



ADDENDUM NO.1

Municipality of the County of Kings

TENDER NO. 24-10

ADDENDUM NO. 1

April 23, 2024

(To be added to and made part of the Tender Documents)

The following changes or modifications shall be made to the Tender Documents:

**TO THE SPECIFICATIONS**

**APPENDIX A - GEOTECHNICAL REPORT**

**Add Appendix A – Geotechnical Report, dated February 7, 2024, attached.**

CBCL Limited  
April 23, 2024





# Geotechnical Investigation



## Regional Forcemain Replacement

### Kings County, NS

231048.01 • February 07, 2024





01	Final	MA	2024-01-30	NB
02	Final Rev. 2	MA	2024-02-07	NB
Issue or Revision		Reviewed By:	Date	Issued By:
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February 07, 2024

Mr. Aaron Dondale,  
Manager of Operations, EPW  
Municipality of the County of Kings

Dear Mr. Dondale,

*RE: Geotechnical Investigation – Regional Forcemain Replacement Proposal for Engineering Services*

Please find below CBCL Limited's Geotechnical Investigation Report in support of the design and replacement of the regional forcemain from RG5 Pump Station to Eaves Hollow in Kings County, NS. This report presents our findings and our geotechnical recommendations for foundation design and general site work.

The recommendations presented herein should not be extended beyond the limits of the investigated area.

Yours very truly,

CBCL Limited

Prepared by:  
Nivya Basheer, M.A.Sc., P.Eng.  
Geotechnical Engineer  
Direct: 902-266-4782  
E-Mail: nbasheer@cbcl.ca

Reviewed by:  
Mohammad Ashari, M.A.Sc., P.Eng.  
Senior Geotechnical Engineer  
Direct: 902-233-1665  
E-Mail: mashari@cbcl.ca

Project No.: 231048.01

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# 1 Introduction

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CBCL Limited (CBCL) was retained by the Municipality of the County of Kings to conduct a geotechnical investigation in support of the design and replacement of the regional forcemain from RG5 Pump Station to Eaves Hollow in Kings County, NS. The purpose of this geotechnical investigation was to evaluate subsurface conditions at this location.

This report presents our findings during the geotechnical investigation at the site.

This report has been prepared for the sole benefit of the Municipality of the County of Kings and was prepared specifically for the subject site. The findings contained in this report should not be extrapolated beyond the area investigated.

## 2 Geology

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Surficial geology mapping indicates that the site lies within Glaciofluvial Deposits, consisting of gravel, sand and silt and Marine Deposits, consisting of gravel, sand, silt and clay, locally overlain by peat (Stea et al. 1992). The bedrock is located within the Wolfville Formation. Mapping by Keppie (2000) indicates that the bedrock consists of fluvial sandstone and conglomerate, aeolian sandstone and minor deltaic-lacustrine deposits.

## 3 Fieldwork Procedure

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To obtain information on the subsurface conditions at the site, CBCL Limited (CBCL) has carried out a Geotechnical Investigation Program from January 4th to January 5th, 2024, which involved drilling seven (7) boreholes along/close to the proposed forcemain alignment. The approximate borehole locations are shown in Drawing C01 (Appendix A).

Borehole drilling was conducted by Nova Drilling Inc. using a CME-55 drill rig mounted on a tracked carrier. All boreholes were filled with drill cuttings and silica sand. During fieldwork, representative samples were collected, and borehole conditions were logged in detail by qualified CBCL geotechnical personnel.

Borehole locations were selected based on the location of the proposed structures. Borehole coordinates and elevations were recorded in the field and provided to us by the municipality's surveyor. The borehole coordinates, elevations, and final depths are provided in Table 1 below.

**Table 1 Borehole Locations and Depths**

Borehole ID	Elevation (m) <sup>1</sup>	Northing (m) <sup>2</sup>	Easting (m) <sup>2</sup>	Borehole Depth (m)
BH-01-2024	6.7	4992600.0	382837.8	7.6
BH-02-2024	7.6	4992528.2	382920.5	7.2
BH-03-2024	7.0	4992455.1	383013.6	4.3
BH-04-2024	6.9	4992270.8	383186.6	4.3
BH-05-2024	6.7	4992177.7	383395.6	4.3
BH-06-2024	7.4	4992147.4	383671.8	4.3
BH-07-2024	7.0	4992370.1	383093.6	4.3

Notes: 1 - CGVD28  
2 - UTM Zone 20T

Sampling in overburden soils consisted of split-spoon sampling (51-mm outer sampler diameter) with Standard Penetration Testing (SPT) based on the procedures discussed in ASTM D1586.

The soil samples were classified and logged in the field by visual examination according to the Standard Practice for Description and Identification of Soils (Visual-Manual Procedures - ASTM D2488), and limited laboratory testing was performed in representative soil samples. Detailed descriptions of the soil layers encountered are provided in the attached Borehole Records (Appendix B).

Following completion of the fieldwork, soil samples were returned to our laboratory in Bedford, NS, where additional testing and evaluation were carried out. The samples will be stored in the laboratory for a maximum of three months following the date of the report, after which they will be discarded.



## 4 Summarized Subsurface Conditions

The soil identification and classification methodology are based on visual-manual field observation and laboratory testing procedures in general accordance with ASTM D2488 and D2487. These methods provide for a descriptive classification of soils based on engineering properties and are referenced in many geotechnical engineering design approaches and literature.

The subsurface conditions encountered in the boreholes are summarized below and presented in the Borehole Records (Appendix B). Subsurface profile is presented in Appendix D.

The subsurface conditions encountered between boreholes BH-01-2024 to BH-07-2024 (which includes boreholes BH-01-2024, BH-02-2024, BH-03-2024 and BH-07-2024) mainly consist of a layer of lean CLAY and a layer of SAND to Gravel. A layer of 0.1 m thick topsoil and a layer of 0.5 m thick fill were observed at the location of BH-02-2024 at the surface.

It is observed that the subsurface conditions change gradually from the location of BH-07-2024 to BH-04-2024.

The subsurface conditions encountered between boreholes BH-04-2024, BH-05-2024 and BH-06-2024 generally consist of fat CLAY. A 0.1 m thick layer of fill was observed at the surface of BH-06-2024.

**Table 2 Subsurface Conditions Summary**

Borehole ID	Thickness of TOPSOIL (m)	Thickness of FILL (m)	Thickness of lean CLAY/gravelly lean CLAY (m)	Thickness of fat Clay (m)	Thickness SAND to GRAVEL (m)	Borehole Depth (m)
BH-01-2024	-	-	1.0	-	>6.6 <sup>1</sup>	7.6
BH-02-2024	0.1	0.5	1.5	-	>5.1 <sup>1</sup>	7.2
BH-03-2024	-	-	1.5	-	>2.7 <sup>1</sup>	4.3
BH-04-2024	-	-	-	>4.3 <sup>1</sup>	-	4.3
BH-05-2024	-	-	-	>4.3 <sup>1</sup>	-	4.3
BH-06-2024	-	0.1	-	>4.2 <sup>1</sup>	-	4.3
BH-07-2024	-	-	1.6	-	>2.7 <sup>1</sup>	4.3

Notes: <sup>1</sup>A thickness shown with a greater than sign (>) means the borehole was terminated within this stratum  
 -Not encountered

Borehole Records (Appendix B) and Table 2 represent our interpretation of the soil conditions based on observations of the samples obtained from the drilling method. Stratification lines on the Borehole Records represent approximate boundaries between the

soil types. However, the actual boundaries may be different, and there may be a gradual transition between soil layers.

## 4.1 TOPSOIL and FILL

A layer of topsoil and FILL was encountered at the location of borehole BH-02-2024. The topsoil at this location represents the surface of the fill layer that has become overgrown with a cover of saplings and shrubbery. The fill layer encountered at this location was 0.5 m thick and consisted of compact, brown, moist, silty SAND with some gravel.

At the location of BH-06-2023, a layer of 0.1 m thick FILL was observed. This layer was described as compact, brown, moist, SAND with gravel.

FILL was not encountered in any other borehole.

## 4.2 Lean CLAY

A layer of lean CLAY was encountered at the ground surface in boreholes BH-01-2023, BH-03-2023 and BH-07-2023 and below the FILL layer in borehole BH-02-2023. The thickness of this layer ranged from 1.0 to 1.5 m. This layer was generally described as soft to very stiff, moist, brown to dark brown lean CLAY to gravelly lean CLAY.

Moisture content tests were conducted on four (4) samples of this layer. The average moisture content from the laboratory results is 24.2%, with a minimum of 17.5% and a maximum of 35.9%. Atterberg limits test conducted on one (1) sample from this layer showed a Liquid Limit of 31 and a Plastic Limit of 20. The corresponding Plasticity Index is 11. The results are indicative of lean CLAY, which was consistent with our visual observations.

A layer of compact, moist, brown sand with gravel was stratified within this layer in BH-02-2024 from a depth of 0.8 to 1.2 m.

The test results are shown on the appended borehole records. Laboratory test results are also presented in Appendix C.

## 4.3 SAND and GRAVEL

A layer of sand and gravel was encountered below the lean clay in boreholes BH-01-2023, BH-02-2023, BH-03-2023 and BH-07-2023. These boreholes were terminated in this layer. This layer generally consisted of loose to very dense, moist to wet, dark brown/light brown silty SAND, some gravel to well-graded GRAVEL with sand and silt and poorly graded to well-graded SAND with silt and gravel. At the location of BH-01-2023 to BH-03-2023, this layer consisted of alternating layers of SAND and GRAVEL. At the location of borehole BH-07-2023, this layer mainly consisted of GRAVEL with sand and silt.

Moisture content tests were conducted on six (6) samples of this layer. The average moisture content from the laboratory results is 17.4%, with a minimum of 11.1% and a maximum of 20.7%. Two (2) sieve analysis tests were also conducted on samples of this layer. One sample tested on sandy soil showed 28% gravel, 66% sand and 6% fines content. The results are indicative of well-graded SAND with silt and gravel, which was consistent with our visual observations. Another sample tested on gravelly soil showed 46% gravel, 43% sand and 11% fines content, indicative of well-graded GRAVEL with silt and sand.

The test results are shown on the appended borehole records and Appendix C.

## 4.4 Fat CLAY

A layer of fat CLAY was encountered at or near the ground surface in boreholes BH-04-2023, BH-05-2023, and BH-06-2023. These boreholes were terminated in this layer. This layer was generally described as very soft to very stiff, moist to wet, brown to dark brown/brown fat CLAY.

Moisture content tests were conducted on eleven (11) samples of this layer. The average moisture content from the laboratory results is 43.2%, with a minimum of 27.6% and a maximum of 58.1%. Atterberg limits test conducted on one (1) sample from this layer showed a Liquid Limit of 52 and a Plastic Limit of 27. The corresponding Plasticity Index is 25. The results are indicative of the soil being fat CLAY, which was consistent with our visual observations.

## 4.5 Groundwater

The groundwater table was visible at the surface for the majority of the site. Groundwater levels should be expected to fluctuate seasonally, with precipitation, site development, and/or construction activity.



## 5 Closure

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This report has been prepared for the sole benefit of the Client. All information, documentation or other material contained in, attached to, or forming part of this report reflects CBCL's opinion and best judgment based on the information available to us at the time of preparation. Any use or reliance on this report by the Client in circumstances where there has been a change in site conditions or for any purpose not expressly intended by or delineated in this report shall be the sole responsibility of the Client and CBCL accepts no liability for such use or reliance. Any use or reliance on this report by any third party, without CBCL's prior express written consent, shall be the sole responsibility of that third party. CBCL accepts no liability whatsoever for such use or reliance.

The information and conclusions contained in this report are generally consistent with professional standards for engineering and scientific professionals providing similar services at the same time, in similar locations and under similar circumstances.

A geotechnical field investigation is a limited sampling of a site. Some variation between sampling locations should be expected. The conclusions presented in this report represent the technical judgment of CBCL, based on the data obtained from the work and on CBCL's understanding of the project. The data obtained by CBCL is specific to the time the work was performed at the specific testing and/or sampling locations and can only be extrapolated to an undefined limited area surrounding these locations. The extent of the limited area depends on the soil and groundwater conditions, as well as the history of the site reflecting natural, construction and other activities. Due to the nature of the investigation and the limited data available, CBCL cannot and does not warrant that undiscovered environmental liabilities and/or undetected subsurface conditions may not arise.

We trust this is the information you require at this time. We are available to discuss the contents of this report at your convenience. This report was prepared by Nivya Basheer, M.A.Sc., P.Eng., and reviewed by Mohammad Ashari, M.A.Sc., P.Eng.

Respectfully submitted,

**CBCL Limited**

# APPENDIX A

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## Borehole Location Plan





BH-01-2024  
 N 4992600 m  
 E 382838 m

BH-02-2024  
 N 4992528 m  
 E 382920 m

BH-03-2024  
 N 4992455 m  
 E 383014 m

BH-07-2024  
 N 499370 m  
 E 383094 m

BH-04-2024  
 N 4992271 m  
 E 383187 m

BH-05-2024  
 N 4992178 m  
 E 383396 m

BH-06-2024  
 N 4992147 m  
 E 383672 m



**LEGEND**



APPROXIMATE BOREHOLE LOCATIONS



PROJECT  
**BOREHOLE LOCATION PLAN**  
 REGIONAL FORCEMAIN REPLACEMENT  
 KINGS COUNTY, NS

JOB #: 231048.01  
 DATE: 29-JAN-2024  
 DRAWN BY: NB  
 CHECKED BY: MA

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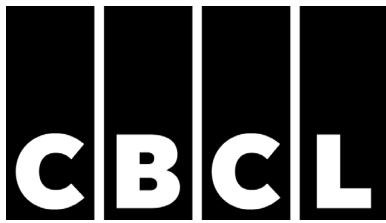
DRAWING: 1  
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# APPENDIX B

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## Borehole Records



## SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

### SOIL DESCRIPTION

Terminology describing common soil genesis:

<i>Topsoil</i>	variable mixture of mineral particles and organic matter
<i>Peat</i>	decomposing vegetative matter having fibrous and/or amorphous structure
<i>Till</i>	unstratified glacial deposit which may range from clay to boulders
<i>Fill</i>	any materials below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

<i>Desiccated</i>	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
<i>Fissured</i>	having cracks, and hence a blocky structure
<i>Varved</i>	composed of regular alternating layers of silt and clay
<i>Stratified</i>	composed of alternating successions of different soil types, e.g. silt and sand
<i>Layer</i>	>75 mm
<i>Seam</i>	2 mm to 75 mm
<i>Parting</i>	< 2 mm
<i>Well Graded</i>	having wide range in grain sizes and substantial amounts of all intermediate particle sizes
<i>Uniformly Graded</i>	predominantly of one grain size

Terminology describing soils on the basis of grain size and plasticity is based on the ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). The classification excludes particles larger than 76 mm (3 inches). This system provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

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

<i>Trace, or occasional</i>	Less than 10%
<i>Some</i>	10-20%
<i>Frequent</i>	Greater than 20%

The standard terminology to describe cohesionless soils includes the compactness as determined by laboratory test or by the Standard Penetration Test 'N' – value.

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



The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests, or occasionally by standard penetration tests.

Consistency	Undrained Shear Strength (Su)		'N' Value
	Kips/sq.ft.	KPa	
<i>Very Soft</i>	< 0.25	< 12.5	< 2
<i>Soft</i>	0.25 – 0.5	12.5 – 25	2 – 4
<i>Firm</i>	0.5 – 1.0	25 – 50	4 – 8
<i>Stiff</i>	1.0 – 2.0	50 – 100	8 – 15
<i>Very Stiff</i>	2.0 – 4.0	100 – 200	15 – 30
<i>Hard</i>	> 4.0	> 200	> 30

## ROCK DESCRIPTION

### Rock Quality Designation (RQD)

The 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 due to close shearing, jointing, faulting, or weathering in the rock mass and are not counted. RQD was originally intended to be done on N-size (45 mm) core; however, it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures.

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

Terminology describing rock mass:

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

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

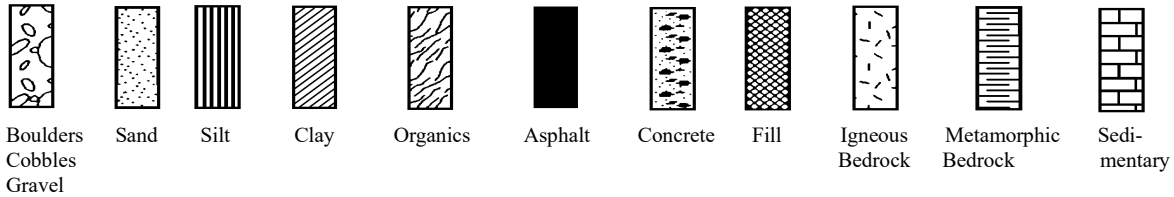
Terminology describing weathering:

- Slight* - Weathering limited to the surface of major discontinuities. Typically iron stained.
- Moderate* - Weathering extends throughout rock mass. Rock is not friable.
- High* - Weathering extends throughout rock mass. Rock is friable.



## STRATA PLOT

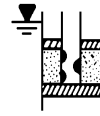
Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols:



## WATER LEVEL MEASUREMENT



Borehole or  
Standpipe



Piezometer

## SAMPLE TYPE AND/OR FIELD TESTS

SS	Split Spoon Sample (obtained by performing the Standard Penetration Test)	AS	Auger Sample
ST	Shelby Tube or Thin Wall Tube	BS	Bulk Sample
PS	Piston sample	WS	Wash Sample
DC	Dynamic Cone Penetration	HQ, NQ, BQ, etc.	Rock Core Samples (obtained with the use of standard size diamond drilling bits)
FSV	Field Shear Vane		

## N- VALUE

Numbers in this column are the results of the SPT (Standard Penetration Test): the number of blows of a 140 pound (64kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (305 mm) into the soil. For split spoon samples where insufficient penetration was achieved and 'N' values cannot be presented, the abbreviation SSR (Split Spoon Refusal) will appear in place of a numerical value.

## OTHER TESTS

Symbols in this column indicate that the following laboratory tests have been carried out and the results are presented separately.

S	Sieve analysis	H	Hydrometer analysis
G <sub>s</sub>	Specific gravity of soil particles	γ	Unit weight
k	Permeability	C	Consolidation
↓	Single packer permeability test; test interval from depth shown to bottom of borehole	CD	Consolidated drained triaxial
┃	Double packer permeability test; Test interval as indicated	CU	Consolidated undrained triaxial with pore pressure measurements
○	Falling head permeability test using casing	UU	Unconsolidated undrained triaxial
○	Falling head permeability test using well point or piezometer	DS	Direct shear
		Q <sub>u</sub>	Unconfined compression
		I <sub>p</sub>	Point Load Index (I <sub>p</sub> on Borehole Records equals I <sub>p</sub> (50); the index corrected to a reference diameter of 50 mm)
		MSV	Laboratory Miniature Shear Vane



# BOREHOLE RECORD: BH-01-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/4/2024  
**BORING END DATE** 1/4/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 6.7 m **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992600.0 m N; 382837.8 m E  
**LOGGED BY** AM **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL (m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲						
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL				
			6.7															
1			5.7	Firm, moist, brown, gravelly lean CLAY - Trace organics (i.e. rootlets) - Dark grey below 0.8m	SS	1	310	5										
			5.1	Loose, moist, dark brown, silty SAND, some gravel	SS	2	510	7										
2			3.9	Dense to very dense, wet, dark brown, well graded GRAVEL with silt and sand	SS	3	440	37										
				Compact, wet, light brown, poorly graded SAND to well graded SAND with silt and gravel	SS	4	540	69										
3					SS	5	420	17										
4					SS	6	320	13										
5					SS	7	130	16	28	66	6							
6					SS	8	230	16										
7					SS	9	0	17										
			-1.0		SS	10	200	19										

End of borehole at 7.6 m





# BOREHOLE RECORD: BH-02-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/4/2024  
**BORING END DATE** 1/4/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger and Rotary Diamond Drilling

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 7.6 m **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992528.2 m N; 382920.5 m E  
**LOGGED BY** AM **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL (m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲			
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL	
			7.6	TOPSOIL/ROOTMAT											
			7.5	FILL: Compact, moist, brown, silty SAND with some gravel	SS	1	500	19							
1			7.0	Soft to stiff, moist, brown, lean CLAY - Stratified with compact, moist, brown, sand with gravel from 0.8 to 1.2 m	SS	2	480	13							
2			5.5		SS	3	500	3							
3			4.6	Compact, moist, dark brown, silty SAND, some gravel	SS	4	250	16							
4				Compact to very dense, moist, brown, well graded GRAVEL with silt and sand	SS	5	280	42							
5					SS	6	260	48							
5					SS	7	380	59	46	43	11				
6					SS	8	200	20							
6					SS	9	0	13							
7					SS	10	250	17							
			0.4												

End of borehole at 7.2 m

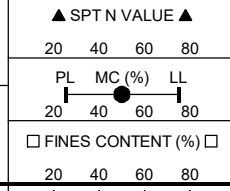


# BOREHOLE RECORD: BH-03-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/4/2024  
**BORING END DATE** 1/4/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 7.0 m      **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992455.1 m N; 383013.6 m E  
**LOGGED BY** AM      **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL (m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲							
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL					
			7.0																
1				Firm to stiff, moist, brown, lean CLAY, trace gravel	SS	1	340	5											
			5.5																
2				Dense to very dense, moist, brown, well graded GRAVEL with silt and sand	SS	3	500	44											
			4.2																
3				Compact, moist, brown, silty SAND															
			3.6																
4				Compact, moist, brown, well graded GRAVEL with silt and sand	SS	5	440	17											
			2.7																
End of borehole at 4.3 m																			





# BOREHOLE RECORD: BH-04-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/5/2024  
**BORING END DATE** 1/5/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 6.9 m      **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992270.8 m N; 383186.6 m E  
**LOGGED BY** AM      **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲						
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL				
			6.9															
1				Very soft to very stiff, moist, brown to dark brown, fat CLAY, trace organic	SS	1	330	7										
					SS	2	460	16										
2					SS	3	610	2										
					SS	4	380	2										
3																		
					SS	5	600	0										
4					SS	6	610	2										
			2.6															

End of borehole at 4.3 m



# BOREHOLE RECORD: BH-05-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/5/2024  
**BORING END DATE** 1/5/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 6.7 m      **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992177.7 m N; 383395.6 m E  
**LOGGED BY** AM      **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲							
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL					
			6.7																
1				Very soft to stiff, moist, dark brown, fat CLAY - Trace organics from 0.0 to 1.2 m	SS	1	400	7											
					SS	2	460	9											
2					SS	3	610	0											
					SS	4	610	2											
3																			
					SS	5	610	0											
4					SS	6	610	1											
			2.5																

End of borehole at 4.3 m



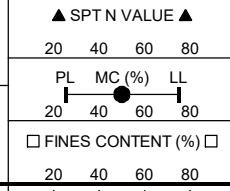
# BOREHOLE RECORD: BH-06-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/5/2024  
**BORING END DATE** 1/5/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 7.4 m **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992147.4 m N; 383671.8 m E  
**LOGGED BY** AM **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL(m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲		
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%)	LL
			7.4											
			7.3	FILL: Compact, moist, brown, SAND with gravel Very soft to stiff, moist to wet, brown to dark brown, fat CLAY	SS	1	240	12						
1					SS	2	310	9						
2					SS	3	420	1						
					SS	4	480	4						
3					SS	5	610	2						
4					SS	6	520	4						
			3.2											

End of borehole at 4.3 m







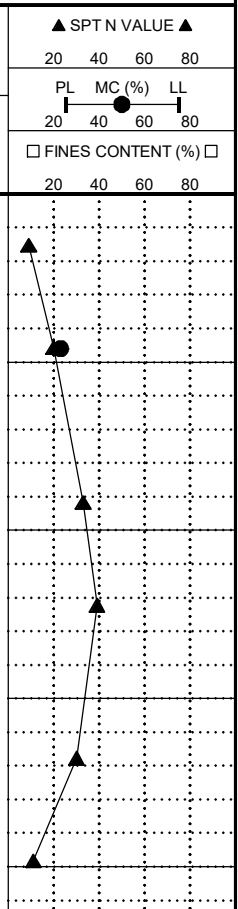
# BOREHOLE RECORD: BH-07-2024

**CLIENT** Municipality of the County of Kings  
**PROJECT NUMBER** 231048.01  
**BORING START DATE** 1/5/2024  
**BORING END DATE** 1/5/2024  
**BORING CONTRACTOR** Nova Drilling Inc.  
**BORING METHOD** Solid Stem Auger

**PROJECT NAME** GI Regional Forcemain Replacement  
**PROJECT LOCATION** Kings County, NS  
**GROUND ELEVATION** 7.0 m **GWT DATE** -  
**DATUM** NAD 83 (CRS-2010) UTM Zone 20 N, CGVD28  
**COORDINATES** 4992370.1 m N; 383093.6 m E  
**LOGGED BY** AM **CHECKED BY** MA

DEPTH SCALE (m)	WATER LEVEL (m)	GRAPHIC LOG	ELEVATION (m)	MATERIAL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY SOIL (mm) ROCK (%)	SOIL ("N" VALUE) ROCK (RQD (%))	GRAIN SIZE DISTRIBUTION			▲ SPT N VALUE ▲						
									Gravel (%)	Sand (%)	Fines (%)	PL	MC (%) LL					
			7.0															
1				Stiff to very stiff, moist, brown to dark brown, lean CLAY - Trace organics from 0.0 to 0.3 m	SS	1	350	9										
			5.4															
2				Compact to dense, moist, brown, well graded GRAVEL with silt and sand	SS	3	450	33										
3																		
4																		
			2.7															

End of borehole at 4.3 m



# APPENDIX C

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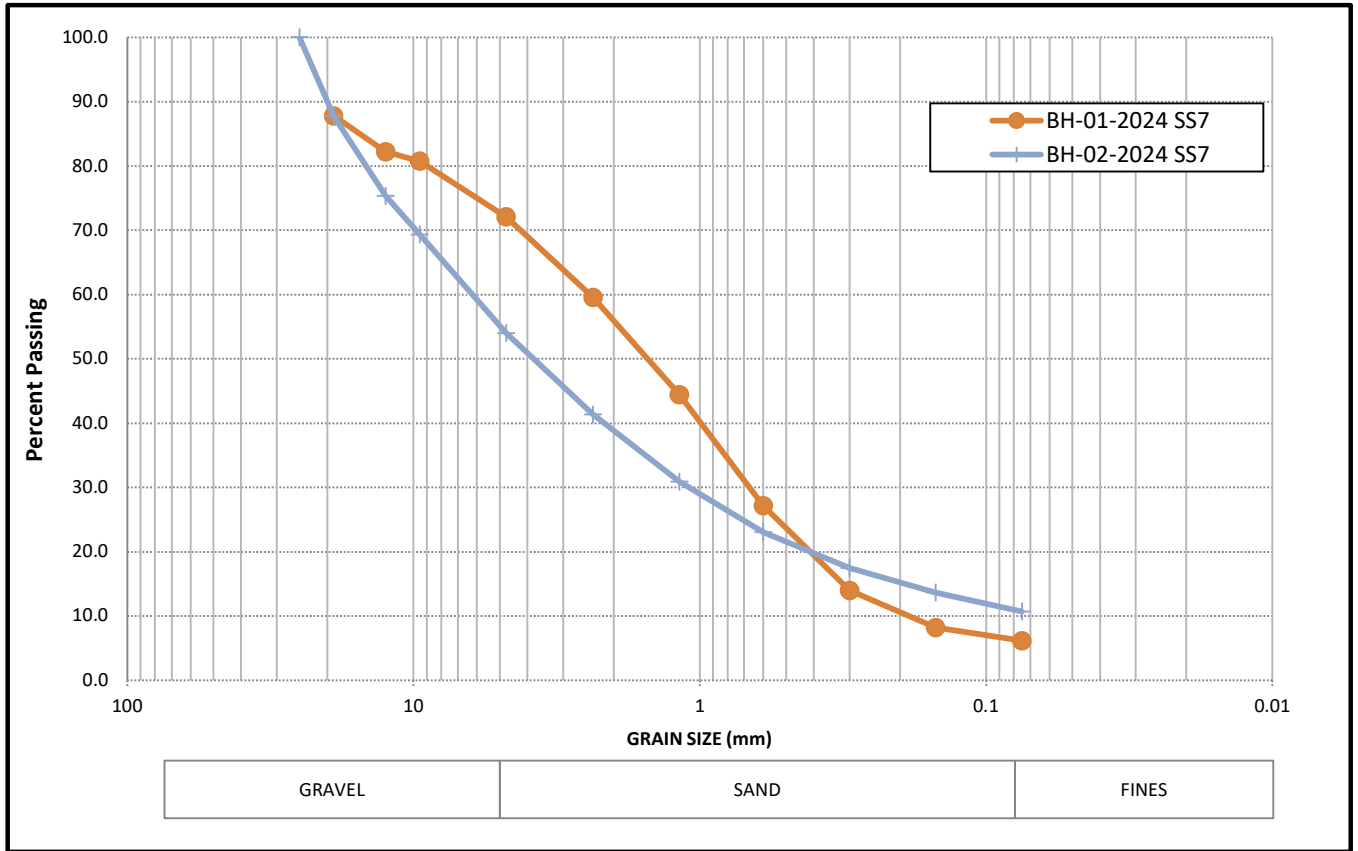
## Laboratory Test Results



# GRAIN SIZE REPORT

Project: Regional Forcemain Replacement  
 Client: Municipality of the County of Kings  
 Project No: 231048.01

## GRAIN SIZE DISTRIBUTION PLOT



## SOIL CLASSIFICATION

Sample No	Depth(m)	Classification	Moisture Content (%)	Gravel (%)	Sand (%)	Silt and Clay (%)
BH-01-2024 SS7	5.0	Well graded SAND with silt and gravel (SW-SM)	17.2%	28	66	6
BH-02-2024 SS7	4.7	Well graded GRAVEL with silt and sand (GW-GM)	11.1%	46	43	11

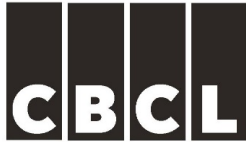
## CBCL limited

348 Bluewater Road, Bedford, NS B4B 1J6  
 Office (902) 835-7313 • Fax (902) 835-1260

Comments: \_\_\_\_\_

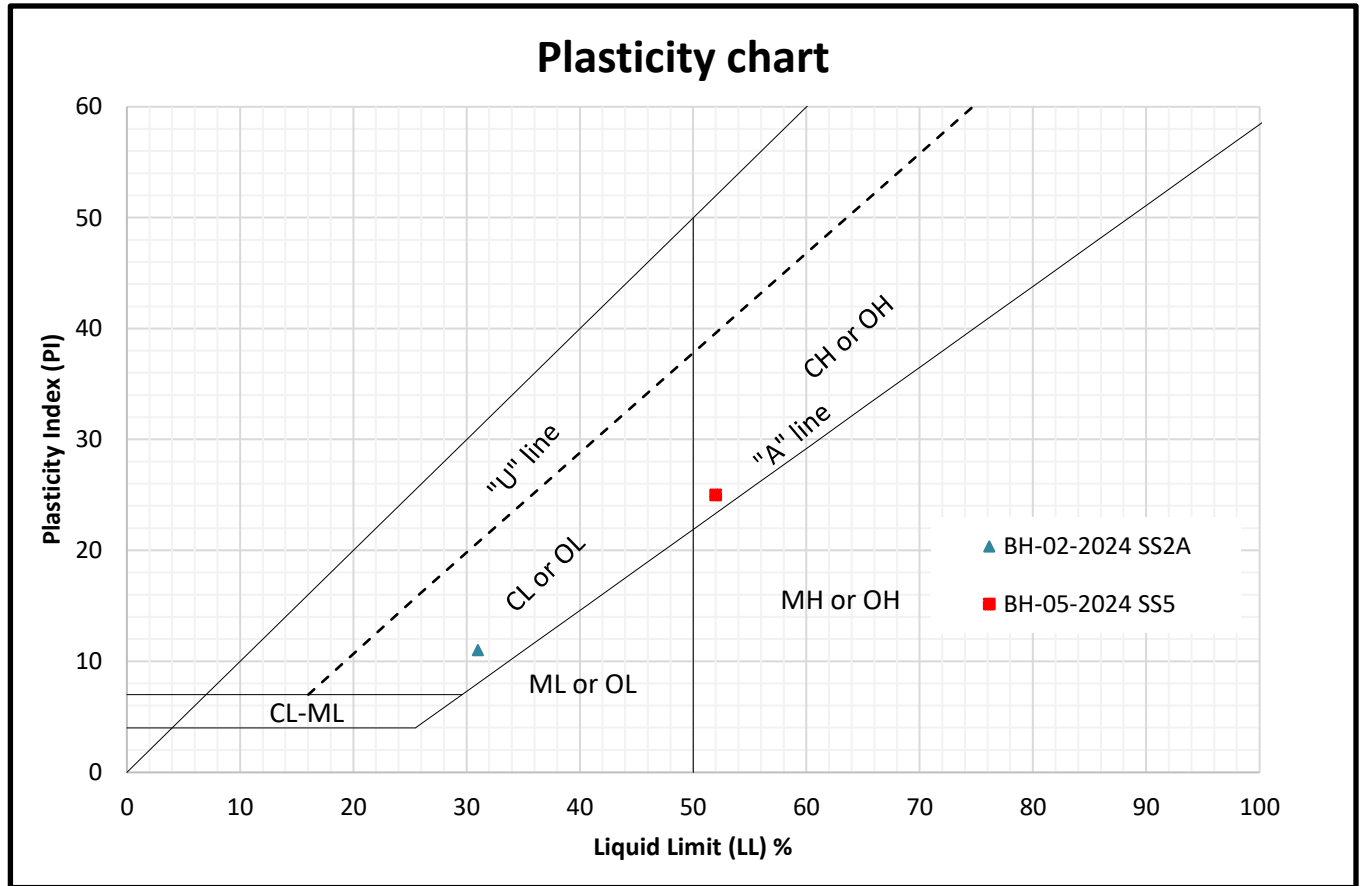
\_\_\_\_\_

\_\_\_\_\_



# PLASTICITY CHART

Project: Regional Forcemain Replacement  
 Client: Municipality of the County of Kings  
 Project No:231048.01



Sample No	Depth(m)	Liquid Limit (LL) %	Plastic Limit (PL) %	Plasticity Index (PI)
BH-02-2024 SS2A	0.7	31	20	11
BH-05-2024 SS5	3.4	52	27	25

### CBCL limited

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 Office (902) 835-7313 • Fax (902) 835-1260

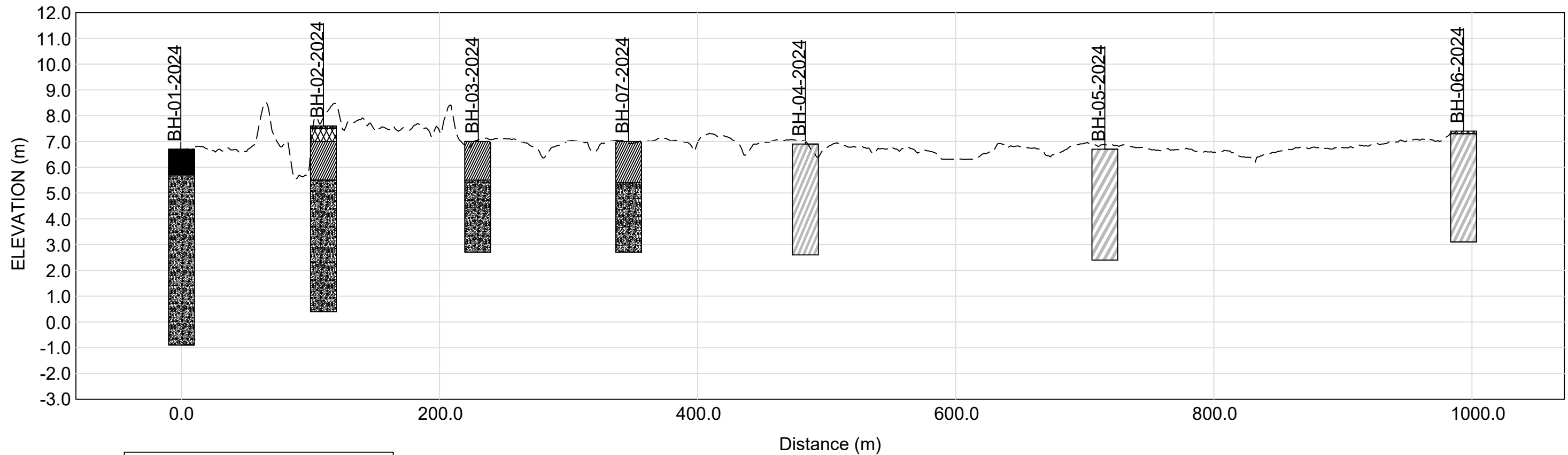
Comments: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# APPENDIX D

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## Subsurface Profile





**LEGEND**

- TOPSOIL
- FILL
- LEAN CLAY
- GRAVELLY LEAN CLAY
- FAT CLAY
- SAND AND GRAVEL

Notes:  
 - Elevations are referenced to Canadian Geodetic Vertical Datum of 1928 (CGVD28)  
 - Ground surface elevation is based on LIDAR data. The LIDAR elevations are converted from CGVD2013 to CGVD28 (+0.661 m)

	<b>PROJECT</b>	JOB #:	231048.01	DOCUMENTS PREPARED BY CBCL ARE TO BE USED ONLY FOR THE SPECIFIC PROJECT AND SPECIFIC USE FOR WHICH THEY WERE PREPARED. ANY EXTENSION OF USE TO OTHER PROJECTS, BY OWNER, OR ANY OTHER PARTY, WITHOUT THE EXPRESSED, WRITTEN AUTHORIZATION OF CBCL IS DONE AT THE USERS OWN RISK. IF USED IN A WAY OTHER THAN WHAT WAS SPECIFICALLY INTENDED, THE OWNER WILL HOLD CBCL HARMLESS FROM ALL CLAIMS AND LOSSES.	DRAWING:	2	
	<b>SUBSURFACE PROFILE</b>	DATE:	07-FEB-2024		AUTHORIZATION OF CBCL IS DONE AT THE USERS OWN RISK. IF USED IN A WAY OTHER THAN WHAT WAS SPECIFICALLY INTENDED, THE OWNER WILL HOLD CBCL HARMLESS FROM ALL CLAIMS AND LOSSES.	REV:	0
	REGIONAL FORCEMAIN REPLACEMENT KINGS COUNTY, NS	DRAWN BY:	NB				
		CHECKED BY:	MA				



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[www.CBCL.ca](http://www.CBCL.ca)