



re: Groundwater Monitoring Program
Proposed Industrial Addition
158 Cardevco Road – Ottawa

to: Pri-Tec Construction Ltd. – **Mike Watters** – Mike@pritec.ca

date: November 20, 2024

file: PH4559-MEMO.02

Further to your request and authorization, Paterson Group (Paterson) conducted a groundwater monitoring program in support of a Low Impact Development (LID) design for the proposed industrial addition at the aforementioned site. This report should be read in conjunction with Paterson Report PG6233-1 Revision 3 dated November 30, 2023.

1.0 Background Information

Geotechnical field investigations were carried out between May 20, 2022, and March 24, 2023. At that time, a total of six (6) boreholes and three (3) test pits were advanced to a maximum depth of 4.7 m and 3.1 m below existing grade (bgs), respectively. The test holes were distributed in a manner to provide general coverage of the study area, taking into consideration existing site features.

Field Survey

The borehole locations, and ground surface elevations at each borehole location, were surveyed by Paterson using a high precision, handheld GPS and referenced to a geodetic datum. The location and ground surface elevation at each borehole location is presented on Drawing PG6233-1 - Test Hole Location Plan attached to the current memorandum.

Subsurface Profile

The subsurface profile at the borehole locations generally consisted of fill material followed by a native silty sand deposit. The above noted fill layer typically consisted of dense to compact brown silty sand with varying amounts of gravel, crushed stone, and construction debris. The native silt sand with varying amounts of gravel and cobbles was encountered underlying the glacial till. Practical refusal to augering/excavation was encountered in select test holes between 2.1 to 4.3 m bgs.

Details of the subsurface profile can be found in the Soil Profile and Test Data Sheets attached to the current report.



Monitoring Well Installation

Typical monitoring well construction details are described below:

- ☐ 1.5 m of slotted 51 mm diameter PVC screen at the base of the aforementioned boreholes.
- ☐ 51 mm diameter PVC riser pipe from the top of the screen to ground surface.
- ☐ No.3 silica sand backfill within the annular space around the screen.
- ☐ Bentonite hole plug placed directly above PVC slotted screen extending to the existing ground surface.
- ☐ The 51 mm diameter PVC riser was covered with a protective steel flush mount well casing at ground surface.

Specific details of the installation of the monitoring well is further included in the Soil Profile and Test Data Sheet attached to the current report.

2.0 Groundwater Monitoring Program

The monitoring well installed at BH 2-23 was equipped with a Van Essen Instrument Mini-Diver Water Level Logger on November 16, 2023, to accurately monitor fluctuations in the groundwater levels. In addition, a Van Essen Instruments Baro-Diver was installed in BH 2-23 to monitor changes in atmospheric pressure. The Mini-Diver was programmed to continuously measure and record groundwater levels throughout the subject site at a rate of 1 reading every 24 hours for a period of approximately 7 months.

The results of the groundwater fluctuations and correlated precipitation events at the monitoring well location between November 2023 and June 2024, have been summarized in Figure 1 attached to the current report.

3.0 Groundwater Monitoring Results

The data presented in Figure 1 illustrates the collected groundwater elevations between November 2023 and June 2024. The groundwater readings measured within the monitoring well varied from an elevation of 114.88 m asl to a maximum elevation of 115.94 m asl. The low and high groundwater elevation are summarized in Table 1 below.



Based on our analysis of the data logger groundwater readings, seasonal groundwater fluctuations can be observed at the well location with a difference in elevation between low and high readings of 1.06 m.

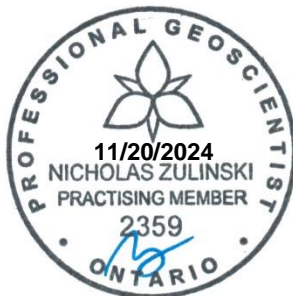
Table 1: Groundwater Monitoring Summary				
Monitoring Well ID	Ground Surface Elevation (m asl)	Low Groundwater Elevation (m asl)	High Groundwater Elevation (m asl)	Difference in Groundwater Elevation (m asl)
BH 2-23	117.47	114.88	115.94	1.06

We trust that this information satisfies your requirements.

Best Regards,

Paterson Group Inc.

Nicholas Zulinski, P.Ge., géo.



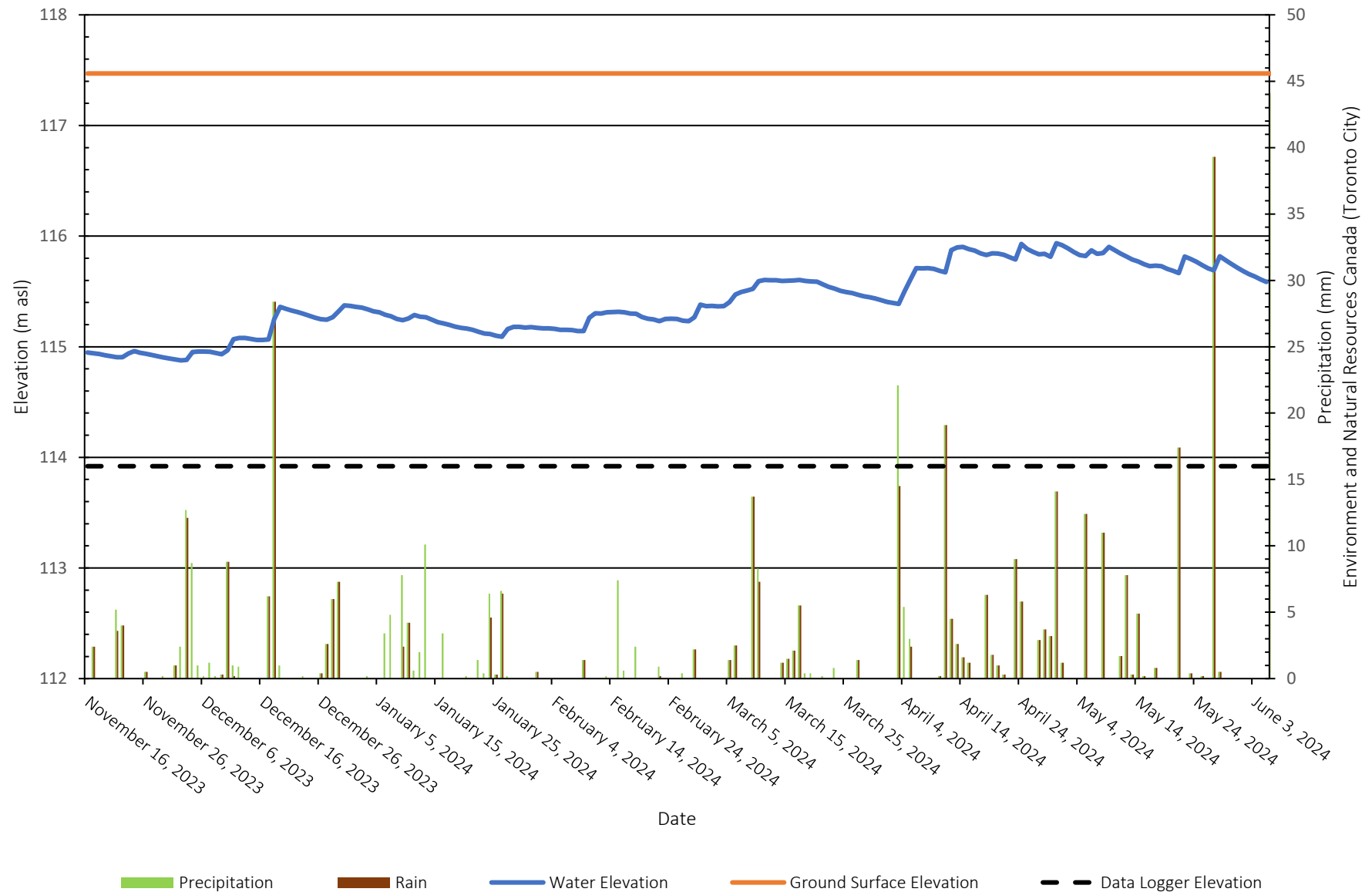
Erik Ardley, P.Ge.

Attachments

- ☐ Figure 1 – Groundwater Monitoring Levels
- ☐ Soil Profile and Test Data Sheets
- ☐ Drawing PG6233-1 – Test Hole Location Plan



BH2-23 - Monitoring Well Water Elevations



DATUM Elevations are referenced to a geodetic datum

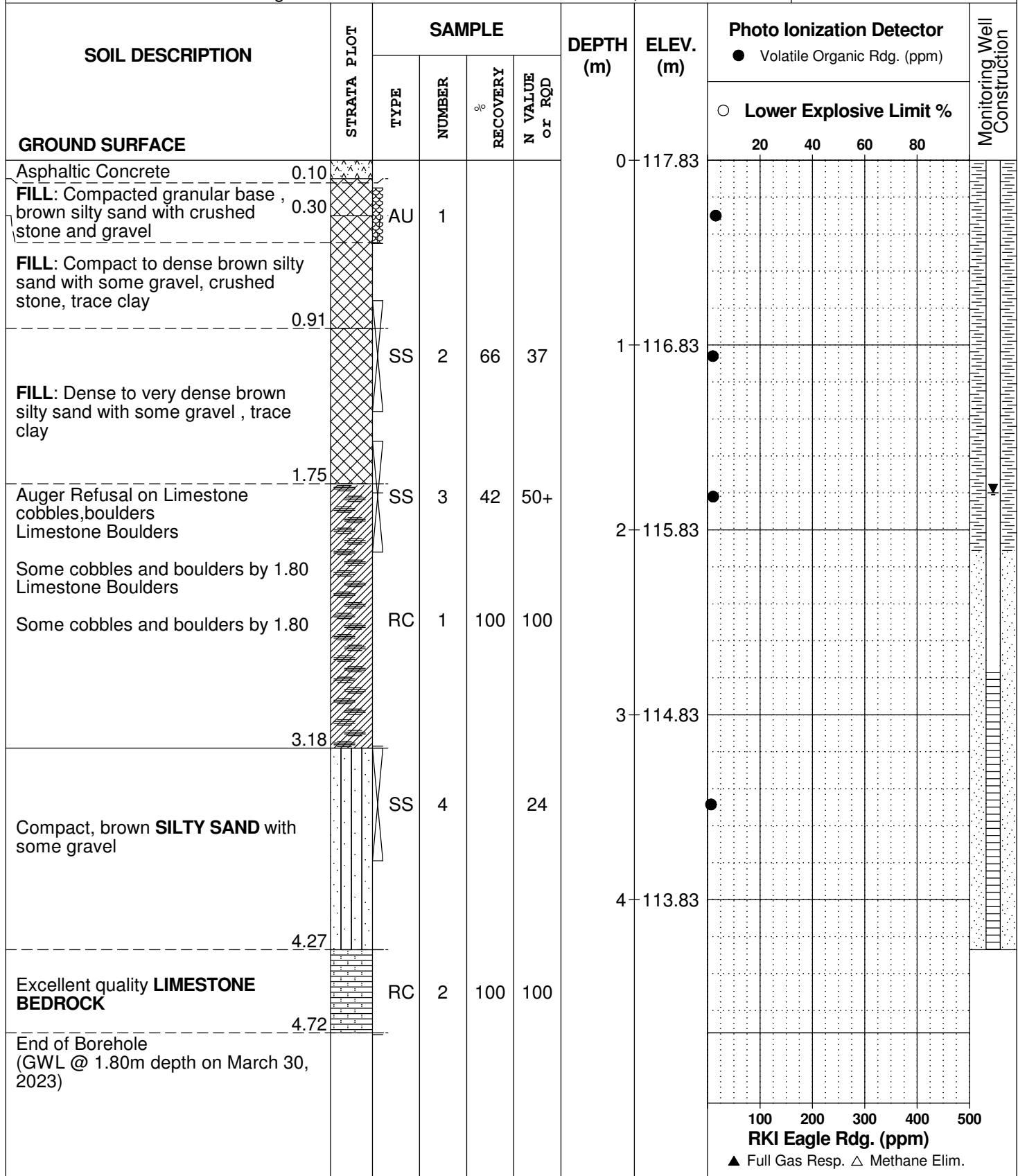
REMARKS

BORINGS BY CME 55 Power Auger

DATE March 24, 2023

FILE NO.
PG5996

HOLE NO.
BH 1-23



SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
158 Cardevco Road
Ottawa, Ontario

DATUM Elevations are referenced to a geodetic datum

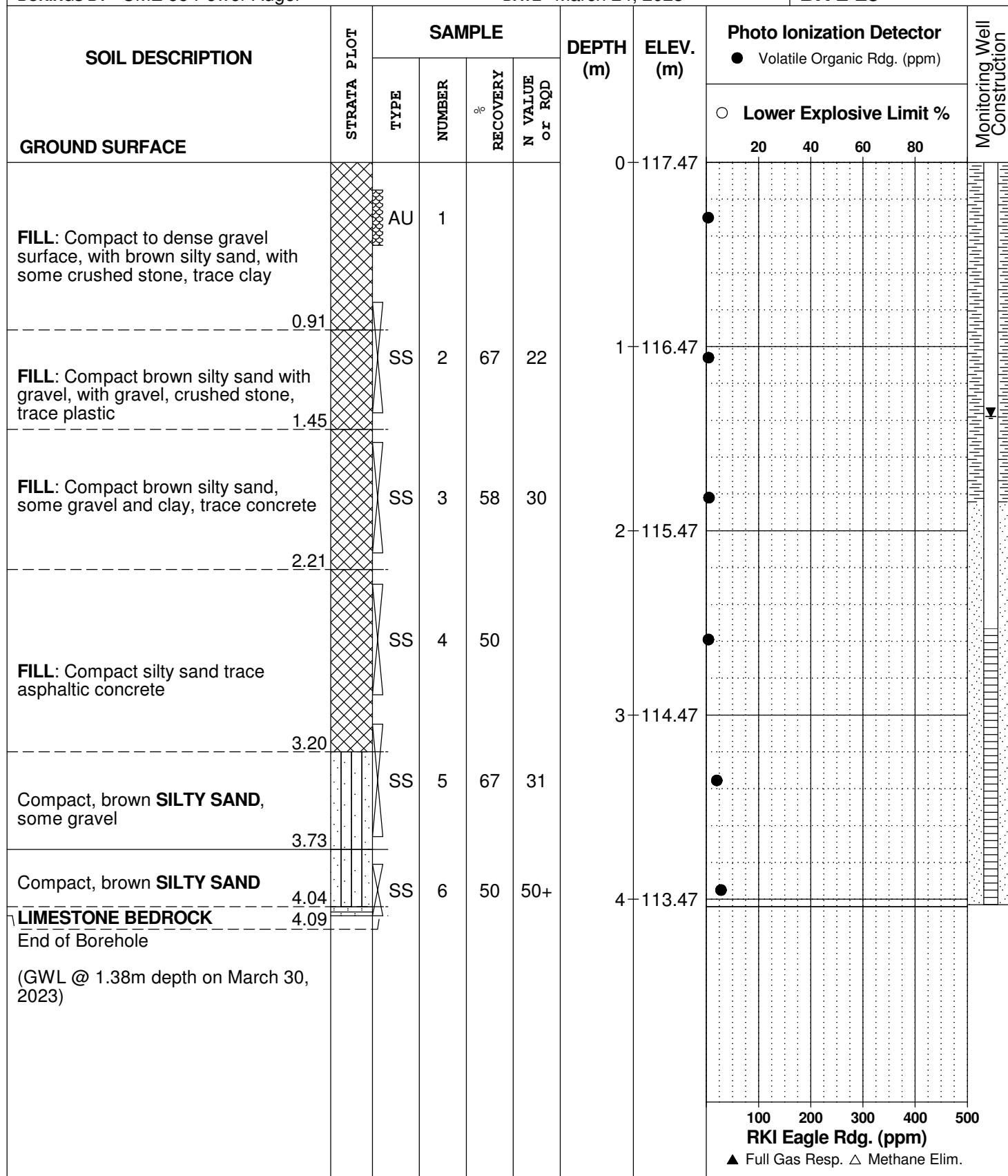
REMARKS

BORINGS BY CME 55 Power Auger

DATE March 24, 2023

FILE NO.
PG5996

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SOIL PROFILE AND TEST DATA

Phase II - Environmental Site Assessment
158 Cardevco Road
Ottawa, Ontario

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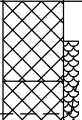


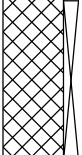


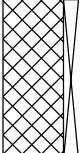


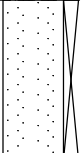

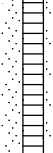
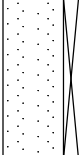

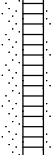









REMARKS

BORINGS BY CME 55 Power Auger

DATE March 24, 2023

FILE NO.
PG5996

HOLE NO.
BH 3-23

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Photo Ionization Detector				Monitoring Well Construction	
		TYPE	NUMBER	RECOVERY %	N VALUE or RQD			● Volatile Organic Rdg. (ppm)					
								○ Lower Explosive Limit %					
GROUND SURFACE								20	40	60	80		
FILL: Compact to dense brown silty sand with gravel, crushed stone, sand and clay		AU	1			0	117.30						
FILL: Compact, redish brown silty sand, some gravel, occasional cobbles and boulders,		SS	2	75	21	1	116.30						
Some concrete fragments by 1.52m depth		SS	3	42	29	2	115.30						
		SS	4										
Dense, brown SAND with gravel		SS	5	38		3	114.30						
													
Compact, brown SILTY SAND													
End of Borehole													
(GWL @ 1.09m depth on March 30, 2023)		SS	6	50									
			</										

[illegible]

[illegible]

SOIL PROFILE AND TEST DATA

FILE NO.
PG6233

HOLE NO.
TP 1-22

REMARKS

DATE May 20, 2022

[illegible]

SOIL PROFILE AND TEST DATA

FILE NO.
PG6233

HOLE NO.
TP 1A-22

REMARKS

BORINGS BY Excavator

DATE 2022 May 20

[illegible]

SOIL PROFILE AND TEST DATA

FILE NO.
PG6233

HOLE NO.
TP 2-22

REMARKS

BORINGS BY Excavator

DATE 2022 May 20

[illegible]

DATUM	Geodetic
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REMARKS

BORINGS BY Excavator

DATE 2022 May 20

FILE NO.
PG6233

HOLE NO.
TP 3-22

[illegible]

SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the relative strength of cohesionless soils is the compactness condition, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm. An SPT N value of "P" denotes that the split-spoon sampler was pushed 300 mm into the soil without the use of a falling hammer.

Compactness Condition	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory shear vane tests, unconfined compression tests, or occasionally by the Standard Penetration Test (SPT). Note that the typical correlations of undrained shear strength to SPT N value (tabulated below) tend to underestimate the consistency for sensitive silty clays, so Paterson reviews the applicable split spoon samples in the laboratory to provide a more representative consistency value based on tactile examination.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity, S_t , is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil. The classes of sensitivity may be defined as follows:

Low Sensitivity:	$S_t < 2$
Medium Sensitivity:	$2 < S_t < 4$
Sensitive:	$4 < S_t < 8$
Extra Sensitive:	$8 < S_t < 16$
Quick Clay:	$S_t > 16$

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NQ or larger size core. However, it can be used on smaller core sizes, such as BQ, if the bulk of the fractures caused by drilling stresses (called “mechanical breaks”) are easily distinguishable from the normal in situ fractures.

RQD %	ROCK QUALITY
90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard Penetration Test (SPT))
TW	-	Thin wall tube or Shelby tube, generally recovered using a piston sampler
G	-	"Grab" sample from test pit or surface materials
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size BQ, NQ, HQ, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D_{30})^2 / (D_{10} \times D_{60})$
Cu	-	Uniformity coefficient = D_{60} / D_{10}

Cc and Cu are used to assess the grading of sands and gravels:

Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$

Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$

Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.

Cc and Cu are not applicable for the description of soils with more than 10% silt and clay
(more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

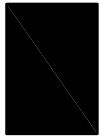
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidation ratio = p'_c / p'_o
Void Ratio		Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k	-	Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.
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SYMBOLS AND TERMS (continued)

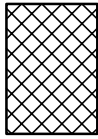
STRATA PLOT



Topsoil



Asphalt



Fill



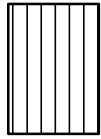
Peat



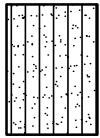
Sand



Silty Sand



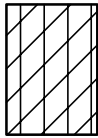
Silt



Sandy Silt



Clay



Silty Clay



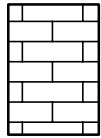
Clayey Silty Sand



Glacial Till



Shale



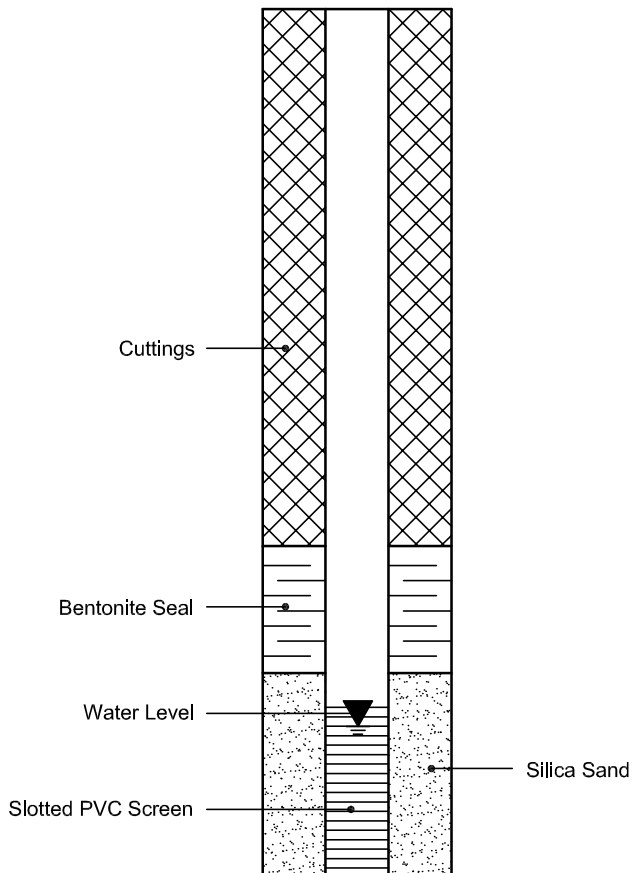
Bedrock

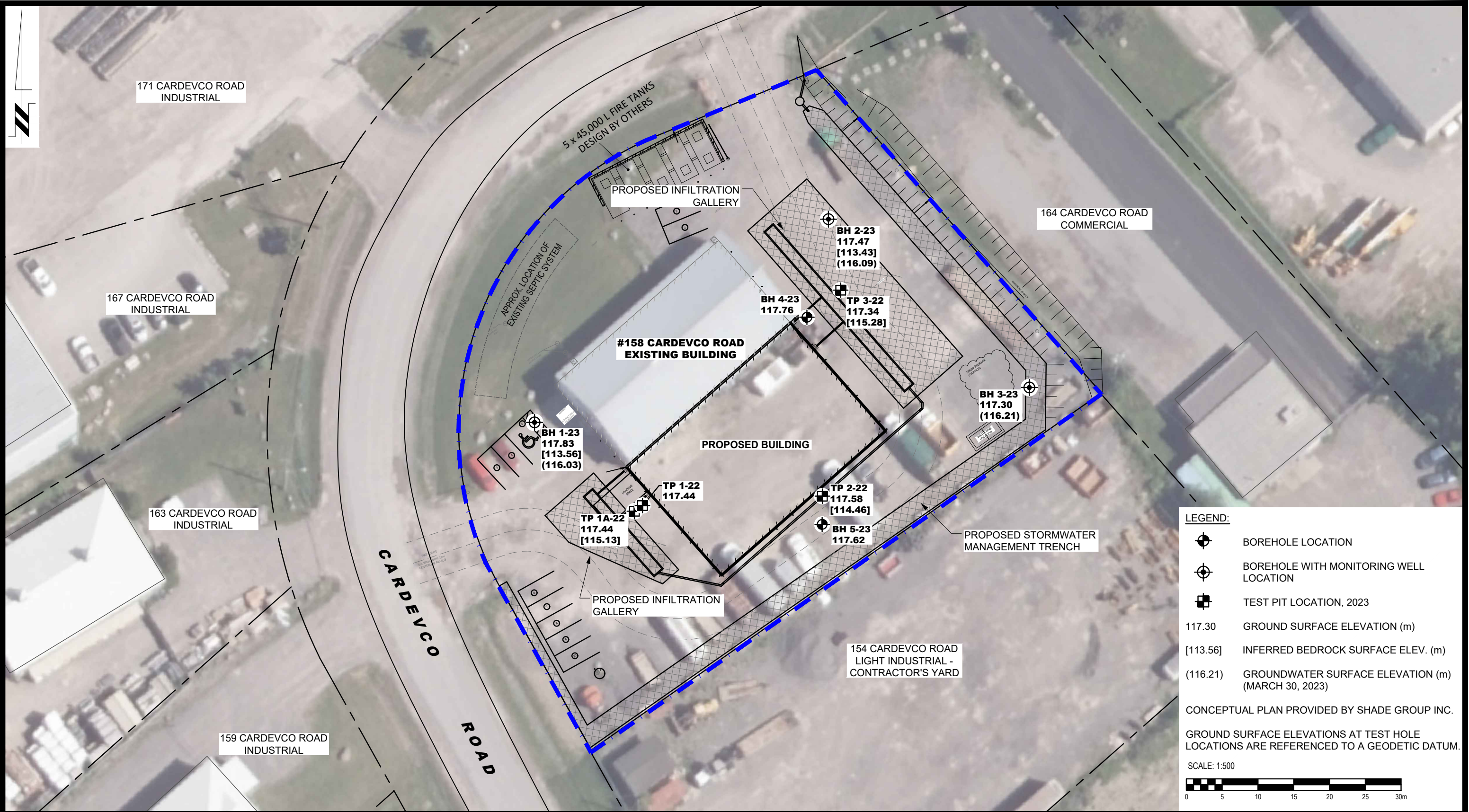
MONITORING WELL AND PIEZOMETER CONSTRUCTION


MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





<div><div><div>PATERSON GROUP</div><div>9 AURIGA DRIVE OTTAWA, ON K2E 7T9 TEL: (613) 226-7381</div></div></div>					OTTAWA, Title:	WHELAN TRUCK REPAIR GEOTECHNICAL INVESTIGATION PROPOSED BUILDING ADDITION 158 CARDEVCO ROAD ONTARIO	Scale:	1:500	Date:	12/2023	
							Drawn by:	NFRV	Report No.:	PG6233-1	
							Checked by:	BN	Dwg. No.: PG6233-1		
	1	REVISE TO UPDATE SITE PLAN	11/11/2024	NZ			Approved by:	SD		Revision No.:	1
	NO.	REVISIONS	DATE	INITIAL							