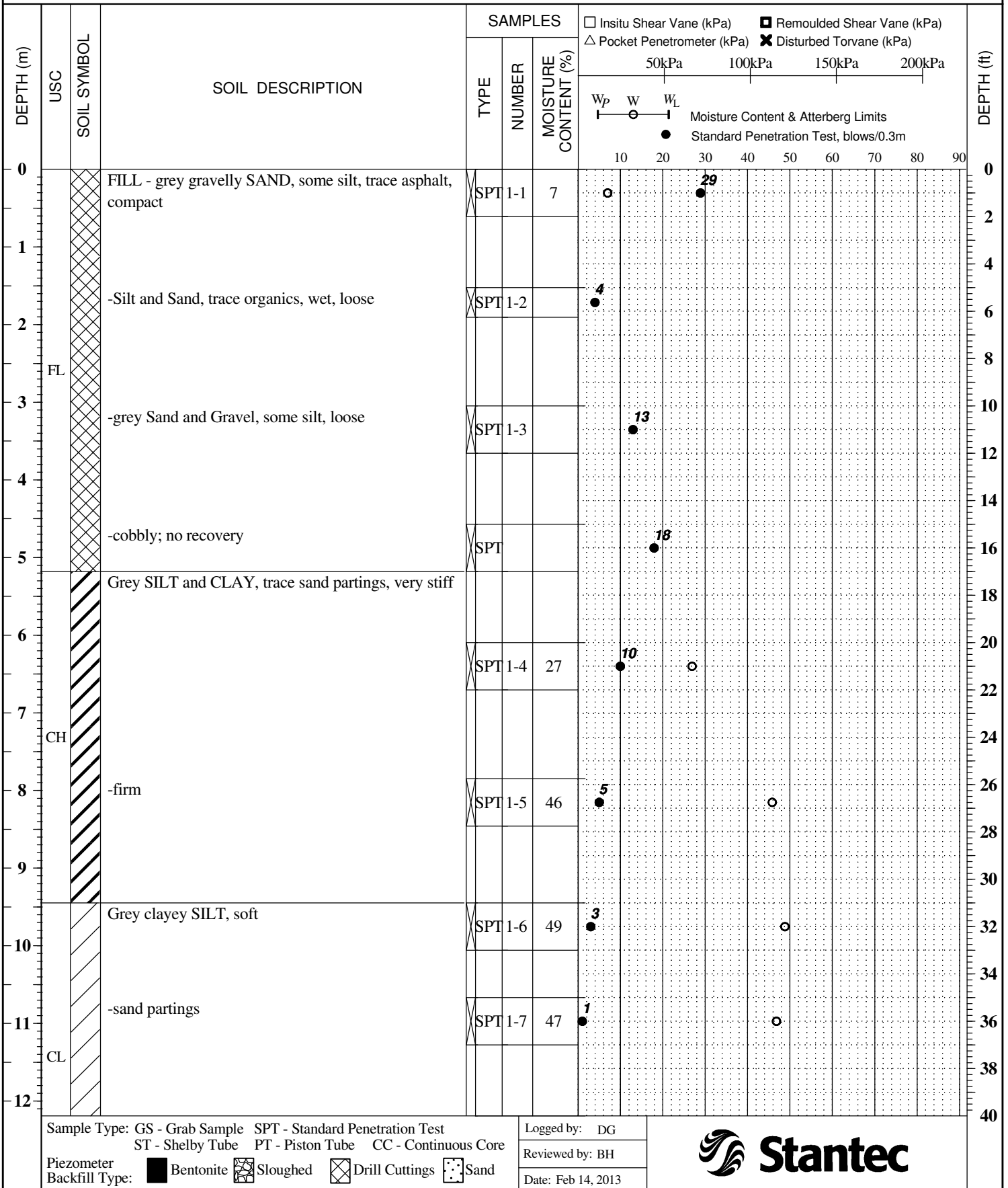
Logged by: EV/RI
 Reviewed by: BH
 Date: Dec 21, 2012



BOREHOLE RECORD

BH13-1

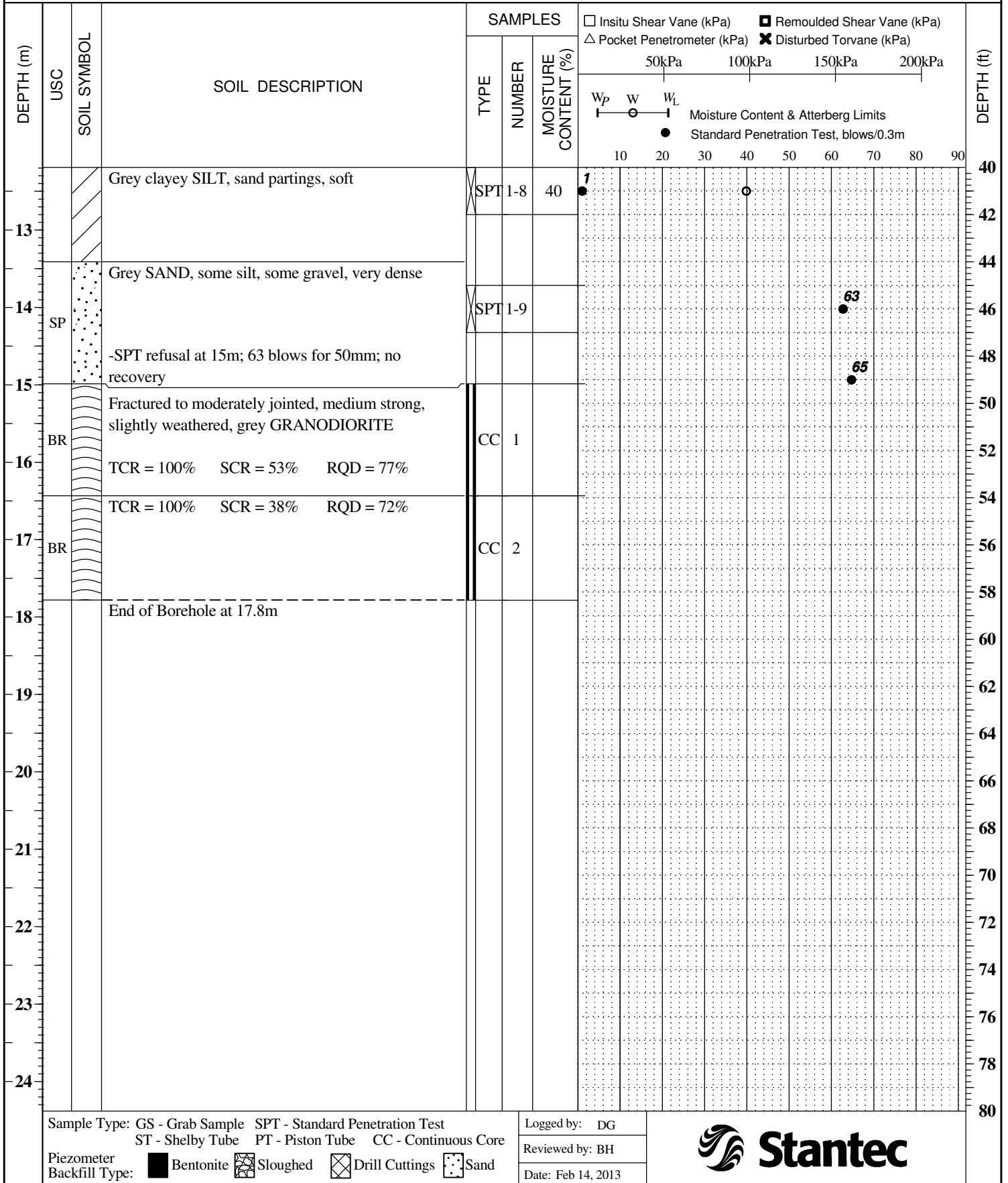
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5362903
 LOCATION Ogden Point, Victoria BC ELEVATION 3m (est.) EASTING 471434
 DRILLING DATE Feb 5, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

BH13-1 cont'd

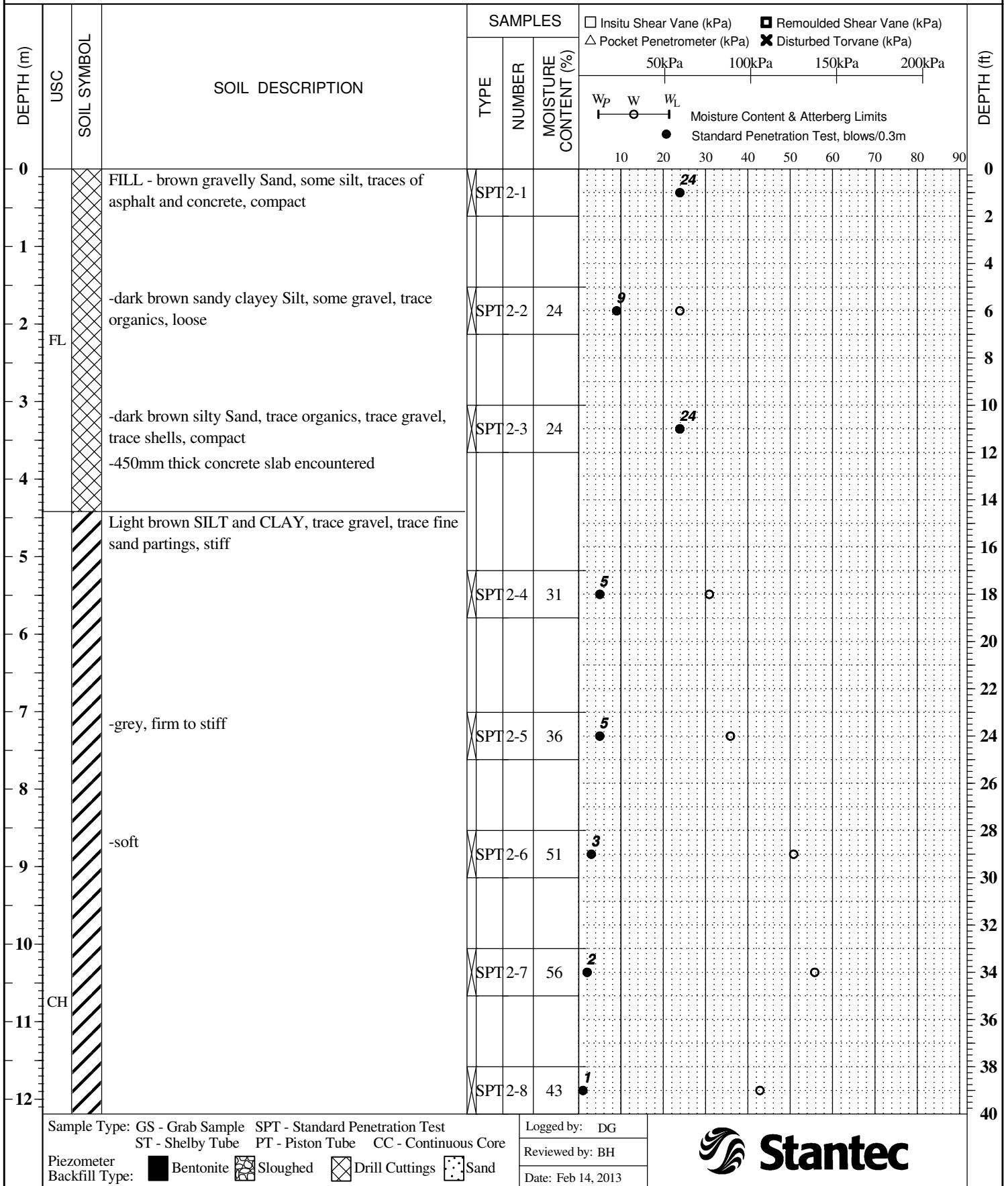
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5362903
 LOCATION Ogden Point, Victoria BC ELEVATION 3m (est.) EASTING 471434
 DRILLING DATE Feb 5, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

BH13-2

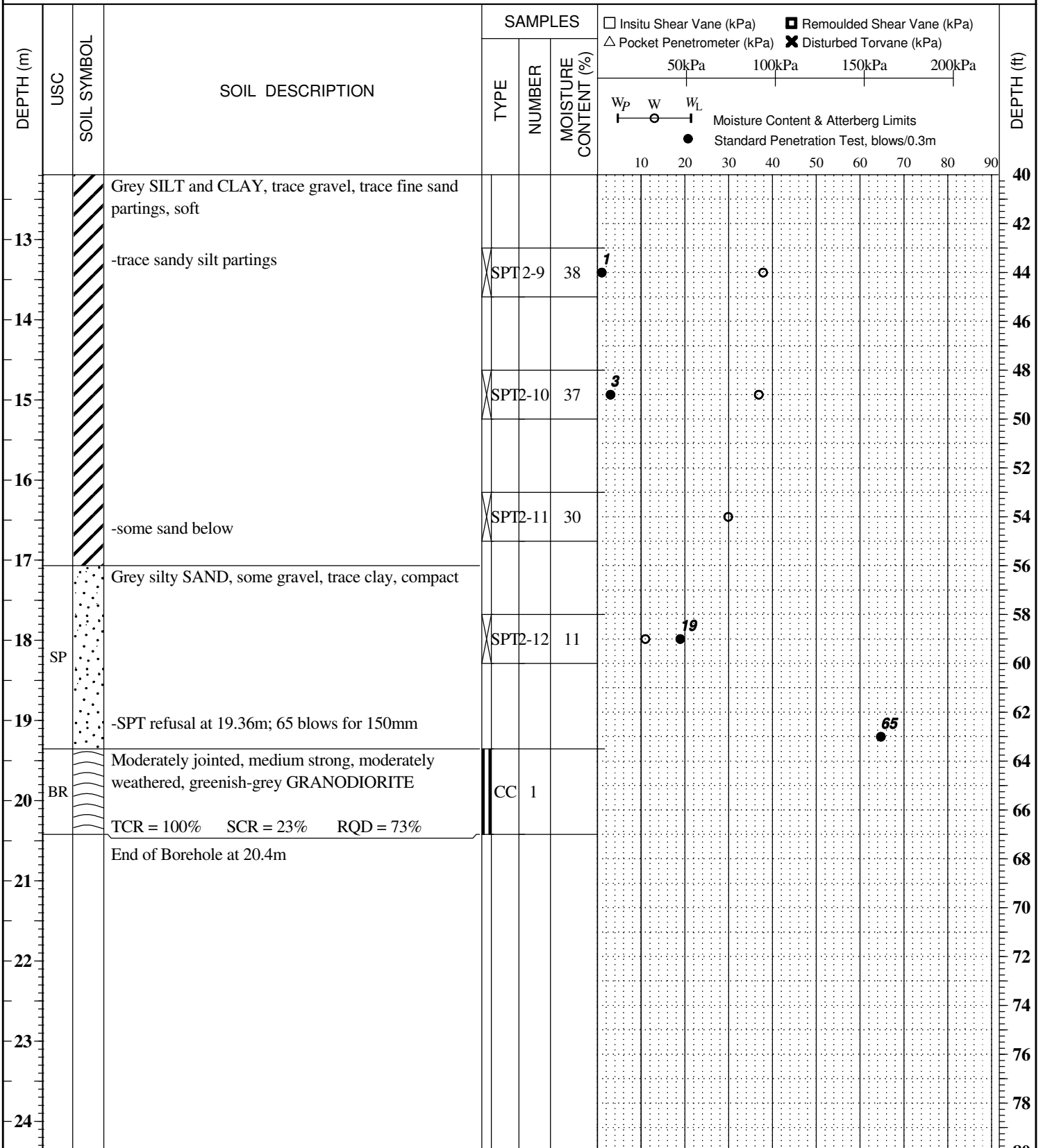
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5362891
 LOCATION Ogden Point, Victoria BC ELEVATION 3.2m (est.) EASTING 471457
 DRILLING DATE Feb 6, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

BH13-2 cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Geodetic NORTHING 5362891
 LOCATION Ogden Point, Victoria BC ELEVATION 3.2m (est.) EASTING 471457
 DRILLING DATE Feb 6, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: DG
 Reviewed by: BH
 Date: Feb 14, 2013

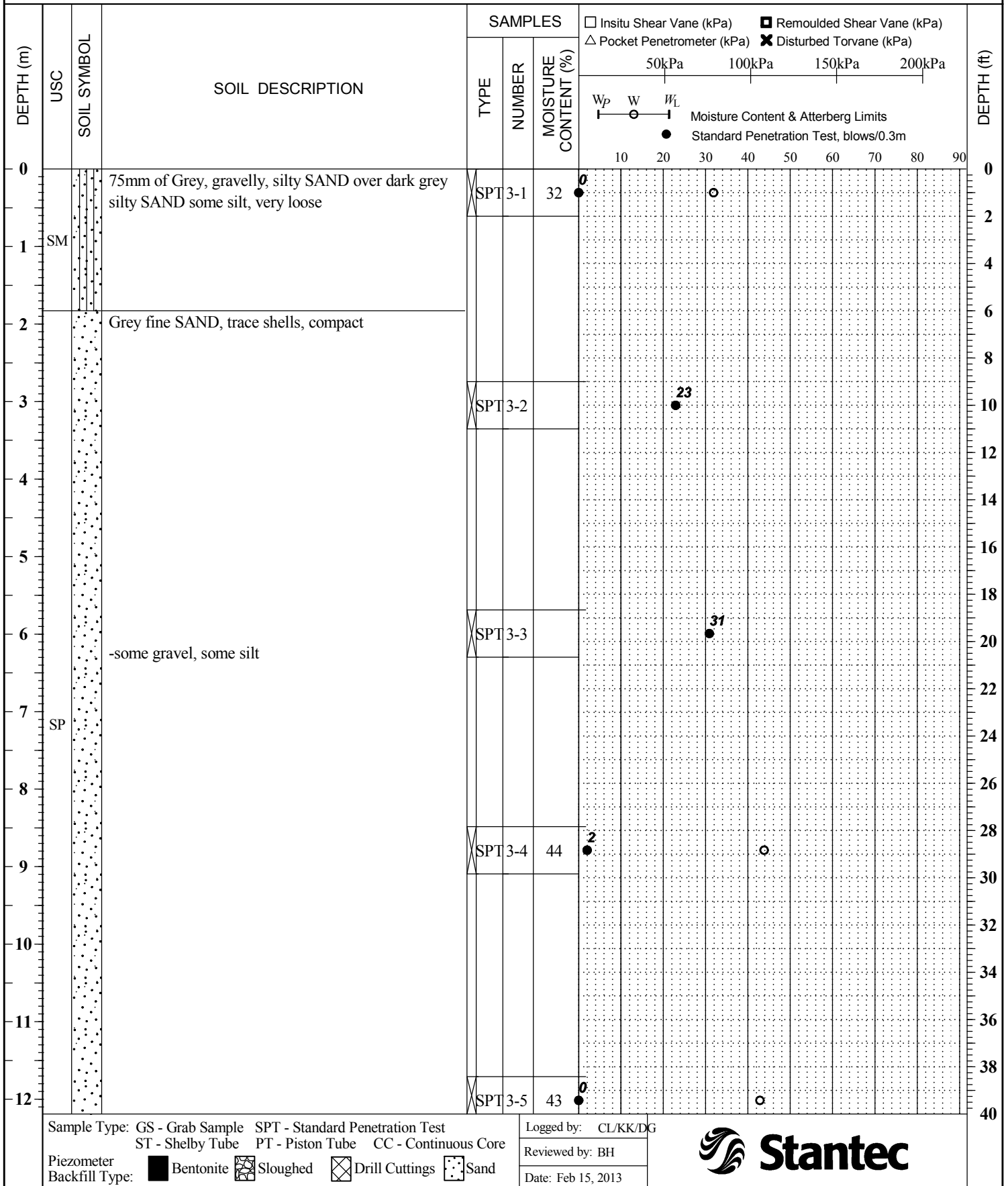


80

BOREHOLE RECORD

MBH13-1

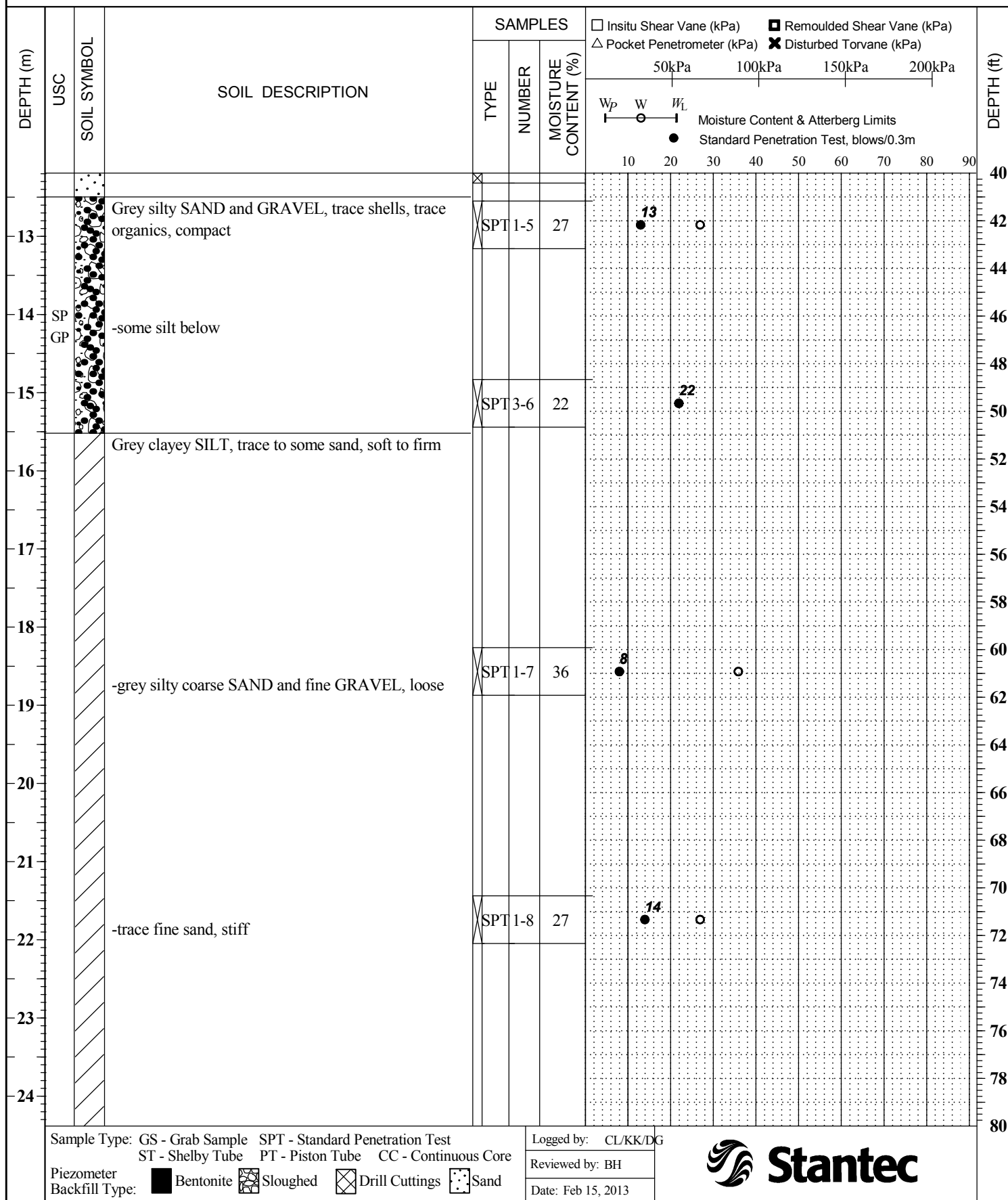
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
 LOCATION Victoria Harbour ELEVATION -6.27m EASTING 470746
 DRILLING DATE February 1, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-1cont'd

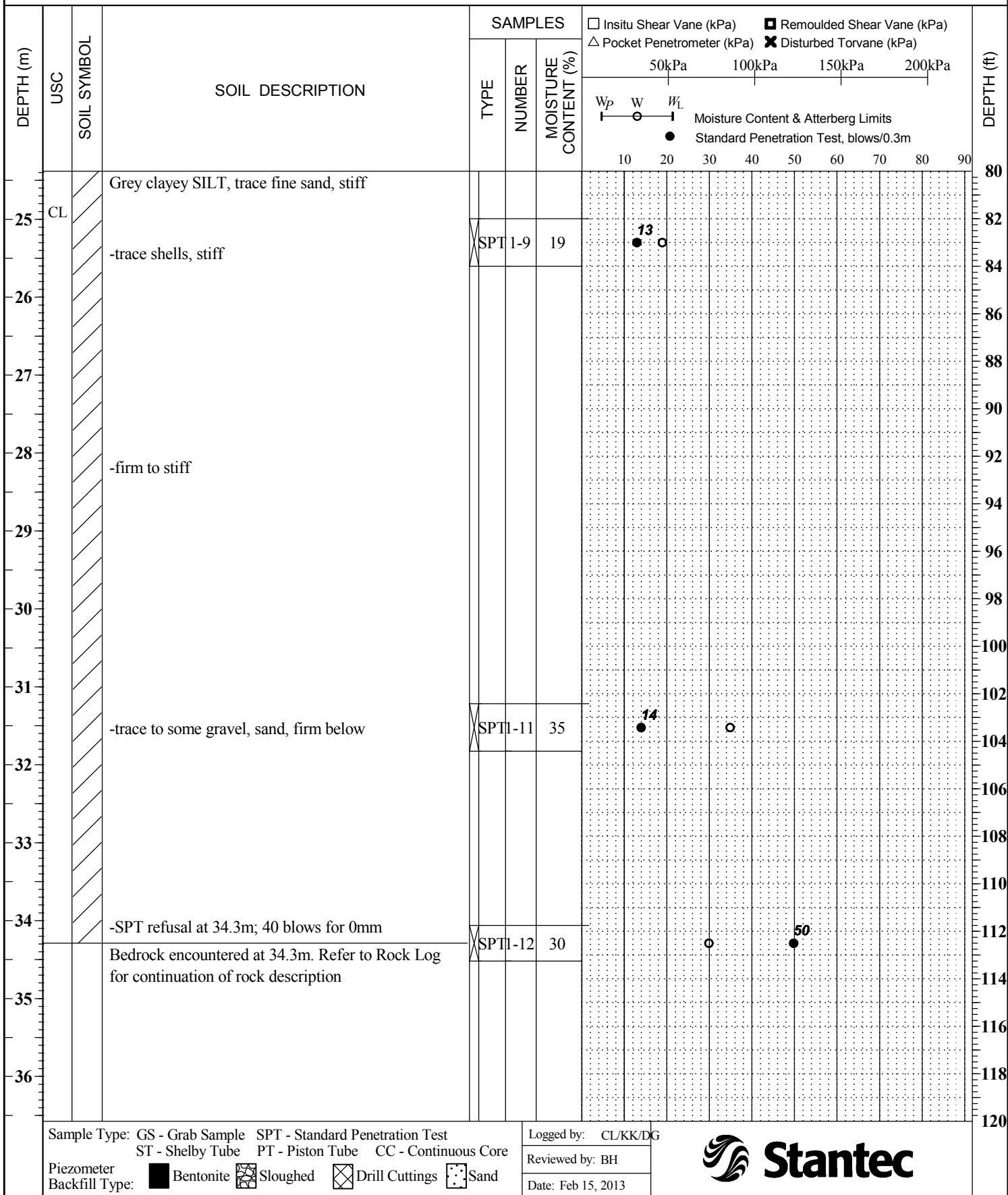
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
LOCATION Victoria Harbour ELEVATION -6.27m EASTING 470746
DRILLING DATE February 1, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-1cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
 LOCATION Victoria Harbour ELEVATION -6.27m EASTING 470746
 DRILLING DATE February 1, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-1

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
 LOCATION Victoria Harbour Crossing ELEVATION -6.27m EASTING 470746
 DRILLING DATE 2/1/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										Q-VALUE Q = $\frac{R_{QD} \times J_r \times J_w}{J_n \times J_a \times SRF}$ WHERE: J _w =1 & SRF=1	OTHER TESTS	DEPTH (ft)	
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J _n	J _r				J _a	TYPE AND SURFACE DESCRIPTION
-6.3																		
25																		
26																		
27																		
28																		
29																		
30																		
31																		
32																		
33																		
34																		
35	-41.4	Bedrock encountered at 34.3 m. Refer to Soil Log for overburden description.																
36	-42.4	Very severely fractured, moderately weathered, weak, dark grey ANDESITE DYKE	RC 1										20	2	2	J - PL, R, PC	0.5	
		Moderately jointed, slightly weathered, strong, grey GRANODIORITE																



BOREHOLE RECORD

MBH13-1

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
 LOCATION Victoria Harbour Crossing ELEVATION -6.27m EASTING 470746
 DRILLING DATE 2/1/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	STRUCTURE				DISCONTINUITY DATA				C-VALUE Q = $\frac{RQD}{L} \times \frac{J_r}{J_n} \times \frac{J_a}{SRF}$ WHERE: J _w =1 & SRF=1	OTHER TESTS	DEPTH (ft)	
					TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	TYPE AND SURFACE DESCRIPTION							
-6.3				RC 2A	80	80	60	5								
37	-43.5	Very severely fractured, highly weathered, weak, dark grey ANDESITE DYKE		RC 2B	80	80	60	5						27.3		121
				RC 3	80	80	60	5						0.4		122
38				RC 4	80	80	60	5						0.5		123
39				RC 5	80	80	60	5						0.5		124
40	-46.5	Severely fractured to moderately jointed, slightly weathered, medium strong, grey GRANODIORITE - Very severely fractured from 40.14 - 41.7 m - Occasional disseminated sulphides - Occasional microdefects/veins		RC 6	80	80	60	5						10		125
41				RC 7	80	80	60	5						39.5		126
42				RC 8	80	80	60	5						43		127
43				RC 9	80	80	60	5						8		128
44				RC 10	80	80	60	5						8		129
45					RC 11	80	80	60	5						17.5		130



BOREHOLE RECORD

MBH13-1

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363132
 LOCATION Victoria Harbour Crossing ELEVATION -6.27m EASTING 470746
 DRILLING DATE 2/1/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

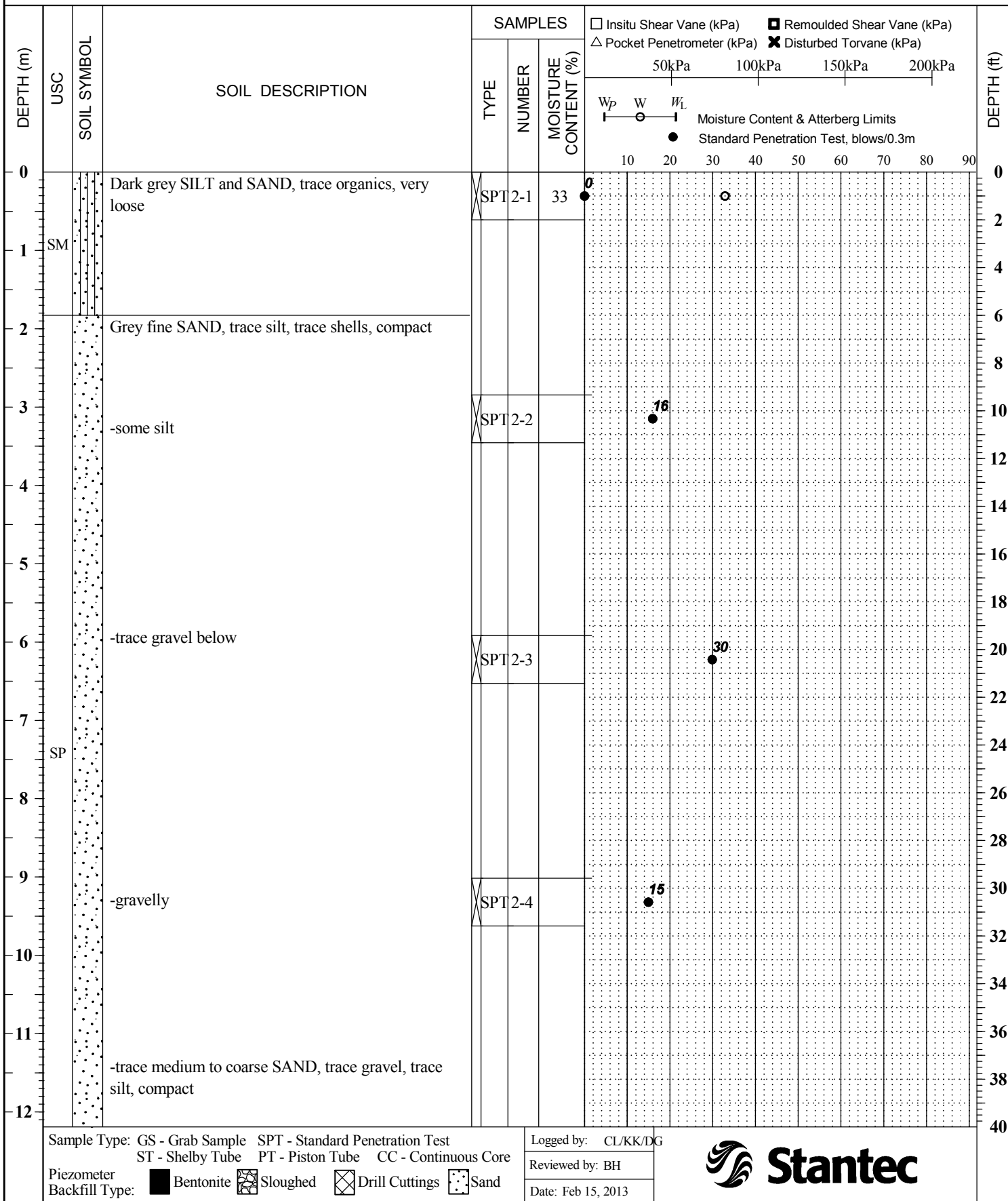
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										C-VALUE Q = $\frac{RQD}{J_n} \times \frac{J_w}{J_r} \times \frac{J_a}{SRF}$ WHERE: J _w =1 & SRF=1	OTHER TESTS	DEPTH (ft)	
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J _n	J _r				J _a	TYPE AND SURFACE DESCRIPTION
49	-6.3			RC 11														61
50																		62
50.53		End of Borehole MBH13-1 at 50.53 m																63
51																		64
52																		65
53																		66
54																		67
55																		68
56																		69
57																		70
58																		71
59																		72
60																		73
61																		74
																		75
																		76
																		77
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																		88
																		89
																		90
																		91
																		92
																		93
																		94
																		95
																		96
																		97
																		98
																		99
																		200



BOREHOLE RECORD

MBH13-2

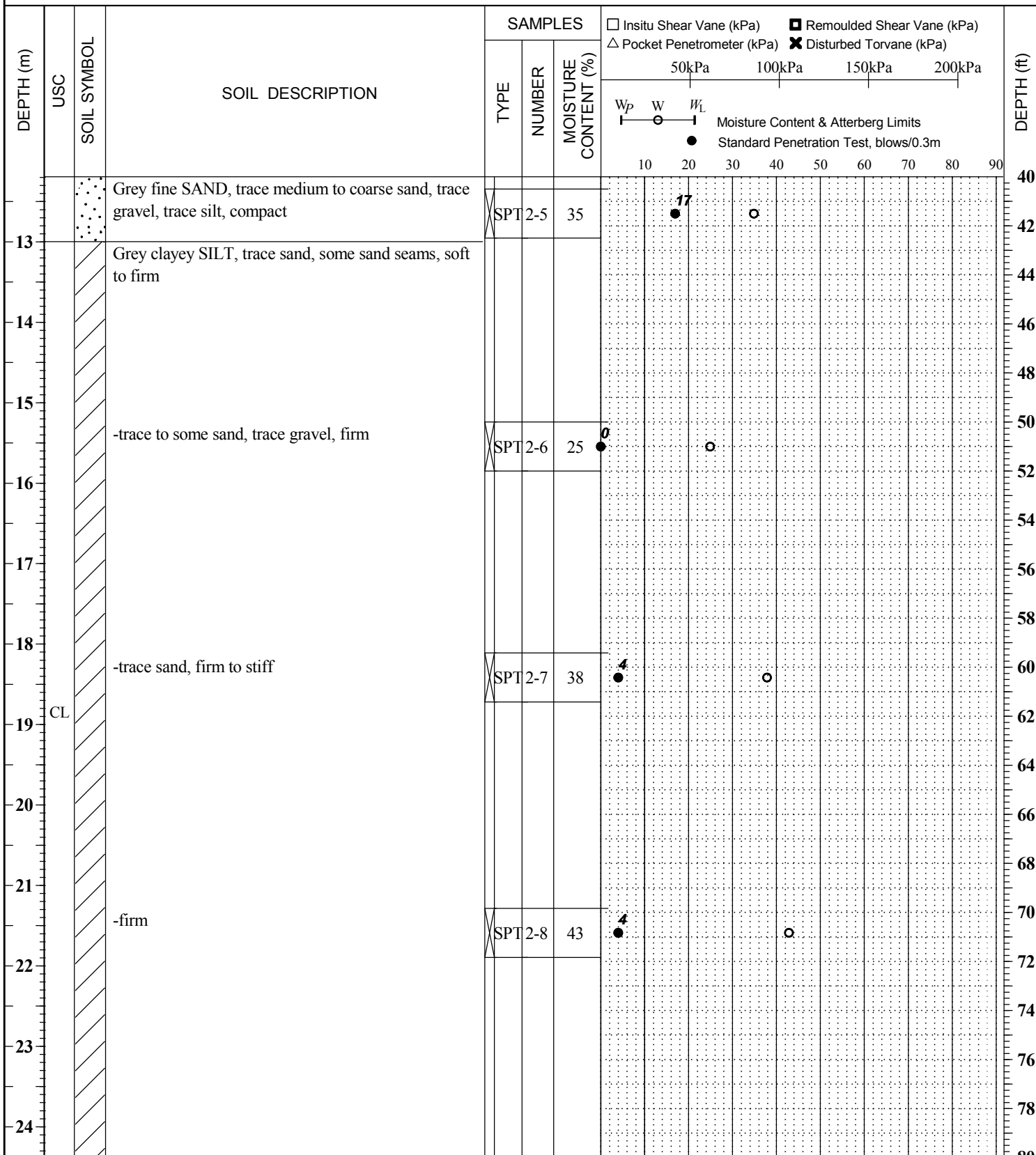
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363072
 LOCATION Victoria Harbour ELEVATION -9.5m EASTING 470923
 DRILLING DATE January 31, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-2cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363072
 LOCATION Victoria Harbour ELEVATION -9.5m EASTING 470923
 DRILLING DATE January 31, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

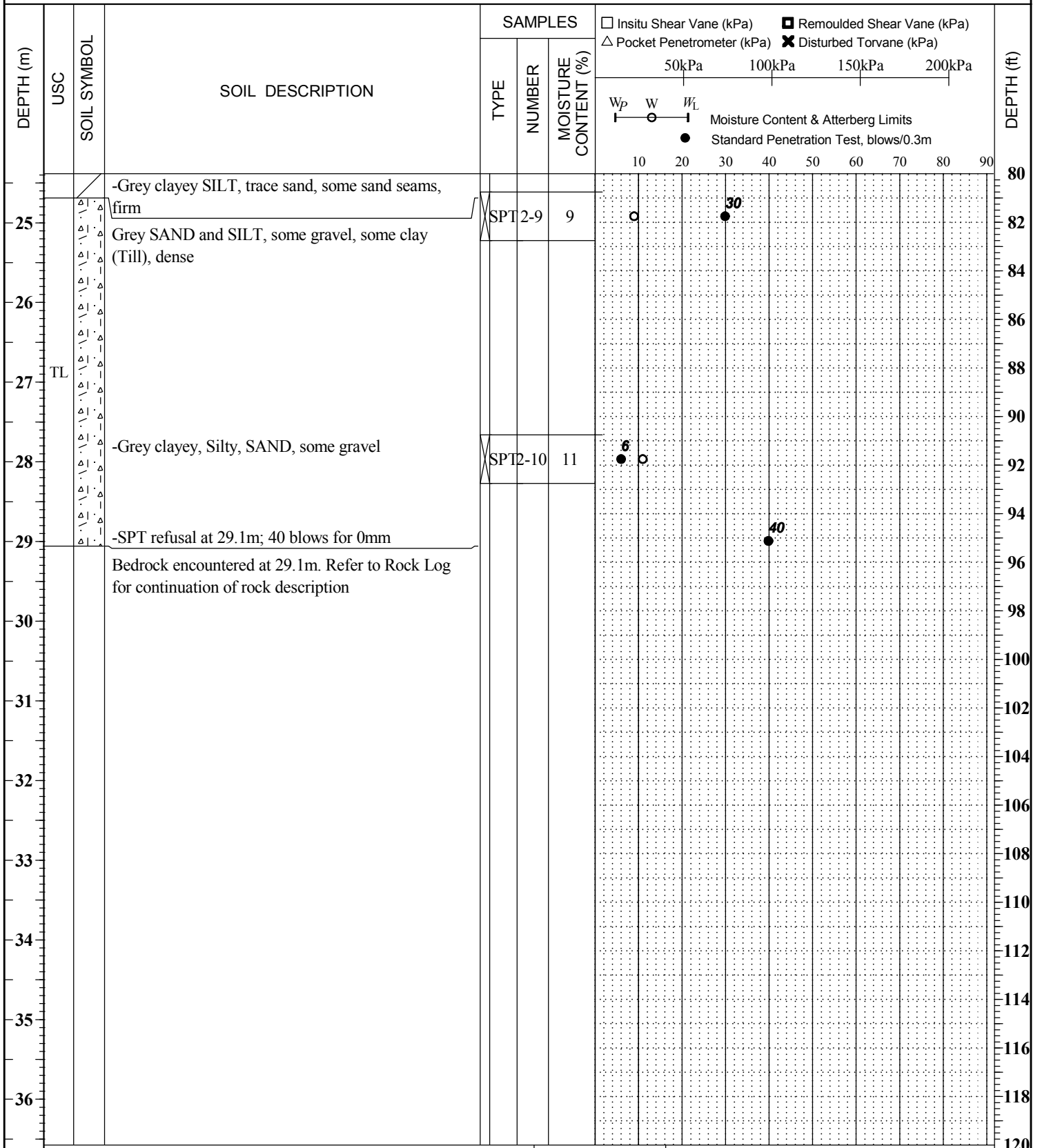
Logged by: CL/KK/DG
 Reviewed by: BH
 Date: Feb 15, 2013



BOREHOLE RECORD

MBH13-2cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363072
 LOCATION Victoria Harbour ELEVATION -9.5m EASTING 470923
 DRILLING DATE January 31, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CL/KK/DG
 Reviewed by: BH
 Date: Feb 15, 2013



BOREHOLE RECORD

MBH13-2

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363072
 LOCATION Victoria Harbour Crossing ELEVATION -9.5m EASTING 470923
 DRILLING DATE 1/31/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	STRUCTURE				R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DISCONTINUITY DATA			C-VALUE Q = Jn x Jj x Jk x Jl x Jm x Jn x Jp x Jq x Jr x Js x Jt x Ju x Jv x Jw x Jx x Jy x Jz WHERE: Jw=1 & SRF=1	OTHER TESTS	DEPTH (ft)			
					TOTAL CORE %	SOLID CORE %	FX-FRACTURE	J-JOINT					CL-CLEAVAGE	VN-VEIN	UN-UNDULATING				PO-POLISHED	CL-CLEAN	K-SLICKENSIDED	CC-COMpletely COATED	IN-FILLED
	-9.5																				
37	46.2	Moderately jointed to intact, slightly weathered, strong, grey GRANODIORITE - Occasional disseminated sulphides		RC 6														39	121		
38				RC 7															58.7	122	
39				RC 8															41	123	
40				RC 9															84	124	
41				RC 10															92	125	
42				RC 11															82	126	
43	52.2		Fractured to moderately jointed, slightly weathered, medium strong, grey to dark grey GRANODIORITE - Occasional disseminated sulphides		RC 12														26.5	127	
44					RC 13															37	128
45					RC 14															25	129
46					RC 15															21.3	130
47																				131	



BOREHOLE RECORD

MBH13-2

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363072
 LOCATION Victoria Harbour Crossing ELEVATION -9.5m EASTING 470923
 DRILLING DATE 1/31/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

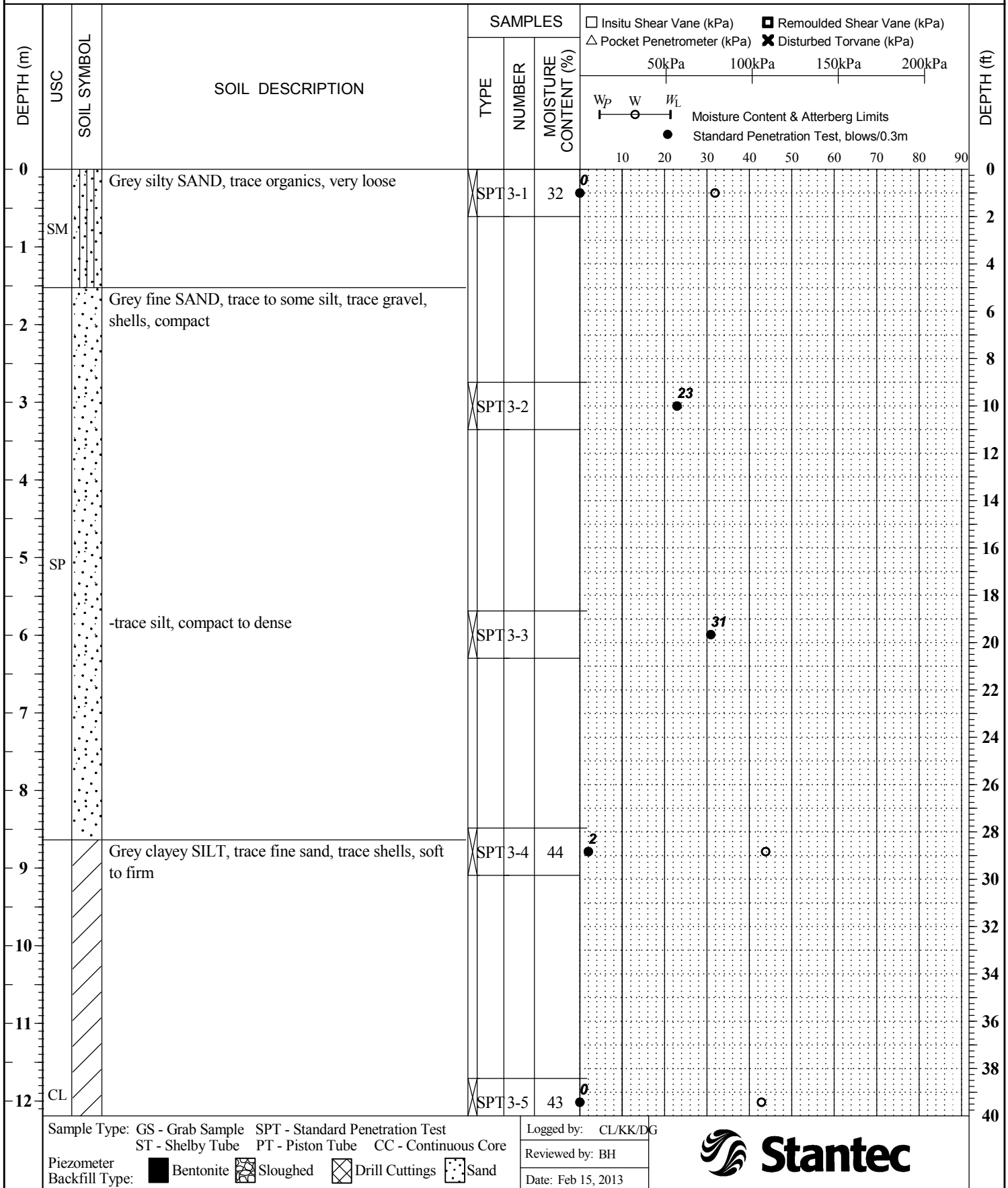
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										C-VALUE Q= ROD x J1 x J2 x J3 x J4 x SRP WHERE: JW=1 & SRP=1	OTHER TESTS	DEPTH (ft)					
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J1	J2				J3	J4	TYPE AND SURFACE DESCRIPTION		
	-9.5																					
49				RC 16																		61
50																						62
50																						63
50																						64
50																						65
50																						66
50.59		End of borehole MBH13-2 at 50.59 m																				66.5
51																						67
52																						68
53																						69
54																						70
55																						71
56																						72
57																						73
58																						74
59																						75
60																						76
61																						77
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																						98
																						99
																						200



BOREHOLE RECORD

MBH13-3

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363008
 LOCATION Victoria Harbour ELEVATION -12.78m EASTING 471110
 DRILLING DATE January 25, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-3cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363008
 LOCATION Victoria Harbour ELEVATION -12.78m EASTING 471110
 DRILLING DATE January 25, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	USC	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLES			<input type="checkbox"/> Insitu Shear Vane (kPa) <input type="checkbox"/> Remoulded Shear Vane (kPa) <input type="checkbox"/> Pocket Penetrometer (kPa) <input checked="" type="checkbox"/> Disturbed Torvane (kPa)				DEPTH (ft)
				TYPE	NUMBER	MOISTURE CONTENT (%)	50kPa	100kPa	150kPa	200kPa	
13		/ / / / /	Grey clayey SILT, trace fine sand, trace shells, soft to firm	X							40
14											42
15			-trace to some gravel								44
16	SM	. . . . .	Grey silty SAND, some clay, trace gravel, compact	X	SPT 3-6	22					46
17	SP	. . . . .	-600mm diameter boulder Grey SAND, trace silt, shells								48
18			Bedrock encountered at 16.9m. Refer to Rock Log for continuation of rock description								50
19											52
20											54
21											56
22											58
23											60
24											62

Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CL/KK/DG
 Reviewed by: BH
 Date: Feb 15, 2013



BOREHOLE RECORD

MBH13-3A

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363008
 LOCATION Victoria Harbour Crossing ELEVATION -12.78m EASTING 471110
 DRILLING DATE 1/25/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										C-VALUE Q = $\frac{RQD}{L} \times \frac{J_r}{J_n} \times \frac{J_a}{SRF}$ WHERE: J _w =1 & SRF=1	OTHER TESTS	DEPTH (ft)				
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J _n	J _r				J _a	TYPE AND SURFACE DESCRIPTION		
	-12.8																				
13																					41
14																					42
15																					43
16																					44
17																					45
18																					46
19																					47
20																					48
21																					49
22																					50
23																					51
24																					52
25																					53
26																					54
27																					55
28																					56
29																					57
30																					58
31																					59
32																					60
33																					61
34																					62
35																					63
36																					64
37																					65
38																					66
39																					67
40																					68
41																					69
42																					70
43																					71
44																					72
45																					73
46																					74
47																					75
48																					76
49																					77
50																					78
51																					79
52																					80



BOREHOLE RECORD

MBH13-3A

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363008
 LOCATION Victoria Harbour Crossing ELEVATION -12.78m EASTING 471110
 DRILLING DATE 1/25/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	STRUCTURE				R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DISCONTINUITY DATA				C-VALUE Q = R _{QD} x J ₁ x J ₂ x J ₃ x SRF ² WHERE: J _W =1 & SRF=1	OTHER TESTS	DEPTH (ft)	
					TOTAL CORE %	SOLID CORE %	FX-FRACTURE	J-JOINT					CL-CLEAVAGE	VN-VEIN	UN-UNDULATING	PO-POLISHED				PC-PARTIALLY COATED	CC-COMpletely COATED	IN-FILLED	TYPE AND SURFACE DESCRIPTION
	-12.8																			
	49.6																			
37																				
38				RC 15									80		4	3	2	J - UN, R, PC	23.6	
39	-51.8	Fractured to intact, slightly weathered, medium strong to strong, grey GRANODIORITE		RC 16									0	0	3	3	1	J - UN, R, CL	86	
40				RC 17									0	0	3	3	2	J - UN, R, PC	34	
41				RC 18									0	0	3	2	2	J - UN, S, PC	23.3	
42				RC 19A											3	3	1	J - UN, R, CL	100	
43	-56.2	Severely fractured, moderately weathered, weak to medium strong, dark grey ANDESITE DYKE		RC 19B									0	0	6	2	2	J - UN, S, PC	4.2	
44	-57.1	Moderately jointed, moderately altered, medium strong, greenish grey ALTERED GRANODIORITE		RC 20									0		2	3	2	J - UN, R, PC	67.5	
45	-58.0	Moderately jointed to intact, medium strong, grey GRANODIORITE		RC 21									0	0	3	3	2	J - UN, R, PC	49	
46				RC 22									0	0	3	3	1	J - UN, R, CL	91	
47																				
48																				



BOREHOLE RECORD

MBH13-3A

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5363008
 LOCATION Victoria Harbour Crossing ELEVATION -12.78m EASTING 471110
 DRILLING DATE 1/25/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

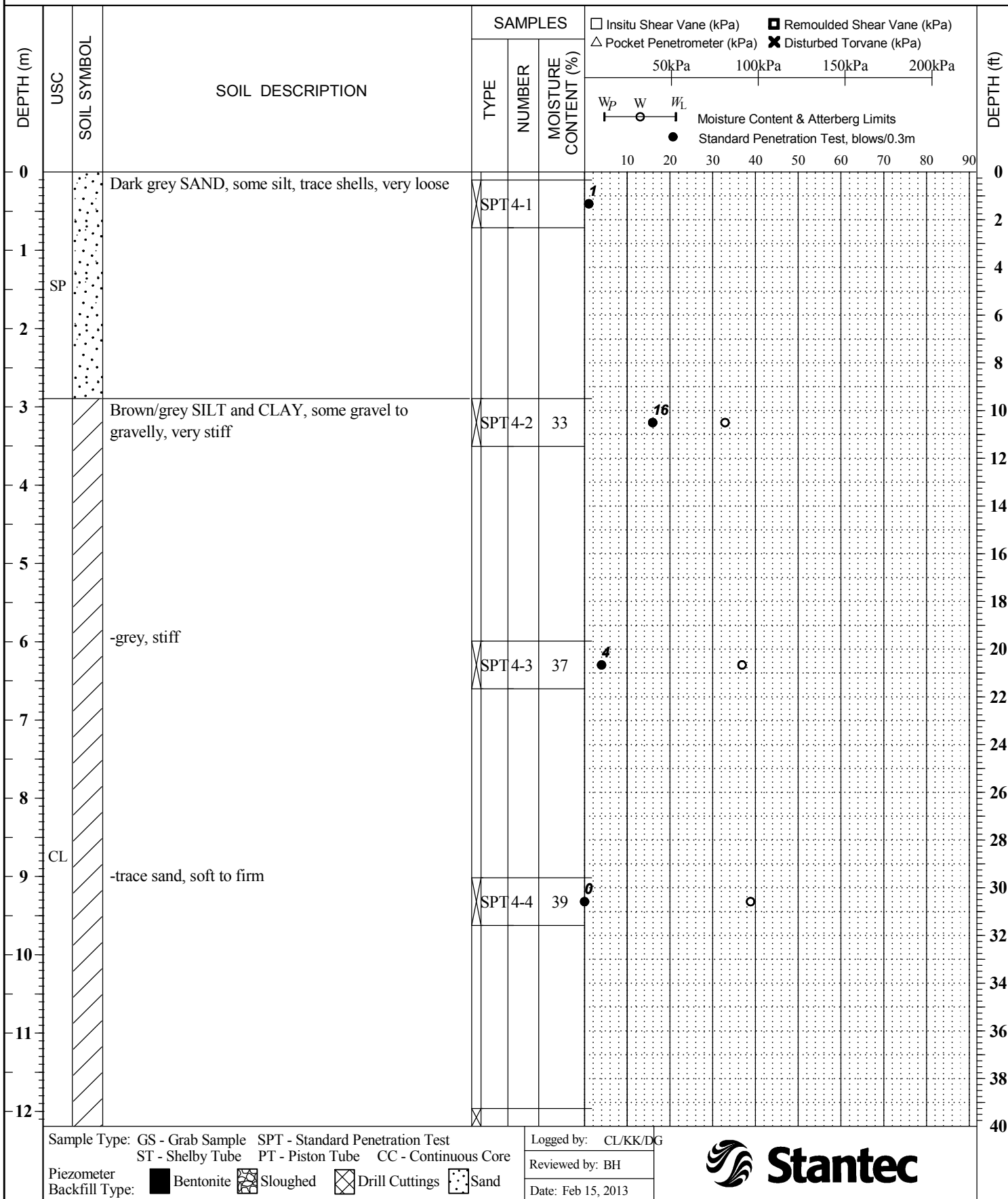
DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										C-VALUE Q= ROD x J1 x J2 x J3 x J4 x SRF WHERE: JW=1 & SRF=1	OTHER TESTS	DEPTH (ft)				
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J1	J2				J3	J4	TYPE AND SURFACE DESCRIPTION	
-12.8																					
49				RC 23																	61
50	62.9	End of borehole MBH13-3A at 50.08 m		RC 24																	64
51																					65
52																					66
53																					67
54																					68
55																					69
56																					70
57																					71
58																					72
59																					73
60																					74
61																					75



BOREHOLE RECORD

MBH13-4

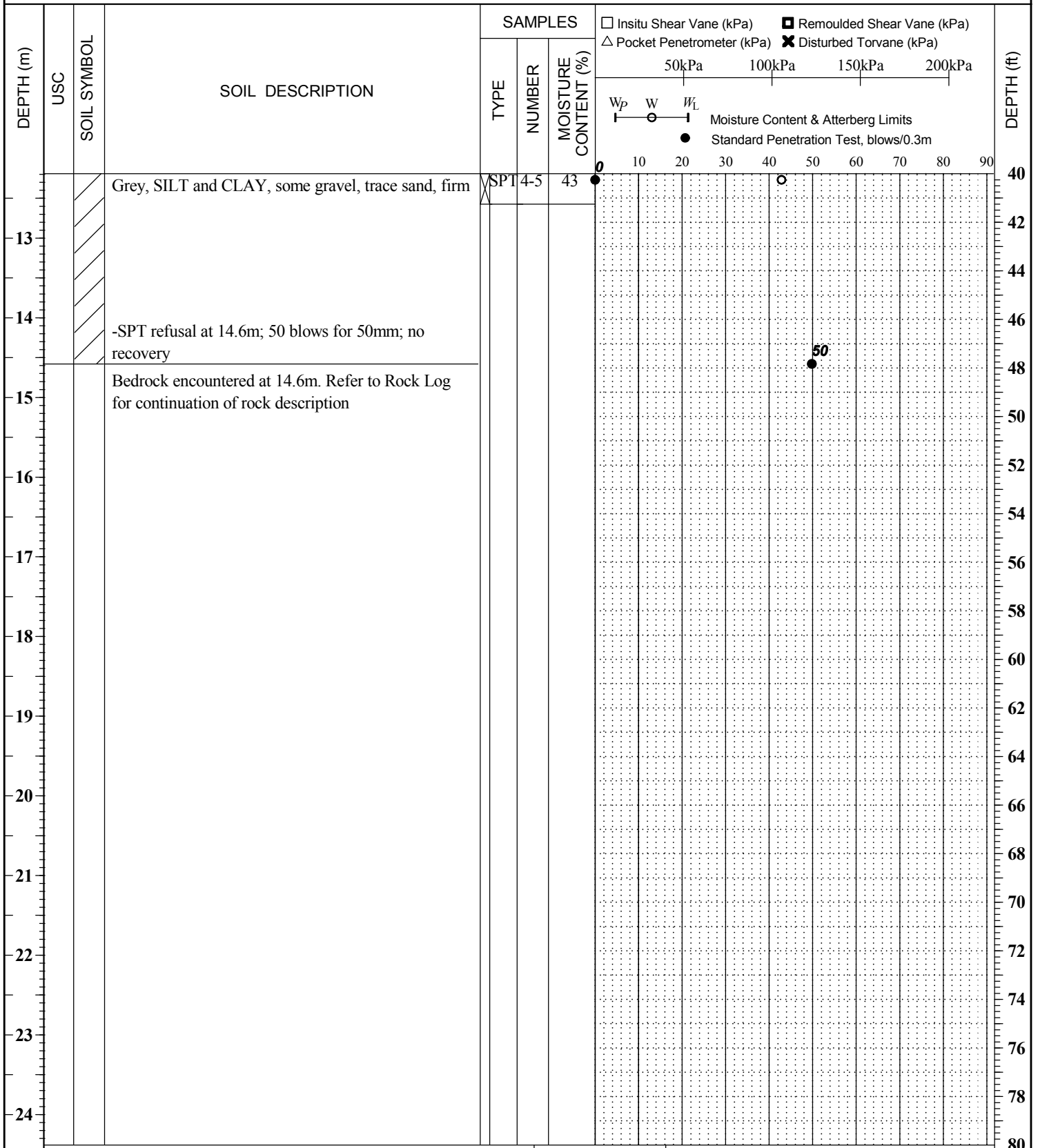
CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5362952
 LOCATION Victoria Harbour ELEVATION -4.16m EASTING 471275
 DRILLING DATE February 2, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



BOREHOLE RECORD

MBH13-4cont'd

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5362952
 LOCATION Victoria Harbour ELEVATION -4.16m EASTING 471275
 DRILLING DATE February 2, 2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring



Sample Type: GS - Grab Sample SPT - Standard Penetration Test
 ST - Shelby Tube PT - Piston Tube CC - Continuous Core
 Piezometer Backfill Type: Bentonite Sloughed Drill Cuttings Sand

Logged by: CL/KK/DG
 Reviewed by: BH
 Date: Feb 15, 2013



BOREHOLE RECORD

MBH13-4

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5362952
 LOCATION Victoria Harbour Crossing ELEVATION -4.16m EASTING 471275
 DRILLING DATE 2/2/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA												C-VALUE Q= ROD x J1 x J2 x J3 x J4 WHERE: J1=1 & SRF=1	OTHER TESTS	DEPTH (ft)
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	UN-UNDULATING			TYPE AND SURFACE DESCRIPTION			
													J1	J2	J3				
4.2																			
13																			
14		Bedrock encountered at 14.6 m. Refer to Soil Log for overburden description.																	
18.8		Fractured to intact, slightly weathered to fresh, strong, grey GRANODIORITE	[Strata Plot Symbol]																
15																			
16																			
17																			
18																			
19																			
20																			
24.6																			
21		Very severely fractured, highly altered, very weak, greenish grey GRANODIORITE	[Strata Plot Symbol]																
25.4		Moderately jointed to intact, slightly weathered, medium strong, grey GRANODIORITE - Frequent microdefects/veins - Occasional disseminated sulphides	[Strata Plot Symbol]																
22																			
23																			
24																			



BOREHOLE RECORD

MBH13-4

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5362952
 LOCATION Victoria Harbour Crossing ELEVATION -4.16m EASTING 471275
 DRILLING DATE 2/2/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.										DISCONTINUITY DATA			C-VALUE Q = $\frac{RQD}{L} \times \frac{J_r}{J_n} \times \frac{J_a}{SRF}$ WHERE: J _w =1 & SRF=1	OTHER TESTS	DEPTH (ft)					
				STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J _n	J _r	J _a	TYPE AND SURFACE DESCRIPTION									
	-4.2																							
37																								
38																								
39																								
40	-43.5	Very severely fractured to severely fractured, moderately to highly altered, weak to medium strong, greenish grey ALTERED GRANODIORITE - "flaky", friable character - From 41.31 - 41.59 m, rock strength reduced to residual soil																						
41																								
42																								
43																								
44																								
45																								
46																								
47																								
48																								



BOREHOLE RECORD

MBH13-4

CLIENT CAPITAL REGIONAL DISTRICT PROJECT No. 111700431
 PROJECT Core Area Wastewater Treatment Program DATUM Chart NORTHING 5362952
 LOCATION Victoria Harbour Crossing ELEVATION -4.16m EASTING 471275
 DRILLING DATE 2/2/2013 DRILLING CO. Mud Bay Drilling DRILLING METHOD Mud Rotary/Coring

DEPTH (m)	ELEVATION (m)	LITHOLOGICAL DESCRIPTION	STRATA PLOT	SAMPLE TYPE & No.	DISCONTINUITY DATA										C-VALUE $Q = \frac{RQD}{L} \times \frac{J_r}{J_n} \times \frac{J_a}{J_w} \times \frac{SRF}{SRF}$ WHERE: $J_w = 1$ & $SRF = 1$	OTHER TESTS	DEPTH (ft)	
					STRUCTURE	TOTAL CORE %	SOLID CORE %	R.Q.D. %	FRACTURE FREQUENCY	ROCK STRENGTH INDEX	WEATHERING INDEX	DIP w.r.t. CORE AXIS	J _n	J _r				J _a	TYPE AND SURFACE DESCRIPTION
	-4.2																	
49																		61
																		62
50																		63
																		64
	-54.5	End of borehole MBH13-4 at 50.3 m																65
51																		66
52																		67
53																		68
54																		69
55																		70
56																		71
57																		72
58																		73
59																		74
60																		75
61																		76
																		77
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																		98
																		99
																		200





APPENDIX C

CPT Results



Job No: 12-1011
Client: Mud Bay Drilling Co. Ltd.
Project: Esquimalt, BC
Date: December 20th, 2012

CPT SUMMARY

CPT Sounding	File Name	Date	Cone	Assumed Phreatic Surface (m)	Final Depth (m)	Handheld GPS UTM Northing (m)	Handheld GPS UTM Easting (m)
CPT12-01	1011CP01	12/20/12	342:T1500F15U500	2.3	13.725	5363161	470587
CPT12-02	1011CP02	12/20/12	342:T1500F15U500	3.0	10.275	5363192	470597
CPT12-03	1011CP03	12/20/12	342:T1500F15U500	2.6	11.975	5363130	470604

Datum: WGS 84 / UTM Zone 10 North

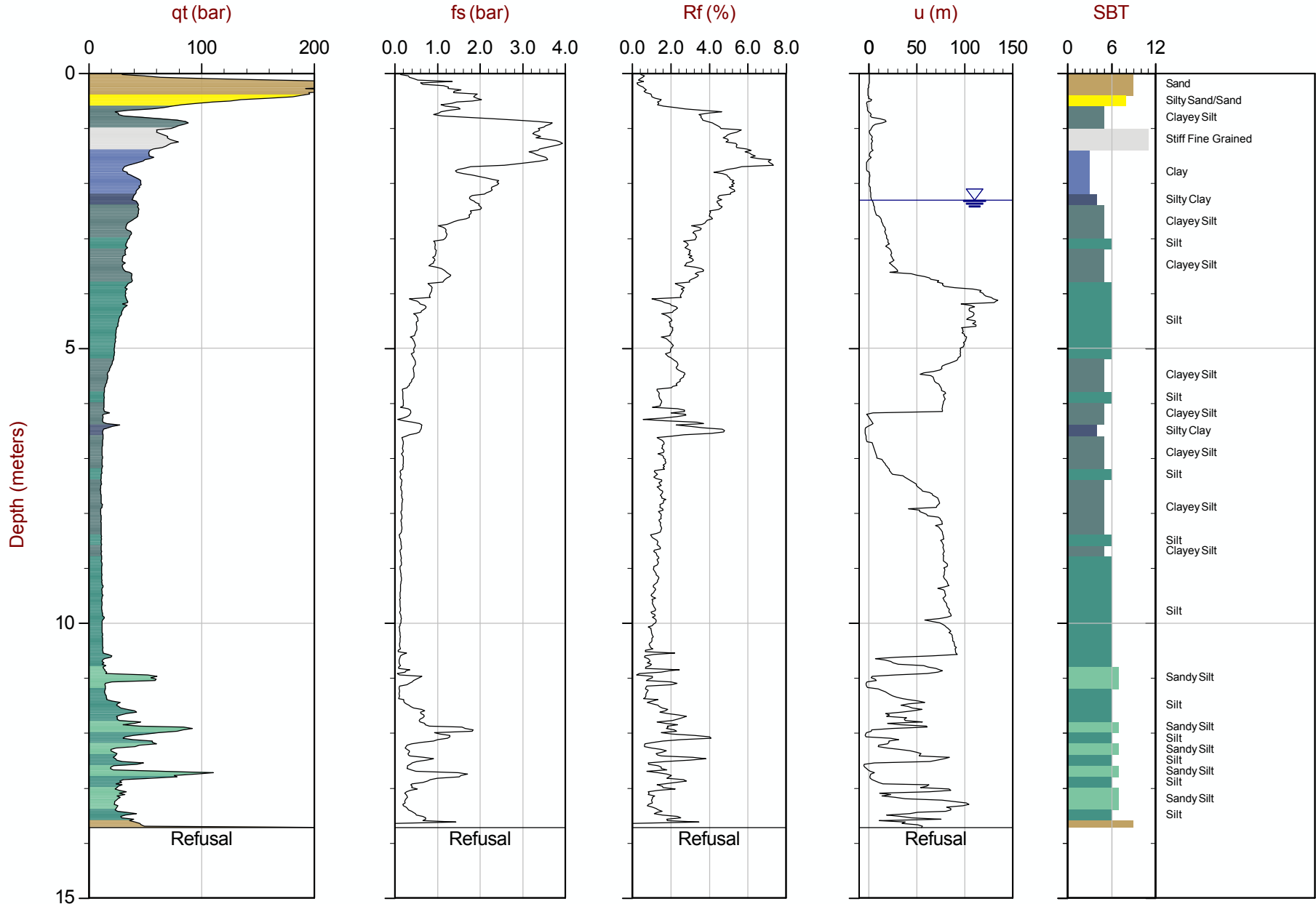
Note: Assumed phreatic surface based on dynamic pore pressure response.
Hydrostatic conditions assumed for interpretation tables.



Mud Bay

Job No: 12-1011
Date: 12:20:12 09:35
Site: Esquimalt, BC

Sounding: CPT12-01
Cone: 342:T1500F15U500



Max Depth: 13.725 m / 45.03 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: 0.200m

File: 1011CP01.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 10 N: 5363161m E: 470587m
Page No: 1 of 1

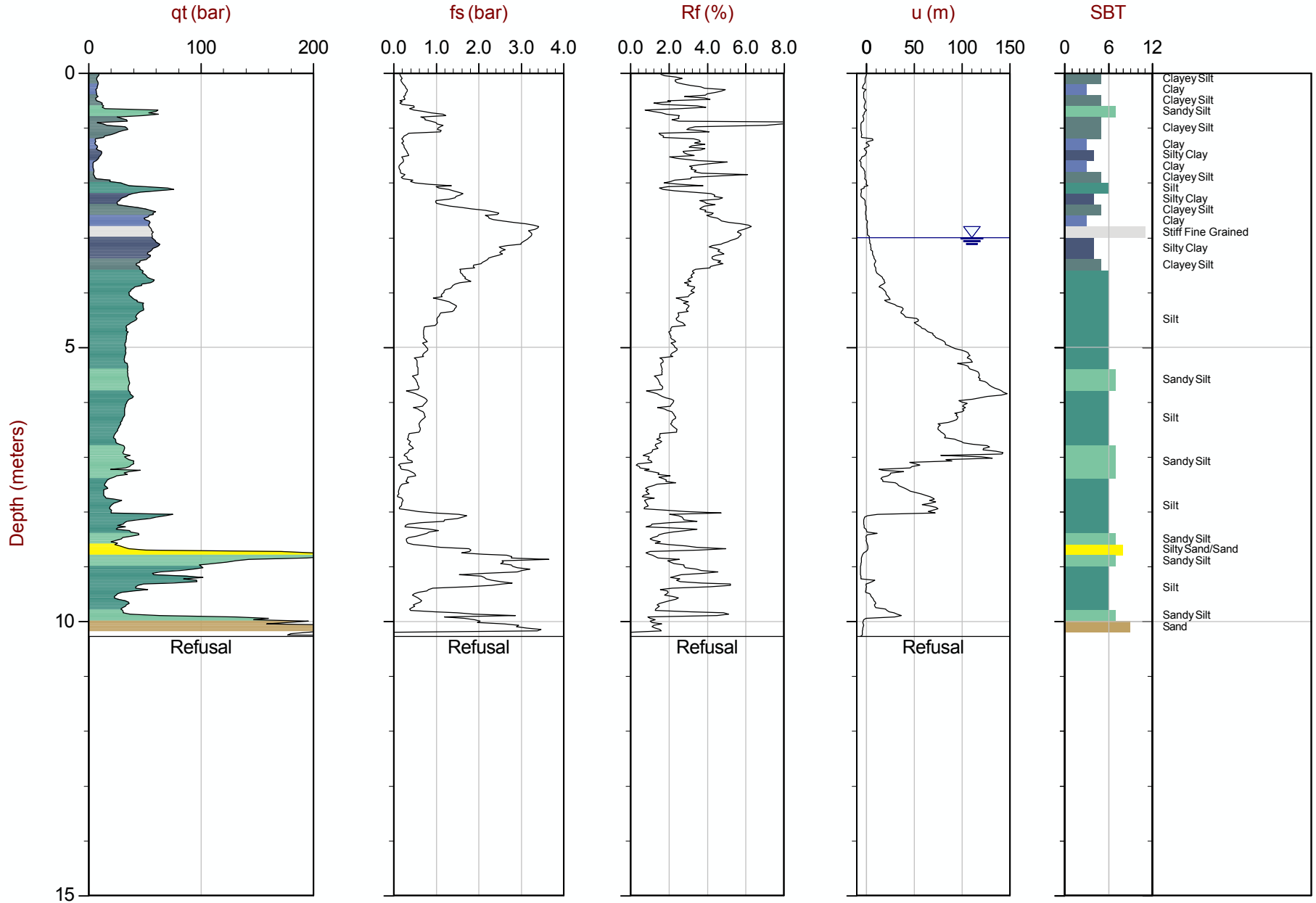
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Mud Bay

Job No: 12-1011
Date: 12:20:12 12:09
Site: Esquimalt, BC

Sounding: CPT12-02
Cone: 342:T1500F15U500



Max Depth: 10.275 m / 33.71 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: 0.200m

File: 1011CP02.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 10 N: 5363192m E: 470597m
Page No: 1 of 1

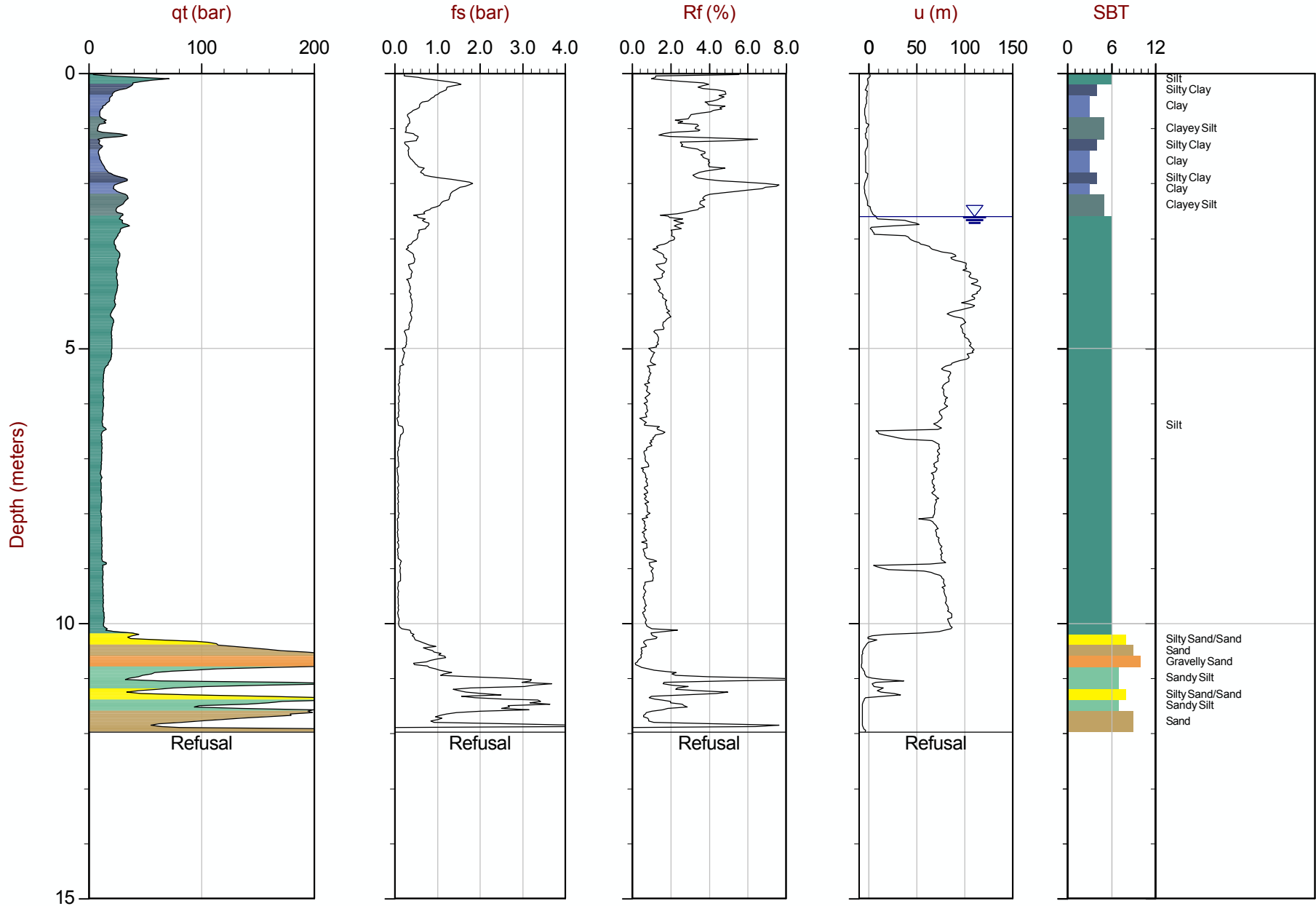
The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Mud Bay

Job No: 12-1011
Date: 12:20:12 14:12
Site: Esquimalt, BC

Sounding: CPT12-03
Cone: 342:T1500F15U500



Max Depth: 11.975 m / 39.29 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: 0.200m

File: 1011CP03.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: UTM Zone 10 N: 5363130m E: 470604m
Page No: 1 of 1

The reported coordinates were acquired from hand-held GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Job No: 12-1011
Client: Mud Bay Drilling Co. Ltd.
Project: Esquimalt, BC
Date: December 20th, 2012

PPD SUMMARY

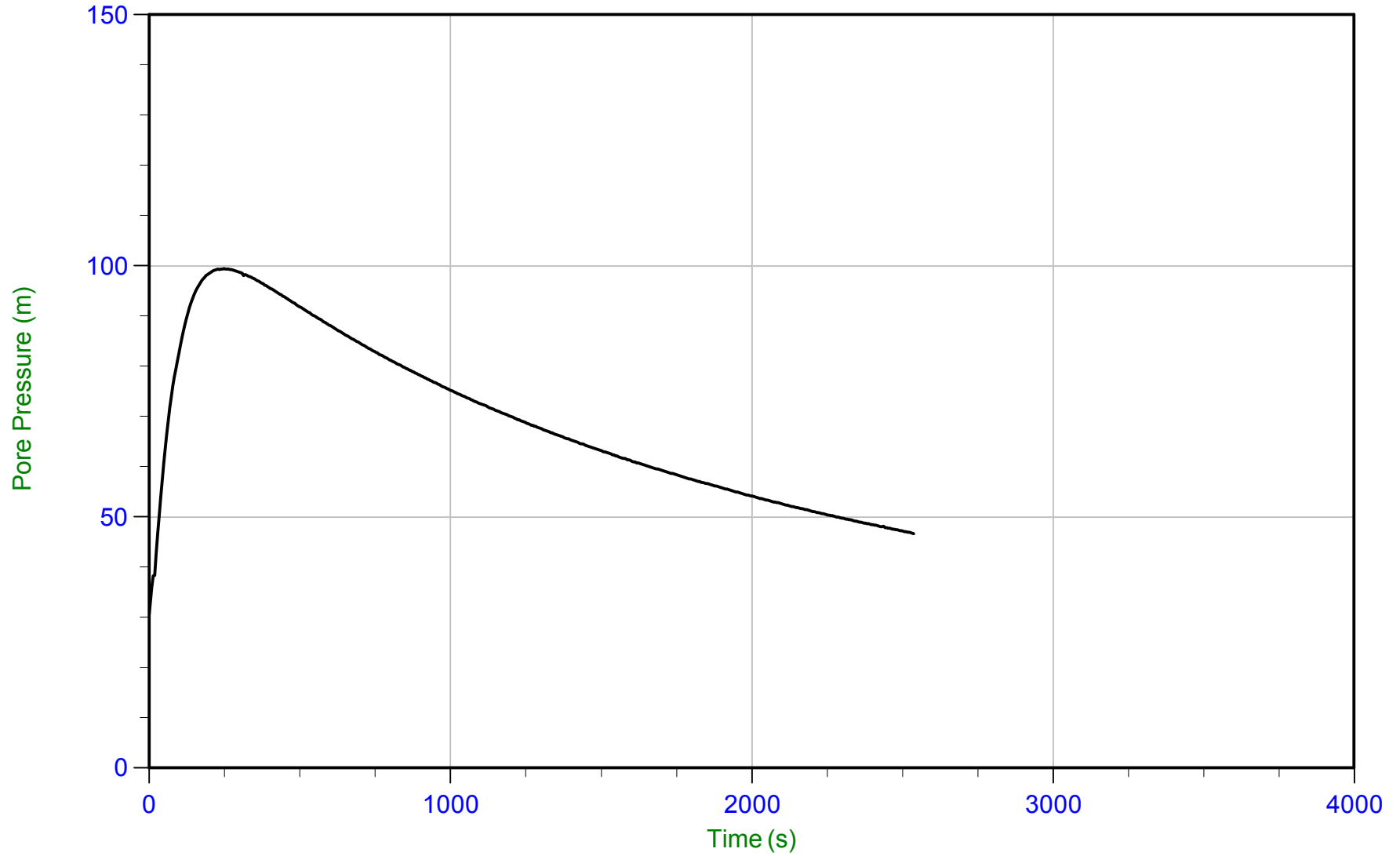
CPT Sounding	Duration (s)	Test Depth (m)	Equilibrium Pore Pressure U_{eq} (m)	Calculated Phreatic Surface (m)
CPT12-01	2540	3.600	Not Achieved	



Mud Bay

Job No: 12-1011
Date: 12/20/2012 09:35
Site: Esquimalt

Sounding: CPT12-01
Cone: 342:T1500F15U500
Cone Area: 15 sq cm



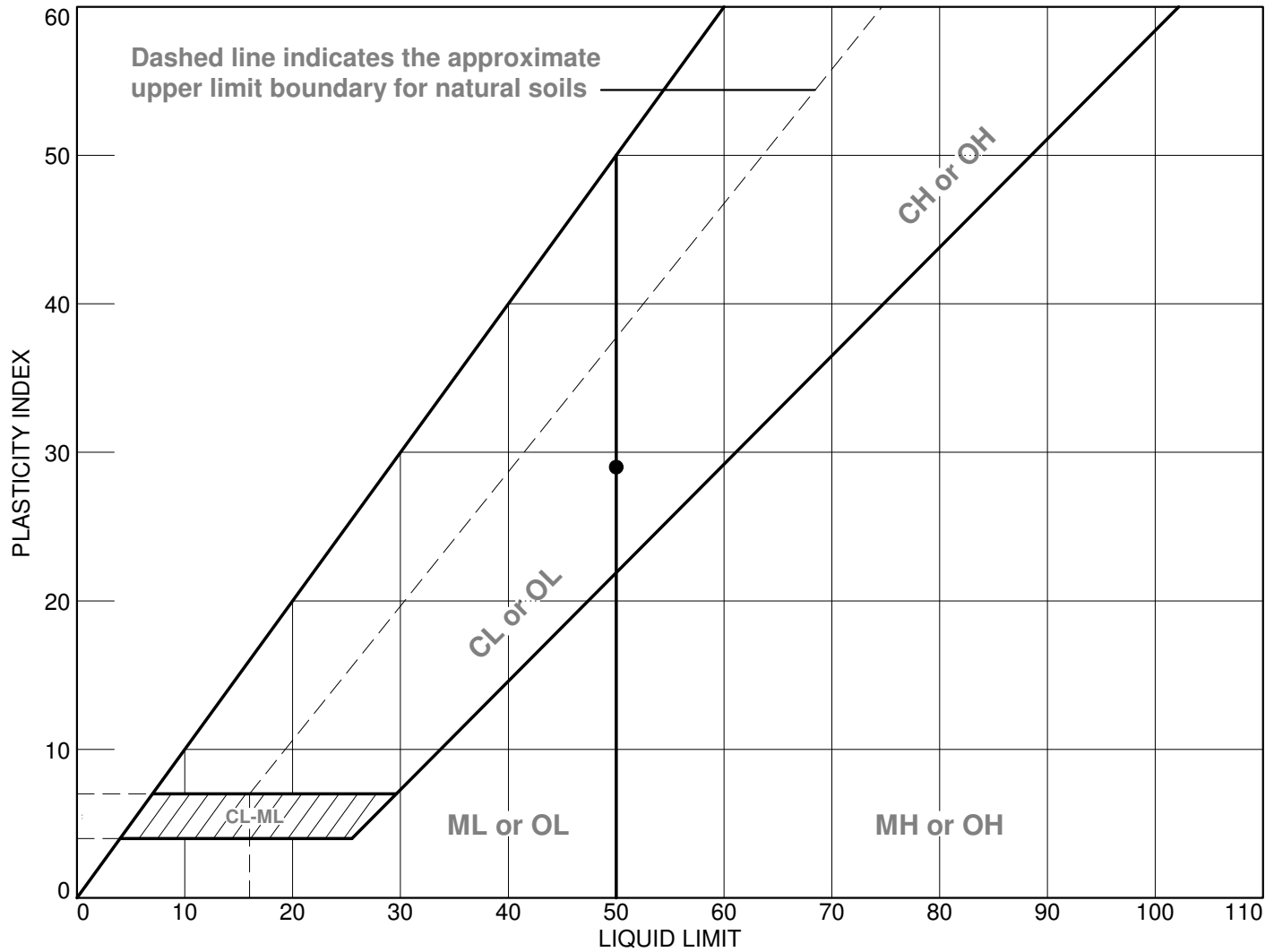
Trace Summary: Filename: 1011CP01.PPD U Min: 30.6 m
Depth: 3.600 m / 11.811 ft U Max: 99.4 m
Duration: 2540.0 s



APPENDIX D

Laboratory Test Results

LIQUID AND PLASTIC LIMITS TEST REPORT

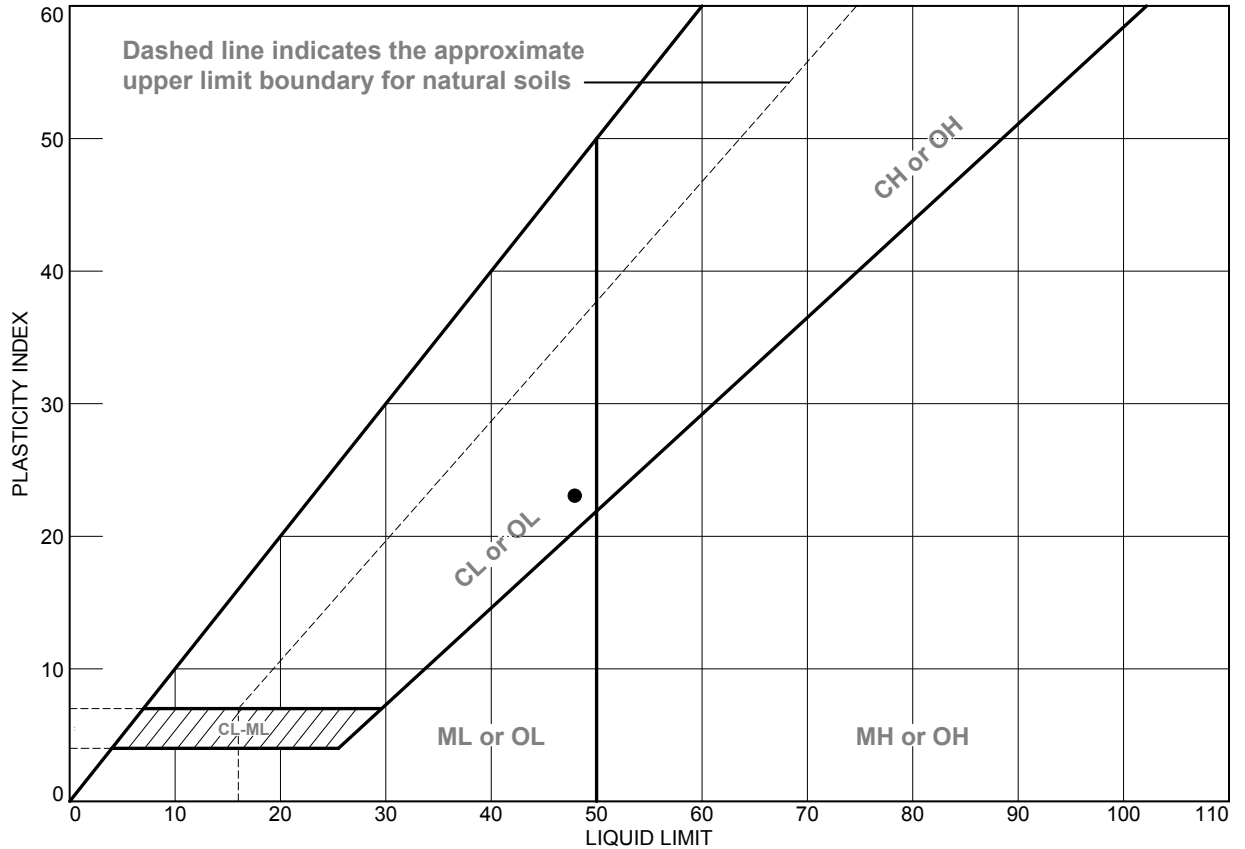


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BH12-1	1-4	3.3m	29.0	21	50	29	CL-CH

Stantec Consulting, Ltd. Burnaby, British Columbia	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC Project No.: 111700431	Figure
---------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------	---------------

Tested By: CG _____ **Checked By:** BH _____

LIQUID AND PLASTIC LIMITS TEST REPORT



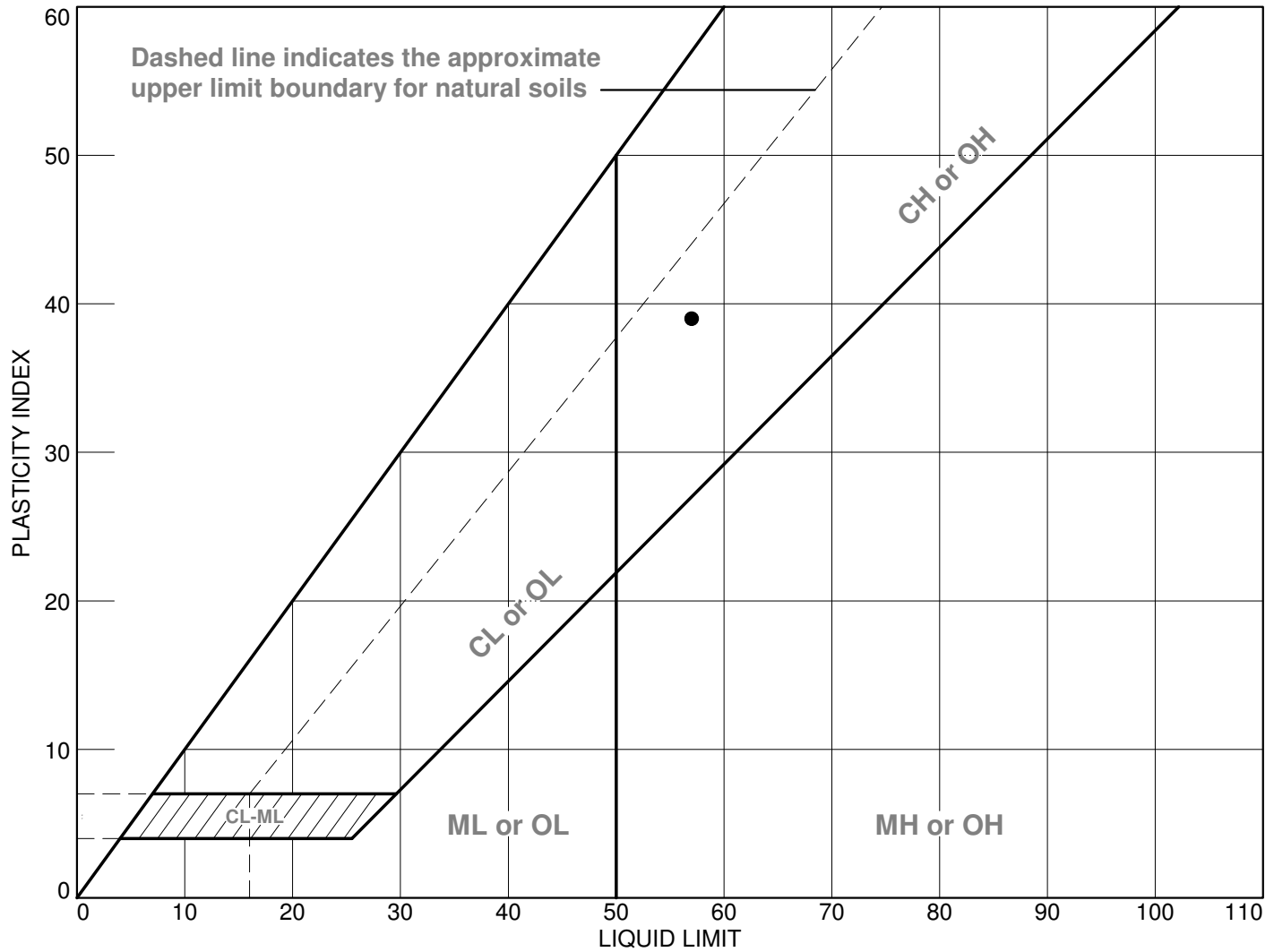
SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BH12-2	2-4	4.8m	33.0	25	48	23	CL

Stantec Consulting, Ltd. Burnaby, British Columbia	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC Project No.: 111700431
-------------------------------------------------------------------------	---------------------------------------------------------------------------------------------------------------------------------

Figure

Tested By: RI Checked By: BH

LIQUID AND PLASTIC LIMITS TEST REPORT

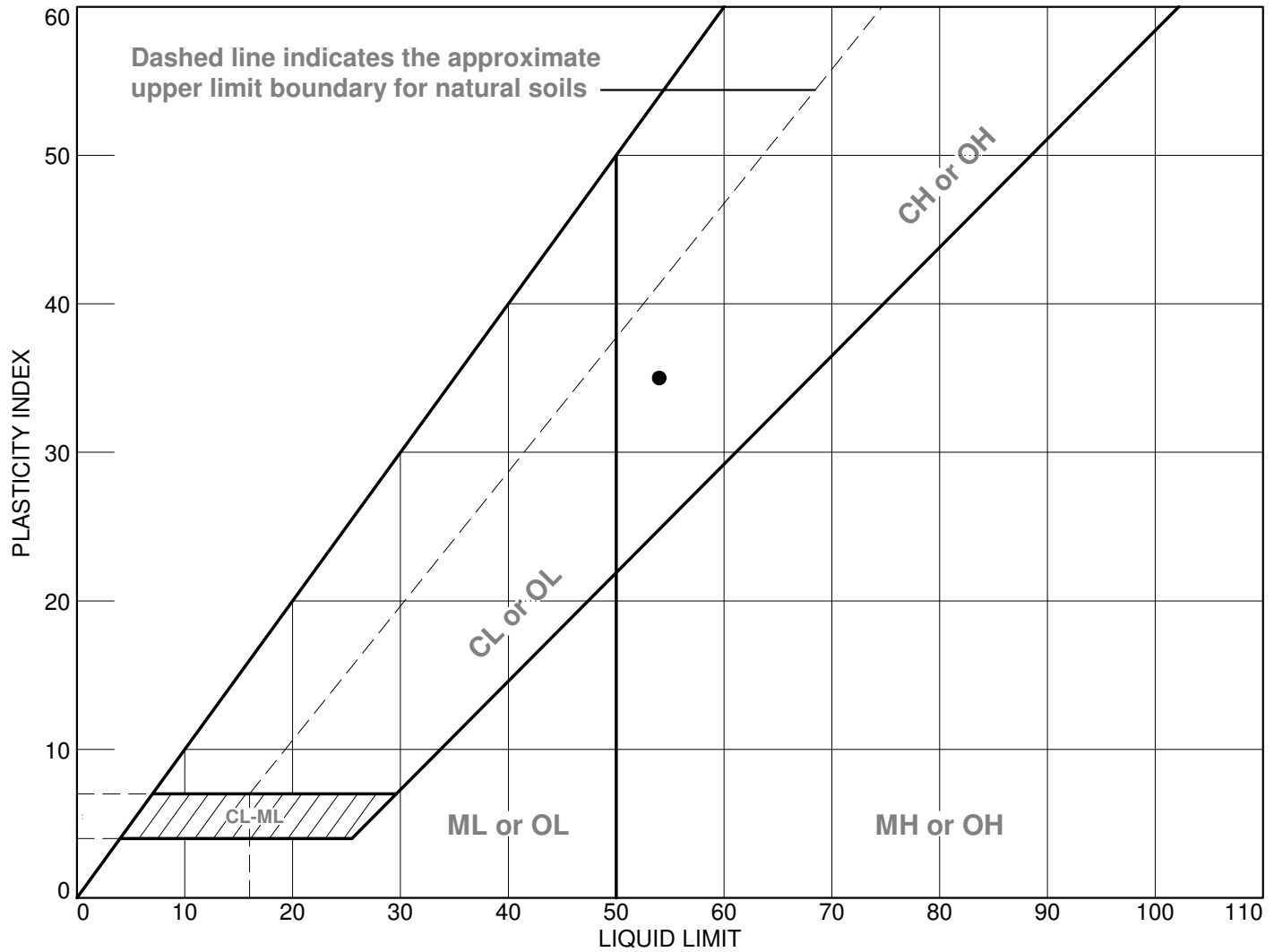


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BH12-3	3-3	4.8m	41.0	18	57	39	CH

Stantec Consulting, Ltd. Burnaby, British Columbia	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC Project No.: 111700431	Figure
---------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------	---------------

Tested By: CG _____ **Checked By:** BH _____

LIQUID AND PLASTIC LIMITS TEST REPORT

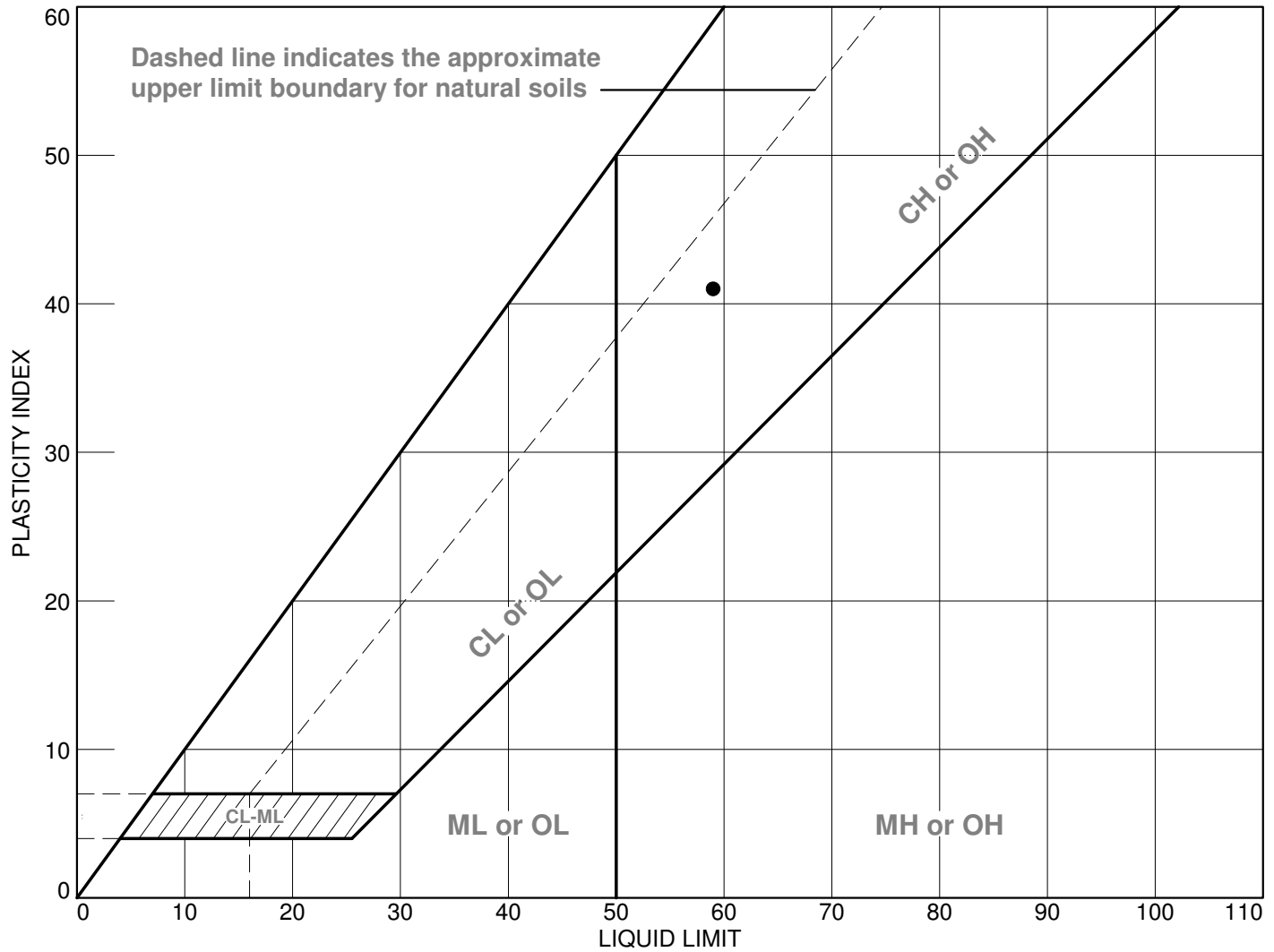


SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BH12-4	4-4	4.8m	36.0	19	54	35	CH

Stantec Consulting, Ltd. Burnaby, British Columbia	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC Project No.: 111700431	Figure
--------------------------------------------------------------	--------------------------------------------------------------------------------------------------------	--------

Tested By: CG Checked By: BH

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA								
SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
●	BH12-7	7-4	4.8m	36.0	18	59	41	CH

Stantec Consulting, Ltd. Burnaby, British Columbia	Client: CAPITAL REGIONAL DISTRICT Project: McLouglin Point, Esquimalt, BC Project No.: 111700431	Figure
---------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------------	---------------

Tested By: CG **Checked By:** BH

Project No: 111700431
 Core Area Wastewater Treatment Program - McLoughlin Point
 Geotechnical Investigation
 Table D-1 Point Load Testing Summary



Borehole ID	Sample Depth		Rock Type	Test Type	Core Diameter [mm]	Length [mm]	Is(45mm) [Mpa]	Is(50) [Mpa]
	[ft]	[m]						
BH12-05	19.00	5.79	Granodiorite	D	44.41	90.00	3.70	3.50
BH12-05	31.00	9.45	Alt Granodiorite	D	44.41	110.00	2.84	2.69
BH12-06	14.67	4.47	Granodiorite	D	44.41	95.00	7.15	6.78
BH12-06	15.00	4.57	Granodiorite	D	44.41	130.00	4.96	4.70
BH12-06	25.42	7.75	Granodiorite	D	44.41	120.00	7.07	6.70
BH12-06	29.50	8.99	Granodiorite	D	44.41	120.00	11.11	10.54
BH12-06	34.00	10.37	Granodiorite	D	44.41	95.00	7.91	7.50
BH12-08	28.08	8.56	Granodiorite	D	44.41	100.00	0.87	0.83
BH12-08	31.08	9.48	Granodiorite	D	44.41	130.00	10.62	10.07
BH12-09	13.08	3.99	Granodiorite	D	44.41	90.00	9.85	9.34
BH12-09	16.42	5.01	Granodiorite	D	44.41	100.00	4.49	4.26
BH12-09	21.75	6.63	Granodiorite	D	44.41	100.00	7.22	6.84
BH12-09	25.33	7.72	Granodiorite	D	44.41	100.00	7.77	7.36
BH12-09	37.17	11.33	Granodiorite	D	44.41	80.00	12.05	11.42
BH12-09	50.00	15.24	Alt Granodiorite	D	44.41	80.00	7.28	6.90
BH12-09	55.33	16.87	Alt Granodiorite	D	44.41	60.00	5.60	5.31

Statistics

Is(50)

Rock Type	Avg	Min	Max
Granodiorite	6.91	0.83	11.42
Alt Granodiorite	4.97	2.69	6.90
ALL	6.55	0.83	11.42

Project No: 111700431

Core Area Wastewater Treatment Program - Victoria Harbour Crossing

Geotechnical Investigation

Table D-2 Point Load Testing Summary



Borehole ID	Sample Depth		Rock Type	Test Type	Core Diameter [mm]	Length [mm]	Is(60mm) [Mpa]	Is(50) [Mpa]
	[ft]	[m]						
MBH13-1	138.42	42.2	Granodiorite	D	60.78	70	2.2	2.4
MBH13-1	150.17	45.8	Granodiorite	D	60.78	105	3.5	3.8
MBH13-1	156.25	47.6	Granodiorite	D	60.78	116	5.8	6.4
MBH13-1	164.50	50.2	Granodiorite	D	60.78	90	6.0	6.6
MBH13-2	97.42	29.7	Granodiorite	D	60.78	90	1.1	1.2
MBH13-2	117.17	35.7	Granodiorite	D	60.78	85	0.6	0.6
MBH13-2	125.42	38.2	Granodiorite	D	60.78	100	3.3	3.6
MBH13-2	132.83	40.5	Granodiorite	D	60.78	65	5.9	6.4
MBH13-2	142.67	43.5	Granodiorite	D	60.78	100	3.3	3.7
MBH13-2	152.08	46.4	Granodiorite	D	60.78	85	2.2	2.4
MBH13-2	154.00	47.0	Granodiorite	D	60.78	85	1.8	2.0
MBH13-2	161.00	49.1	Granodiorite	D	60.78	95	1.0	1.1
MBH13-3A	59.67	18.2	Alt Granodiorite	D	60.78	80	2.0	2.2
MBH13-3A	69.33	21.1	Alt Granodiorite	D	60.78	100	0.8	0.8
MBH13-3A	71.17	21.7	Alt Granodiorite	D	60.78	110	0.9	0.9
MBH13-3A	81.00	24.7	Alt Granodiorite	D	60.78	95	0.4	0.5
MBH13-3A	94.00	28.7	Alt Granodiorite	D	60.78	70	1.7	1.9
MBH13-3A	97.42	29.7	Alt Granodiorite	D	60.78	70	1.2	1.4
MBH13-3A	104.50	31.9	Granodiorite	D	60.78	100	3.5	3.8
MBH13-3A	131.42	40.1	Granodiorite	D	60.78	100	1.5	1.7
MBH13-3A	138.00	42.1	Granodiorite	D	60.78	90	6.1	6.7
MBH13-3A	141.00	43.0	Granodiorite	D	60.78	90	1.6	1.7
MBH13-3A	143.50	43.8	Andesite	D	60.78	90	0.4	0.4
MBH13-3A	150.00	45.7	Granodiorite	D	60.78	90	5.4	5.9
MBH13-3A	150.25	45.8	Granodiorite	D	60.78	90	8.7	9.5
MBH13-3A	154.33	47.1	Granodiorite	D	60.78	90	5.9	6.5
MBH13-3A	157.75	48.1	Granodiorite	D	60.78	110	2.3	2.5
MBH13-3A	161.58	49.3	Granodiorite	A	60.78	45	2.8	3.1
MBH13-4	52.08	15.9	Granodiorite	D	60.78	90	6.9	7.5
MBH13-4	61.75	18.8	Granodiorite	D	60.78	95	5.3	5.8
MBH13-4	62.08	18.9	Granodiorite	D	60.78	100	7.1	7.7
MBH13-4	70.50	21.5	Granodiorite	D	60.78	110	6.6	7.2
MBH13-4	84.75	25.8	Granodiorite	D	60.78	90	5.6	6.1
MBH13-4	90.42	27.6	Granodiorite	D	60.78	100	7.1	7.7
MBH13-4	93.42	28.5	Granodiorite	D	60.78	105	4.2	4.6
MBH13-4	108.42	33.1	Granodiorite	D	60.78	100	2.2	2.3
MBH13-4	116.08	35.4	Granodiorite	D	60.78	100	2.3	2.5
MBH13-4	123.58	37.7	Granodiorite	D	60.78	80	3.9	4.3
MBH13-4	132.83	40.5	Alt Granodiorite	D	60.78	90	1.4	1.5

Project No: 111700431

Core Area Wastewater Treatment Program - Victoria Harbour Crossing
Geotechnical Investigation

Table D-2 Point Load Testing Summary



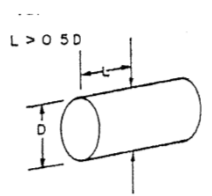
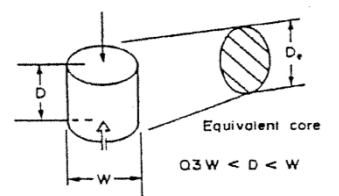
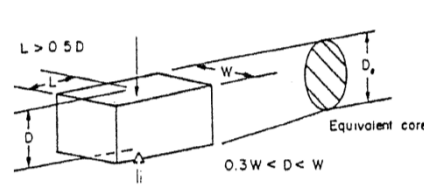
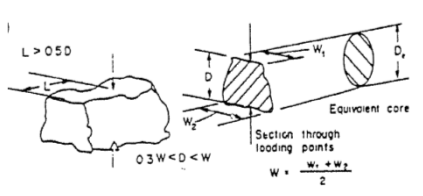
Statistics

Is(50)

Rock Type	Avg	Min	Max
Granodiorite	3.7	0.4	9.5
Alt Granodio	4.2	1.5	7.7
Andesite	0.1	0.1	0.1
ALL	3.8	0.4	9.5

POINT LOAD STRENGTH INDEX TEST ASTM D5731-08

Project Number		09-1416-0062/5000							Location		Not Provided		
Project		CRD WWTP Geotechnical Investigation							Schedule #		52		
Client		Stantec							Machine ID		A1252-9-05		
Test #	Type	Borehole	Sample #	Depth (ft)	Width W (mm)	Diameter D (mm)	Load P (kN)	De ² (mm ²)	De (mm)	I _s (MPa)	F	I _{s(50)} (MPa)	Remarks
1	D	MBH13-1	N/A	139.00-140.00		60.56	15.615	3667.51	60.56	4.26	1.09	4.64	Failed partially along foliation
2	D	MBH13-1	N/A	162.17-163.67		60.77	18.661	3692.99	60.77	5.05	1.09	5.52	
3	D	MBH13-3A	N/A	112.83-113.92		61.21	3.687	3746.66	61.21	0.98	1.10	1.08	Failed along foliation
4	D	MBH13-4	N/A	82.58-84.33		60.68	22.308	3682.06	60.68	6.06	1.09	6.61	Failed partially along foliation
5	D	MBH13-4	N/A	123.83-125.42		60.86	13.064	3703.94	60.86	3.53	1.09	3.85	Failed partially along foliation
6	D	BH12-05	N/A	25.58-26.83		44.5	20.784	1980.25	44.50	10.50	0.95	9.96	
7	D	BH12-06	N/A	11.58-12.75		44.73	16.793	2000.77	44.73	8.39	0.95	7.98	
8	D	BH12-09	N/A	11.17-12.50		44.01	12.534	1936.88	44.01	6.47	0.94	6.11	Failed partially along foliation

TESTING GEOMETRIES			
Diametral (D)	Axial (A)	Block (B)	Irregular Lump (L)
			
M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
Technician	Date	Checked	Dated

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-1
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	139.00-140.00
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>257.60</u>	Diameter (mm)	<u>60.66</u>
Stress σ (MPa)	<u>89.1</u>	Height (mm)	<u>128.41</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.90</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>371.10</u>
		Mass (g)	<u>976.40</u>
		Moisture Content (%)	<u>0.15</u>
		Wet Density (Kg/m ³)	<u>2631.08</u>
		Dry Density (Kg/m ³)	<u>2627.03</u>

Failure Mode	Notes
Type: <u>1,2</u>	- Water content as received
Degrees:* <u>20</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments


BEFORE TEST

AFTER TEST

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.*

M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-1
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	162.17-163.67
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>214.70</u>	Diameter (mm)	<u>60.71</u>
Stress σ (MPa)	<u>74.2</u>	Height (mm)	<u>123.94</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.95</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>358.77</u>
		Mass (g)	<u>951.30</u>
		Moisture Content (%)	<u>0.12</u>
		Wet Density (Kg/m ³)	<u>2651.52</u>
		Dry Density (Kg/m ³)	<u>2648.45</u>

Failure Mode	Notes
Type: <u>1,2</u>	- Water content as received
Degrees.* <u>25</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens

Reference
ASTM D7012-10 Method C

Project No.: 09-1416-0062/5000	Borehole: MBH13-2
Project: CRD WWTP Geotechnical Investigation	Sample Number: N/A
Location: Not Provided	Depth (ft): 134.58-135.67
Client: Stantec	Lab ID No: 52

Testing Results		Sample Measurements	
Max Load (kN)	<u>317.90</u>	Diameter (mm)	<u>60.92</u>
Stress σ (MPa)	<u>109.1</u>	Height (mm)	<u>128.90</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>29.15</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>375.72</u>
		Mass (g)	<u>984.00</u>
		Moisture Content (%)	<u>0.09</u>
		Wet Density (Kg/m ³)	<u>2618.98</u>
		Dry Density (Kg/m ³)	<u>2616.59</u>

Failure Mode	Notes
Type: <u>4</u>	- Water content as received
Degrees:* <u>22</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



BEFORE TEST



AFTER TEST

** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.*

M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-2
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	158.92-159.42
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>143.50</u>	Diameter (mm)	<u>60.68</u>
Stress σ (MPa)	<u>49.6</u>	Height (mm)	<u>128.20</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.92</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>370.74</u>
		Mass (g)	<u>972.40</u>
		Moisture Content (%)	<u>0.09</u>
		Wet Density (Kg/m ³)	<u>2622.86</u>
		Dry Density (Kg/m ³)	<u>2620.43</u>

Failure Mode	Notes
Type: <u>4</u>	- Water content as received
Degrees:* <u>30</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-3A
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	84.33-85.75
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>39.50</u>	Diameter (mm)	<u>60.74</u>
Stress σ (MPa)	<u>13.6</u>	Height (mm)	<u>125.73</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.98</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>364.32</u>
		Mass (g)	<u>913.30</u>
		Moisture Content (%)	<u>0.61</u>
		Wet Density (Kg/m ³)	<u>2506.89</u>
		Dry Density (Kg/m ³)	<u>2491.79</u>

Failure Mode	Notes
Type: <u>4</u>	- Water content as received
Degrees:* <u>15</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens

 Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-3A
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	112.83-113.92
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>51.10</u>	Diameter (mm)	<u>60.84</u>
Stress σ (MPa)	<u>17.6</u>	Height (mm)	<u>128.89</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>29.07</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>374.70</u>
		Mass (g)	<u>985.00</u>
		Moisture Content (%)	<u>0.11</u>
		Wet Density (Kg/m ³)	<u>2628.75</u>
		Dry Density (Kg/m ³)	<u>2625.81</u>

Failure Mode	Notes
Type: <u>1</u>	- Water content as received
Degrees:* <u>20</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-4
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	82.58-84.33
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>146.90</u>	Diameter (mm)	<u>60.71</u>
Stress σ (MPa)	<u>50.7</u>	Height (mm)	<u>124.28</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.95</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>359.76</u>
		Mass (g)	<u>946.60</u>
		Moisture Content (%)	<u>0.18</u>
		Wet Density (Kg/m ³)	<u>2631.21</u>
		Dry Density (Kg/m ³)	<u>2626.48</u>

Failure Mode	Notes
Type: <u>4</u>	- Water content as received
Degrees:* <u>18</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	MBH13-4
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	123.83-125.42
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>186.80</u>	Diameter (mm)	<u>60.65</u>
Stress σ (MPa)	<u>64.7</u>	Height (mm)	<u>125.72</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>28.89</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>363.21</u>
		Mass (g)	<u>953.70</u>
		Moisture Content (%)	<u>0.24</u>
		Wet Density (Kg/m ³)	<u>2625.77</u>
		Dry Density (Kg/m ³)	<u>2619.43</u>

Failure Mode	Notes
Type: <u>2,1</u>	- Water content as received
Degrees:* <u>30</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens

 Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	BH12-05
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	25.58-26.83
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>346.50</u>	Diameter (mm)	<u>44.51</u>
Stress σ (MPa)	<u>222.7</u>	Height (mm)	<u>94.77</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>15.56</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>147.46</u>
		Mass (g)	<u>395.20</u>
		Moisture Content (%)	<u>0.10</u>
		Wet Density (Kg/m ³)	<u>2680.04</u>
		Dry Density (Kg/m ³)	<u>2677.36</u>

Failure Mode	Notes
Type: <u>1</u>	- Water content as received
Degrees:* <u>22</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens

 Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	BH12-06
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	11.58-12.75
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>187.20</u>	Diameter (mm)	<u>44.81</u>
Stress σ (MPa)	<u>118.7</u>	Height (mm)	<u>95.81</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>15.77</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>151.10</u>
		Mass (g)	<u>395.30</u>
		Moisture Content (%)	<u>0.05</u>
		Wet Density (Kg/m ³)	<u>2616.23</u>
		Dry Density (Kg/m ³)	<u>2614.85</u>

Failure Mode	Notes
Type: <u>2,1</u>	- Water content as received
Degrees:* <u>10</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

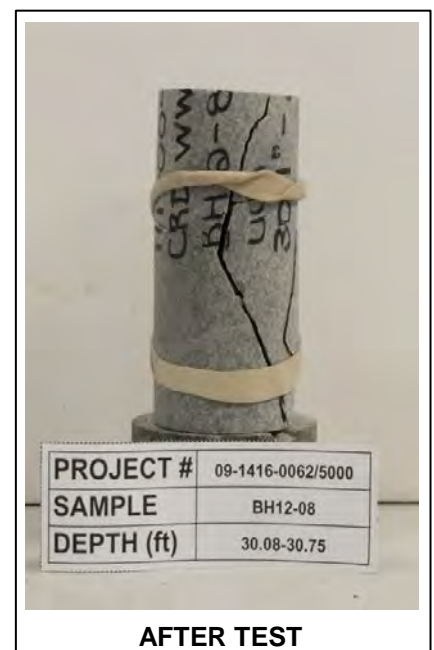
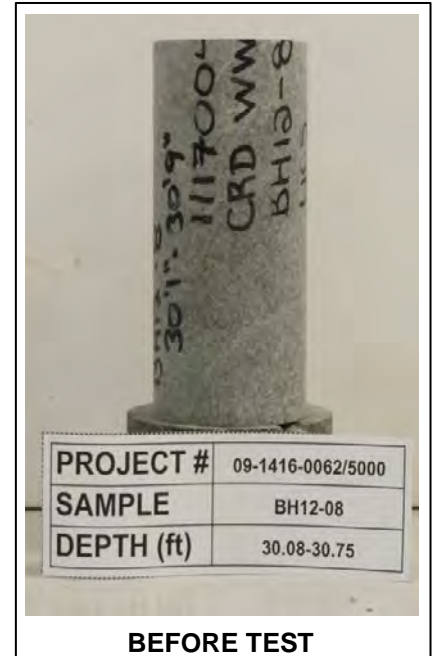
Unconfined Compressive Strength of Intact Rock Core Specimens
Reference
 ASTM D7012-10 Method C

Project No.:	09-1416-0062/5000	Borehole:	BH12-08
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	30.08-30.75
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>130.90</u>	Diameter (mm)	<u>44.75</u>
Stress σ (MPa)	<u>83.2</u>	Height (mm)	<u>94.00</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>15.73</u>
Lithology	<u>Gneiss</u>	Volume (cm ³)	<u>147.84</u>
		Mass (g)	<u>392.20</u>
		Moisture Content (%)	<u>0.10</u>
		Wet Density (Kg/m ³)	<u>2652.80</u>
		Dry Density (Kg/m ³)	<u>2650.07</u>

Failure Mode	Notes
Type: <u>4,2</u>	- Water content as received
Degrees:* <u>23</u>	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.*

M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Unconfined Compressive Strength of Intact Rock Core Specimens

Reference
ASTM D7012-10 Method C

Project No.: 09-1416-0062/5000	Borehole:	BH12-09
Project: CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location: Not Provided	Depth (ft):	11.17-12.50
Client: Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (kN)	<u>152.90</u>	Diameter (mm)	<u>44.02</u>
Stress σ (MPa)	<u>100.5</u>	Height (mm)	<u>93.79</u>
Pace Rate (kN/s)	<u>1.25</u>	Area (cm ²)	<u>15.22</u>
Lithology	<u>Granodiorite</u>	Volume (cm ³)	<u>142.74</u>
		Mass (g)	<u>377.70</u>
		Moisture Content (%)	<u>0.08</u>
		Wet Density (Kg/m ³)	<u>2646.06</u>
		Dry Density (Kg/m ³)	<u>2643.96</u>

Failure Mode	Notes
Type: <u>6,2</u>	- Water content as received
Degrees.* _____	Mode:
	(1) Diagonal shear plane(s)
	(2) Vertical fracture(s)
	(3) Vertical splitting
	(4) Shear along foliation /discontinuity
	(5) Conical
* Degrees measured with respect to core axis.	(6) Spalling
	(7) Other

Comments



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M. Miller	March 21, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test
Reference
 ISRM 1981 (p120-121)

Project No.:	09-1416-0062/5000	Borehole:	MBH13-1
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	162.17-163.67
Client:	Stantec	Lab ID No:	52

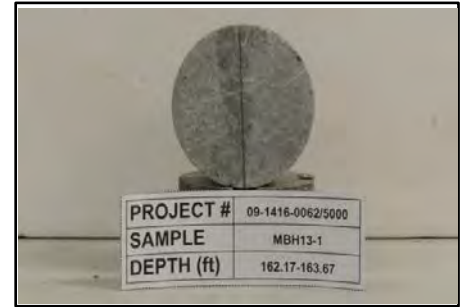
Testing Results		Sample Measurements	
Max Load (MN)	<u>0.0272</u>	Diameter (mm)	<u>60.90</u>
Tensile Stress (MPa)	<u>8.3</u>	Thickness (mm)	<u>34.12</u>
		Area (cm ²)	<u>29.13</u>
		Volume (cm ³)	<u>99.39</u>
		Mass (g)	<u>260.50</u>
		Moisture Content (%)	<u>0.08</u>
		Wet Density (Kg/m ³)	<u>2621.04</u>
		Dry Density (Kg/m ³)	<u>2619.04</u>

Failure Mode		Calibration	
Type:	<u>Vertical Splitting</u>	Machine ID	<u>TestNet-GP</u>
Load Orientation		Transducer ID	<u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees	<u>90</u>	Ram Area cm ²	<u>N/A</u>
		Data Logger	<u>N/A</u>

Comments

Lithology: Granodiorite

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FRONT BEFORE

BACK BEFORE

FRONT AFTER

BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test
Reference
 ISRM 1981 (p120-121)

Project No.:	09-1416-0062/5000	Borehole:	MBH13-2
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	134.58-135.67
Client:	Stantec	Lab ID No:	52

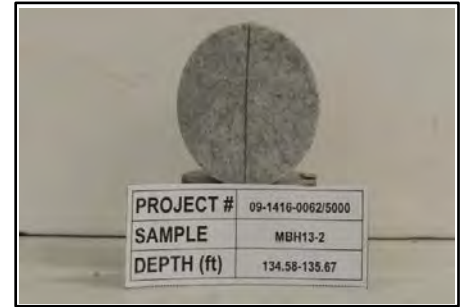
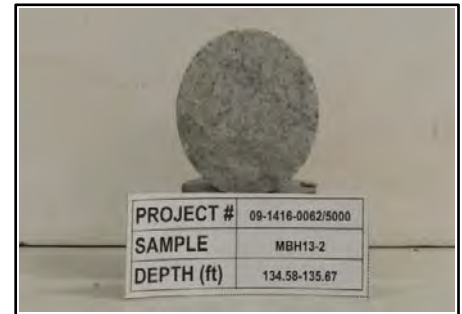
Testing Results		Sample Measurements	
Max Load (MN)	<u>0.0333</u>	Diameter (mm)	<u>60.91</u>
Tensile Stress (MPa)	<u>10.6</u>	Thickness (mm)	<u>32.93</u>
		Area (cm ²)	<u>29.14</u>
		Volume (cm ³)	<u>95.95</u>
		Mass (g)	<u>252.20</u>
		Moisture Content (%)	<u>0.12</u>
		Wet Density (Kg/m ³)	<u>2628.37</u>
		Dry Density (Kg/m ³)	<u>2625.25</u>

Failure Mode		Calibration	
Type:	<u>Vertical Splitting</u>	Machine ID	<u>TestNet-GP</u>
Load Orientation		Transducer ID	<u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees	<u>90</u>	Ram Area cm ²	<u>N/A</u>
		Data Logger	<u>N/A</u>

Comments

Lithology: Granodiorite

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FRONT BEFORE

BACK BEFORE

FRONT AFTER

BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test

Reference
ISRM 1981 (p120-121)

Project No.: 09-1416-0062/5000	Borehole:	MBH13-3A
Project: CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location: Not Provided	Depth (ft):	84.33-85.75
Client: Stantec	Lab ID No.:	52

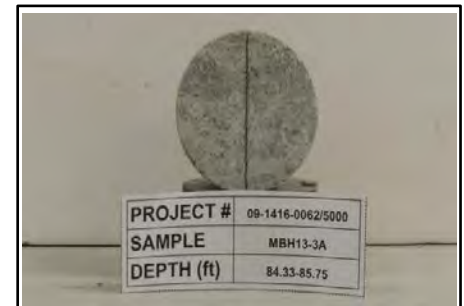
Testing Results	Sample Measurements
Max Load (MN) <u>0.0106</u>	Diameter (mm) <u>60.82</u>
Tensile Stress (MPa) <u>3.3</u>	Thickness (mm) <u>33.17</u>
	Area (cm ²) <u>29.05</u>
	Volume (cm ³) <u>96.37</u>
	Mass (g) <u>240.90</u>
	Moisture Content (%) <u>0.37</u>
	Wet Density (Kg/m ³) <u>2499.82</u>
	Dry Density (Kg/m ³) <u>2490.50</u>

Failure Mode	Calibration
Type: <u>Vertical Splitting</u>	Machine ID <u>TestNet-GP</u>
Load Orientation	Transducer ID <u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees <u>90</u>	Ram Area cm ² <u>N/A</u>
	Data Logger <u>N/A</u>

Comments

Lithology: Gneiss

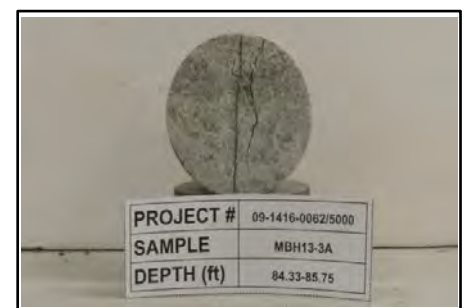
** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.*



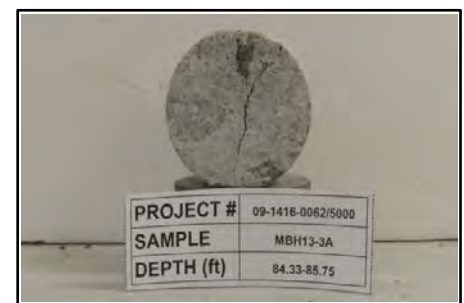
FRONT BEFORE



BACK BEFORE



FRONT AFTER



BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test

Reference
ISRM 1981 (p120-121)

Project No.: 09-1416-0062/5000	Borehole:	MBH13-4
Project: CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location: Not Provided	Depth (ft):	82.58-84.33
Client: Stantec	Lab ID No:	52

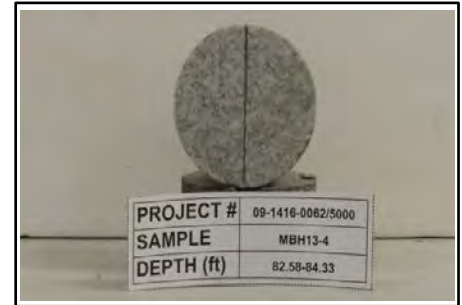
Testing Results	Sample Measurements
Max Load (MN) <u>0.0396</u>	Diameter (mm) <u>60.75</u>
Tensile Stress (MPa) <u>12.1</u>	Thickness (mm) <u>34.30</u>
	Area (cm ²) <u>28.99</u>
	Volume (cm ³) <u>99.42</u>
	Mass (g) <u>258.70</u>
	Moisture Content (%) <u>0.15</u>
	Wet Density (Kg/m ³) <u>2602.08</u>
	Dry Density (Kg/m ³) <u>2598.07</u>

Failure Mode	Calibration
Type: <u>Vertical Splitting/Shear</u>	Machine ID <u>TestNet-GP</u>
Load Orientation	Transducer ID <u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees <u>90</u>	Ram Area cm ² <u>N/A</u>
	Data Logger <u>N/A</u>

Comments

Lithology: Granodiorite

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FRONT BEFORE



BACK BEFORE



FRONT AFTER



BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test

Reference
ISRM 1981 (p120-121)

Project No.: 09-1416-0062/5000	Borehole:	BH12-05
Project: CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location: Not Provided	Depth (ft):	25.58-26.83
Client: Stantec	Lab ID No.:	52

Testing Results	Sample Measurements
Max Load (MN) <u>0.0228</u>	Diameter (mm) <u>44.49</u>
Tensile Stress (MPa) <u>13.2</u>	Thickness (mm) <u>24.62</u>
	Area (cm ²) <u>15.55</u>
	Volume (cm ³) <u>38.27</u>
	Mass (g) <u>102.00</u>
	Moisture Content (%) <u>0.11</u>
	Wet Density (Kg/m ³) <u>2665.00</u>
	Dry Density (Kg/m ³) <u>2661.97</u>

Failure Mode	Calibration
Type: <u>Vertical Splitting</u>	Machine ID <u>TestNet-GP</u>
Load Orientation	Transducer ID <u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees <u>90</u>	Ram Area cm ² <u>N/A</u>
	Data Logger <u>N/A</u>

Comments

Lithology: Gneiss

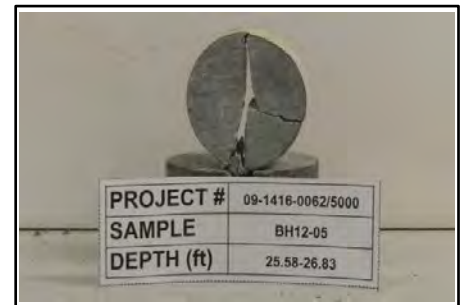
** The test data given herein pertain to the sample provided only. This report constitutes a testing service only. Interpretation of the data given here may be provided upon request.*



FRONT BEFORE



BACK BEFORE



FRONT AFTER



BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

Tensile Strength By The Brazil Test
Reference
 ISRM 1981 (p120-121)

Project No.:	09-1416-0062/5000	Borehole:	BH12-09
Project:	CRD WWTP Geotechnical Investigation	Sample Number:	N/A
Location:	Not Provided	Depth (ft):	11.17-12.50
Client:	Stantec	Lab ID No:	52

Testing Results		Sample Measurements	
Max Load (MN)	<u>0.0152</u>	Diameter (mm)	<u>44.03</u>
Tensile Stress (MPa)	<u>8.4</u>	Thickness (mm)	<u>26.04</u>
		Area (cm ²)	<u>15.23</u>
		Volume (cm ³)	<u>39.65</u>
		Mass (g)	<u>104.10</u>
		Moisture Content (%)	<u>0.19</u>
		Wet Density (Kg/m ³)	<u>2625.56</u>
		Dry Density (Kg/m ³)	<u>2620.55</u>

Failure Mode		Calibration	
Type:	<u>Vertical Splitting</u>	Machine ID	<u>TestNet-GP</u>
Load Orientation		Transducer ID	<u>N/A</u>
Direction of loading axis with respect to bedding or foliation in degrees	<u>90</u>	Ram Area cm ²	<u>N/A</u>
		Data Logger	<u>N/A</u>

Comments

Lithology: Granodiorite

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FRONT BEFORE

BACK BEFORE

FRONT AFTER

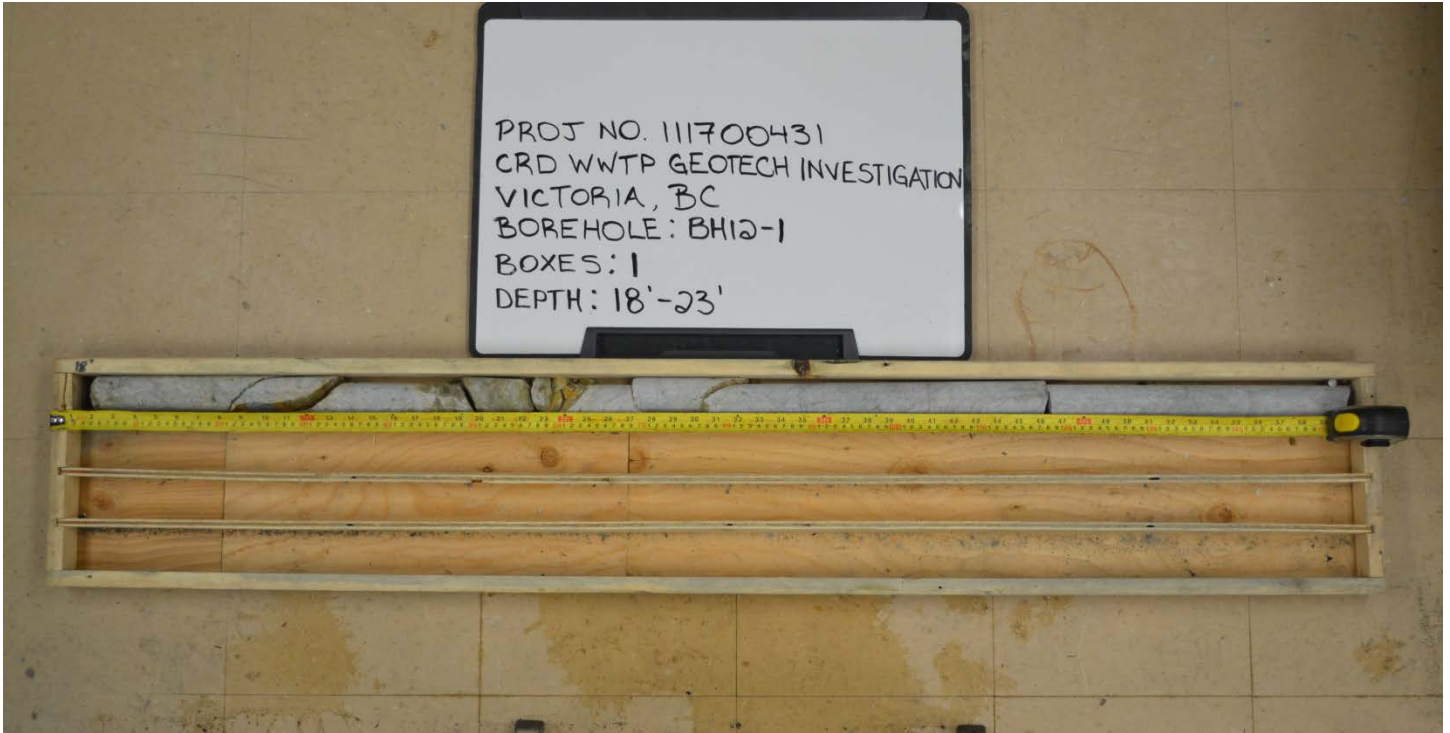
BACK AFTER

M. Miller	March 25, 2013	E. Kostyukov	March 26, 2013
TESTED BY	DATE	CHECKED BY	DATE

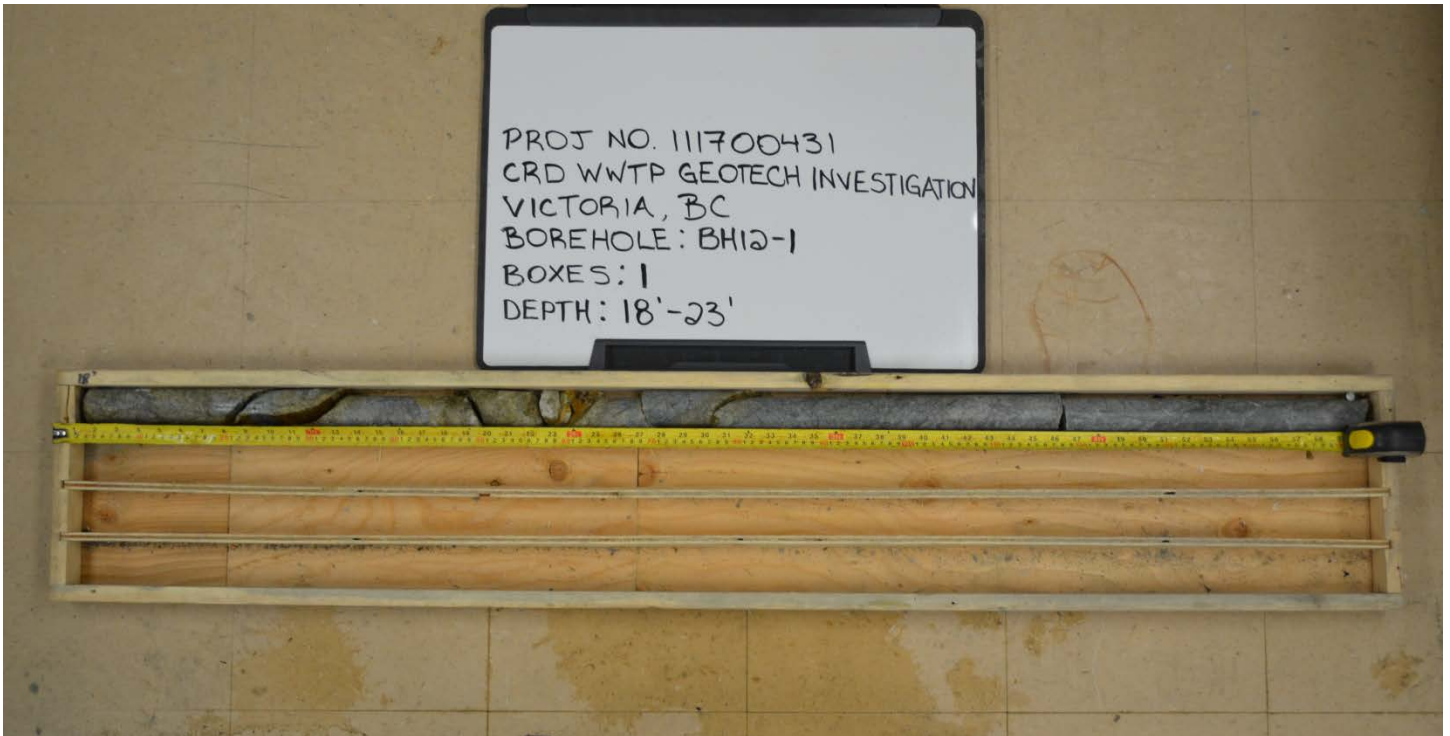


APPENDIX E

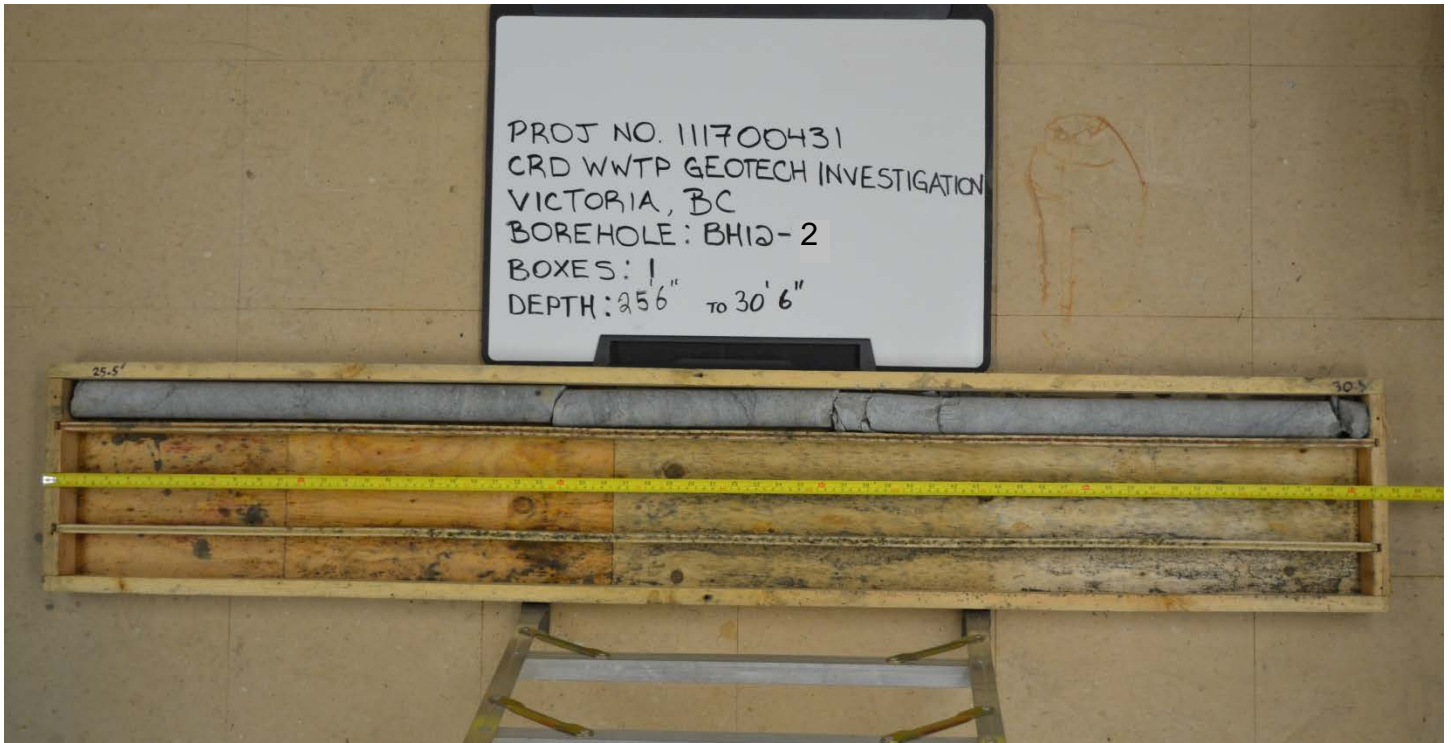
Rock Core Photos



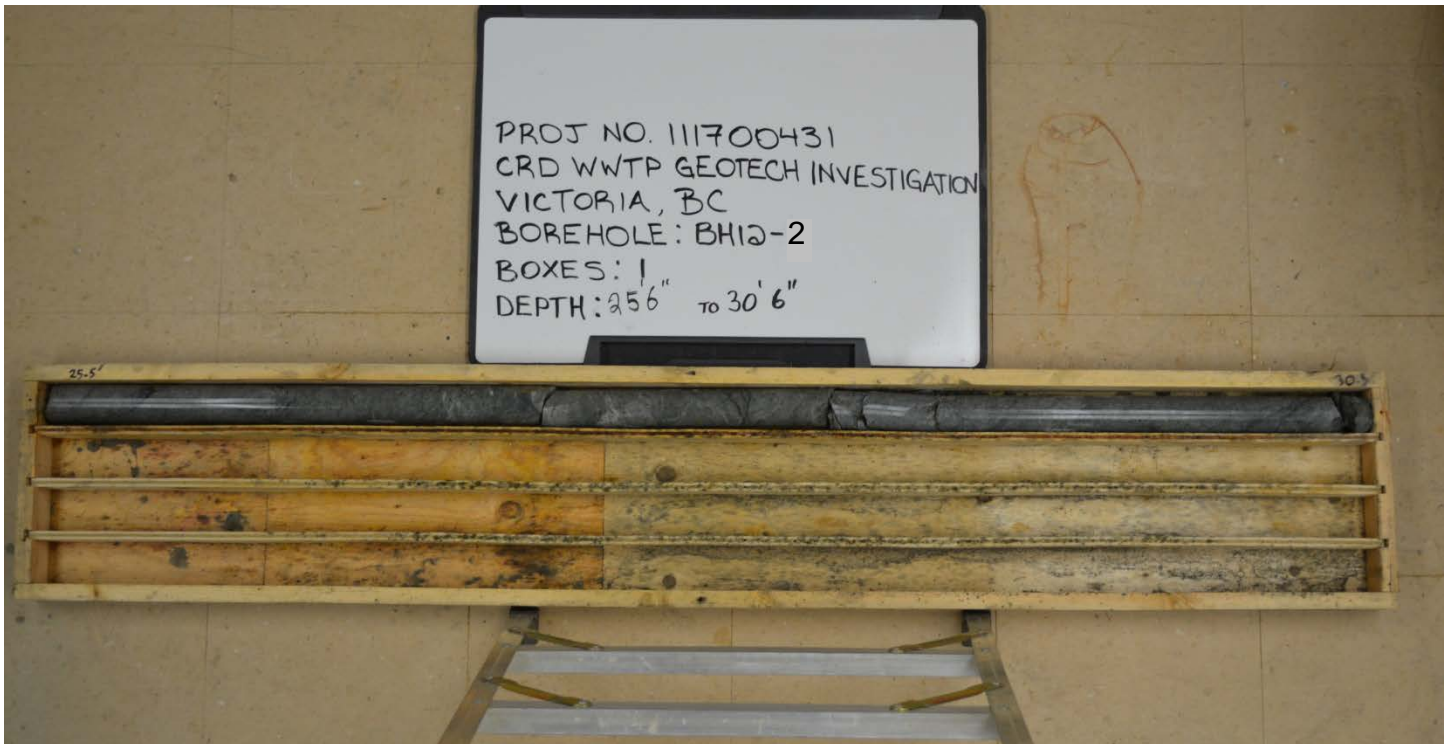
BH12-1B - Depth from 18' to 23' – Dry



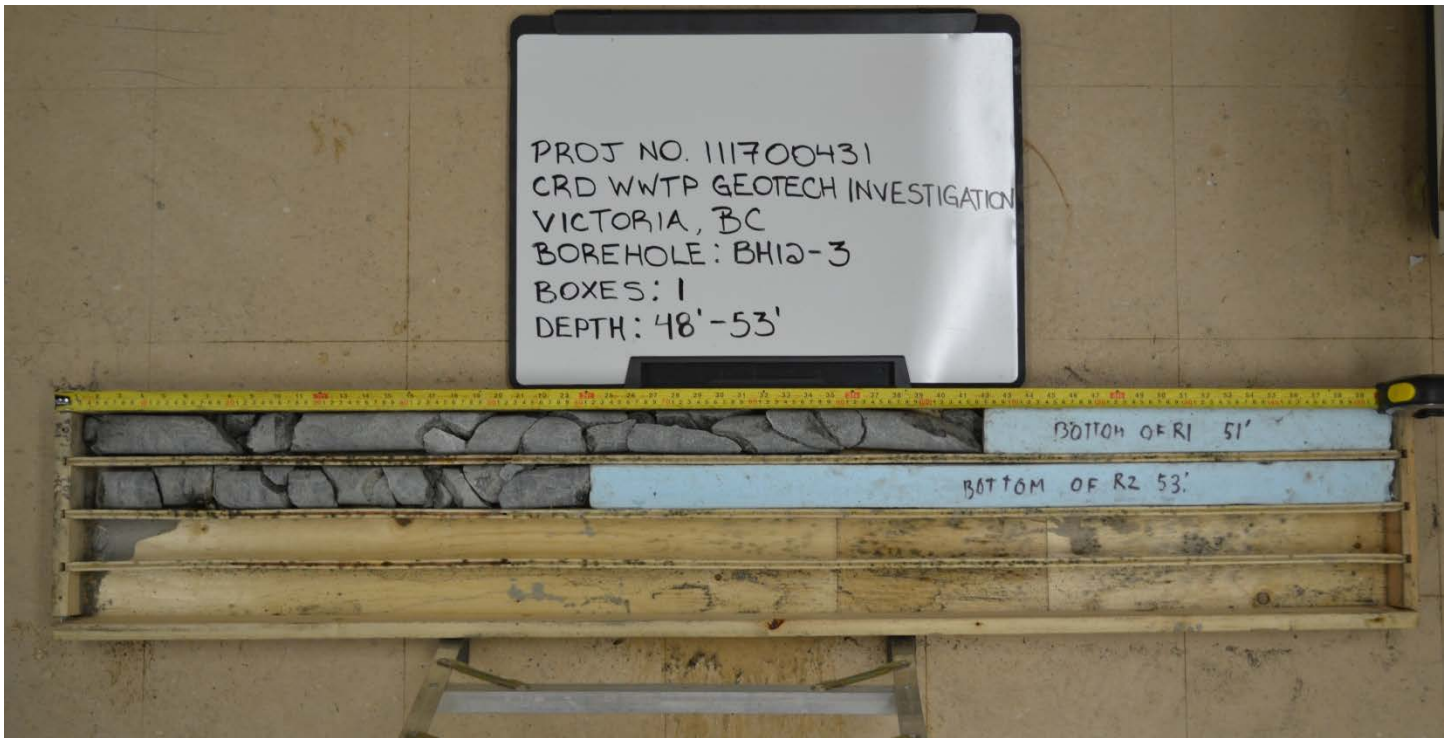
BH12-1B - Depth from 18' to 23' – Wet



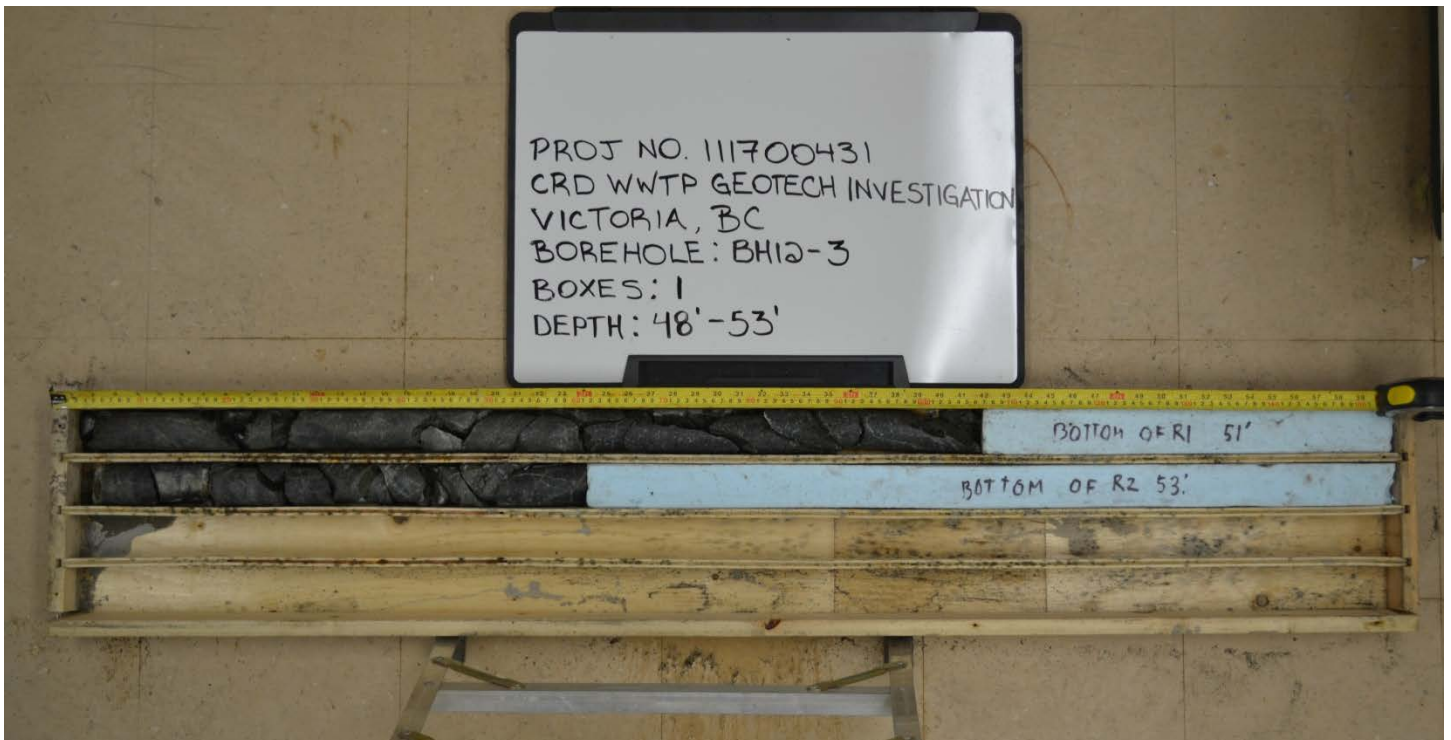
BH12-1 - Depth from 25'6" to 30'6" – Dry



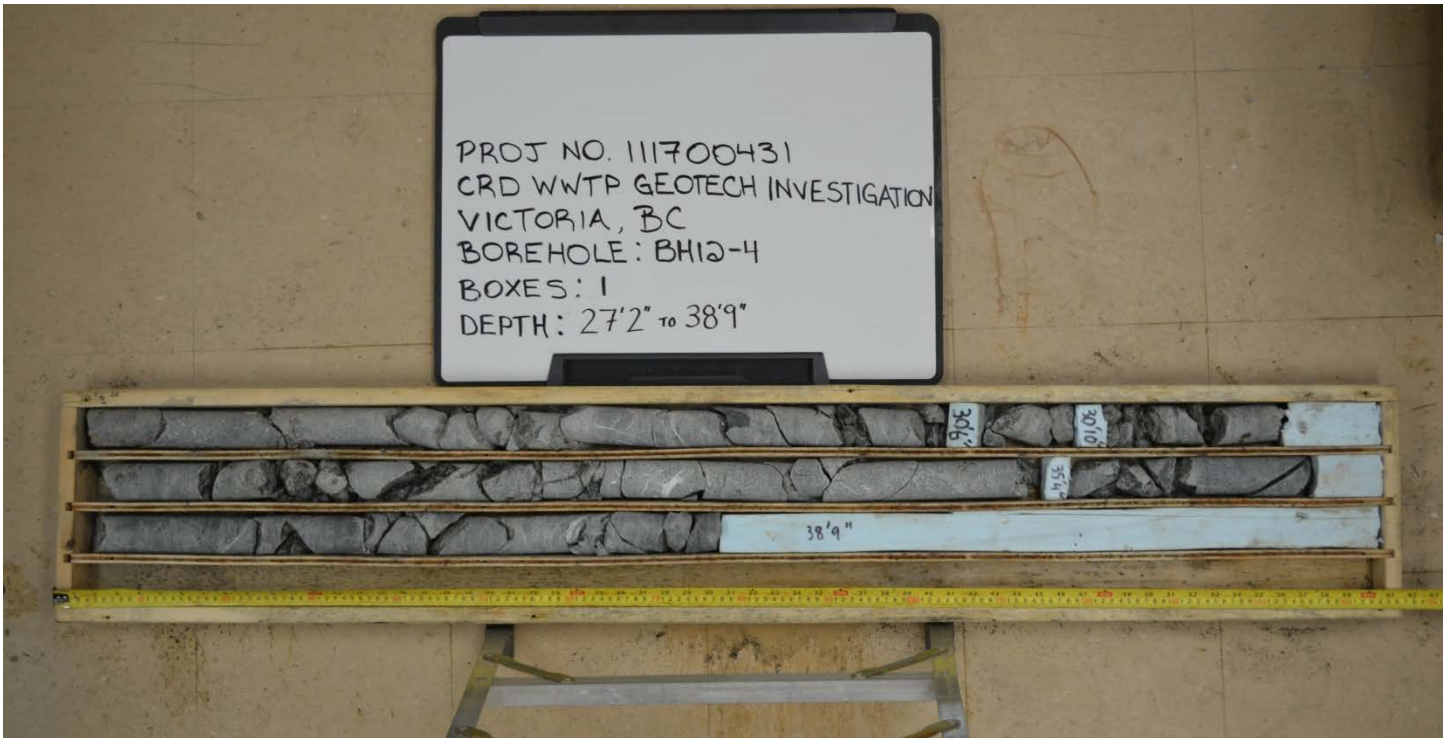
BH12-1 - Depth from 25'6" to 30'6" – Wet



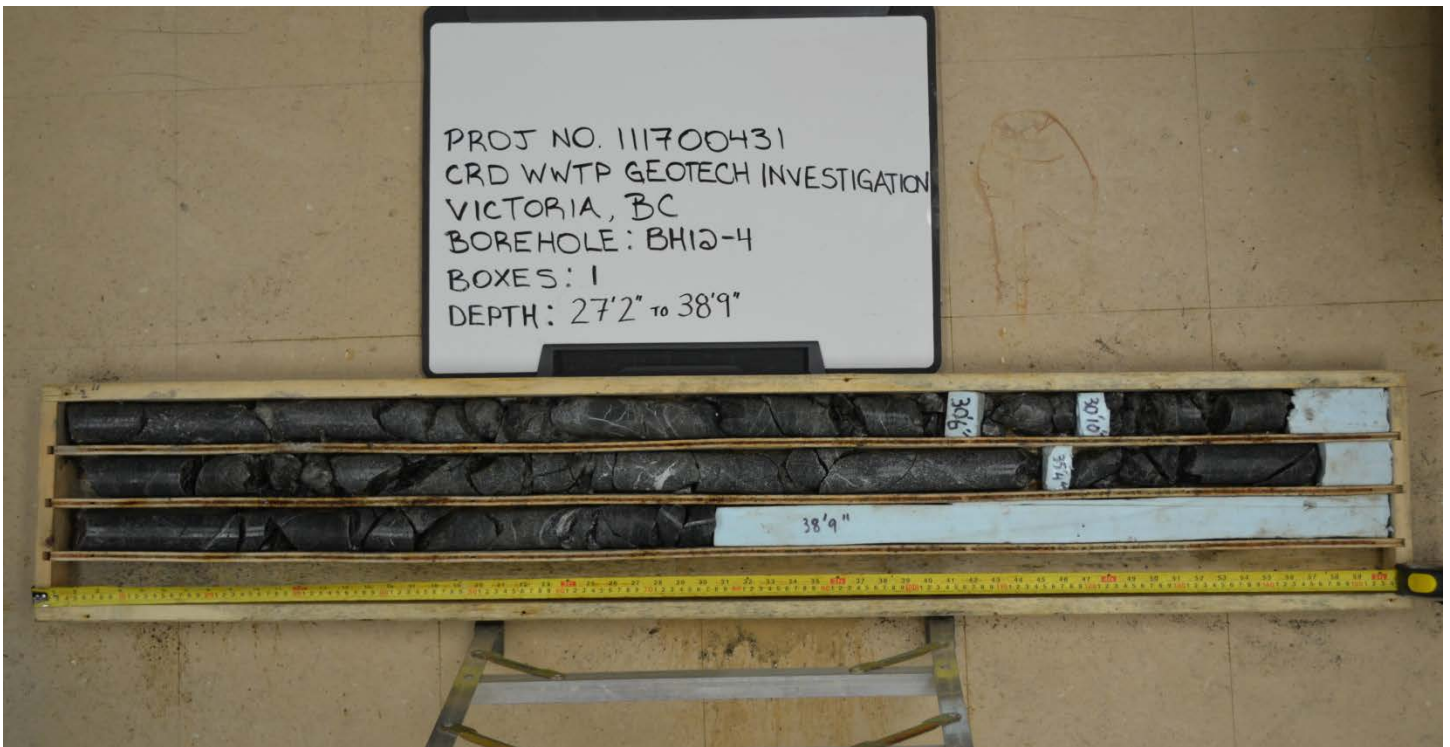
BH12-3 - Depth from 48' to 53' – Dry



BH12-3 - Depth from 48' to 53' – Wet



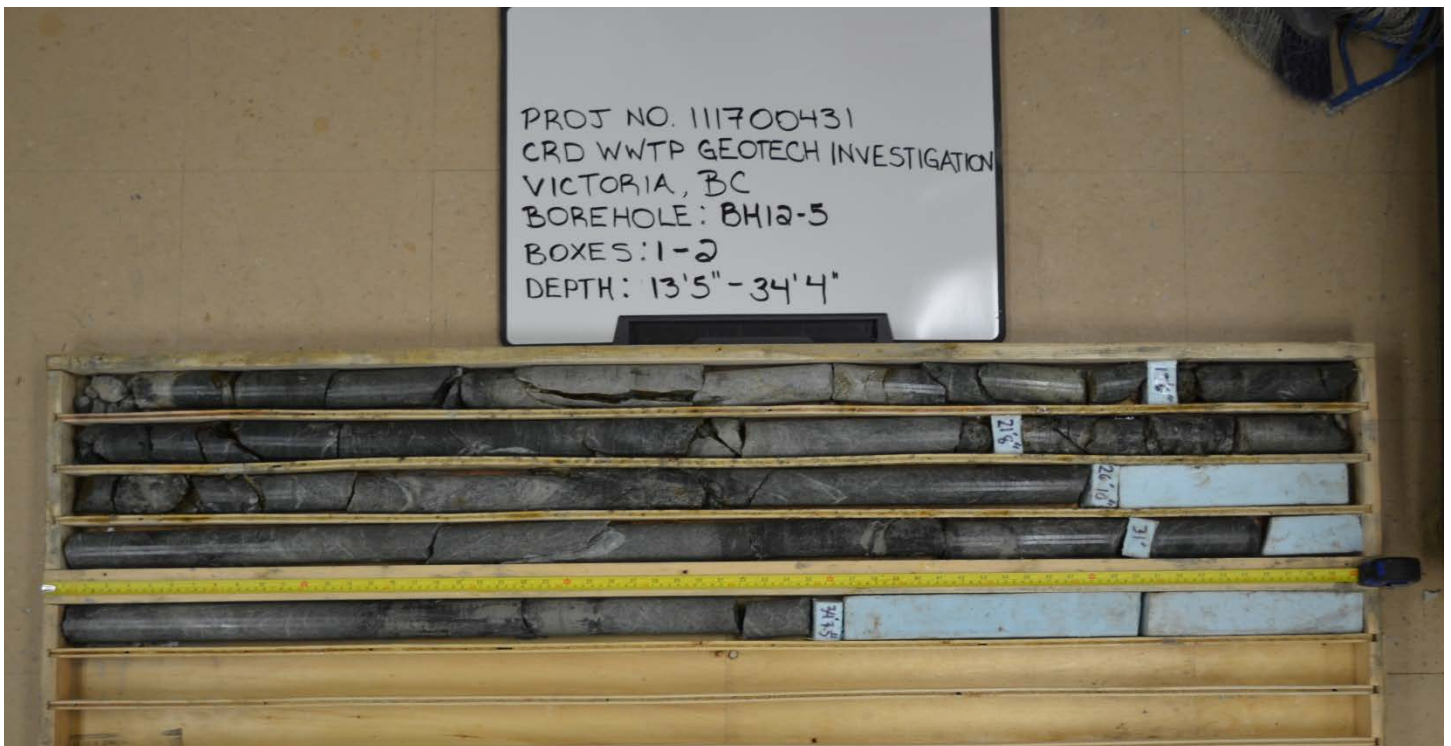
BH12-4 - Depth from 27'2" to 38'9" – Dry



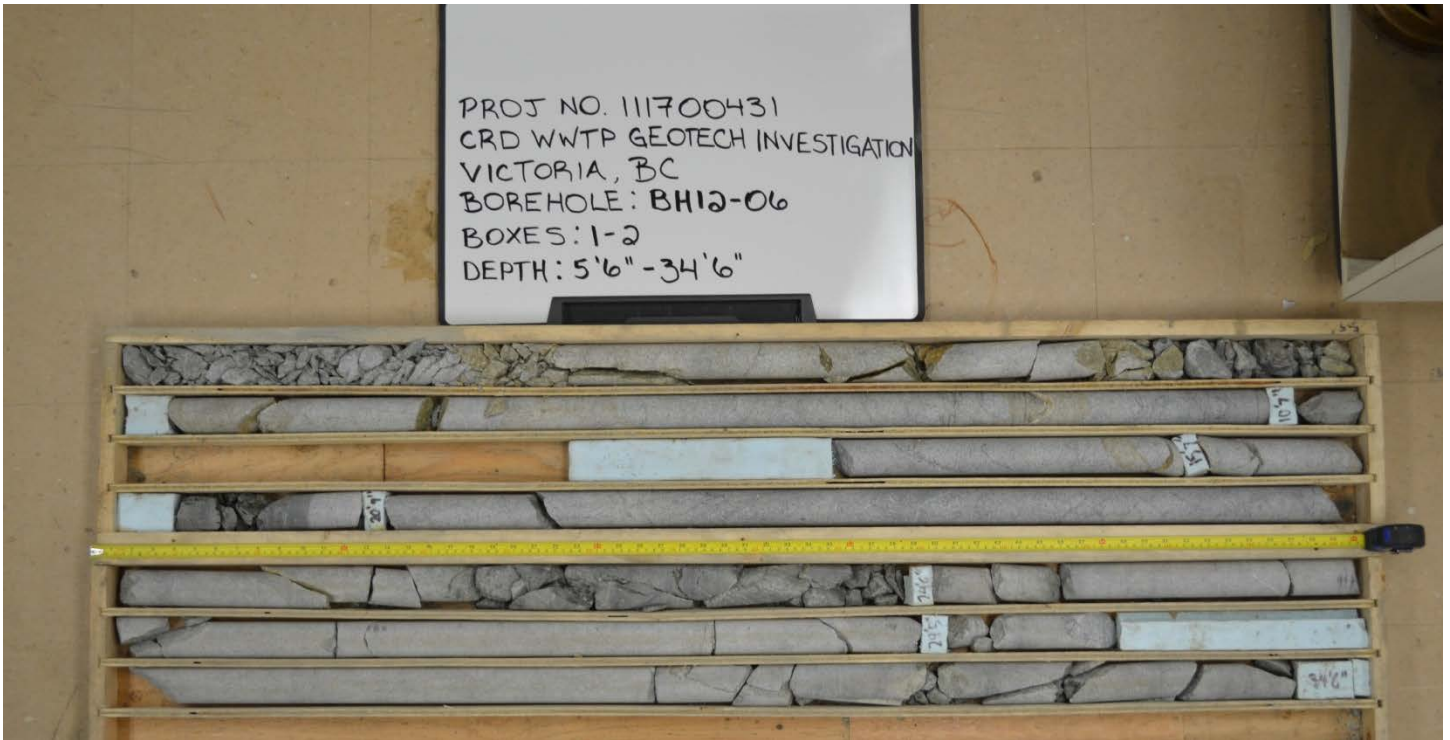
BH12-4 - Depth from 27'2" to 38'9" – Wet



BH12-5 - Depth from 13'5" to 34'4" – Dry



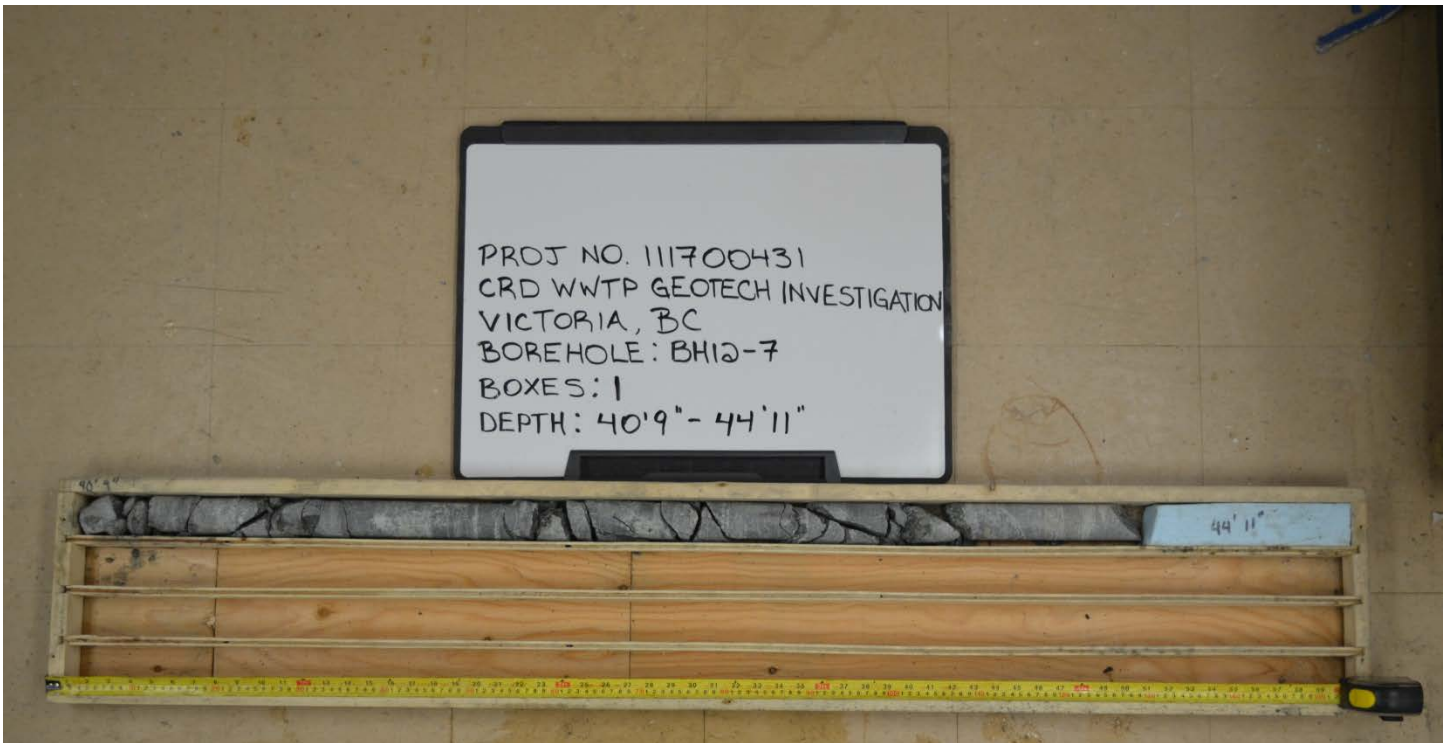
BH12-5 - Depth from 13'5" to 34'4" – Wet



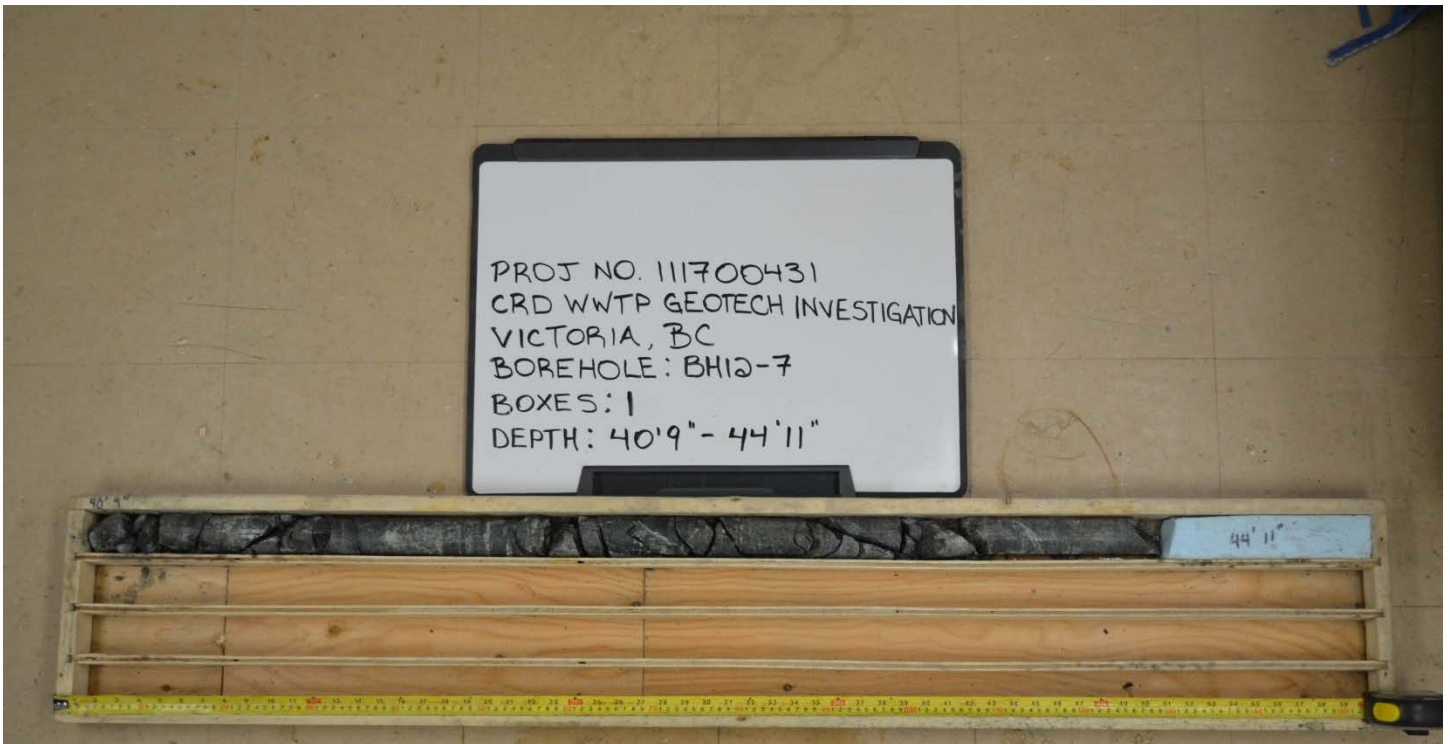
BH12-6 - Depth from 5'6" to 34'6" – Dry



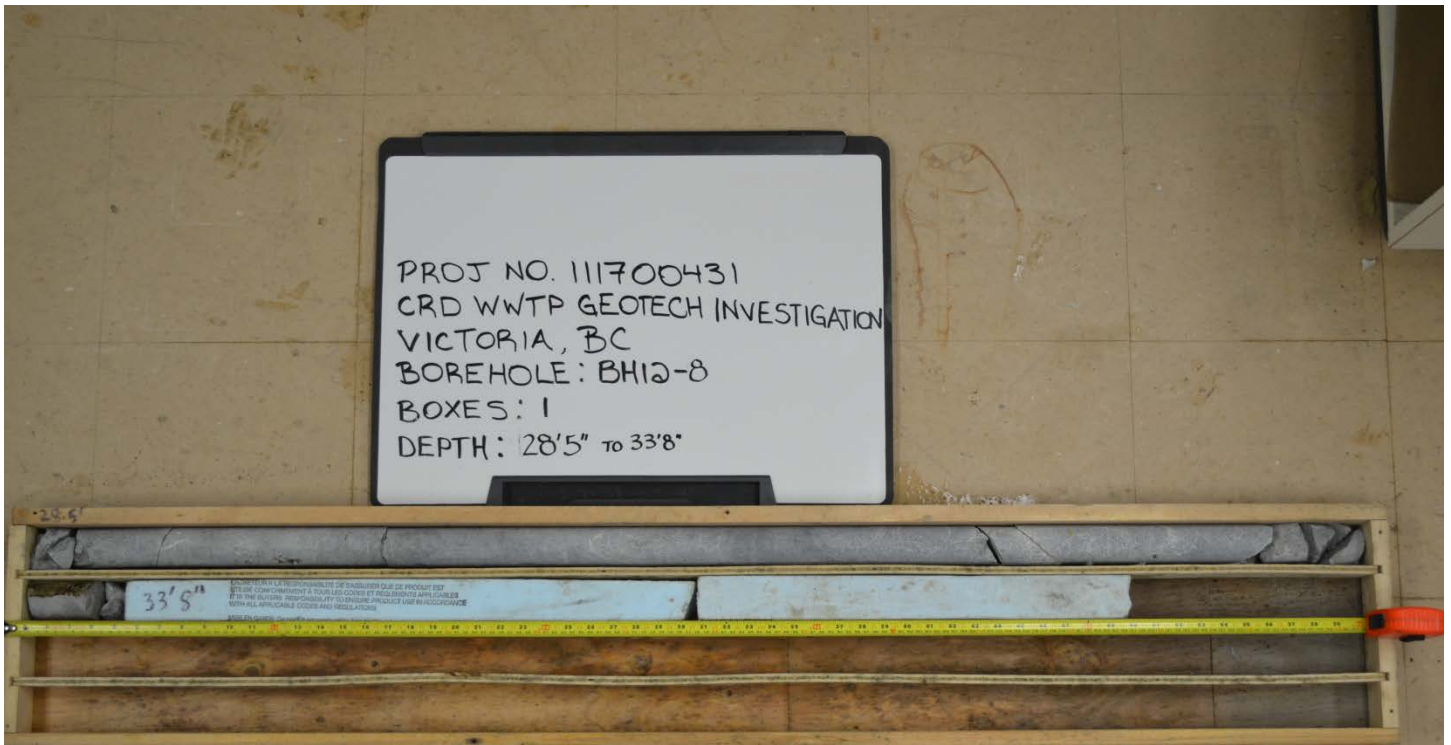
BH12-6 - Depth from 5'6" to 34'6" – Wet



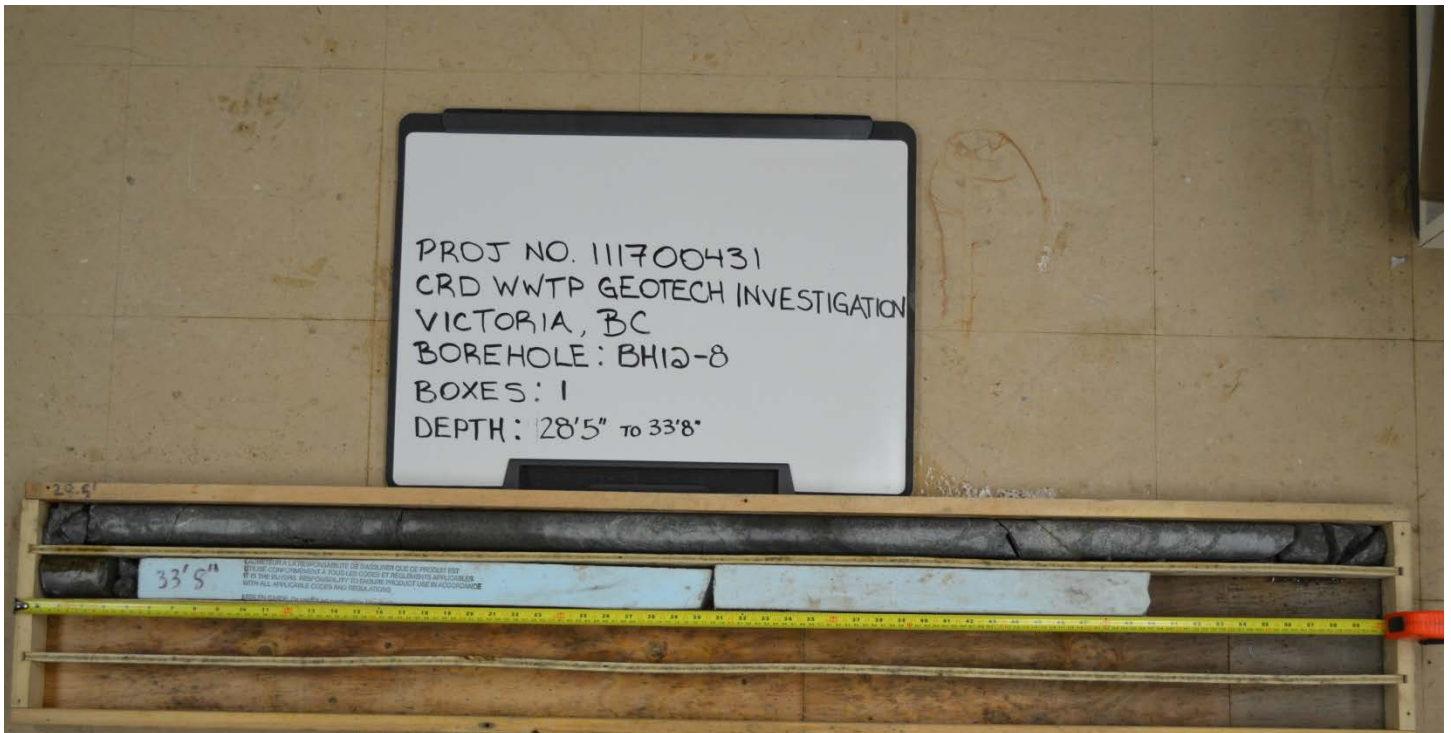
BH12-7 - Depth from 40'9" to 44'11" – Dry



BH12-7 - Depth from 40'9" to 44'11" – Wet



BH12-8 - Depth from 28'5" to 33'8" – Dry



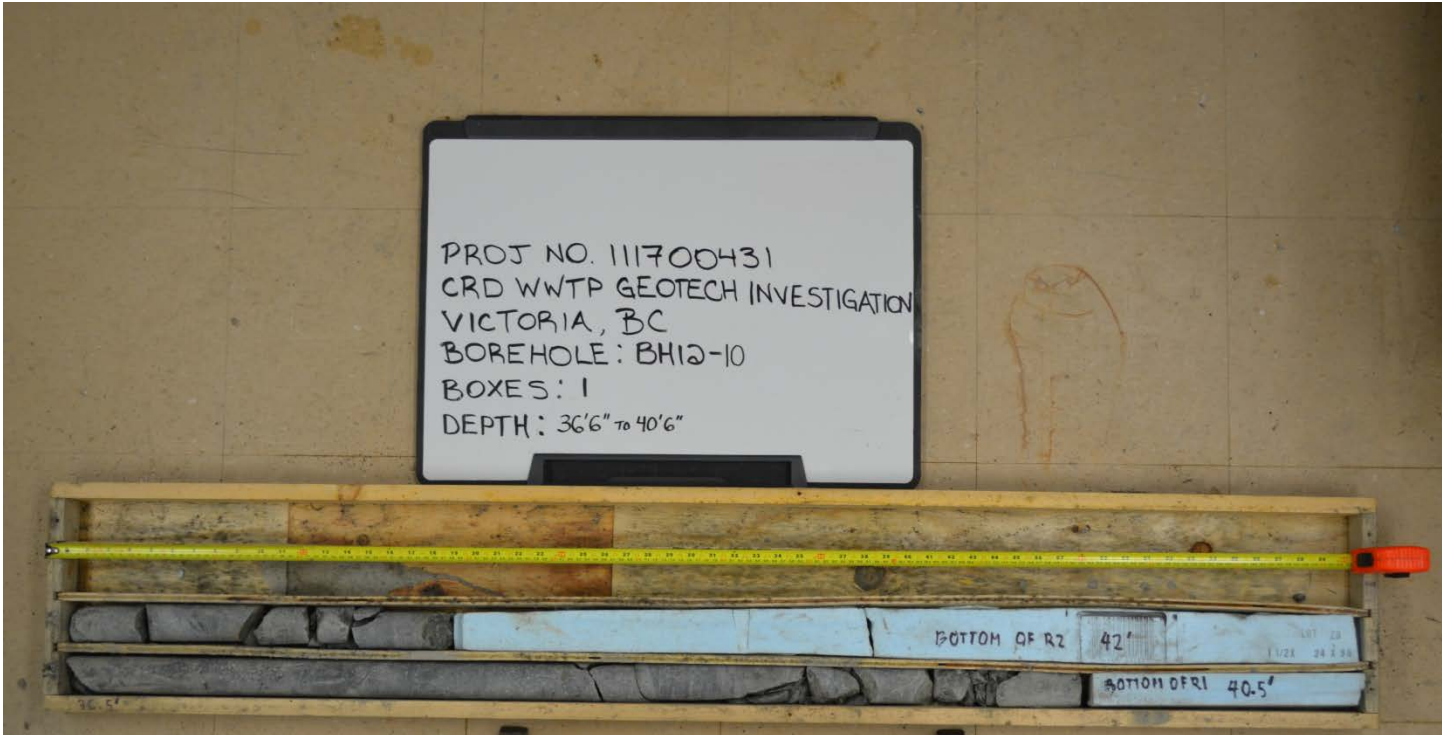
BH12-8 - Depth from 28'5" to 33'8" – Wet



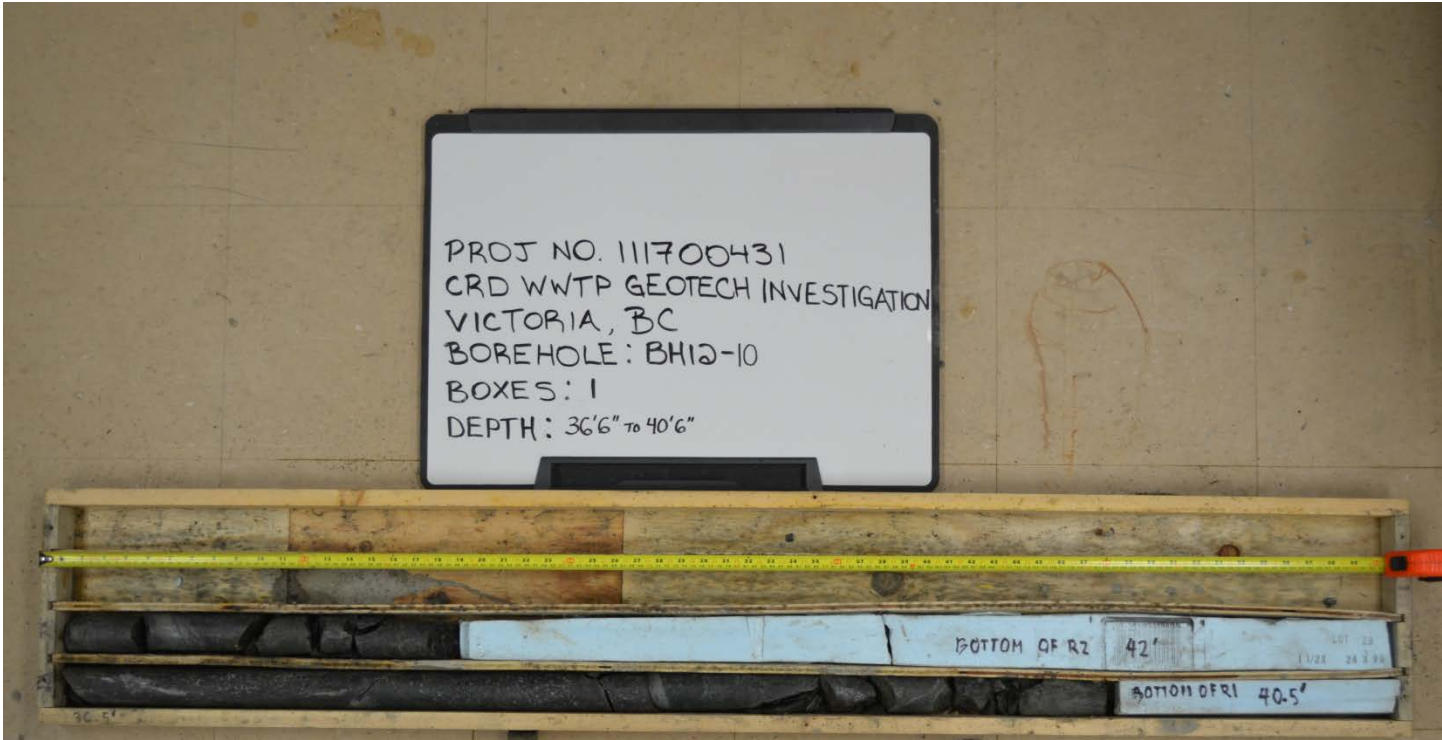
BH12-9 - Depth from 6' to 65' – Dry



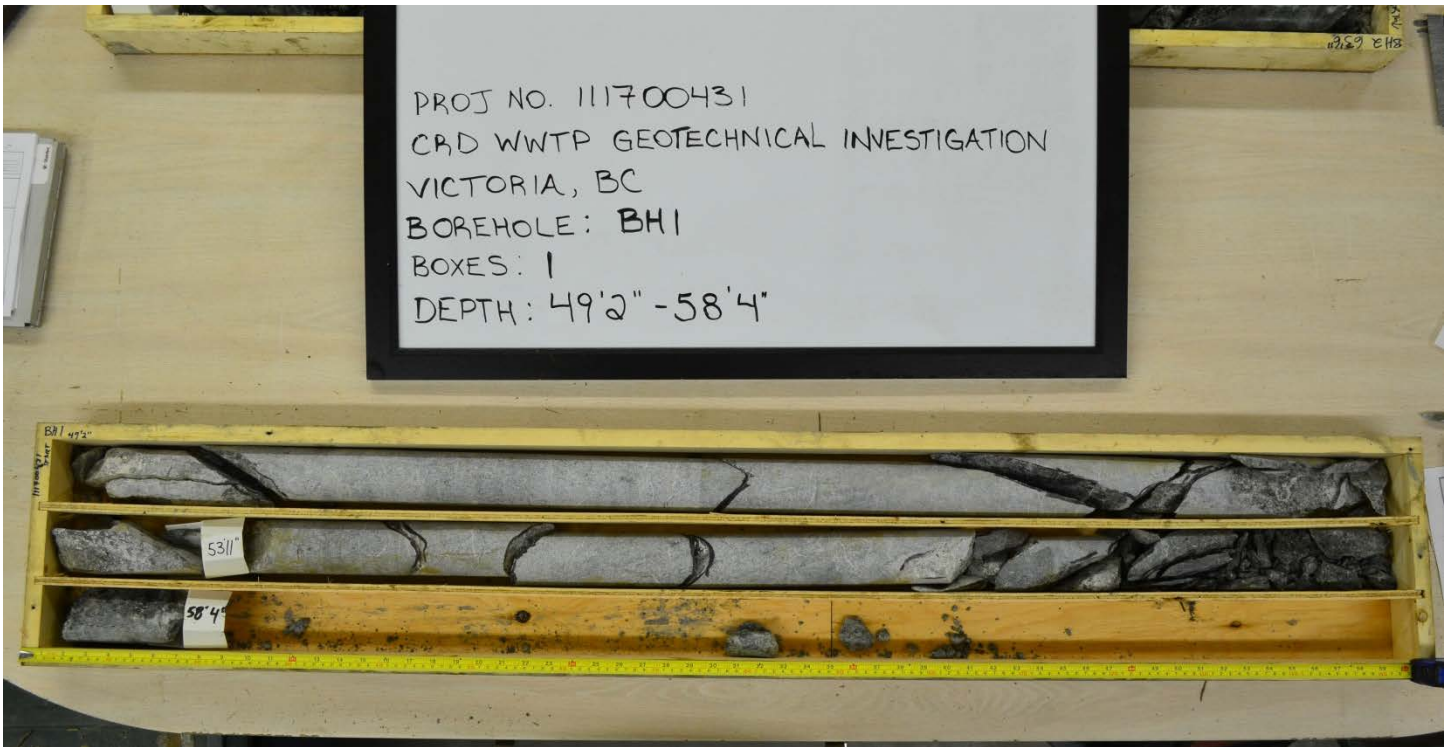
BH12-9 - Depth from 6' to 65' – Wet



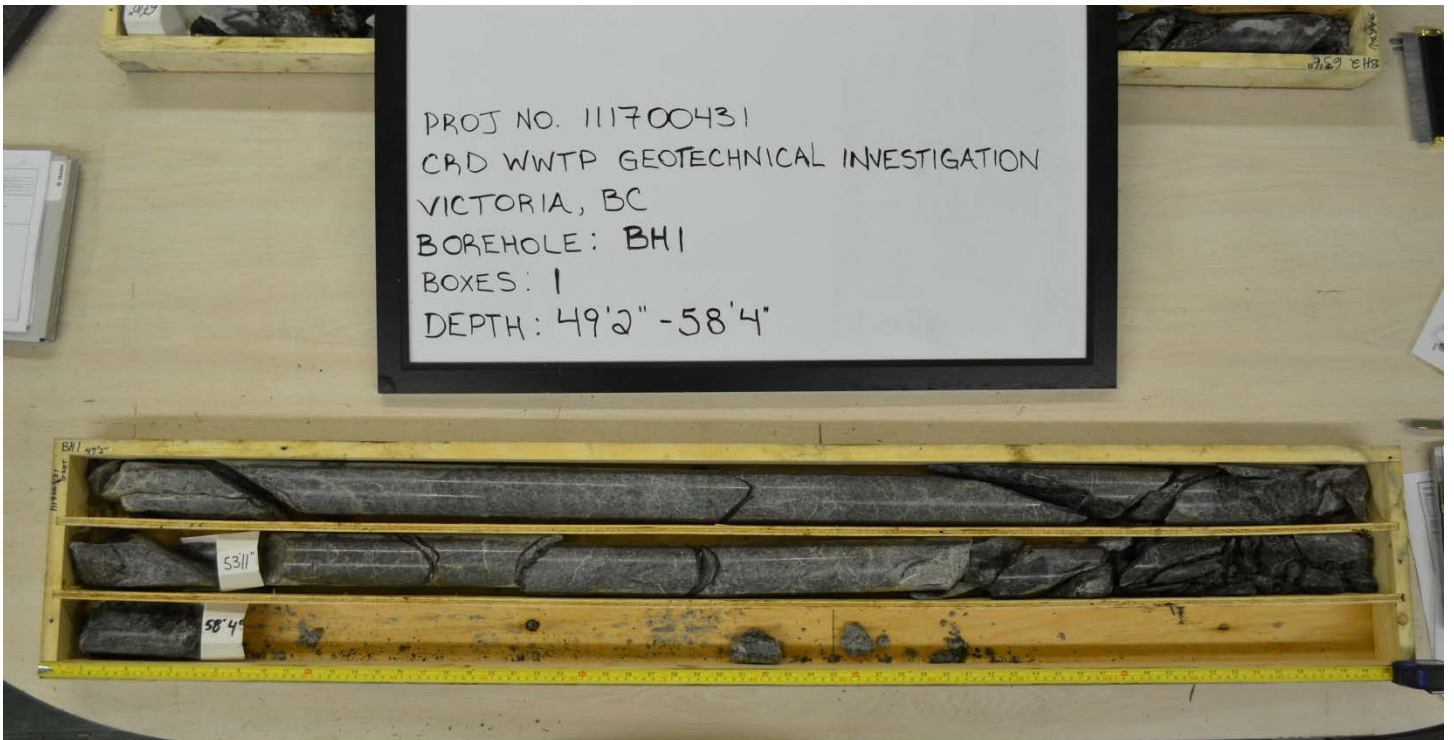
BH12-10 - Depth from 36'6" to 40'6" – Dry



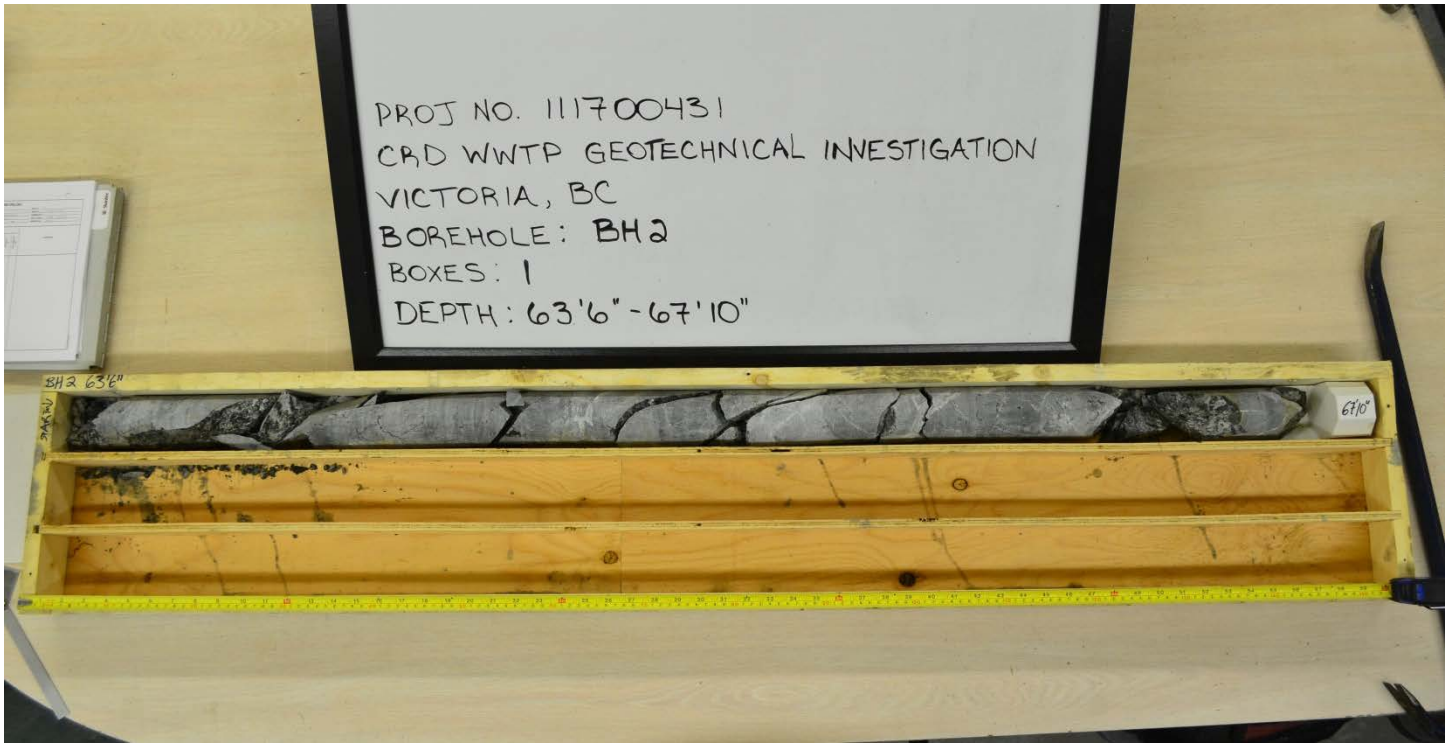
BH12-10 - Depth from 36'6" to 40'6" – Wet



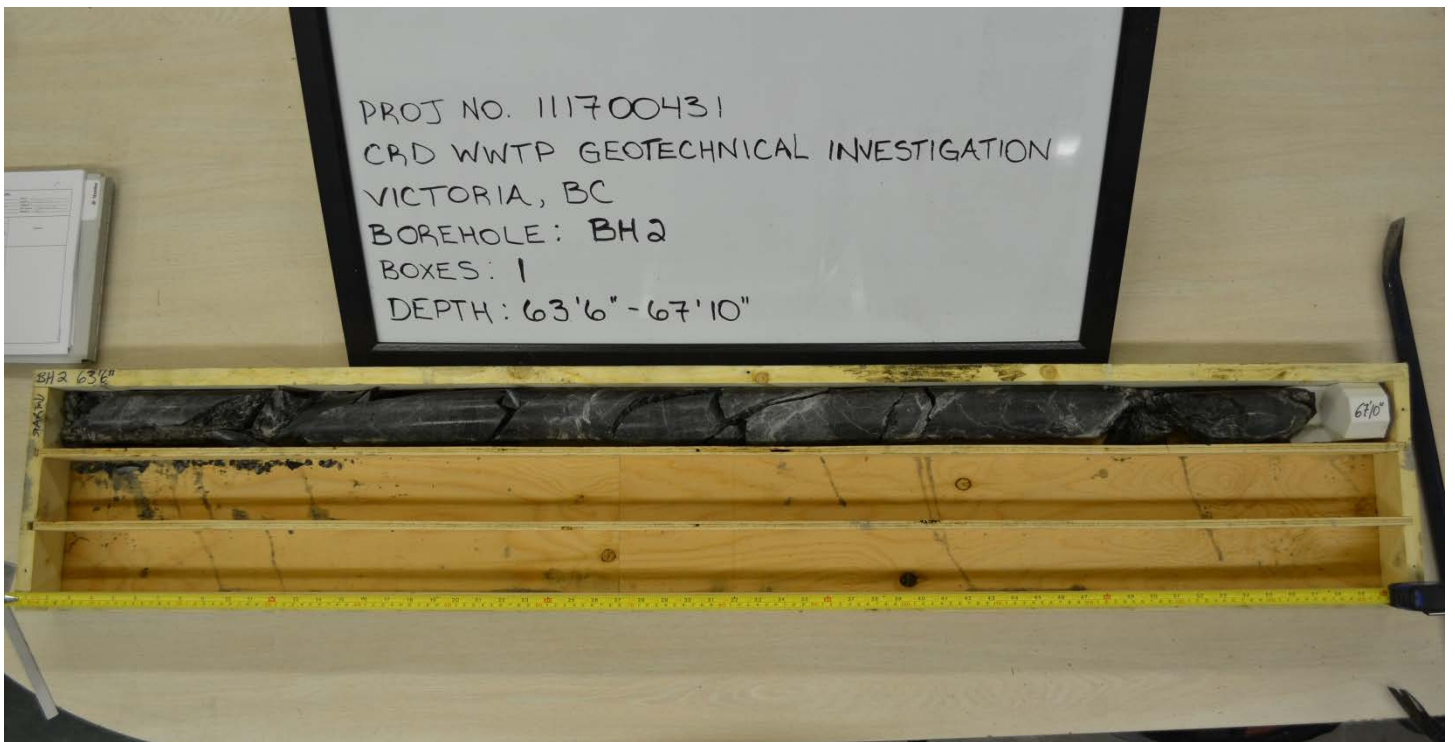
BH1 – Depth from 49'2" to 58'4" - Dry



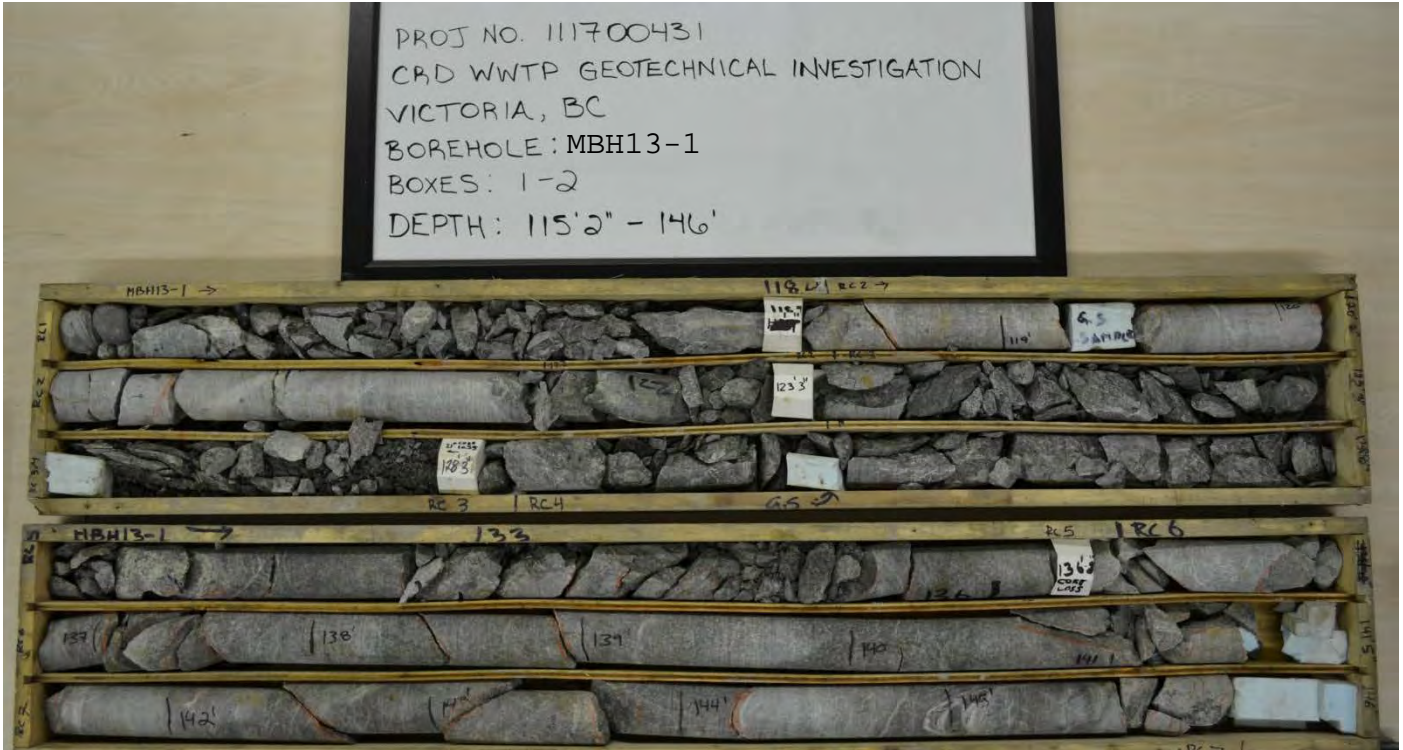
BH1 – Depth from 49'2" to 58'4" – Wet



BH2 – Depth from 63'6" to 67'10" – Dry



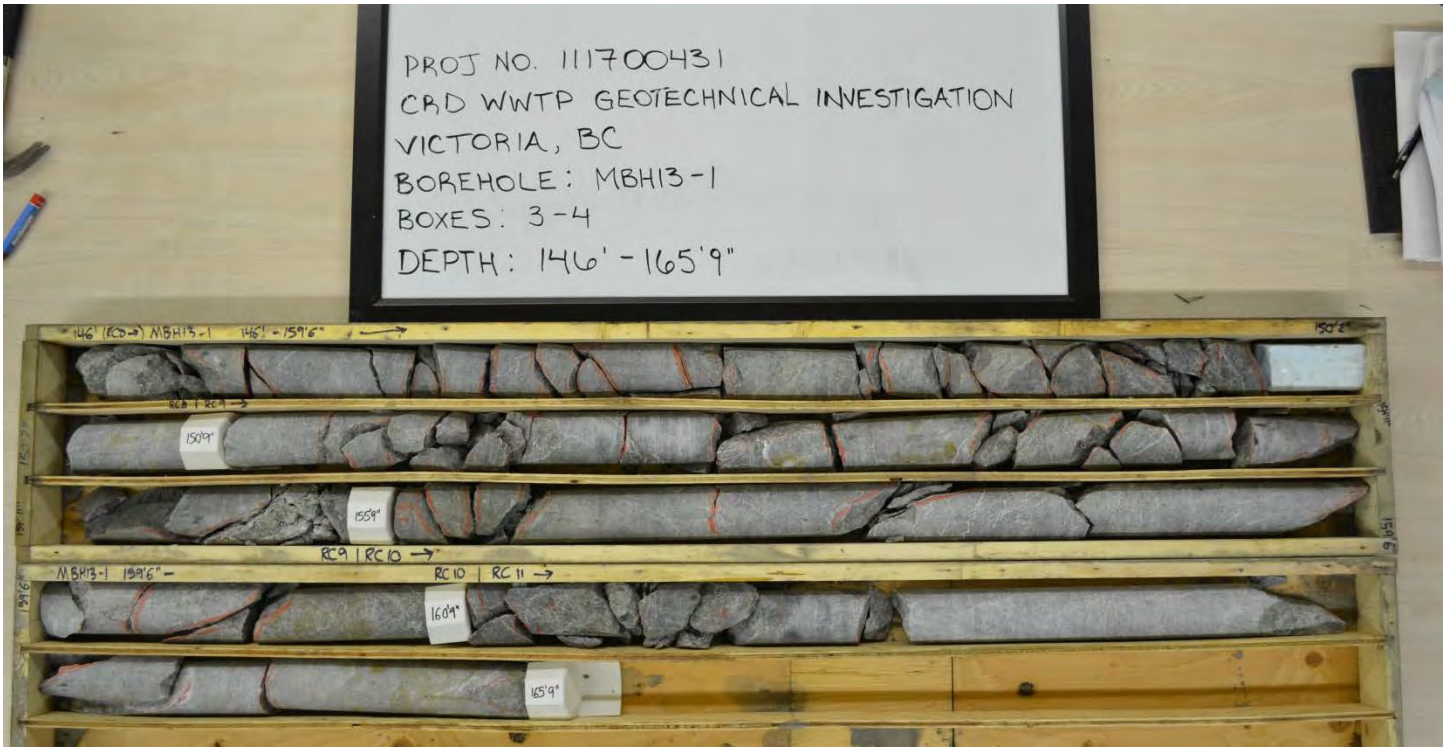
BH2 – Depth from 63'6" to 67'10" – Wet



MBH13-1 - Depth from 115'2" to 146' - Dry



MBH13-1 - Depth from 115'2" to 146' - Wet



MBH13-1 - Depth from 146' to 165'9" – Dry



MBH13-1 - Depth from 146' to 165'9" – Wet



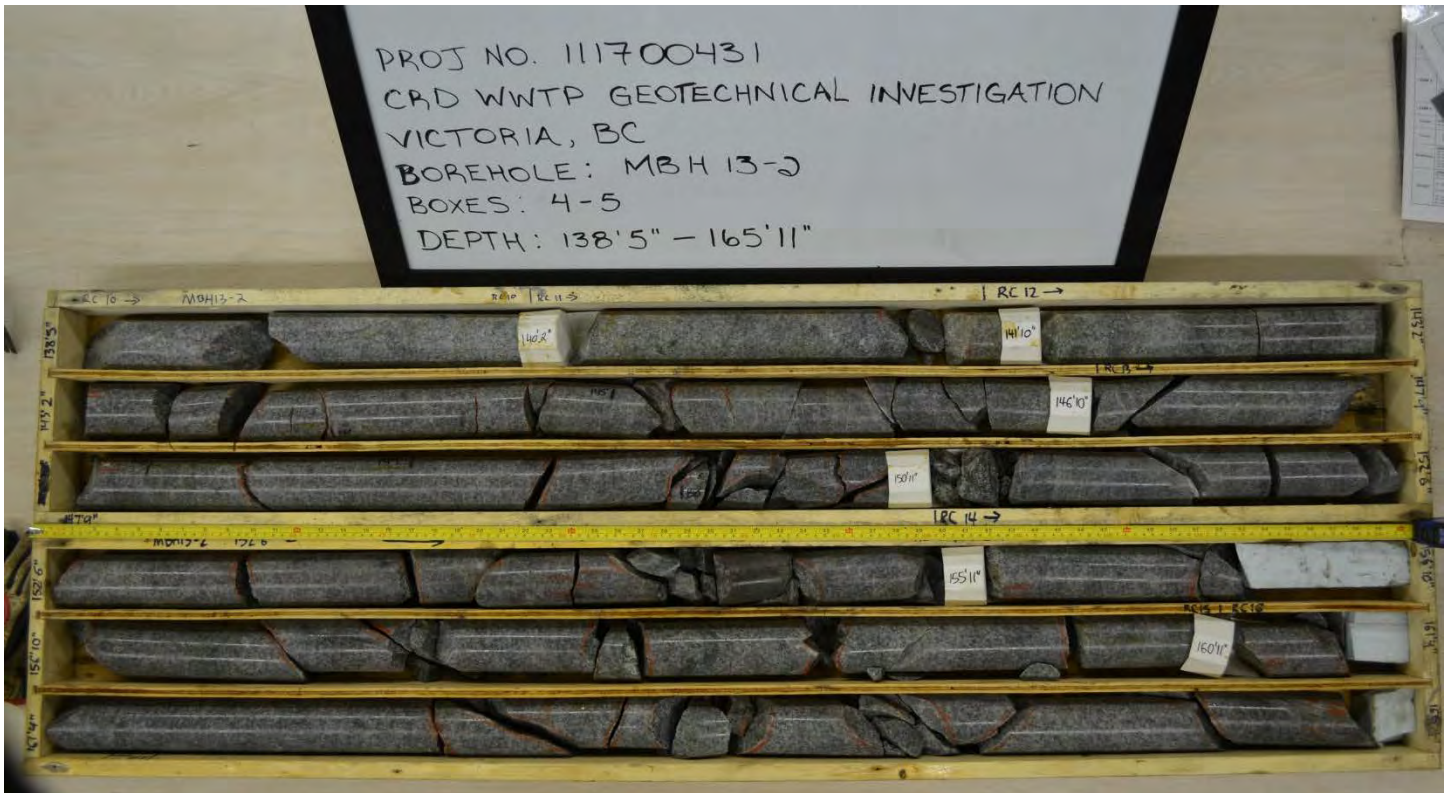
MBH13-2 - Depth from 95'4" to 138'5" – Dry



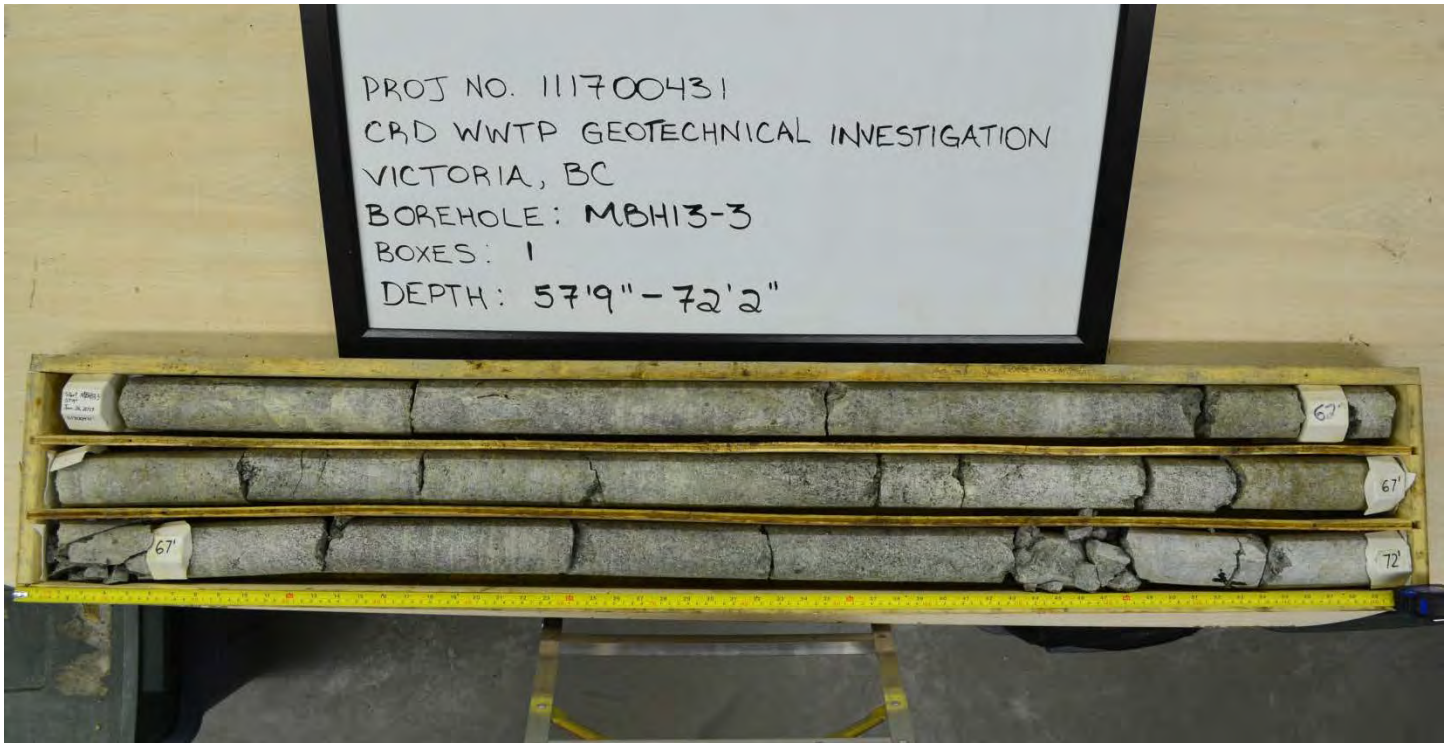
MBH13-2 - Depth from 95'4" to 138'5" – Wet



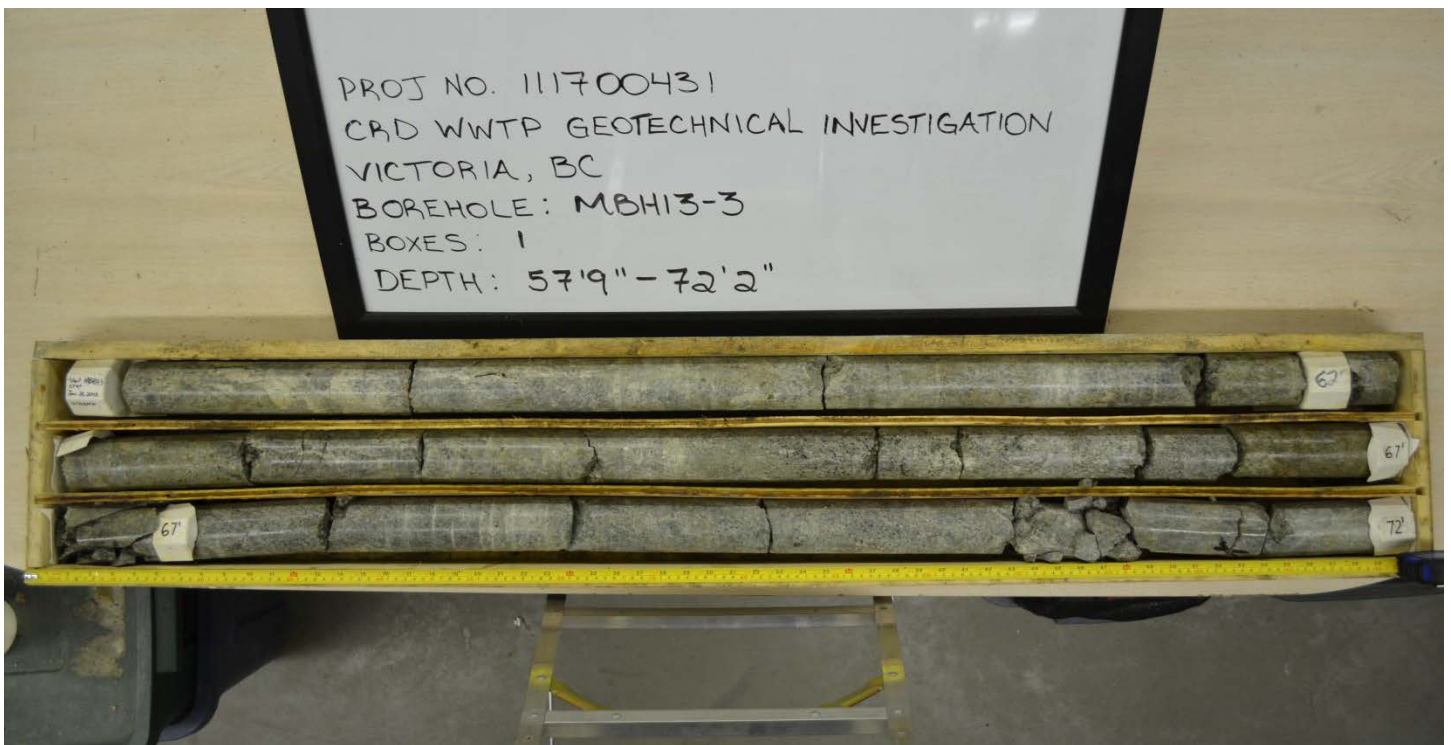
MBH13-2 - Depth from 138'5" to 165'11" – Dry



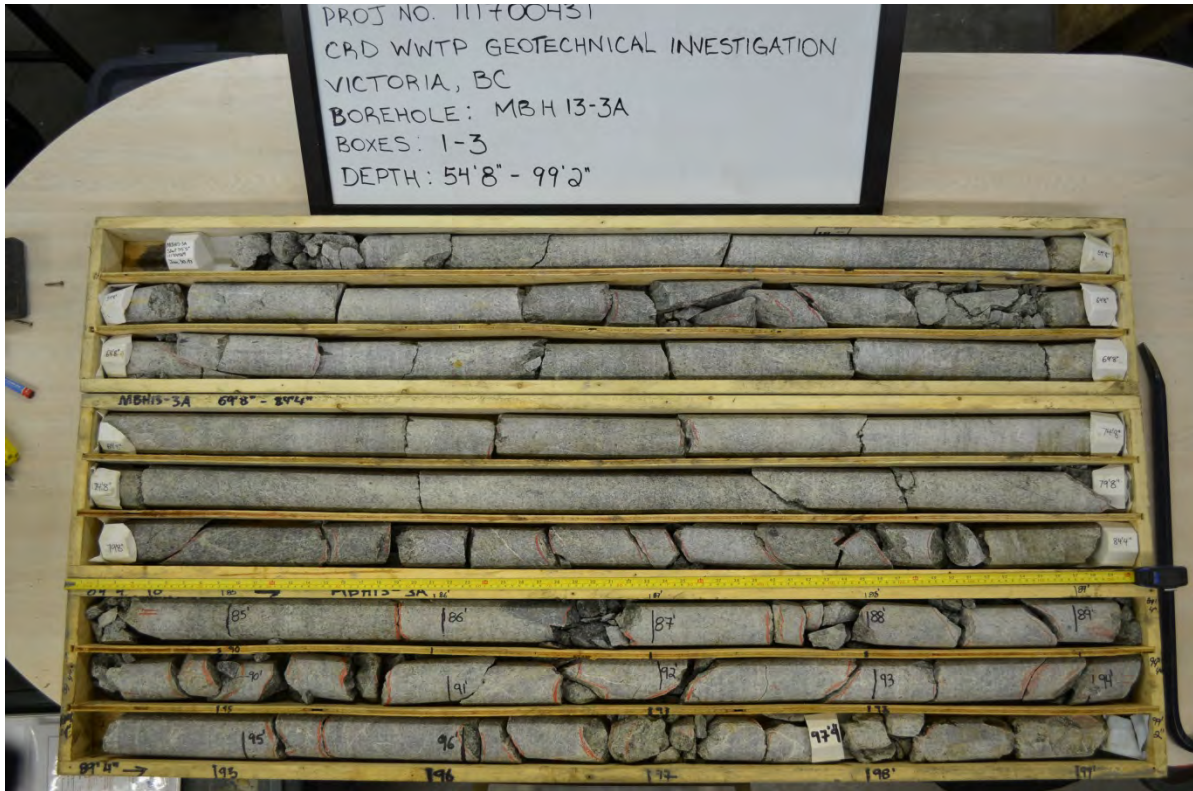
MBH13-2 - Depth from 138'5" to 165'11" – Wet



MBH13-3 - Depth from 57'9" to 72'2" – Dry



MBH13-3 - Depth from 57'9" to 72'2" – Wet



MBH13-3A - Depth from 54'8" to 99'2" – Dry



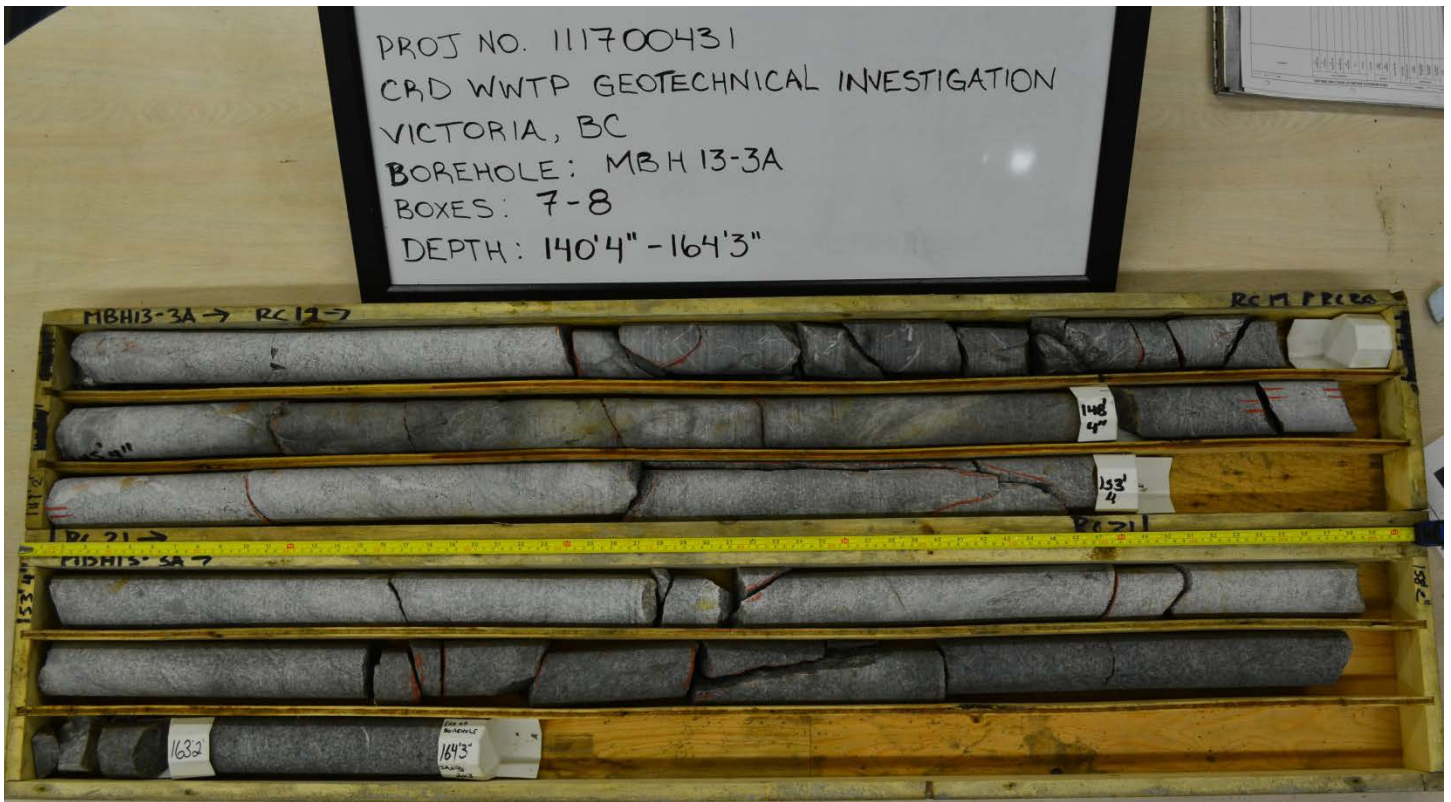
MBH13-3A - Depth from 54'8" to 99'2" – Wet



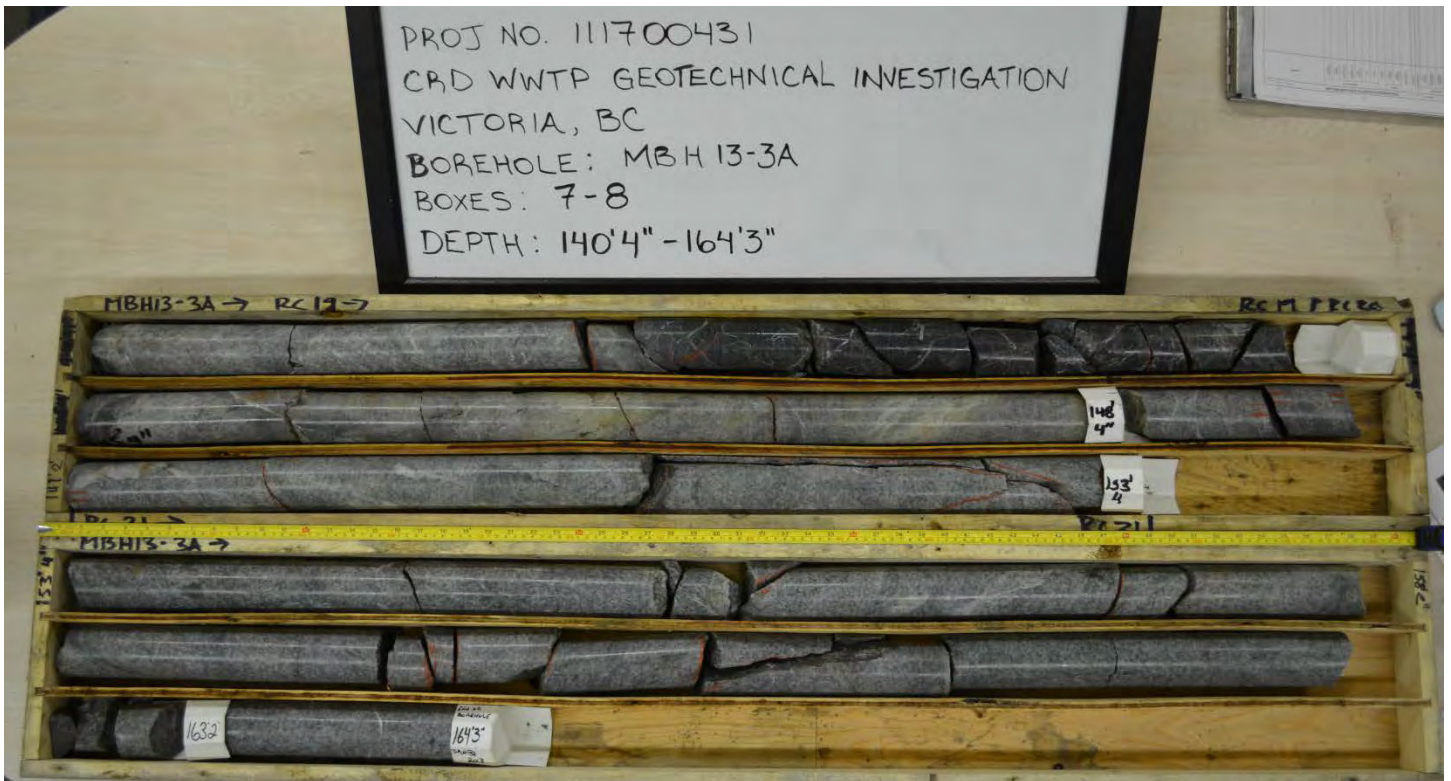
MBH13-3A - Depth from 100' to 140'1" – Dry



MBH13-3A - Depth from 100' to 140'1" – Wet



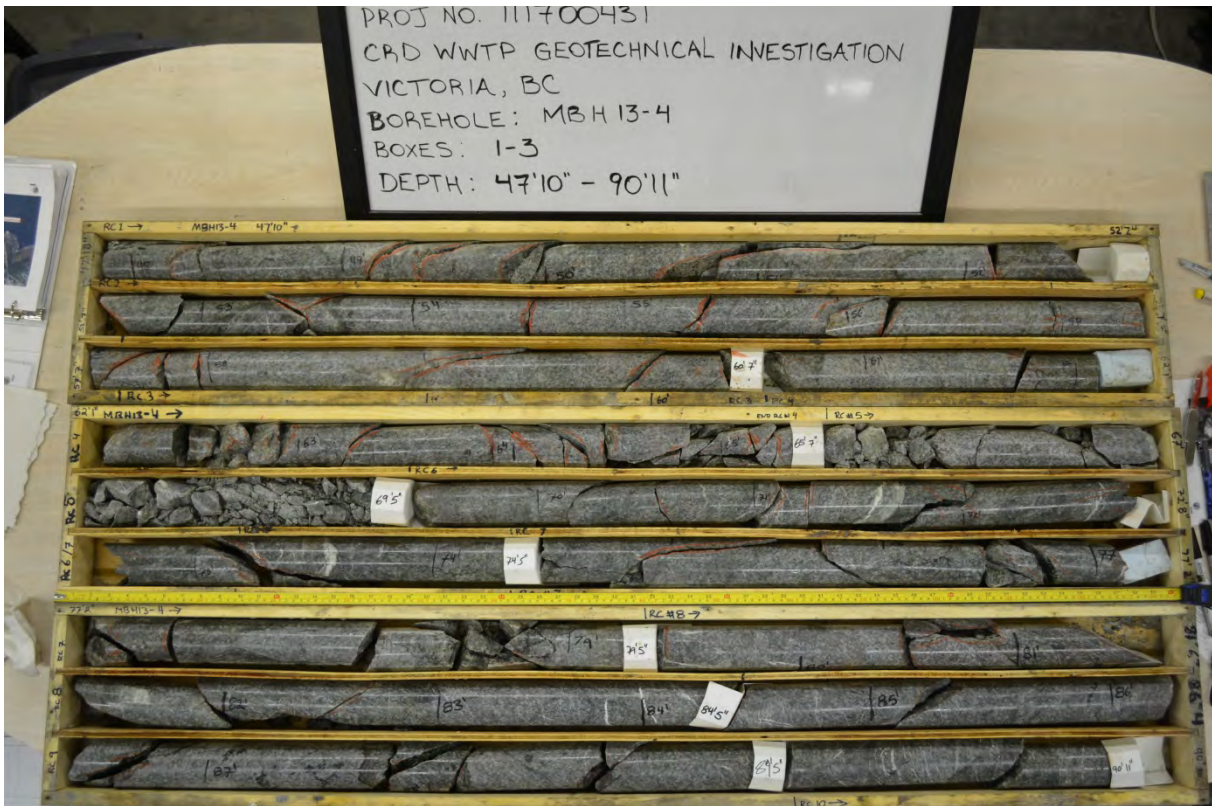
MBH13-3A - Depth from 140'4" to 164'3" – Dry



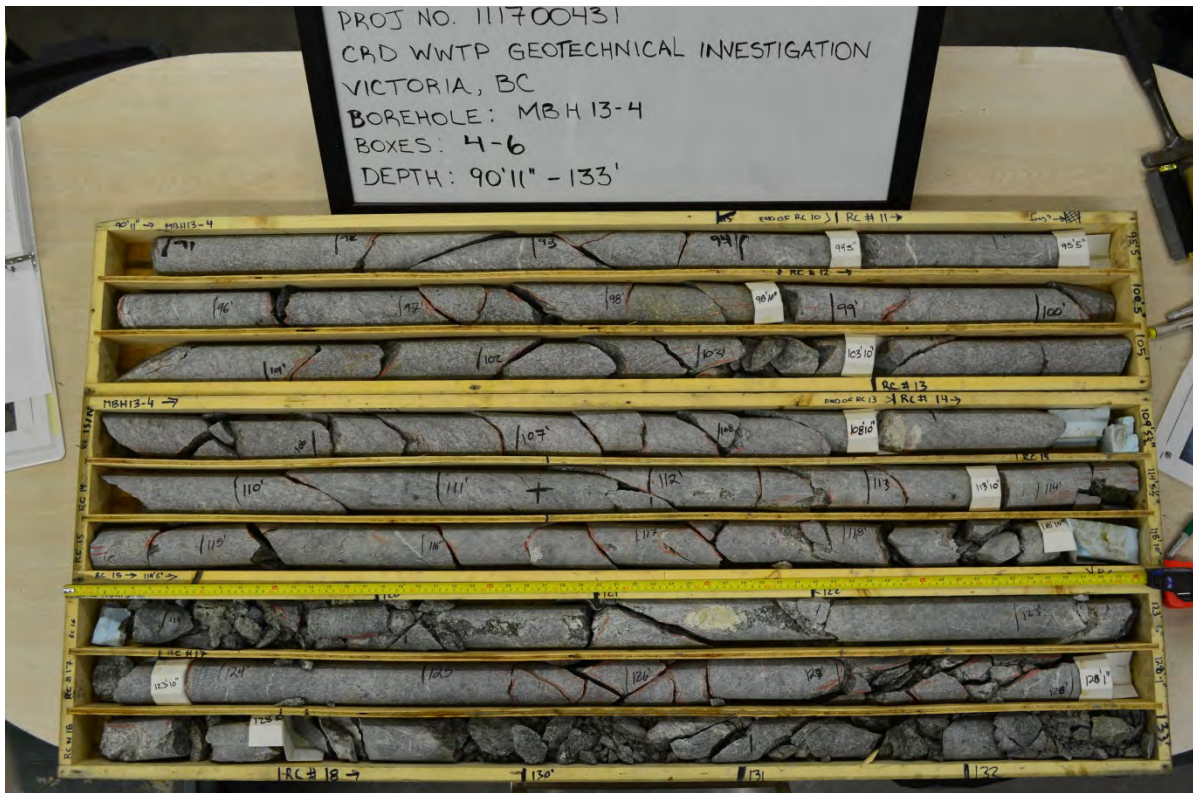
MBH13-3A - Depth from 140'4" to 164'3" – Wet



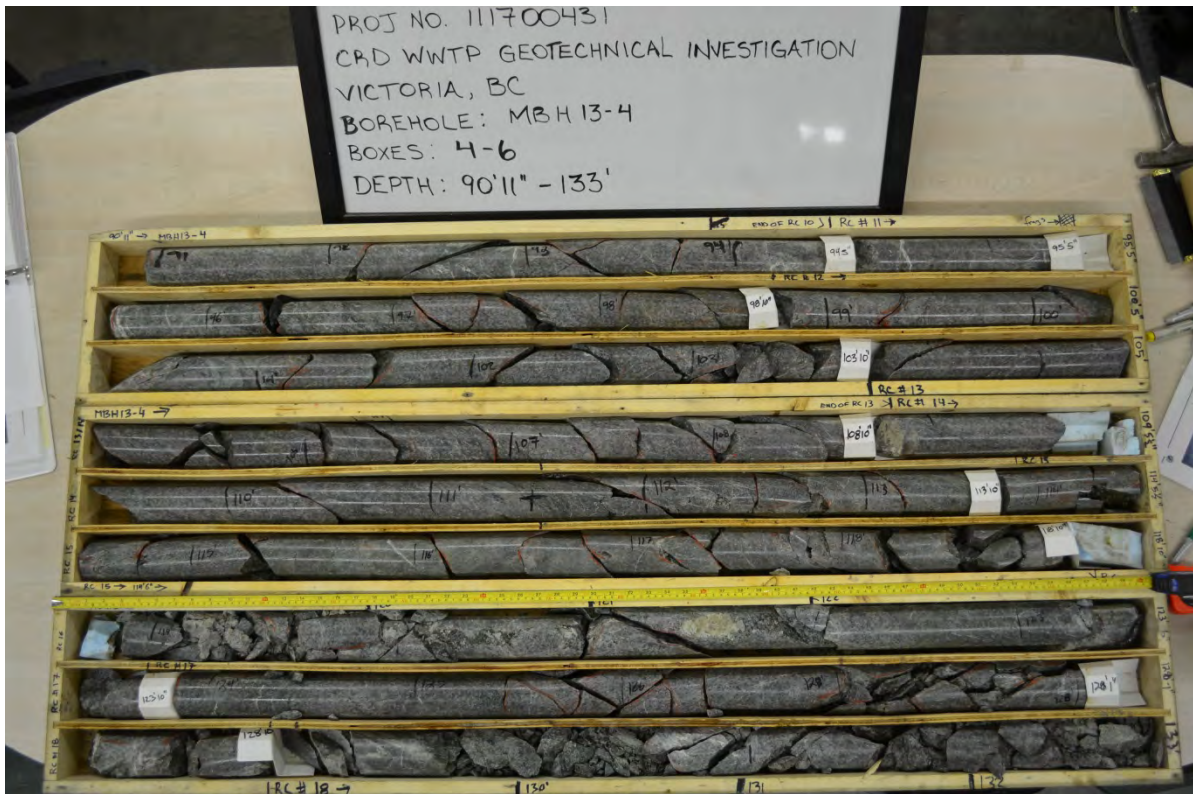
MBH13-4 - Depth from 47'10" to 90'11" – Dry



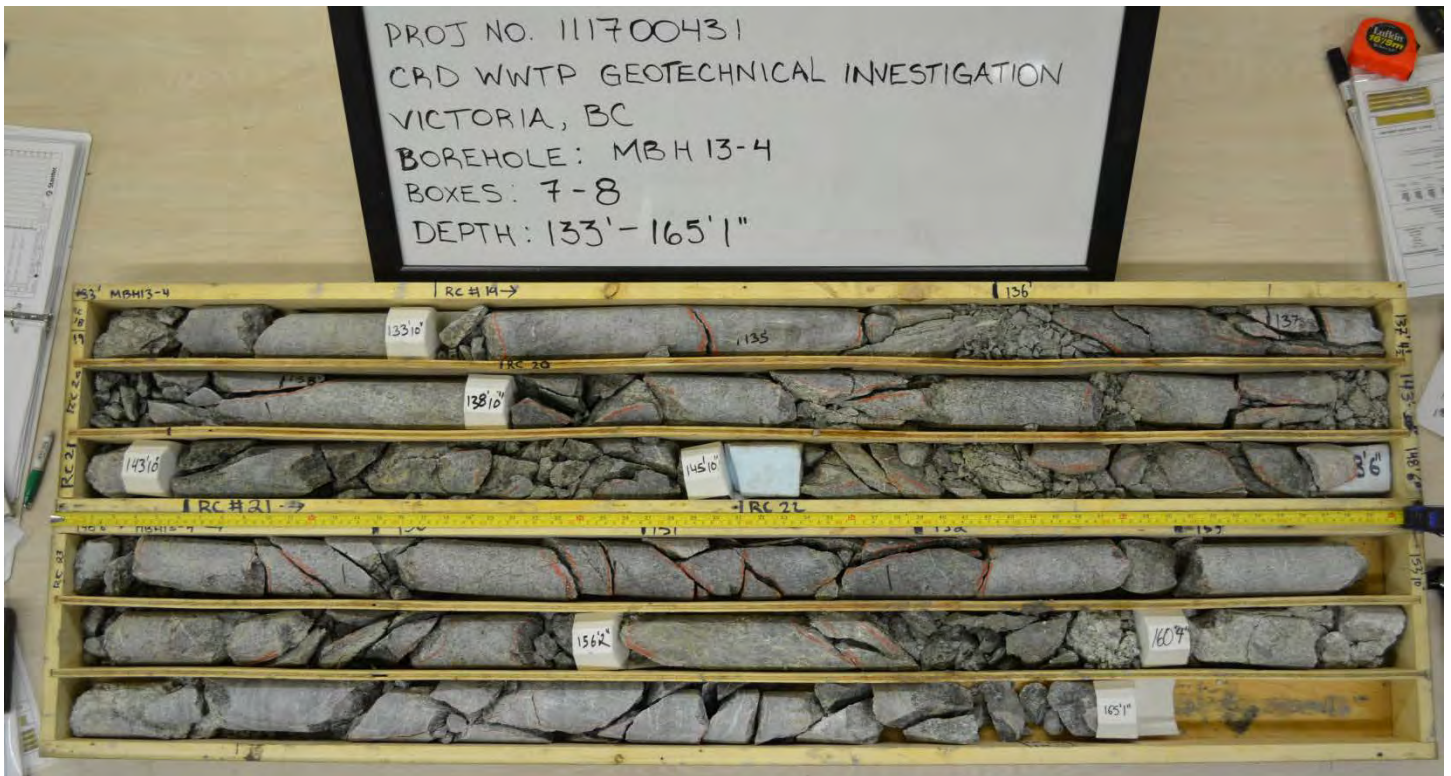
MBH13-4 - Depth from 47'10" to 90'11" – Wet



MBH13-4 - Depth from 90'11" to 133' – Dry



MBH13-4 - Depth from 90'11" to 133' – Wet



MBH13-4 - Depth from 133' to 165' 1" – Dry



MBH13-4 - Depth from 133' to 165' 1" – Wet



APPENDIX F

Drawing and Test Hole Logs from Stage 2 PSI by Golder Associates



LEGEND

- CROSS SECTION LINE
- FORMER REFERENCE LINE
- BOREHOLE LOCATION COMPLETED
- BOREHOLE LOCATION COMPLETED AS A MOUNTING WELL
- TEST PIT LOCATION

LIST OF APPLICABLE ABBREVIATIONS

UG UNDERGROUND

REFERENCE

IMPERIAL OIL LIMITED PROJECT FILE NO. 03-7022000003
 SCALE 1:250 DATE 2008/04/25/2008 FILE NO. 03-7022000003
 SCALE 1:250 DATE 2008/04/25/2008 FILE NO. 03-7022000003
 APRIL 27, 1999
 AND IS FOR GENERAL REFERENCE ONLY. ACCESS PERMITTED FROM 10:00 AM TO 4:00 PM
 SCALE 1:578 IMAGE DATE UNKNOWN

CLIENT IMPERIAL OIL LIMITED
FORMER PETROLEUM TERMINAL
 337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.
TITLE

SITE PLAN

PROJECT	03-7022000003	FILE NO.	03-7022000003
DESIGN	MM	SCALE	AS SHOWN
DRAWN	MM	DATE	07/26/11
CHECK	MM	DATE	07/26/11
SCALE	AS SHOWN	DATE	07/26/11

FIGURE: 3



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: November 28, 2008

RECORD OF TEST PIT: TP08-01

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
		ELEV. DEPTH (m)			100	200	300	400	
0	Ground Surface Loose, moist, dark brown, coarse SAND and GRAVEL, rootlets. [FILL]	0.00	01-1	GS					
		1.40	01-2	GS					
	Loose, wet to saturated, dark brown, coarse SAND, some gravel, root and septic pipe tile inclusions. [FILL]	1.80	01-3	GS					
	Soft, moist to wet, grey and light-brown with orange-brown banding, fine SAND and SILT, silt seams.	2.70	01-4	GS					
	Firm, moist, grey and orange-brown mottled CLAYEY SILT, trace fine sand seams.	3.50							
	End of TEST PIT.								
1									
2									
3									
4									
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: November 28, 2008

RECORD OF TEST PIT: TP08-02




DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
		ELEV. DEPTH (m)			100	200	300	400	
0	Ground Surface Loose, moist, brown and orange-brown, coarse SAND and GRAVEL, roots, brick rubble fragments. [FILL]		02-1	GS					
1	Dense, moist, grey with orange-brown mottling silty SAND. - slight hydrocarbon-like odour.		02-2	GS					
2	Firm, moist, grey with light brown banding CLAYEY SILT. - some black and dark grey staining. - hydrocarbon-like odour.		02-3 02-4	GS					160
3	Firm, moist, orange-brown with grey banding CLAYEY SILT.		02-5	GS					
4	End of TEST PIT. Note: Sample 02-4 is a Field Duplicate of Sample 02-3.								
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: November 28, 2008

RECORD OF TEST PIT: TP08-03

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	10	20	30	40		
						ppm	ppm	ppm	ppm		
0	Ground Surface Loose, dry, brown and orange-brown, GRAVEL and SAND, coarse, concrete debris, rootlets. [FILL]		0.00								
1				03-1	GS						
2	Stiff, moist, light grey and orange-brown CLAYEY SILT, trace coarse gravel. - very slight hydrocarbon-like odour.		1.70								
				03-2	GS						
3	Stiff, moist, grey with orange-brown and brown banding SILT, some clay. - at 3.0m depth: becoming brown throughout, very stiff, breaking in planes with dark brown staining in fractured zones. No odour.		2.30								
				03-3	GS						
				03-4	GS						
4	End of TEST PIT.		3.30								
5											

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 01, 2008

RECORD OF TEST PIT: TP08-04




DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
0	Ground Surface Concrete (oil water separator).								
1	Loose, wet, grey SAND, HC-like odour, stained. [FILL] - hydrocarbon-like odour and grey stained.		04-1	GS					110 ⊕
2	Soft, moist, grey and orange-brown SILT, some clay. - hydrocarbon-like odour.		04-2	GS					⊕
3	Stiff, moist, brown with grey mottling CLAYEY SILT, trace fine sand.		04-3 04-4	GS					⊕
4	End of TEST PIT. Note: Sample 04-4 is a Field Duplicate of Sample 04-3.								
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 02, 2008

RECORD OF TEST PIT: TP08-05



DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
0	Ground Surface Loose, brown, wet to moist, medium SAND and GRAVEL, rootlets. [FILL]		ELEV. DEPTH (m)						
			0.00						
				05-4	GS				
2	Loose, wet, dark grey and black, medium to coarse SAND. - odours and sheen.		2.00						
				05-1	GS				
	Stiff to very stiff, moist, blue-grey and banded brown CLAYEY SILT, trace fine sand.		2.40						
				05-2	GS				
3									
				05-3	GS				
	End of TEST PIT.		3.50						
4									
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 02, 2008

RECORD OF TEST PIT: TP08-06




DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
0	Ground Surface Loose, moist, brown and rust-orange/brown, coarse SAND and GRAVEL, rootlets. [FILL]								
			06-1	GS					
1									
	Soft to stiff, moist, brown and grey banded CLAYEY SILT, trace fine sand seams.		06-2 06-3	GS					
2									
3	End of TEST PIT. Note: Sample 06-3 is a Field Duplicate of Sample 06-2.								
4									
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 02, 2008

RECORD OF TEST PIT: TP08-07

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
		ELEV. DEPTH (m)			100	200	300	400	
0	Ground Surface Soft, moist, black and brown with grey SAND and SILTY CLAY, some coarse sand, rootlets, brick pieces. [FILL]		0.00						
1				07-1	GS	⊕			
				07-2	GS	⊕			
	Dense, dark brown and rusty-brown, coarse GRAVEL, some coarse sand.		1.60						
	Stiff, moist, grey and brown CLAYEY SILT, trace fine sand seams.		1.80						
2									
				07-3	GS	⊕			
3	End of TEST PIT.		3.00						
4									
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 02, 2008

RECORD OF TEST PIT: TP08-08

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
		ELEV. DEPTH (m)			100	200	300	400	
0	Ground Surface Loose, moist, rust-brown, SAND and GRAVEL, coarse, rounded, concrete and brick inclusions. [FILL] - at 0.9m depth: Brick/Terra cotta pipe approximately 254mm diameter.								
1			08-1	GS					
2	Stiff, moist to wet, tan and blue-grey mottled CLAYEY SILT, with coarse sand, some gravel.		08-2	GS					
3	Stiff to very stiff, moist, grey with brown-tan mottling, CLAYEY SILT, trace fine sand seams.		08-3	GS					
	End of TEST PIT.								
4									
5									

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : HAZCO
 EQUIPMENT USED: Cat 320C
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: December 02, 2008

RECORD OF TEST PIT: TP08-09

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter ppm				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	10	20	30	40	
					ppm				
0	Ground Surface Loose, moist, brown, coarse SAND and GRAVEL, with fragments of concrete and brick. [FILL]								
1			09-1	GS					
2	Loose, wet, rusty-brown, SAND and GRAVEL, trace silt, coarse sand. - at 2.2m depth: blue-grey, some silt, hydrocarbon-like odour to 2.4m depth.		09-2	GS					
3	Stiff, moist, brown with blue-grey mottling, CLAYEY SILT, trace fine sand seams. - at 2.9m depth: becoming brown throughout.		09-3	GS				120	
4			09-4	GS					
5	End of TEST PIT.								

IOL TP LOG IOL-TP.GPJ IOL.GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 16, 2008
 DATUM: Local

RECORD OF MONITORING WELL: MW08-01

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.44m		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	Soil Vapour Content (%LEL)							
								10	20	30	40				
0	Ground Surface		6.58												
	Loose, dry, brown, medium SAND. [FILL]		0.00												
			6.12	Sa1	DO										
	Firm, moist, dark brown SILT, some sand, trace gravel, concrete and brick pieces. [FILL] - at 1.37m depth: Large chunks of concrete (100 - 152mm).		0.46												
			5.06	Sa2	DO										
			1.52	Sa5	DO										
	Loose, wet, dark brown SAND and GRAVEL. [FILL]		4.75												
	Very stiff, moist, brown with grey mottling, silty CLAY.		1.83												
			1.70	Sa3	DO										
			4.88	Sa4	DO										
5	End of MONITORING WELL.														

IOL-BH-LOG IOL-BH-GPJ_IOL-GDT_05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 16, 2008
 DATUM: Local

RECORD OF BOREHOLE: MW08-02

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.05m
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	Soil Vapour Content (%LEL)					
								10	20	30	40		
0	Ground Surface Soft, moist, dark brown, sandy SILT, coarse sand, some gravel. [FILL] - wet at 0.61m depth. - at 1.37m depth: brick and concrete pieces.		6.37										Filter Sand
			0.00	Sa1	DO								
1	Firm to stiff, dry, light grey and rusty-brown banded SILT. - at 3.35m depth: grey with brown mottling.		4.69										Bentonite Seal
			1.68	Sa2	DO								
2													Filter Sand
				Sa3	DO								
3													Bentonite Seal
				Sa4	DO								
4													Filter Sand
				Sa5	DO								
5	Stiff, dry to slightly moist, grey and brown CLAYEY SILT. - at 6.1m depth: Soft.		0.88										Bentonite Seal
			5.49	Sa6	DO								
6	Very dense to stiff, moist, grey-brown, fine sandy SILT, some gravel, contains cobbles.		-0.34										Slotted PVC Pipe
			6.71	Sa7	DO								
7	Refusal - grey BEDROCK.		-0.95										Filter Sand
	End of BOREHOLE.		7.32										
8			-1.25										
			7.62										
9													
10													

IOL-BH LOG IOL-BH.GPJ IOL-GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 16, 2008
 DATUM: Local

RECORD OF MONITORING WELL: MW08-03

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 6.66m
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	10	20	30	40		
			DEPTH (m)					Soil Vapour Content (%LEL)					
0	Ground Surface Soft, moist to wet, brown to dark brown, coarse sandy SILT, some gravel. [FILL] - at 0.91m depth: Brick and Concrete pieces.		5.80 0.00	Sa1	DO								Filter Sand
1	Stiff to very stiff, dry to moist, brown with grey banding, SILT, some clay. - at 4.27m depth: Increased clay, plasticity increasing.		4.43 1.37	Sa2	DO								Bentonite Seal
2													
3													
4	Medium dense, moist, brown and grey, SAND and GRAVEL, some cobbles, trace silt.		0.77 5.03	Sa4	DO								Filter Sand
5													
6													
6	Refusal (BEDROCK)		0.01 5.79	Sa6/7	DO								Filter Sand
6	End of MONITORING WELL. Note: Sample 7 is a Field Duplicate of Sample 6.		-0.30 6.10										
7													
8													
9													
10													

IOL-BH LOG IOL-BH.GPJ IOL-GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 16, 2008
 DATUM: Local

RECORD OF MONITORING WELL: MW08-04

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.04m	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	Soil Vapour Content (%LEL)						
								10	20	30	40			
0	Ground Surface Soft, moist to wet, dark brown, coarse sandy SILT, some gravel. [FILL]	[Cross-hatched pattern]	6.66 0.00											FilterSand
1	Stiff to very stiff, dry, olive brown and grey mottled SILT, trace to some clay. - at 4.27m depth: Increased moisture, grades to CLAYEY SILT - at 5.18m depth: Colour change to light brown, becoming wet.	[Vertical lines pattern]	5.75 0.91	Sa1	DO			⊕						Bentonite Seal
2				Sa2	DO			⊕						FilterSand
3														
4				Sa3	DO			⊕						Bentonite Seal
5				Sa4	DO			⊕						FilterSand
6	Refusal (BEDROCK) Cored to 6.25m depth..	[Diagonal lines pattern]	0.87 5.79	Sa5	DO			⊕						Slotted PVC Pipe
7	End of MONITORING WELL.		0.41 6.25											
8														
9														
10														

IOL-BH-LOG IOL-BH-GPJ_IOL-GDT_05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 16, 2008
 DATUM: Local

RECORD OF MONITORING WELL: MW08-05

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.34m		
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	Soil Vapour Content (%LEL)							
								10	20	30	40				
0	Ground Surface Loose, moist, dark brown, coarse sandy SILT, trace gravel, contains cobbles. [FILL]		6.58 0.00												
1	Loose, moist, olive brown with grey fissure SILT.		5.82 0.76	Sa1/2	DO			⊕						Bentonite Seal	
2				Sa3	DO			⊕						Filter Sand	
3	Loose, moist to wet, brown SAND and GRAVEL, coarse, contains cobbles.		3.53 3.05	Sa4	DO			⊕						Bentonite Seal	
4				Sa5	DO			⊕						Filter Sand	
5	End of MONITORING WELL.		1.70 4.88											Slotted PVC Pipe	
6															
7															
8															
9															
10															

IOL-BH LOG IOL-BH.GPJ IOL-GDT 05/19/11



LOCATION: 343 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR: Mud Bay Drilling Co. Ltd.
 EQUIPMENT USED : Truck Mounted Sonic Drill Rig
 OVM TYPE: RKI Eagle
 BORING DATE: December 17, 2008
 DATUM: Local

RECORD OF MONITORING WELL: MW08-06

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES				PID ppm				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION Top of Pipe Elevation = 7.65m	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	BLOWS/0.3m	10	20	30	40			
			DEPTH (m)					Soil Vapour Content (%LEL)						
0	Ground Surface Loose, moist, brown, silty SAND, some gravel, brick and concrete pieces. [FILL]	6.91 0.00												Filter Sand
1			Sa1	DO										Bentonite Seal
2			Sa2	DO										Filter Sand
3	Stiff to very stiff, dry, olive-brown with blue grey fissure SILT, trace clay.	4.47 2.44												Slotted PVC Pipe
3			Sa3	DO										
4	End of MONITORING WELL.	3.25 3.66	Sa4	DO										
5														
6														
7														
8														
9														
10														

IOL-BH LOG IOL-BH.GPJ IOL-GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-01

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.66							
	Compact, dry, grey SAND and GRAVEL. (FILL) - no odour. - some red staining below 0.2m.		0.00	1	GS					
			4.16							
	Loose, moist, green-grey SAND, with some gravel, peat (black) interbedded lenses. (FILL) - musty odour.		0.50	2	GS					
1			3.46							
	Firm, moist, brown and grey, blocky, sandy SILT, trace clay. - no odour or staining. - moisture increases and silt content with depth. - very dense, grey at 2.8m.		1.20	3	GS					
2										
				4	GS					
3	End of TEST PIT.		1.86 2.80	5	GS					
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-02

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.14							
	Compact, dry, brown, angular SAND and GRAVEL, (FILL) - no odour. - some grey staining at 0.4m.		0.00							
			3.64	1	GS					
	Loose, wet, grey stained SAND, with gravel (sub-rounded). (FILL) - water ponding at 0.9m. - sidewalls caving.		0.50							
			2.64	2/3	GS	⊕				
1			2.64							
	Loose to compact, moist, brown and grey mottled, silty SAND to sandy SILT, occasional peat inclusions. - becoming grey, with some clay below 2.3m. - trace hydrocarbon-like odour to 2.6m.		1.50	4	GS	⊕				
2			1.54							
	Dense, grey, moist, silty CLAY, blocky.		1.54	5	GS	⊕				
3			1.54							
	End of TEST PIT.		2.70	6	GS	⊕				
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-03

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	400	800	1200	1600	
					Soil Vapour Content (%LEL)				
					10	20	30	40	
0	Ground Surface								
	Compact, dry, brown SAND and GRAVEL. (FILL)								
1	Loose, wet, grey to silver, sub-rounded SAND and GRAVEL. (FILL) - strong hydrocarbon-like odour. - water seepage at 0.7m with heavy hydrocarbon-like sheen.		1	GS					2150 ⊕
2	Firm to stiff, moist, brown, grey mottled, fractured SILT, trace sand to 2.5m. - very dense below 2.5m. - brown, dense, silty sand (almost sandstone like at base of test pit). - moist, grey pockets near base.		2	GS ⊕					
3			3	GS ⊕					
4			4	GS ⊕					
5	End of TEST PIT.		5/6	GS ⊕					

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-04



DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
						10	20	30	40		
0	Ground Surface		4.57								
	Loose, brown, dry, GRAVEL, some fine sand. (FILL)		0.00								
			4.07								
	Loose, moist, grey, gravelly SAND. (FILL) - hydrocarbon-like odour.		0.50	1	GS				⊕		
1			3.07								
	Dense, moist, brown red, oxidized, silty SAND, some grey mottlings. - dense, dry to moist, brown and grey SILT, fractured, trace hydrocarbon-like odour to 3.0m. - trace to some clay below 3.3m.		1.50	2	GS				⊕		
2			0.77								
			3.80								
	Dense, moist, grey CLAY, trace silt.		0.77								
4			0.77								
			3.80								
			0.77								
			3.80	3	GS				⊕		
3			0.77								
			3.80								
			0.77								
			3.80	4	GS				⊕		
4			0.77								
			3.80								
			0.77								
			3.80	5	GS				⊕		
5			-0.23								
	End of TEST PIT.		4.80								

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-05

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
0	Ground Surface Loose to compact, dry, red-brown, oxidized SAND and GRAVEL (sub-rounded). (FILL)		5.82 0.00	1	GS					
1	Stiff, moist, brown SILT, trace sand and occasional clay pockets. - no odour or staining.		5.12 0.70							
	Refusal in Bedrock at 1.7m.		4.12	2	GS					
	End of TEST PIT.		1.70							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 06, 2009

RECORD OF TEST PIT: TP09-06

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose to compact, dry, red-brown, SAND and GRAVEL, fine to coarse sand and sub-rounded gravel, some large blast rock pieces. (FILL)		5.53 0.00							
				1	GS					
			4.83 0.70							
1	Loose, moist, red-brown mottled, silty SAND, interbedded, fine angular gravel. - no odour. - large weathered bedrock boulders below 1.0m.			2	GS					
			4.23 1.30							
	BEDROCK. - no odour or staining.			3	GS					
	End of TEST PIT.		4.03 1.50							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-07

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
			5.42								
0	Ground Surface Loose, dry to moist, brown to red-brown, silty SAND, some sub-rounded gravel. (FILL) - no odour or staining.		0.00								
				1	GS	⊕					
				2	GS	⊕					
1											
			3.92								
	Stiff, moist, stained, grey SILT, trace sand. - hydrocarbon-like odour and hydrogen sulphide-like odour.		1.50	3/4	GS	⊕					
2											
			2.92								
	Compact, brown and grey, silty SAND, trace to some fine gravel. - trace hydrocarbon-like odour. - less gravel at 3.0m and increasing sand.		2.50	5	GS	⊕					
3	Refusal in Bedrock at 3.0m.		2.42								
	End of TEST PIT.		3.00								
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-08

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	☐
0	Ground Surface		5.42							
	Loose to compact, moist, red-brown SAND and GRAVEL. (FILL) - no odour		0.00							
			4.72	1	GS	⊕				
			0.70							
	Stiff, moist, red-brown, sandy SILT, trace fine to medium sub-rounded gravel. - no odour or staining.		4.42	2	GS	⊕				
			1.00							
1	Loose, moist, coarse, red-brown, gravelly SAND, sub-rounded.		4.12	3	GS	⊕				
	Refusal in Bedrock at 1.3m.		1.30	4	GS	⊕				
	End of TEST PIT.									
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-09






DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose to compact, dry to moist, brown SAND and GRAVEL, with some silt below 0.3m. (FILL)		6.16 0.00	1	GS					
				2	GS					
1	Stiff, moist, red-brown to grey mottled SILT, trace to some fine sand. (FILL) - occasional medium sub-rounded gravel. - clay pockets increasing to some clay below 1.4m. - some wood pieces to 1.4m.		5.26 0.90	3	GS					
				4	GS					
2	Dense, moist, mottled brown and red-brown and grey, oxidized sandy SILT, trace clay with large blast rock pieces. (FILL) - red brick fragment.		4.26 1.90	5	GS					
	Refusal in Bedrock at 2.7m.		3.46	6	GS					
	End of TEST PIT.		2.70							
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-10

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
			6.20								
0	Ground Surface Loose to compact, dry to moist, brown SAND and GRAVEL. (FILL) - 6" corrugated steel drain pipe identified running north-south direction at 0.2m below grade. - Test Pit extended west of pipe.		0.00	1	GS						
			5.90								
			0.30								
	Stiff, dry, brown and grey SILT, some fine sand, medium sub-rounded gravel. Refusal in bedrock at 0.5m. End of TEST PIT.		5.70	2	GS						
			0.50								
1											
2											
3											
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-11

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
						10	20	30	40		
0	Ground Surface Loose, dry, grey SAND and GRAVEL. (FILL)		6.60 0.00	1	GS						
	Firm, moist, brown, with grey pockets/staining SILT, some clay, some sand. (FILL) - gravel lense, red-brown from 0.6m - 0.7m. - grey at 0.7m. - hydrocarbon-like odour. - some concrete, metal and wood debris.		6.30 0.30	2	GS						
1	Compact to loose, brown and grey, coarse SAND, some medium sub-rounded gravel. - strong hydrocarbon-like odour. - grey staining from 1.5m - 1.8m.		5.20 1.40	3	GS						
	Refusal in Bedrock at 1.8m.		4.80	4	GS					2400	
2	End of TEST PIT.		1.80								
3											
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-12





DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose, moist, brown-red SAND, with gravel. (FILL)		5.58 0.00	1	GS					
	Moist, brown to black and grey SILT, trace sand. (FILL) - strong hydrocarbon-like odour. - stained below 0.6m. - metal debris, wire conduits, with product surrounding lines, concrete. - occasional gravel.		5.28 0.30	2/3	GS					
1			4.38 1.20							
	Soft, wet, black SLUDGE. (FILL) - product ponding at 1.7m.									
	Refusal in Bedrock at 1.7m.		3.68	4	GS					
2	End of TEST PIT.		1.90							
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-13

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	400	800	1200	1600	
						Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose, dry to moist, light brown, coarse SAND and GRAVEL. (FILL)		5.39 0.00	1	GS	⊕				
	Firm to stiff, moist, green-grey, stained SILT. (FILL) - hydrocarbon-like odour. - some electrical conduits.		4.89 0.50	2	GS	⊕				
	Dense, moist, wheathered BEDROCK, with some black sludge material. - oily black product seeping from bedrock		4.49 0.90	3	GS	⊕				
1	Refusal in Bedrock at 1.3m.		4.09	4	GS	⊕				
	End of TEST PIT.		1.30							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-14

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.65							
	Loose, moist, brown, coarse SAND and GRAVEL (FILL)		0.00	1	GS					
1	Firm, moist, brown and grey mottled, sandy SILT. - grey stained lens from 0.9m - 1.1m. - hydrocarbon-like odour throughout.		3.75	2	GS					
			0.90							
				3	GS					
2										
			2.15							
	Firm, moist, grey SILT, some clay. - strong hydrocarbon-like odour to 3.8m.		2.50	4/5	GS					
3										
4										
				6	GS					
			0.05							
	End of TEST PIT.		4.60							
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-15

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	400	800	1200	1600	
					Soil Vapour Content (%LEL)				
					10	20	30	40	
0	Ground Surface Compact, moist, red-brown, silty SAND, with organics. (FILL) - wet lense at east end of the Test Pit.								
			1	GS					
	Dense, moist, mottled brown and grey SILT, trace sand. - hydrocarbon-like odour. - occasional peat inclusions to 2.0m. - trace to some clay, increasing with depth.								
			2	GS					
1									
			3	GS					
2									
			4	GS					
3									
			5	GS					
4									
			6	GS					
5	End of TEST PIT.								

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-16

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
						10	20	30	40		
0	Ground Surface Loose, moist, light brown, coarse SAND and GRAVEL. (FILL)		4.79 0.00	1	GS	⊕					
1	Loose, moist to wet, silver GRAVEL. (FILL) - strong hydrocarbon-like odour. - metal grate like debris. - black product on gravel - oily product seeping at 0.8m.		4.19 0.60	2	GS	⊕					
2											
3	Firm to stiff, moist, brown and grey SILT. - hydrocarbon-like odour. - trace to some clay below 4.0m. - hydrocarbon-like odour decreasing with depth.		3.69 1.10	3	GS	⊕					
4											
5	End of TEST PIT.		0.19 4.60	5	GS	⊕					

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-17

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.95							
	Loose, dry to moist, brown-grey SAND and GRAVEL. (FILL) - no odour.		0.00	1	GS					
			4.45							
	Loose, moist, red-brown to grey, coarse SAND and GRAVEL, some silt. (FILL) - strong hydrocarbon-like odour.		0.50	2/3	GS					
			3.95							
1	Dense, moist, brown and grey SILT, some fine sand lenses. - no odour.		1.00	4	GS					
2				5	GS					
3										
4				6	GS					
			0.75							
	End of TEST PIT.		4.20							
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-18




DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose, dry, brown, coarse SAND and GRAVEL (FILL) - orange staining below 0.5m.		5.22 0.00	1	GS					
				2	GS					
1	Stiff, moist, red-brown with grey SILT, trace sand, occasional rootlets.		4.22 1.00	3	GS					
2				4/5	GS					
3										
4										
	Dense, moist, brown SILT, no organics, trace clay.		0.72 4.50	6	GS					
	End of TEST PIT.		0.52 4.70							
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-19

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	400	800	1200	1600	
						Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose, moist, red-brown SAND and GRAVEL. (FILL) - no odour. - 4" wrapped pipe and metal wire debris below surface.		5.22 0.00	1	GS	⊕				
1	Compact, moist, dark brown to black, with a thin grey lense sandy SILT, some organics. - musty odour.		4.32 0.90	2	GS	⊕				
	Stiff, moist, brown and grey SILT, trace clay below 4.5m, fissured. - no odour.		4.02 1.20							
2				3	GS	⊕				
3				4	GS	⊕				
4				5	GS	⊕				
5	End of TEST PIT.		0.52 4.70							

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 07, 2009

RECORD OF TEST PIT: TP09-20

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
						10	20	30	40		
0	Ground Surface		4.81								
	Loose, moist, brown to grey stained SAND and GRAVEL, coarse sand pockets. (FILL) - strong hydrocarbon-like odour.		0.00	1/2	GS					⊕	
	Soft, moist, black, organic SILT. - hydrocarbon-like odour and musty.		4.51 0.30	3	GS					⊕	
	Loose, moist, green-grey, silty fine SAND, with organic seams, mottled black organics. - hydrocarbon-like odour.		4.21 0.60								
1				4	GS					⊕	
				5	GS					⊕	
2	Dense, grey, moist SILT. - strong hydrocarbon-like odour		3.01 1.80								
				6/7	GS					⊕	
3											
4				8	GS					⊕	
5	End of TEST PIT.		0.01 4.80								

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-21

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200		1600
			DEPTH (m)			Soil Vapour Content (%LEL)				
0	Ground Surface		4.72							
	Loose, brown to silver grey, GRAVEL, trace sand. (FILL) - strong hydrocarbon-like odour. - strong hydrocarbon-like sheen. - metal debris at the north end of Test Pit. - water seepage at 0.8m.		0.00	1	GS					
1				2	GS					
	Soft to stiff, moist, brown and grey mottled SILT, occasional clay pockets, peat - like inclusions. - strong hydrocarbon-like odour		3.52	3	GS					
			1.20							
2	Stiff, moist, brown-grey SILT, trace clay below 4.0m. - trace to no hydrocarbon-like odour.		2.72	4	GS					
			2.00							
3				5	GS					
4										
	End of TEST PIT.		0.12	6	GS					
			4.60							
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-22




DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.42							
	Loose, moist, black, sandy SILT, some bedrock/blast rock, pipes, concrete footings and plywood debris below surface. (FILL) - product seeping from south side of Test Pit. - strong hydrocarbon-like odour.		0.00							
			3.62	1	GS	⊕				
			0.80							
	Loose, moist to wet, stained black, gravelly SAND, with fine rock, product covered. (FILL)		3.42	2/3	GS	⊕				
1	End of TEST PIT. Refusal in Bedrock at 1.0m		1.00							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-23

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
0	Ground Surface Loose, moist, grey GRAVEL. (FILL)		4.32 0.00	1	GS					
1	Loose, wet, black stained SAND and GRAVEL, some silt, some wood debris. (FILL) - strong hydrocarbon-like odour. - seepage from all walls at 0.8m.		3.72 0.60	2	GS					
2	Loose, moist, green-grey SILT. - heavy black organic inclinations. - strong hydrocarbon-like odour.		3.02 1.30	3/4	GS					
3				5	GS					
4				6	GS					
4	End of TEST PIT. Refusal in Bedrock at 3.9m		0.42 3.90	7	GS					
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

SHEET 1 OF 1

RECORD OF TEST PIT: TP09-24

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
			4.25			10	20	30	40	
0	Ground Surface Loose, moist, grey GRAVEL. (FILL)		0.00	1	GS					
			3.75							
	Loose, wet, heavily black stained, gravelly SAND, some fine gravel. (FILL) - asphalt pieces near 0.5m. - hydrocarbon-like odour and sheen. - water seepage at 0.8m, heavy hydrocarbon-like sheen and product seepage.		0.50	2	GS					
1			2.65							
	Soft to stiff, moist, brown and grey mottled SILT. - strong hydrocarbon-like odour. - heavy staining (green-grey to 2.3m).		1.60	3	GS					
2										
				4	GS					
3										
				5	GS					
4			-0.15							
	End of TEST PIT.		4.40							
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-25





DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
0	Ground Surface 2 layers of ASPHALT.		4.30 0.00							
1	Loose to compact, moist, red brown SAND and GRAVEL. (FILL) - grey stained and hydrocarbon-like odour below 1.4m. - wet caving sands with heavy sheen (product) at 1.6m.		3.90 0.40	1	GS	⊕				
2	Soft to firm, moist, grey-brown mottled SILT. - hydrocarbon-like odour to 3.0m. - stiff below 3.0m.		2.70 1.60							
3										
4										
5	End of TEST PIT.		-0.30 4.60	5	GS	⊕				

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-26

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
0	Ground Surface		4.14								
	Compact to loose, moist, grey, fine GRAVEL (FILL) - 4" dia. vertical pipe at east end of Test Pit.		0.00	1	GS	⊕					
			3.54								
	Soft, moist, dark brown, organic SILT. - strong hydrocarbon-like odour. - concrete footing debris approximately 6" thick at 0.7m (northwest corner of Test Pit).		0.60	2	GS					⊕	
1			3.04								
	Soft, moist, green, grey and black mottled SILT, trace to some sand, organic inclusions. - strong hydrocarbon-like odour.		1.10	3	GS	⊕					
			2.54								
	Stiff to firm, moist, green-grey CLAY. - slight hydrocarbon-like odour.		1.60								
2				4	GS	⊕					
	Refusal in Bedrock at 2.6m.		1.54								
	End of TEST PIT.		2.60	5	GS					⊕	
3											
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-27





DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface		4.14							
	Dense to compact, moist, grey GRAVEL. (FILL)		0.00							
			3.84							
	Moist, black, fine gravelly SAND, concrete, metal, wood and ground wire debris. (FILL) - hydrocarbon-like odour and staining. - product seepage from wall at 1.2m.		0.30	1	GS	⊕				
1			2.94							
	Soft to firm, moist, brown-grey SILT, product on surface and in seams. - strong hydrocarbon-like odour.		1.20	2/3	GS	⊕				
2			2.14							
	Stiff to firm, moist, brown-grey with red organic inclusions CLAY, trace sand. - hydrocarbon-like odour.		2.00	4	GS	⊕				
3										
				5	GS	⊕				
4										
				6	GS	⊕				
5	End of TEST PIT.		-0.46 4.60							

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-28

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
0	Ground Surface		4.27								
	Loose to compact, moist GRAVEL. (FILL)		0.00								
	Loose, moist, black SAND, some gravel. (FILL) - strong hydrocarbon-like odour.		3.97 0.30	1	GS	⊕					
1											
	Soft, moist, grey SILT, trace to some fine sand. - strong hydrocarbon-like odour.		2.97 1.30	2	GS	⊕					
2											
	Stiff to firm, moist, brown and grey CLAY. - strong hydrocarbon-like odour. - red organic inclusions to 3.5m.		1.27 3.00	3	GS	⊕					
3											
	End of TEST PIT.		-0.33 4.60	4/5	GS	⊕					
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-29

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600		
			DEPTH (m)			Soil Vapour Content (%LEL)					
			4.18								
0	Ground Surface Loose, dry to moist, brown SAND and GRAVEL (FILL) - concrete, wood, electrical conduits and metal debris. - at 0.3m red staining and oily product seeping from sidewalls. - product on ponding water.		0.00	1	GS	⊕					
			3.58								
	Moist to wet, grey, fine to medium SAND, some fine gravel. - strong hydrocarbon-like odour.		0.60								
1	Refusal in Bedrock at 1.2m.		2.98	2	GS			⊕			
	End of TEST PIT.		1.20								
2											
3											
4											
5											

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-30

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	400	800	1200	1600	
			DEPTH (m)			Soil Vapour Content (%LEL)				
						10	20	30	40	
0	Ground Surface Loose, moist, grey SAND and GRAVEL. (FILL)		4.29 0.00	1	GS					
	Soft, moist, dark brown, organic SILT. - musty, organic-like odour.		3.99 0.30	2	GS					
	Soft, moist to wet, red-brown SILT. - no odour.		3.49 0.80	3	GS					
1	End of TEST PIT. Refusal in Bedrock at 1.0m.		3.29 1.00							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road, Esquimalt, B.C.
 CONTRACTOR : Hazco
 EQUIPMENT USED: Excavator EX125
 OVM TYPE: RKI Eagle
 EXCAVATION DATE: July 08, 2009

RECORD OF TEST PIT: TP09-31






DEPTH SCALE METRES	SOIL PROFILE		SAMPLES		Organic Vapour Meter				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	400	800	1200	1600		
					Soil Vapour Content (%LEL)					
					10	20	30	40		
0	Ground Surface Loose, moist, dark brown SILT, some gravel, some red staining, some tiles and concrete debris. (FILL)		4.52	1	GS	⊕				
	Soft, moist, dark brown, organic SILT, some large boulders.		0.10	2	GS	⊕				
			3.82							
1	Soft, moist, red-brown, some grey mottling SILT.		0.70	3	GS	⊕				
			3.22							
	Soft, moist, grey and brown mottled SILT. - no odour or staining.		1.30							
			3.02	4/5	GS	⊕				
	End of TEST PIT.		1.50							
2										
3										
4										
5										

IOL TP LOG 08-1436-0047 (5026_2001)TP.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF BOREHOLE: BH09-03

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200			
							Soil Vapour Content (%LEL) □						
							20	40	60	80			
0	Ground Surface		0.00										
	SAND, coarse, trace subrounded gravel, compact to loose, moist, brown			1	GRAB		⊕						
	Sandy SILT, stiff, dry to moist, brown, no odour, no staining		0.51	2	GRAB		⊕					METALS	
1	Coarse SAND with subrounded GRAVEL, occasional large cobbles, compact, moist to wet, brown		1.07	3	GRAB		⊕					BTEX VPHEPH	
	BEDROCK		1.22										
	End of BOREHOLE.		1.37										
2													
3													
4													
5													
6													
7													
8													
9													
10													

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 17, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-01

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm)				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			Soil Vapour Content (%LEL)									
	Ground Surface		4.48									Stickup = 0.96 m
0	SAND and GRAVEL, loose to compact, moist to wet, brown to grey		0.15	1	GRAB							Sand
	CLAY, blocky, trace silt, dense, moist, brown and grey, mottled											Bentonite
1				2	GRAB							Sand
												26-Aug-09 ▽
												Slotted Section
2				3	GRAB							
	--- Heavy end hydrocarbon odour from 0 m to 2.1 m											
3				4	AS							
4				5	AS							
5				6	AS							
6				7	AS							
6	End of MONITORING WELL.		-1.62 6.10									
7												
8												
9												
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11

DEPTH SCALE
1 : 50



2535 - 3rd Avenue S.E.
 Calgary, Alberta
 Canada T2A 7W5

LOGGED: PM
 CHECKED: WB/RP

LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 17, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-02

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
							Soil Vapour Content (%LEL) □					
0	Ground Surface SAND, loose, subrounded gravel, loose to compact, dry to moist, reddish brown to grey		5.12 0.00	1	GRAB		⊕					Stickup = 0.85 m Sand
1	Silty SAND, fine, subrounded gravel, stiff, dry to moist, mottled, brown and grey --- Black staining, odour from 0.9 m to 1.8 m		4.36 0.76	2,3	GRAB						BTEX VPH PAH EPH VOC METALS	
2				4	GRAB		⊕				BTEX VPH EPH	
3	SILTY CLAY, some rocks, firm, moist, light brown		2.68 2.44	5	AS			⊕				Bentonite
4				6	AS			⊕			BTEX VPH EPH	26-Aug-09 ▽
5				7	AS			⊕				Sand
6				8	AS			⊕				Slotted Section
7	CLAY, very soft, moist, grey		-1.58 6.71									
8	End of MONITORING WELL.		-2.50 7.62									
9												
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11

LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-04

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Content (%LEL) □						
							20	40	60	80			
0	Ground Surface		4.75										Stickup = 0.98 m
	Coarse gravelly SAND, loose, moist, grey, no odour, no staining		0.00	1	GRAB		⊕						Sand
			3.99										Bentonite
			0.76										Sand
1	Gravelly SAND, some subrounded GRAVEL, loose, wet, grey, hydrocarbon like odour, hydrocarbon like sheen on surface of ponding water at 1.4 m		0.76	2	GRAB		⊕					METALS	26-Aug-09 ▽
			2.77										Slotted Section
2	Sandy SILT, dense, wet, grey, hydrocarbon like odour		1.98	3	GRAB		⊕					BTEX EPH VPH PAH	Sand
			2.32										
			2.44										
3	SILTY CLAY, occasional fine angular gravel, stiff to firm, brown to grey --- Hydrocarbon like odour from 2.4 m to 4.3 m --- Moist from 3 m to to 2.8 m		2.44	4	AS		⊕						
			-1.04										
			5.79										Bentonite
6	CLAY, soft, wet, grey, no odour, no staining		5.79	7	AS		⊕						
			-3.17										
			7.92	8	AS		⊕						
			-3.78										
8	CLAY, with weathered bedrock pieces, dense, wet, grey, no odour, no staining		7.92	9	AS		⊕					BTEX VPH EPH	
			-3.78										
			8.69										
	BEDROCK		-3.78										
9	End of MONITORING WELL.		8.69										
10													

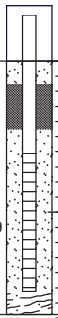
IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-05

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Content (%LEL) □						
0	Ground Surface		5.39									BTEX VOC EPH PAH METALS VPH	Sand Bentonite Sand Slotted Section Slough
	Coarse SAND, some subrounded GRAVEL, compact to loose, moist, brown, no odour, no staining		0.00										
			5.09	GRAB									
	SANDY SILT, firm, moist to wet, greenish, grey with black staining, hydrocarbon like odour and staining		0.30										
			4.58	2,3	GRAB								
1	Blast ROCK, with sludge, dense, wet, black, hydrocarbon like odour and staining		0.81										
			3.72	4	AS								
			1.68	5	AS								
2	End of MONITORING WELL.												
3													
4													
5													
6													
7													
8													
9													
10													



IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11

LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-06

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Content (%LEL) □						
							20	40	60	80			
0	Ground Surface		4.21										Stickup = 1.16 m
	Coarse SAND and subrounded GRAVEL, loose to compact, dry, brown, hydrocarbon like odour		0.15	1	GRAB		⊕						Sand
	Sandy SILT, stiff, moist, greenish grey with black staining, hydrocarbon like odour, hydrocarbon like sheen on ponding water, asphalt like patches to 0.6 m												Bentonite 26-Aug-09 Sand
1				2	GRAB		⊕					METALS	Slotted Section
2	--- Wet and ponding water at 2.0 m			3	GRAB			⊕				BTEX VOC EPH VPH	
			1.77										
	CLAY, trace silt, stiff, moist, brown, grey mottled --- Occasional fine subrounded gravel from 2.6 m to 8.8 m		2.44	4,5	AS					⊕		BTEX EPH PAH VPH	Sand
3													
	--- Hydrocarbon like odour to 3.4 m			6	AS					⊕			
4													
				7	AS					⊕		BTEX VPH EPH	
5													
				8	AS					⊕			Bentonite
6													
				9	AS					⊕			
7													
			-4.63										
	Coarse SAND, compact, wet, grey, hydrocarbon like odour --- Clay lens at 9.1 m on bedrock		8.84	10	AS					⊕			Slough
	End of MONITORING WELL.		-4.94										
			9.14										
9													
10													

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11

DEPTH SCALE
1 : 50






2535 - 3rd Avenue S.E.
Calgary, Alberta
Canada T2A 7W5

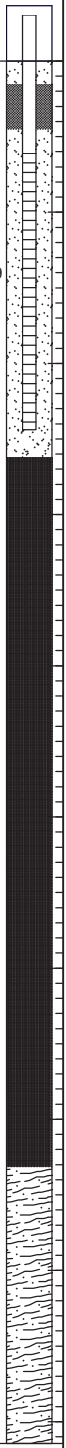
LOGGED: PM
CHECKED: WB/RP

LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-07

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Content (%LEL) □					
0	Ground Surface		4.57									Stickup = 1.13 m
	Coarse SAND and subrounded GRAVEL, compact to loose, moist, brown, 0.1 m diameter pipe identified at 0.6 m below grade, hydrocarbon like odour		0.00	1	GRAB							Sand
			3.87									Bentonite
1	SANDY SLIT, occasionally subrounded gravel, stiff, moist, brown, greenish grey, mottled, hydrocarbon like odour and staining, water ponding at 2 m with hydrocarbon sheen		0.70	2	GRAB	⊕						Sand
			2.13									BTEX VOC EPH PAH VPH
2			2.44	3	GRAB	⊕						BTEX VPH EPH METALS
			2.13									
	CLAY, trace subrounded gravel, stiff, moist, brown and grey, no odour, no staining		2.44	4	AS	⊕						Sand
3												
				5	AS	⊕						BTEX VPH EPH
4	--- Firm start from 4.0 m											
				6	AS	⊕						
5	--- Soft, wet, grey from 5.2 m											Bentonite
				7	AS	⊕						
6												
				8	AS	⊕						
7												
				9	AS	⊕						
8												
9	End of MONITORING WELL.		-4.57									
			9.14									
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 18, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-08





DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Content (ppm)				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Content (%LEL)					
		ELEV.				20	40	60	80		
		DEPTH (m)									
0	Ground Surface	4.27									Stickup = 0.95 m
	Fine to medium SAND and subrounded GRAVEL, loose to compact, moist, brown, no odour, no staining	0.00 4.06 0.20	1	GRAB						METALS	Sand
	Medium to coarse SAND and subrounded GRAVEL, loose to compact, wet, grey, hydrocarbon like odour, water ponding with hydrocarbon like sheen	3.66 0.61	2,3	GRAB						BTEX VPH EPH PAH	Sand
1	Sandy SILT, some organic pockets, occasional subrounded gravel, soft to stiff, wet, brown and grey, with black staining, hydrocarbon like odour and sheen (possible free product)										26-Aug-09 ▽
		2.44									Slotted Section
2	CLAY, some coarse sand, stiff, wet, brown, grey, hydrocarbon like odour to 5.8 m	1.83	4	GRAB		⊕				BTEX VPH EPH	Sand
3			5	AS		⊕					
4			6	AS		⊕					Bentonite
5	--- weathered bedrock pieces from 4.9 m to 5.8 m --- Soft from 4.9 m to 5.8 m		7	AS		⊕				BTEX VPH EPH	
		-1.37									Slough
6	BEDROCK End of MONITORING WELL.	5.79									
7											
8											
9											
10											

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-09






DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Content (%LEL) □						
				20	40	60	80						
0	Ground Surface		4.21										Stickup = 0.81 m
	Gravel, dense to compact, moist, grey (FILL)		0.00										Sand
			3.90										Bentonite
	Fine gravelly SAND, concrete, metal, wood and ground wire debris, moist, black (FILL), hydrocarbon like odour and staining		0.30										Sand
1	--- Product seepage from wall at 1.2 m		2.99										26-Aug-09 ▽
	SILT, product on surface and in seams, soft to firm, moist, brown and grey		1.22										Slotted Section
2	Red organic inclusions CLAY, trace sand, stiff to firm, moist, brown and grey, hydrocarbon like odour		2.19										
	End of MONITORING WELL.		2.13										
3													
4													
5													
6													
7													
8													
9													
10													

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

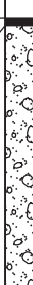



RECORD OF MONITORING WELL: MW09-10

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Content (%LEL) □					
0	Ground Surface		4.11									Stickup = 1.0 m
	Coarse SAND and subrounded GRAVEL, loose to compact, dry to moist, no odour, no staining		0.00	1	GRAB	⊕						Sand
			3.41									Bentonite
			0.70	2	GRAB	⊕						Sand
1	Coarse SAND and subrounded GRAVEL, some large cobbles, loose, wet, grey, hydrocarbon like odour, ponding water at 1.5 m, hydrocarbon like sheen		2.29									26-Aug-09 ▽
			1.83	3	GRAB	⊕						Slotted Section
2	Sandy SILT, stiff, wet, brown, no odour, no staining		1.83									BTEX VPH EPH
			2.29									Sand
3	CLAY, stiff, moist, brown and grey, no odour, no staining			4	AS	⊕						METALS
				5	AS	⊕						BTEX VPH EPH
4				6	AS	⊕						Bentonite
				7	AS	⊕						Bentonite
5				8	AS	⊕						Slough
	--- Soft and grey from 6.1 m		-3.20									
	Coarse SAND with clay, and weathered bedrock pieces, no odour, no staining		7.32									
	End of MONITORING WELL.		-3.51									
			7.62									
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11

LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-11

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
							Soil Vapour Content (%LEL) □					
0	Ground Surface ASPHALT		3.78									Stickup = 0.9 m
	Medium to coarse SAND and subrounded GRAVEL, some angular cobbles, loose to compact, moist, brown to grey below 5.8 m, no odour, no staining		0.05	1	GRAB		⊕					Sand and Concrete Bentonite Sand
1				2	GRAB		⊕					BTEX VPH EPH
2	SILTY CLAY, occasional fine subrounded gravel, firm, moist to wet, brown and grey, no odour, no staining		1.95									BTEX VPH EPH PAH
			1.83	3	GRAB		⊕					
												Slotted Section
				4	AS		⊕					
3	Silty SAND, some fine angular gravel below 3 m, loose to compact, moist, brown, no odour, no staining		1.04									
			2.74	5	AS		⊕					
												Slough
				6	AS		⊕					
	BEDROCK		0.58									
	End of MONITORING WELL.		3.35									



IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-12

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Content (%LEL) □					
							20	40	60	80		
0	Ground Surface		3.66									
	ASPHALT		0.05									
	SAND and GRAVEL, loose, moist, black, debris (wood boards, 2 diameter pipe) between 0.3 m to 0.35 m, hydrocarbon like odour and sheen			1	GRAB					⊕		
			2.83									
1	Fine to medium SAND, loose, moist, grey, hydrocarbon like odour		0.82							⊕	BTEX VPH EPH	
			1.83							⊕	METALS	
			1.83							⊕	BTEX/VPH EPH/PAH/VOC	
2	Fine to medium SAND, loose to compact, wet, black, hydrocarbon like odour			4.5	GRAB					⊕		
	BEDROCK		2.13									
	End of MONITORING WELL.											
3												
4												
5												
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-13

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Content (%LEL) □					
						20	40	60	80		
0	Ground Surface CONCRETE										
	Medium to coarse gravelly SAND, loose, moist, brown, no odour, no staining	0.09	1	GRAB		⊕					Flushmounted Casing Concrete Sand Bentonite Sand
1			2	GRAB		⊕				BTEX VPH EPH METALS	
	Coarse gravelly SAND, loose, wet, black	2.12 1.45									26-Aug-09 ▽ Slotted Section
3	--- Hydrocarbon like odour from 2.7 m		3,4	AS		□				BTEX VPH EPH PAH VOC	
4	--- Free product at 4.0 m		5	AS						BTEX VPH EPH	
	BEDROCK	-0.40									Sand
	End of MONITORING WELL.	4.11									
5											
6											
7											
8											
9											
10											

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-14

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Content (%LEL) □					
						20	40	60	80		
0	Ground Surface CONCRETE										Flushmounted Casing Concrete Sand Bentonite Sand 26-Aug-09 ▽ Slotted Section Slough
	Fine to medium SAND and subrounded GRAVEL, compact, moist, reddish brown mottled, hydrocarbon like odour		1	GRAB		⊕				METALS	
	Coarse SAND, some subround GRAVEL, loose, moist to wet, grey, hydrocarbon like odour — Water ponding at 1 m with hydrocarbon like sheen		2	GRAB		⊕				BTEX VPH EPH	
1	Sandy SILT, firm, moist, greenish grey with black staining, hydrocarbon like odour		3	AS		⊕				BTEX VPH EPH PAH VOC	
2	CLAY, some fine sand seams, stiff, moist, brown, grey, no odour, no staining		4	AS		⊕				BTEX VPH EPH	
	End of MONITORING WELL.										

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Rd, Victoria
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track - Mount + VAC Truck
 OVM TYPE: RKI Eagle
 BORING DATE: August 19, 2009
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW09-15

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Content (ppm) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150			200
							Soil Vapour Content (%LEL) □					
	Ground Surface											
0	ASPHALT											
	Fine SAND, compact, moist, black, no odour, no staining		0.08	1	GRAB	⊕						Sand
	Medium to coarse SAND and subrounded GRAVEL, some silt, loose, moist to wet, reddish, brown, no odour, no staining		0.61	2	GRAB	⊕						Bentonite
1												
	CLAY, trace subrounded gravel, dense, moist to wet, grey, no odour, no staining --- Water ponding at 2.0 m		1.83	3	GRAB	⊕						
2	End of MONITORING WELL.		2.13									
3												
4												
5												
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047.5026.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: May 17, 2010
 DATUM: Geodetic

RECORD OF BOREHOLE: MW10-01

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	
	DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
						20	40	60	80		
0	Ground Surface										
	CONCRETE (CORED)										
	SAND and GRAVEL (FILL), large cobbles, debris (brick and concrete), compact, moist to wet, black staining	0.08									
	--- Standing water, sheen at 0.8 m										
1											
	SILT, stiff, wet, brown, hydrocarbon odour	1.22									
	NO RECOVERY	1.68									
2											
	SILT, stiff, moist, grey to brown	2.13	1			⊕					METALS
	--- Very stiff, some clay at 3.1 m and below										
3											
			2			⊕					BTEX EPH PAH VPH
4											
	--- Some subrounded gravel at 4.4 m										
5			3			⊕					
	SILTY CLAY, trace subrounded gravel, moist, brown with grey mottles	5.49	4			⊕					
6											
	SILTY CLAY, trace fine gravel, soft, moist, grey	6.40	5			⊕					BTEX EPH PAH VPH
7											
	SILTY SAND, trace gravel, fine, compact, moist to wet, grey, --- Hard drilling at 7.5 m	7.32	6			⊕					BTEX EPH VPH
	Pulverized BEDROCK, angular pieces --- Rock at 7.9 m	7.62									
8	End of BOREHOLE.	7.92									
	Upon completion of drilling, the borehole was backfilled with bentonite from the bottom of hole to 0.3 m below ground surface. The last 0.3 m was backfilled with sand.										
9											
10											

IOL BH LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vacuum Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: June 02, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-01A

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
						20	40	60	80		
0	Ground Surface	4.54									Flushmount Roadbox
	ASPHALT (CORED)	0.08									
	SAND and GRAVEL (FILL), cobbles, with debris (brick and concrete), compact, moist to wet, black stained, faint odour		1,2			⊕					METALS
1											
			3			⊕					
	SILT, firm, wet, dark brown to black	3.02									BTEX EPH VPH
	--- Grey and black, stiff, hydrocarbon at 1.7 m	1.52									
2	--- Pooling water, hydrocarbon sheen and odour at 1.8 m	2.71	4			⊕					
	SILT, stiff, moist, brown and grey	1.83									
3	--- Very stiff at 3.1 m and below	1.34									Bentonite
	SILTY CLAY, firm, moist, brown and grey	3.20									
5	CLAY, soft, wet, grey, some brown oxidation	-0.34 4.88									
6	Fine to medium grained SILTY SAND, some embedded subrounded fine gravel, brown to grey	-1.40 5.94									Sand
7	Weathered BEDROCK, silty sand, grey	-2.32 6.86									
	--- Hard drilling (reported by drillers) at 7.0 m										Slotted Section
	--- Bedrock 76.2 mm long pieces										
	--- Refusal at 7.5 m										Sand
	End of MONITORING WELL.	-3.23 7.77									

28 July 2010

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11

DEPTH SCALE

1 : 50



2535 - 3rd Avenue S.E.
 Calgary, Alberta
 Canada T2A 7W5

LOGGED: AEK/PM
 CHECKED: WB/RP

LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: May 18 and June 2, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-02

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Concentration (%LEL) □						
							20	40	60	80			
0	Ground Surface		5.04										Flushmount Roadbox
	ASPHALT (CORED)		0.08	1							METALS		
	SAND and GRAVEL (FILL), subrounded, moist, grey to brown												
1	--- Standing water at 0.96 m			2							BTEX EPH PAH VPH		
			3.52										Bentonite
	SILT, some sand, firm, moist to wet, grey to brown, hydrocarbon like odour		1.52	3									6 July 2010 ▽
2			2.81										
	--- Becoming stiff with no sand below 2.3 m		2.23	4									
	SILT, trace clay, stiff, dry to moist, brown and grey												
3	--- Wet, fractured, more clay, occasional coarse sand lens, mainly brown with grey seams below 3.1 m			5,6							BTEX EPH VPH		Sand
4	--- Gravel at 3.9 m (only 50.8 mm recovery from 3.1 m to 4.6 m)												
	--- Cobble lens, subrounded, flat, green, white to black, ranging from 0.35 m to 0.38 m length at 3.9 m			7							EPH VOC VPH		Slotted Section
5													
6				8,9							BTEX EPH VPH		
7			-1.97										Sand
	End of MONITORING WELL.		7.01	10,11									

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT. 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: May 18 and June 1, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-03

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Concentration (%LEL) □						
							20	40	60	80			
0	Ground Surface		4.83										6 July 2010
	SILTY SAND, some gravel, compact, moist, dark brown, hydrocarbon like odour		0.00										Flushmount Roadbox
			4.07	1			□					METALS	
1	SILT, trace sand, firm, moist, grey and brown, slight hydrocarbon like odour --- Some fine sand, strong hydrocarbon like odour at 1.1 m		0.76						⊕			BTEX EPH METALS VPH	
			2.70	2								BTEX EPH PAH VPH	
2	SILT, some clay, firm, wet, brown with grey		2.13									BTEX EPH PAH VPH	
			0.26	3,4			□					BTEX EPH METALS PAH VPH	
3	--- Red oxidation below 3.1 m --- Large subrounded gravel at 3.2 m. Some fine gravel, becoming stiff, no odours below 3.2 m		4.57									BTEX EPH METALS PAH VPH	
			0.26	5			⊕					BTEX EPH METALS PAH VPH	
4			4.57									BTEX EPH METALS PAH VPH	
			0.26	6			⊕					BTEX EPH METALS PAH VPH	
5	SILTY CLAY, trace gravel (fine subround below 6.2 m), soft to very soft		4.57									BTEX EPH METALS PAH VPH	Bentonite
			0.26	7,8			⊕					BTEX EPH METALS PAH VPH	
6	--- Wet puddles at 6.1 m --- No odours, break on core run at 3.1 m		4.57									BTEX EPH METALS PAH VPH	
			0.26	9			⊕					BTEX EPH METALS PAH VPH	
7			4.57									BTEX EPH METALS PAH VPH	
			0.26	10			⊕					BTEX EPH METALS PAH VPH	
8			4.57									BTEX EPH METALS PAH VPH	
			0.26	11			⊕					BTEX EPH METALS PAH VPH	
9	--- Some silt pockets (becomes firm) from 8.8 m to 9.1 m		4.57									BTEX EPH METALS PAH VPH	
			0.26	12			⊕					BTEX EPH METALS PAH VPH	
10	--- Becoming soft to firm below 9.7 m		4.57									BTEX EPH METALS PAH VPH	

CONTINUED NEXT PAGE

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT. 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vacuum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: May 18 and June 1, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-03

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
							Soil Vapour Concentration (%LEL) □					
							20	40	60	80		
10	SILTY CLAY, trace gravel (fine subround below 6.2 m), soft to very soft (<i>continued</i>)											
			-5.84									
11	SILTY SAND, medium to coarse grained, loose, wet, grey, no odour or staining		10.67	13,14			⊕					
			-6.90									
12	SANDY SILT, fine grained, firm to soft, wet, grey		11.73	15			⊕				BTEX EPH VPH	Bentonite
			-7.36									
	SAND, some silt, medium to coarse grained, wet, grey --- Coarse sand lens with some coarse gravel from 12.6 to 12.7		12.19				⊕					
			-7.97	16,17			⊕					
13	SILTY SAND, with weathered bedrock pieces (50.8 mm thick at 13.2 m and 76.2 mm at 13.5 m), flat, subangular, wet		12.80				⊕					Sand
			-8.89	18			⊕					
14	Large BEDROCK pieces with silt, green to grey, no odour --- 76.2 mm flat, very dense --- Hard drilling, possible bedrock		13.72	19,20			⊕				BTEX EPH PAH VPH	Slotted Section
			-9.54									Sand
	End of MONITORING WELL.		14.37									
15												
16												
17												
18												
19												
20												

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vacuum Truck and Track mounted - Hollow Auger with Split Spoon and ODEX
 OPERATOR: RKI Eagle
 BORING DATE: May 18 and June 15, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-04

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
		ELEV. DEPTH (m)				20	40	60	80		
10	SILTY SAND, with some medium subrounded gravel, fine to medium grained, loose, wet, grey --- Course sand lens from 10.51 m to 10.53 m --- Embedded fine gravel, wet below 10.7 m Saturated from 11.4 m to 11.7 m	-5.58 10.06	17,18	SS		⊕					Bentonite
11			19	SS		⊕					
12		Weathered BEDROCK, some silty fine sand, dense, moist, grey	-7.49 11.96	20	SS		⊕				
13	BEDROCK --- Cave at 12.8 m --- Bedrock depth confirmed with tape	-8.15 12.62									Slotted Section
14	End of MONITORING WELL.	-8.94 13.41									Sand
15											
16											
17											
18											
19											
20											

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vacuum Truck and Track mounted - Hollow Auger with Split Spoon and ODEX
 OPERATOR: RKI Eagle
 BORING DATE: May 18 and June 16, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-05

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
		ELEV. DEPTH (m)				20	40	60	80		
10	CLAY, stiff, moist, brown (<i>continued</i>) --- Silt band 50.8 mm thick at 10.2 m --- Fine grained sand lens, 10 mm thick, wet at 10.7 m		14	SS							
11											
12	SANDY SILT, some fine subangular gravel, some clay, firm, wet, grey --- Musty odour from 11.9 m to 12.2 m --- Gravel increasing below 12.2 m	-6.81	15,16	SS							
			11.96								
13	SILTY SAND, fine to medium grained gravel, compact, moist, grey --- Fine sand lenses layered with silt lenses between 13.1 to 13.3 m --- Some fine subangular gravel and increasing at 13.5 m	-7.88	17	SS						EPH VOC VPH	Bentonite
			13.03	18	SS						
14				19	SS						
15	--- Coarse sand lens 50.8 mm thick with large subangular cobble (green bedrock-like) between 14.7 m to 14.8 m Course grained SAND, with fine to medium subangular gravel, some silt, compact to dense, grey --- Saturated from 15.2 m to 15.6 m	-9.86	20	SS						BTEX EPH VPH	Sand
			15.01								
16	SILTY SAND, fine to medium grained, some fine subrounded gravel, compact, wet, grey	-10.47	21	SS							
		15.62									
	BEDROCK (green to black)	-11.00									Slotted Section
		16.15									
17	End of MONITORING WELL.	-11.61									Sand
		16.76									
18											
19											
20											

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: June 2 and 3, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-06

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
		ELEV. DEPTH (m)				20	40	60	80		
0	Ground Surface	4.70									
	CONCRETE (CORED)										Flushmount Roadbox
	SAND (FILL), some gravel, medium sand, loose, moist, grey to brown	0.08	1			⊕					
	--- Coarse sand, wet at 0.6 m	3.97	2			⊕					
1	SAND and GRAVEL, some silt pockets, coarse grained with medium subrounded gravel, wet, black stained, hydrocarbon odour	0.73									
	--- Very loose, with gravel at 0.9 m	3.48	3			⊕					6 July 2010
	SILTY CLAY, firm, moist to wet, grey to black stained, hydrocarbon odour	1.22	4			⊕					▽
	--- SILT, dry to moist, compact	3.18	5,6								
	--- Becomes brown and grey, still hydrocarbon odour at 1.7 m	1.52									
2			7			⊕					
	--- Becomes very stiff below 2.3 m										
			8			⊕					
3											
	--- Riverbed gravel lens (subrounded) from 3.1 m to 3.7 m										
	--- Generally grey at 3.7 m	1.04									
4	CLAYEY SILT, some embedded fine to medium grained subrounded gravel, beige paint or metal chips below gravel lens, dense	3.66	9,10			⊕					
		0.13									
	CLAY, firm to soft, moist, brown with grey inclusions, no odour	4.57									Bentonite
5			11			⊕					
			12			⊕					
6											
			13,14			⊕					
7											
	--- Grey, wet below 7.6 m										
8			15			⊕					
	--- Trace bedrock fragments below 8.2 m										
	BEDROCK, dense, dry	-3.83									
		8.53									
9	End of MONITORING WELL.	-4.29									
		8.99									

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11

DEPTH SCALE
1 : 50



2535 - 3rd Avenue S.E.
Calgary, Alberta
Canada T2A 7W5

LOGGED: AEK/PM
CHECKED: WB/RP

LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vacuum Truck
 OVM TYPE: Rkl Eagle
 BORING DATE: June 2 and 3, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-06A(Nest)

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	Soil Vapour Concentration (%LEL) □					
							20	40	60			80
0	Ground Surface		4.66									
	ASPHALT		0.08									Flushmount Roadbox
	SAND (FILL), medium to coarse grained, some gravel, loose, wet (flowing Saturated), brown and grey, hydrocarbon odour											Bentonite 6 July 2010 ▽
1												
			3.14									
	SILT, trace gravel to 0.9 m, firm to stiff, black stained to 2.1 m with hydrocarbon odour, then brown to grey		1.52									Sand
2												Slotted Section
3												
			1.31									Sand
	CLAY, very stiff, brown to grey, some reddish oxidation		3.35									Bentonite
4												
			0.09									
	End of MONITORING WELL.		4.57									
5												
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: June 10, 17 and 18, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-07

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			DEPTH (m)				Soil Vapour Concentration (%LEL) □						
							20	40	60	80			
0	Ground Surface		4.18										Stickup = 0.94 m
	Coarse SAND and subrounded GRAVEL, loose to compact, dry to moist, no odour, no staining		0.00										
	--- Sand and gravel, compact, moist, brown, hydrocarbon odour from 0 to 1.5 m		3.48										
1	Coarse SAND and subrounded GRAVEL, some large cobbles, loose, wet, grey, hydrocarbon like odour, ponding water at 1.5 m, hydrocarbon like sheen		0.70										
	--- Silt, stiff, light brown, wet from 1.5 m to 3.1 m		2.35										
2	Sandy SILT, stiff, wet, brown, no odour, no staining		1.83										
	CLAY, stiff, moist, brown and grey, no odour, no staining		1.89										
			2.29										28 July 2010 ▽
3	--- Brown, dense, wet, clay at 3.1 m												
4													
5													Bentonite
6	--- Soft and grey from 6.1 m												
	CLAY, firm, moist, brown and grey		-1.92										
	--- Fine sand seams 10 mm thick between 6.48 m and 6.58 m		6.10	1	SS								BTEX EPH VPH
	--- Some gravel (subrounded) below 6.6 m		-2.75										
7	SAND, coarse grained, some fine to medium subangular gravel, some silt, compact, moist		6.93	2									
	--- Wet from 7.6 m to 8.0 m												
8	--- Gravel is finer below 8.2 m			3									
	--- Coarse sand lens from 8.61 m to 8.64 m and 9.47 m to 9.54 m		-4.66										
9	SILTY SAND, fine to medium grained, trace to some medium subrounded gravel, dense, moist		8.84	4									BTEX EPH VPH
				5,6	SS								
10													

CONTINUED NEXT PAGE

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT. 05/19/11

DEPTH SCALE

1 : 50



2535 - 3rd Avenue S.E.
 Calgary, Alberta
 Canada T2A 7W5

LOGGED: PM
 CHECKED: WB/RP

LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: June 10, 17 and 18, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-07


DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
		ELEV. DEPTH (m)				20	40	60	80		
10	SILTY SAND, fine to medium grained, trace to some medium subrounded gravel, dense, moist (<i>continued</i>) --- Finer gravel and sand, increasing density below 10.4 m		7	SS							
11	SAND, coarse grained, with some gravel, wet, some flat subangular gravel, grey --- Coarse gravel lens, wet, fine from 11.68 m to 11.73 m	-6.89 11.07	8	SS							Bentonite
12	SILTY SAND, fine grained, some fine gravel, compact, wet SAND, medium grained, some fine gravel, compact, wet, grey	-7.63 11.81 -8.04 12.22	9	SS							Sand
13	BEDROCK --- One piece of rock at 13.1 m Complete at BEDROCK	-8.90 13.26	10	SS							Slotted Section
14	End of MONITORING WELL.	-9.84 14.02									Sand
15											
16											
17											
18											
19											
20											

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Sonic Truck Percussion Rig / Vaccum Truck
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF BOREHOLE: MW10-08

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200	
			Soil Vapour Concentration (%LEL) □								
0	Ground Surface SAND and GRAVEL, angular gravel, some roots, fine to medium gravel, dense, dry, brown, organic to musty odour Coarse grained SAND and GRAVEL, finer gravel, compact, moist, orange staining below 0.4 m, reddish brown --- Some orange (slag-line pieces and metal) at 0.5 m End of BOREHOLE. Upon completion of drilling, the borehole was backfilled with bentonite from the bottom of hole to 0.3 m below ground surface. The last 0.3 m was backfilled with sand.		0.00	1	GRAB	⊕					BTEX,EPH METALS,VPH METALS
			0.18	2	GRAB	⊕					
1			0.56								
2											
3											
4											
5											
6											
7											
8											
9											
10											

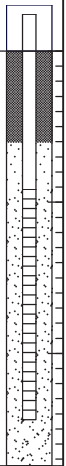
IOL BH LOG 08-1436-0047-5026-2006 MW LOGS.GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR:
 EQUIPMENT USED : Hand Dug with Clam Digger
 OVM TYPE: Rkl Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-09

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Concentration (%LEL) □					
						20	40	60	80			
0	Ground Surface HAND AUGER		5.15 0.00									Stickup = 0.54 m
1												Bentonite
2			3.63 1.52									Sand
2	HOLLOW STEM AUGER											Slotted Section
3	End of MONITORING WELL.		2.41 2.74									Sand
3	Monitoring well was dry on July 28, 2010 Please refer to borehole log for MW10-05 for detailed soil description results											
4												
5												
6												
7												
8												
9												
10												



IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : R-53 (Track Rig) Hollow Stem Auger / Hand Auger
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-10

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Concentration (%LEL) □					
0	Ground Surface		4.72									Flushmount Roadbox Bentonite Sand 6 July 2010 Slotted Section Sand
	ASPHALT											
	HAND AUGER		0.15									
1												
	HOLLOW STEM AUGER		3.35 1.37									
2												
	End of MONITORING WELL.		1.98 2.74									
3												
4												
5												
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : R-53 (Track Rig) Hollow Stem Auger / Hand Auger
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-11

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Concentration (%LEL) □					
						20	40	60	80			
0	Ground Surface HOLLOW STEM AUGER		4.16 0.00									Stickup = 0.92 m
1												
	HOLLOW STEM AUGER		2.64 1.52									28 July 2010 ▽
2												
	HOLLOW STEM AUGER		1.11 3.05									Bentonite
3												
	HOLLOW STEM AUGER		-0.41 4.57									
4												
	HOLLOW STEM AUGER		-1.94 6.10									
5												
	HOLLOW STEM AUGER		-3.46 7.62									Sand
6												Slotted Section
	HOLLOW STEM AUGER		-4.37 8.53									Sand
7	End of MONITORING WELL.											
8												
	Please refer to TP09-03 for detailed soil description results											
9												
10												

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT. 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : R-53 (Track Rig) Hollow Stem Auger / Hand Auger
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-12

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
		ELEV. DEPTH (m)				20	40	60	80		
0	Ground Surface HAND AUGER	4.44 0.00									Stickup = 0.98 m
1											
2	HOLLOW STEM AUGER	2.92 1.52									Bentonite
3											
4	HOLLOW STEM AUGER	1.39 3.05									Sand 6 July 2010 Slotted Section
5	End of MONITORING WELL. Please refer to MW10-04 for detailed soil description results.	-0.44 4.88									Sand
6											
7											
8											
9											
10											

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT. 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : R-53 (Track Rig) Hollow Stem Auger / Solid Stem Auger
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-13

DEPTH SCALE METRES	SOIL PROFILE		SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	RECOVERY %	50	100	150	200		
						Soil Vapour Concentration (%LEL) □					
	Ground Surface										
	CONCRETE (previously cored)										
	SAND (FILL), some fine gravel, compact, moist, grey to brown, odour (mildew/organic like) --- Medium sand, trace subrounded gravel (fine)										
0		3.55									Flushmount Roadbox
		0.12									Bentonite
1			1		60	⊕					Sand
											Slotted Section
2											
	--- Refusal, potential bedrock at 2.3 m		2.3		50	⊕					
		0.96									
	End of MONITORING WELL.	2.59									
3	Well was dry on July 7, 2010.										
4											
5											
6											
7											
8											
9											
10											

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : R-53 (Track Rig) Hollow Stem Auger / Solid Stem Auger
 OVM TYPE: RKI Eagle
 BORING DATE: June 28, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-14

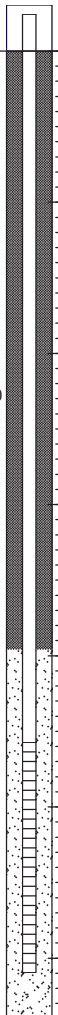
DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200		
							Soil Vapour Concentration (%LEL) □					
0	Ground Surface		5.01									Flushmount Roadbox Bentonite
	ASPHALT											
	HAND AUGER		0.08									Slotted Section 6 July 2010 ▽
			3.49									
	HOLLOW STEM AUGER		1.52									
2												
	End of MONITORING WELL.		2.88									
			2.13									
	Please refer to MW10-02 for detailed soil description results											
3												
4												
5												
6												
7												
8												
9												
10												

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11



LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track Mounted R53 ODEX Drilling Rig
 OVM TYPE: Rkl Eagle
 BORING DATE: October 05, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-15

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	RECOVERY %	50	100	150	200			
			Soil Vapour Concentration (%LEL) □				20	40	60	80			
0	Ground Surface		5.77									Stickup = 0.82 m	
	SAND and GRAVEL (FILL), loose		0.00										
			5.31										
	SAND (FILL), medium grained, some rounded gravel, loose, moist, brown		0.46	1	AS	80							
	CLAYEY SILT, some sand, firm, grey, moist		5.08										
1			0.69										
	BEDROCK		4.55	2	AS	80							
			1.22										
2	--- Fracture zone, hydrocarbon-like odour from 1.83 m to 1.98 m												Bentonite
													22 Nov 2010 ▽
3	--- Soft rock, easy drilling from 3.05 m to 3.35 m												
	--- Competant bedrock from 3.35 m to 3.81 m												
4												Sand	
	--- Fracture zone from 4.57 m to 4.67 m												
5												Slotted Section	
	--- Competant bedrock from 5.33 m to 6.25 m												
6			-0.63									Sand	
	End of MONITORING WELL.		6.40										
7													
8													
9													
10													

IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11

LOCATION: 337 Victoria View Road
 CONTRACTOR: Beck Drilling and Environmental Services Ltd.
 EQUIPMENT USED : Track Mounted R53 ODEX Drilling Rig
 OVM TYPE: RKI Eagle
 BORING DATE: October 05, 2010
 DATUM: Geodetic

RECORD OF MONITORING WELL: MW10-16

DEPTH SCALE METRES	SOIL PROFILE			SAMPLES			Soil Vapour Concentration (ppmv) ⊕				ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	RECOVERY %	50	100	150	200		
			DEPTH (m)				Soil Vapour Concentration (%LEL) □					
							20	40	60	80		
0	Ground Surface	[Cross-hatch]	5.67									Stickup = 0.93 m
	SAND (FILL), medium grained, some rounded gravel, loose, moist, grey-brown		0.00									
1	CLAYEY SILT, some sand, firm, grey, moist	[Diagonal lines]	4.91 0.76									Bentonite
2	BEDROCK, fractured, hydrocarbon-like odour	[Hatched]	3.84 1.83									Sand
												22 Nov 2010 ▽
3												Slotted Section
	--- Water in hole at 3.20 m		2.32									
	End of MONITORING WELL.		3.35									Sand
4												
5												
6												
7												
8												
9												
10												

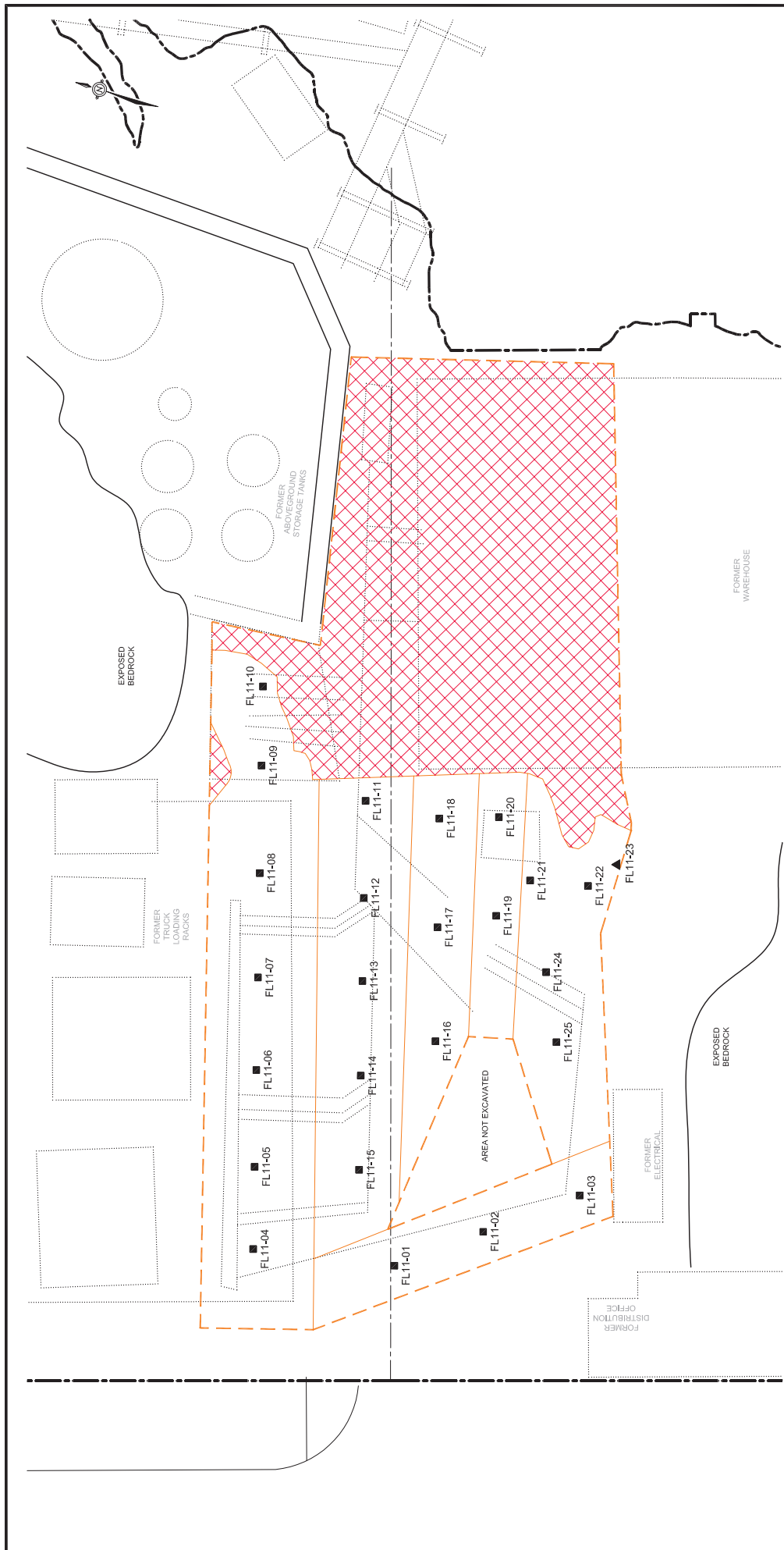
IOL MW LOG 08-1436-0047-5026-2006 MW LOGS:GPJ IOL.GDT 05/19/11





APPENDIX G

Remedial Site Works Drawings by Golder Associates



- LEGEND**
- PROPERTY BOUNDARY
 - - - EXCAVATION LIMITS
 - ▣ EXCAVATED TO BEDROCK BASE
 - ▣ FORMER FACILITY
 - NATIVE CLAYSILT SOIL SAMPLE TAKEN (EXCAVATION BASE)
 - ▲ NATIVE CLAYSILT SOIL SAMPLE TAKEN (EXCAVATION WALL)



CLIENT
IMPERIAL OIL LIMITED
 FORMER PETROLEUM TERMINAL
 337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.
 TITLE

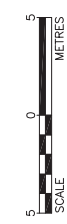
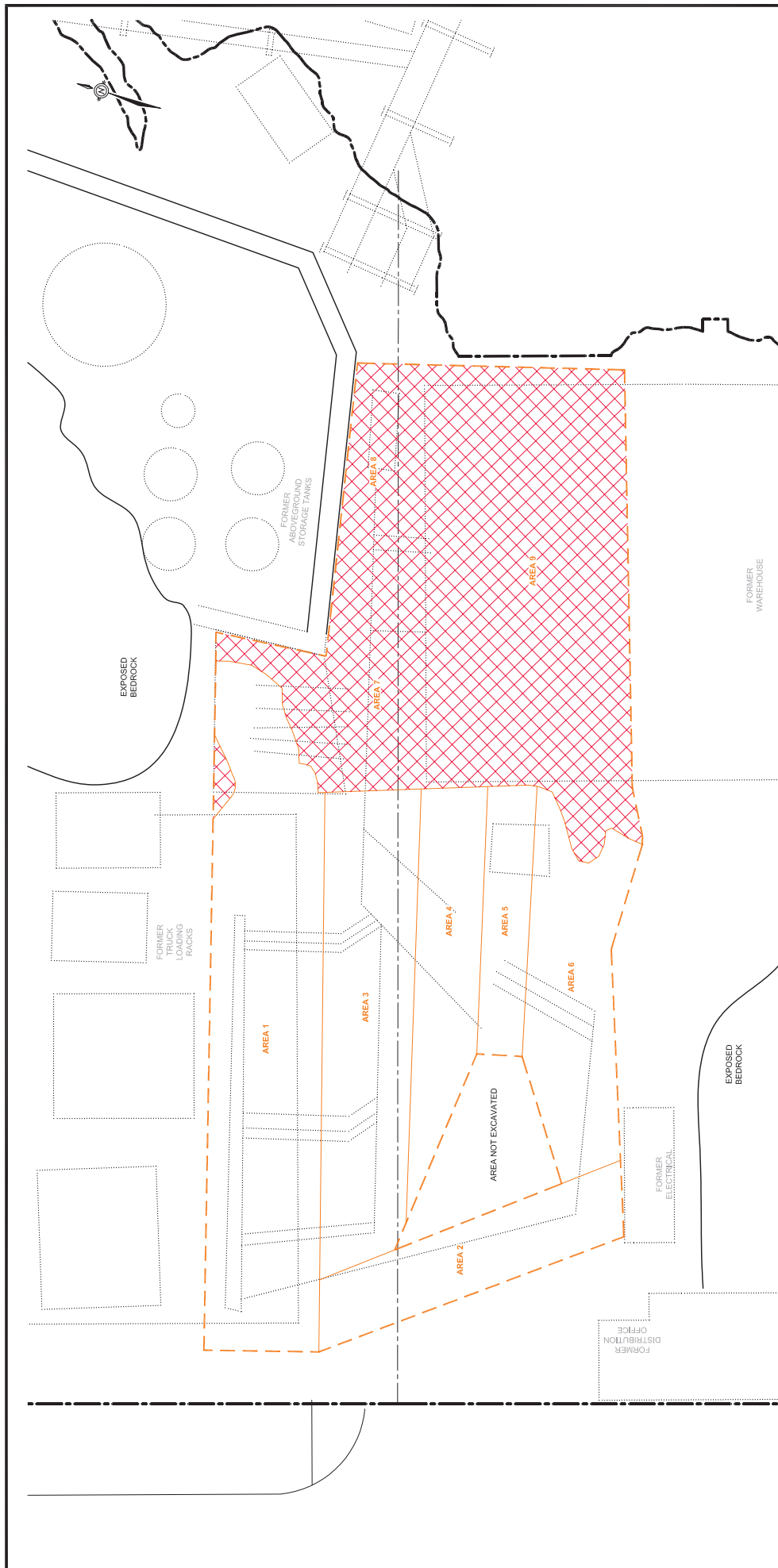
EXCAVATION DETAIL

PROJECT 11.1520.0045.5755		FILE 1014200026200904
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CADD	SSB 2/7/11	REV. 0
CHECK	AA 20/12/11	
REVIEW	RP 20/12/11	



FIGURE: 4

REFERENCE
 ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS. FILE NO: 093000426-104152. SCALE: 1:250. DATE: 2008-06-24 AND ESSO
 IMPERIAL PRODUCTION DIVISION. DATED: APRIL 27, 1999.



CLIENT
IMPERIAL OIL LIMITED
 FORMER PETROLEUM TERMINAL
 337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.

TITLE
EXCAVATION BACKFILL

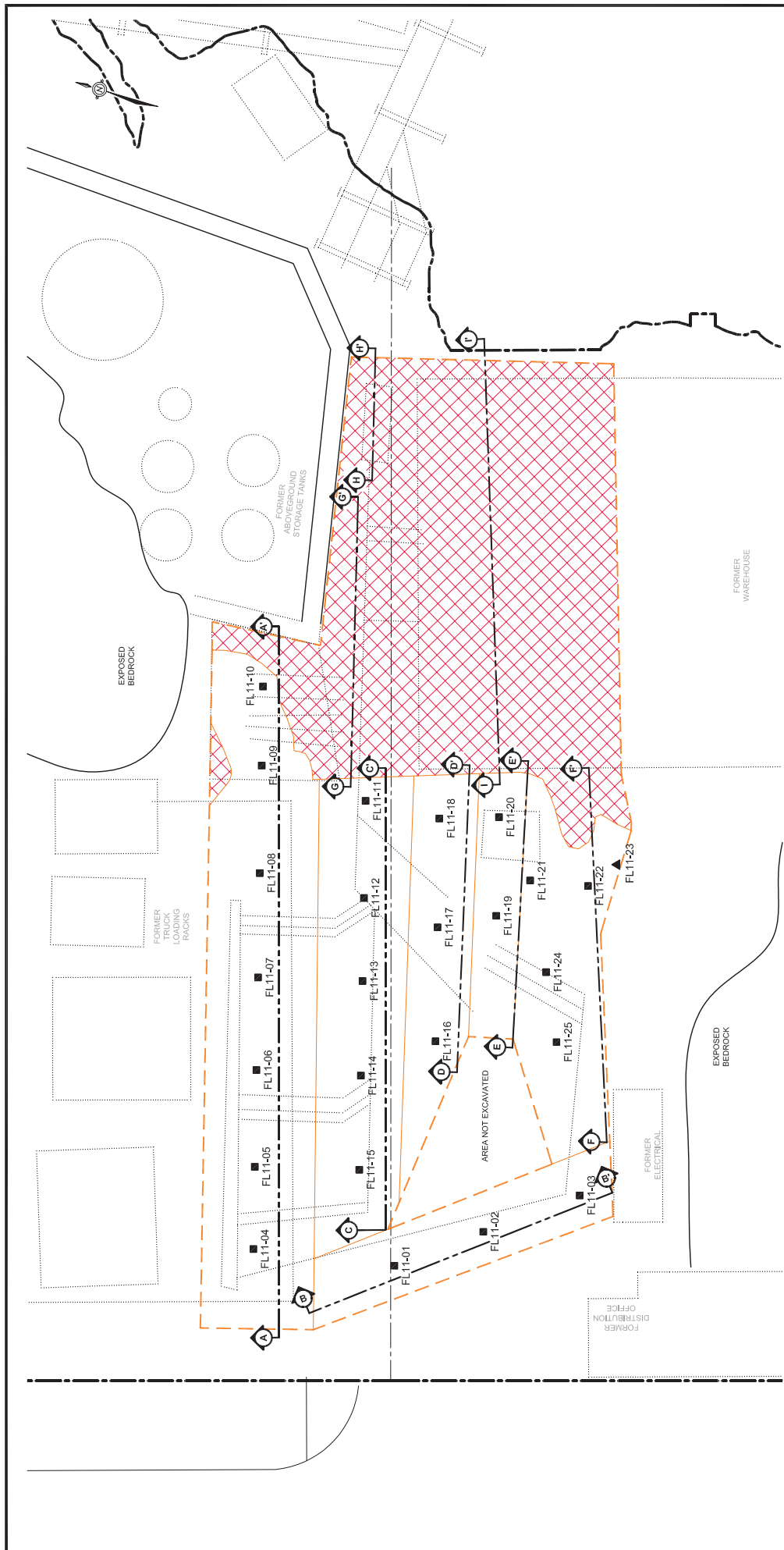
PROJECT 11.1520.0045.0245 FILE 1014426025008007
 DESIGN AL 2/7/11 SCALE AS SHOWN REV. 0
 CAD SSB 2/7/11
 CHECK MA 20/12/11
 REVIEW RP 20/12/11

FIGURE: 7

AREA	BACKFILL
1	3 INCH GRAVEL ROAD BASE
2	IMPORTED SILT FILL
3	3 INCH GRAVEL ROAD BASE EXCAVATED IN-SITU FILL
4	3 INCH GRAVEL ROAD BASE
5	3 INCH GRAVEL ROAD BASE
6	3 INCH GRAVEL ROAD BASE
7	NO FILL OVER EXPOSED BEDROCK
8	3 INCH GRAVEL ROAD BASE
9	3 INCH GRAVEL ROAD BASE IMPORTED SILT FILL

- LEGEND**
- PROPERTY BOUNDARY
 - - - EXCAVATION LIMITS
 - - - EXCAVATED TO BEDROCK BASE
 - ▣ EXCAVATION BACKFILL
 - ⋯ FORMER FACILITY

REFERENCE
 ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS. FILE NO. 030200426-104TS2;
 SCALE: 1:250. DATE: 2009-08-24 AND ESSO IMPERIAL PRODUCTION DIVISION DATED:
 APRIL 27, 1998.



NOTE
1. EXTENTS OF BEDROCK IS APPROXIMATE AND NOT TO SCALE

- LEGEND**
- PROPERTY BOUNDARY
 - - - EXCAVATION LIMITS
 - - - EXTENT OF BEDROCK IS APPROXIMATE AND NOT TO SCALE
 - FORMER FACILITY
 - CROSS SECTION LOCATION AND ORIENTATION
 - NATIVE CLAYSILT SOIL SAMPLE TAKEN (EXCAVATION BASE)
 - ▲ NATIVE CLAYSILT SOIL SAMPLE TAKEN (EXCAVATION WALL)

REFERENCE
ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS. FILE NO: 093000426-104TSZ. SCALE: 1:250. DATE: 2008-06-24 AND ESSO
IMPERIAL - PRODUCTION DIVISION. DATE: APRIL 27, 1995.

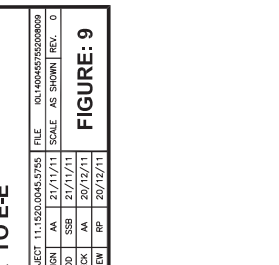
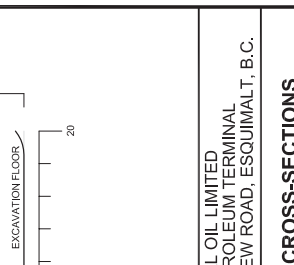
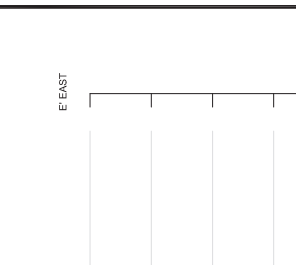
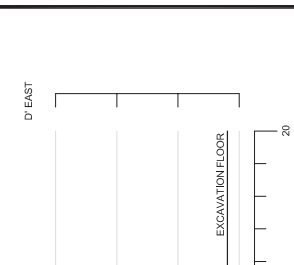
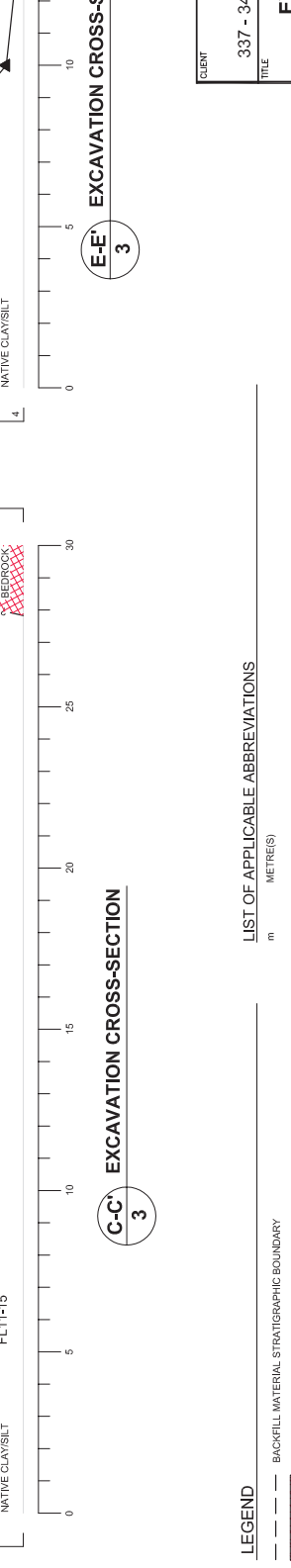
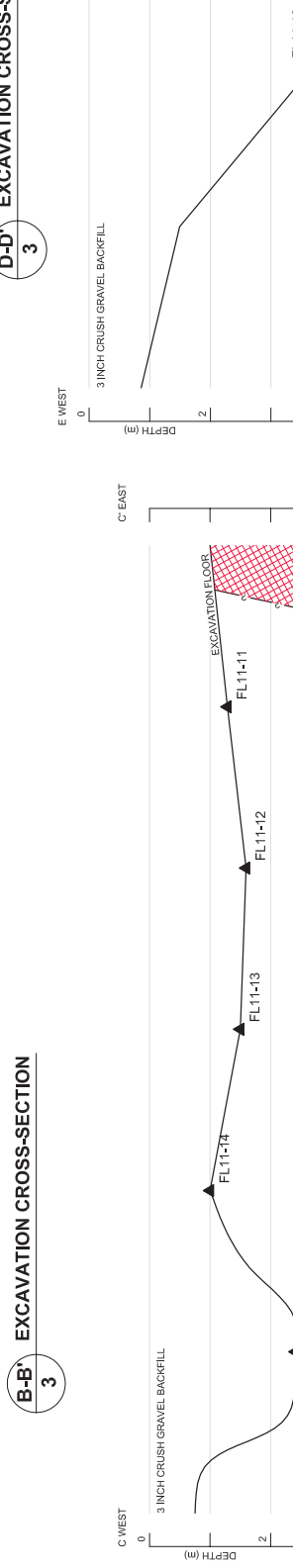
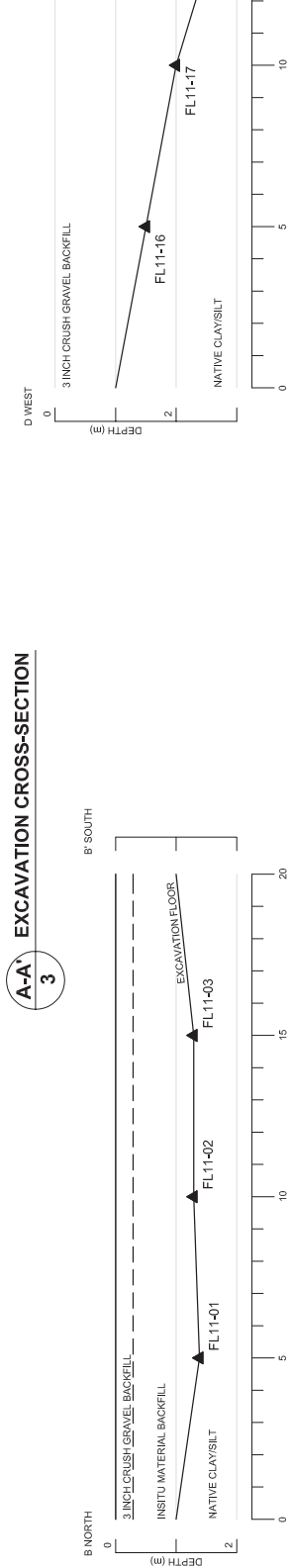
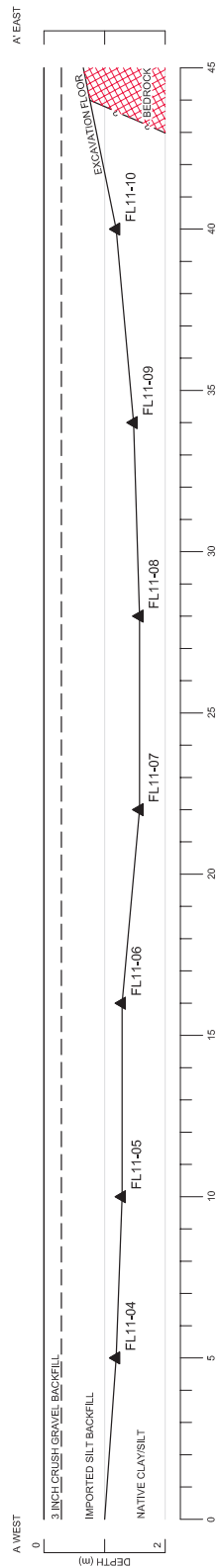
CLIENT
IMPERIAL OIL LIMITED
FORMER PETROLEUM TERMINAL
337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.

TITLE
EXCAVATION CROSS-SECTION LOCATIONS

PROJECT	11.1520.0045.5755	FILE	101400455752008008
DESIGN	AL	2/1/11	SCALE AS SHOWN
CADD	SSB	2/1/11	REV. 0
CHECK	MA	20/12/11	
REVIEW	RP	20/12/11	

Golden Associates
CONSULTANTS

FIGURE: 8



LEGEND

- BACKFILL MATERIAL STRATIGRAPHIC BOUNDARY
- EXCAVATION FLOOR
- NATIVE CLAYSILT
- 3 INCH CRUSH GRAVEL BACKFILL
- IMPORTED SILT BACKFILL
- INSITU MATERIAL BACKFILL
- BEDROCK

NOTE

EXTENT AND ELEVATION OF BEDROCK IS APPROXIMATE AND NOT TO SCALE

REFERENCE

GROUND SURFACE TOPOGRAPHY OBTAINED FROM GOLDER ASSOCIATES SKETCH.

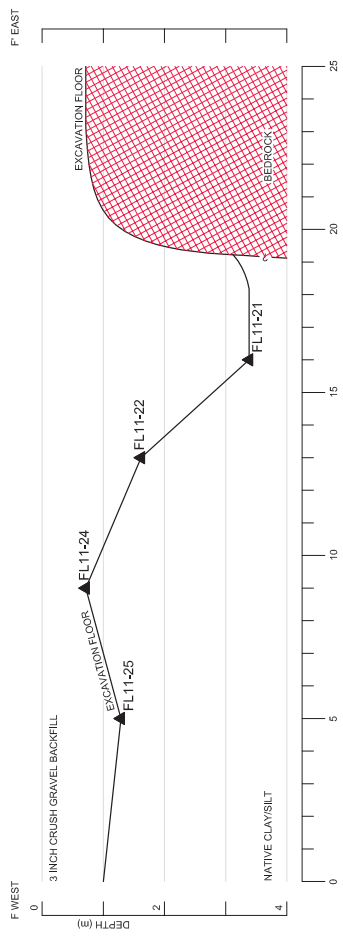
CLIENT
IMPERIAL OIL LIMITED
FORMER PETROLEUM TERMINAL
337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.

TITLE
EXCAVATION CROSS-SECTIONS
A-A' TO E-E'

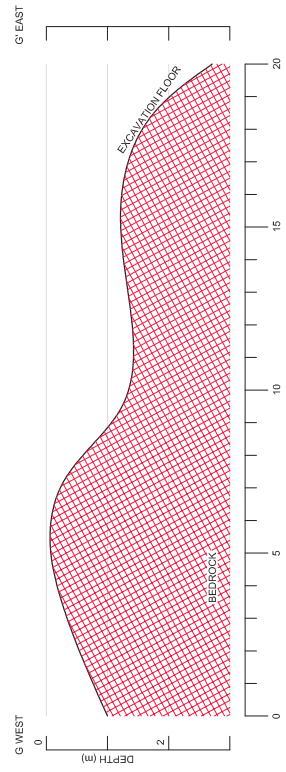
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SCALE	AS SHOWN	REVIEW	RP
REV.	0	DATE	20/12/11



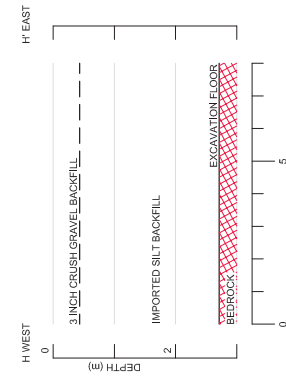
FIGURE: 9



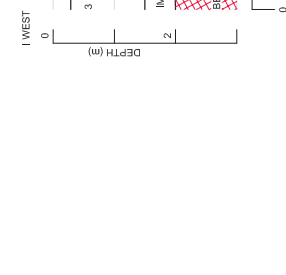
F-F' EXCAVATION CROSS-SECTION
3



G-G' EXCAVATION CROSS-SECTION
3



H-H' EXCAVATION CROSS-SECTION
3



I-I' EXCAVATION CROSS-SECTION
3

LIST OF APPLICABLE ABBREVIATIONS
m METRE(S)

LEGEND
 --- BACKFILL MATERIAL STRATIGRAPHIC BOUNDARY
 --- EXTENT AND ELEVATION OF BEDROCK IS APPROXIMATE AND NOT TO SCALE

REFERENCE
 GROUND SURFACE TOPOGRAPHY OBTAINED FROM GOLDBER ASSOCIATES SKETCH.

NOTE
 EXTENT AND ELEVATION OF BEDROCK IS APPROXIMATE AND NOT TO SCALE.

CLIENT
 IMPERIAL OIL LIMITED
 FORMER PETROLEUM TERMINAL
 337 - 343 VICTORIA VIEW ROAD, ESQUIMALT, B.C.

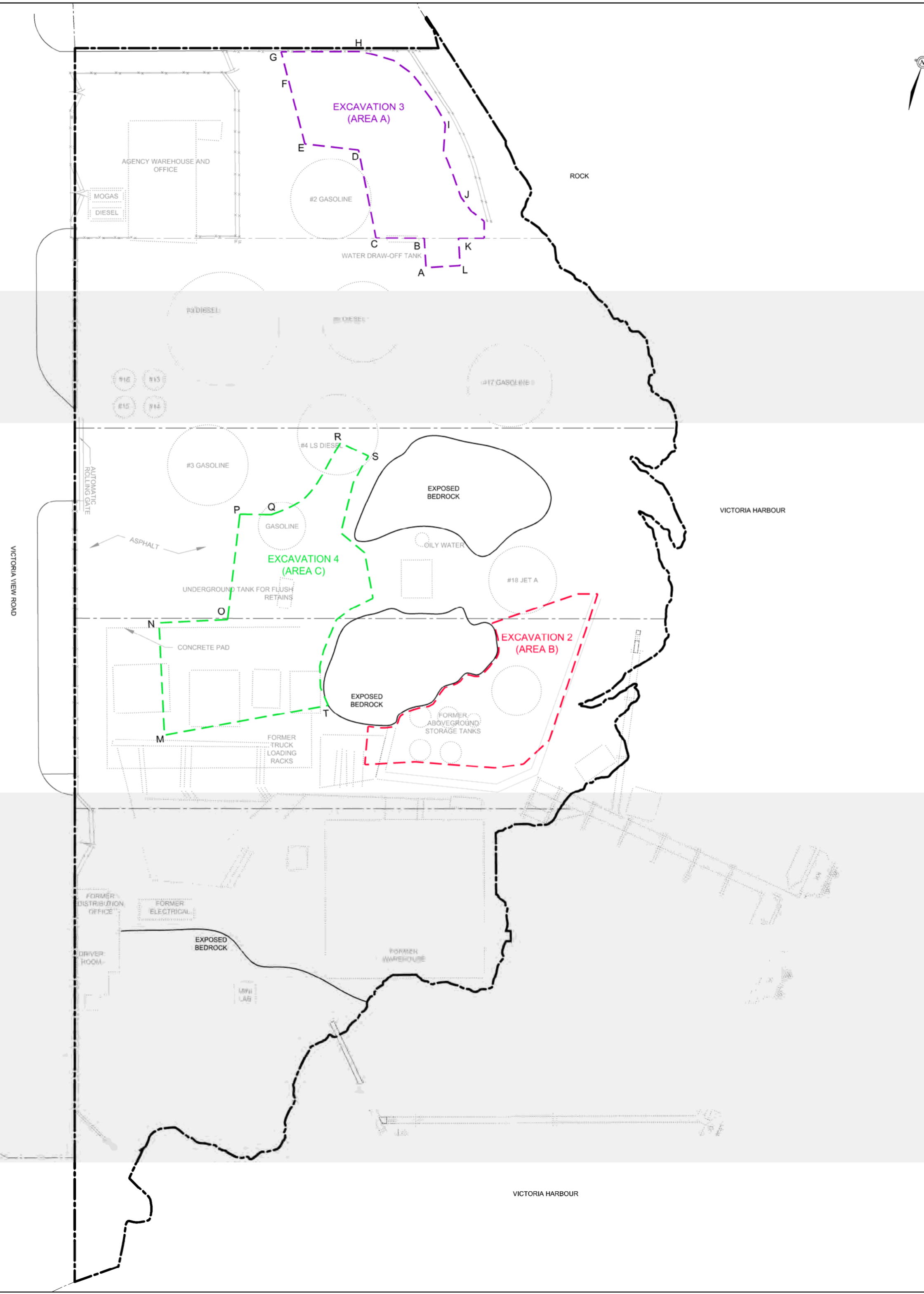
TITLE
 EXCAVATION CROSS-SECTIONS
 F-F' TO I-I'



PROJECT	11.1520.0045.5745	FILE	1014200455752008010
DESIGN	AL	21/11/11	SCALE AS SHOWN
CADD	SSB	21/11/11	REV. 0
CHECK	MA	20/12/11	
REVIEW	RP	20/12/11	

FIGURE: 10

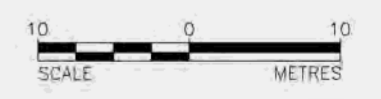
I:\2012\1520\12-1520-0025\5755\2008\Fig 05 1012002557552008005 Site Plan with 2012 EX.dwg Jun 16, 2013 8:50am



LEGEND

- PROPERTY BOUNDARY
- EXCAVATION LIMITS (EX3)
- EXCAVATION LIMITS (EX4)
- EXCAVATION LIMITS (AREA B)
- FORMER FENCE LINE
- FORMER FACILITY

REFERENCE
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 SCALE: 1:250, DATE: 2009-08-24 AND ESSO IMPERIAL PRODUCTION DIVISION, DATED:
 APRIL 27, 1999.



CLIENT
 IMPERIAL OIL LIMITED
 337 - 343 VICTORIA VIEW ROAD
 ESQUIMALT, BC

TITLE
**SITE PLAN
 WITH EXCAVATION LIMITS LOCATIONS
 (2012)**

	PROJECT	12.1520.0025.5755	FILE No.	020002557552008005	
	DESIGN	MM	22/10/12	SCALE	AS SHOWN
	CADD	YAW	24/10/12	REV.	0
	CHECK	HM	16/01/13	FIGURE: 5	
	REVIEW	RP	16/01/13		

L:\2012\1520\12-1520-0025\5755\2008\Fig 12 IOL20002557552008012 EX3 Backfill Detail.dwg Jun 16, 2013 8:52am



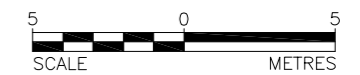
LEGEND

- PROPERTY BOUNDARY
- EXCAVATION LIMITS (EX3)
- FORMER FENCE LINE
- FORMER FACILITY

AREA	BACKFILL
1	SP12-02-01 AND SP12-02-02
2	MIXTURE OF CLEAN SOIL FROM BERM AND SP12-01
3	SILTY BACKFILL (FILL 1)

REFERENCE

ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS, FILE NO: 030200426-104TS2;
 SCALE: 1:250, DATE: 2009-08-24 AND ESSO IMPERIAL PRODUCTION DIVISION; DATED:
 APRIL 27, 1999.



CLIENT		IMPERIAL OIL LIMITED 337 - 343 VICTORIA VIEW ROAD ESQUIMALT, BC	
TITLE		EXCAVATION 3 BACKFILL	
	PROJECT	12.1520.0025.5755	FILE IOL20002557552008012
	DESIGN	HM 22/10/12	SCALE AS SHOWN REV. 0
	CADD	YAW 24/10/12	
	CHECK	HM 16/01/13	
	REVIEW	RP 16/01/13	
		FIGURE: 12	

L:\2012\1520\12-1520-0025\5755\2008\Fig 19 IOL20002557552008019 EX4 Backfill Detail.dwg Jan 16, 2013 8:53am

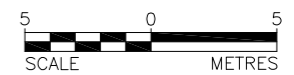


AREA	BACKFILL
1	SP12-02-03, SP12-02-04, SP12-02-05 AND SP12-02-06 ON BEDROCK
2	BLAST ROCK FROM AREA B, COVERED WITH SP12-02-03, SP12-02-04, SP12-02-05 AND SP12-02-06
3	SP12-03-01 AND SP12-03-02
4	3" MINUS (FILL 3)
5	LAYERED
	3" MINUS (FILL 3)
	FINE SAND (FILL 4)
	3" - 6" CLEAR
6	SP12-05
7	SILTY BACKFILL (FILL 1)

LEGEND

	PROPERTY BOUNDARY
	EXCAVATION LIMITS (EX4)
	EXCAVATION LIMITS (AREA B)
	FORMER FACILITY

REFERENCE
 ORIGINAL DRAWING OBTAINED FROM FOCUS GEOMATICS, FILE NO: 030200426-104TS2; SCALE: 1:250,
 DATE: 2009-08-24 AND ESSO IMPERIAL PRODUCTION DIVISION; DATED: APRIL 27, 1999.



CLIENT	IMPERIAL OIL LIMITED 337 - 343 VICTORIA VIEW ROAD ESQUIMALT, BC		
TITLE	EXCAVATION 4 BACKFILL		
	PROJECT	12.1520.0025.5755	FILE IOL20002557552008019
	DESIGN	HM	22/10/12
	CADD	YAW	24/10/12
	CHECK	HM	16/01/13
	REVIEW	RP	16/01/13
		SCALE	AS SHOWN
		REV.	0
			FIGURE: 19



APPENDIX H

Frontier Geoscience Report

STANTEC
REPORT ON
BATHYMETRIC AND ACOUSTIC
SUB-BOTTOM SURVEY
VICTORIA AND ESQUIMALT
PIPELINE PROJECT
VICTORIA, B.C.

by

Pierre Foicik, M.Sc.

Cliff Candy, P.Geo.

September, 2010

PROJECT FGI-1154

CONTENTS

	<u>page</u>
1. INTRODUCTION	1
2. THE OVERWATER BATHYMETRY SURVEY	3
2.1 Equipment	3
2.2 Survey Procedure and Positioning	3
3. THE SUB-BOTTOM ACOUSTIC PROFILING SURVEY	4
3.1 Equipment	4
3.2 Data Processing and Interpretation Procedure	4
4. GEOPHYSICAL RESULTS	5
4.1 General	5
4.2 Discussion	5
4.2.1 Esquimalt Harbour Area	5
4.2.2 Victoria Harbour Area	7
5. LIMITATIONS	8
6. REFERENCES	9

ILLUSTRATIONS

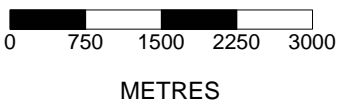
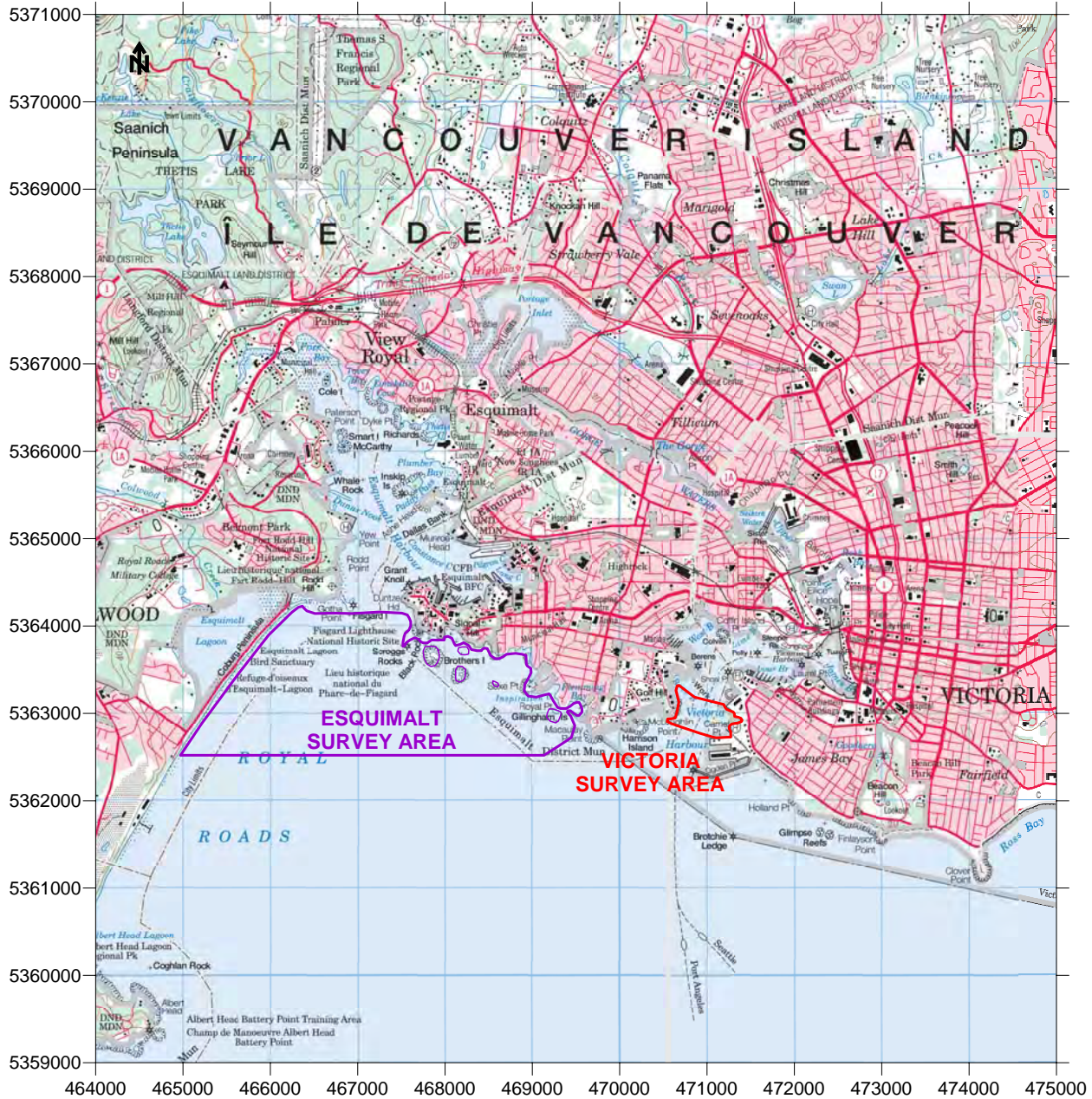
	<u>location</u>
Figure 1	Page 2
Dwg ESQ-BAT	Appendix
Dwg ESQ-BED	Appendix
Dwg ESQ-SED	Appendix
Dwg ESQ-DS-DR	Appendix
Dwg ESQ-DS-01	Appendix
Dwg ESQ-DS-02	Appendix
Dwg ESQ-EX	Appendix
Dwg VIC-BAT	Appendix
Dwg VIC-BED	Appendix
Dwg VIC-SED	Appendix
Dwg VIC-DS	Appendix

1. INTRODUCTION

In the period Sept. 8 to Sept. 24, 2010, Frontier Geosciences Inc. carried out an overwater geophysical survey for Stantec at the entrance to Victoria harbour and at Royal Roads near the entrance to Esquimalt harbour. The purpose of the survey was to determine ocean bottom contours, thicknesses of overburden materials and the depths to and configuration of the bedrock surface. This information will aid in planning the route of proposed pipelines and assist in deciding the appropriate emplacement technology.

The survey work at Royal Roads extends from Fleming Bay on the east to the south end of the Coburg Peninsula on the west and covers an area of approximately 3600 metres by 1600 metres. The Victoria harbour overwater survey encompassed an area at the entrance to Victoria harbour of approximately 650 metres by 300 metres.

A Survey Location Plan of the survey areas is illustrated at a scale of 1: 75,000 in Figure 1.



STANTEC		
ESQUIMALT AND VICTORIA HARBOURS		
OVERWATER ACOUSTIC PROFILING SURVEY		
SURVEY LOCATION PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:75,000	FIG. 1

2. THE OVERWATER BATHYMETRY SURVEY

2.1 Equipment

The overwater bathymetric survey was completed with a Marinetek, PCS-200 Sounder. The system was calibrated with respect to water temperature and water salinity and used a broadband output with a 200 kHz centre frequency. Power for the field computer and Marinetek Sounder was provided by the survey vessel through an inverter. The work was carried out from a 31 foot Camano Trawler survey vessel.

2.2 Survey Procedure and Positioning

The bathymetric transducer was placed in the water at a depth of 0.30 metres at the stern of the vessel. The transducer location was carefully determined to facilitate the best operating environment for the transmission and reception of sound pulses. In operation, the source transducer pulsed twice every second with a sounding frequency of 200 kHz. The pulses emitted from the transducer were reflected by the ocean bottom and then digitally recorded and visually reviewed in real time on the high resolution display of a notebook computer. The digital record of the reflected signal was stored in the notebook hard drive and played back to interpret the water depth.

Data collected on the Marinetek PCS-200 Sounder was correlated with a differential Ray Marine GPS so that each pulse position could be contoured for final data presentation and interpretation. The positioning accuracy of the differential GPS was 0.5 metres to 1 metre. The positioning datum of NAD83 in UTM grid coordinates was used on all plans.

As some parts of survey were carried out in high traffic areas, all operations were co-ordinated with the Harbourmaster, for the Victoria site, and with the Fleet Manager, for the Esquimalt Naval Base. The survey was carried out in good conditions, and the continuity and quality of the data was excellent.

3. THE SUB-BOTTOM ACOUSTIC PROFILING SURVEY

3.1 Equipment

The overwater acoustic profiling was completed with an electric pulser source. The pulser system was used with a multi-element hydrophone receiver array. The system was calibrated in milliseconds and has a broad band output with a 250 Hz centre frequency. Reflected signals were amplified for viewing and recorded in a field computer. The field computer recorded a seismogram of 200 milliseconds two-way time duration approximately twice per second. Power for the seismic system was also provided from the power inverter.

The pulser source was placed in the water, 5 metres astern of the vessel with the midpoint of the receiver hydrophone "eel," 15 metres behind the source. In operation, pulses from the source were reflected from the bottom and sub-bottom objects or horizons and were summed in the eel hydrophone elements and transferred to the recording amplifiers.

3.2 Data Processing and Interpretation Procedure

The sub-bottom acoustic profiling data was processed into SEG-2 format and imported into the Seismic Unix reflection processing package. The positioning information was processed to account for the lay-back of the source and receiver from the GPS transducer. The data was then converted to SEG-Y format and together with the GPS position information, was imported into the Seismic Micro Technologies (SMT) 2D/3D seismic interpretation package. This software is a comprehensive 2D/3D seismic interpretation program that provides interpretive and horizon picking tools integrated into a map and section database, data management and display system. As well, the bathymetry data was imported as a horizon into the SMT package for interpretation and to allow full handling of the time to depth conversion.

The first stage in the analysis was the use of the horizon picking tools to identify the bedrock reflector and reflectors present within the sediment column. The software shows time markers at the intersection of lines and tie-lines, facilitating the picking of a consistent event throughout the map area. The data was then converted to depth, and the surfaces were plotted in colour contour format.

4. GEOPHYSICAL RESULTS

4.1 General

The results of the overwater bathymetry survey are displayed in map and profile format in the Appendix. These include contour plans of the bathymetry, interpreted bedrock depth, isopachs of the sediment thickness, and depth sections along the proposed alignments. The Esquimalt data is displayed at a scale of 1:12,500 and the Victoria data is displayed at a scale of a 1:2500. The depths shown on the bathymetric plan were referenced to the Canadian Hydrographic Survey Tide and Chart Datum.

An example of acoustic profiling data illustrating key sub-bottom reflectors is illustrated in Dwg. ESQ-EX. The interpreted bedrock reflector is shown in green. The shallow, yellow line is the sea floor reflector, which is consistent with bathymetric depths acquired from the sounder system.

4.2 Discussion

4.2.1 Esquimalt Harbour Area

The bathymetric survey for the Royal Roads area is displayed in Dwg. ESQ-BAT. The eastern shores are predominantly rock controlled, consistent with the numerous islands in the area. In the east-central segment of the coverage area, a series of terraced depressions are evident at depths ranging from 28 to 40 metres. These features are described by Mosher and Hewitt (Ref. 1) as either primary depositional features, or possibly post-depositional structures produced from a rotational slide failure.

The central and western shores area of the survey coverage show very uniform variations in water depths, extending to a maximum of approximately 22 metres at the southwestern survey boundary.

The eastern shoreline of the bedrock depth map Dwg. ESQ-BED shows numerous bedrock highs and troughs between Gillingham Islands and Scroggs Rocks. The central area of the survey coverage shows two depressions in bedrock that are approximately 140 metres deep. A very prominent feature in the bedrock topography is present in the western area of the survey, near the Coburg Peninsula. This north-northwesterly trending bedrock ridge rises to approximately 30 metres depth at its shallowest point. East of this ridge, bedrock depths of

up to 90 metres are extant, indicating thick sediment cover shoreward into the Esquimalt Lagoon area.

An interpreted sediment isopach plan was prepared by contouring the thicknesses of sediments overlying bedrock. This plot displayed on Dwg. ESQ-SED, is particularly pertinent in the area of the eastern shoreline, where it clearly shows the areas of thinner sediment cover over the complex bedrock surface.

Stantec determined three possible alignments for the pipeline routes to Colwood. These routes were used to interrogate the bathymetry and interpreted bedrock surfaces, and profiles were derived to plot the depths of these surfaces along the chosen alignment. Displayed on Dwg, ESQ-DR-DR, ESQ-DR-01, and ESQ-DS-02, these plots show the proposed dredge emplacement alignment, and tunnel alignments Options 1 and 2, respectively. These profiles employ a 10 to 1 vertical scale exaggeration.

The seismic data show a number of reflectors within the overall sediment column. Mosher and Hewitt indicate that three main lithologic units overlie bedrock in the region (from the top down): modern (Holocene) sediment, glacial-marine sediment, and a glacial diamict. Three main horizons were also interpreted from the seismic data. These horizons are referred to as the first, second and third intermediate sediment layer on Dwg. ESQ-DR-01; the section exhibiting the thickest sediment. While correlation of the second and third horizon with lithology would have to be determined by drilling, some information is available within the survey area to provide correlation for the first interpreted horizon.

Mosher and Hewitt describe sea floor drilling that was carried out south of Brothers Island. This work showed the presence of post-glacial (Holocene) sediments consisting of fine Sand to coarse Sand/Pebbles in the materials overlying the first intermediate sediment horizon. Below this horizon, the boreholes showed the presence of Silty-Clays that are interpreted by Mosher and Hewitt to be glacial-marine sediment.

4.2.2 Victoria Harbour Area

The bathymetric depth contours in Dwg. VIC-BAT display the ocean bottom configuration in the survey area. The western area of the bathymetric plan shows a steeper gradient and is fairly irregular, as the shoreline is controlled by complex, shallow bedrock. The more central channel area is a uniform sediment surface varying between 6 and 14 metres depth. The eastern area, near Ogden Point, is shallow and irregular, indicative of the thinner sediment cover over bedrock.

The bedrock surface shown on Dwg. VIC-BED is dominated by a north-northwest trending, steep-walled trough with the greatest depths of approximately 70 metres at the southern survey boundary. A second bedrock low is observed east of this main feature that is present at a depth of approximately 50 metres. A number complex of bedrock troughs and ridges are evident in the eastern survey area. The variations in sediment thickness are illustrated in Dwg. VIC-SED.

Two proposed pipeline alignments were provided by Stantec. The profile information associated with these alignments is displayed on Dwg. VIC-DS. As was the case with the profiles for the Esquimalt area, a distinct reflector is present approximately 15 metres below the sea floor in the central part of the channel. No drillholes are present within the survey area, but the depth and character of the reflector strongly suggests that it corresponds to the boundary between the post-glacial (Holocene) sediments and the glacial-marine sediment.

5. LIMITATIONS

The depths to subsurface boundaries derived from overwater seismic acoustic profiling surveys are generally accepted as accurate to within ten percent of the true depths to the boundaries. In practice, the seismic velocity of sub-bottom materials is not determined in the course of an overwater acoustic profiling investigation. Errors may arise from application of an assumed velocity for saturated materials to determine the depths to sub-surface horizons when only the travel time to the horizon is known. An underestimate of the velocity function would produce depths that are too shallow, and the reverse occurring with an overestimate of velocity. True depths may be established by carrying out overwater seismic refraction surveying or by determining velocities with known borehole intersections. Small errors may also occur in data gridding. In this survey, a compressional wave velocity of 1442 m/s was utilized for conversion of travel times for the water column into depth. The sediment column was converted using a estimated velocity of 1560 m/s.

In addition, the nature and composition of sub-bottom objects and layers identified in acoustic profiling surveys cannot be determined by inspection of the data. Several indicators such as reflector strength, diffraction patterns, lack of internal reflectors, multiple thin-bed reflectors, depth position, smoothness of reflectors and reflector relief may provide insight into subsurface features. The geology of horizons identified in an overwater acoustic profiling investigation would have to be established by borehole intersections.

The information in this report is based upon acoustic measurements and field procedures and our interpretation of the data. The geological information is based upon our estimate of subsurface conditions considering the acoustic data and all other information available to us. The results are interpretive in nature and are considered to be a reasonably accurate presentation of existing lake bottom and subsurface conditions within the limitations of the acoustic profiling method.

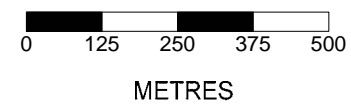
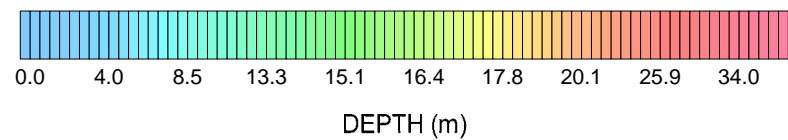
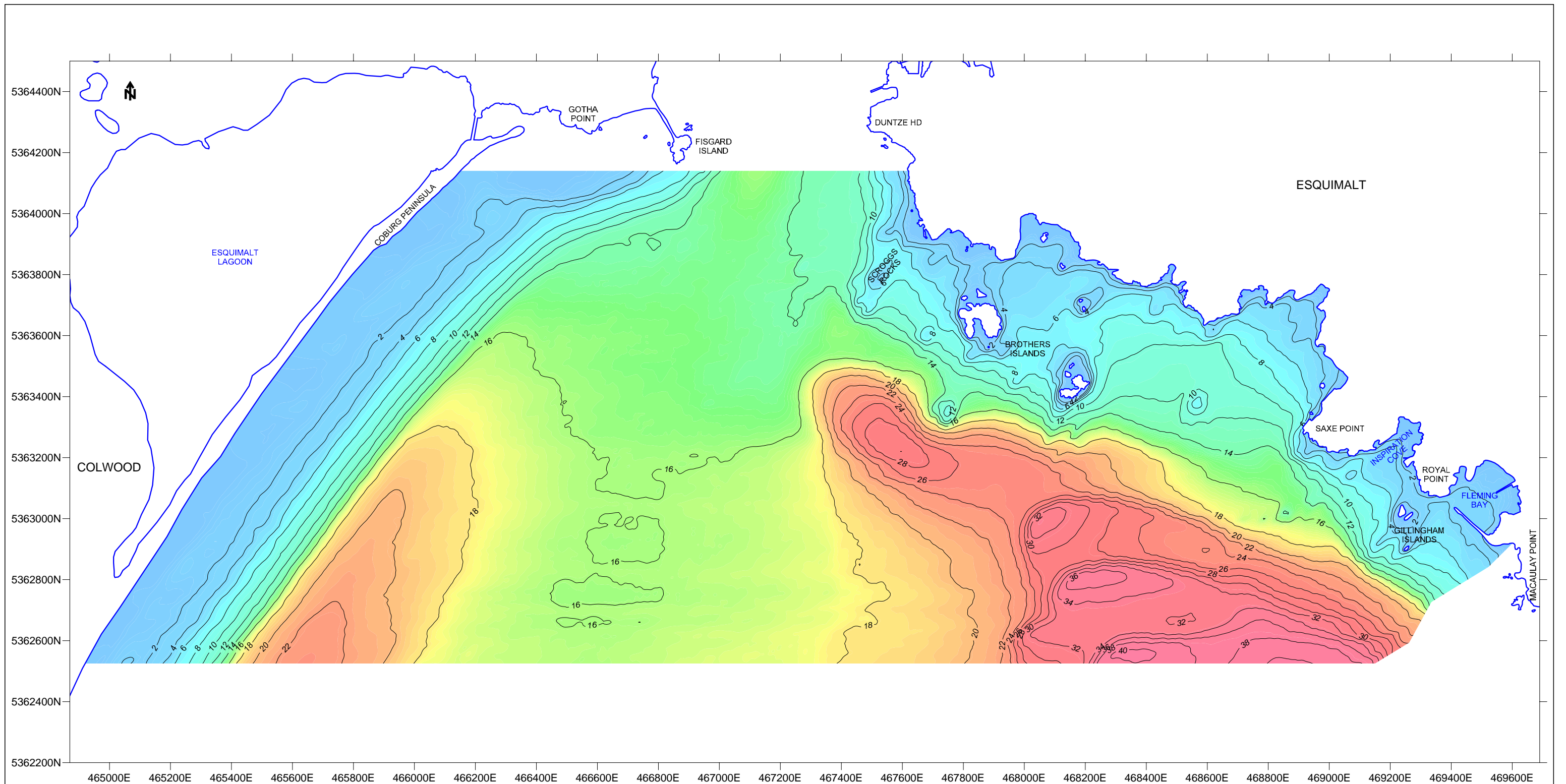
For: Frontier Geosciences Inc.

Pierre Foicik, M.Sc.

Cliff Candy, P.Geo.

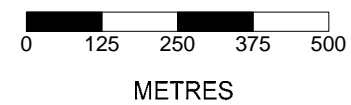
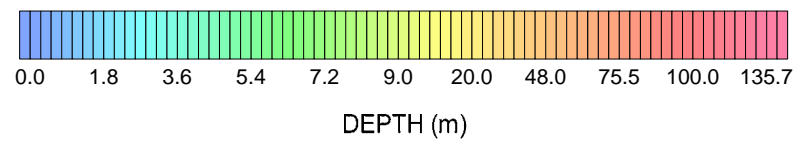
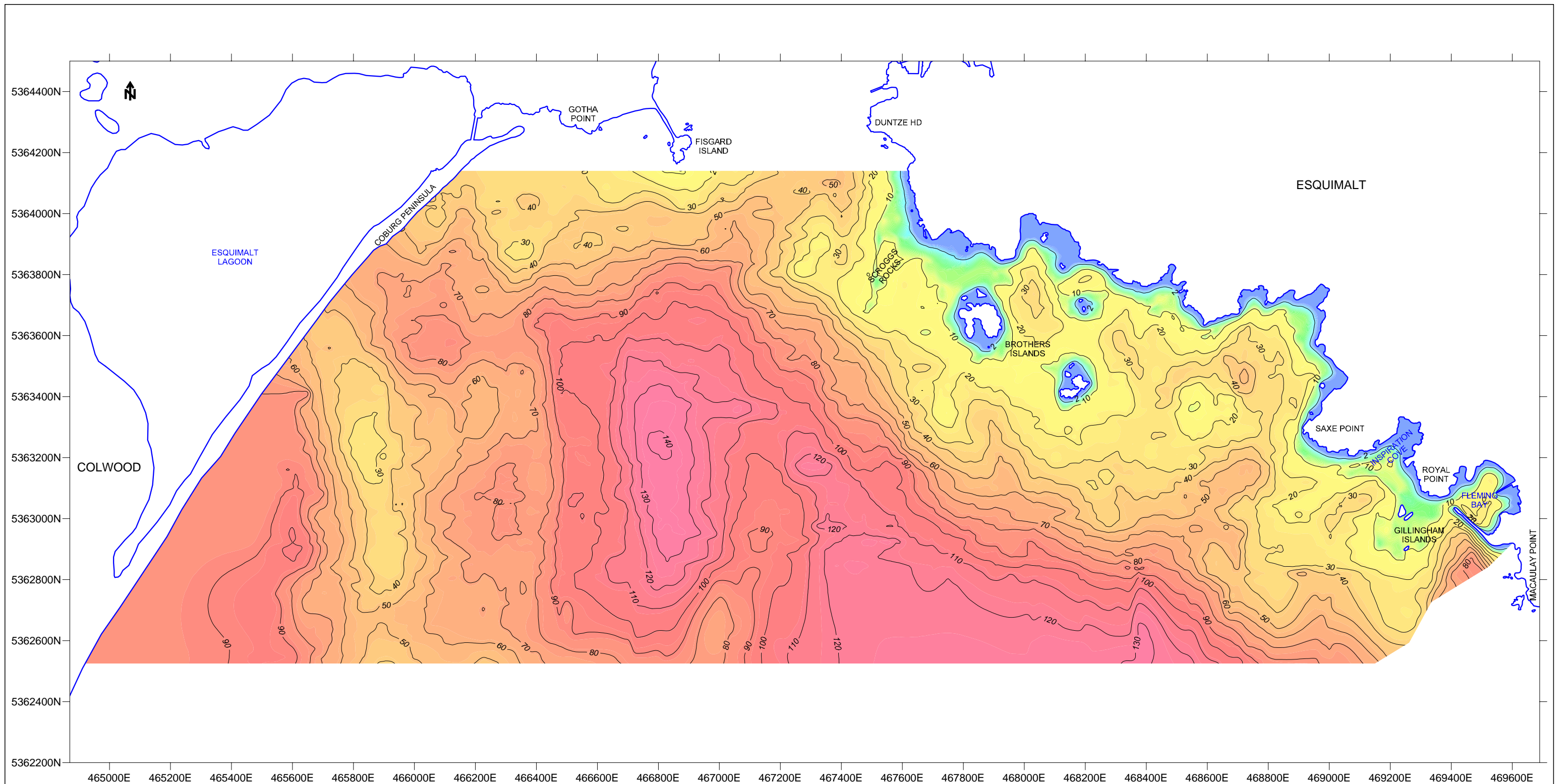
6. REFERENCES

Ref 1: Late Quaternary deglaciation and sea-level history of eastern Juan de Fuca Strait, Cascadia, David C. Moshera, Antony T. Hewitt, Quaternary International 121 (2004) 23–39



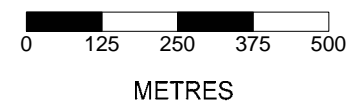
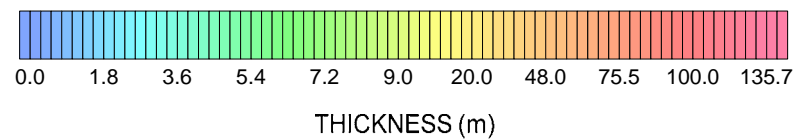
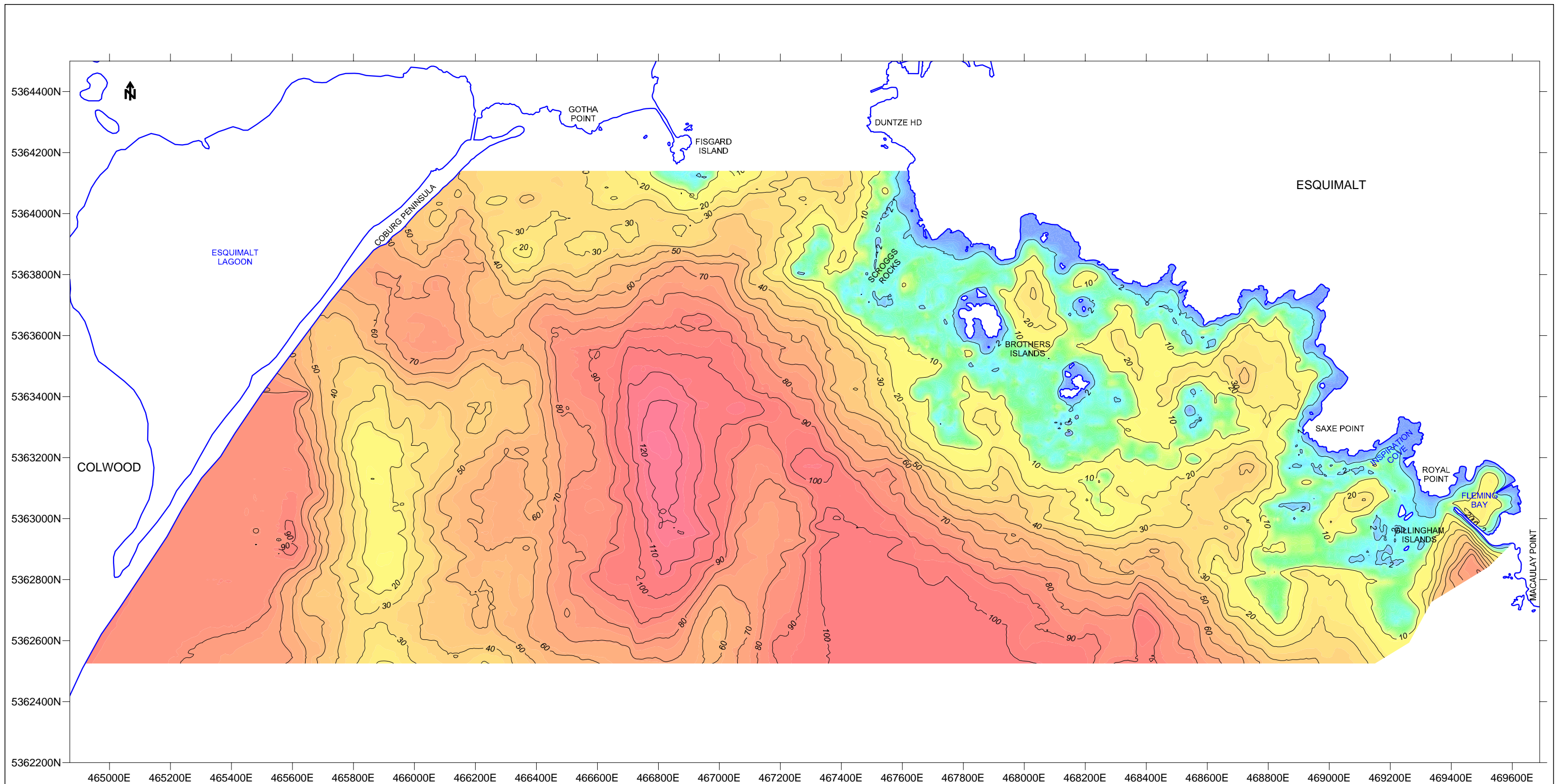
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NAD83 ZONE 10

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OVERWATER ACOUSTIC PROFILING SURVEY		
BATHYMETRIC CONTOUR PLAN		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:12,500	DWG: ESQ-BAT



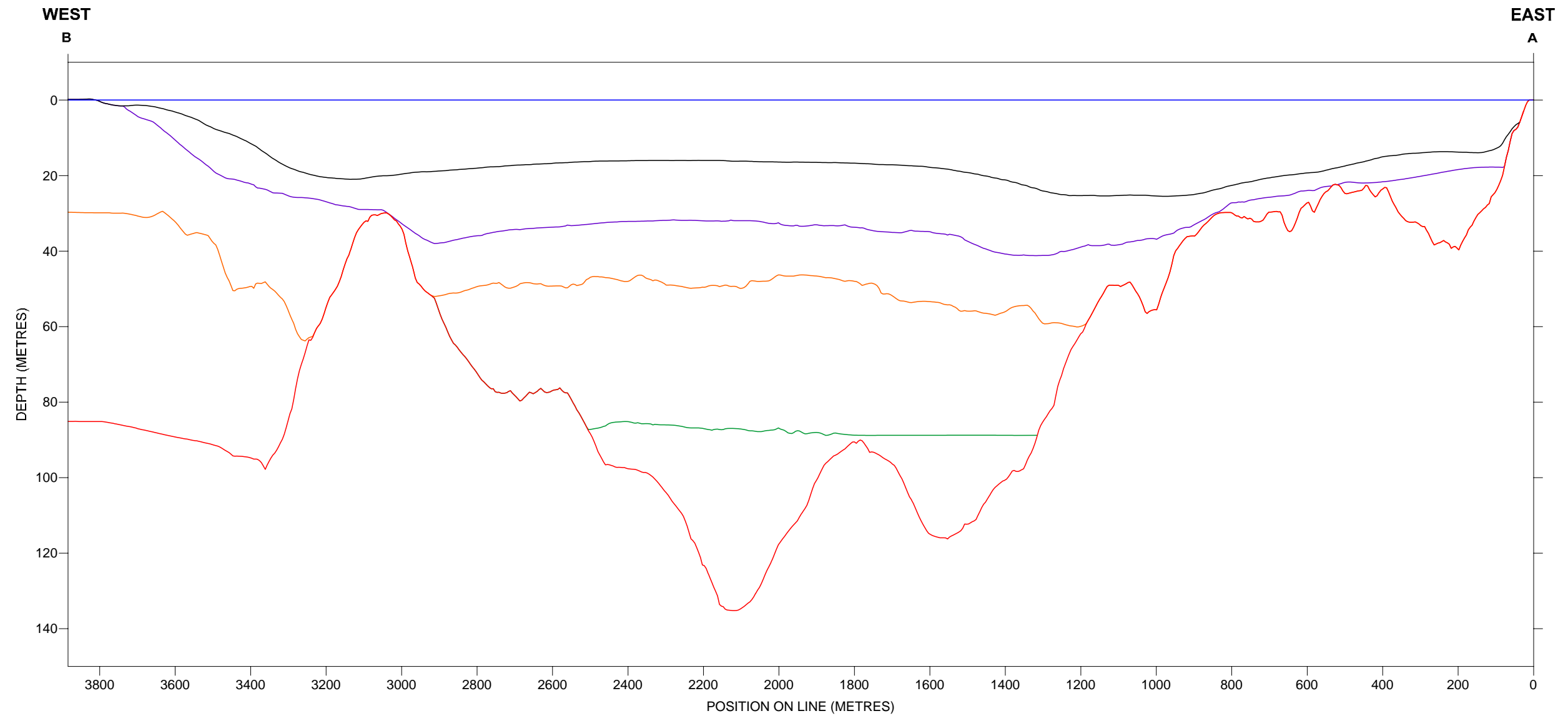
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FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:12,500	DWG: ESQ-BED



NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10

STANTEC ESQUIMALT HARBOUR		
OVERWATER ACOUSTIC PROFILING SURVEY		
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FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:12,500	DWG: ESQ-SED

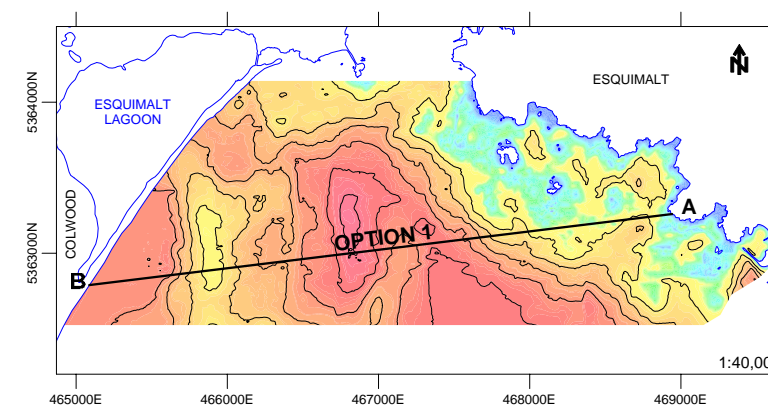


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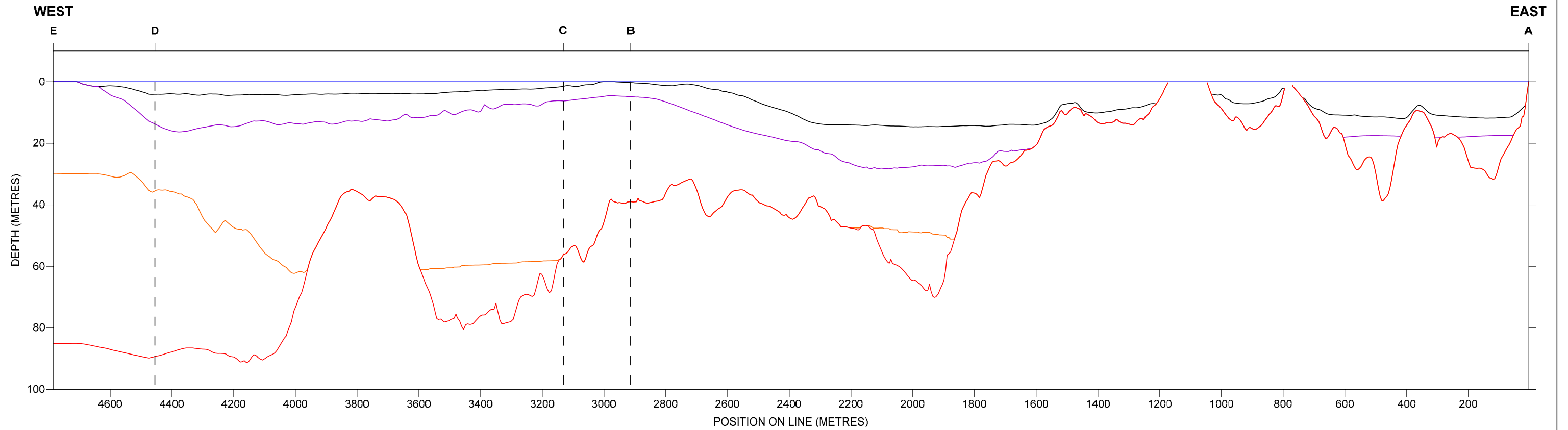
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- FIRST INTERMEDIATE SEDIMENTARY HORIZON
- SECOND INTERMEDIATE SEDIMENTARY HORIZON
- THIRD INTERMEDIATE SEDIMENTARY HORIZON
- BEDROCK HORIZON

NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10

VERTICAL SCALE: 1:1,250
HORIZONTAL SCALE: 1:12,500



STANTEC ESQUIMALT HARBOUR	
OVERWATER ACOUSTIC PROFILING SURVEY	
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FRONTIER GEOSCIENCES INC.	
DATE: SEPT. 2010	DWG: ESQ-DS-01

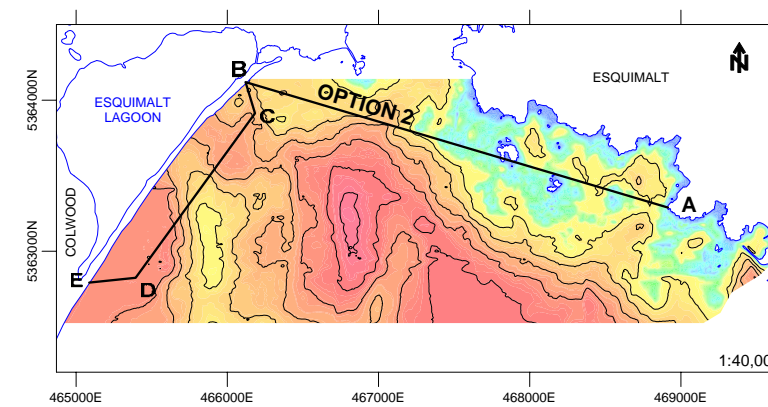


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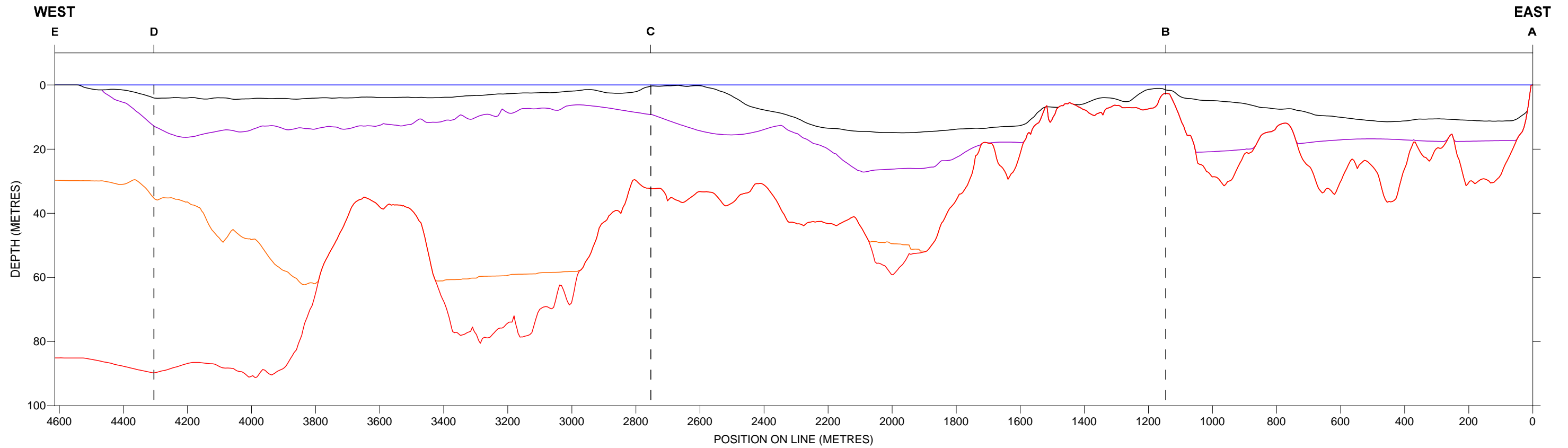
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- FIRST INTERMEDIATE SEDIMENTARY HORIZON
- SECOND INTERMEDIATE SEDIMENTARY HORIZON
- BEDROCK HORIZON

NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10

VERTICAL SCALE: 1:1,250
HORIZONTAL SCALE: 1:12,500



STANTEC ESQUIMALT HARBOUR	
OVERWATER ACOUSTIC PROFILING SURVEY	
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FRONTIER GEOSCIENCES INC.	
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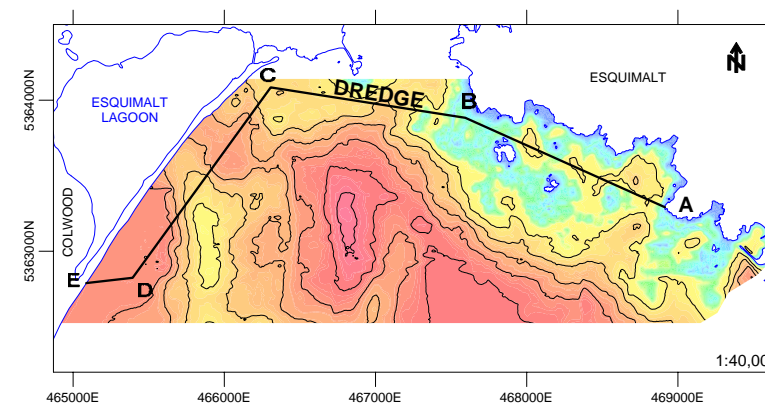


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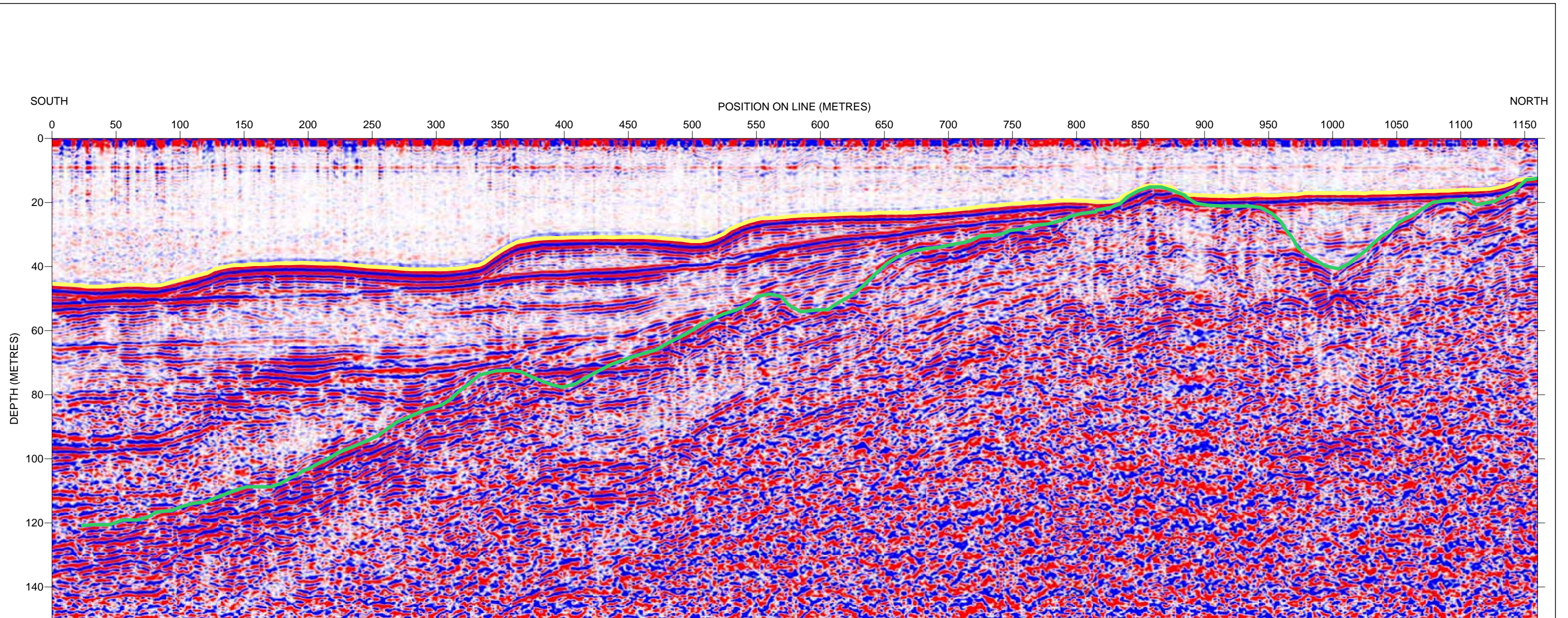
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NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10

VERTICAL SCALE: 1:1,250
HORIZONTAL SCALE: 1:12,500

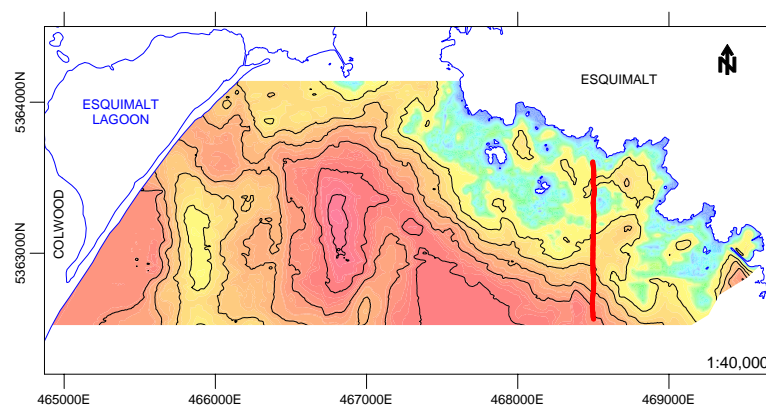
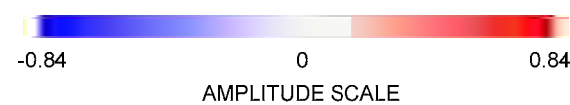


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DATE: SEPT. 2010	DWG: ESQ-DS-DR



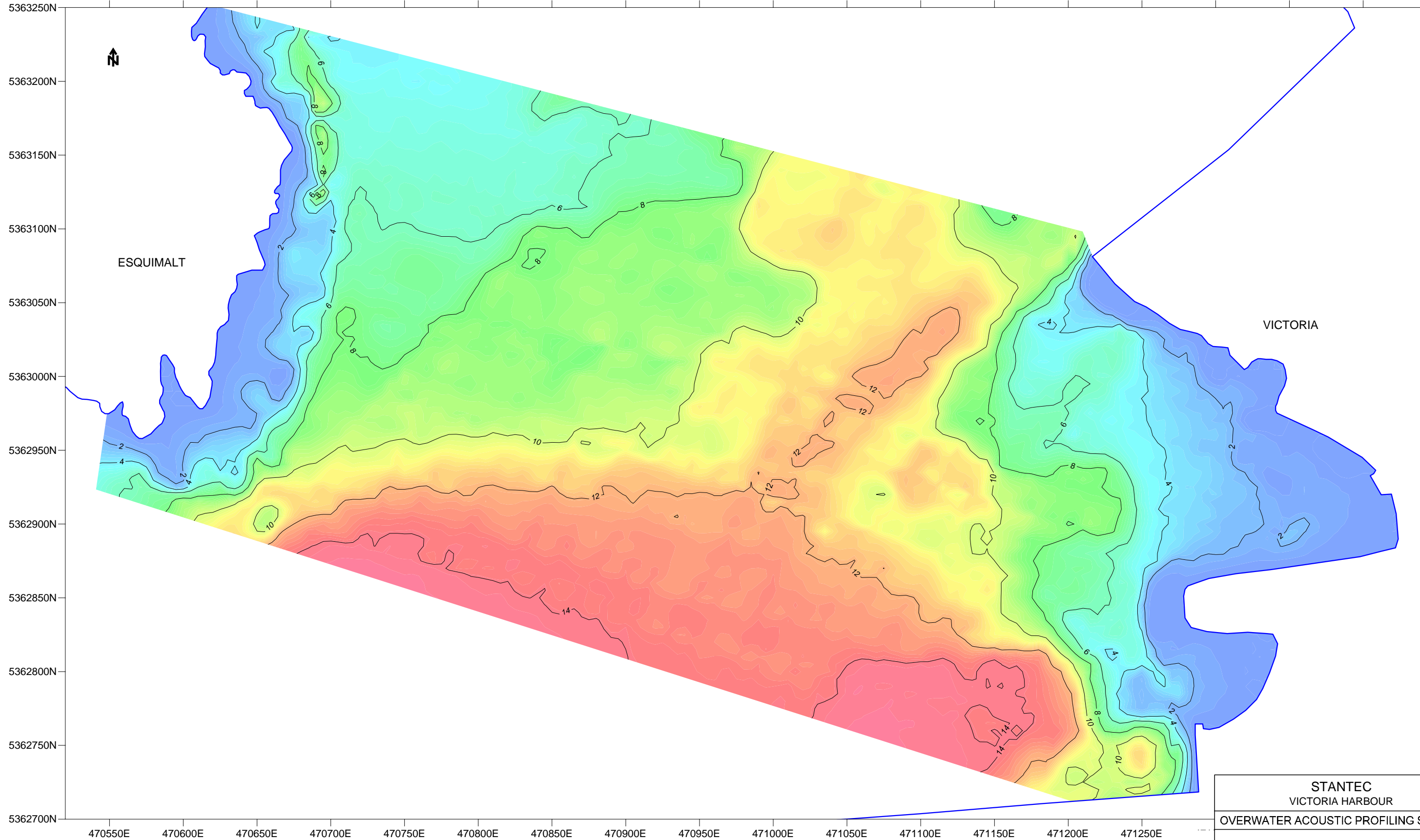
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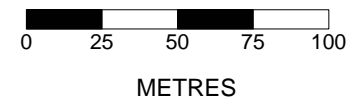
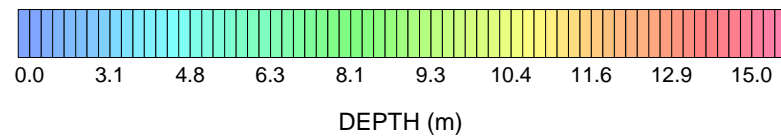


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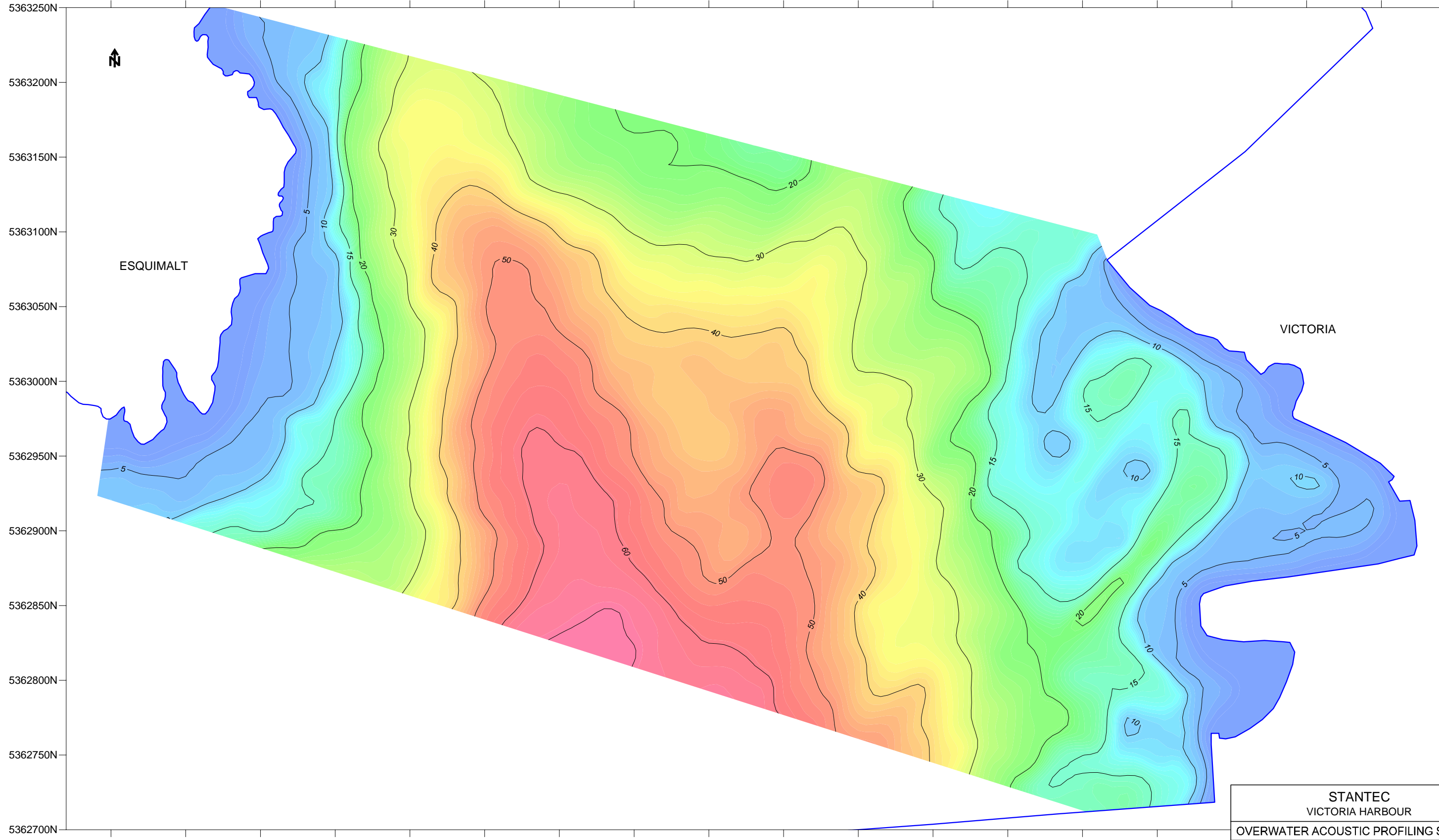
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DATE: SEPT. 2010		DWG: ESQ-EX



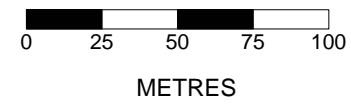
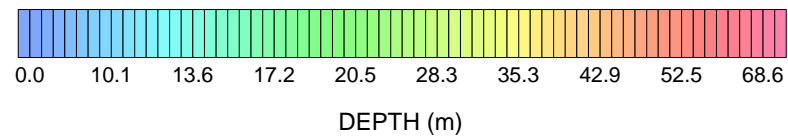
NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10



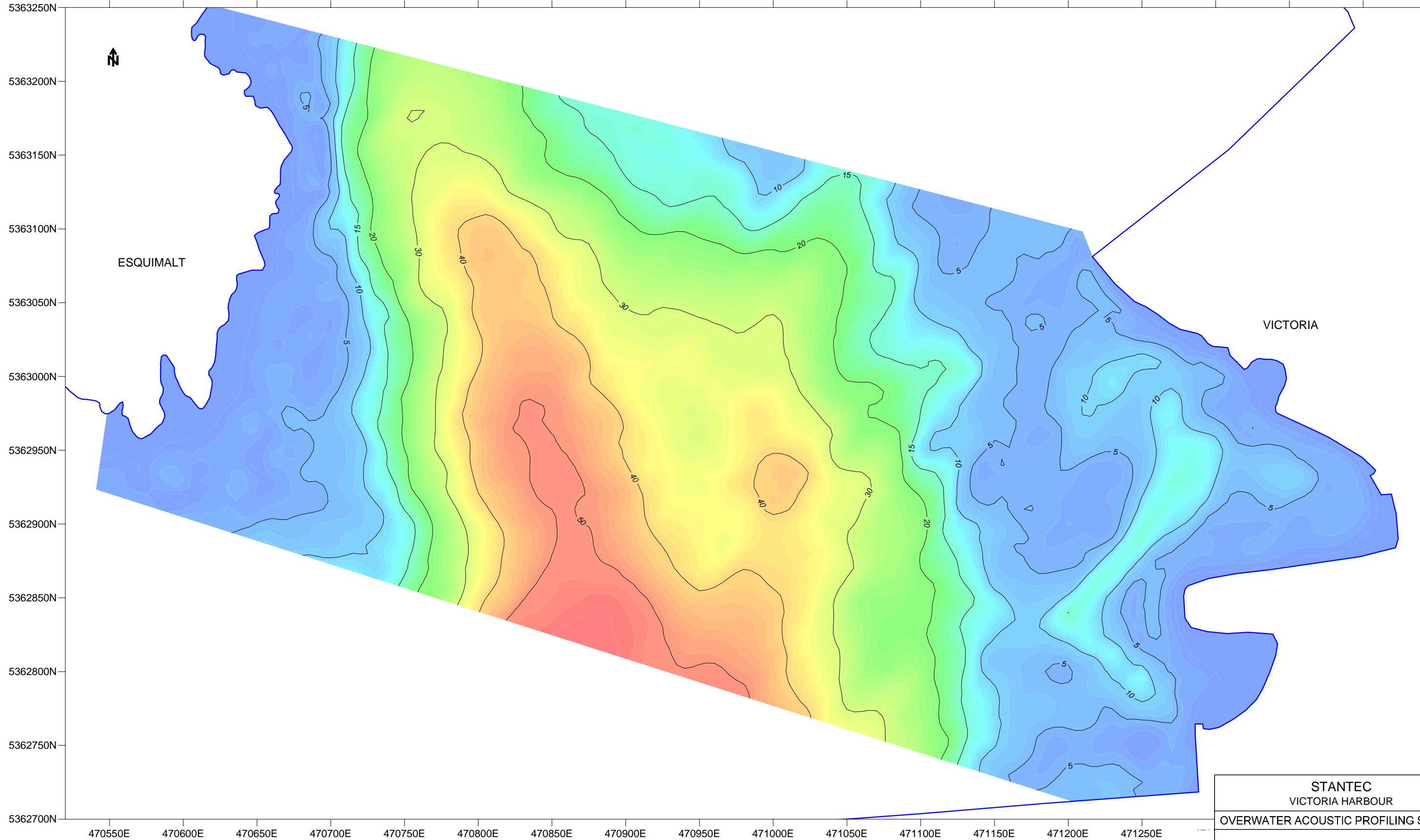
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OVERWATER ACOUSTIC PROFILING SURVEY		
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FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:2,500	DWG: VIC-BAT



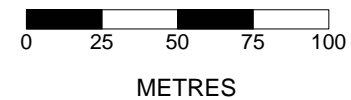
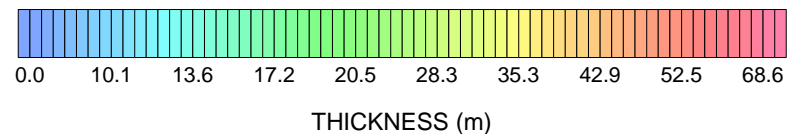
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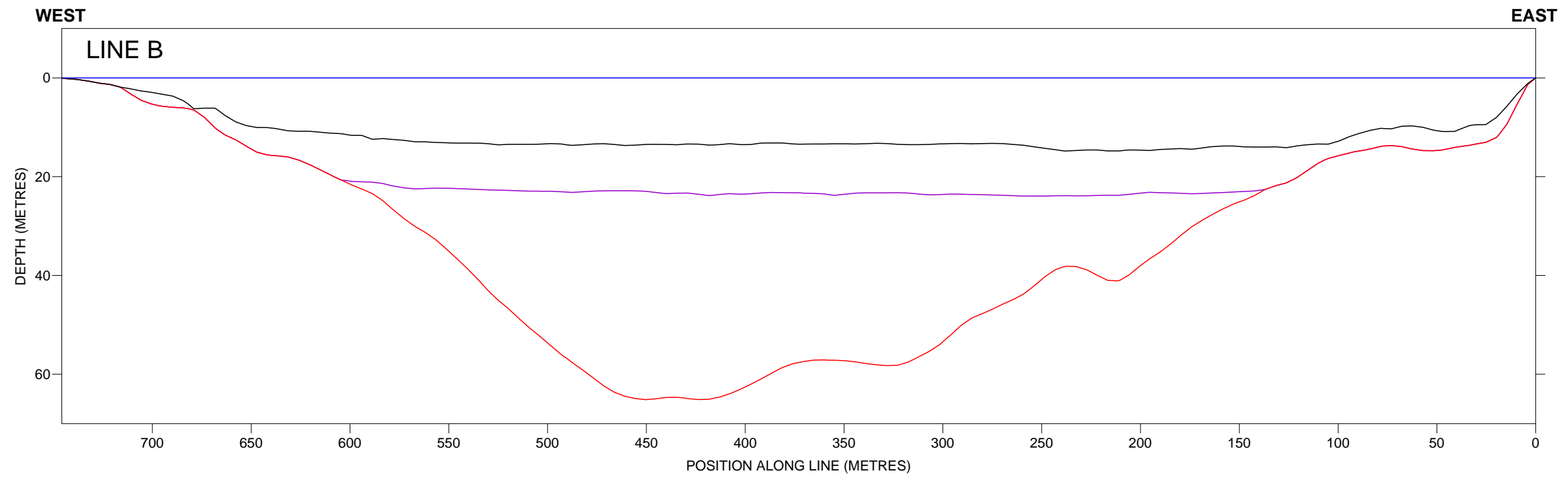
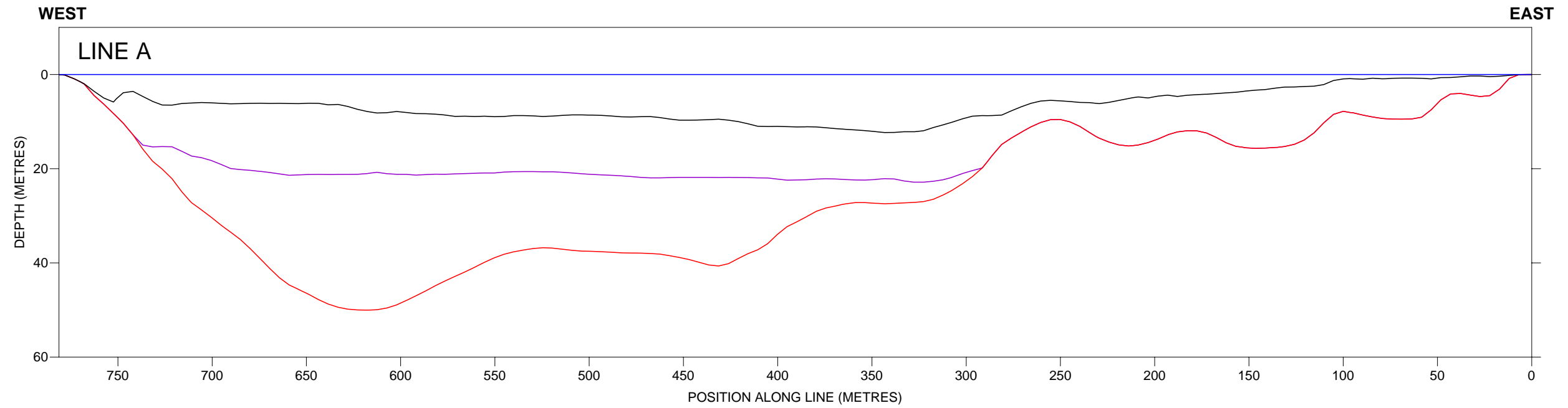
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FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:2,500	DWG: VIC-BED



NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10



STANTEC VICTORIA HARBOUR		
OVERWATER ACOUSTIC PROFILING SURVEY		
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FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010	SCALE 1:2,500	DWG: VIC-SED

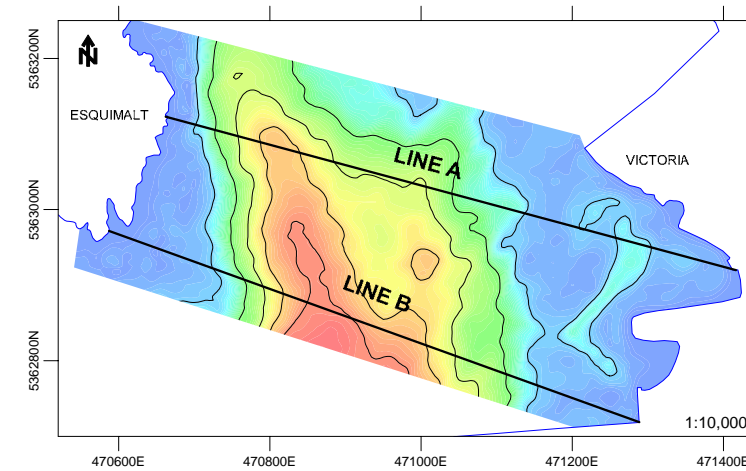


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- BEDROCK HORIZON

NOTE: DATUM IS TIDE AND CHART
NAD83 ZONE 10

VERTICAL SCALE: 1:250
HORIZONTAL SCALE: 1:1,000



STANTEC VICTORIA HARBOUR		
OVERWATER ACOUSTIC PROFILING SURVEY		
DEPTH SECTION LINES A & B		
FRONTIER GEOSCIENCES INC.		
DATE: SEPT. 2010		DWG: VIC-DS