November 4, 2024 Report No. 230114-G1R

The Cellular Connection Ltd.
514504 2nd Line
Amaranth, Ontario
L0N 1L0

Attention: Mr. Stuart Turk, Owner

GEOTECHNICAL INVESTIGATION
PROPOSED RESIDENTIAL SUBDIVISION
514504 2ND LINE, AMARANTH, ONTARIO

Prepared for:

The Cellular Connection Ltd.

CANADA ENGINEERING SERVICES INC.
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EXECUTIVE SUMMARY

Re: Geotechnical Investigation for Proposed Residential Subdivision at 514504 2nd Line, Amaranth, Ontario

We have completed the geotechnical investigation you requested at the above site and our report is enclosed.

Ten boreholes were put down at the site to a depth of 9.4 m, 5.0 m, 9.6 m, 5.0 m, 5.0 m, 9.6 m, 9.6 m, 5.0 m, 5.0 m and 9.4 m in Borehole Numbers 1 to 10 respectively. Monitoring wells were installed in Borehole Numbers 1, 3, 6, 7 and 10. The general soil profile at the site consisted of the following materials starting in sequence below existing ground surface:

Topsoil
Silty Sand (compact)
Peat
Silt and Clay Till (stiff to very stiff)
Silty Sand Till (compact to very dense)

Water was encountered at a depth of 6.28 m in Borehole Number 1, no water in Borehole Number 2, 8.53 m in Borehole Number 3, no water in Borehole Number 4, no water in Borehole Number 5, 8.53 m in Borehole Number 6, no water in Borehole Number 7, 4.26 m in Borehole Number 8, no water in Borehole Number 9 and 2.0 m in Borehole Number 10. It appears that an aquifer exists within the silty sand till and silt and clay till layers around a depth of 2.0 m to 8.53 m below ground surface. The handling of de-watering of the site is covered fully in our hydrogeological report.

Conventional strip footings at this site, for the proposed residential dwellings with one level basements may be placed on the stiff to very stiff silt and clay till or compact to very dense silty sand till. The bearing capacity available is 150 kPa (3000 psf) for serviceability limit states (SLS) and 225 kPa (4500 psf) for factored ultimate limit states (ULS) any where within the native silt and clay till and silty sand till, which can be found at depth of 1.8 m to 2.4 m below ground surface.

The Seismic Site Response Classification for this site has been evaluated as Type D.

INTRODUCTION

Canada Engineering Services Inc., was authorized by Mr. Stuart Turk of The Cellular Connection Ltd, owner of the property located at 514504 2nd Line, in Amaranth, Ontario to carry out a Geotechnical Investigation.

It was understood that the owner is proposing to construct roadways with services and total of 24 two-storey residential dwellings with single basement levels.

The purpose of this investigation was to:

(a) determine the subsoil and water table conditions by placing ten boreholes at selected locations representing the site. Monitoring wells were installed in Borehole Numbers 1, 3, 6, 7 and 10.

(b) provide recommendations for the design of building foundations, floor slab design, pavements and driveways, shoring, excavation, de-watering, bedding and backfilling.

(c) make recommendations for allowable soil bearing pressures and lateral earth pressures for the proposed 24 two-storey residential dwellings with one level basements and make recommendations for road construction, pavement design and floor slab design.

GEOLOGY

The surficial geology at the site, as published in the Ontario Geological Survey, Surficial Geology of Southern Ontario, consists of: Till - Clay to silt-textured till (derived from glaciolacustrine deposits or shale).

SITE DESCRIPTION

The site is located at 514504 2nd Line, in Amaranth, Ontario. The subject property is mostly vacant and grass covered with one residential building on site. There are storm water ponds on the north and south side of the subject property.

The site is located in a developed rural residential area with some agricultural lands. It is bounded by residential dwellings on the north and east sides and vacant lands on the south and west sides. Further east and south beyond 2nd Line and the vacant plot of land are residential dwellings. The subject property has mild undulating topography with a general gentle slope toward the south and east. The existing building on site is on an elevated area with mild slopes all around. The gravel driveway from the building towards 2nd Line slopes down towards south and southeast.

GEOTECHNICAL PROCEDURE

The field work for the boreholes was carried out with a track-mounted drill rig with solid stem augers on October 18, 19 and 20, 2023 and was supervised by an engineer from our office. A total of ten boreholes was put down at the site. Monitoring wells were installed to the bottoms of all the deeper boreholes (Borehole Numbers 1, 3, 6, 7 and 10). From the boreholes, soil samples were taken at 500 mm intervals between ground surface and a depth of 3.0 m and thereafter at 1.5 m intervals to the termination of the boreholes. The samples were taken by means of a split-spoon sampler, in accordance with the requirements of the Standard Penetration Test, (CSA test specifications A119.1).

Ten boreholes were put down at the site to a depth of 9.4 m, 5.0 m, 9.6 m, 5.0 m, 5.0 m, 9.6 m, 9.6 m, 5.0 m, 5.0 m and 9.4 m in Borehole Numbers 1 to 10 respectively.

All soil samples taken were brought back to our laboratory where moisture content tests, grain size analyses and further visual observations were carried out. Our field and laboratory findings are plotted on the Borehole Log Numbers 1 to 10. Grain size graphs are shown on Figure Numbers 1 and 2.

Where practical, field penetrometer readings were taken on the samples from the boreholes to determine the different bearing values of the soils encountered. The approximate bearing pressure values of these are recorded on the borehole logs in the soils description columns.

Drawing Number 1 shows the site and its surrounding, while Drawing Number 2 shows the locations of the boreholes which were established by staff from CESI. The ground surface elevation of each borehole was referenced to the elevations from the contours of the topographic survey plan by Schaffer Dzaldov Purcell Limited, dated September 12, 2023. The geotechnical terms and symbols used in this report are shown in Appendix "A."

SOILS DESCRIPTION

Topsoil

A layer of topsoil was encountered at the surfaces of Borehole Numbers 1, 2, 4, 5, 6, 7, 8, 9 and 10. This layer consisted of a dark grey to grey silty sand, some organics. It was wet and in a loose state and varied in thickness from 100 mm to 900 mm thick.

Silty Sand

A layer of silty sand was encountered at the surface of Borehole Number 3. This layer was brown

in colour, was wet and in a compact state down to a depth of 0.76 m below ground surface. This layer was also encountered in Borehole Number 10 below the surficial topsoil layer, however it also consisted of varved clay interbedded within the silty sand, down to a depth of 3.4 m below ground surface.

Peat

A layer of peat was found below the silty sand layer in Borehole Number 3. This layer was black in colour, was wet and in a loose state down to a depth of 0.9 m below ground surface.

Silty Sand Till

Below the topsoil layer in Borehole Numbers 7 and 9 was a layer of silty sand till, some clay, trace gravel. This layer was moist and in a dense state down to a depth of 2.2 m and 1.5 m in Borehole Numbers 7 and 9 respectively. Penetrometer readings taken on samples recovered in the boreholes varied from 300 kPa to 450 kPa.

Silt and Clay Till

Below the topsoil layer in Borehole Numbers 1, 4, 5, 6 and 8, below the silty sand till in Borehole Numbers 2, 7 and 9 and below the peat and silty sand layer in Borehole Numbers 3 and 10 , was a layer of silt and clay till, trace to some sand, trace gravel. This layer was mottled grey-brown in colour, was moist to wet and in a stiff to very stiff state down to depths of 4.6 m, 6.1 m in Borehole Numbers 1, 7 respectively and extended down to the bottoms of Borehole Numbers 2, 3, 4, 5, 6, 8, 9 and 10. Penetrometer readings taken on samples recovered in the boreholes varied from 75 kPa to 450 kPa.

Silty Sand Till

Below the silt and clay till layer in Borehole Numbers 7 was a layer of silty sand till, some clay, trace gravel. This layer was moist and in a very dense state down to the bottom of Borehole Number 7. Penetrometer readings taken on samples recovered in the boreholes was greater than 450 kPa.

The location of the site and its surrounding are shown on Drawing Number 1, while the locations of the boreholes are shown on Drawing Number 2. The boreholes were located in the field by staff from CESI and their surface elevations were referenced to the elevations from the contours of the topographic survey plan by Schaffer Dzaldov Purcell Limited, dated September 12, 2023. The geotechnical terms and symbols used in this report are shown in Appendix “A”.

GROUNDWATER

During the drilling of the boreholes some water seepage was obtained from the boreholes within the silt and clay till and silty sand till layers. Monitoring wells were installed in deep boreholes. The water level readings were also taken on November 3, 2023. The highest water level was found at depth 2.61 m in Borehole Number 6 at elevation 487.54 masl.

Table Number 3

Borehole ID	Date of reading	Depth of Water Level (m)	Elevation of Water Level Reading (masl)	Remarks
BH 1	October 18, 2023	6.28	483.92	Upon Completion
BH 2	October 19, 2023	dry	-	Upon Completion
BH 3	October 20, 2023	8.53	476.47	Upon Completion
BH 4	October 18, 2023	dry	-	Upon Completion
BH 5	October 18, 2023	dry	-	Upon Completion
BH 6	October 19, 2023	8.53	481.62	Upon Completion
BH 7	October 19, 2023	dry	-	Upon Completion
BH 8	October 19, 2023	4.26	485.48	Upon Completion
BH 9	October 19, 2023	dry	-	Upon Completion
BH 10	October 20, 2023	2.0	485.90	Upon Completion
BH 1	November 3, 2023	5.81	484.39	
BH 3	November 3, 2023	1.09	483.91	
BH 6	November 3, 2023	2.61	487.54	Highest water level
BH 7	November 3, 2023	3.90	486.55	
BH 10	November 3, 2023	1.33	486.57	

PERCOLATION TESTING AND T-TIME DETERMINATION

Percolation tests were conducted in two boreholes (P1 and P2) drilled down to a depth of 1.5 m. Percolation rate or T- Time is defined as the rate at which treated wastewater will be absorbed into the soil or as the number of minutes it takes for the water level to fall one centimeter in a hole drilled into a soil and filled with water.

The boreholes were put down with a truck-mounted drill rig down to a depth of 1.5 m in both percolation holes P1 and P2 respectively. The soils found consisted of a brown silt and clay till and extended down to the bottoms of the percolation holes.

A few inches of gravel was placed at the base of each of these holes. The holes were then filled with water and the drops in water levels monitored and recorded. In each case, the test was terminated when three consecutive drops in water levels monitored over consecutive 30 minute periods were within 10% of each other or where the water level virtually ceased to drop over an extended period of time. Using the rates of drops of the water levels, the rates of percolation or T-Time were calculated. From the percolation rates, the hydraulic conductivity of the soils were extrapolated and the results are as follows:

Percolation Hole No.	Hydraulic Conductivity (cm/sec)	Percolation "T" Time (min/cm)
P1	2.04×10^{-3}	8.18
P2	1.0×10^{-7}	over 50

The locations of the percolation test holes are shown on Drawing Number 2 attached.

EXCAVATION FOR SEWERS AND WATERMAINS AND FOOTINGS

Sewers are expected to be installed around 2 m to 2.5 m below the final ground surface level, while footings are expected to be at a depth of 1.8 m to 2.1 m below the existing ground surface.

It is expected that all the excavations for the sewers and footings will be primarily within the fill and the native silty sand, silty sand till and silt and clay till strata. We do not anticipate any problems with the excavations.

For the excavations for sewers and watermains, the walls of the excavations should be sloped at 45 degrees to the horizontal with the lower 1.2 m vertical. Where the fill is found to be loose, the angle of repose may have to be increased. The temporary slopes of the excavation should conform to the Occupational Health and Safety Act (OHSA) and all local regulations.

BACKFILLING

The existing fill and native soils can be used to backfill the footings, watermains and sewers. A sand backfill should be used at the bottom and around all pipes to avoid puncturing.

For backfilling around manholes, catch basins and confined spaces, a granular material should be used. If additional fill is required, then it is recommended that an imported fill such as granular "B" be used for backfilling. Backfilling Details are shown in Appendix "A".

The fill should be compacted in maximum lift thicknesses of 200 mm, with a heavy sheep's foot vibratory compactor, or a jumping jack to 98% of the standard proctor maximum dry density. The fill operations should be monitored by a geotechnical engineer/technician to ensure that all areas are adequately compacted.

FOUNDATIONS

Conventional strip footings at this site, for the proposed residential dwellings with one level basements may be placed on the stiff to very stiff silt and clay till or compact to very dense silty sand till. The bearing capacity available is 150 kPa (3000 psf) for serviceability limit states (SLS) and 225 kPa (4500 psf) for factored ultimate limit states (ULS) any where within the native silt and clay till and silty sand till, which can be found at depth of 1.8 m to 2.4 m below ground surface.

If engineered fill is used for supporting foundations, an allowable serviceability limit states bearing capacity of 75 kPa (1500 psf) and an allowable factored ultimate limit states bearing capacity of 112.5 kPa (2250 psf)should be used. All footings on fill must be inspected by Canada Engineering Services Inc. staff to verify the recommended bearing pressures in this report.

Footings placed on fill should be reinforced with 2 - 15 mm diameter rebars placed horizontally and a minimum of 75 mm above the base of the footings. Where footings are constructed on engineered fill, we recommend only poured concrete basement walls be used and that these be reinforced with 2 - 15 mm bars, placed 150 mm above the footings and 150 mm below all window and door sills. The bars should be overlapped 500 mm along the footings and basement walls and should extend at least 600 mm beyond either side of the door and window openings.

Footings which are to be constructed next to each other at different elevations should be located far enough away, such that the slope from the bases of the adjacent sides of the footings is at least 10 horizontal to 7 vertical.

All footings exposed to frost action should be covered with at least 1.2 m of earth cover or an equivalent value of insulation.

The total and differential settlements from footings designed as per our recommendations above are expected to be less than 25 mm and 20 mm respectively.

EARTHQUAKE DESIGN FACTORS

According to the Ontario Building Code (2012), The Seismic Site Response Classification for strip and pad foundations at this site has been evaluated as Type D.

FLOOR SLAB CONSTRUCTION AND DRAINAGE

The floor slabs of the proposed townhouse blocks may be constructed as slab on grade providing all deleterious material such as topsoil and organics are removed and any soft areas replaced with an approved fill, compacted to 98% of the standard proctor maximum dry density (SPMDD).

A 100 mm thick layer of clear stone should be used immediately below the floor slab to serve as a moisture barrier. A perimeter weeping tile wrapped in filter cloth and surrounded top and sides with pea gravel should be used around the proposed buildings.

LATERAL EARTH PRESSURES ON BASEMENT WALLS

If basements are used, the basement walls should be designed for an earth pressure P, as given by:

$$P = 0.65\ Ka\ (\gamma H + q)$$

where P = Earth pressure at depth H
Ka= Coefficient of active earth pressure
γ = Unit weight of the soil behind the wall
H = depth of excavation
q = any surcharge load

The above expression assumes that free draining conditions exist behind the wall. This expression is for sandy soils. For this site the following values may be used:

	FILL	NATIVE UNDISTURBED SOIL
Wet unit Weight (γ) kN/cu. m	20.0	21.0
Coefficient of Earth Pressure at rest (Ko)	0.5	0.4
Coefficient of active earth pressure (Ka)	0.33	0.28
Coefficient of Passive earth pressure (Kp)	3.0	3.5

All temporary excavations should conform with the Ontario Occupational Health and Safety Act.

PAVEMENT DESIGN

The subgrade for pavement construction along trenched areas at this site is expected to be primarily compacted reworked silty sand till and silt and clay till on-site materials.

The following pavement structure thicknesses are recommended:

Minimum Pavement Design Thickness			
Pavement Layer	**Local Road**	**Collector Road**	**Major Collector**
Asphaltic Concrete	40 mm HL 3 50 mm HL 8 (OPSS Form 310)	40 mm HL3 65 mm HL8 (OPSS Form 310)	40 mm HL3 75 mm HL8 (OPSS Form 310)
Granular "A" Base	150 mm	150 mm	150 mm
Granular "B" Subbase	300 mm	400 mm	450 mm

The above pavement thickness assumes adequate positive drainage of the subbase, that dry condition prevails during the construction phase. The granular subbase thickness may require adjustment depending upon the subgrade soil condition, weather conditions during construction and the use by heavy construction traffic. If wet weather conditions and heaving and rolling of the subgrade occur, the subbase thicknesses may have to be increased substantially to obtain a stable pavement.

The upper 600 mm of the subgrade should be compacted to at least 98% SPMDD and below this, the compaction should be to 95% of the SPMDD. The granular subbase and base materials should be compacted to at least 100% SPMDD.

HDBC, Superpave 19, mm, 25mm and 37.5 mm mixes should be compacted to not less than 91% and not more than 97.5% of their Maximum Relative Densities. DFC and Superpave 12.5 mm FC mixes should be compacted to not less than 92% and not more than 98.5% of their Maximum Relative Densities. All other asphaltic concrete mixes should be compacted to not less than 92.5% and not more than 97.5% of their Maximum Relative Densities.

It is essential that the subgrade be properly crowned and graded to avoid ponding of water along its lengths and sides so as to drain towards catch basins. In preparing the final subgrade levels, it should be fine graded free from depressions, with the final compaction carried out by a smooth drum roller. All runoff water from the asphalt surface should also be channelled away from the edges of the pavements to catch basins or natural road side drains.

For pavement design directly above the parking garage, two layers of liquid waterproofing should be applied with a total thickness of 6 mm. These should be covered with protection boards. And then 6 mm crusher run screening with a minimum thickness of 50 mm over the paved areas. Paving should consist of 50 mm HL 8 base course followed by 40 mm HL 3 surface course asphaltic concrete. The same should apply for sodded areas without the crusher run limestone.

GENERAL COMMENTS

It is possible that the soil and water conditions between boreholes are quite different from those found at the borehole locations. Any interpretation of data for areas between boreholes should be viewed with this in mind. The accuracy of our report is limited to the findings at specific borehole locations.

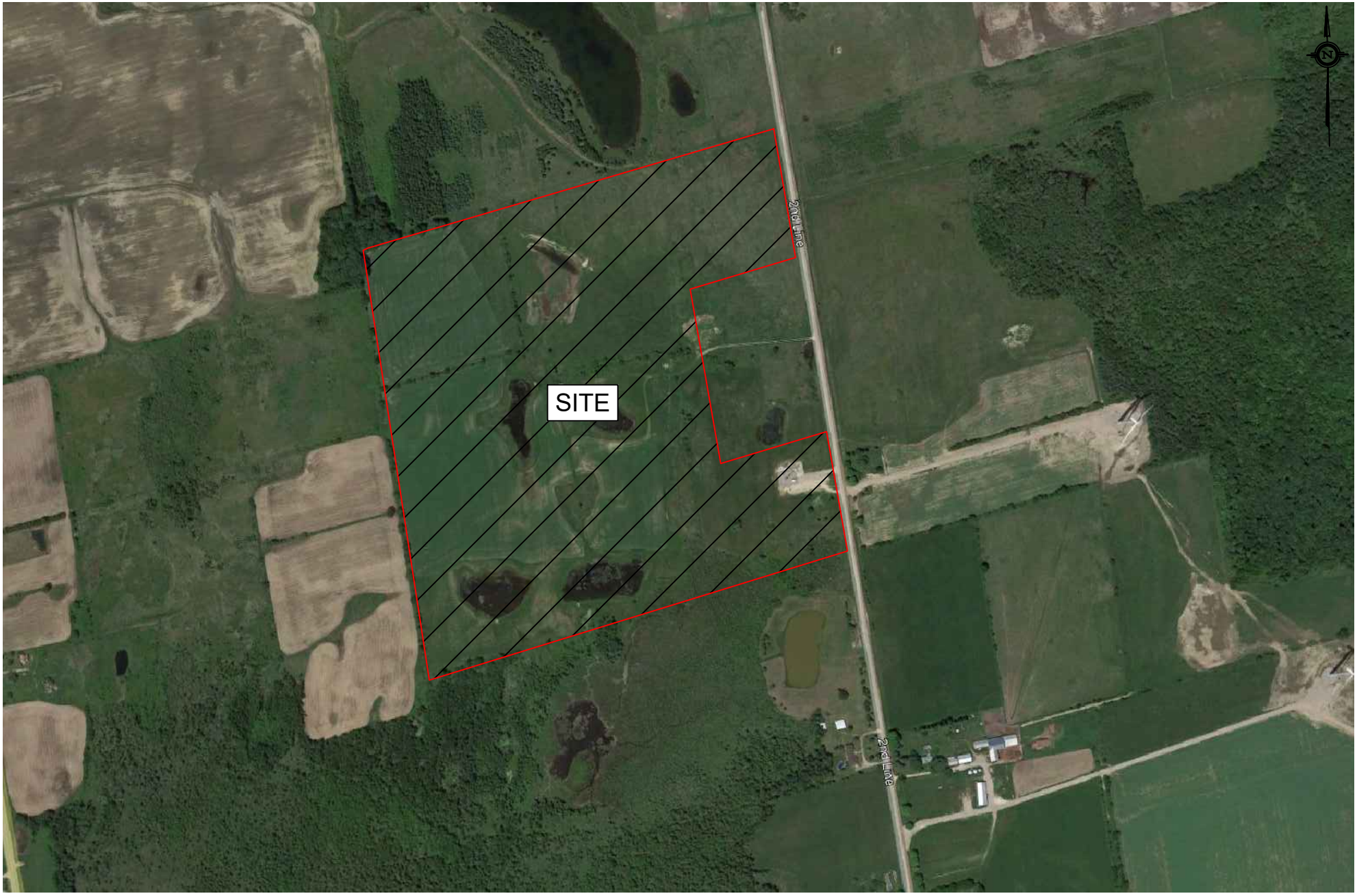
The inspections and reviews of data described above were carried out based on the terms of reference as outlined earlier in this report. It was prepared specifically for the use of The Cellular Connection Ltd., the owner. Contractors bidding on the site services should carry out their own investigations to determine how the soil conditions at this site will affect their performance.

This report was prepared from limited data of the proposed subdivision design. Should there be any design or construction changes that would require a review of the geotechnical analyses or any questions regarding the geotechnical aspects of any codes or standards, then this office should be consulted. This may necessitate a supplementary investigation and report for our recommendations to be reliable.

Sincerely,
CANADA ENGINEERING SERVICES INC.

Lawrence Yu, P. Eng.
Senior Project Engineer

Ram Jagdat. P. Eng.
Consulting Engineer
Principal



CLIENT: THE CELLULAR CONNECTION LTD. 514504 LINE 2, AMARANTH, ONTARIO L0N 1L0	PROJECT: GEOTECHNICAL INVESTIGATION 514504 LINE 2, AMARANTH, ONTARIO L0N 1L0	TITLE: KEYPLAN SHOWING SITE AND SURROUNDING AREA	SCALE: AS SHOWN DRAWING NO: 1	DATE: JAN / 2024 PROJECT NO 230114

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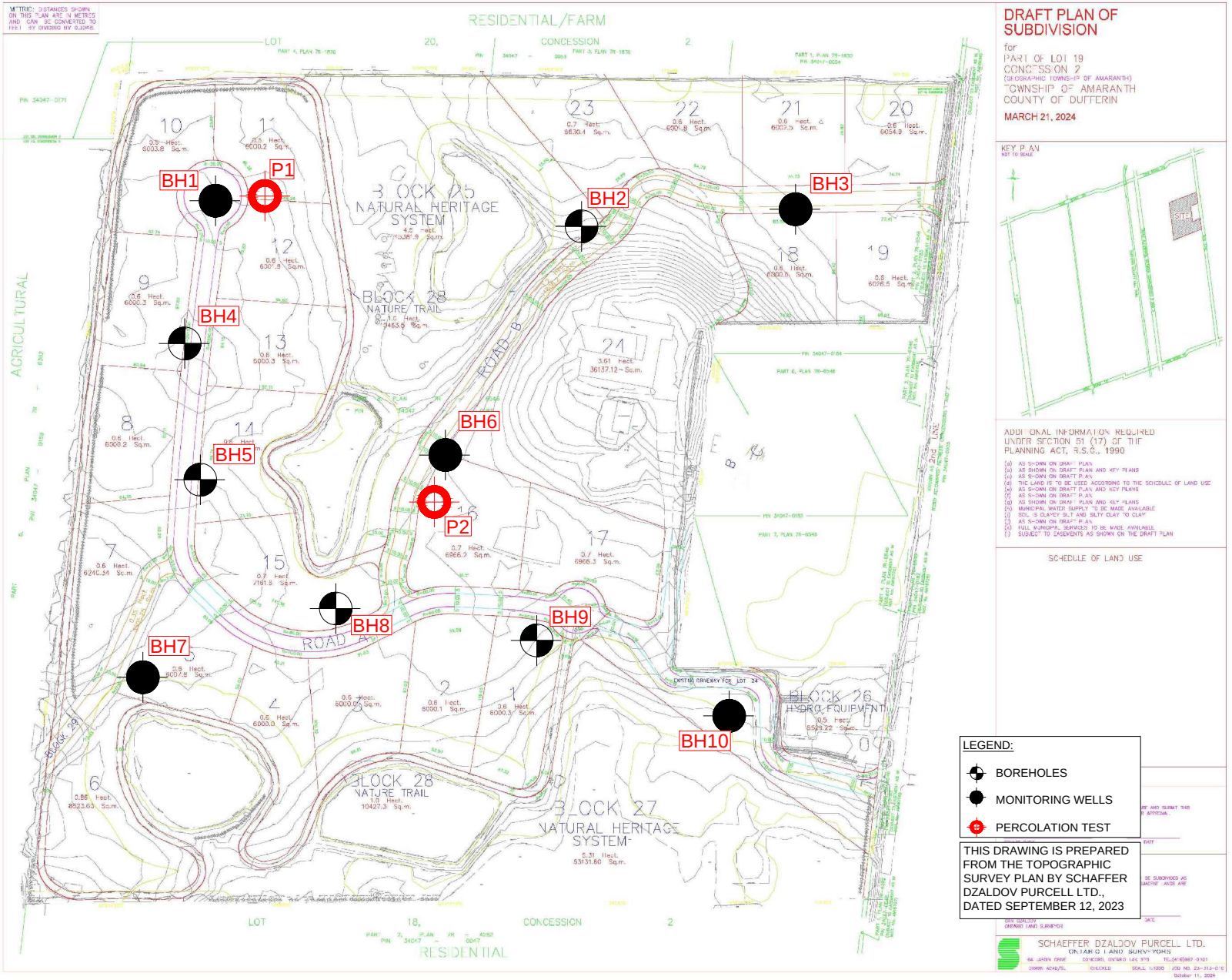

CLIENT: THE CELLULAR CONNECTION LTD. 514504 LINE 2, AMARANTH, ONTARIO L0N 1L0	PROJECT: HYDROGEOLOGICAL INVESTIGATION 514504 LINE 2, AMARANTH, ONTARIO L0N 1L0	TITLE: BOREHOLES/MONITORING WELLS AND PERCOLATION TEST LOCATIONS	SCALE: AS SHOWN DATE: OCT / 2024 DRAWING NO: 2 PROJECT NO 230114

CANADA ENGINEERING SERVICES INC.
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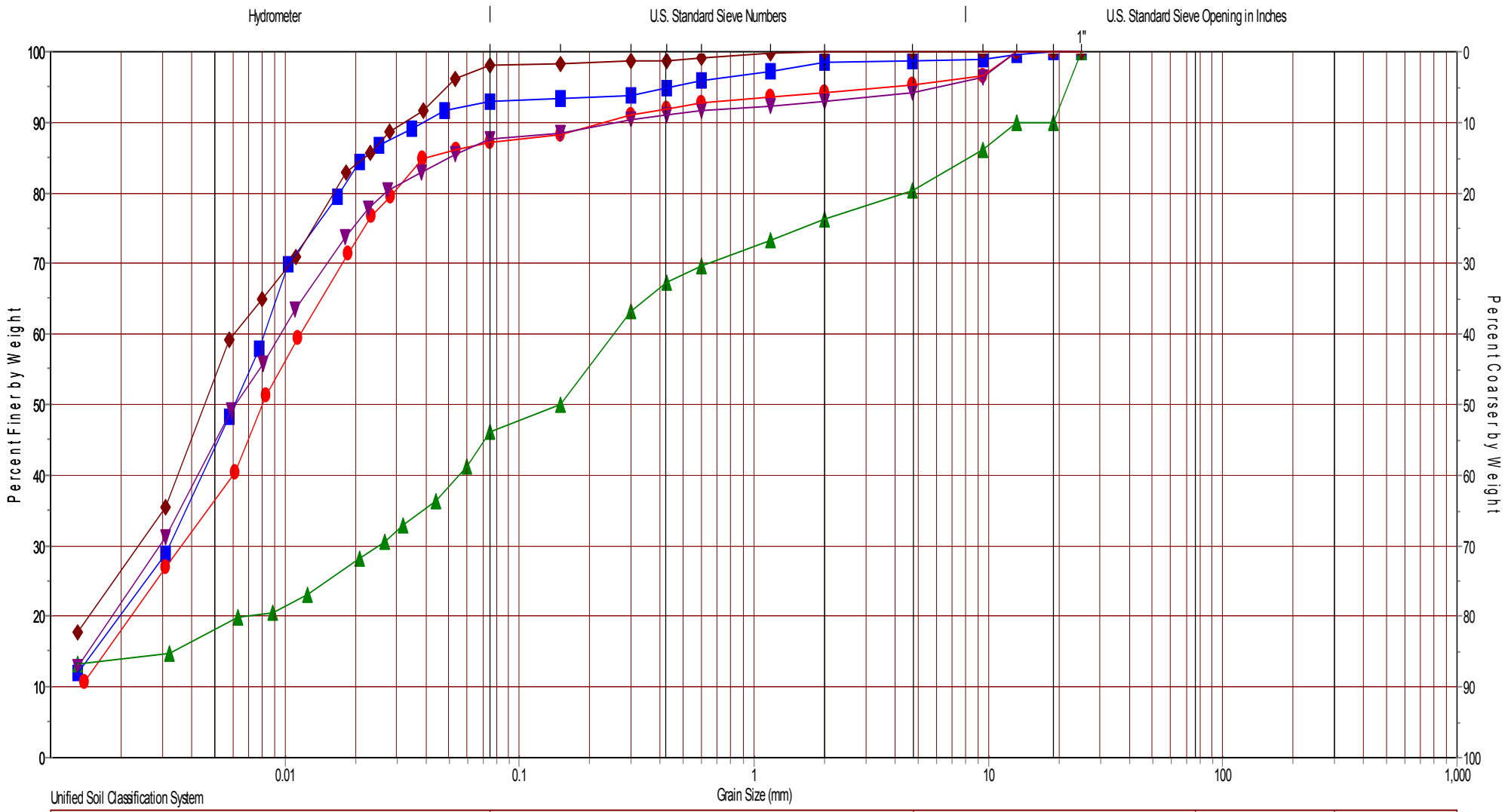
Figure 1	Project No.: 230114	GRAINSIZE DISTRIBUTION GRAPH
	Location: 514504 Line 2	Tested By: DA
	Client: The Cellular Connection Ltd.	Test Date: 31-Oct-2023

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
■	BH1 SA3	29.0	64.0	1.1	4.7	0.3	1.3	0.0	0.0
●	BH1 SA5	27.0	60.2	3.9	3.2	1.1	4.8	0.0	0.0
▲	BH1 SA7	14.9	31.3	17.2	13.0	4.1	9.7	10.1	0.0
▼	BH2 SA3	31.1	56.6	2.9	2.6	1.2	5.9	0.0	0.0
◆	BH2 SA4	35.4	62.8	0.5	1.3	0.1	0.0	0.0	0.0

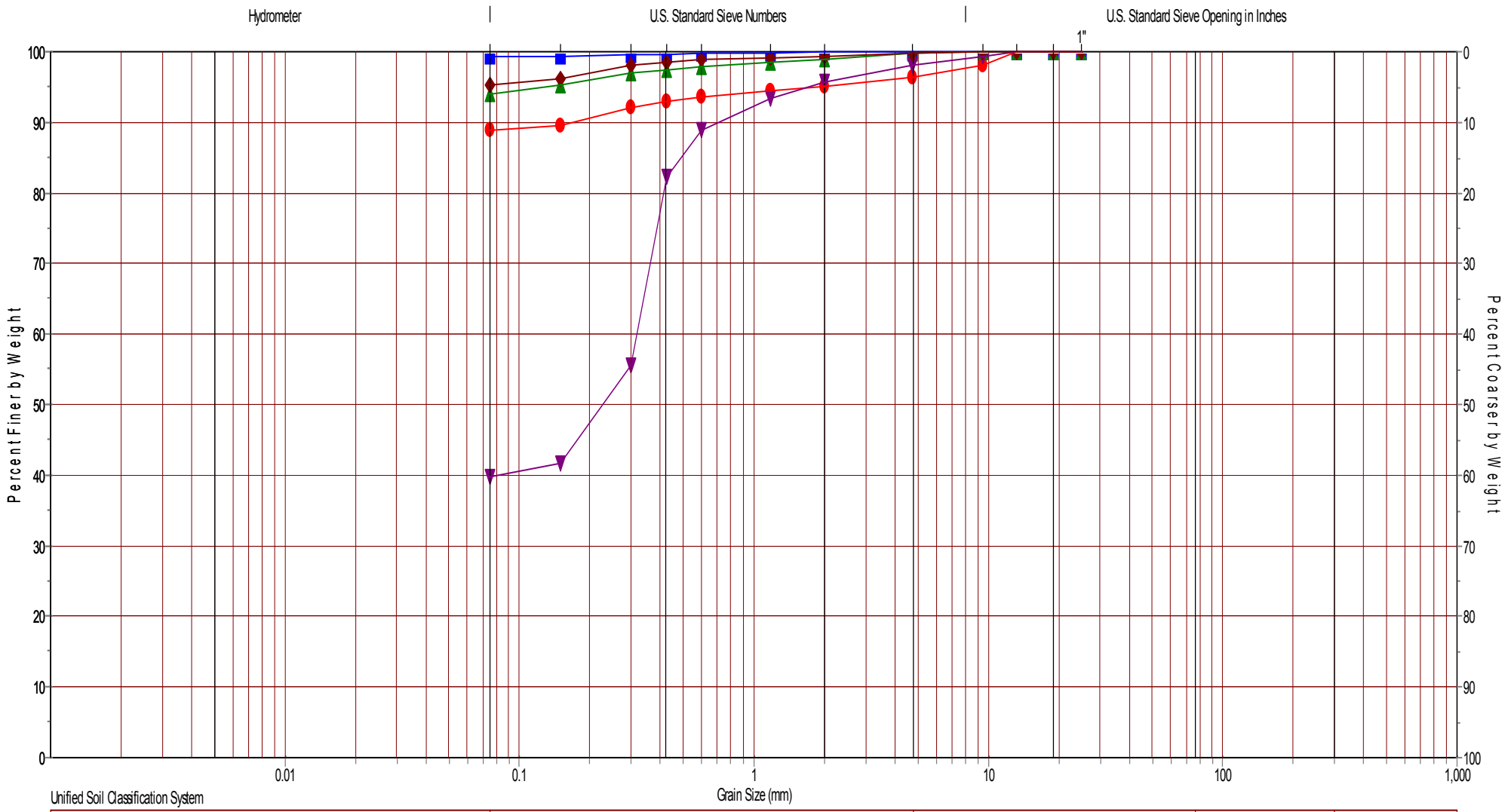


Unified Soil Classification System

SILT or CLAY		SAND			GRAVEL		COBBLES	BOULDERS
Clay	Silt	fine	medium	coarse	fine	coarse		

Figure 2	Project No.: 230114	GRAINSIZE DISTRIBUTION GRAPH
	Location: 514504 Line 2, Amaranth	Tested By: DA
	Client: The Cellular Connection Ltd.	Test Date: 31-Oct-2023

Symbol	Sample No.	% Clay	% Silt	% Fine Sand	% Medium Sand	% Coarse Sand	% Fine Gravel	% Coarse Gravel	% Cobbles
■	BH6 SA5	<99.3	<99.3	0.3	0.4	0.0	0.0	0.0	0.0
●	BH6 SA8	<88.9	<88.9	3.2	3.0	1.2	3.8	0.0	0.0
▲	BH7 SA5	<94.1	<94.1	3.1	2.1	0.9	0.3	0.0	0.0
▼	BH10 SA4	<39.9	<39.9	15.9	40.1	2.4	2.0	0.0	0.0
◆	BH10 SA6	<95.4	<95.4	2.9	1.2	0.4	0.3	0.0	0.0



Unified Soil Classification System

SILT or CLAY		SAND			GRAVEL		COBBLES	BOULDERS
Clay	Silt	fine	medium	coarse	fine	coarse		

CANADA ENGINEERING SERVICES INC

Consulting Engineers - Geotechnical, Environmental and Structural

Atterberg Limits Data Sheet

ASTM D4318-10

Project Name:	Proposed Subdivision	**Date:**	10-Nov-2023
Location:	514504 Line 2, Amaranth	**Tested By:**	MK
Sample No	BH1 SA3	**Test Number:**	1
Sample Depth:	1.5 m		

USCS Soil Classification: SILT AND CLAY TILL, TRACE TO SOME SAND, TRACE GRAVEL

TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					37	30	24	18
Can Number	---	---	4	55	3		22	12	13	9
Mass of Empty Can	M_C	(g)	31.60	31.18	31.04		31.55	31.12	31.43	34.75
Mass Can & Soil (Wet)	M_{CMS}	(g)	35.28	34.12	35.57		42.10	52.71	49.79	58.38
Mass Can & Soil (Dry)	M_{CDS}	(g)	34.64	33.58	34.78		39.59	47.58	45.33	52.45
Mass of Soil	M_S	(g)	3.04	2.40	3.74		8.04	16.46	13.90	17.70
Mass of Water	M_W	(g)	0.64	0.54	0.79		2.51	5.13	4.46	5.93
Water Content	w	(%)	21.1	22.5	21.1		31.2	31.2	32.1	33.5

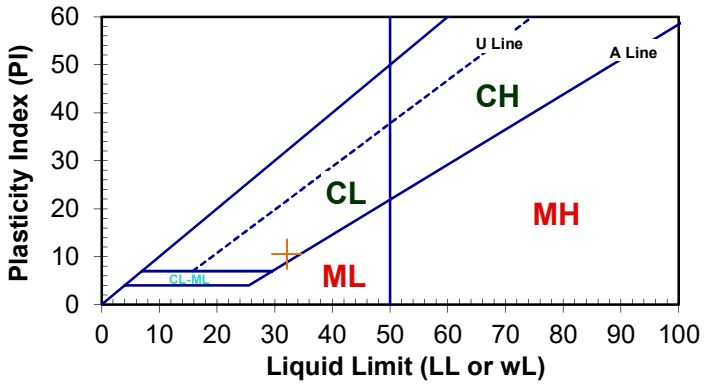
Liquid Limit (LL or w_L) (%):	**32.1**
Plastic Limit (PL or w_P) (%):	**21.6**
Plasticity Index (PI) (%):	**10.5**
USCS Classification:	**CL**

LOW TO MEDIUM PLASTIC CLAY

PI at "A" Line = 0.73(LL-20)

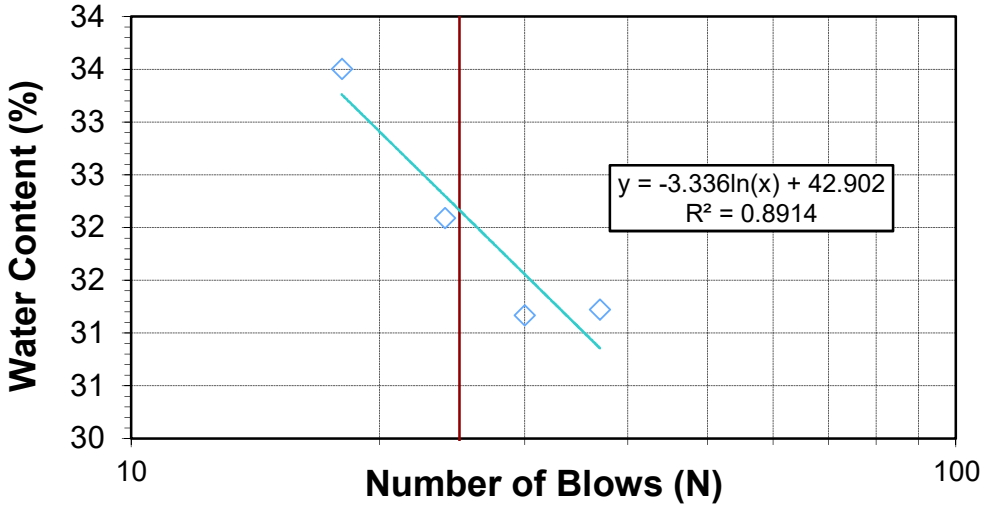
One Point Liquid Limit Calculation:

$LL = w_n (N/25)^{0.12}$



PROCEDURE USED

- ☐ Wet Preperation Multipoint
- ☐ Dry Preperation Multipoint
- ☐ Procedure A Multipoint
- ☐ Procedure B One-Point



Project No: 230114

Log of Borehole No. 1

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Location: 514504 Line 2, Amaranth, Ontario

Technologist: MK

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	WELL	Standard Penetration Test (10 20 30 40 50)	Moisture Content % (10 20 30 40 50)
	Ground Surface	490.20							
0 / 0	**TOPSOIL** Grey topsoil, organics, wet, loose	489.90	1	SS	14	50			37.05
1 / 0	**SILT AND CLAY TILL (CL)** Brown silt and clay till, trace to some sand, trace gravel, wet, stiff to very stiff PPR at 0.6 m = 400 kPa PPR at 1.06 m = 400 kPa PPR at 1.8 m = 400 kPa		2	SS	22	100			17.51
2 / 1			3	SS	22	100			23.56
3 / 1	PPR at 2.6 m = 250 kPa		4	SS	13	100			24.83
4 / 2			5	SS	11	100			28.78
5 / 3	PPR at 3.4 m = 200 kPa	485.63							
6 / 4	**SILTY SAND TILL** Brown to grey silty sand till, some clay, some gravel, moist, compact to very dense PPR at 4.9 m = 250 kPa		6	SS	26	100			6.54
7 / 5			7	SS	28	100			8.65
8 / 6	PPR at 6.4 m = 200 kPa								
9 / 7	Turned grey at 7.6 m								
10 / 8	PPR at 7.9 m = 300 kPa		8	SS	100	100			7.95
11 / 9	PPR at 9.3 m > 450 kPa	480.75	9	SS	100	60			8.36
12 / 10	**END OF BOREHOLE** Borehole completely open upon completion Water level upon completion = 6.28 m Water level on November 3, 2023 = 5.81 m PPR = Pocket Penetrometer Reading								

WELL: BENTONITE SEAL; SAND FILL

Drill Method: Track mounted drill rig

Drill Date: October 18, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 2

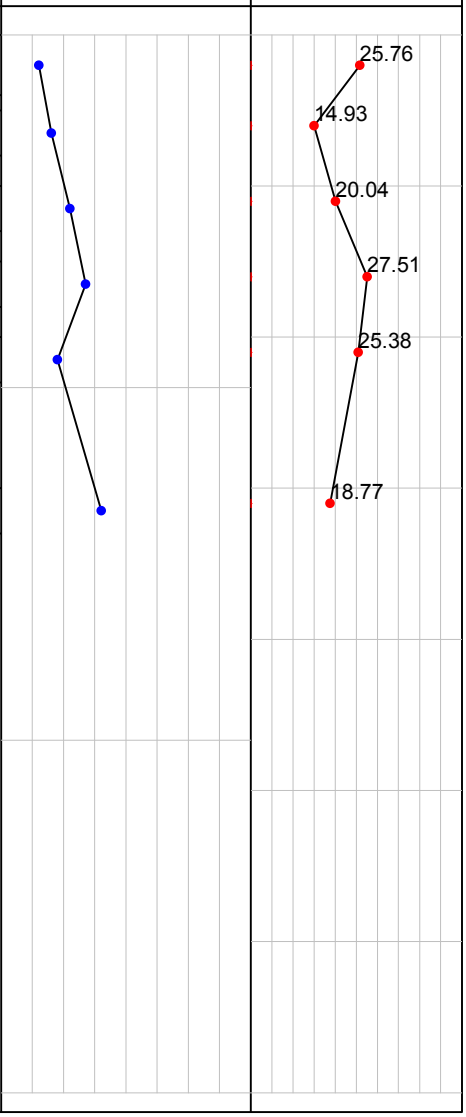
Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Engineer: MK

Location: 514504 Line 2, Amaranth, Ontario

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY
0 / 0	Ground Surface	487.00				
0–3 / 0–1	**TOPSOIL** Grey topsoil, organics, wet, compact	486.09	1	SS	12	100
3–7 / 1–2	**SILTY SAND TILL** Brown to grey silty sand till, some clay, trace gravel, wet, compact PPR at 1.06 m = 300 kPa PPR at 1.8 m = 450 kPa	484.71	2 3	SS SS	16 22	100 100
7–16 / 2–5	**SILT AND CLAY TILL (CL)** Mottled grey-brown silt and clay till, trace to some sand, trace gravel, moist to wet, very stiff PPR at 2.6 m = 400 kPa PPR at 3.4 m = 350 kPa Turned grey at 4.6 m PPR at 4.9 m = 450 kPa	481.97	4 5 6	SS SS SS	27 18 32	100 100 100
16–35 / 5–10	**END OF BOREHOLE** Borehole completely open and dry upon completion PPR = Pocket Penetrometer Reading					



Drill Method: Track mounted drill rig

Drill Date: October 19, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 3

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Location: 514504 Line 2, Amaranth, Ontario

Technologist: MK

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	WELL	Standard Penetration Test (10 20 30 40 50)	Moisture Content % (10 20 30 40 50)
0 / 0	Ground Surface	485.00							
0–3 / 0–1	**SILTY SAND** Brown silty sand, some clay, wet, compact		1	SS	11	100			24.99
3 / 1		484.24							
3–6 / 1–2	**PEAT** Black peat, wet, loose		2	SS	9	100			24.64
6–10 / 2–3	**SILT AND CLAY TILL (CL)** Mottled brown-grey silt and clay till, trace to some sand, trace gravel, wet, stiff to very stiff PPR at 1.8 m = 300 kPa PPR at 2.6 m = 400 kPa		3	SS	10	100			24.09
			4	SS	13	100			19.46
10 / 3	PPR at 3.4 m = 300 kPa		5	SS	15	100			28.42
15 / 4	PPR at 4.9 m = 400 kPa		6	SS	17	100	BENTONITE SEAL		17.3
20 / 6	PPR at 6.4 m = 75 kPa		7	SS	11	100			15.25
25 / 7	PPR at 7.9 m = 300 kPa		8	SS	60	100	SAND FILL		19.01
30 / 9	PPR at 9.3 m = 400 kPa		9	SS	27	100			19.23
31 / 9		475.40							
32 / 10	**END OF BOREHOLE** Borehole completely open upon completion Water level upon completion = 8.53 m Water level on November 3, 2023 = 1.09 m PPR = Pocket Penetrometer Reading								

Drill Method: Track mounted drill rig

Drill Date: October 20, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 4

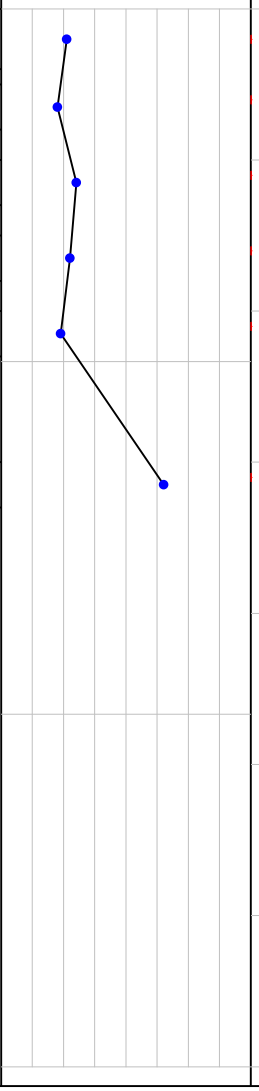
Project: Proposed Subdivision

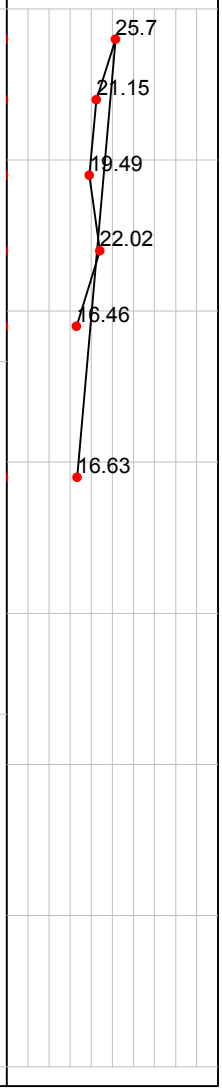
Client: The Cellular Connection Ltd.

Engineer: MK

Location: 514504 Line 2, Amaranth, Ontario

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY
0 / 0	Ground Surface	490.80				
0 – 1	**TOPSOIL** Grey topsoil, organics, wet, compact	490.50	1	SS	21	100
1 – 3	**SILT AND CLAY TILL (CL)** Mottled grey-brown silt and clay till, trace to some sand, trace gravel, moist to wet, very stiff PPR at 0.6 m = 400 kPa PPR at 1.06 m > 450 kPa PPR at 1.8 m > 450 kPa		2	SS	18	100
2 – 4			3	SS	24	100
4 – 5	PPR at 2.6 m = 350 kPa		4	SS	22	100
5 – 6	PPR at 3.4 m = 350 kPa		5	SS	19	100
6 – 7	Turned grey at 4.6 m PPR at 4.9 m = 450 kPa					
7 – 8		485.77	6	SS	52	100
8 – 10	**END OF BOREHOLE** Borehole completely open and dry upon completion PPR = Pocket Penetrometer Reading					





Drill Method: Track mounted drill rig

Drill Date: October 18, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 5

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Engineer: MK

Location: 514504 Line 2, Amaranth, Ontario

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	SPT (10 20 30 40 50 60 70)	Moisture Content (% 10 20 30 40)
0 / 0	Ground Surface	490.56						
0–2 / 0	**TOPSOIL** Grey topsoil, organics, wet, compact	490.10	1	SS	19	100		19.34
2–5 / 1	**SILT AND CLAY TILL (CL)** Mottled grey-brown silt and clay till, trace to some sand, trace gravel, moist to wet, very stiff PPR at 0.6 m = 450 kPa PPR at 1.06 m > 450 kPa		2	SS	49	100		22.14
5–6 / 2	PPR at 1.8 m > 450 kPa		3	SS	28	100		16.9
8–9 / 2	PPR at 2.6 m > 450 kPa		4	SS	36	100		20.6
10–11 / 3	PPR at 3.4 m = 450 kPa Turned grey at 3.5 m		5	SS	28	100		25.74
13–15 / 4	PPR at 4.9 m = 450 kPa							
16 / 5		485.53	6	SS	39	100		15.75
17–35 / 5–10	**END OF BOREHOLE** Borehole completely open and dry upon completion PPR = Pocket Penetrometer Reading	479.89						

Drill Method: Track mounted drill rig

Drill Date: October 18, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 6

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Location: 514504 Line 2, Amaranth, Ontario

Technologist: MK

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	WELL
0 / 0	Ground Surface	490.15					
0 – 1	**TOPSOIL** Grey topsoil, organics, wet, loose		1	SS	16	100	
1 – 2	**SILT AND CLAY TILL (CL)** Mottled brown-grey silt and clay till, trace to some sand, trace gravel, wet, very stiff to hard PPR at 0.6 m = 300 kPa PPR at 1.1 m = 400 kPa PPR at 1.8 m = 400 kPa		2	SS	28	100	
2 – 3	PPR at 2.6 m = 350 kPa		3	SS	22	100	
3 – 4	Turned grey at 3.3 m PPR at 3.4 m = 350 kPa		4	SS	21	100	
4 – 5	PPR at 4.9 m = 350 kPa		5	SS	21	100	
5 – 6	PPR at 6.4 m = 300 kPa		6	SS	23	100	
6 – 7	PPR at 7.9 m = 350 kPa		7	SS	18	100	
7 – 8	PPR at 9.3 m = 300 kPa		8	SS	27	100	
8 – 9		480.55	9	SS	68	100	
9 – 10	**END OF BOREHOLE** Borehole completely open upon completion Water level upon completion = 8.53 m Water level on November 3, 2023 = 2.61 m PPR = Pocket Penetrometer Reading						

WELL: BENTONITE SEAL; SAND FILL

Standard Penetration Test (10 20 30 40 50)

Moisture Content (% — 10 20 30 40 50)

Depth (m)	Moisture Content (%)
0.5	14.06
1.1	22.81
1.7	23.39
2.3	23.42
3.0	25.16
4.0	25.74
5.0	27.1
6.5	14.93
7.5	20.45

Drill Method: Track mounted drill rig

Drill Date: October 19, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 7

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Location: 514504 Line 2, Amaranth, Ontario

Technologist: MK

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	WELL	Standard Penetration Test (10 20 30 40 50)	Moisture Content % (10 20 30 40 50)
0 / 0	Ground Surface	490.45							
0–2 / 0	**TOPSOIL** Grey topsoil, organics, wet, loose	489.84	1	SS	12	100			28.53
2–7 / 0–2	**SILTY SAND TILL** rey to brown silty sand till, some clay, trace gravel, moist, dense PPR at 1.06 m > 450 kPa PPR at 1.8 m > 450 kPa	488.16	2 3	SS SS	47 42	100 100			9.12 7.07
7–30 / 2–9	**SILT AND CLAY TILL (CL)** Brown to grey silt and clay till, trace to some sand, trace gravel, wet, very stiff to hard PPR at 2.6 m > 450 kPa Turned grey at 3.0 m PPR at 3.4 m > 450 kPa PPR at 4.9 m = 350 kPa PPR at 6.4 m = 200 kPa PPR at 7.9 m> 450 kPa	481.31	4 5 6 7 8	SS SS SS SS SS	32 25 21 17 86	100 100 100 100 100	BENTONITE SEAL SAND FILL		22.26 19.78 20.44 21 12.49
30–33 / 9–10	**SILTY SAND TILL** Grey silty sand till, some clay, trace gravel, moist, very dense PPR at 9.3 m > 450 kPa	480.85	9	SS	62	100			7.38
33–37 / 10–11	**END OF BOREHOLE** Borehole completely open and dry upon completion Water level on November 3, 2023 = 3.90 m PPR = Pocket Penetrometer Reading								

Drill Method: Track mounted drill rig

Drill Date: October 19, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 8

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Engineer: MK

Location: 514504 Line 2, Amaranth, Ontario

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY
0 / 0	Ground Surface	489.74				
0–3 / 0–1	**TOPSOIL** Grey topsoil, organics, wet, compact	488.83	1	SS	10	100
3–7 / 1–2	**SILT AND CLAY TILL (CL)** Mottled grey-brown silt and clay till, trace to some sand, trace gravel, moist to wet, stiff to very stiff PPR at 1.06 m = 300 kPa PPR at 1.8 m = 300 kPa	487.45	2 3	SS SS	11 16	100 100
7–15 / 2–4	**SILTY SAND TILL** Brown silty sand till, some clay, some gravel, wet, dense to compact PPR at 2.6 m > 450 kPa PPR at 3.4 m = 450 kPa	485.17	4 5	SS SS	35 27	100 100
15–16 / 4–5	**SILT AND CLAY TILL (CL)** Grey silt and clay till, some sand, trace gravel, wet, hard PPR at 4.9 m = 450 kPa	484.71	6	SS	36	100
16–35 / 5–10	**END OF BOREHOLE** Borehole completely open upon completion Water level upon completion = 4.26 m PPR = Pocket Penetrometer Reading	479.07				

SPT
10 20 30 40 50 60 70

Moisture Content
% 10 20 30 40

Depth (m)	Moisture Content (%)
0	36.96
1	25.95
2	19.18
3	10.85
4	11.86
5	21.87

Drill Method: Track mounted drill rig

Drill Date: October 19, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 9

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

Engineer: MK

Location: 514504 Line 2, Amaranth, Ontario

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY
0 / 0	Ground Surface	489.87				
0–3 / 0–1	**TOPSOIL** Grey topsoil, organics, wet, compact		1	SS	11	100
3–5 / 1–1.5	**SILTY SAND TILL** Brown silty sand till, some clay, some gravel, wet, compact PPR at 1.06 m = 300 kPa	488.35	2	SS	22	100
5–16 / 1.5–5	**SILT AND CLAY TILL (CL)** Grey silt and clay till, some sand, trace gravel, wet, very stiff PPR at 1.8 m = 300 kPa PPR at 2.6 m = 300 kPa PPR at 3.4 m = 300 kPa PPR at 4.9 m = 350 kPa	484.84	3 4 5 6	SS SS SS SS	17 24 21 27	100 100 100 100
16 / 5	**END OF BOREHOLE** Borehole completely open and dry upon completion PPR = Pocket Penetrometer Reading	479.20				

SPT: 10 20 30 40 50 60 70

Moisture Content (%): 10 20 30 40

Depth (m)	Moisture Content (%)
1	15.2
2	16.24
3	18.56
4	17.5
5	17.67
6	23.04

Drill Method: Track mounted drill rig

Drill Date: October 19, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Project No: 230114

Log of Borehole No. 10

Project: Proposed Subdivision

Client: The Cellular Connection Ltd.

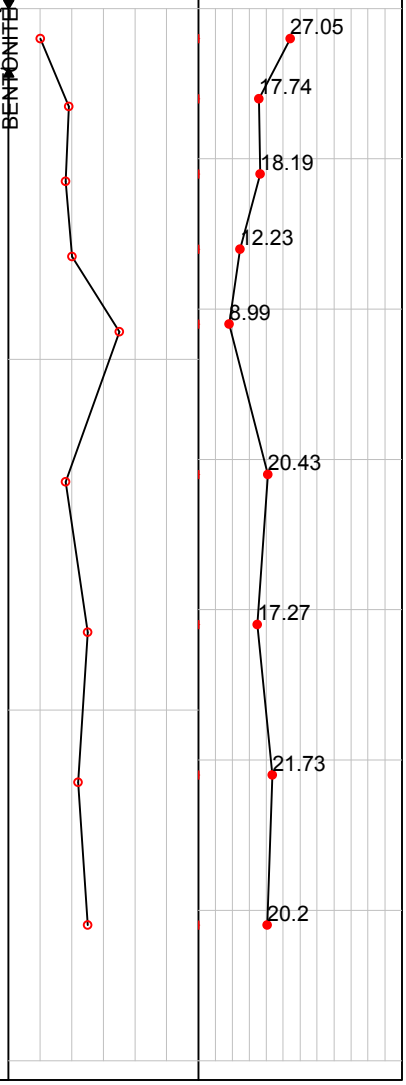
Location: 514504 Line 2, Amaranth, Ontario

Technologist: MK

Depth (ft / m)	Description	Depth/Elev.	NUMBER	Sample Type (SS)	Blows/ft	RECOVERY	WELL
	Ground Surface	487.90					
0 / 0	**TOPSOIL** Grey topsoil, organics, wet, loose	487.60	1	SS	10	100	BENTONITE SEAL
1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 1 / 2 / 3	**VARVED SILTY CLAY AND SILTY SAND** Mottled grey-brown silty clay interbedded with silty sand with gravel sizes, wet, compact PPR at 0.6 m = 150 kPa PPR at 1.06 m = 400 kPa PPR at 1.8 m = 400 kPa PPR at 2.6 m = 400 kPa		2 3 4	SS SS SS	19 18 20	100 100 100	SAND FILL
11 / 12 / 13 / 14 / 15 / 16 / 17 / 18 / 19 / 20 / 21 / 22 / 23 / 24 / 25 / 26 / 27 / 28 / 29 / 30 / 31 / 4 / 5 / 6 / 7 / 8 / 9	**SILT AND CLAY TILL (CL)** Brown to grey silt and clay till, trace to some sand, trace gravel, wet, very stiff PPR at 3.4 m = 200 kPa Turned grey at 4.9 m PPR at 4.9 m = 200 kPa PPR at 6.4 m = 350 kPa PPR at 7.9 m = 300 kPa PPR at 9.3 m > 450 kPa	484.55 478.45	5 6 7 8 9	SS SS SS SS SS	35 18 25 22 25	60 50 60 50 0	
32 / 33 / 34 / 35 / 10	**END OF BOREHOLE** Borehole open up to 2.1 m upon completion Water level upon completion = 2.0 m Water level on November 3, 2023 = 1.38 m PPR = Pocket Penetrometer Reading						

Standard Penetration Test (10 20 30 40 50)

Moisture Content (% — 10 20 30 40 50)



Drill Method: Track mounted drill rig

Drill Date: October 20, 2023

Hole Size: 150 mm diameter

Canada Engineering Services Inc.
39 Davisbrook Blvd.
Scarborough, Ontario
M1T 2H6

Checked By: RJ

Datum: Geodetic Elevations from Topographic Survey Map by Schaeffer Dzaldov Purcell Ltd., Dated September 12, 2023

Appendix A

GEOTECHNICAL SYMBOLS AND TERMS USED IN BOREHOLE/TEST PIT LOGS

Soil Description

Terminology describing soil types:

Topsoil	-	Mixture of soil and humus capable of supporting good vegetative growth
Peat	-	Fibrous fragments of visible and invisible decayed organic matter
Till	-	Unstratified and unsorted glacial deposit which may include any particle sizes Such as clay, silt, sand, stone, cobbles and boulders
Fill	-	Materials not identified as deposited by natural geological processes

Terminology describing soil structure:

Desiccated	-	Having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	-	Material breaks along plane of fracture
Varved	-	Composed of regular alternating layers of silt and clay
Laminated	-	Alternating layers of beds less than 6 mm thick
Stratified	-	Alternating layers of beds greater than 6 mm thick
Blocky	-	Material can be broken into small and hard angular lumps
Lensed	-	Irregular shaped pockets of soil having different particle size, texture, or colour from materials above and below
Well Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes
Uniformly Graded		Predominantly one grain size

Soil descriptions and classification are based on the Unified Soil Classification System (USCS) (ASTM D-2488), which classifies soils on the basis of engineering properties. The system divides soils into three major categories: (1) coarse grained, (2) fine-grained, and (3) highly organic. The soil is then subdivided based on either gradation or plasticity characteristics. This system provides a group symbol (eg. SM) and group name (eg. silty sand) for identification. The classification excludes particles larger than 76 mm.

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

Trace	- Trace sand, trace silt, etc.	Less than 10%
Some	- Some sand, some silt, etc.	10 - 20%
Adjective	- Gravelly, sandy, silty, clayey, etc.	20 - 30%
“And”	- and gravel, and silt, etc.	> 35%
Noun	- Gravel, Sand, Silt, Clay	> 35% and main fraction

The standard terminology to describe cohesionless soils includes the compactness as determined by the Standard Penetration Test “N” -value.

Compactness	**“N” Value**
Very Loose	< 4
Loose	4 - 10
Compact	10 - 30
Dense	30 - 50
Very Dense	> 50

GEOTECHNICAL SYMBOLS AND TERMS USED IN BOREHOLE/TEST PIT LOGS

The standard terminology to describe cohesive soils includes consistency, which is based on undrained shear strength as measured by in-situ vane tests, penetrometer tests, unconfined compression tests or similar field and laboratory analysis. Standard Penetration Test "N" values can also be used to provide an approximate indication of the consistency and shear strength of fine grained, cohesive soils.

Consistency	Undrained Shear Strength (kPa)	"N" Value	Field Identification
Very Soft	< 12.5	< 2	Easily penetrated several cm by the fist
Soft	12.5 - 25	2 - 4	Easily penetrated several cm by the thumb
Firm	25 - 50	4 - 8	Can be penetrated several cm by the thumb with moderate effort
Stiff	50 - 100	8 - 15	Readily indented by the thumb but penetrated only with great effort
Very Stiff	100 - 200	15 - 30	Readily indented by the thumb nail
Hard	> 200	> 30	Indented with difficulty by the thumbnail

Note: "N" Value - The Standard Penetration Test records the number of blows of a 140 lb (64 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler 1 foot (305 mm). For split spoon samples where full penetration is not achieved, the number of blows is reported over the sampler penetration in millimeters (eg. 50/75).

STRATA PLOT

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

Asphalt Concrete Topsoil Fill Peat Clay Silt Sand Gravel

WATER LEVEL MEASUREMENTS

Open Borehole or Test Pit

Monitoring Well, Piezometer or Standpipe

SAMPLE TYPE

SS Split spoon sample (obtained from the Standard Penetration Test)

AS Auger sample

ST Thin Wall Sample or Shelby Tube

VS Shovel sample