



VICTORIA HANDYDART FACILITY

Geotechnical Summary Report

WSP Canada Inc

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31 January 2018

WSP File No.: 169-00385-30

BC Transit
520 Gorge Road East,
Victoria, BC
V8W 2P3

Attention: Lori Beaulieu, PMP, Project Manager

Subject: Geotechnical Summary Report for the Victoria HandyDART Facility

DOCUMENT HISTORY - VERSION	ISSUED
1 st Draft	December 20, 2018
FINAL VERSION	January 31, 2019

Dear Madam:

WSP Canada Inc. is pleased to submit a final PDF copy of the Geotechnical Site Assessment report for the above-referenced property.

We trust that the enclosed report meets your current requirements. If you have questions regarding this project, the enclosed reports, or our services, please do not hesitate to call the undersigned at (250) 475-1000.

Thank you for using our professional services. We look forward to serving your future environmental and engineering needs.

Sincerely,

WSP Canada Inc.

Stewart Dolan, P.Eng.
Geotechnical Engineer



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INTRODUCTION

WSP Canada Inc. (WSP) was engaged by BC Transit (the Client) to provide engineering services for the proposed Victoria HandyDART Facility. WSP geotechnical was originally retained in 2017 to conduct a site assessment using machine excavated test pits only. However, thick deposits of unfavourable ground conditions were encountered and the site layout was also revised following our site assessment in September 2017. A revised proposed scope of work was submitted on 08 April 2018 and was modified upon client request and resubmitted 05 October 2018. Authorization to proceed was given by Lori Beaulieu of BC Transit on 06 September 2018.

This report provides geotechnical comments and recommendations for the proposed development based on the 2018 BC Building Code and has been prepared in support of the building permit application process. It is anticipated that the information present in the report will be used by the client to assist the design engineers to further the structural and civil engineering aspects of the development. Further interaction with the design team will be required as the project develops to the detailed design and construction phase of the works.

SCOPE OF WORK

The scope of geotechnical work set out in our proposal was to:

- Carry out a desk study of available information including geological mapping, aerial photography and any information made available by the client;
- Conduct a site reconnaissance;
- Conduct a site investigation comprising intrusive fieldwork and laboratory testing; and
- Prepare this geotechnical report summarizing the above and giving geotechnical recommendations for the proposed development.

PROJECT INFORMATION

The site is located at 2401 Burnside Road West in View Royal, BC as shown on the site location plan included in Appendix A. The site is bound to the northwest by Burnside Road W, to the north by Watkiss Way, to the east by Craigflower Creek and to the south by the Trans Canada Highway off-slip.

The site was surveyed by WSP geomatics in 2017 and the survey is included in Appendix B. At the time of writing the site was occupied by the Victoria Bowmans Outdoor Range archery club. The site comprised relatively flat areas at the northwest and east parts of the site, used as parking and archery range respectively. The parking lot had a gravel surface and the archery range was grassed. The west part of the site was a hill that was overgrown with blackberry bushes and mature trees. A creek was



identified across the southwest corner of the site. A second creek (or drainage ditch) flows south across the centre of the site. A CRD watermain with a cathodic protection system orientated east-west was located across the north part of the site. High voltage BC Hydro overhead cables orientated north south were located across the centre of the site. The Galloping Goose Trail was also located across the east part of the site.

Based on our review of the most recent site layout drawings provided to us (Architecture 49 drawing no. VR-A1 dated 12 January 2018, included in Appendix C) we understand that the proposed facilities on site will include an office, stores and maintenance workshop located on the current archery range, and a fuel station, bus wash and bus parking areas located across the existing hillside on the west part of the site.

A preliminary grading plan from WSP civil shows the west side of the site will comprise mostly cut of up to 5m, and the central and northwest parts of the site will be filled by around 2m. The preliminary grading plan is included in Appendix C.

We note that the preliminary grading plan is subject to change based on possible limitations to changes in site grades, including areas around the CRD watermain, the BC Hydro high voltage distribution tower, the Galloping Goose Trail and the SPEA setback. Retaining walls and revisions to the access location may be required as detail design progresses. Site grades may vary by +/- 1m from what is shown on the conceptual grading plan.

BACKGROUND INFORMATION

GEOLOGICAL MAPPING

Surficial geological mapping¹ indicates the site is underlain by either thin soils over shallow bedrock or thick soft Victoria clays over bedrock with local areas of thicker softer clays. Geological mapping² notes the underlying bedrock is expected to comprise of wark gneiss.

WATER WELL RECORDS

Review of the Water Resources BC website³ did not show any available well records within 100m of the site.

¹ Quaternary Geology Map of Greater Victoria – Geoscience Mapp 2000-2

² Geological Survey of Canada (1980) Victoria Map 1553A, 1:10,000 Scale

³ Data BC, Province of British Columbia. (2013). *Water Resources Atlas*. Retrieved on 06 September 2018 from <http://maps.gov.bc.ca/ess/hm/wrbc/>



BC BUILDING CODE DESIGN EARTHQUAKE

The seismic design tool for engineers was used to obtain the 2015 National Building Code (2018 BC Building Code) peak ground acceleration (PGA) for the site. The PGA value representing the 1 in 2475 year and 1 in 475-year return period earthquakes are presented in Table 1 below. A copy of the report is included in Appendix D.

Table 1: 2018 BC Building Code peak ground accelerations at the proposed HandyDART site

Probability of Exceedance in 50 years	Peak Ground Acceleration (PGA)
2%	0.588 g
10%	0.308 g

ASSESSMENT WORK

The initial investigation was conducted on 07 September 2017 and consisted of five test pits at the locations shown on the Test Pit Location Plan (Appendix A). The test pit locations were focused across the western hill due to the proposed site layout at the time, and access constraints. In general, the test pits encountered fill materials including reworked natural fill, shotrock, and construction waste. Generally native soil was not encountered, and test pits were terminated in fill at the extent of the excavator reach. Additional geotechnical work was proposed at the time of the initial investigation but was put on hold at the request of the Project Manager until a final design layout was agreed.

WSP carried out a 2018 test pit assessment on 28 September 2018 which consisted of the advancement of four test pits, advanced by a CAT 303.5E mini excavator operated by Michell Excavating of Saanich, BC. The test pit locations are shown on the Test Hole Location Plan in Appendix A.

Subsequently a borehole sub-surface assessment began on 01 October 2018 that consisted of two solid stem augured boreholes, advanced by a track mounted auger drill operated by Drillwell Enterprise of Duncan, BC. WSP left site on 01 October at the request of the Client before completing our proposed boreholes. WSP was then authorized to return to site on 03 December 2018 to continue the sub-surface assessment which consisted of advancing an additional three boreholes. The borehole locations are also shown on the Test Hole Location Plan in Appendix A.

WSP was unable to complete the borehole assessment program on 03 December due to cancellation by our traffic control sub-contractor, making rig access to the west part of the site not possible. WSP returned to site on 08 January 2019 to complete our proposed drill program and advanced an additional 3 boreholes.

The test pit and borehole logs are included in Appendix E. In general, the boreholes were advanced to refusal.

The general conditions encountered in the eastern portion of the site consisted of:

- Organic topsoil;
- Firm brown clays; overlying
- Soft blue grey clay; overlying
- Inferred bedrock.

Based on the test pits advanced in September 2017 on the western portion of the site fills are present to depths greater than 4 m below ground level (bgl). The additional drilling conducted in January 2019 indicated fill soils are present to depths of approximately 7.5 m. Firm brown clays overlying soft blue grey clays were encountered under the fills in the western portion of the site.

Standard penetration tests (SPT), hand-held shear vane and pocket penetrometer tests were conducted during our field program and the results are presented on the borehole logs in Appendix E. Soil samples were recovered and returned to WSP's Victoria laboratory for review and testing.

A groundwater monitoring well was installed in BH18-03. Groundwater was measured at 1.5m bgl at the time of drilling.

LABORATORY TESTING

Laboratory testing performed included moisture content determination and Atterberg limits. The test results are presented on the soil logs included in Appendix E. A summary of the Atterberg limits test results are presented in Table 2 below.

Table 2: Summary of Atterberg limits

Borehole	Depth	Plastic Limit	Liquid Limit	Moisture Content
BH18-01	2.7 m	28.41	58.88	22.1
BH18-01	5.5 m	22.26	42.84	36.5
BH18-06	3.8 m	32.22	59.86	33.4
BH18-06	10.8 m	24.02	51.48	41.5



GEOTECHNICAL RECOMMENDATIONS

GENERAL

The following geotechnical comments and parameters are related to information that was made available to WSP at the time of preparing this report. We understand that this report will be used by the civil engineer to assist with their design. Ongoing interaction between WSP's geotechnical and civil engineers is expected as detailed design progresses.

The findings of our desk study and site assessment indicates the site is geotechnically suitable for the proposed development provided the following recommendations are followed. Follow up field reviews should be carried out by WSP to verify the assumptions made in this report.

The natural soils are expected to consist of fine grained cohesive soils which can become softened under repeated construction traffic, especially during wet conditions. We therefore recommend that construction takes place during the drier summer and early fall months of the year. Construction sequencing should also consider covering exposed natural soils as soon as practicable to avoid disturbance of the surface. All exposed subgrades should be reviewed by WSP prior to placement of fills.

An effective erosion and sediment control plan should be in place prior to construction and should be monitored for effectiveness during the works.

SITE SEISMIC CLASS

Based upon the findings of our site characterization program, we consider the site to be Site Class D in terms of the 2018 BC Building Code.

SITE PREPARATION

Preparation work for the site will largely depend on discussions with the civil/structural engineer. The elevation of the subgrade surface will depend on detailed design and interactions with the structural engineer. Site preparation will involve the removal of all the unsuitable soils including fills and organic soils within the building and parking lot footprints. Fill was encountered up to 7.5 m below ground surface in the western portion of the site. Fill thickness may vary across the western portion of the site and may be thicker than 7.5 m in some areas.

The test pits excavated during the fieldwork were backfilled and only modestly compacted in a manner that is not suitable for the support of any key infrastructure. Any test pits located directly within the building, driveway or parking lot footprints, or below any other paved surfaces, should be identified during construction, re-excavated, and backfilled in accordance with engineered fill recommendations noted below.



ENGINEERED FILL

Structural engineered fill where required should consist of well graded soil with a maximum particle size of 75 mm and less than 5% by mass smaller than 0.075 mm. Engineered fill material to support foundation elements should be placed in maximum 300 mm lifts and compacted to 95% modified Proctor maximum dry density (MPMDD). Crushed rock would be suitable for this purpose; however, other well graded granular soils could also be considered, subject to review by WSP.

For general backfill a well graded 150 mm minus crushed rock (e.g. shotrock) would be suitable to raise the site grades. This material should be placed in maximum 450 mm thick lifts and compacted by a heavy steel drum vibratory roller with a minimum of six passes in each direction.

In-place density testing must be carried out by WSP to verify that the field densities meet the design intent.

All engineered fills should be approved by WSP before being delivered to site.

The natural clay/silt or 'fine soils' material is not considered suitable for re-use as backfill or engineered soil due to its high fines content and sensitivity to moisture conditioning. It could, however, be used for landscaping purposes.

SETTLEMENT MONITORING

We note that softer soils up to 8 m thick were identified during our drilling program and that the preliminary grading plan shows filling of 1-2 m across parts of the site. Based on the proposed fill thickness and the likely vehicle loadings we estimate that post construction settlements in certain parts of the site could be in the order of 100-200 mm and is expected to vary locally depending on the final grade change and localised thickness of softer soils.

We recommend the site be pre-loaded to mitigate the risk of post-construction deformations caused by filling and traffic loading. A preload typically comprises the placement of approved fill up to a design grade representing design load conditions. Around 1.5 m of additional fill (above finished ground level) would be sufficient for planning purposes; however, this should be reviewed during detailed design. The lateral extent of the preload will depend on the final site grading and layout plans, and should be reviewed during detailed design.

We also recommend surface monitoring carried out every 3-months to observe the surface settlements. For planning purposes, we estimate one year should be sufficient to allow consolidation of the softer soils to complete. This would be reviewed as the settlement monitoring results are made available.

CRD WATER MAIN

The CRD should be consulted with regards to their buried water main and cathodic protection system during the design and construction process. Before works begin



we recommend the pipe be exposed at select locations across the site to visually confirm its location, orientation, depth and founding material.

Discussions should be held with the CRD before any works begin with regards to working around the pipe, how much load the pipe can tolerate, acceptable fill materials to be placed around the pipe, and compaction energy. WSP should participate in these discussions (both civil and geotechnical).

BUILDING FOUNDATIONS

We have assumed that the proposed structures will be supported on shallow concrete footings placed on an approved subgrade of either well compacted engineered fill placed onto natural subgrade, or directly onto natural soils. Foundations should be designed considering a serviceability limits states design (SLS) and ultimate limit states design (ULS) bearing capacities presented in Table 3 below for foundations on geotechnically approved subgrades. WSP must review all foundation subgrade prior to concrete placement.

Table 3: SLS and ULS bearing capacities for foundation design

SUBGRADE MATERIAL	SLS	ULS
Natural clay	100kPa	150kPa
1m or more of engineered fill over natural clay	150kPa	225kPa

We have assumed that foundations for the office building would be above 1 m bgl. Based upon the preliminary grading plan the finished ground level around the proposed buildings will be within 0.5 m of existing ground level. Provided foundations are not constructed below 2m bgl, the total post-construction settlement of foundations is estimated to be less than 25 mm, with approximately half of this as differential movements.

The proposed buildings at the west part of the site are currently shown located partly on cut and partly on fill e.g. the west side of the proposed fuel station will be in a 2.5 m cut; the east side will be on 1.5 m of fill. We also note that 7 m of soft soils were encountered in BH18-06 and there is a risk of differential settlements occurring across the footprint of the building due to the cut/fill works. This effect will be mitigated provided our recommendations on preloading and settlement monitoring are followed.

The building foundations must be reviewed with regards to settlements by WSP geotechnical once the building layout, footing dimensions, elevations and bearing pressures are known as this may affect the preloading requirements.



PERIMETER DRAINAGE

As noted, static groundwater levels were recorded at about 1.5 m below grade. We note that seasonal groundwater fluctuations are to be expected that could result in higher groundwater levels during periods of prolonged precipitation.

Perimeter foundation drainage should be provided around the footings as per the BC Building Code. The drains should be placed below the slab elevation.

RETAINING WALLS

Based on the plans provided to us, we do not anticipate retaining walls being used on this site. If retaining walls are to be considered, we can review and provide additional advice if requested.

PARKING LOT BASE PREPARATION

Where required, well graded granular fill should be used to establish the final parking lot subgrade elevation. The subgrade may comprise natural soils (in areas of cut), or engineered fill (in areas of fill). WSP shall review all exposed natural soils before placement of engineered fill.

After the design subgrade elevation has been established and compaction is completed (where required), the subgrade area shall be proof rolled in the presence of WSP with a standard proof-roller that consists of a rubber-tired roller with four wheels abreast, a total mass of 45,360kg, a maximum centre-to-centre wheel spacing of 740 mm and a tire inflation pressure of 0.62MPa. If the use of alternative proof-rolling equipment is requested by the Contractor, a new level of proof-rolling will need to be determined based on loading characteristics of that proof roller. Soft areas of subgrade that deflect more than 25 mm or show permanent deformation greater than 25 mm should be removed and replaced with engineered fill material and compacted to 95% MPMDD.

PARKING LOT BASE AND SUBBASE MATERIALS

Subbase materials should consist of a 75 mm minus well graded crushed gravel with less than 5% by mass smaller than 0.075 mm.

Base material should consist of well graded 25 mm crushed gravel that fits within the following gradation limits.

Table 4 Gradation of Aggregate Base

Sieve Designation as per ASTM C136 and ASTM C117	Percentage By Weight Passing Sieves
25 mm	100
19 mm	75-100
9.5 mm	50-75
4.75 mm	30-50
0.425 mm	10-30
0.075 mm	0-5

Base course shall consist of crushed aggregate and shall consist of clean, sound, durable stones and rock crushed to specified size and shall be free from excess soft or disintegrated pieces, dirt, or other objectionable matter.

Based upon the assumption that the parking lot structure will be used for moderate vehicle loads, we recommend the following MOTI pavement structure for preliminary design considerations: The actual vehicle loadings should be reviewed during detailed design.

Table 5: Preliminary Parking lot pavement structure

Course	Material	Thickness (mm)
Subbase	75 mm minus crushed rock	300
Base	25 mm minus crushed rock	200
Surface	Asphalt	75

The aggregate subbase and base materials should be placed and constructed in layers of uniform thickness not more than 300 mm of compacted thickness. Once placed and spread, each layer should be compacted with a heavy vibratory steel drum roller to 95% MPMDD.

In-place density testing by nuclear densometer should be carried out by WSP on each lift to verify that design densities have been achieved in the field.

DRAINAGE

Drainage is a key component to a successful pavement structure. WSP's parking lot structure design has assumed the base and subbase materials shall have sufficient cross fall towards the drainage system. If perimeter pipe drains are to be used, then they should be surround by drain rock and a non- woven geotextile. If ditches are to be used then the invert of the ditches should be at least 300 mm below the elevation of the subgrade. Side slopes of ditches should be no steeper than 2H:1V.

Poor drainage will lead to early deterioration and breakup of pavements and may include the development of seasonal potholes.

The natural soils beneath the site are clays confirmed to depth. Based on the visual and tactile assessment of the soil we expect this material will have a very low permeability somewhere in the region of 10^{-8} to 10^{-10} m/s (Table 2.1 in Craig's Soil Mechanics) and would be unsuitable for stormwater disposal using infiltration methods.

MONITORING AND MAINTENANCE

A pavement structure must be monitored through regular pavement evaluation surveys to determine if there is a need for immediate or routine maintenance. Pavement evaluation surveys such as PASER or the MOTI's Pavement Surface Condition Rating Manual would be an appropriate tool.

Maintenance could include routine crack sealing, cleaning of ditches or other drainage elements, or resurfacing over time.

FUTURE GEOTECHNICAL WORK

As works progress we envisage the following geotechnical work will be required:

- Discussions with BC Transit, the structural engineer, civil engineer and other members of the design team;
- Review geotechnical elements of the design including pavement structure, building foundations, preloading and settlement monitoring;
- Assist preparing or reviewing of geotechnically relevant specifications for earthworks;
- Input into an erosion and sediment control plan;
- Prepare and submit Building Code Schedules relating to the geotechnical aspects of construction; and
- Undertake engineering field reviews and quality assurance testing during construction to monitor general compliance with the design.

WSP would be pleased to further define the additional geotechnical scope of work, and provide additional budgets, if requested.



CLOSING AND TERMS

This report was prepared in accordance with our service contract with BC Transit for this project. The District of View Royal is considered to be an approved user of this report subject to the same contract terms.

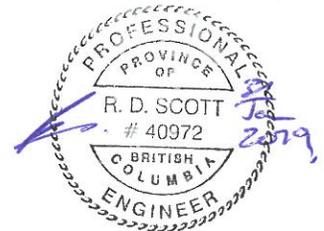
This document represents an electronic version of the original hard copy document, sealed, signed and dated by Russell Scott, P.Eng and retained on file. The content of the electronically transmitted document can be confirmed by referring to the original hard copy on file.

Yours sincerely,

WSP Canada Inc.

Stewart Dolan, P.Eng.
Geotechnical Engineer

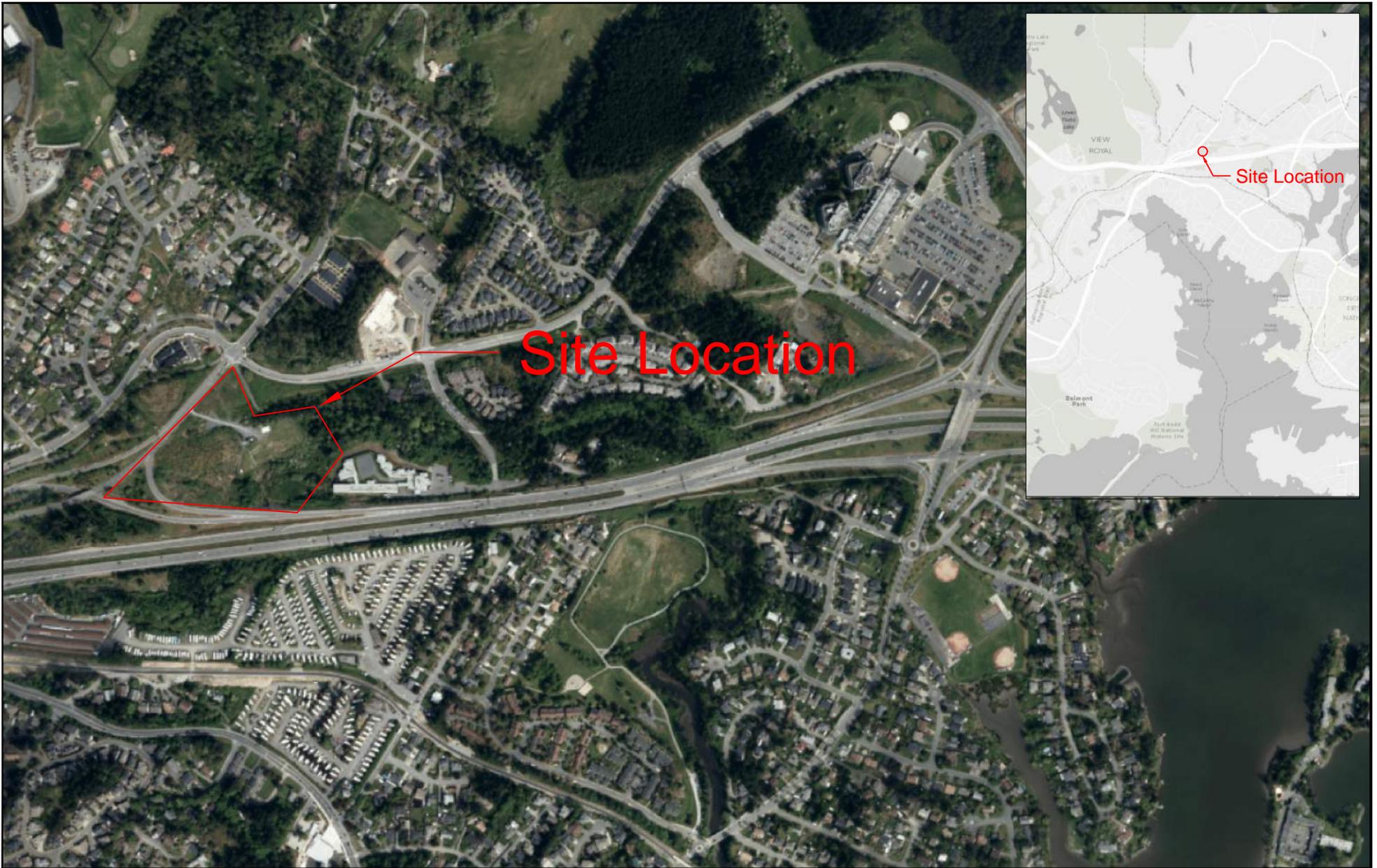
Russell Scott, M.Sc., P.Eng.
Senior Geotechnical Engineer



APPENDIX

A

SITE LOCATION
PLAN AND TEST
HOLE LOCATION
PLAN

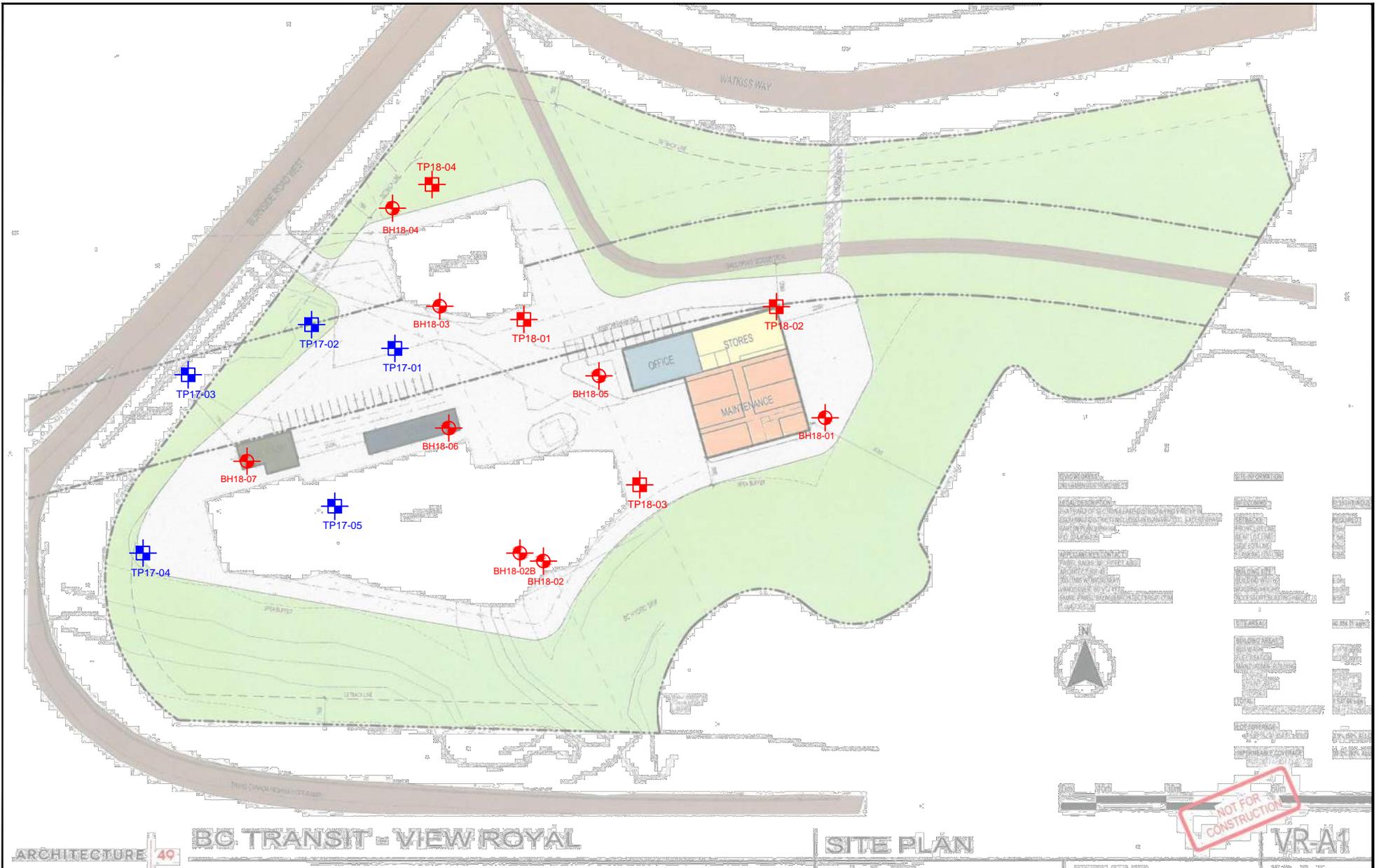


Site Location

Site Location

	PROJECT:	HandyDART Maintenance Facility	DATE:	JAN 2018	 WSP Canada Inc. Victoria, BC V8Z 6R4 T: 250.475.1000 F: 250.475.2211 E: victoria@levelton.com www.wspgroup.com
	DESIGN BY:	RDS	DRAWN BY:	RJP	
	CLIENT:	BC Transit	CHECKED BY:	RDS	
	TITLE:	Site Location Plan	SCALE:	NTS	
			PROJECT No.:	169-00385-20	
<small>THIS DRAWING IS THE SOLE PROPERTY OF WSP CANADA INC. AND CANNOT BE USED OR DUPLICATED IN ANY WAY WITHOUT THE EXPRESSED WRITTEN CONSENT OF WSP. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES OR OMISSIONS TO WSP.</small>			FIGURE No.:	1	

Base drawing obtained from the CRD Atlas.



ARCHITECTURE 49

BC TRANSIT - VIEW ROYAL

SITE PLAN

NOT FOR CONSTRUCTION

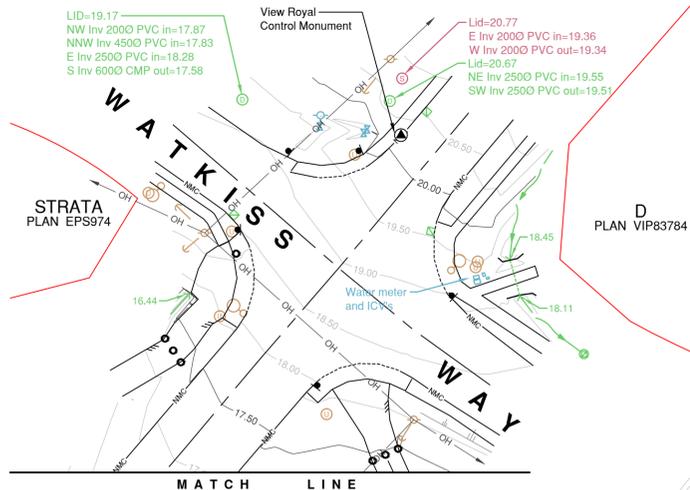
VR-A1

Legend 2018 Test Pit 2017 Test Pit Borehole	PROJECT: HandyDART Maintenance Facility	DATE: JAN 2018	 WSP Canada Inc. Victoria, BC V8Z 6R4 T: 250.475.1000 F: 250.475.2211 E: victoria@levelton.com www.wspgroup.com
	CLIENT: BC Transit	DESIGN BY: RDS	
	TITLE: Site Plan	DRAWN BY: RJP	
	<small>THIS DRAWING IS THE SOLE PROPERTY OF WSP CANADA INC. AND CANNOT BE USED OR DUPLICATED IN ANY WAY WITHOUT THE EXPRESSED WRITTEN CONSENT OF WSP. THE GENERAL CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES OR OMISSIONS TO WSP.</small>	CHECKED BY: RDS	
	PROJECT No.: 169-00385-20	FIGURE NO.: 2	

APPENDIX

B

TOPOGRAPHIC
SURVEY



The intended plot size of this plan is 864mm in width by 560mm in height (D size) when plotted at a scale of 1:500.

All distances are in metres and decimals thereof.

- LEGEND**
- denotes catchbasin
 - denotes culvert
 - denotes ditch and direction of flow
 - denotes water course and direction of flow
 - denotes cathodic protection
 - denotes water chamber
 - denotes utility manhole
 - denotes hydro pole
 - denotes pole anchor
 - denotes streetlight davit
 - denotes overhead wire
 - denotes sign
 - denotes gate post
 - denotes top of bank
 - denotes bottom of bank
 - denotes non-mountable curb
 - denotes curb letdown
 - denotes edge of gravel
 - denotes center line of road
 - denotes concrete roadside barrier
 - denotes tree derived from GPS waypoints provided by Stantec. Locations are approximate.
 - denotes property line

Date of Field Survey: September 5-6, 2017

Contour interval = 0.5 m.

Elevations are to geodetic datum.

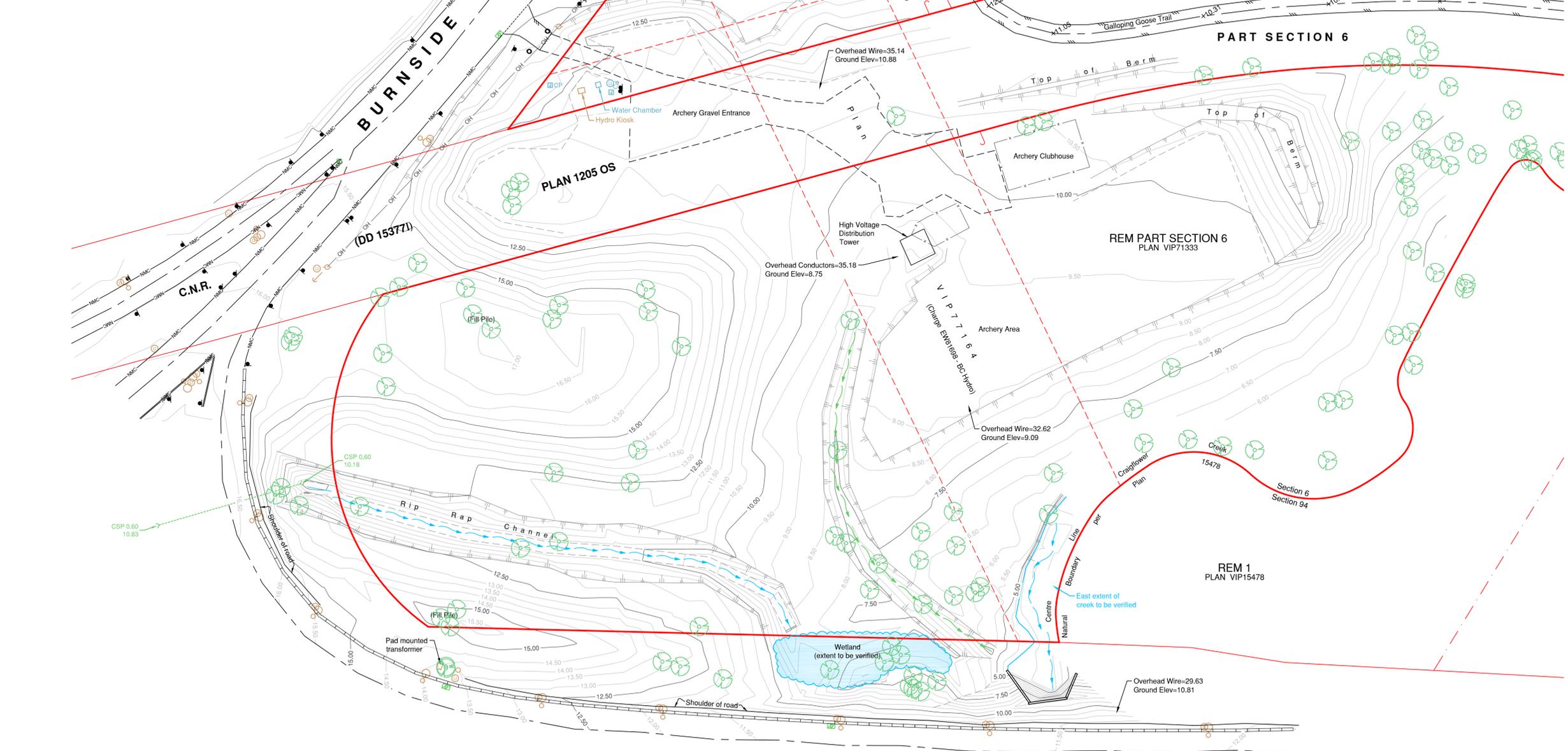
Vertical Datum CGVD28 (HTV2.0).

Lot boundaries shown hereon are derived from ties to existing survey evidence and Land Title Office records. Lot boundaries are subject to change upon legal survey.

This plan represents the best information available at the time of survey. WSP Surveys (BC) Limited Partnership and its employees take no responsibility for the location of any underground conduits, pipes, or other facilities whether shown on or omitted from this plan. All underground installations should be located by the respective authorities prior to construction.

See WSP drawing 169-00385-21-000-00-SSDSK001-R0 for complete legal boundaries.

Date of Field Survey: October 16, 2017 (overhead lines)
 Temperature: 12°C
 Pressure: 102.2 kPa
 Wind: S 28km/h



Rev No.	Date	Comment
3	2017-12-08	additional survey - Archery Range
2	2017-11-22	additional overhead wire data
1	2017-10-16	survey of overhead lines and Stantec tree survey data

wsp

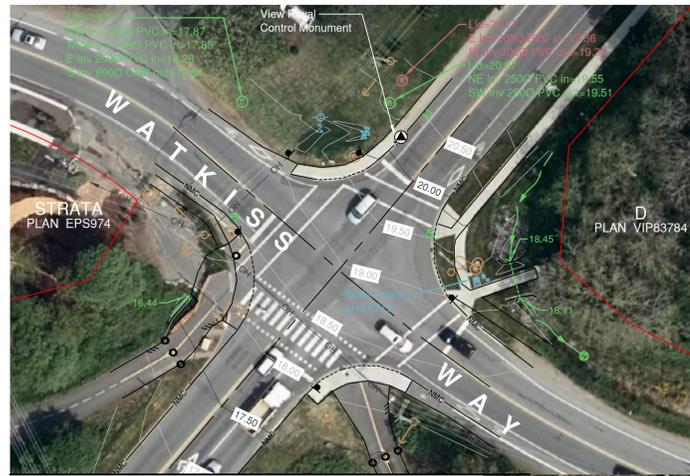
WSP Surveys (BC) Limited Partnership
 301-3600 Uptown Boulevard, Victoria, BC V8Z 0B9
 T: 250-364-5510 www.wspgroup.com

PROJECT
BC TRANSIT
HANDY DART FACILITY

SHEET TITLE
2401 BURNSIDE ROAD WEST
TOPOGRAPHIC SURVEY

DRAWN	DATE	CHECKED	SCALE
ME	2017-09-13	ML	1:500

SHEET No. **169-00385-21-000-00-SSDI001-R3**



The intended plot size of this plan is 864mm in width by 560mm in height (D size) when plotted at a scale of 1:500.

All distances are in metres and decimals thereof.

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- denotes catchbasin
 - denotes culvert
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 - denotes water course and direction of flow
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Rev No.	Date	Comment
3	2017-12-08	additional survey - Archery Range
2	2017-11-22	additional overhead wire data
1	2017-10-16	survey of overhead lines and Stantec tree survey data

wsp
 WSP Surveys (BC) Limited Partnership
 301-3600 Uptown Boulevard, Victoria, BC V8Z 0B9
 T: 250-364-5510 www.wspgroup.com

PROJECT
BC TRANSIT
HANDY DART FACILITY

PROJECT REF.
2401 BURNSIDE ROAD WEST
TOPOGRAPHIC SURVEY

DRAWN	DATE	CHECKED	SCALE
ME	2017-09-13	ML	1:500

SHEET No. **169-00385-21-000-00-SSDSI001-R3**

APPENDIX

C

ARCHITECTURAL
PLAN AND CIVIL
GRADING PLAN



CIVIC ADDRESS:
2401 BURNSIDE ROAD WEST

LEGAL DESCRIPTION:
THAT PART OF SECTION 6 LAKE DISTRICT (LYING PARTLY IN ESQUIMALT DISTRICT) INCLUDED IN PLAN VP71333, EXCEPT THAT PART IN PLAN VP86064
PID: 024-850-225

APPLICANT/KEY CONTACT:
PANEL BALAS, ARCHITECT A/B/C
ARCHITECTURE 49
200-1085 W. BROADWAY
VANCOUVER, BC V6J 4Y3
EMAIL: PANEL.BALAS@ARCHITECTURE49.COM
T: 604 736 5329



SITE INFORMATION

SITE ZONING:

I-1 LIGHT INDUSTRIAL

SETBACKS:	REQUIRED	PROPOSED
FRONT LOT LINE	7.5m	7.5m
REAR LOT LINE	7.5m	-
SIDE LOT LINE	6.0m	7.5m
FLANKING LOT LINE	6.0m	7.5m

BUILDING SIZE:

BUILDING WIDTH	6.0m	30.2m
BUILDING HEIGHT	12.0m	9.0m
ACCESSORY BUILDING HEIGHT	4.5m	-

SITE AREA:

40,854.71 sqm

BUILDING AREAS:

BUS WASH	139.78 sqm
FUEL STATION	153.82 sqm
MAINT./ADMIN. BUILDING	-
OFFICE	509.82 sqm
MAINT. BAYS	733.30 sqm
STORES	324.46 sqm
TOTAL:	1,547.86 sqm

FOR: 1,850.66 / 40,854.71 = 0.045

04 (1.25 ALLOWED)

LOT COVERAGE:

1,595.75 / 40,854.71 = 0.039

3.9% (50% ALLOWED)

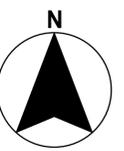
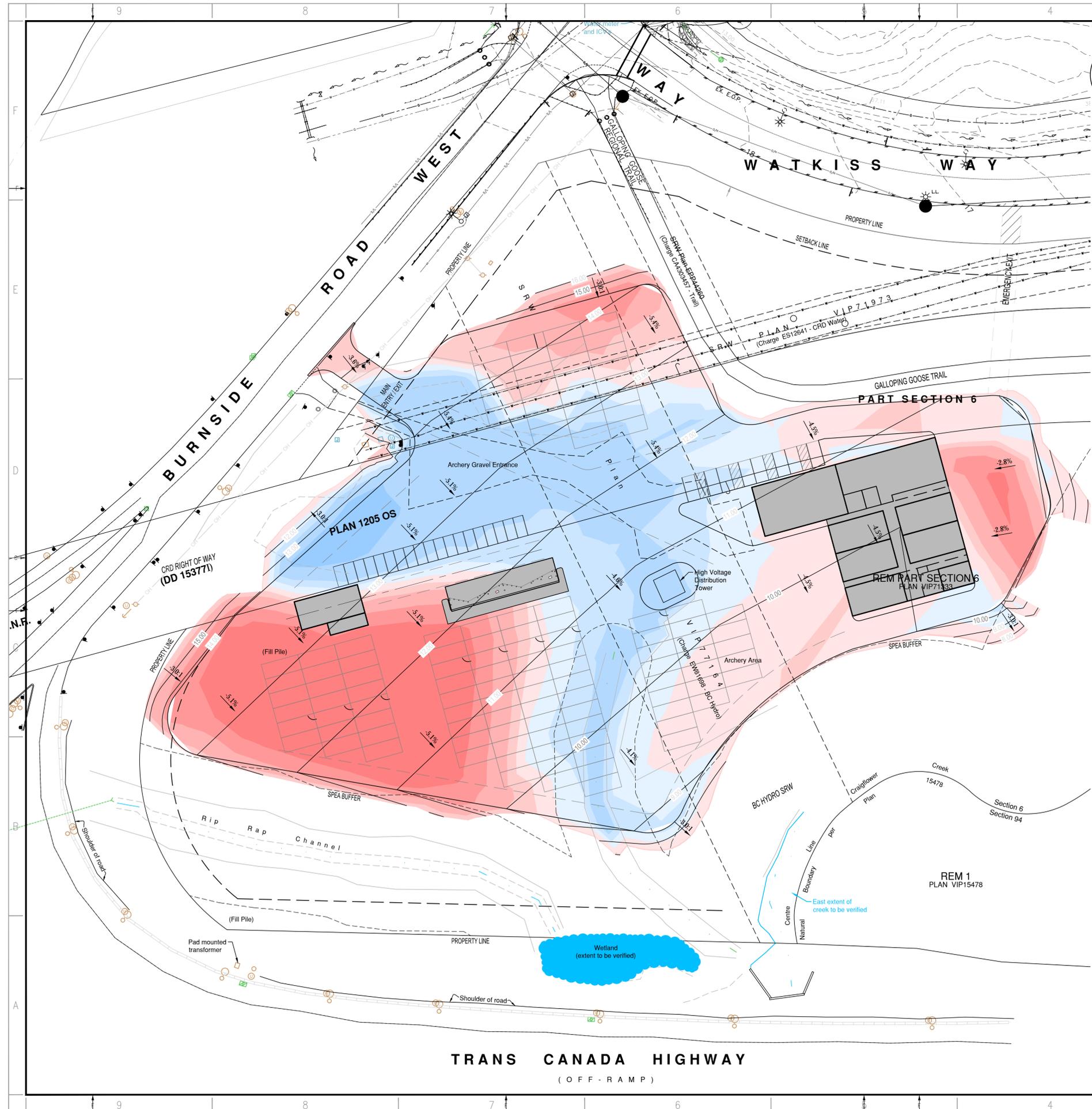
IMPERMEABLE COVERAGE:

16,127.27 / 40,854.71 = 0.392

39.2% (80% ALLOWED)



NOT FOR CONSTRUCTION



Elevations Table

Number	Min Elev	Max Elev	Color
1	-4.99	3.00	Red
2	-3.00	-2.00	Light Red
3	-2.00	-1.00	Lighter Red
4	-1.00	-0.50	Very Light Red
5	-0.50	0.00	Lightest Red
6	0.00	0.50	Lightest Blue
7	0.50	1.00	Light Blue
8	1.00	2.00	Medium Blue
9	2.00	2.73	Dark Blue

CUT/FILL SUMMARY

NAME	SURFACE AREA (m ²)	CUT (m ³)	FILL (m ³)
EXISTING GROUND/ FINISHED GROUND	17,995	15,940	6,440
SUBGRADE (ASSUMED 550mm BELOW)/FINISHED GROUND	17,995	0	9,900



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 Victoria BC, Canada
 V8P 0B9
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 F: 1-250-386-2844
 wsp.com

CONSULTANT:
ARCHITECTURE | 49
 SUITE 200 - 1885 W. BROADWAY
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 TEL: 604-736-5329
 www.vancouver@architecture49.com

SEAL:
 CLIENT:



520 GORGE RD EAST
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 TEL: 1-250-385-2551 | FAX: 1-250-995-5740
 WWW.BCTRANSIT.COM

CLIENT REF. # -
 PROJECT:
**BC TRANSIT - CAMPBELL RIVER
 OPERATIONS AND
 MAINTENANCE FACILITY**

#169-00385-09
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ISSUED FOR - REVISION:

NO	RE	DATE	DESCRIPTION
0	0	2017/11/11	ISSUED FOR -

PROJECT NO: 169-00385-20
 ORIGINAL SCALE: 1:500
 DESIGNED BY:
 DRAWN BY: CLD
 CHECKED BY: JCS
 DISCIPLINE: CIVIL
 TITLE:

DATE:
 IF THIS BAR IS NOT 25mm LONG, ADJUST YOUR PLOTTING SCALE.

SHEET NUMBER:
 SHEET # 1 OF 1
 ISSUE:
 DATE OF: 2017/11/27

TRANS CANADA HIGHWAY
 (OFF-RAMP)

APPENDIX

D

SEISMIC
HAZARD
REPORT

2015 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

December 13, 2018

Site: 48.4645 N, 123.4458 W User File Reference:

Requested by: ,

National Building Code ground motions: 2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.05)	Sa(0.1)	Sa(0.2)	Sa(0.3)	Sa(0.5)	Sa(1.0)	Sa(2.0)	Sa(5.0)	Sa(10.0)	PGA (g)	PGV (m/s)
0.716	1.095	1.314	1.319	1.172	0.690	0.408	0.128	0.045	0.588	0.841

Notes. Spectral ($S_a(T)$, where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC 2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are specified in **bold** font. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. *These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.*

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.05)	0.163	0.372	0.510
Sa(0.1)	0.251	0.574	0.789
Sa(0.2)	0.305	0.695	0.947
Sa(0.3)	0.301	0.693	0.949
Sa(0.5)	0.246	0.598	0.832
Sa(1.0)	0.117	0.314	0.461
Sa(2.0)	0.060	0.172	0.264
Sa(5.0)	0.012	0.038	0.073
Sa(10.0)	0.0040	0.013	0.025
PGA	0.132	0.308	0.423
PGV	0.148	0.395	0.574

References

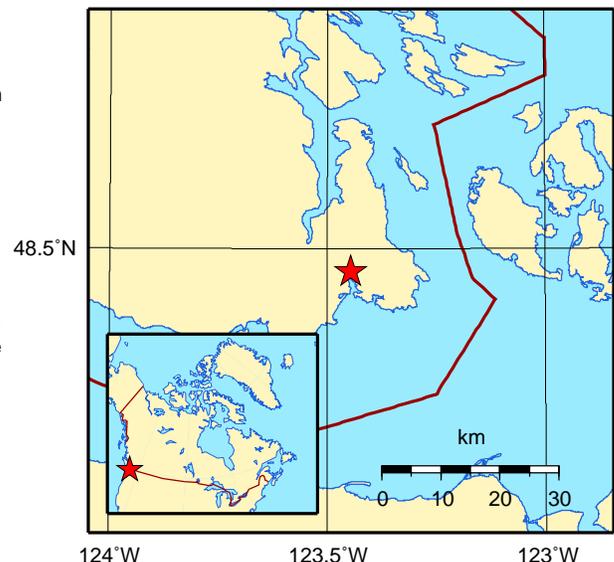
National Building Code of Canada 2015 NRCC no. 56190;
Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

User's Guide - NBC 2015, Structural Commentaries NRCC no. xxxxxx (in preparation)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Aussi disponible en français



Natural Resources
Canada

Ressources naturelles
Canada



APPENDIX

E

TEST PIT AND
BOREHOLE
LOGS



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 www.wspgroup.com

BC HandyDART
BC Transit
 2401 Burnside Road West
 View Royal, BC

TP17-01

Pg 1 of 1
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	FILL - Grey/brown coarse shotrock fill																			
2	FILL - Brown sandy silt, moist, trace organic, some gravel, some blue grey clay zones																			
4	FILL - Dark brown organic, top soil, moist																			
6	Grey brown CLAY some mottling, some sand, some silt, trace organics, moist to wet																			
6	Grey silty CLAY some sand, trace gravel, wet																			
12	Test pit terminated in silty clay at 3.3m, some caving of pit walls.																			

▼ P1
 Sep 7
 2017

C: Condition of Sample
 Good
 Disturbed
 No Recovery

Type: Type of Sampler
 SPT : 2 in. standard
 ST : Shelby
 G : Grab
 CORE

N: Number of Blows
 WH : Weight of Hammer
 WR : Weight of Rod
 Standard Penetration Test : ASTM D1586
 Hammer Type:

Plastic Limit (%) Liquid Limit (%)
 Moisture Content (%)
 ▼ Ground Water Level
 ⊗ Shear strength in kPa (Torvane)
 PP Pocket Penetrometer
 (compressive strength in kPa)
 X Shear strength in kPa (Unconfined)
 ⊗ Shear strength in kPa (Field vane)
 ⊠ Remolded strength in kPa
 ■ Percent Passing # 200 sieve

Drill Method: Test Pit
 Date Drilled: 07/09/2017
 Logged by: RP
 Checked by: RS

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STANDARD PENETRATION TEST

1 LOG PER PAGE 25/1/19



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TP17-02

Pg 1 of 1
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	FILL - Brown sandy silt, moist, some gravel, some cobbles																			
2	FILL - Blue grey clay, moist, plastic																			
4	FILL - Dark brown organic topsoil																			
6	FILL - Grey silty clay, mottled brown some sand, brown, some zones of shotrock fills (reworked natural fill)																			
8																				
10																				
12																				
14																				
16	Test pit terminated in fill at 4.5m, some caving of pit walls.																			
18																				
20																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 07/09/2017 Logged by: RP Checked by: RS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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TP17-03

Pg 1 of 1
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	FILL - Dark brown organic topsoil, rootlets																			
2	FILL - Brown sandy silt, some gravel, some blue clay zones, some cobbles, trace boulders, moist																			
4																				
6																				
8	FILL - Brown-grey silty clay, some shotrock cobbles, moist																			
10	FILL - Grey shotrock approx. 10 to 30 cm diameter, some boulders >60 cm diameter																			
12	FILL - grey-brown clay, some silt, some sand, some cobbles (reworked natural fill)																			
14																				
16	Test pit terminated in fill at 4.5m, some caving of pit walls.																			
18																				
20																				

C: Condition of Sample
 Good
 Disturbed
 No Recovery

Type: Type of Sampler
 SPT : 2 in. standard
 ST : Shelby
 G : Grab
 CORE

N: Number of Blows
 WH : Weight of Hammer
 WR : Weight of Rod
 Standard Penetration Test : ASTM D1586
 Hammer Type:

Plastic Limit (%) Liquid Limit (%)
 Moisture Content (%)
 ▾ Ground Water Level
 ⊗ Shear strength in kPa (Torvane)
 PP Pocket Penetrometer
 (compressive strength in kPa)
 X Shear strength in kPa (Unconfined)
 ⊗ Shear strength in kPa (Field vane)
 ⊠ Remolded strength in kPa
 ■ Percent Passing # 200 sieve

Drill Method: Test Pit
 Date Drilled: 07/09/2017
 Logged by: RP
 Checked by: RS

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TP17-04

Pg 1 of 1
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	FILL - Dark brown organic topsoil, rootlets																			
2	FILL - Brown silty sand, dry, some shotrock boulders < 60 cm diamete																			
1	FILL - Dark brown organic topsoil, moist, earthy odour																			
4	FILL - Blue grey clay, moist, some sand, trace organics																			
6																				
2	FILL - Grey-brown clay, moist, some silt, some sand, some cobbles, some zones of blue-grey clay (reworked natural fill)																			
8																				
3																				
10																				
12																				
4																				
14																				
16	Test pit terminated in fill at 4.5m, some caving of pit walls.																			
5																				
18																				
6																				
20																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 07/09/2017 Logged by: RP Checked by: RS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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TP17-05

Pg 1 of 1
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
2	FILL - Dark brown organic topsoil, rootlets																			
	FILL - Brown silty sand, moist, some organics, some shotrock, some wood																			
4																				
	FILL - Dark brown organic topsoil																			
6	FILL - Grey-brown clay, moist, some silt, some sand, some cobbles, some zones of blue-grey clay (reworked natural fill)																			
8																				
10																				
12																				
14																				
16	Test pit terminated in fill at 4.5m, some caving of pit walls.																			
18																				
20																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 07/09/2017 Logged by: RP Checked by: RS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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TP18-01

Pg 1 of 1
Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level																
						10	20	30	40	50	60	70	80	90							
0 - 1	FILL - Grey SAND and GRAVEL, some silt, dry. Gravel is fine to coarse, subangular (roadbase)																				
1 - 2	FILL - Dark brown gravelly SAND, moist, organics. Gravel is fine to coarse, rounded to subrounded.																				
2 - 4	Firm to stiff dark brown sandy CLAY, friable, moist, trace organics																				
4 - 6	...no organics																				
6 - 8	Firm dark brown CLAY, some sand, friable, wet Some seepage PP = 3.5 / 3.5 / 2.75 kg/cm ²			G1																	
8 - 2.3	Test pit terminated 2.3m bgl in CLAY																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 28/09/2018 Logged by: SKD Checked by: RDS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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TP18-02

Pg 1 of 1
 Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level																
						10	20	30	40	50	60	70	80	90							
0 - 0.5	TOPSOIL																				
0.5 - 2.8	FILL - Dark grey SAND and GRAVEL, some silt, trace cobbles and boulders, organics, moist. Gravel is fine to coarse, subrounded to rounded																				
2.8 - 9.8	Stiff dark brown silty CLAY, some sand, moist ...becoming hard			G1																	
9.8 - 32	Test pit terminated 2.8m bgl due to reach of excavator																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 28/09/2018 Logged by: SKD Checked by: RDS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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TP18-03

Pg 1 of 1
Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0 - 2	TOPSOIL																			
2 - 4	FILL - Brown silty SAND, some gravel, trace cobbles and boulders, dry, organics, wood pieces, copper wire, plastic pipe, brick. Cobbles and boulders are subangular																			
4 - 6	FILL - Black sandy SILT, trace gravel, moist, organics, organic odour, wood pieces. Gravel is medium, rounded.																			
6 - 8	Some seepage (slow)																			
8 - 10	Firm to stiff blue CLAY, some sand, moist PP = 1.25 / 1.25 / 1.25 kg/cm ²			G1																
10 - 12	...becoming wet, firm			G2																
12 - 14	...becoming soft																			
14 - 16	Test pit terminated 3.4m bgl due to reach of excavator																			
16 - 18																				
18 - 20																				
20 - 22																				
22 - 24																				
24 - 26																				
26 - 28																				
28 - 30																				
30 - 32																				

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) ⊗ Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊗ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 28/09/2018 Logged by: SKD Checked by: RDS
	SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.		STANDARD PENETRATION TEST		
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 2401 Burnside Road West
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TP18-04

Pg 1 of 1
 Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level																
						10	20	30	40	50	60	70	80	90							
0	TOPSOIL																				
2	FILL - Brown sandy SILT, some gravel, trace cobbles, trace organics, moist. Gravel is fine to coarse, subrounded.																				
4	FILL - Becoming some cobbles, trace boulders																				
6	...boulder 0.8m x 0.6m																				
6	Firm to stiff black organic sandy SILT, moist, organic odour																				
8	Black/brown organic sandy SILT, moist, organic odour. Contains pieces of timber.																				
10	Firm to stiff blue sandy SILT, moist PP = 2.5 / 3 / 3 kg/cm ²																				
12	...becoming very sandy and friable.																				
12	Test pit terminated 3.5m bgl due to reach of excavator																				
14																					
16																					
18																					
20																					
22																					
24																					
26																					
28																					
30																					
32																					

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) Moisture Content (%) ▾ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Test Pit Date Drilled: 28/09/2018 Logged by: SKD Checked by: RDS
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BH18-01

Pg 1 of 1
Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0 - 0.5	TOPSOIL Light brown sandy SILT, trace gravel, dry (possible fill)																			
0.5 - 2.0	Brown sandy CLAY, damp PP=4.25kg/cm ² , appears hard (field description)			G1																
2.0 - 6.0	Brown CLAY, trace sand, appears stiff (field description), moist PP=3.0 / 3.75 / 4.25kg/cm ²		17	SPT																
6.0 - 10.0	Angular cobble 100mm diameter, trace gravel, gravel is rounded, coarse Blueish brown sandy CLAY, appears stiff (field description), moist		7	SPT																
10.0 - 14.0	Blue CLAY, appears firm, moist PP=1.0 / 1.0 / 1.0kg/cm ²																			
14.0 - 18.0	Blue CLAY, appears soft, moist to wet PP=0.22 / 0.16 kg/cm ²			G3																
18.0 - 20.0	Gravel obstruction Soft blue sandy gravelly CLAY, wet																			
20.0 - 32.0	Borehole terminated 6.1m bgl due to refusal (possible bedrock)																			

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
⊗ Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊗ Remolded strength in kPa
■ Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
Date Drilled: 01/10/2018
Logged by: SKD
Checked by: RDS

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Pg 1 of 2
Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	TOPSOIL																			
2	FILL - Light brown sandy gravelly SILT, moist. Gravel is subangular to subrounded.																			
4	FILL - Stiff dark brown sandy gravelly SILT, moist																			
6	FILL - Soft dark grey sandy gravelly organic CLAY, moist, organic odour, contains pieces of wood and roots			G																
8	FILL - Soft to firm black sandy organic CLAY, wet, organic fibres			G																
10	Stiff to hard blue/grey CLAY, trace sand, moist																			
12	Stiff blue/grey CLAY, some sand, moist																			
14	Firm to stiff blue/grey sandy CLAY, some gravel, moist			SPT																
16	Firm to stiff brown grey sandy CLAY, trace gravel, fine to coarse, subrounded, moist to wet, plastic PP= 2 / 2 / 2 kg/cm ²			SPT																
18				G																
20	Soft to firm grey/blue silty CLAY, trace sand, moist to wet, plastic PP=1.5 / 1 kg/cm ²																			
22	... at 6.8m, transition to soft CLAY PP=0.5 / 0.5 / 0.25 / 0.5 kg/cm ²																			
24																				
26																				
28				G																
30																				
32																				

Continued on Pg 2 of 2

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
⊗ Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊗ Remolded strength in kPa
■ Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
Date Drilled: 08/01/2019
Logged by: SKD / RJP
Checked by: RDS

SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.

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Pg 2 of 2
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level																									
						10	20	30	40	50	60	70	80	90																
34	Soft to firm grey/blue silty CLAY, trace sand, moist to wet, plastic (<i>continued</i>)			G																										
36																														
38																														
40																														
42																														
44																														
46						Firm to hard grey sandy SILT / silty SAND, some gravel, fine to coarse, subrounded, wet, some plastic zones																								
48																														
50											Borehole terminated at 15m in silty sand. Note 0-4.5 m drilled 2018-10-01, 4.5 - 15m drilled on 2019-01-08																			
52																														
54																														
56																														
58																														
60																														
62																														
64																														

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) ▼ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) X Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Solid Stem Auger Date Drilled: 08/01/2019 Logged by: SKD / RJP Checked by: RDS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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Pg 1 of 1
Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0 - 2	Brown silty ORGANICS, some sand, moist, some wood fibres																			
2 - 4	Firm grey silty SAND / sandy SILT, moist, low plasticity PP= 1.5kg/cm ²		8	SPT																
4 - 8	PP=2kg/cm ²			G																
8 - 10			8	SPT																
10 - 14	... at 4.2m, transition to silty CLAY / clayey SILT, some sand, moist PP=3kg/cm ²																			
14 - 18	Soft to firm grey/blue silty CLAY, moist to wet, plastic PP=0.5 / 0.5 / 1kg/cm ²			G																
18 - 24	Firm to stiff grey blue silty CLAY, some to trace sand, moist, low plasticity			G																
24 - 32	Borehole terminated 8.6m bgl due to refusal (possible bedrock)																			

C: Condition of Sample
Good
Disturbed
No Recovery

Type: Type of Sampler
SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows
WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)
Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer
(compressive strength in kPa)
⊗ Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊗ Remolded strength in kPa
■ Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
Date Drilled: 03/12/2018
Logged by: RJP
Checked by: RDS

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Pg 1 of 1
Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0 - 2	Brown silty ORGANICS, some sand, moist, some wood fibres																			
2 - 6	FILL - Light brown sandy gravelly SILT, moist. Gravel is subangular to subrounded.																			
6 - 10	FILL - Soft dark grey sandy gravelly organic CLAY, moist, organic odour, contains pieces of wood and roots																			
10 - 14	Firm to stiff grey blue silty CLAY, some to trace sand, moist, low plasticity ... at 3.1m, wet PP= 3.5 / 4kg/cm ²		4	SPT																
14 - 18	PP= 2kg/cm ² ... at 5.2m, transition to grey brown		6	SPT G																
18 - 22	PP= 2kg/cm ²																			
22 - 26	Soft to firm grey blue silty CLAY, some to trace sand, moist, plastic PP= 0.5kg/cm ²			G																
26 - 28	Firm to stiff grey blue silty CLAY, some to trace sand, moist, low plasticity																			
28 - 32	Borehole terminated 7.9m bgl due to refusal (possible bedrock)																			

C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) Moisture Content (%) ▾ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) ⊗ Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊗ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Solid Stem Auger Date Drilled: 03/12/2018 Logged by: RJP Checked by: RDS

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Pg 1 of 1
 Project No: 169-00385-30

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	TOPSOIL																			
2	FILL - Light brown sandy gravelly SILT, moist. Gravel is subangular to subrounded.																			
4	FILL - Stiff dark brown sandy gravelly SILT, moist																			
6	FILL - Soft dark grey sandy gravelly organic CLAY, moist, organic odour, contains pieces of wood and roots																			
8	Stiff to hard grey brown CLAY, trace sand, moist, low plasticity PP=3.0 / 2.5 / 2.5kg/cm ²																			
10	Stiff blue/grey CLAY, some sand, moist, low plasticity PP=1.0 / 1.0 / 1.0kg/cm ²																			
14	Firm becoming soft blue/grey CLAY, some sand, wet, plastic																			
16																				
18																				
20	PP=0.5 / 0.25 / 0.5kg/cm ²																			
22																				
24																				
26																				
28	Grey silty SAND, some gravel, coarse to fine, subrounded, wet																			
30	Borehole terminated 8.2m bgl due to refusal (possible bedrock)																			
32																				

C: Condition of Sample
 Good
 Disturbed
 No Recovery

Type: Type of Sampler
 SPT : 2 in. standard
 ST : Shelby
 G : Grab
 CORE

N: Number of Blows
 WH : Weight of Hammer
 WR : Weight of Rod
 Standard Penetration Test : ASTM D1586
 Hammer Type:

Plastic Limit (%) Liquid Limit (%)
 Moisture Content (%)
 ▾ Ground Water Level
 ⊗ Shear strength in kPa (Torvane)
 PP Pocket Penetrometer
 (compressive strength in kPa)
 ⊗ Shear strength in kPa (Unconfined)
 ⊗ Shear strength in kPa (Field vane)
 ⊠ Remolded strength in kPa
 ■ Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
 Date Drilled: 03/12/2018
 Logged by: RJP
 Checked by: RDS

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Pg 1 of 2
Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0	TOPSOIL																			
2	FILL - grey silty clay, reworked natural material, some organics																			
4																				
6																				
8	FILL - organic clay with zones of blue grey clay																			
10	Stiff to hard grey brown sandy CLAY, trace gravel, fine to coarse, subrounded, moist, plastic ... at 3.2m, wet																			
12	PP= 3 / 4 / 3.5 kg/cm ²																			
14																				
16	Firm to stiff grey/blue silty CLAY, trace sand, moist to wet, plastic																			
18	PP= 2 / 1.5 / 2 / 2 kg/cm ²																			
20																				
22	Soft to firm grey/blue silty CLAY, trace sand, moist to wet, plastic																			
24																				
26	PP= 0.5 / 0.25 / 0.5 kg/cm ²																			
28																				
30																				
32																				

Continued on Pg 2 of 2

C: Condition of Sample

Good
Disturbed
No Recovery

Type: Type of Sampler

SPT : 2 in. standard
ST : Shelby
G : Grab
CORE

N: Number of Blows

WH : Weight of Hammer
WR : Weight of Rod
Standard Penetration Test : ASTM D1586
Hammer Type:

Plastic Limit (%) Liquid Limit (%)

Moisture Content (%)
▼ Ground Water Level
⊗ Shear strength in kPa (Torvane)
PP Pocket Penetrometer (compressive strength in kPa)
⊗ Shear strength in kPa (Unconfined)
⊗ Shear strength in kPa (Field vane)
⊠ Remolded strength in kPa
■ Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
Date Drilled: 08/01/2019
Logged by: RJP
Checked by: RDS

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Pg 2 of 2
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90				
34	Soft to firm grey/blue silty CLAY, trace sand, moist to wet, plastic (<i>continued</i>)			G														
36																		
38																		
40																		
42	Firm to hard grey sandy SILT / silty SAND, some gravel, fine to coarse, subrounded, wet, some plastic zones			G														
44																		
46																		
48																		
50	Borehole terminated at 15m in silty sand.																	
52																		
54																		
56																		
58																		
60																		
62																		
64																		

1 LOG PER PAGE 25/1/19	C: Condition of Sample Good Disturbed No Recovery	Type: Type of Sampler SPT : 2 in. standard ST : Shelby G : Grab CORE	N: Number of Blows WH : Weight of Hammer WR : Weight of Rod Standard Penetration Test : ASTM D1586 Hammer Type:	Plastic Limit (%) Liquid Limit (%) Moisture Content (%) ▽ Ground Water Level ⊗ Shear strength in kPa (Torvane) PP Pocket Penetrometer (compressive strength in kPa) ⊗ Shear strength in kPa (Unconfined) ⊗ Shear strength in kPa (Field vane) ⊠ Remolded strength in kPa ■ Percent Passing # 200 sieve	Drill Method: Solid Stem Auger Date Drilled: 08/01/2019 Logged by: RJP Checked by: RDS
	<small>SOIL CLASSIFICATION IN ACCORDANCE WITH THE CANADIAN FOUNDATION ENGINEERING MANUAL 4TH EDITION 2006.</small>		STANDARD PENETRATION TEST		
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BH18-07

Pg 1 of 2
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level															
						10	20	30	40	50	60	70	80	90						
0 - 0.3	TOPSOIL																			
0.3 - 2.0	FILL - blue grey clay, reworked natural soil, hog fuel, construction waste																			
2.0 - 14.0	... at 4.0m, wet																			
14.0 - 25.5	Dark brown organic SILT																			
25.5 - 30.0	Firm to stiff grey/blue mottled silty CLAY, trace sand, moist to wet, plastic PP= 2.5 / 3 / 2 kg/cm ²																			
30.0 - 32.0	PP= 1.5 / 2 / 2 kg/cm ²																			

Continued on Pg 2 of 2

C: Condition of Sample

Good
 Disturbed
 No Recovery

Type: Type of Sampler

SPT : 2 in. standard
 ST : Shelby
 G : Grab
 CORE

N: Number of Blows

WH : Weight of Hammer
 WR : Weight of Rod
 Standard Penetration Test : ASTM D1586
 Hammer Type:

Plastic Limit (%) Liquid Limit (%)



- Ground Water Level
- Shear strength in kPa (Torvane)
- PP** Pocket Penetrometer (compressive strength in kPa)
- Shear strength in kPa (Unconfined)
- Shear strength in kPa (Field vane)
- Remolded strength in kPa
- Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
 Date Drilled: 08/01/2019
 Logged by: RJP
 Checked by: RDS

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Pg 2 of 2
 Project No: 181-12239-00

Depth (m) (ft)	Description	C	N	Type/ Sample #	Water Level	10	20	30	40	50	60	70	80	90
34	Firm to stiff grey/blue mottled silty CLAY, trace sand, moist to wet, plastic (<i>continued</i>) PP= 2 / 1.5 kg/cm ²			G				●						
36														
38	Soft to firm grey/blue silty CLAY, trace sand, moist to wet, plastic PP= 1 / 0.5 kg/cm ²													
40														
42														
44														
46														
48														
50														
52														
54														
56	Borehole terminated at 16.5m in silty sand.													
58														
60														
62														
64														

C: Condition of Sample

Good 
 Disturbed 
 No Recovery 

Type: Type of Sampler

SPT : 2 in. standard
 ST : Shelby
 G : Grab
 CORE

N: Number of Blows

WH : Weight of Hammer
 WR : Weight of Rod
 Standard Penetration Test : ASTM D1586
 Hammer Type:

Plastic Limit (%) Liquid Limit (%)

- Moisture Content (%)
- ▼ Ground Water Level
 - ⊗ Shear strength in kPa (Torvane)
 - PP Pocket Penetrometer (compressive strength in kPa)
 - ⊗ Shear strength in kPa (Unconfined)
 - ⊗ Shear strength in kPa (Field vane)
 - ⊗ Remolded strength in kPa
 - Percent Passing # 200 sieve

Drill Method: Solid Stem Auger
 Date Drilled: 08/01/2019
 Logged by: RJP
 Checked by: RDS

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APPENDIX

F

PHOTO TABLE



PHOTO TABLE

Photo	Description
	<p>Photo 1:</p> <p>Taken 27 Sept 2018</p> <p>Overview of site entrance looking south east from Burnside Rd West</p>
	<p>Photo 2:</p> <p>Taken 27 Sept 2018</p> <p>Overview of Victoria Bowmen parking lot</p>



Photo 3:
Taken 27 Sept
2018
Overview of
the archery
field in the
Eastern
portion of the
site



Photo 4:
Taken 3 Dec
2018
Overview of
watercourse
on the
western edge
of the archery
field



Photo 5:
Taken 28 Sept
2018
Test Pit TP18-
01, advanced
in the parking
lot



Photo 6:
Taken 28 Sept
2018
Test Pit TP18-
02 being
advanced



Photo 7:
Taken 28 Sept
2018

Location of
test Pit TP18-
04 after
backfilling was
completed



Photo 8:
Taken 01 Oct
2018

Auger flight at
BH18-01



Photo 9:
Taken 01 Oct
2018
Overview of
drilling at
BH18-02



Photo 10:
Taken 01 Oct
2018
Overview of
completed
backfill at
BH18-02



Photo 11:
Taken 03 Dec
2018
Overview of
drilling at
BH18-03



Photo 12:
Taken 03 Dec
2018
Auger flight at
BH18-04



Photo 13:
Taken 08 Jan
2018
Drill rig set up
at BH18-06



Photo 14:
Taken 08 Jan
2018
Drill rig set up
at BH18-07

APPENDIX

G

TERMS OF
REFERENCE
FOR
GEOTECHNICAL
REPORTS



TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC.

1. STANDARD OF CARE

WSP Canada Inc. ("WSP") prepared and issued this geotechnical report (the "Report") for its client (the "Client") in accordance with generally-accepted engineering consulting practices for the geotechnical discipline. No other warranty, expressed or implied, is made. Unless specifically stated in the Report, the Report does not address environmental issues.

The terms of reference for geotechnical reports issued by WSP (the "Terms of Reference") contained in the present document provide additional information and caution related to standard of care and the use of the Report. The Client should read and familiarize itself with these Terms of Reference.

2. COMPLETENESS OF THE REPORT

All documents, records, drawings, correspondence, data, files and deliverables, whether hard copy, electronic or otherwise, generated as part of the services for the Client are inherent components of the Report and, collectively, form the instruments of professional services (the "Instruments of Professional Services"). The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to WSP by the Client, the communications between WSP and the Client, and to any other reports, writings, proposals or documents prepared by WSP for the Client relative to the specific site described in the Report, all of which constitute the Report.

TO PROPERLY UNDERSTAND THE INFORMATION, OBSERVATIONS, FINDINGS, SUGGESTIONS, RECOMMENDATIONS AND OPINIONS CONTAINED IN THE REPORT, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WSP CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT AND ITS VARIOUS COMPONENTS.

3. BASIS OF THE REPORT

WSP prepared the Report for the Client for the specific site, development, building, design or building assessment objectives and purpose that the Client described to WSP. The applicability and reliability of any of the information, observations, findings, suggestions, recommendations and opinions contained in the Report are only valid to the extent that there was no material alteration to or variation from any of the said descriptions provided by the Client to WSP unless the Client specifically requested WSP to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information, observations, findings, suggestions, recommendations and opinions contained in the Report, or any component forming the Report, are for the sole use and benefit of the Client and the team of consultants selected by the Client for the specific project that the Report was provided. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION OR COMPONENT WITHOUT THE WRITTEN CONSENT OF WSP. WSP will consent to any reasonable request by the Client to approve the use of this Report by other parties designated by the Client as the "Approved Users". As a condition for the consent of WSP to approve the use of the Report by an Approved User, the Client must provide a copy of these Terms of Reference to that Approved User and the Client must obtain written confirmation from that Approved User that the Approved User will comply with these Terms of Reference, such written confirmation to be provided separately by each Approved User prior to beginning use of the Report. The Client will provide WSP with a copy of the written confirmation from an Approved User when it becomes available to the Client, and in any case, within two weeks of the Client receiving such written confirmation.

The Report and all its components remain the copyright property of WSP and WSP authorises only the Client and the Approved Users to make copies of the Report, but only in such quantities as are reasonably necessary for the use of the Report by the Client and the Approved Users. The Client and the Approved Users may not give, lend, sell or otherwise disseminate or make the Report, or any portion thereof, available to any party without the written permission of WSP. Any use which a third party makes of the Report, or any portion of the Report, is the sole responsibility of such third parties. WSP accepts no responsibility for damages suffered by any third party resulting from the use of the Report. The Client and the Approved Users acknowledge and agree to indemnify and hold harmless WSP, its officers, directors, employees, agents, representatives or sub-consultants, or any or all of them, against any claim of any nature whatsoever brought against WSP by any third parties, whether in contract or in tort, arising or related to the use of contents of the Report.



TERMS OF REFERENCE FOR GEOTECHNICAL REPORTS ISSUED BY WSP CANADA INC. (continued)

5. INTERPRETATION OF THE REPORT

- a. **Nature and Exactness of Descriptions:** The classification and identification of soils, rocks and geological units, as well as engineering assessments and estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1 above. The classification and identification of these items are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations or assessments utilizing the standards of Paragraph 1 involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to changes over time and the parties making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or when the Client has special considerations or requirements, the Client must disclose them to WSP so that additional or special investigations may be undertaken, which would not otherwise be within the scope of investigations made by WSP or the purposes of the Report.
- b. **Reliance on information:** The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site investigation and field review and on the basis of information provided to WSP. WSP has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, WSP cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. **Additional Involvement by WSP:** To avoid misunderstandings, WSP should be retained to assist other professionals to explain relevant engineering findings and to review the geotechnical aspects of the plans, drawings and specifications of other professionals relative to the engineering issues pertaining to the geotechnical consulting services provided by WSP. To ensure compliance and consistency with the applicable building codes, legislation, regulations, guidelines and generally-accepted practices, WSP should also be retained to provide field review services during the performance of any related work. Where applicable, it is understood that such field review services must meet or exceed the minimum necessary requirements to ascertain that the work being carried out is in general conformity with the recommendations made by WSP. Any reduction from the level of services recommended by WSP will result in WSP providing qualified opinions regarding adequacy of the work.

6. ALTERNATE REPORT FORMAT

When WSP submits both electronic and hard copy versions of the Instruments of Professional Services, the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding upon WSP. The hard copy versions submitted by WSP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions; furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed and sealed versions of the Instruments of Professional Services maintained or retained, or both, by WSP shall be deemed to be the overall originals for the Project.

The Client agrees that the electronic file and hard copy versions of Instruments of Professional Services shall not, under any circumstances, no matter who owns or uses them, be altered by any party except WSP. The Client warrants that the Instruments of Professional Services will be used only and exactly as submitted by WSP.

The Client recognizes and agrees that WSP prepared and submitted electronic files using specific software or hardware systems, or both. WSP makes no representation about the compatibility of these files with the current or future software and hardware systems of the Client, the Approved Users or any other party. The Client further agrees that WSP is under no obligation, unless otherwise expressly specified, to provide the Client, the Approved Users and any other party, or any or all of them, with specific software and hardware systems that are compatible with any electronic submitted by WSP. The Client further agrees that should the Client, an Approved User or a third party require WSP to provide specific software or hardware systems, or both, compatible with the electronic files prepared and submitted by WSP, for any reason whatsoever included but not restricted to an order from a court, then the Client will pay WSP for all reasonable costs related to the provision of the specific software or hardware systems, or both. The Client further agrees to indemnify and hold harmless WSP, its officers, directors, employees, agents, representative or sub-consultant, or any or all of them, against any claim or any nature whatsoever brought against WSP, whether in contract or in tort, arising or related to the provision or use of any specific software or hardware provided by WSP.