May 24, 2023

David Elsie
Manager of Transfer and Processing Facility
Drain-All Ltd
2705 Stevenage Drive
Ottawa, Ontario

Via Email: David.Elsie@drainall.com

Project Name: **Geotechnical Investigation – Slope Stability Analysis in Support of Zoning By-Law Amendment, 4380 Trail Road, Ottawa, Ontario**

EXP Project Number: **OTT-21023795-A0**

EXP Services Inc. (EXP) is pleased to present the results of the slope stability analysis to assess the stability of the existing slopes at the Drain-all Ltd. Transferring and Processing Facility located at 4380 Trail Road, Ottawa, Ontario (Figure 1). The work was completed in accordance with our proposal dated March 30, 2022 and accepted on April 4, 2022.

EXP understands that Drain-All Ltd. has been managing inert fill and clean soil at the 4380 Trail Road Landfill site since 2013. The property covers an area of approximately 4.3 hectares and is located east of the closed Nepean Landfill site and directly south of the current operating Trail Road Landfill Site. It is understood that the facility is to be infilled with inert fill in staged phases. To demonstrate that the site is geotechnically suitable for the proposed use (i.e., current condition, various stages of infill, and final site rehabilitation) a slope stability study is required. Field work to include three boreholes/monitoring wells which are coupled with groundwater monitoring program. At this time, plans are under development for the infilling and final site rehabilitation. Therefore, only the existing conditions can be analyzed at this stage.

1.0 Scope of Work

The geotechnical investigation was undertaken to:

i. Establish the subsurface conditions at three (3) boreholes located at the site;

ii. Assess the stability of the existing slopes; and,

iii. Provide recommendation on any slope stabilization required prior to the commencement of any filling operations.

2.0 Procedure

The fieldwork for the geotechnical investigation was undertaken on May 12 and 13, 2022, and consisted of drilling three (3) boreholes (Boreholes MW-05, MW-06, and MW-07). The sampling in the boreholes was undertaken from the ground surface and was advanced to termination at 6.7 m to 9.8 m depth (Elevation 94.1 m to Elevation 93.3 m). The borehole locations are shown in Figure 2. The fieldwork was supervised on a full-time basis by EXP. The elevations of the boreholes refer to the Geodetic datum.

The boreholes were cleared of private and public underground services, prior to the start of drilling operations. The boreholes were drilled using a CME-850 track mounted drill rig equipped with continuous

flight hollow stem auger and wash-boring equipment. Standard penetration tests (SPTs) were performed in all the boreholes at 0.75 m depth intervals with soil samples retrieved by the split-barrel sampler. The soil conditions in each borehole were logged based on visual examination of the soil samples. The soil samples were placed in plastic bags and labelled. Standpipes (50 mm diameter) with slotted section were installed in all three boreholes for long-term monitoring of the groundwater levels. The standpipes were installed in accordance with EXP standard practice, and the installation configuration is documented on the respective borehole logs. The boreholes were backfilled upon completion of drilling and the installation of the standpipes.

All the soil samples were visually examined in the field, logged, preserved in plastic bags and identified. On completion of the fieldwork, all the samples were transported to the EXP laboratory in the City of Ottawa where they were visually examined by a geotechnical engineer and detailed borehole logs prepared. Geotechnical laboratory testing consisted of performing natural moisture content tests on all the retrieved soil samples as well as grain size analyses on select soil samples.

3.0 Subsurface Conditions and Groundwater Levels

A detailed description of the geotechnical conditions encountered in the borehole is presented in the attached borehole logs, Figures 3 to 5 inclusive. The borehole logs and related information depict subsurface conditions only at the specific location and times indicated. Subsurface conditions and water levels at other locations may differ from conditions at the locations where sampling was conducted. The passage of time may also result in changes in the conditions interpreted to exist at the locations where sampling was conducted.

The boreholes were drilled to provide representation of subsurface conditions as part of a geotechnical exploration program and is not intended to provide evidence of potential environmental conditions.

It should be noted that the soil boundaries indicated on the borehole logs are intended to reflect approximate transition zones for the purpose of geotechnical design and should not be interpreted as exact planes of geological change. The “Notes on Sample Descriptions” preceding the borehole logs form an integral part of this report and should be read in conjunction with this report.

Borehole records from previous investigation were provided to EXP for review. The relevant borehole records are included in this report in Appendix ‘A’.

A review of the borehole logs indicates the following subsurface soil conditions with depth.

3.1 Fill

The surficial soil is fill which extends to 0.3 m to 3.0 m depths (Elevation 100.5 m to Elevation 99.1 m). The fill consists of sandy silt or sand with gravel and various debris. The fill contains cobbles and boulders or other obstructions. It is brown in colour. Based on standard penetration N-values of 6 to 35 for 300 mm of sampler penetration, the fill is in a loose to dense state. The natural moisture content of the fill is 5 to 22 percent. The unit weight of the fill was determined as 21.0 kN/m^3 to 22.0 kN/m^3.

3.2 Sandy Gravel

Underlying the fill in borehole MW-07 is a layer of sandy gravel which extends to 1.4 m depth (Elevation 99.4 m). The sandy gravel is brown in colour. Based on the standard penetration N-values of 42 for 300 mm of sampler penetration, followed by 50 blows for 100 mm of penetration of the sampler, the

sandy gravel is considered to be in a dense state. It contains boulders and cobbles. The natural moisture content of the sandy gravel is 3 percent. The results of a grain size analysis performed on this stratum are given on Table 1.

Table 1: Results of Grain Size Analysis on Sandy Gravel

BH #	Depth (m)	Grain-Size Analysis (%) Fines (Clay and Silt)	Sand	Gravel	USCS Soil Classification (USCS)
MW7_SS2	0.8 - 1.4	8	31	61	Gravel with silt and sand (GW-GM)

This stratum comprises of 8 percent clay and silt, 31 percent sand and 61 percent gravel. (Figure 6). This stratum was not encountered in boreholes MW-05 or MW-06.

3.3 Sand

The fill in boreholes MW-05 and MW-06 and the sandy gravel in borehole MW-07 are underlain by a layer of sand which extends to the entire depth investigated in all three boreholes, i.e., from 6.7 m to 9.8 m depth (Elevation 94.1 m to Elevation 93.3 m). It is brown in colour and becomes grey at 5.3 m to 7.6 m depth (Elevation 96.2 m to Elevation 95.2 m). Based on standard penetration N-values of 4 to 48 for 300 mm of sampler penetration, the sand is considered to be in a loose to dense state. The natural moisture content of the sand is 2 to 26 percent. It comprises of 5 to 16 percent clay and silt, 84 to 92 percent sand and 0 to 3 percent gravel. (Figures 7 to 9). The results of the grain size analyses have been summarized on Table 2.

Table 2: Results of Grain Size Analyses on Sand

BH #	Depth (m)	Grain-Size Analysis (%) Fines (Clay and Silt)	Sand	Gravel	USCS Soil Classification (USCS)
MW5_SS6	3.8 - 4.4	16	84	0	Sand (SM)
MW6_SS12	8.4 – 9.0	15	85	0	Sand (SM)
MW7_SS3	1.5 - 2.1	5	92	3	Sand (SM)

3.4 Bedrock

Auger refusal was not encountered within the termination depth of the boreholes. Bedrock is therefore expected to be deeper than the depth investigated.

3.5 Groundwater Levels

There are seven monitoring wells present at the Site. Two of the wells (P-1 and P-2; shallow and deep) were installed as part of the landfill groundwater monitoring program. Two wells (MW-3 and MW-4) were installed prior to Drain-All purchasing the Site. Three additional wells (MW-5, MW-6, and MW-7) were installed following the recommendations of the hydrogeological assessment (EXP, May 2022) as part of the current groundwater monitoring program.

Groundwater measurements were taken on May 25, 2022, and June 8, 2022, from the standpipes installed at all boreholes. Groundwater levels are given in Table 3 below.

Table 3: Summary of Groundwater Level Measurements					
BH #	Ground Surface Elevation (m)	Date of Measurement	Groundwater Depth Below Ground Surface (Elevation) (m)	Date of Measurement	Groundwater Depth Below Ground Surface (Elevation) (m)
MW-1 (P-1)	99.58	May 25, 2022	3.2 (96.4)	June 08, 2022	3.2 (96.4)
MW-2 (P-2)	99.66	May 25, 2022	3.5 (96.2)	June 08, 2022	3.6 (96.1)
MW-3	101.23	May 25, 2022	5.0 (96.2)	June 08, 2022	5.0 (96.2)
MW-4	100.90	May 25, 2022	4.7 (96.3)	June 08, 2022	4.7 (96.3)
MW-5	101.54	May 25, 2022	5.5 (96.1)	June 08, 2022	5.5 (96.1)
MW-6	104.14	May 25, 2022	7.0 (96.1)	June 08, 2022	7.0 (96.1)
MW-7	100.77	May 25, 2022	4.5 (96.3)	June 08, 2022	4.5 (96.3)

The groundwater elevation recorded in the wells ranged from 3.2 m to 7.0 m depth (Elevation 96.4 m to Elevation 96.1 m). Based on the above water levels, groundwater flow direction on the Site is to the north.

A groundwater contour plan is shown in Figure 10.

Note that seasonal fluctuations in the level of groundwater may occur and the groundwater may be at a higher level during wet weather periods.

4.0 Slope Stability Analysis

The stability of the existing slopes at the site under consideration were analysed using Morgenstern-Price Method, GeoStudio/Geo-slope office, Version 10.2.1 computerized system. The purpose of the analysis was to assess the stability of the existing slopes. A total of five cross-sections were analysed. These cross-sections have been shown as Sections A-A to E-E on Figure 2.

The topography was surveyed by Farley, Smith and Denis Surveying Limited, Ontario Land Surveyors, in a survey dated April 27, 2022.

Table 4 presents the results of the natural slope inclinations at the cross-sections analysed based on the results of the topographical survey.

Table 4: Slope Inclination at Cross-Sections Analyzed				
Section	**Crest of Slope Elevation (m)**	**Toe of Slope Elevation (m)**	**Height of Slope (m)**	**Overall Slope Inclination**
A-A	112.0	101.3	10.7	3.0H:1V
B-B	111.1	103.4	7.7	3.0H:1V
C-C	109.5	100.5	9.0	2.6H:1V
D-D	109.8	99.8	10.0	1.8H:1V
E-E	111.2	101.0	10.2	2.2H:1V

The slopes were analyzed for the following conditions:

(1) Effective stress analysis to assess long-term stability of the slopes; and,

(2) Effective stress analysis with seismic loading to assess stability of the slope due to a seismic event.

The analyses of slopes due to a seismic event were undertaken using pseudo-static analyses. The design ground acceleration for the subject site was determined by site classification and peak ground acceleration. Based on the soil conditions, the site classification Class D was used for this site. Design ground acceleration for the project site was determined from the Earthquake Hazards Program Website by interpolating 2015 National Building Code of Canada Seismic hazard values, see Appendix A. The earthquake design ground motion was determined with an earthquake having 2 percent probability of exceedance in a 50-year period (0.000404 per annum probability or 2,475 return year). The map indicates a peak ground acceleration (PGA) of approximately 0.267 g[1] at the subject site.

For sustained earthquake loading, horizontal seismic coefficient of 0.178 g (~2/3 PGA) was applied for the analyses. It was assumed that horizontal and vertical acceleration will not occur simultaneously. Therefore, the applied vertical seismic coefficient is equal to 0.

The following assumptions were made:

(1) The crest of the existing slopes varies from Elevation 112.0 m to Elevation 109.5 m whereas the toe of the slopes is at Elevation 103.4 m to Elevation 99.8 m (Table 4).

(2) The soil stratigraphy for the various cross-sections is shown on Figure Nos. 6 to 10 inclusive. The soil Stratigraphy was established from the boreholes drilled at the site during the 2022 EXP investigation as well as from the historical borehole records.

(3) The unit weight and the effective shear strength parameters were selected based on literature research and EXP's experience in the area. Table 5 presents the engineering properties of the various soils used in global slope stability analyses.

[1] g = the acceleration of gravity, ~9.81 m/sec^2

Table 5: Soil Properties used in Stability Analyses			
Soil Type	**Unit Weight (kN/m^3)**	**Cohesion (kPa)**	**Angle of Internal Friction (degrees)**
Fill	19.0	0	27
Compact to dense sand	19.7	0	31
Sand	19.8	0	30
Sand and Gravel	22.0	0	33
Sandy Gravel	22.0	0	33
Silty Sand	19.8	0	30

The results of the slope stability analyses for Sections A-A to E-E have been summarized on Table 6 and are given on Figures 11A and 11B to 15A and 15B inclusive.

Table 6: Results of Slope Stability Analyses			
Section	**Loading Condition**	**Factor of Safety**	**Figure No.**
Section A-A	Effective Stress Analysis	1.76	11A
	Effective Stress Analysis with seismic loading	1.1	11B
Section B-B	Effective Stress Analysis	1.73	12A
	Effective Stress Analysis with seismic loading	1.1	12B
Section C-C	Effective Stress Analysis	1.38	13A
	Effective Stress Analysis with seismic loading	0.93	13B
Section D-D	Effective Stress Analysis	1.11	14A
	Effective Stress Analysis with seismic loading	0.76	14B
Section E-E	Effective Stress Analysis	1.42	15A
	Effective Stress Analysis with seismic loading	0.92	15B

4.1 Discussion

Current practice in the industry and the City of Ottawa requires a factor of safety of 1.5 for static loading conditions (i.e., for effective stress and total stress analyses). The minimum acceptable factor of safety for seismic loading conditions is 1.1 (Mitchell 1983). A review of Table 6 indicates that the slope sections C-C, D-D, and E-E do not meet the City of Ottawa criteria for static loading conditions. Also, Sections C-C, D-D, and E-E do not meet the acceptable factor of safety for seismic loading conditions.

It is understood that the placement of inert fill at the site is to be undertaken in stages, however no plans have been approved at the time of this report. As indicated previously, a number of slopes at the site do not meet the requirements of stable slopes. It is understood that with the exception of slope E-E, infilling is planned at or close to the analyzed slopes.

There are two options available to ensure that the stability of the slopes do not present a danger to the workers during the filling operations. These are as follows:

(1).....Stabilize all the slopes in areas where the work will be undertaken close to the slopes. This may be achieved by cutting the slopes back at an inclination of 3H:1V if space permits. Alternatively, the slopes may be stabilized by placing fill close to the toes of the slopes to achieve a 3H:1V slope. This option has the advantage that the entire site will be available to workmen and equipment during filling operations.

(2).....The second option is to stabilize the slope(s) in stages, i.e., only in the area where filling is to be undertaken. This may be achieved by first placing the fill at the toe of the slope(s) where requisite factor of safety is not suitable. This option will necessitate fencing off area with unstable slopes so that workmen and equipment do not have access to areas where the slopes do not meet the required factors of safety.

The filling operations at the site should be conducted in such a manner that the stability of the existing slopes is not adversely impacted by any of the following measures/actions:

(1) Additional excavation is not undertaken at the site, especially close to the toes of the slopes;

(2) The current height of the slopes is not increased by placing fill close to the crest of the slopes;

(3) All construction equipment is kept at least 3 m back from the crest of the slopes;

(4) The groundwater table at the site is maintained below Elevation 100.0 m during filling operations; and,

(5) Any localized sloughing or failure of slope(s) due to freeze-thaw action, etc., should be restored immediately to prevent progressive failure of the slope(s).

It is recommended that the future work is to be undertaken at the site should ensure that the stability of the existing slopes is not adversely impacted in any way.

The above recommendations are preliminary and subject to change depending on the methodology used to undertake the filling operations. Further slope stability of the proposed slopes is recommended once the plans have been finalized.

5.0 General Closure

The comments given in this geotechnical report are a preliminary assessment of the current status of the slopes. No comment is made about the stability of the proposed slopes, the geometry of which have not been finalized. The number of boreholes required to determine the localized underground conditions, between boreholes affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well, as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

The information contained in this report is not intended to reflect on the environmental aspects of the soils. Should specific information be required, including for example, the presence of pollutants, contaminants or other hazards in the soil, additional testing may be required.

We trust that the information contained in this letter type report will be satisfactory for your purposes. Should you have any questions, please contact this office.

Sincerely,

EXP Services Inc.

Daniel Wall, M.Eng., P.Eng.
Senior Geotechnical Engineer
Earth and Environment

Surinder K. Aggarwal, M.Eng., P.Eng.
Senior Geotechnical Engineer
Earth and Environment

Figures

exp Services Inc. 100-2650 Queensview Drive Ottawa, ON K2B 8H6 **www.exp.com**	DESIGN CK / LW DRAWN AS DATE JULY 2022 FILE NO OTT-21023795	SLOPE STABILITY ANALYSIS 4380 TRAIL ROAD, OTTAWA, ONTARIO SITE LOCATION PLAN	SCALE 1:25,00 SKETCH NO FIG 1

Filename: \\exp\data\OTT\OTT-21023795-A0\60 Execution\65 Drawings\21023795 – Figure 1.dwg
Last Saved: Jul 13, 2022 9:55 AM Last Plotted: Jul 13, 2022 9:55 AM Plotted by: SeverA

NOTES:

1. THE BOUNDARIES AND SOIL TYPES HAVE BEEN ESTABLISHED ONLY AT TEST HOLE LOCATIONS. BETWEEN TEST HOLES THEY ARE ASSUMED AND MAY BE SUBJECT TO CONSIDERABLE ERROR.
2. SOIL SAMPLES WILL BE RETAINED IN STORAGE FOR THREE MONTHS AND THEN DESTROYED UNLESS THE CLIENT ADVISES THAT AN EXTENDED TIME PERIOD IS REQUIRED.
3. TEST HOLE ELEVATIONS SHOULD NOT BE USED TO DESIGN BUILDING(S) OR FLOOR SLABS OR PARKING LOT(S) GRADES.
4. TOPSOIL QUANTITIES SHOULD NOT BE ESTABLISHED FROM THE INFORMATION AT THE TEST HOLE LOCATIONS.
5. THIS DRAWING FORMS PART OF THE REPORT PROJECT NUMBER AS REFERENCED AND SHOULD BE USED ONLY IN CONJUNCTION WITH THIS REPORT.
6. BASE PLAN INFORMATION OBTAINED FROM FARLEY, SMITH AND DENIS SURVEYING LTD DATED APRIL 27, 2022.

LEGEND

MONITORING WELL LOCATION — MW-1

GROUND ELEVATION — ×99.58

OFF-SITE MONITORING WELL NO. & LOCATION — BH125-1

SECTION

0 10m 20m 40m

HORIZONTAL 1:1000

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

DESIGN	CK / LW
DRAWN	AS
DATE	JULY 2022
FILE NO	OTT-21023795

PHASE ONE ENVIRONMENTAL SITE ASSESSMENT
4380 TRAIL ROAD, OTTAWA, ONTARIO

SITE LAYOUT

SCALE 1:1000

SKETCH NO FIG 2

Filename: E:\OTT\OTT-21023795-A0\60 Execution\65 Drawings\21023795 - Figure 2 geo.dwg
Last Saved: Aug 26, 2022 11:18 PM Last Plotted: Aug 26, 2022 11:26 PM Plotted by: WalID

Notes On Sample Descriptions

1. All sample descriptions included in this report follow the Canadian Foundations Engineering Manual soil classification system. This system follows the standard proposed by the International Societv for Soil Mechanics and Foundation Engineering. Laboratory grain size analyses provided by **exp** Services Inc. also follow the same system. Different classification systems may be used by others; one such system is the Unified Soil Classification. Please note that, with the exception of those samples where a grain size analysis has been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		

0.002 0.006 0.02 0.06 0.2 0.6 2.0 6.0 20 60 200

EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Log of Borehole MW-05

Project No: OTT-21023795-A0

Project: Slope Stability Analysis

Location: 4380 Trail Road, Ottawa, ON

Date Drilled: 'May 13, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Figure No. 3

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Sandy silt, with gravel , clay, rootlets, asphalt and construction debris, possible cobble/boulder, brown, moist, (loose to compact)	101.54	0	6		SS1	22.0
				1	9		SS2	22.0
		Auger grinidng 1.5 m to 2.1 m depth		2	10		SS3	
		SILTY SAND (SM) Withl silt seams, brown, moist, (compact to dense)	99.1	3	9		SS4	
					24		SS5	
				4	26		SS6	
				5	40		SS7	
		Grey and wet below 5.3 m	96.04		30		SS8	
				6	30		SS9	
		Basal heave at 6.9 m depth		7	4		SS10	
		Borehole Terminated at 7.5 m Depth	94.0					

Standard Penetration Test N Value: 20 40 60 80
Shear Strength kPa: 50 100 150 200
Combustible Vapour Reading (ppm): 250 500 750
Natural Moisture Content % / Atterberg Limits (% Dry Weight): 20 40 60

NOTES:
1. Borehole data requires interpretation by EXP before use by others
2. A 50 mm diameter monitoring well was installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21023795-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	5.5	5.5
May 25, 2022	5.5	
June 8, 2022	5.5	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-21023795 - 4380 TRAIL ROAD BH LOGS.GPJ TROW OTTAWA.GDT 8/26/22

Log of Borehole MW-06

Project No: OTT-21023795-A0

Project: Slope Stability Analysis

Location: 4380 Trail Road, Ottawa, ON

Date Drilled: 'May 12, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Figure No. 4

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)

Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Silty sand, with gravel, clay, rootlets, roots and construction debris, brown, moist, (loose to compact)	103.12	0	15		SS1	
				1	20		SS2	21.0
				2	8		SS3	
					14		SS4	
		SILTY SAND (SM) Brown, moist, (compact to dense)	100.1	3	48		SS5	
				4	25		SS6	
				5	26		SS7	
					20		SS8	
				6	18		SS9	
		Wet below 6.9 m depth	96.12	7	19		SS10	
		Grey below 7.6 m depth		8	14		SS11	
		Basal heave at 8.4 m depth			14		SS12	
				9	21		SS13	
			93.3					
		Borehole Terminated at 9.8 m Depth						

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 50 mm diameter monitoring well was installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21023795-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	8.3	9.0
May 25, 2022	7.0	
June 8, 2022	7.0	

CORE DRILLING RECORD

Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-21023795 - 4380 TRAIL ROAD BH LOGS.GPJ TROW OTTAWA.GDT 8/26/22

Log of Borehole MW-07

Project No: OTT-21023795-A0

Project: Slope Stability Analysis

Location: 4380 Trail Road, Ottawa, ON

Date Drilled: 'May 12, 2022

Drill Type: CME-850 Track Mounted Drill Rig

Datum: Geodetic Elevation

Logged by: M.Z. Checked by: I.T.

Figure No. 5

Page. 1 of 1

Split Spoon Sample
Auger Sample
SPT (N) Value
Dynamic Cone Test
Shelby Tube
Shear Strength by Vane Test (S)
Combustible Vapour Reading
Natural Moisture Content
Atterberg Limits
Undrained Triaxial at % Strain at Failure
Shear Strength by Penetrometer Test

GWL	SYMBOL	SOIL DESCRIPTION	Geodetic Elevation m	Depth	Standard Penetration Test N Value / Shear Strength kPa	Combustible Vapour Reading (ppm) / Natural Moisture Content % / Atterberg Limits (% Dry Weight)	SAMPLES	Natural Unit Wt. kN/m³
		FILL Sand with wood and metal debris, brown, moist, (compact)	100.77 / 100.5	0	35		SS1	
		SANDY GRAVEL (GP) Trace silt, with cobble or boulder, brown, moist, (very dense)	99.4	1	42 then 50 / 100 mm		SS2	
		SAND (SP) With gravel, brown, moist, (compact)		2	22		SS3	
					18		SS4	
				3	20		SS5	
				4	20		SS6	
			96.27					
				5	17		SS7	
		Grey below 5.6 m depth			15		SS8	
		Basal heave at 6.1 m depth		6	14		SS9	
		Borehole Terminated at 6.7 m Depth	94.1					

NOTES:

1. Borehole data requires interpretation by EXP before use by others
2. A 50 mm diameter monitoring well was installed as shown.
3. Field work supervised by an EXP representative.
4. See Notes on Sample Descriptions
5. Log to be read with EXP Report OTT-21023795-A0

WATER LEVEL RECORDS

Date	Water Level (m)	Hole Open To (m)
Completion	4.3	5.5
May 25, 2022	4.5	
June 8, 2022	4.5	

CORE DRILLING RECORD

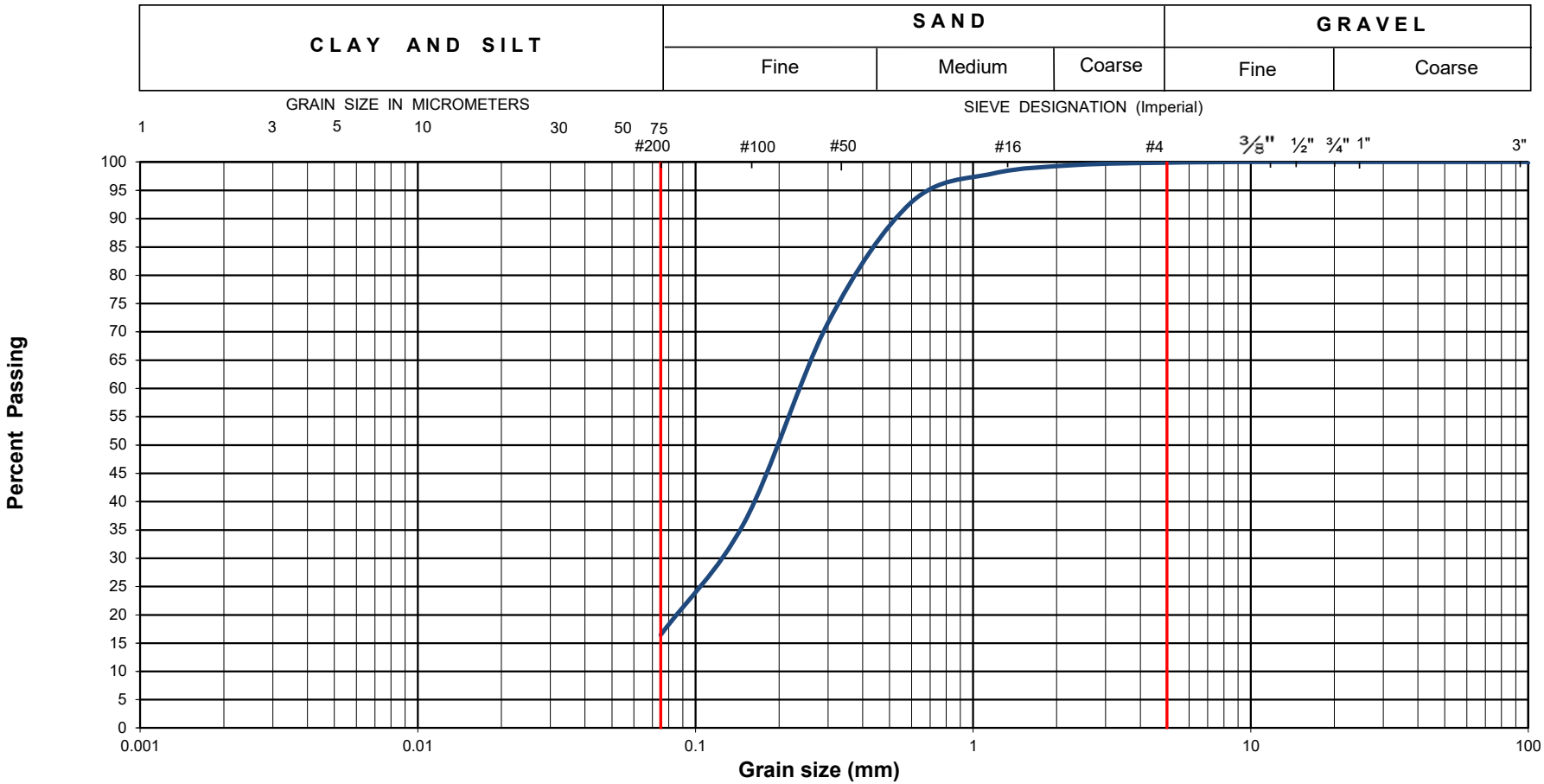
Run No.	Depth (m)	% Rec.	RQD %

LOG OF BOREHOLE OTT-21023795 - 4380 TRAIL ROAD BH LOGS.GPJ TROW OTTAWA.GDT 8/26/22

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System



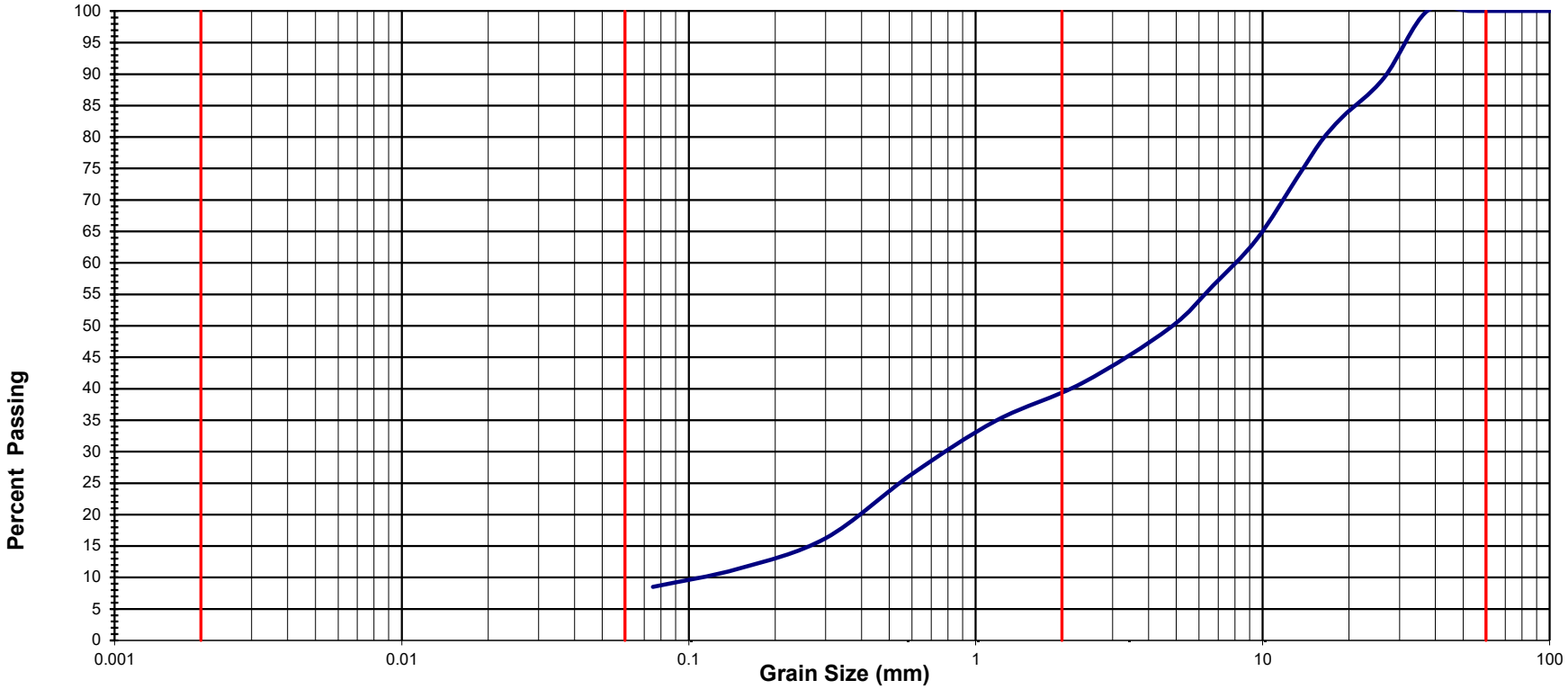
EXP Project No.:	**OTT-21023795-A0**	**Project Name :**	**Geotechnical Investigation - Slope Stability Trail Road**				
Client :	**Drain-All Ltd.**	**Project Location :**	**4380 Trail Road, Ottawa, Ontario**				
Date Sampled :	**May 13, 2022**	**Borehole No:**	**MW5**	**Sample:**	**SS6**	**Depth (m) :**	**3.8 - 4.4**
Sample Composition :		**Gravel (%)**	**0**	**Sand (%)**	**84**	**Silt & Clay (%)**	**16**
Sample Description :		**Silty Sand (SM)**				**Figure :**	**6**

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method Test for Sieve Analysis of Aggregate
ASTM C-136

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	



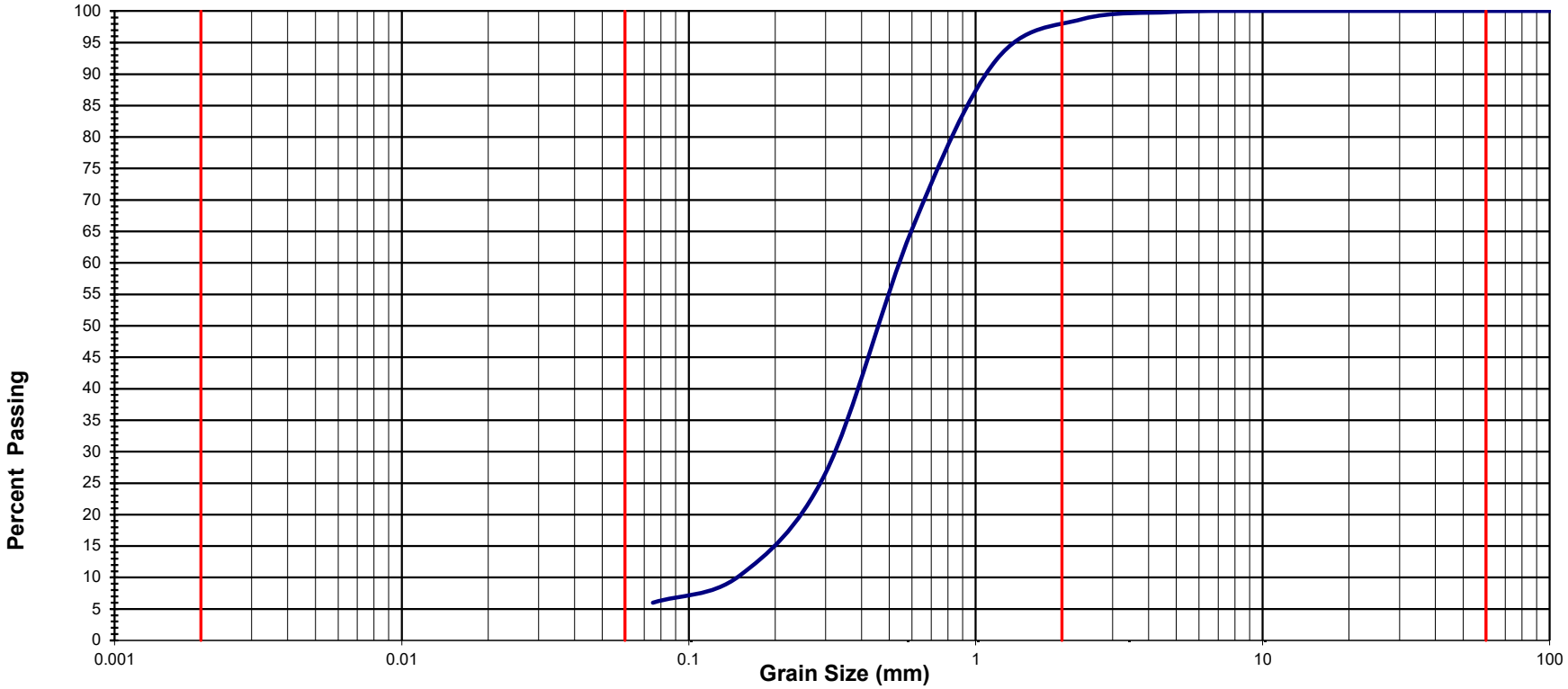
EXP Project No.:	**OTT-21023795-A0**	**Project Name :**	**Geotechnical Investigation - Slope Stability Trail Road**						
Client :	**Drain-All Ltd.**	**Project Location :**	**4380 Trail Road, Ottawa, Ontario**						
Date Sampled :	**May 12, 2022**	**Borehole No:**	**MW7**	**Sample:**	**SS2**	**Depth (m) :**	**0.8 - 1.4**		
Sample Composition :		**Gravel (%)**	**61**	**Sand (%)**	**31**	**Silt & Clay (%)**	**8**	**Figure :**	**7**
Sample Description :		**Poorly Graded Sandy Gravel (SP)**							

EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method Test for Sieve Analysis of Aggregate
ASTM C-136

Modified M.I.T. Classification

CLAY	SILT			SAND			GRAVEL			
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse	

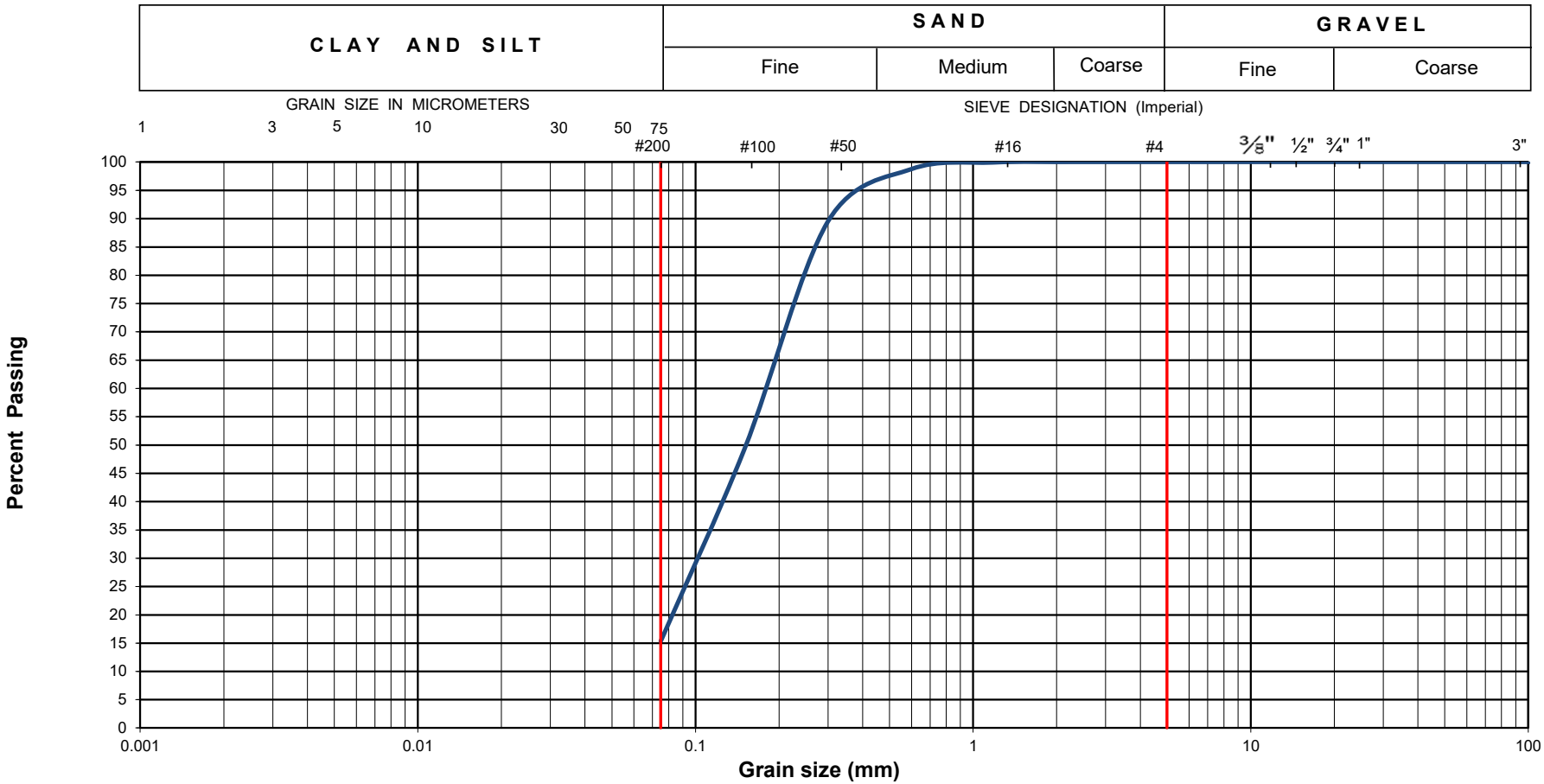


EXP Project No.:	**OTT-21023795-A0**	**Project Name :**	**Geotechnical Investigation - Slope Stability Trail Road**						
Client :	**Drain-All Ltd.**	**Project Location :**	**4380 Trail Road, Ottawa, Ontario**						
Date Sampled :	**May 12, 2022**	**Borehole No:**	**MW7**	**Sample:**	**SS3**	**Depth (m) :**	**1.5 - 2.1**		
Sample Composition :		**Gravel (%)**	**3**	**Sand (%)**	**92**	**Silt & Clay (%)**	**5**	**Figure :**	**8**
Sample Description :		**Poorly Graded Sand (SP)**							

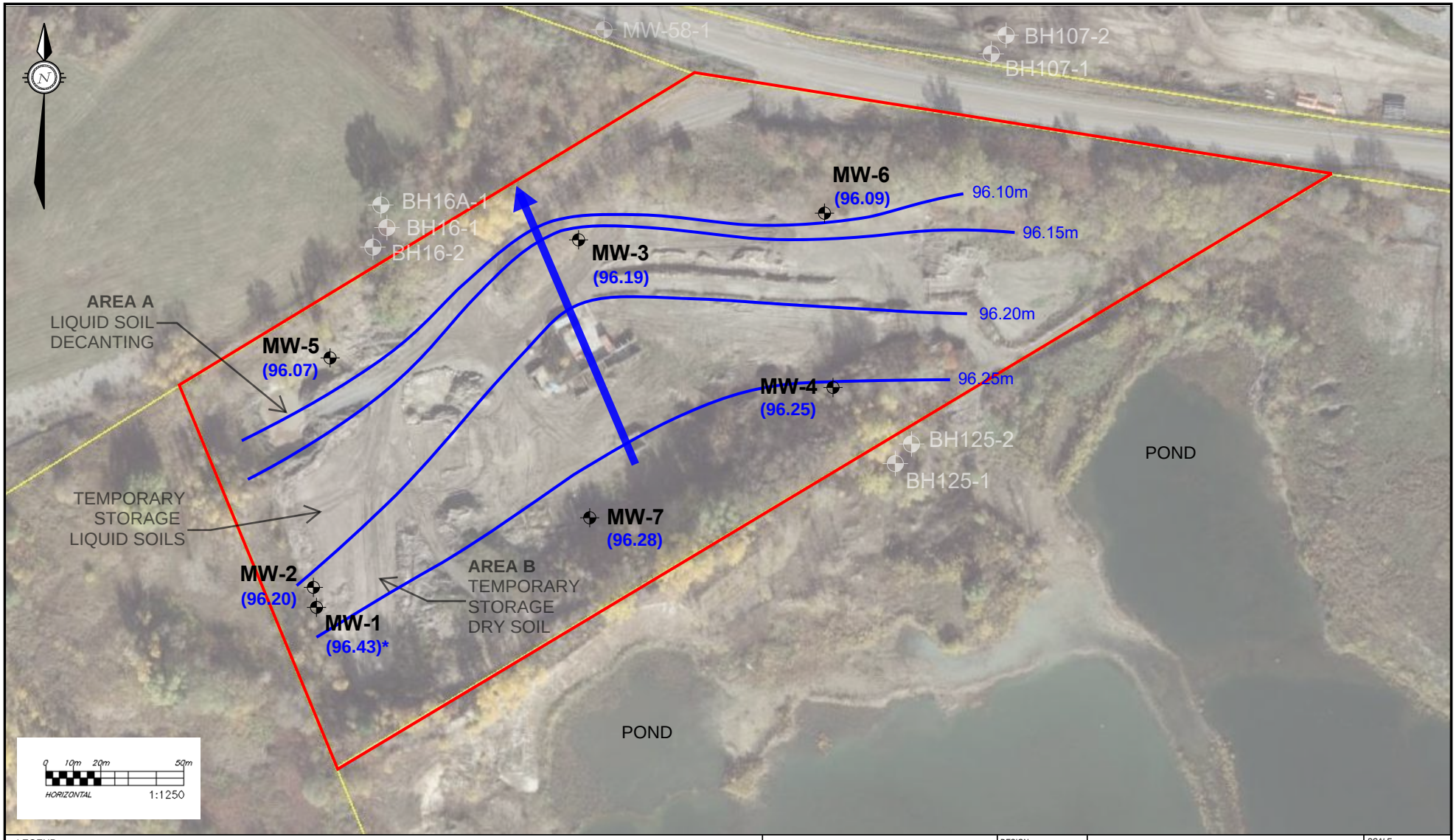
EXP Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6

Grain-Size Distribution Curve
Method of Test For Sieve Analysis of Aggregate
ASTM C-136

Unified Soil Classification System



EXP Project No.:	**OTT-21023795-A0**	**Project Name :**	**Geotechnical Investigation - Slope Stability Trail Road**				
Client :	**Drain-All Ltd.**	**Project Location :**	**4380 Trail Road, Ottawa, Ontario**				
Date Sampled :	**May 12, 2022**	**Borehole No:**	**MW6**	**Sample:**	**SS12**	**Depth (m) :**	**8.4 - 9.0**
Sample Composition :		**Gravel (%)**	**0**	**Sand (%)**	**85**	**Silt & Clay (%)**	**15**	**Figure :**	**9**
Sample Description :		**Silty Sand (SM)**					



LEGEND

- SITE BOUNDARY
- MONITORING WELL NAME AND LOCATION (GROUNDWATER ELEVATION)
- MW-5 GROUNDWATTER SAMPLE LOCATION
- GROUNDWATER FLOW DIRECTION
- (95.75m) GROUNDWATER CONTOUR ELEVATION
- (96.20m) GROUNDWATER ELEVATION
- (96.43m)* ELEVATION NOT USED

*GROUNDWATER ELEVATIONS FROM MAY 25, 2022

exp Services Inc.
100-2650 Queensview Drive
Ottawa, ON K2B 8H6
www.exp.com

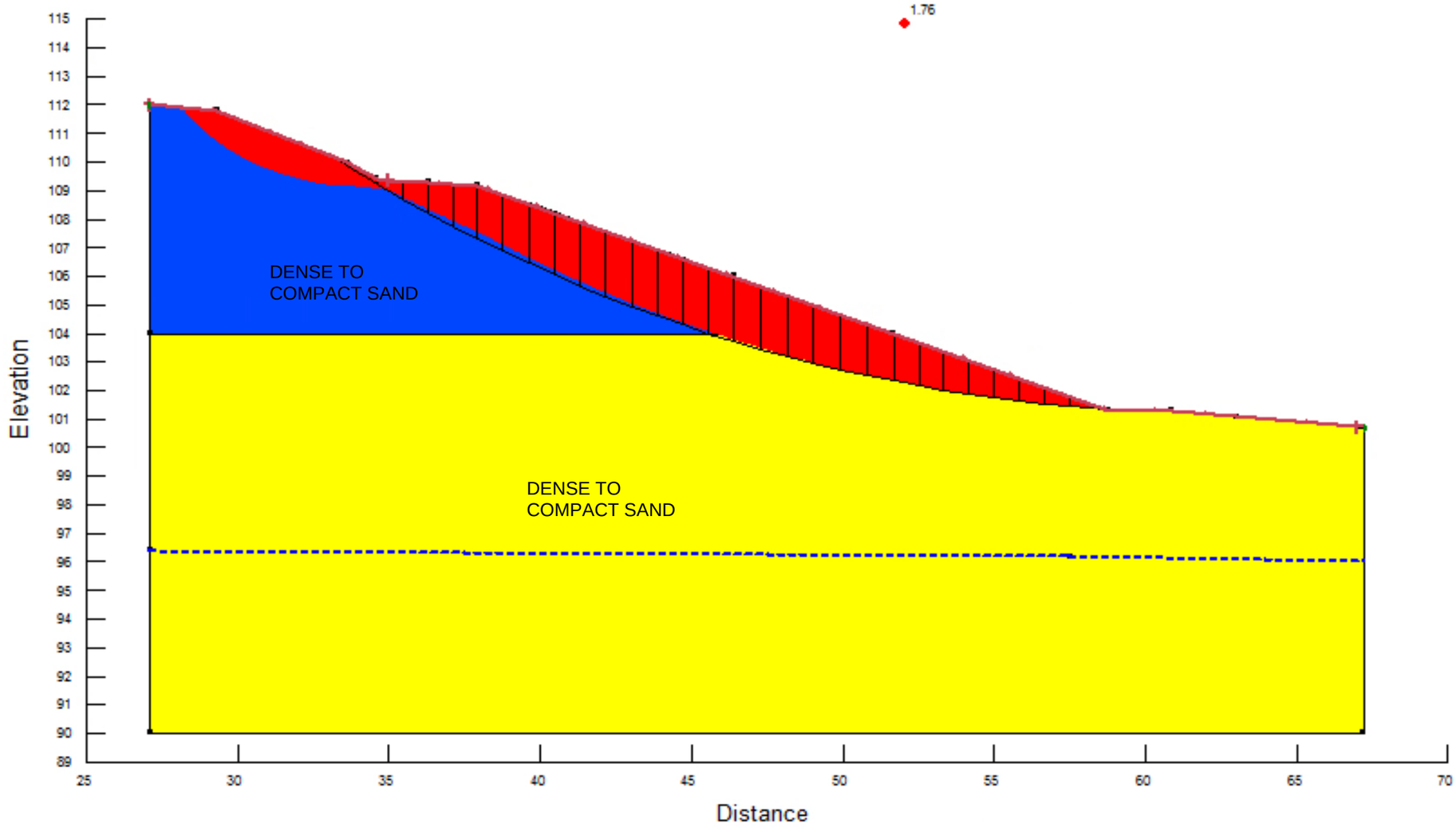
DESIGN	CK / LW
DRAWN	LW / AS
DATE	JULY 2022
PROJECT NO.	OTT-21023795-A0

GROUNDWATER SAMPLING PROGRAM
4380 TRAIL ROAD, OTTAWA, ONTARIO

GROUNDWATER SAMPLING LOCATIONS & FLOW DIRECTION

SCALE 1:1250

FIG 10

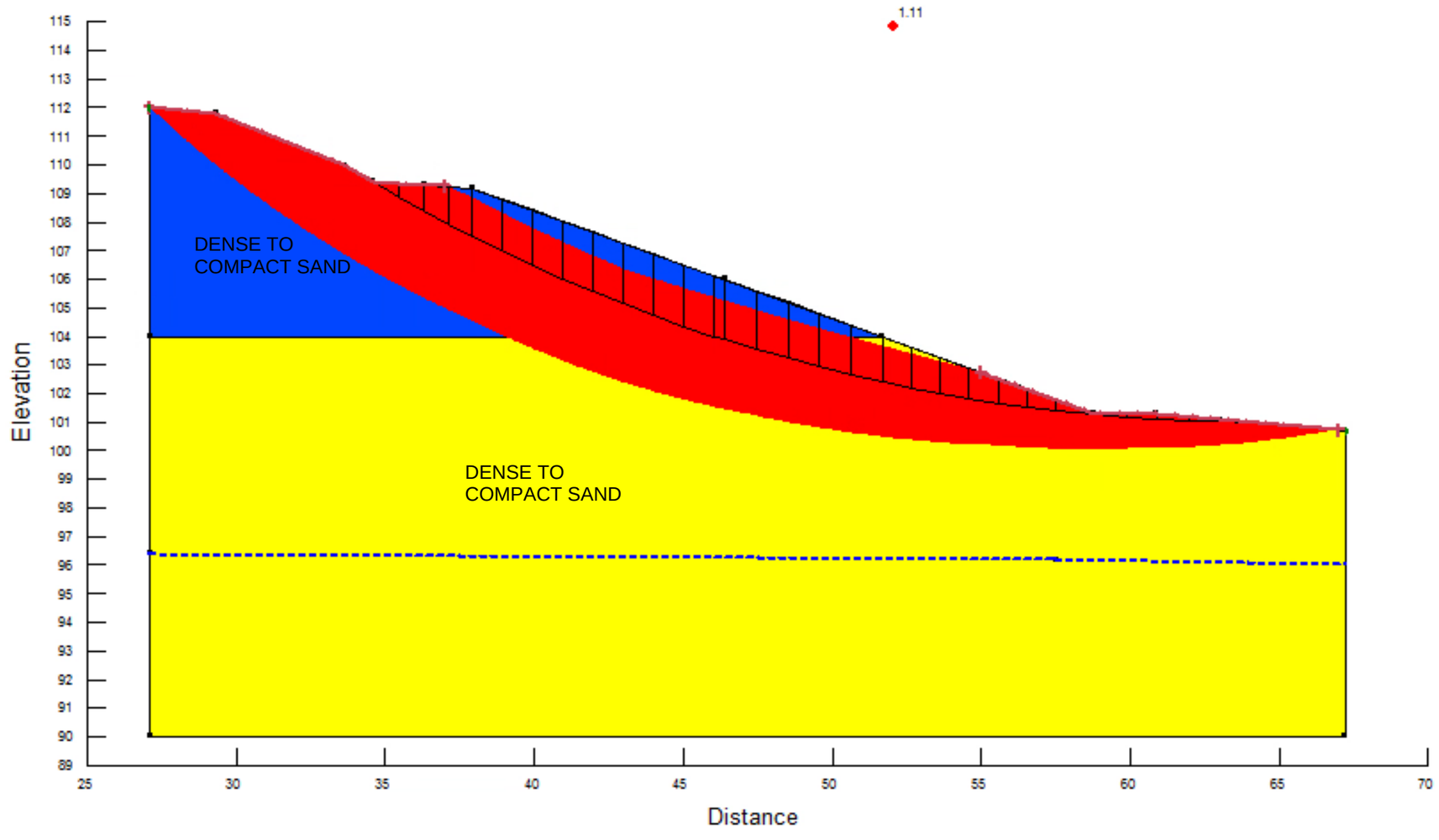


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Compact to dense sand	Mohr-Coulomb	19.7	0	31
	Dense to compact sand	Mohr-Coulomb	19.7	0	31

Section A-A'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022
CLIENT: DRAIN-ALL LTD.
project no.: OTT-21023795-A0
DESIGN: DW
CHECKED: SA
DRAWN BY: DW
TITLE: STATIC SLOPE STABILITY ANALYSIS
4380 Trail Road, Ottawa, Ontario
scale: Not to scale
Figure 11A

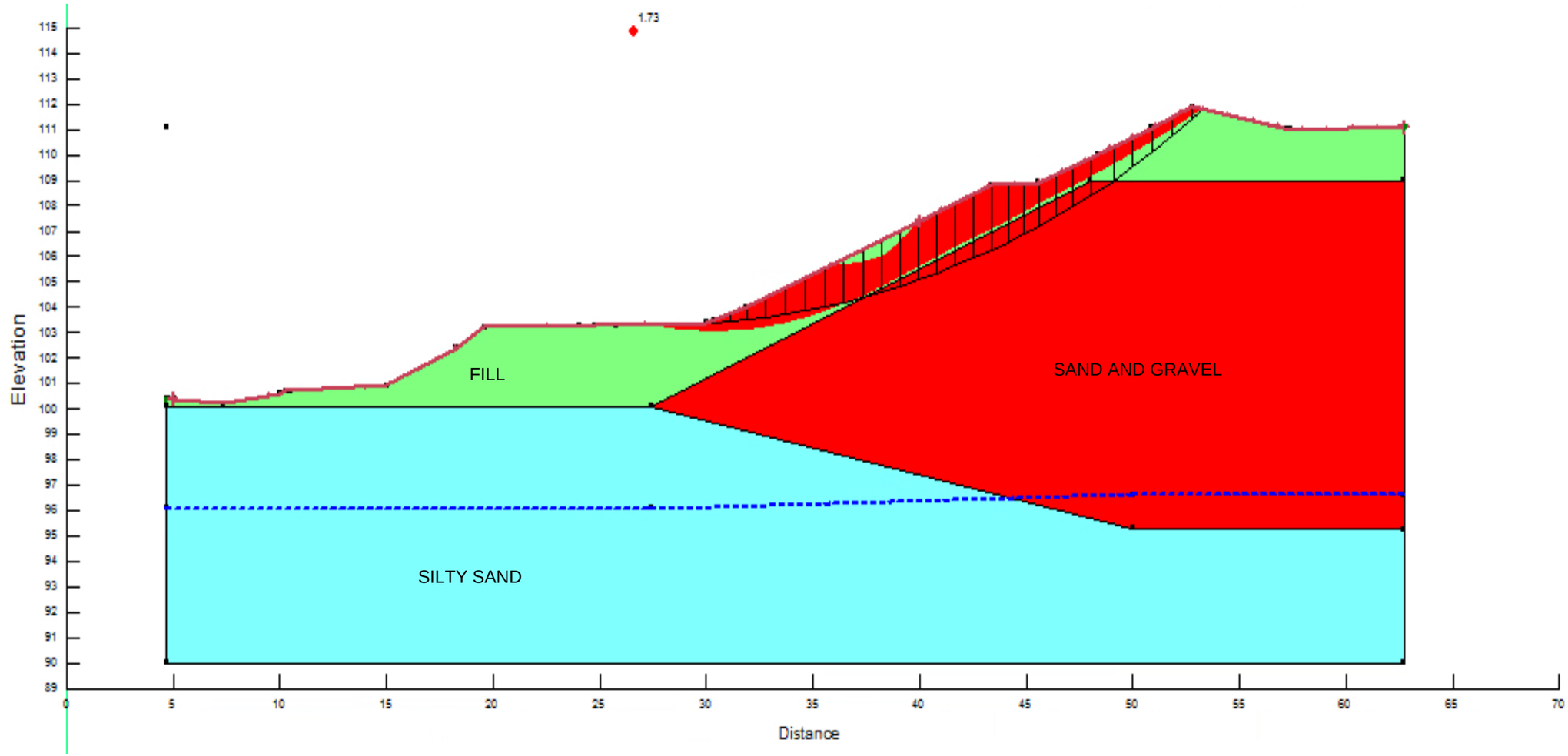


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Compact to dense sand	Mohr-Coulomb	19.7	0	31
	Dense to compact sand	Mohr-Coulomb	19.7	0	31

Section A-A'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022
CLIENT: DRAIN-ALL LTD.
project no.: OTT-21023795-A0
DESIGN: DW
CHECKED: SA
DRAWN BY: DW
TITLE: PSEUDO-STATIC SLOPE STABILITY ANALYSIS
4380 Trail Road, Ottawa, Ontario
scale: Not to scale
Figure 11B

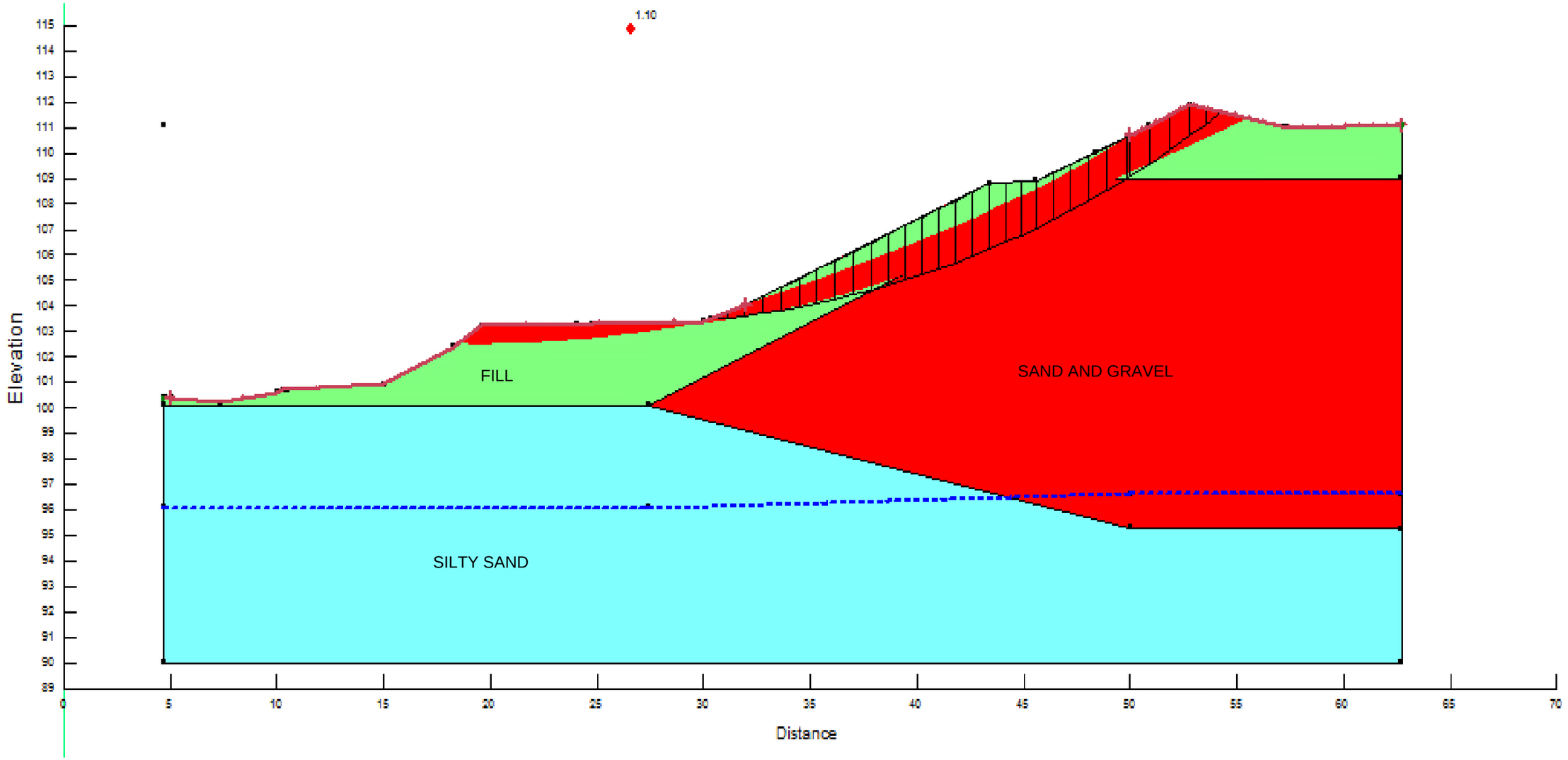


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	FILL	Mohr-Coulomb	19	0	27
	Sand and Gravel	Mohr-Coulomb	22	0	33
	Silty Sand	Mohr-Coulomb	19.8	0	30

Section B-B'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.	project no. OTT-21023795-A0
DESIGN: DW / CHECKED: SA / DRAWN BY: DW	TITLE: STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale
		Figure 12A

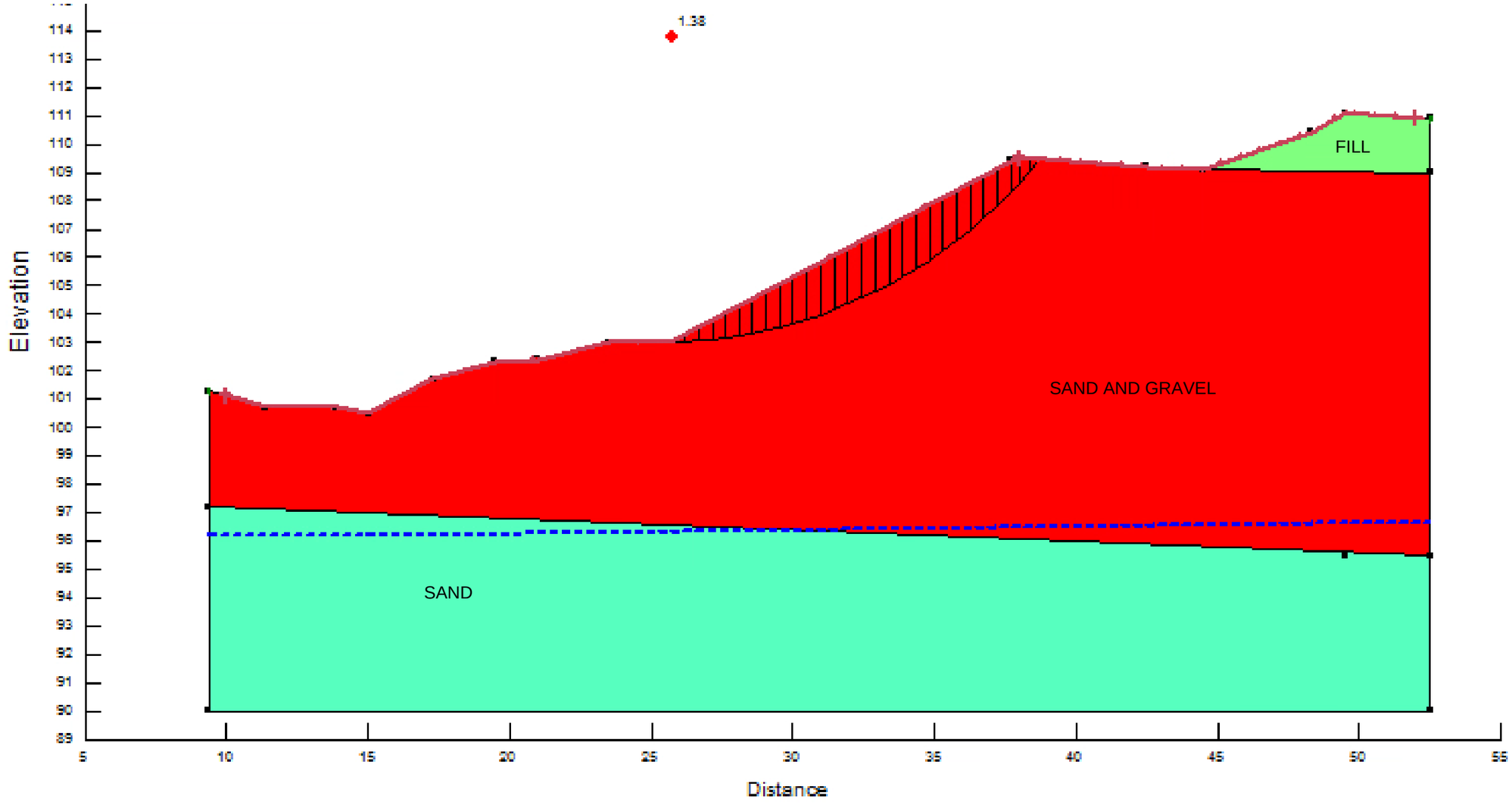


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	FILL	Mohr-Coulomb	19	0	27
	Sand and Gravel	Mohr-Coulomb	22	0	33
	Silty Sand	Mohr-Coulomb	19.8	0	30

Section B-B'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022
DESIGN: DW
CHECKED: SA
DRAWN BY: DW
CLIENT: DRAIN-ALL LTD.
TITLE: PSEUDO-STATIC SLOPE STABILITY ANALYSIS
4380 Trail Road, Ottawa, Ontario
project no.: OTT-21023795-A0
scale: Not to scale
Figure 12B

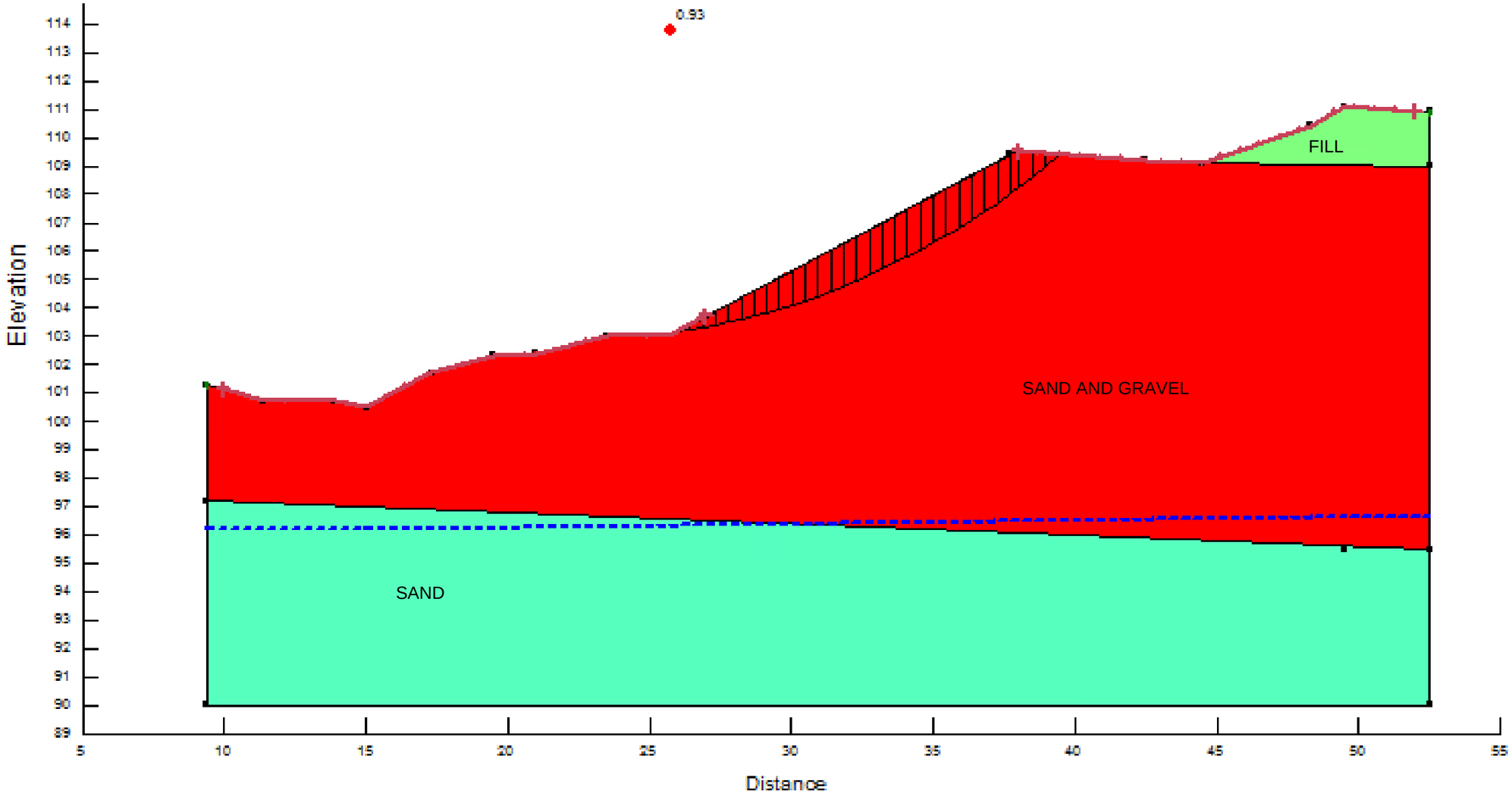


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	FILL	Mohr-Coulomb	19	0	27
	Sand	Mohr-Coulomb	19.8	0	30
	Sand and Gravel	Mohr-Coulomb	22	0	33

Section C-C'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022
CLIENT: DRAIN-ALL LTD.
project no.: OTT-21023795-A0
DESIGN: DW
CHECKED: SA
DRAWN BY: DW
TITLE: STATIC SLOPE STABILITY ANALYSIS
4380 Trail Road, Ottawa, Ontario
scale: Not to scale
Figure 13A



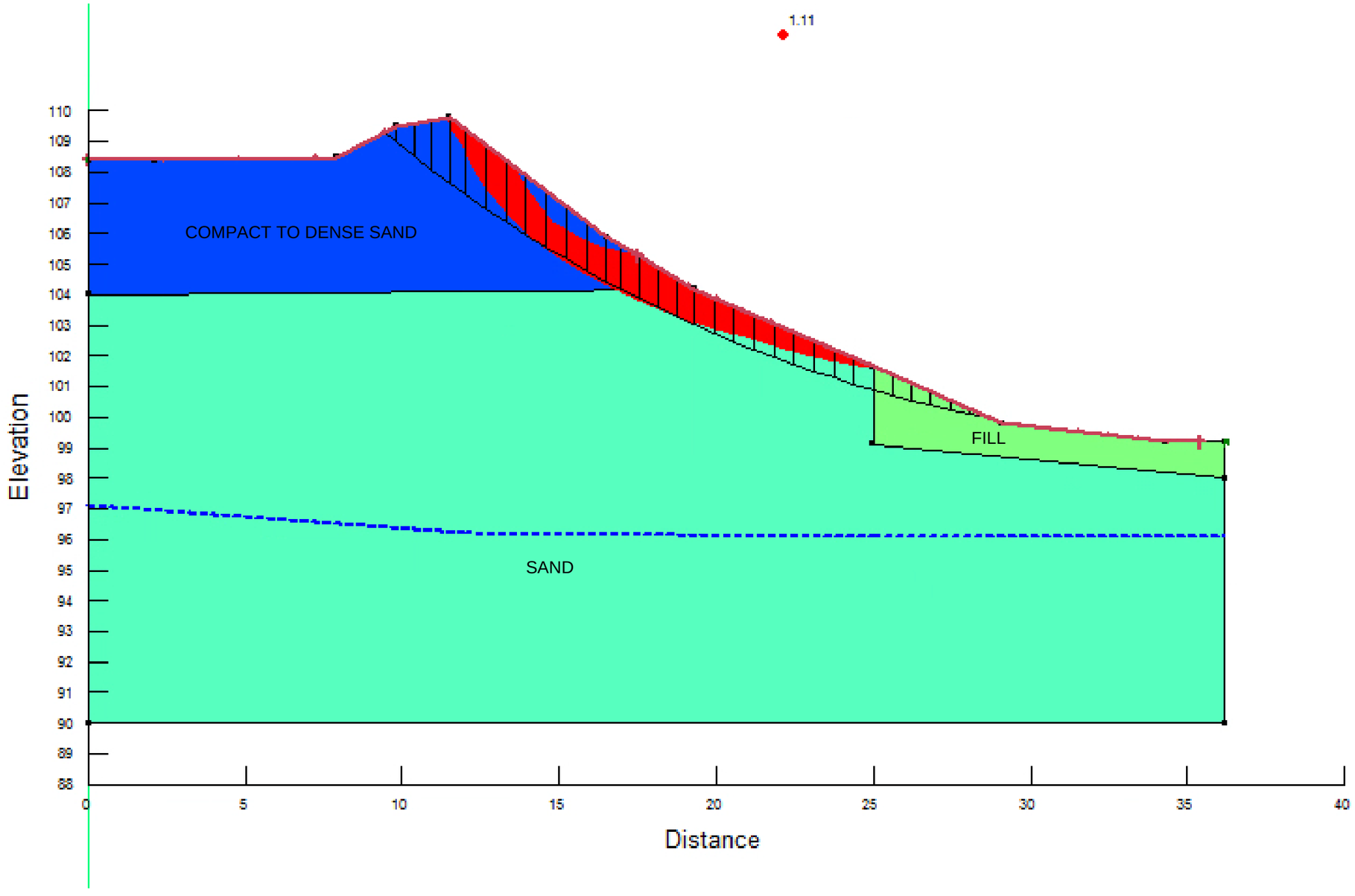
Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	FILL	Mohr-Coulomb	19	0	27
	Sand	Mohr-Coulomb	19.8	0	30
	Sand and Gravel	Mohr-Coulomb	22	0	33

Section C-C'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com

• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.	project no. OTT-21023795-A0
DESIGN: DW / CHECKED: SA	TITLE: PSEUDO-STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale
DRAWN BY: DW		Figure 13B

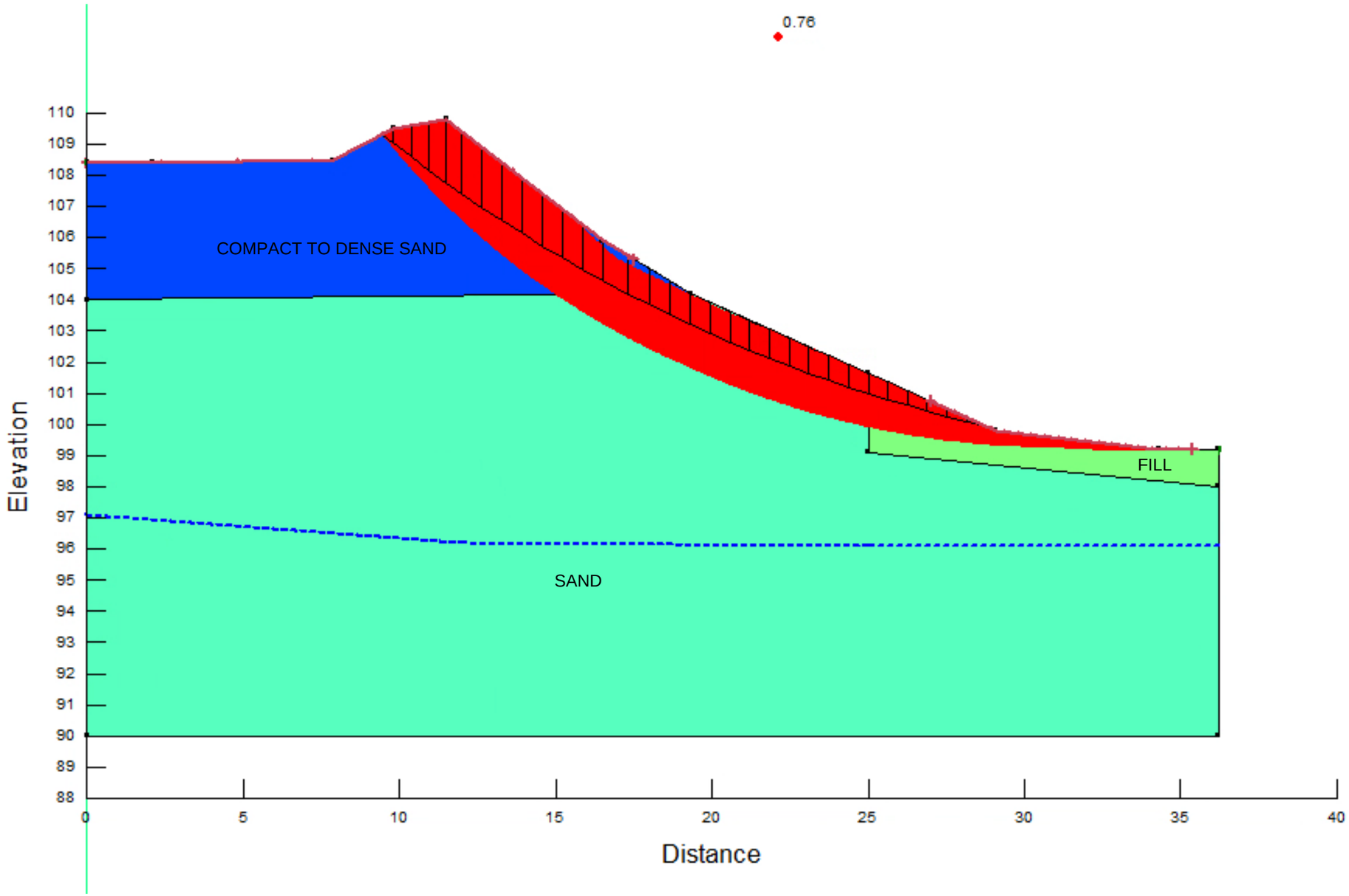


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Compact to dense sand	Mohr-Coulomb	19.7	0	31
	FILL	Mohr-Coulomb	19	0	27
	Sand	Mohr-Coulomb	19.8	0	30

Section D-D'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.		project no. OTT-21023795-A0
DESIGN: DW	CHECKED: SA	TITLE: STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale
DRAWN BY: DW			Figure 14A

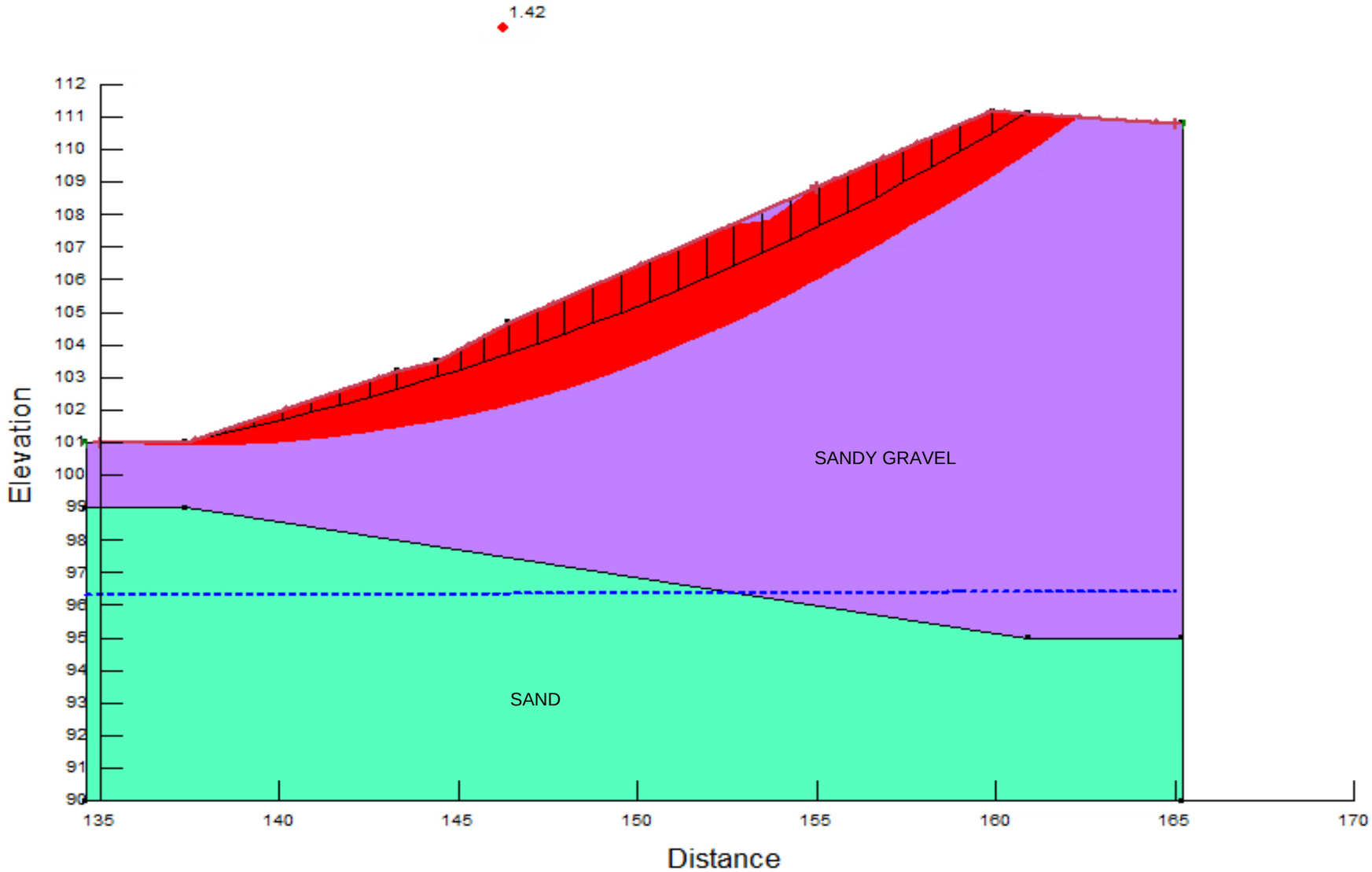


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Compact to dense sand	Mohr-Coulomb	19.7	0	31
	FILL	Mohr-Coulomb	19	0	27
	Sand	Mohr-Coulomb	19.8	0	30

Section D-D'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.	project no. OTT-21023795-A0
DESIGN: DW / CHECKED: SA	TITLE: PSEUDO-STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale
DRAWN BY: DW		Figure 14B

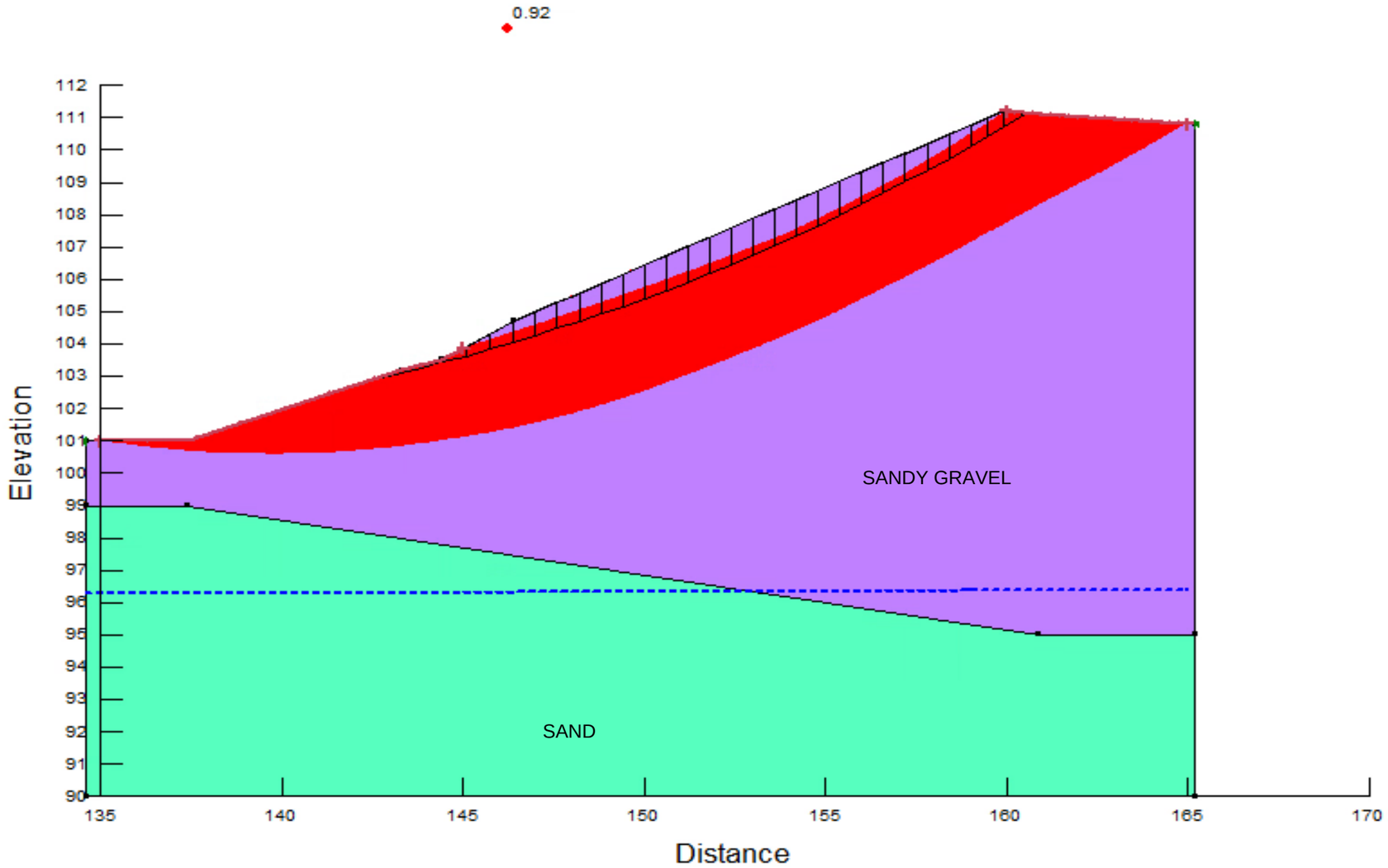


Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Sand	Mohr-Coulomb	19.8	0	30
	Sandy Gravel	Mohr-Coulomb	22	0	33

Section E-E'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.	project no. OTT-21023795-A0
DESIGN: DW / CHECKED: SA	TITLE: STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale
DRAWN BY: DW		Figure 15A



Color	Name	Model	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Sand	Mohr-Coulomb	19.8	0	30
	Sandy Gravel	Mohr-Coulomb	22	0	33

Section E-E'

EXP Services Inc.
t: +1.613.688.1899 | f: +1.613.225.7337
2650 Queensview Drive, Suite 100
Ottawa, ON K2B 8H6
Canada
www.exp.com
• BUILDINGS • EARTH & ENVIRONMENT • ENERGY •
• INDUSTRIAL • INFRASTRUCTURE • SUSTAINABILITY •

DATE: Aug 26, 2022	CLIENT: DRAIN-ALL LTD.	project no. OTT-21023795-A0
DESIGN: DW / CHECKED: SA / DRAWN BY: DW	TITLE: PSEUDO-STATIC SLOPE STABILITY ANALYSIS 4380 Trail Road, Ottawa, Ontario	scale: Not to scale Figure 15B

Appendix A: Historical Borehole Logs Used in Slope Stability Analyses

PROJECT: 991-2806

RECORD OF BOREHOLE: BH16A

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: December 14, 1999

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	Gastechtor ppm / ppm	HYDRAULIC CONDUCTIVITY, k, cm/s / WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		113.30 / 0.00							
	Power Auger 200mm Diam (Hollow Stem)	Compact to dense light brown stratified fine SAND, occasional to trace silt,			1	50 DO	20				Cement Seal; Native Backfill; Bentonite Seal
					2	50 DO	31				
5					3	50 DO	24				
				103.96 / 9.34	4	50 DO	40				
10		Dense to compact brown to grey fine to medium stratified SAND, occasional coarse sizes, occasional to trace silt			5	50 DO	34				Native Backfill
					6	50 DO	44				
15					7	50 DO	28				
					8	50 DO	41				
20					9	50 DO	27				Caved Material
25					10	CS	-				
					11	CS	-				Bentonite Seal; Granular Filter; 38mm PVC #10 Slot Screen #1
30					12	CS	-				
35		END OF BOREHOLE		78.25 / 35.05							
40											

BOREHOLE 991-2906.GPJ HYDROGEO.GDT 2.5.01

DEPTH SCALE
1 : 200

Golder Associates

LOGGED: D.J.S.
CHECKED: AH

PROJECT: 011-2929

RECORD OF BOREHOLE: M107-2

SHEET 1 OF 1

LOCATION: SEE SITE PLAN

BORING DATE: NOV 12, 2001

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp — W — Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		111.17							
		Brown silty sand, trace gravel (FILL)		0.00	1	50 DO	6				
		Brown fine sand, scattered trace gravel (FILL)		0.30							
		Brown SILTY fine SAND, trace gravel		110.26 0.91							
		Dark brown silty sand TOPSOIL		109.49							
2		Compact to dense brown SAND and GRAVEL, occasional cobble and boulder		1.83							
		Compact brown fine to coarse SAND		108.27 2.90	2	50 DO	5				
4		Brown SAND and GRAVEL, some cobbles, occasional boulder		107.36 3.81							
6											Native Backfill
8	ROTARY DRILLING HW CASING										
10											
12											
14											Bentonite Seal
				95.63							Granular Filter
16		Probably mainly sands, occasional trace of gravel or cobble		15.54							32 mm PVC #10 slot screen
				94.11	3	50 DO	37				W.L. in screen at elev. 95.63 m on Dec. 3, 2001 (top of pipe at elev. 111.98 m on Nov. 12, 2001)
		END OF BOREHOLE STRATIGRAPHY INFERRED FROM DEEP BOREHOLE		17.08							
18											
20											

DEPTH SCALE

1 : 100

Golder Associates

E-290A

LOGGED: C.A.S.

CHECKED: ----

BOREHOLE 011-2929.GPJ GLDR_CAN.GDT 21/3/02 M.A.C.

PROJECT: 991-2806

RECORD OF BOREHOLE: M107

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 26, 1999

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
		Ground Surface		111.07				
0		Brown silty sand, trace gravel (FILL)		110.16				Cement Seal
		Brown fine sand, scattered trace gravel (FILL)		109.30				Bentonite Seal
		Brown SILTY fine SAND, trace gravel		1.83	1	50 DO	22	Granular Filter
		Dark brown silty sand TOPSOIL		108.17				25mm PVC #10 Slot Gas Monitor
		Compact to dense brown SAND and GRAVEL, occasional cobble and boulder		2.90	2	50 DO	19	
		Compact brown fine to coarse SAND		107.26				Bentonite Seal
		Brown SAND and GRAVEL, some cobbles, occasional boulder		3.81	3	50 DO	85	
5								
10								
15				95.53				
	Rotary Drilling HW Casing	Probably mainly sands, occasional trace of gravel or cobble		15.54				
20								Native Backfill
25								
30								
35								50mm PVC #10 Slot Screen
	Rotary Drilling NQ Core			73.18	4	NQ RC DD		
		Slightly weathered grey LIMESTONE BEDROCK, trace calcite and very thin shale interbed END OF BOREHOLE		37.89	5	NQ RC DD		
				71.57	6	NQ RC DD		
40				39.50				

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp — W — Wl (10 20 30 40)

ADDITIONAL LAB. TESTING

DEPTH SCALE

1 : 200

Golder Associates

LOGGED: D.J.S.

CHECKED: AH

BOREHOLE 991-2806.GPJ HYDROGEO.GDT 2 6 01

RECORD OF BOREHOLE: M125-1

PROJECT: 011-2930

LOCATION: See Site Plan

SAMPLER HAMMER, 64kg; DROP, 760mm

BORING DATE: November 20, 2001

SHEET 1 OF 1

DATUM: Geodetic

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		97.17							
	POWER AUGER 200 mm Diam. (Hollow Stem)	Loose to dense brown to grey fine SAND, trace silt		0.00	1	50 DO	-				Bentonite Seal
					2	50 DO	8				
5					3	50 DO	4				Native Backfill
					4	50 DO	37				
10					5	50 DO	13				
15					6	50 DO	14				Bentonite Seal Silica Sand 50 mm PVC #10 slot screen A
	ROTARY DRILL NQ Core	Fresh grey LIMESTONE BEDROCK		79.49 17.68	7	NQ RC	DD	T.C.R. (%) 93	S.C.R. (%) 89	R.Q.D. (%) 68	Bentonite Seal
20				76.97	8	NQ RC	DD				
		END OF BOREHOLE		20.20							W.L. in screen at elev. 96.57 m on Dec. 3, 2002 (top of pipe (screen A) at elev. 97.97 m on Jan. 29, 2002)
25											
30											
35											
40											
45											
50											

DEPTH SCALE

1 : 250

Golder Associates

E-324

LOGGED:

CHECKED:

BOREHOLE 011-2930.GPJ HYDROGEO.GDT 4/8/02

PROJECT: 011-2930

RECORD OF BOREHOLE: M125-2

SHEET 1 OF 1

LOCATION:

BORING DATE: 18 January 2002

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		Ground Surface		97.16							
		For stratigraphy refer to record of borehole M125-1		0.00							Bentonite Seal Native Backfill Caved Material 32 mm PVC # 10 slot screen B
5				89.17							
		END OF BOREHOLE		7.99							(top of pipe (screen B) at elev. 98.06 m on Jan. 29, 2002)
10											
15											
20											
25											
30											
35											
40											
45											
50											

BOREHOLE 011-2930.GPJ HYDROGEO.GDT 21/3/02

DEPTH SCALE

1 : 250

Golder Associates

E-325

LOGGED: D.J.S.

CHECKED:

Appendix B: 2015 National Building Code Seismic Hazard Calculations

2015 - 2005 National Building Code of Canada seismic hazard values

Building code year

2015

Latitude

45.231107

The latitude should be between 42 and 90 degree. Decimal degree (DD.DDD) and degree:minute:second (DD:MM:SS) format accepted.

Longitude

-75.768162

The longitude should be between -141 and -45 degree. Decimal degree (DD.DDD) and degree:minute:second (DD:MM:SS) format accepted.

Number of closest points for interpolation

7

Location name (optional)

Location name (optional)

Company/Organization (optional)

Company/Organization (optional)

Name (optional)

Name (optional)

Format

Accessible HTML Table

Submit

2015 National Building Code interpolated seismic hazard values

Spectral (Sa(T), where T is in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s2). Peak ground velocity is given in m/s. NBCC2015 and S14 values are specified in bold font. Three additional periods are provided – their use is discussed in the NBCC2015 Commentary. These values have been interpolated Using Shepards method from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.

Click on the column title to see the map of nearby seismic hazard values and the calculated interpolated value

2%/50 years (0.000404 per annum) probability

Distance	Latitude	Longitude	Sa (0.05)	Sa (0.1)	Sa (0.2)	Sa (0.3)	Sa (0.5)	Sa (1.0)	Sa (2.0)	Sa (5.0)	Sa (10.0)	PGA (g)	PGV (m/s)
0.000	45.231	-75.768	0.424	0.497	0.417	0.317	0.225	0.113	0.054	0.014	0.005	0.267	0.187
4.925	45.233	-75.831	0.408	0.480	0.404	0.308	0.219	0.110	0.053	0.014	0.005	0.259	0.182
5.046	45.227	-75.704	0.444	0.519	0.435	0.330	0.234	0.116	0.055	0.015	0.005	0.278	0.194
11.083	45.323	-75.823	0.421	0.495	0.416	0.317	0.225	0.113	0.054	0.014	0.005	0.266	0.187
11.136	45.317	-75.695	0.450	0.526	0.441	0.335	0.237	0.118	0.056	0.015	0.005	0.282	0.196
11.250	45.138	-75.712	0.433	0.506	0.424	0.322	0.228	0.114	0.054	0.014	0.005	0.271	0.189
11.261	45.143	-75.839	0.390	0.461	0.389	0.297	0.212	0.107	0.052	0.014	0.005	0.249	0.177
14.892	45.239	-75.958	0.384	0.454	0.382	0.291	0.209	0.106	0.051	0.014	0.005	0.245	0.174

* The requested site is highlighted in blue