APPENDIX

GEMTEC

Geotechnical Investigation Report
Wolfe Lake Rest Area

Fundy National Park, Alma, New Brunswick
March 31, 2016

Prepared for Public Works & Government Services Canada
Project No. 10456.06

GEMTEC
Consulting Engineers and Scientists

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31 March 2016

File: 10456.06 – R01

Public Works & Government Services Canada
189 Prince William Street
Saint John, NB
E2L 2B9

Attention: Nathalie Sears, P.Eng.

Re: Geotechnical Investigation Report
Wolfe Lake Rest Area, Fundy National Park, Alma, NB

Please find enclosed our report for the geotechnical investigation at the Wolfe Lake Rest Area in Fundy National Park in Alma, New Brunswick.

Topsoil, fill soils, and peat were encountered in the boreholes. These soils are not suitable bearing materials and they shall be excavated in the area of the proposed development.

This report was prepared by Ashlee Allison and reviewed by Corey Keats.

Sincerely,

Ashlee Allison, PhD, EIT

Corey Keats, M.Sc.E., P.Eng.

AA

Enclosures

2016aa0331R01(Geotechnical Investigation – Wolfe Lake Rest Area).docx

Geotechnical Investigation Report
Wolfe Lake Rest Area
Fundy National Park, Alma, NB

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1.0 Introduction

Public Works & Government Services Canada (PWGSC) retained GEMTEC Limited to conduct a geotechnical investigation for the proposed building to be constructed at the Wolfe Lake Rest Area in Fundy National Park. The geotechnical investigation was conducted in accordance with the requirements of the Standing Offer Contract (EC373-152028/A) between PWGSC and GEMTEC Limited.

The purpose of this geotechnical investigation was to characterize the soil and bedrock conditions in the area of the proposed building and provide recommendations for the design and construction of the foundation. Four boreholes were advanced in the area of the proposed building. Due to the presence of underground utilities at the site, several of the planned borehole locations had to be moved. See Appendix A for borehole location plan; see Appendix B for descriptive terms and borehole logs.

On March 17, 2016 the boreholes were advanced at the site using a track-mounted geotechnical drill rig. Borehole advancement was supervised by GEMTEC geotechnical personnel.

During borehole advancement, SPT N[1]-values and RQD[2] values were recorded throughout soil and bedrock sampling. Soil and bedrock samples were collected for laboratory testing. Moisture content measurements, soil sieve analyses of particle size distributions, and total organic material content tests were carried out on the subgrade soils; see Appendices C, D, and E. Due to the highly fractured nature of the bedrock, compressive strength testing was not possible.

One borehole was terminated within the bedrock at a depth of 10.7 m; the other boreholes were terminated within the overburden soils at depths of 6.1 – 8.8 m. The subgrade soils at the site generally consist of a layer of topsoil underlain by silty sand and gravel, followed by glacial till. In BH1 bedrock was encountered at depth. A layer of peat was encountered in BH1 and BH3.

[1] The number of blows of a 475-Joule free-fall hammer required to advance a 50 mm ø split spoon sampler a distance of 300 mm

[2] Percent of core consisting of hard, sound pieces in excess of 100 mm long (excluding machine breaks)

2.0 Site Description

The site is located at the Wolfe Lake rest area in Fundy National Park in Alma, New Brunswick. The rest area is located along the southern side of Route 114, near the north-western border of Fundy National Park. Wolfe Lake is immediately adjacent to the rest area, less than 100 metres away.

The location of the proposed building is on the western side of the rest area entrance road, beyond the existing washroom facilities. The proposed building location is less than 100 metres from the intersection Route 114 and the rest area entrance road; see Appendix A for site location and borehole layout on site.

Presently, the proposed building location is grassed land. The site is bordered to the north by a thin line of trees, followed by Route 114; it is bordered to the east by the rest area; and it is bordered to the south and west by treed land and Wolfe Lake. It is our understanding that another building was previously located at the site. The former building has been demolished; however, the underground utilities remain.

3.0 Subsurface Soil Description

The subsurface soil conditions at the site generally consist of a thin layer of topsoil underlain by sand and gravel fill soil with glacial till and bedrock at depth. Some peat and organic matter was encountered within the fill soils, indicating that fill soil was placed directly over the in-situ soils without fully grubbing the site.

Surficial geology mapping of the area (Rampton, 1984) indicates that the surficial soils in this area originated during Wisconsinan and/or Pre-Wisconsinan time and they are composed of:

> *MORAINAL AND COLLUVIAL SEDIMENTS: loamy till and colluvium, regolith and weathered bedrock, and isolated boulder fields, undifferentiated; mixture of deposits formed directly from ice of unknown age and materials produced by weathering processes; generally greater than 1 m thick. Mainly stony deposits (more than 35% of clasts pebble-sized and larger).*
>
> A *Kame or isolated glaciofluvial deposit* is located very near the site.

This soil description is consistent with the soil underlying the fill materials in the boreholes. See Table 1 for a summary of subsurface soil conditions encountered in the boreholes.

3.1 Topsoil

At the surfaces of each of the boreholes, approximately 300 – 500 mm of topsoil was encountered. This soil is not a suitable bearing subgrade; it shall be removed from the area of the proposed development prior to construction.

3.2 Silty Sand and Gravel (Fill)

Underlying the topsoil, sand and gravel with varying amounts of silt was encountered in each of the boreholes. Underlying this layer, peat was encountered in BH1 and BH3 which indicates that the sand and gravel soil is not native to this location; it is a fill material placed over the peat. The peat layer was not encountered in BH2.

The sand and gravel fill was encountered at a depth of approximately 300 - 500 mm below the ground's surface (elevation +302 m). The thickness of the fill ranges from approximately 3.1 – 4.3 m before transitioning to native glacial till soils.

The SPT N-values encountered in the silty sand and gravel soil range from 4 – 44, averaging 18 which indicates that this is a medium-compactness soil.

The soil sieve analyses (see Appendix C) indicate that this soil is composed of approximately 35 – 55% gravel and cobbles, 30 – 55% sand, and 9 – 12% silt- and clay-sized particles. The

moisture content in this soil layer is approximately 5 - 10% with some higher values near the surface; see Appendix D.

3.3 Peat

At the locations of BH1 and BH3 a layer of loose to very loose-compactness (SPT N-values of 2 – 6) peat was encountered beneath the fill soils, indicating that fill soil was placed directly over the peat. The peat was encountered at depths of 3.8 – 4.6 m (elevation +298 to +299 m). The thickness of the peat encountered in BH1 is 0.2 m; the thickness of the peat in BH3 is 1.5 m. In BH3, the organic material content measured in the peat layer is 19% and the moisture content is 100%.

This material is not a suitable bearing soil, it shall be excavated in the area of the proposed building prior to construction.

3.4 Glacial Till

Underlying the peat in BH1 and BH3 and underlying the fill soils in BH2, sand and gravel with trace to some silt (glacial till) was encountered. The top 0.5 – 1.2 m of glacial till encountered in BH1 and BH2 was loose to very loose-compactness (SPT N-values 2 – 9) soil. This is likely native soil that was disturbed prior to or during the placement of the fill soils at the site.

3.5 Bedrock

Bedrock was encountered beneath the glacial till in borehole 1. The bedrock was encountered at a depth of 5.8 m (elevation +297 m). The upper 3.4 m of the bedrock core extracted from BH1 consists of cobbles and boulders with RQD 0 – 16 (average 7). The bedrock transitions to grey slatey boulders intermixed with granite at depth.

Overall, the bedrock quality is very poor. None of the extracted bedrock pieces are large enough for compressive strength testing.

Geological mapping of the area around the site (New Brunswick Department of Natural Resources and Energy, 2000) indicates that the bedrock in this region is composed of mafic and felsic volcanic rock from the Coldbrook Group, Late Neoproterozoic formation.

3.6 Groundwater

Groundwater seepage was encountered at depths of 2.6 – 2.7 m (elevation +300 m) within the fill soils in BH1, BH2, and BH3. Groundwater seepage was not identified in BH4. The elevation of the groundwater table should be expected to fluctuate seasonally and in response to precipitation events and nearby construction activity.

Table 1 Summary of Subsurface Soil Conditions

Borehole	Surface Elevation (m)	Topsoil Thickness (m)	Fill Soil Thickness (m)	Peat Thickness (m)	Glacial Till Thickness (m)	Bedrock Elevation (m)	Groundwater Table Elevation (m)
BH1	302.8	0.5	3.2	0.2	1.8	297.0	300.2
BH2	302.8	0.3	2.7	N.E.	5.8[2]	N.E.	300.1
BH3	302.6	0.5	4.1	1.5	0.6[2]	N.E.	299.9
BH4[1]	302.8	N.I.	4.6	N.I.	1.5[2]	N.E.	N.I.

[1] BH4 was augered, not split spoon sampled. Layer thicknesses are assumed from resistance to augering

[2] BH2, BH3, and BH4 were terminated within the glacial till layer; therefore, the total thickness of the glacial till layer could not be identified

N.I. Could not be identified in borehole

N.E. Not Encountered

4.0 Discussion and Recommendations

4.1 General

This section of the report provides engineering guidelines on the geotechnical design and construction aspects of the project based on our interpretation of the borehole information and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

4.2 Overview

It is our understanding that another building was previously located at this site. We understand that the former building location was very near the location of the new, proposed building. Remnants of the former building may be encountered during excavations and site preparation activities; these items/ materials will need to be removed prior to constructing the foundation of the new building.

We understand that the proposed building will be a single-storey structure with a full basement. Furthermore, it is our understanding that the building will be heated throughout the year.

Based on the soil conditions encountered at the site, we are of the opinion that the site is suitable for the proposed structure, provided that our recommendations are followed.

4.3 Foundation

- If the foundation is designed and constructed as per our recommendations it can be founded upon the undisturbed glacial till, or the bedrock, or engineered fill built up from the glacial till or bedrock, at an allowable bearing pressure of 200 kPa for total and differential settlements not exceeding 25 and 20 mm, respectively.
- **The near-surface topsoil, fill soils, and peat are not suitable bearing materials, they shall be excavated in the area of the proposed development.**
- The disturbed glacial till shall be excavated in the area of the proposed development. The excavation shall advance to undisturbed glacial till.
- Structural fill under footings or slabs-on-grade should be placed in lifts not exceeding 300 mm and compacted to at least 95% of the maximum dry density as determined by the latest version of the Standard Proctor test (ASTM D698).
- Minimum footing widths of 0.6 m and 1.0 m are recommended for strip and square footings, respectively.

- For protection against frost heaving, footings should be founded at least 1.5 and 1.8 metres below final grade for heated and unheated buildings, respectively.
- Exterior below-grade foundation walls should be damp-proofed or water-proofed and backfilled with a clean granular material having less than 15% fines (% passing the 0.080 mm sieve size) in order to prevent adfreezing.
- Properly installed footing drains should be incorporated into the foundation design. This will prevent water from building up within the perimeter drainage material. A build-up of water within the perimeter drainage material would provide a supply of water to the surrounding frost-susceptible glacial till.
- The finished surface adjacent to buildings should be sloped away from the buildings at a slope of no less than 2%.
- If some of the footings are to bear on glacial till and others on bedrock, it is our recommendation that all footings are constructed on at least 300 mm of engineered fill. This will reduce differential conditions caused by footings bearing on different materials. This will also aid with construction by providing some in-trench drainage below the footings and allowing in-trench construction to proceed without disturbing the glacial till. As noted above, the engineered fill shall be compacted to at least 95% of the maximum dry density as determined by the latest version of ASTM D698.
- The glacial till soils are susceptible to softening in the presence of construction activities and water. Proper surface drainage shall be provided in the excavations. If groundwater is encountered, ditching and pumping techniques may be required to keep excavations free of water. Based on the elevations of groundwater seepage encountered in the boreholes, it is likely that groundwater will be encountered during excavations.
- Equipment traffic at load-bearing elevation should be minimized to avoid disturbing the glacial till. Excessive proof-rolling of the glacial till soils is not recommended. The placement of a geotextile (NBDTI W2) between the glacial till and engineered fill may be necessary if construction takes place during a period of heavy rainfall. Some undercutting may be required in areas where glacial till soils have become softened by groundwater and/or construction activities.
- Trenches should be excavated in accordance with the requirements of the WorkSafeNB Occupational Health and Safety Act.
- The bedrock encountered in BH1 can generally be described as very poor quality. This bedrock could likely be excavated with a heavy excavator.
- A geotechnical engineer should inspect the bottom of foundation excavations prior to fill or footing placement to ensure that satisfactory undisturbed bearing soils are reached.
- Throughout construction a geotechnical engineer should assess the foundation conditions, engineered fill, and construction practices.

- If construction is to take place during cold weather, the subgrade shall be protected against freezing throughout construction and the engineered fill shall be placed and compacted in an unfrozen state.
- Seismic Site Class C can be used for design.

4.4 Slab-on-Grade

Typical interior concrete slabs are constructed as follows:

- Concrete slab
- Vapour barrier
- 150 mm thick layer of NBDTI 31.5 mm minus crushed rock
- Approved subgrade

5.0 Closure

The boreholes put down at this site are widely scattered and soil and bedrock conditions may vary from those determined at the borehole locations. Although representative samples were taken, GEMTEC Limited personnel should be contacted immediately if the soils encountered during excavations are different than those encountered in our geotechnical investigation.

The investigation outlined in this report is strictly geotechnical in nature and should not be viewed as an environmental assessment of this site.

6.0 References

New Brunswick Department of Natural Resources and Energy. (2000). *Bedrock Geology of New Brunswick, Minerals and Energy Division, Map NR-1. Scale 1:500 000.*

Rampton, V. (1984). *Surficial Geology, New Brunswick.* Geological Survey of Canada, Map 1594A, scale 1:500 000.

Appendix A

Borehole Layout on Site

Legend

- BOREHOLE LOCATION
- NAIL "ASPHALT"

Note

1. COORDINATE SYSTEM: NEW BRUNSWICK; STEREOGRAPHIC PROJECTION, NAD83 (CSRS) DATUM.
2. THIS SURVEY REFERENCED NAIL "ASPHALT" WITH AN ELEVATION OF 302.38m

Drawn By	Checked By
CHG	MB
Calculations By	**Checked By**
---	----

Date: MARCH 2016

Project: GEOTECHNICAL INVESTIGATION
WOLF LAKE REST AREA

Drawing: BOREHOLE LOCATION PLAN

Scale: 1:750

0 15 30 45m

File No.	Drawing	Revision No.
104560601	FIGURE 1	0

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N:\DRAWINGS\104001\104560601.DWG

Appendix B

Descriptive Terms and Borehole Logs

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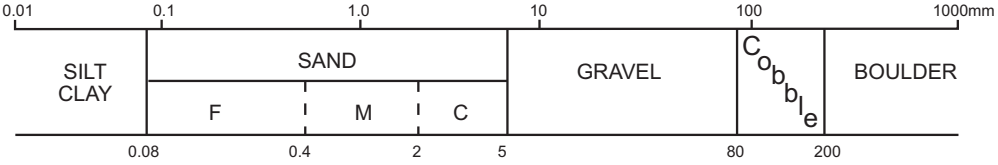
FREDERICTON, MONCTON, BATHURST, GRAND FALLS, SAINT JOHN, NB

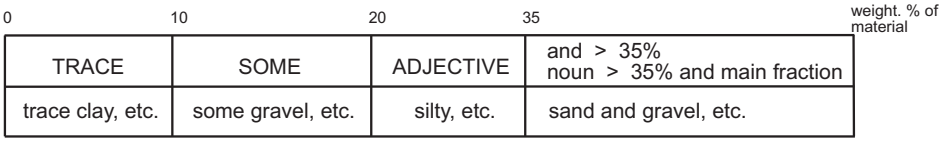
DESCRIPTIVE TERMS- BOREHOLE/TEST PIT LOG

SOILS

GRAIN SIZE



DESCRIPTIVE TERMINOLOGY



TRACE	SOME	ADJECTIVE	and > 35% noun > 35% and main fraction
trace clay, etc.	some gravel, etc.	silty, etc.	sand and gravel, etc.

COMPACTNESS gravels, sands, tills

N, RANGE	0 - 4	4 - 10	10 - 30	30 - 50	> 50
DENSITY	V. LOOSE	LOOSE	MEDIUM	DENSE	V. DENSE

CONSISTENCY silt, clay

S, KPa	< 12.5	12.5 - 25	25 - 50	50 - 100	100 - 200
CONSISTENCY	V. SOFT	SOFT	MEDIUM	STIFF	V. STIFF

ROCK

RQD	OVERALL QUALITY	FRACTURE SPACING
0 - 25	VERY POOR	VERY CLOSE 20 - 60 mm
25 - 50	POOR	CLOSE 60 - 200 mm
50 - 75	FAIR	MODERATE 200 - 600 mm
75 - 90	GOOD	WIDE 600 - 2000 mm
90 - 100	EXCELLENT	VERY WIDE 2 - 6 m

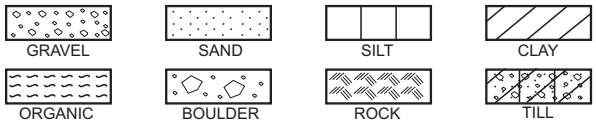
COMP. STR. MPa	1 - 5	5 - 25	25 - 50	50 - 100	100 - 250
DESCRIPTION	V. WEAK	WEAK	MODERATE	STRONG	V. STRONG

SAMPLE TYPES (location to scale on log)

S	SPLIT TUBE	G	SHOVEL
T	SHELBY TUBE	H	CARVED BLOCK
P	PISTON	K	SLOTTED
F	AUGER	V	IN SITU VANE
W	WASH	NR	NO RECOVERY

ROCK CORES A(30mm); B(41mm); N(54mm)

LOG SYMBOLS



WELL SYMBOLS

N - standard penetration test; blows by 475 J drop hammer to advance Std. 50mm O.D. split tube sampler 0.3m

RQD - percent of core consisting of hard, sound pieces in excess of 100mm long (excluding machine breaks)

RECOVERY - sample recovery expressed as percent or length

S - shear strength , kPa; vane ⊕ ; penetrometer ■; unconfined ○; Uc unconfined compressive strength

Sr - shear strength, remoulded; vane ⊗ ; penetrometer □

Dd - dry density; t/m^3

W - natural moisture content, percent ✳

PL - plastic limit, percent ⊢

LL - liquid limit, percent ⊣

ND - non detect, total petroleum hydrocarbons (TPH) not detected in soil

Groundwater Level ▼ ; Seepage ▽

Revised Oct, 2009

BHDESCRM-2009.CDR

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BOREHOLE LOGS

Client	Public Works & Government Services Canada	Proj No. 10456.06	BOREHOLE BH1
Project	Geotechnical Investigation, Wolfe Lake Rest Area	Date Drilled 17.March.2016	Page 1 of 1
Location	Fundy National Park, New Brunswick		
Ground Level, m 302.78	Datum: Geodetic	Logged By TPD	

Undrained Shear Strength - kPa (0, 25, 50, 75, 100)
Unconfined Compression; Pocket Penetrometer
Field Vane Test; Remoulded
Water Content & Atterburg Limits (W_P, W, W_L)
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
(0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100)

DEPTH m	No	TYPE	N (RQD)	REC (mm)	LOG	DESCRIPTION	
0	1	S	10	590		TOPSOIL	
						0.53	302.25
	2	S	40	430		0.61 Grey brown Sand and Gravel FILL	302.17
1						Grey to brown SAND and GRAVEL, trace silt and cobbles	
						- Sand and gravel, trace silt (AASHTO A-1-a)	
	3	S	15	50		- Cobble blocked tip	
2						2.13	300.65
	4	S	8	120		Brown Silty SAND and GRAVEL	
						▽	
3	5	S	11	120			
						3.66	299.12
	6	S	2	300		3.76 Brown Sandy SILT	299.02
4						3.96 Brown PEAT with grass	298.82
						Washed GRAVEL	
	7	S	5	100			
5						5.18	297.60
	8	S	9	100		Brown Gravelly silty sand, some cobbles (GLACIAL TILL)	
						5.79 - Auger refusal at 5.79 metres	296.99
6	9	NQ	0%	150		COBBLES and BOULDERS	
	10	NQ	16%	380			
7							
	11	NQ	0%	480			
8							
9						9.22	293.56
	12	NQ	0%	410		Grey Slatey BOULDERS intermixed with GRANITE	
10							
						10.74	292.04
						End of borehole at 10.74 metres below surface grade Groundwater seepage encountered at 2.60 metres below surface grade	

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BOREHOLE LOGS

Client	Public Works & Government Services Canada	Proj No.	10456.06
Project	Geotechnical Investigation, Wolfe Lake Rest Area	Date Drilled	17.March.2016
Location	Fundy National Park, New Brunswick		
Ground Level, m 302.81	Datum: Geodetic	Logged By	TPD

BOREHOLE BH2
Page 1 of 1

Undrained Shear Strength - kPa
0 25 50 75 100
○ Unconfined Compression ■ Pocket Penetrometer
⊕ Field Vane Test ⊗ Remoulded
Water Content & Atterburg Limits W_P W W_L
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

DEPTH m	SAMPLE No	TYPE	N (RQD)	REC (mm)	LOG	DESCRIPTION
0	1	S	47	510		TOPSOIL 0.30 302.51
						Brown-grey Silty SAND and GRAVEL
1	2	S	21	360		
	3	S	13	250		
2	4	S	25	300		- Some cobbles encountered between 2.13 and 2.74 metres - Gravel and sand, some silt (ASSHTO A-1-a)
						3.05 299.76
3	5	S	4	230		Brown SAND and GRAVEL - Sandy gravel, some silt (AASHTO A-1-a)
	6	S	21	180		- Harder augering at 3.66 metres - Some cobbles encountered between 3.66 and 4.27 metres
4						
	7	S	20	100		
5						
6						
7						
	8	S	21	100		
8	9	S	26	0		8.84 293.97
						End of borehole at 8.84 metres below surface grade Groundwater seepage encountered at 2.74 metres below surface grade

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BOREHOLE LOGS

Client	Public Works & Government Services Canada	Proj No. 10456.06	BOREHOLE BH3
Project	Geotechnical Investigation, Wolfe Lake Rest Area	Date Drilled 17.March.2016	Page 1 of 1
Location	Fundy National Park, New Brunswick		
Ground Level, m 302.59	Datum: Geodetic	Logged By TPD	

Undrained Shear Strength - kPa
0 25 50 75 100
Unconfined Compression
Field Vane Test
Pocket Penetrometer
Remoulded
Water Content & Atterburg Limits
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

DEPTH m	SAMPLE No	TYPE	N (RQD)	REC (mm)	LOG	DESCRIPTION	
0	1	S	9	460		0.30 TOPSOIL	302.29
						0.45 Brown SAND and GRAVEL with organics	302.14
1	2	S	44	430		Brown SAND and GRAVEL, some silt - Gravelly sand, some silt (AASHTO A-1-b)	
2	3	S	18	150		2.13	300.46
	4	S	22	330		COBBLES	
						2.74	299.85
3	5	S	10	200		Brown-grey SAND and GRAVEL	
						3.66	298.93
4	6	S	7	180		Brown Silty SAND and GRAVEL	
						4.57	298.02
5	7	S	6	120		PEAT	
	8	S	6	50			
6						6.10	296.49
	9	S	94	180		Brown SAND and GRAVEL, trace silt	
						6.70	295.89
						End of borehole at 6.70 metres below surface grade Groundwater seepage encountered at 2.74 metres below surface grade	

GEOTG 10456.06.GPJ GEMTEC 2004.GDT 16/03/30

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BOREHOLE LOGS

Client	Public Works & Government Services Canada	Proj No.	10456.06
Project	Geotechnical Investigation, Wolfe Lake Rest Area	Date Drilled	17.March.2016
Location	Fundy National Park, New Brunswick		
Ground Level, m 302.83	Datum: Geodetic	Logged By	TPD

BOREHOLE BH4
Page 1 of 1

Undrained Shear Strength - kPa
0 25 50 75 100
Unconfined Compression
Field Vane Test
Pocket Penetrometer
Remoulded
Water Content & Atterburg Limits
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m
0 10 20 30 40 50 60 70 80 90 100

DEPTH m	SAMPLE No	SAMPLE TYPE	SAMPLE N (RQD)	SAMPLE REC (mm)	LOG	DESCRIPTION
0		F				Auger Probe. Soft, easy augering from 0 to 2.1 metres
2.13						300.70
						Auger Probe. Moderate augering from 2.1 to 4.6 metres
4.57						298.26
						Auger Probe. Hard augering from 4.6 to 6.1 metres
6.10						296.73
						End of borehole at 6.10 metres below surface grade Groundwater seepage not identified

GEOTG 10456.06.GPJ GEMTEC 2004.GDT 16/03/30

Appendix C

Soil Sieve Analyses

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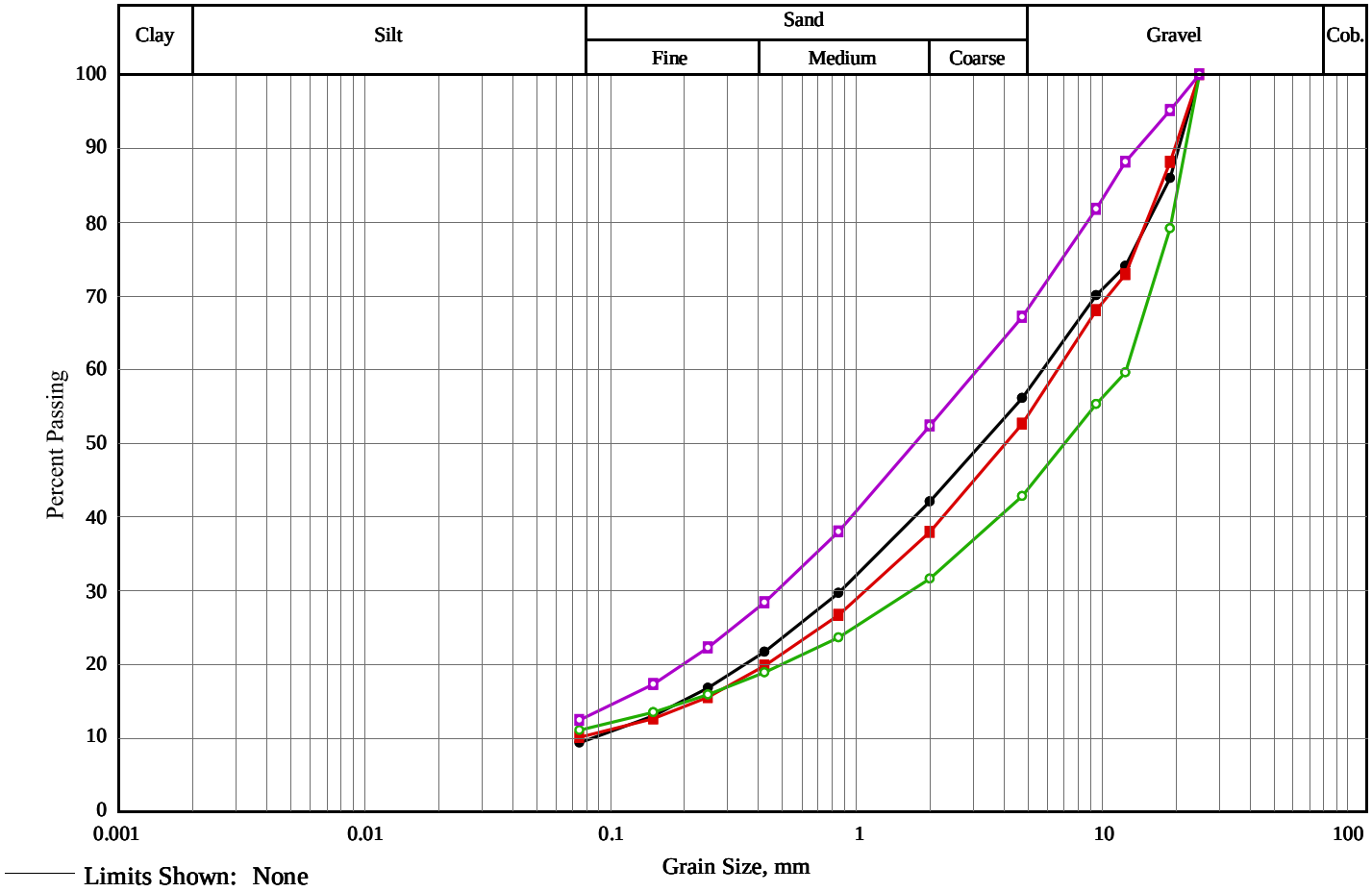
Client:	Public Works and Government Services Canada
Project:	Geotechnical Investigation, Wolf Lake Rest Area
Project #:	1045606

Soils Grading Chart



Line Symbol	Description	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay	Date Sampled
		1	2	0-61-1.22m	43.9	46.8	9.3		16/03/22
		2	4	2.13-2.74m	47.4	42.5	10.1		16/03/24
		2	5	3.05-3.66,	57.2	31.8	11.0		16/03/24
		3	2	0.61-1.22m	32.9	54.7	12.4		16/03/24

Line Symbol	Sample Description	AASHTO	D_{10}	D_{15}	D_{50}	D_{85}	% 5-75µm
	Sand and gravel , trace silt	A-1-a	0.09	0.20	3.26	18.38	---
	Gravel and sand , some silt	A-1-a	---	0.23	4.08	17.44	---
	Sandy gravel , some silt	A-1-a	---	0.21	7.09	20.53	---
	Gravelly sand , some silt	A-1-b	---	0.11	1.74	10.92	---

Appendix D

Soil Moisture Contents

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Client	Public Works and Government Services Canada
Project:	Geotechnical Investigation, Wolf Lake Rest Area
Project #:	1045606

Moisture Content and Density

Borehole:	1	Date/Time Sampled:	16/03/22 9:14:00 AM	Mass of Cont. + Wet Soil, g:	972.50
Depth:	0-61-1.22m	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	929.40
Sample:	2			Mass of Container, g:	170.72
Description:				Moisture Content, %:	5.68
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	
Borehole:	2	Date/Time Sampled:	16/03/24 9:22:31 AM	Mass of Cont. + Wet Soil, g:	734.00
Depth:	0.61-1.22m	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	649.00
Sample:	2			Mass of Container, g:	170.42
Description:				Moisture Content, %:	17.76
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	
Borehole:	2	Date/Time Sampled:	16/03/24 9:22:31 AM	Mass of Cont. + Wet Soil, g:	719.00
Depth:	2.13-2.74m	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	694.30
Sample:	4			Mass of Container, g:	165.06
Description:				Moisture Content, %:	4.67
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	

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Client	Public Works and Government Services Canada
Project:	Geotechnical Investigation, Wolf Lake Rest Area
Project #:	1045606

Moisture Content and Density

Borehole:	2	Date/Time Sampled:	16/03/24 9:22:31 AM	Mass of Cont. + Wet Soil, g:	813.50
Depth:	3.05-3.66,	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	754.70
Sample:	5			Mass of Container, g:	171.41
Description:				Moisture Content, %:	10.08
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	
Borehole:	2	Date/Time Sampled:	16/03/24 9:22:00 AM	Mass of Cont. + Wet Soil, g:	544.39
Depth:	3.66-4.27m	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	514.70
Sample:	6			Mass of Container, g:	165.82
Description:				Moisture Content, %:	8.51
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	
Borehole:	3	Date/Time Sampled:	16/03/24 9:22:31 AM	Mass of Cont. + Wet Soil, g:	972.30
Depth:	0.61-1.22m	Date/Time Tested:	16/03/24 9:22:31 AM	Mass of Cont. + Dry Soil, g:	928.60
Sample:	2			Mass of Container, g:	166.87
Description:				Moisture Content, %:	5.74
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	

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Project:	Geotechnical Investigation, Wolf Lake Rest Area
Project #:	1045606

Moisture Content and Density

Borehole:	3	Date/Time Sampled:	16/03/24 9:22:00 AM	Mass of Cont. + Wet Soil, g:	744.90
Depth:	3.05-3.66m	Date/Time Tested:	16/03/24 10:48:15 AM	Mass of Cont. + Dry Soil, g:	690.10
Sample:	5			Mass of Container, g:	165.79
Description:				Moisture Content, %:	10.45
				Sample Length, mm:	
				Sample Diameter, mm:	
				Sample Mass, g:	
				Sample Volume, mm^3	
				Wet Density, kg/m^3	
				Dry Density, kg/m^3	

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Consulting Engineers and Scientists

Client: Public Works and Government Services Canada

Project: Geotechnical Investigation, Wolf Lake Rest Area

Project #: 1045606

Moisture Content and Density

Borehole / Testpit	Depth	Sample	Description	Date/Time Sampled	Moisture Content, %	Sample Volume, mm^3	Wet Density, kg/m^3	Dry Density, kg/m^3
1	2.13-2.74m	4		16/03/24 7:39:00 AM	7.77			
3	4.56-5.17m	7		16/03/24 7:39:53 AM	100.49			

Appendix E

Organic Materials Content

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Client	Public Works and Government Services Canada
Project:	Geotechnical Investigation, Wolf Lake Rest Area
Project #:	1045606

Organic Content

Date/Time Sampled: 16/03/24 7:39:00 AM	Date/Time Tested: 16/03/24 7:41:43 AM

Sample Number	Description	Borehole	Depth	Mass of Cont. + Dry Soil, g	Mass of Cont. + Ashed Soil, g	Mass of Container, g	Organic Content, %
4		1	2.13-2.74m	119.40	118.10	32.80	1.50
7		3	4.56-5.17m	82.30	72.80	32.20	18.96