PATERSON GROUP

Geotechnical Investigation

Proposed Commercial Development
3700 Twin Falls Place

Ottawa, Ontario

Prepared for Riverside South Development Corporation

Report PG4958-2 Revision 2 dated March 29, 2023

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1.0 Introduction

Paterson Group (Paterson) was commissioned by Riverside South Development Corporation to conduct a geotechnical investigation for the subject site to be located at 3700 Twin Falls Place in the City of Ottawa (refer to Figure 1 - Key Plan in Appendix 2 of this report).

The objective of the geotechnical investigation was to:

- Determine the subsoil and groundwater conditions at this site by means of boreholes.
- Provide geotechnical recommendations for the design of the proposed development including construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

Investigating the presence or potential presence of contamination on the subject property was not part of the scope of work of the present investigation. Therefore, the present report does not address environmental issues.

2.0 Proposed Development

It is anticipated that the future development will generally consist of a series of low rise commercial buildings and associated parking areas, access lanes and local roadways with rural cross-sections. It is further understood that low impact development (LID) measures are proposed for the subject site.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

The field program for the current investigation was carried out on March 22, 29, 30, 31, and April 1 and 4, 2022. At that time, 19 boreholes were advanced to a maximum depth of 8.1 m below the existing ground surface. A previous investigation was completed at the subject site by this firm in 2005, at that time 6 boreholes were advanced to a maximum depth of 15.9 m below the existing ground surface. The test hole locations were placed in a manner to provide general coverage of the subject site taking into consideration site features and underground utilities. The test hole locations for the current investigation are presented on Drawing PG4958-8 - Test Hole Location Plan included in Appendix 2.

The boreholes were completed using a track mounted drill rig operated by a two-person crew. All fieldwork was conducted under the full-time supervision of Paterson personnel under the direction of a senior engineer from the geotechnical division. The testing procedure consisted of augering to the required depths and at the selected locations sampling the overburden.

Sampling and In Situ Testing

The soil samples were recovered from the auger flights and using a 50 mm diameter split-spoon sampler. The samples were initially classified on site, placed in sealed plastic bags and transported to our laboratory. The depths at which the auger, and split-spoon samples were recovered from the boreholes are shown as AU, and SS, respectively, on the Soil Profile and Test Data sheets in Appendix 1.

The Standard Penetration Test (SPT) was conducted in conjunction with the recovery of the split-spoon samples. The SPT results are recorded as “N” values on the Soil Profile and Test Data sheets. The “N” value is the number of blows required to drive the split-spoon sampler 300 mm into the soil after a 150 mm initial penetration using a 63.5 kg hammer falling from a height of 760 mm.

Undrained shear strength testing was carried out in cohesive soils using a field vane apparatus.

The overburden thickness was evaluated by dynamic cone penetration tests (DCPT) completed at boreholes BH 4-22-EL, BH 12-22-EL, and BH 13-22-EL. DCPT testing was carried out at boreholes BH 1-05, BH 3-05, and BH 6-05 from the 2005 investigation. The DCPT testing consists of driving a steel drill rod, equipped with a 50 mm diameter cone at the tip, using a 63.5 kg hammer falling from a height of 760 mm. The number of blows required to drive the cone into the soil is recorded for each 300 mm increment.

The subsurface conditions observed in the test holes were recorded in detail in the field. The soil profiles are logged on the Soil Profile and Test Data sheets in Appendix 1 of this report.

Groundwater

Boreholes BH 3-22-EL, BH 4-22-EL, BH 5-22-EL, BH 7-22-EL, BH 9-22-EL, BH 11-22-EL, BH 12-22-EL, BH 14-22-EL, BH 16-22-EL, and BH 18-22-EL were fitted with 51 mm diameter PVC groundwater monitoring wells. All remaining boreholes were fitted with a flexible polyethylene standpipe to allow groundwater level monitoring. The groundwater level readings were obtained after a suitable stabilization period subsequent to the completion of the field investigation.

Data loggers were installed within the monitoring wells to monitor fluctuating groundwater levels for a period of four months following the completion of the field investigation. The groundwater observations are discussed in Subsection 4.3 and presented in the Soil Profile and Test Data sheets in Appendix 1.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the subject site. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson using a high precision GPS and referenced to a geodetic datum. The location of the boreholes is presented on Drawing PG4958-8 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

Soil samples were recovered from the subject site and visually examined in our laboratory to review the results of the field logging. Soil samples will be stored for a period of one month after this report is completed, unless otherwise directed.

3.4 Analytical Testing

One (1) soil sample was submitted for analytical testing to assess the corrosion potential for exposed ferrous metals and the potential of sulphate attacks against subsurface concrete structures. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the sample. The results are presented in Appendix 1 and are discussed further in Subsection 6.7.

4.0 Observations

4.1 Surface Conditions

The subject site currently consists of undeveloped agricultural land which is currently still being used for farming operations. Mosquito Creek runs in a south-east to north-west direction adjacent to the south and west boundaries of the site. A tributary stream to the creek also runs adjacent to the north-west site boundary. The side slopes of the creek adjacent to the site boundaries were generally observed to be covered with brush and trees. A Slope Stability Assessment Report of Mosquito Creek and its tributary watercourses, Paterson Group Report PG4958-LET.01 Revision 3 dated June 24, 2020, was previously completed by this firm.

The ground surface across the subject site gradually slopes down toward the south and west directions, with approximate geodetic elevations of 91.7 to 88.9 m. The site was generally observed to be lower than the adjacent roadways by approximately 0.5 to 1.0 m.

The site is generally bordered by undeveloped agricultural land and further by Leitrim Road, with a portion of the site being boarded by a tributary of Mosquito Creek, to the north. The site is bordered by Limebank Road and further by undeveloped agricultural land to the east, by Mosquito Creek and further by undeveloped land to the south, and by Mosquito Creek and further by a residential development to the west.

4.2 Subsurface Profile

Generally, the subsurface soil profile encountered at the test hole locations consisted of a 0.1 to 0.3 m thick topsoil layer underlain by a deep deposit of silty clay.

The silty clay deposit consisted of a hard to stiff brown silty clay crust underlain by a stiff to firm grey silty clay. The brown silty clay weathered crust was observed in all boreholes, extending to depths ranging between 2.8 to 4.6 m below the ground surface. Trace silty sand was observed within the brown silty clay crust at borehole BH 8-22-EL and boreholes BH 4-05 and BH 5-05 from the previous investigation. Sand and/or silt seams were also observed within the grey silty clay in boreholes BH 1-05, BH 2-05, BH 3-05, and BH 4-05 from the previous investigation.

A 3.0 m thick layer of grey clayey silt overlaying a deposit of glacial till at a depth of 15.2 m, consisting of silty sand with gravel, cobbles, and boulders, was encountered at borehole BH 4-05 from the previous investigation.

Practical refusal to DCPT testing, carried out during the current investigation and previous investigation, was encountered at depts ranging from 12.7 to 26.7 m below ground surface.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profile encountered at each test hole location.

Bedrock

Based on available geological mapping, the bedrock in the subject area is part of the March formation, which consists of interbedded sandstone and dolomite with an overburden drift thickness ranging between 15 to 25 m depth.

Laboratory Testing

Atterberg limits testing, as well as associated moisture content testing, was completed on the recovered silty clay samples where encountered. The results of the Atterberg limits test are presented in Table 1 and on the Atterberg Limits Results sheet in Appendix 1. The tested silty clay samples classify as inorganic silts of high plasticity (MH) and inorganic clays of high plasticity (CH) in accordance with the Unified Soil Classification System.

Table 1 - Atterberg Limits Results

Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
BH 1-22-EL	1.83	81	38	43	50.00	MH
BH 2-22-EL	1.83	80	38	42	45.33	MH
BH 3-22-EL	1.83	68	31	37	38.00	CH
BH 4-22-EL	1.83	70	33	37	48.96	CH
BH 5-22-EL	1.83	73	35	38	38.33	MH
BH 6-22-EL	1.07	73	36	37	41.88	MH
BH 7-22-EL	1.83	70	25	37	51.34	CH
BH 8-22-EL	1.83	70	32	38	47.58	CH
BH 9-22-EL	1.83	77	39	38	50.28	MH
BH 10-22-EL	1.07	62	29	33	39.00	CH
BH 11-22-EL	1.83	72	34	38	44.68	CH
BH 12-22-EL	1.07	73	34	39	36.46	CH
BH 13-22-EL	1.83	73	35	38	49.95	MH
BH 14-22-EL	1.07	66	30	36	33.11	CH
BH 15-22-EL	1.83	77	37	40	44.47	MH
BH 16-22-EL	1.07	64	28	36	37.14	CH
BH 17-22-EL	1.83	72	33	39	45.79	CH
BH 18-22-EL	1.07	69	31	38	35.98	CH
BH 19-22-EL	1.83	78	40	38	52.35	MH

Notes: LL: Liquid Limit; PL: Plastic Limit; PI: Plasticity Index; w: water content;
MH: Inorganic Silt of High Plasticity CH: Inorganic Clay of High Plasticity

Grain size distribution analysis was completed on select recovered silty clay samples. The results of the grain size distribution analysis are presented in Table 2 and on the Grain Size Distribution sheets in Appendix 1.

Table 2 – Grain Size Distribution Results

Sample	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
BH 1-22-EL	1.07	0.0	2.1	30.4	67.5
BH 3-22-EL	1.07	0.0	2.7	40.3	57.0
BH 4-22-EL	1.07	0.0	3.6	36.4	60.0
BH 7-22-EL	1.07	0.0	2.0	32.0	66.0
BH 9-22-EL	1.07	0.0	4.3	50.7	45.0
BH 11-22-EL	1.07	0.0	2.5	38.0	59.5
BH 13-22-EL	1.07	0.0	1.2	32.8	66.0
BH 15-22-EL	1.07	0.0	1.9	29.1	69.0
BH 17-22-EL	1.07	0.0	1.8	38.7	59.5
BH 19-22-EL	1.07	0.0	0.6	38.4	61.0

Linear shrinkage testing was completed on a sample recovered from 1.83 m depth from borehole BH 10-22-EL and yielded a shrinkage limit of 21.64 and a shrinkage ratio of 1.81. The results of the shrinkage testing are presented on the Linear Shrinkage sheet in Appendix 1.

4.3 Groundwater

Groundwater levels were recorded at each monitoring well location on April 27, 2022 and at each piezometer location on May 12, 2022. The groundwater level readings are presented in the Soil Profile and Test Data sheets in Appendix 1. The measured groundwater levels and observed depth of infiltration are presented in Table 3 below:

Table 3 – Summary of Groundwater Levels				
Borehole Number	**Ground Surface Elevation (m)**	**Measured Groundwater Level**		**Date Recorded**
		Depth (m)	**Elevation (m)**	
BH 1-22-EL	91.61	0.73	90.88	May 12, 2022
BH 2-22-EL	91.12	0.90	90.22	May 12, 2022
BH 3-22-EL	89.75	0.59	89.16	April 27, 2022
BH 4-22-EL	90.33	0.70	89.63	April 27, 2022
BH 5-22-EL	90.29	0.18	90.11	April 27, 2022
BH 6-22-EL	90.90	0.76	90.14	May 12, 2022
BH 7-22-EL	91.25	0.88	90.37	April 27, 2022
BH 8-22-EL	90.53	1.03	89.50	May 12, 2022
BH 9-22-EL	90.77	0.89	89.88	April 27, 2022
BH 10-22-EL	91.44	Blocked/Dry	-	May 12, 2022
BH 11-22-EL	91.38	0.81	90.57	April 27, 2022
BH 12-22-EL	91.73	0.38	91.35	April 27, 2022
BH 13-22-EL	91.57	0.65	90.92	May 12, 2022
BH 14-22-EL	91.40	0.64	90.76	April 27, 2022
BH 15-22-EL	91.09	0.72	90.37	May 12, 2022
BH 16-22-EL	91.01	0.84	90.17	April 27, 2022
BH 17-22-EL	90.68	0.36	90.32	May 12, 2022
BH 18-22-EL	91.02	0.46	90.56	April 27, 2022
BH 19-22-EL	91.27	0.59	90.68	May 12, 2022
Note: The ground surface elevation at each borehole location was surveyed using a handheld GPS using a geodetic datum.				

It should be noted that surface water can become trapped within a backfilled borehole that can lead to higher than typical groundwater level observations.

The Long-term groundwater levels can also be estimated based on the observed colour, consistency, and moisture content of the recovered soil samples. Based on these observations, the long-term groundwater table can be expected at approximately 2.8 to 4.4 m below ground surface. Groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could vary at the time of construction.

It should be further noted that the four-month groundwater monitoring program was ongoing at the time of issuance of the current report. The results of the full monitoring program will be provided upon completion of the program.

Hydraulic Conductivity Testing

Slug Testing

Slug testing was completed at all monitoring well locations on April 27, 2022. Following the completion of the slug testing, the test data was analyzed as per the method set out by Hvorslev (1951). Assumptions inherent in the Hvorslev method include a homogeneous and isotropic aquifer of infinite extent with zero-storage assumption, and a screen length significantly greater than the monitoring well diameter. The assumption regarding aquifer storage is considered to be appropriate for groundwater flow through the overburden aquifer. The assumption regarding screen length and well diameter is considered to be met based on a screen length of 1.5 m and a diameter of 0.05 m.

While the idealized assumptions regarding aquifer extent, homogeneity, and isotropy are not strictly met in this case (or in any real-world situation), it has been our experience that the Hvorslev method produces effective point estimates of hydraulic conductivity in conditions similar to those encountered at the subject site.

Hvorslev analysis is based on the line of best fit through the field data (hydraulic head recovery vs. time), plotted on a semi-logarithmic scale. In cases where the initial hydraulic head displacement is known with relative certainty, such as in this case where a physical slug has been introduced, the line of best fit is considered to pass through the origin.

Based on the above test methods, the grey silty clay yielded field saturated hydraulic conductivity values ranging between **1.8×10^{-8} and 1.1×10^{-7} m/sec**. The values measured within the monitoring wells are generally consistent with similar material Paterson has encountered on other sites and typical published values for silty clay. These values typically range from 1×10^{-7} to 1×10^{-12} m/sec for silty clay. The range in hydraulic conductivity values is due to the variability in the composition and shear strength of the silty clay. The results of the hydraulic conductivity testing are presented in Appendix 1.

Permeameter Testing

Permeameter testing was completed near surface at depths ranging from 0.3 to 0.6 m below ground surface within the brown silty clay layer adjacent to twelve monitoring well locations on April 29 and May 2, 2022.

Preparation and testing for this investigation was done in accordance with the Canadian Standards Association (CSA) B65-12 - Annex E. The field saturated hydraulic conductivity (K_{fs}) and estimated infiltration values for each test hole location are presented in Table 4 below.

Table 4 - Permeameter Testing Results

BH ID	Depth of Testing (m)	Material	K_{fs} (m/sec)	Unfactored Infiltration Rate (mm/hr)
BH3-22-EL	0.3	Br. Silty Clay	1.5×10^{-8}	16
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH4-22-EL	0.4	Br. Silty Clay	3.0×10^{-7}	33
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH5-22-EL	0.3	Br. Silty Clay	1.9×10^{-7}	29
	0.6	Br. Silty Clay	3.0×10^{-8}	19
BH7-22-EL	0.3	Br. Silty Clay	9.0×10^{-7}	44
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH8-22-EL	0.3	Br. Silty Clay	4.9×10^{-8}	21
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH9-22-EL	0.3	Br. Silty Clay	4.5×10^{-8}	22
	0.6	Br. Silty Clay	3.0×10^{-8}	19
BH11-22-EL	0.3	Br. Silty Clay	7.5×10^{-7}	40
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH12-22-EL	0.3	Br. Silty Clay	1.1×10^{-6}	49
	0.6	Br. Silty Clay	3.0×10^{-8}	19
BH14-22-EL	0.3	Br. Silty Clay	3.0×10^{-8}	19
	0.6	Br. Silty Clay	1.5×10^{-8}	16
BH16-22-EL	0.3	Br. Silty Clay	3.0×10^{-8}	19
	0.6	Br. Silty Clay	7.5×10^{-9}	9
BH18-22-EL	0.3	Br. Silty Clay	3.8×10^{-7}	33
	0.6	Br. Silty Clay	3.0×10^{-8}	19
BH19-22-EL	0.3	Br. Silty Clay	4.5×10^{-8}	22
	0.6	Br. Silty Clay	1.5×10^{-8}	16

Field saturated hydraulic conductivity values were determined using Engineering Technologies Canada (ETC) Ltd. reference tables provided in the most recent ETC Pask Permeameter User Guide dated March 2016. The field saturated hydraulic conductivity values were used to estimate the infiltration rates based on the approximate relationship between infiltration rate and hydraulic conductivity, as described in the 2010 Low Impact Development Stormwater Management Planning and Design Guide prepared by the CVC and the TRCA. Based on the subsurface profile encountered across the subject site, it is recommended that a minimum correction factor of 2.5 be applied to the chosen infiltration rate at the time of design.

4.4 Settlement Monitoring Program

A total of two (2) test fill piles, identified as Piles E and EE, were constructed within the subject site in December 2019 to complete a test fill pile monitoring program for the sensitive marine clay deposit. The test fill piles were constructed to a height of 2 and 2.5 m above the original ground surface, and two (2) settlement plates, identified as SPE1, SPE2, SPEE1, and SPEE2, were installed at each pile location. The test fill piles consist of a brown silty clay fill material, placed and packed in suitable lifts to eliminate voids within the fill pile material.
Settlement survey results collected between December 2019 and December 2020 yielded total settlements of 14 mm, 5 mm, 17 mm, and 37 mm for SPE1, SPE2, SPEE1, and SPEE2, respectively. Reference should be made to Figure 28 – Settlement Monitoring Program for the results of our monitoring program. The test fill pile locations are presented in Drawing PG4958-8 – Test Hole Location Plan in Appendix 2.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is considered suitable for the proposed development. It is anticipated that the future commercial buildings will be founded over conventional shallow footings placed on an undisturbed, hard to stiff, brown silty clay crust or an approved engineered fill placed on an undisturbed silty clay bearing surface.

Due to the presence of the sensitive silty clay deposit, the proposed development will be subjected to grade raise restrictions. Permissible grade raise recommendations have been provided for the subject site. If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements.

The above and other considerations are discussed in the following sections.

5.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures. Care should be taken not to disturb subgrade soils during site preparation activities.

Existing foundation walls and other construction debris should be entirely removed from within the building perimeters. Under paved areas, existing construction remnants such as foundation walls should be excavated to a minimum of 1 m below final grade.

Fill Placement

Fill placed for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A, Granular B Type II or . The imported fill material should be tested and approved prior to delivery. The fill should be placed in maximum 300 mm thick loose lifts and compacted by suitable compaction equipment. Fill placed beneath the building should be compacted to a minimum of 98% of the standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil could be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in lifts with a maximum thickness of 300 mm and compacted by the tracks of the spreading equipment to minimize voids. If these materials are to be used to build up the subgrade level for areas to be paved, they should be compacted in thin lifts to a minimum density of 95% of the SPMDD.

Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

5.3 Foundation Design

Bearing Resistance Values (Conventional Shallow Foundation)

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed over an undisturbed, hard to stiff silty clay bearing surface or engineered fill over an undisturbed, stiff silty clay can be designed using a bearing resistance value at serviceability limit states (SLS) of **200 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **300 kPa** incorporating a geotechnical factor of 0.5.

An undisturbed soil bearing surface consists of one from which all topsoil and deleterious materials, such as loose, frozen, or disturbed soil, have been removed, in the dry, prior to the placement of concrete footings.

Footings bearing on an undisturbed soil bearing surface and designed using the bearing resistance values provided above will be subjected to potential post-construction total and differential settlements of 25 and 20 mm, respectively.

Lateral Support

The bearing medium under footing-supported structures is required to be provided with adequate lateral support with respect to excavations and different foundation levels. Adequate lateral support is provided to stiff silty clay above the groundwater table when a plane extending down and out from the bottom edges of the footing, at a minimum of 1.5H:1V, passes only through in situ soil of the same or higher capacity as that of the bearing medium.

Permissible Grade Raise Recommendations

Based on the undrained shear strength values of the silty clay deposit encountered throughout the subject site, the recommended permissible grade raise areas for buildings are defined in Drawing PG4958-9 - Permissible Grade Raise Plan in Appendix 2.

If higher than permissible grade raises are required, preloading with or without a surcharge, lightweight fill, and/or other measures should be investigated to reduce the risks of unacceptable long-term post construction total and differential settlements. Provided sufficient time is available to induce the required settlements, consideration could be given to surcharging the subject site.

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed for our calculations.

5.4 Design for Earthquakes

The site class for seismic site response can be taken as **Class E** for foundations bearing over the deep silty clay deposit identified throughout the subject site. The soils underlying the subject site are not susceptible to liquefaction. Reference should be made to the latest revision of the 2012 Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Pavement Design

For design purposes, the pavement structure presented in the following tables could be used for the design of driveways, local residential streets, and roadways with bus traffic.

It should be noted that for residential driveways and car only parking areas, an Ontario Traffic Category A is applicable. For local roadways, an Ontario Traffic Category B should be used for design purposes.

Table 5 – Recommended Pavement Structure – Driveways

Thickness (mm)	Material Description
50	**Wear Course –** HL-3 or Superpave 12.5 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
300	**SUBBASE –** OPSS Granular B Type II
SUBGRADE – Either in-situ soil, or OPSS Granular B Type I or II material over in-situ soil.	
Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this Pavement Structure.	

Table 6 – Recommended Pavement Structure – Local Residential Roadways	
Thickness (mm)	**Material Description**
40	**Wear Course –** Superpave 12.5 Asphaltic Concrete
50	**Wear Course –** Superpave 19.0 Asphaltic Concrete
150	**BASE –** OPSS Granular A Crushed Stone
400	**SUBBASE –** OPSS Granular B Type II
SUBGRADE – Either in-situ soil, or OPSS Granular B Type I or II material over in-situ soil. **Minimum Performance Graded** (PG) 58-34 asphalt cement should be used for this Pavement Structure.	

Table 7 – Recommended Pavement Structure – Arterial Roadways with Bus Traffic	
Thickness (mm)	**Material Description**
40	**Wear Course –** Superpave 12.5 Asphaltic Concrete
50	**Upper Binder Course –** Superpave 19.0 Asphaltic Concrete
50	**Lower Binder Course – Superpave 19.0 Asphaltic Concrete**
150	**BASE –** OPSS Granular A Crushed Stone
600	**SUBBASE –** OPSS Granular B Type II
SUBGRADE – Either in-situ soil, or OPSS Granular B Type I or II material over in-situ soil. **Minimum Performance Graded** (PG) 64-34 asphalt cement should be used for this Pavement Structure.	

If soft spots develop in the subgrade during compaction or due to construction traffic, the affected areas should be excavated and replaced with OPSS Granular B Type II material. Weak subgrade conditions may be experienced over service trench fill materials. This may require the use of a geotextile, thicker subbase or other measures that can be recommended at the time of construction as part of the field observation program.

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for driveways and local roadways and PG 64-34 asphalt cement should be used for roadways with bus traffic. The pavement granular base and subbase should be placed in maximum 300 mm thick lifts and compacted to a minimum of 100% of the material's SPMDD using suitable vibratory equipment.

Pavement Structure Drainage

Satisfactory performance of the pavement structure is largely dependent on the contact zone between the subgrade material and the base stone in a dry condition. Failure to provide adequate drainage under conditions of heavy wheel loading can result in the fine subgrade soil being pumped into the voids in the stone subbase, thereby reducing load carrying capacity.

Due to the low permeability of the subgrade materials consideration should be given to installing subdrains during the pavement construction as per City of Ottawa standards. The subdrain inverts should be approximately 300 mm below subgrade level. The subgrade surface should be crowned to promote water flow to the drainage lines.

6.0 Design and Construction Precautions

6.1 Foundation Drainage and Backfill

Foundation Drainage

It is recommended that a perimeter foundation drainage system be designed for the future structures. The system should consist of a 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 19 mm clear crushed stone, placed at the footing level around the exterior perimeter of the structures. The pipe should have a positive outlet, such as a gravity connection to a drainage ditch.

Backfill against the exterior sides of the foundation walls should consist of free-draining non-frost susceptible granular materials. The greater part of the site excavated materials will be frost susceptible and, as such, are not recommended for re-use as backfill against the foundation walls, unless used in conjunction with a composite drainage system, such as Delta Drain 6000 or an approved equivalent. Imported granular materials, such as clean sand or OPSS Granular B Type I granular material, should otherwise be used for this purpose.

6.2 Protection of Footings Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effects of frost action. A minimum 1.5 m thick soil cover (or insulation equivalent) should be provided in this regard.

Other exterior unheated footings, such as those for isolated exterior piers, are more prone to deleterious movement associated with frost action than the exterior walls of the proper structure. These footings should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

6.3 Excavation Side Slopes

The side slopes of excavations in the overburden materials should be either cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the excavation to be undertaken by open-cut methods (i.e., unsupported excavations).

Unsupported Side Slopes

The excavation side slopes above the groundwater level extending to a maximum depth of 3 m should be cut back at 1H:1V or flatter. The flatter slope is required for excavation below groundwater level. The subsoil at this site is considered to be mainly a Type 2 and 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

Excavated soil should not be stockpiled directly at the top of excavations and heavy equipment should be kept away from the excavation sides.

Slopes in excess of 3 m in height should be periodically inspected by the geotechnical consultant in order to detect if the slopes are exhibiting signs of distress.

It is recommended that a trench box be used at all times to protect personnel working in trenches with steep or vertical sides. It is expected that services will be installed by “cut and cover” methods and excavations will not be left open for extended periods of time.

6.4 Pipe Bedding and Backfill

Bedding and backfill materials should be in accordance with the most recent Material Specifications and Standard Detail Drawings from the Department of Public Works and Services, Infrastructure Services Branch of the City of Ottawa.

At least 150 mm of OPSS Granular A should be used for pipe bedding for sewer and water pipes. The bedding should extend to the spring line of the pipe. Cover material, from the spring line to at least 300 mm above the obvert of the pipe, should consist of OPSS Granular A or Granular B Type II with a maximum size of 25 mm. The bedding layer should be increased to a minimum thickness of 300 mm where the subgrade consists of grey silty clay. The bedding and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material’s standard Proctor maximum dry density.

It should generally be possible to re-use the upper portion of the dry to moist (not wet) silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Any stones greater than 200 mm in their longest dimension should be removed from these materials prior to placement.

The backfill material within the frost zone (about 1.5 m below finished grade) should match the soils exposed at the trench walls to reduce potential differential frost heaving. The backfill should be placed in maximum 225 mm thick loose lifts and compacted to a minimum of 95% of the material’s SPMDD.

Clay Seals

To reduce long-term lowering of the groundwater level at this site, clay seals should be provided in the service trenches. The seals should be at least 1.5 m long and should extend from trench wall to trench wall. Generally, the seals should extend from the frost line and fully penetrate the bedding, sub-bedding and cover material. The barriers should consist of relatively dry and compactable brown silty clay placed in maximum 225 mm thick loose layers and compacted to a minimum of 95% of the material's SPMDD. The clay seals should be placed at the site boundaries and at strategic locations at no more than 60 m intervals in the service trenches.

6.5 Groundwater Control

Due to the relatively impervious nature of the silty clay materials, it is anticipated that groundwater infiltration into the excavations should be low to moderate and controllable using open sumps. Pumping from open sumps should be sufficient to control the groundwater influx through the sides of shallow excavations. The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbances to the founding medium.

Permit to Take Water

A temporary Ministry of the Environment, Conservation and Parks (MECP) permit to take water (PTTW) may be required for this project if more than 400,000 L/day of ground and/or surface water is to be pumped during the construction phase. A minimum 4 to 5 months should be allowed for completion of the PTTW application package and issuance of the permit by the MECP.

For typical ground or surface water volumes being pumped during the construction phase, typically between 50,000 to 400,000 L/day, it is required to register on the Environmental Activity and Sector Registry (EASR). A minimum of two to four weeks should be allotted for completion of the EASR registration and the Water Taking and Discharge Plan to be prepared by a Qualified Person as stipulated under O.Reg. 63/16. If a project qualifies for a PTTW based upon anticipated conditions, an EASR will not be allowed as a temporary dewatering measure while awaiting the MECP review of the PTTW application.

6.6 Winter Construction

Precautions must be taken if winter construction is considered for this project.

The subsoil conditions at this site consist of frost susceptible materials. In the presence of water and freezing conditions, ice could form within the soil mass. Heaving and settlement upon thawing could occur.

In the event of construction during below zero temperatures, the founding stratum should be protected from freezing temperatures by the use of straw, propane heaters and tarpaulins or other suitable means. In this regard, the base of the excavations should be insulated from sub-zero temperatures immediately upon exposure and until such time as heat is adequately supplied to the building and the footings are protected with sufficient soil cover to prevent freezing at founding level.
Trench excavations and pavement construction are also difficult activities to complete during freezing conditions without introducing frost in the subgrade or in the excavation walls and bottoms. Precautions should be taken if such activities are to be carried out during freezing conditions. Additional information could be provided, if required.

6.7 Corrosion Potential and Sulphate

The results of analytical testing show that the sulphate content is less than 0.1%. This result is indicative that Type 10 Portland cement (normal cement) would be appropriate for this site. The chloride content and the pH of the sample indicate that they are not significant factors in creating a corrosive environment for exposed ferrous metals at this site, whereas the resistivity is indicative of a non-aggressive to slightly aggressive corrosive environment.

6.8 Landscaping Considerations

Tree Planting Considerations

In accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines), Paterson completed a soils review of the site to determine applicable tree planting setbacks. Atterberg limits testing was completed for the recovered silty clay samples at selected locations throughout the subject site. The soil samples were recovered from elevations below the anticipated design underside of footing elevation and 3.5 m depth below anticipated finished grade. The results of our testing are presented in Table 1 in Subsection 4.2 and in Appendix 1.

Based on the results of our review, two areas were defined within the subject site in which the tree planting restrictions are defined. The two areas are detailed below and are outlined in Drawing PG4958-10 - Tree Planting Setback Recommendations presented in Appendix 2.

Area 1 - Low to Medium Sensitivity Clay Area

A low to medium sensitivity clay soil was encountered between anticipated underside of footing elevations and 3.5 m below preliminary finished grade as per City Guidelines at the areas outlined in Drawing PG4958-10 - Tree Planting Setback Recommendations in Appendix 2. Based on our Atterberg Limits' test results, the modified plasticity limit does not exceed 40% in these areas. The following tree planting setbacks are recommended for the low to medium sensitivity area.

- ❑ Large trees (mature height over 14 m) can be planted within these areas provided that a tree to foundation setback equal to the full mature height of the tree can be provided.

- ❑ Tree planting setback limits may be reduced to 4.5 m for small (mature tree height up to 7.5m) and medium size trees (mature tree height 7.5 m to 14 m) provided that the conditions noted below are met.

Area 2 - High Sensitivity Clay Area

Paterson completed a soils review of the site to determine applicable tree planting setbacks, in accordance with the City of Ottawa Tree Planting in Sensitive Marine Clay Soils (2017 Guidelines). Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. The above-noted test results were completed on samples taken at depths between proposed design underside of footing elevation and a 3.5 m depth below finished grade (any structure with shallow foundation). The results of our testing are presented in Table 1 in Subsection 4.2 and in Appendix 1.

Based on the results of our review, a high sensitivity clay soil was encountered between the anticipated design underside of footing elevation and 3.5 m below finished grade as per City Guidelines. Based on our Atterberg limits test results, the modified plasticity index generally exceeds 40% in these areas. The following tree planting setbacks are recommended for these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided. Tree planting setback limits are 7.5 m for small (mature height up to 7.5 m) and medium size trees (mature tree height 7.5 to 14 m), provided that the following conditions are met.

- ❑ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade for footings within 10 m from the tree, as measured from the center of the tree trunk and verified by means of the Grading Plan.

- A small tree must be provided with a minimum of 25 m^3 of available soils volume while a medium tree must be provided with a minimum of 30 m^3 of available soil volume, as determined by the Landscape Architect. The developer is to ensure that the soil is generally un-compacted when backfilling in street tree planting locations.

- The tree species must be small (mature tree height up to 7.5 m) to medium size (mature tree height 7.5 m to 14 m) as confirmed by the Landscape Architect.

- The foundation walls are to be reinforced at least nominally (minimum of two upper and two lower 15M bars in the foundation wall).

- Grading surrounding the tree must promote drainage to the tree root zone (in such a manner as not to be detrimental to the tree), as noted on the Grading Plan.

Above-Ground Swimming Pools, Hot Tubs, Decks and Additions

The in-situ soils are considered acceptable for in-ground swimming pools. Above ground swimming pools must be placed at least 5 m away from the residence foundation and neighbouring foundations. Otherwise, pool construction is considered routine, and can be constructed in accordance with the manufacturer's requirements.

Additional grading around the hot tub should not exceed permissible grade raise restrictions. Otherwise, hot tub construction is considered routine, and can be constructed in accordance with the manufacturer's specifications.

Additional grading around proposed deck or additions should not exceed permissible grade raises restrictions. Otherwise, standard construction practices are considered acceptable.

6.9 Slope Stability Assessment

A slope stability assessment was previously completed by this firm for Mosquito Creek. Reference should be made to Paterson Group Report PG4958-LET.01 Revision 3 dated June 24, 2020. A total of 14 slope sections within the vicinity of the subject site were completed during the previous assessment.

At the time of our analysis, Mosquito Creek and the associated tributaries were observed to range in width between 2 to over 15 m, with a water depth ranging between 0.3 and 0.9 m. Signs of erosion were observed along some areas of Mosquito Creek and the tributary watercourses.

Limit of Hazard Lands

The analysis of slope stability was carried out using SLIDE, a computer program that permits a two-dimensional slope stability analysis using several methods, including the Bishop's method, which is a widely used and accepted analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to those favouring failure. Theoretically, a factor of safety of 1.0 represents a condition where the slope is stable. However, due to intrinsic limitations of the calculation methods and the variability of the subsoil and groundwater conditions, a factor of safety greater than one is usually required to ascertain than the risks of failure are acceptable. A minimum factor of safety of 1.5 is generally recommended for conditions where the failure of the slope would endanger permanent structures.

A slope stability assessment was carried out to determine the required stable slope allowance setback from the top of slope based on a factor of safety of 1.5. A toe erosion and 6 m access allowances were also included in the determination of limits of hazard lands and are discussed below. The proposed limit of hazard lands (as shown on Drawings PG4958-8 – Test Hole Location Plan) includes:

- ❑ A stable slope allowance with a factor of safety of 1.5.
- ❑ A toe erosion allowance, where applicable, of 8 m.
- ❑ A 6 m erosion access allowance and top of slope.

Slope Stability Analysis

Subsoil conditions at the cross-sections were inferred based on nearby boreholes. For a conservative review of the groundwater conditions, the silty clay deposit was noted to be fully saturated for our analysis and exiting at the toe of the slope. The results are shown in Figures 2A, 2C, 3A, 3C, 4A, 4C, 5A, 6A, 7A, 8A, 9A, 10A, 10C, 11A, 11C, 12A, 12C, 19A, 19C, 20A, 20C, 21A, 21C, 26A, and 26C in Appendix 2. The results indicate a slope with a factor of safety ranging between 1.1 and 2.2. Based on these results, a stable slope setback varying between 3.3 and 27.9 m from the top of the slope are required to achieve a factor of safety of 1.5 for the limit of the hazard lands.

Seismic Loading Analysis

An analysis considering seismic loading and the groundwater at ground surface was also completed. A horizontal acceleration of 0.16g was considered for all slopes. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The results of the analyses including seismic loading are shown in Figures 2B, 2D, 3B, 3D, 4B, 4D, 5B, 6B, 7B, 8B, 9B, 10B, 10D, 11B, 11D, 12B, 12D, 19B, 19D, 20B, 20D, 21B, 21D, 26B, and 26D in Appendix 2. The results indicate a slope with a factor of safety ranging between 1.1 and 2.4. Based on these results, there is no stable slope setback required.

7.0 Recommendations

The following is recommended to be completed once the preliminary site plan and site development are determined:

- ❑ Carry out a detailed geotechnical investigation for the final detailed design which would include further test holes and laboratory testing.
- ❑ Review detailed grading plan(s) from a geotechnical perspective, once available.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Periodic observation of the condition of unsupported excavation side slopes in excess of 3 m in height, if applicable.
- ❑ Observation of all subgrades prior to backfilling.
- ❑ Field density tests to determine the level of compaction achieved.
- ❑ Sampling and testing of the bituminous concrete including mix design reviews.
- ❑ Review of slope stability remedial work.
- ❑ Review of Low Impact Development (LID) design from a geotechnical perspective, once available.
- ❑ Review of the installation of clay seals.

All excess soils must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management.*

A report confirming that these works have been conducted in general accordance with our recommendations could be issued upon the completion of a satisfactory inspection program by the geotechnical consultant.

8.0 Statement of Limitations

The recommendations provided are in accordance with the present understanding of the project. Paterson requests permission to review the recommendations when the drawings and specifications are completed.

A soils investigation is a limited sampling of a site. Should any conditions at the site be encountered which differ from those at the test locations, Paterson requests immediate notification to permit reassessment of our recommendations.

The recommendations provided herein should only be used by the design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the factual information provided in this report and determine the suitability and completeness for their intended construction schedule and methods. Additional testing may be required for their purposes.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than Riverside South Development Corporation or their agents is not authorized without review by Paterson for the applicability of our recommendations to the alternative use of the report.

Paterson Group Inc.

LICENSED PROFESSIONAL ENGINEER
Mar. 29, 2023
D. J. GILBERT
100116130
PROVINCE OF ONTARIO

Nicole R.L. Patey, B.Eng.

David J. Gilbert, P.Eng.

Report Distribution:

- Riverside South Development Corporation (1 digital copy)
- Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

ATTERBERG LIMIT TESTING RESULTS

GRAIN SIZE TESTING RESULTS

ANALYTICAL TESTING RESULTS

SLUG TESTING RESULTS

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9 Auriga Drive, Ottawa, Ontario K2E 7T9

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

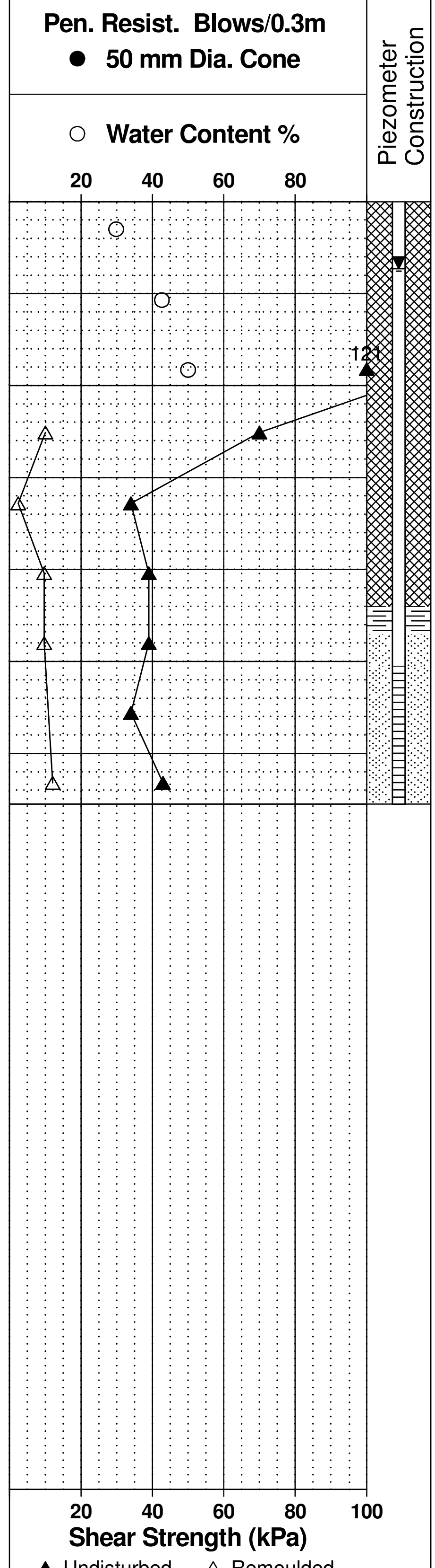
BORINGS BY Track-Mount Power Auger

DATE March 22, 2022

FILE NO. **PG4958**

HOLE NO. **BH 1-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.61
TOPSOIL 0.25		SS	1	100	11		
		SS	2	100	6	1	90.61
		SS	3	100	P		
Hard to stiff, brown **SILTY CLAY**						2	89.61
- firm and grey by 2.9m depth						3	88.61
						4	87.61
						5	86.61
						6	85.61
6.55							
End of Borehole							
(GWL @ 0.73m - May 12, 2022)							



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3700 Twin Falls Place
Ottawa, Ontario

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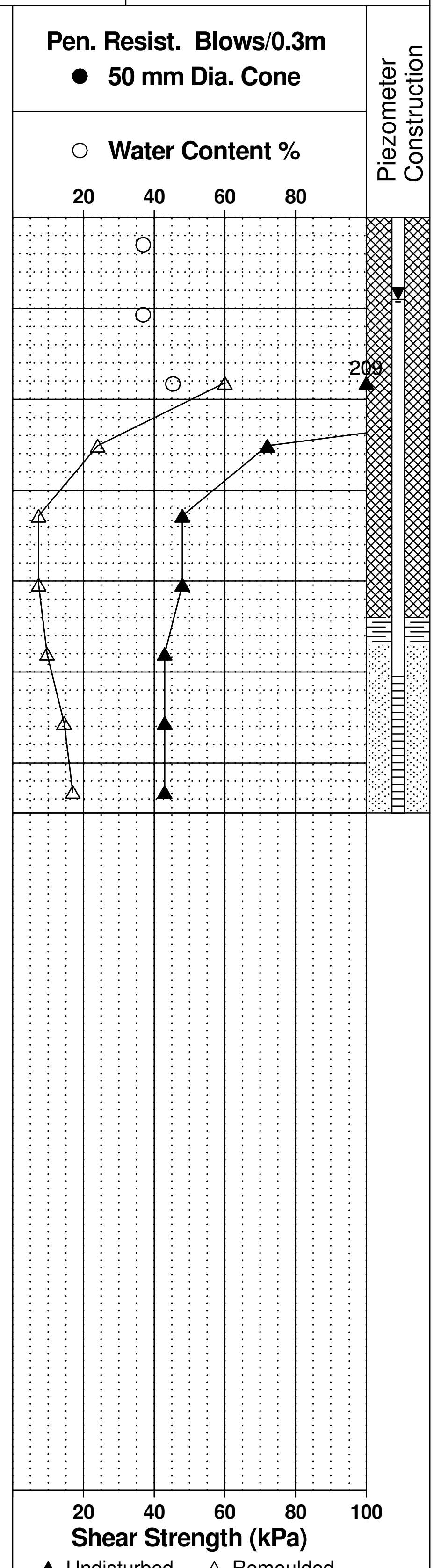
BORINGS BY Track-Mount Power Auger

DATE March 22, 2022

FILE NO. PG4958

HOLE NO. BH 2-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.12
TOPSOIL 0.23		SS	1	83	10		
		SS	2	50	10	1	90.12
		SS	3	50	P		
Hard to stiff, brown **SILTY CLAY**						2	89.12
- firm and grey by 3.0m depth						3	88.12
						4	87.12
						5	86.12
						6	85.12
6.55							
End of Borehole							
(GWL @ 0.90m - May 12, 2022)							



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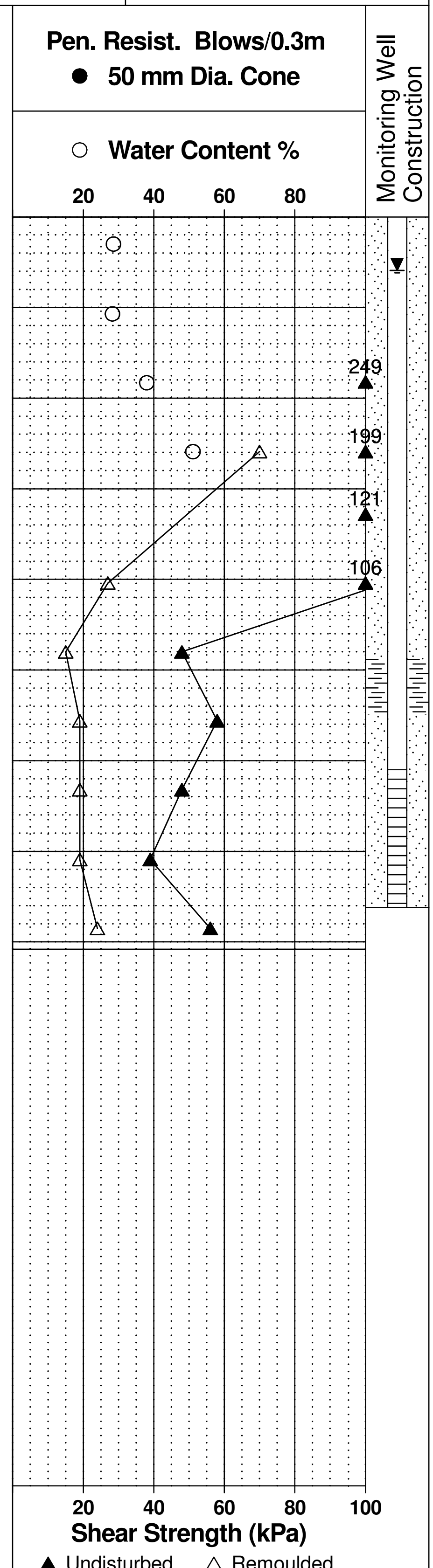
BORINGS BY Track-Mount Power Auger

DATE March 29, 2022

FILE NO. **PG4958**

HOLE NO. **BH 3-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.75
TOPSOIL 0.23		SS	1	42	8		
		SS	2	67	10	1	88.75
		SS	3	75	P	2	87.75
		SS	4	83	P		
Hard to very stiff, brown **SILTY CLAY**						3	86.75
						4	85.75
- stiff to firm and grey by 4.4m depth						5	84.75
						6	83.75
						7	82.75
8.08						8	81.75
End of Borehole							
(GWL @ 0.59m - May 12, 2022)							



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Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** March 30, 2022

FILE NO. **PG4958**

HOLE NO. **BH 4-22-EL**

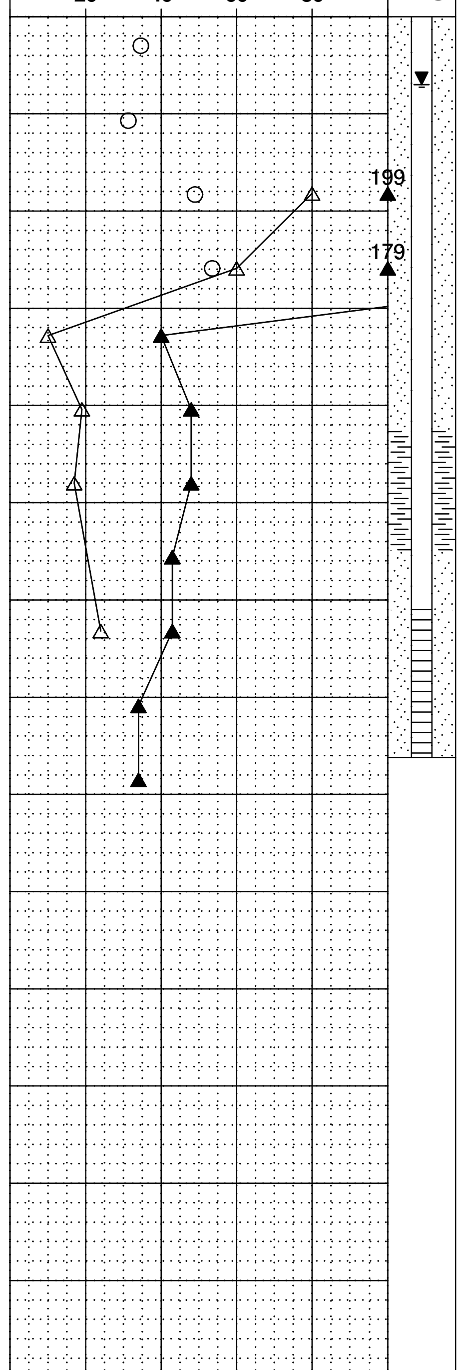
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.33
TOPSOIL 0.10		SS	1	25	7		
Hard to very stiff, brown **SILTY CLAY**		SS	2	50	7	1	89.33
		SS	3	75	P	2	88.33
		SS	4	75	P		
- stiff to firm and grey by 3.0m depth						3	87.33
						4	86.33
						5	85.33
						6	84.33
						7	83.33
8.08						8	82.33
Dynamic Cone Penetration Test commenced at 8.08m depth. Cone pushed to 17.7m depth.						9	81.33
						10	80.33
						11	79.33
						12	78.33
						13	77.33
						14	76.33

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**

○ **Water Content %**

20 40 60 80

Monitoring Well Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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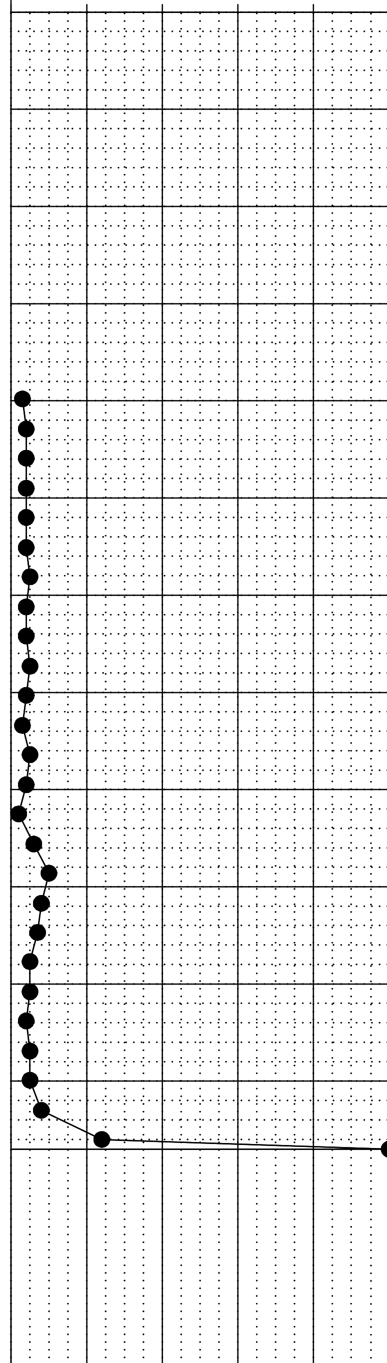
DATE March 30, 2022

FILE NO. PG4958

HOLE NO. BH 4-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Monitoring Well Construction
GROUND SURFACE								20 40 60 80	
						14	76.33		
						15	75.33		
						16	74.33		
						17	73.33		
						18	72.33		
						19	71.33		
						20	70.33		
						21	69.33		
						22	68.33		
						23	67.33		
						24	66.33		
						25	65.33		
25.70									
End of Borehole Practical DCPT refusal at 25.70m depth. (GWL @ 0.70m - May 12, 2022)									



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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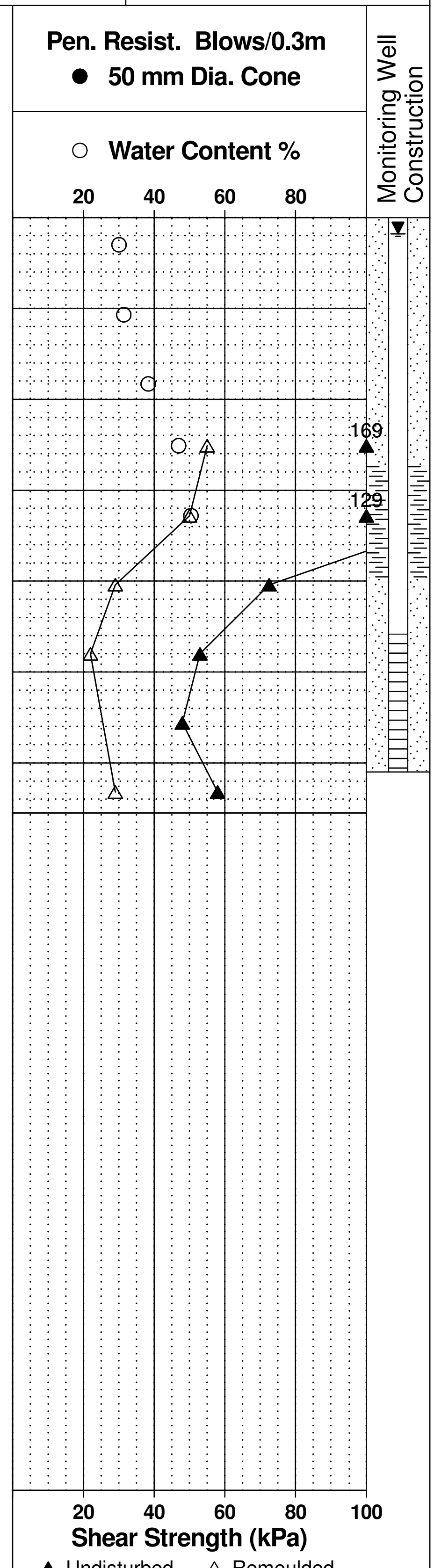
DATE March 30, 2022

FILE NO. PG4958

HOLE NO. BH 5-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.29
TOPSOIL 0.20		SS	1	25	5		
		SS	2	67	8	1	89.29
		SS	3	75	9		
Very stiff, brown **SILTY CLAY**						2	88.29
						3	87.29
- stiff to firm and grey by 3.5m depth						4	86.29
						5	85.29
6.55						6	84.29
End of Borehole							
(GWL @ 0.18m - May 12, 2022)							



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REMARKS

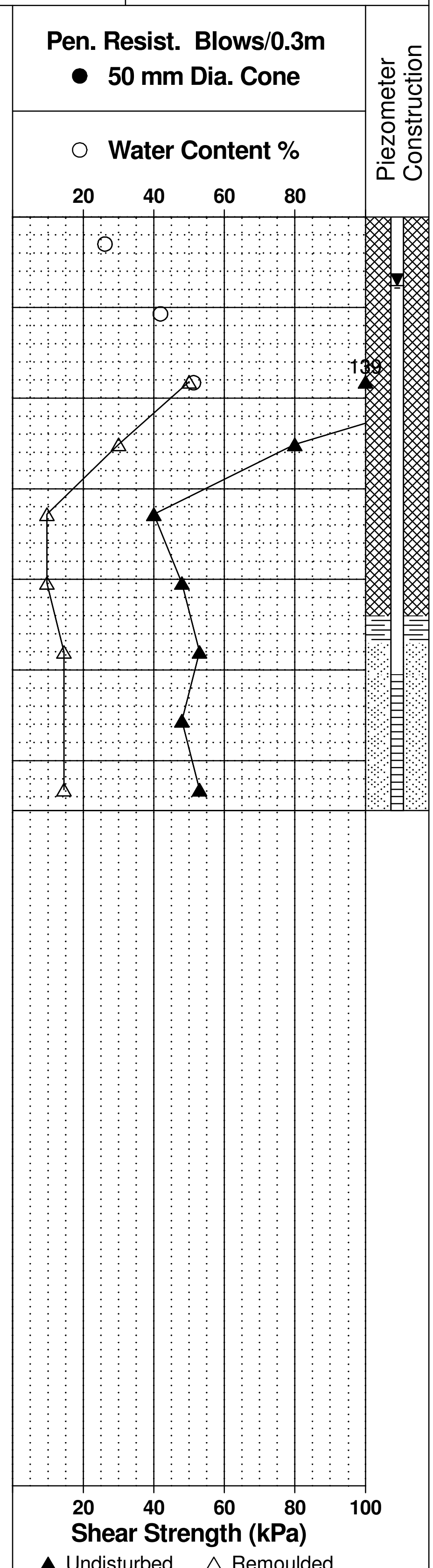
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. PG4958

HOLE NO. BH 6-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.18		SS	1	33	7	0	90.90
		SS	2	50	7	1	89.90
Very stiff to stiff, brown **SILTY CLAY**		SS	3	75	P	2	88.90
- firm to stiff and grey by 2.9m depth						3	87.90
						4	86.90
						5	85.90
6.55						6	84.90
End of Borehole							
(GWL @ 0.76m - May 12, 2022)							



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REMARKS

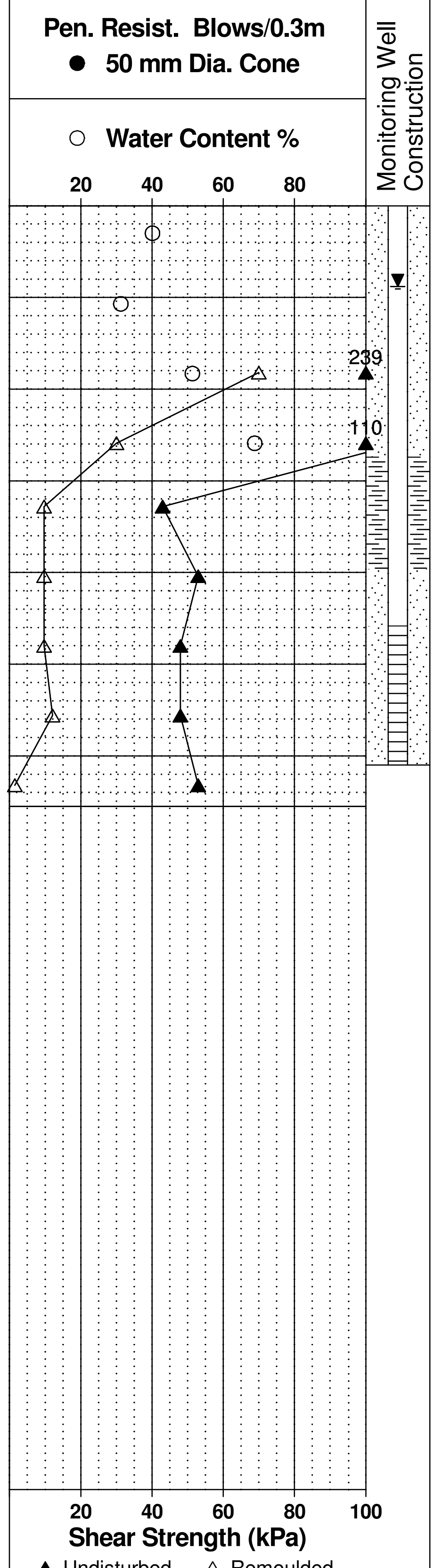
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. **PG4958**

HOLE NO. **BH 7-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.25
TOPSOIL 0.25		SS	1	42	8		
Hard to very stiff, brown **SILTY CLAY**		SS	2	67	7	1	90.25
		SS	3	83	P	2	89.25
- firm to stiff and grey by 3.0m depth		SS	4	100	P	3	88.25
						4	87.25
						5	86.25
6.55						6	85.25
End of Borehole							
(GWL @ 0.88m - May 12, 2022)							



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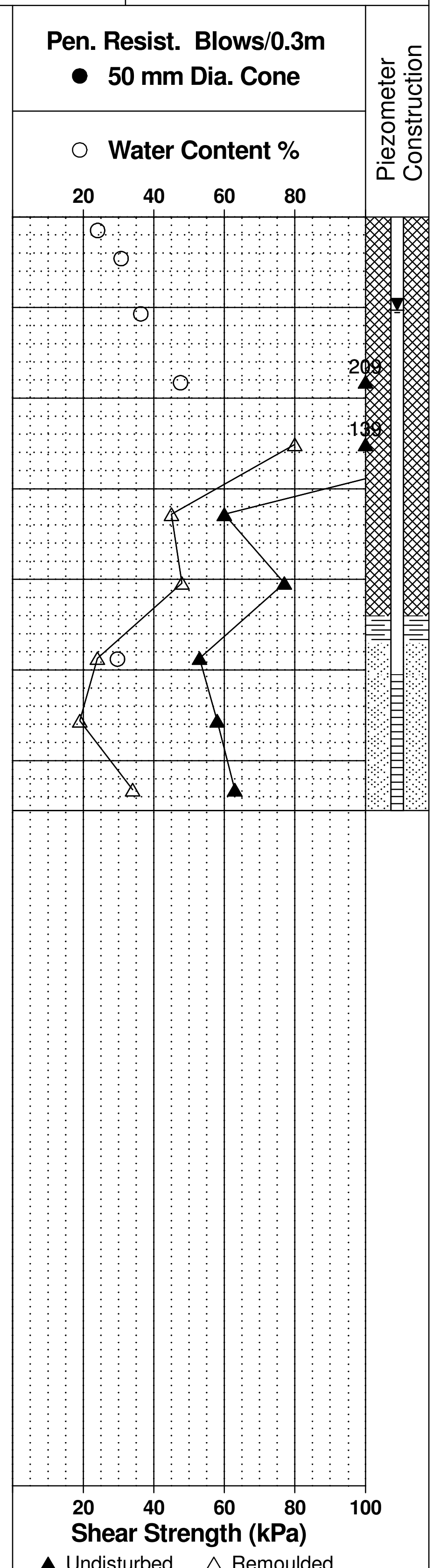
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** March 31, 2022

FILE NO. **PG4958**

HOLE NO. **BH 8-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.53
TOPSOIL 0.25		SS	1	50	8		
Hard to very stiff, brown **SILTY CLAY,** trace sand - sand content decreasing with depth - stiff and grey by 3.0m depth		SS	2	50	9	1	89.53
		SS	3	100	P	2	88.53
						3	87.53
						4	86.53
		SS	4	100	P	5	85.53
6.55						6	84.53
End of Borehole (GWL @ 1.03m - May 12, 2022)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

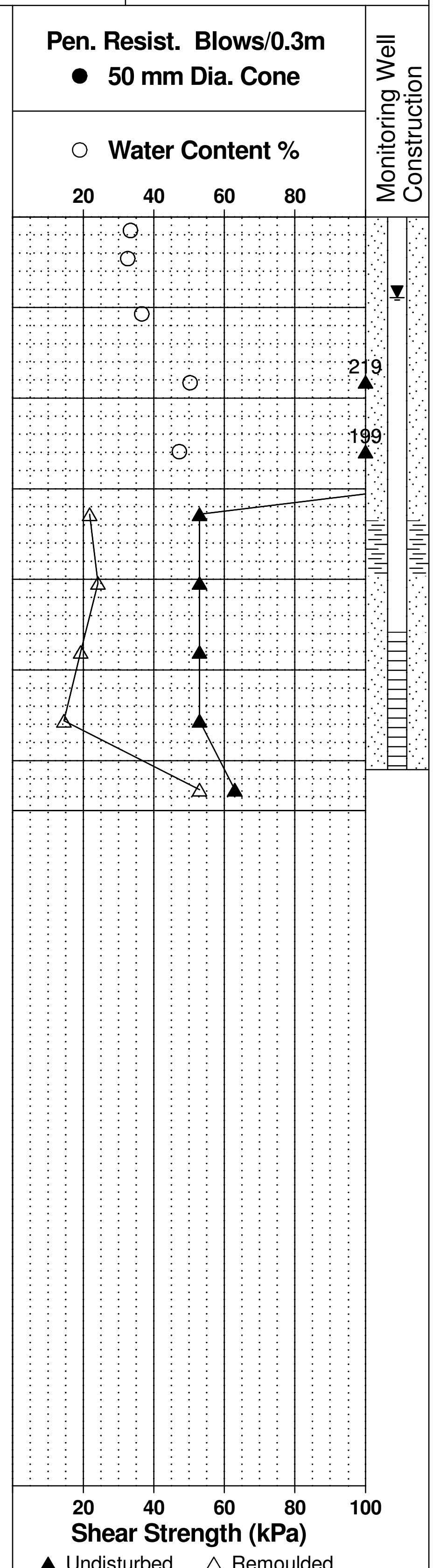
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. PG4958

HOLE NO. BH 9-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.77
TOPSOIL 0.25		SS	1	58	7		
Hard to very stiff, brown **SILTY CLAY**		SS	2	83	9	1	89.77
- stiff and grey by 3.0m depth		SS	3	54	P	2	88.77
		SS	4	75	P	3	87.77
						4	86.77
						5	85.77
6.55						6	84.77
End of Borehole							
(GWL @ 0.89m - May 12, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

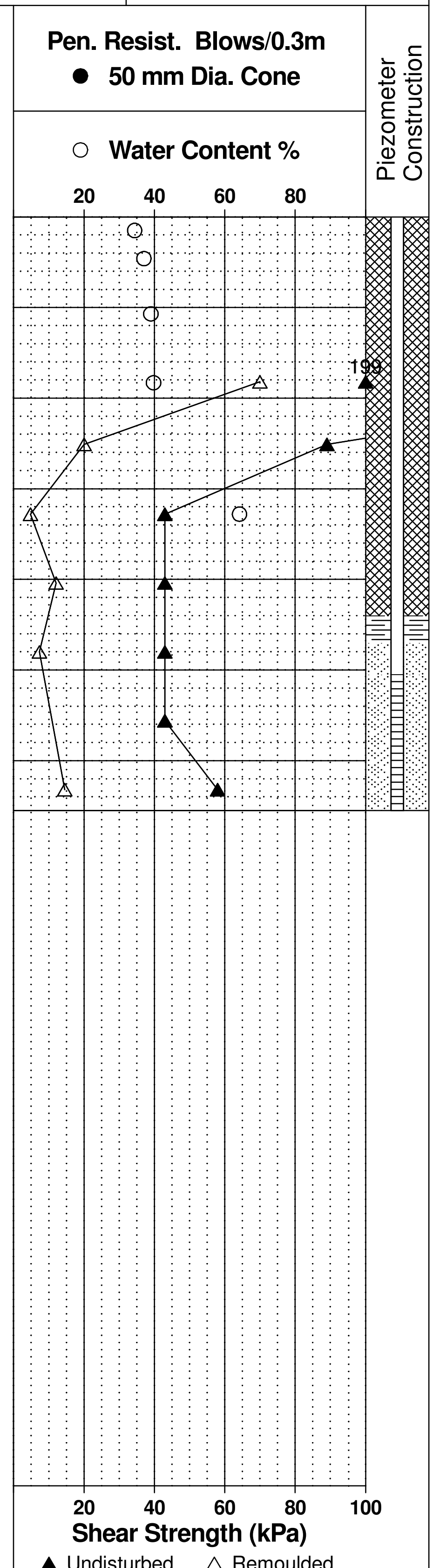
BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. PG4958

HOLE NO. BH10-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.44
TOPSOIL 0.25		SS	1	100	7		
Very stiff to stiff, brown **SILTY CLAY**		SS	2	83	6	1	90.44
- firm to stiff and grey by 3.0m depth		SS	3	75	P	2	89.44
						3	88.44
						4	87.44
						5	86.44
6.55						6	85.44
End of Borehole							
(Piezometer blocked/dry - May 12, 2022)							



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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger

DATE March 31, 2022

FILE NO. **PG4958**

HOLE NO. **BH11-22-EL**

SOIL DESCRIPTION

GROUND SURFACE

TOPSOIL — 0.23

Very stiff to stiff, brown **SILTY CLAY**

- firm and grey by 3.0m depth

— 6.55

End of Borehole

(GWL @ 0.81m - May 12, 2022)

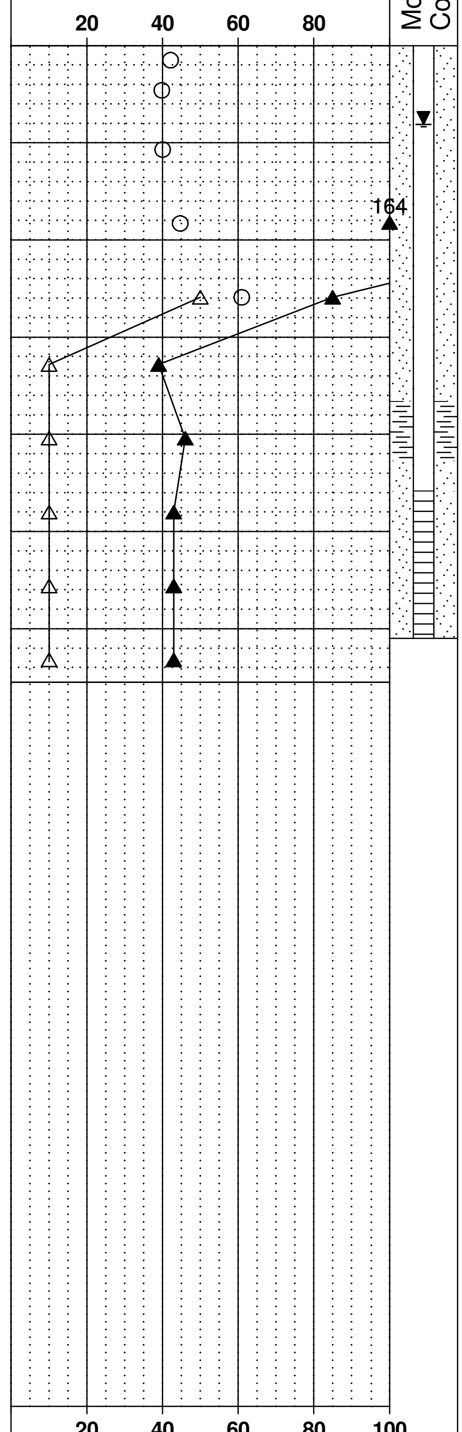
SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD
SS	1	50	9
SS	2	83	8
SS	3	92	P
SS	4	100	P

DEPTH (m)	ELEV. (m)
0	91.38
1	90.38
2	89.38
3	88.38
4	87.38
5	86.38
6	85.38

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Monitoring Well Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

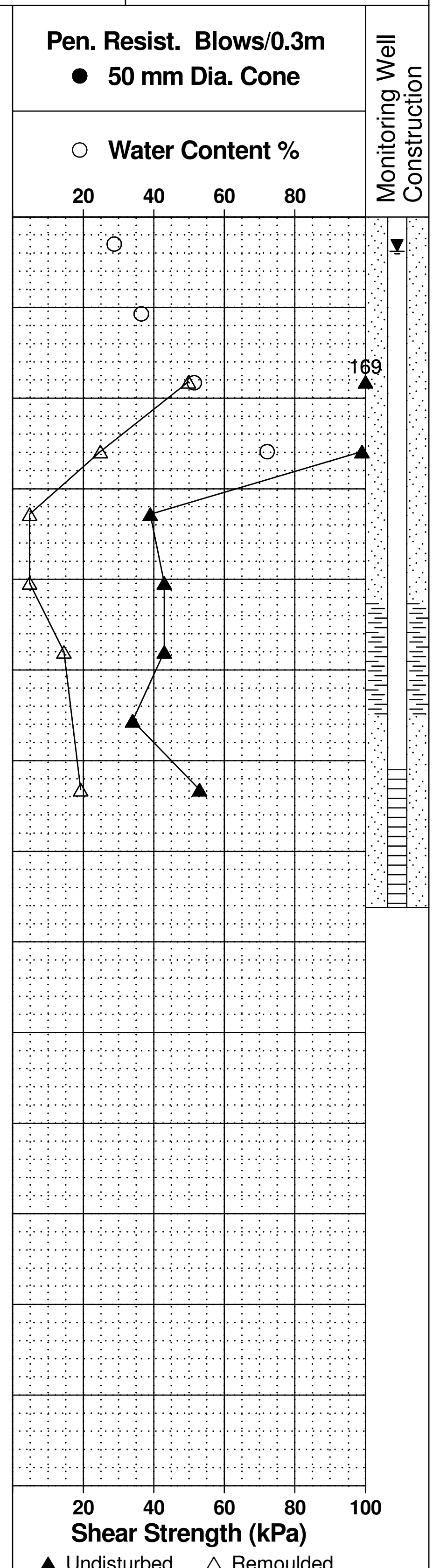
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. PG4958

HOLE NO. BH12-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.73
TOPSOIL 0.23		SS	1	42	7		
Very stiff to stiff, brown **SILTY CLAY**		SS	2	50	7	1	90.73
- firm to stiff and grey by 3.0m depth		SS	3	83	P	2	89.73
		SS	4	100	P	3	88.73
						4	87.73
						5	86.73
6.55						6	85.73
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 16.8m depth.						7	84.73
						8	83.73
						9	82.73
						10	81.73
						11	80.73
						12	79.73
						13	78.73
						14	77.73



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3700 Twin Falls Place
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DATUM Geodetic

REMARKS

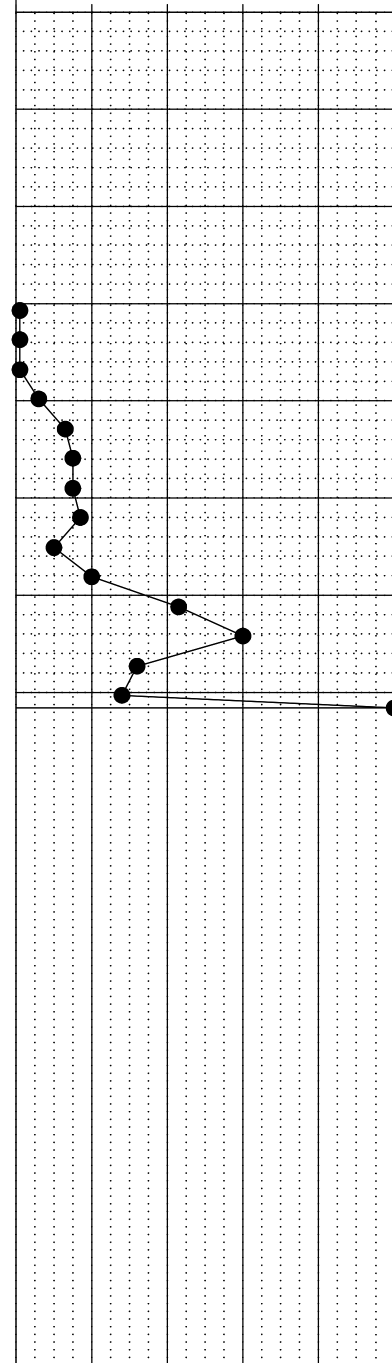
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. PG4958

HOLE NO. BH12-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE: TYPE	SAMPLE: NUMBER	SAMPLE: % RECOVERY	SAMPLE: N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Monitoring Well Construction
GROUND SURFACE								20 40 60 80	
						14	77.73		
						15	76.73		
						16	75.73		
						17	74.73		
						18	73.73		
						19	72.73		
						20	71.73		
21.16						21	70.73		
End of Borehole Practical DCPT refusal at 21.16m depth. (GWL @ 0.38m - May 12, 2022)									



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
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DATUM Geodetic

REMARKS

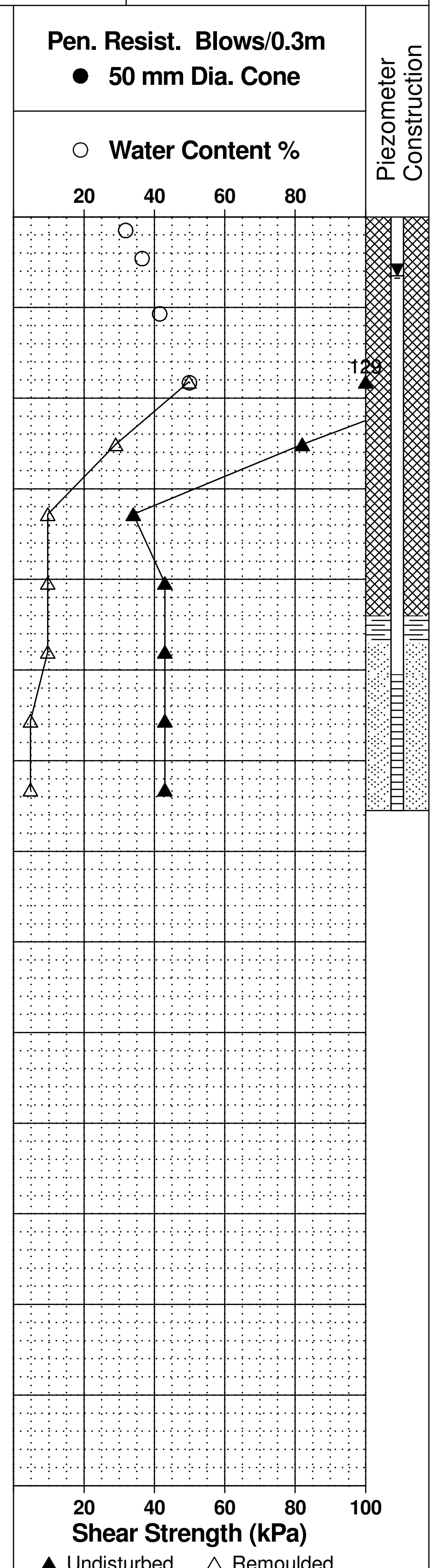
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. **PG4958**

HOLE NO. **BH13-22-EL**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.57
TOPSOIL 0.25		SS	1	58	7		
Very stiff to stiff, brown **SILTY CLAY**		SS	2		6	1	90.57
- firm and grey by 3.0m depth		SS	3	100	P	2	89.57
6.55						3	88.57
Dynamic Cone Penetration Test commenced at 6.55m depth. Cone pushed to 14.3m depth.						4	87.57
						5	86.57
						6	85.57
						7	84.57
						8	83.57
						9	82.57
						10	81.57
						11	80.57
						12	79.57
						13	78.57
						14	77.57



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

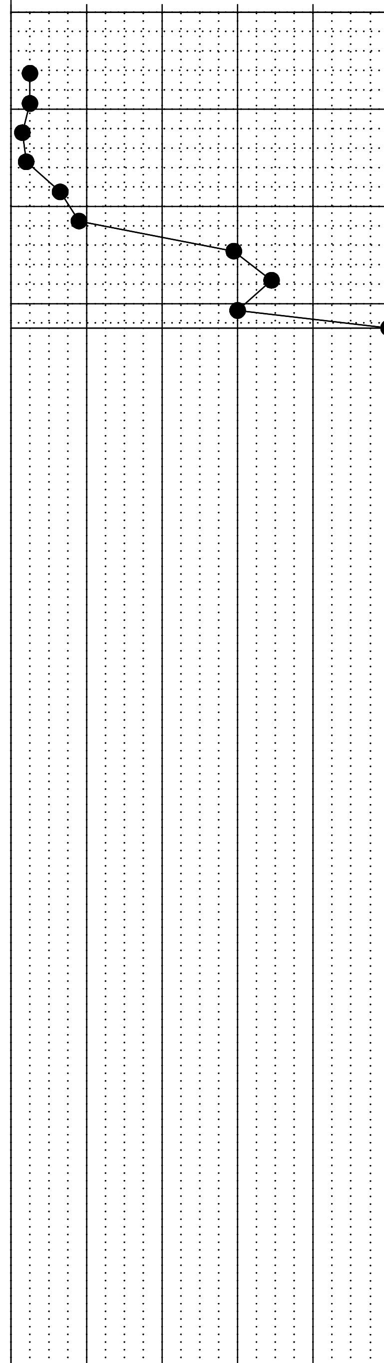
BORINGS BY Track-Mount Power Auger

DATE April 1, 2022

FILE NO. PG4958

HOLE NO. BH13-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
GROUND SURFACE								20 40 60 80	
						14	77.57		
						15	76.57		
						16	75.57		
17.25						17	74.57		
End of Borehole Practical DCPT refusal at 17.25m depth. (GWL @ 0.65m - May 12, 2022)									



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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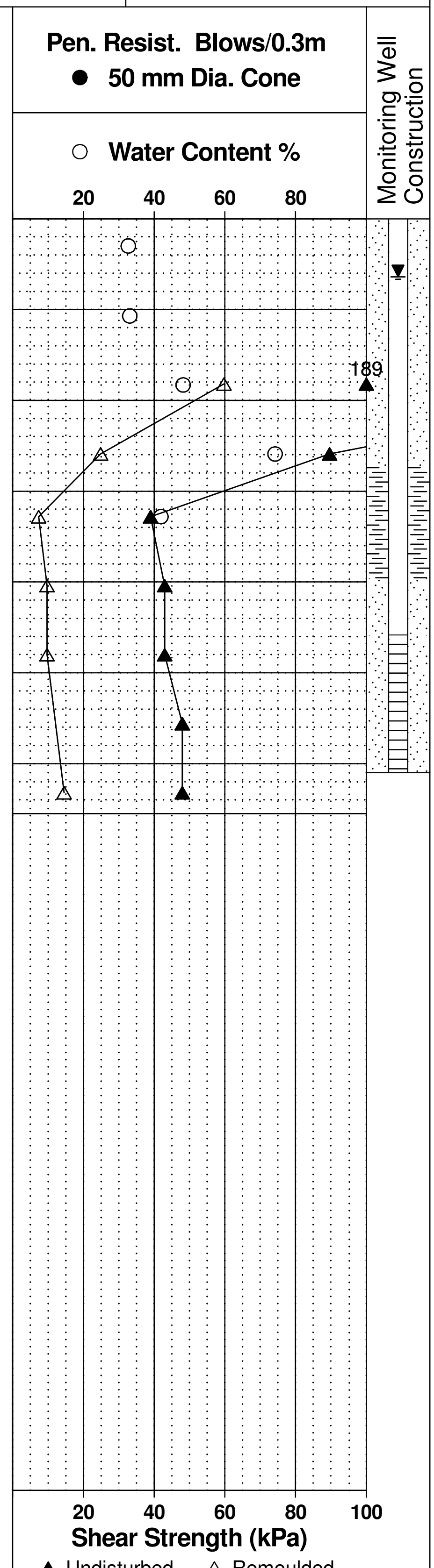
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** April 1, 2022

FILE NO. PG4958

HOLE NO. BH14-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.40
TOPSOIL 0.25		SS	1	50	8		
Very stiff to stiff, brown **SILTY CLAY**		SS	2	67	11	1	90.40
- firm and grey by 3.0m depth		SS	3	75	P	2	89.40
		SS	4	83	P		
						3	88.40
						4	87.40
						5	86.40
6.55						6	85.40
End of Borehole							
(GWL @ 0.64m - May 12, 2022)							



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DATUM Geodetic

REMARKS

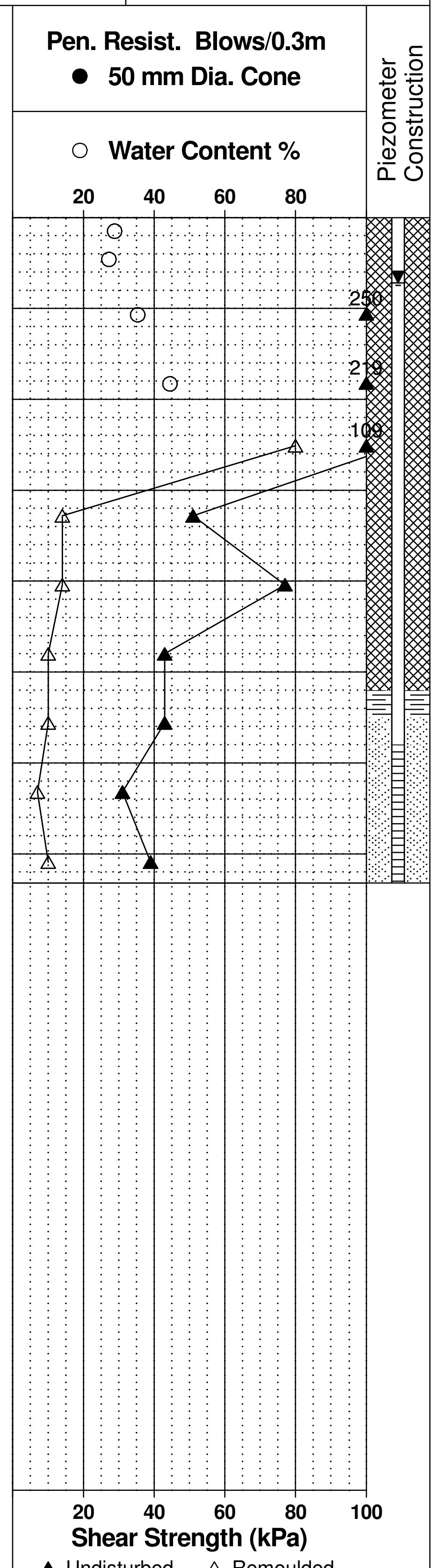
BORINGS BY Track-Mount Power Auger

DATE April 4, 2022

FILE NO. PG4958

HOLE NO. BH15-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.09
TOPSOIL 0.23		SS	1	42	8		
		SS	2	50	P	1	90.09
		SS	3	54	P		
Hard to very stiff, brown **SILTY CLAY**						2	89.09
- stiff to firm and grey by 3.0m depth						3	88.09
						4	87.09
						5	86.09
						6	85.09
7.32						7	84.09
End of Borehole							
(GWL @ 0.72m - May 12, 2022)							



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DATUM Geodetic

REMARKS

BORINGS BY Track-Mount Power Auger **DATE** April 4, 2022

FILE NO. PG4958

HOLE NO. BH16-22-EL

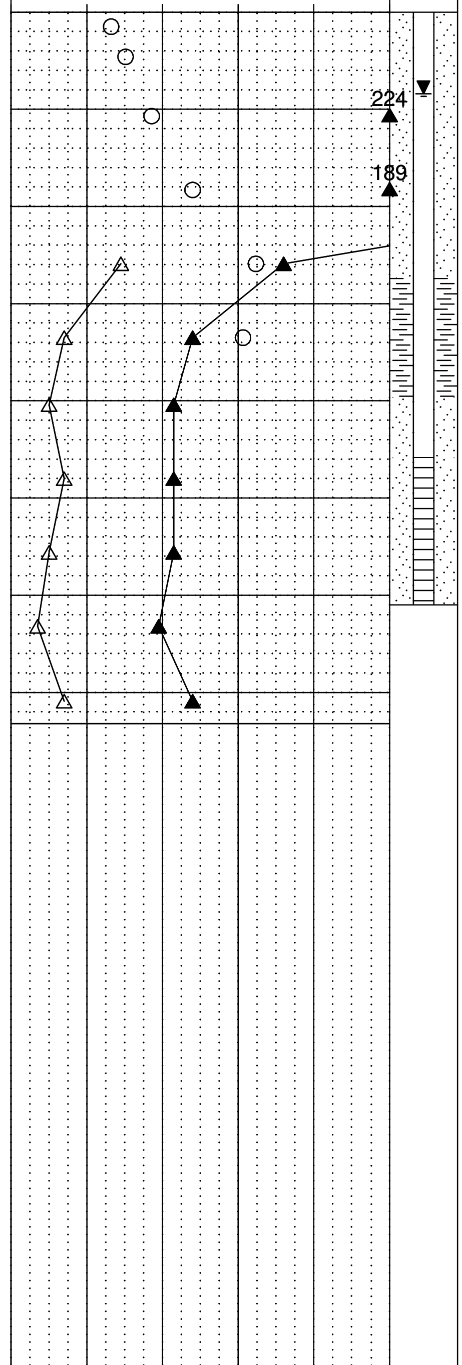
SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.01
TOPSOIL 0.25		SS	1	25	7		
Hard to stiff, brown **SILTY CLAY**		SS	2	42	P	1	90.01
- firm and grey by 2.8m depth		SS	3	83	P	2	89.01
		SS	4	100	P		
		SS	5		P	3	88.01
						4	87.01
						5	86.01
						6	85.01
7.32						7	84.01
End of Borehole							
(GWL @ 0.84m - May 12, 2022)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Monitoring Well Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE AND TEST DATA

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Ottawa, Ontario

DATUM Geodetic

REMARKS

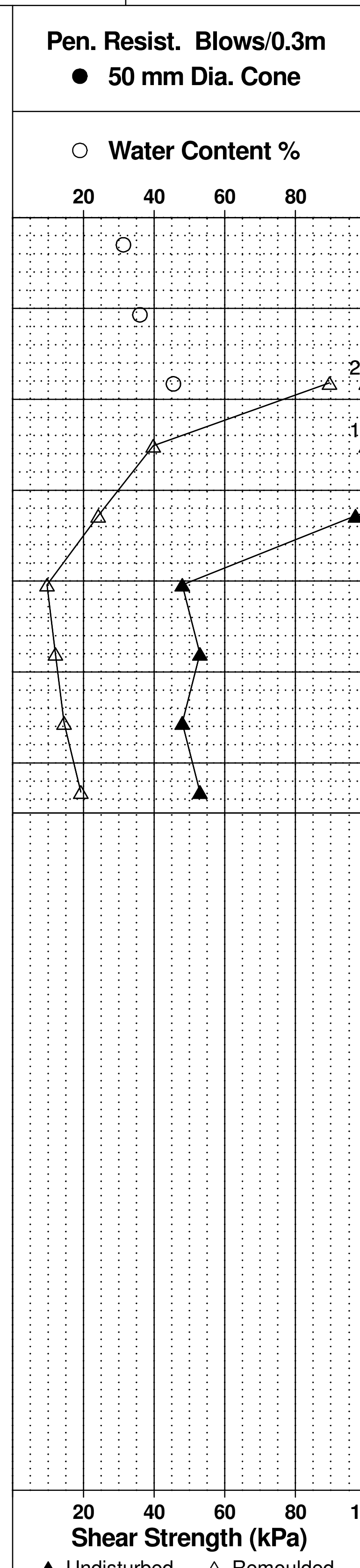
BORINGS BY Track-Mount Power Auger

DATE April 4, 2022

FILE NO. PG4958

HOLE NO. BH17-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.68
TOPSOIL — 0.23		SS	1	50	6		
Hard to stiff, brown **SILTY CLAY**		SS	2	38	10	1	89.68
- firm to stiff and grey by 3.7m depth		SS	3	67	P	2	88.68
						3	87.68
						4	86.68
						5	85.68
6.55						6	84.68
End of Borehole							
(GWL @ 0.36m - May 12, 2022)							



Piezometer Construction

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SOIL PROFILE AND TEST DATA

Geotechnical Investigation
3700 Twin Falls Place
Ottawa, Ontario

DATUM Geodetic

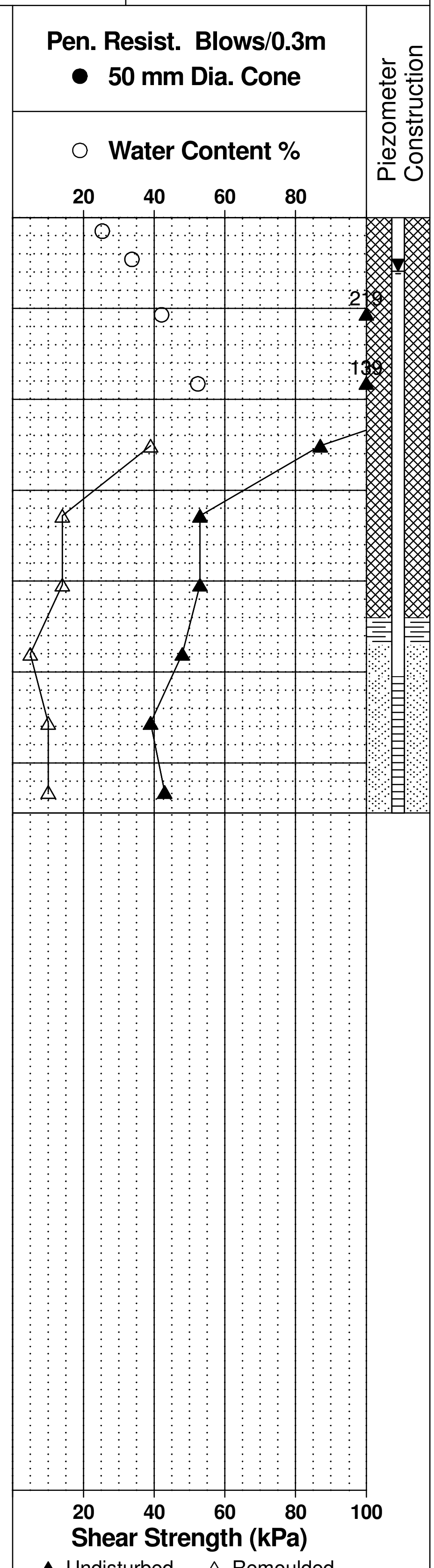
REMARKS

BORINGS BY Track-Mount Power Auger **DATE** April 4, 2022

FILE NO. PG4958

HOLE NO. BH19-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.27
TOPSOIL 0.20		SS	1	42	7		
		SS	2	83	P	1	90.27
Hard to stiff, brown **SILTY CLAY**		SS	3	100	P	2	89.27
- stiff to firm and grey by 3.0m depth						3	88.27
						4	87.27
						5	86.27
6.55						6	85.27
End of Borehole							
(GWL @ 0.59m - May 12, 2022)							



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SOIL PROFILE AND TEST DATA

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DATUM Geodetic

REMARKS

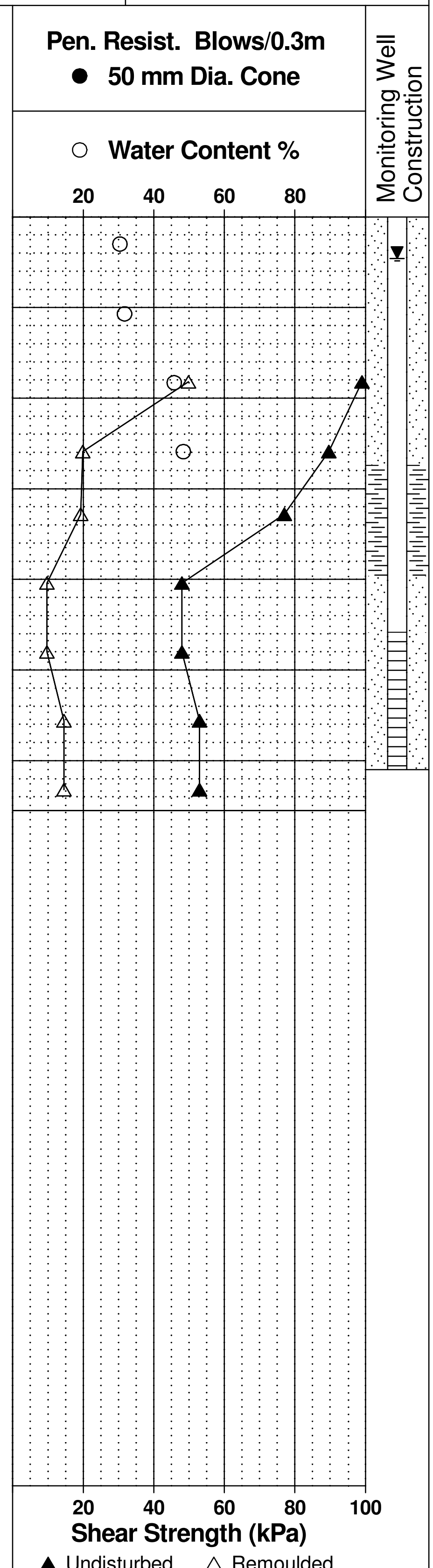
BORINGS BY Track-Mount Power Auger

DATE April 4, 2022

FILE NO. PG4958

HOLE NO. BH18-22-EL

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.02
TOPSOIL 0.25		SS	1	42	4		
Very stiff to stiff, brown **SILTY CLAY**		SS	2	50	7	1	90.02
- firm to stiff and grey by 3.7m depth		SS	3	83	P	2	89.02
		SS	4	67	P		
						3	88.02
						4	87.02
						5	86.02
						6	85.02
6.55							
End of Borehole							
(GWL @ 0.46m - May 12, 2022)							



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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

BORINGS BY CME 75 Power Auger

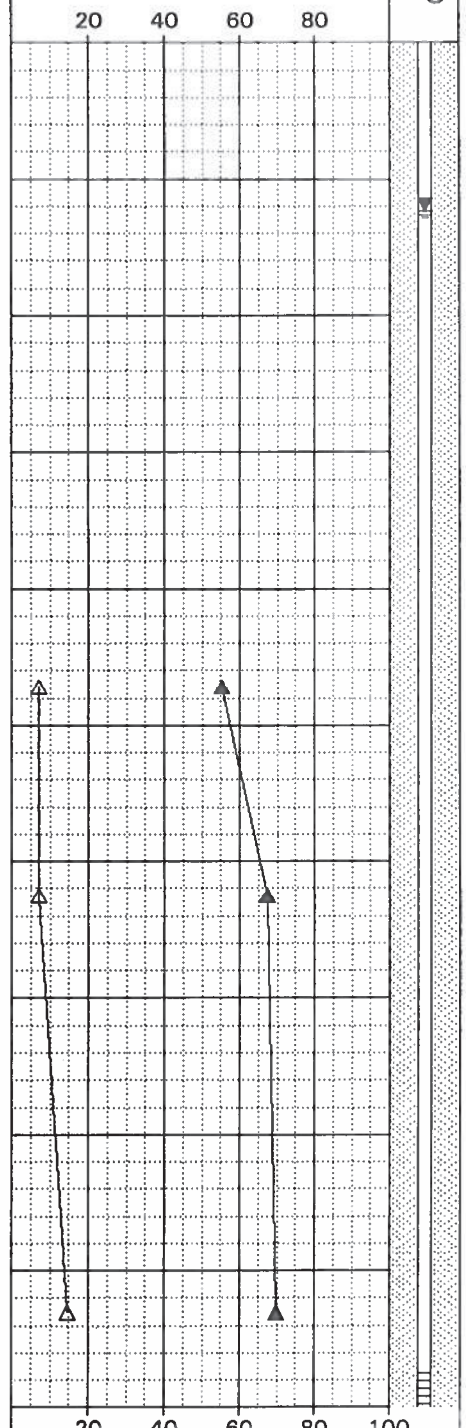
DATE 12 MAY 05

FILE NO. PG0718

HOLE NO. BH 1-05

SOIL DESCRIPTION	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.94
TOPSOIL 0.17						
	SS	1	83	13	1	87.94
	SS	2	100	12		
Stiff, brown SILTY CLAY					2	86.94
	SS	3	100	13		
					3	85.94
	SS	4	100	5		
					4	84.94
	SS	5	100	4		
- grey by 4.3m depth						
					5	83.94
	SS	6	100	2		
					6	82.94
					7	81.94
- dark grey with sand seams by 7.6m depth	SS	7	100	2		
					8	80.94
					9	79.94
					10	78.94

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE & TEST DATA

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Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

BORINGS BY CME 75 Power Auger

DATE 12 MAY 05

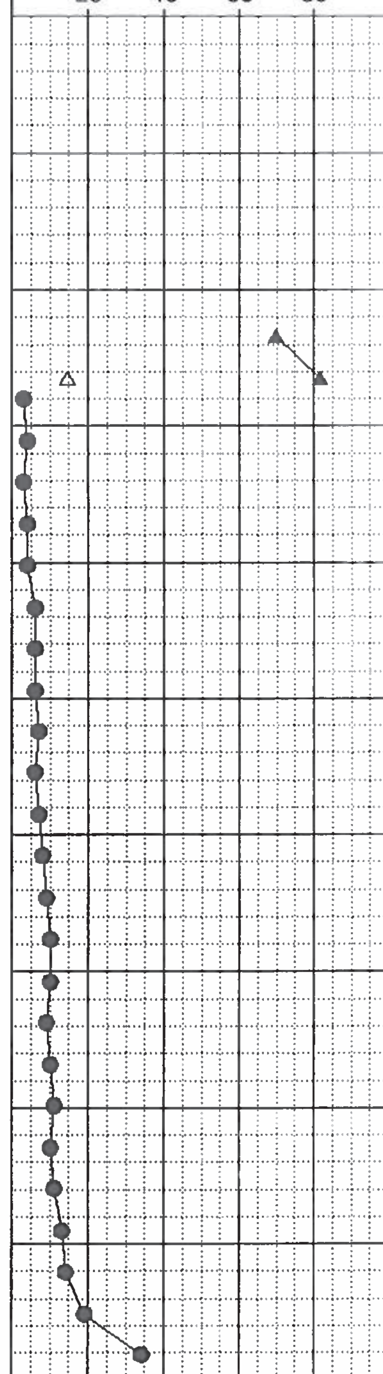
FILE NO. PG0718

HOLE NO. BH 1-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
						10	78.94
Stiff, dark grey SILTY CLAY with sand seams		SS	8	100	2	11	77.94
						12	76.94
12.80							
Dynamic Cone Penetration Test commenced @ 12.80m depth						13	75.94
						14	74.94
Inferred SILTY CLAY						15	73.94
						16	72.94
						17	71.94
						18	70.94
						19	69.94
19.50							
Inferred GLACIAL TILL						20	68.94

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE & TEST DATA

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Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

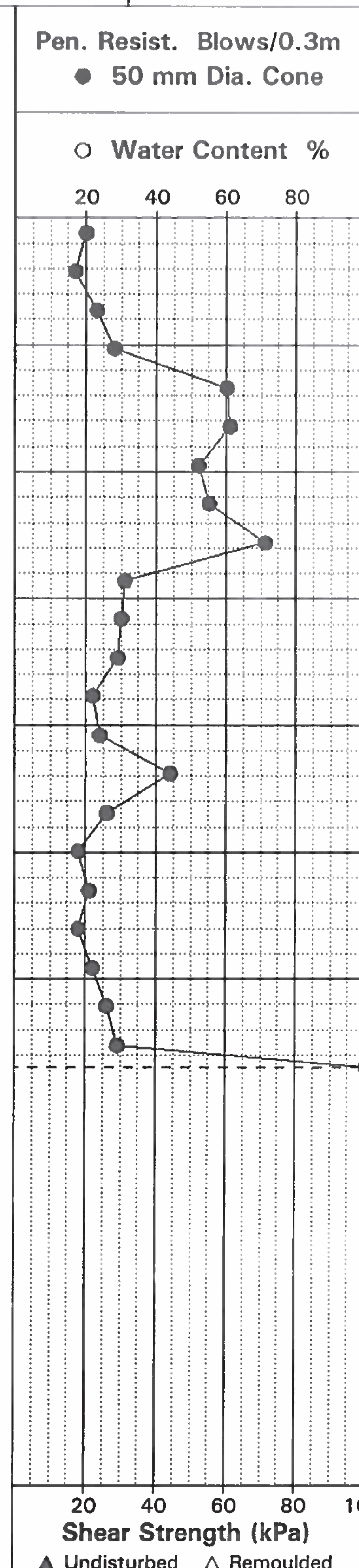
BORINGS BY CME 75 Power Auger

DATE 12 MAY 05

FILE NO. PG0718

HOLE NO. BH 1-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
						20	68.94
						21	67.94
						22	66.94
Inferred GLACIAL TILL						23	65.94
						24	64.94
						25	63.94
						26	62.94
26.69							
End of Borehole DCPT refusal @ 26.69m depth (GWL @ 1.24-May 19/05)							



Piezometer Construction

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

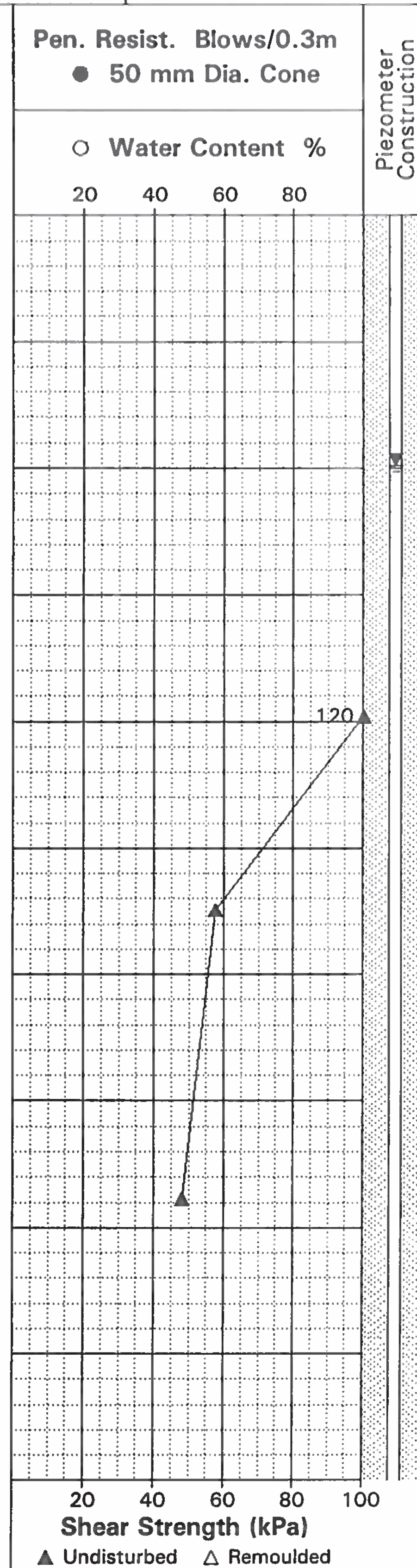
FILE NO. PG0718

REMARKS

HOLE NO. BH 2-05

BORINGS BY CME 75 Power Auger DATE 13 MAY 05

SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.87
TOPSOIL 0.25						
Very stiff, brown SILTY CLAY	AU	1				
	SS	2	75	14	1	87.87
	SS	3	100	11	2	86.87
	SS	4	100	7		
- brown-grey by 3.0m depth	SS	5	100	3	3	85.87
					4	84.87
- stiff and grey by 4.6m depth	SS	6	100	1	5	83.87
- dark grey with silt seams by 6.0m depth	SS	7	100	1	6	82.87
					7	81.87
					8	80.87
	SS	8	100	1	9	79.87
					10	78.87



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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

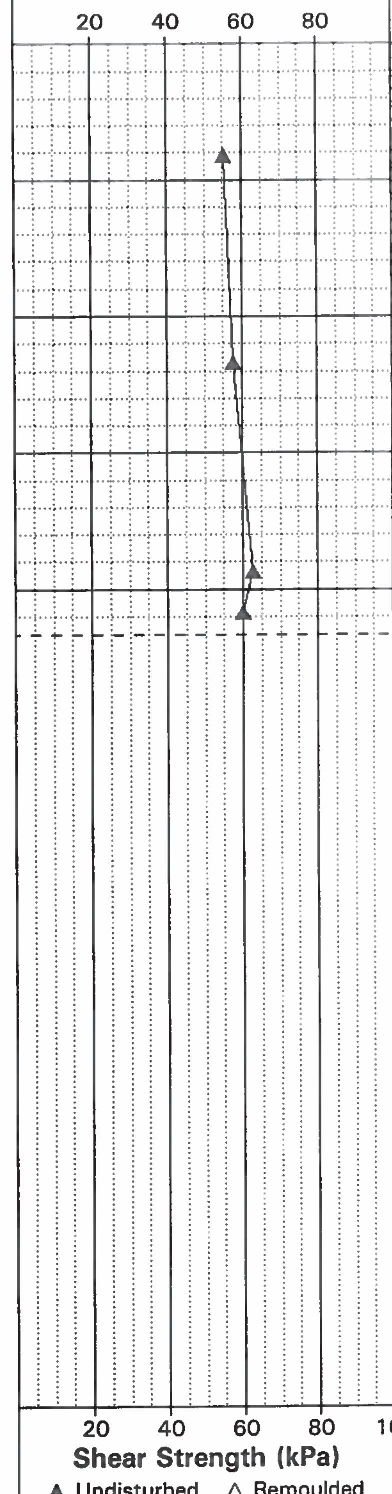
FILE NO. PG0718

REMARKS

HOLE NO. BH 2-05

BORINGS BY CME 75 Power Auger DATE 13 MAY 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
						10	78.87		
						11	77.87		
Stiff, dark grey SILTY CLAY with silt seams						12	76.87		
						13	75.87		
14.33						14	74.87		
End of Borehole									
(GWL @ 1.98-May 19/05)									



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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

FILE NO. PG0718

REMARKS

HOLE NO. BH 3-05

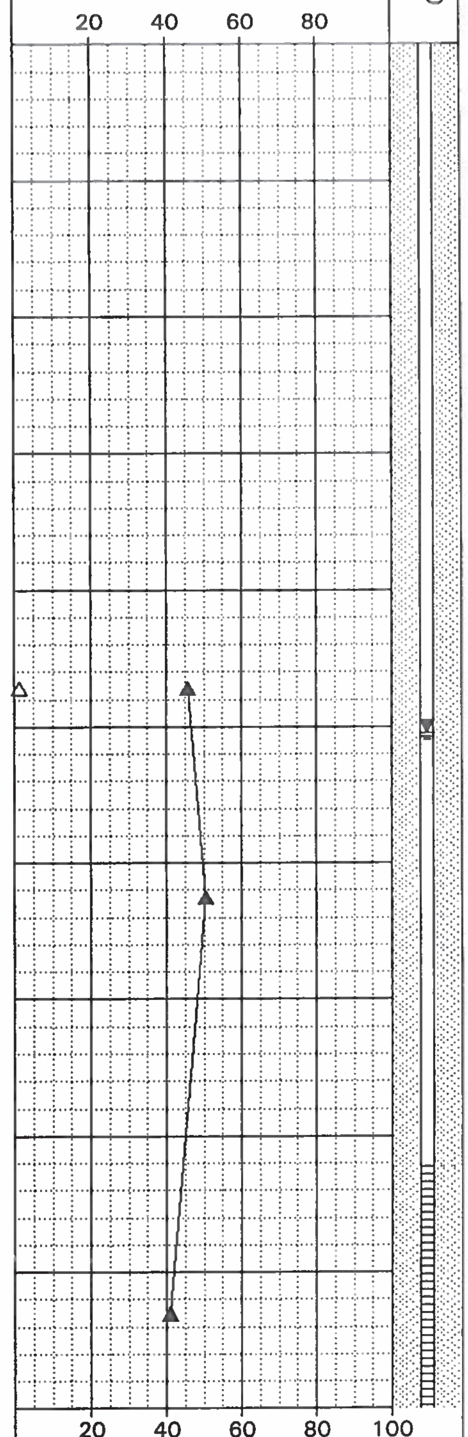
BORINGS BY CME 45 Power Auger DATE 12 MAY 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.30
TOPSOIL 0.30							
		SS	1	100	11	1	89.30
		SS	2	100	10	2	88.30
Stiff, brown SILTY CLAY		SS	3	100	8	3	87.30
		SS	4	100	6		
- firm and grey by 3.8m depth		SS	5	100	3	4	86.30
						5	85.30
		SS	6	100	1	6	84.30
- dark grey with sand seams by 6.0m depth						7	83.30
		SS	7	100	1	8	82.30
						9	81.30
						10	80.30

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

BORINGS BY CME 45 Power Auger

DATE 12 MAY 05

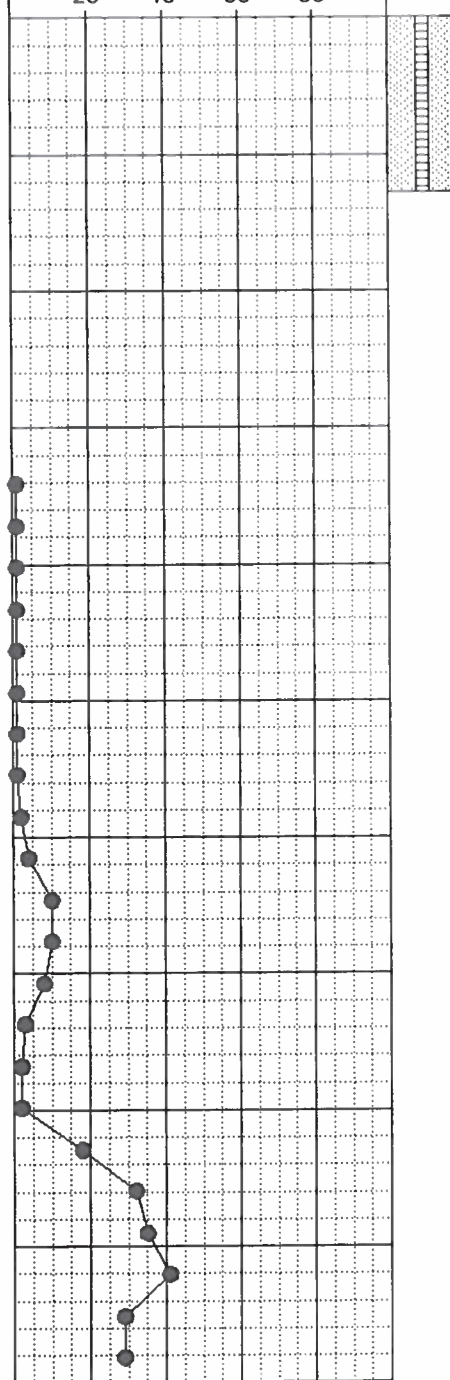
FILE NO. PG0718

HOLE NO. BH 3-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
						10	80.30
Firm, dark grey SILTY CLAY with occasional sand seams		SS	8	100	1	11	79.30
11.28							
Dynamic Cone Penetration Test commenced @ 11.28m depth. Cone pushed to 13.4m depth						12	78.30
						13	77.30
						14	76.30
Inferred SILTY CLAY						15	75.30
						16	74.30
						17	73.30
18.00						18	72.30
Inferred GLACIAL TILL						19	71.30
						20	70.30

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
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Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

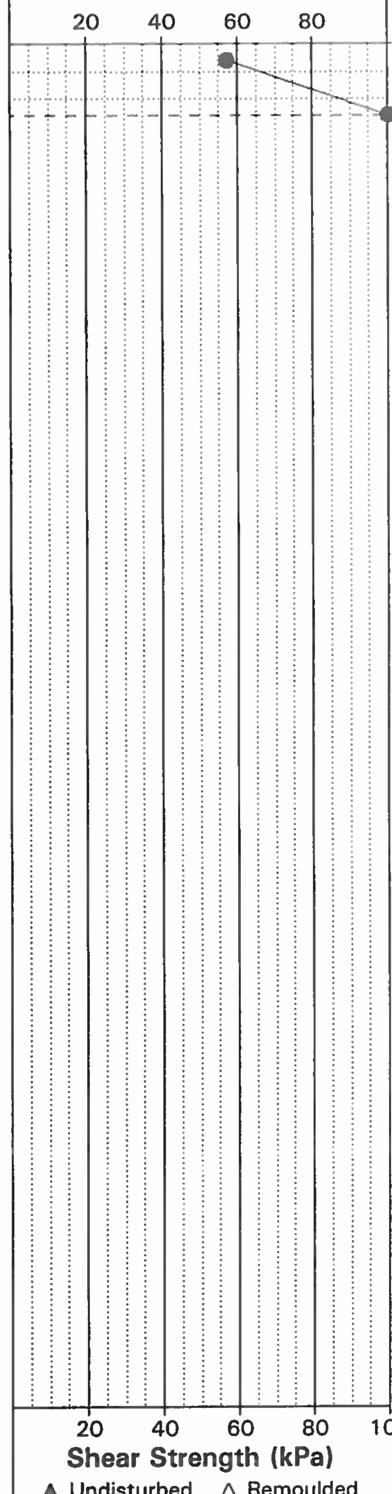
BORINGS BY CME 45 Power Auger

DATE 12 MAY 05

FILE NO. PG0718

HOLE NO. BH 3-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone / ○ Water Content %	Piezometer Construction
Inferred GLACIAL TILL						20	70.30		
20.52									
End of Borehole DCPT refusal @ 20.52m depth (GWL @ 5.05-May 19/05)									



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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

FILE NO. PG0718

REMARKS

HOLE NO. BH 4-05

BORINGS BY CME 45 Power Auger

DATE 12 MAY 05

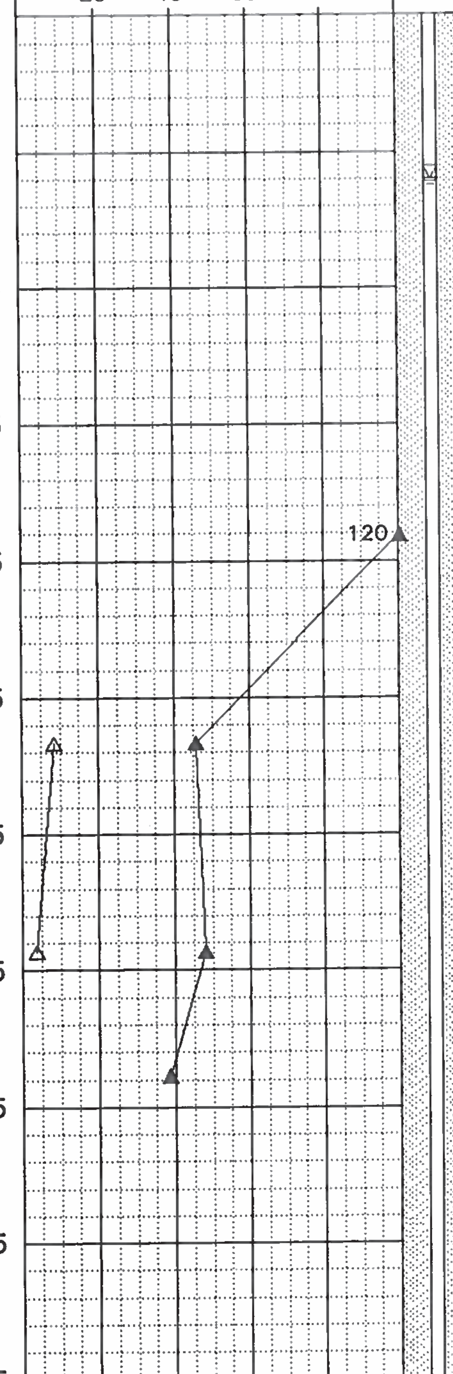
SOIL DESCRIPTION	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	90.55
TOPSOIL 0.30						
Very stiff to stiff, brown SILTY CLAY	SS	1	100	9	1	89.55
	SS	2	100	7	2	88.55
	SS	3	100	8	3	87.55
	SS	4	100	4	4	86.55
- firm and grey with sand seams by 4.6m depth	SS	5	100	1	5	85.55
	SS	6	100	2	6	84.55
					7	83.55
					8	82.55
					9	81.55
	SS	7	100	2	10	80.55

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

Piezometer Construction



20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

BORINGS BY CME 45 Power Auger

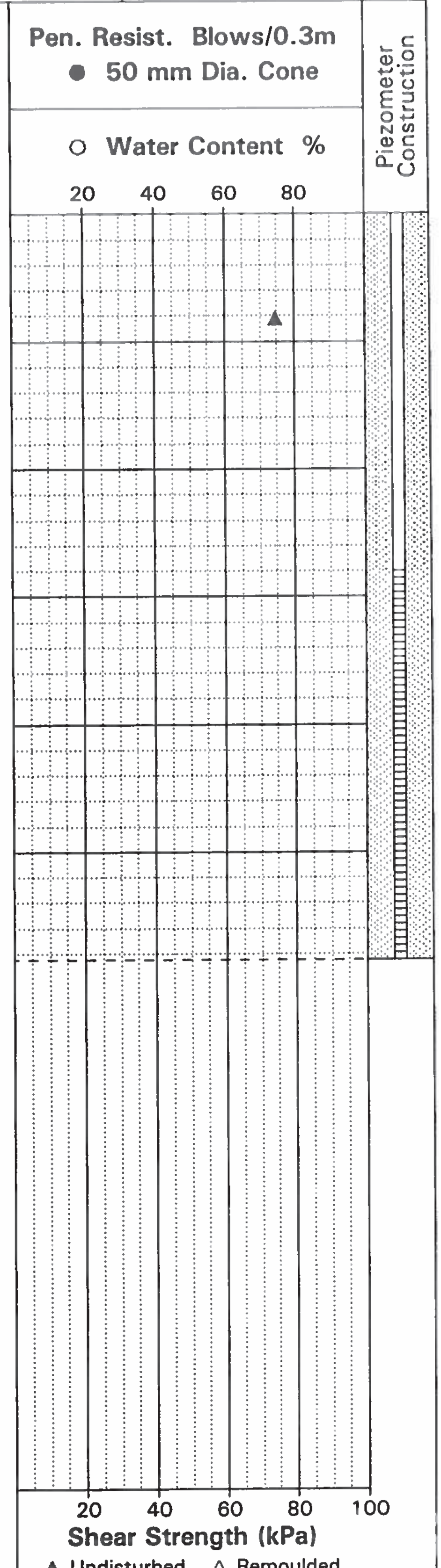
DATE 12 MAY 05

FILE NO. PG0718

HOLE NO. BH 4-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
Stiff, grey SILTY CLAY with sand seams					
12.20					
Firm to stiff, grey CLAYEY SILT		SS	8	100	2
		SS	9	100	2
15.24					
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders		SS	10	25	24
15.85					
End of Borehole					
(GWL @ 1.2-May 19/05)					

DEPTH (m)	ELEV. (m)
10	80.55
11	79.55
12	78.55
13	77.55
14	76.55
15	75.55



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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

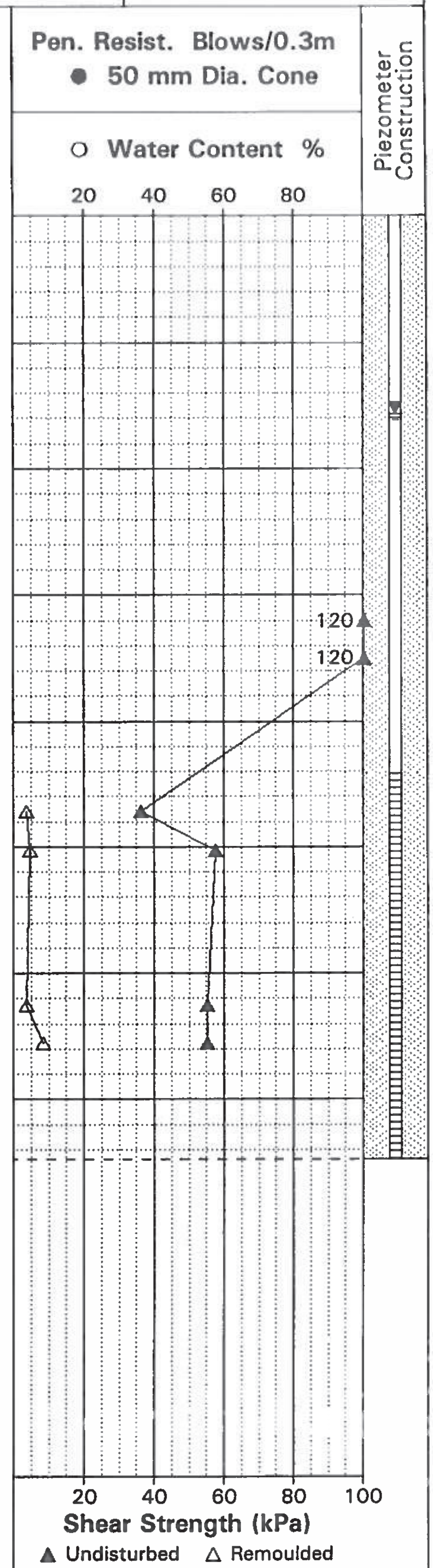
FILE NO. PG0718

REMARKS

HOLE NO. BH 5-05

BORINGS BY CME 45 Power Auger DATE 12 MAY 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.59
TOPSOIL 0.25							
Very stiff, dark brown **SILTY CLAY**		SS	1	100	20	1	89.59
- brown with sand seams by 1.5m depth		SS	2	100	8	2	88.59
		SS	3	100	3	3	87.59
- firm by 3.8m depth - grey by 3.8m depth		SS	4	100	1	4	86.59
						5	85.59
		SS	5	100	1	6	84.59
						7	83.59
7.47		SS	6	100	1		
End of Borehole (GWL @ 1.57-May 19/05)							



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SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

FILE NO. PG0718

REMARKS

HOLE NO. BH 6-05

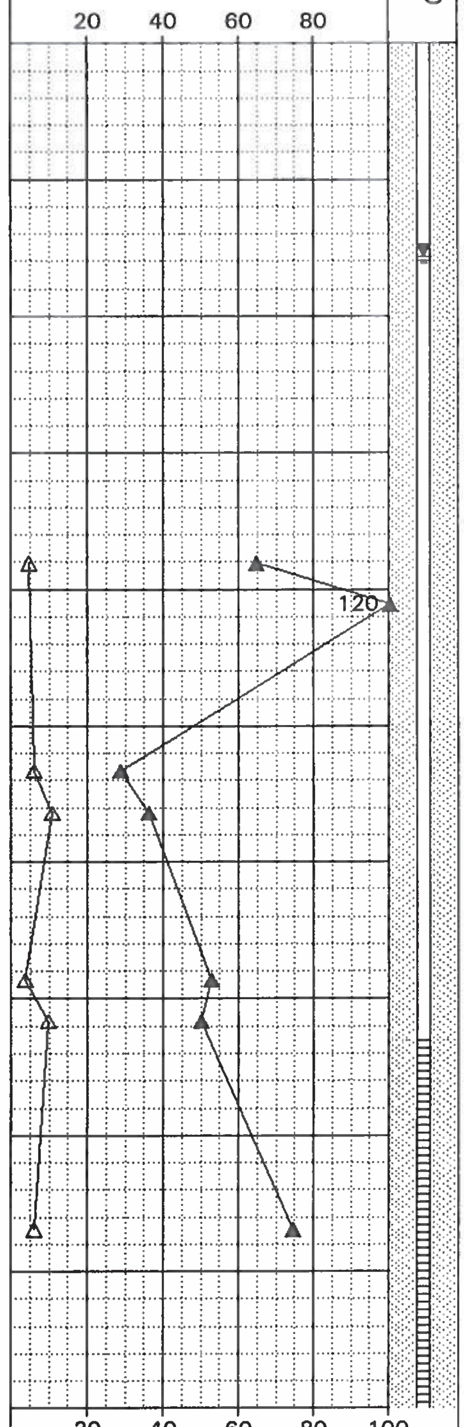
BORINGS BY CME 45 Power Auger DATE 12 MAR 05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.75
TOPSOIL 0.10							
		SS	1	100	10	1	89.75
		SS	2	100	6	2	88.75
Very stiff to stiff, brown SILTY CLAY		SS	3	100	4	3	87.75
		SS	4	100	4		
- grey by 3.7m depth						4	86.75
		SS	5	100	1	5	85.75
- firm by 5.0m depth						6	84.75
		SS	6	100	1		
- stiff by 6.7m depth						7	83.75
		SS	7	100	1	8	82.75
						9	81.75
		SS	8	100	2	10	80.75

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

Piezometer Construction



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

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28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation
Riverside South Subdivision, SWM Ponds 3 and 4
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Consulting.

REMARKS

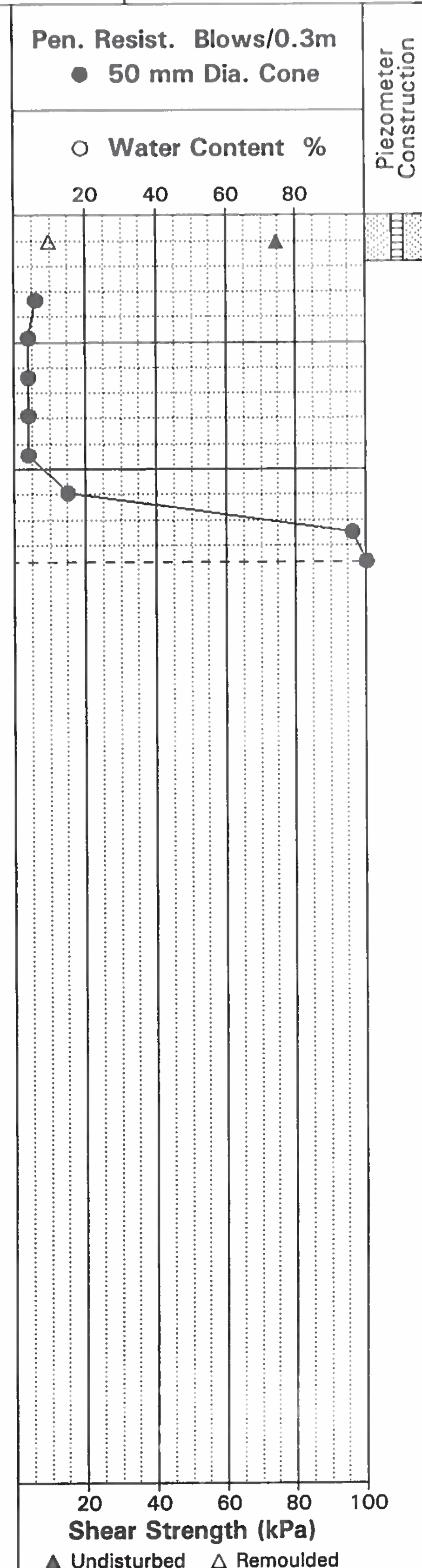
BORINGS BY CME 45 Power Auger

DATE 12 MAR 05

FILE NO. PG0718

HOLE NO. BH 6-05

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
Stiff, grey SILTY CLAY 10.36						10	80.75
Dynamic Cone Penetration Test commenced @ 10.36m depth						11	79.75
Inferred SILTY CLAY 12.20						12	78.75
Inferred GLACIAL TILL 12.73							
End of Borehole							
DCPT refusal @ 12.73m depth							
(GWL @ 1.57-May 19/05)							



SYMBOLS AND TERMS

SOIL DESCRIPTION

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

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

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

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

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

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

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

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

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

ROCK DESCRIPTION

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

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

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

SAMPLE TYPES

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

SYMBOLS AND TERMS (continued)

PLASTICITY LIMITS AND GRAIN SIZE DISTRIBUTION

WC%	-	Natural water content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic Limit, % (water content above which soil behaves plastically)
PI	-	Plasticity Index, % (difference between LL and PL)
Dxx	-	Grain size at which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Cc	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10

Cc and Cu are used to assess the grading of sands and gravels:
Well-graded gravels have: $1 < Cc < 3$ and $Cu > 4$
Well-graded sands have: $1 < Cc < 3$ and $Cu > 6$
Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded.
Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

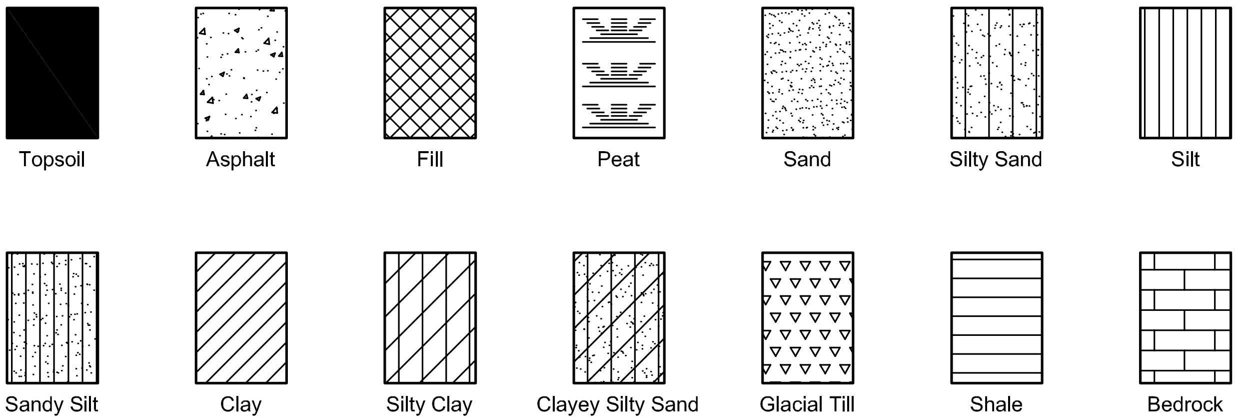
p'_o	-	Present effective overburden pressure at sample depth
p'_c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'_c)
Cc	-	Compression index (in effect at pressures above p'_c)
OC Ratio		Overconsolidaton ratio = p'_c / p'_o
Void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

PERMEABILITY TEST

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

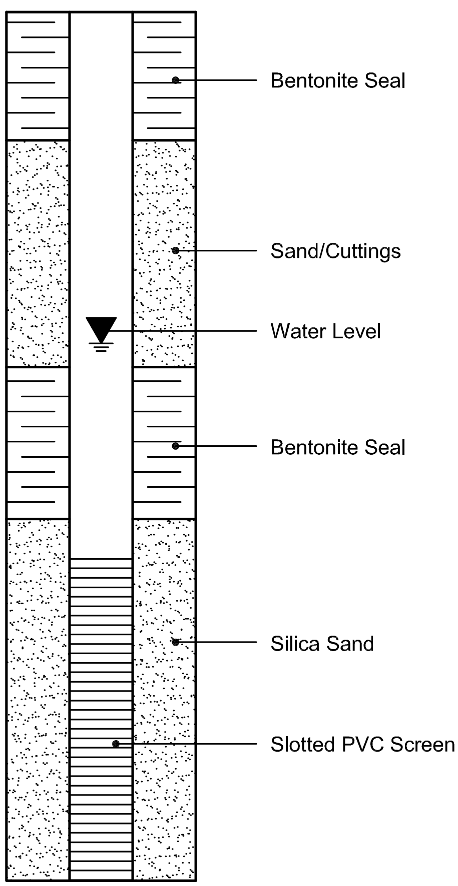
SYMBOLS AND TERMS (continued)

STRATA PLOT

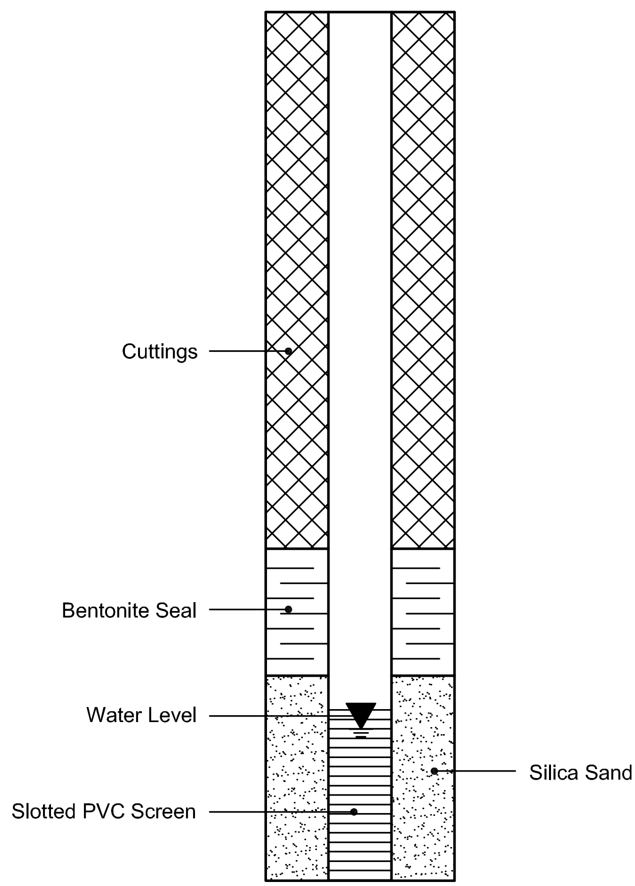


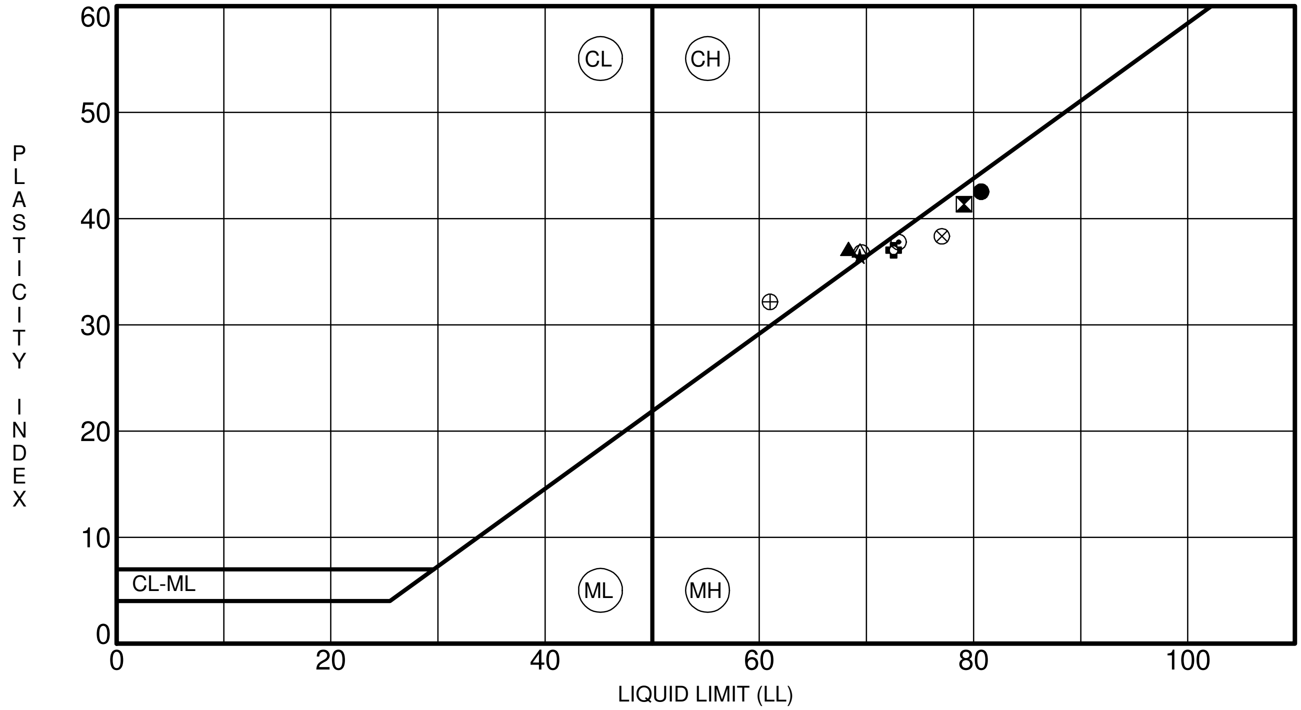
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BH 1-22-EL**	**SS3**	**81**	**38**	**43**		**MH - Inorganic silts of high plasticity**
⧗	**BH 2-22-EL**	**SS3**	**79**	**38**	**41**		**MH - Inorganic silts of high plasticity**
▲	**BH 3-22-EL**	**SS3**	**68**	**31**	**37**		**CH - Inorganic clays of high plasticity**
★	**BH 4-22-EL**	**SS3**	**69**	**33**	**36**		**CH - Inorganic clays of high plasticity**
⊙	**BH 5-22-EL**	**SS3**	**73**	**35**	**38**		**MH - Inorganic silts of high plasticity**
✿	**BH 6-22-EL**	**SS2**	**73**	**36**	**37**		**MH - Inorganic silts of high plasticity**
○	**BH 7-22-EL**	**SS3**	**70**	**33**	**37**		**CH - Inorganic clays of high plasticity**
△	**BH 8-22-EL**	**SS3**	**69**	**32**	**37**		**CH - Inorganic clays of high plasticity**
⊗	**BH 9-22-EL**	**SS3**	**77**	**39**	**38**		**MH - Inorganic silts of high plasticity**
⊕	**BH10-22-EL**	**SS2**	**61**	**29**	**32**		**CH - Inorganic clays of high plasticity**

CLIENT	**Riverside South Development Corp.**	FILE NO.	**PG4958**
PROJECT	**Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**	DATE	**31 Mar 22**

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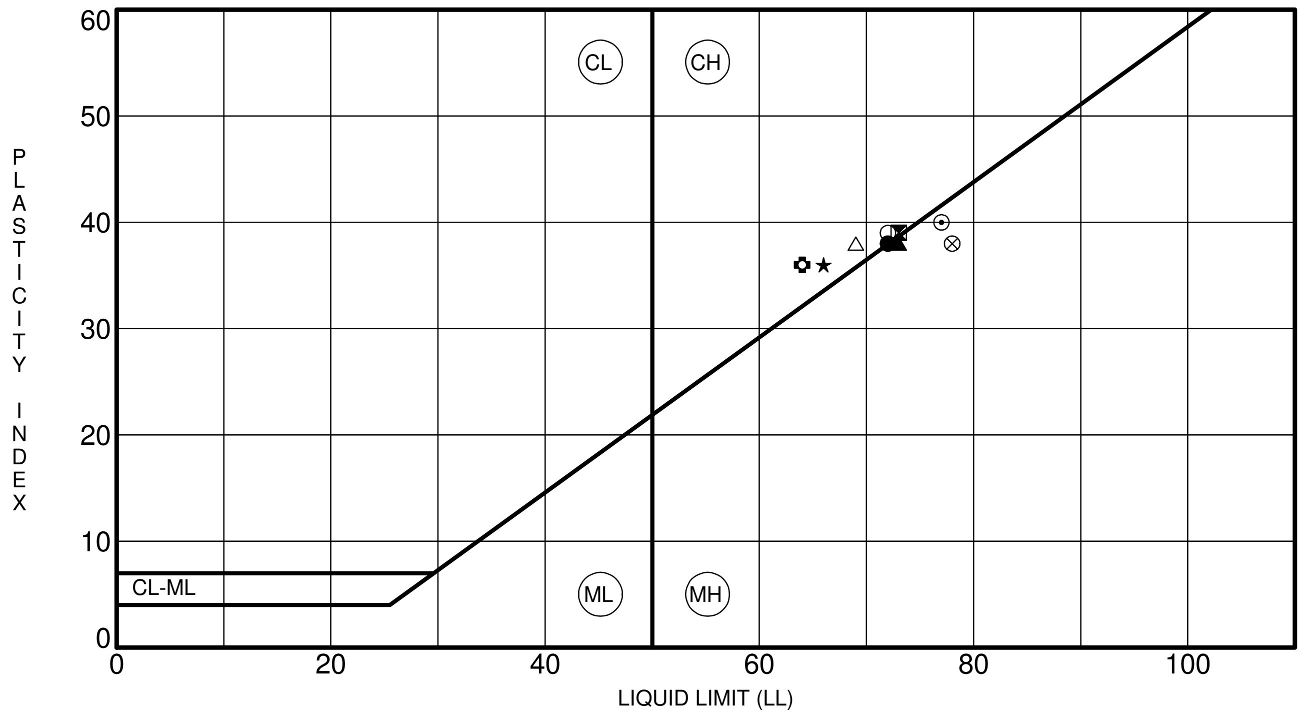
9 Auriga Drive, Ottawa, Ontario K2E 7T9

ATTERBERG LIMITS' RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	BH11-22-EL	SS3	72	34	38		CH - Inorganic clays of high plasticity
⧗	BH12-22-EL	SS2	73	34	39		CH - Inorganic clays of high plasticity
▲	BH13-22-EL	SS3	73	35	38		MH - Inorganic silts of high plasticity
★	BH14-22-EL	SS2	66	30	36		CH - Inorganic clays of high plasticity
⊙	BH15-22-EL	SS3	77	37	40		MH - Inorganic silts of high plasticity
✿	BH16-22-EL	SS2	64	28	36		CH - Inorganic clays of high plasticity
○	BH17-22-EL	ss3	72	33	39		CH - Inorganic clays of high plasticity
△	BH18-22-EL	ss2	69	31	38		CH - Inorganic clays of high plasticity
⊗	BH19-22-EL	SS3	78	40	38		MH - Inorganic silts of high plasticity

CLIENT	**Riverside South Development Corp.**	FILE NO.	**PG4958**
PROJECT	**Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**	DATE	**4 Apr 22**

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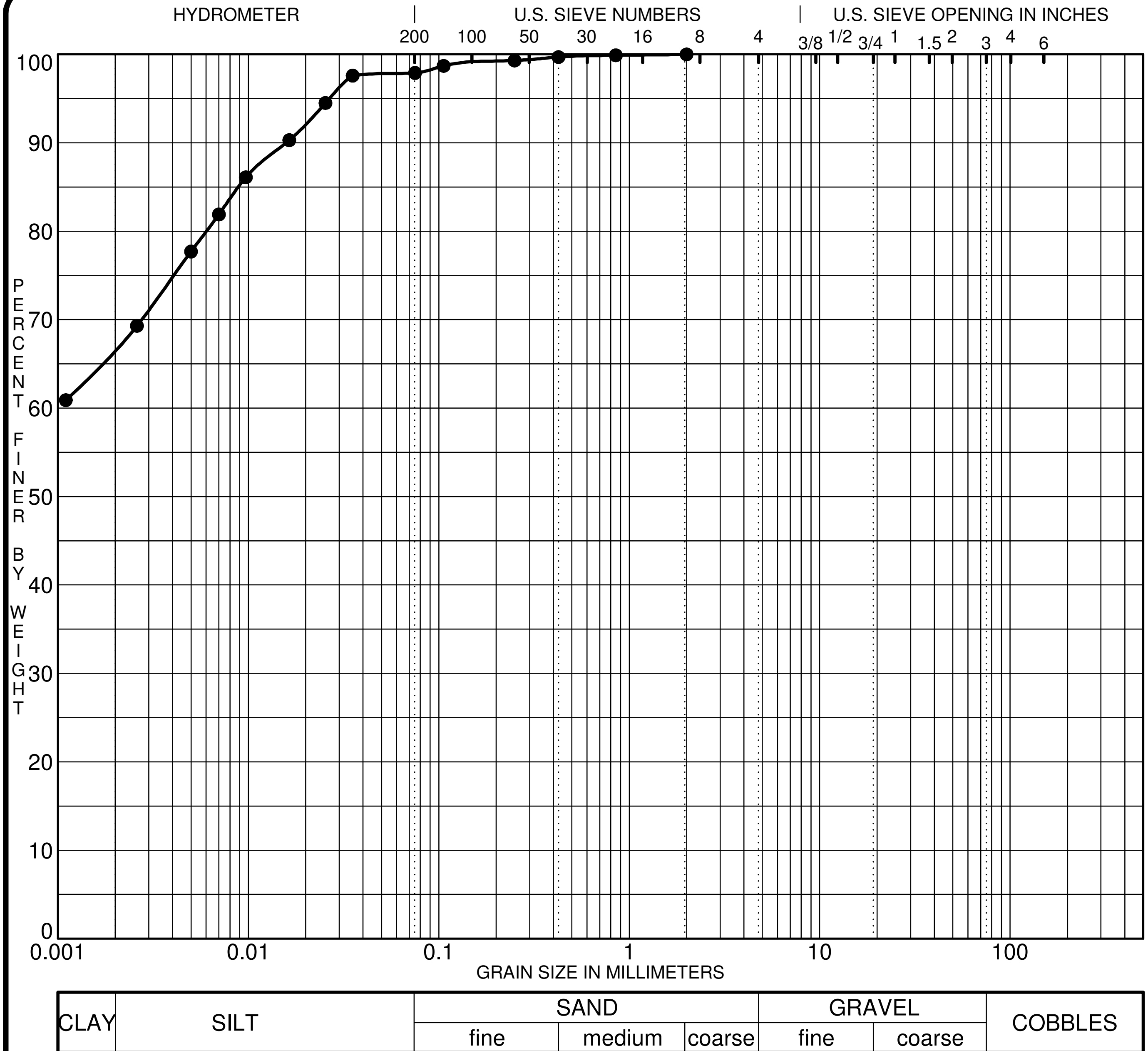
ATTERBERG LIMITS' RESULTS



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH 1-22-EL	SS2		41.2					
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH 1-22-EL	SS2	2.00				0.0	2.1	30.4	67.5
⊠										
▲										
★										

CLIENT	Riverside South Development Corp.	FILE NO.	PG4958
PROJECT	Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario	DATE	22 Mar 22

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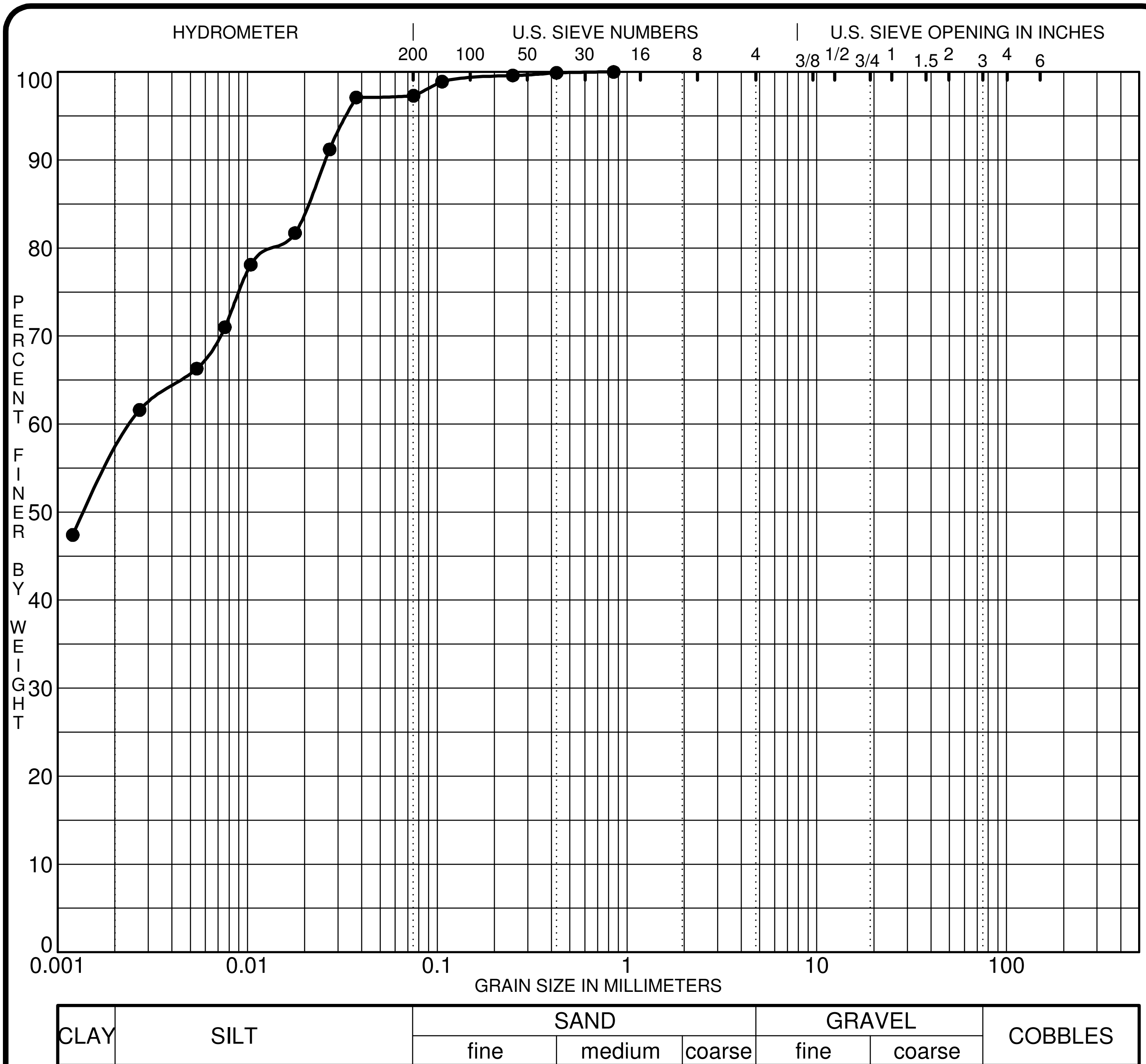
GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 3-22-EL**	**SS2**		**30.2**					
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 3-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**2.7**	**40.3**	**57.0**
⊠										
▲										
★										

CLIENT **Riverside South Development Corp.** FILE NO. **PG4958**

PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario** DATE **29 Mar 22**

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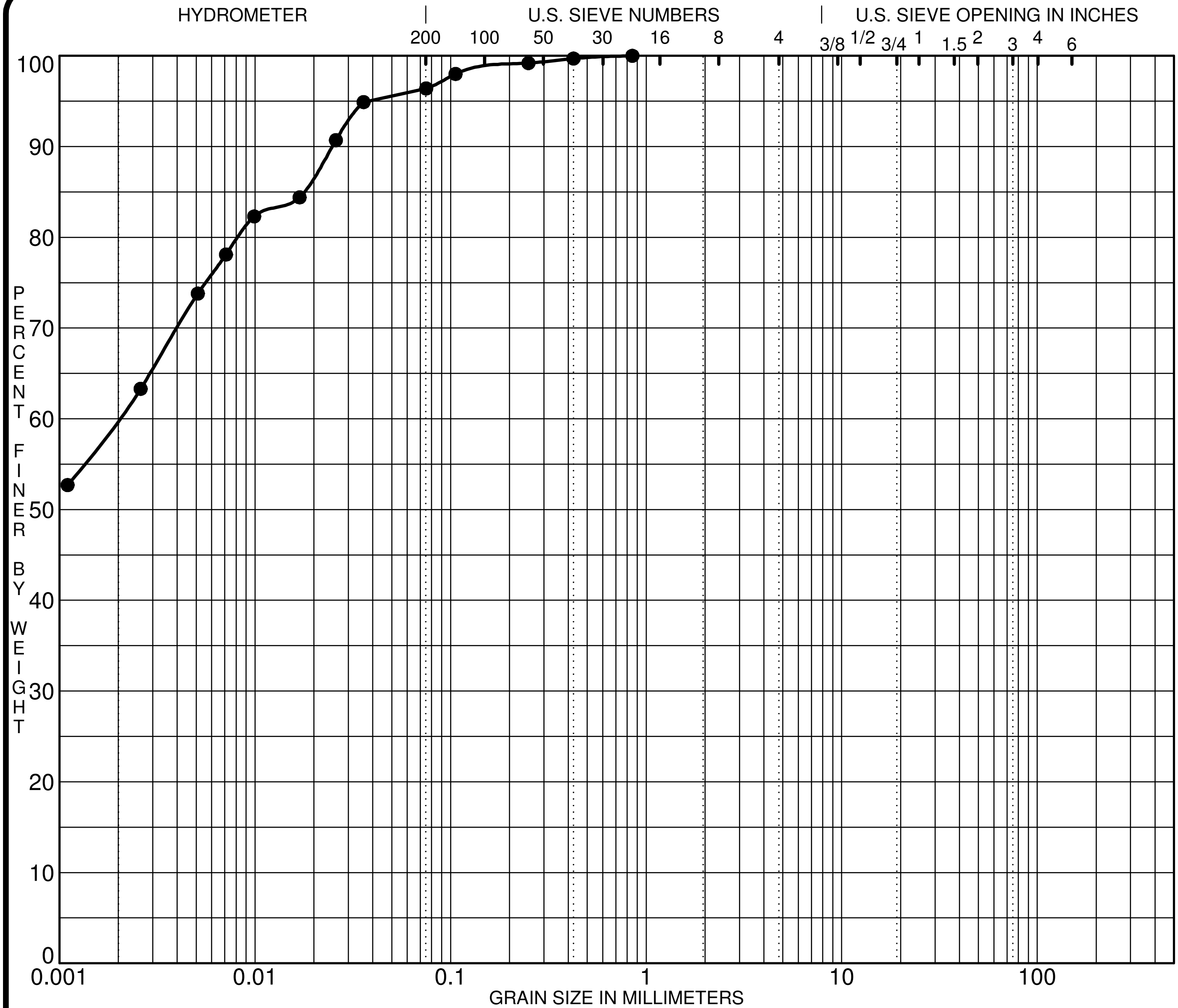
GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH 4-22-EL	SS2		35.8					
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH 4-22-EL	SS2	0.85	0.00			0.0	3.6	36.4	60.0
⊠										
▲										
★										

CLIENT **Riverside South Development Corp.**
FILE NO. **PG4958**
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**
DATE **30 Mar 22**

patersongroup **Consulting Engineers**

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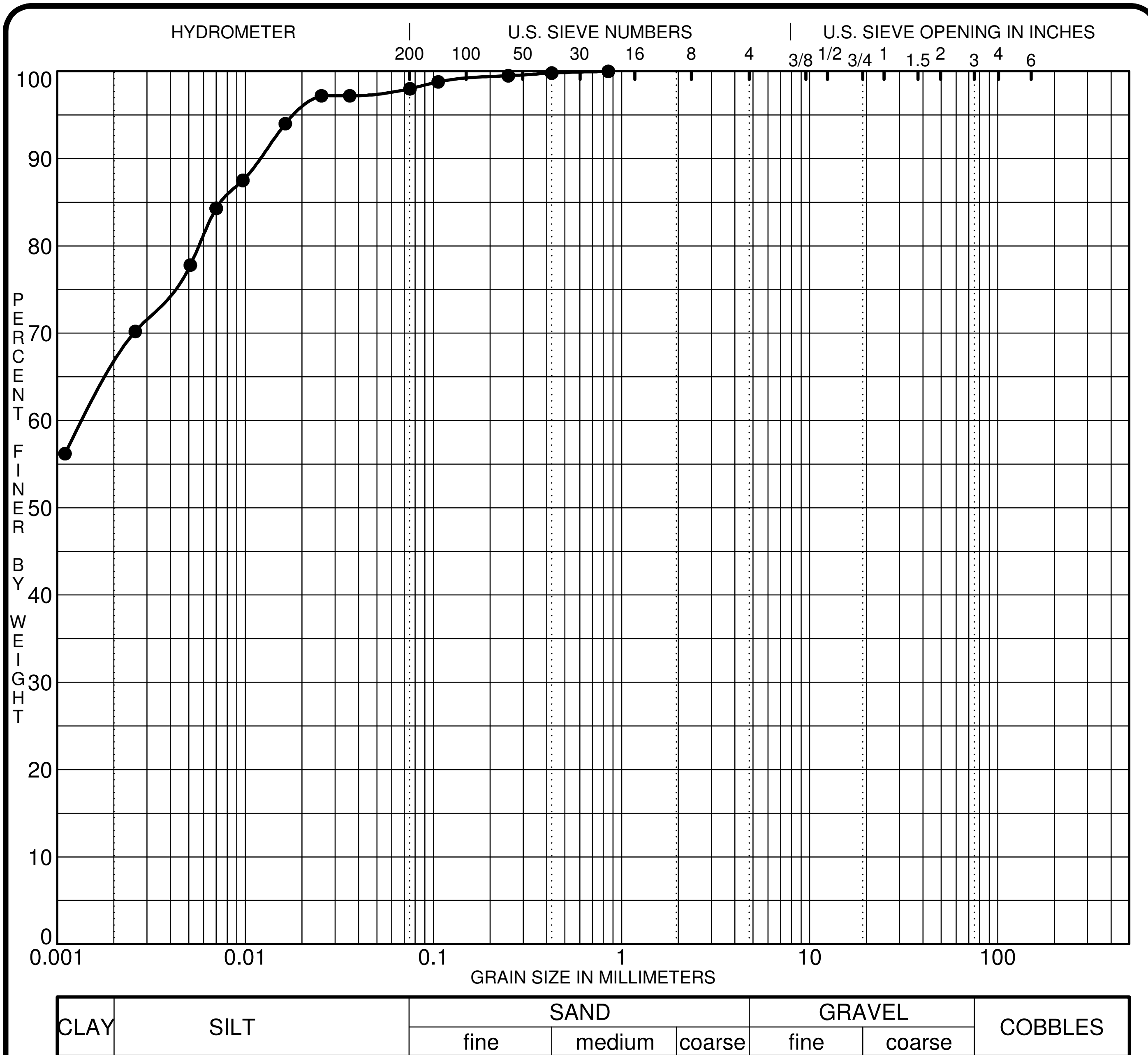
GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 7-22-EL**	**SS2**		**35.0**					
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 7-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**2.0**	**32.0**	**66.0**
⊠										
▲										
★										

CLIENT **Riverside South Development Corp.**

FILE NO. **PG4958**

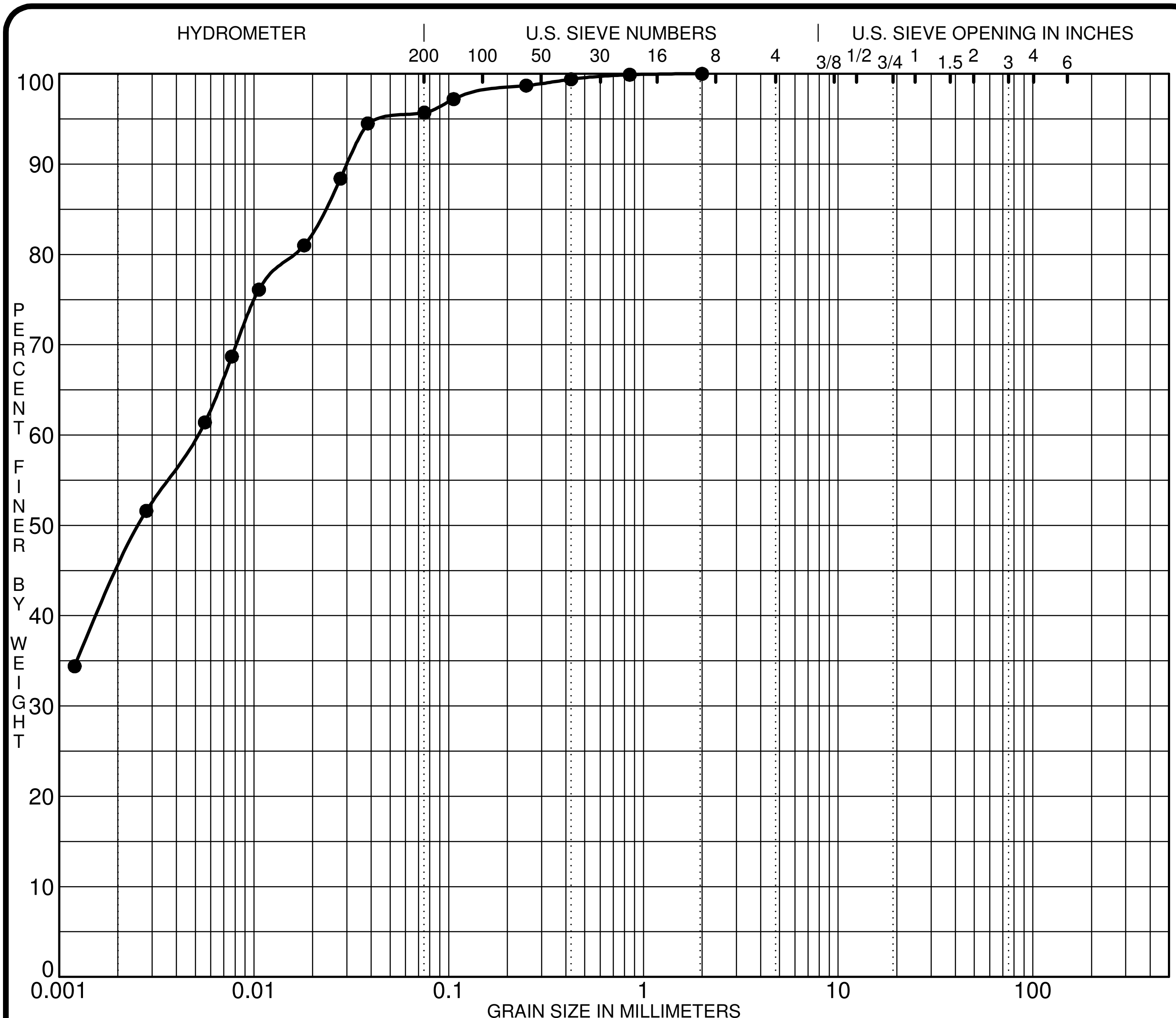
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**

DATE **31 Mar 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

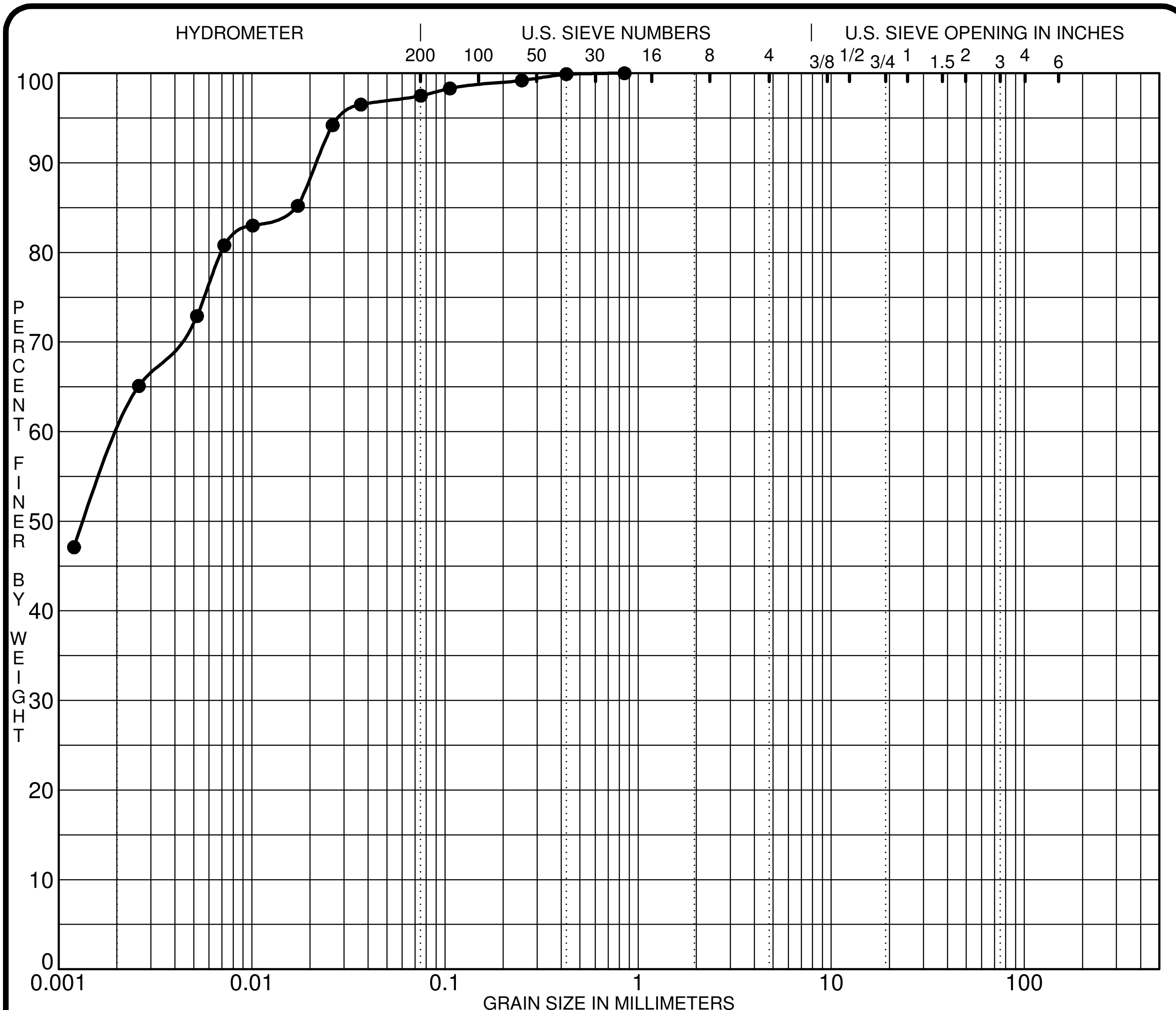
	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH 8-22-EL**	**SS2**		**33.1**					
⊠									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH 8-22-EL**	**SS2**	**2.00**	**0.01**			**0.0**	**4.3**	**50.7**	**45.0**
⊠										
▲										
★										

CLIENT **Riverside South Development Corp.**
FILE NO. **PG4958**
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**
DATE **31 Mar 22**

patersongroup **Consulting Engineers**
9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH11-22-EL**	**SS2**		**32.9**					
⌧									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH11-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**2.5**	**38.0**	**59.5**
⌧										
▲										
★										

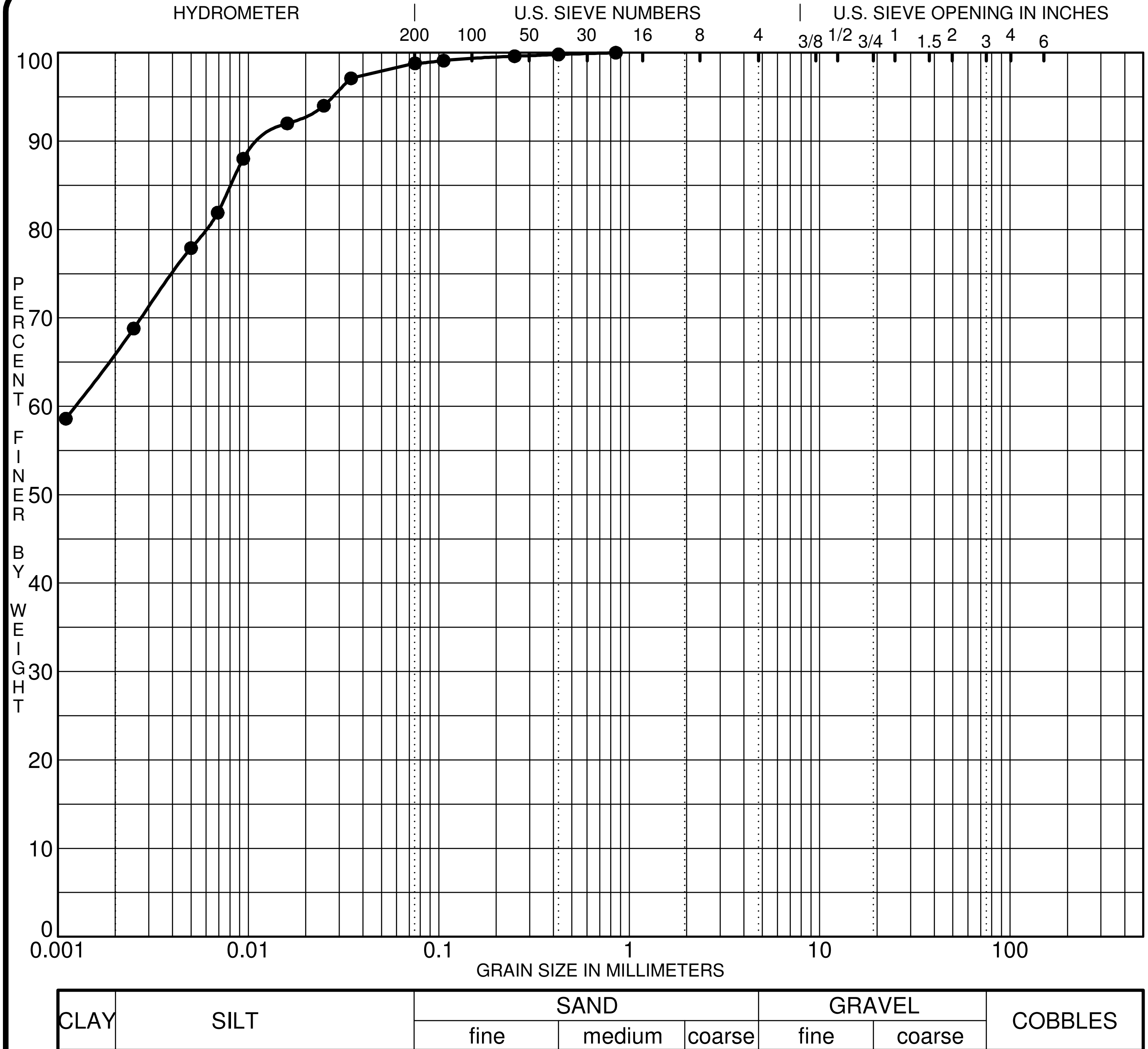
CLIENT **Riverside South Development Corp.** FILE NO. **PG4958**

PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario** DATE **31 Mar 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH13-22-EL**	**SS2**		**46.7**					
⊠									
▲									
★									

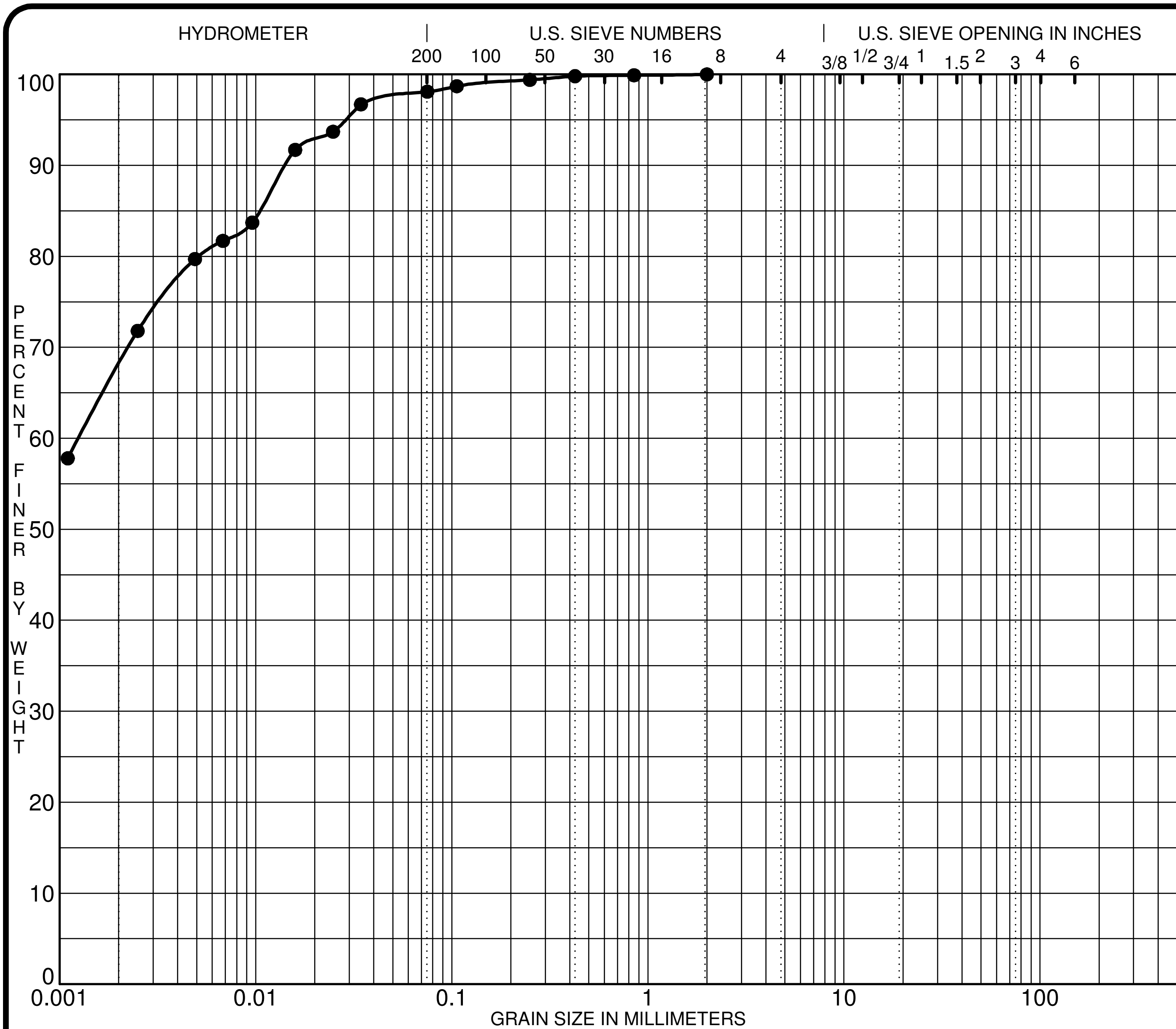
	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH13-22-EL**	**SS2**	**0.85**	**0.00**			**0.0**	**1.2**	**32.8**	**66.0**
⊠										
▲										
★										

CLIENT	**Riverside South Development Corp.**	FILE NO.	**PG4958**
PROJECT	**Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**	DATE	**1 Apr 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**BH15-22-EL**	**SS2**		**37.0**					
⌧									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BH15-22-EL**	**SS2**	**2.00**	**0.00**			**0.0**	**1.9**	**29.1**	**69.0**
⌧										
▲										
★										

CLIENT **Riverside South Development Corp.**

FILE NO. **PG4958**

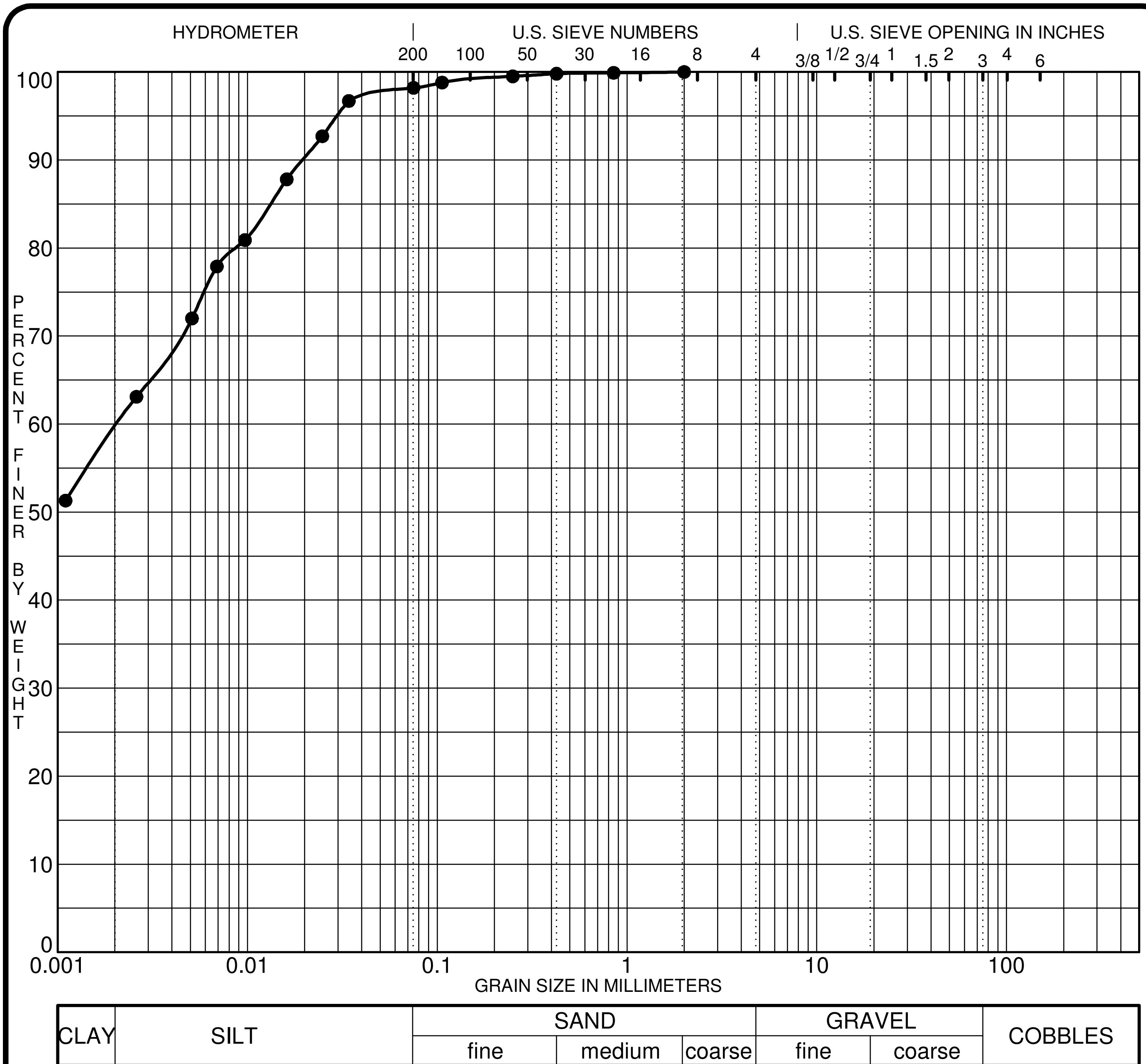
PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**

DATE **4 Apr 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH17-22-EL	SS2		34.2					
⌧									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH17-22-EL	SS2	2.00	0.00			0.0	1.8	38.7	59.5
⌧										
▲										
★										

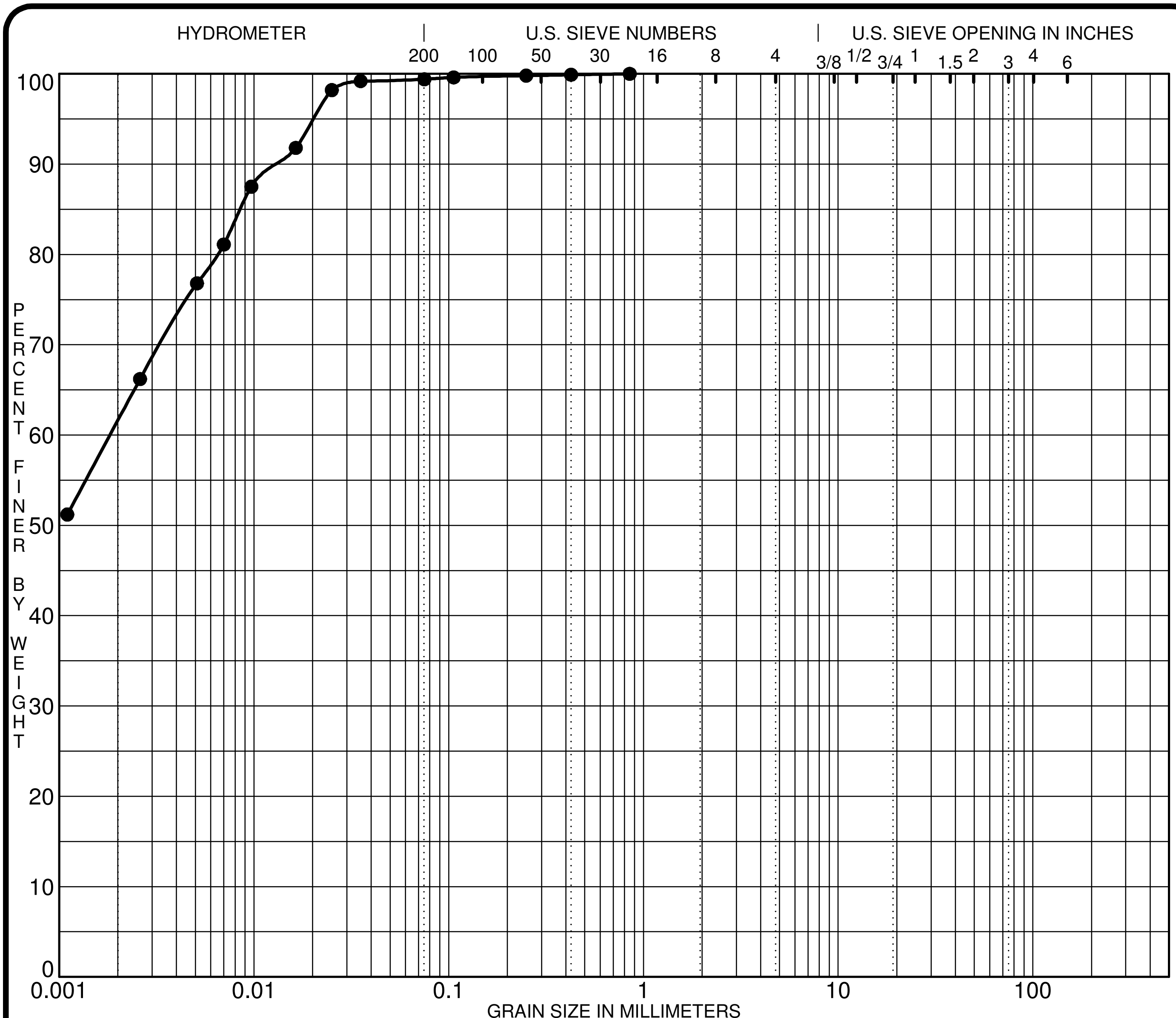
CLIENT **Riverside South Development Corp.** FILE NO. **PG4958**

PROJECT **Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario** DATE **4 Apr 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION



CLAY	SILT	SAND			GRAVEL		COBBLES
		fine	medium	coarse	fine	coarse	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	BH19-22-EL	SS2		44.6					
⌧									
▲									
★									

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	BH19-22-EL	SS2	0.85	0.00			0.0	0.6	38.4	61.0
⌧										
▲										
★										

CLIENT	**Riverside South Development Corp.**	FILE NO.	**PG4958**
PROJECT	**Geotechnical Investigation - 3700 Twin Falls Place, Ottawa, Ontario**	DATE	**4 Apr 22**

patersongroup **Consulting Engineers**

9 Auriga Drive, Ottawa, Ontario K2E 7T9

GRAIN SIZE DISTRIBUTION

patersongroup
consulting engineers

Linear Shrinkage
ASTM D4943-02

CLIENT:	Riverside S Dev Co	DEPTH	5'-0" to 7'-0"	FILE NO.:	PG4958
PROJECT:	Mosquito Creek	BH OR TP No:	BH10-22 SS3	DATE SAMPLED	31-Mar
LAB No:	32302	TESTED BY:	CP/ CS	DATE RECEIVED	1-Apr
SAMPLED BY:	MF	DATE REPORTED:	8-Apr-22	DATE TESTED	6-Apr

LABORATORY INFORMATION & TEST RESULTS

Moisture	No. of Blows(8)	Calibration (Two Trials)	Tin NO.(x215)	
Tare	4.96	Tin	4.83	4.84
Soil Pat Wet + Tare	63.3	Tin + Grease	4.98	5
Soil Pat Wet	58.34	Glass	48.97	48.97
Soil Pat Dry + Tare	36.6	Tin + Glass + Water	91.27	91.36
Soil Pat Dry	31.64	Volume	37.32	37.39
Moisture	**84.39**	**Average Volume**	**37.36**	

Soil Pat + String	31.77
Soil Pat + Wax + String in Air	32.49
Soil Pat + Wax + String in Water	14.18
Volume Of Pat (Vdx)	18.31

RESULTS:

Shrinkage Limit	**21.64**
Shrinkage Ratio	**1.808**
Volumetric Shrinkage	**113.445**
Linear Shrinkage	**22.331**

REVIEWED BY:	**Curtis Beadow**	**Joe Forsyth, P. Eng.**

Certificate of Analysis

Client: Paterson Group Consulting Engineers

Client PO: 33924

Report Date: 01-Apr-2022

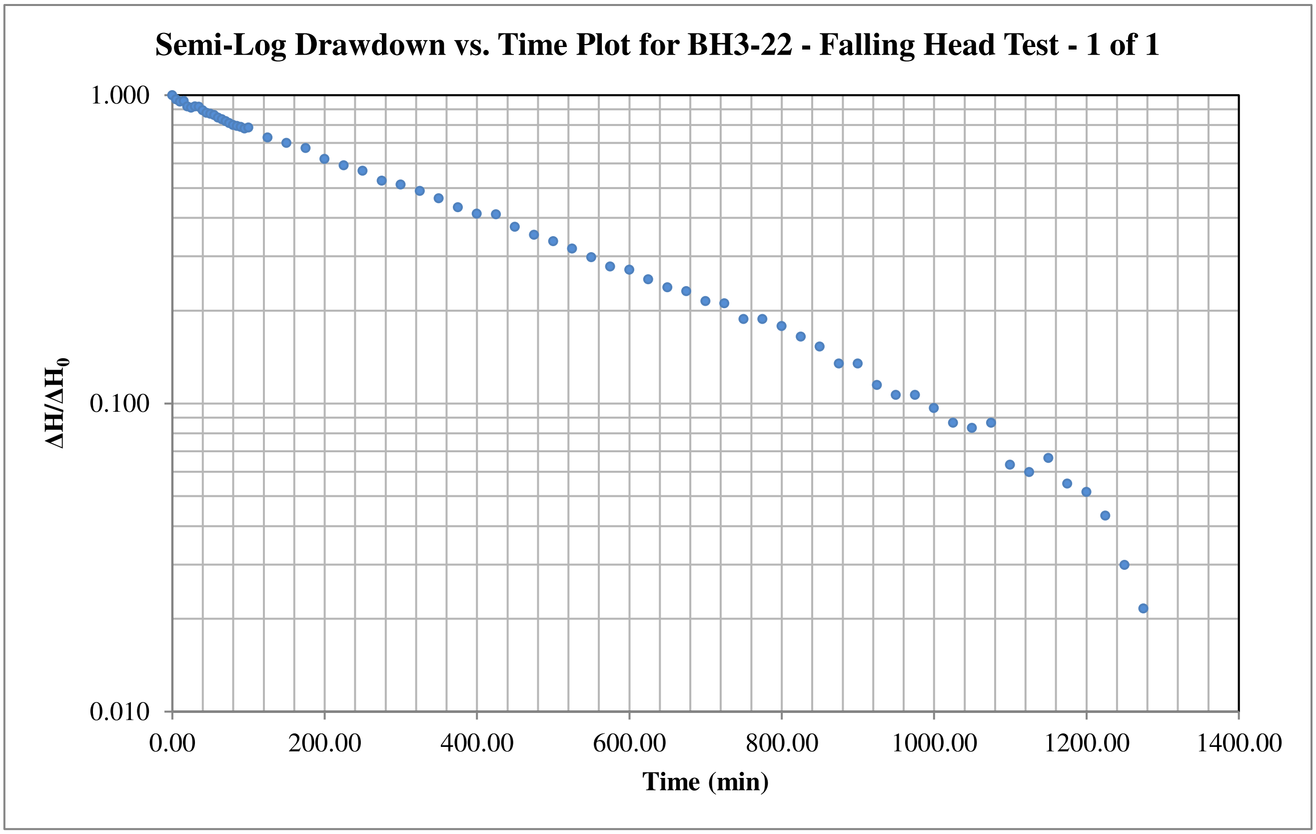
Order Date: 28-Mar-2022

Project Description: PG4958

	Client ID:	BH1-22 SS2	-	-	-
	Sample Date:	22-Mar-22 09:00	-	-	-
	Sample ID:	2214091-01	-	-	-
	MDL/Units	Soil	-	-	-
Physical Characteristics					
% Solids	0.1 % by Wt.	72.2	-	-	-
General Inorganics					
pH	0.05 pH Units	7.42	-	-	-
Resistivity	0.10 Ohm.m	75.7	-	-	-
Anions					
Chloride	5 ug/g dry	11	-	-	-
Sulphate	5 ug/g dry	9	-	-	-

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH3-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5 m	Saturated length of screen or open hole
D	0.0508 m	Diameter of well
r_c	0.0254 m	Radius of well

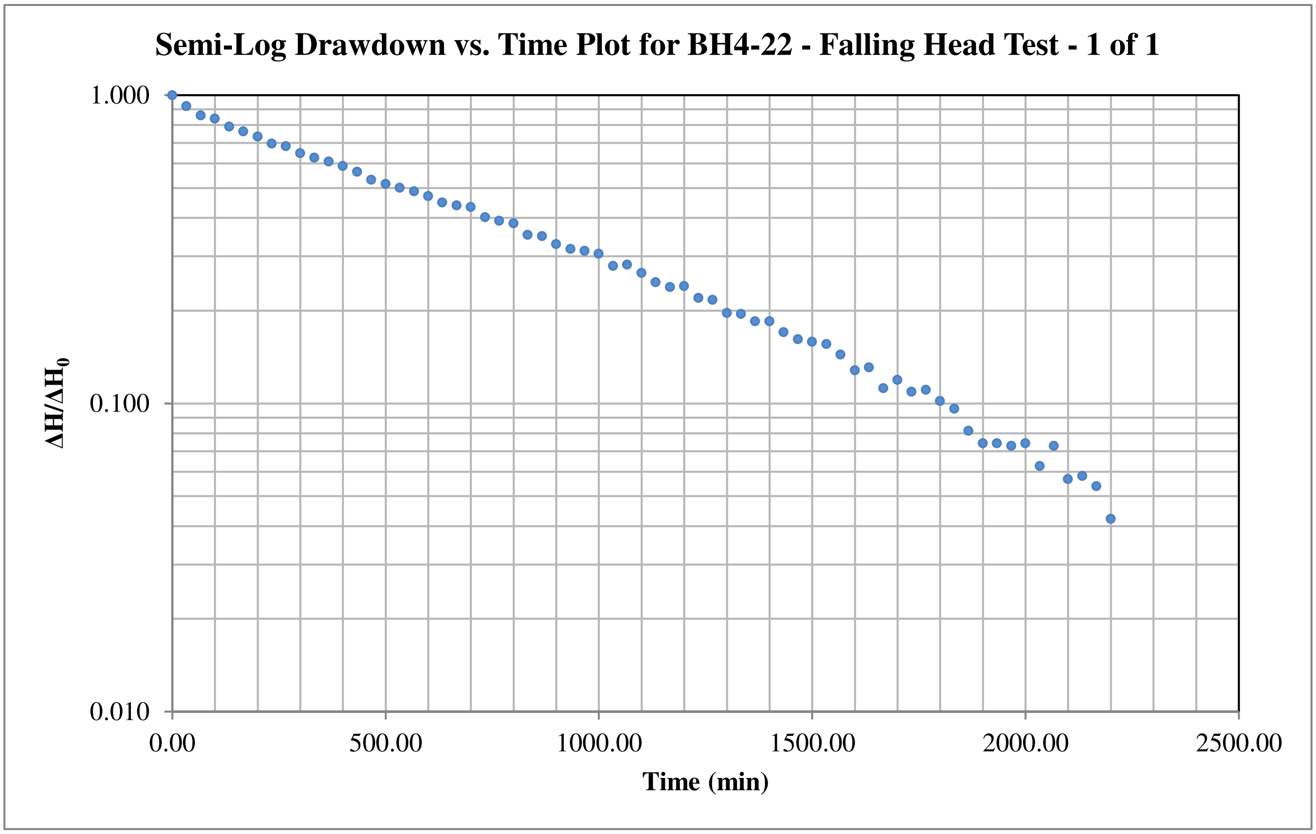
Data Points (from plot):

t^*: 455.058 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 3.19E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH4-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

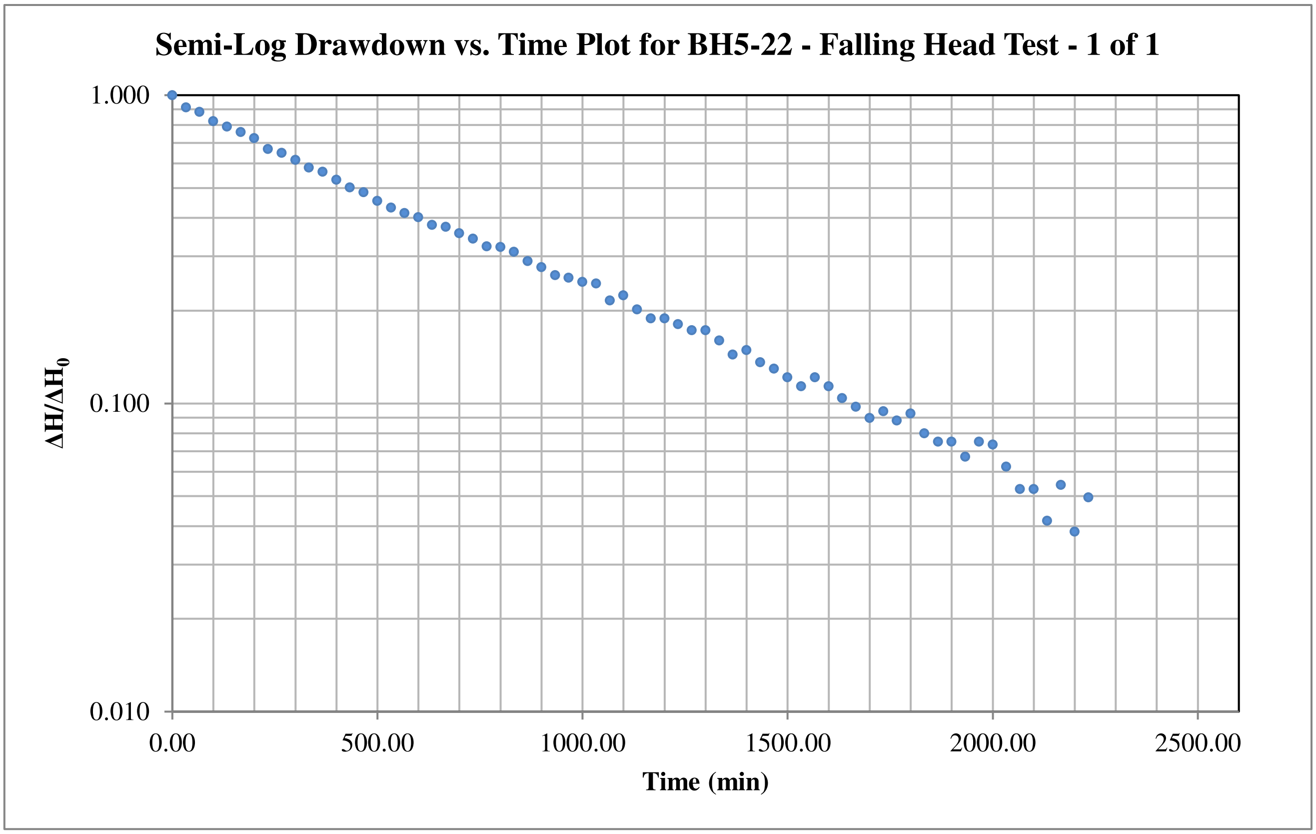
Data Points (from plot):

t^*: 814.864 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 1.78E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH5-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

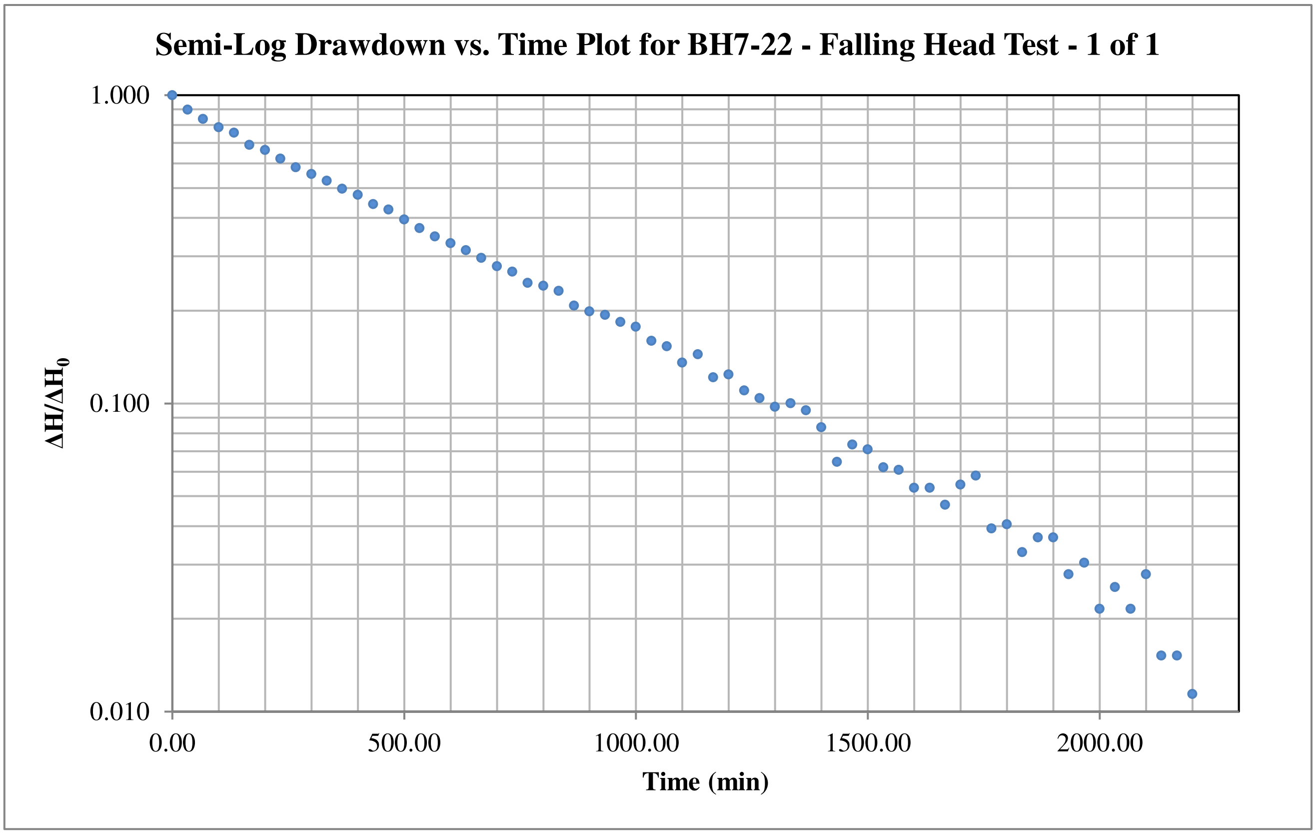
Data Points (from plot):

t^*: 675.000 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 2.15E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH7-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F}\frac{1}{t^*}\ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

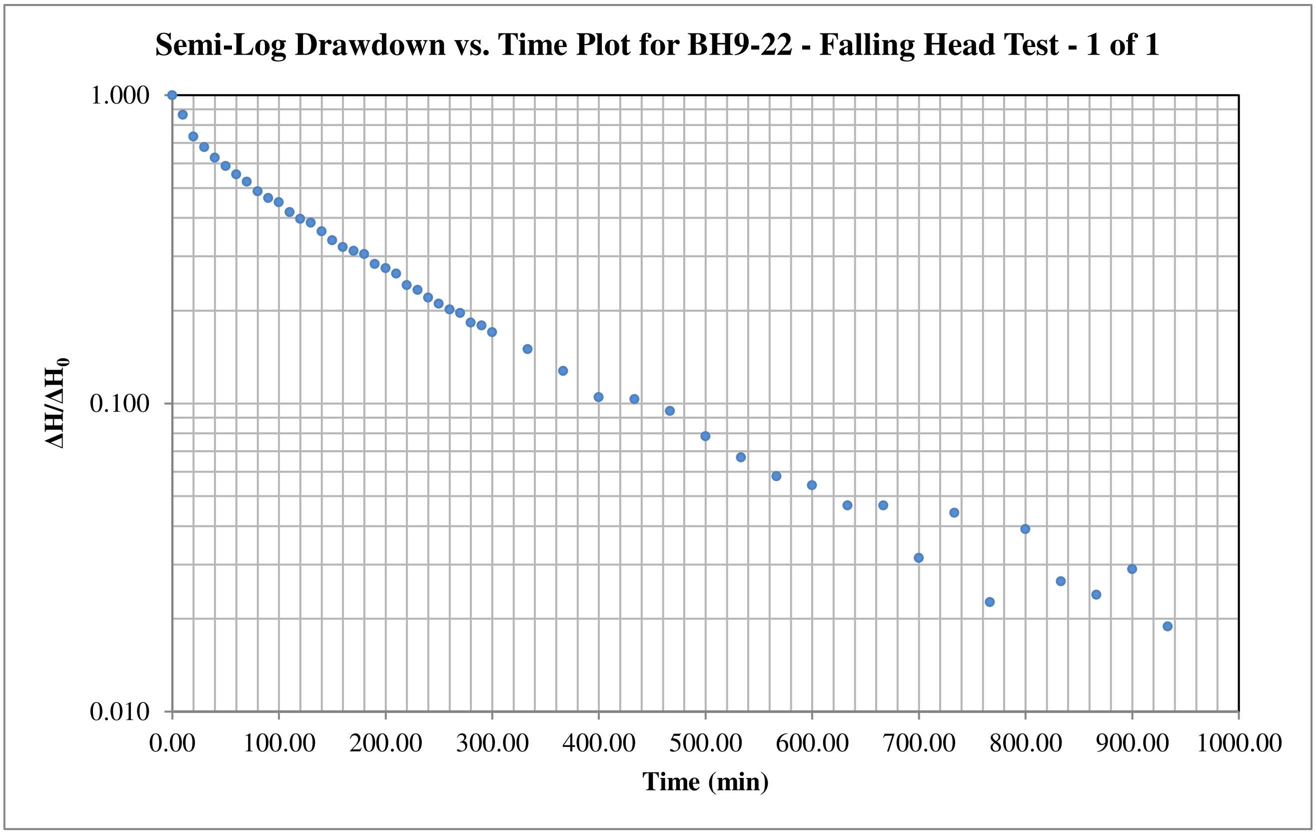
Data Points (from plot):

t^*: 533.721 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 2.72E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH9-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

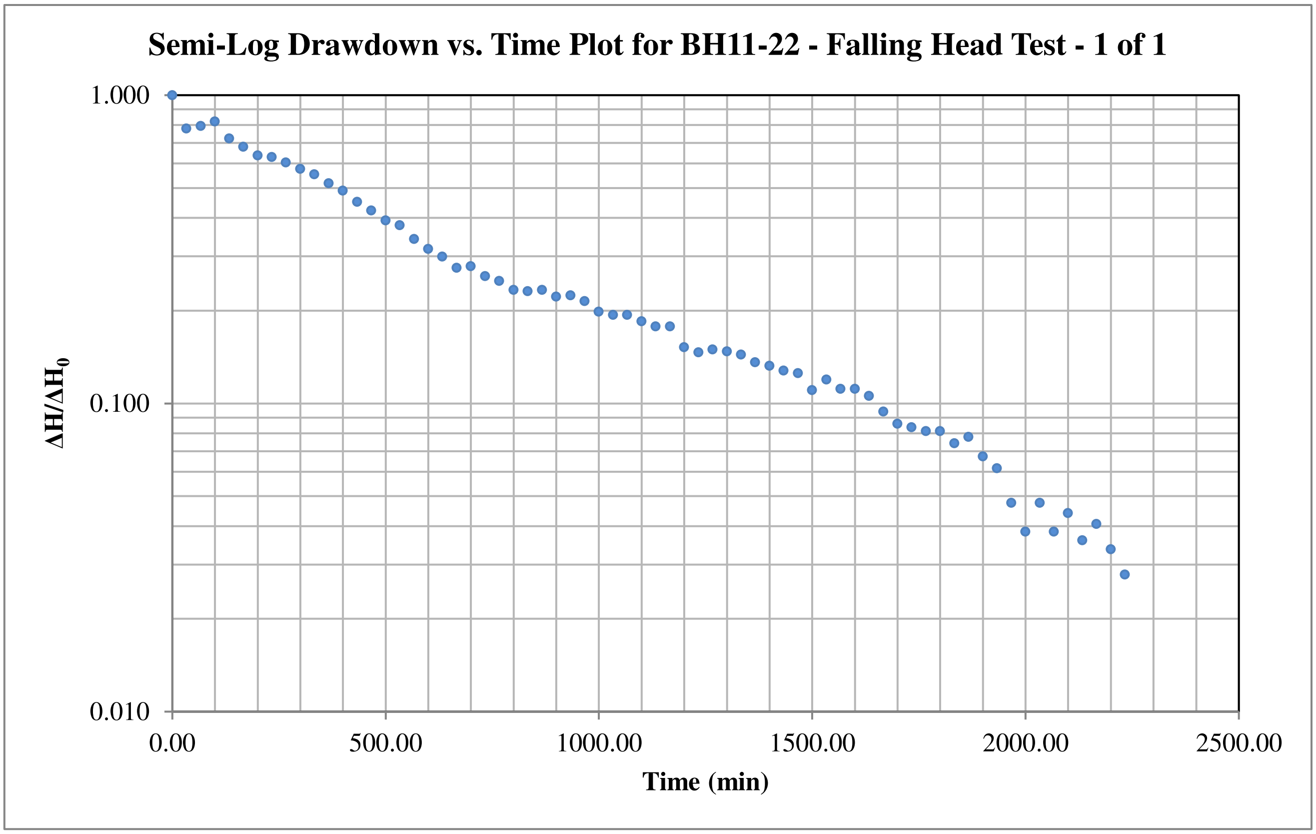
Data Points (from plot):

t*: 136.626 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 1.06E-07 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH11-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

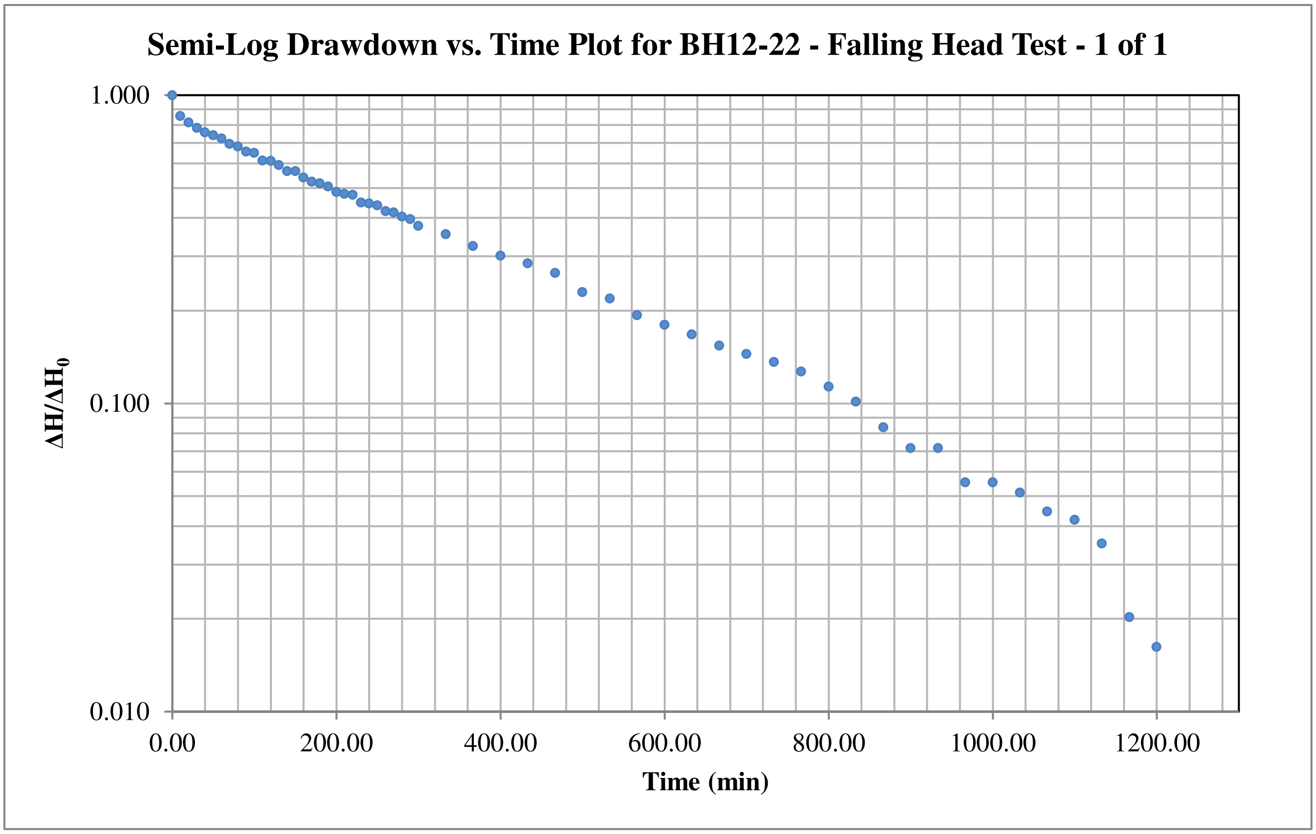
Data Points (from plot):

t^*: 541.073 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 2.69E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH12-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

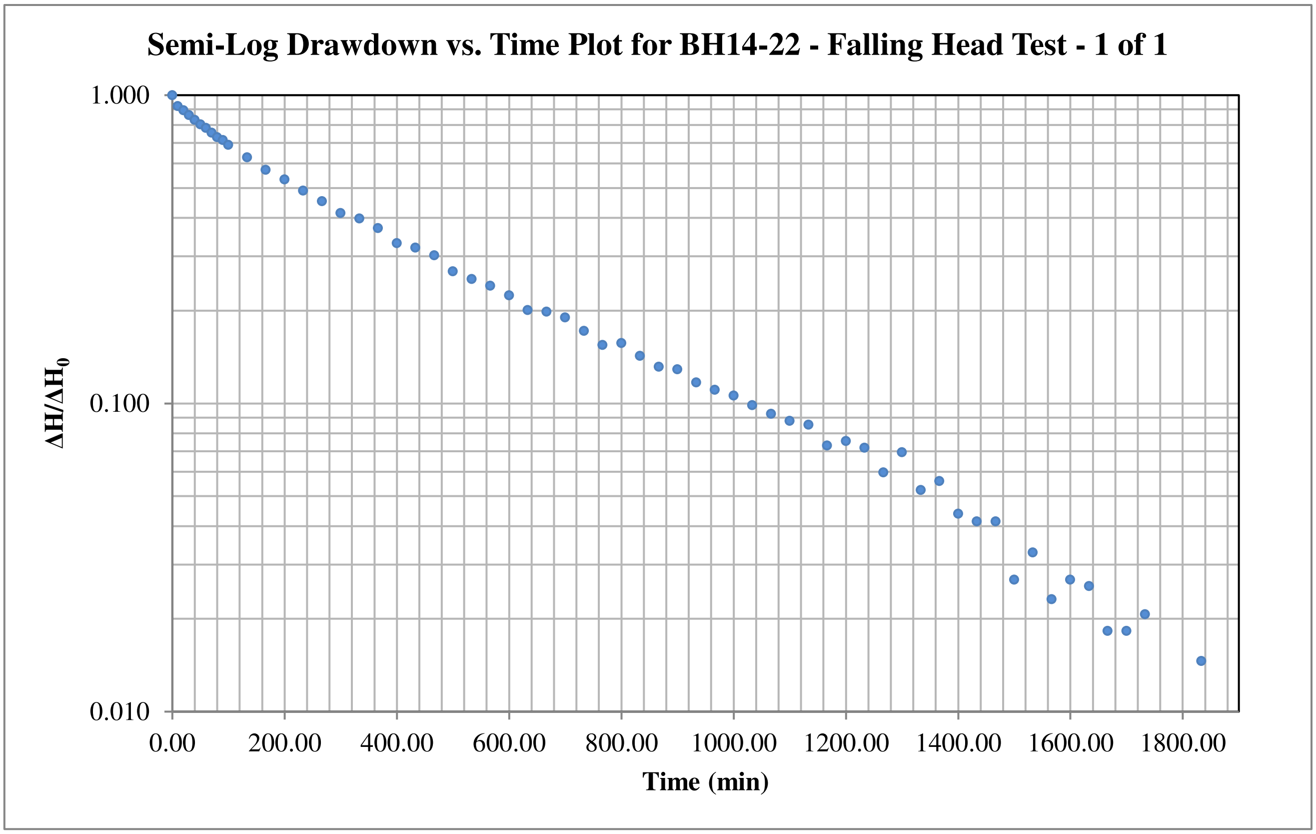
Data Points (from plot):

t^*: 310.196 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 4.69E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH14-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

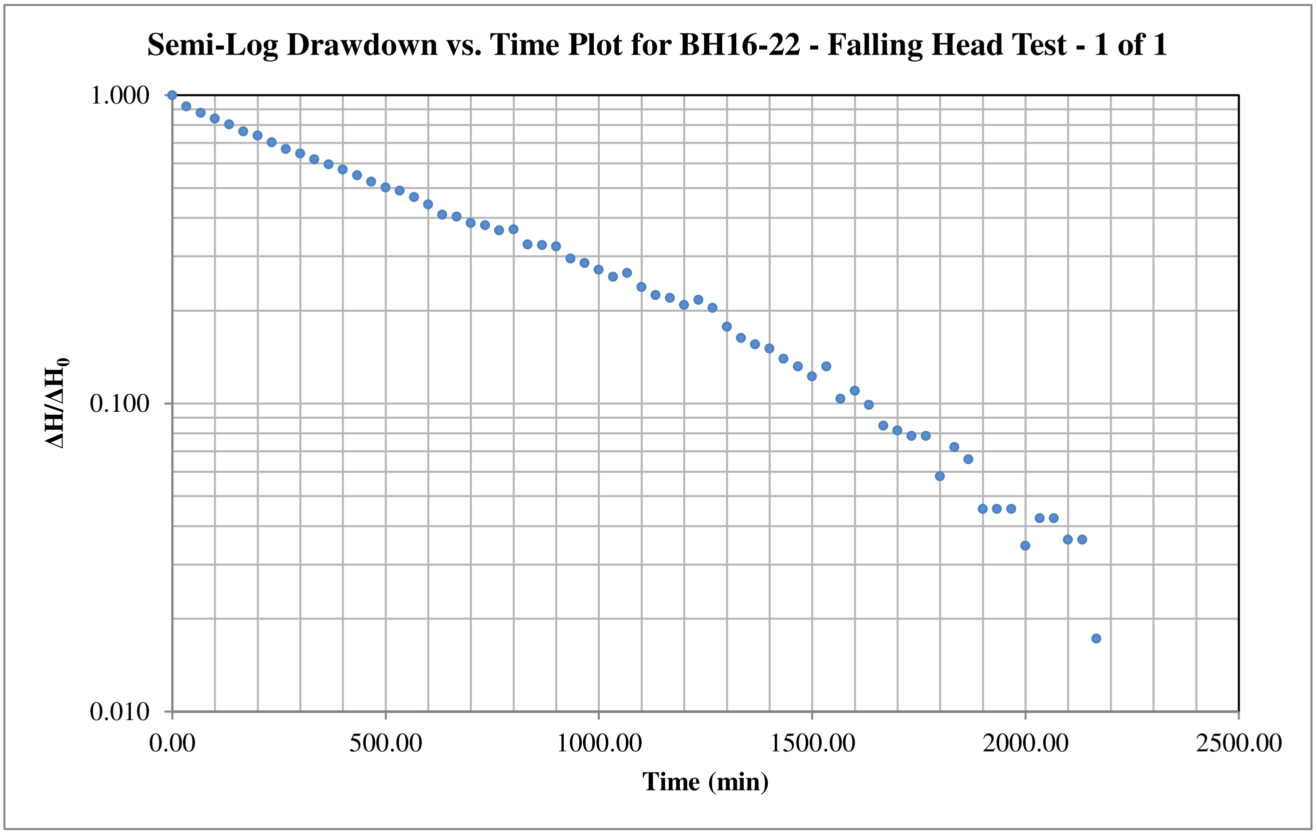
Data Points (from plot):

t*: 349.547 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 4.16E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH16-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

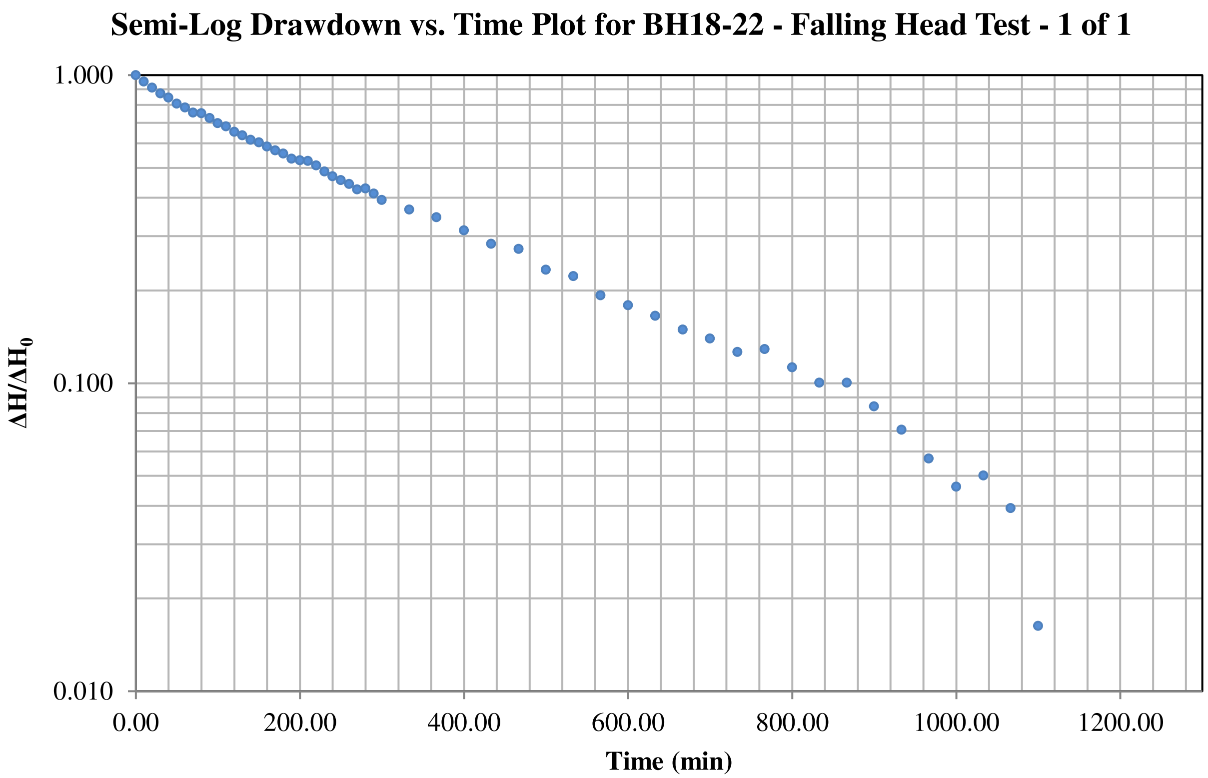
Data Points (from plot):

t^*: 753.000 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 1.93E-08 m/sec

Hvorslev Hydraulic Conductivity Analysis

Project: Riverside Development South - Limebank & Leitrim
Test Location: BH18-22
Test: Falling Head - 1 of 1
Date: April 26, 2022



Hvorslev Horizontal Hydraulic Conductivity

$$K = \frac{\pi r_c^2}{F} \frac{1}{t^*} \ln\left(\frac{\Delta H^*}{\Delta H_0}\right)$$

Hvorslev Shape Factor

$$F = \frac{2\pi L}{\ln\left(\frac{2L}{D}\right)}$$

Valid for L>>D

Hvorslev Shape Factor F: 2.31086

Well Parameters:

L	1.5	m	Saturated length of screen or open hole
D	0.0508	m	Diameter of well
r_c	0.0254	m	Radius of well

Data Points (from plot):

t^*: 328.850 minutes $\Delta H^*/\Delta H_0$: 0.37

Horizontal Hydraulic Conductivity
K = 4.42E-08 m/sec

APPENDIX 2

FIGURE 1 – KEY PLAN

FIGURES 2 TO 11, 19 TO 21, AND 26 – SLOPE STABILITY FIGURES

FIGURE 27 – TYPICAL EROSION CONTROL DETAIL

FIGURE 28 – SETTLEMENT MONITORING PROGRAM

DRAWING PG4958-8 – TEST HOLE LOCATION PLAN

DRAWING PG4958-9 – PERMISSIBLE GRADE RAISE PLAN

DRAWING PG4958-10 – TREE PLANTING SETBACK PLAN

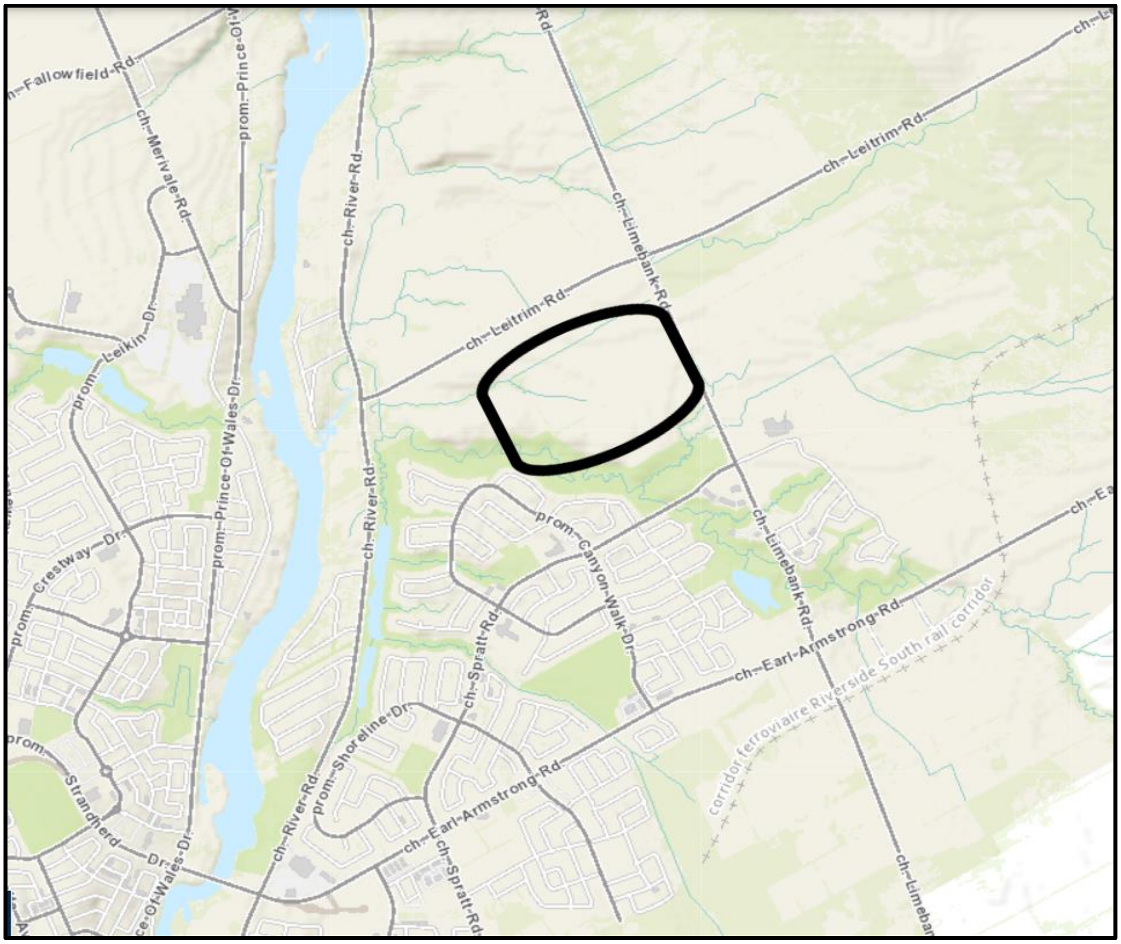


FIGURE 1

KEY PLAN

PATERSON GROUP

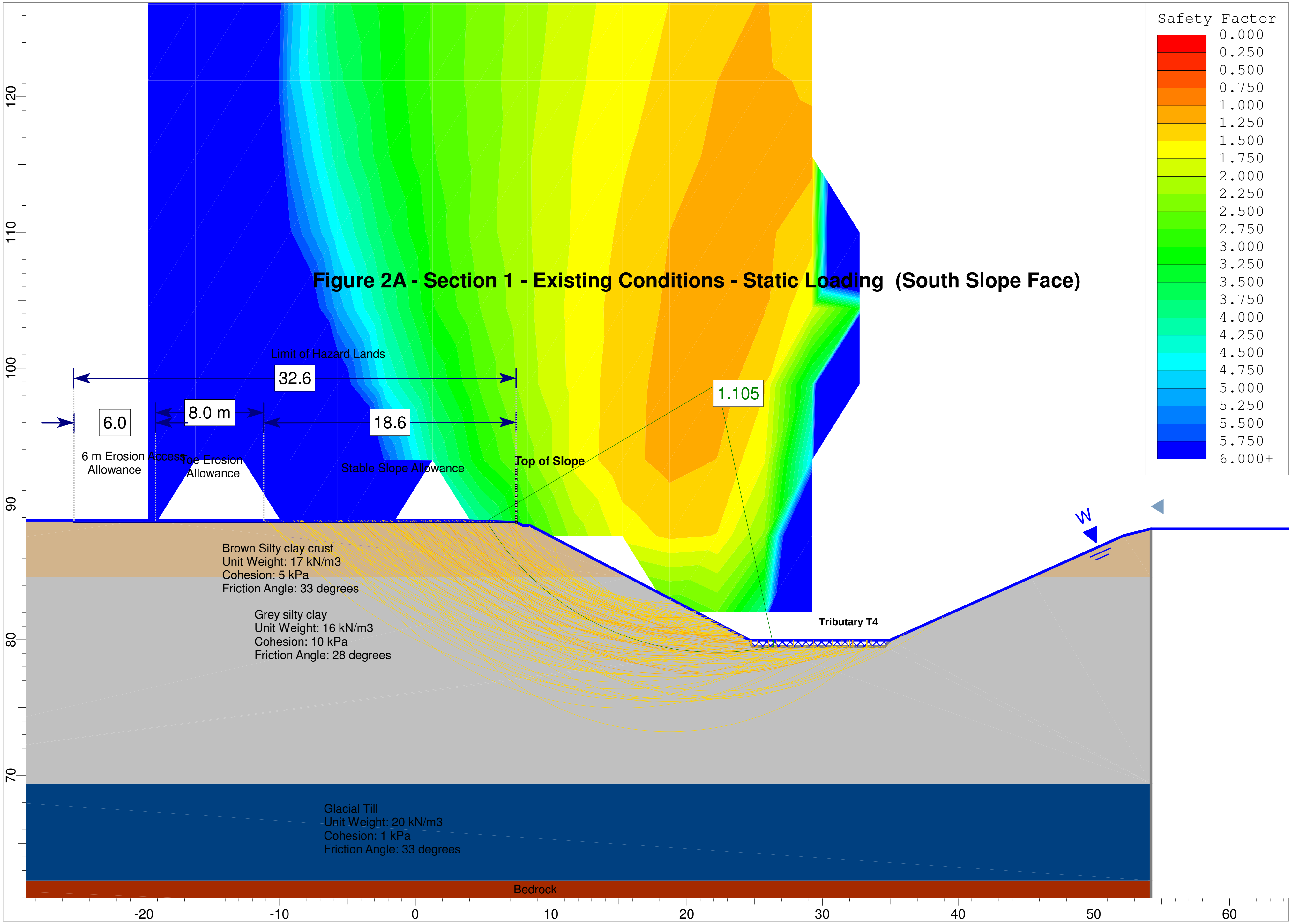
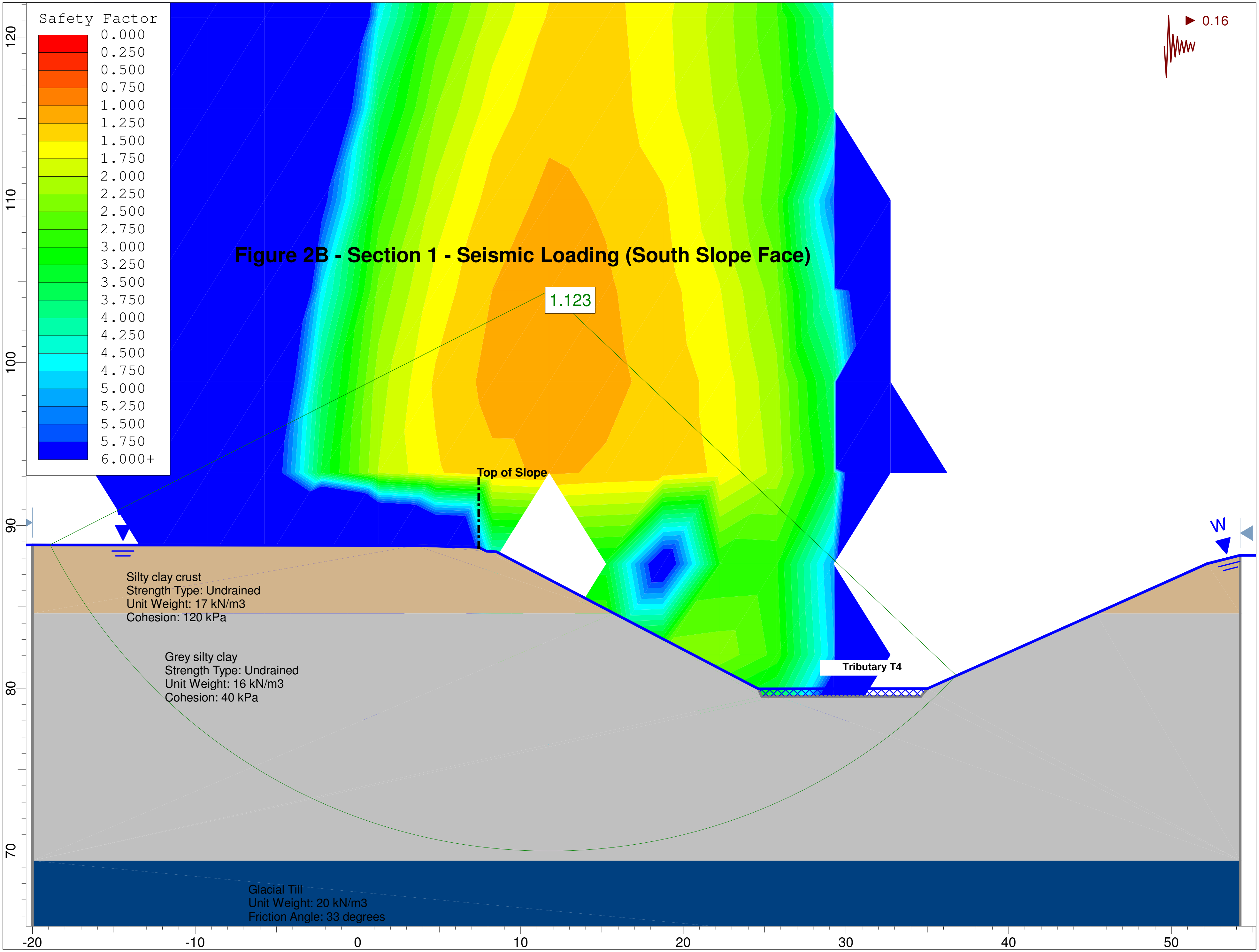


Figure 2A - Section 1 - Existing Conditions - Static Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Limit of Hazard Lands
32.6
6.0
8.0 m
18.6
1.105
6 m Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
W
Brown Silty clay crust
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T4
Glacial Till
Unit Weight: 20 kN/m3
Cohesion: 1 kPa
Friction Angle: 33 degrees
Bedrock
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Figure 2B - Section 1 - Seismic Loading (South Slope Face)
1.123
Top of Slope
W
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Tributary T4
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50

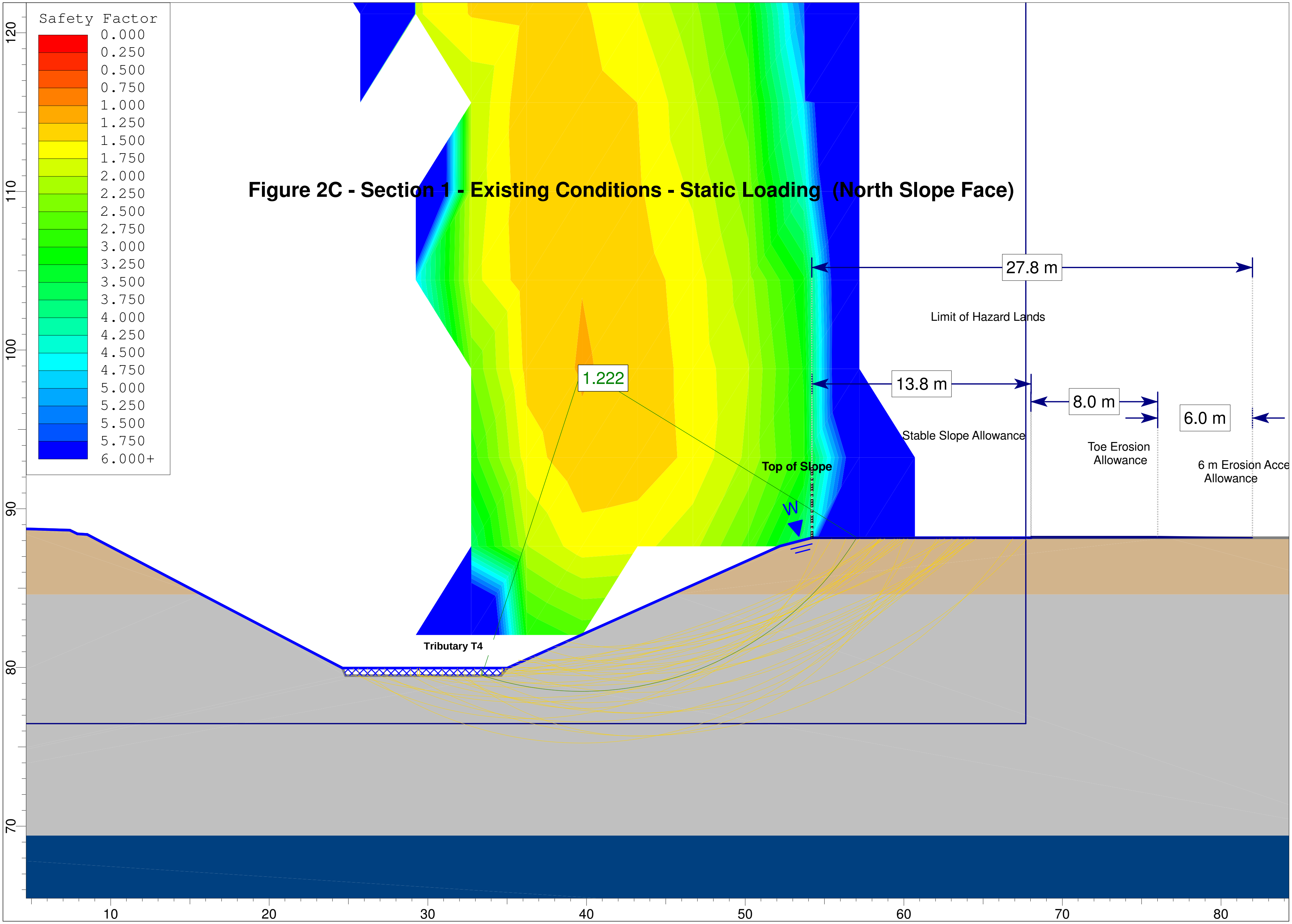
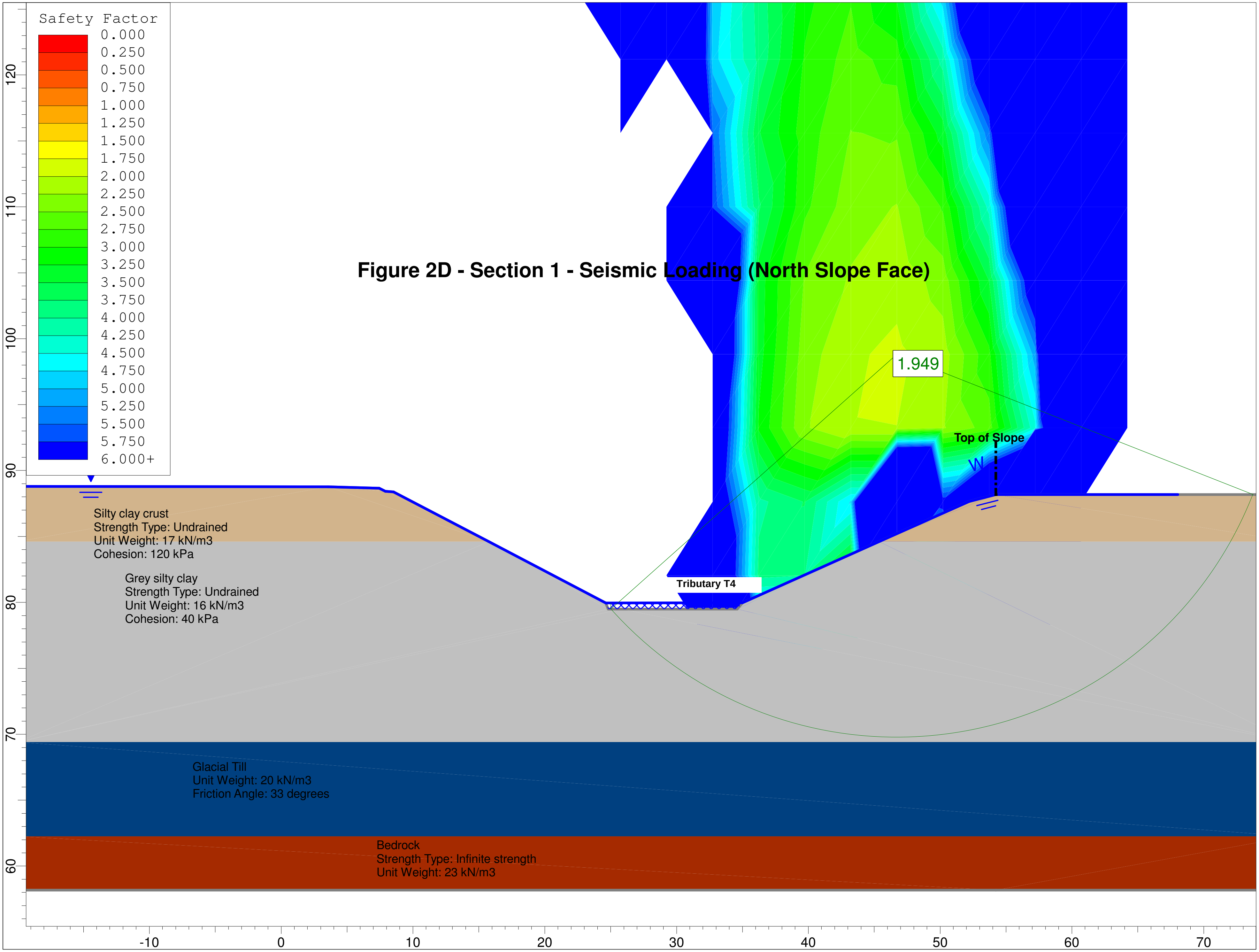


Figure 2C - Section 1 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.222
27.8 m
Limit of Hazard Lands
13.8 m
8.0 m
6.0 m
Stable Slope Allowance
Toe Erosion Allowance
6 m Erosion Acce Allowance
Top of Slope
W
Tributary T4
120
110
100
90
80
70
10
20
30
40
50
60
70
80



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 2D - Section 1 - Seismic Loading (North Slope Face)
1.949
Top of Slope
W
Tributary T4
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
60
-10
0
10
20
30
40
50
60
70

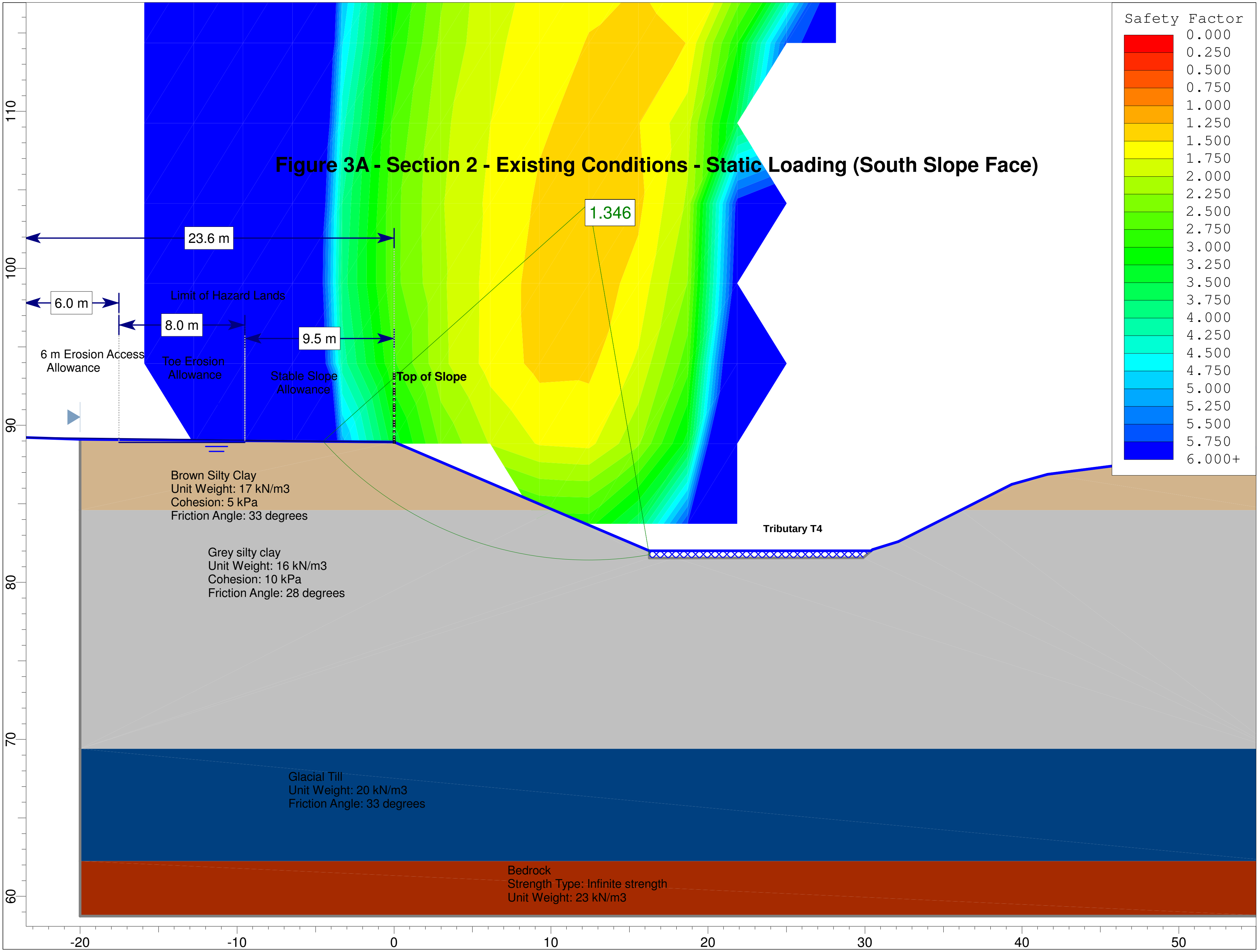


Figure 3A - Section 2 - Existing Conditions - Static Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.346
23.6 m
6.0 m
8.0 m
9.5 m
Limit of Hazard Lands
6 m Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T4
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
110
100
90
80
70
60
-20
-10
0
10
20
30
40
50

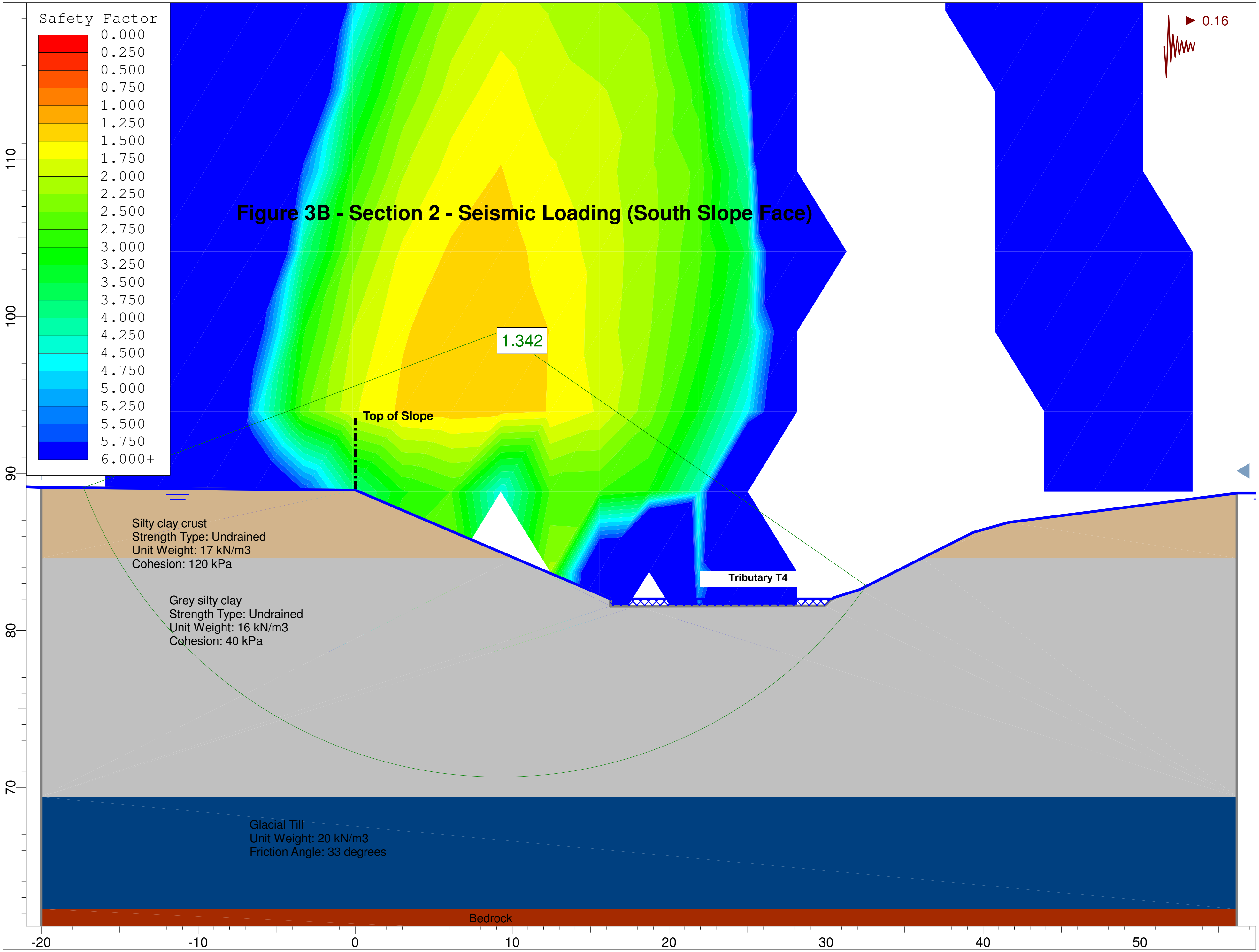


Figure 3B - Section 2 - Seismic Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.342
Top of Slope
Tributary T4
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
110
100
90
80
70
-20
-10
0
10
20
30
40
50

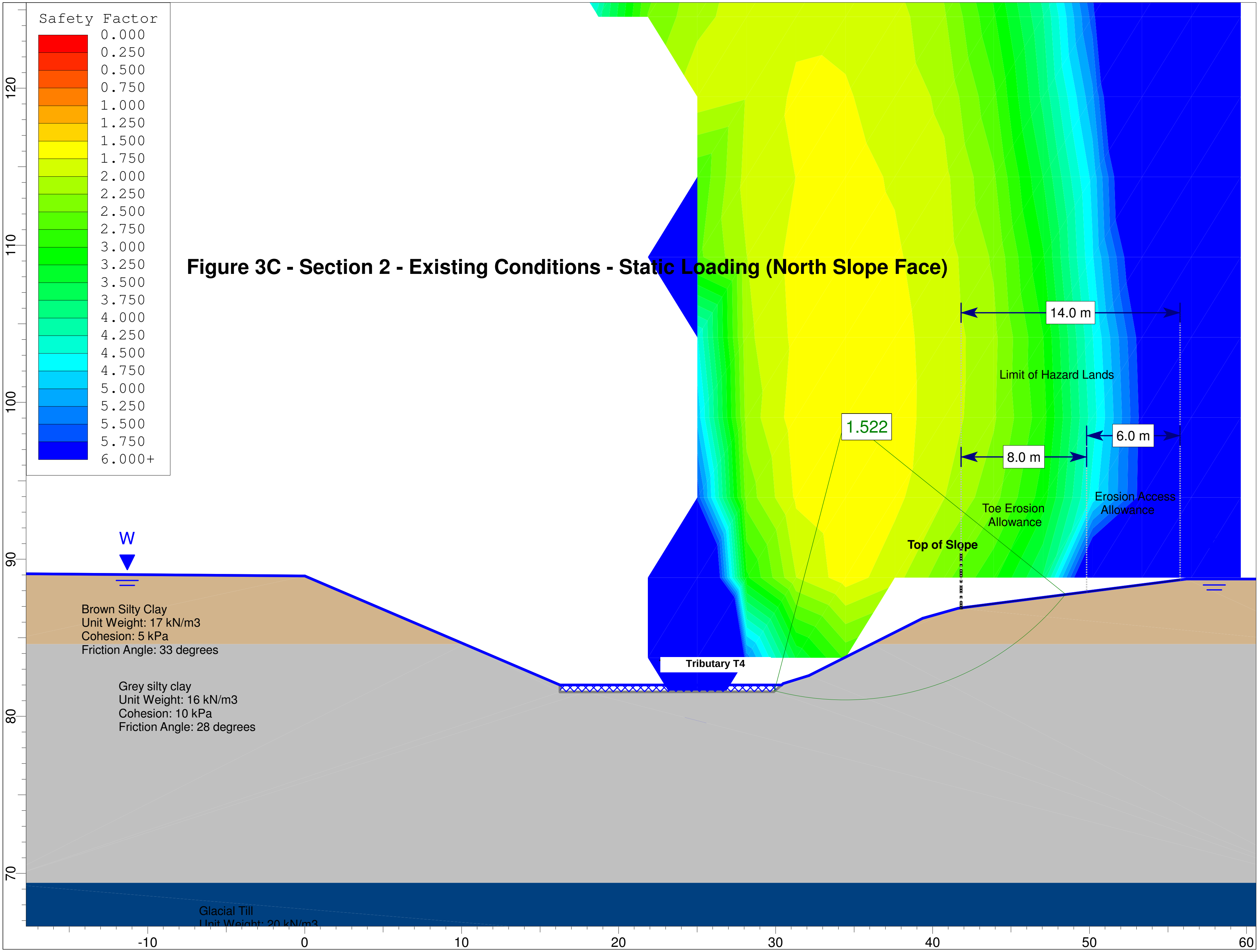


Figure 3C - Section 2 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
14.0 m
Limit of Hazard Lands
1.522
6.0 m
8.0 m
Toe Erosion Allowance
Erosion Access Allowance
Top of Slope
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Tributary T4
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
120
110
100
90
80
70
-10
0
10
20
30
40
50
60

Figure 3D - Section 2 - Seismic Loading (North Slope Face)

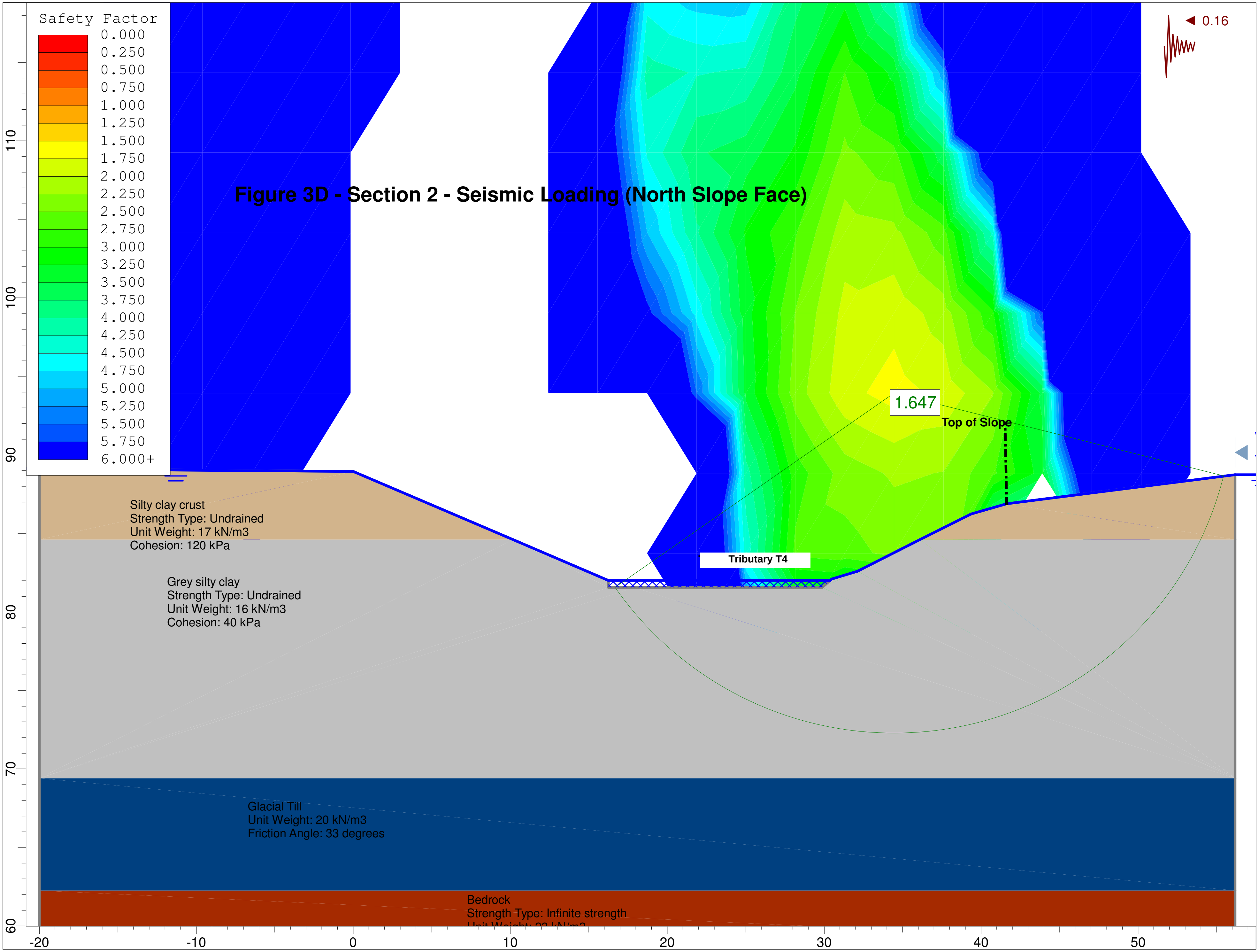
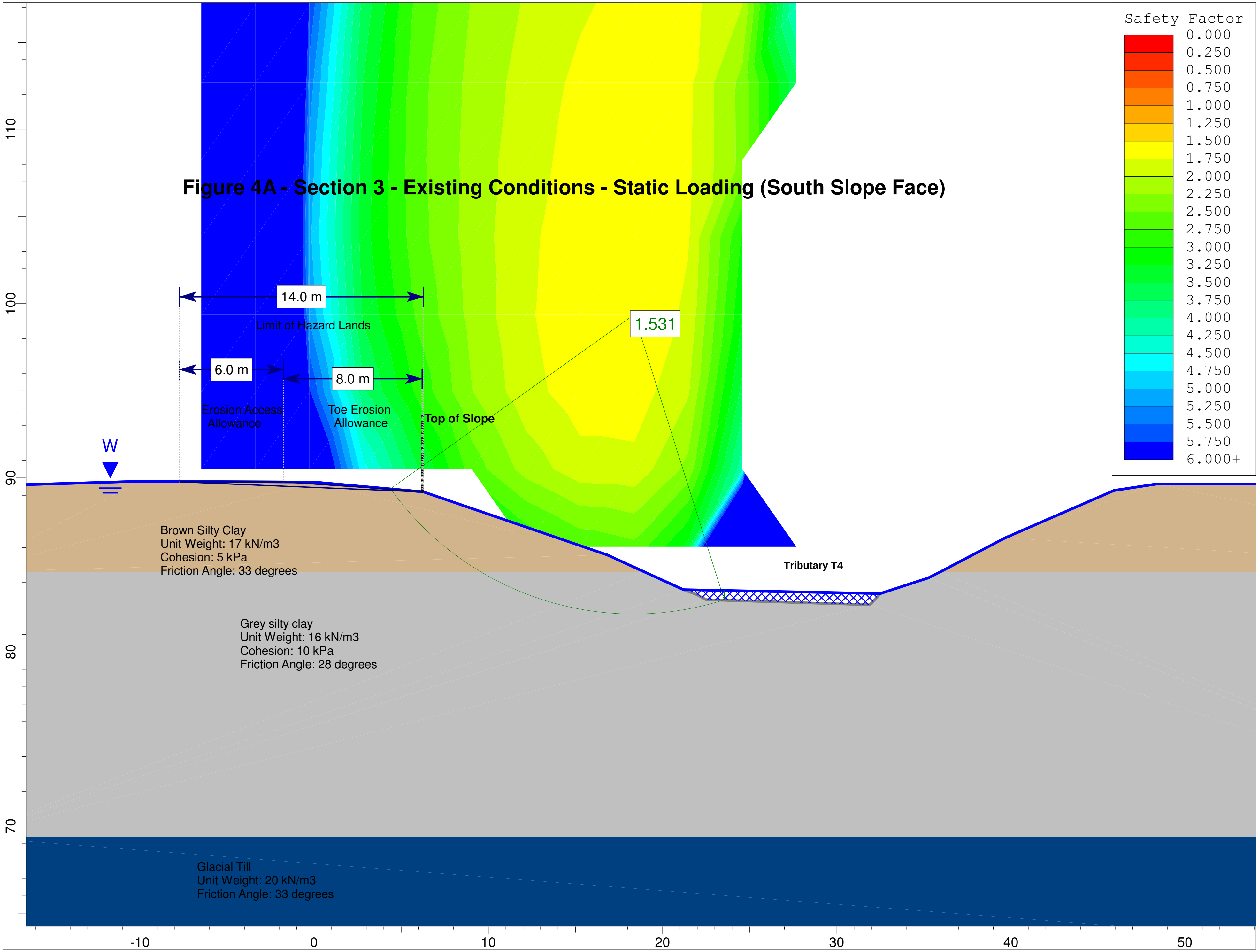
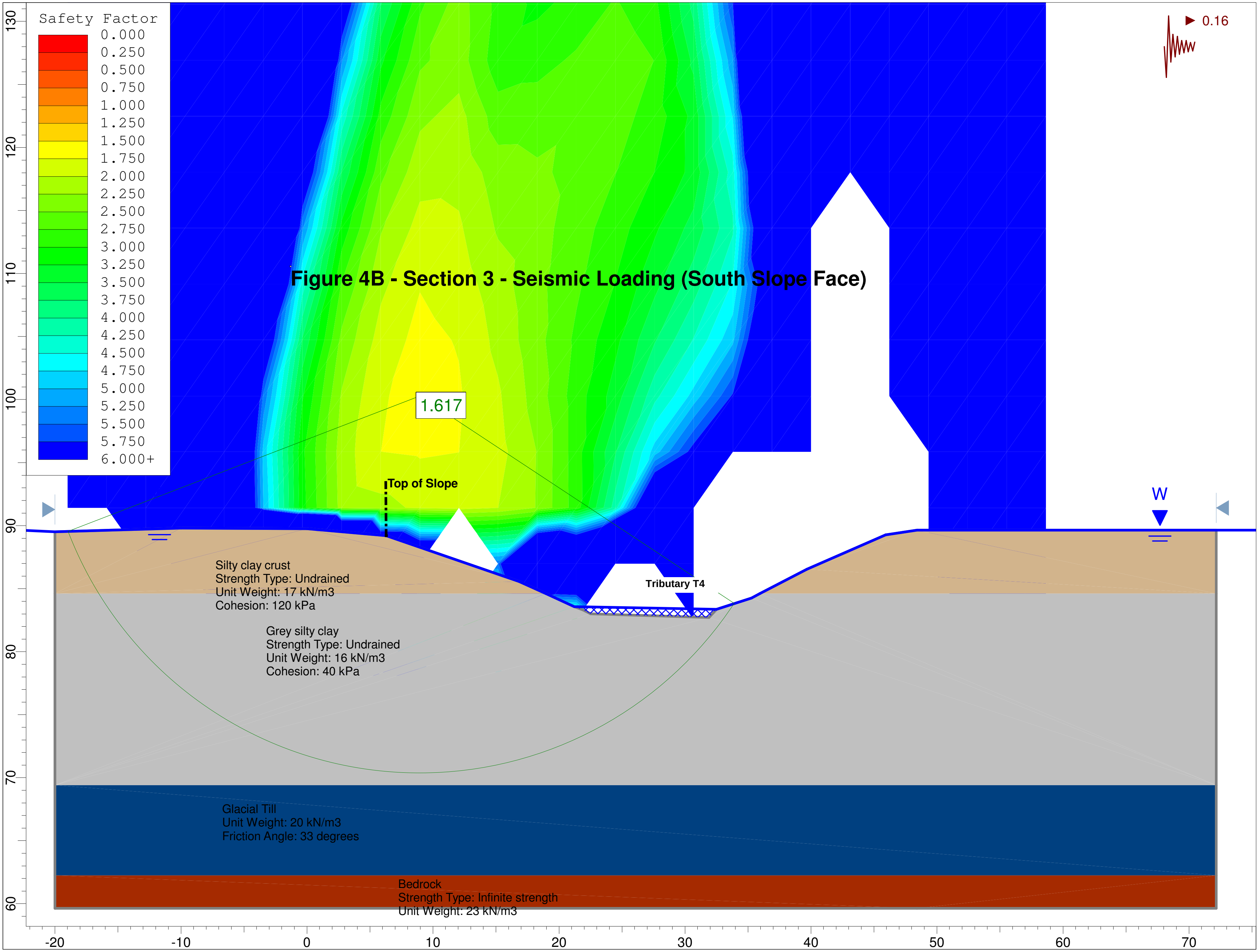
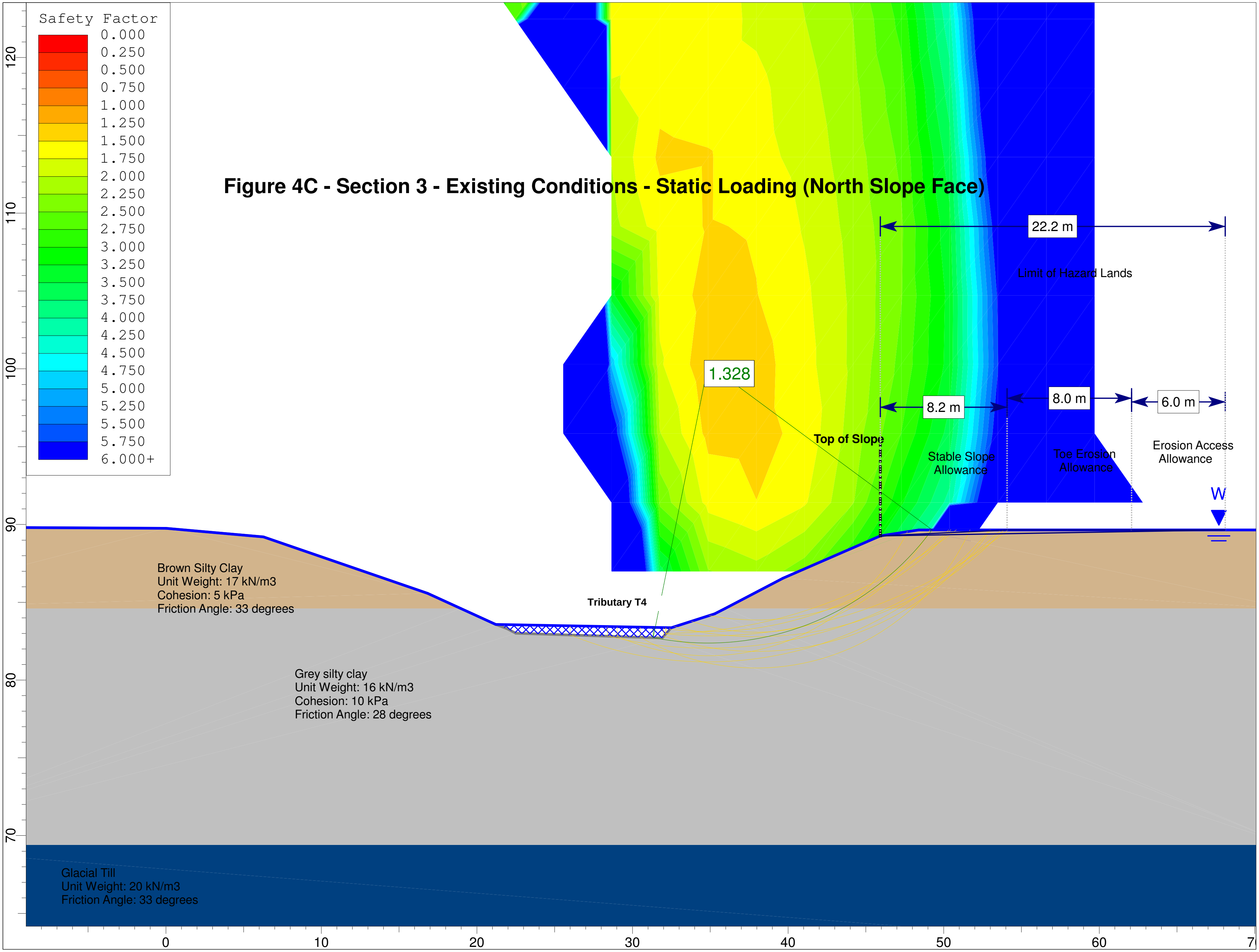


Figure 4A - Section 3 - Existing Conditions - Static Loading (South Slope Face)





Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Figure 4B - Section 3 - Seismic Loading (South Slope Face)
1.617
Top of Slope
W
Tributary T4
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-20
-10
0
10
20
30
40
50
60
70



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 4C - Section 3 - Existing Conditions - Static Loading (North Slope Face)
22.2 m
Limit of Hazard Lands
1.328
8.2 m
8.0 m
6.0 m
Top of Slope
Stable Slope Allowance
Toe Erosion Allowance
Erosion Access Allowance
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Tributary T4
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
120
110
100
90
80
70
0
10
20
30
40
50
60
7

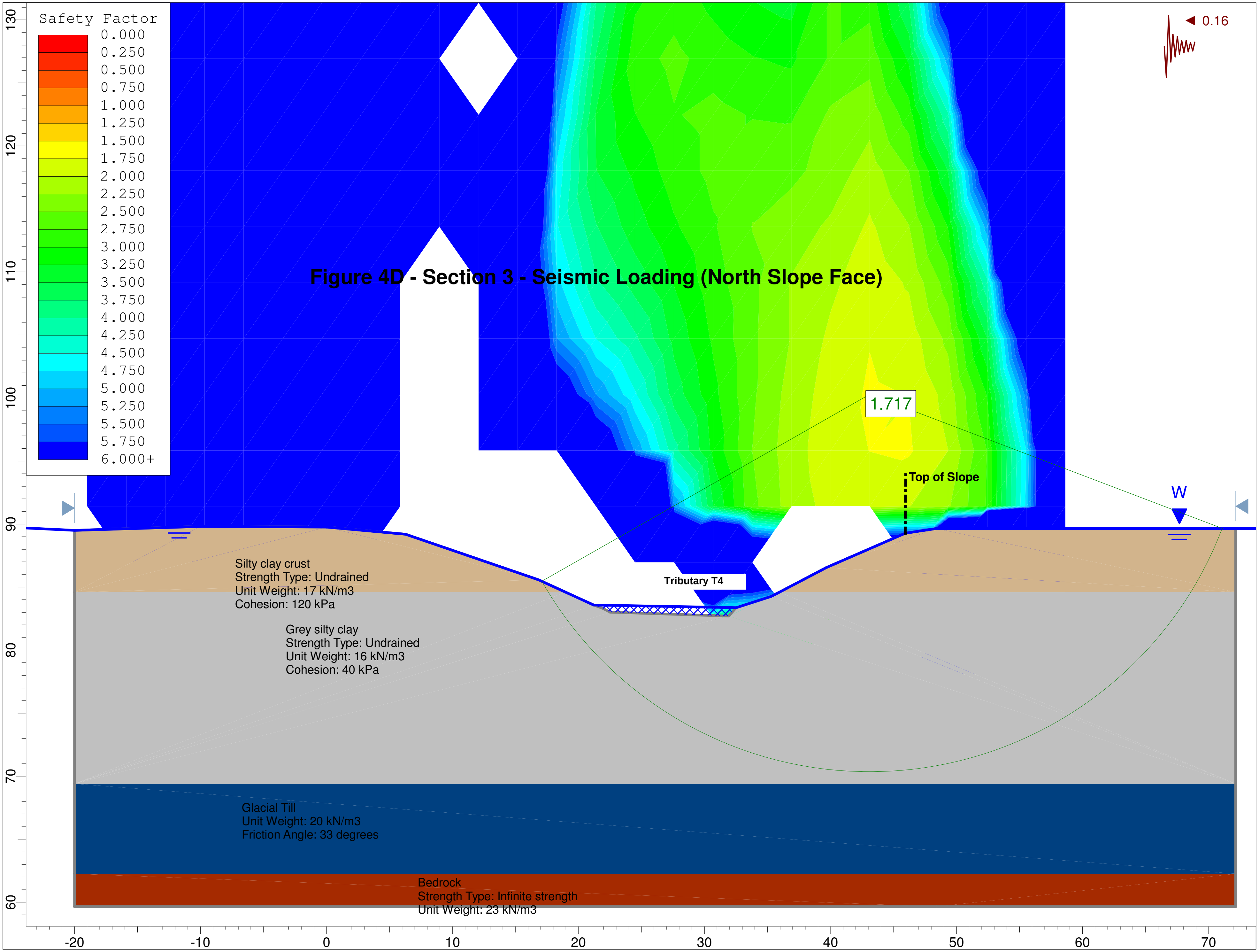


Figure 4D - Section 3 - Seismic Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.717
Top of Slope
W
Tributary T4
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-20
-10
0
10
20
30
40
50
60
70

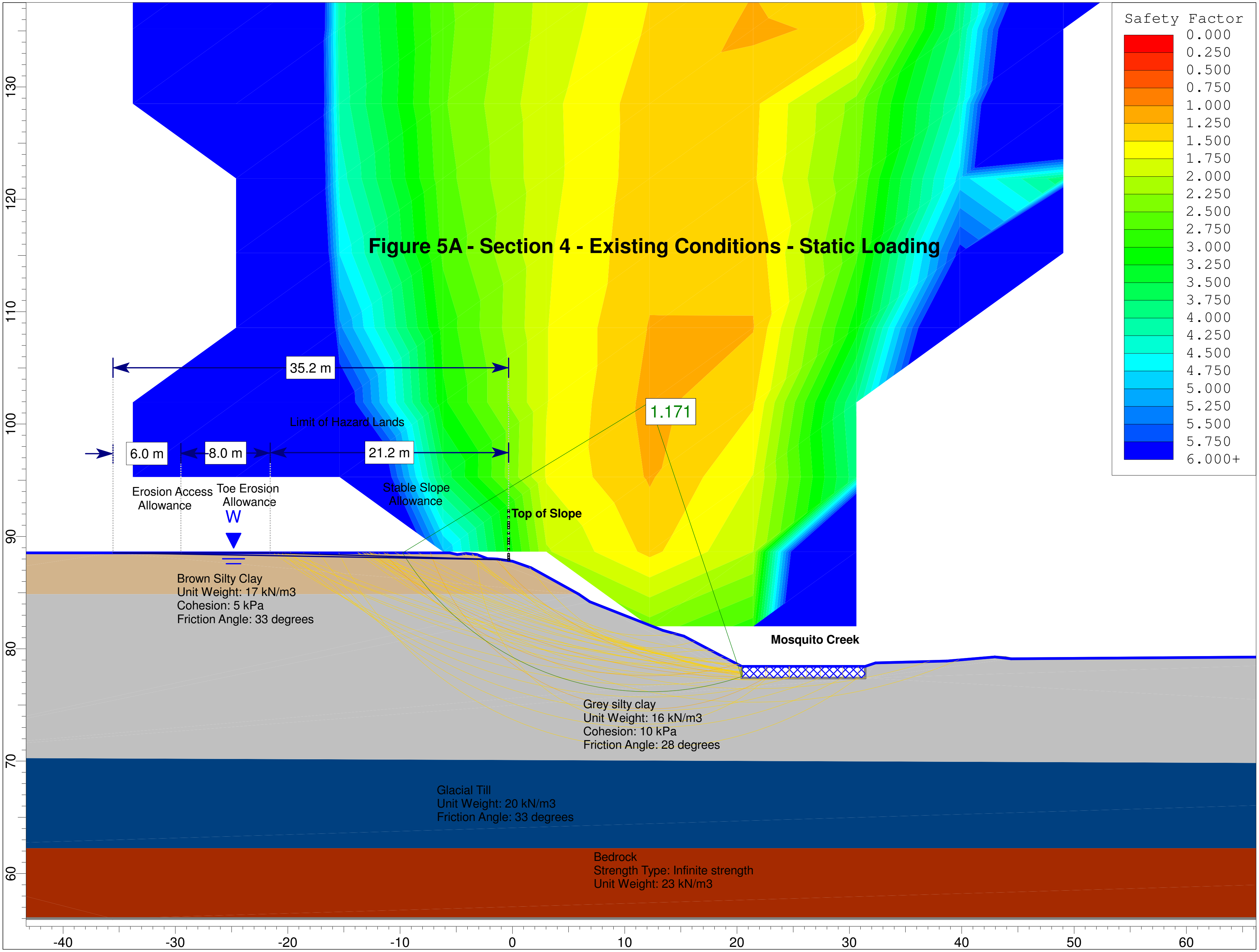


Figure 5A - Section 4 - Existing Conditions - Static Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
35.2 m
Limit of Hazard Lands
1.171
6.0 m
8.0 m
21.2 m
Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Mosquito Creek
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-40
-30
-20
-10
0
10
20
30
40
50
60

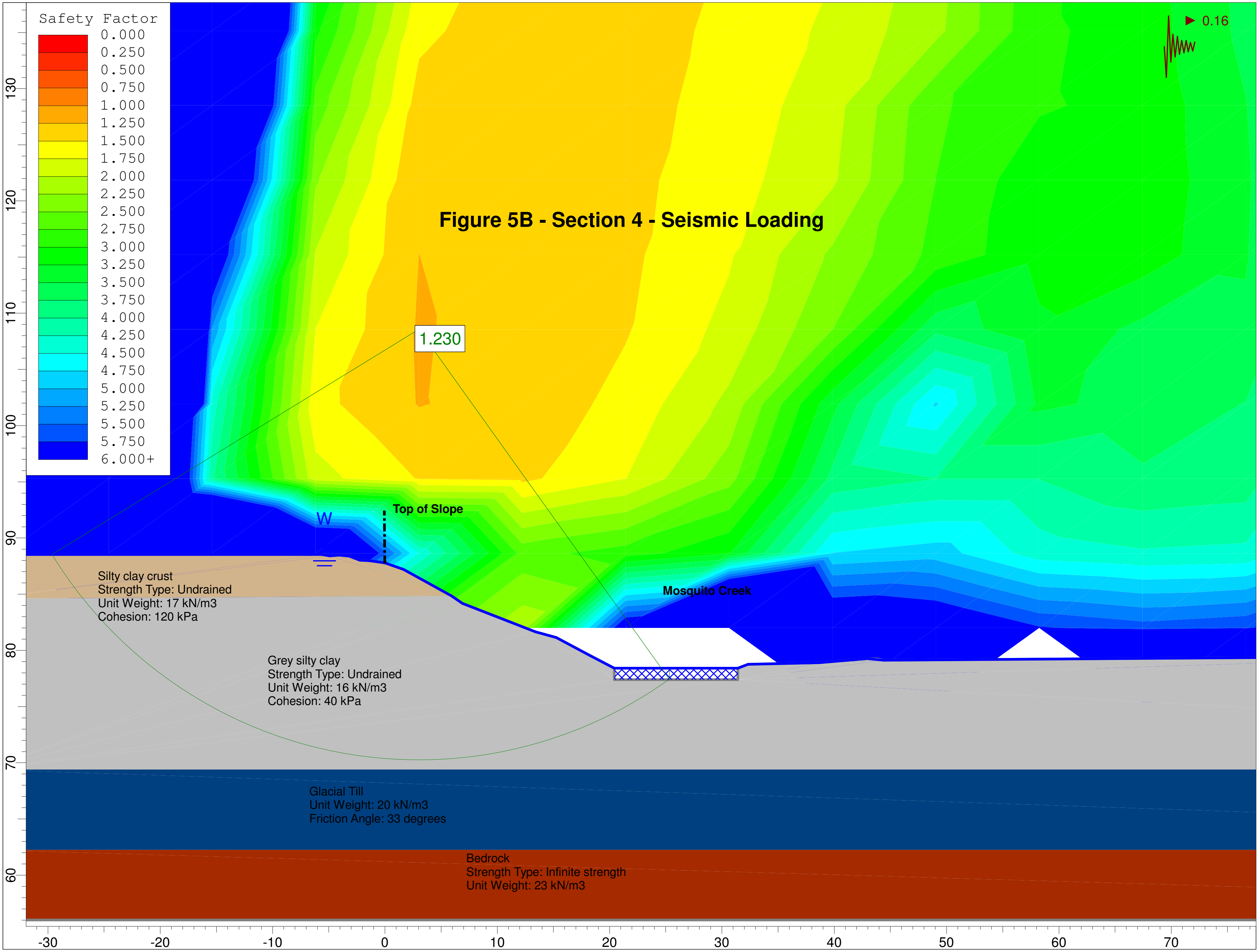


Figure 5B - Section 4 - Seismic Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.230
W
Top of Slope
Mosquito Creek
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-30
-20
-10
0
10
20
30
40
50
60
70

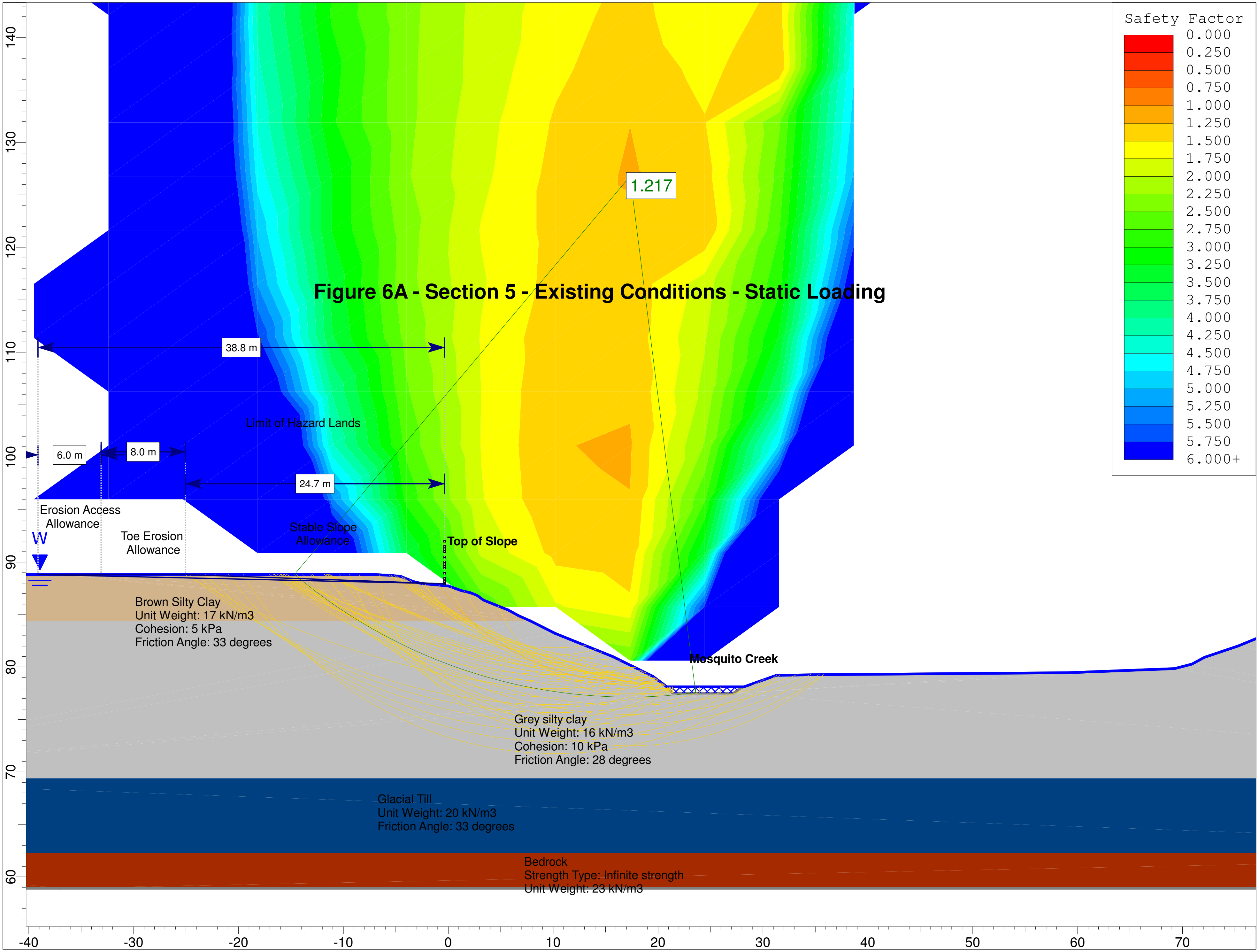
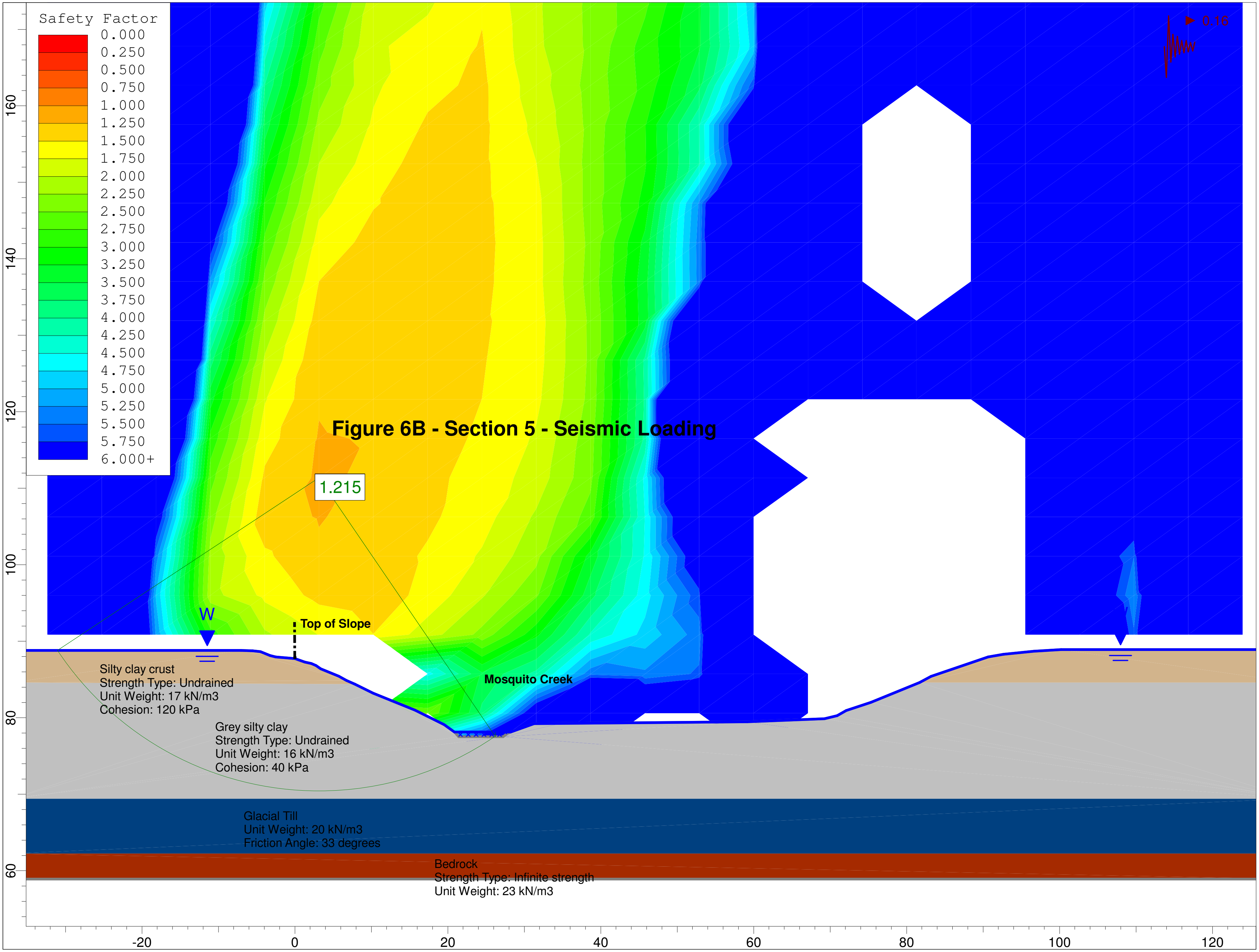


Figure 6A - Section 5 - Existing Conditions - Static Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.217
38.8 m
6.0 m
8.0 m
24.7 m
Limit of Hazard Lands
Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
W
Mosquito Creek
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
60
-40
-30
-20
-10
0
10
20
30
40
50
60
70



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 6B - Section 5 - Seismic Loading
1.215
0.16
W
Top of Slope
Mosquito Creek
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
160
140
120
100
80
60
-20
0
20
40
60
80
100
120

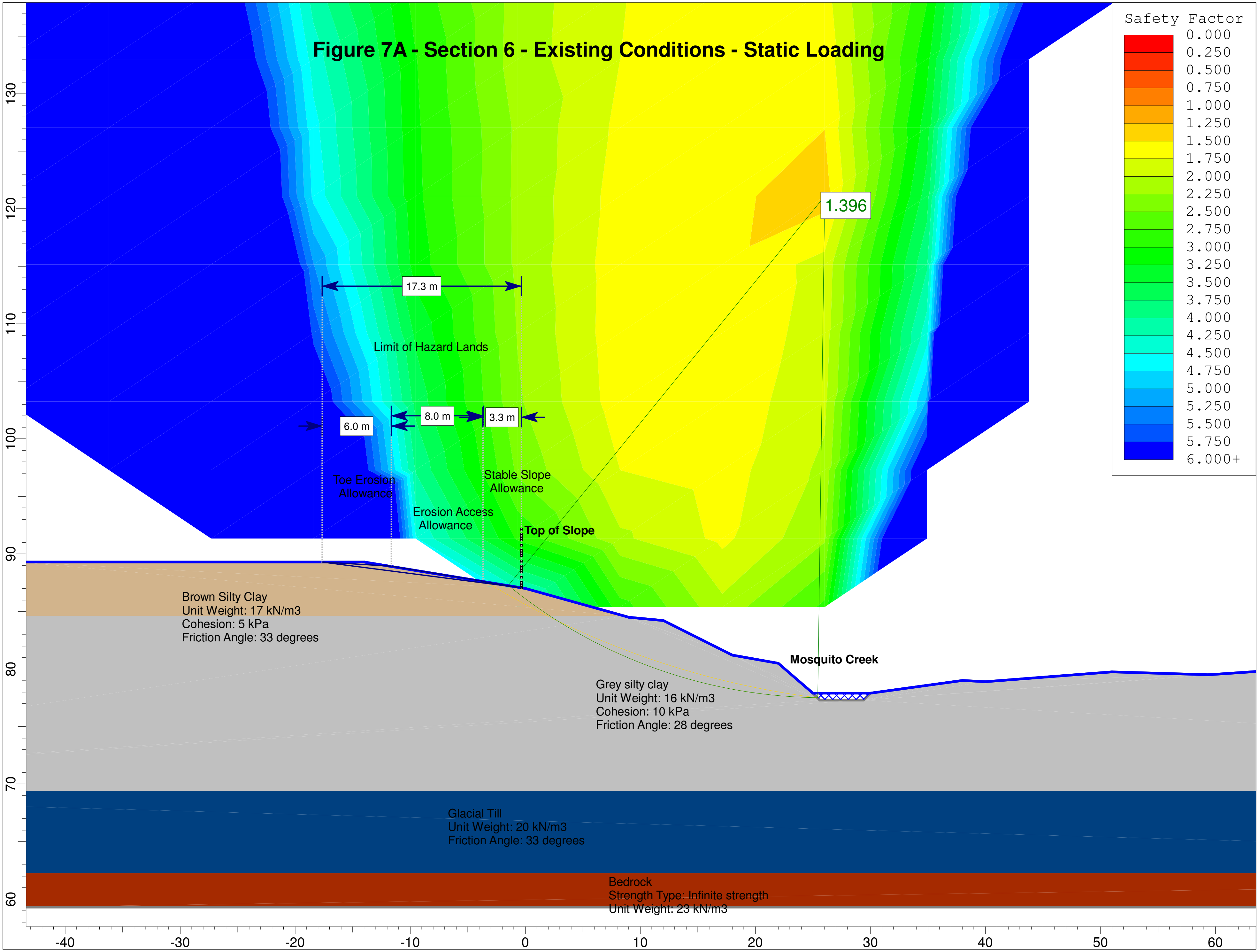
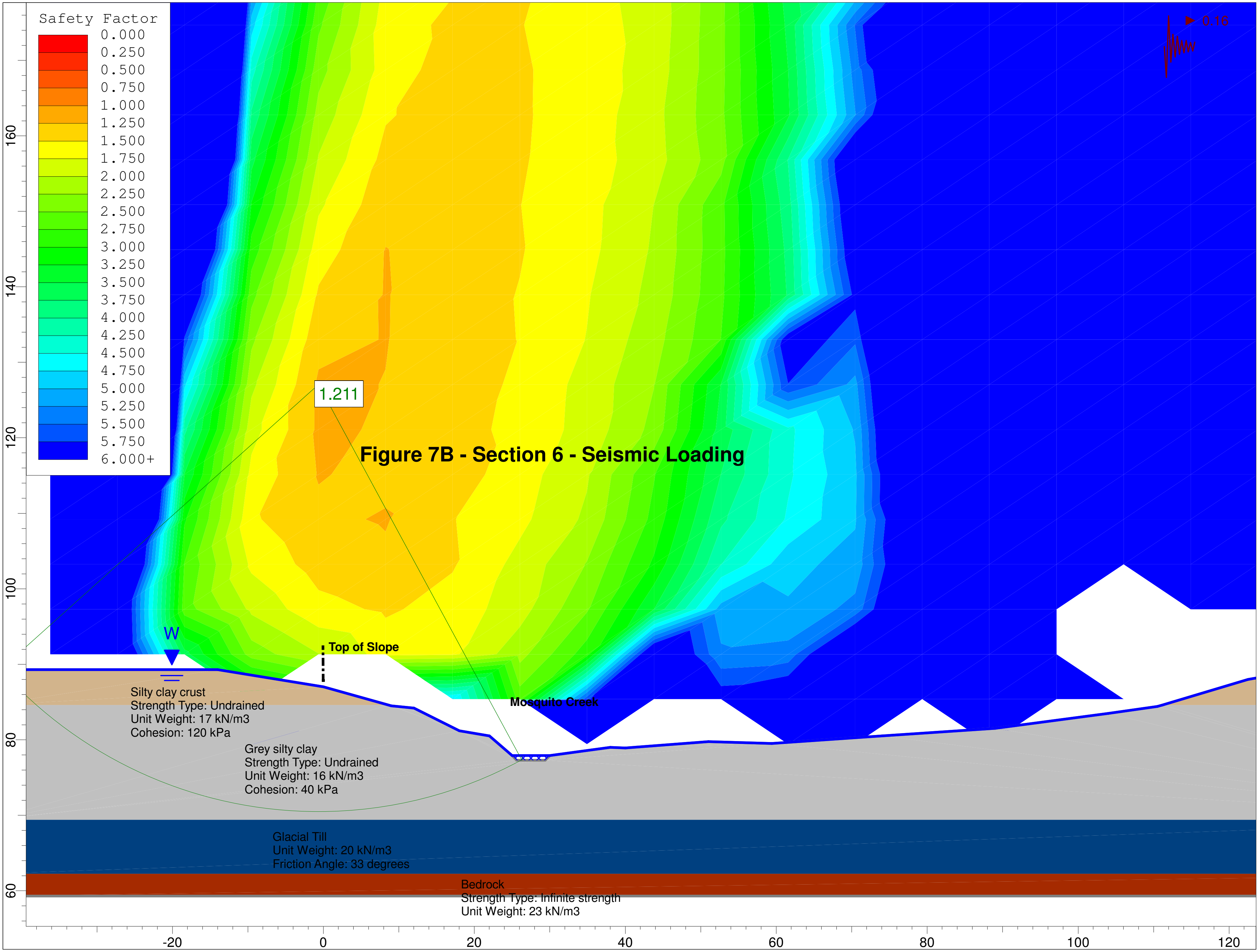


Figure 7A - Section 6 - Existing Conditions - Static Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.396
17.3 m
Limit of Hazard Lands
6.0 m
8.0 m
3.3 m
Toe Erosion Allowance
Erosion Access Allowance
Stable Slope Allowance
Top of Slope
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Mosquito Creek
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-40
-30
-20
-10
0
10
20
30
40
50
60



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.211
Figure 7B - Section 6 - Seismic Loading
W
Top of Slope
Mosquito Creek
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
160
140
120
100
80
60
-20
0
20
40
60
80
100
120

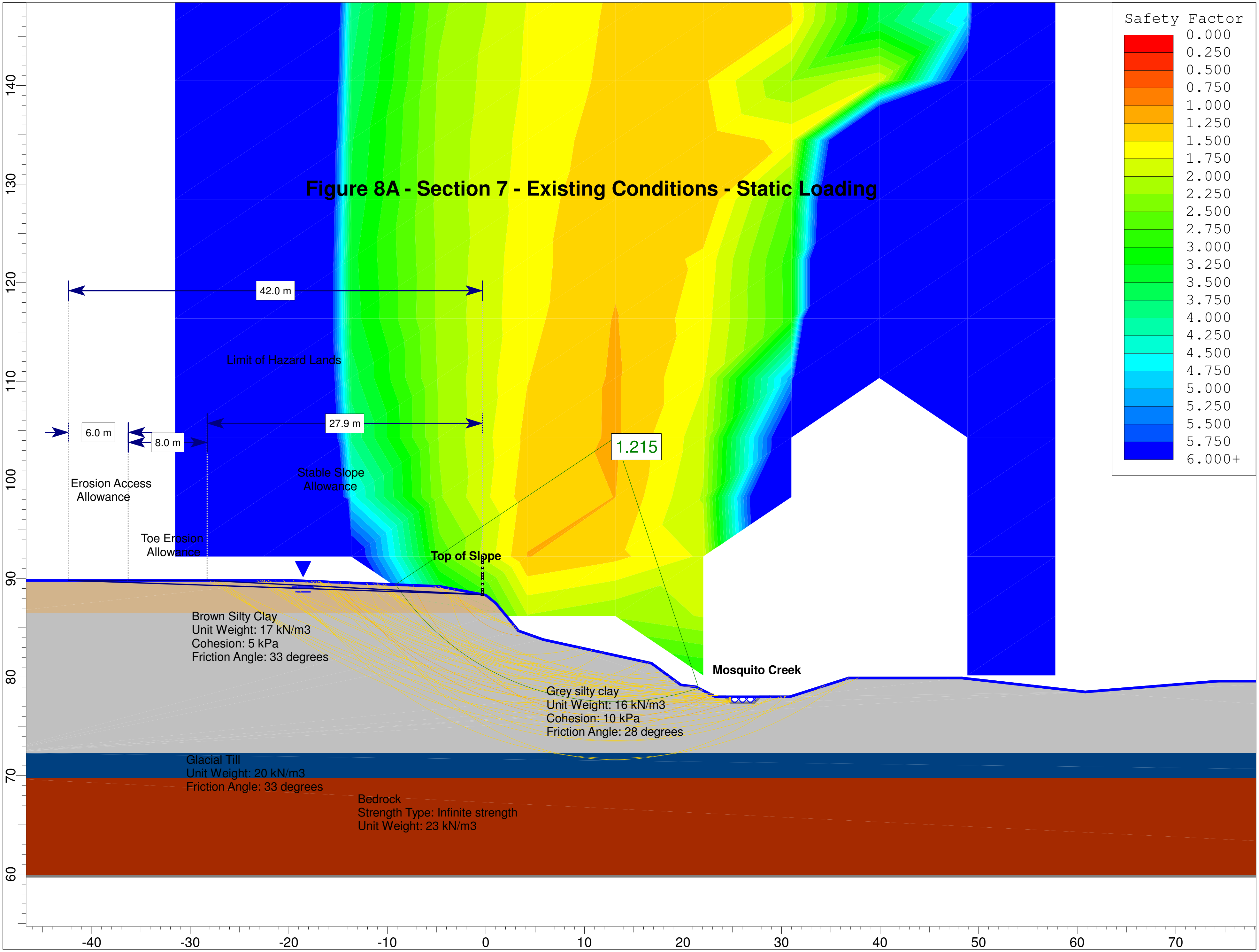
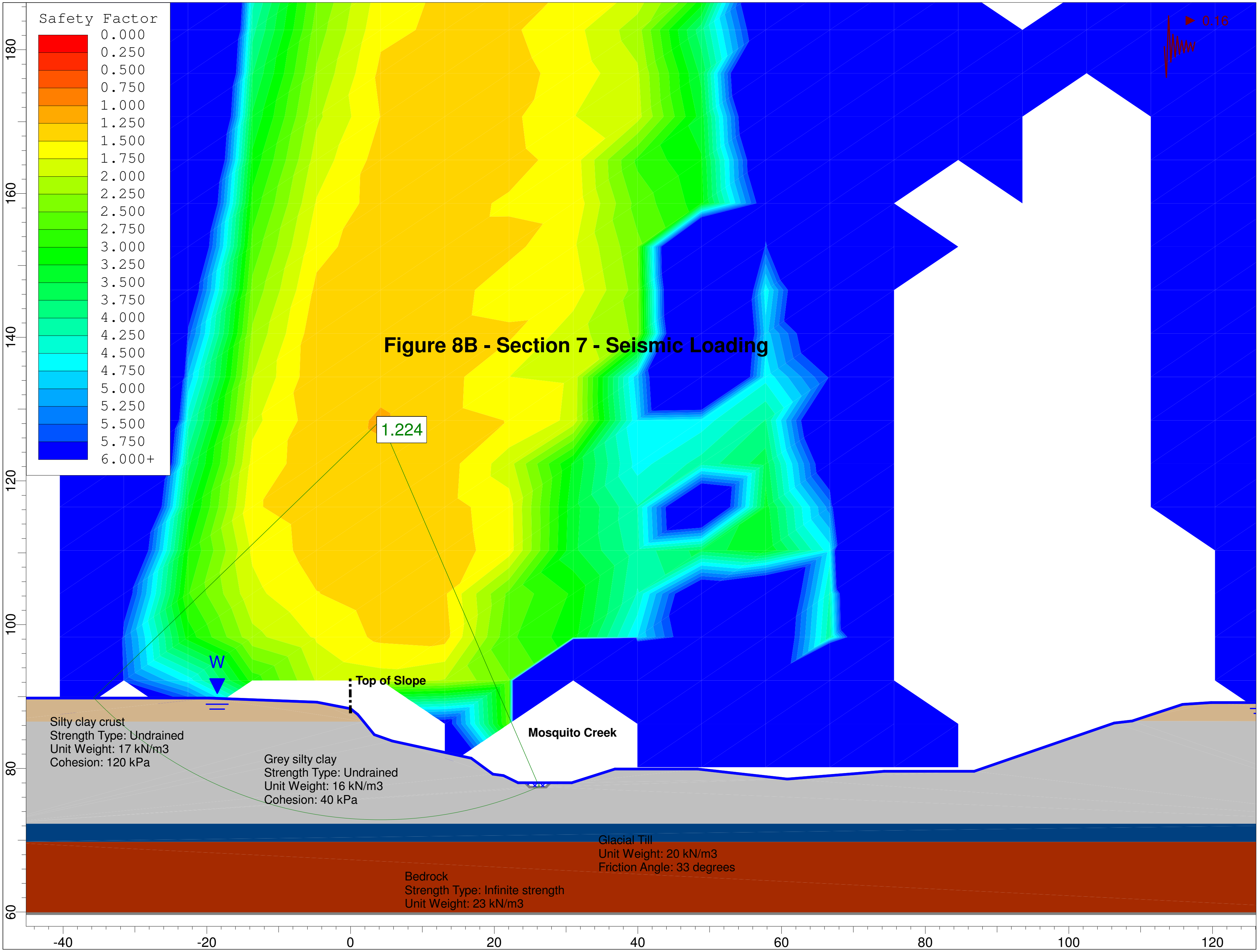


Figure 8A - Section 7 - Existing Conditions - Static Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
42.0 m
Limit of Hazard Lands
6.0 m
8.0 m
27.9 m
1.215
Erosion Access
Allowance
Stable Slope
Allowance
Toe Erosion
Allowance
Top of Slope
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Mosquito Creek
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
60
-40
-30
-20
-10
0
10
20
30
40
50
60
70



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 8B - Section 7 - Seismic Loading
0.16
1.224
W
Top of Slope
Mosquito Creek
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
180
160
140
120
100
80
60
-40
-20
0
20
40
60
80
100
120

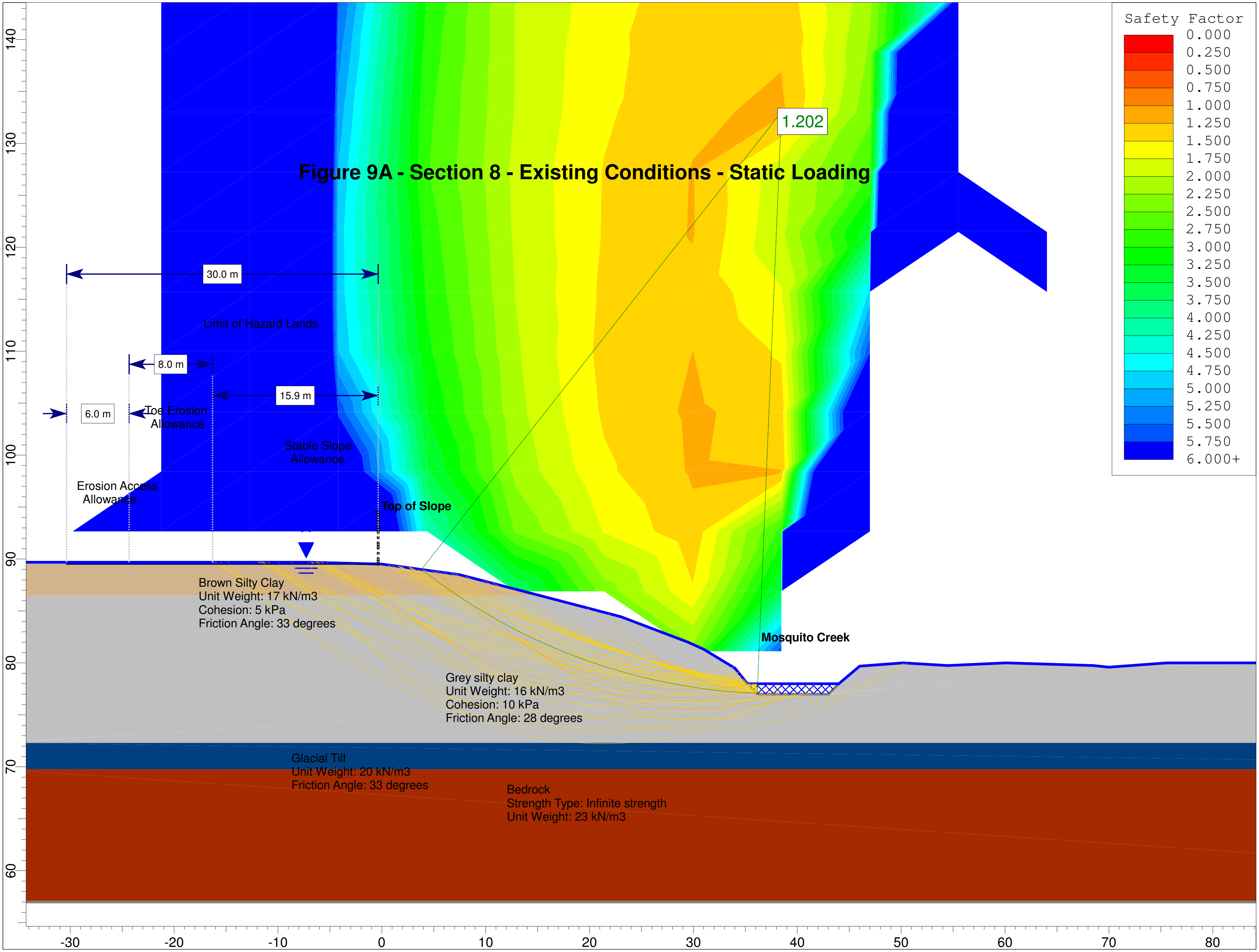


Figure 9A - Section 8 - Existing Conditions - Static Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.202
30.0 m
Limit of Hazard Lands
8.0 m
15.9 m
6.0 m
Toe Erosion Allowance
Stable Slope Allowance
Erosion Access Allowance
Top of Slope
Mosquito Creek
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
60
-30
-20
-10
0
10
20
30
40
50
60
70
80

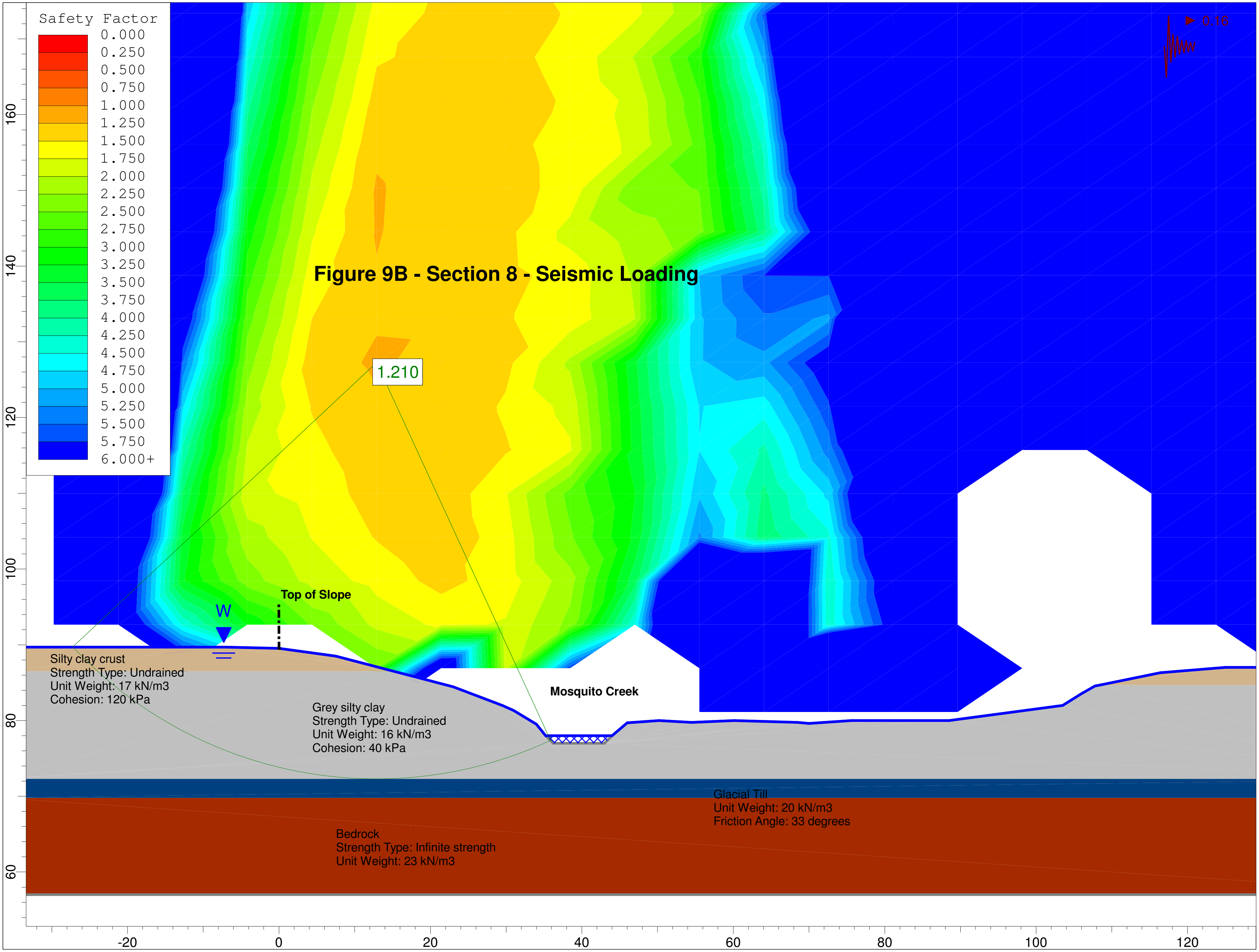


Figure 9B - Section 8 - Seismic Loading
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.210
W
Top of Slope
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Mosquito Creek
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
160
140
120
100
80
60
-20
0
20
40
60
80
100
120

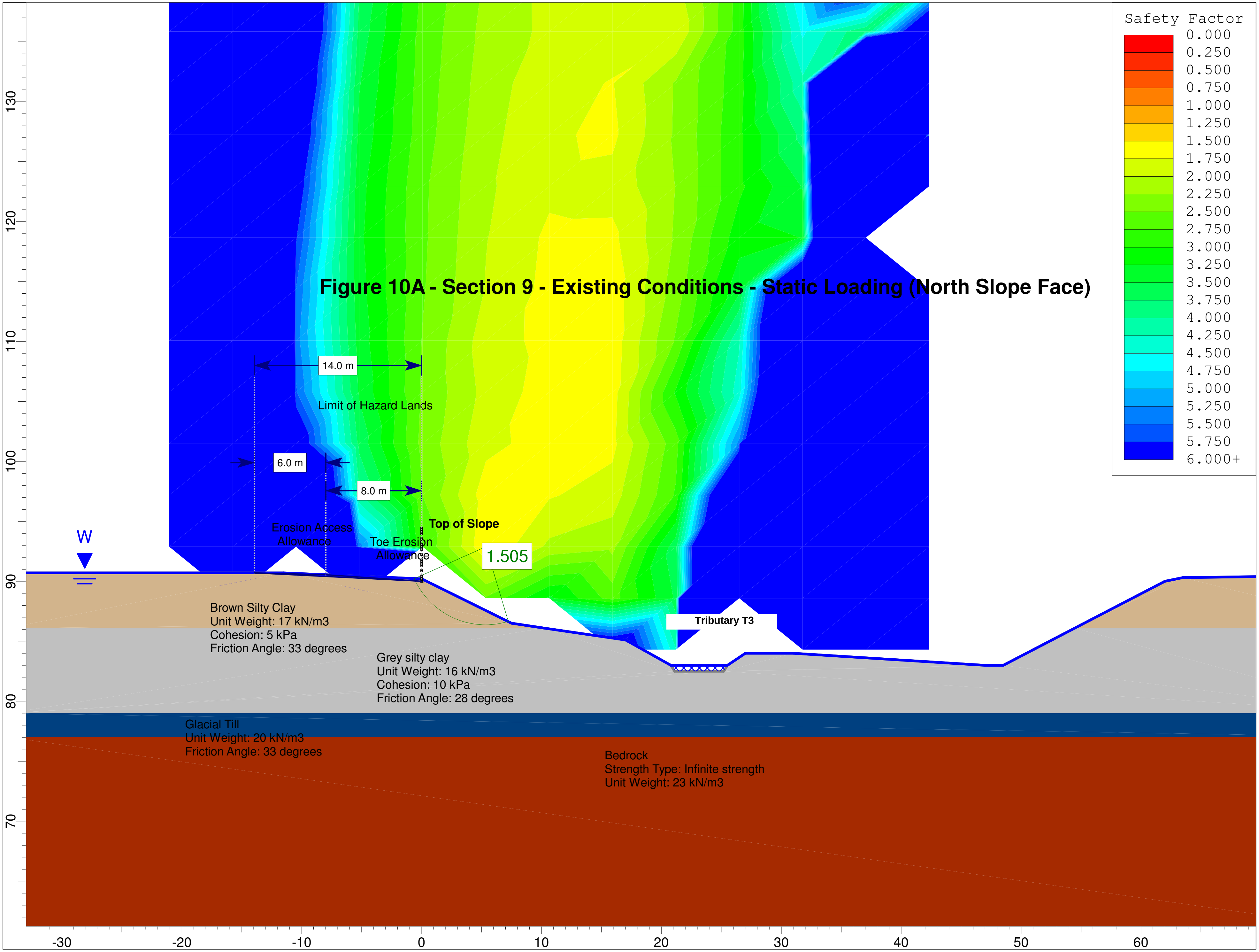
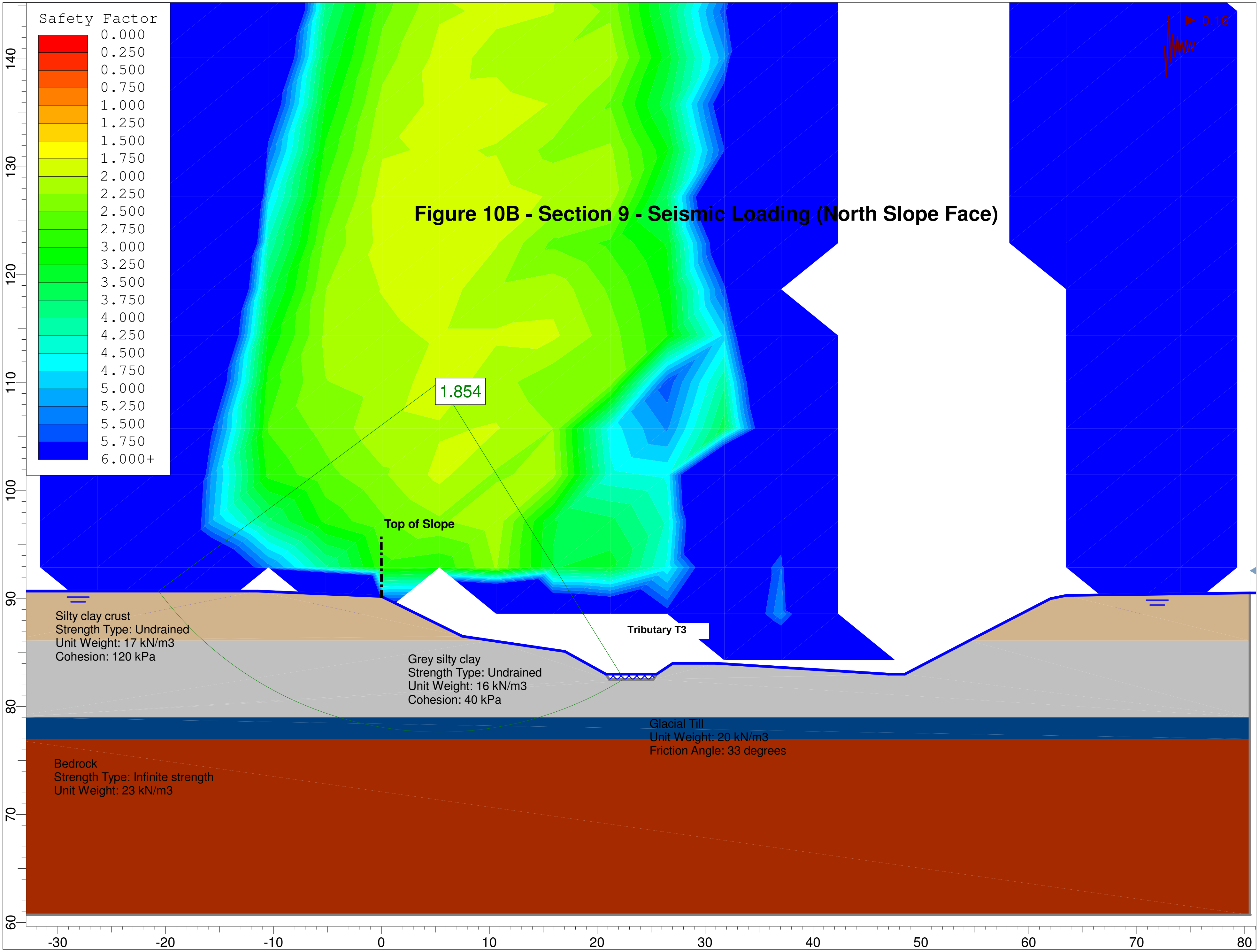


Figure 10A - Section 9 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
14.0 m
Limit of Hazard Lands
6.0 m
8.0 m
Erosion Access Allowance
Toe Erosion Allowance
Top of Slope
1.505
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T3
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
-30
-20
-10
0
10
20
30
40
50
60



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Figure 10B - Section 9 - Seismic Loading (North Slope Face)
1.854
Top of Slope
Tributary T3
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
60
-30
-20
-10
0
10
20
30
40
50
60
70
80

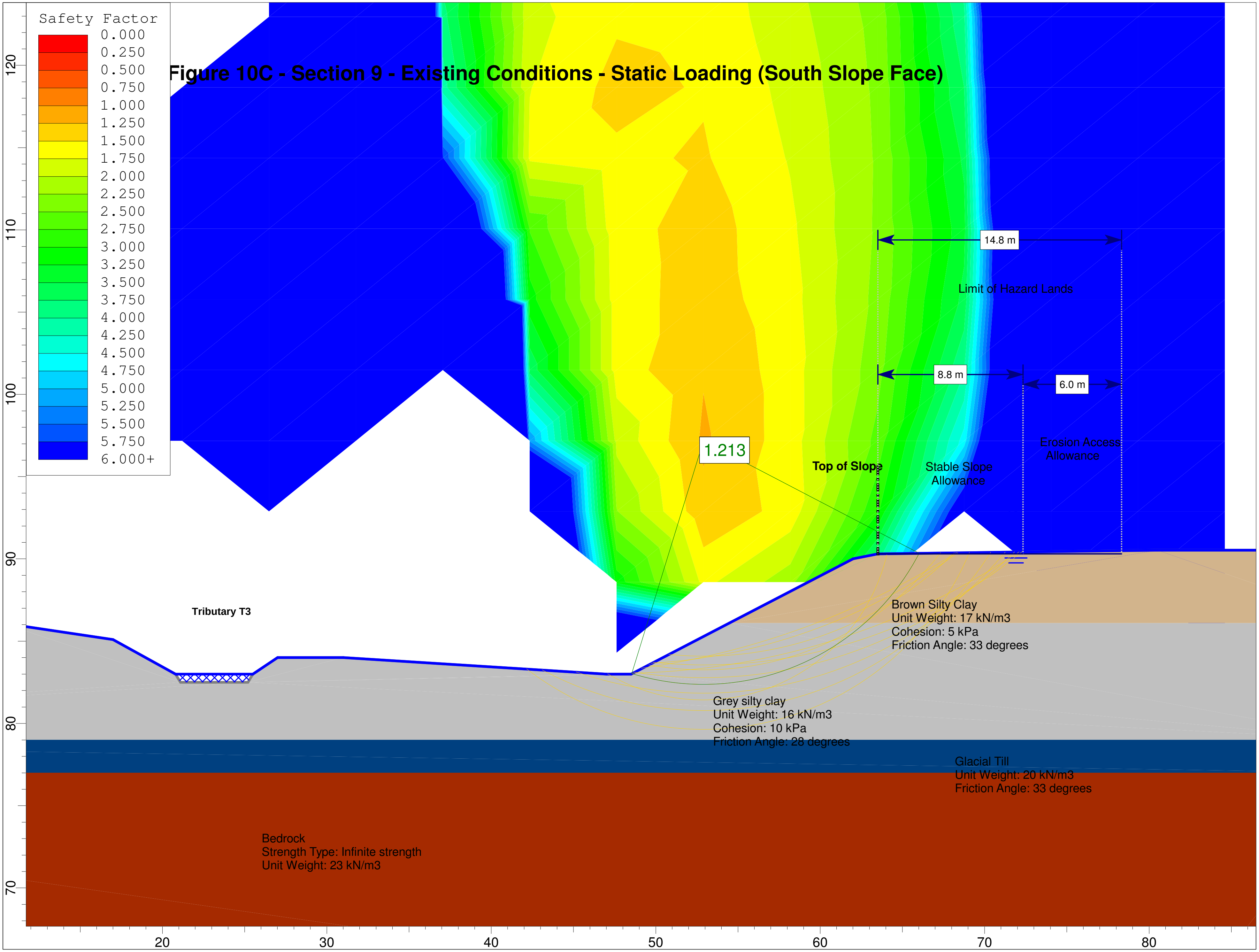
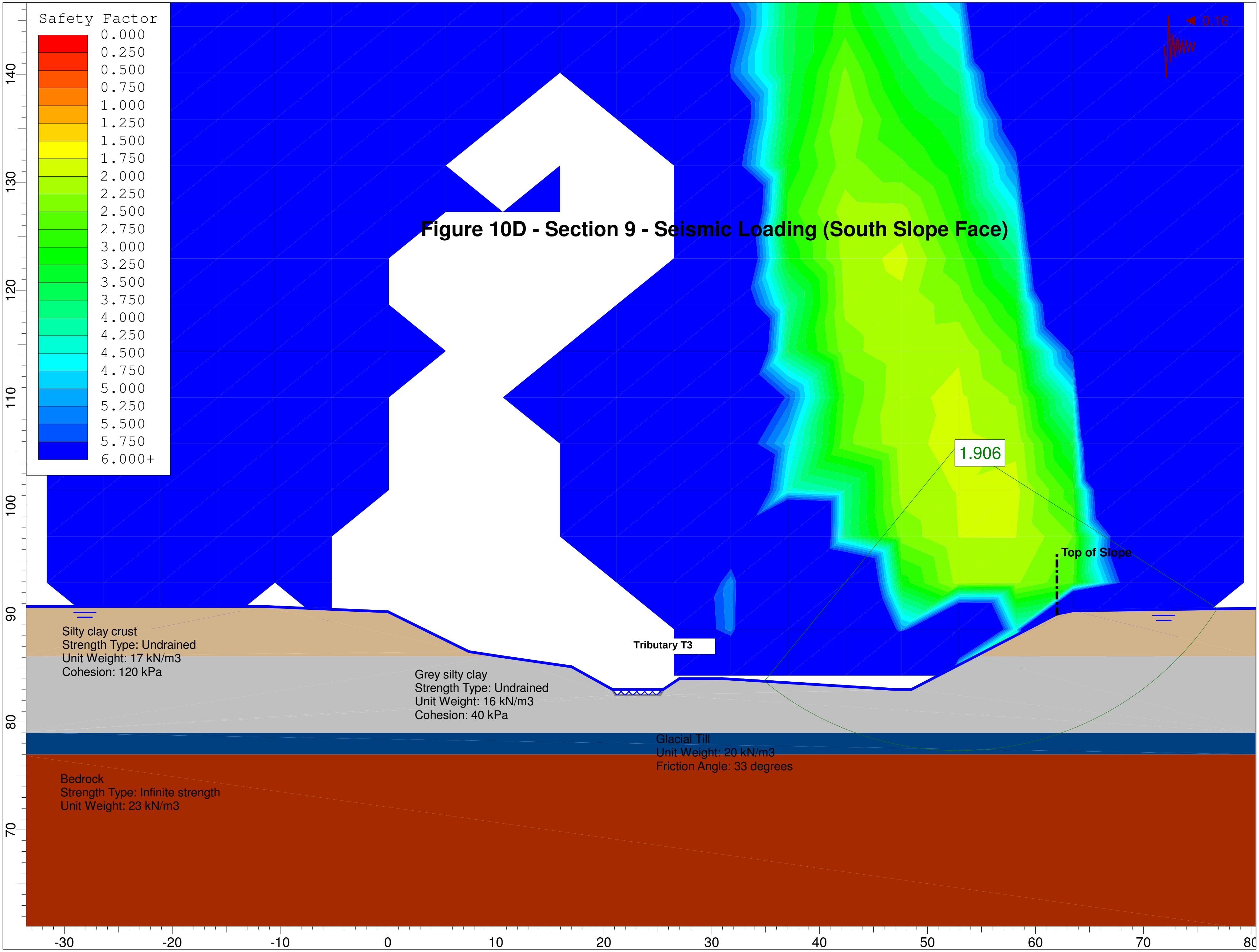


Figure 10C - Section 9 - Existing Conditions - Static Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.213
14.8 m
Limit of Hazard Lands
8.8 m
6.0 m
Erosion Access Allowance
Top of Slope
Stable Slope Allowance
Tributary T3
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
20
30
40
50
60
70
80



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 10D - Section 9 - Seismic Loading (South Slope Face)
0.16
1.906
Top of Slope
Tributary T3
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
-30
-20
-10
0
10
20
30
40
50
60
70
80

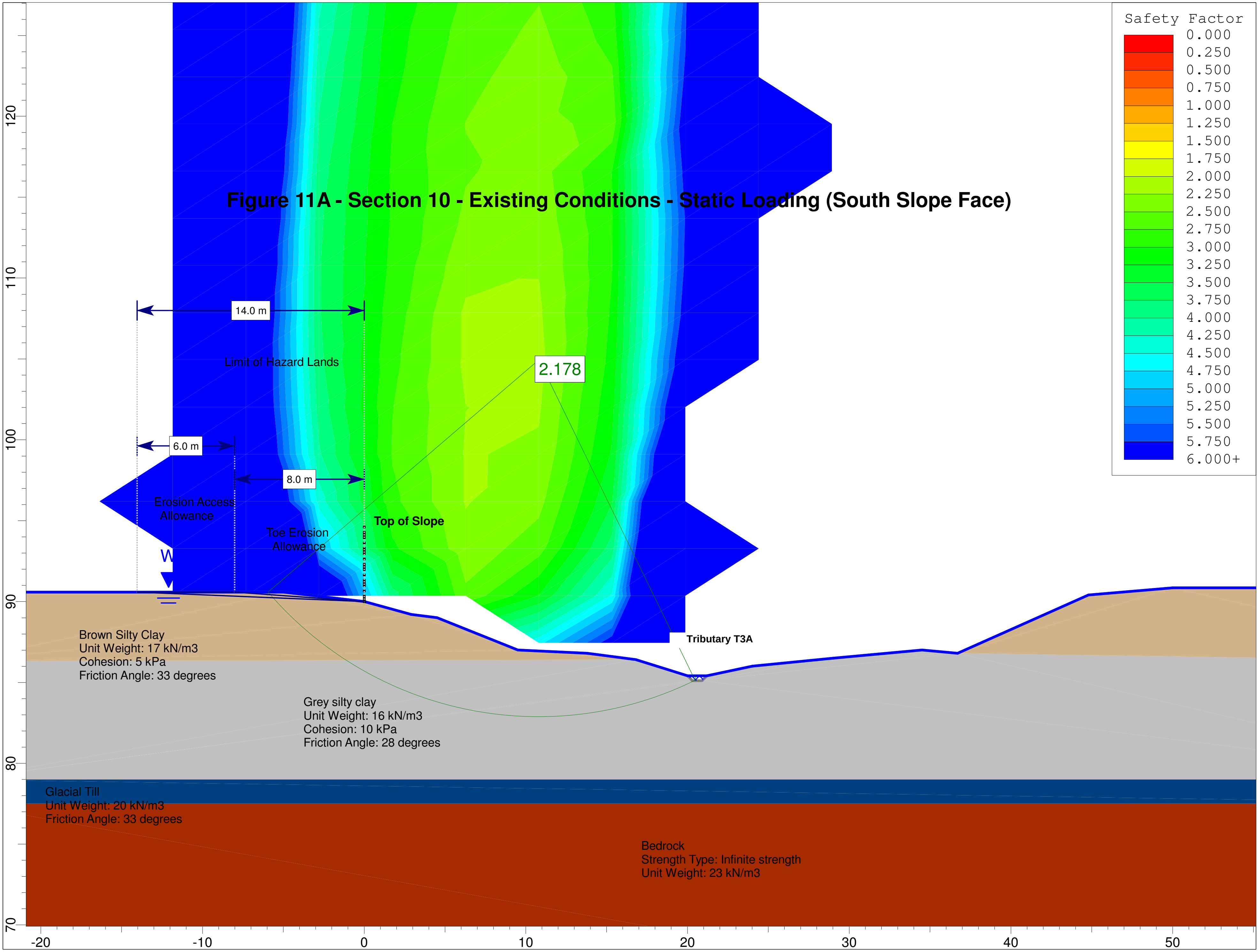


Figure 11A - Section 10 - Existing Conditions - Static Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
14.0 m
Limit of Hazard Lands
2.178
6.0 m
8.0 m
Erosion Access Allowance
Toe Erosion Allowance
Top of Slope
Tributary T3A
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50

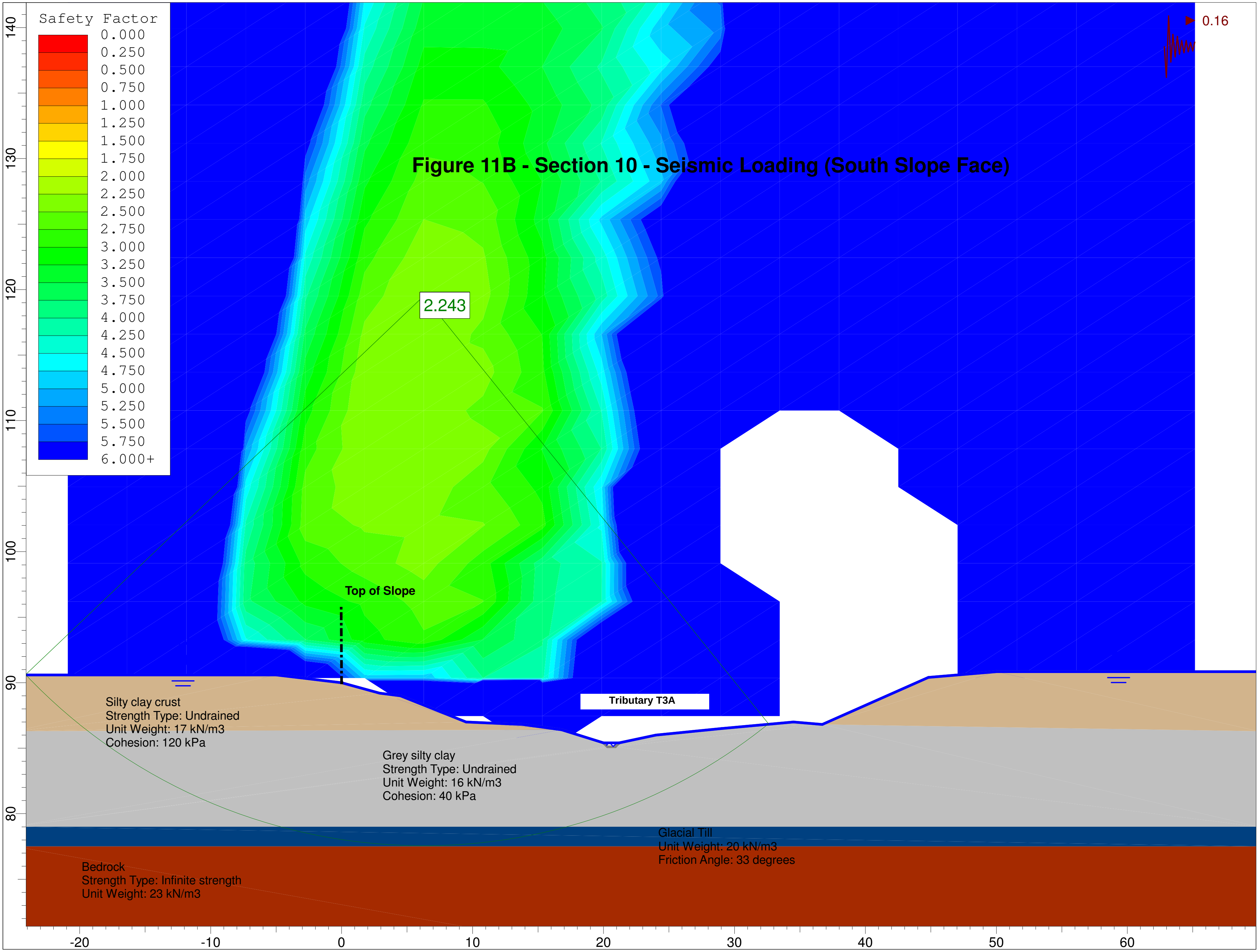


Figure 11B - Section 10 - Seismic Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.243
Top of Slope
Tributary T3A
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
-20
-10
0
10
20
30
40
50
60

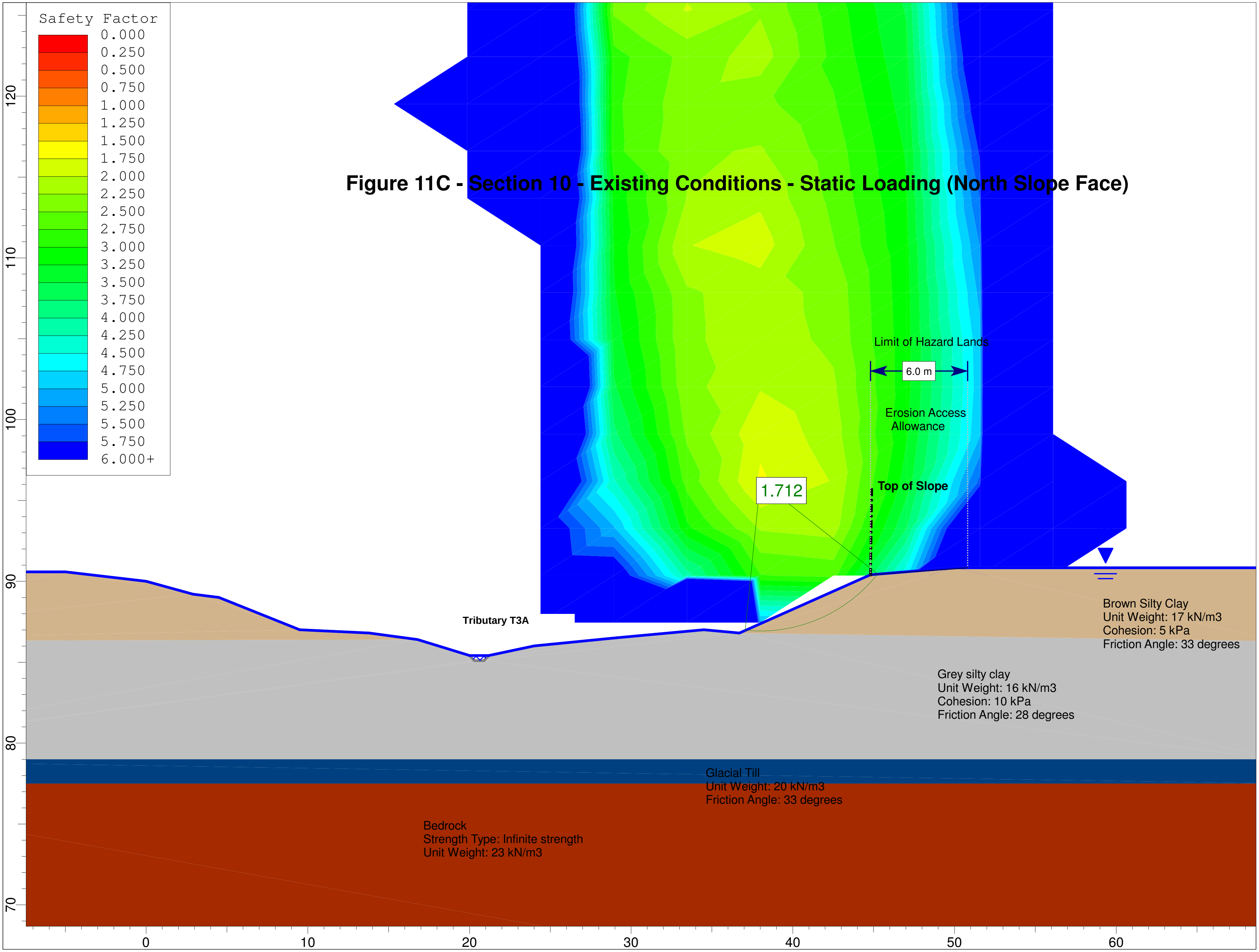


Figure 11C - Section 10 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Limit of Hazard Lands
6.0 m
Erosion Access Allowance
Top of Slope
1.712
Tributary T3A
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
0
10
20
30
40
50
60

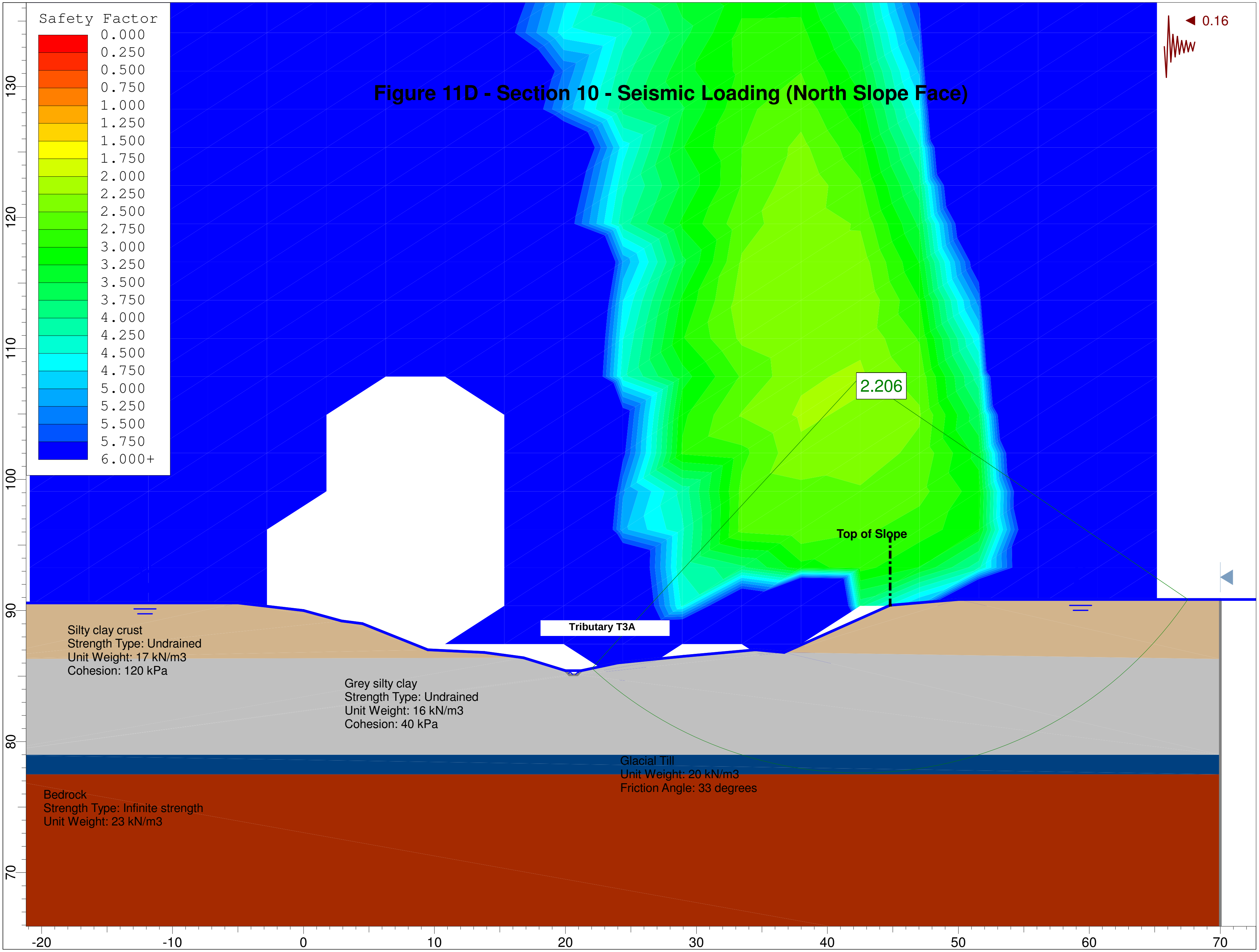


Figure 11D - Section 10 - Seismic Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.206
Top of Slope
Tributary T3A
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60
70

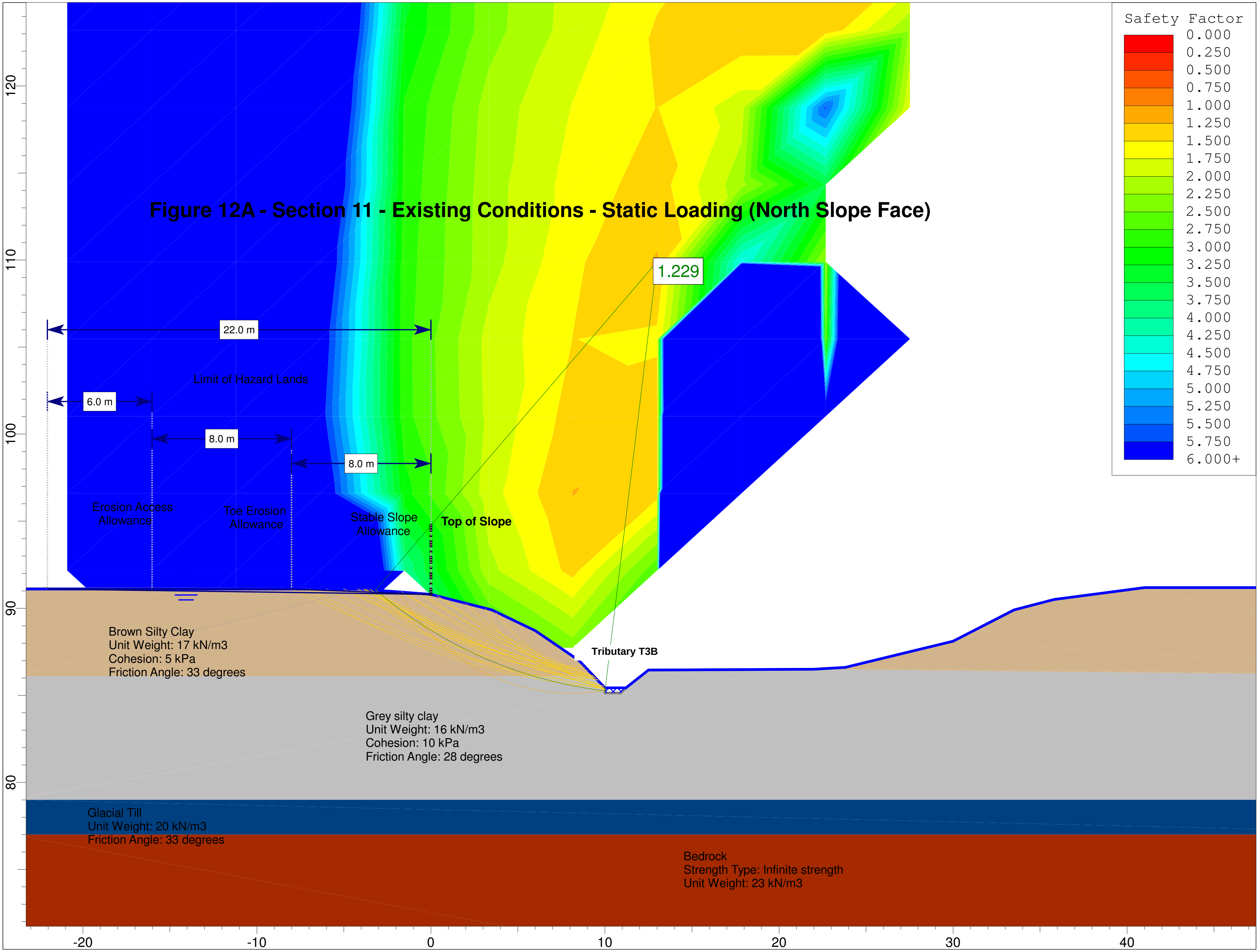


Figure 12A - Section 11 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.229
22.0 m
Limit of Hazard Lands
6.0 m
8.0 m
8.0 m
Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
Tributary T3B
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
-20
-10
0
10
20
30
40

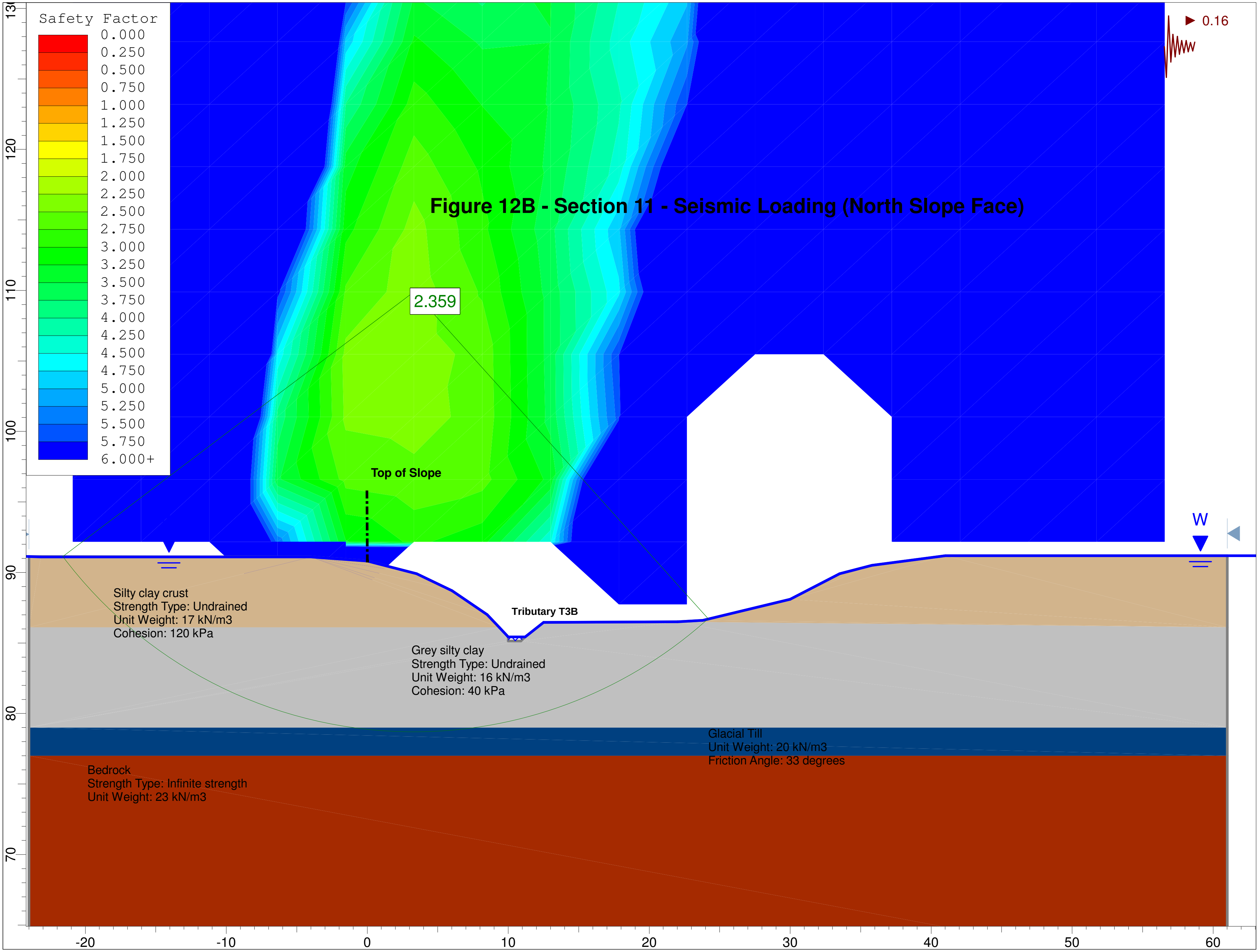
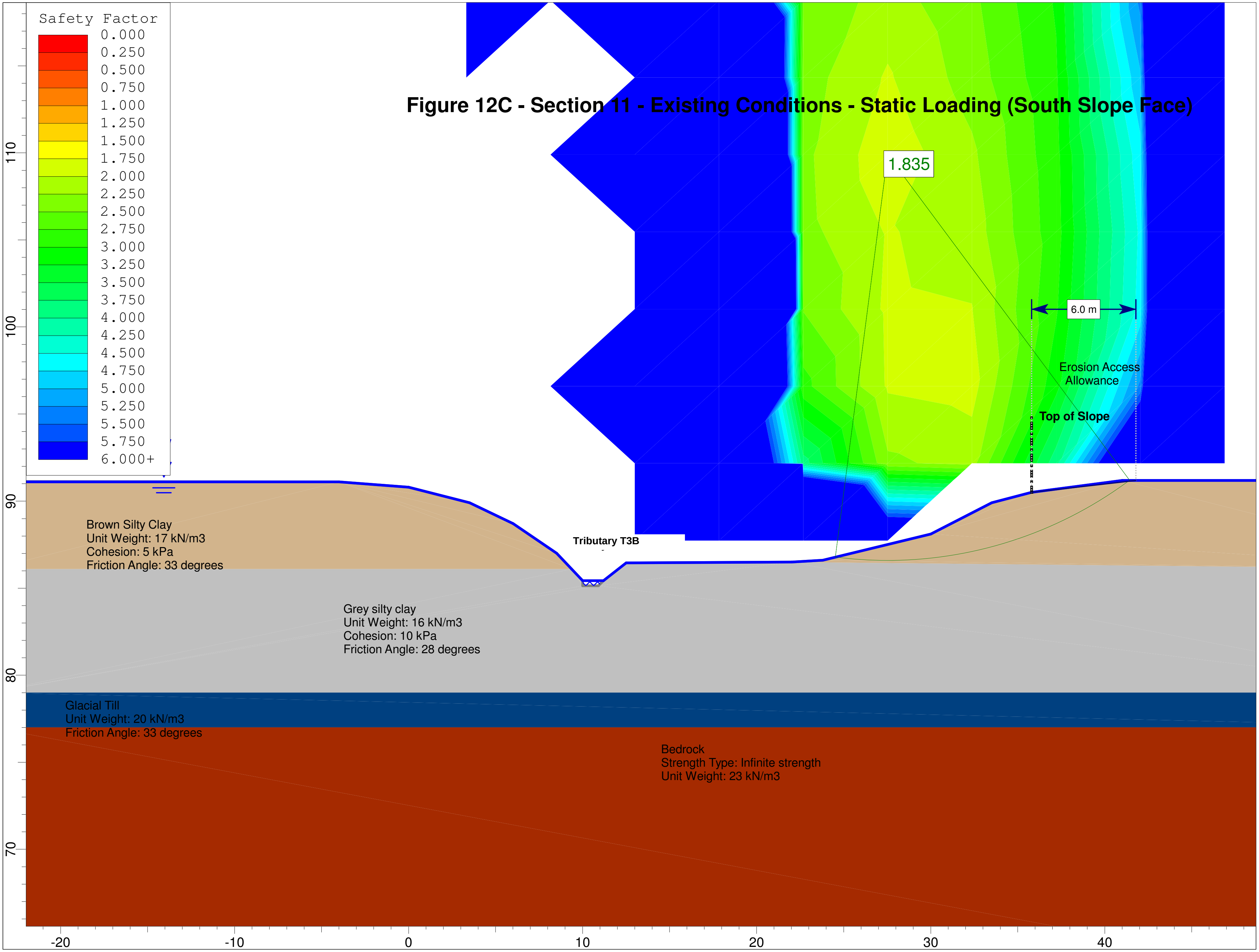


Figure 12B - Section 11 - Seismic Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.359
Top of Slope
Tributary T3B
W
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 12C - Section 11 - Existing Conditions - Static Loading (South Slope Face)
1.835
6.0 m
Erosion Access Allowance
Top of Slope
Tributary T3B
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
110
100
90
80
70
-20
-10
0
10
20
30
40

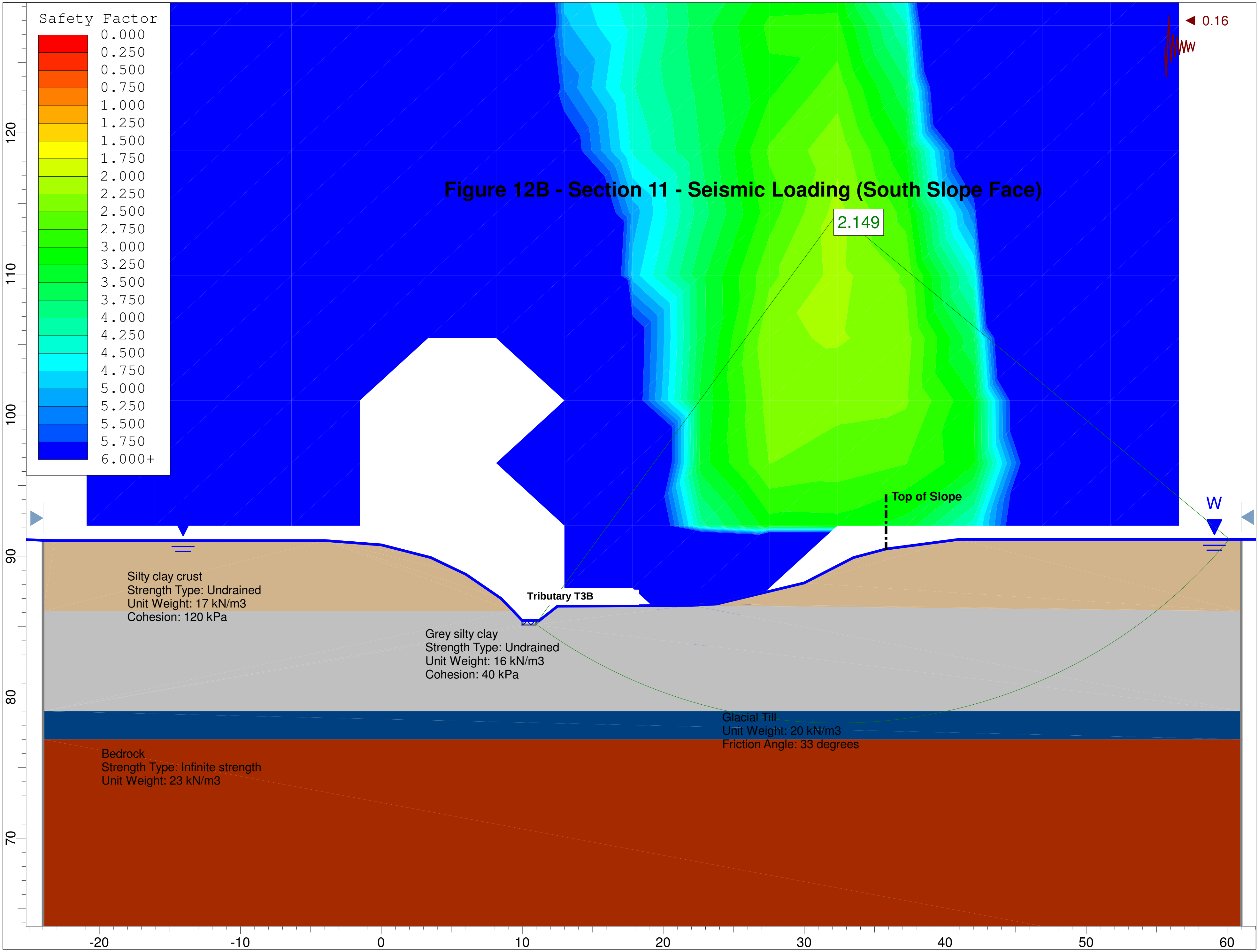


Figure 12B - Section 11 - Seismic Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.149
W
Top of Slope
Tributary T3B
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60

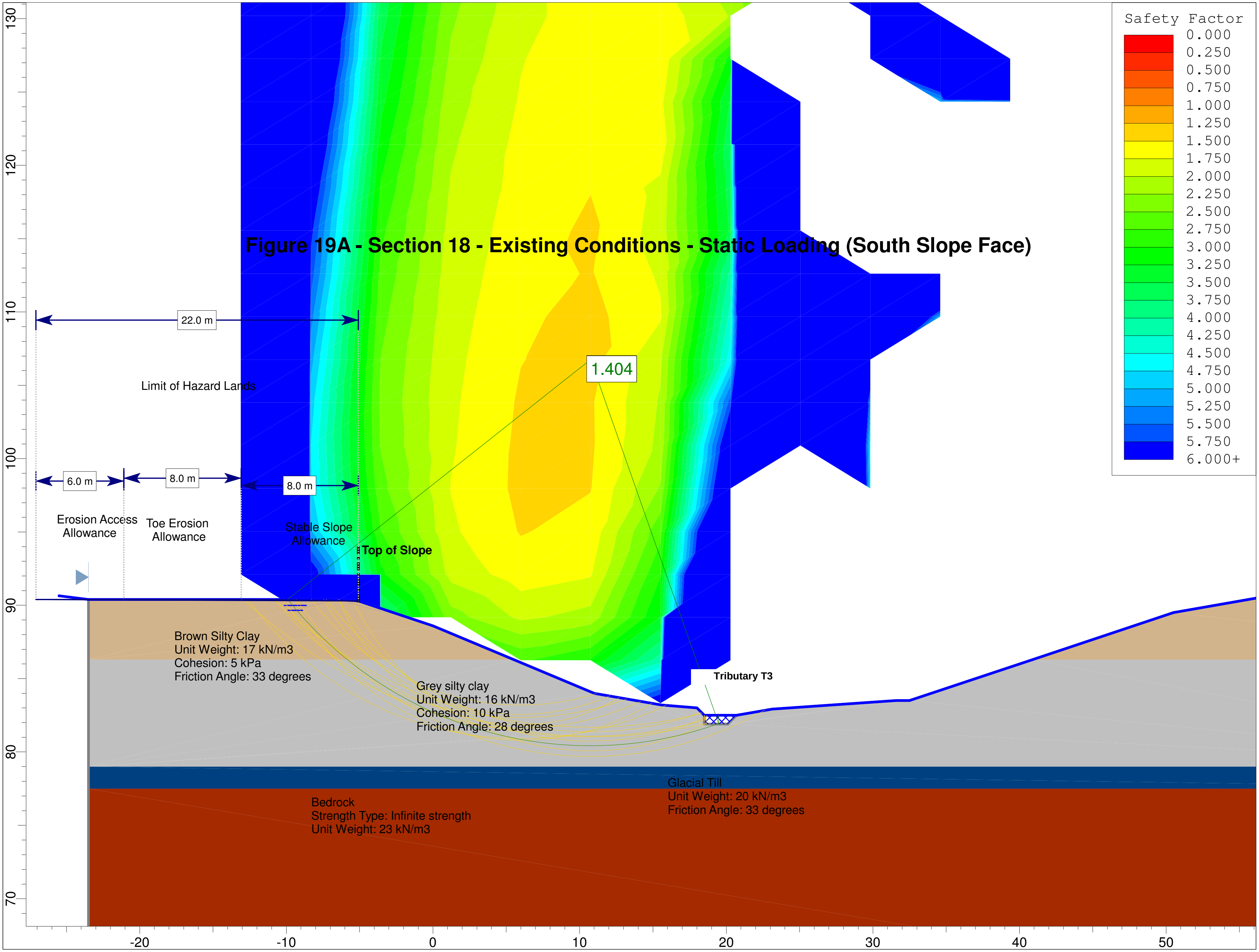


Figure 19A - Section 18 - Existing Conditions - Static Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.404
22.0 m
Limit of Hazard Lands
6.0 m
8.0 m
8.0 m
Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T3
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50

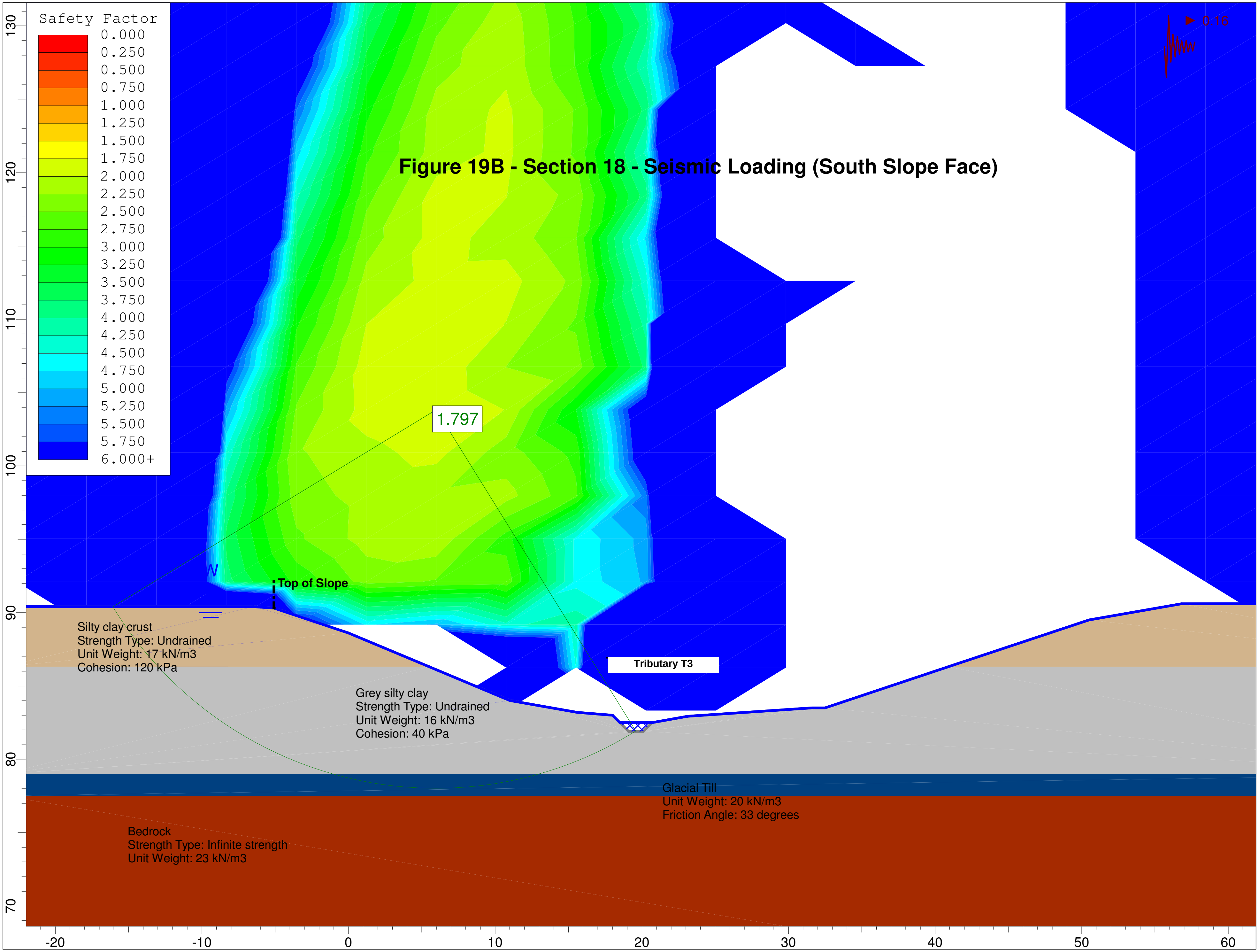
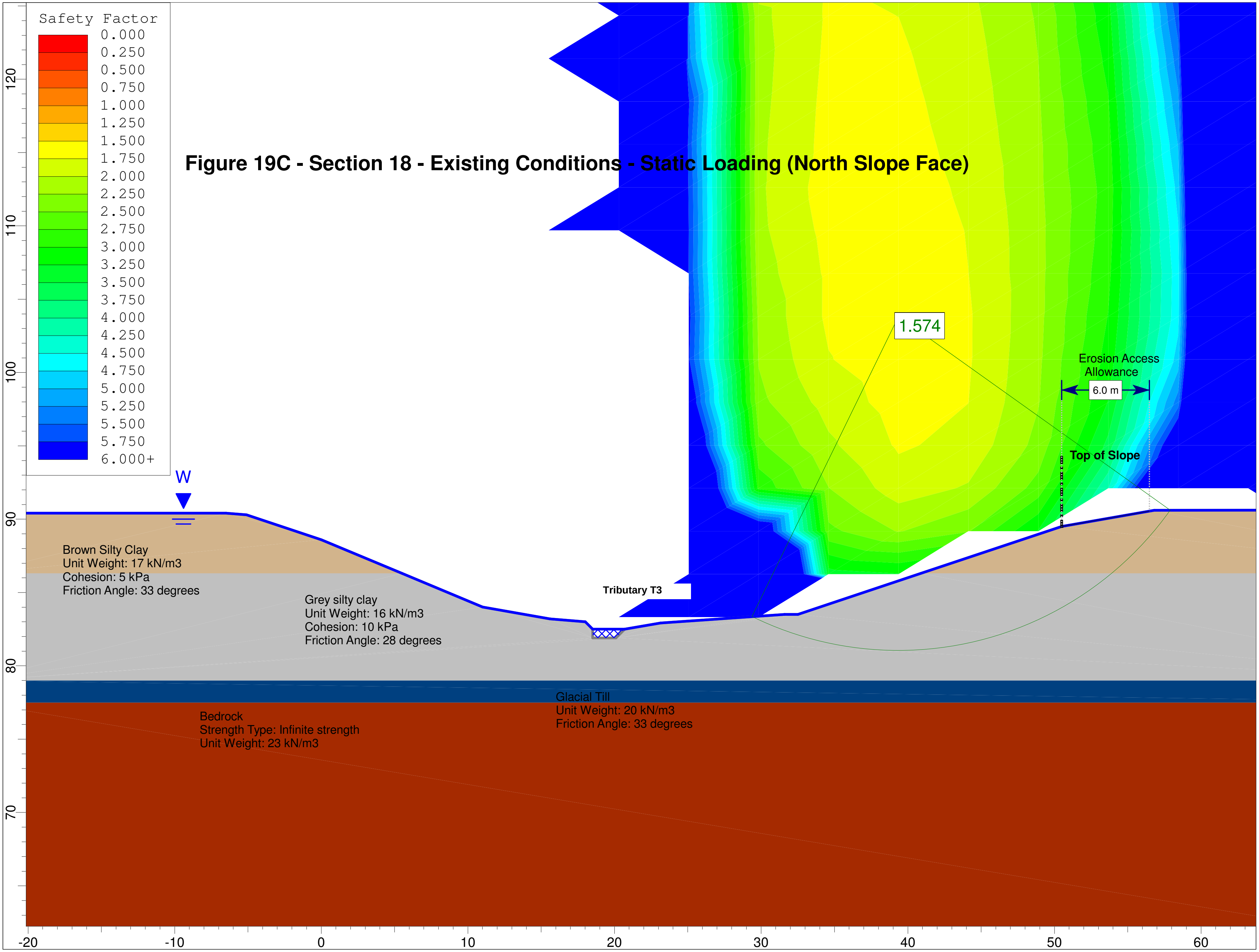


Figure 19B - Section 18 - Seismic Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.797
Top of Slope
W
Tributary T3
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 19C - Section 18 - Existing Conditions - Static Loading (North Slope Face)
1.574
Erosion Access Allowance
6.0 m
Top of Slope
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T3
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60

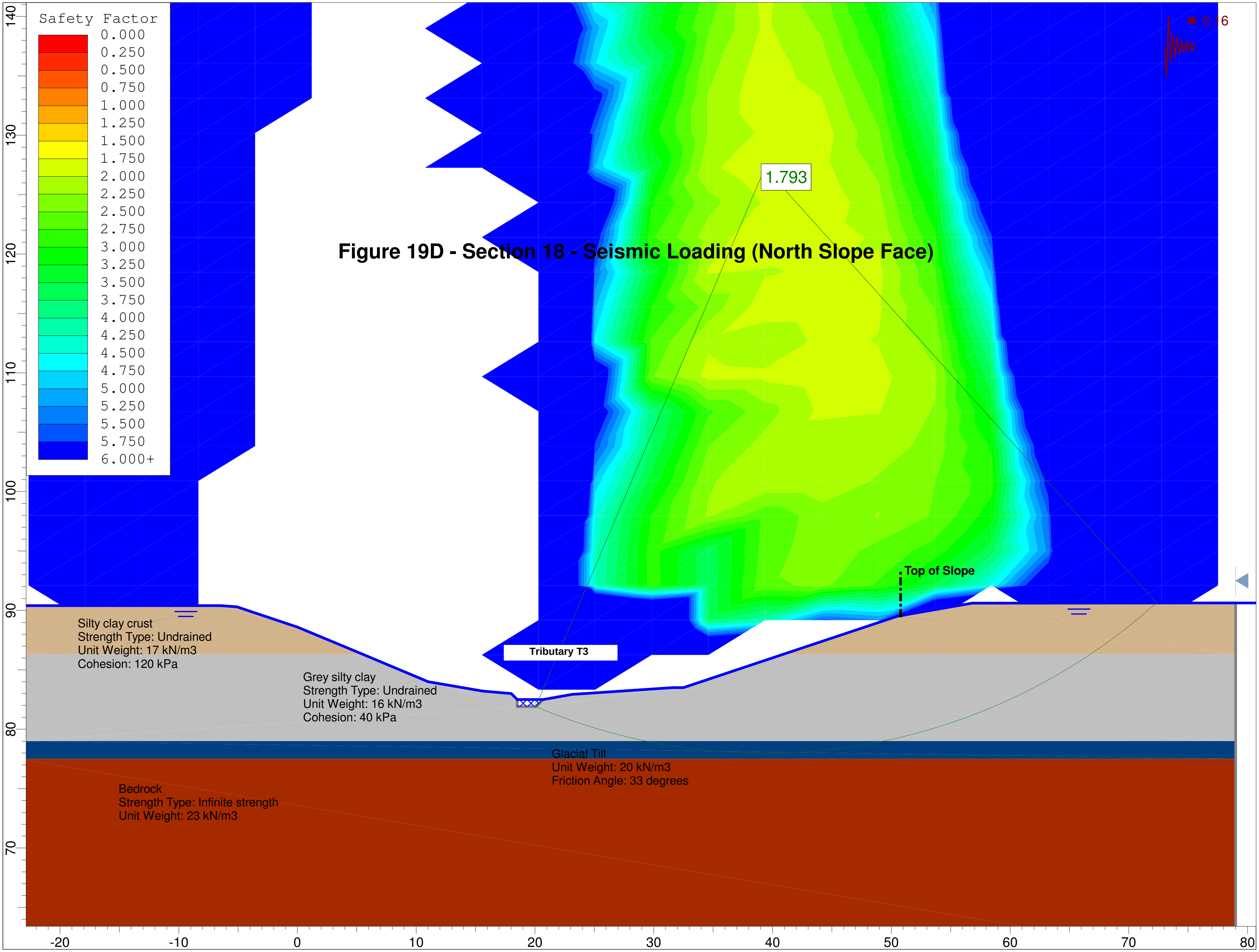


Figure 19D - Section 18 - Seismic Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
1.793
Top of Slope
Tributary T3
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60
70
80

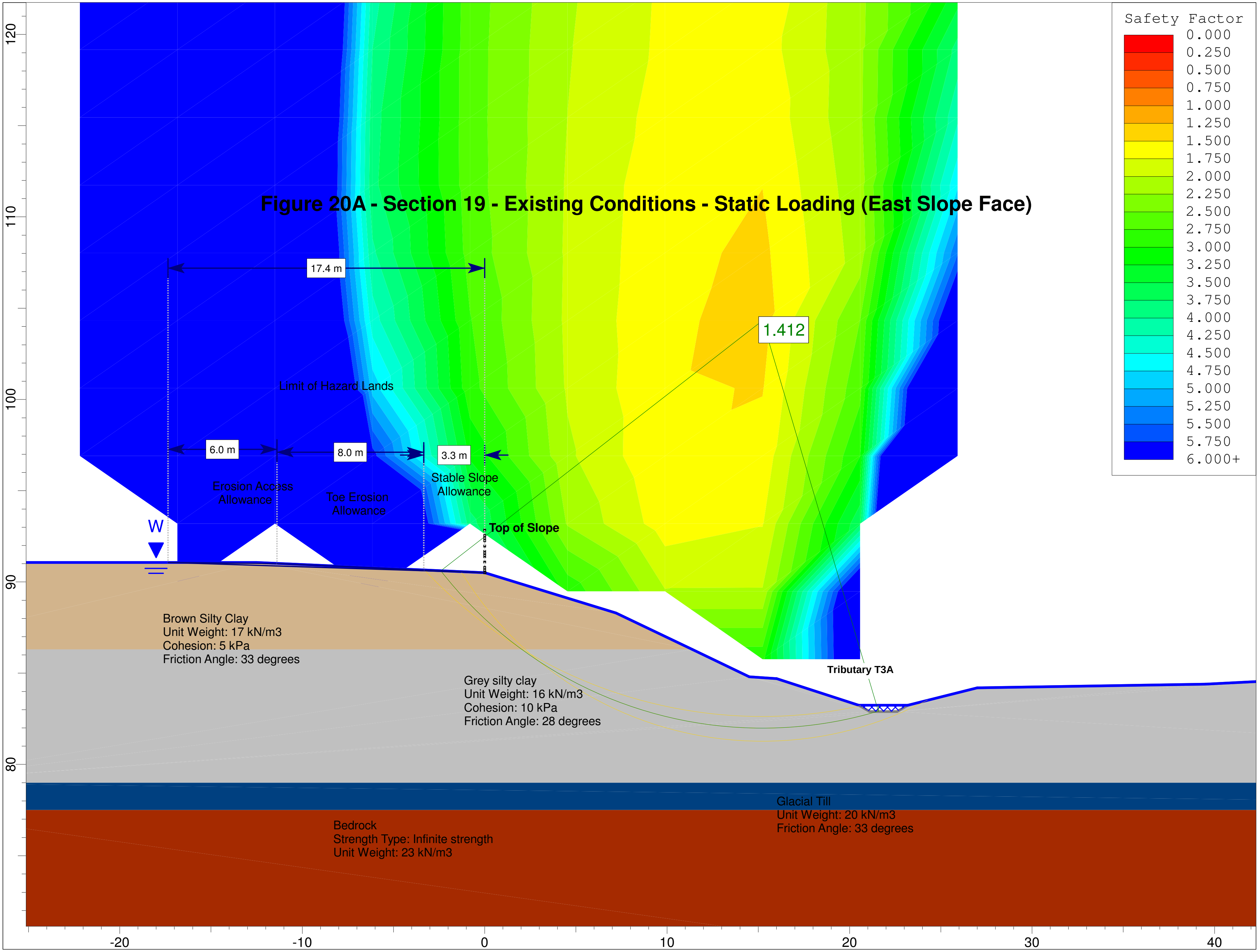
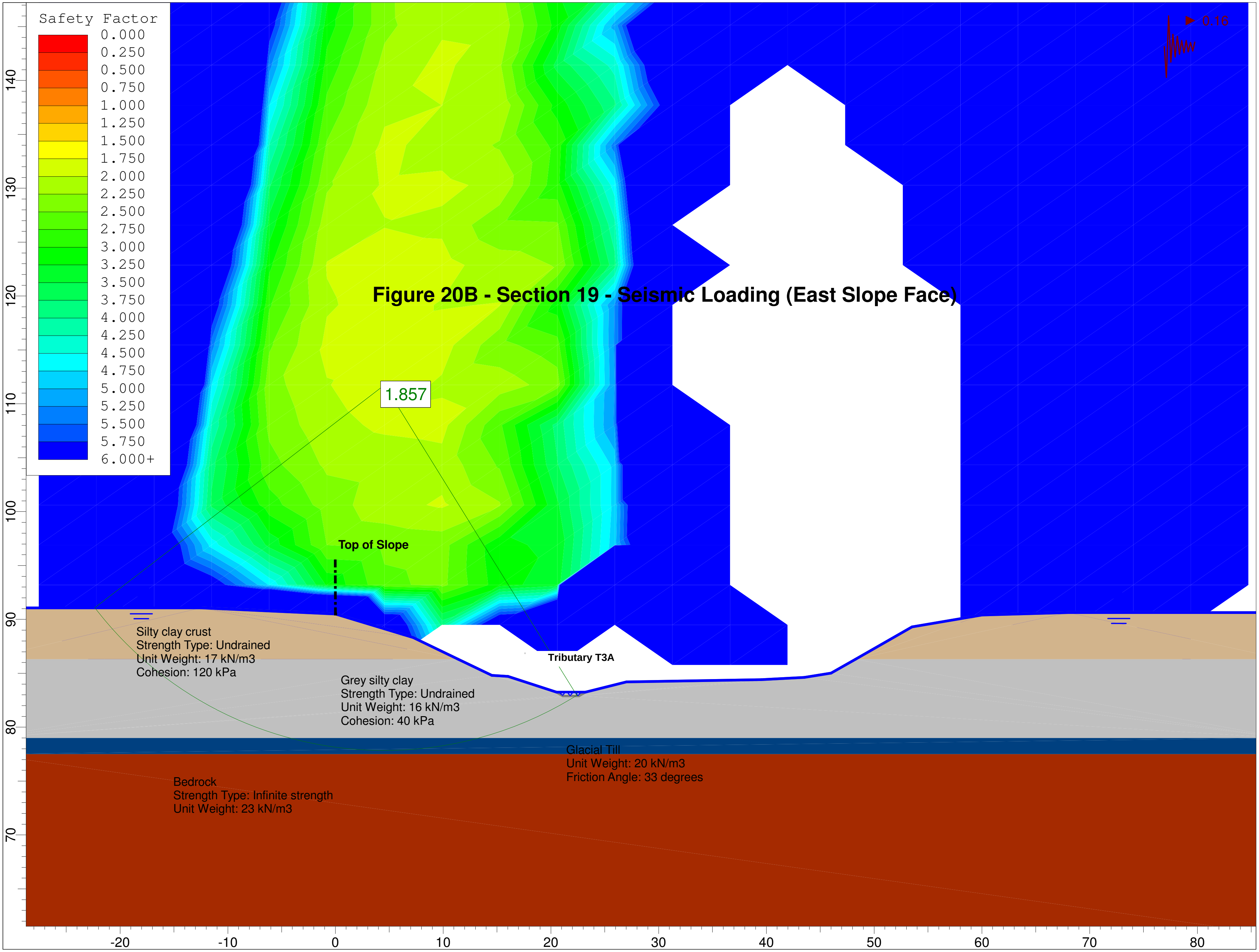


Figure 20A - Section 19 - Existing Conditions - Static Loading (East Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
17.4 m
1.412
Limit of Hazard Lands
6.0 m
8.0 m
3.3 m
Erosion Access Allowance
Toe Erosion Allowance
Stable Slope Allowance
Top of Slope
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Tributary T3A
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
-20
-10
0
10
20
30
40



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Figure 20B - Section 19 - Seismic Loading (East Slope Face)
1.857
Top of Slope
Tributary T3A
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60
70
80

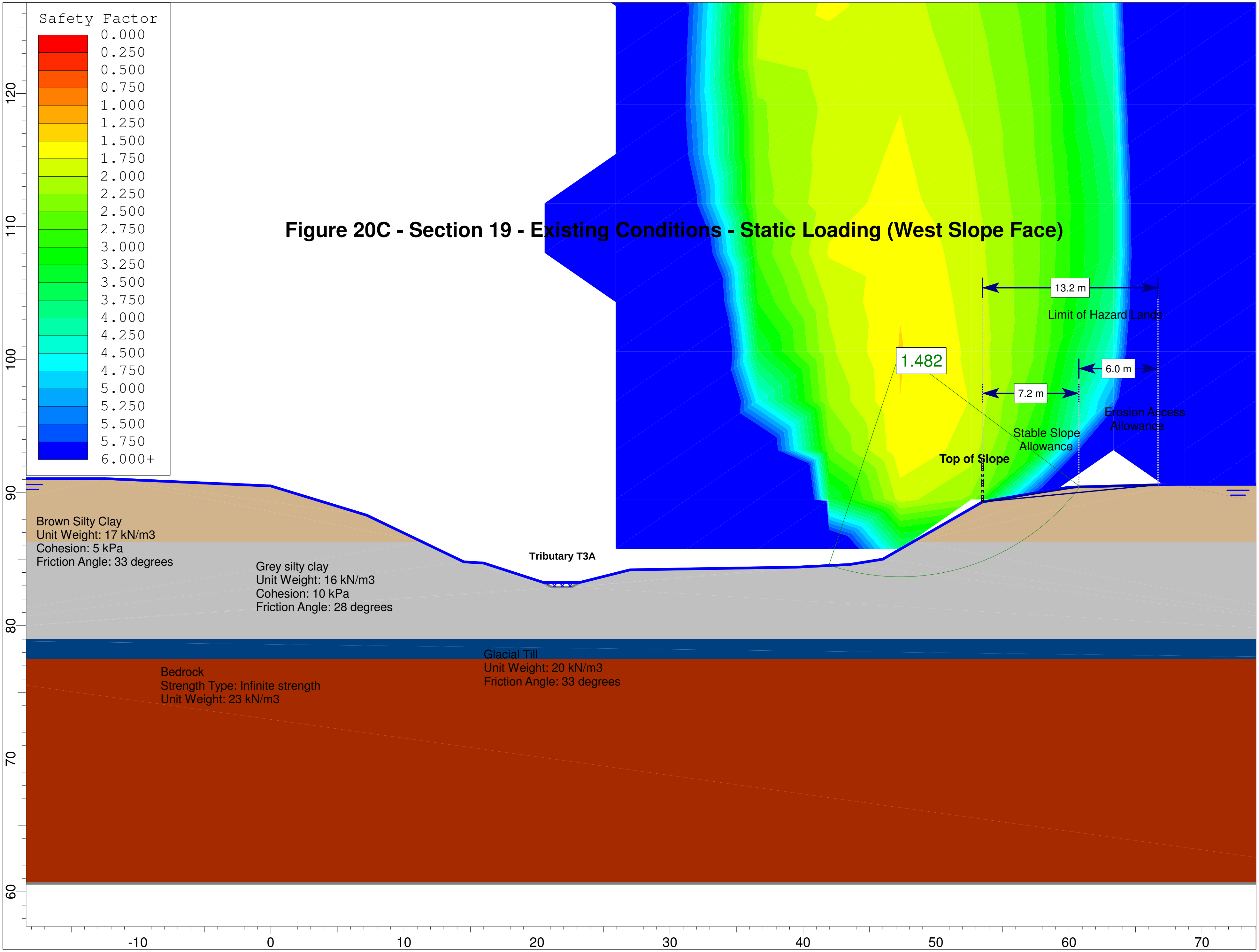
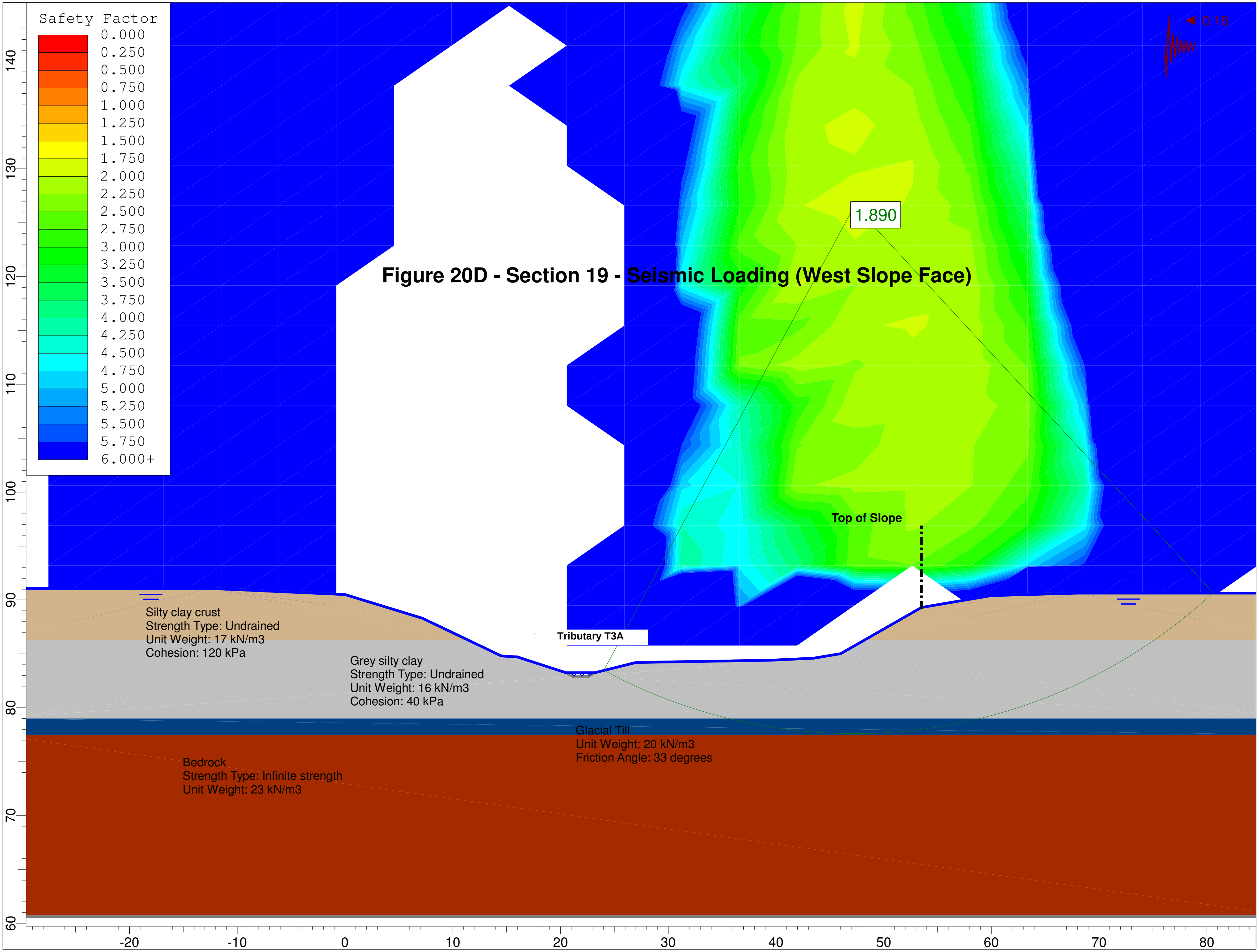
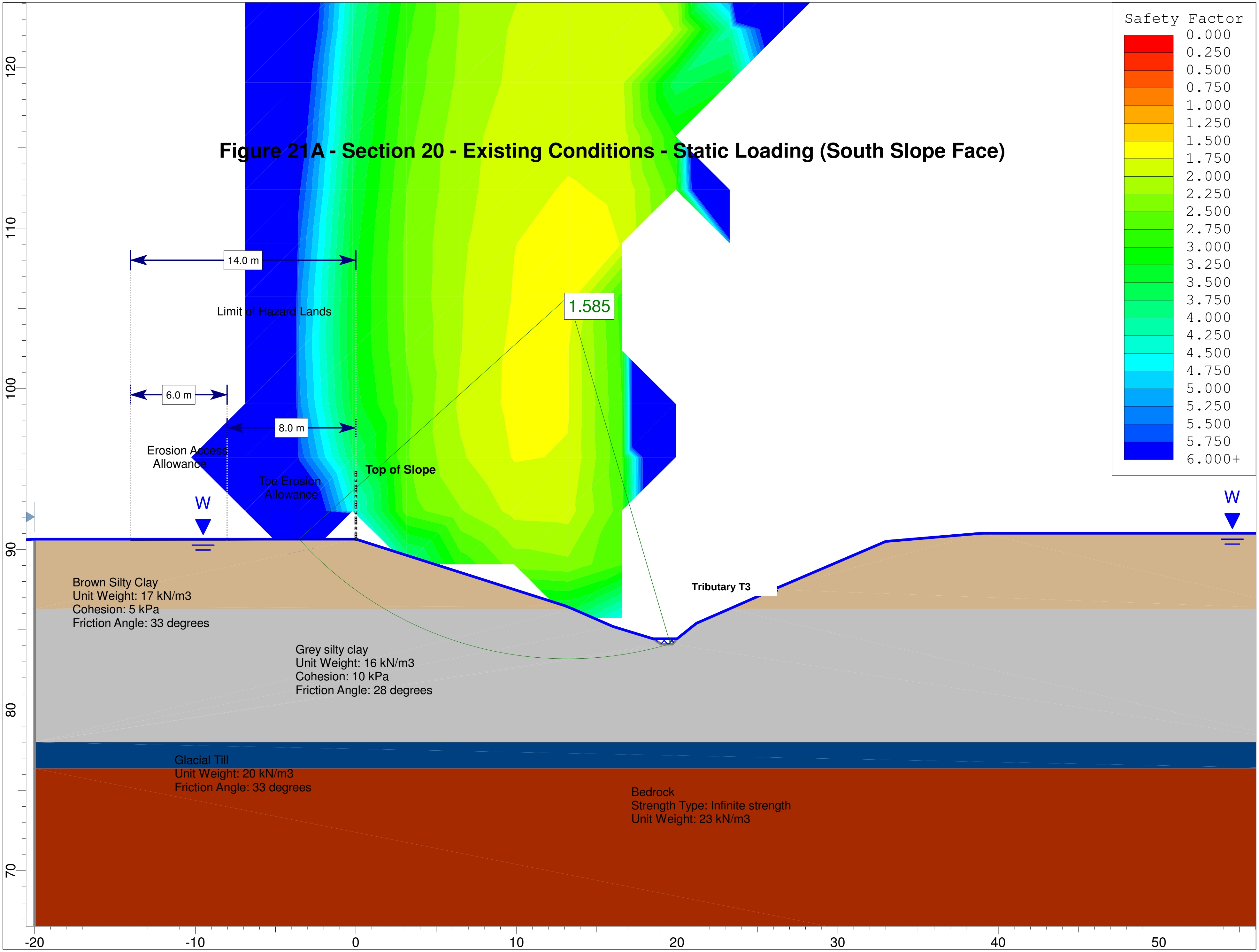


Figure 20C - Section 19 - Existing Conditions - Static Loading (West Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
1.482
13.2 m
Limit of Hazard Lands
6.0 m
7.2 m
Erosion Access Allowance
Stable Slope Allowance
Top of Slope
Tributary T3A
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
60
-10
0
10
20
30
40
50
60
70



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 20D - Section 19 - Seismic Loading (West Slope Face)
1.890
0.16
Top of Slope
Tributary T3A
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3

Figure 21A - Section 20 - Existing Conditions - Static Loading (South Slope Face)



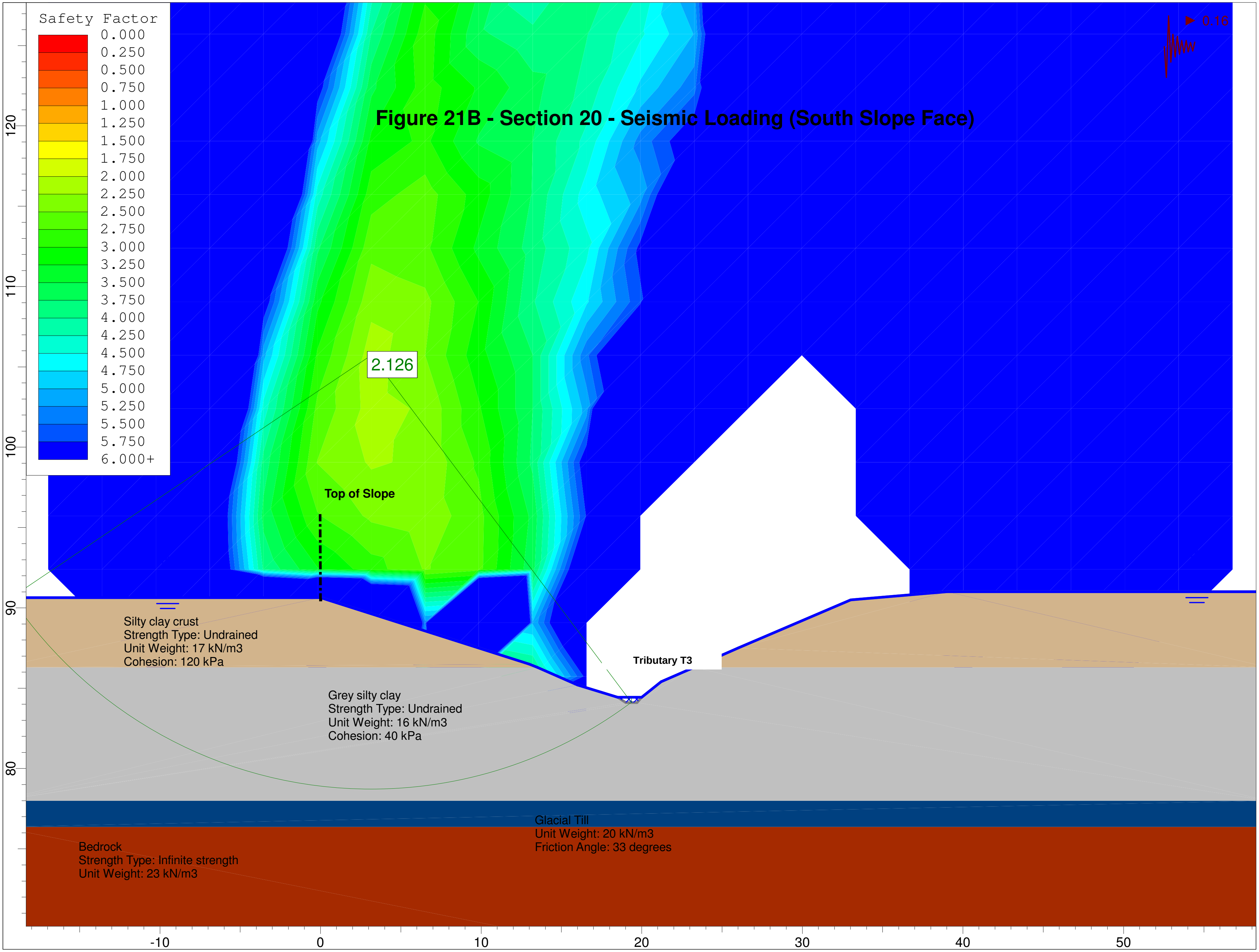


Figure 21B - Section 20 - Seismic Loading (South Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.126
Top of Slope
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Tributary T3
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
-10
0
10
20
30
40
50

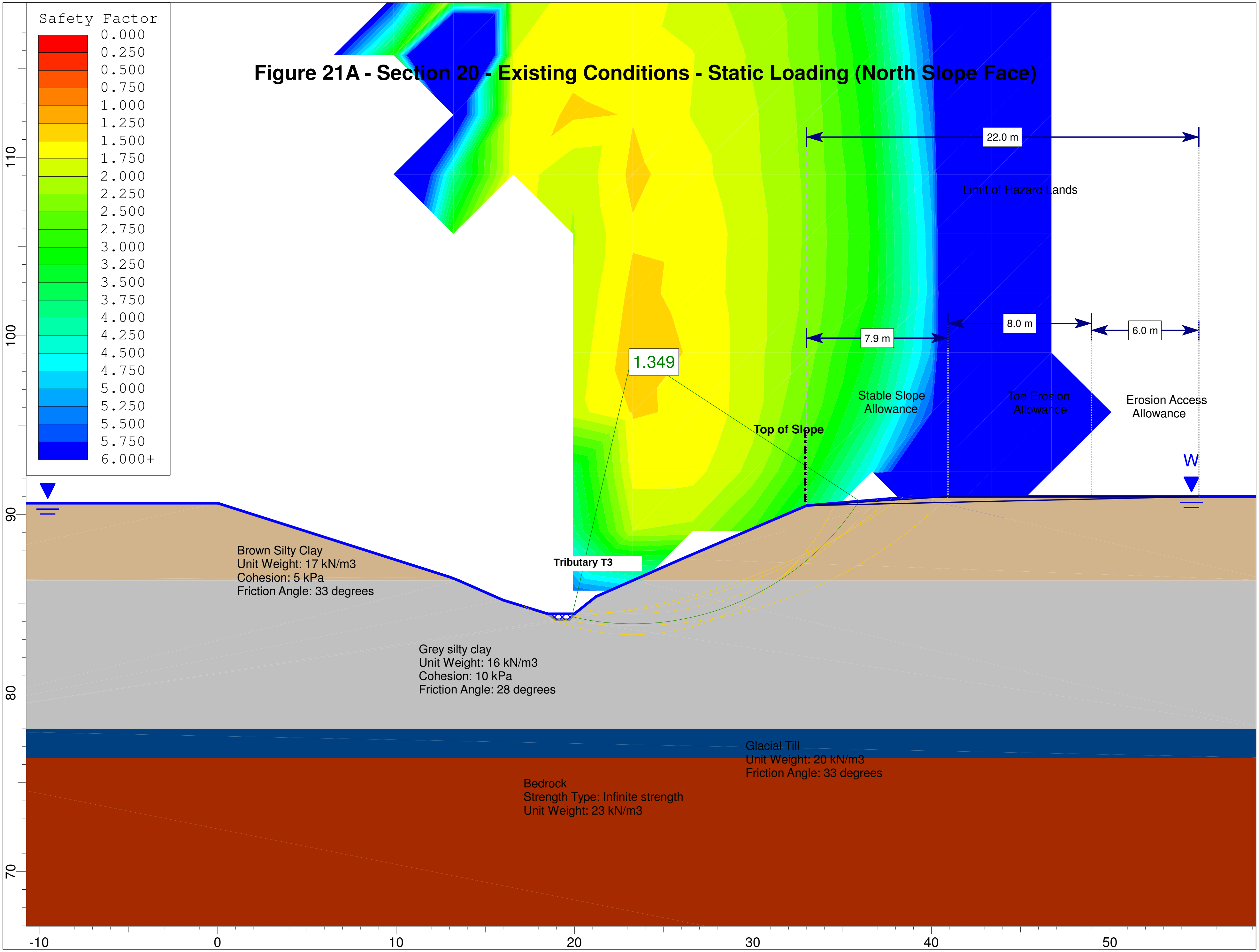
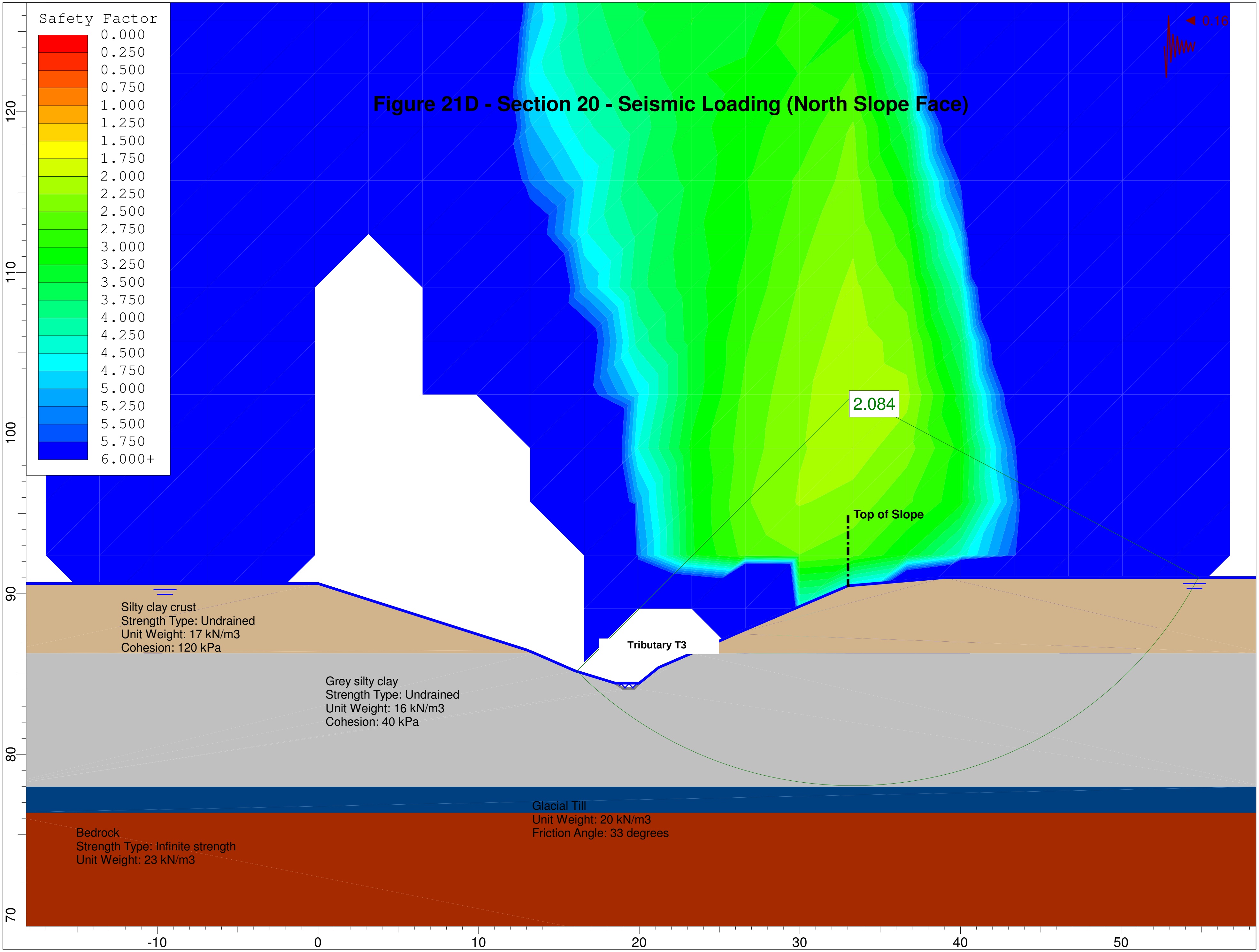


Figure 21A - Section 20 - Existing Conditions - Static Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
22.0 m
Limit of Hazard Lands
7.9 m
8.0 m
6.0 m
1.349
Stable Slope Allowance
Toe Erosion Allowance
Erosion Access Allowance
Top of Slope
W
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
Friction Angle: 33 degrees
Tributary T3
Grey silty clay
Unit Weight: 16 kN/m3
Cohesion: 10 kPa
Friction Angle: 28 degrees
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
110
100
90
80
70
-10
0
10
20
30
40
50



Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Figure 21D - Section 20 - Seismic Loading (North Slope Face)
0.16
2.084
Top of Slope
Tributary T3
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
120
110
100
90
80
70
-10
0
10
20
30
40
50

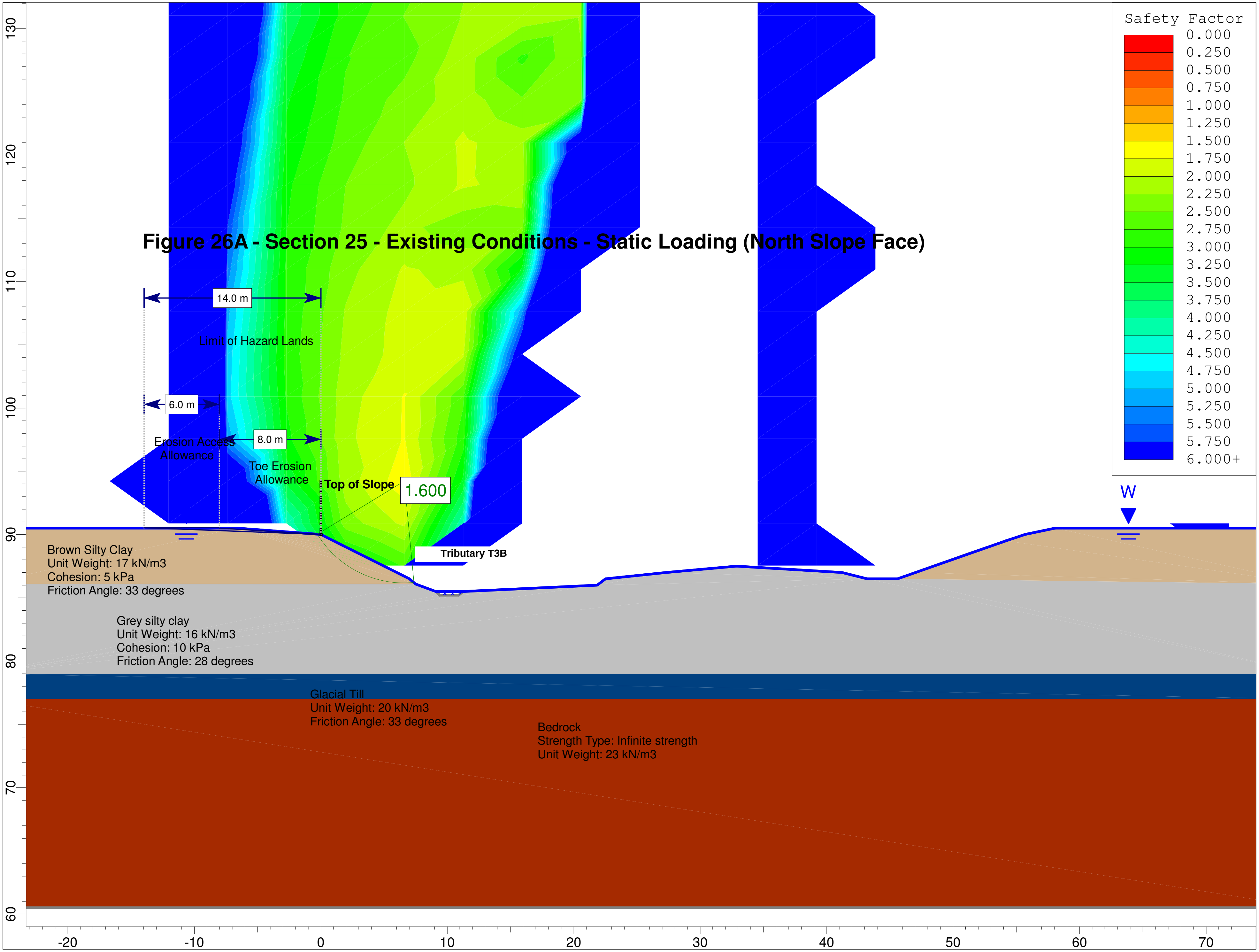


Figure 26A - Section 25 - Existing Conditions - Static Loading (North Slope Face)

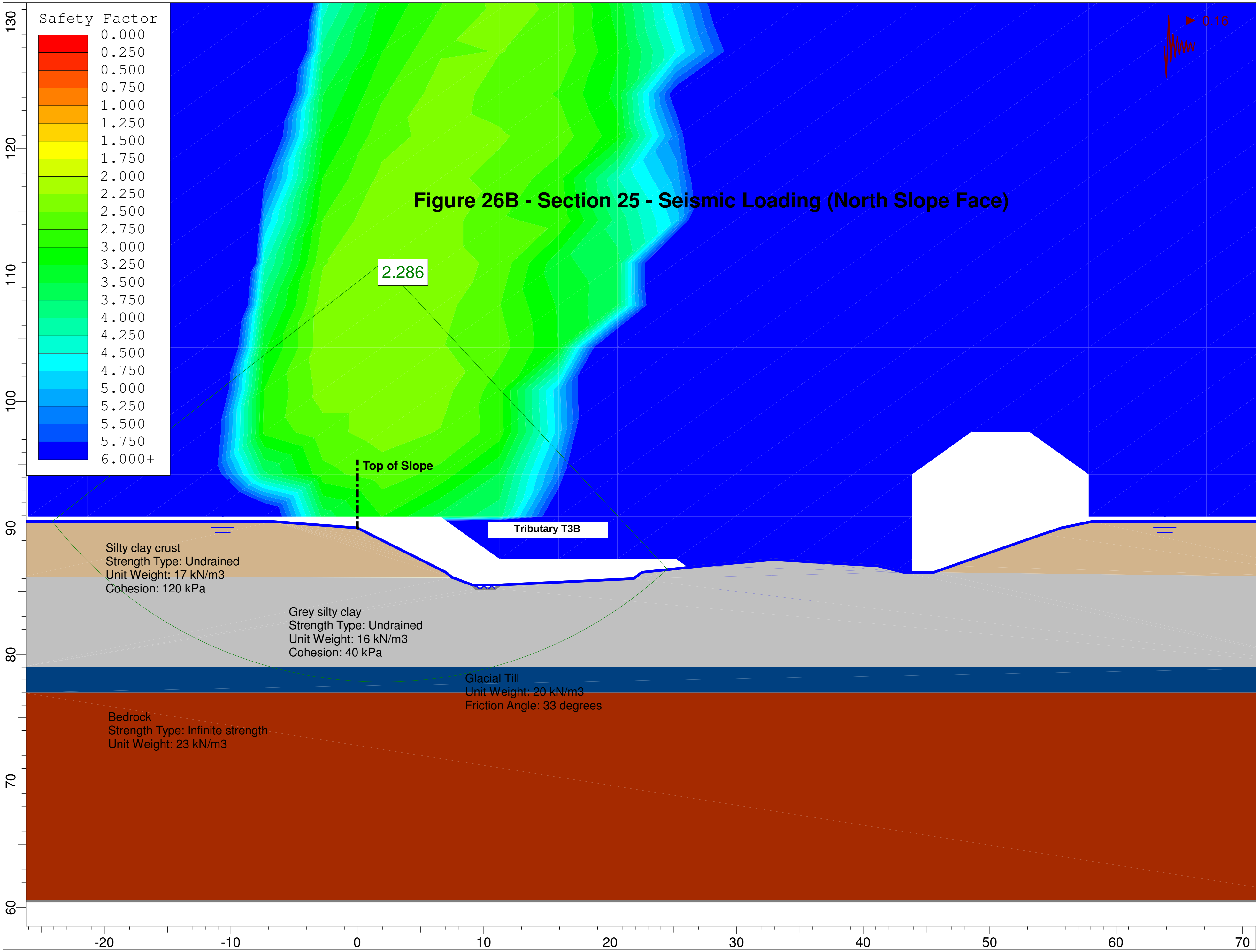
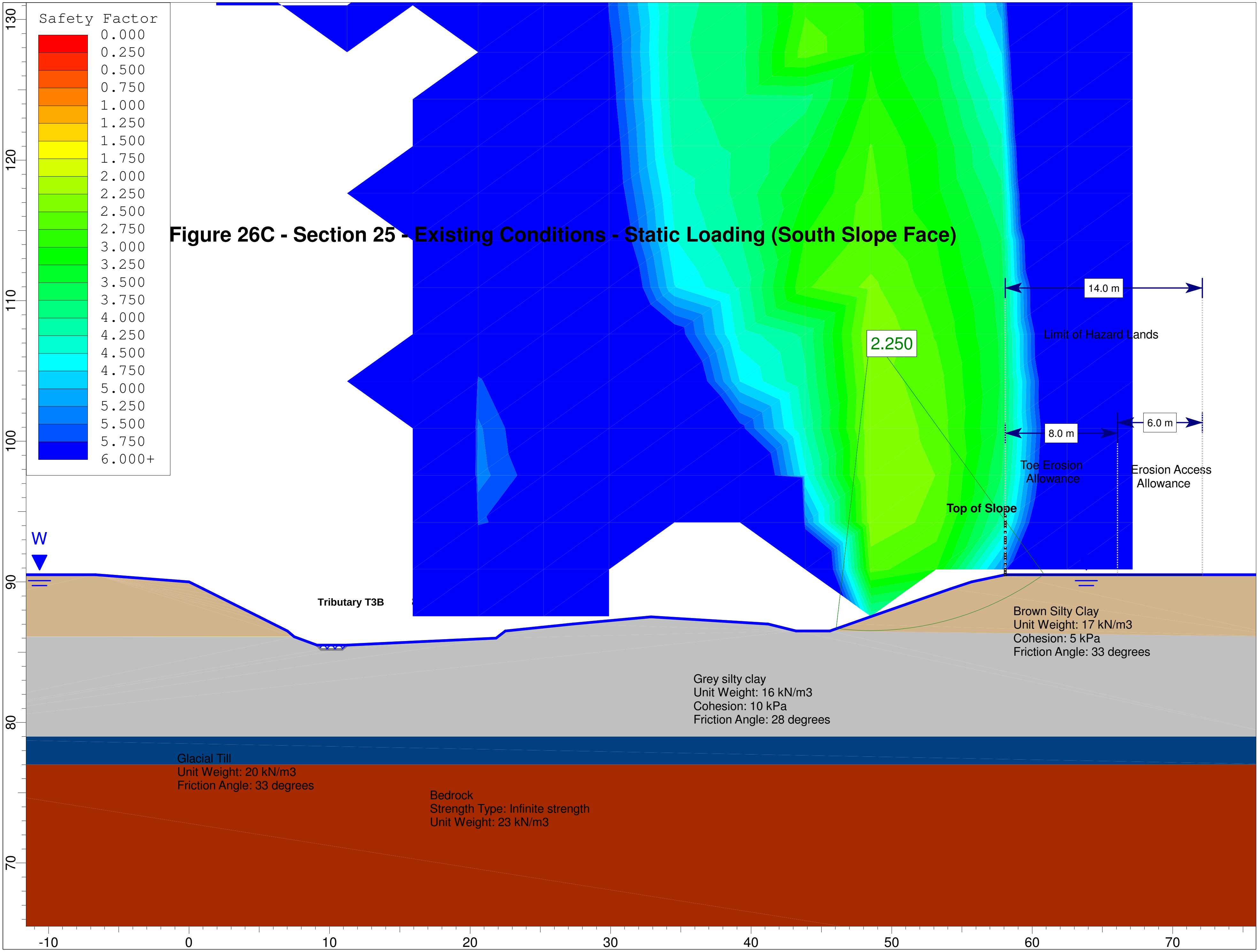
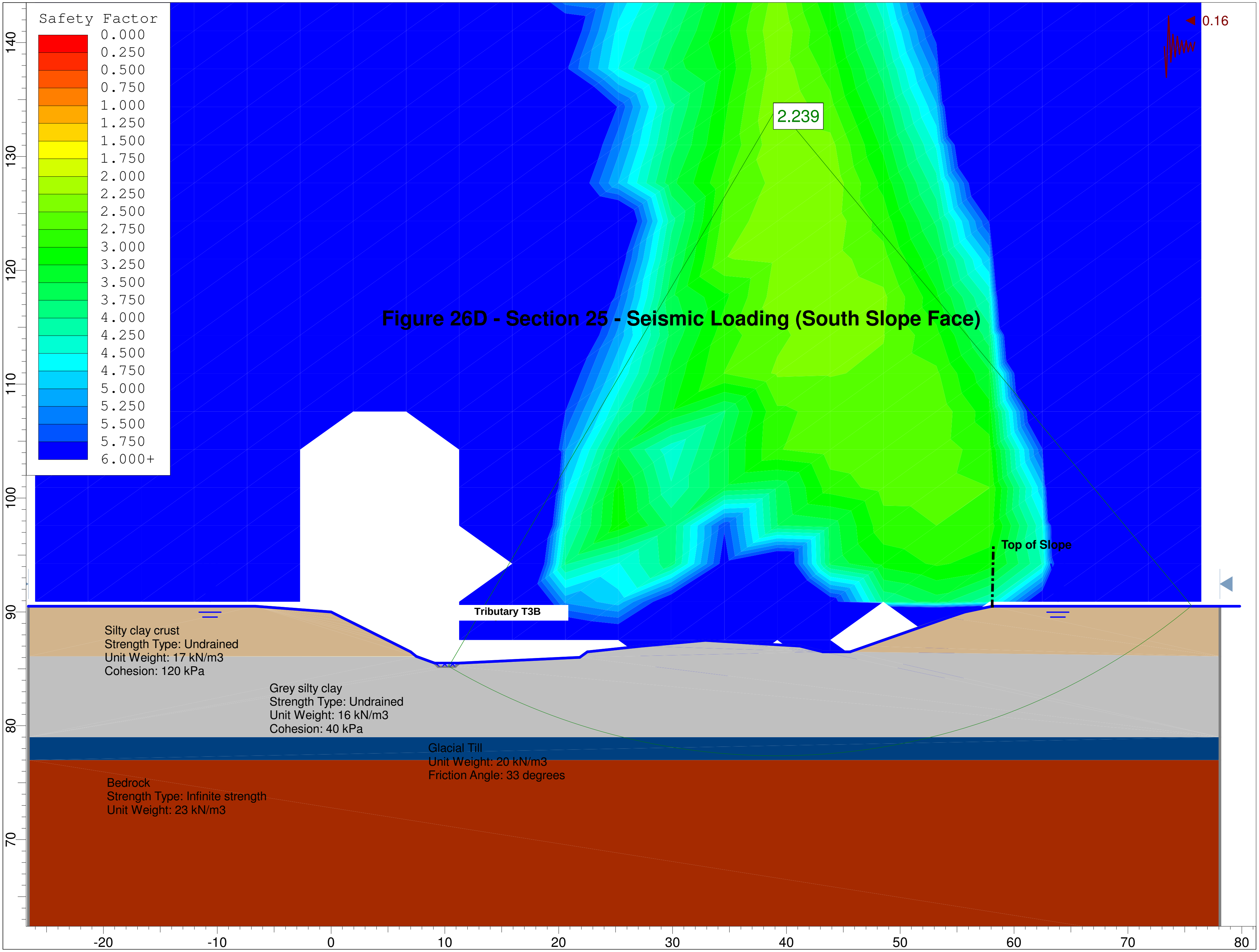
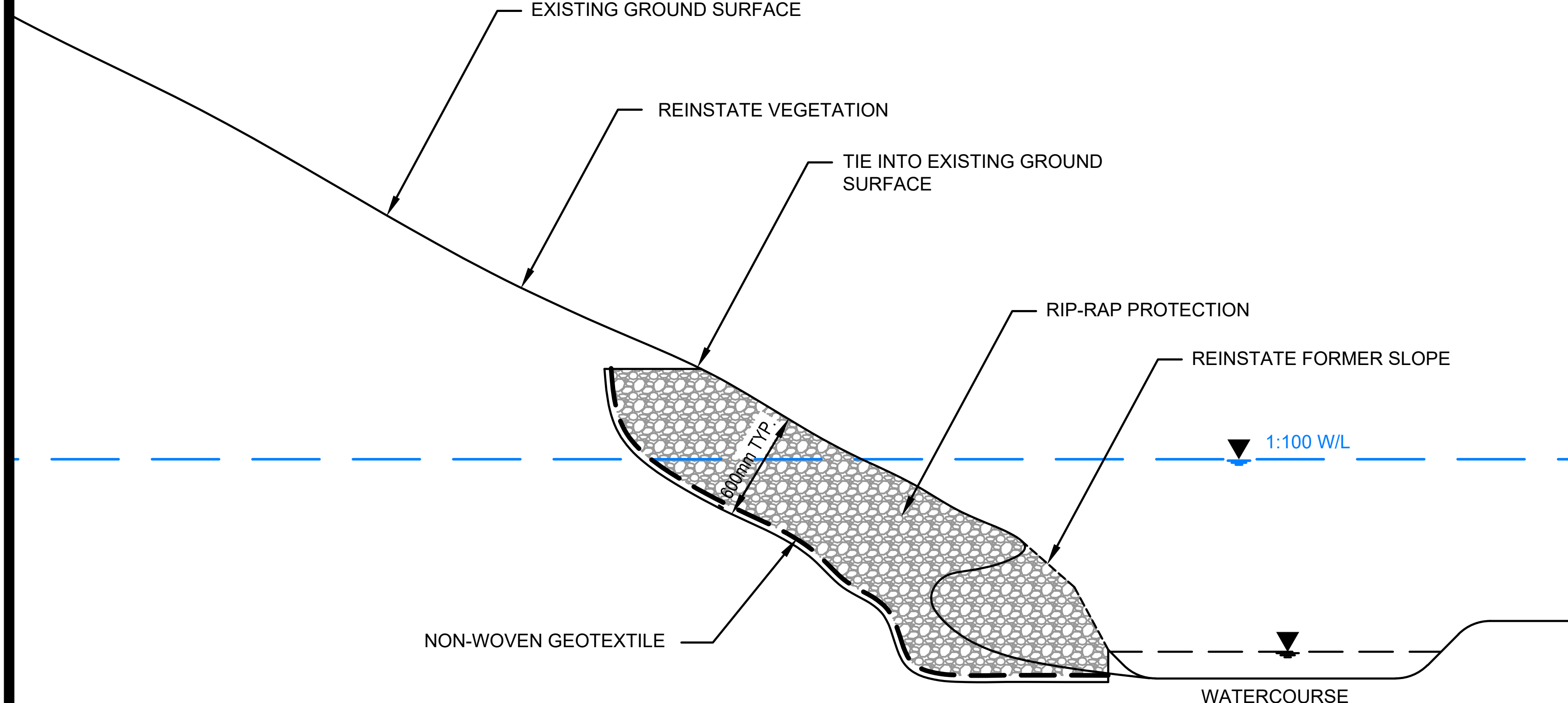


Figure 26B - Section 25 - Seismic Loading (North Slope Face)
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
2.286
0.16
Top of Slope
Tributary T3B
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
130
120
110
100
90
80
70
60
-20
-10
0
10
20
30
40
50
60
70

Figure 26C - Section 25 - Existing Conditions - Static Loading (South Slope Face)




Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
2.239
Figure 26D - Section 25 - Seismic Loading (South Slope Face)
Top of Slope
Tributary T3B
Silty clay crust
Strength Type: Undrained
Unit Weight: 17 kN/m3
Cohesion: 120 kPa
Grey silty clay
Strength Type: Undrained
Unit Weight: 16 kN/m3
Cohesion: 40 kPa
Glacial Till
Unit Weight: 20 kN/m3
Friction Angle: 33 degrees
Bedrock
Strength Type: Infinite strength
Unit Weight: 23 kN/m3
140
130
120
110
100
90
80
70
-20
-10
0
10
20
30
40
50
60
70
80



PATERSON GROUP

FIGURE 27
TYPICAL EROSION CONTROL DETAIL

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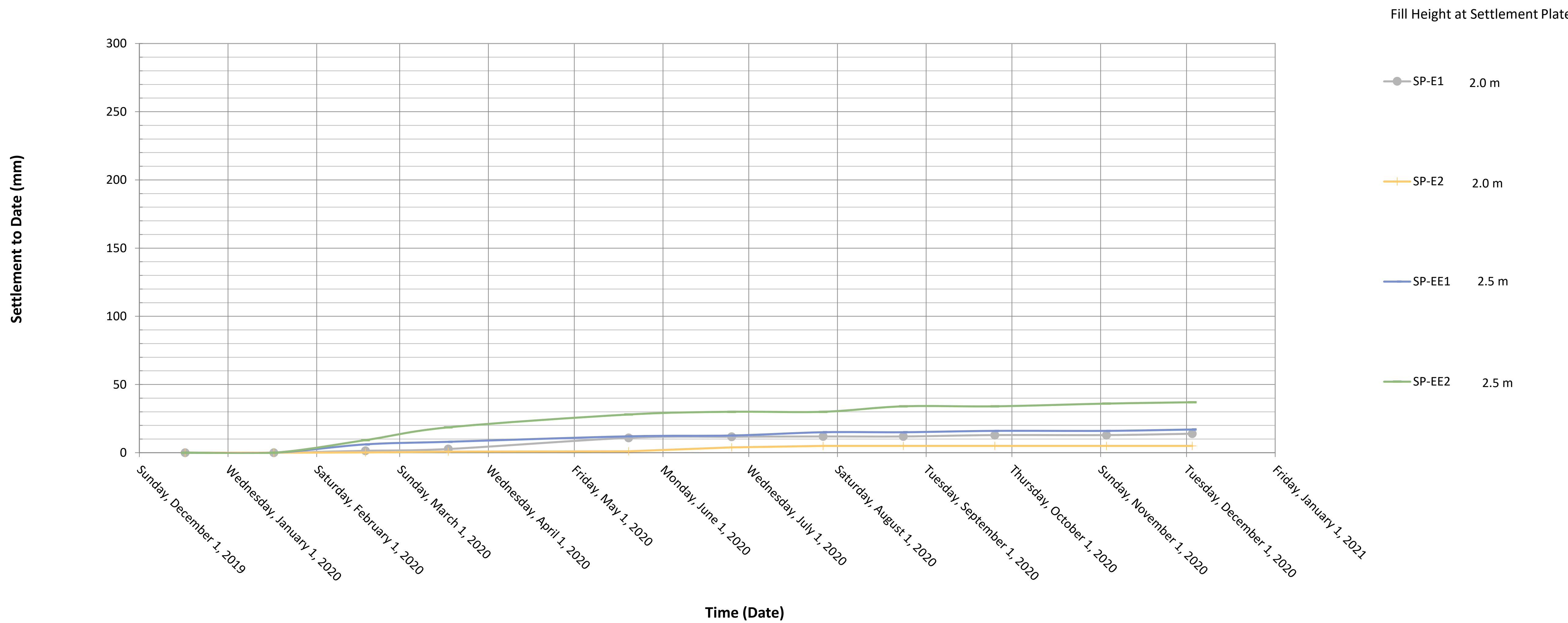
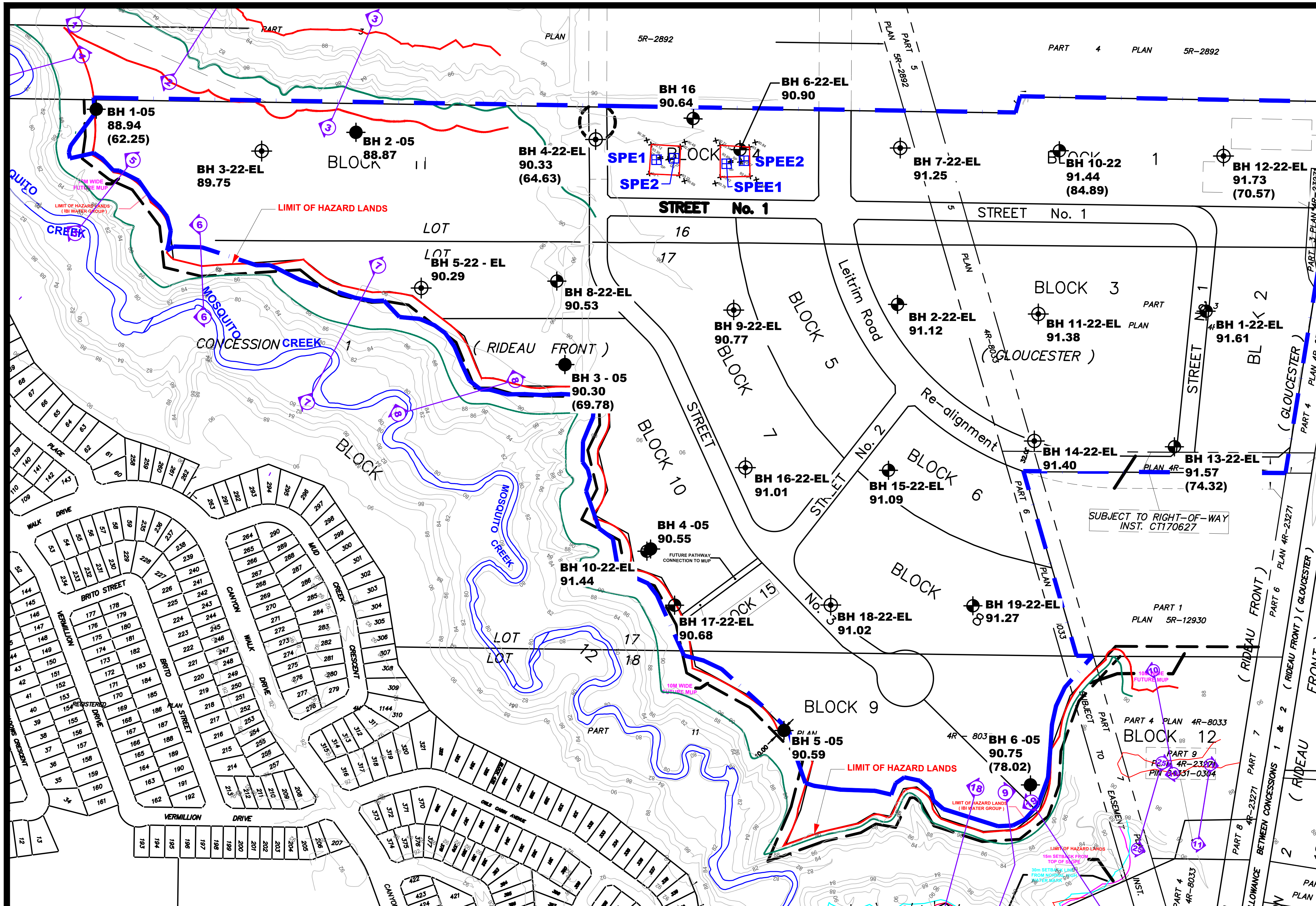
Figure 28 - Settlement Monitoring Program
Employment Lands - Riverside South - Ottawa



PATERSON GROUP



LEGEND:

- BOREHOLE LOCATION
- BOREHOLE LOCATION WITH MONITORING WELL
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PG0718, 05/2006)
- LIMIT OF HAZARD LANDS
- TOP OF SLOPE
- PROPERTY BOUNDARY
- SLOPE STABILITY SECTION
- SETTLEMENT PLATE LOCATION
- APPROX. EXTENT OF AS-BUILT TEST FILL PILE
- 91.57 GROUND SURFACE ELEVATION (m)
- (74.30) PRACTICAL REFUSAL TO DCPT ELEVATION (m)

GROUND SURFACE ELEVATION AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

0 50 100 150 200 250m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	AS PER REVISED CONCEPTUAL SITE PLAN	06/02/2023	NP

RIVERSIDE SOUTH DEVELOPMENT CORP.

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3700 TWIN FALLS PLACE

OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Scale: 1:4000	Date: 04/2022
Drawn by: NFRV	Report No.: PG4958-2
Checked by: NP	Dwg. No.: PG4958-8
Approved by: DG	Revision No.: 1

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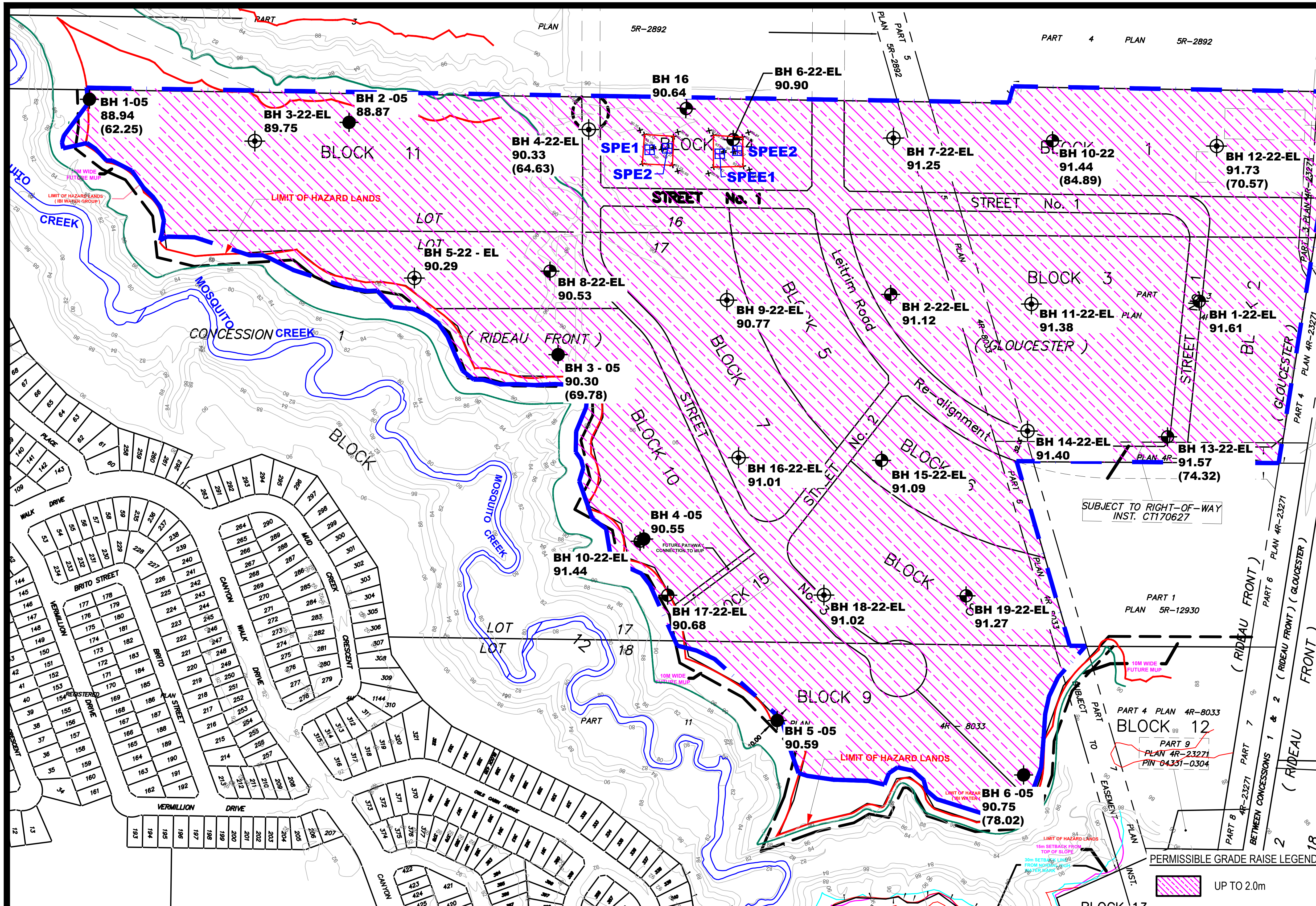

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE LOCATION WITH MONITORING WELL
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PG0718, 05/2006)
- LIMIT OF HAZARD LANDS
- TOP OF SLOPE
- PROPERTY BOUNDARY
- SETTLEMENT PLATE LOCATION
- APPROX. EXTENT OF AS-BUILT TEST FILL PILE
- 91.57 GROUND SURFACE ELEVATION (m)
- (74.30) PRACTICAL REFUSAL TO DCPT ELEVATION (m)

GROUND SURFACE ELEVATION AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

0 50 100 150 200 250m

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	AS PER REVISED CONCEPTUAL SITE PLAN	06/02/2023	NP

RIVERSIDE SOUTH DEVELOPMENT CORP.

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3700 TWIN FALLS PLACE

OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Scale: 1:4000	Date: 04/2022
Drawn by: NFRV	Report No.: PG4958-2
Checked by: NP	Dwg. No.: PG4958-9
Approved by: DG	Revision No.: 1

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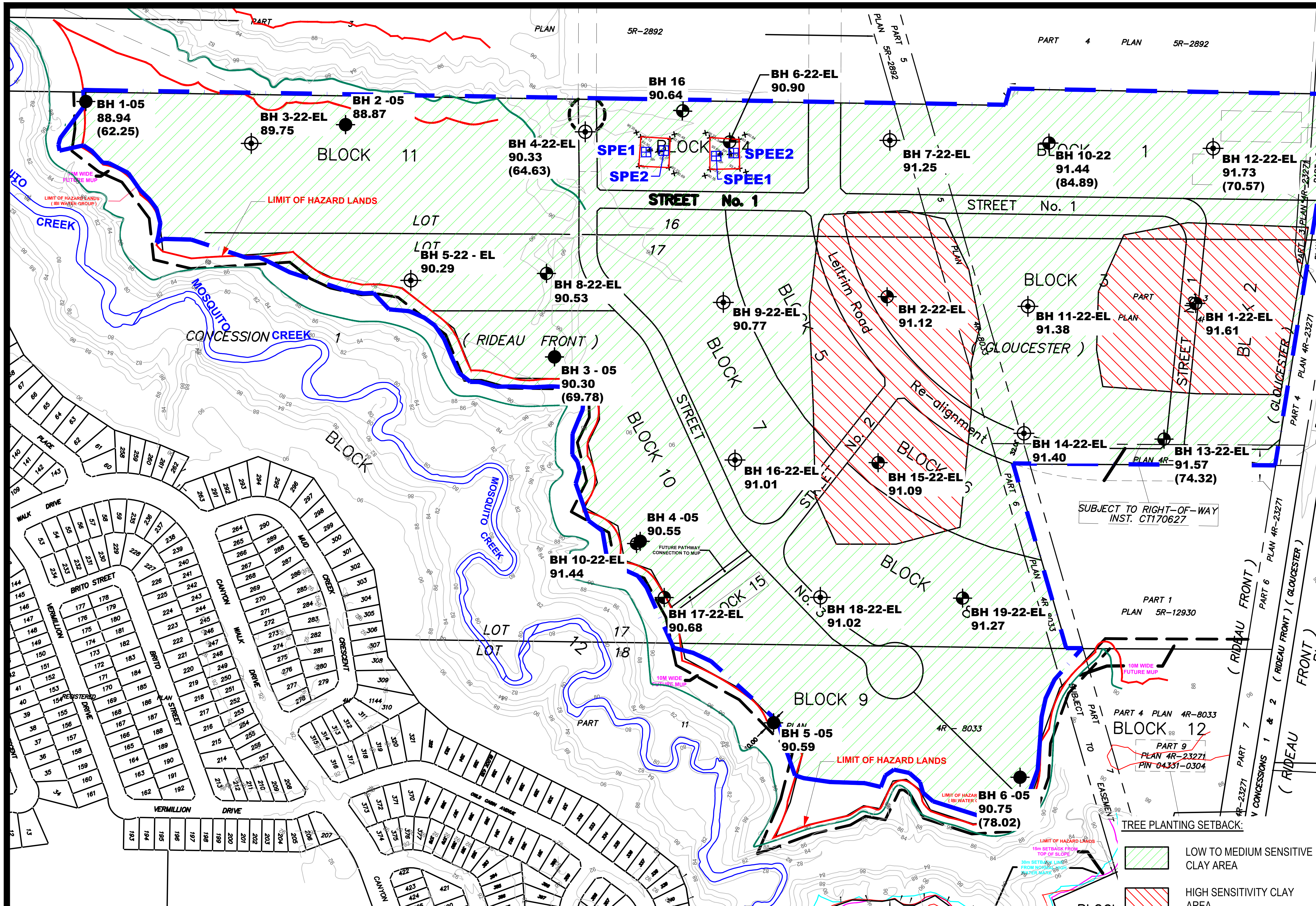

LEGEND:

- BOREHOLE LOCATION
- BOREHOLE LOCATION WITH MONITORING WELL
- BOREHOLE LOCATION, PREVIOUS INVESTIGATION (PG0718, 05/2006)
- LIMIT OF HAZARD LANDS
- TOP OF SLOPE
- PROPERTY BOUNDARY
- SETTLEMENT PLATE LOCATION
- APPROX. EXTEND OF AS-BUILT TEST FILL PILE
- 91.57 GROUND SURFACE ELEVATION (m)
- (74.30) PRACTICAL REFUSAL TO DCPT ELEVATION (m)

GROUND SURFACE ELEVATION AT BOREHOLE LOCATIONS ARE REFERENCED TO A GEODETIC DATUM.

TREE PLANTING SETBACK:

- LOW TO MEDIUM SENSITIVE CLAY AREA
- HIGH SENSITIVITY CLAY AREA

0 50 100 150 200 250m

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PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7S9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
1	AS PER REVISED CONCEPTUAL SITE PLAN	06/02/2023	NP

RIVERSIDE SOUTH DEVELOPMENT CORP.

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3700 TWIN FALLS PLACE

OTTAWA, ONTARIO

Title:

TREE PLANTING SETBACK PLAN

Scale: 1:4000	Date: 04/2022
Drawn by: NFRV	Report No.: PG4958-2
Checked by: NP	Dwg. No.: PG4958-10
Approved by: DG	Revision No.: 1