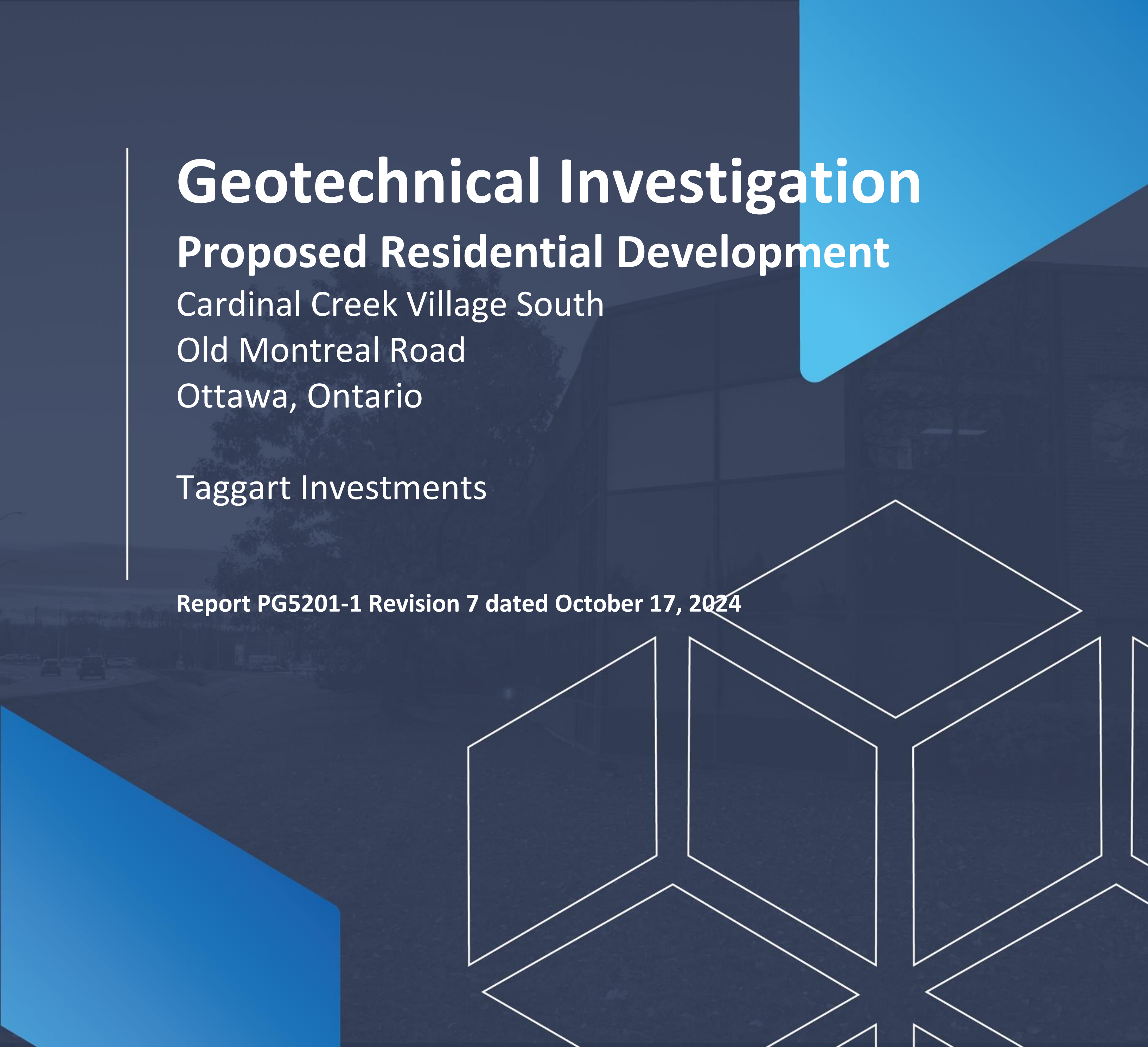


Geotechnical Investigation

Proposed Residential Development

Cardinal Creek Village South
Old Montreal Road
Ottawa, Ontario

Taggart Investments

Report PG5201-1 Revision 7 dated October 17, 2024

Table of Contents

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Taggart Investments to conduct a geotechnical investigation for Cardinal Creek Village South residential development to be located along Old Montreal Road in the City of Ottawa (refer to Figure 1 - Key Plan presented in Appendix 2).

The objectives of the geotechnical investigation were to:

☐ determine the subsoil and groundwater conditions at the site by means of test holes.

☐ provide geotechnical recommendations for the design of the proposed development based on the results of the test holes and other soil information available. These recommendations include permissible grade raises, long term settlements and other construction considerations which may affect the design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. The report contains the geotechnical findings and includes recommendations pertaining to the design and construction of the subject development as 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

Based on the available drawings, it is understood that the proposed development will consist of single and townhouse style residential dwellings with basement or slab-on-grade construction, attached garages, associated driveways, local roadways and landscaped areas. The construction of schools, a park, and a storm water management pond are also included in the proposed development.

It is further anticipated that the proposed development will be serviced by future municipal water, sanitary and storm services.

3.0 Method of Investigation

3.1 Field Investigation

Field Program

Paterson has undertaken several geotechnical investigations throughout the subject site. The initial portion of the geotechnical investigation for the overall development was carried out between January 22 and 26, 2009. At that time, seven (7) boreholes were advanced within the subject site to depths varying between 0.7 and 9.4 m below ground surface. Supplemental investigations were completed in April and June 2012, and January and February 2013. At that time, thirty-two (32) additional boreholes were advanced to depths varying between 0.8 and 10.0 m below ground surface.

Additional geotechnical investigations were carried out in December 2012 and between February and March 2021 and consisted of excavating a total of fifty-four (54) test pits. The test holes were advanced within the subject site to depths between 0.7 and 6.5 m below the existing ground surface. A bedrock delineation program consisting of advancing probeholes to the bedrock surface was also carried out in November 2019 to assess the overburden thickness across the subject site.

The test hole locations were placed in a manner to provide general coverage taking into consideration site access, features and underground utilities. The test hole locations were determined by Paterson personnel and surveyed in the field by Paterson or Stantec Geomatics. It is understood that all test hole elevations are referred to a geodetic datum. The test hole locations for the investigations are presented on Drawing PG5201-2 - Test Hole Location Plan included in Appendix 2.

The boreholes and probeholes were completed using a track mounted drill rig operated by a two-person crew. The test pits were excavated using a rubber-tired backhoe or a hydraulic shovel. 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 or excavating to the required depths and at the selected locations sampling and testing the overburden.

Sampling and In Situ Testing

Soil samples were collected from the boreholes using a 50 mm diameter split-spoon sampler, from the auger flights, or using a 73 mm diameter thin walled Shelby tubes in conjunction with a piston sampler. Grab samples were also collected along the excavated sidewalls of the test pits. All samples were visually inspected and initially classified on site. The auger, grab and split-spoon samples were placed in sealed plastic bags and the Shelby tubes were sealed at both ends on site and protected from disturbances over the entire process.

All samples were transported to our laboratory for further examination and classification. The depths at which the auger, grab, split spoon and Shelby tube samples were recovered from the test holes are shown as AU, G, SS and TW, respectively, on the Soil Profile and Test Data sheets presented 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.

Subsurface conditions observed in the test holes were recorded in detail in the field. Reference should be made to the Soil Profile and Test Data sheets presented in Appendix 1 for specific details of the soil profile encountered at the test hole locations.

Groundwater

Boreholes were fitted with flexible piezometers to allow groundwater level monitoring. Groundwater conditions were also noted upon completion of the test pits. The groundwater observations are presented in the Soil Profile and Test Data sheets in Appendix 1 and discussed in Subsection 4.3.

3.2 Field Survey

The test hole locations were selected by Paterson to provide general coverage of the current phase of the residential development taking into consideration existing site features and underground utilities. The test hole locations and ground surface elevation at each test hole location were surveyed by Paterson or provided by Stantec Geomatics Ltd.

All ground surface elevations at the test hole locations are understood to be referenced to a geodetic datum. The test hole locations and ground surface elevations at the test hole locations are presented on Drawing PG5201-2 - Test Hole Location Plan in Appendix 2.

3.3 Laboratory Testing

The soil samples recovered from the subject site were visually examined in our laboratory to review the results of the field logging. A total of 17 soil samples collected from the test holes were submitted for Atterbeg Limits Testing and a total of 5 soil samples were submitted for grain size distribution analysis. Moisture content analysis was also completed on the majority of the test holes. The results of this testing are provided in Appendix 1 and discussed in Subsection 4.2.

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 by Paterson. The sample was submitted to determine the concentration of sulphate and chloride, the resistivity, and the pH of the samples. 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 consists mostly of undeveloped agricultural lands with several areas covered with trees and mature vegetation. The study area was observed to be intersected by a series of tributary ravines, which drain into Cardinal Creek. Piles of granular and crushed material have been observed on the west portion of the property and north of the main tributary ravine.

The ground surface across the subject site slopes downward gradually from east to west, and in general towards the tributary ravines. The slopes of the ravines were noted to be treed and stable based on our most recent site visit. Some signs of toe erosion were noted throughout where the watercourse is in close proximity to the valley corridor wall.

Due to the presence of the tributary ravines within the subject site, a slope stability assessment was carried out considering the slope conditions present in the subject site and along the sidewalls of the aforementioned watercourses. The results of the slope stability analysis are discussed further in Subsection 6.8 of this report.

4.2 Subsurface Profile

Overburden

Generally, the overburden profile consisted of topsoil, fill and/or asphaltic concrete underlain by a stiff to very stiff silty clay layer followed by a glacial till deposit. The fill was mostly encountered in the boreholes located next to Old Montreal Road. Where encountered, the existing fill layer was observed to extend to ranges between 0.7 and 1.4 m in depth. The fill generally consisted of crushed stone followed by brown silty sand with clay, gravel, and cobbles.

The surficial layer of topsoil and/or fill was observed to be underlain by a silty clay deposit. The upper portion of the silty clay has been weathered to a brown desiccated crust. In situ shear vane field tests carried out within the silty clay crust yielded peak undisturbed shear strength values between 80 and 249 kPa. These values reflect a stiff to hard consistency in the silty clay crust.

Unweathered, grey silty clay was encountered below the brown silty clay crust. The silty clay deposit was observed to present a thickness in excess of 9 m at the west portion of the subject site and thinning out towards the east.

Glacial till was observed underlying the above-noted deposits at most locations at the subject site. The fine matrix of the glacial till generally consisted of silty clay with varying amounts of sand. Gravel, cobbles, and boulders were also present throughout the glacial till deposit at the subject site.

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

Laboratory Testing

Atterberg Limits and Moisture Content Test

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

Table 1 – Atterberg Limits Results

Borehole	Sample	Depth (m)	LL (%)	PL (%)	PI (%)	w (%)	Classification
TP 1-21	G4	2.0	61	31	30	36.0	CH
TP 3-21	G3	1.9	69	31	38	40.7	CH
TP 4-21	G3	1.1	57	32	25	37.6	MH
TP 5-21	G3	2.1	73	37	36	45.0	MH
TP 6-21	G2	0.9	63	34	29	42.3	MH
TP 7-21	G3	0.7	59	32	27	38.5	MH
TP 8-21	G3	1.0	70	44	26	49.7	MH
TP 9-21	G2	0.6	58	32	26	23.6	MH
TP 10-21	G4	1.5	60	33	27	35.8	MH
TP 11-21	G4	2.1	65	35	30	43.6	MH
TP 12-21	G2	0.8	75	37	38	37.4	MH
TP 16-21	G1	0.3	57	29	28	36.9	CH
TP 17-21	G1	0.6	65	36	29	39.9	MH
TP 17-21	G2	1.3	57	31	26	35.1	MH
TP 18-21	G1	0.4	66	36	30	35.5	MH
TP 19-21	G2	1.5	61	32	29	32.9	MH
TP 20-21	G1	1.0	76	39	37	39.2	MH

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

Shrinkage Test

The results of the shrinkage limit test indicate a shrinkage limit of 22% and a shrinkage ratio of 1.71.

Grain Size Distribution Results

Grain size distribution (sieve and hydrometer analysis) was also completed on selected soil samples. The results of the grain size analysis are summarized in Table 2 and presented on the Grain-Size Distribution and Hydrometer Testing Results sheets in Appendix 1.

Table 2 – Summary of Grain Size Distribution Analysis

Borehole	Sample	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
TP 2-21	G4	0.0	0.2	27.3	72.5
TP 7-21	G3	0.0	14.4	29.6	56.0
TP 10-21	G4	0.0	14.4	31.2	67.5
TP 12-21	G2	0.0	2.7	26.8	70.5
TP 18-21	G1	0.0	15.4	34.1	50.5

Bedrock

Based on available geological mapping, the depth to bedrock across the site generally ranges from ground surface to 25 m. The depth to bedrock throughout the western portion of the tributary creek has been mapped to range between 15 to 25 m. Limestone of the Bobcaygeon formation is located throughout the majority of the subject site, with the exception of the western portion which is underlain by interbedded limestone and dolomite of the Gull River formation.

Reference should be made to the Soil Profile and Test Data sheets in Appendix 1 for the details of the soil profiles encountered at each test hole location and Drawing PG5201-1 - Bedrock Contour Plan in Appendix 2 for approximate bedrock contours based on refusal elevations.

4.3 Groundwater

Groundwater levels were recorded at each borehole instrumented with a piezometer and as noted upon completion of the test pits. The long-term groundwater can be estimated based on these observations, recovered soil samples' moisture levels, and observed colouring and consistency of the recovered samples. Based on these observations, the long-term groundwater level is anticipated at a depth of approximately 3 to 4 m below ground surface.

The recorded groundwater levels are noted on the applicable Soil Profile and Test Data sheet presented in Appendix 1. It should be noted that groundwater levels are subject to seasonal fluctuations and could vary at the time of construction.

5.0 Discussion

5.1 Geotechnical Assessment

From a geotechnical perspective, the subject site is adequate for the proposed residential development. It is expected that the proposed buildings will be founded on conventional spread footings placed on an undisturbed, silty clay, glacial till, engineered fill and/or surface-sounded bedrock bearing surface.

Due to the presence of a silty clay layer, proposed grading throughout the subject site will be subjected to a permissible grade raise restriction. Our permissible grade raise recommendations are discussed in Subsection 5.3. Should existing grades be raised at the site for the proposed development, it is expected that several options, such as engineered fill or well graded blast rock, would act as suitable subgrade material for the proposed buildings provided the material is adequately placed and approved by the geotechnical consultant at the time of placement.

It is anticipated that some bedrock removal will be required for basement construction and site servicing activities. All contractors should be prepared for bedrock removal within the subject site.

Follow-up site visits have been completed to review the slope conditions along the tributary ravine slopes to confirm that our original Limit of Hazard Lands recommendations are still applicable for the subject slopes. Photographs from our site visits are presented in Appendix 2.

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

5.2 Site Grading and Preparation

Stripping Depth

Topsoil, and any deleterious fill, such as those containing significant amounts of 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 adequate bearing soils below the founding level during site preparation activities. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional suitable fill material.

Due to the relatively shallow bedrock depth at the east portion of the subject site, bedrock removal might be required for basement construction and site servicing activities.

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 or Granular B Type II. The imported fill material should be tested and approved prior to delivery.

Non-specified existing fill along with site-excavated soil can be placed as general landscaping fill where settlement of the ground surface is of minor concern. These materials should be spread in thin lifts compacted by the tracks of the spreading equipment to minimize voids. If the material is to be placed to increase the subgrade level for areas to be paved, the fill should be compacted in maximum 300 mm lifts and compacted to 95% of the material's SPMDD. Non-specified existing fill and site-excavated soils are not suitable for placement as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Where blast rock it to be used as fill to build up the bearing medium, it should be suitably fragmented to produce a well-graded material with a maximum particle size of 400 mm placed in maximum 600 mm loose lifts and compacted using a large smooth drum vibratory roller making several passes per lift and approved by the geotechnical consultant at the time of placement. Any blast rock greater than 400 mm in diameter should be segregated and hoe rammed into acceptable fragments. The blast rock fill should be capped with a minimum of 300 mm of Granular B Type II or Granular A crushed stone material and should be compacted to at least 98% of its SPMDD.

Bedrock Removal

In areas where shallow bedrock is encountered, and only a small quantity of bedrock is to be removed, bedrock removal may be possible by hoe-ramming. However, dependent on the quantity and condition of the bedrock, line-drilling in conjunction with hoe-ramming may be required to remove the bedrock. All contractors should be prepared for bedrock removal within the subject site.

Vibration Considerations

Construction operations could cause vibrations, and possibly, sources of nuisance to the community. Therefore, means to reduce the vibration levels as much as possible should be incorporated in the construction operations to maintain a cooperative environment with the residents.

The following construction equipment could cause vibrations: hoe ram, compactor, dozer, truck traffic, etc. Vibrations caused by construction operations could cause detrimental vibrations on the adjoining buildings and structures. Therefore, it is recommended that all vibrations be limited.

Two parameters determine the recommended vibration limit: the maximum peak particle velocity and the frequency. As a guideline, the peak particle velocity should be less than 15 mm/s between frequencies of 4 to 12 Hz, and 50 mm/s above a frequency of 40 Hz (interpolate between 12 and 40 Hz). These guidelines are for current construction standards. These guidelines are above perceptible human level and, in some cases, could be very disturbing to some people. A pre-construction survey is recommended to minimize the risks of claims during or following the construction of the proposed buildings.

5.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 2 m wide, and pad footings, up to 4 m wide, placed on an undisturbed, stiff silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **150 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **225 kPa**.

Footings placed on an undisturbed, compact silty sand and/or glacial till bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

An undisturbed soil bearing surface consists of a surface from which all topsoil and deleterious materials, such as loose, frozen or disturbed soil, whether in situ or not, have been removed, in the dry, prior to the placement of concrete for footings.

Footings placed on clean, surface-sounded bedrock can be designed using a factored bearing resistance value at ULS of **500 kPa**. A clean, weathered bedrock surface consists of one from which all topsoil, soils, deleterious materials and loose rock have been removed prior to concrete placement.

Footings placed over an approved engineered fill bearing surface can be designed using a bearing resistance value at SLS of **150 kPa** and a factored bearing resistance value at ULS of **225 kPa**.

A geotechnical resistance factor of 0.5 was applied to the above noted bearing resistance value at ULS.

Settlement

Footings designed using the bearing resistance value at SLS given above will be subjected to potential post construction total and differential settlements of 25 and 20 mm, respectively. A post-development groundwater lowering of 0.5 m was assumed.

Footings bearing on an acceptable bearing surface and designed for the bearing resistance value provided herein will be subjected to negligible potential postconstruction total and differential settlement.

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 a silty sand, clayey silt, silty clay, glacial till or engineered fill bearing medium 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.

Adequate lateral support is provided to a sound bedrock bearing medium when a plane extending horizontally and vertically from the footing perimeter at a minimum of 1H:6V (or shallower) passing through sound bedrock or a material of the same or higher capacity as the bedrock, such as concrete.

A heavily fractured, weathered bedrock will require a lateral support zone of 1H:1V, or flatter.

Permissible Grade Raise

Based on our soil information for the subject site, a **2.0 m** permissible grade raise restriction is recommended for areas where the silty clay deposit is located below design footing level and in the immediate area of settlement sensitive structures. However, in areas where the silty clay deposit is located below roads, a permissible grade raise restriction of **2.5 m** is recommended. Permissible grade raise areas are indicated on Drawing PG5201-3 – Permissible Grade Raise Restriction Area, included in Appendix 2 of this report.

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.

5.4 Design for Earthquakes

The subject site can be taken as seismic site response **Class D** as defined in Table 4.1.8.4.A of the Ontario Building Code (OBC) 2012 for foundations considered at this site. A site specific shear wave velocity test may be completed to accurately determine the applicable seismic site classification for foundation design of the proposed residential development.

The soils underlying the site are not susceptible to liquefaction. Reference should be made to the latest revision of the Ontario Building Code for a full discussion of the earthquake design requirements.

5.5 Basement Slab / Slab-on-Grade Construction

With the removal of all topsoil and deleterious fill within the footprint of the proposed buildings, the native undisturbed soil surface or approved engineered fill surface will be considered to be an acceptable subgrade upon which to commence backfilling for floor slab construction.

Any soft areas should be removed and backfilled with appropriate backfill material prior to placing any fill. OPSS Granular B Types I or II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab.

For structures with basements, it is recommended that the upper 200 mm of sub-floor fill consist 19 mm clear crushed stone. For structures with slab-on-grade construction, the upper 200 mm of sub-slab fill is recommended to consist of OPSS Granular A crushed stone.

All backfill material within the footprint of the proposed buildings should be placed in maximum 300 mm thick loose layers and compacted to a minimum of 98% of SPMDD.

5.6 Pavement Structure

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 3 - Recommended Asphalt 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

Notes:
SUBGRADE - Either in situ soil or OPSS Granular B Type I or II material placed over in situ soil. Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this pavement structure.

Table 4 - Recommended Asphalt Pavement Structure - Local Residential Roadways

Thickness (mm)	Material Description
40	**Wear Course** - Superpave 12.5 Asphaltic Concrete
50	**Binder Course** - Superpave 19.0 Asphaltic Concrete
150	**Base** - OPSS Granular A Crushed Stone
400	**Subbase** - OPSS Granular B Type II

Notes:
SUBGRADE - Either in situ soil or OPSS Granular B Type I or II material placed over in situ soil. Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this pavement structure.

Table 5 - Recommended Asphalt Pavement Structure - Collector/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

Notes:
SUBGRADE - Either in situ soil or OPSS Granular B Type I or II material placed 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 I or 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

It is recommended that a perimeter foundation drainage system be provided for the proposed structures. The system should consist of a 100 to 150 mm diameter perforated and 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 structure. The pipe should have a positive outlet, such as a gravity connection to the storm sewer.

Foundation Backfill

Backfill against the exterior sides of the foundation walls should consist of free-draining, non frost susceptible granular materials. The site materials will be frost susceptible and, as such, are not recommended for re-use as backfill unless a composite drainage system is connected to a drainage system is provided.

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 are more prone to deleterious movement associated with frost action. These should be provided with a minimum 2.1 m thick soil cover (or insulation equivalent).

6.3 Excavation Side Slopes

Open Excavation

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

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.

It is recommended that a dewatering program, such as a series of well points design and installed by a licensed contractor specialized in dewatering, be completed for service installation completed below the groundwater level for areas in non-cohesive soils.

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.

Excavation Base Stability

The base of supported excavations can fail by three (3) general modes:

- ❒ Shear failure within the ground caused by inadequate resistance to loads imposed by grade difference inside and outside of the excavation,
- ❒ Piping from water seepage through granular soils, and
- ❒ Heave of layered soils due to water pressures confined by intervening low permeability soils.

Shear failure of excavation bases is typically rare in granular soils if adequate lateral support is provided. Inadequate dewatering can cause instability in excavations made through granular or layered soils. The potential for base heave in cohesive soils should be determined for stability of flexible retaining systems.

The factor of safety with respect to base heave, FS_b, is:

$$FS_b = N_b s_u / \sigma_z$$

where:

N_b - stability factor dependent upon the geometry of the excavation and provided in Figure 1 below.
s_u - undrained shear strength of the soil below the base level.
σ_z - total overburden and surcharge pressures at the bottom of the excavation.

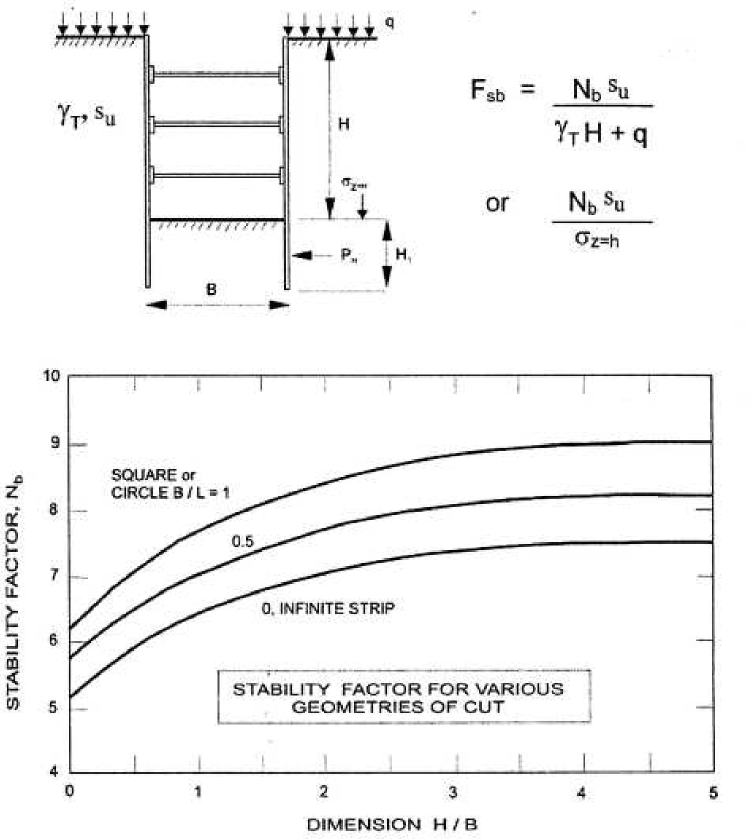


Figure 1 – Stability Factors for Various Cut Geometries

In the case of soft to firm clays, a factor of safety of 2 is recommended for base stability.

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 City of Ottawa.

The pipe bedding for sewer and water pipes placed on a relatively dry, undisturbed subgrade surface should consist of a minimum of 150 mm of OPSS Granular A crushed stone. However, the bedding thickness should be increased to 300 mm for areas over a bedrock subgrade or grey silty clay.

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 and cover materials should be placed in maximum 225 mm thick lifts compacted to 99% of the material's SPMDD.

It is recommended that the subgrade medium be inspected in the field to determine how steeply the bedrock surface, where encountered, drops off. A transition should be provided where the bedrock slopes more than 3H:1V. At these locations, the bedrock should be excavated and replaced with additional bedding materials to provide a 3H:1V (or flatter) transition from the bedrock subgrade towards the soil subgrade. This treatment reduces the propensity for bending stress to occur in the services.

Generally, it should be possible to re-use the moist (not wet) brown silty clay above the cover material if the excavation and filling operations are carried out in dry weather conditions. Wet silty clay should be given a sufficient drying period to decrease its moisture content to an acceptable level to make compaction possible prior to being re -used. All cobbles greater than 200 mm in the longest direction should be removed prior to the site materials being reused.

Where hard surface areas are considered above the trench backfill, the trench backfill material within the frost zone (about 1.8 m below finished grade) should consist of the soils exposed at the trench walls to minimize differential frost heaving. The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to a minimum of 95% of the SPMDD.

To reduce long-term lowering of the groundwater level at the subject site, clay seals should be provided in the servicing 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, subbedding and cover material. The barriers should consist of a relatively dry 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

Groundwater Control for Building Construction

Due to the relatively impervious nature of the silty clay, it is expected that groundwater infiltration into the excavations should be controllable using open sumps and pumps for the relatively shallow excavations.

The contractor should be prepared to direct water away from all bearing surfaces and subgrades, regardless of the source, to prevent disturbance 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.

6.6 Winter Construction

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

The subsoil conditions at this site consist mostly 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 from an adjacent site 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 slightly aggressive to non-aggressive corrosive environment.

6.8 Limit of Hazard Lands

Summary of Assessment

The existing slope conditions were reviewed by Paterson field personnel throughout multiple site visits. The initial visit was completed on April 18, 2012, to document the conditions of the tributaries to Cardinal Creek (south tributary, Mid Branch 1 and Mid Branch 2). A second site visit was completed on September 10, 2022. At the time, it was concluded that the slopes along the tributaries to Cardinal Creek were observed to be stable. However, some toe erosion was noted throughout the watercourse, close to the valley corridor wall.

A third site visit was completed on July 12, 2023, to compare the current conditions with previous observations made at the subject site. Photos comparing the previous and current conditions have been included in Appendix 2.

The field review completed during the aforementioned visits generally consisted of observing surface conditions along the length of the tributaries, including identifying the presence of vegetation, erosion and other features associated with slope stability. Paterson field personnel verified subsurface information and in-situ shear strength of cohesive soils at select slope sections using a hand-auger and field vane apparatus, respectively, to compare them to the findings from our borehole and test pit test hole observations.

Water levels and flow within the watercourses were generally observed, including identifying signs of recent high-water marks or other signs of previous rises in the water levels.

Overall, a total of twenty-three (23) slope cross sections throughout the above-noted locations were analyzed as part of the slope stability analysis. Topographic surface elevation measured at the selected locations and LiDAR information were used to complete the slope stability analysis.

Based on the results of our field observations and slope stability analysis, a Limit of Hazard Lands was assigned from the top of slope for the above-noted sections of the study areas. The cross-section locations and associated Limit of Hazard Lands setbacks are presented on Drawing PG5201-2 - Test Hole Location Plan, included in Appendix 2 of the present geotechnical report.

Summary of Field Observations

The following section is a summary of our observations during the time of our field review of the subject slopes.

The subject site is intersected by a number of watercourses including the south tributary ravine that drains into Cardinal Creek and two branches opening from the aforementioned tributary designated in this report, from south to north, as Mid Branch 1 and Mid Branch 2. The south tributary was observed to flow in east to west direction throughout the central portion of the subject site and the two branches were observed to flow from a southeast to a northwest direction.

The general slope of the bank was observed to range between 3 to 15 m high and appeared to have a profile generally shaped 5H:1V with local sections with approximate steepness of up to 1H:1V. The watercourses were observed to be up to 6 m wide, with seasonal variations in water flow.

The majority of the slope appeared to consist of stiff, brown silty clay, which was underlain by firm, grey silty clay in close proximity to the water level. Some erosion of the toe of slope had been observed where the watercourse is located in close proximity to the valley corridor wall. This generally consisted of some erosion of the bank face resulting in some undercutting along the channels edge at some locations. Occasional shallow and low slip surfaces restricted to close proximity to the water level were observed in areas with sharp bends in the channel alignment. Overall, vegetation was observed to be intact and mature across the majority of the tributary valley. The bed of the water course generally observed to consist of glacial till and transition to stiff, grey silty clay further downstream along its footprint.

Reference should be made to Drawing PG5201-2 – Test Hole Location Plan in Appendix 2 which depicts the above-noted tributaries and the associated slope stability cross-sections and setback information.

Slope Stability Analysis

A slope stability assessment has been conducted to determine the applicable geotechnical Limit of Hazard Lands setback along the north bank of the main tributary to Cardinal Creek within the subject site. The analysis of the stability of the slope was carried out using SLIDE, a computer program which 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 favoring 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 that 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 total of twenty-three (23) slope cross-sections were analyzed under static and seismic conditions. The cross-sections for existing and proposed conditions were analyzed utilizing the latest topographic mapping and proposed grading, respectively, and assuming the worst-case-scenario by assigning cohesive soils under fully saturated conditions.

Subsoil conditions at the sections were determined based on the findings at borehole locations along the top of slope, field observations during site visits and general knowledge of the area's geology. The soil parameters were determined for the slope soils based on subsoil conditions at the boreholes along the top of slope. The analysis was carried out in accordance with the City of Ottawa's standard guidelines prepared by Golder Associates titled Slope Stability Guidelines for Development Applications in the City of Ottawa, dated 2004.

The effective strength soil parameters used for static analysis were chosen based on the subsoil information recovered during the geotechnical investigation. The effective strength soil parameters used for static analysis are presented in Table 6 on the following page.

Table 6 - Effective Soil and Material Parameters (Static Analysis)

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Brown Silty Clay Crust	17	36	9
Grey Silty Clay	16	36	12
Glacial Till	20	33	1
Bedrock	Impenetrable		

The total strength parameters for seismic analysis were chosen based on the in situ, undrained shear strengths recovered within the test holes completed at the time of our geotechnical investigation and based on our general knowledge of the area's geology. The strength parameters used for seismic analysis at the slope cross-sections are presented in Table 7 below.

Table 7 - Total Stress Soil and Material Parameters (Seismic Analysis)

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Undrained Shear Strength (kPa)
Brown Silty Clay Crust	17	-	100
Grey Silty Clay	16	-	80
Glacial Till	20	33	N/A
Bedrock	Impenetrable		

Static Conditions Analysis - Existing Conditions

The results for the existing static slope conditions at the slope stability sections are presented in Appendix 2. The slope stability factors of safety were found to be greater than 1.5 at all sections analyzed, except for Sections F and JJ, which require a 4.7 and 17 m setback, respectively from top of slope to obtain a factor or safety greater than 1.5.

Static Conditions Analysis - Proposed Conditions

The results for the analysis of the stability of the slope under proposed conditions are presented in Appendix 2. The slope stability factors of safety were found to be greater than 1.5 at all sections analyzed.

Seismic Loading Analysis- Existing Conditions

An analysis considering seismic loading was also completed as part of our slope stability assessment. A horizontal seismic acceleration, K_h, of 0.21g was considered for the analyzed sections. This acceleration is considered to be higher than half of the peak (horizontal) ground acceleration (PGA) of 0.32g, specified in the National Building Code of Canada (NBCC 2015) seismic calculator for the subject site.

A factor of safety of 1.1 is considered to be satisfactory for stability analysis including seismic loading (i.e., pseudo-static) as per the City of Ottawa's Slope Stability Guidelines for Development Applications.

The results of the analysis including seismic loading fully saturated conditions (worst-case-scenario) are shown in Appendix 2. The overall slope stability factor of safety at all slope cross-sections when considering seismic loading was found to be greater than 1.1 which is considered to be stable under seismic loading.

Seismic Loading Analysis- Proposed Conditions

An analysis considering seismic loading was completed for the proposed conditions as part of the slope assessment. A horizontal seismic acceleration, K_h, of 0.16g was considered for the slopes. This acceleration is considered as half of the peak (horizontal) ground acceleration (PGA) of 0.32g, specified in the NBCC 2015. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading.

The results of the analysis including seismic loading fully saturated conditions (worst-case-scenario) are shown in Appendix 2. The overall slope stability factor of safety at all slope cross-sections when considering seismic loading was found to be greater than 1.1 which is considered to be stable under seismic loading.

Limit of Hazard Lands

Based on our review, the slopes reviewed as part of this assessment are considered stable from a geotechnical perspective. Since the slopes are in close proximity to an active watercourse, erosion of the toe of slope is considered to be a notable factor in assessing slope stability. The banks abutting the watercourse were observed to be affected by minor signs of erosion. Signs of active erosion were mostly noted in the lower portion of the slopes and consisted of occasional small patches of loss vegetation or exposed root systems along the face of slope.

Generally, subsurface conditions at the toe of slope varied between in-situ, stiff, brown to grey silty clay. Based on the cohesive nature of the soils, the observed current erosional activities and the width and location of the current watercourse, the toe erosion allowance for the valley corridor slopes was determined.

Based on the above-note observations, and in accordance with the City of Ottawa's *Slope Stability Guidelines for Development Applications* (2004) and the Ministry of Natural Resource's *Technical Guide – River and Stream Systems: Erosion Hazard Limit* (2002), it is considered that a toe erosion allowance of 5 m is appropriate for the corridor walls confining the subject tributaries. The toe erosion allowance should be applied from the top of stable slope.

If portions of the slope were to be improved by the use of erosion protection methods, those portions would not be subject to the aforementioned toe erosion allowance as the toe of slope would no longer be susceptible to erosion that would impact the stability of the overlying slopes.

A stable slope allowance in accordance with the requirements outlined for Section F and Section JJ should also be taken from the top of slope, as required.

The limit of hazard lands, including a 6 m erosion access allowance, stable slope allowance (where required) and a 5 m toe erosion allowance, is presented on Drawing PG5201-2 - Test Hole Location Plan in Appendix 2.

In-filling The Side Slopes at Select Locations

Based on Paterson's geotechnical review of select locations along the creek, it can be observed that the creek is branching out towards the north side of the creek, just east of Section EE and Section FF. This is a consequence of the predevelopment conditions associated with the agricultural use of the lands and the current grading. However, it is expected that under the proposed conditions, and providing a favourable grading, the creek will cease branching and the slope will remain stable. To mitigate the temporary branching of the tributary, it is recommended that the slope face be in-filled using the following methodology:

- ❒ Site excavated material such as workable, brown silty sand or any approved site excavated material, free of deleterious fill such as organics or construction debris, can be used as backfill material to in-fill the current slope and extend the slope face to match the existing adjacent slopes.
- ❒ The existing slope should be excavated in a benching style where each "bench" should be excavated with a minimum 1.2 m long horizontal ledge and maximum vertical cut of 600 mm.

- ☐ The backfill material should be placed in maximum 300 mm thick loose lifts and compacted to a minimum 98% of the material's SPMDD using suitable compaction equipment. The placement of the backfill material should be completed under dry conditions and above freezing temperatures to achieve optimum compaction levels.
- ☐ The backfill material should be topped with a minimum 300 mm thick layer of topsoil followed by an erosion control blanket (coco mat) and hardy grass seed. The erosion control blanket should be anchored to the top of the slope using steel pins penetrating the top of slope by a minimum of 600 mm to keep the erosion control blanket stable until vegetation is established.
- ☐ The proposed slope face should be finished to match the adjacent slope faces material and inclination. Planting trees along the slope face can be beneficial to increase the stability of the slope face and minimize erosion, if applicable.
- ☐ All work within the slope face should be reviewed and approved by Paterson at the time of construction to ensure the work is being completed in accordance with the recommendations provided herein.
- ☐ Refer to Figure 42 - Recommended Slope In-filling Program presenting a cross section of the above noted program. The limit of hazard lands line will also be modified as a new top of slope line will be identified, please refer to Drawing PG5201-2 - Test Hole Location Plan, in Appendix 2.

6.9 Landscaping Considerations

Tree Planting Restrictions

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) for trees planted within a public right-of-way (ROW). Atterberg limits testing was completed for recovered silty clay samples at selected locations throughout the subject site. Grain size distribution analysis was also completed on selected soil samples.

The above-noted test results were completed on samples taken at depths between the anticipated underside of footing elevation and a 3.5 m depth below finished grade. The results of our testing are presented in Tables 1 and 2 in Subsection 4.2 and in Appendix 1.

A low to medium sensitivity clay was encountered between the anticipated design underside of footing elevation and 3.5 m below finished grade as per City Guidelines. Based on the results of the Atterberg limit testing mentioned above, the modified plasticity index does not exceed 40% across the subject site.

The following tree planting setbacks are recommended for the proposed development. Large trees (mature height over 14 m) can be planted within these areas provided a tree to foundation setback equal to the full mature height of the tree can be provided (e.g. in a park or other green space).

Tree planting setback limits may be reduced to 4.5 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 condition noted below are met:

- ❒ The underside of footing (USF) is 2.1 m or greater below the lowest finished grade must be satisfied for footings within 10 m from the tree, as measured from the centre of the tree trunk and verified by means of the Grading Plan. Based on our review of the silty clay crust at the founding elevation, this number can be lowered to 1.8 m due to the depth of the groundwater table and our assessment of the impacts of tree planting on the founding medium.
- ❒ A small tree must be provided with a minimum of 25 m^3 of available soil 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).

It is well documented in the literature, and is our experience, that fast-growing trees located near buildings founded on cohesive soils that shrink on drying can result in long-term differential settlements of the structures.

Tree varieties that have the most pronounced effect on foundations are seen to consist of poplars, willows and some maples (i.e., Manitoba Maples) and, as such, they should not be considered in the landscaping design.

Preference should be provided throughout the subject site to landscaping that do not require overwatering and/or sprinkler systems.

Aboveground Swimming Pools

The in-situ soils are considered to be 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 recommendations.

Aboveground Hot Tubs

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

Decks and Building Additions

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

Additional Recommendations

Swimming pools, hot tubs and ponds located along the south tributary of Cardinal Creek should not be permitted to sheet drain/outlet along the existing slope, including top, face and/or toe of slope. Aboveground swimming pools or building additions that might result in increased surcharge along the slope of the tributary ravine should require reassessment of the slope stability analysis by Paterson at the time of planning those works.

7.0 Recommendations

It is recommended that the following be completed by Paterson once the final master plan and site development are determined:

- Review detailed grading plan(s) from a geotechnical perspective.
- Observation of all bearing surfaces prior to the placement of concrete.
- Sampling and testing of the concrete and fill materials.
- Review and inspection of all foundation drainage systems.
- 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.

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.

All excess soil, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site, must be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management*.

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 Taggart Investments 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
October 18, 2024
F. I. ABOU-SEIDO
100156744
PROVINCE OF ONTARIO

Drew Petahtegoose, P.Eng.

Faisal I. Abou-Seido, P.Eng.

Report Distribution:

- ☐ Taggart Investments (Digital copy)
- ☐ Paterson Group (1 copy)

APPENDIX 1

SOIL PROFILE AND TEST DATA SHEETS

SYMBOLS AND TERMS

GRAIN SIZE DISTRIBUTION AND ANALYSIS RESULTS

ATTERBERG LIMIT TESTING RESULTS

ANALYTICAL TESTING RESULTS

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

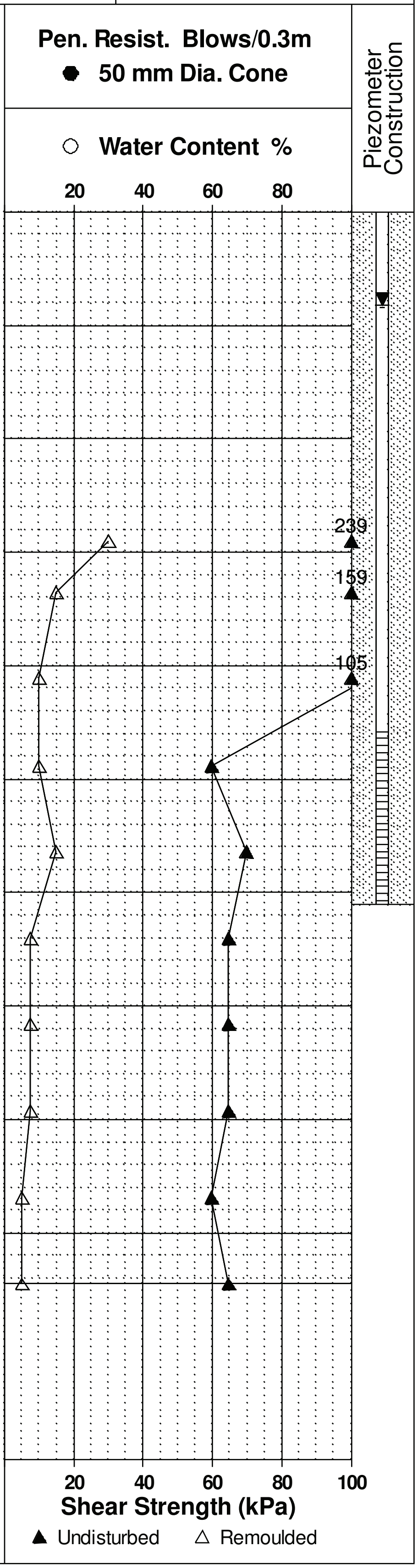
BORINGS BY CME 55 Power Auger

DATE January 23, 2009

FILE NO. PG1796

HOLE NO. BH 8

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.11
TIOPSOIL 0.30		AU	1				
		SS	2	42	9	1	86.11
		SS	3	67	5	2	85.11
Hard to very stiff, brown **SILTY CLAY**						3	84.11
						4	83.11
- stiff and grey-brown by 4.3m depth						5	82.11
						6	81.11
						7	80.11
- grey by 7.9m depth						8	79.11
						9	78.11
9.45							
End of Borehole (GWL @ 0.82m-Feb. 3/09)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

REMARKS

HOLE NO. BH10

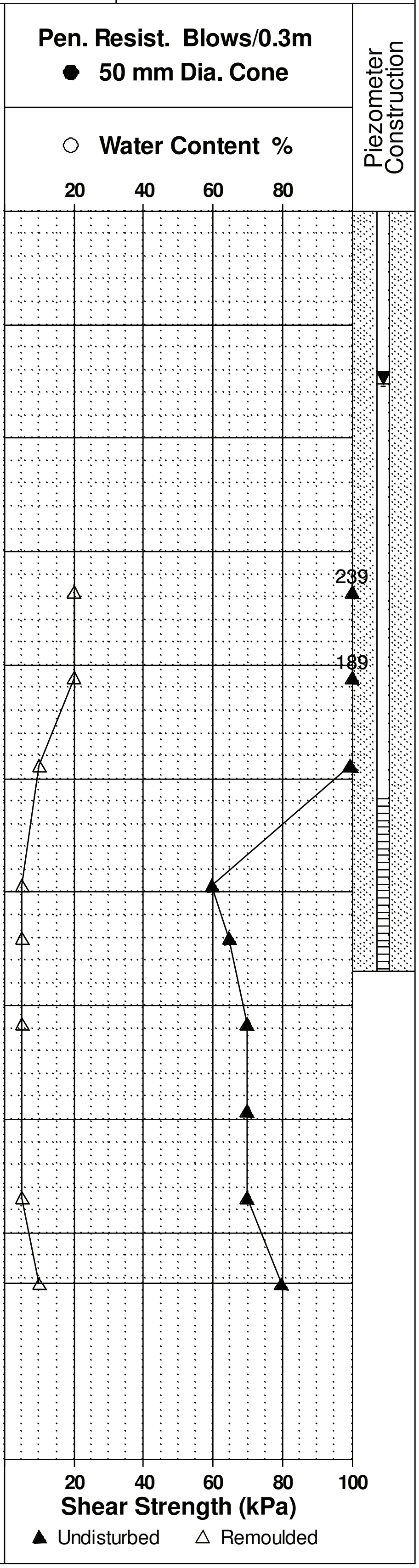
BORINGS BY CME 55 Power Auger

DATE January 22, 2009

SOIL DESCRIPTION	Depth (m)
GROUND SURFACE	
TOPSOIL	0.20
Hard to very stiff, brown **SILTY CLAY** - stiff and grey by 4.3m depth	9.45
End of Borehole (GWL @ 1.52m-Feb. 3/09)	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
AU	1		
SS	2	58	10
SS	3	75	11
SS	4	83	8

DEPTH (m)	ELEV. (m)
0	86.36
1	85.36
2	84.36
3	83.36
4	82.36
5	81.36
6	80.36
7	79.36
8	78.36
9	77.36



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 23, 2009

FILE NO. PG1796

HOLE NO. BH11

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.75
TOPSOIL 0.30		AU	1				
Very stiff, brown **SILTY CLAY** with organic matter 0.69							
GLACIAL TILL: Compact to dense, brown silty sand with clay, gravel, cobbles and boulders		SS	2	75	8	1	88.75
		SS	3	50	20	2	87.75
2.95		SS	4	80	50+		
End of Borehole Practical refusal to augering @ 2.95m depth							

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

○ **Water Content %**

20 40 60 80

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

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

REMARKS

HOLE NO. BH13

BORINGS BY CME 55 Power Auger

DATE January 26, 2009

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 % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	92.03		
TOPSOIL 0.30	■	AU	1						
Very stiff, brown **SILTY CLAY**, some sand 0.71	▨								
End of Borehole Practical refusal to augering @ 0.71m depth									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

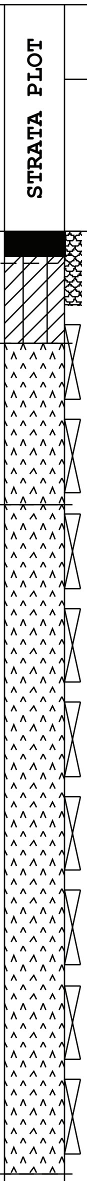
REMARKS

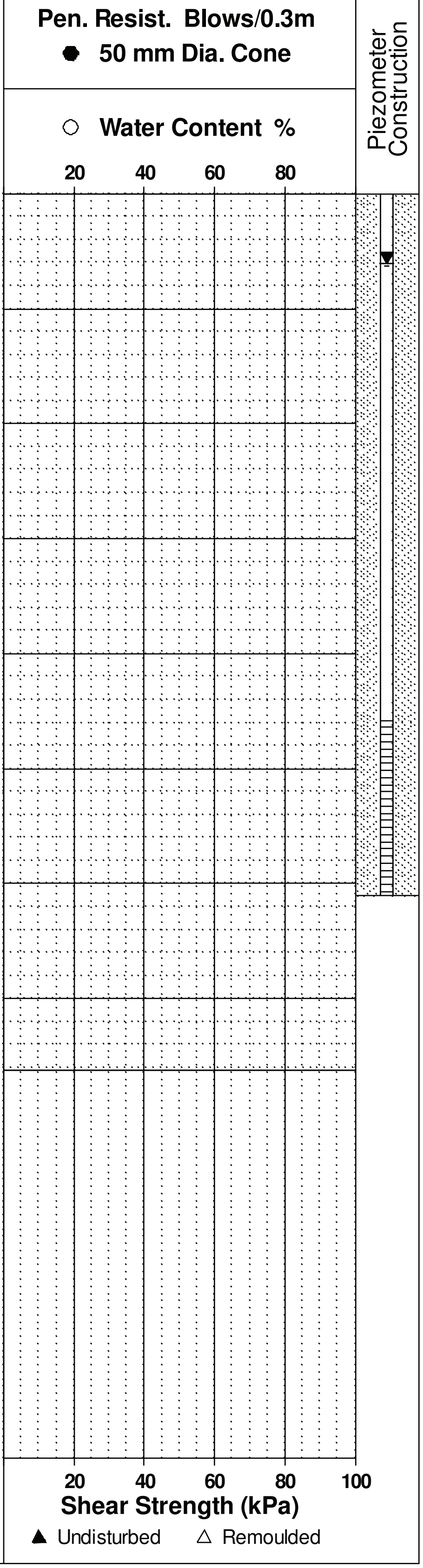
BORINGS BY CME 55 Power Auger

DATE January 26, 2009

HOLE NO. BH14

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.88
TOPSOIL	0.20	AU	1				
Very stiff, brown **SILTY CLAY**	0.91						
		SS	2	67	54	1	87.88
GLACIAL TILL: Very dense, brown silty sand with clay, gravel, cobbles and boulders		SS	3	33	54		
	2.21					2	86.88
		SS	4	50	24	3	85.88
		SS	5	50	13		
		SS	6	33	16	4	84.88
GLACIAL TILL: Very stiff, grey silty clay with sand, gravel, cobbles and boulders		SS	7	38	30	5	83.88
		SS	8	25	31	6	82.88
		SS	9	38	44	7	81.88
		SS	10	42	42		
	7.62						
End of Borehole							
(GWL @ 0.61m-Feb. 3/09)							





patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 26, 2009

FILE NO. PG1796

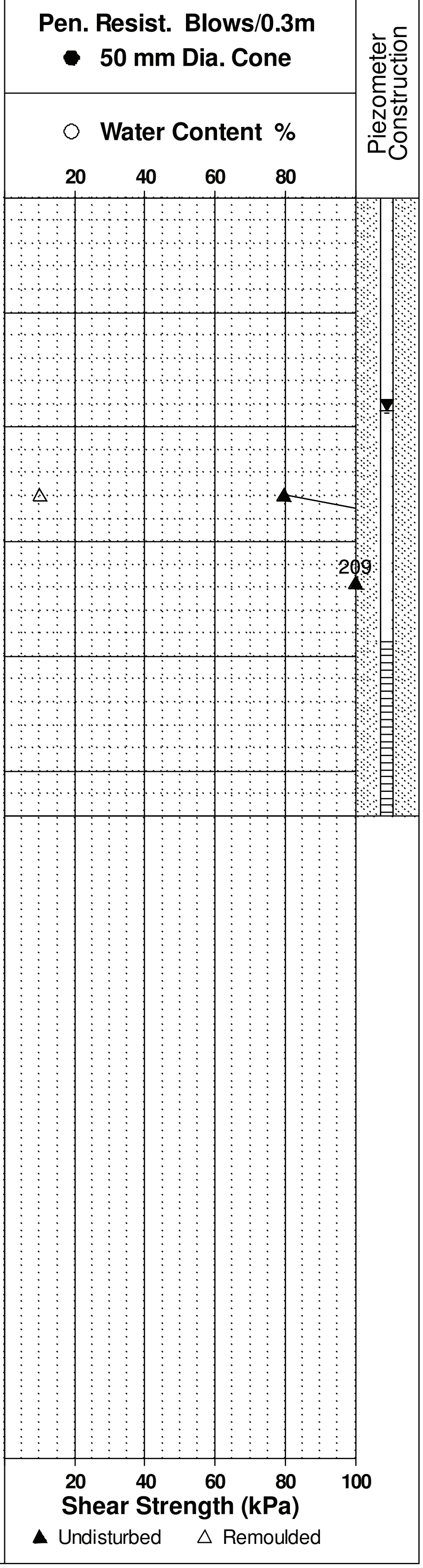
HOLE NO. BH15

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	88.13
TOPSOIL 0.25		AU	1				
Stiff, brown **SILTY CLAY**, some organic matter to 1.4m depth		SS	2	8	9	1	87.13
		SS	3	42	4	2	86.13
2.82							
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles		SS	4	100	2	3	85.13
						4	84.13
		SS	6	42	14	5	83.13
5.13							
GLACIAL TILL: Compact, grey silty sand with gravel, cobbles and boulders 5.39		SS	7	0	50+		

End of Borehole

Practical refusal to augering @ 5.39m depth

(GWL @ 1.86m-Feb. 3/09)



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

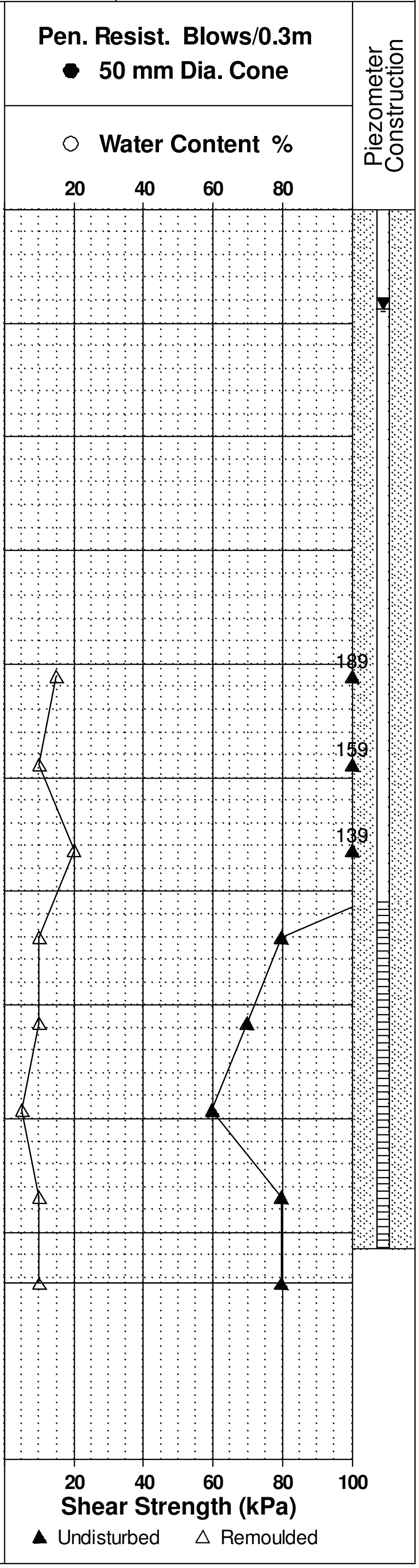
BORINGS BY CME 55 Power Auger

DATE January 23, 2009

FILE NO. PG1796

HOLE NO. BH17

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.28
TOPSOIL	0.20	AU	1				
		SS	2	54	14	1	85.28
		SS	3	50	12	2	84.28
		SS	4	71	9	3	83.28
		SS	5	75	5		
Very stiff, brown **SILTY CLAY**						4	82.28
						5	81.28
- stiff and grey-brown by 5.9m depth						6	80.28
- grey by 6.6m depth						7	79.28
						8	78.28
						9	77.28
End of Borehole	9.45						
(GWL @ 0.88m-Feb. 3/09)							



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

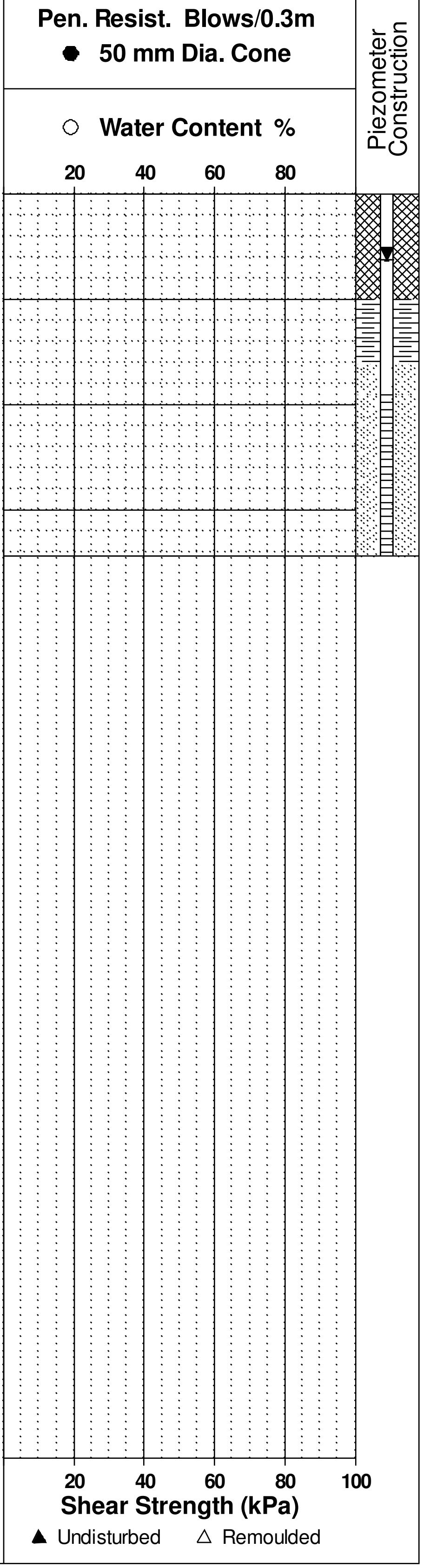
BORINGS BY CME 55 Power Auger

DATE April 4, 2012

FILE NO. PG1796

HOLE NO. BH 8-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.00
TOPSOIL 0.23							
Hard, brown **SILTY CLAY**		AU	1				
		SS	2	100	34	1	89.00
1.45							
GLACIAL TILL: Very dense, brown silty sand with gravel, cobbles, boulders, trace clay		SS	3	82	50+	2	88.00
3.43		SS	4	100	50+	3	87.00
End of Borehole Practical refusal to augering @ 3.43m depth (GWL @ 0.62m-April 13, 2012)							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

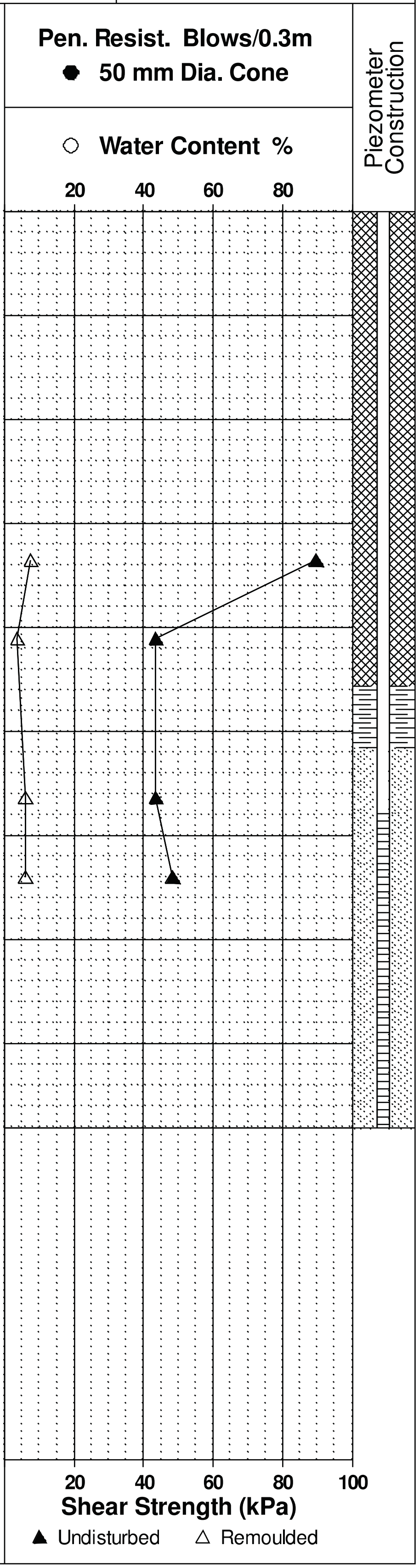
REMARKS

HOLE NO. BH24-12

BORINGS BY CME 55 Power Auger

DATE April 2, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.44
Brown **SILTY SAND,** trace clay 0.20		AU	1				
		AU	2				
		SS	3	100	21	1	86.44
		SS	4	100	16		
						2	85.44
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	9		
						3	84.44
- firm and grey by 3.6m depth							
						4	83.44
		TW	6	100			
						5	82.44
						6	81.44
6.63							
						7	80.44
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	7	62	15	8	79.44
8.81							
End of Borehole Practical refusal to augering @ 8.81m depth (BH dry - April 13, 2012)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

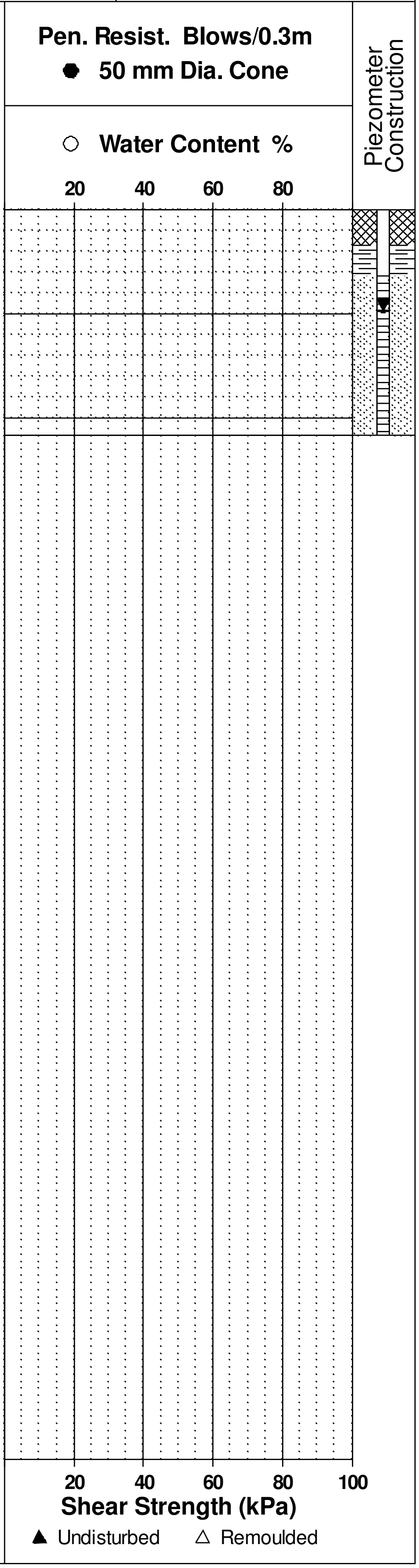
BORINGS BY CME 55 Power Auger

DATE April 3, 2012

FILE NO. **PG1796**

HOLE NO. **BH26-12**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	89.45
TOPSOIL 0.30							
Very stiff, brown **SILTY CLAY,** trace sand 1.45		SS	1	100	18	1	88.45
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 2.16		SS	2	100	50+	2	87.45
End of Borehole Practical refusal to augering @ 2.16m depth (GWL @ 0.97m-April 13, 2012)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE April 9, 2012

FILE NO. PG1796

HOLE NO. BH27-12

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						0	96.23		
TOPSOIL 0.20		AU	1						
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 1.45		SS	2	60	50+	1	95.23		

End of Borehole

Practical refusal to augering @ 1.45m depth

(BH dry upon completion)

Pen. Resist. / Water Content % scale: 20 40 60 80

Shear Strength scale: 20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE April 3, 2012

FILE NO. PG1796

HOLE NO. BH28-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.10
TOPSOIL 0.30		AU	1				
		AU	2				
Very stiff, brown **SILTY CLAY**		SS	3	100	23	1	88.10
2.21		SS	4	100	15	2	87.10
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 2.82		SS	5	79	49		

End of Borehole

Practical refusal to augering @ 2.82m depth

(GWL @ 0.40m-April 13, 2012)

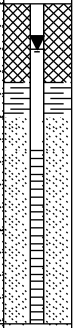
Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone

○ Water Content %

20 40 60 80

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

Piezometer Construction



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE April 3, 2012

FILE NO. PG1796

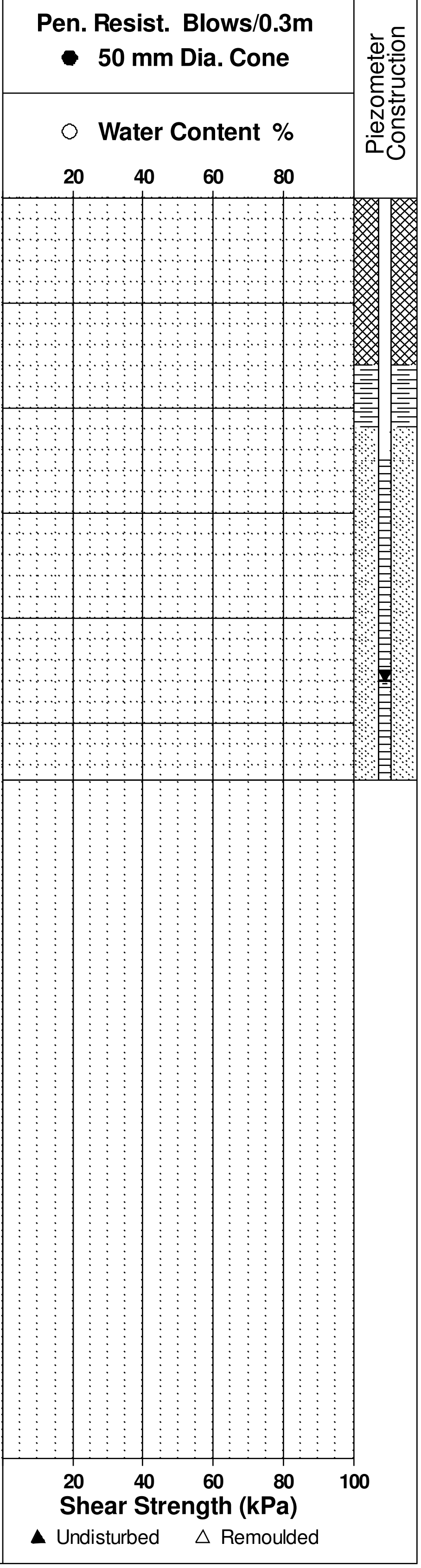
HOLE NO. BH29-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.20
TOPSOIL 0.25	AU	1				
Very stiff to stiff, brown **SILTY CLAY**	SS	2	100	21	1	86.20
	SS	3	100	20	2	85.20
	SS	4	100	17	3	84.20
3.73	SS	5	100	12		
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders	SS	6	50	34	4	83.20
5.26	SS	7	4	9	5	82.20
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders 5.54	SS	8	100	50+		

End of Borehole

Practical refusal to augering @ 5.54m depth

(Piezometer damaged - April 13, 2012)



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE April 3, 2012

FILE NO. PG1796

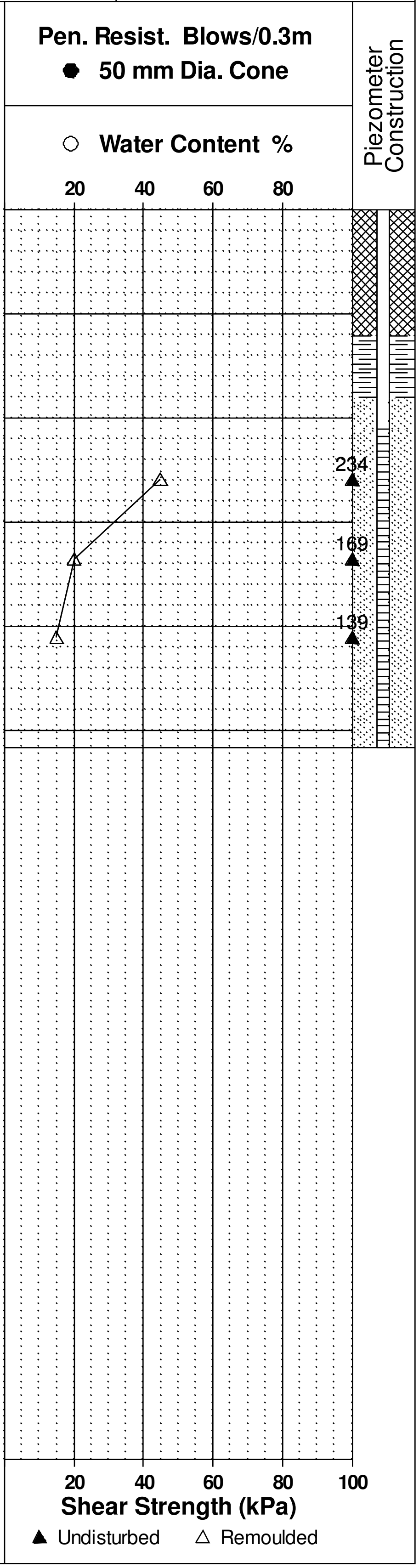
HOLE NO. BH30-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	88.74
TOPSOIL 0.25						
Hard to very stiff, brown **SILTY CLAY** 4.34	AU	1				
	SS	2	83	18	1	87.74
	SS	3	75	12	2	86.74
					3	85.74
					4	84.74
GLACIAL TILL: Brown silty sand with gravel, cobbles and boulders 5.16	SS	4	100	50+	5	83.74

End of Borehole

Practical refusal to augering @ 5.16m depth

(Piezometer damaged-April 13,2012)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE April 3, 2012

FILE NO. **PG1796**

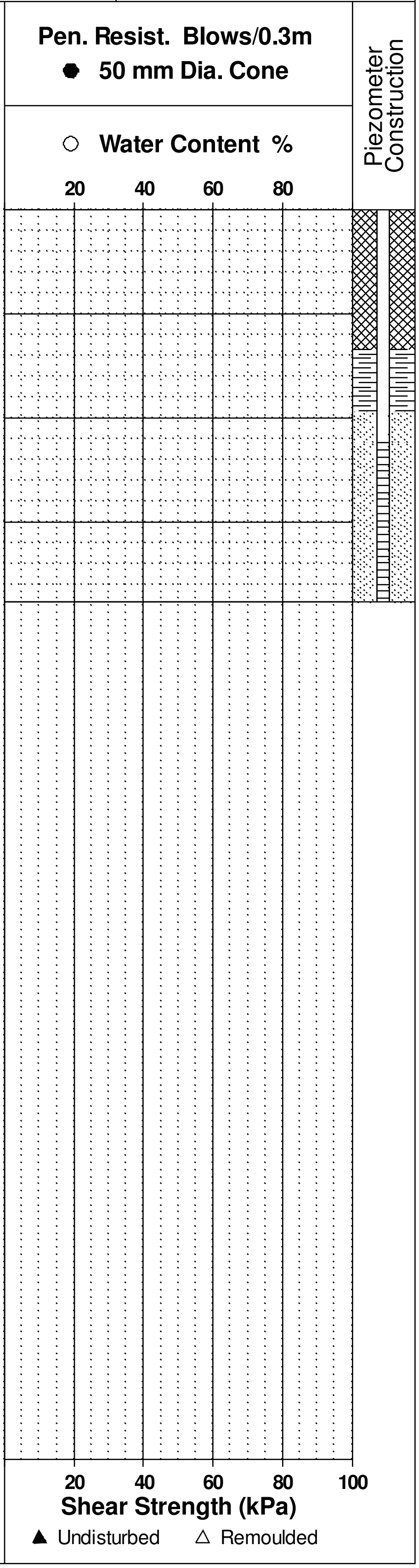
HOLE NO. **BH31-12**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.70
TOPSOIL 0.28		AU	1				
Very stiff to stiff, brown **SILTY CLAY**		SS	2	100	12	1	85.70
		SS	3	100	19	2	84.70
2.97		SS	4	100	19		
						3	83.70
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 3.76		SS	5	82	50+		

End of Borehole

Practical refusal to augering @ 3.76m depth

(GWL @ 1.12m-April 13, 2012)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG1796**

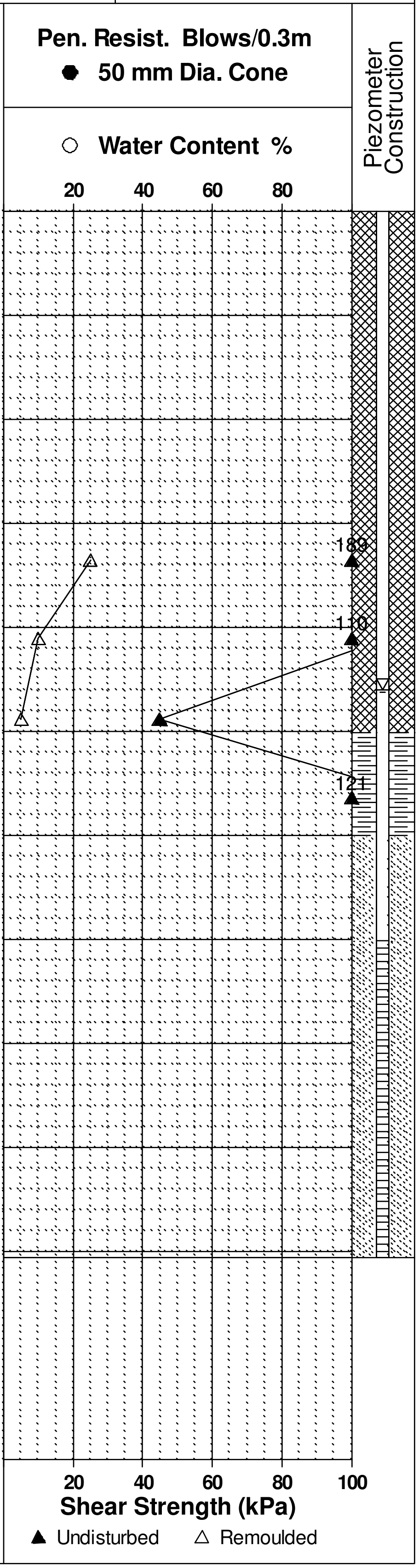
REMARKS

HOLE NO. **BH32-12**

BORINGS BY CME 55 Power Auger

DATE June 26, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	87.94
		SS	1	100	22	1	86.94
		SS	2	100	18		
						2	85.94
Very stiff to stiff, brown **SILTY CLAY**		SS	3	100	13		
						3	84.94
						4	83.94
- firm by 4.3m depth							
						5	82.94
						6	81.94
6.60		SS	4	100	2		
		SS	5	42	38		
						7	80.94
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles and boulders		SS	6	67	50+		
						8	79.94
						9	78.94
		SS	7	100	50+		
10.06						10	77.94
End of Borehole (GWL @ 4.6m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG1796**

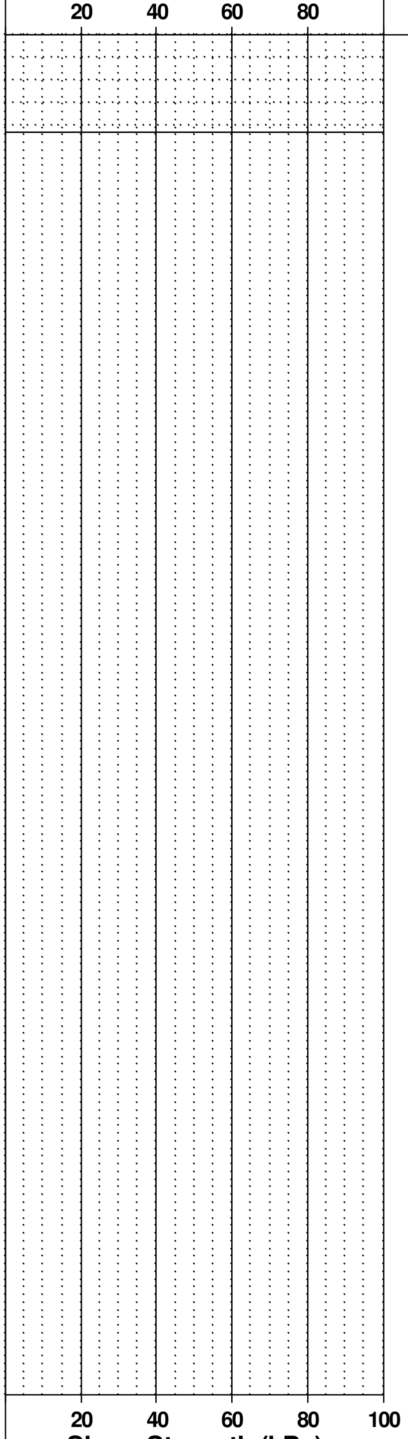
REMARKS

HOLE NO. **BH33-12**

BORINGS BY CME 55 Power Auger

DATE June 27, 2012

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						0	91.15		
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders		AU	1						
0.86		SS	2	33	50+				
End of Borehole Practical refusal to augering at 0.86m depth (BH dry upon completion)									



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

REMARKS

HOLE NO. BH34-12

BORINGS BY CME 55 Power Auger

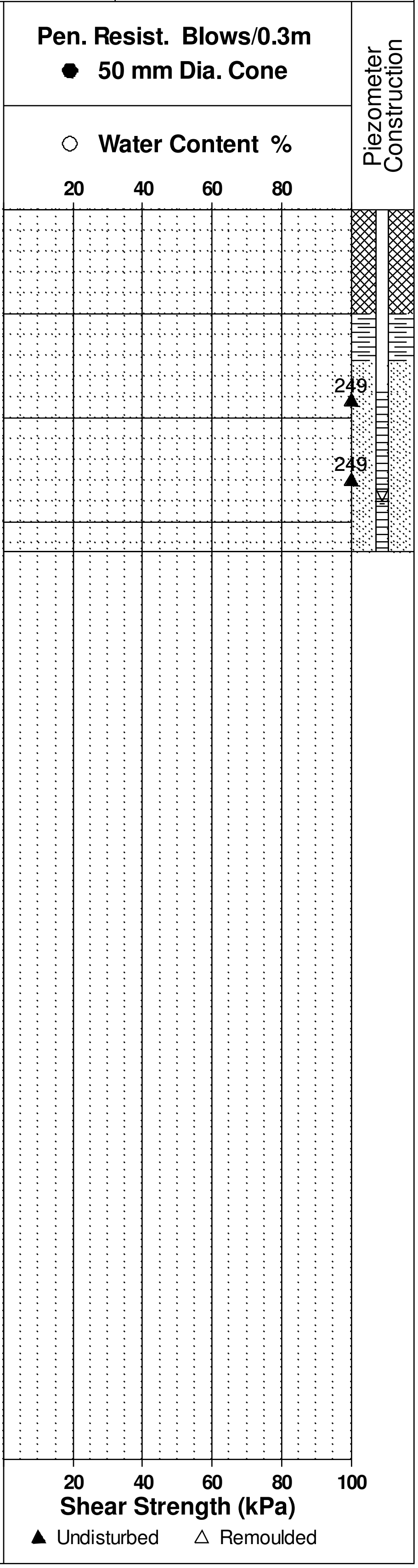
DATE June 26, 2012

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	89.99
Hard to very stiff, brown **SILTY CLAY**	AU	1				
	SS	2	100	17	1	88.99
					2	87.99
2.82						
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 3.28	SS	3	33	50+	3	86.99

End of Borehole

Practical refusal to augering at 3.28m depth

(GWL @ 2.8m depth based on field observations)



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

BORINGS BY CME 55 Power Auger

DATE June 27, 2012

FILE NO. **PG1796**

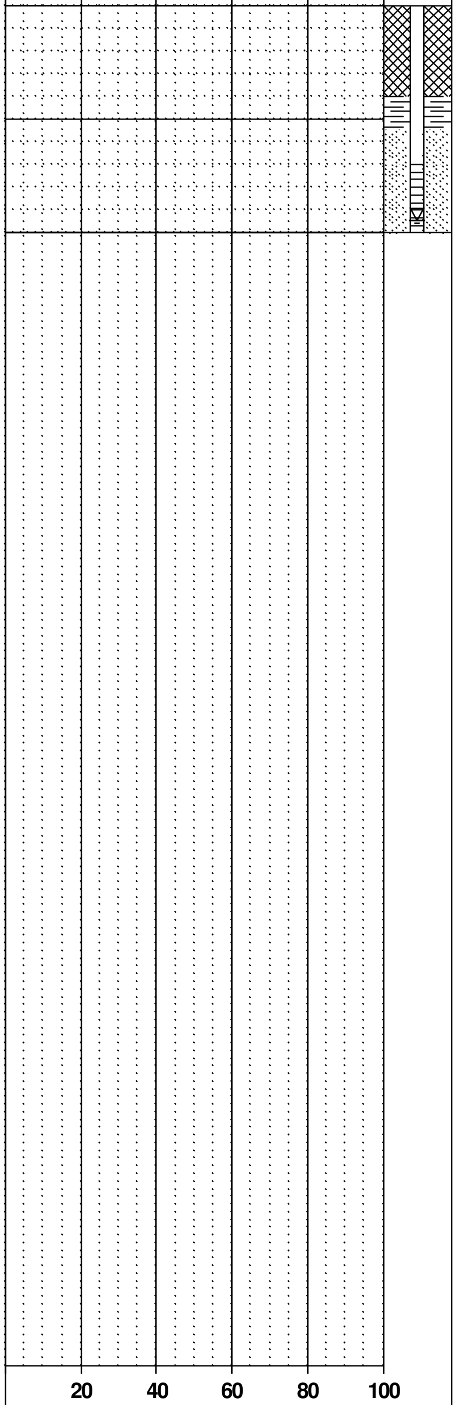
HOLE NO. **BH35-12**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.07
Hard, brown **SILTY CLAY**		SS	1	100	23	1	89.07
1.90		SS	2	76	50+		
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 2.00						2	88.07

End of Borehole

Practical refusal to augering at 2.00m depth

(GWL @ 1.9m depth based on field observations)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. PG1796

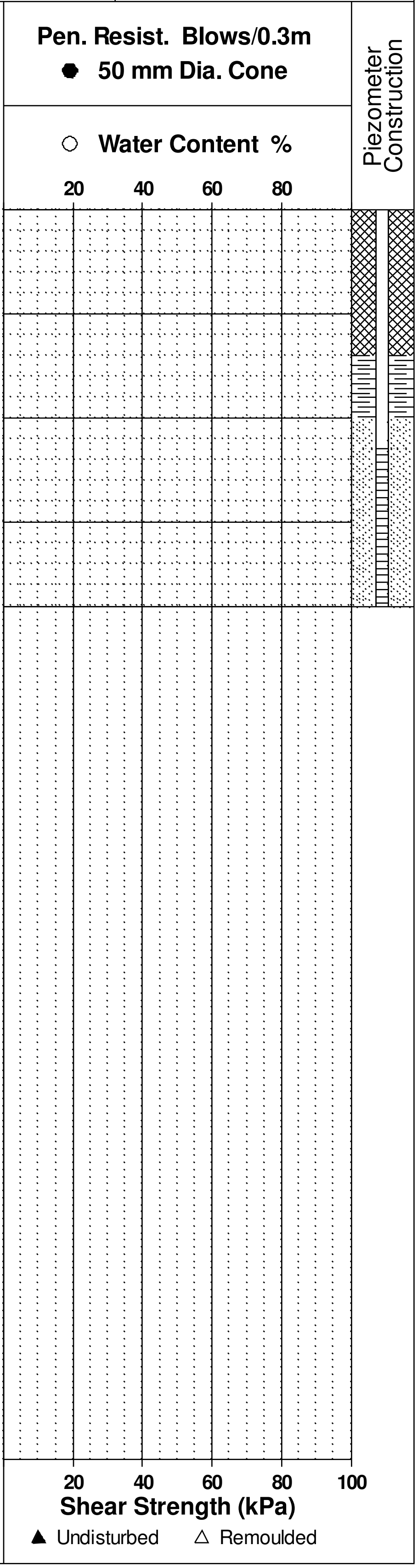
REMARKS

HOLE NO. BH36-12

BORINGS BY CME 55 Power Auger

DATE June 26, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	91.15
Brown **SILTY SAND** with clay		AU	1				
0.60							
		SS	2	100	6	1	90.15
		SS	3	67	16	2	89.15
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders		SS	4	54	39	3	88.15
		SS	5	56	50+		
3.81							
End of Borehole Practical refusal to augering at 3.81m depth (BH dry upon completion)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

REMARKS

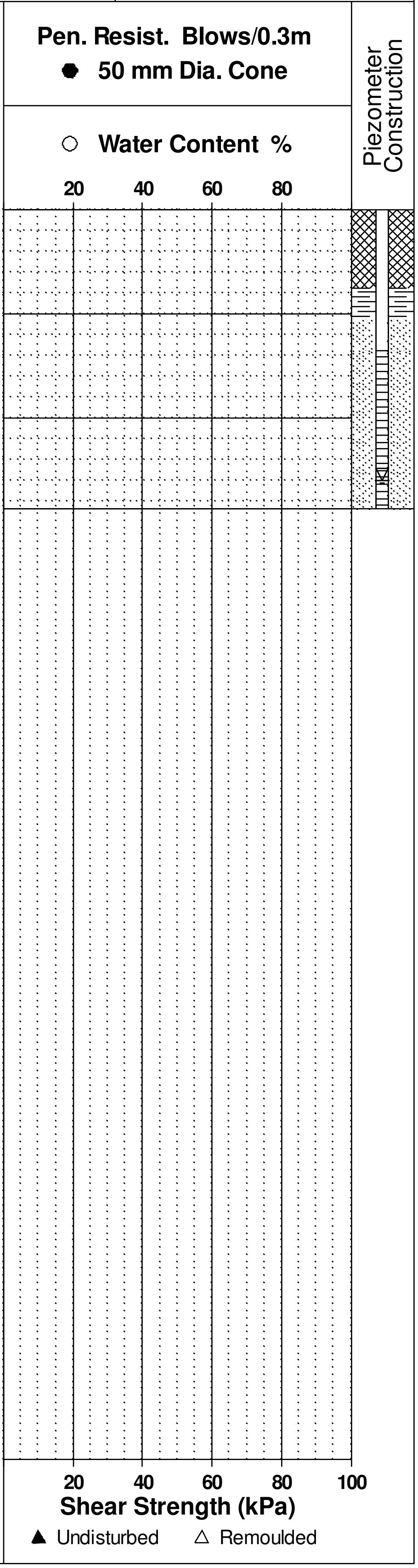
BORINGS BY CME 55 Power Auger

DATE June 26, 2012

FILE NO. PG1796

HOLE NO. BH37-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.42
Hard, brown **SILTY CLAY**		SS	1	100	22	1	88.42
2.21		SS	2	100	16	2	87.42
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 2.87		SS	3	75	50+		
End of Borehole Practical refusal to augering at 2.87m depth (GWL @ 2.6m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Ltd.

FILE NO. **PG1796**

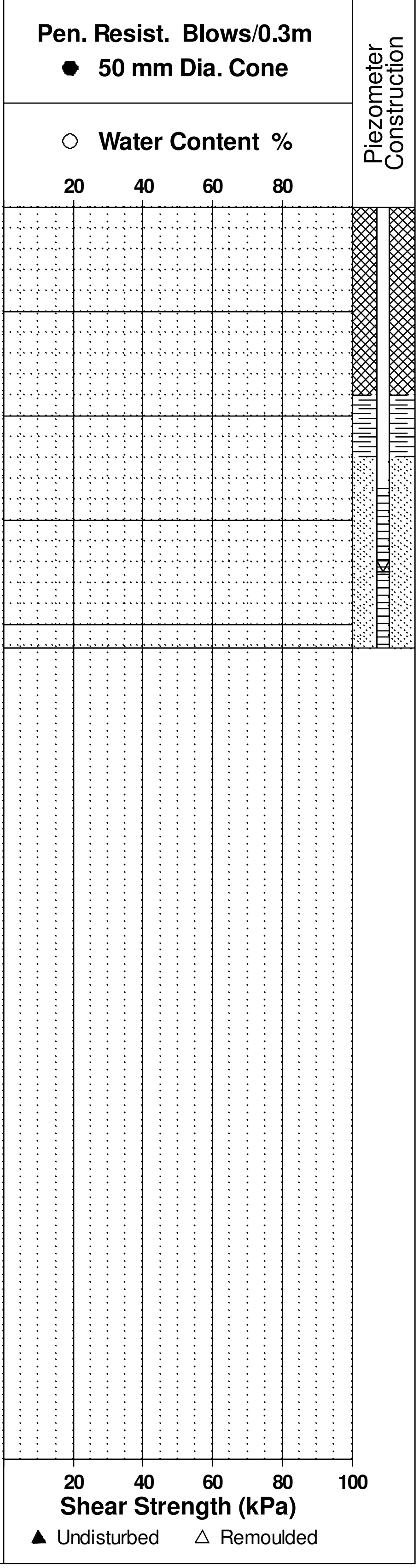
REMARKS

HOLE NO. **BH38-12**

BORINGS BY CME 55 Power Auger

DATE June 26, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.92
		SS	1	100	19	1	87.92
Very stiff to stiff, brown **SILTY CLAY**							
		SS	2	100	16		
						2	86.92
		SS	3	100	20		
2.97							
		SS	4	100	50+	3	85.92
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders							
		SS	5	50	50+	4	84.92
4.22							
End of Borehole Practical refusal to augering at 4.22m depth (GWL @ 3.5m depth based on field observations)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

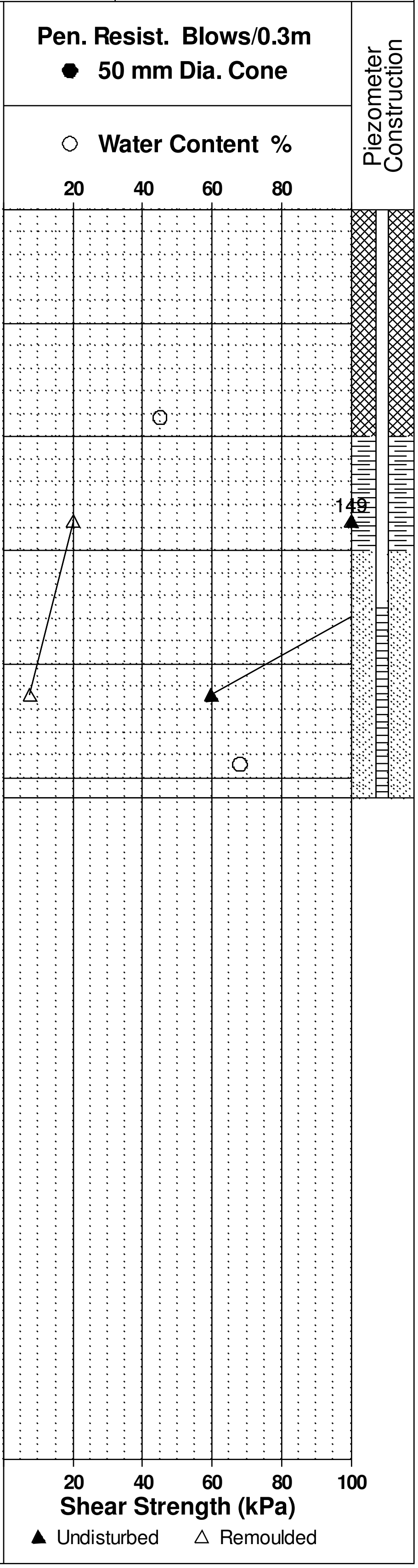
REMARKS

HOLE NO. **BH67-12**

BORINGS BY CME 55 Power Auger

DATE February 5, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	67.29
Asphaltic concrete 0.20							
FILL: Crushed stone with sand 0.36		AU	1				
FILL: Brown silty sand with gravel 0.60		AU	2				
		SS	3	83	11	1	66.29
		SS	4	100	5		
						2	65.29
Very stiff to stiff, brown **SILTY CLAY**							
						3	64.29
		SS	5	100	3		
						4	63.29
- grey-brown by 4.4m depth							
		SS	6	100	2		
5.18						5	62.29
End of Borehole							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **BH68-12**

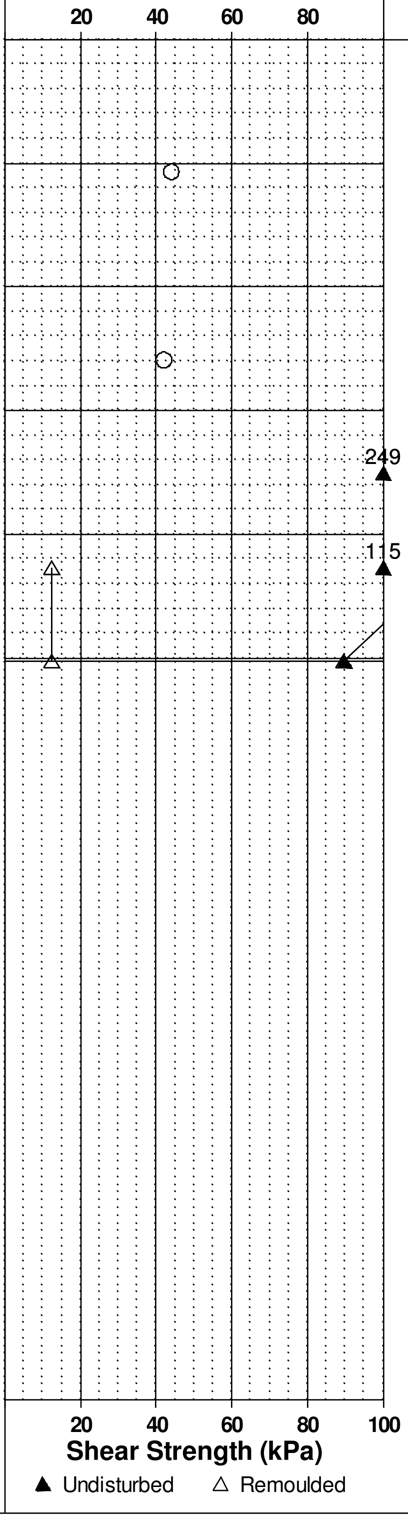
BORINGS BY CME 55 Power Auger

DATE February 5, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	70.35
Asphaltic concrete 0.20							
FILL: Crushed stone with sand 0.46		AU	1				
FILL: Brown silty sand with gravel 0.68		AU	2				
FILL: Brown silty clay with gravel 0.91							
		SS	3	25	12	1	69.35
		SS	4	100	11	2	68.35
Hard to very stiff, brown **SILTY CLAY**		SS	5	100	12		
						3	67.35
						4	66.35
- stiff by 4.4m depth							
5.03						5	65.35
End of Borehole (BH dry upon completion)							

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

Piezometer Construction



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

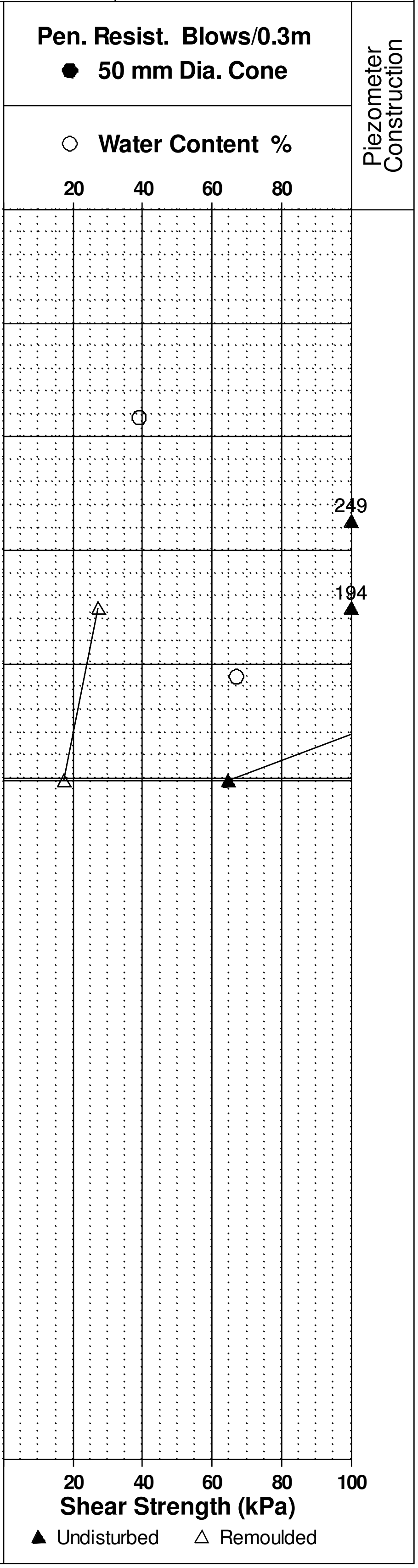
BORINGS BY CME 55 Power Auger

DATE February 5, 2013

FILE NO. PG1796

HOLE NO. BH69-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	71.21
Asphaltic concrete 0.20	AU	1				
FILL; Crushed stone with sand 0.33	AU	2				
FILL: Brown silty sand with gravel 0.69						
	SS	3	75	18	1	70.21
	SS	4	100	13		
					2	69.21
Hard to very stiff, brown **SILTY CLAY**					3	68.21
- stiff by 3.8m depth						
					4	67.21
	SS	5	100	3		
5.03					5	66.21
End of Borehole						
(BH dry upon completion)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

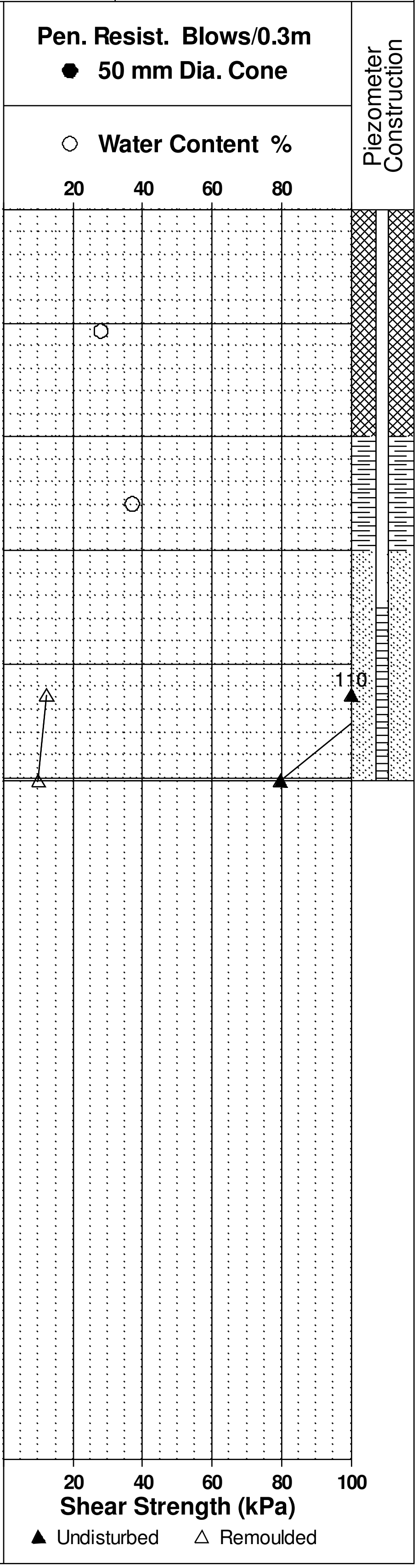
BORINGS BY CME 55 Power Auger

DATE February 5, 2013

FILE NO. PG1796

HOLE NO. BH70-12

SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	72.78
Asphaltic concrete	0.18						
FILL: Crushed stone with sand	0.38	AU	1				
FILL: Brown silty sand with gravel	0.79	AU	2				
		SS	3	58	11	1	71.78
		SS	4	100	20		
						2	70.78
Very stiff to stiff, brown **SILTY CLAY**		SS	5	100	12		
						3	69.78
		SS	6	100	9		
						4	68.78
	5.03					5	67.78
End of Borehole (BH dry upon completion)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

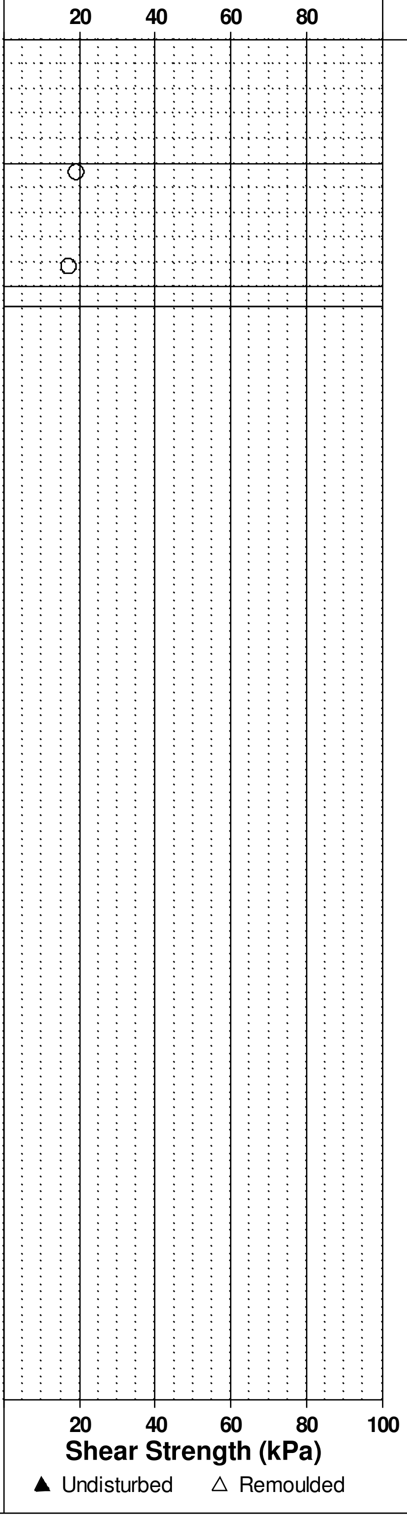
BORINGS BY CME 55 Power Auger

DATE February 4, 2013

FILE NO. PG1796

HOLE NO. BH71-12

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						0	75.79		
Asphaltic concrete 0.20									
FILL: Crushed stone with sand 0.38		AU AU	1 2						
FILL: Brown silty sand with gravel 1.45		SS	3		15	1	74.79		
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, boulders 2.16		SS	4		40	2	73.79		
End of Borehole Practical refusal to augering at 2.16m depth (BH dry upon completion)									



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

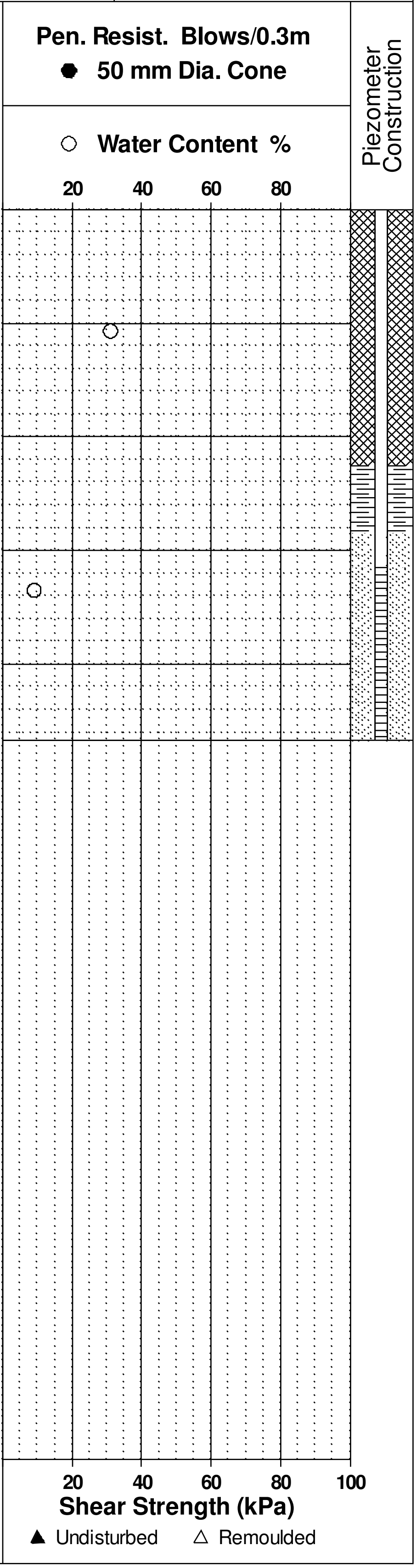
BORINGS BY CME 55 Power Auger

DATE February 4, 2013

FILE NO. PG1796

HOLE NO. BH72-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	77.23
Asphaltic concrete 0.20						
FILL: Crushed stone with sand 0.38	AU	1				
FILL: Brown silty sand with gravel 0.69	AU	2				
Stiff, brown **SILTY CLAY** 1.45	SS	3	50	23	1	76.23
GLACIAL TILL: Brown silty clay with sand, gravel, trace cobbles 2.20	SS	4	67	13	2	75.23
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders	SS	5	43	50+		
					3	74.23
	SS	6	83	27		
					4	73.23
4.67	SS	7		50+		
End of Borehole (BH dry upon completion)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE January 31, 2013

FILE NO. PG1796

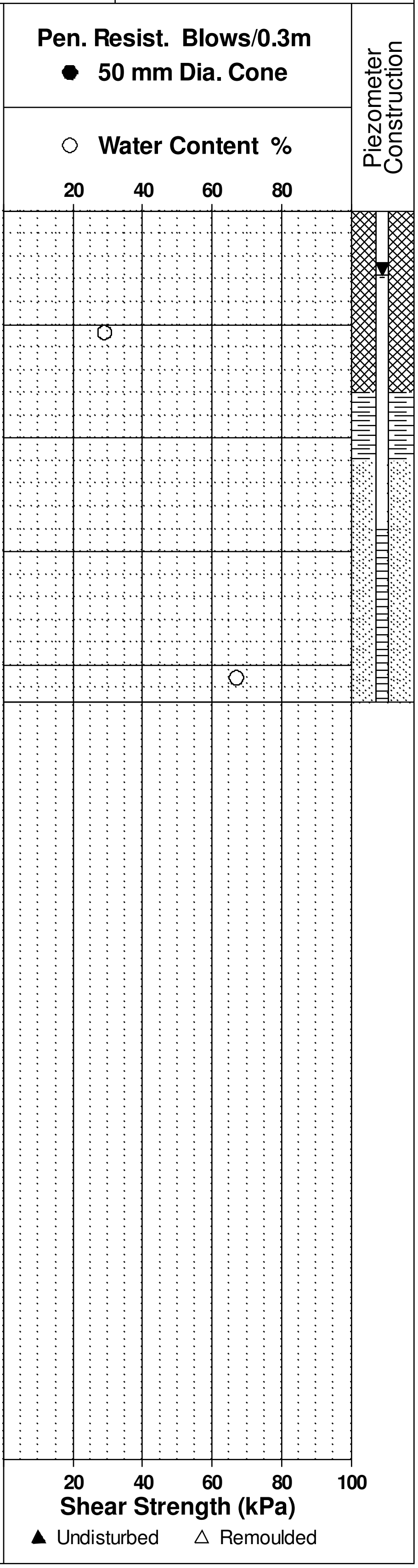
HOLE NO. BH73-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
FILL: Crushed stone with sand 0.33		AU	1			0	80.21
FILL: Brown silty sand with clay and gravel 0.69		AU	2				
Very stiff to stiff, brown **SILTY CLAY**		SS	3	33	9	1	79.21
		SS	4	83	13	2	78.21
2.90		SS	5	100	18		
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 3.73		SS	6	67	10	3	77.21
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay 4.32		SS	7		21	4	76.21

End of Borehole

Practical refusal to augering at 4.32m depth

(GWL @ 0.56m-Mar. 27, 2013)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

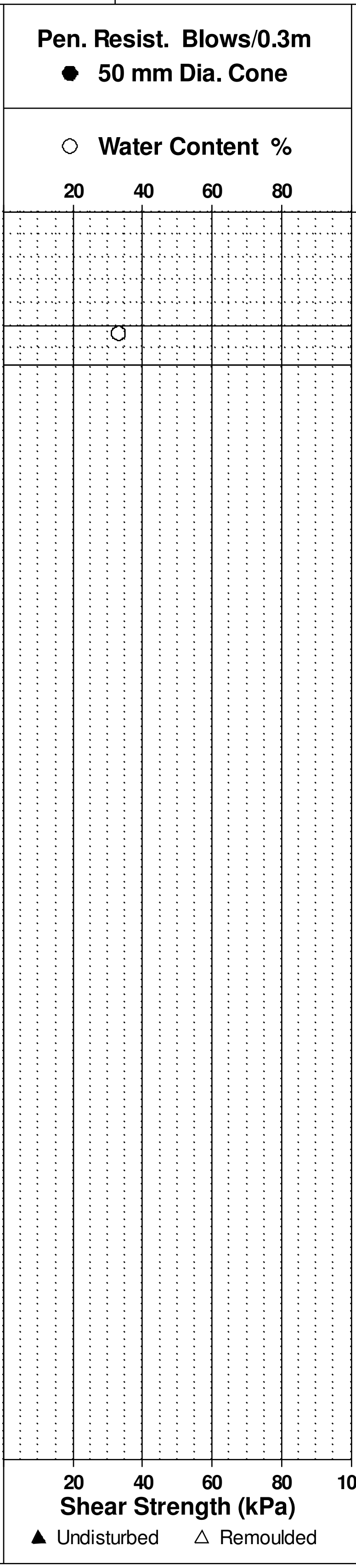
REMARKS

HOLE NO. **BH74-12**

BORINGS BY CME 55 Power Auger

DATE January 31, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	81.02	
FILL: Crushed stone with sand 0.30								
FILL: Brown silty sand with gravel 0.69								
Very stiff, brown **SILTY CLAY** 0.99								
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders 1.35		SS	1	80	15	1	80.02	
End of Borehole Practical refusal to augering at 1.35m depth (BH dry upon completion)								



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

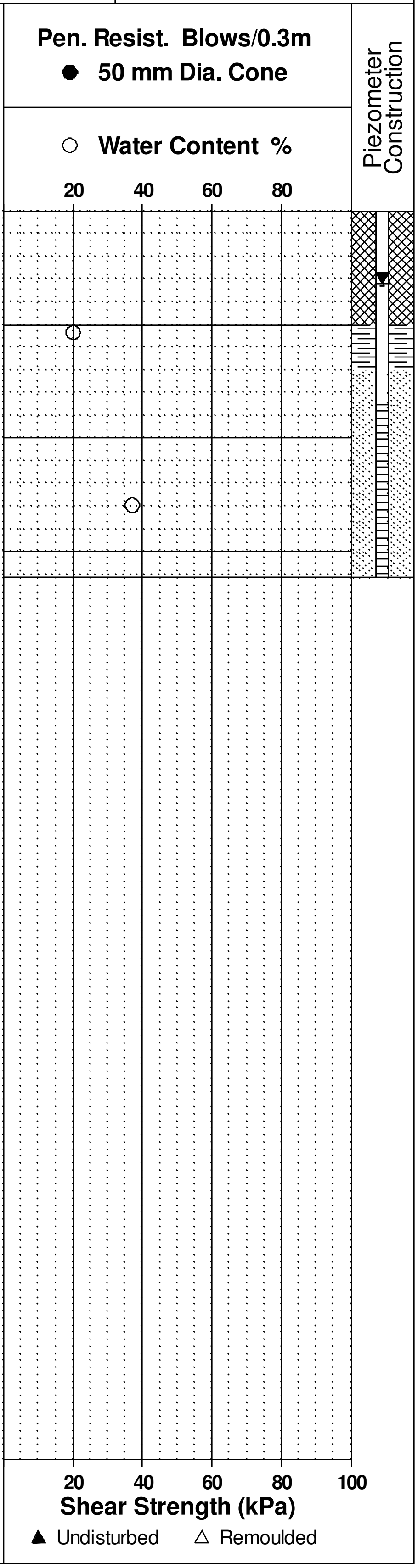
BORINGS BY CME 55 Power Auger

DATE February 1, 2013

FILE NO. PG1796

HOLE NO. BH75-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	83.02
Asphaltic concrete 0.20						
FILL: Crushed stone with sand 0.51	AU	1				
FILL: Brown silty sand with gravel 0.81	AU	2				
Compact, brown **SILTY SAND** with gravel 1.45	SS	3	50	10	1	82.02
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders	SS	4	100	50+	2	81.02
	SS	5	0	50+	3	80.02
3.22						
End of Borehole Practical refusal to augering at 3.22m depth (GWL @ 0.64m-Mar. 27, 2013)						



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE February 1, 2013

FILE NO. PG1796

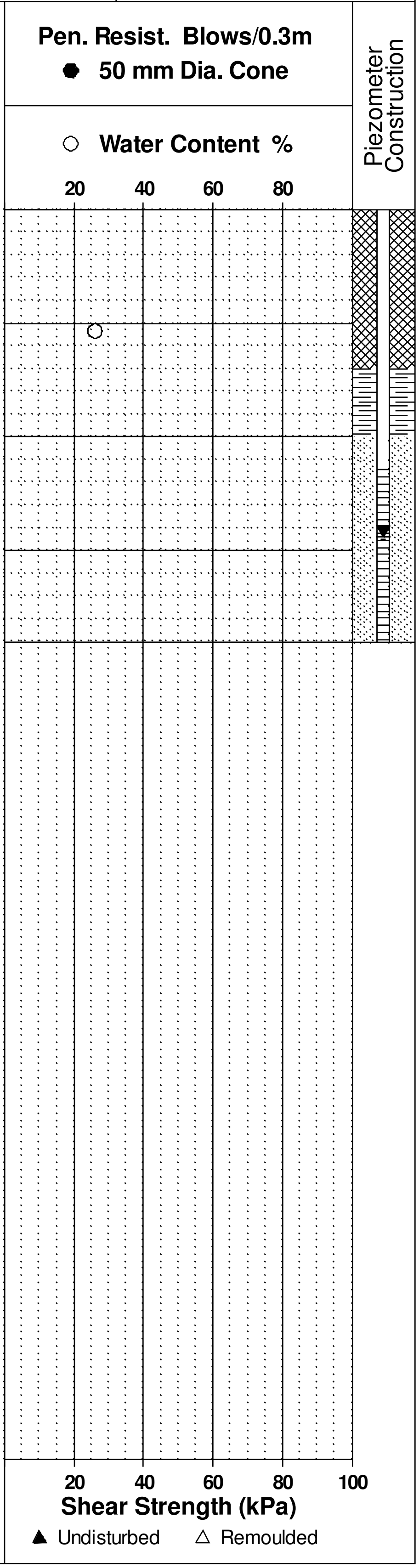
HOLE NO. BH76-12

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.83
Asphaltic concrete 0.20						
FILL: Crushed stone with sand 0.46	AU	1				
FILL: Brown silty sand with gravel 0.69	AU	2				
Loose, brown **SILTY SAND** with gravel, trace cobbles 1.45	SS	3	83	6	1	86.83
	SS	4	100	50+		
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay					2	85.83
	SS	5	50	1		
- brown silty clay matrix from 1.8 to 3.0m depth					3	84.83
3.81	SS	6	77	50+		

End of Borehole

Practical refusal to augering at 3.81m depth

(GWL @ 2.88m-Mar. 27, 2013)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **BH77-12**

BORINGS BY CME 55 Power Auger

DATE February 1, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. Resist. Blows/0.3m ● 50 mm Dia. Cone ○ Water Content % 20 40 60 80	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD				
GROUND SURFACE						0	88.17		
FILL: Crushed stone with sand 0.28		AU	1						
FILL: Brown silty sand with gravel 0.69		AU	2						
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders		SS	3	33	15	1	87.17		
		SS	4	0	14				
2.26						2	86.17		
End of Borehole Practical refusal to augering at 2.26m depth									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **BH77A-12**

BORINGS BY CME 55 Power Auger

DATE February 1, 2013

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	88.17		
OVERBURDEN						1	87.17		
						2	86.17		
2.21									
End of Borehole Practical refusal to augering at 2.21m depth									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

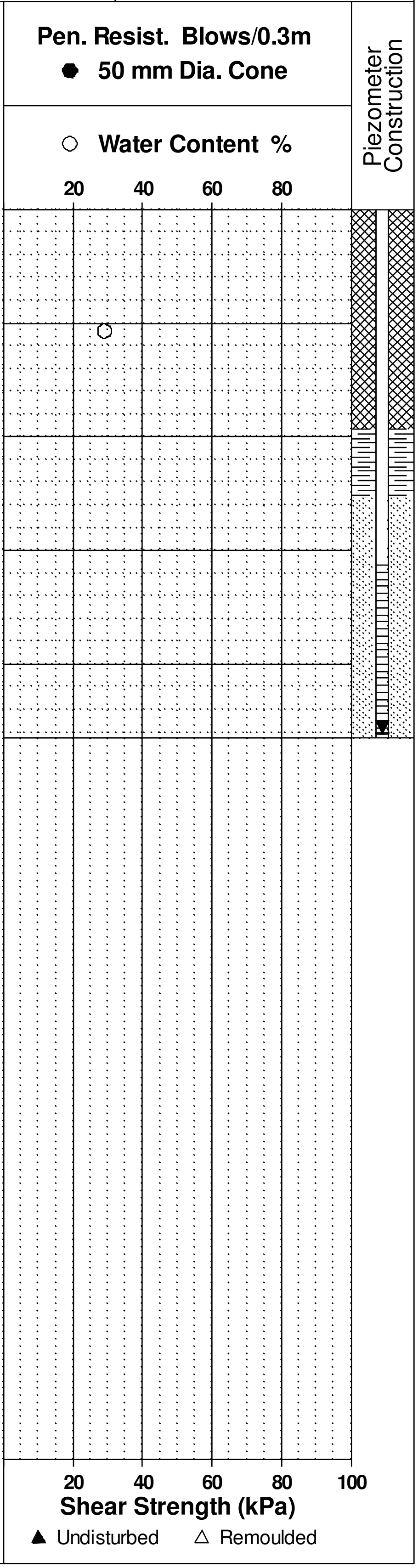
BORINGS BY CME 55 Power Auger

DATE February 1, 2013

FILE NO. PG1796

HOLE NO. BH78-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	91.80
FILL: Crushed stone 0.30		AU	1				
FILL: Brown silty sand with gravel 0.69		AU	2				
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders		SS	3	25	3	1	90.80
1.75							
						2	89.80
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders		SS	4		50+		
		SS	5	100	50+	3	88.80
						4	87.80
4.65		SS	6	0	50+		
End of Borehole							
(GWL @ 2.88m-Mar. 27, 2013)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

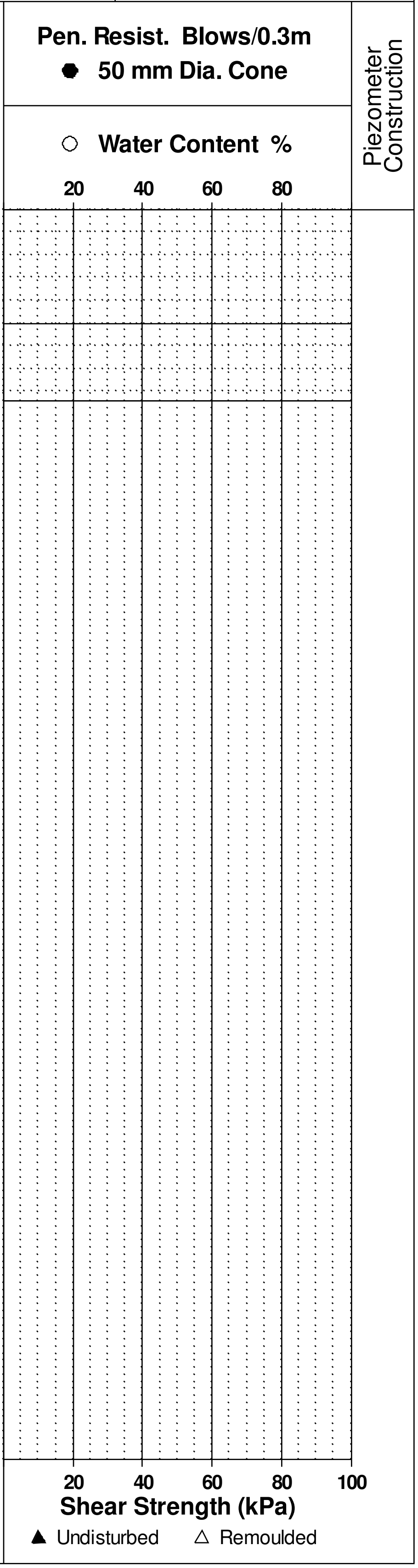
BORINGS BY CME 55 Power Auger

DATE February 1, 2013

FILE NO. PG1796

HOLE NO. BH79-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD		
GROUND SURFACE						0	94.45
FILL: Crushed stone 0.28							
FILL: Brown silty sand with gravel 0.69		AU	1				
GLACIAL TILL: Brown silty sand with gravel, trace clay and organics		SS	2	50	8	1	93.45
1.68		SS	3	100	50+		
End of Borehole Practical refusal to augering at 1.68m depth (BH dry upon completion)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

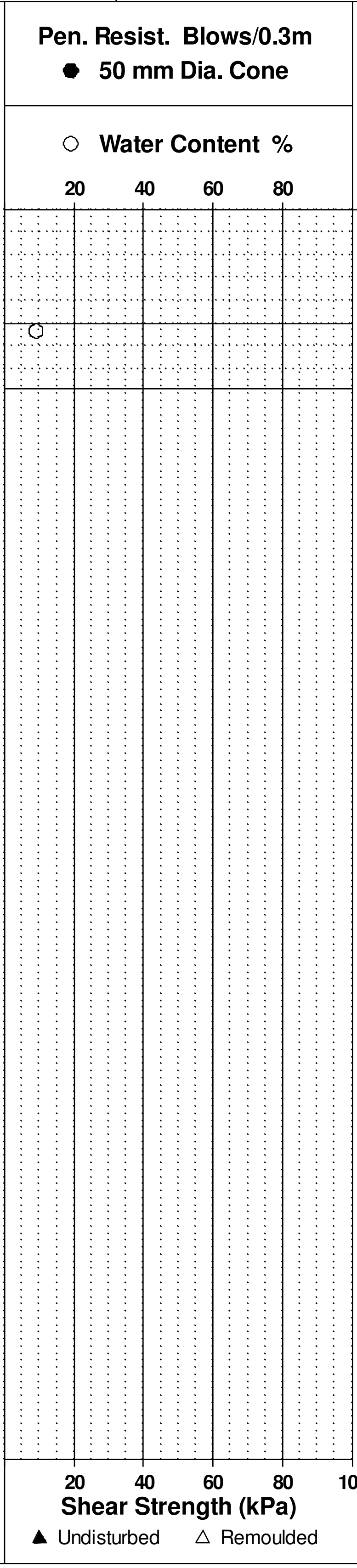
BORINGS BY CME 55 Power Auger

DATE January 31, 2013

FILE NO. **PG1796**

HOLE NO. **BH80-12**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE				DEPTH (m)	ELEV. (m)	Piezometer Construction
		TYPE	NUMBER	% RECOVERY	N VALUE or RQD			
GROUND SURFACE						0	96.02	
FILL: Crushed stone 0.30		AU	1					
FILL: Brown silty sand with gravel, cobbles, clay 1.07		AU	2					
		SS	3	38	20	1	95.02	
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders 1.58		SS	4	100	50+			
End of Borehole Practical refusal to augering at 1.58m depth (BH dry upon completion)								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY CME 55 Power Auger

DATE February 1, 2013

FILE NO. PG1796

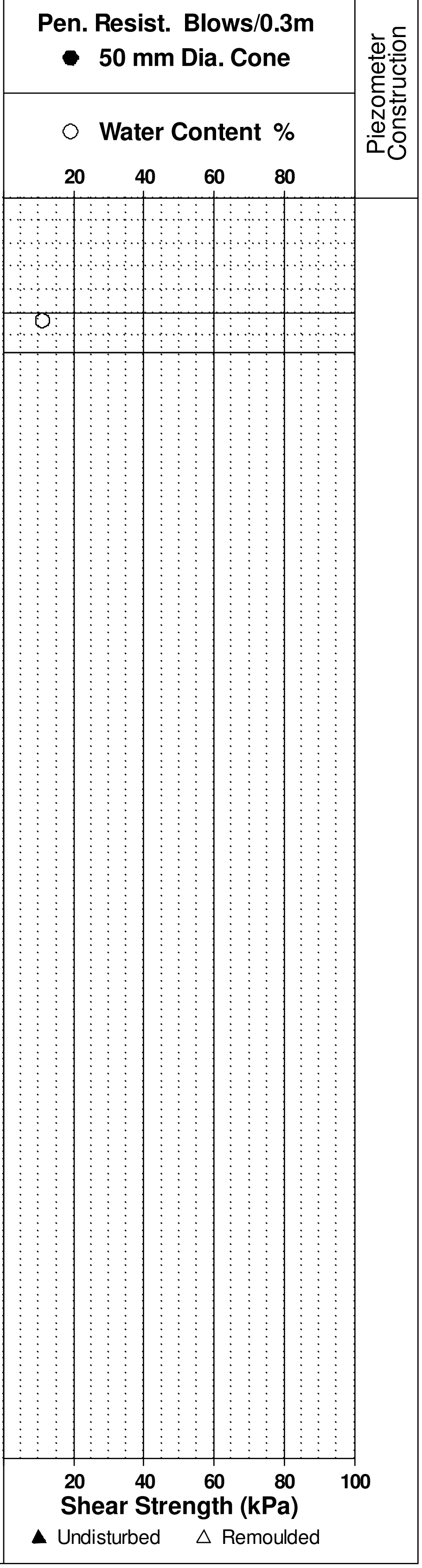
HOLE NO. BH81-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.77
FILL: Crushed stone with sand 0.30		AU	1				
FILL: Brown silty sand with gravel 0.69		AU	2				
GLACIAL TILL: Brown silty sand with gravel, cobbles, boulders, trace clay 1.35		SS	3	57	15	1	94.77

End of Borehole

Practical refusal to augering at 1.35m depth

(Piezometer damaged - March 27, 2013)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. BH82-12

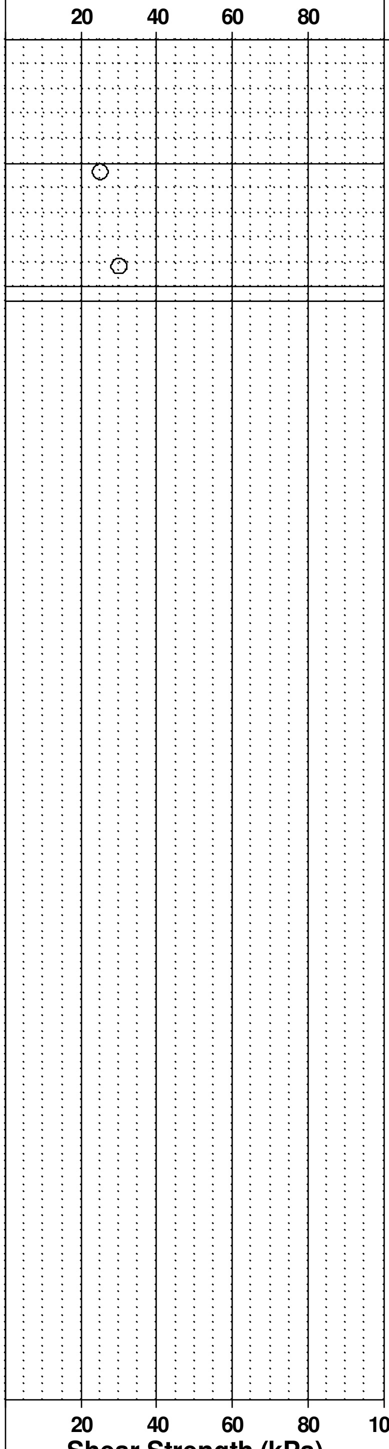
BORINGS BY CME 55 Power Auger

DATE January 31, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
FILL: Crushed stone with gravel 0.30	▨	AU	1			0	95.86
FILL: Brown silty sand with gravel 1.45	▨	SS	2	58	31	1	94.86
GLACIAL TILL: Brown silty sand with gravel, trace clay 2.11		SS	3	78	31	2	93.86
End of Borehole Practical refusal to augering at 2.11m depth (BH dry upon completion)							

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

○ Water Content %



Shear Strength (kPa)

▲ Undisturbed △ Remoulded

Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **BH82A-12**

BORINGS BY CME 55 Power Auger

DATE January 31, 2013

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	95.86		
OVERBURDEN						1	94.86		
1.52									
End of Borehole Practical refusal to augering at 1.52m depth									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

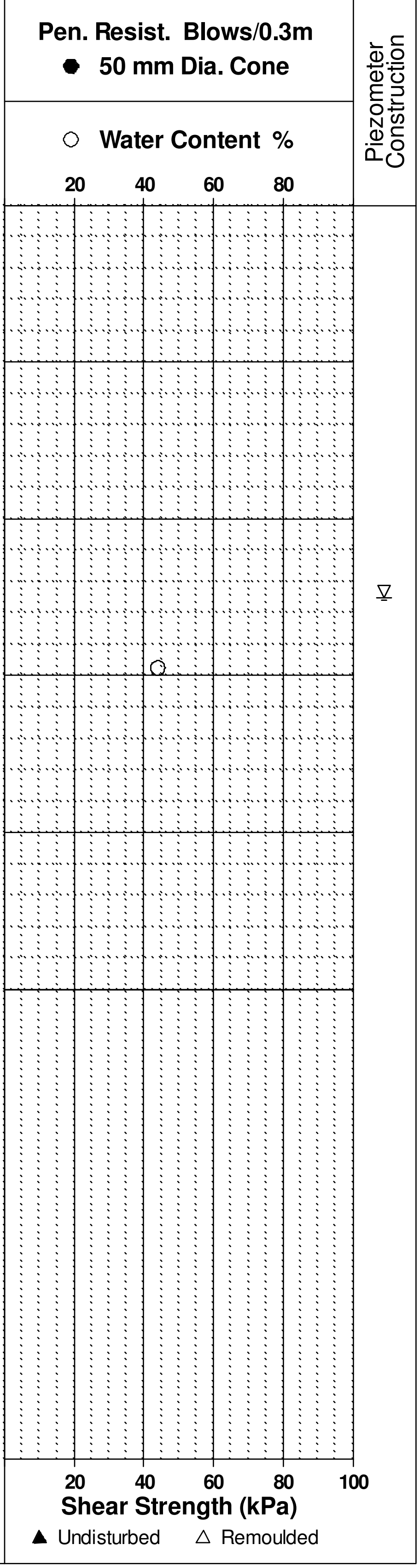
HOLE NO. TP 1-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.12
TOPSOIL 0.30							
						1	86.12
						2	85.12
Hard to very stiff, brown **SILTY CLAY,** trace sand seams		G	1			3	84.12
						4	83.12
5.00						5	82.12

End of Test Pit

TP terminated in very stiff silty clay at 5.00m depth

(Groundwater infiltration at 2.5m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

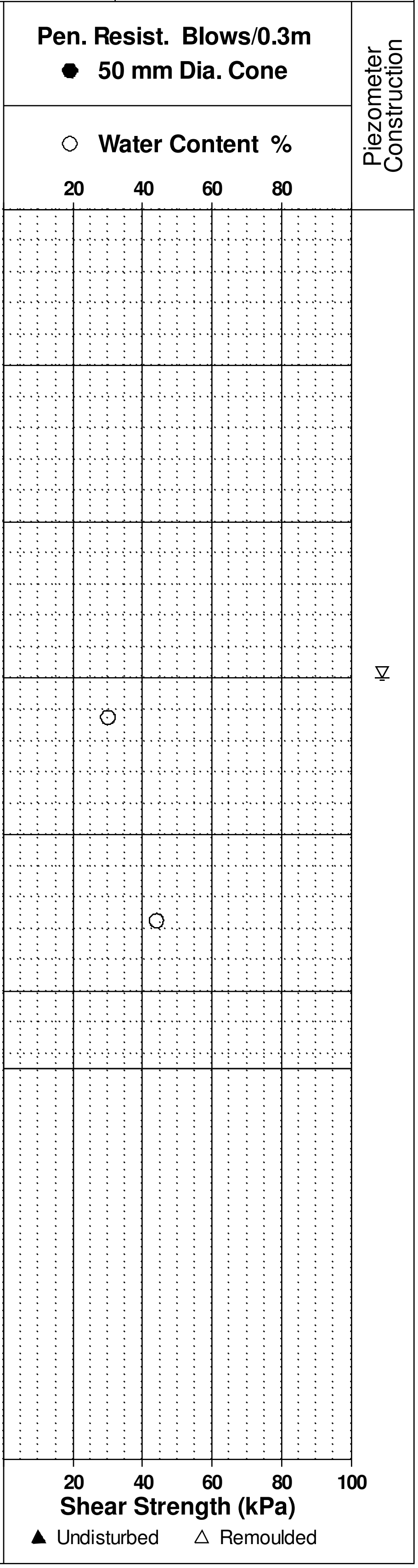
HOLE NO. TP 2-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.43
TOPSOIL 0.10							
Very stiff, brown **SILTY CLAY,** some sand 1.25						1	85.43
						2	84.43
Hard to very stiff, brown **SILTY CLAY,** trace sand seams						3	83.43
		G	1				
						4	82.43
		G	2				
5.50						5	81.43

End of Test Pit

TP terminated in very stiff silty clay at 5.50m depth

(Groundwater infiltration at 3.0m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

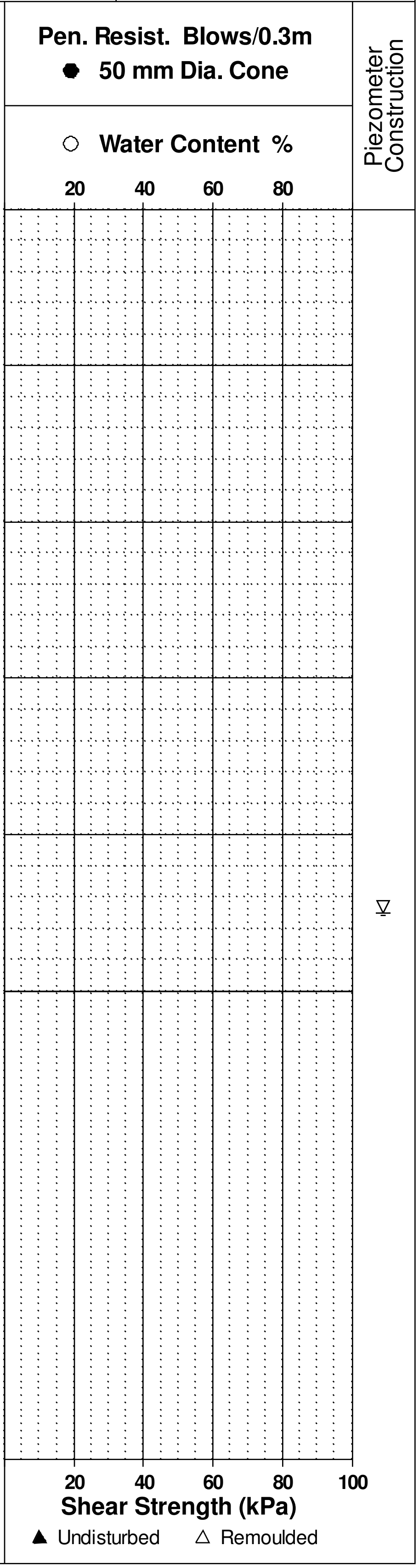
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. **PG1796**

HOLE NO. **TP 3-12**

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.65
TOPSOIL 0.20	■						
Hard to stiff, brown **SILTY CLAY** 5.00	▨	G	1			1 2 3 4 5	86.65 85.65 84.65 83.65 82.65
End of Test Pit TP terminated in stiff silty clay at 5.00m depth (Groundwater infiltration at 4.5m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

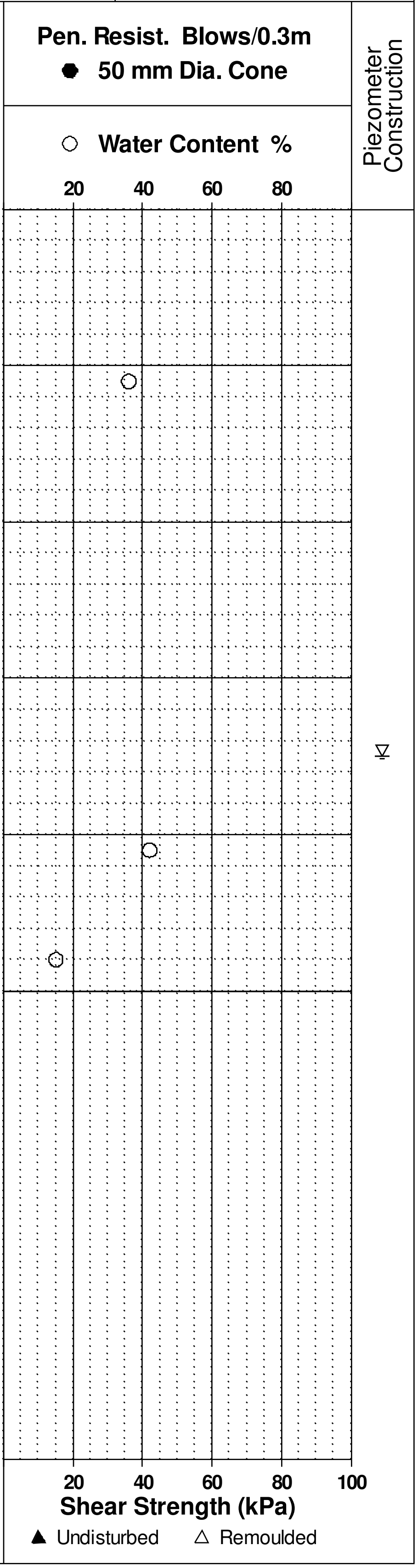
REMARKS

HOLE NO. **TP 4-12**

BORINGS BY Backhoe

DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.33
TOPSOIL 0.25							
		G	1			1	87.33
Hard to very stiff, brown **SILTY CLAY,** trace sand seams						2	86.33
						3	85.33
4.30		G	2			4	84.33
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles, trace boulders 5.00		G	3			5	83.33
End of Test Pit TP terminated in dense glacial till at 5.00m depth (Groundwater infiltration at 3.5m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP 5-12

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	89.64		
TOPSOIL 0.05									
Brown **SILTY SAND,** some clay 0.25									
						1	88.64		
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, boulders						2	87.64		
						3	86.64		
3.30									
End of Test Pit TP termination on inferred bedrock surface at 3.30m depth (TP dry upon completion)									

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP 6-12

BORINGS BY Backhoe

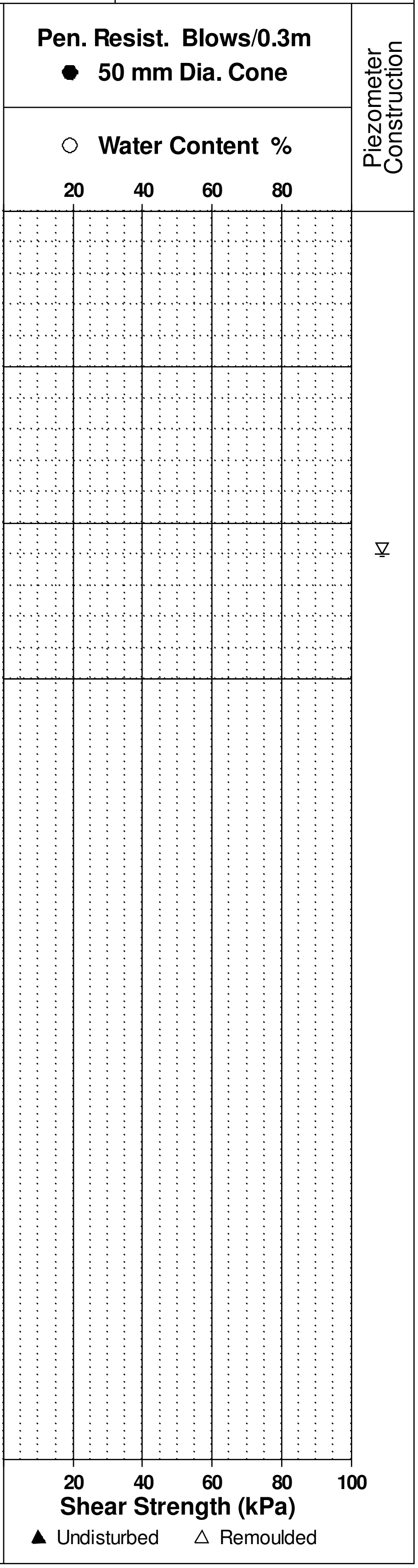
DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.33
TOPSOIL 0.20							
Stiff, brown **SILTY CLAY** 0.30							
GLACIAL TILL: Compact, brown silty clay with sand, gravel, cobbles, trace boulders						1	89.33
						2	88.33
3.00						3	87.33

End of Test Pit

TP terminated in compact glacial till at 3.00m depth

(Groundwater infiltration high at 2.2m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

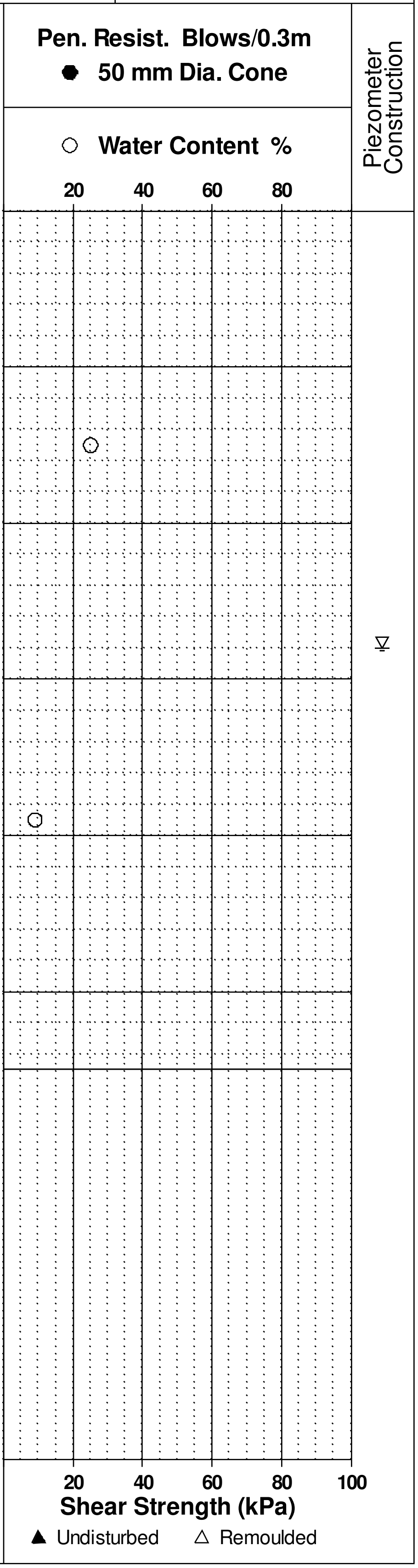
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP 7-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.82
TOPSOIL 0.20							
Hard to very stiff, brown **SILTY CLAY** 2.80		G	1			1	88.82
						2	87.82
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, trace boulders 3.10						3	86.82
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, trace cobbles and boulders 5.50		G	2			4	85.82
						5	84.82
End of Test Pit TP terminated in dense glacial till at 5.50m depth (Groundwater infiltration at 2.8m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

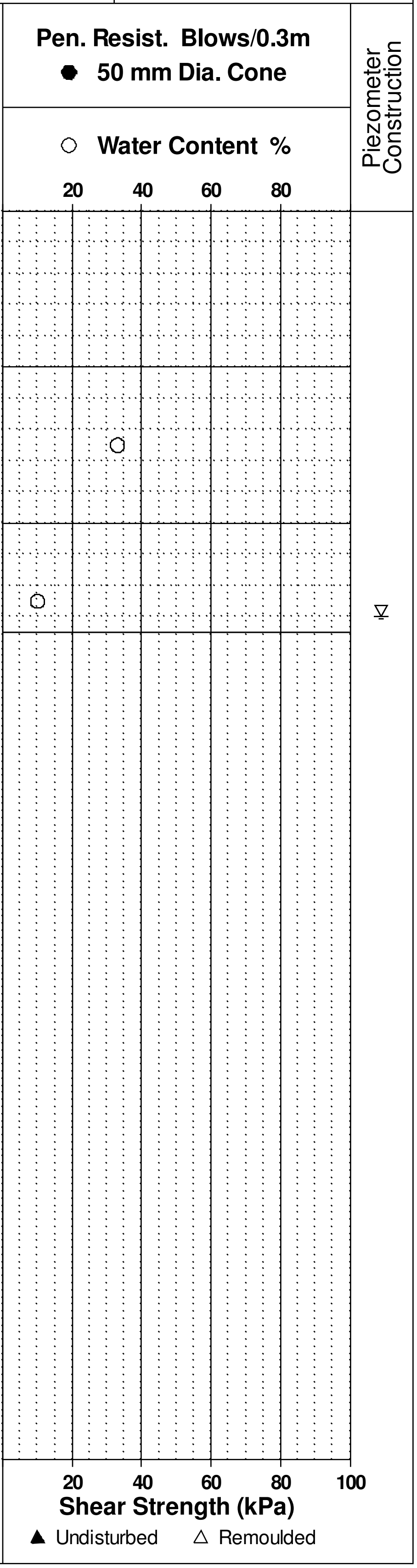
HOLE NO. TP 8-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.51
TOPSOIL 0.30	■						
Hard to very stiff, brown **SILTY CLAY** 1.70	▨	G	1			1	89.51
GLACIAL TILL: Brown silty clay with sand, trace gravel, cobbles, boulders 2.70	^^^	G	2			2	88.51

End of Test Pit

TP terminated on inferred bedrock surface at 2.70m depth

(Groundwater infiltration at 2.6m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

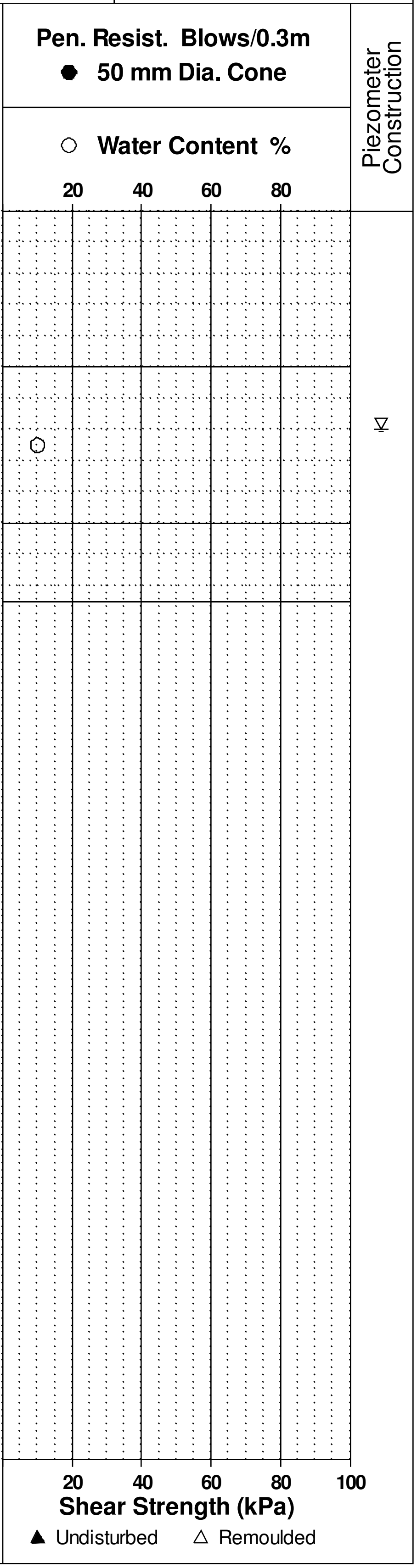
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP 9-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.98
TOPSOIL 0.20							
Hard to very stiff, brown **SILTY CLAY**						1	88.98
1.35							
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles, trace boulders		G	1			2	87.98
2.50							
End of Test Pit TP terminated on inferred bedrock surface at 2.5m depth (Groundwater infiltration at 1.4m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

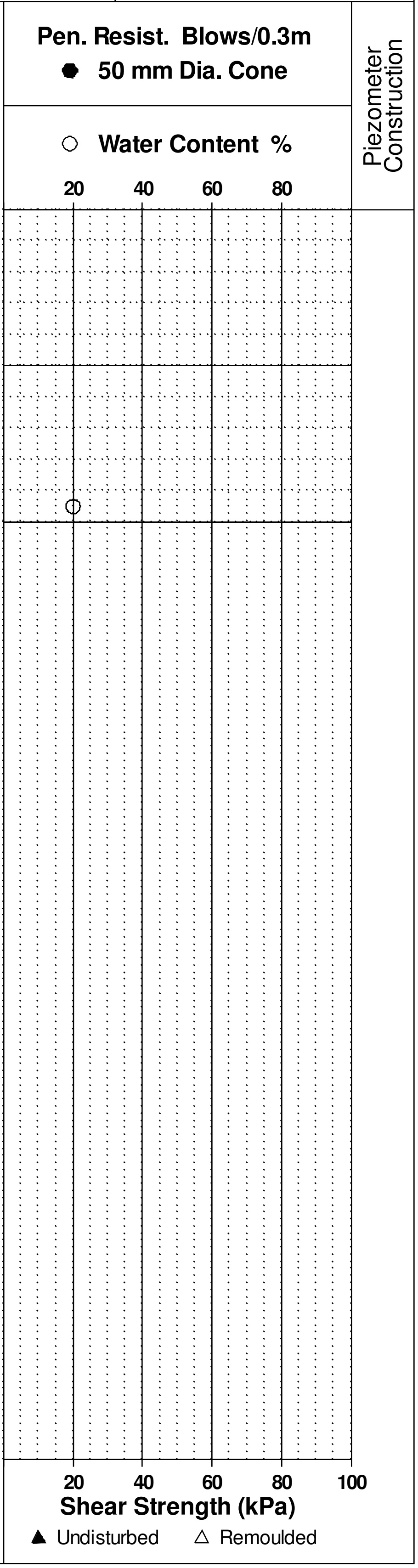
REMARKS

HOLE NO. TP10-12

BORINGS BY Backhoe

DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.09
TOPSOIL 0.20							
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, trace boulders		G	1			1	91.09
2.00						2	90.09
End of Test Pit TP terminated on inferred bedrock surface at 2.00m depth (TP dry upon completion)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

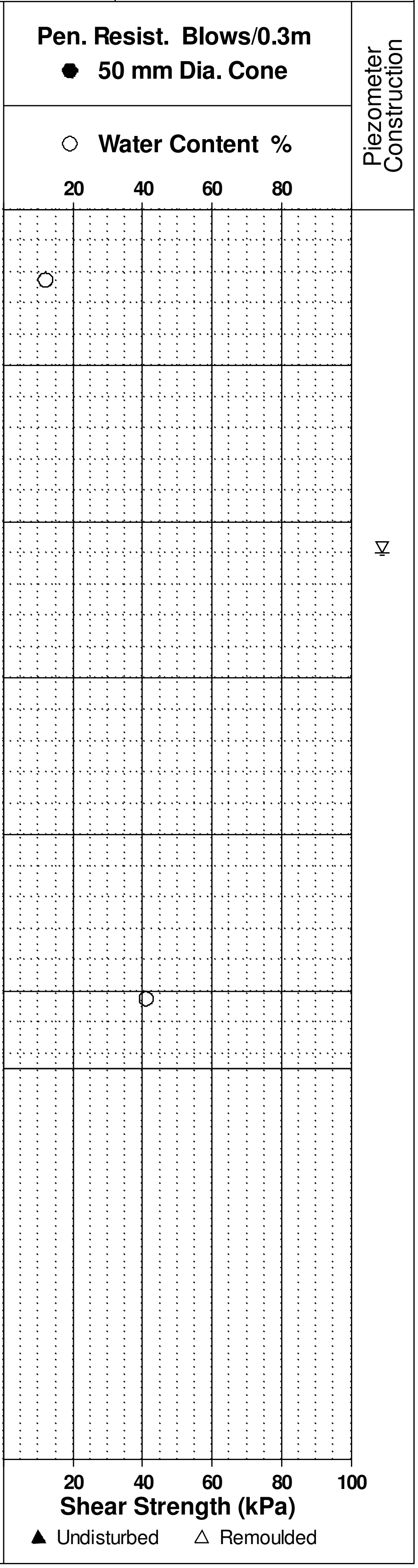
HOLE NO. TP11-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL — 0.15					
Stiff, brown **SILTY CLAY** with sand — 0.90		G	1		
Hard to stiff, brown **SILTY CLAY** — 3.00					
Stiff, grey **SILTY CLAY** — 5.50		G	2		
End of Test Pit					

DEPTH (m)	ELEV. (m)
0	87.13
1	86.13
2	85.13
3	84.13
4	83.13
5	82.13

TP terminated in stiff silty clay at 5.50m depth

(Groundwater infiltration at 2.2m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

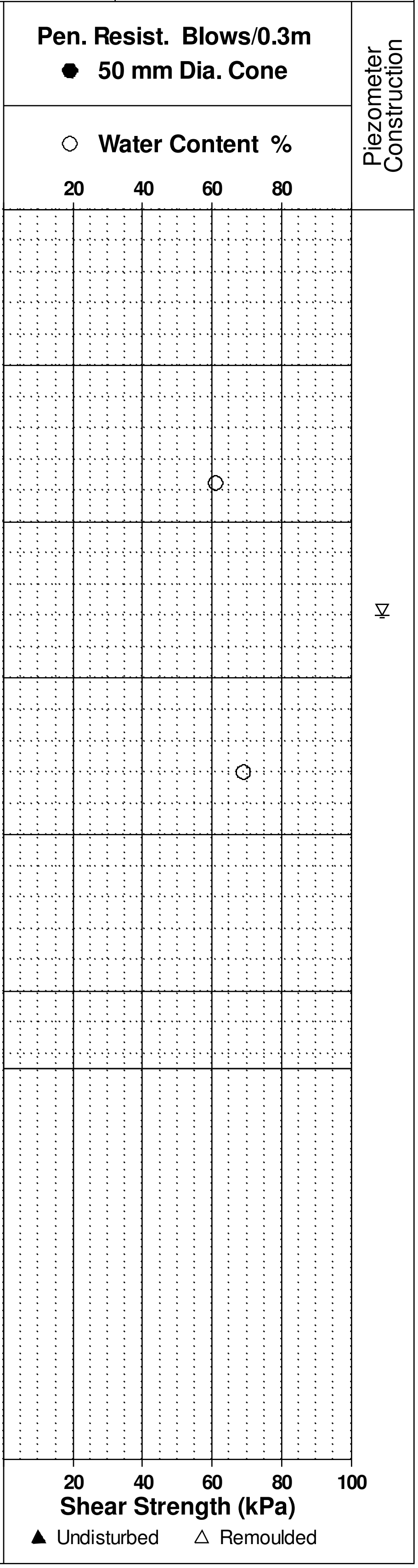
HOLE NO. TP12-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.10	■				
Stiff, brown **SILTY CLAY,** trace sand 0.50	▨				
Hard to stiff, brown **SILTY CLAY** 2.60	▨	G	2		
Stiff, grey **SILTY CLAY** 5.50	▨	G	3		
End of Test Pit					

TP terminated in stiff silty clay at 5.50m depth

(Groundwater infiltration at 2.6m depth)

DEPTH (m)	ELEV. (m)
0	87.50
1	86.50
2	85.50
3	84.50
4	83.50
5	82.50



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

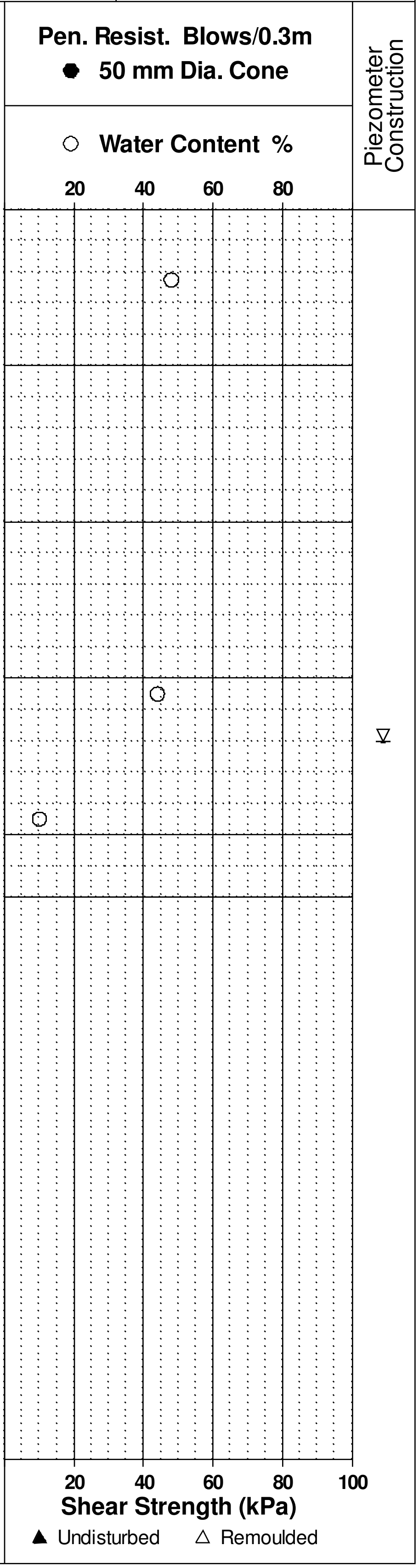
HOLE NO. TP13-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL 0.30	■				
Stiff, brown **SILTY CLAY,** trace sand 0.60	▨	G	1		
Hard to very stiff, brown **SILTY CLAY** 3.40	▨	G	2		
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles, trace boulders 4.40	^ ^ ^	G	3		
End of Test Pit					

TP terminated in dense glacial till at 4.40m depth

(Groundwater infiltration at 3.4m depth)

DEPTH (m)	ELEV. (m)
0	88.52
1	87.52
2	86.52
3	85.52
4	84.52



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **TP14-12**

BORINGS BY Backhoe

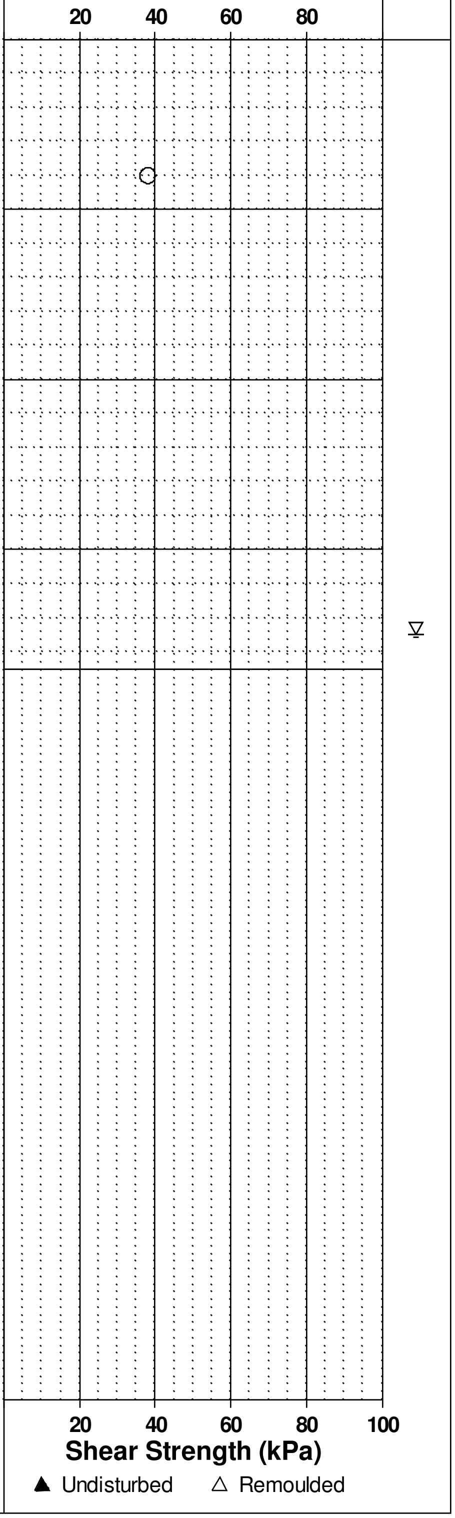
DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	92.23
TOPSOIL 0.15							
Hard to very stiff, brown **SILTY CLAY,** trace sand 1.15		G	1			1	91.23
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, boulders, trace clay 3.70						2 3	90.23 89.23
End of Test Pit TP terminated on inferred bedrock surface at 3.70m depth (Groundwater infiltration at 3.5m depth)							

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

○ **Water Content %**

Piezometer Construction



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

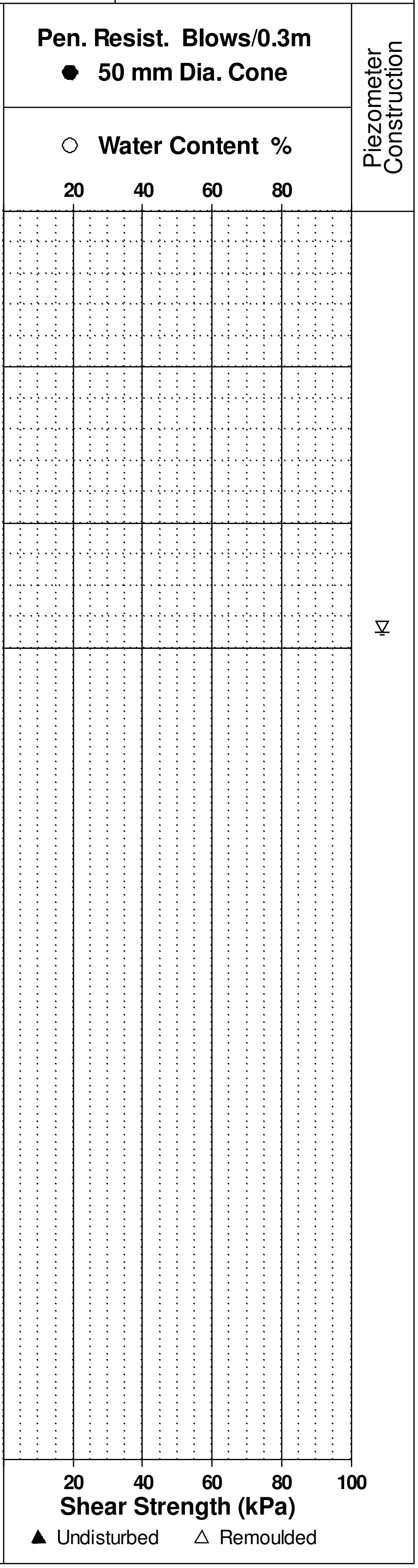
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP15-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	95.08
TOPSOIL 0.30	■						
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles, trace boulders 2.80	^^^					1	94.08
						2	93.08
End of Test Pit TP terminated on inferred bedrock surface at 2.80m depth (Groundwater infiltration at 2.7m depth)							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

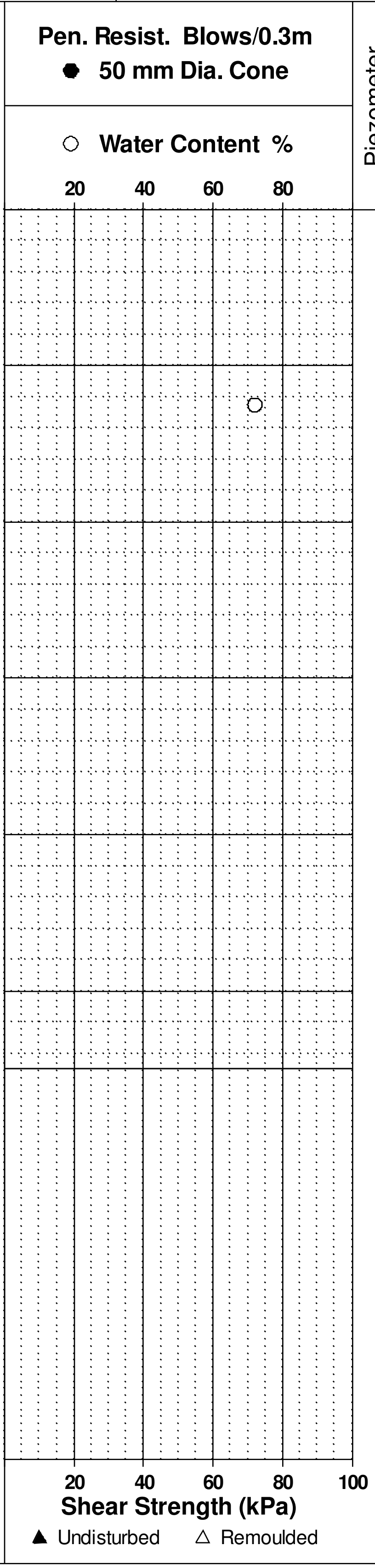
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP16-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	88.51	
TOPSOIL 0.20	■							
Stiff to very stiff, brown **SILTY CLAY,** trace sand 1.00	▨					1	87.51	
		G	1					
Hard to stiff, brown **SILTY CLAY**	▨					2	86.51	∇
		G	2					
3.60						3	85.51	
Stiff, grey **SILTY CLAY**	▨					4	84.51	
5.50						5	83.51	
End of Test Pit TP terminated in stiff silty clay at 5.50m depth (Groundwater infiltration at 2.3m depth)								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP17-12

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	87.74		
TOPSOIL 0.15									
Brown **SILTY SAND** with clay 0.75									
Very stiff, brown **SILTY CLAY,** trace sand 1.05						1	86.74		
Very stiff to stiff, brown **SILTY CLAY** 2.30						2	85.74		
End of Test Pit TP terminated on inferred bedrock surface at 2.30m depth (TP dry upon completion)									

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

patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

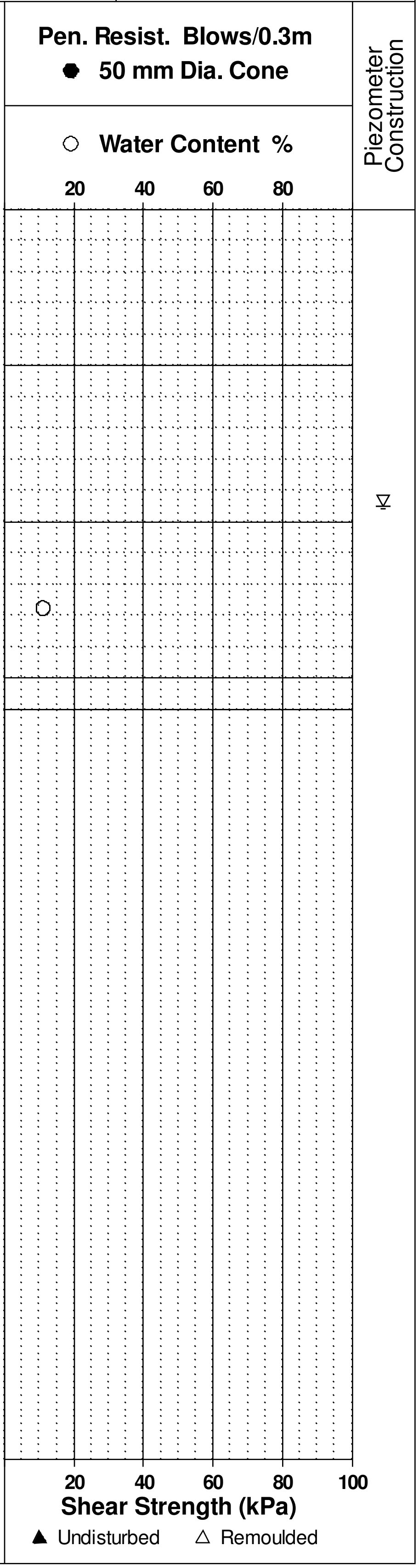
HOLE NO. TP18-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.64
TOPSOIL 0.15							
Stiff, brown **SILTY CLAY** with sand 1.20						1	86.64
Hard to very stiff, brown **SILTY CLAY** 1.90						2	85.64
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles, trace boulders 3.20		G	1			3	84.64

End of Test Pit

TP terminated on inferred bedrock surface at 3.20m depth

(Groundwater infiltration at 1.9m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP19-12

BORINGS BY Backhoe

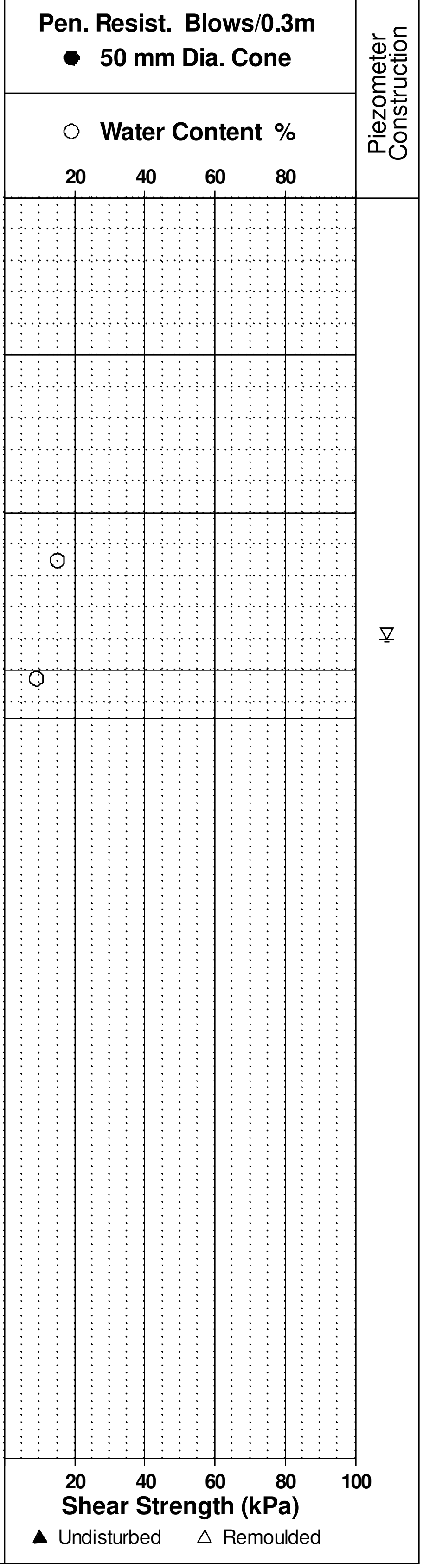
DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	90.02
TOPSOIL 0.25							
Compact, brown **SILTY SAND,** some clay 0.95							
						1	89.02
GLACIAL TILL: Dense, brown silty sand with clay, gravel, cobbles, trace boulders		G	1				
						2	88.02
- grey by 2.8m depth							
						3	87.02
3.30		G	2				

End of Test Pit

TP terminated in dense glacial till at 3.30m depth

(Groundwater infiltration at 2.8m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

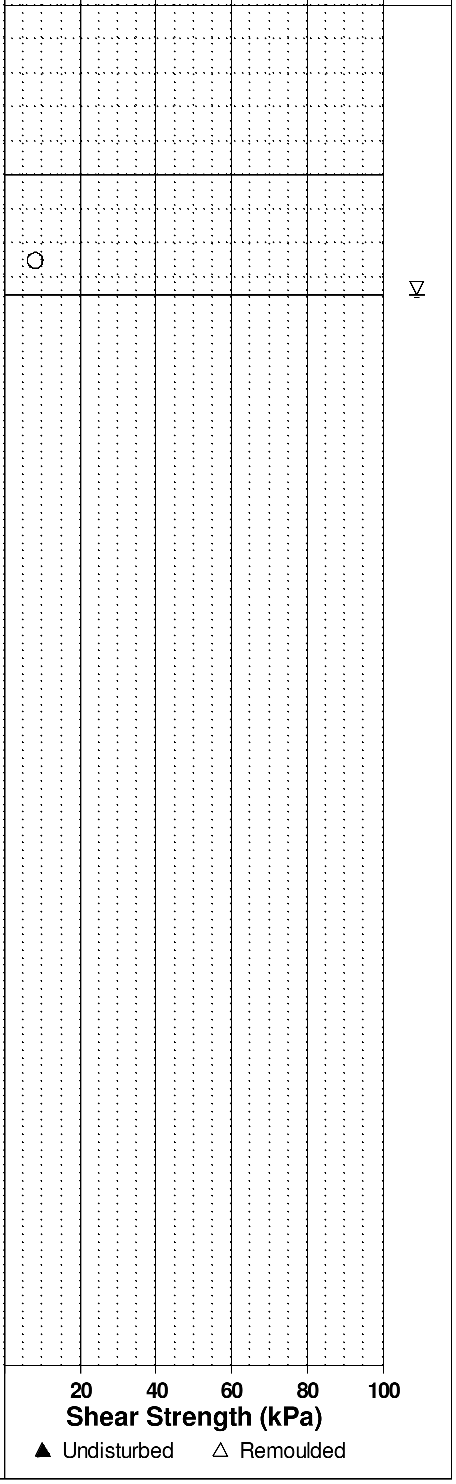
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP20-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.24
TOPSOIL 0.40							
GLACIAL TILL: Dense, brown silty sand with gravel, cobbles, trace clay and boulders						1	88.24
1.70		G	1				
End of Test Pit TP terminated on inferred bedrock surface at 1.70m depth (Groundwater infiltration at 1.7m depth)							



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

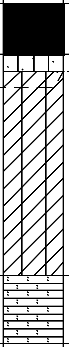
BORINGS BY Backhoe

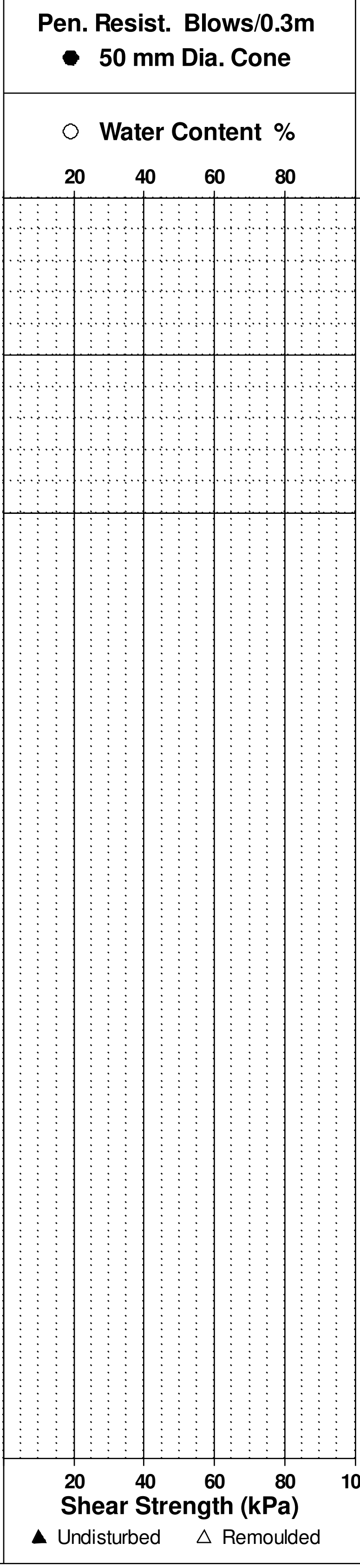
DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP21-12

SOIL DESCRIPTION	Bottom depth	TYPE	NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.41
TOPSOIL	0.30						
Compact, brown **SILTY SAND**	0.40						
Very stiff, brown **SILTY CLAY,** trace sand	1.60					1	88.41
Fractured **BEDROCK**	2.00					2	87.41
End of Test Pit (TP dry upon completion)							





SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP22-12

BORINGS BY Backhoe

DATE December 18, 2012

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 % (20, 40, 60, 80)	Piezometer Construction
GROUND SURFACE						0	89.36		
TOPSOIL 0.30	■								
Very stiff, brown **SILTY CLAY,** trace sand 1.40	▨					1	88.36		
End of Test Pit TP terminated on inferred bedrock surface at 1.40m depth (TP dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP23-12

BORINGS BY Backhoe

DATE December 18, 2012

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	93.53		
TOPSOIL 0.35	■								
Very stiff, brown **SILTY CLAY,** trace sand 0.75	▨								
End of Test Pit TP terminated on inferred bedrock surface at 0.75m depth (TP dry upon completion)									

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

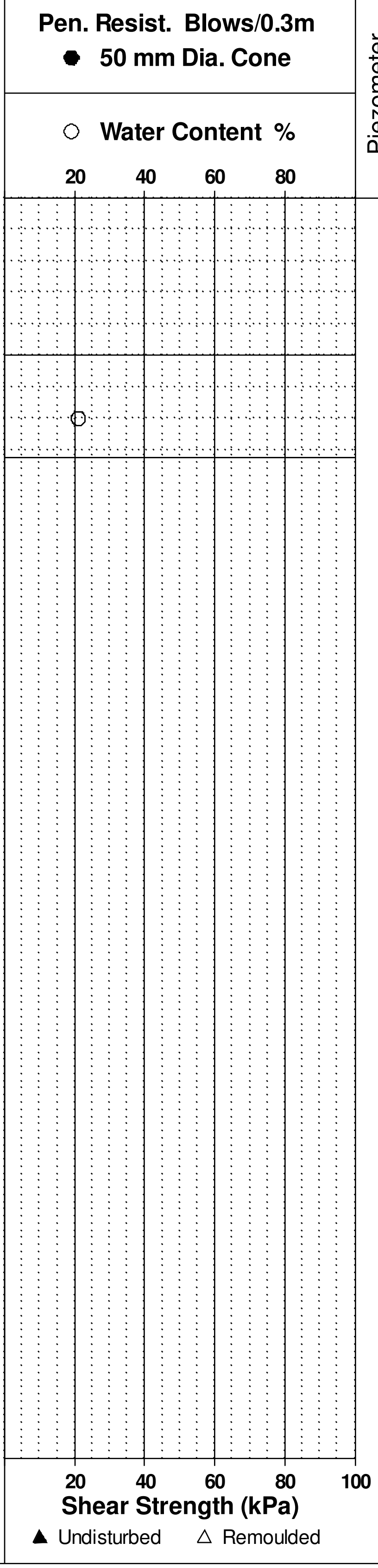
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP24-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	93.69	
TOPSOIL 0.30								
GLACIAL TILL: Very stiff, brown silty clay with sand, gravel, trace cobbles and boulders 1.65						1	92.69	
		G	1					
End of Test Pit TP terminated on inferred bedrock surface at 1.65m depth (TP dry upon completion)								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 17, 2012

FILE NO. PG1796

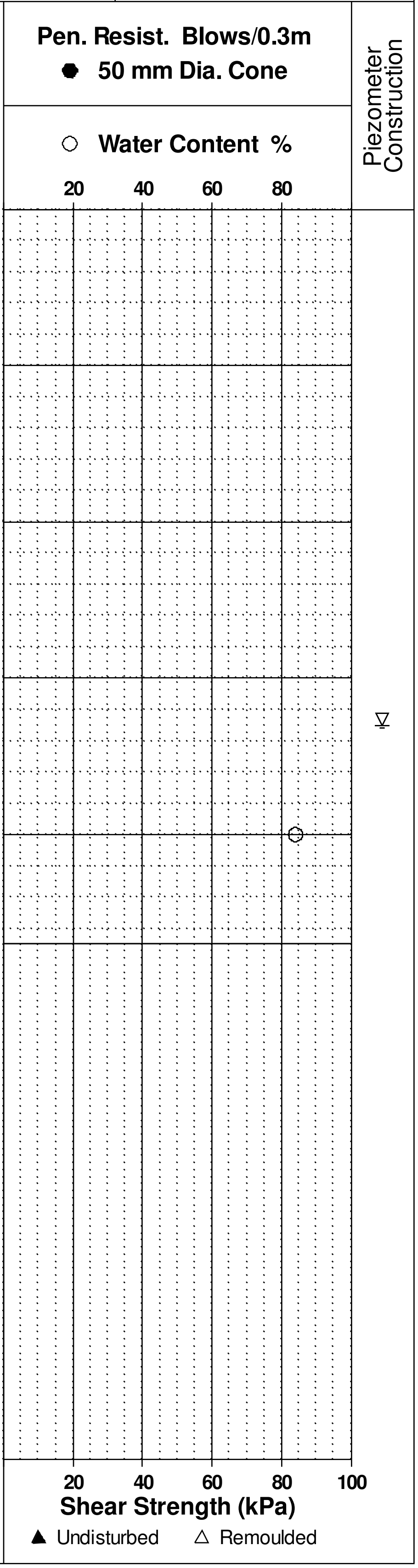
HOLE NO. TP25-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.41
TOPSOIL 0.25	■						
Brown **SILTY SAND,** trace clay 0.35							
Very stiff, brown **SILTY CLAY,** trace sand 1.00	▨					1	87.41
Hard to stiff, brown **SILTY CLAY** 3.30	▨					2 3	86.41 85.41
Stiff, grey **SILTY CLAY** 4.70	▨	G	1			4	84.41

End of Test Pit

TP terminated in stiff silty clay at 4.70m depth

(Groundwater infiltration at 3.3m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP26-12

BORINGS BY Backhoe

DATE December 18, 2012

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 % (20 40 60 80)	Piezometer Construction
GROUND SURFACE						0	88.44		
TOPSOIL 0.15	■								
Hard to very stiff, brown **SILTY CLAY,** trace sand 0.60	▨								
Very stiff, brown **SILTY CLAY** 1.80	▨					1	87.44		
GLACIAL TILL: Dense, brown silty clay with sand, gravel, cobbles, trace boulders - grey by 2.8m depth 3.30	^^^					2 3	86.44 85.44		▽
End of Test Pit TP terminated in dense glacial till at 3.30m depth (Groundwater infiltration high at 3.14m depth)									

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

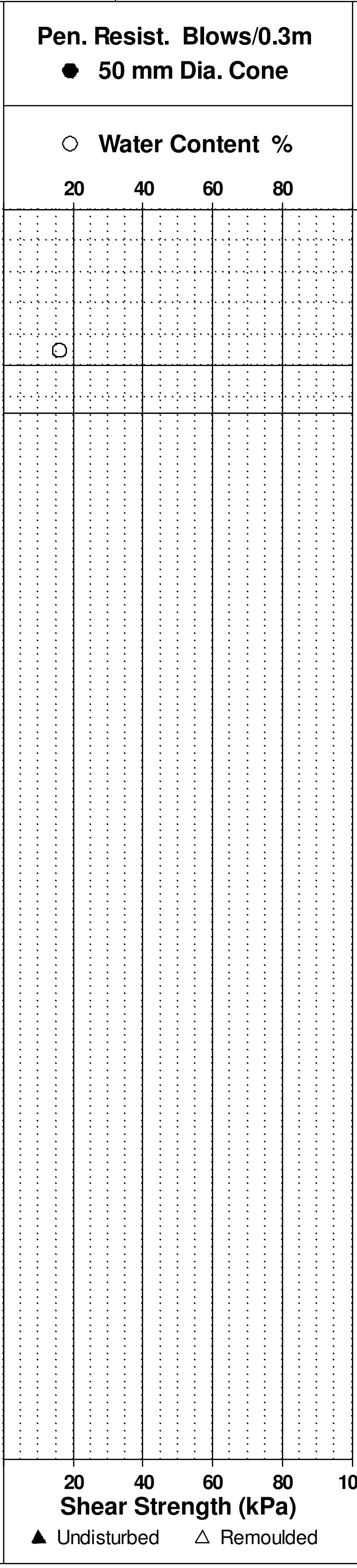
BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP27-12

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	90.90	
TOPSOIL 0.15								
GLACIAL TILL: Compact to dense, brown silty sand with clay, gravel, cobbles, trace boulders 1.30		G	1			1	89.90	
End of Test Pit TP terminated on inferred bedrock surface at 1.30m depth (TP dry upon completion)								



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. **PG1796**

REMARKS

HOLE NO. **TP28-12**

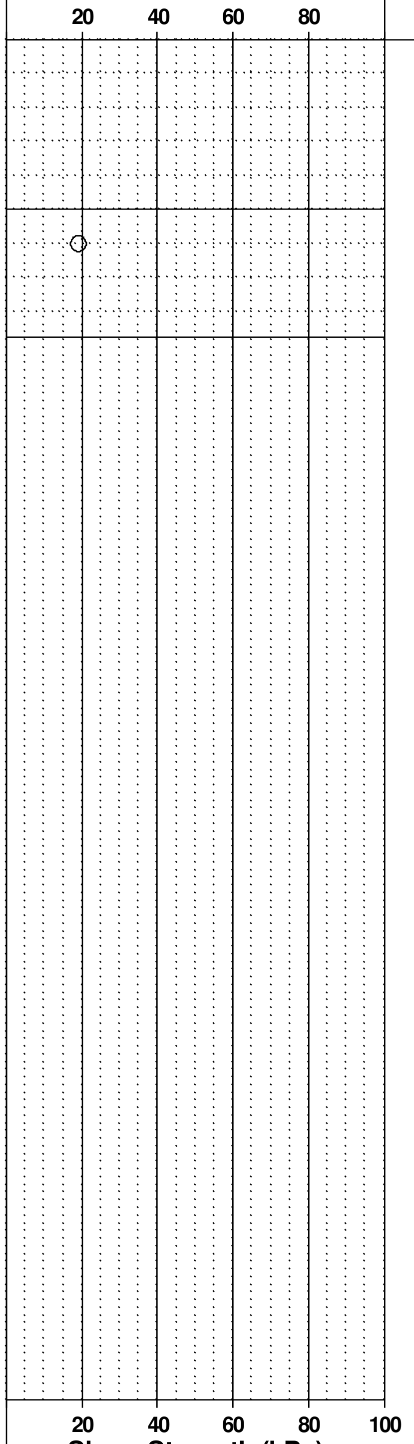
BORINGS BY Backhoe

DATE December 18, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.94
TOPSOIL/ORGANICS 0.60							
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles, trace boulders 1.75		G	1			1	86.94
End of Test Pit TP terminated on inferred bedrock surface at 1.75m depth (TP dry upon completion)							

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

○ **Water Content %**



Shear Strength (kPa)
▲ Undisturbed △ Remoulded

Piezometer Construction

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP29-12

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						0	87.08		
TOPSOIL 0.15									
Very stiff, brown **SILTY CLAY,** trace sand 1.00						1	86.08		
Hard to stiff, brown **SILTY CLAY**						2	85.08		
						3	84.08		
4.35						4	83.08		
End of Test Pit TP terminated on inferred bedrock surface at 4.35m depth (TP dry upon completion)									

Water Content %: 20 40 60 80

Shear Strength (kPa): 20 40 60 80 100

▲ Undisturbed △ Remoulded

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 18, 2012

FILE NO. PG1796

HOLE NO. TP30-12

SOIL DESCRIPTION		STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE							0	86.57	
TOPSOIL	0.15								
Loose, brown **SILTY SAND**	0.25								
Stiff, brown **SILTY CLAY,** trace sand	0.85								
							1	85.57	
							2	84.57	
Hard to stiff, brown **SILTY CLAY**									
							3	83.57	
							4	82.57	
	4.60								∇
							5	81.57	
Stiff, grey **SILTY CLAY**	5.80								
							6	80.57	

End of Test Pit

TP terminated in stiff silty clay at 5.80m depth

(Groundwater infiltration at 4.6m depth)

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

○ **Water Content %**
20 40 60 80

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

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 17, 2012

FILE NO. **PG1796**

HOLE NO. **TP31-12**

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 % 20 40 60 80	Piezometer Construction
GROUND SURFACE						0	82.57		
TOPSOIL 0.20									
Loose, brown **SILTY SAND,** trace clay 0.50									
Hard to very stiff, brown **SILTY CLAY** 3.50						1 2 3	81.57 80.57 79.57		∇
Stiff, grey **SILTY CLAY** 4.17						4	78.57		

End of Test Pit

TP terminated on inferred bedrock surface at 4.17m depth

(Groundwater infiltration at 3.5m depth)

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 17, 2012

FILE NO. **PG1796**

HOLE NO. **TP32-12**

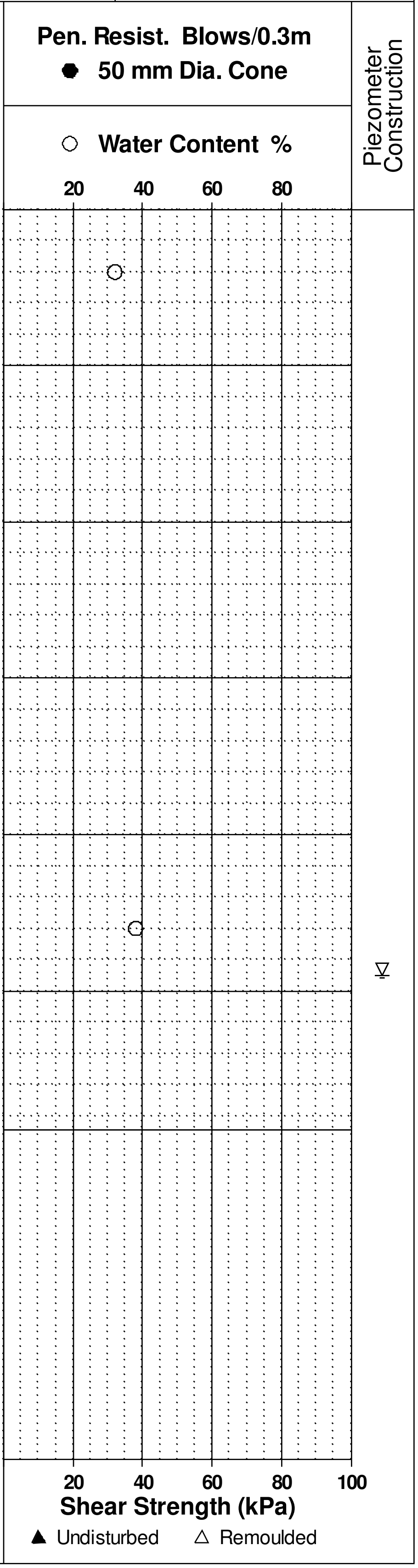
SOIL DESCRIPTION		SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE					
TOPSOIL	0.20				
Loose, brown **SILTY SAND,** trace clay	0.60	G	1		
Hard to very stiff, brown **SILTY CLAY**	4.90	G	2		
Stiff, grey **SILTY CLAY**	5.89				

DEPTH (m)	ELEV. (m)
0	82.26
1	81.26
2	80.26
3	79.26
4	78.26
5	77.26

End of Test Pit

TP terminated on inferred bedrock surface at 5.89m depth

(Groundwater infiltration high at 4.9m depth)



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

FILE NO. PG1796

REMARKS

HOLE NO. TP33-12

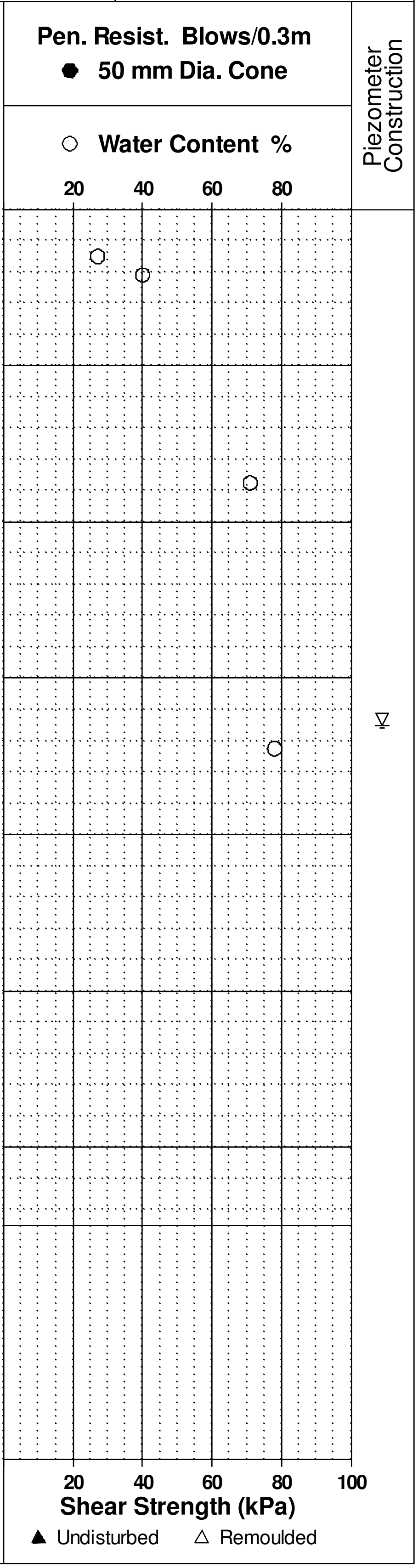
BORINGS BY Backhoe

DATE December 17, 2012

SOIL DESCRIPTION	Depth (m)
GROUND SURFACE	
TOPSOIL	0.25
Loose, brown **SILTY SAND**	0.35
Stiff, brown **SILTY CLAY,** trace sand	0.50
Hard to very stiff, brown **SILTY CLAY**	3.30
Stiff, grey **SILTY CLAY**	6.50
End of Test Pit TP terminated in stiff silty clay at 6.50m depth (Groundwater infiltration at 3.3m depth)	

TYPE	NUMBER	% RECOVERY	N VALUE or RQD
G	1		
G	2		
G	3		
G	4		

DEPTH (m)	ELEV. (m)
0	86.70
1	85.70
2	84.70
3	83.70
4	82.70
5	81.70
6	80.70



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development - Queen Street
Ottawa, Ontario

DATUM Ground surface elevations provided by Stantec Geomatics Limited.

REMARKS

BORINGS BY Backhoe

DATE December 17, 2012

FILE NO. PG1796

HOLE NO. TP34-12

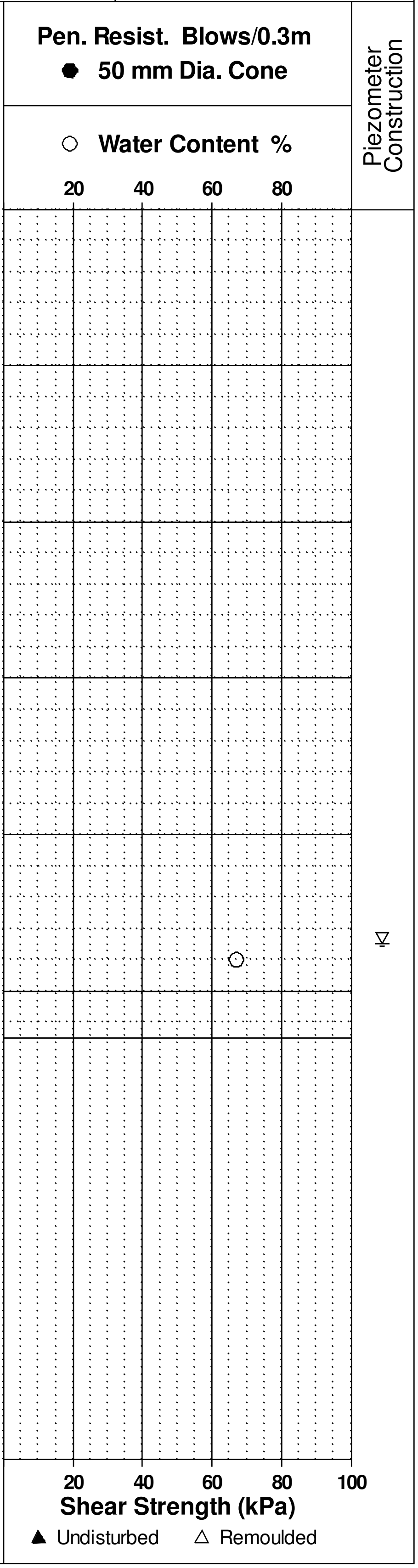
SOIL DESCRIPTION	Depth to base (m)	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD
GROUND SURFACE						
TOPSOIL	0.25	■				
Loose, brown **SILTY SAND**	0.50					
Stiff, brown **SILTY CLAY,** trace sand	0.90	▨				
Hard to stiff, brown **SILTY CLAY**	4.70	▨				
Stiff, grey **SILTY CLAY**	5.30	▨	G	1		

End of Test Pit

TP terminated in stiff silty clay at 5.30m depth

(Groundwater infiltration at 4.7m depth)

DEPTH (m)	ELEV. (m)
0	86.21
1	85.21
2	84.21
3	83.21
4	82.21
5	81.21



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5201**

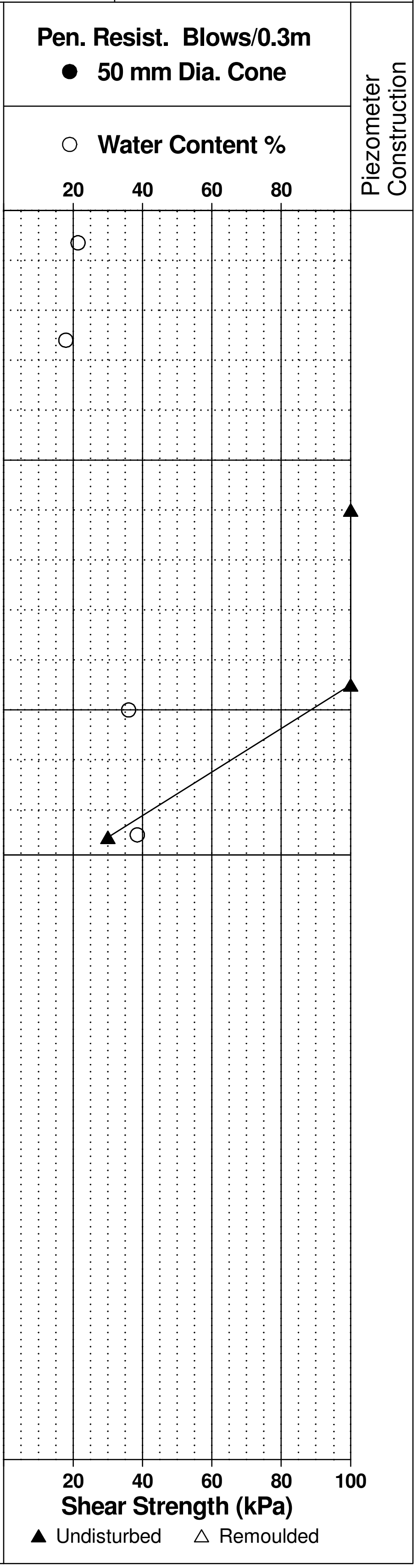
REMARKS

HOLE NO. **TP 1-21**

BORINGS BY Excavator

DATE 2021 February 26

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	82.71
TOPSOIL 0.13		G	1				
Brown **SILTY CLAY** 0.52		G	2				
Very stiff brown **SILTY CLAY** some silty sand		G	3				
						1	81.71
						2	80.71
		G	4				
2.58		G	5				
End of Test Pit							



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

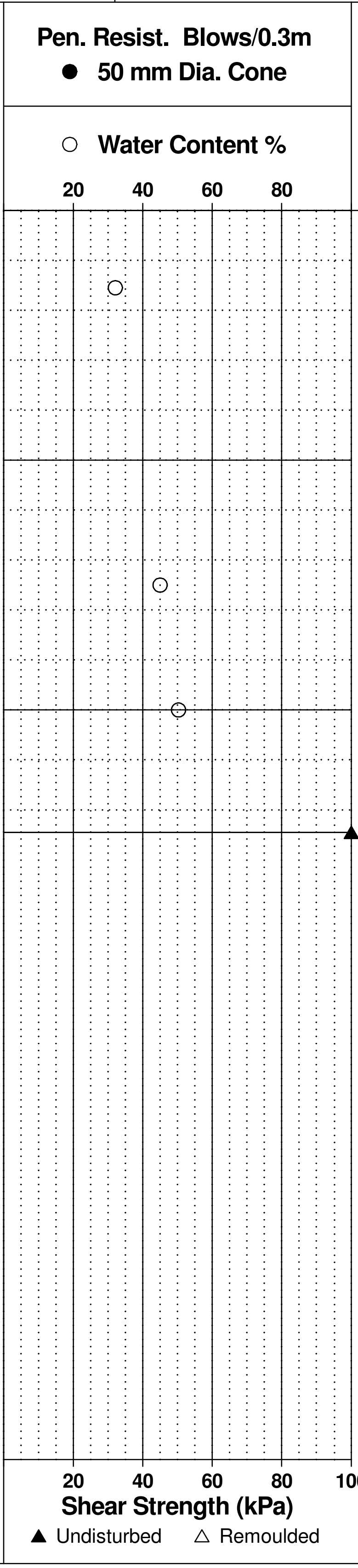
BORINGS BY Excavator

DATE 2021 February 26

FILE NO. PG5201

HOLE NO. TP 2-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.19		G	1			0	86.51
Brown **SILTY CLAY** with sand 0.31							
Very stiff brown **SILTY CLAY**		G	2				
						1	85.51
		G	3				
						2	84.51
2.49		G	4				
End of Test Pit							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5201

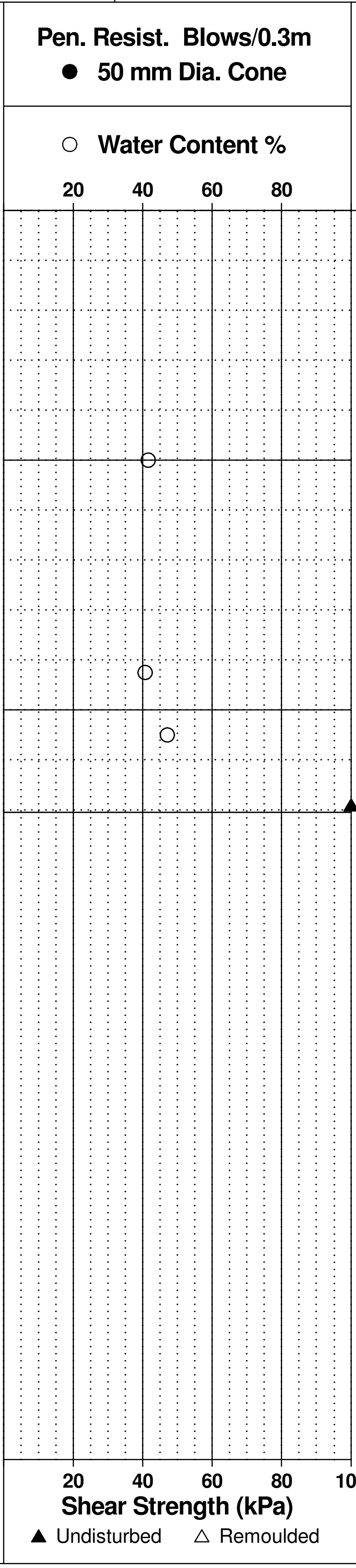
REMARKS

HOLE NO. TP 3-21

BORINGS BY Excavator

DATE 2021 February 26

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	86.26
TOPSOIL 0.14	G	1				
Brown **SILTY CLAY** some sand 0.31						
Very stiff brown **SILTY CLAY**					1	85.26
	G	2				
	G	3				
					2	84.26
	G	4				
2.38 End of Test Pit						



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5201

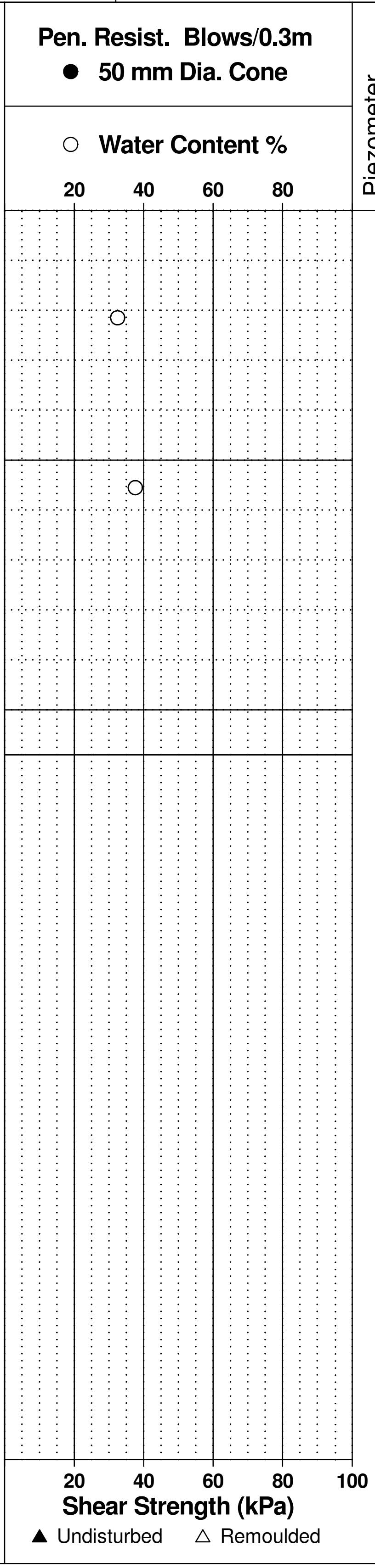
REMARKS

HOLE NO. TP 4-21

BORINGS BY Excavator

DATE 2021 February 26

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.13
FILL: Brown silty sand with crushed stone, gravel, cobbles and boulders	▨	G	1				
	▨	G	2				
0.98							
Stiff brown **SILTY CLAY**	▨	G	3			1	86.13
	▨					2	85.13
	▨	G	4				
2.18							
End of Test Pit							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

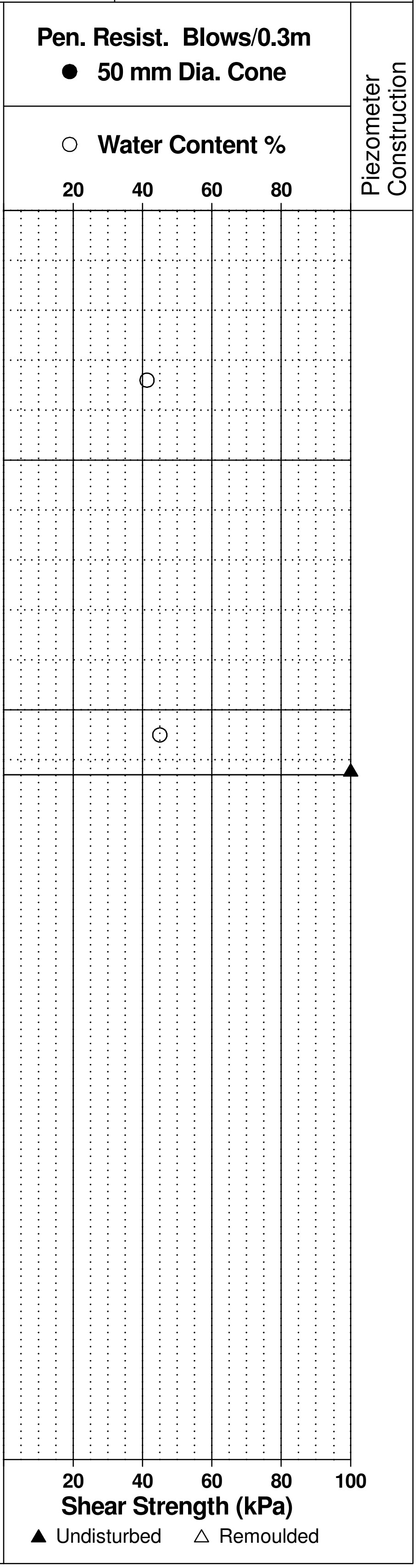
BORINGS BY Excavator

DATE 2021 February 26

FILE NO. PG5201

HOLE NO. TP 5-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.15		G	1			0	86.65
Very stiff brown **SILTY CLAY**							
		G	2				
						1	85.65
						2	84.65
2.24		G	3				
End of Test Pit							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5201

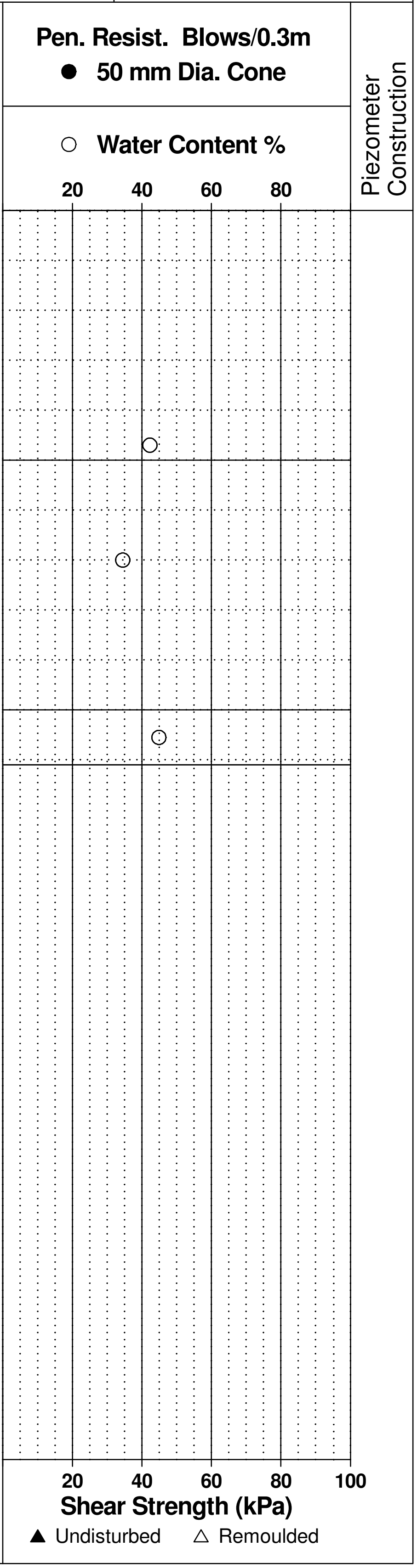
REMARKS

HOLE NO. TP 6-21

BORINGS BY Excavator

DATE 2021 February 26

SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE					0	87.93
TOPSOIL 0.19	G	1				
Brown **SILTY CLAY**					1	86.93
	G	2				
1.79	G	3				
GLACIAL TILL: Brown silty clay with some sand, gravel, cobbles and boulders 2.22	G	4			2	85.93
End of Test Pit						



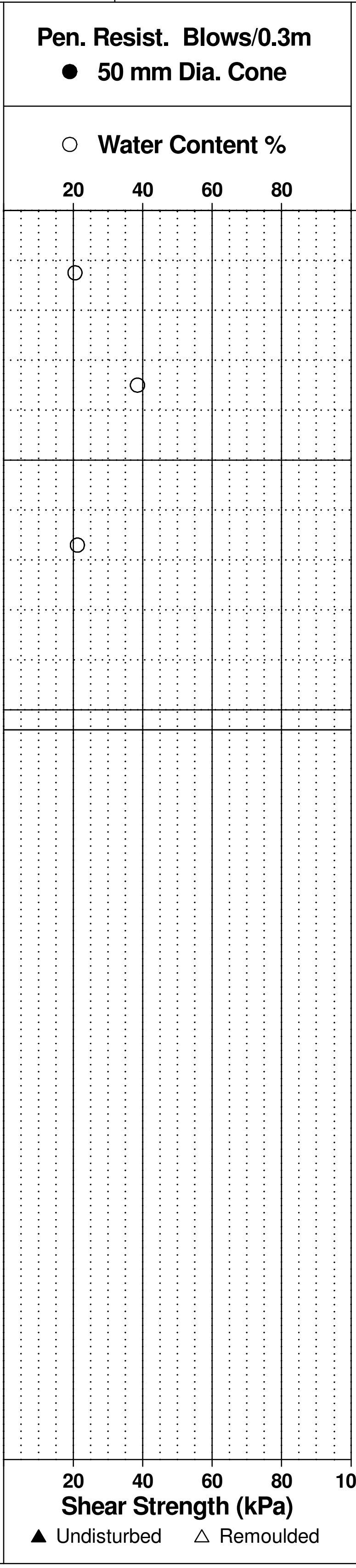
patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Excavator
DATE 2021 February 26
FILE NO. PG5201
HOLE NO. TP 7-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or ROD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	88.71	
TOPSOIL 0.25		G	1					
Brown **SILTY SAND** 0.46		G	2					
Stiff brown **SILTY CLAY** 1.35		G	3			1	87.71	
GLACIAL TILL: Brown silty clay, with gravel, cobbles and boulders 2.08		G	4			2	86.71	
End of Test Pit								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

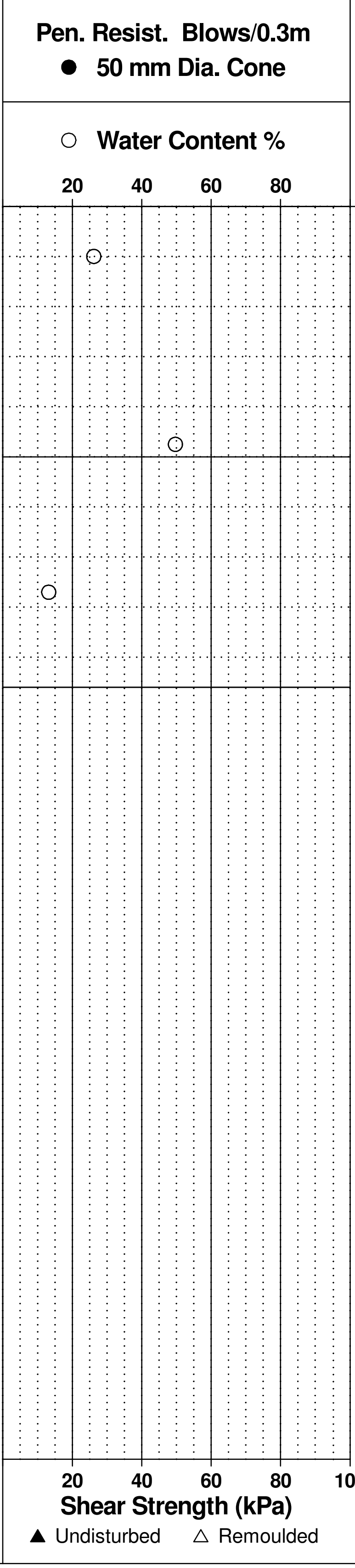
BORINGS BY Excavator

DATE 2021 February 26

FILE NO. PG5201

HOLE NO. TP 8-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.57
TOPSOIL 0.19		G	1				
Brown **SILTY SAND** 0.95		G	2				
Stiff brown **SILTY CLAY** 1.54		G	3			1	88.57
GLACIAL TILL: Brown silty clay with sand, gravel, cobbles and boulders 1.92		G	4				
End of Test Pit Refusal to excavation on bedrock surface at 1.92 m depth							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

BORINGS BY Excavator

DATE 2021 February 26

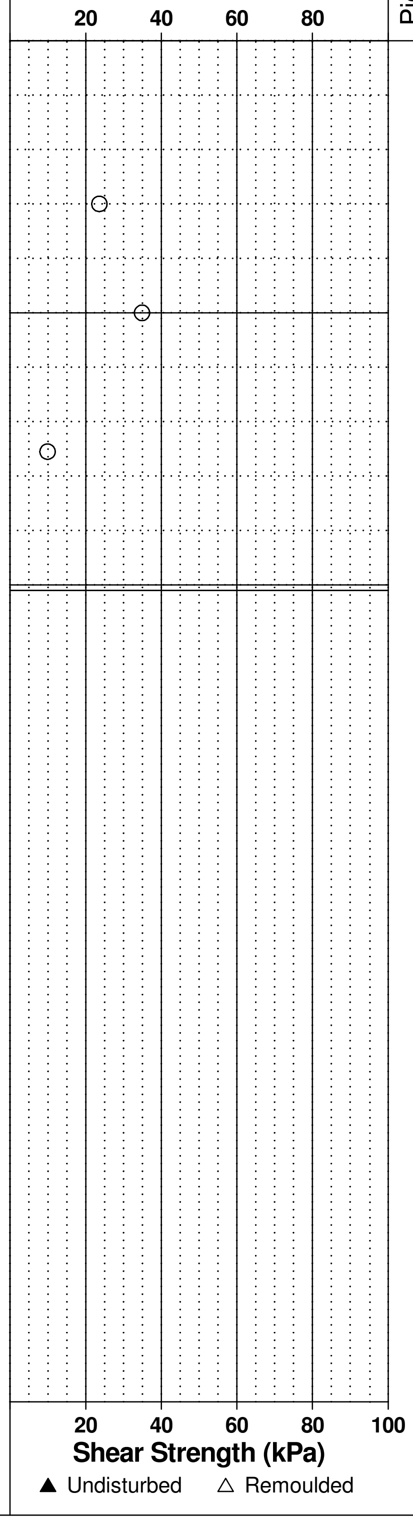
FILE NO. PG5201

HOLE NO. TP 9-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.24
TOPSOIL 0.16							
Stiff brown **SILTY CLAY**		G	1				
		G	2			1	88.24
		G	3				
1.81		G	4				
GLACIAL TILL: Brown silty clay with brown silty sand, gravel, cobbles and boulders 2.02						2	87.24
End of Test Pit Refusal to excavation on bedrock surface at 2.02 m depth							

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

○ Water Content %



Piezometer Construction

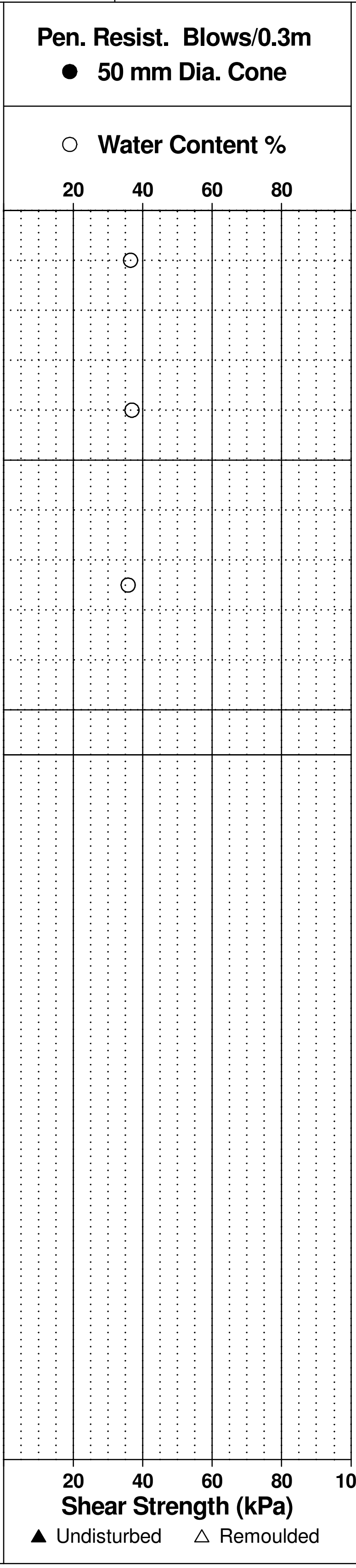
patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic
REMARKS
BORINGS BY Excavator
DATE 2021 February 26
FILE NO. PG5201
HOLE NO. TP10-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	88.32	
TOPSOIL 0.19	■	G	1					
Brown **SILTY CLAY**	▨	G	2					
	▨	G	3			1	87.32	
2.18	▨	G	4			2	86.32	
End of Test Pit Refusal to excavation on bedrock surface at 2.18 m depth								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

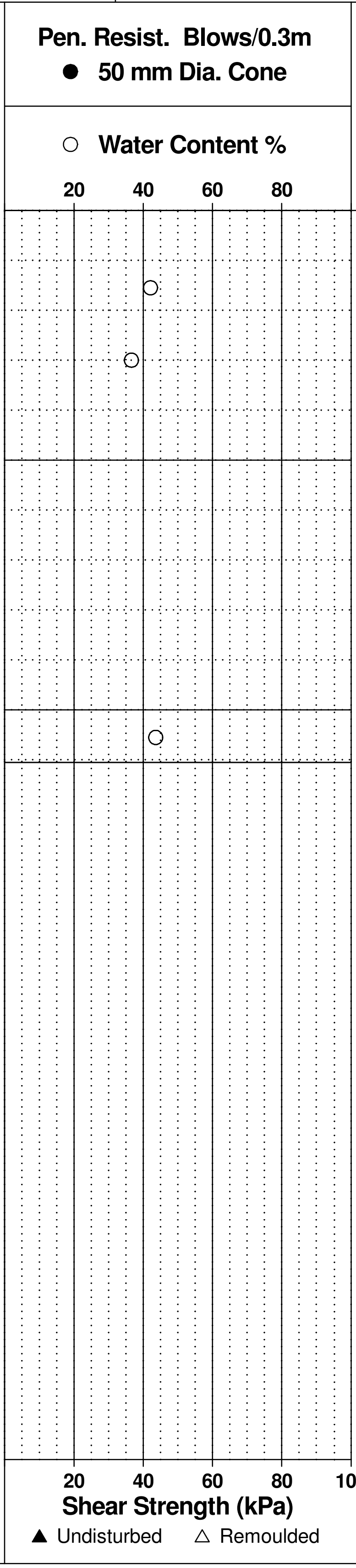
BORINGS BY Excavator

DATE 2021 February 26

FILE NO. PG5201

HOLE NO. TP11-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	86.87
TOPSOIL 0.21	■	G	1				
Brown **SILTY CLAY**	▨	G	2				
	▨	G	3			1	85.87
	▨					2	84.87
2.21	▨	G	4				
End of Test Pit							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

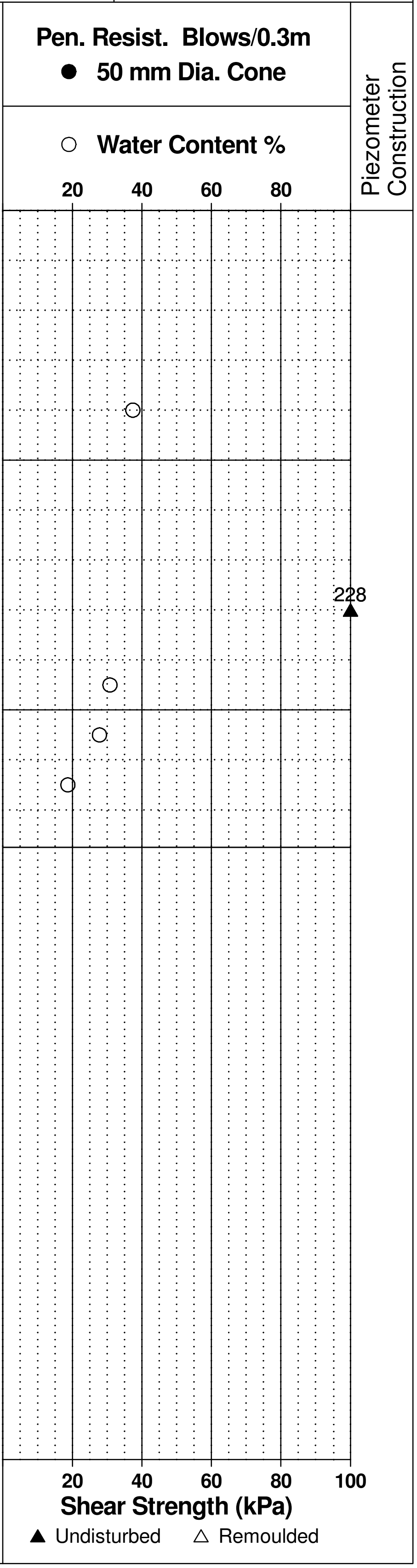
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP12-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	82.56
FILL: Fragmented rock with brown silty sand	▩	G	1				
0.45							
Hard brown **SILTY CLAY**	▨	G	2			1	81.56
		G	3			2	80.56
		G	4				
2.30							
GLACIAL TILL: Brown silty sand, some clay, gravel, cobbles and boulders		G	5				
2.55							
End of Test Pit Refusal to excavation on bedrock surface at 2.55 m depth							



patersongroup Consulting Engineers
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

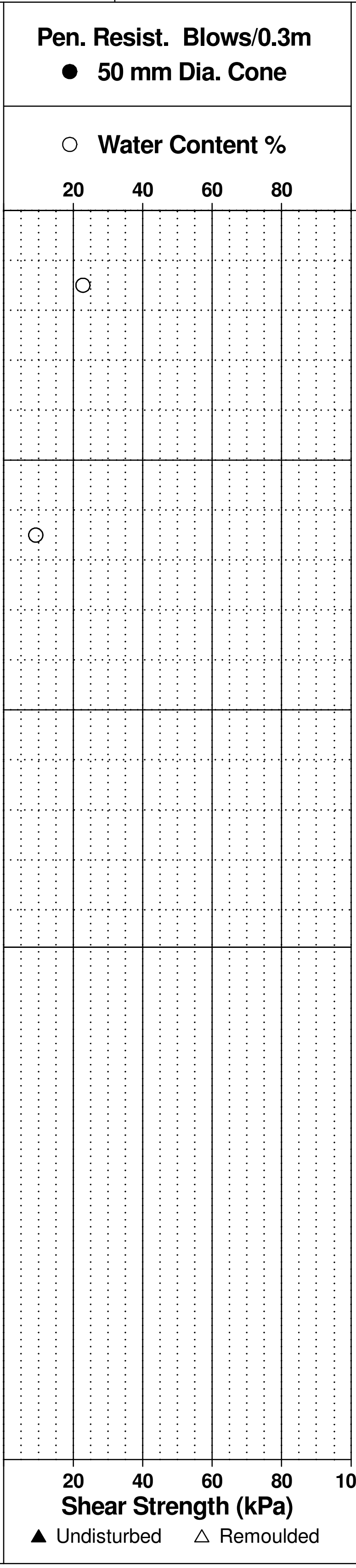
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP13-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL 0.22						0	87.22
GLACIAL TILL: Brown silty clay some sand, trace gravel, cobbles and boulders 0.60		G	1				
GLACIAL TILL: Brown silty sand some gravel, cobbles and boulders 2.95		G	2			1 2	86.22 85.22
End of Test Pit Refusal to excavation on bedrock surface at 2.95 m depth							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5201**

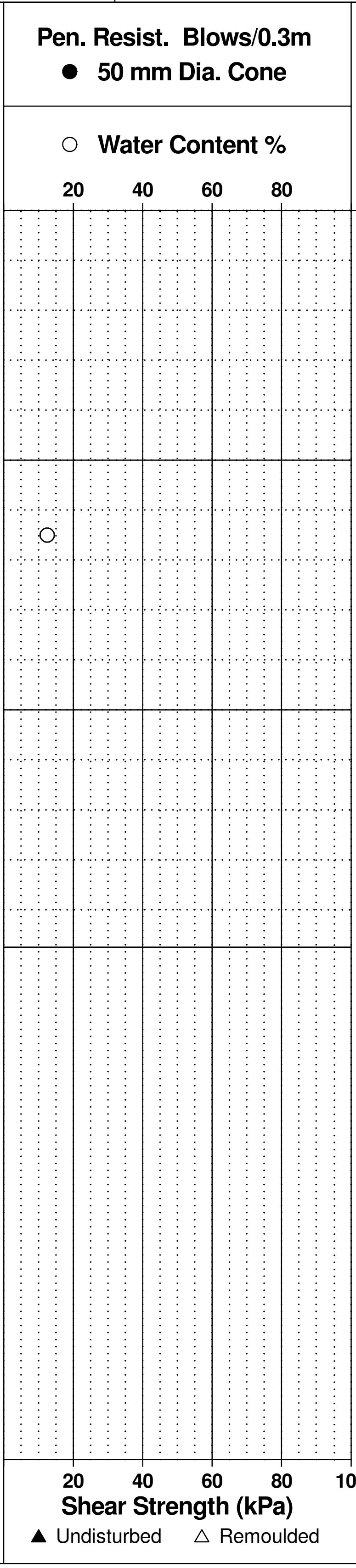
REMARKS

HOLE NO. **TP14-21**

BORINGS BY Excavator

DATE 2021 March 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	93.44
TOPSOIL	■	G	1				
0.25							
GLACIAL TILL: Brown silty sand some gravel, cobbles and boulders	^^^					1	92.44
		G	2				
						2	91.44
2.95							
End of Test Pit Refusal to excavation on bedrock surface at 2.95 m depth							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

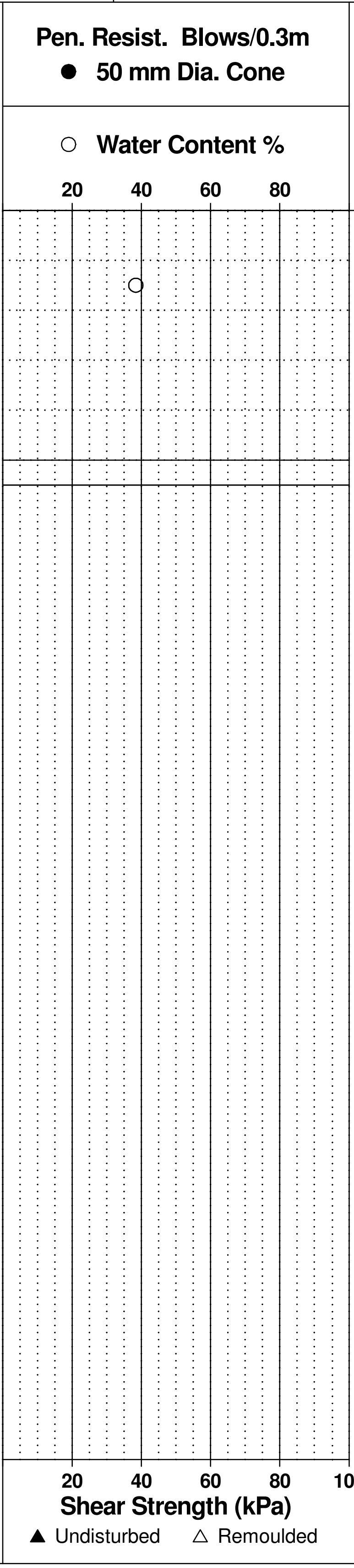
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP15-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE							
TOPSOIL	■					0	94.54
0.27							
GLACIAL TILL: Brown silty sand some gravel, cobbles and boulders	^^^	G	1				
						1	93.54
1.10							
End of Test Pit Refusal to excavation on bedrock surface at 1.10 m depth							



Piezometer Construction

patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

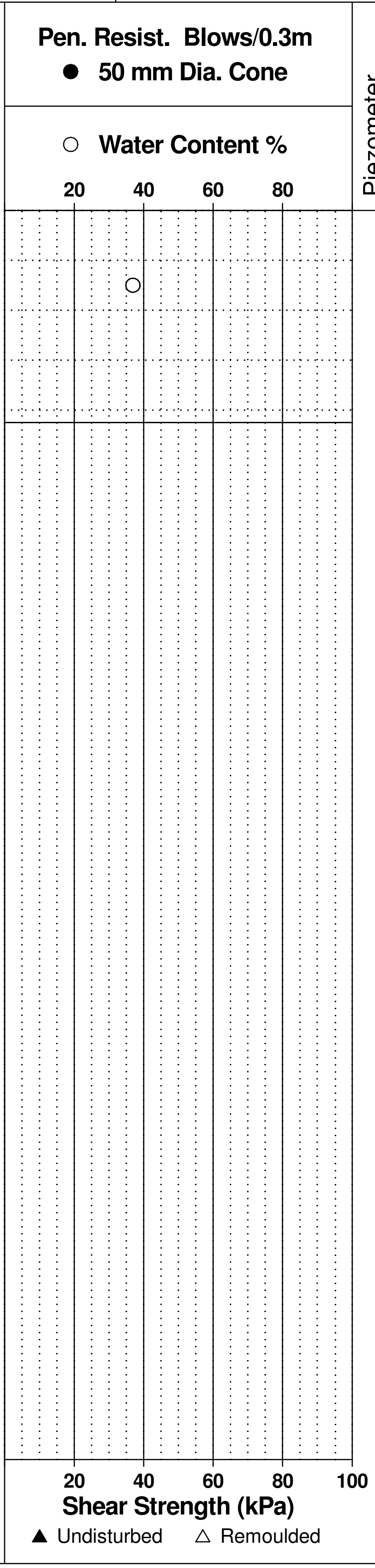
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP16-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	90.42	
TOPSOIL 0.26	■							
GLACIAL TILL: Brown silty clay, some sand, gravel, cobbles and boulders 0.85	^	G	1					
End of Test Pit								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. PG5201

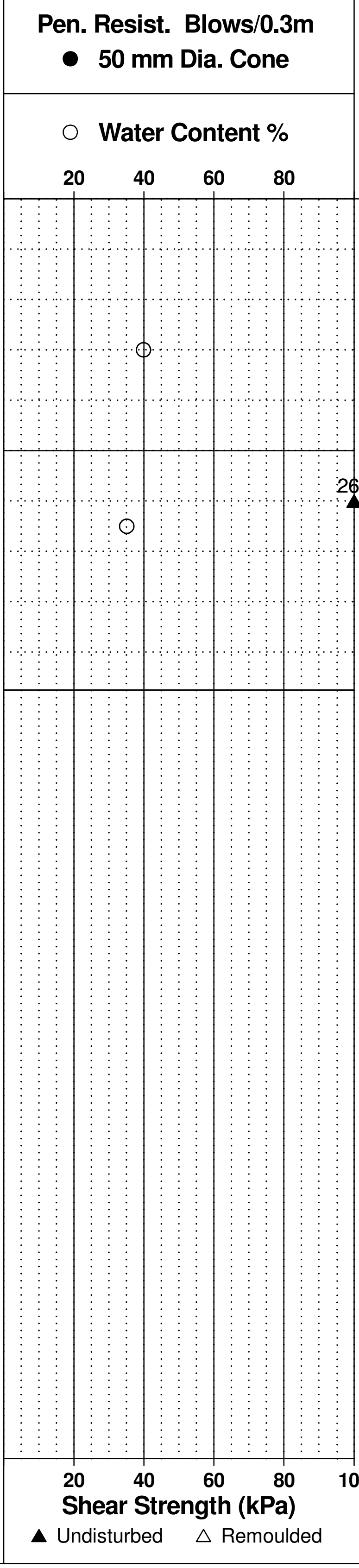
REMARKS

HOLE NO. TP17-21

BORINGS BY Excavator

DATE 2021 March 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	% RECOVERY	N VALUE or RQD	DEPTH (m)	ELEV. (m)	Piezometer Construction
GROUND SURFACE						0	89.57	
TOPSOIL 0.27	■							
Hard brown **SILTY CLAY**	▨	G	1					
	▨					1	88.57	
	▨	G	2					
1.95	▨							
End of Test Pit Refusal to excavation on bedrock surface at 1.95 m depth								



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

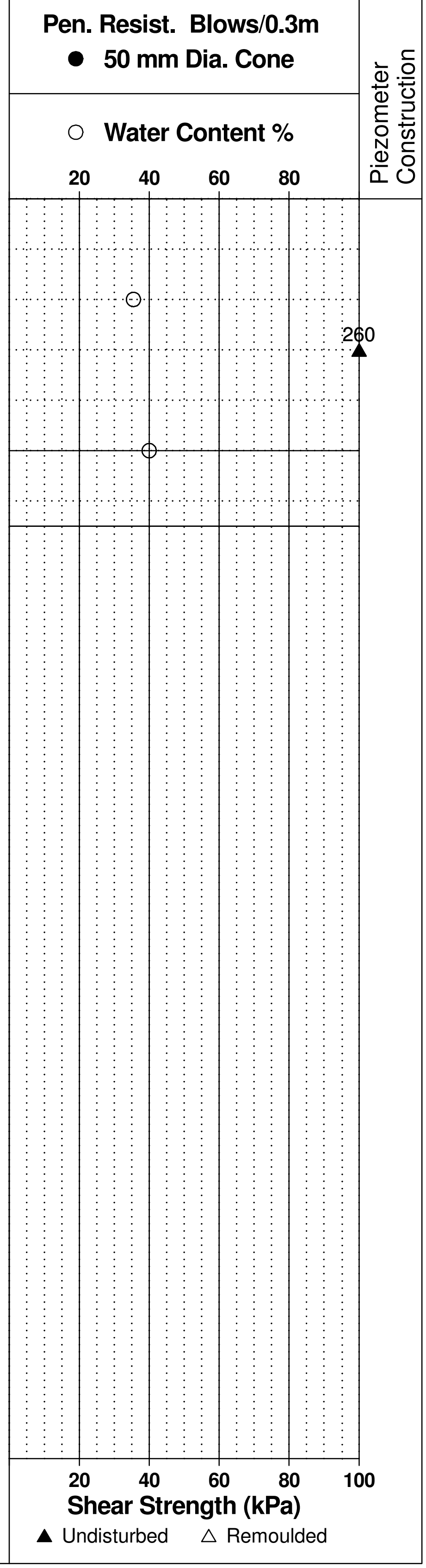
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP18-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	89.96
TOPSOIL 0.26	■						
Hard brown **SILTY CLAY**	▨	G	1				
	▨	G	2			1	88.96
1.30							
End of Test Pit Refusal to excavation on bedrock surface at 1.30 m depth							



patersongroup Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

FILE NO. **PG5201**

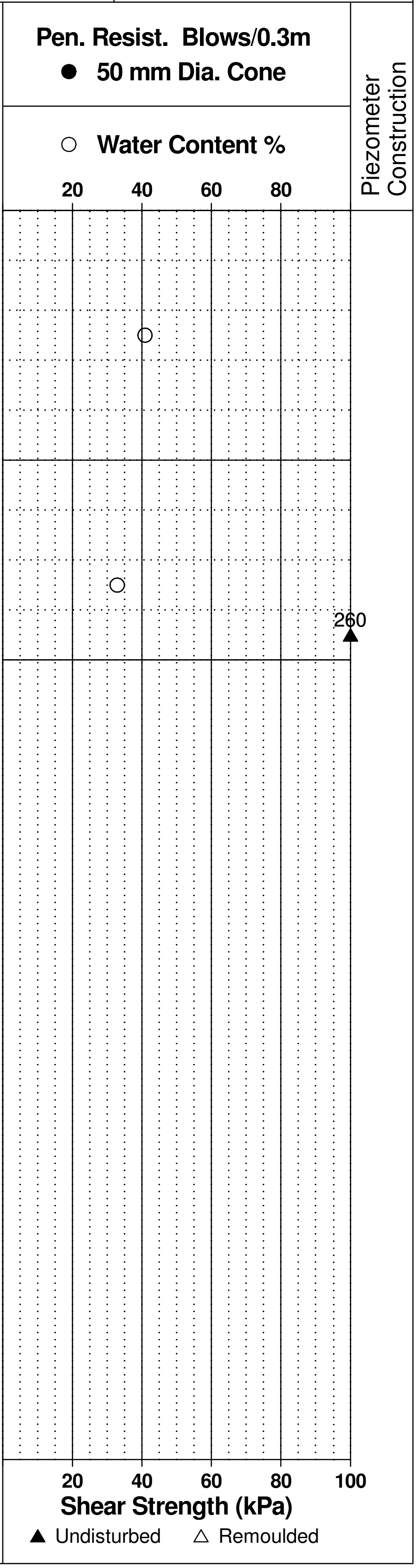
REMARKS

HOLE NO. **TP19-21**

BORINGS BY Excavator

DATE 2021 March 1

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	88.27
TOPSOIL 0.28							
ard brown **SILTY CLAY**		G	1				
						1	87.27
1.80		G	2				



SOIL PROFILE AND TEST DATA

Geotechnical Investigation
Proposed Residential Development
Cardinal Creek Village South - Ottawa, Ontario

DATUM Geodetic

REMARKS

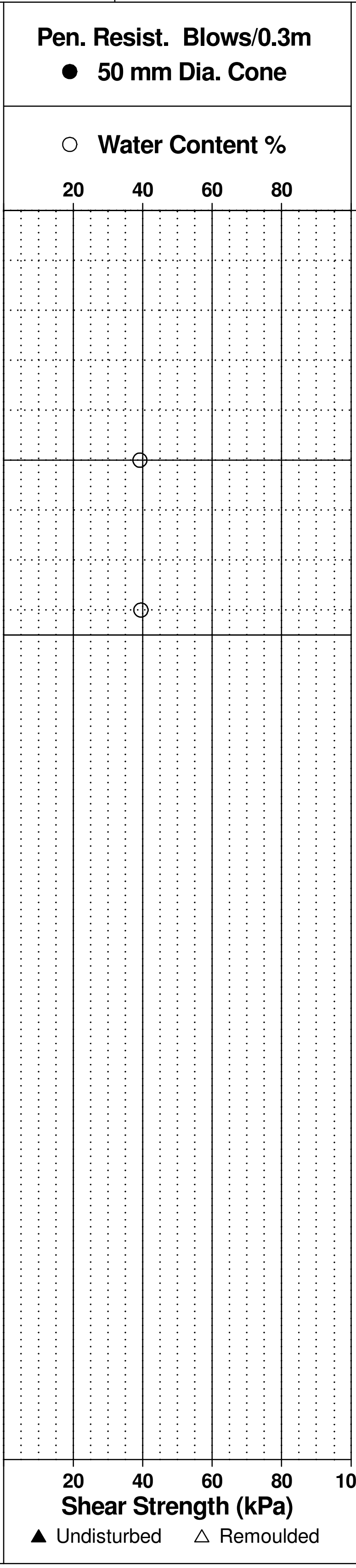
BORINGS BY Excavator

DATE 2021 March 1

FILE NO. PG5201

HOLE NO. TP20-21

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	87.43
TOPSOIL 0.29	■						
Hard brown **SILTY CLAY**	▨	G	1			1	86.43
1.70	▨	G	2				
End of Test Pit Refusal to excavation on bedrock surface at 1.70 m depth							



Piezometer Construction

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 strength of cohesionless soils is the relative density, 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.

Relative Density	'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 vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

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

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their “sensitivity”. The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

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 NXL size core. However, it can be used on smaller core sizes, such as BX, 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
PS	-	Piston sample
AU	-	Auger sample or bulk sample
WS	-	Wash sample
RC	-	Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC% - Natural moisture 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 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 x 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)

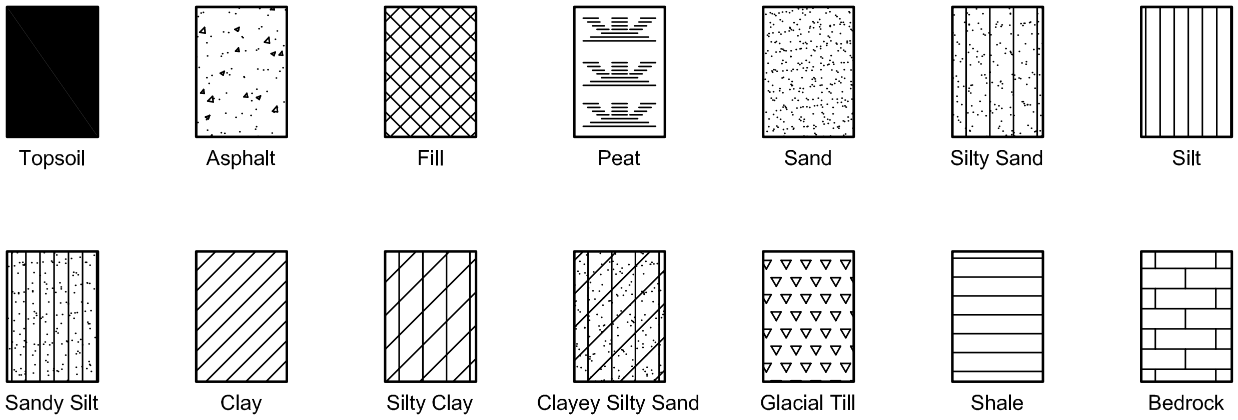
OC Ratio Overconsolidaton ratio = p'_c / p'_o
Void Ratio Initial sample void ratio = volume of voids / volume of solids
Wo - Initial water content (at start of consolidation test)

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.

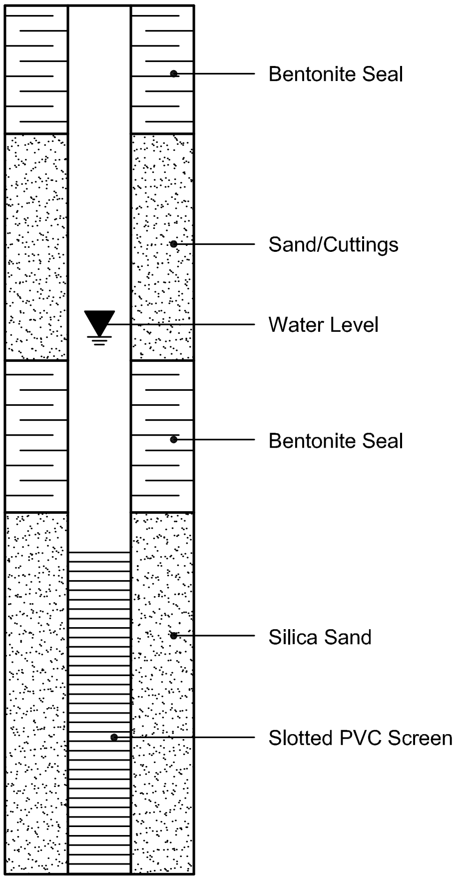
SYMBOLS AND TERMS (continued)

STRATA PLOT

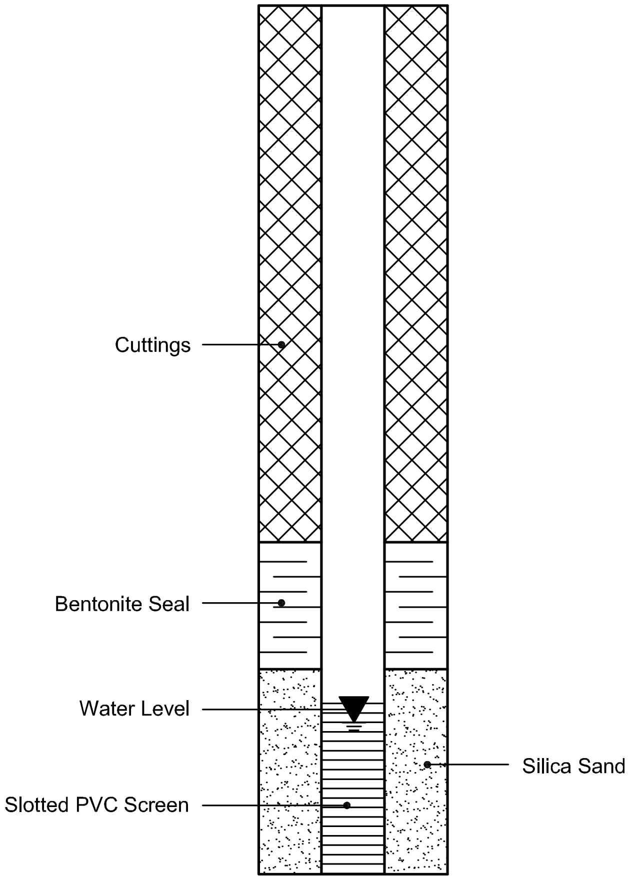


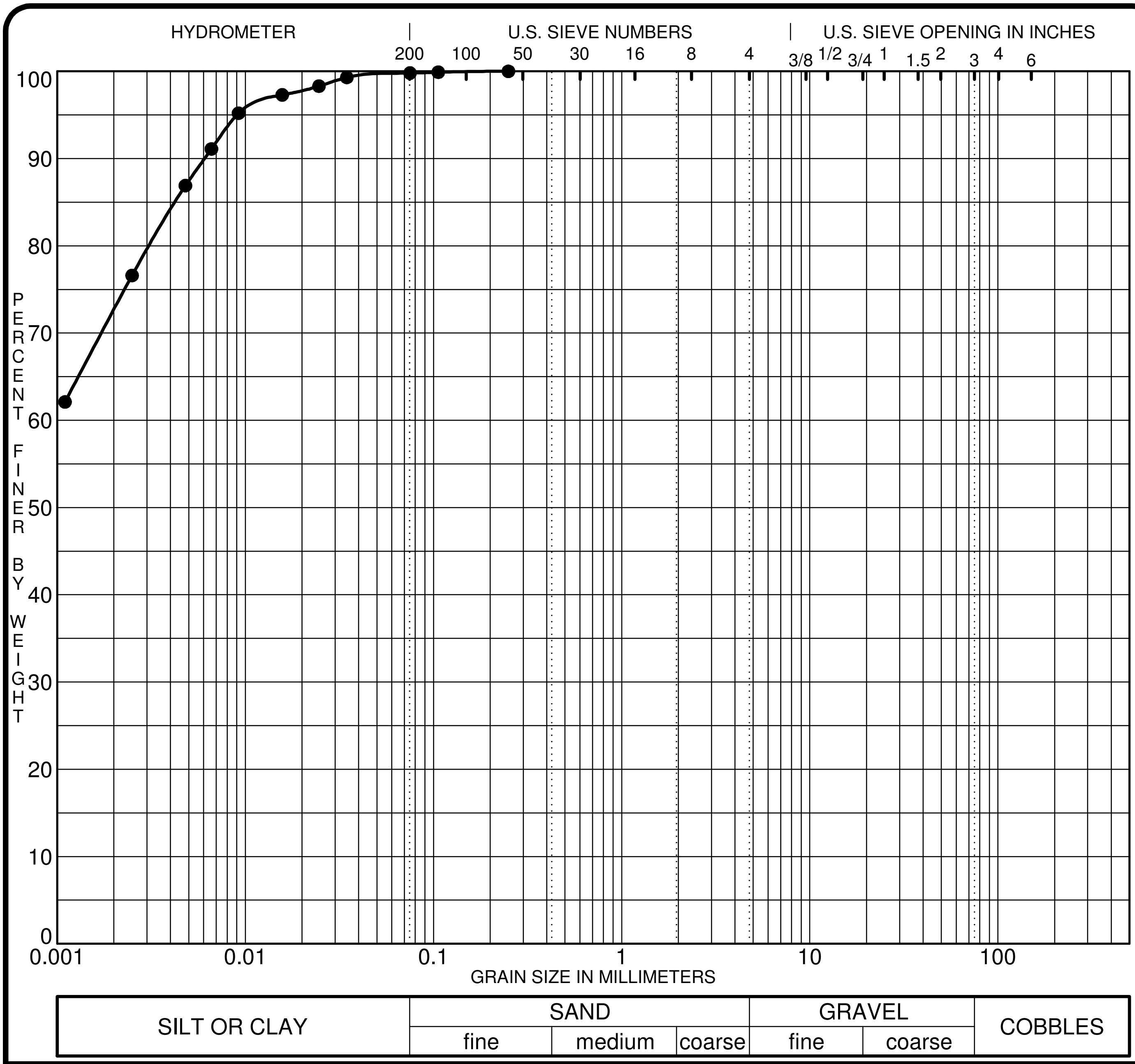
MONITORING WELL AND PIEZOMETER CONSTRUCTION

MONITORING WELL CONSTRUCTION



PIEZOMETER CONSTRUCTION





Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP 2-21 G4**	**CH = Inorganic Clays of High Plasticity**		**71**	**29**	**42**		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP 2-21 G4**	**0.25**				**0.0**	**0.2**	**99.8**	

CLIENT **Taggart Investments**

PROJECT **Geotechnical Investigation - Proposed Residential Development**

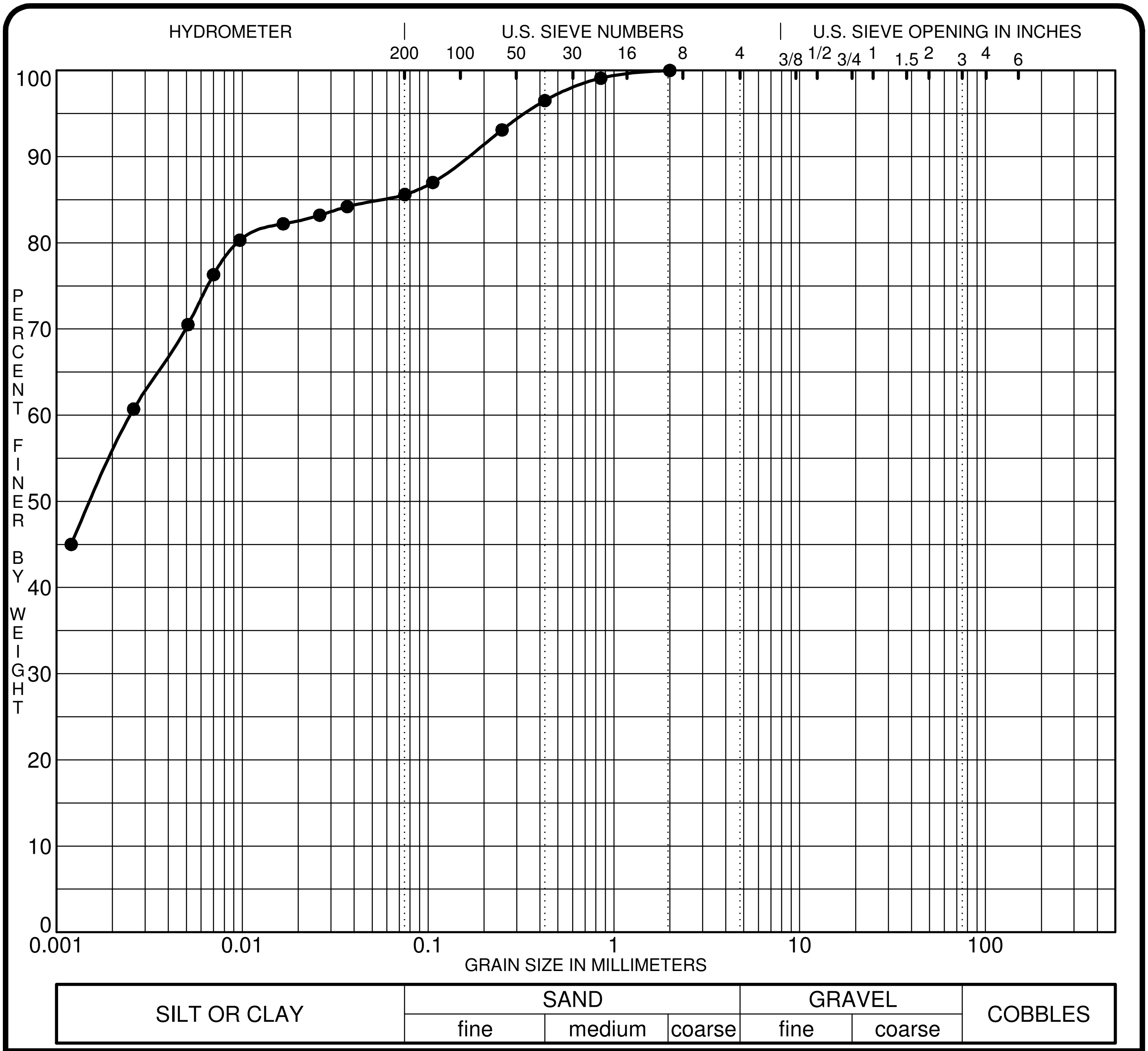
FILE NO. **PG5201**

DATE **26 Feb 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP 7-21 G3**	**MH = Inorganic Silts of High Plasticity**		**59**	**32**	**27**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP 7-21 G3**	**2.00**	**0.00**			**0.0**	**14.4**	**85.6**	

CLIENT **Taggart Investments**

PROJECT **Geotechnical Investigation - Proposed Residential Development**

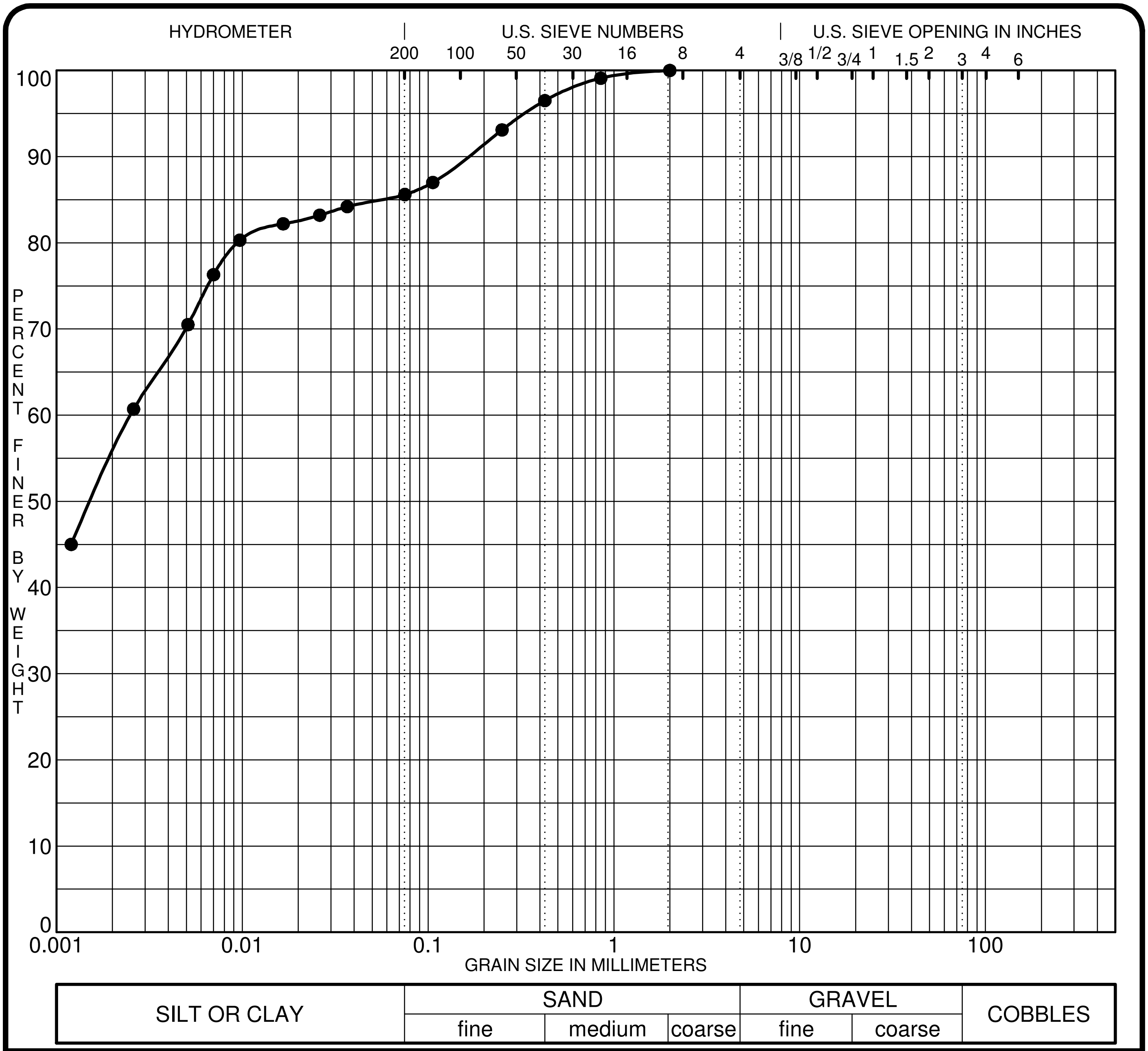
FILE NO. **PG5201**

DATE **26 Feb 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP10-21 G4**	**MH = Inorganic SIlts of High Plasticity**		**60**	**33**	**27**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP10-21 G4**	**2.00**	**0.00**			**0.0**	**14.4**	**85.6**	

CLIENT **Taggart Investments**

PROJECT **Geotechnical Investigation - Proposed Residential Development**

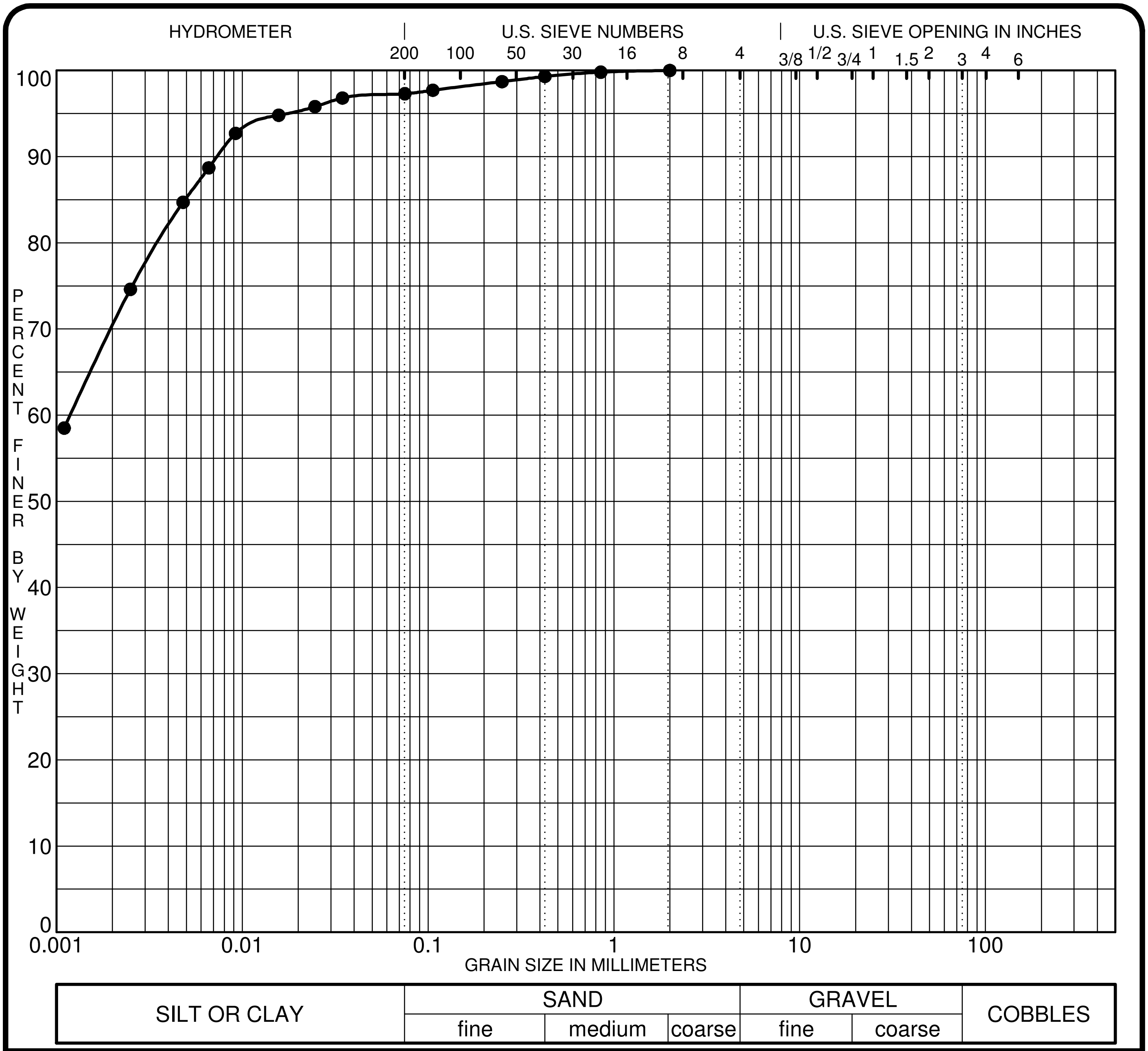
FILE NO. **PG5201**

DATE **26 Feb 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP12-21 G2**	**MH = Inorganic Silts of High Plasticity**		**75**	**37**	**38**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP12-21 G4**	**2.00**	**0.00**			**0.0**	**2.7**	**97.3**	

CLIENT **Taggart Investments**

FILE NO. **PG5201**

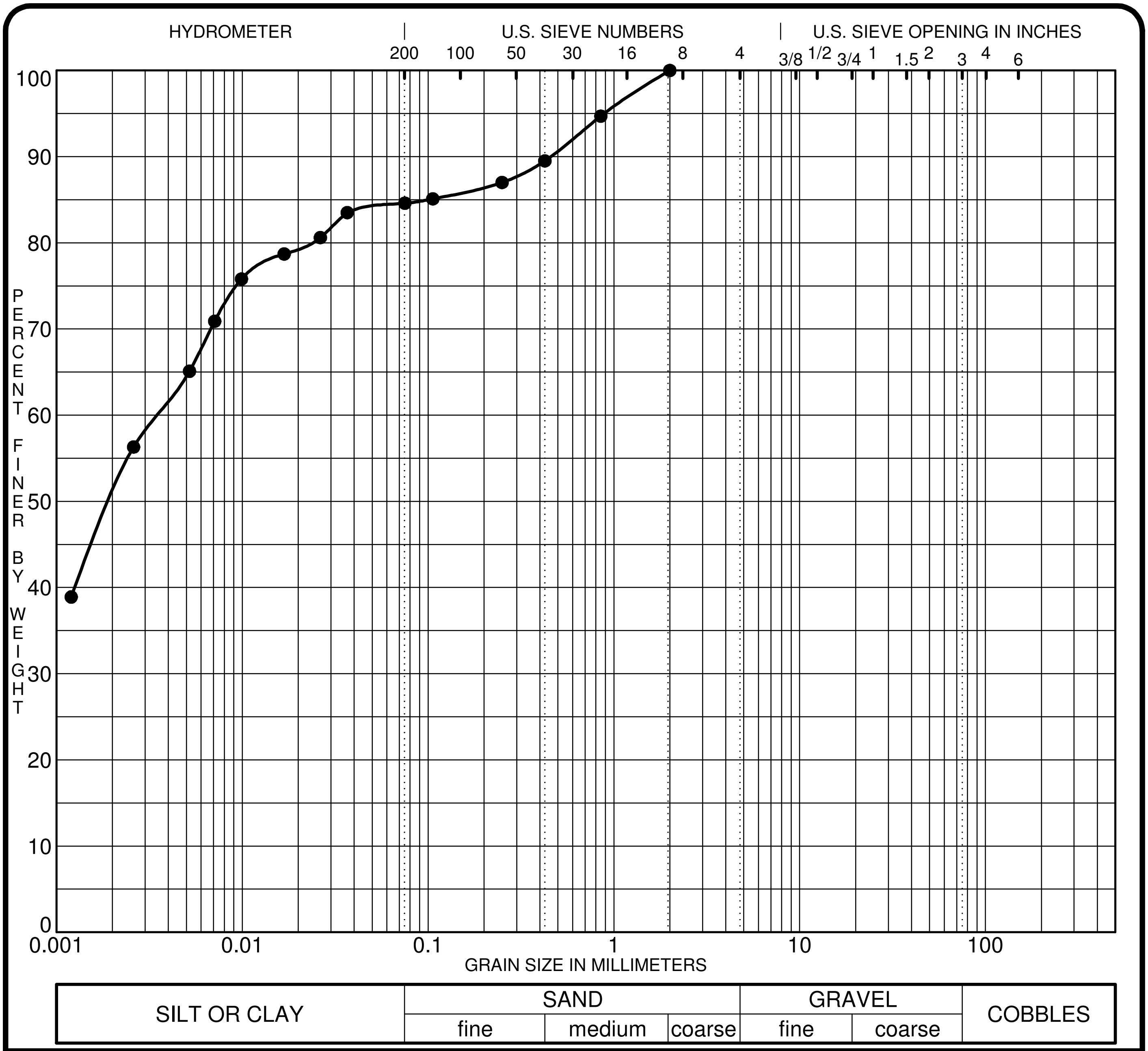
PROJECT **Geotechnical Investigation - Proposed Residential Development**

DATE **1 Mar 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



	Specimen Identification	Classification	MC%	LL	PL	PI	Cc	Cu
●	**TP18-21 G1**	**MH = Inorganic Silts of High Plasticity**		**66**	**36**	**30**		

	Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**TP18-21 G1**	**2.00**	**0.00**			**0.0**	**15.4**	**84.6**	

CLIENT **Taggart Investments**

FILE NO. **PG5201**

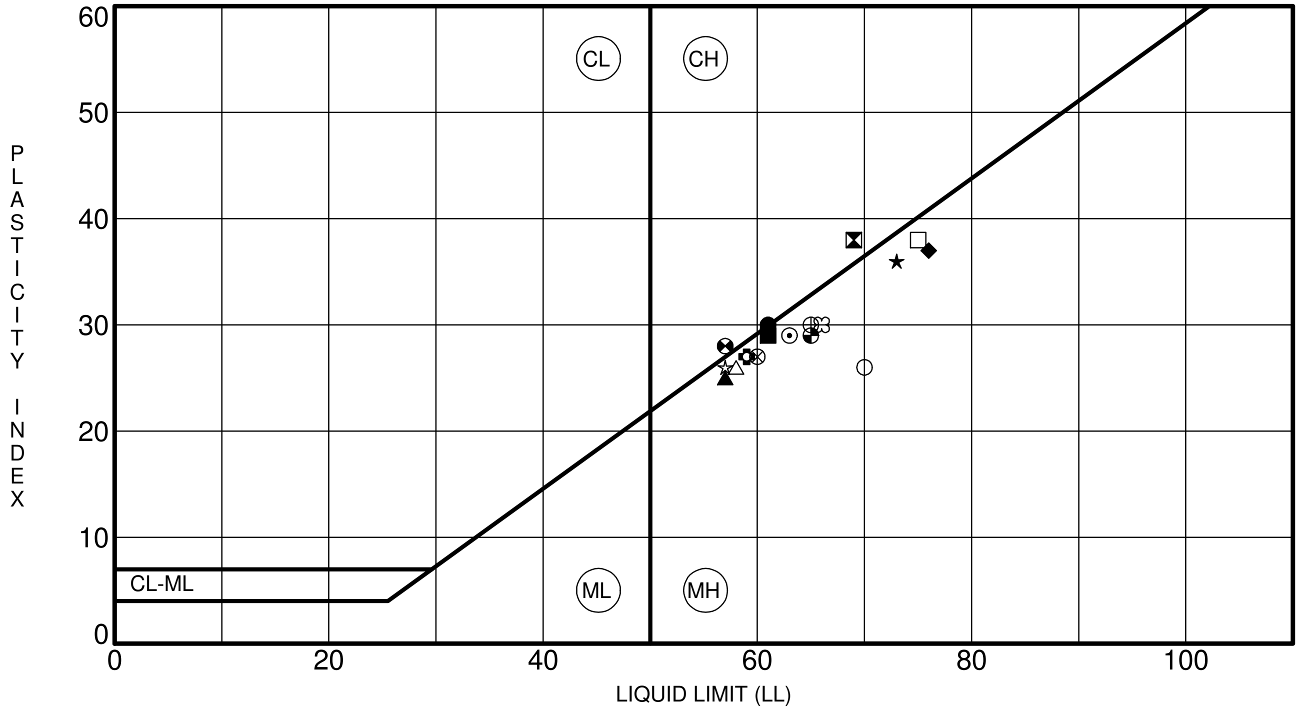
PROJECT **Geotechnical Investigation - Proposed Residential Development**

DATE **1 Mar 21**

patersongroup **Consulting Engineers**

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

GRAIN SIZE DISTRIBUTION



Specimen Identification		LL	PL	PI	Fines	Classification
●	TP 1-21 G4	61	31	30		CH = Inorganic Clays of High Plasticity
⧗	TP 3-21 G3	69	31	38		CH = Inorganic Clays of High Plasticity
▲	TP 4-21 G3	57	32	25		MH = Inorganic Silts of High Plasticity
★	TP 5-21 G3	73	37	36		MH = Inorganic Silts of High Plasticity
⊙	TP 6-21 G2	63	34	29		MH = Inorganic Silts of High Plasticity
✿	TP 7-21 G3	59	32	27	85.6	MH = Inorganic Silts of High Plasticity
○	TP 8-21 G3	70	44	26		MH = Inorganic Silts of High Plasticity
△	TP 9-21 G2	58	32	26		MH = Inorganic Silts of High Plasticity
⊗	TP10-21 G4	60	33	27	85.6	MH = Inorganic SIlts of High Plasticity
⊕	TP11-21 G4	65	35	30		MH = Inorganic Silts of High Plasticity
□	TP12-21 G2	75	37	38	97.3	MH = Inorganic Silts of High Plasticity
☢	TP16-21 G1	57	29	28		CH = Inorganic Clays of High Plasticity
◕	TP17-21 G1	65	36	29		MH = Inorganic Silts of High Plasticity
☆	TP17-21 G2	57	31	26		MH = Inorganic Silts of High Plasticity
⌘	TP18-21 G1	66	36	30	84.6	MH = Inorganic Silts of High Plasticity
■	TP19-21 G2	61	32	29		MH = Inorganic Silts of High Plasticity
◆	TP20-21 G1	76	39	37		MH = Inorganic Silts of High Plasticity

CLIENT **Taggart Investments**
FILE NO. **PG5201**
PROJECT **Geotechnical Investigation - Proposed Residential Development**
DATE **1 Mar 21**

patersongroup **Consulting Engineers**
154 Colonnade Road South, Ottawa, Ontario K2E 7J5

ATTERBERG LIMITS' RESULTS

Client: **Paterson Group Consulting Engineers**

Order Date: 17-Aug-2023

Client PO: 58163

Project Description: PG5201

	Client ID:	TP5-21 @ 6FT	-	-	-	-	-
	Sample Date:	16-Aug-23 09:00	-	-	-		
	Sample ID:	2333440-01	-	-	-		
	Matrix:	Soil	-	-	-		
	MDL/Units						
Physical Characteristics							
% Solids	0.1 % by Wt.	69.7	-	-	-	-	-
General Inorganics							
pH	0.05 pH Units	6.94	-	-	-	-	-
Resistivity	0.1 Ohm.m	104	-	-	-	-	-
Anions							
Chloride	10 ug/g	12	-	-	-	-	-
Sulphate	10 ug/g	25	-	-	-	-	-

APPENDIX 2

FIGURE 1 – KEY PLAN

PHOTOGRAPHS FROM SITE VISITS - 2012, 2020 AND 2023

FIGURES 6 to 41 - SLOPE STABILITY SECTIONS

FIGURE 42 - SLOPE IN-FILLING DETAIL

DRAWING PG5201-1 BEDROCK CONTOUR PLAN

DRAWING PG5201-2 - TEST HOLE LOCATION PLAN

DRAWING PG5201-3 PERMISSIBLE GRADE RAISE RESTRICTION PLANS

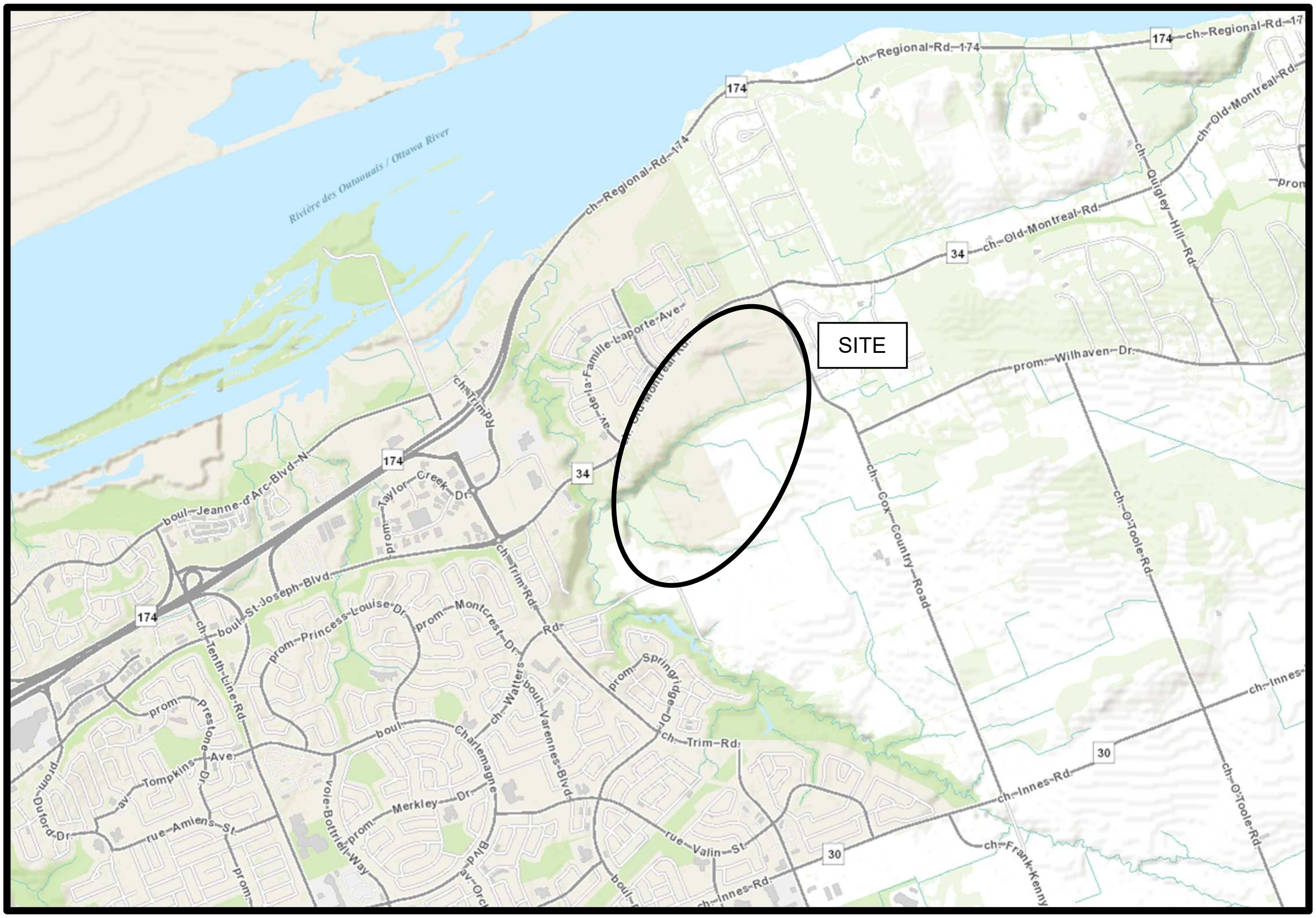


FIGURE 1

KEY PLAN

PATERSON
GROUP

Photo 1A: Photo taken on April 18, 2012 from the north bank of the valley corridor wall along the South Tributary looking east (upstream) near Section I.

18.04.2012 12:04

Photo 1B: Photo taken on July 19, 2023 from the north bank of the valley corridor wall along the South Tributary looking east (upstream) near Section I.

Photo 2A: Photo taken on April 18, 2012 from the centre of the watercourse along the South Tributary looking west (downstream) near Section H.

Photo 2B: Photo taken on July 19, 2023 from the centre of the watercourse along the South Tributary looking west (downstream) near Section H.

Photographs from Site Visit

Photo 3: Photo taken on April 18, 2012 from the north bank of the valley corridor wall along the South Tributary looking west (downstream) at Section G.

Photo 4: Photo taken on April 18, 2012 from the south bank of the South Tributary looking west (downstream) near Section F.

Photo 5: Photo taken on April 18, 2012 of the east bank of the valley corridor along Mid-Branch 1, north of Section J.

Photographs from Site Visit

Photo 6A: Photo taken on April 18, 2012 along the watercourse along Mid-Branch 1 looking east (upstream) near Section N.

Photo 6B: Photo taken on July 19, 2023 along the watercourse along Mid-Branch 1 looking east (upstream) near Section N.

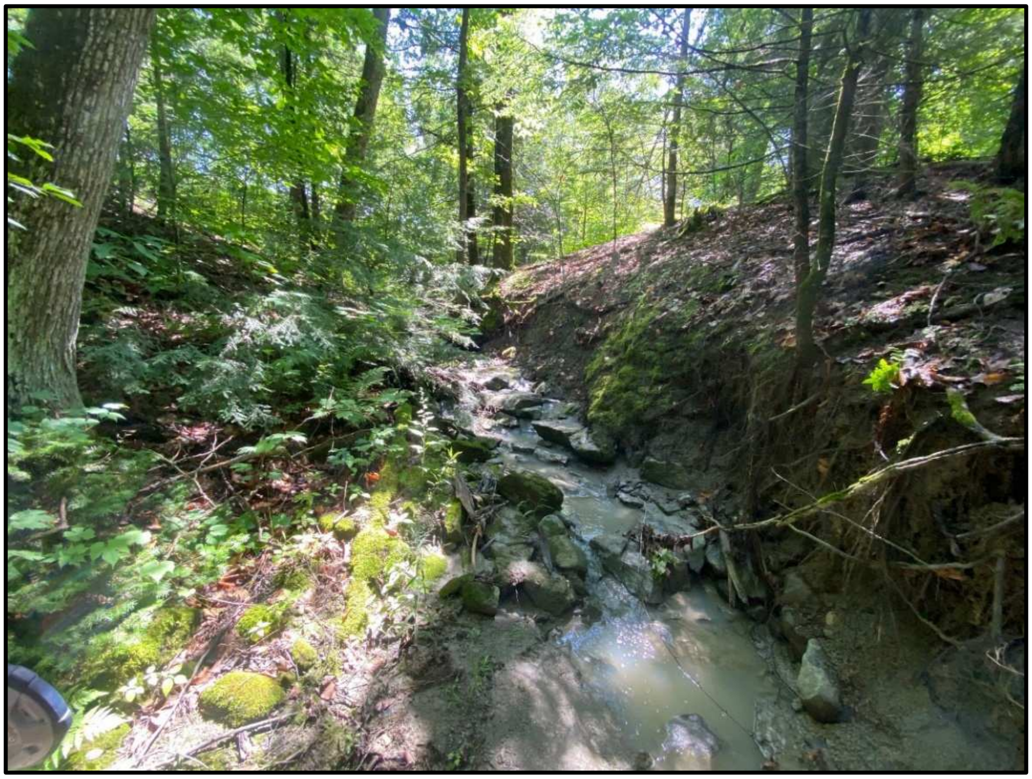


Photo 7A: Photo taken on April 18, 2012 of the drainage ravine near Section K.

Photo 7B: Photo taken on July 19, 2023 of the drainage ravine near Section K.

Photo 8A: Photo taken on September 10, 2020 of the north slope face, looking northwest.

Photo 8B: Photo taken on July 19, 2023 of the north slope face, looking northwest.

Photo 9A: Photo taken on September 10, 2020 of the north slope face, looking northwest.

Photo 9B: Photo taken on July 19, 2023 of the north slope face, looking northwest.

Photo 10A: Photo taken on September 10, 2020 of the north slope face, looking north.

Photo 10B: Photo taken on July 19, 2023 of the north slope face, looking north.

Photographs from Site Visit

Photo 11A: Photo taken on September 10, 2020 of the south slope face looking southeast near Section O

Photo 11B: Photo taken on July 14, 2023 of the south slope face, looking southeast near Section O

Photo 12A: Photo taken on September 10, 2020 of the north slope face, looking northwest.

Photo 12B: Photo taken on July 19, 2023 of the north slope face, looking northwest.

Photo 13A: Photo taken on September 10, 2020 of the north slope face, looking east (upstream) near Section H.

Photo 13B: Photo taken on July 19, 2023 of the north slope face, looking east (upstream) near Section H.

Photo 14A: Photo taken on September 10, 2020 of the north slope face, looking northwest near Section CC.

Photo 14B: Photo taken on July 19, 2023 of the north slope face, looking northeast near Section CC.

Photo 15A: Photo taken on September 10, 2020 of the north slope face, looking northwest near sections G and II

Photo 15B: Photo taken on July 19, 2023 of the north slope face, looking northwest near sections G and II

Photo 16A: Photo taken on September 10, 2020 of the south slope face near section HH.

Photo 16B: Photo taken on July 19, 2023 of the south slope face near section HH.

Photo 17A: Photo taken on September 10, 2020 along the watercourse, looking east (upstream).

Photo 17B: Photo taken on July 19, 2023 along the watercourse, looking east (upstream).

Photo 18A: Photo taken on September 10, 2020 of the north slope face, looking north at section GG.

Photo 18B: Photo taken on July 19, 2023 of the north slope face, looking north at section GG.

Photo 19A: Photo taken on September 10, 2020 along the watercourse, looking east (upstream).

Photo 19B: Photo taken on July 19, 2023 along the watercourse, looking east (upstream).

Photo 20A: Photo taken on September 10, 2020 along the watercourse along Mid-Branch 1 looking east (upstream) near Section OO.

Photo 20B: Photo taken on July 19, 2023 along the watercourse along Mid-Branch 1 looking east (upstream) near Section OO.

Photo 21A: Photo taken on September 10, 2020 along the watercourse along Mid-Branch 1 looking east (upstream) near Section N.

Photo 21B: Photo taken on July 19, 2023 along the watercourse along Mid-Branch 1 looking east (upstream) near Section N.

Photo 22A: Photo taken on September 10, 2020 along the watercourse along Mid-Branch 1 looking north.

Photo 22B: Photo taken on July 19, 2023 along the watercourse along Mid-Branch 1 looking north.

Photo 23: Photo taken on July 19, 2023 of the north slope face, looking west (downstream) near Section H.

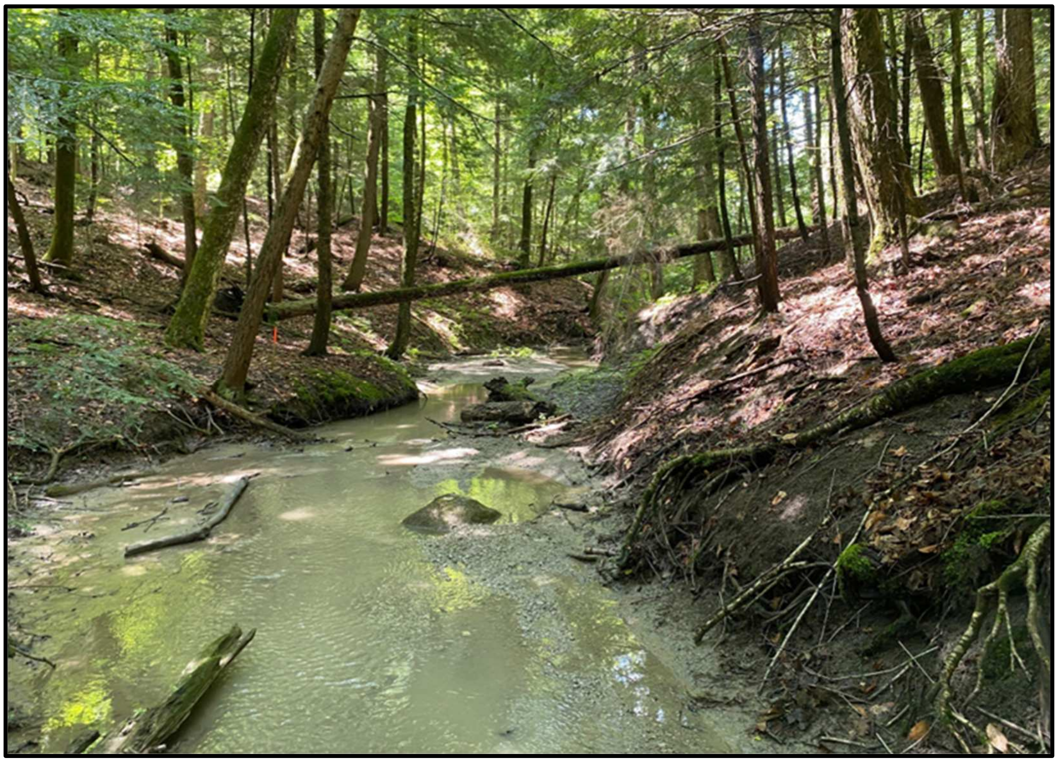
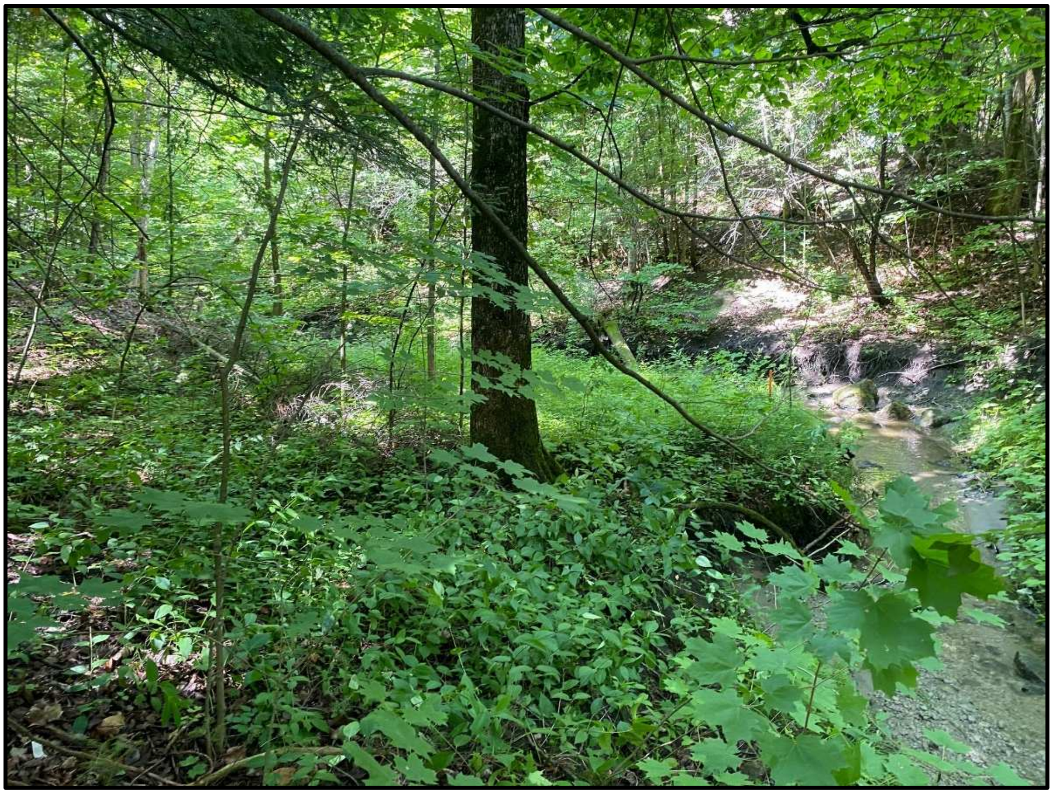


Photo 24: Photo taken on July 19, 2023 of the north slope face, looking west (downstream) near Section CC.

Photo 25: Photo taken on July 19, 2023 of the north slope face, looking east (upstream) near Section CC.

Photo 26: Photo taken on July 19, 2023 of the north slope face, looking west (downstream) near Section F.



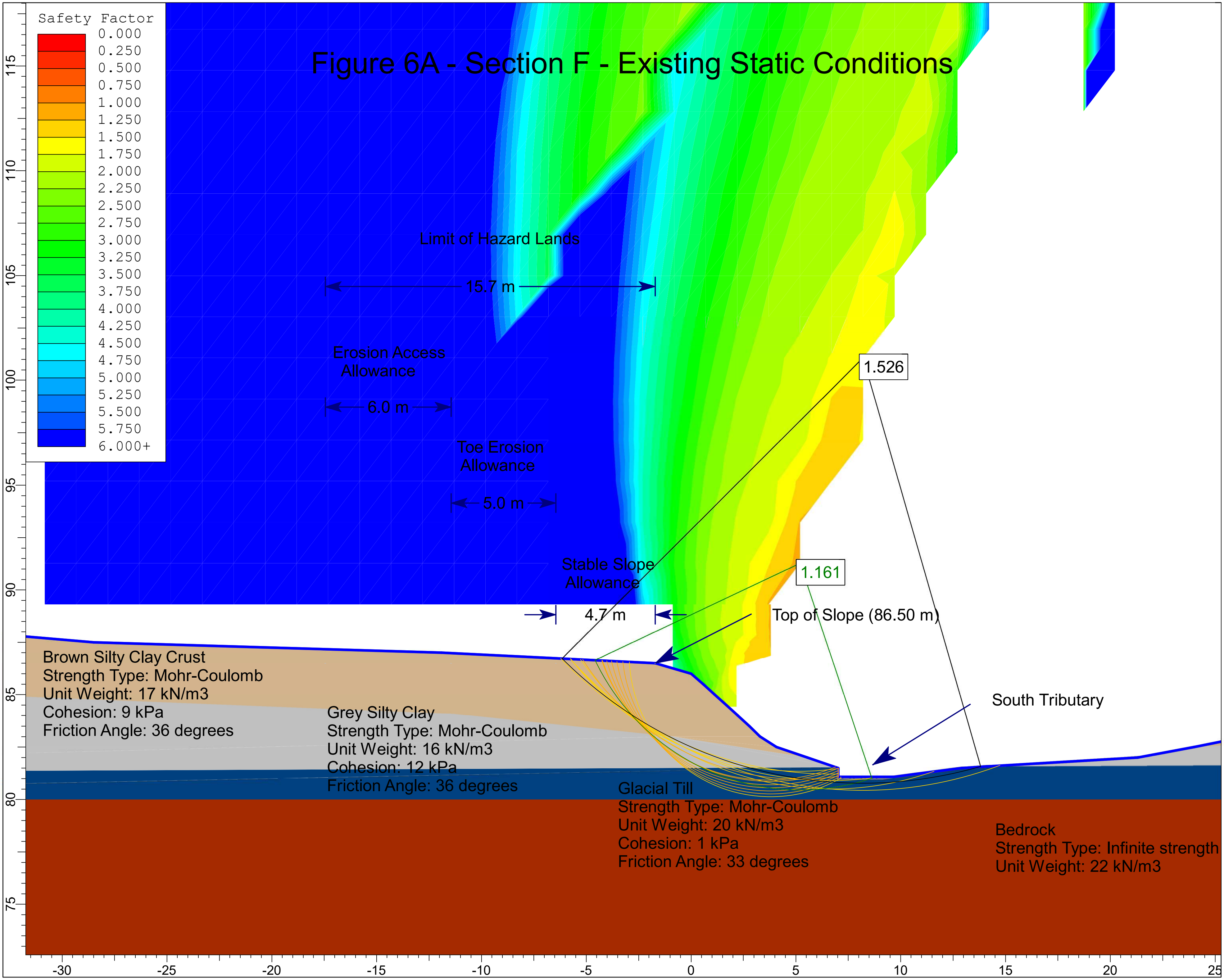
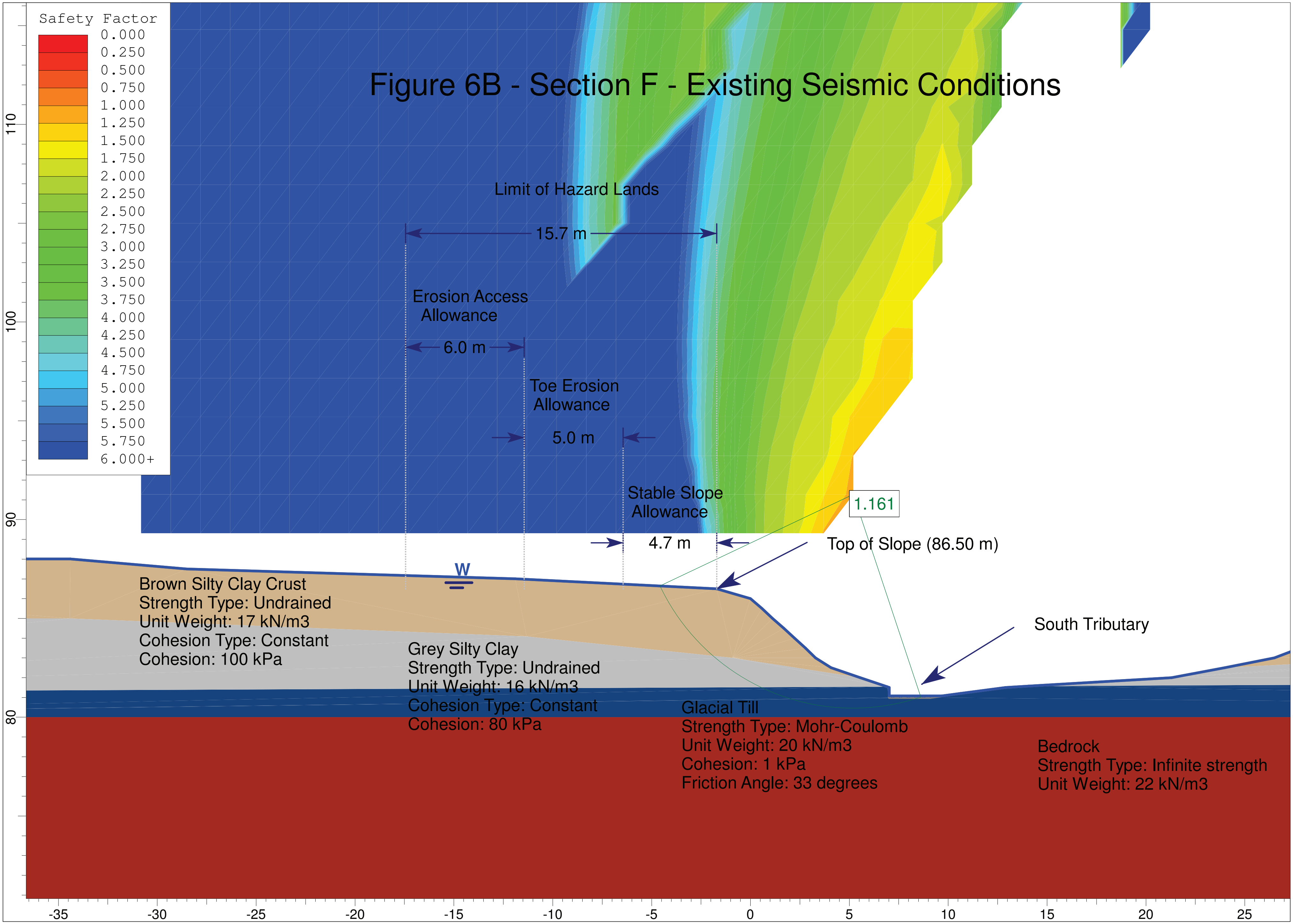
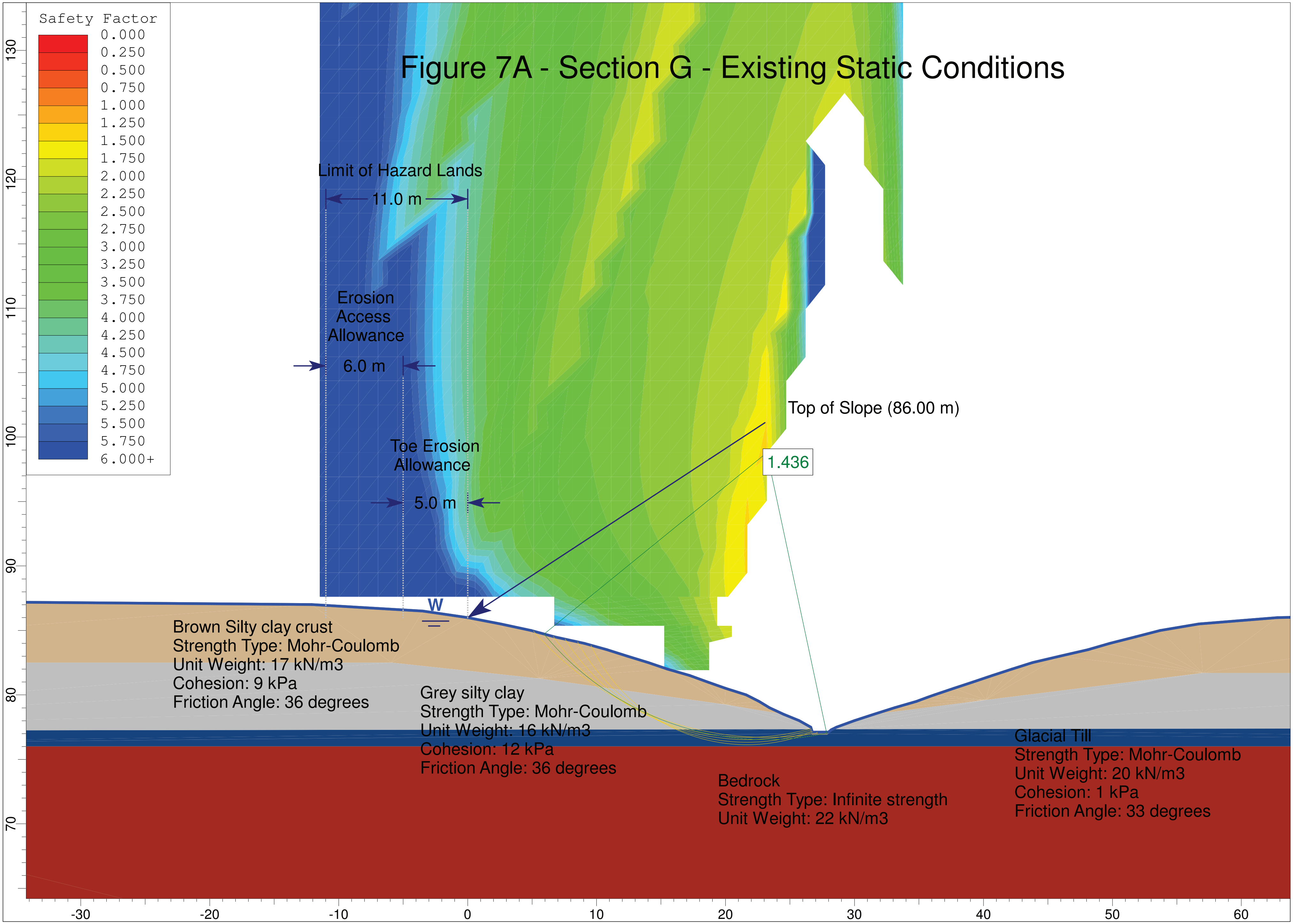


Figure 6A - Section F - Existing Static Conditions

Figure 6B - Section F - Existing Seismic Conditions



# Figure 7A - Section G - Existing Static Conditions

Brown Silty clay crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 9 kPa
Friction Angle: 36 degrees

Grey silty clay
Strength Type: Mohr-Coulomb
Unit Weight: 16 kN/m3
Cohesion: 12 kPa
Friction Angle: 36 degrees

Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3

Glacial Till
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m3
Cohesion: 1 kPa
Friction Angle: 33 degrees

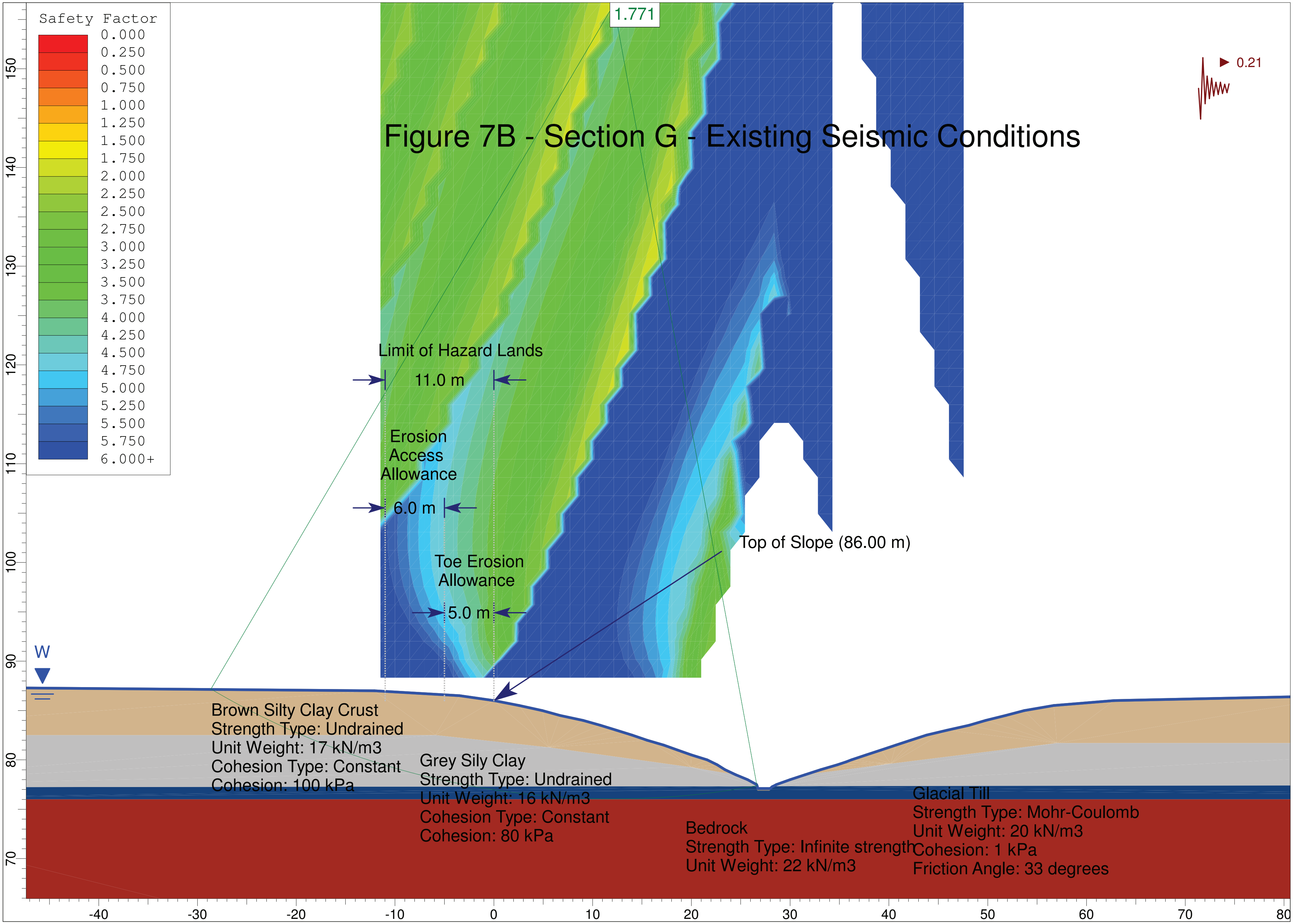
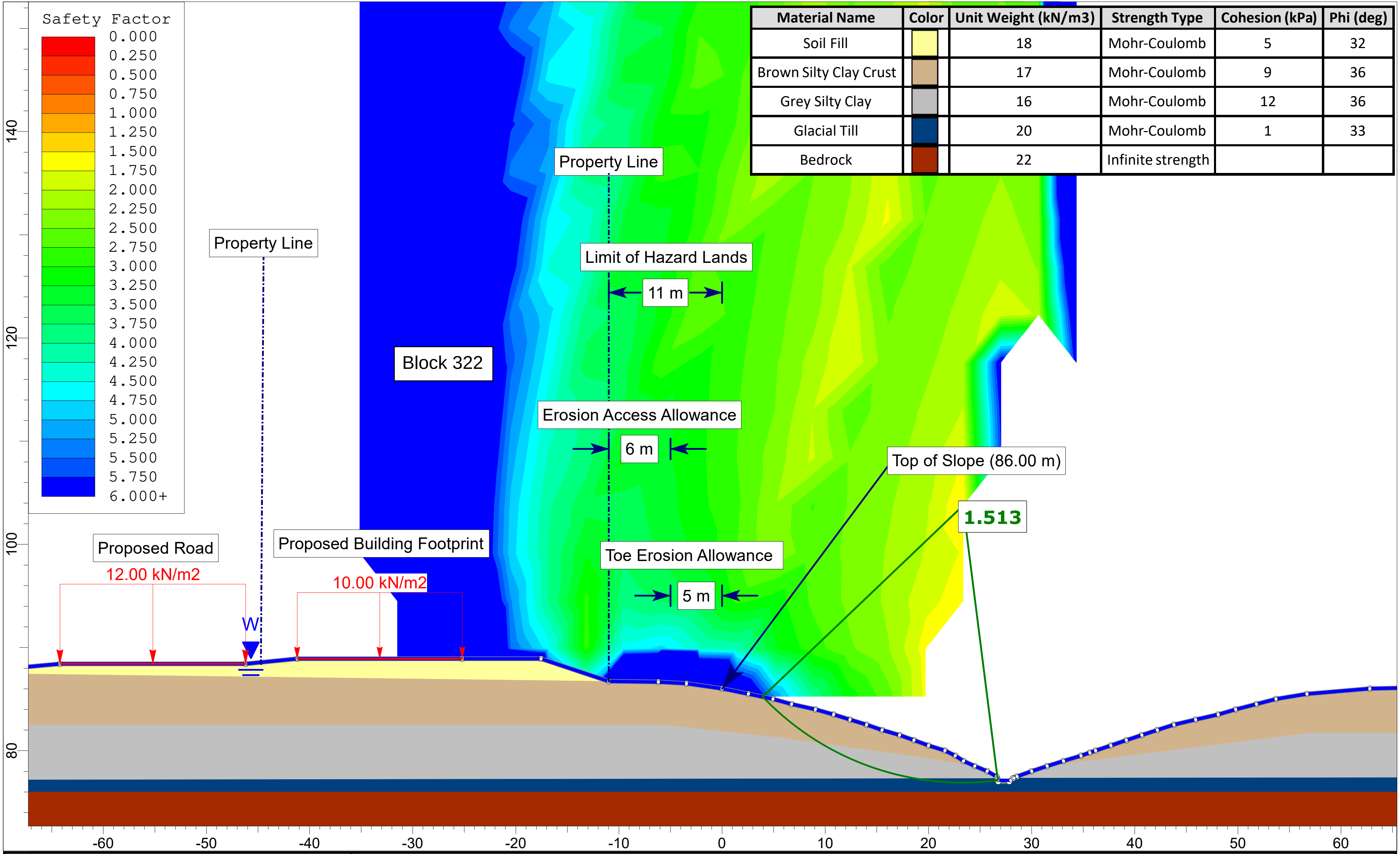


Figure 7B - Section G - Existing Seismic Conditions

Figure 7C - Section G - Proposed Static Conditions



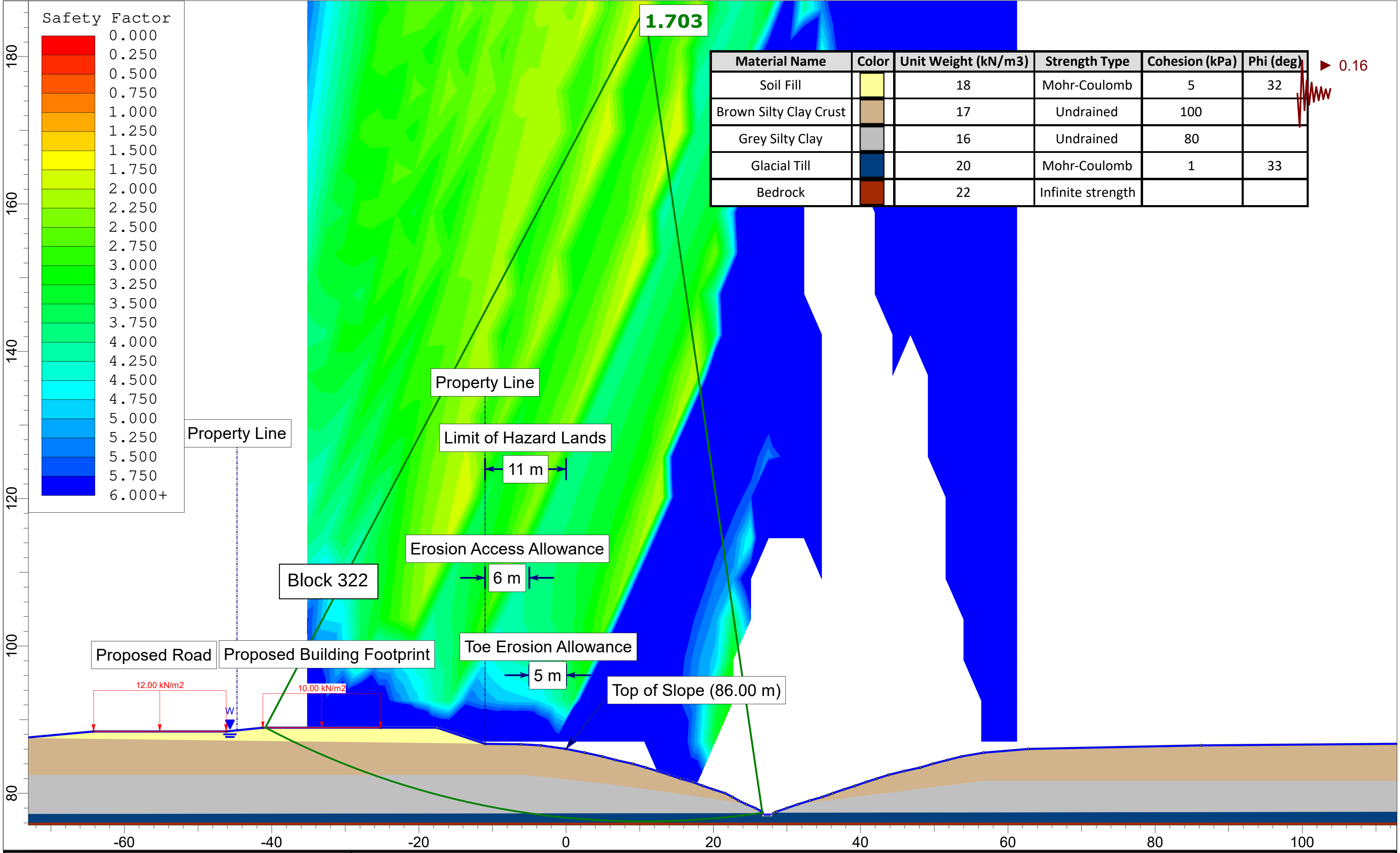
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Mohr-Coulomb	9	36
Grey Silty Clay	⬜	16	Mohr-Coulomb	12	36
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	G	*Scenario*	Static - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/18/2023	*File Name*	Geotechnical Investigation

Figure 7D - Section G - Proposed Seismic Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Undrained	100	
Grey Silty Clay	⬜	16	Undrained	80	
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	G	*Scenario*	Seismic - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/18/2023	*File Name*	Geotechnical Investigation

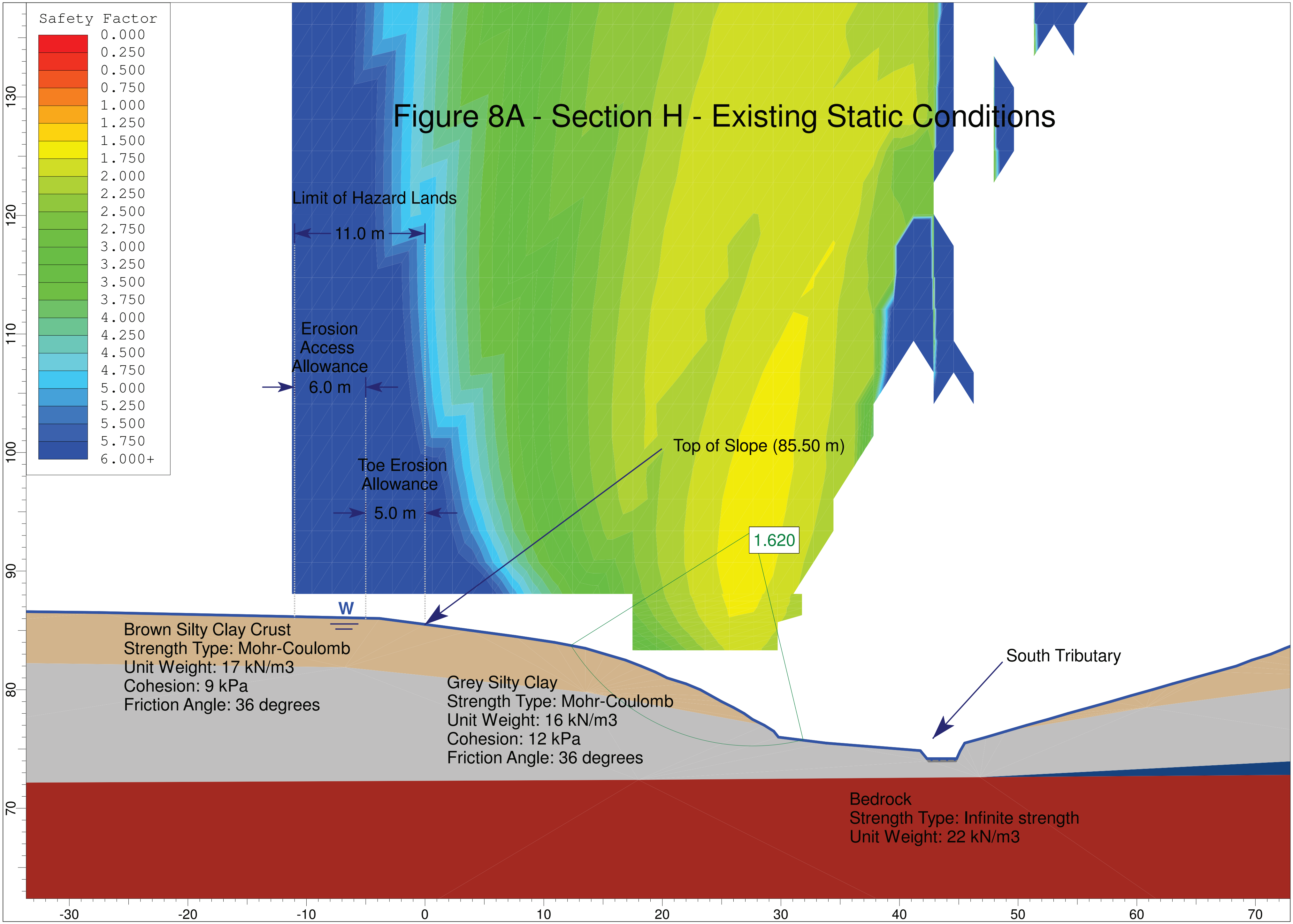


Figure 8A - Section H - Existing Static Conditions

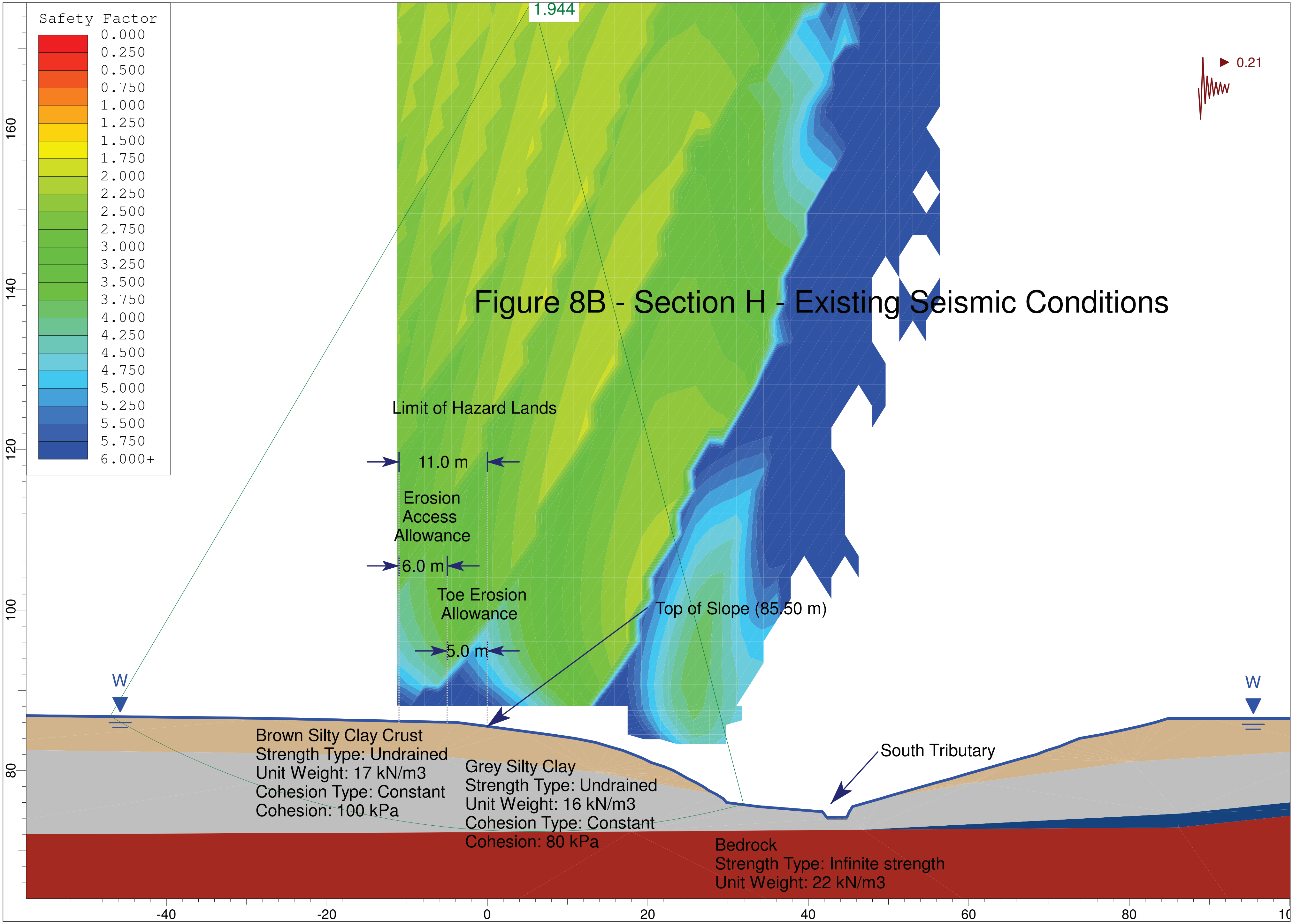


Figure 8B - Section H - Existing Seismic Conditions

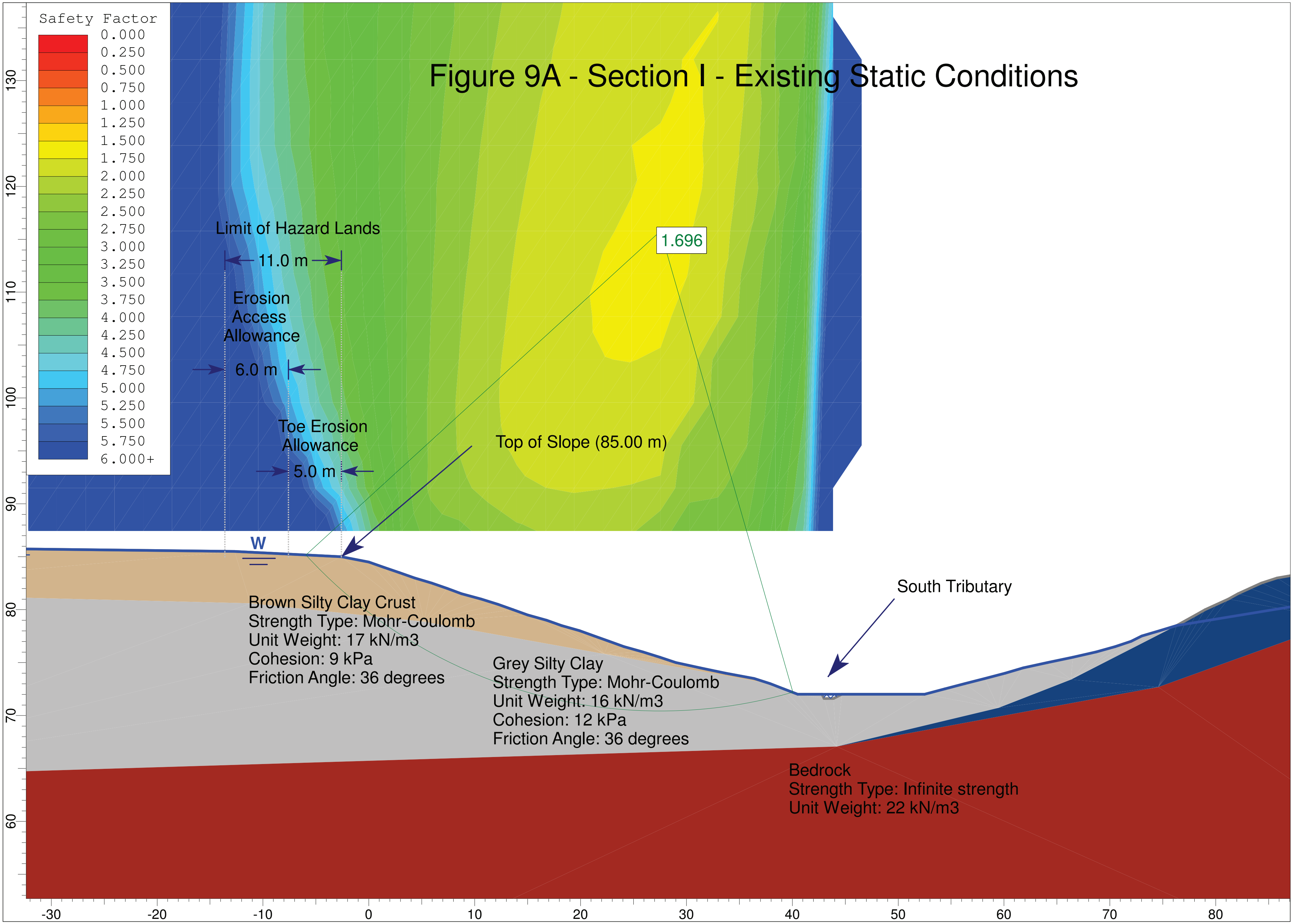


Figure 9A - Section I - Existing Static Conditions

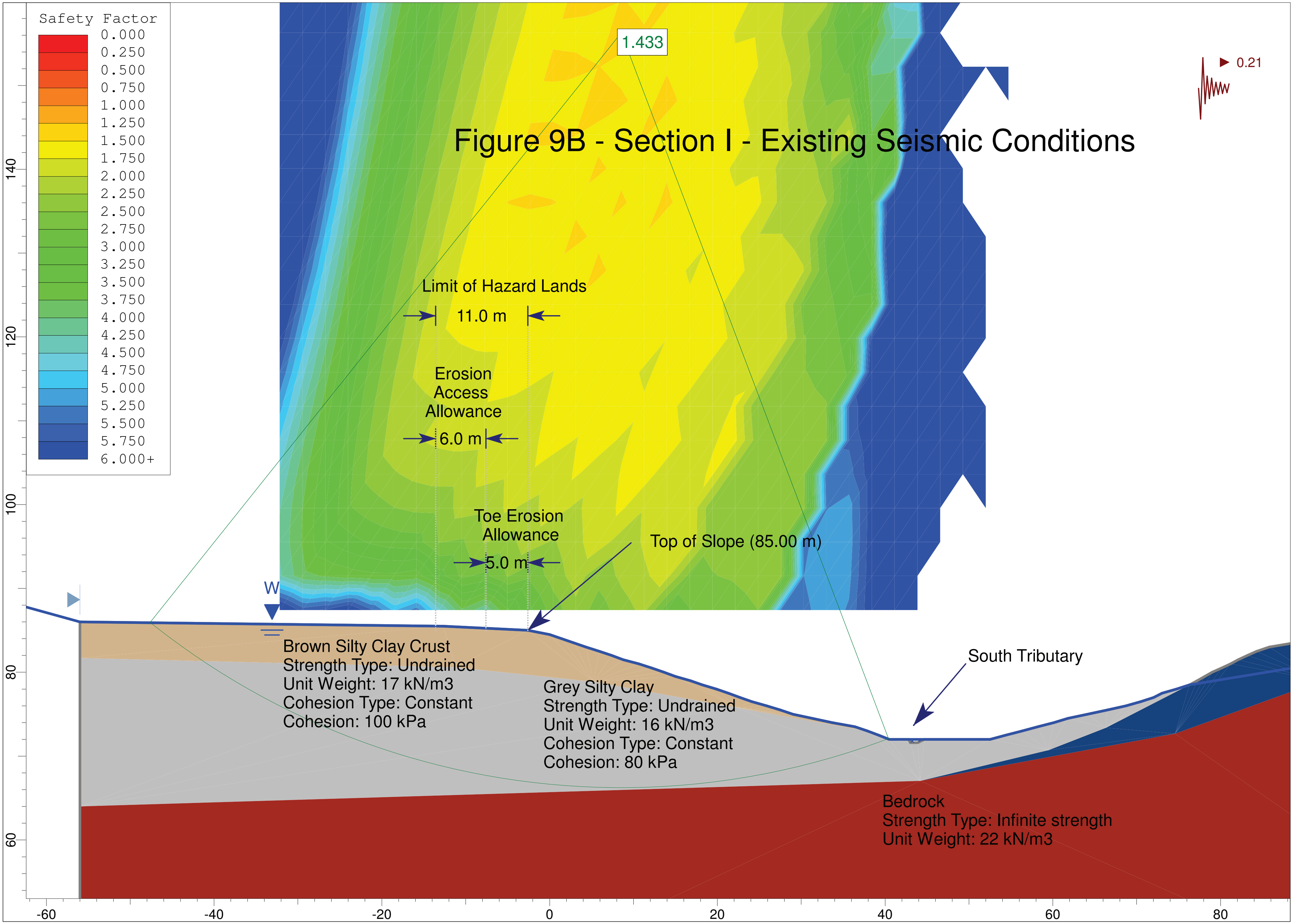


Figure 9B - Section I - Existing Seismic Conditions

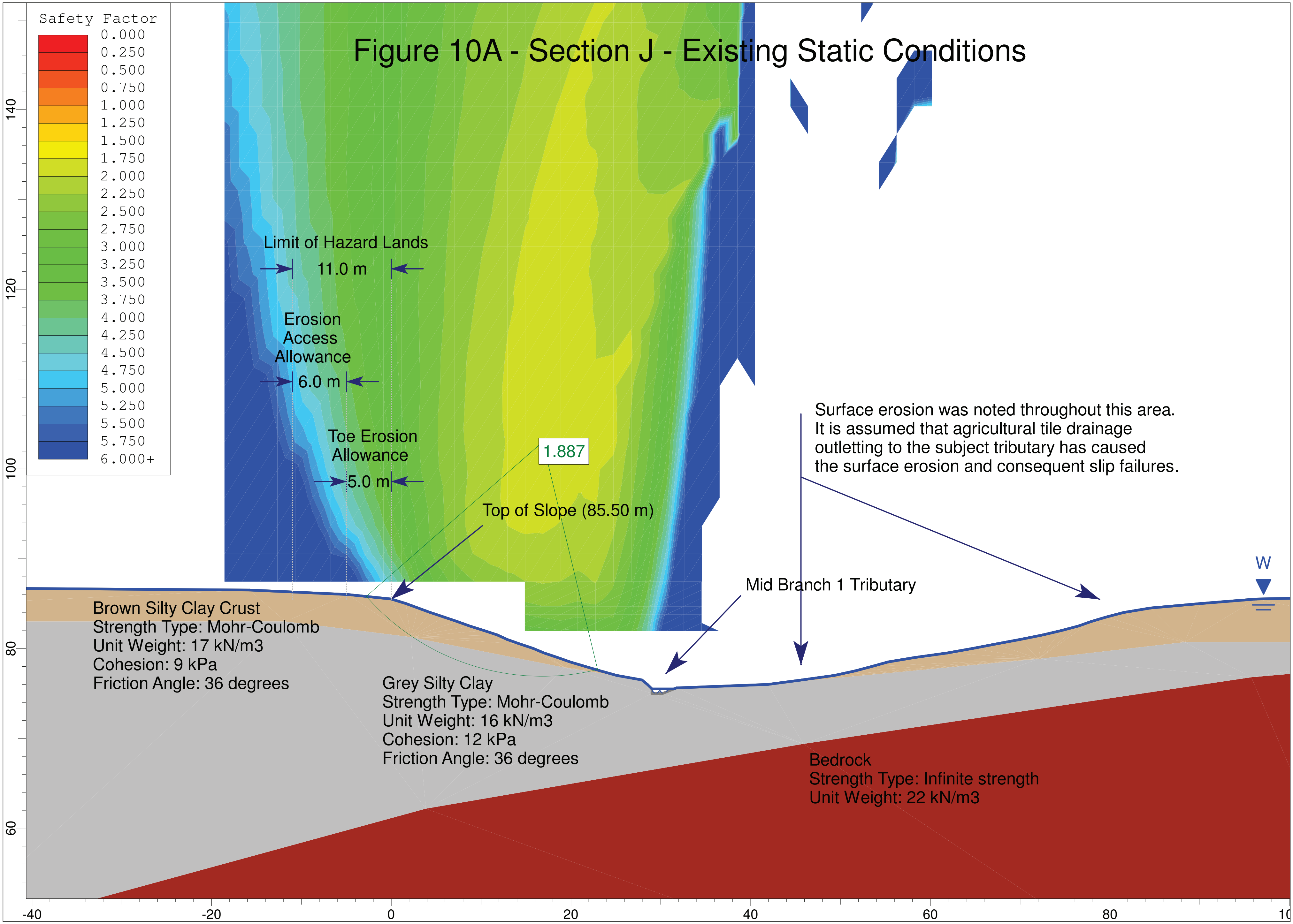


Figure 10A - Section J - Existing Static Conditions

Limit of Hazard Lands

11.0 m

Erosion Access Allowance

6.0 m

Toe Erosion Allowance

5.0 m

Top of Slope (85.50 m)

Surface erosion was noted throughout this area. It is assumed that agricultural tile drainage outletting to the subject tributary has caused the surface erosion and consequent slip failures.

Mid Branch 1 Tributary

Brown Silty Clay Crust
Strength Type: Mohr-Coulomb
Unit Weight: 17 kN/m3
Cohesion: 9 kPa
Friction Angle: 36 degrees

Grey Silty Clay
Strength Type: Mohr-Coulomb
Unit Weight: 16 kN/m3
Cohesion: 12 kPa
Friction Angle: 36 degrees

Bedrock
Strength Type: Infinite strength
Unit Weight: 22 kN/m3

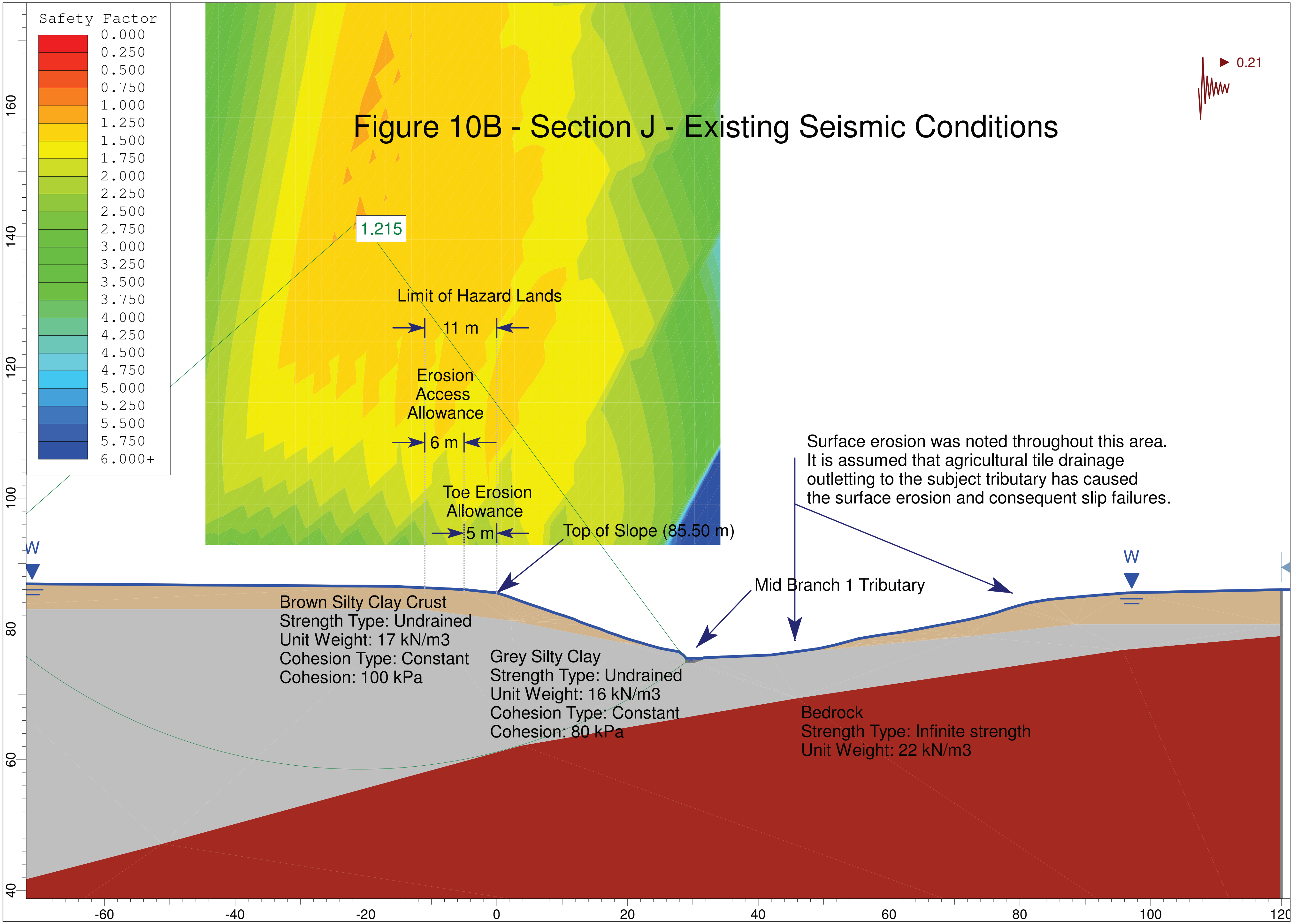


Figure 10B - Section J - Existing Seismic Conditions

Surface erosion was noted throughout this area. It is assumed that agricultural tile drainage outletting to the subject tributary has caused the surface erosion and consequent slip failures.

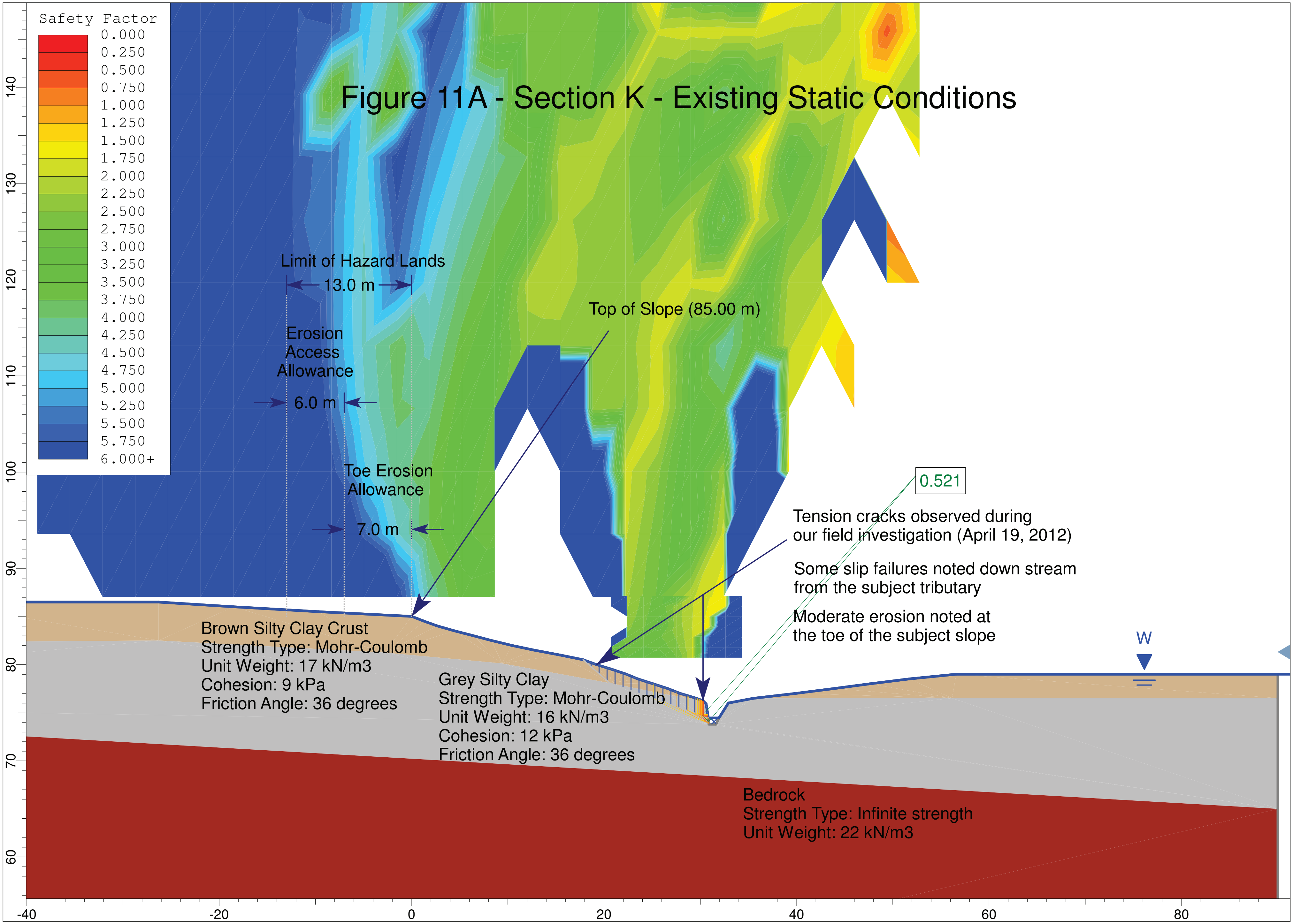


Figure 11A - Section K - Existing Static Conditions

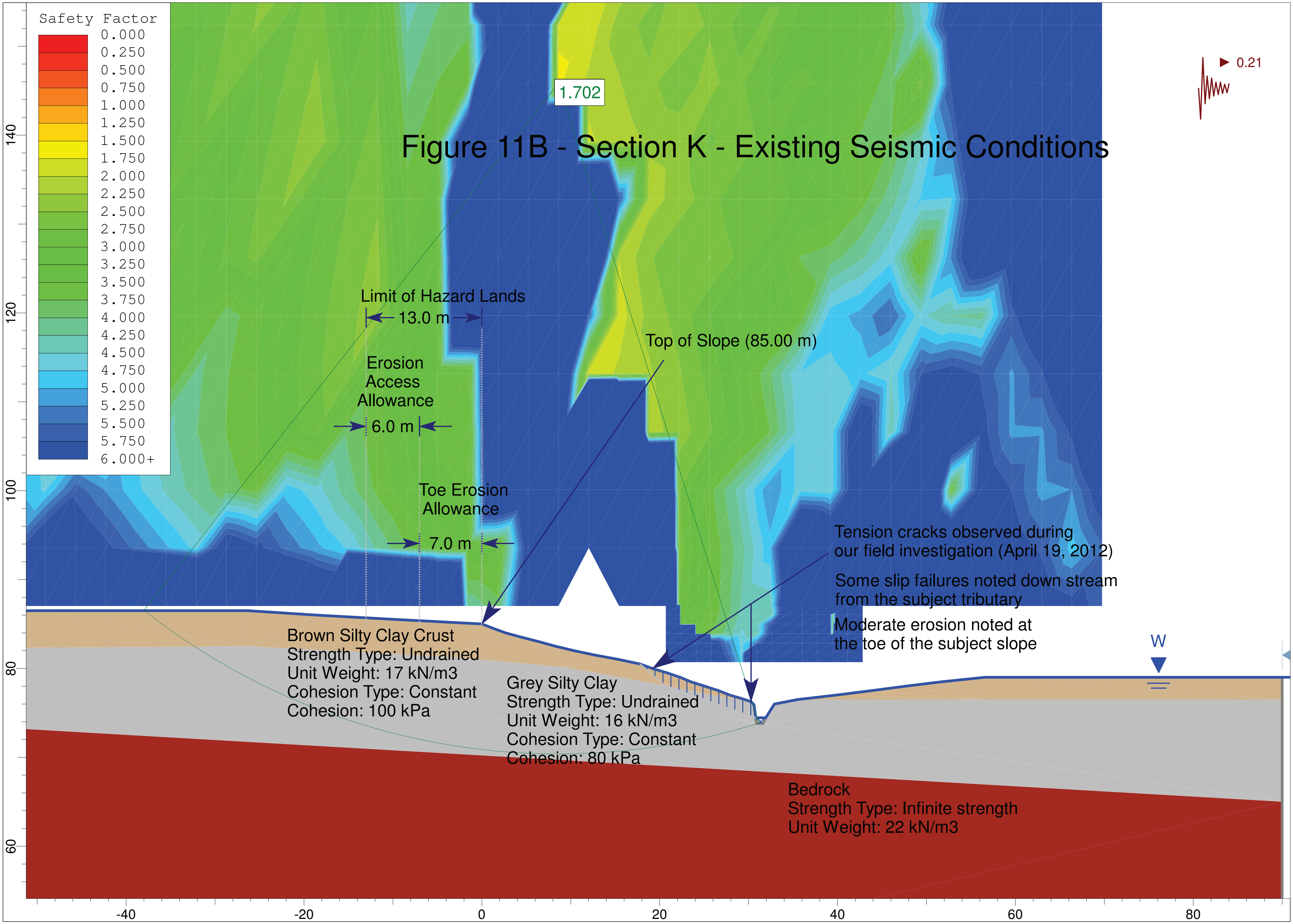


Figure 11B - Section K - Existing Seismic Conditions

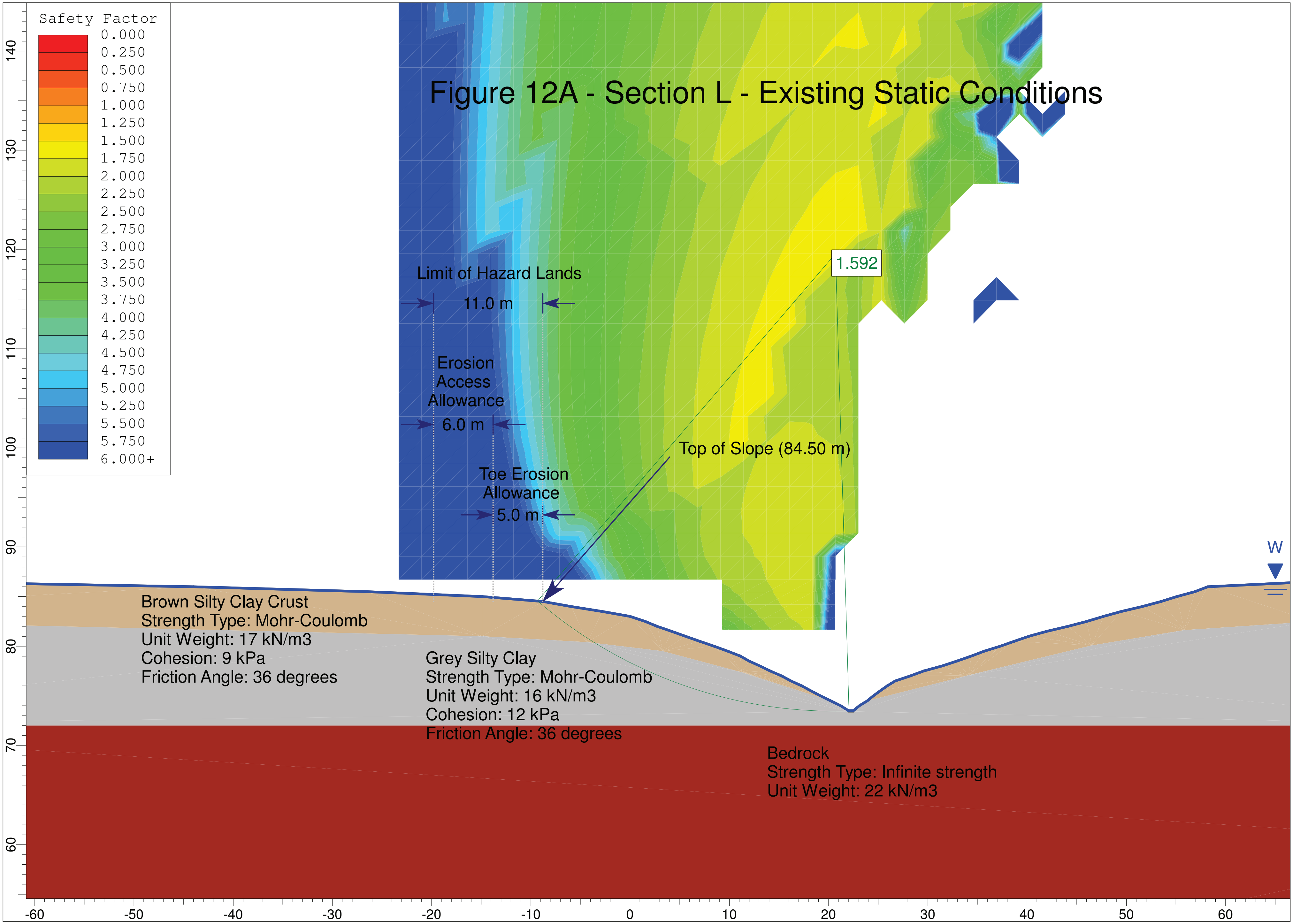


Figure 12A - Section L - Existing Static Conditions

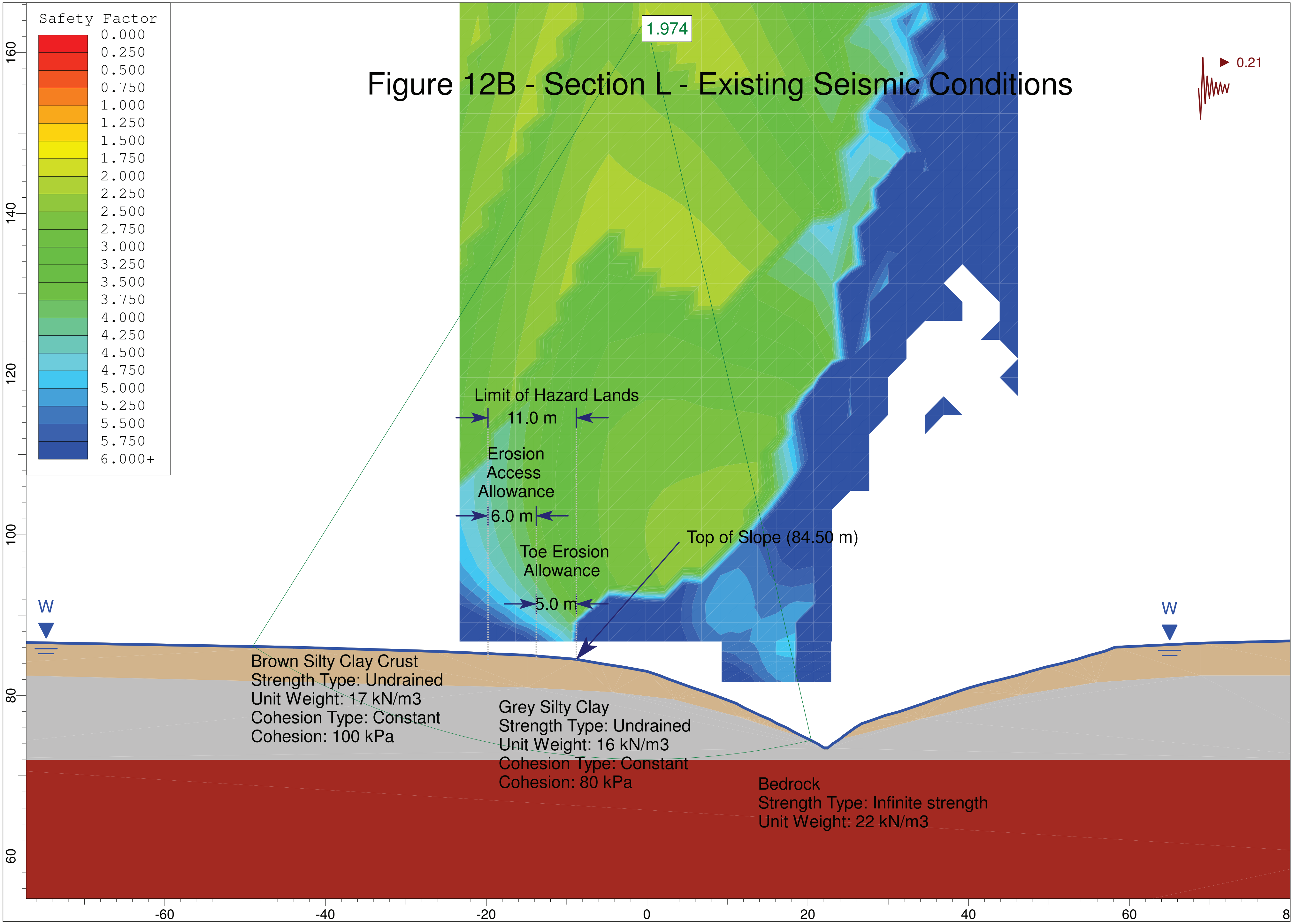


Figure 12B - Section L - Existing Seismic Conditions

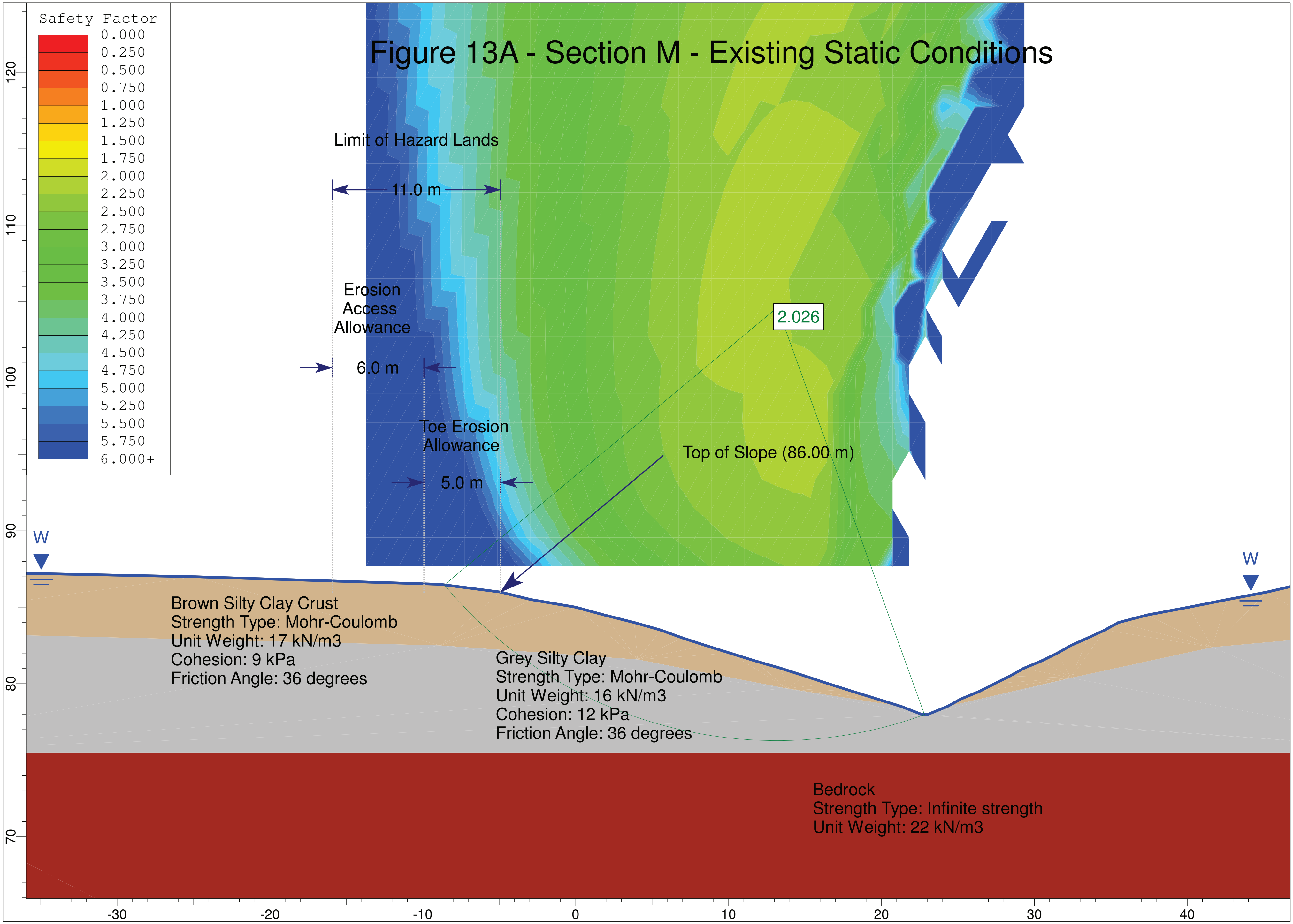


Figure 13A - Section M - Existing Static Conditions

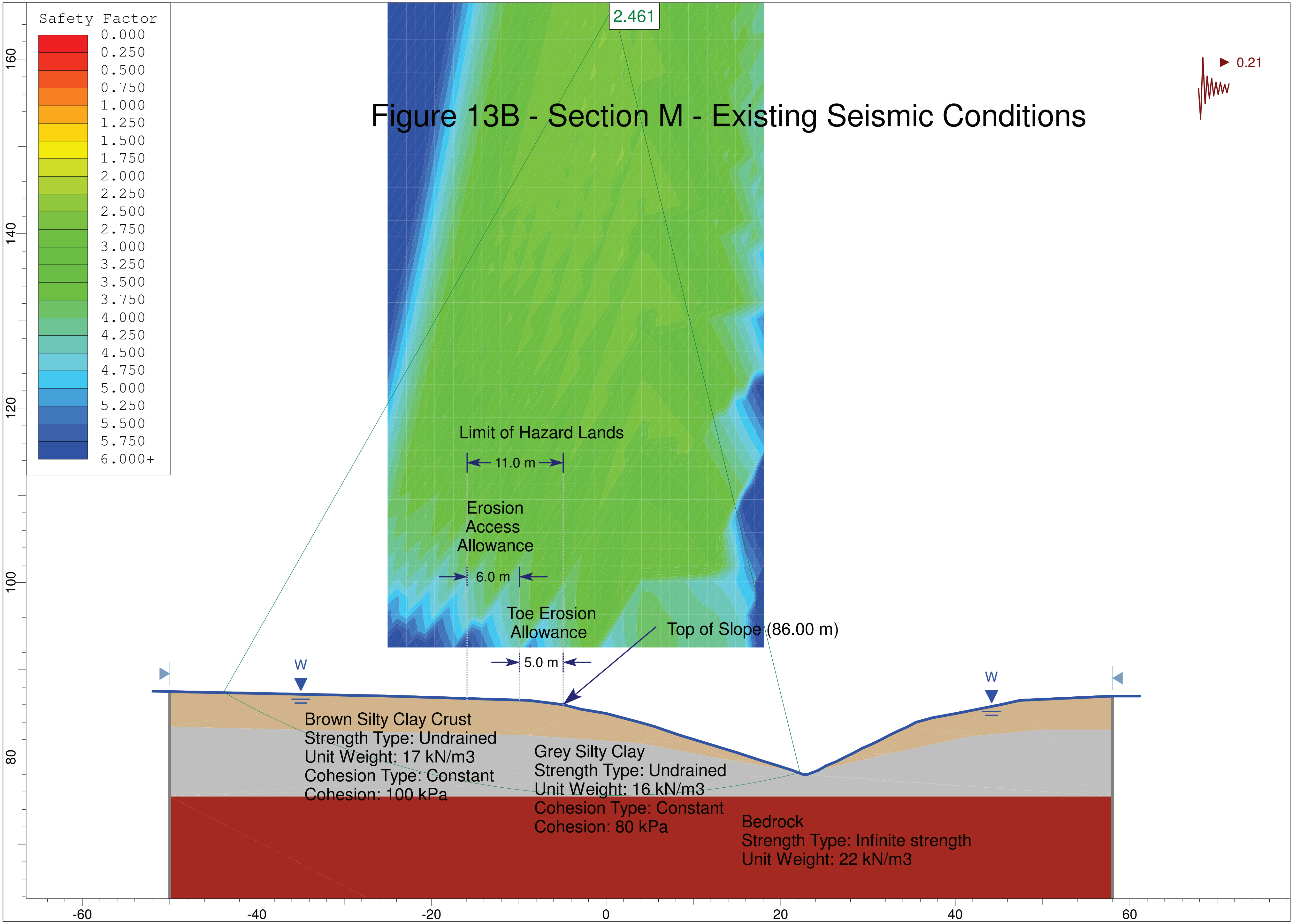


Figure 13B - Section M - Existing Seismic Conditions

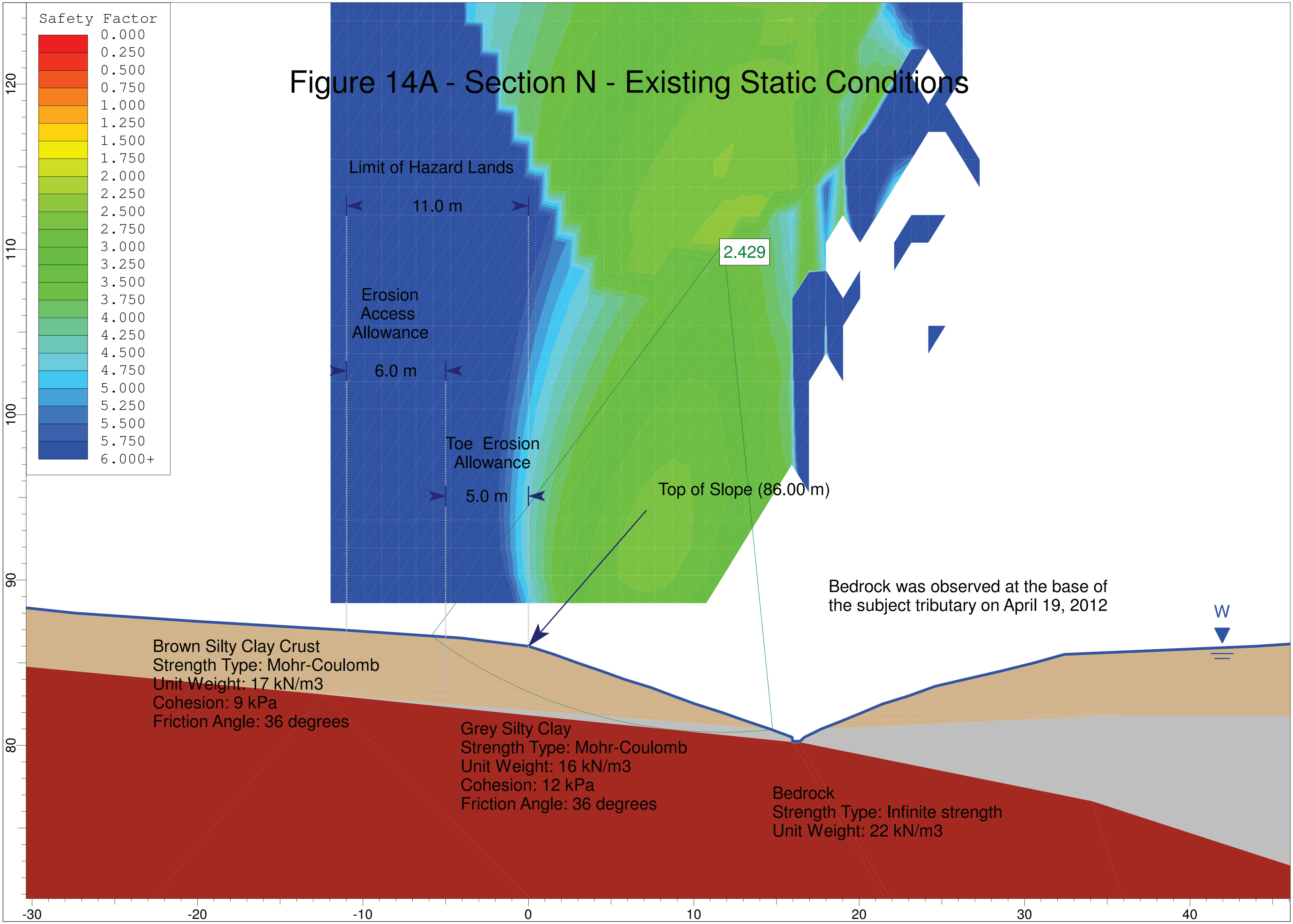
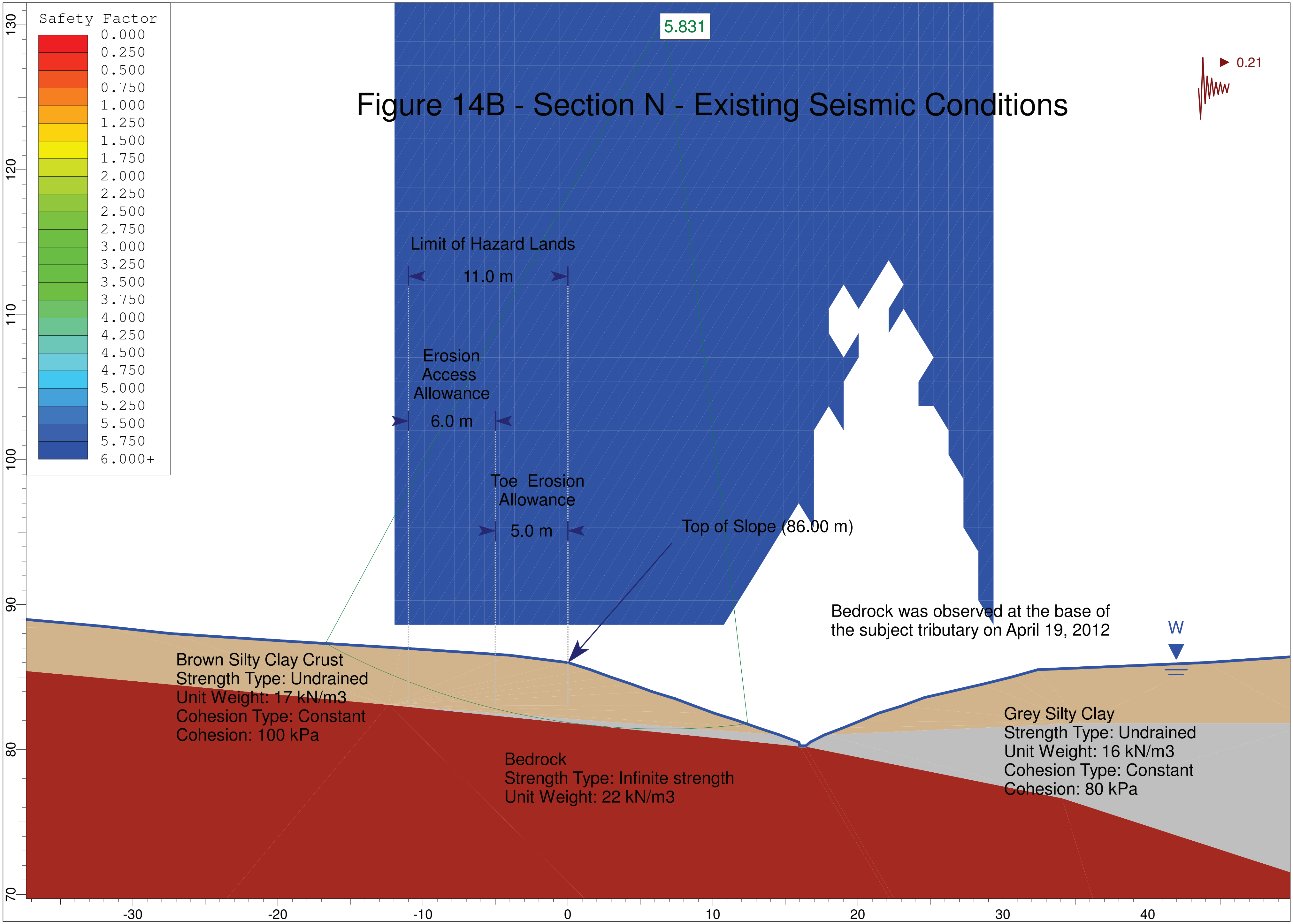


Figure 14A - Section N - Existing Static Conditions

Figure 14B - Section N - Existing Seismic Conditions



Bedrock was observed at the base of the subject tributary on April 19, 2012

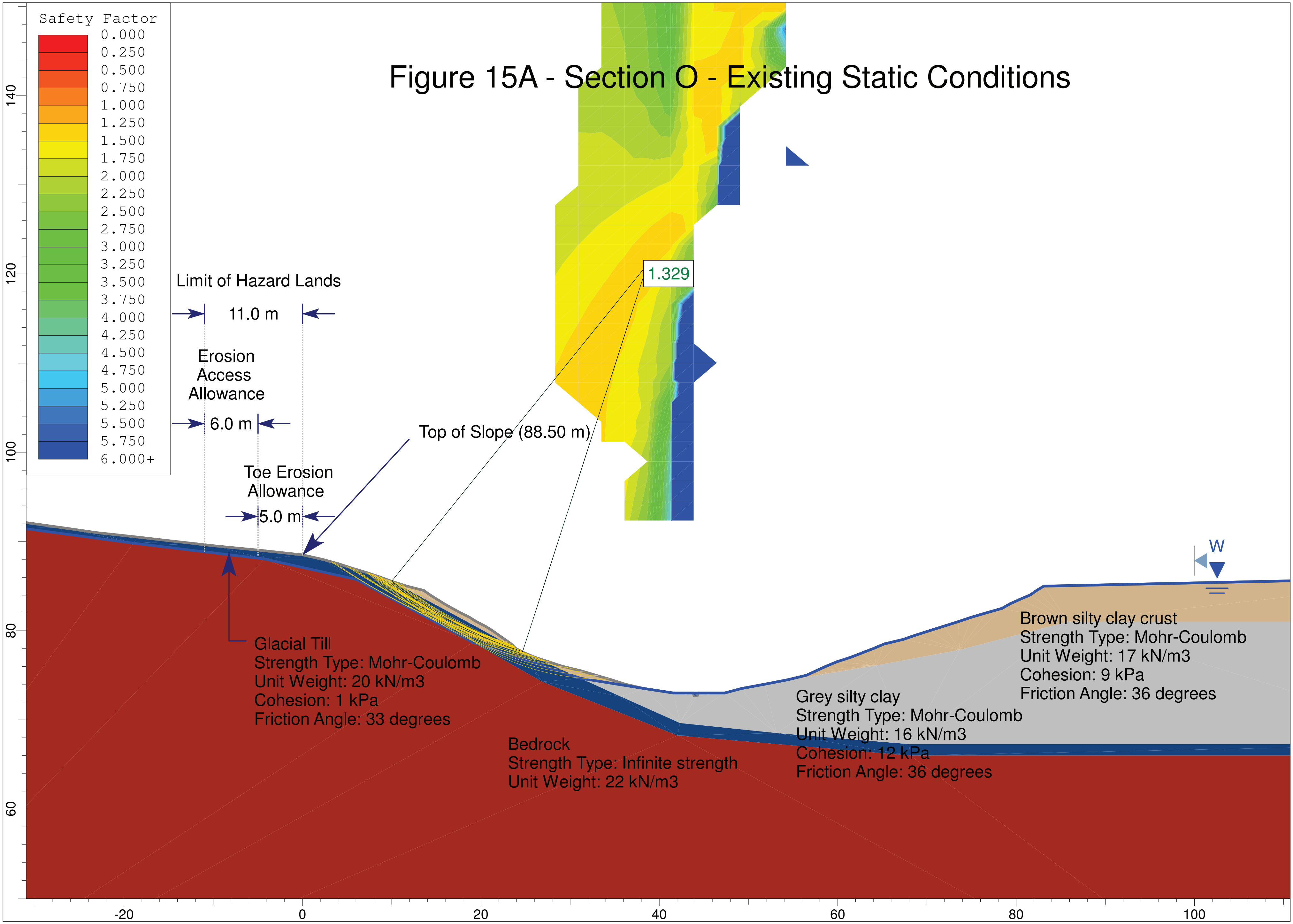


Figure 15A - Section O - Existing Static Conditions

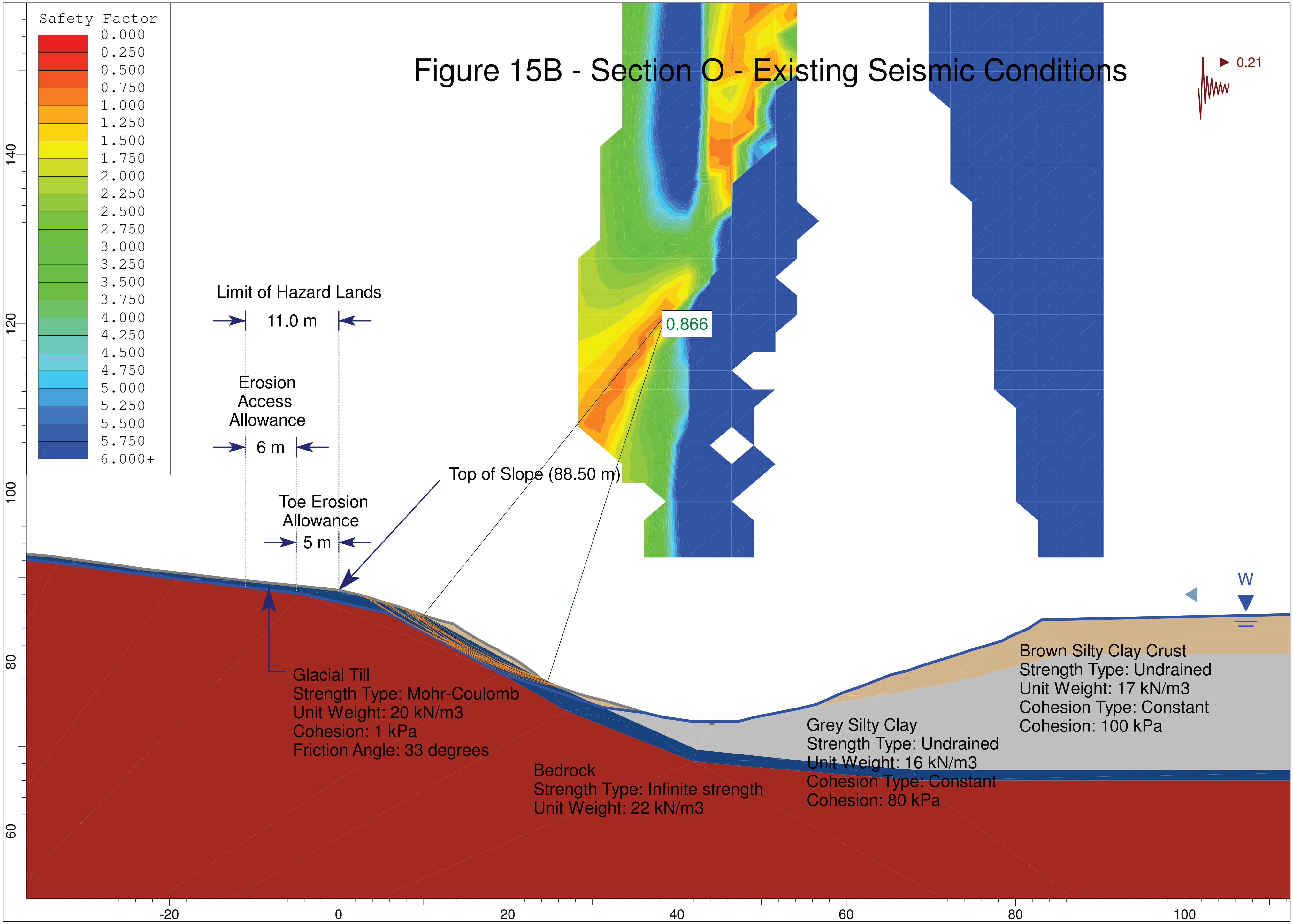


Figure 15B - Section O - Existing Seismic Conditions

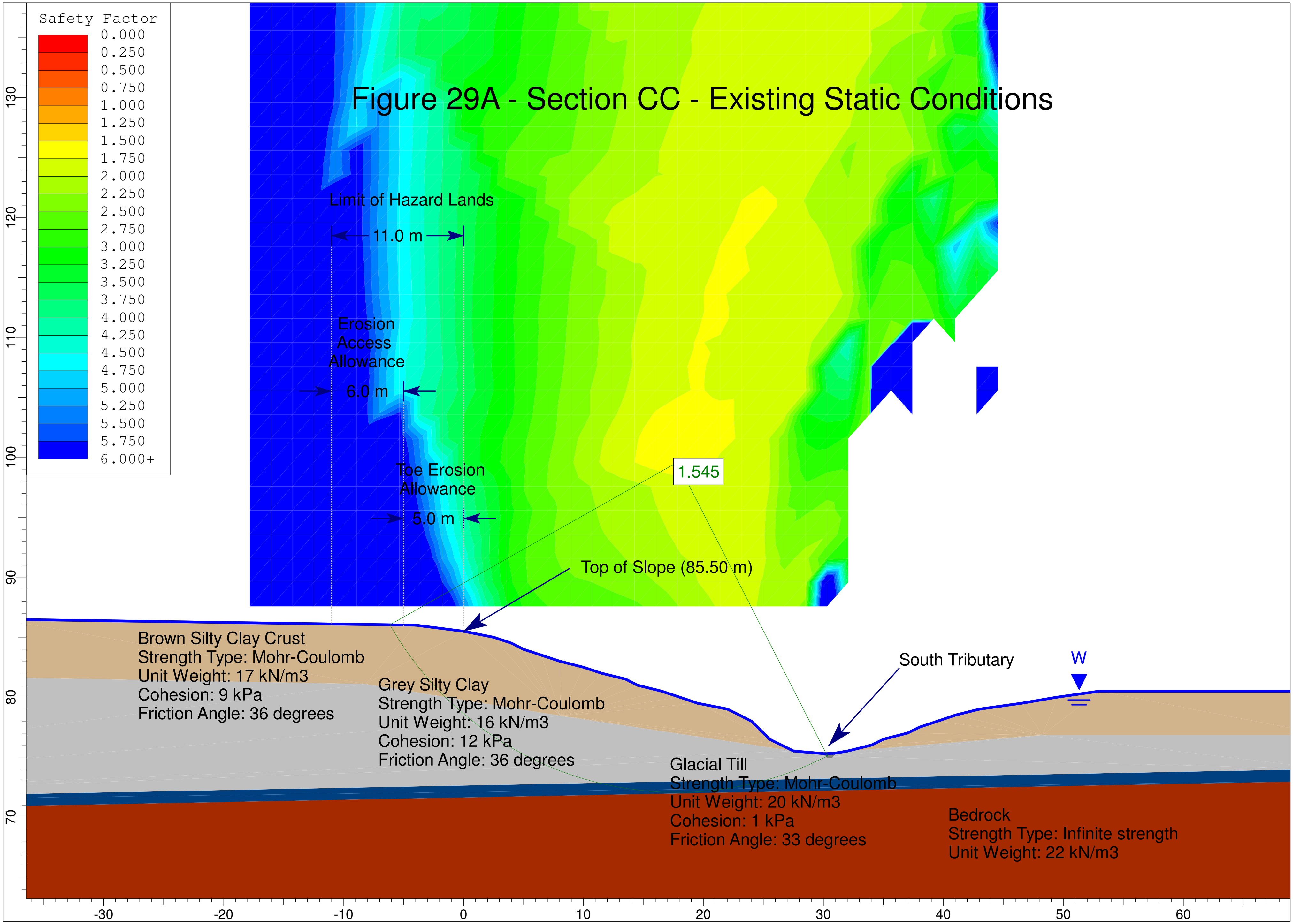


Figure 29A - Section CC - Existing Static Conditions

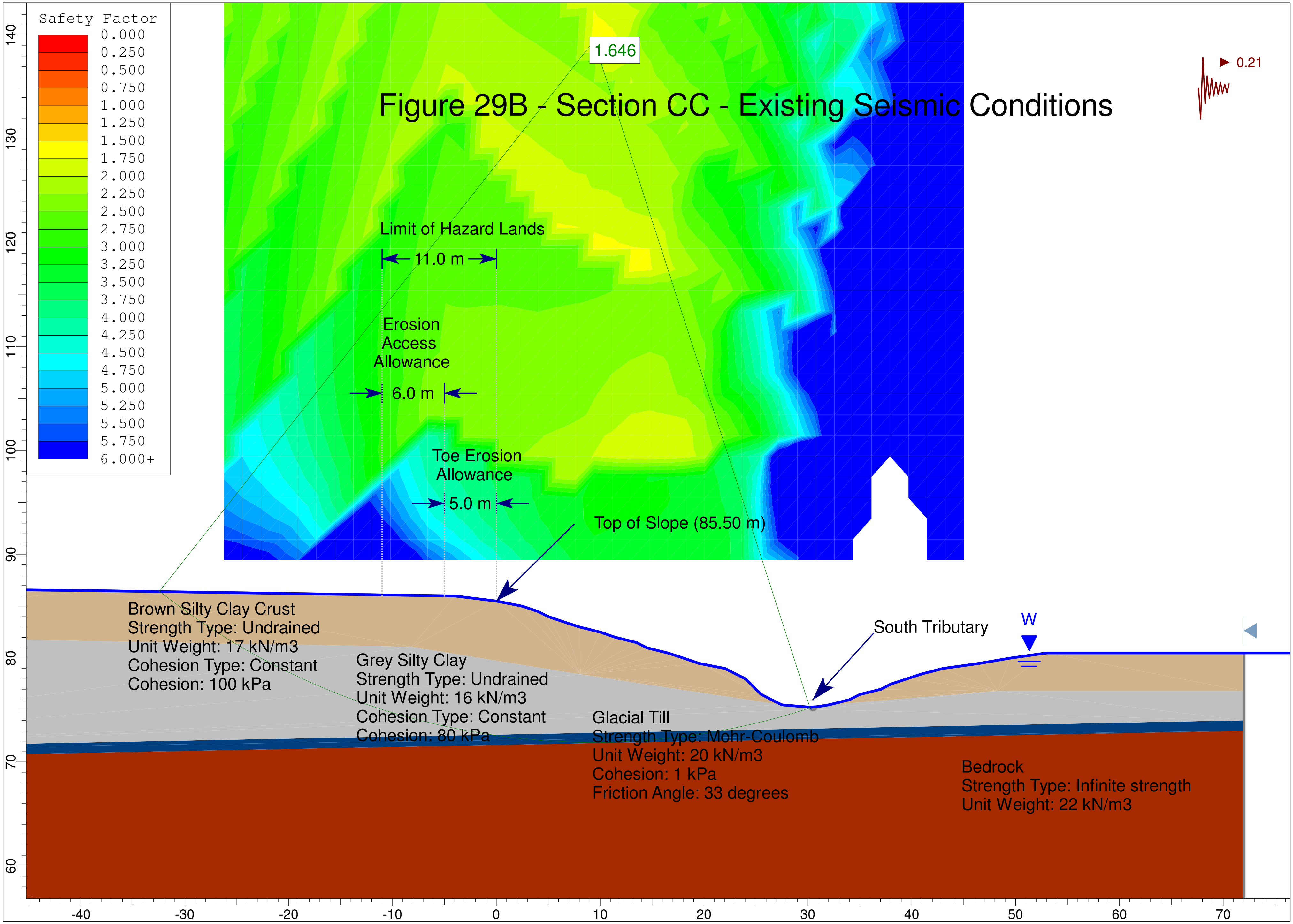
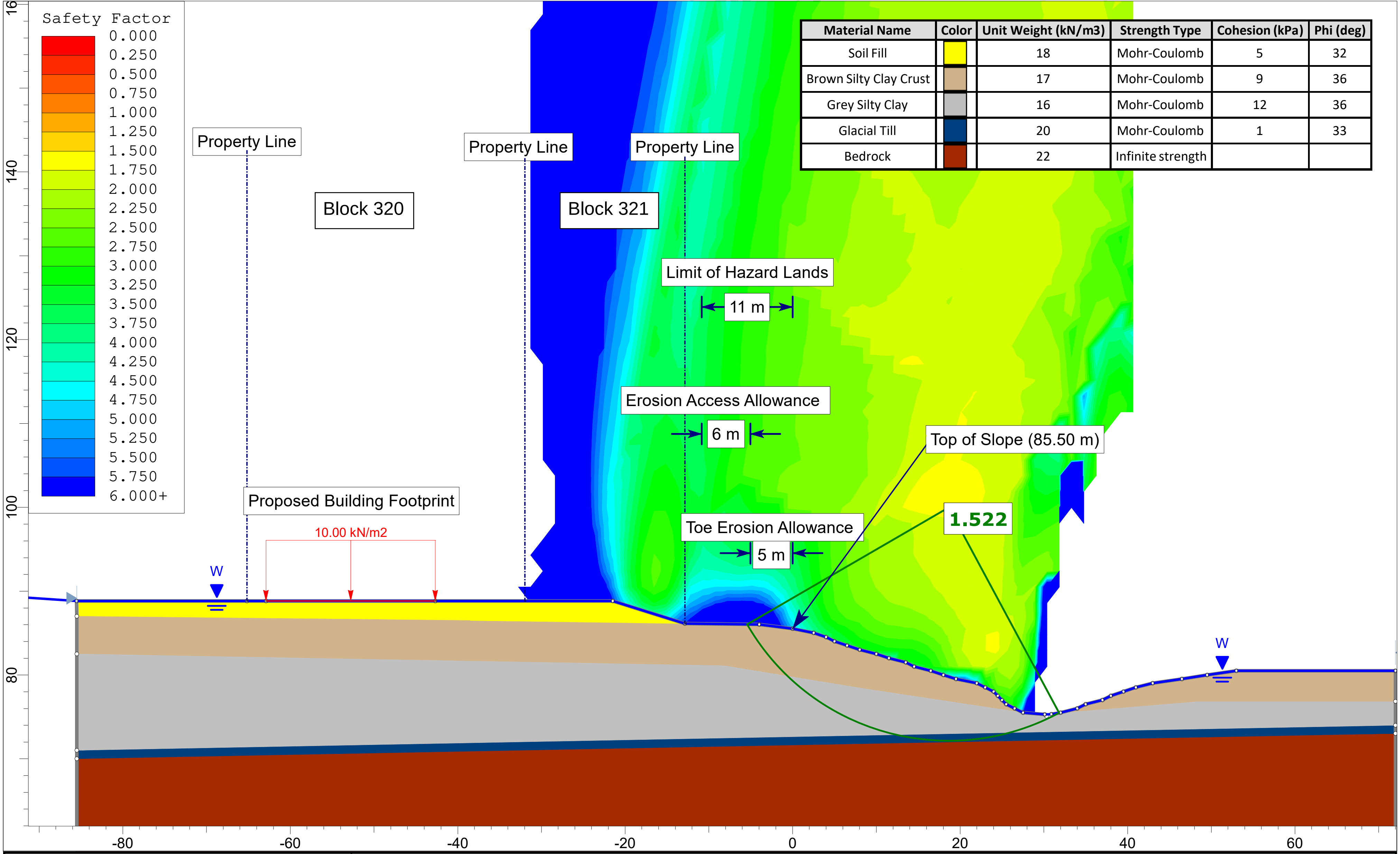


Figure 29B - Section CC - Existing Seismic Conditions

Figure 29C - Section CC - Proposed Static Conditions



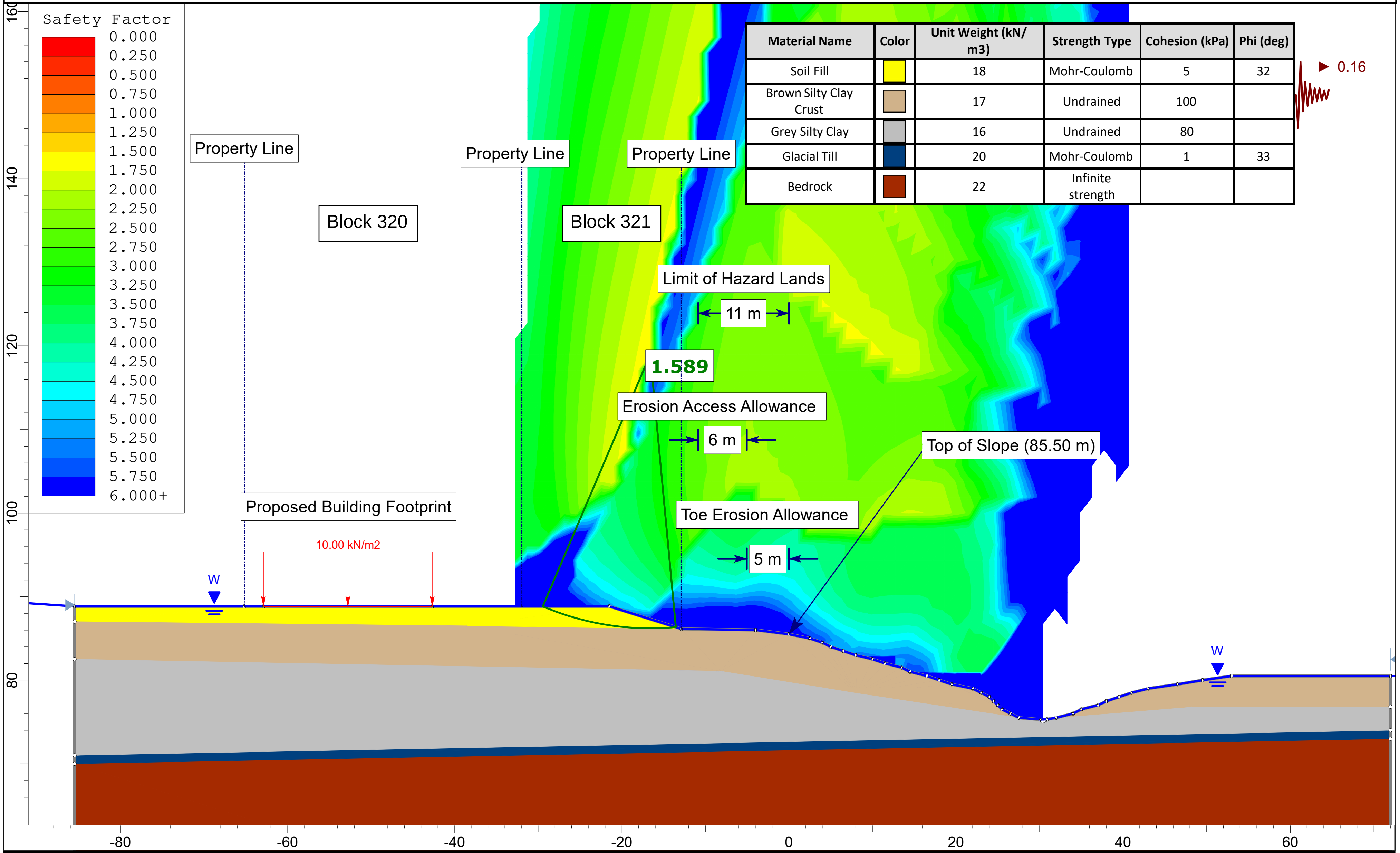
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Mohr-Coulomb	9	36
Grey Silty Clay	⬜	16	Mohr-Coulomb	12	36
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	CC	*Scenario*	Static - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

Figure 29D - Section CC - Proposed Seismic Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Undrained	100	
Grey Silty Clay	⬜	16	Undrained	80	
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	CC	*Scenario*	Seismic - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

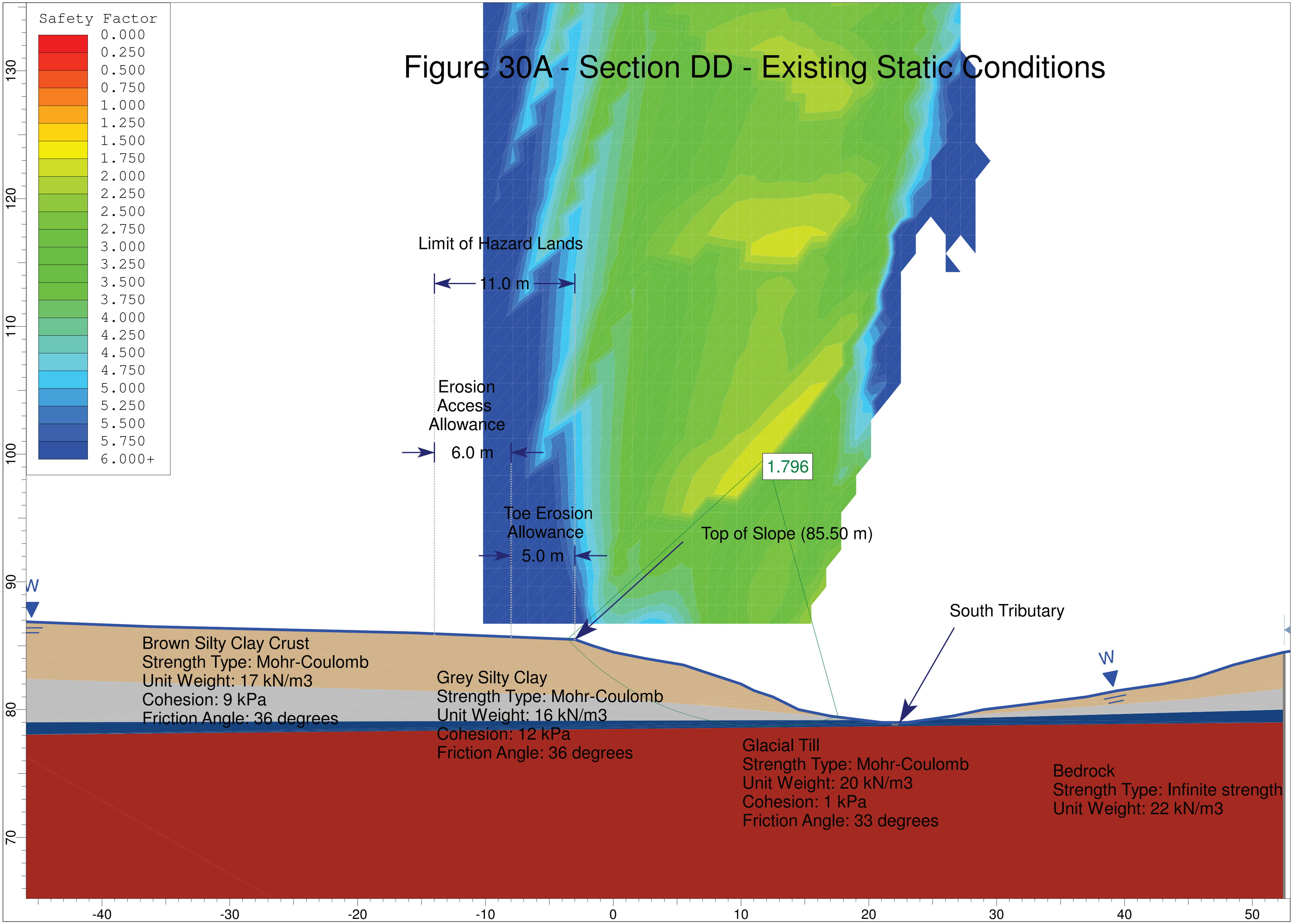


Figure 30A - Section DD - Existing Static Conditions

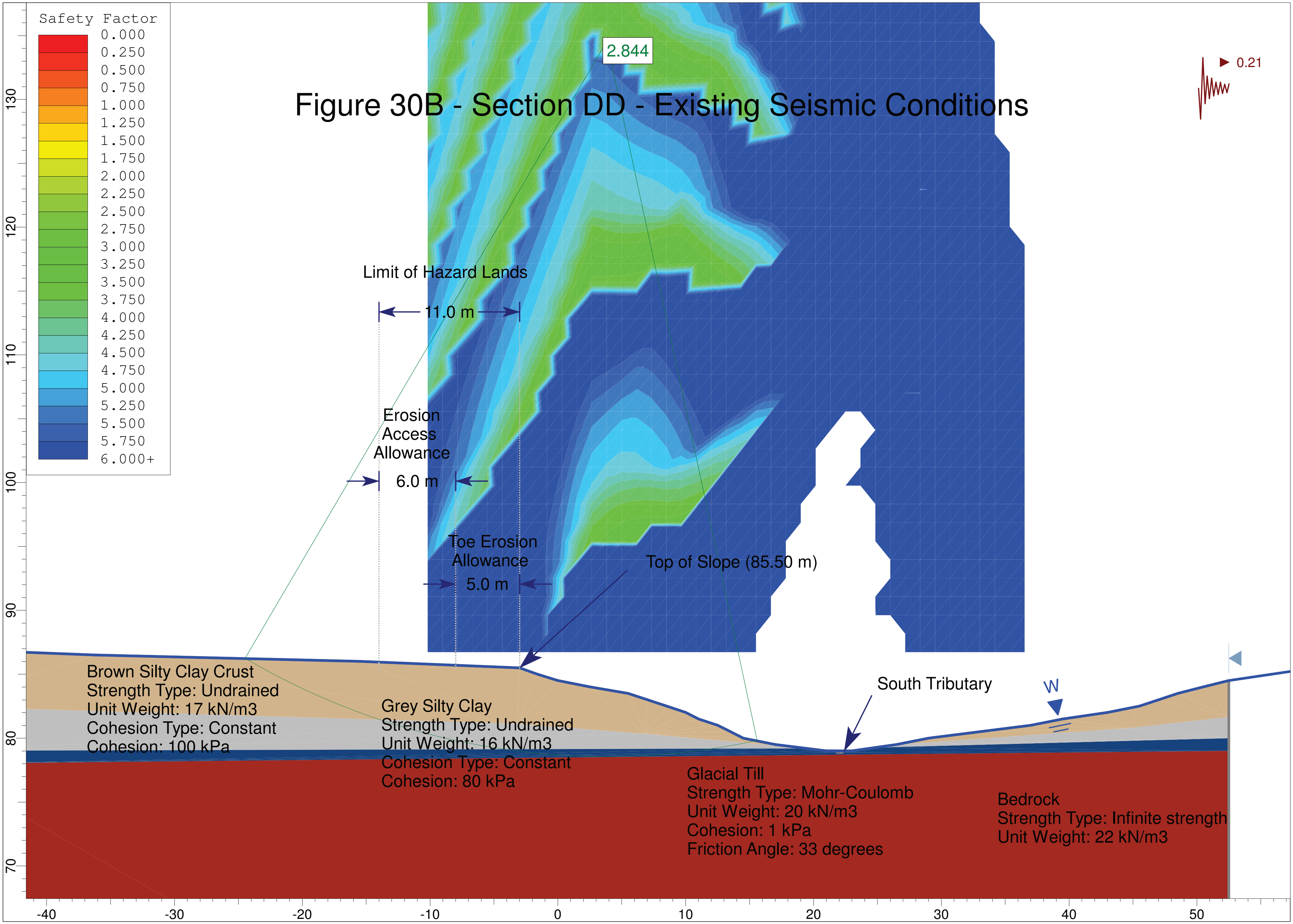


Figure 30B - Section DD - Existing Seismic Conditions

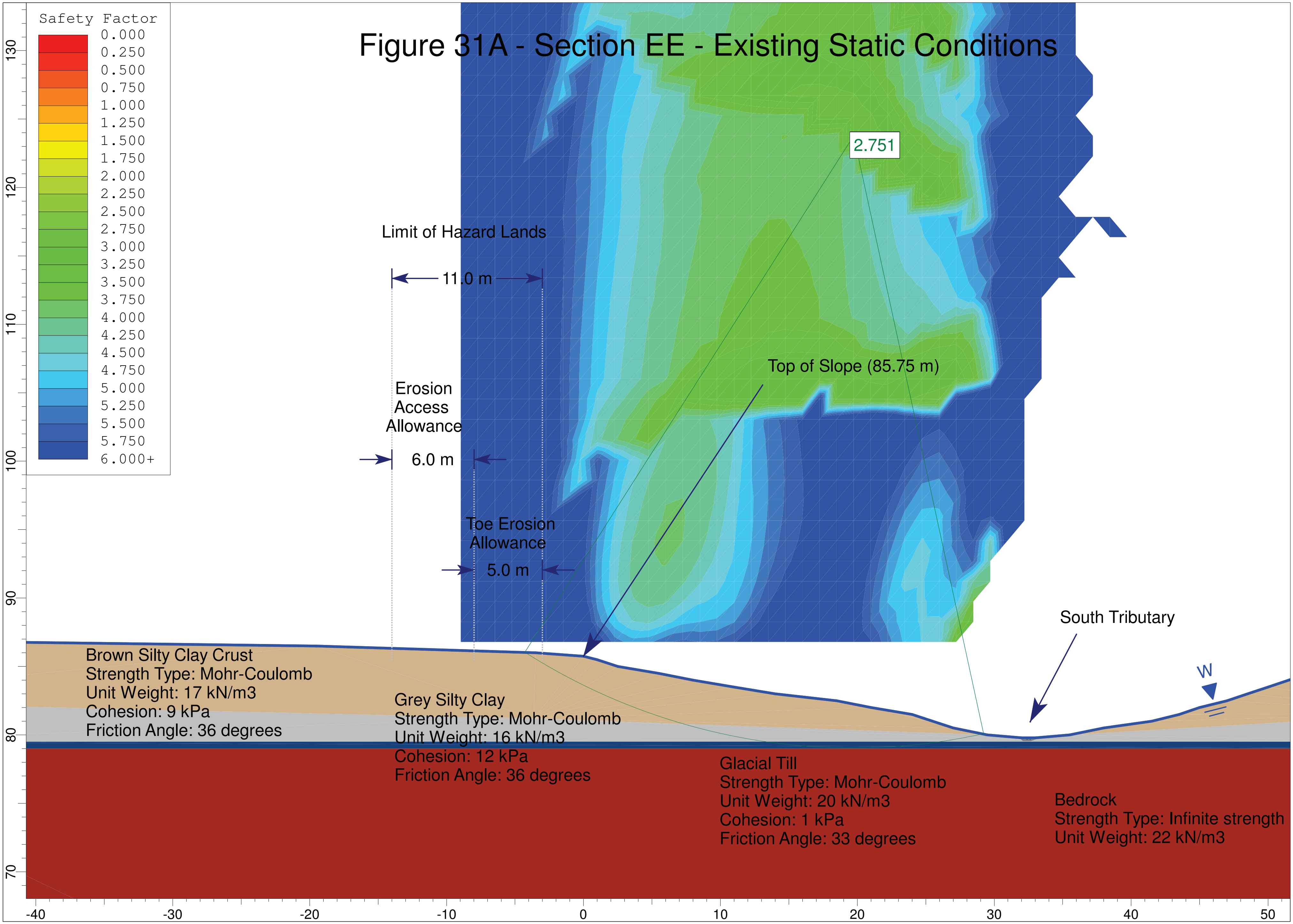


Figure 31A - Section EE - Existing Static Conditions

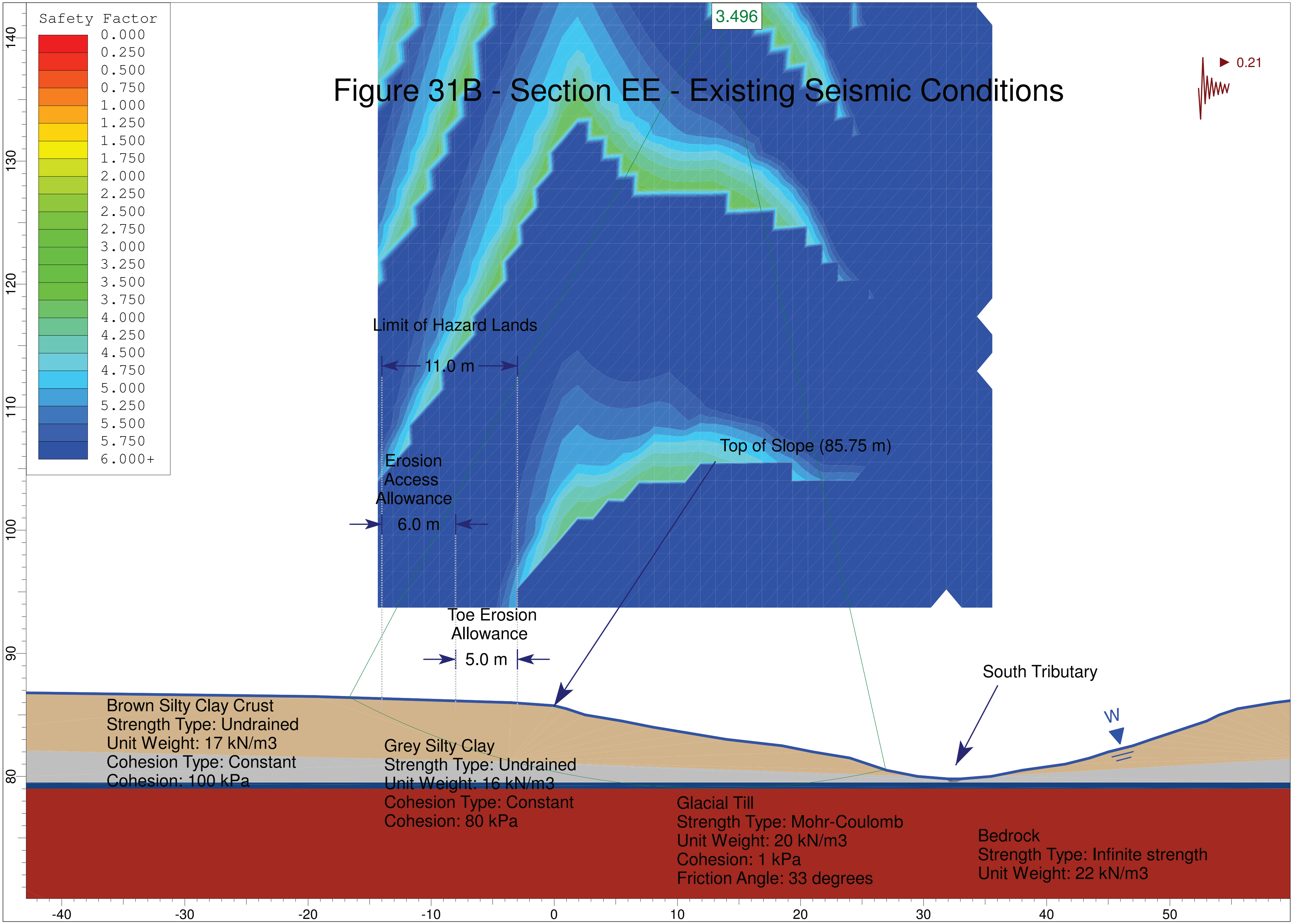
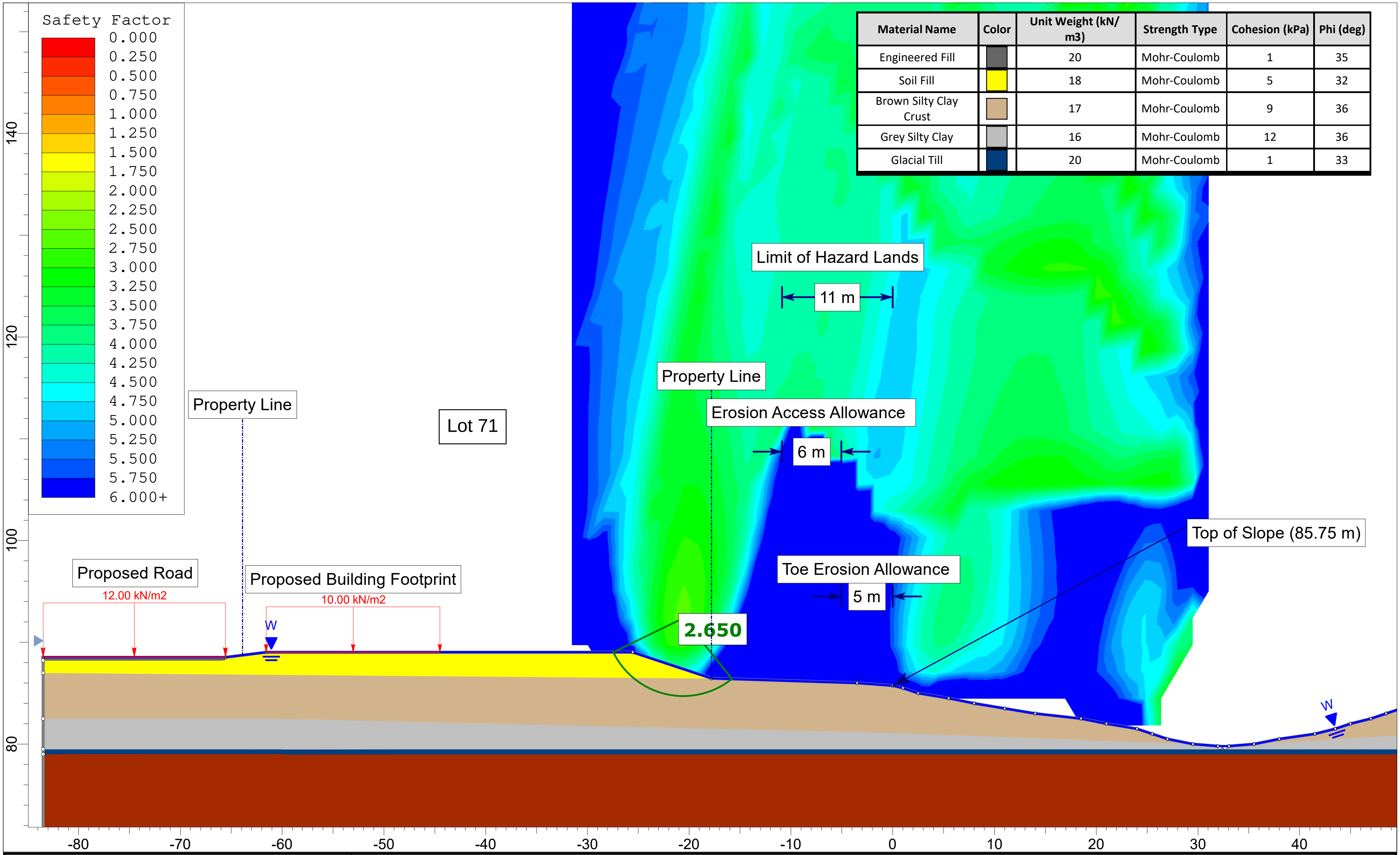


Figure 31B - Section EE - Existing Seismic Conditions

Figure 31C - Section EE - Proposed Static Conditions



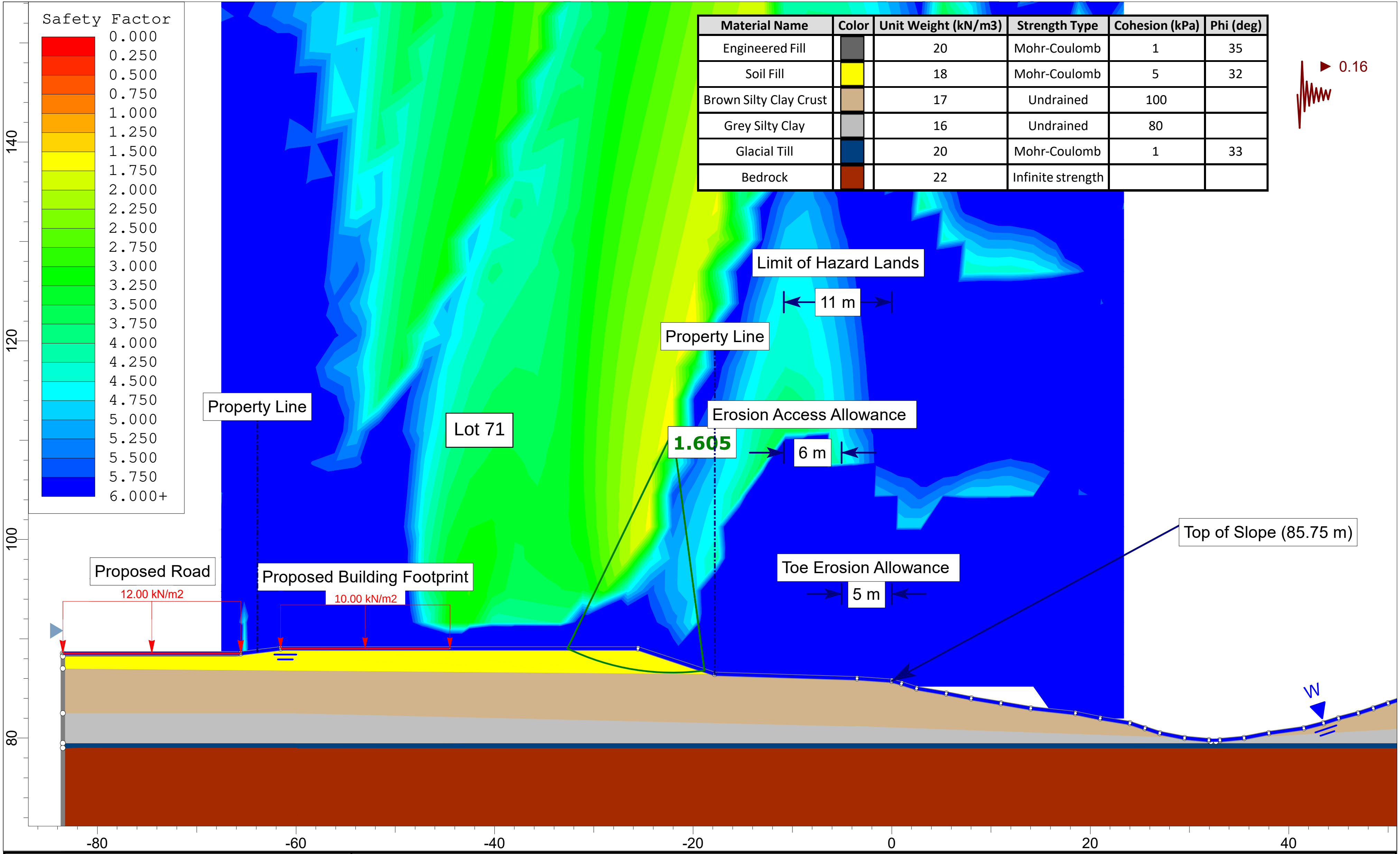
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Engineered Fill	⬛	20	Mohr-Coulomb	1	35
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Mohr-Coulomb	9	36
Grey Silty Clay	⬜	16	Mohr-Coulomb	12	36
Glacial Till	🟦	20	Mohr-Coulomb	1	33

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	EE	*Scenario*	Static - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

Figure 31D - Section EE - Proposed Seismic Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Engineered Fill	⬛	20	Mohr-Coulomb	1	35
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Undrained	100	
Grey Silty Clay	⬜	16	Undrained	80	
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	EE	Scenario	Siesmic - Proposed Condition
Drawn By	EA	Company	Tamarack Homes
Date	8/15/2023	File Name	Geotechnical Investigation

PATERSON GROUP

SLIDEINTERPRET 9.025

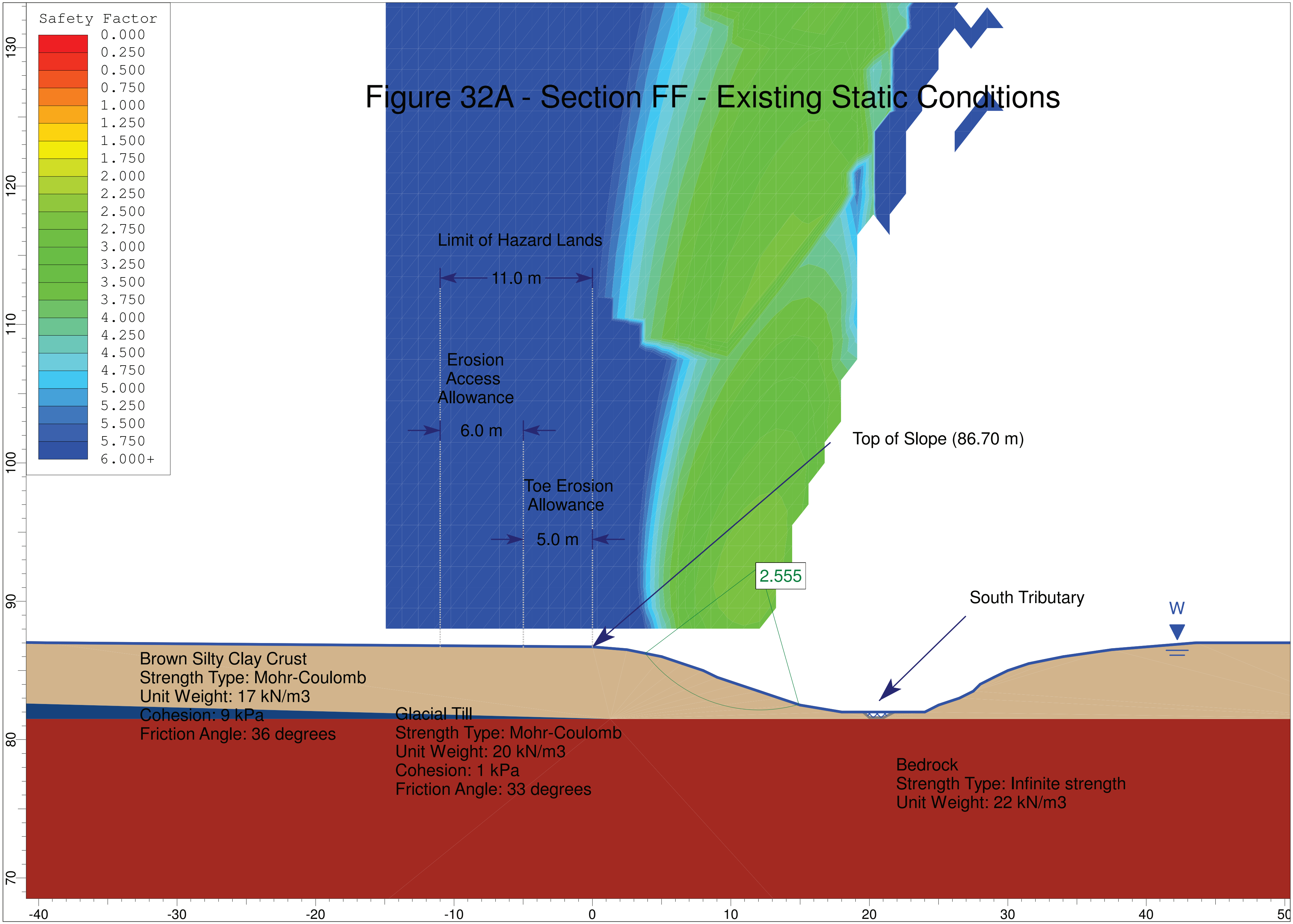


Figure 32A - Section FF - Existing Static Conditions

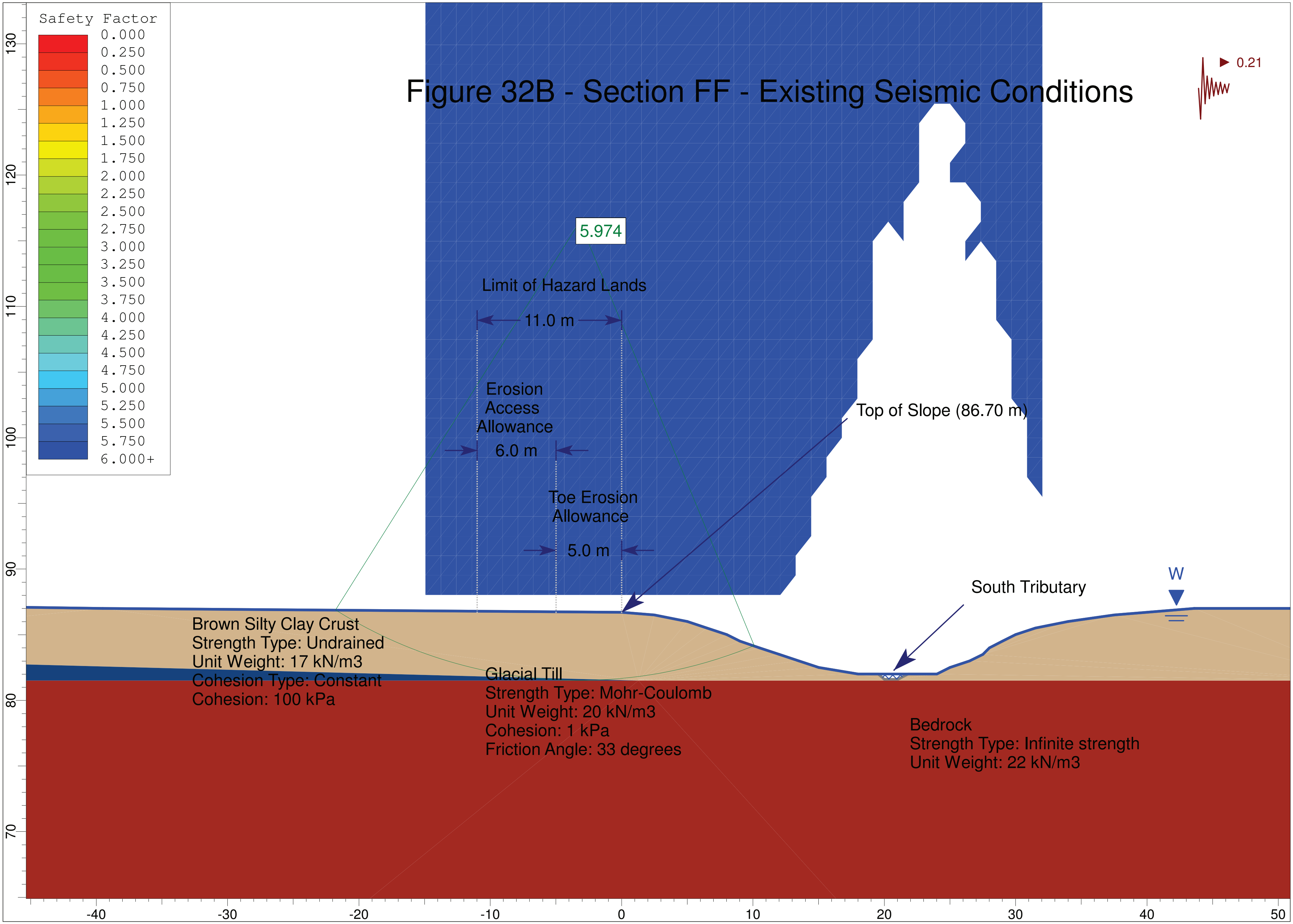


Figure 32B - Section FF - Existing Seismic Conditions

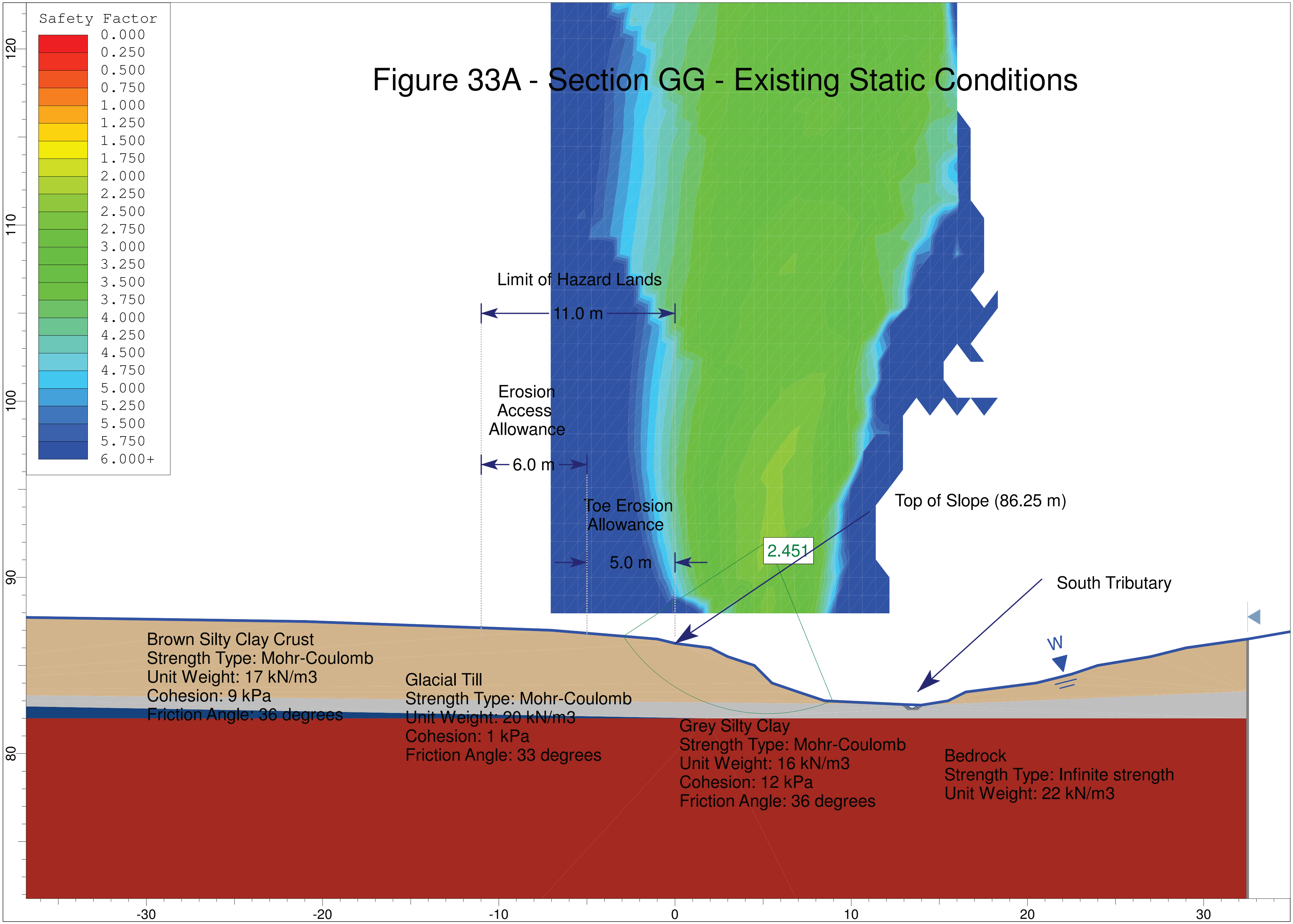


Figure 33A - Section GG - Existing Static Conditions

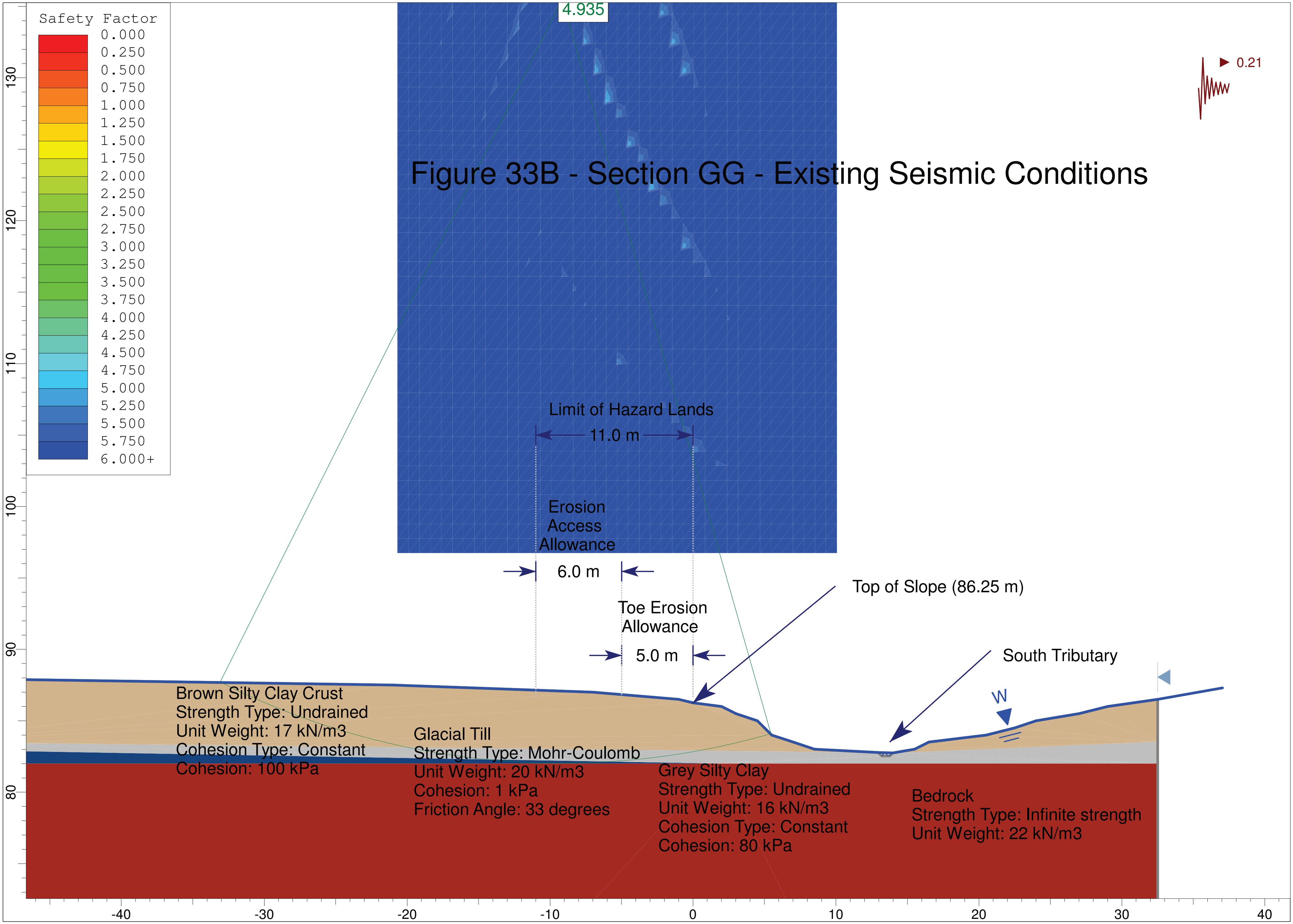
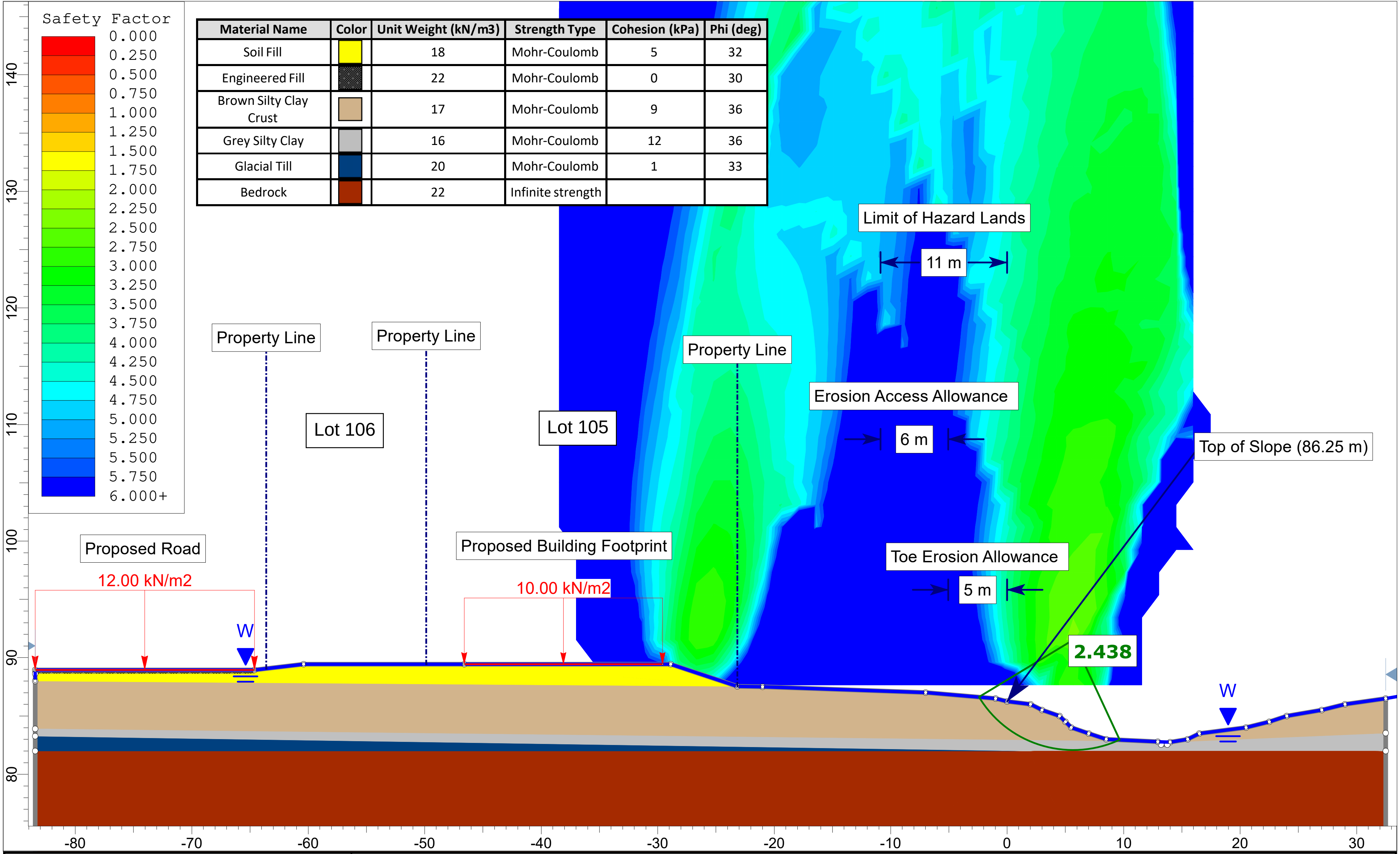


Figure 33B - Section GG - Existing Seismic Conditions

Figure 33C - Section GG - Proposed Static Conditions



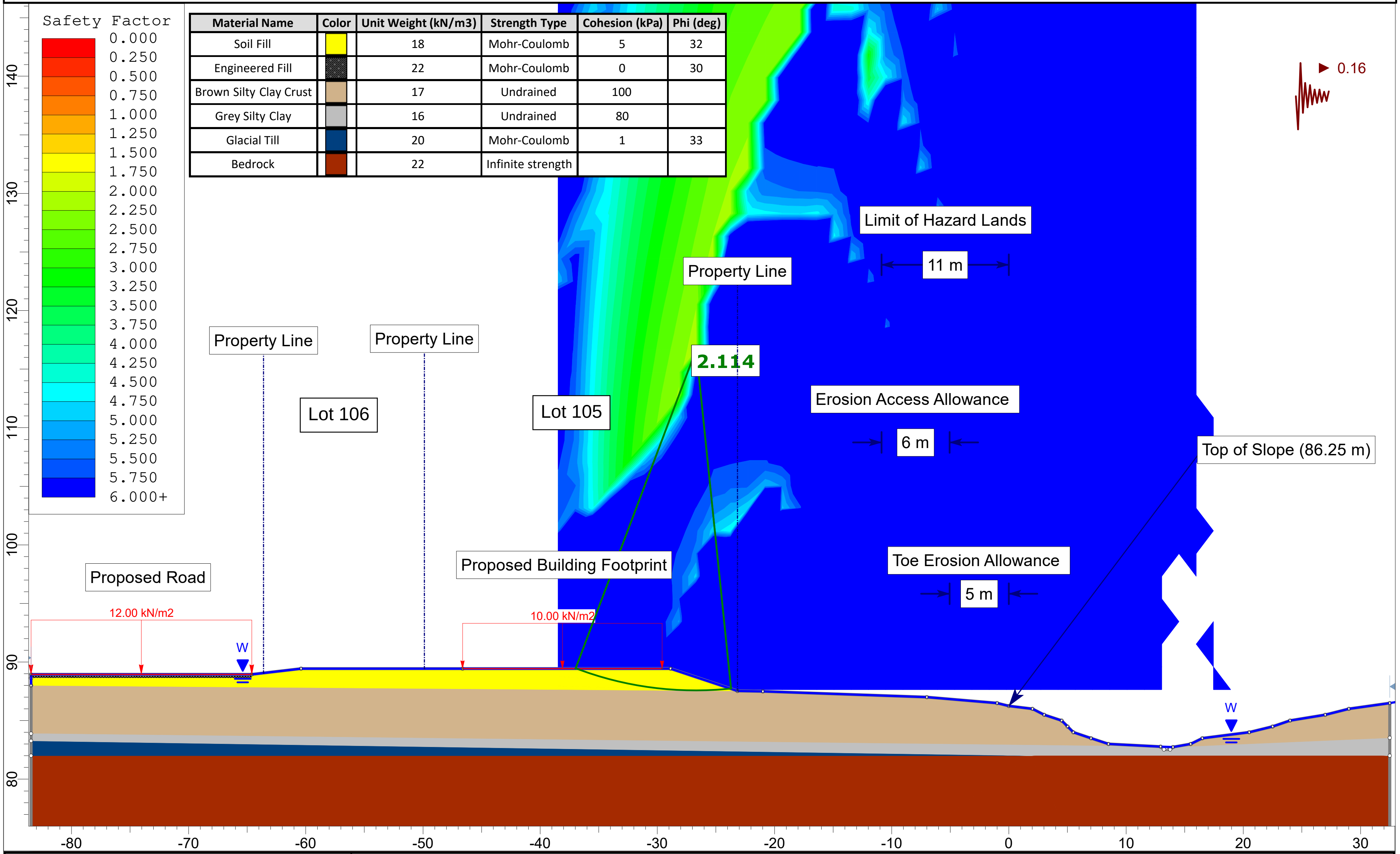
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Engineered Fill	▨	22	Mohr-Coulomb	0	30
Brown Silty Clay Crust	🟫	17	Mohr-Coulomb	9	36
Grey Silty Clay	⬜	16	Mohr-Coulomb	12	36
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	GG	*Scenario*	Static - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

Figure 33D - Section GG - Proposed Seismic Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Engineered Fill	▩	22	Mohr-Coulomb	0	30
Brown Silty Clay Crust	🟫	17	Undrained	100	
Grey Silty Clay	⬜	16	Undrained	80	
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario

Cross Section	GG	*Scenario*	Seismic - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

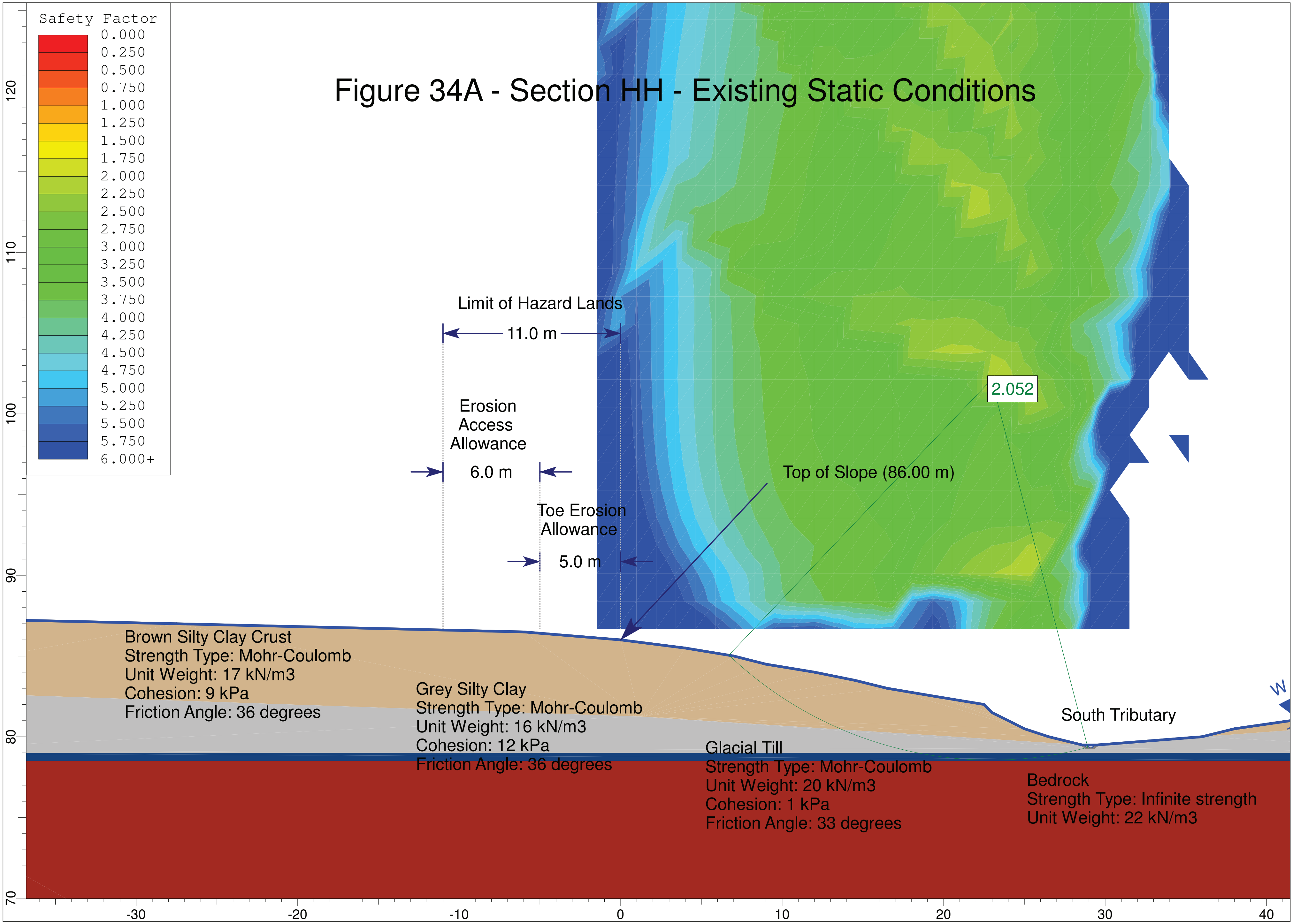


Figure 34A - Section HH - Existing Static Conditions

Figure 34B - Section HH - Existing Seismic Conditions

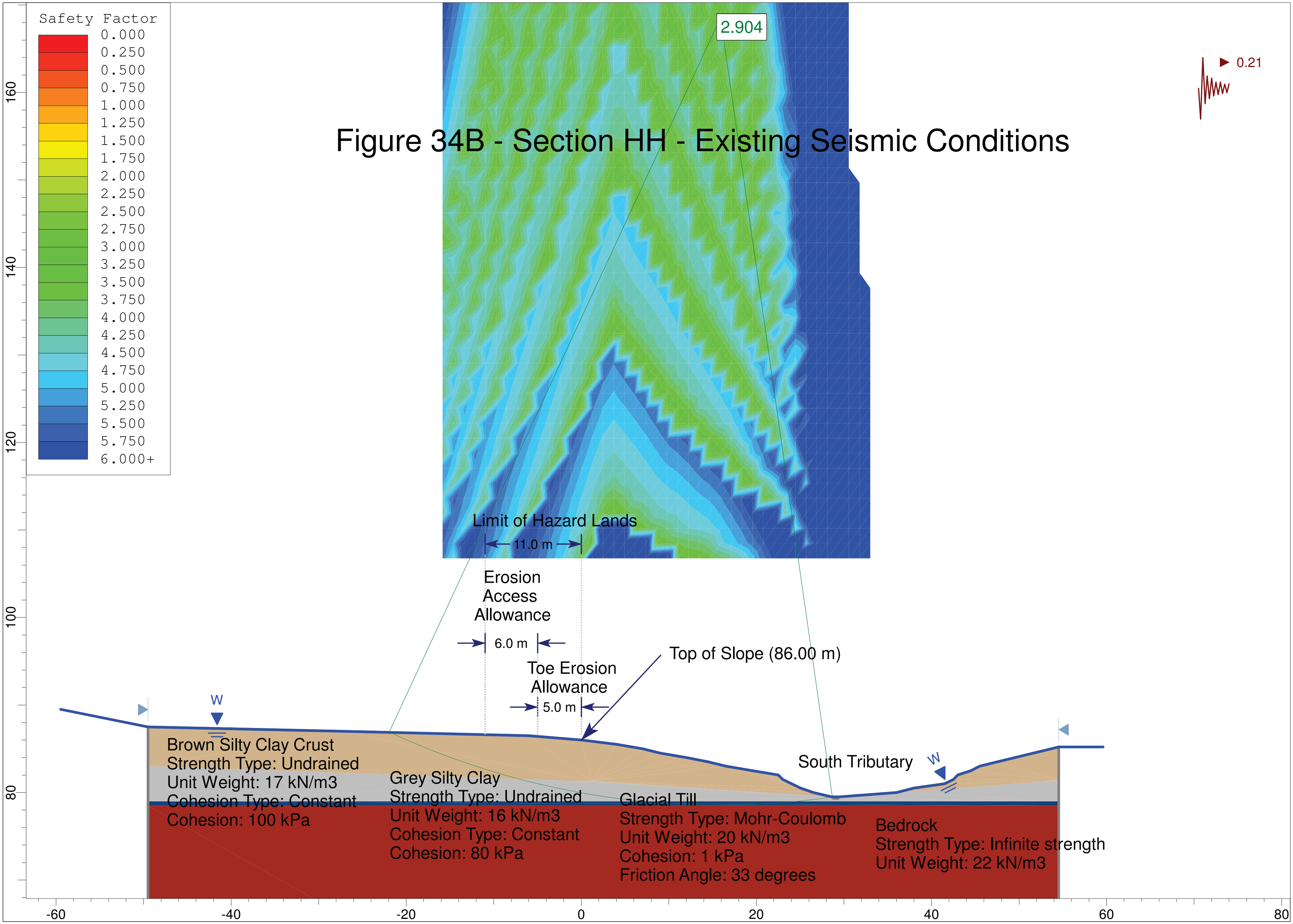
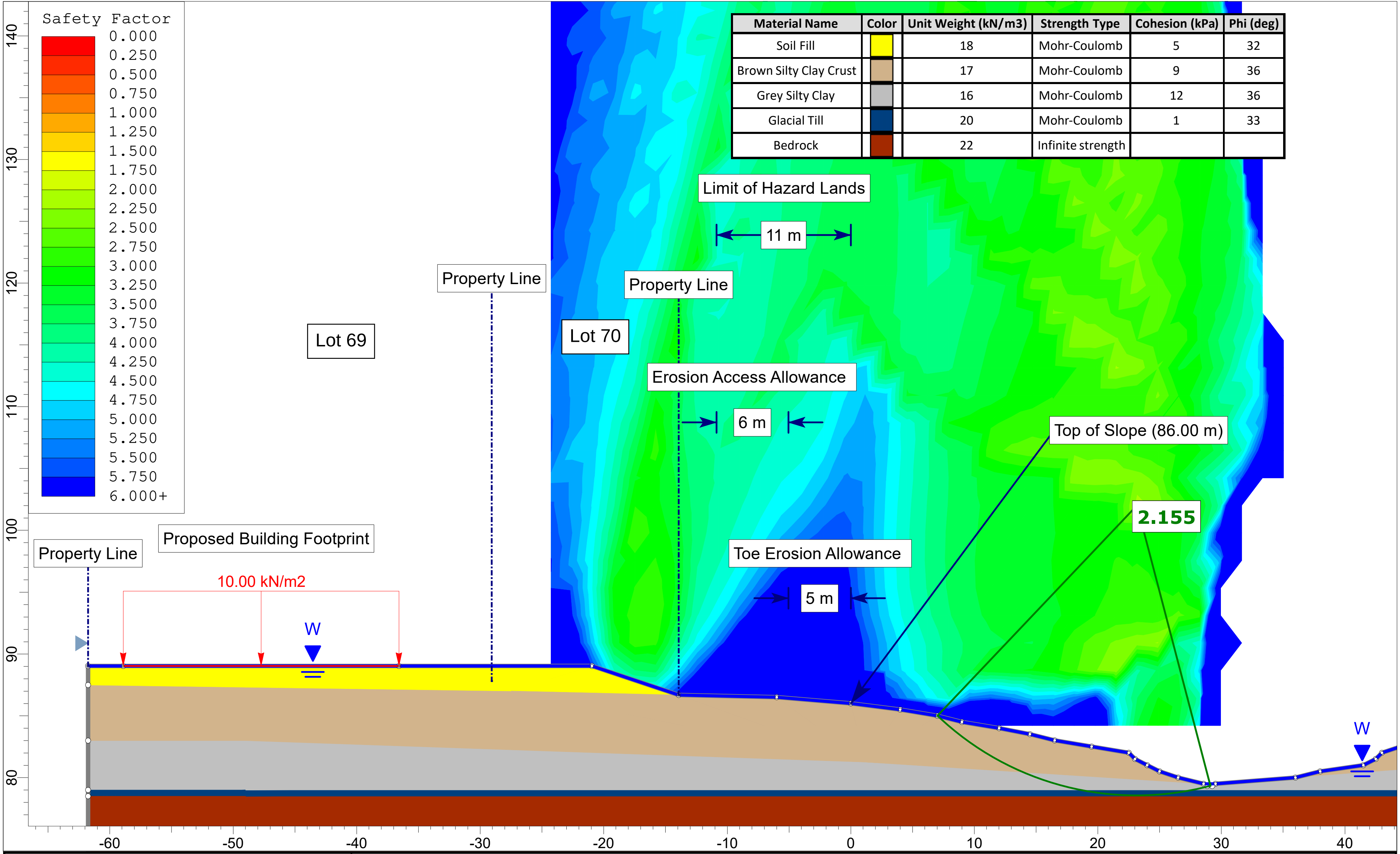


Figure 34C - Section HH - Proposed Static Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Mohr-Coulomb	9	36
Grey Silty Clay	⬜	16	Mohr-Coulomb	12	36
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

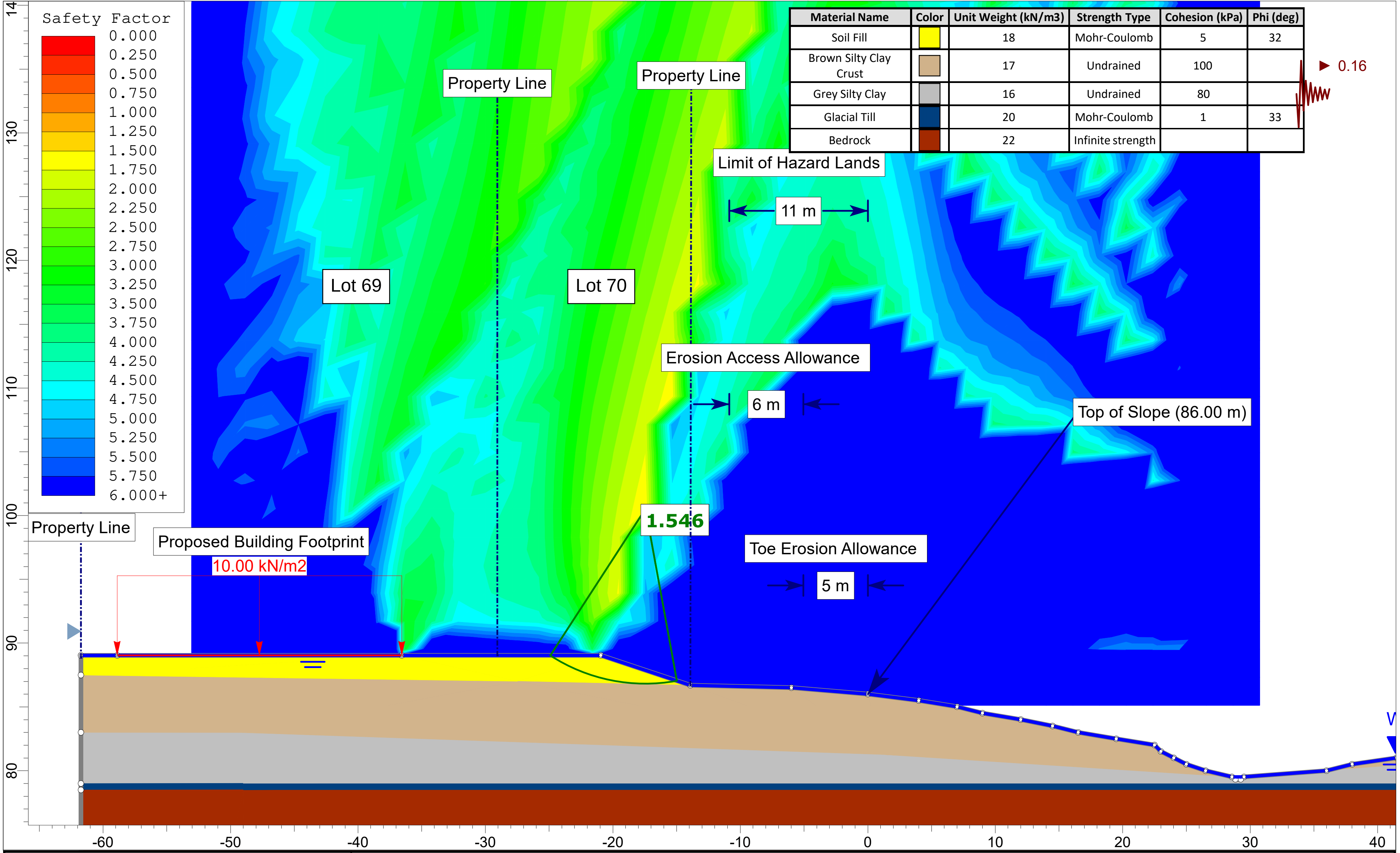
PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario

Cross Section	HH	*Scenario*	Static - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

Figure 34D - Section HH - Proposed Seismic Conditions



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Soil Fill	🟨	18	Mohr-Coulomb	5	32
Brown Silty Clay Crust	🟫	17	Undrained	100	
Grey Silty Clay	⬜	16	Undrained	80	
Glacial Till	🟦	20	Mohr-Coulomb	1	33
Bedrock	🟥	22	Infinite strength		

PATERSON GROUP

SLIDEINTERPRET 9.025

Project	PG5201 - Proposed Residential Development - Cardinal Creek Village South Old Montreal Road, Ottawa, Ontario		
Cross Section	HH	*Scenario*	Seismic - Proposed Condition
Drawn By	EA	*Company*	Tamarack Homes
Date	8/15/2023	*File Name*	Geotechnical Investigation

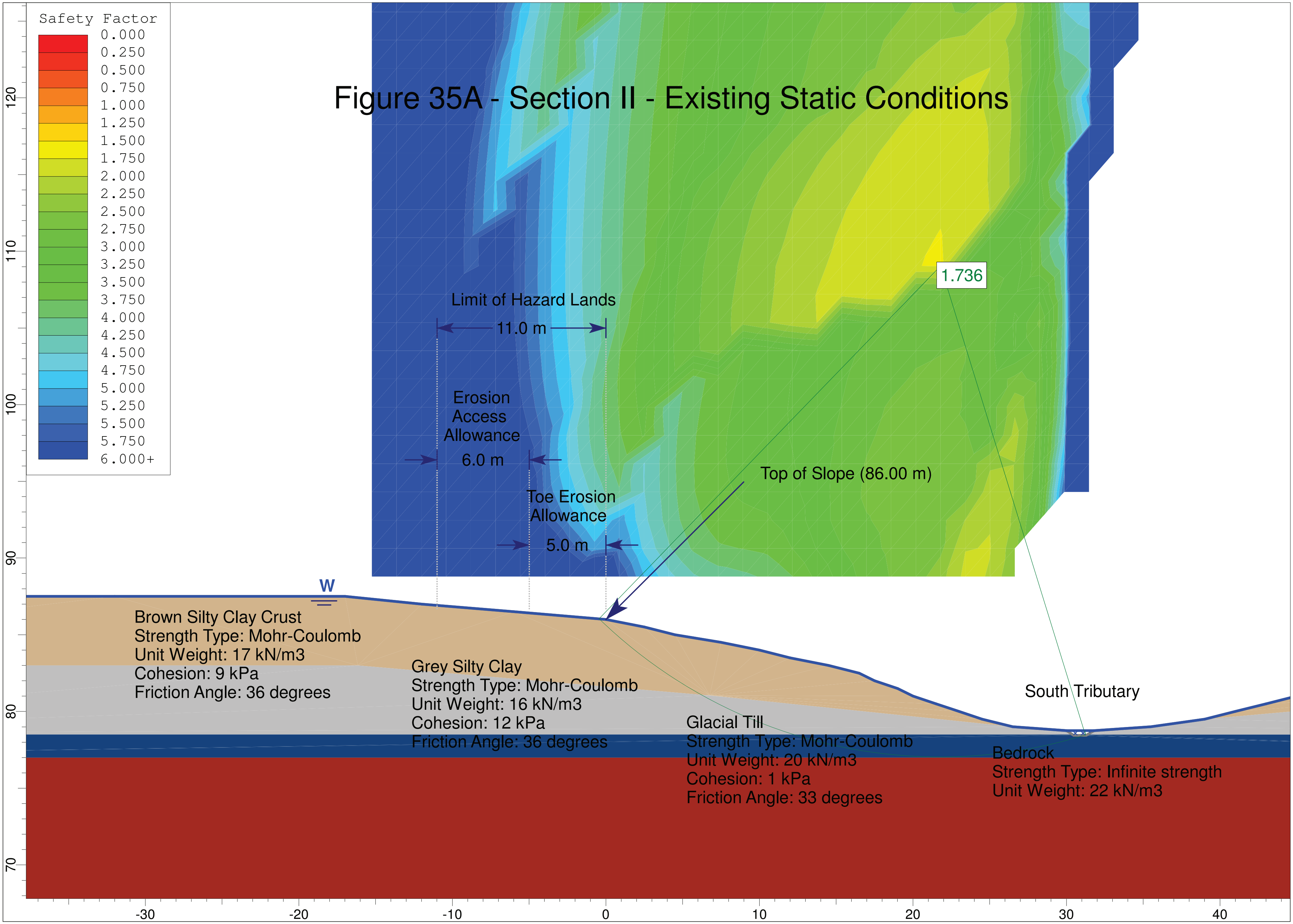
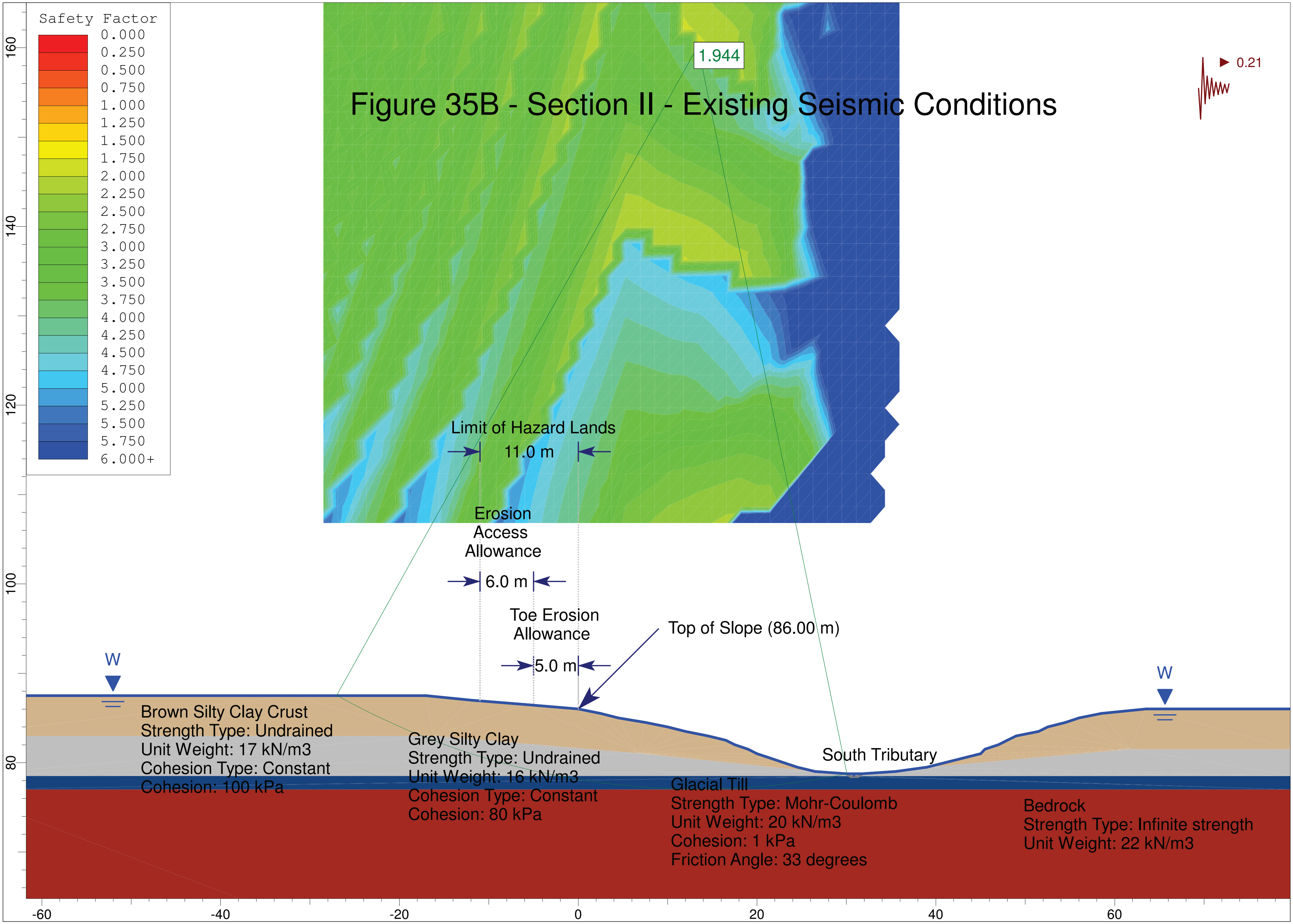


Figure 35A - Section II - Existing Static Conditions

Figure 35B - Section II - Existing Seismic Conditions



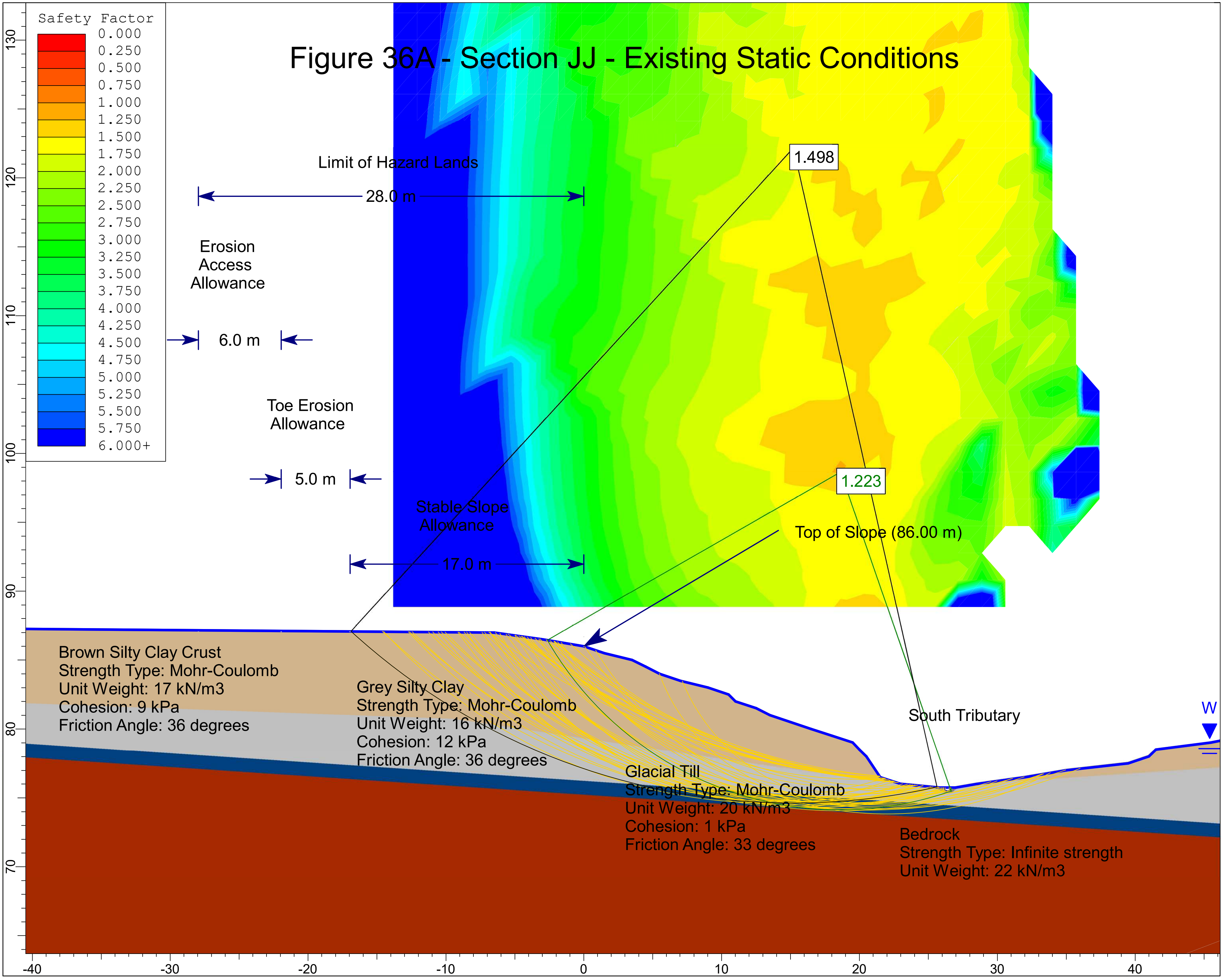


Figure 36A - Section JJ - Existing Static Conditions

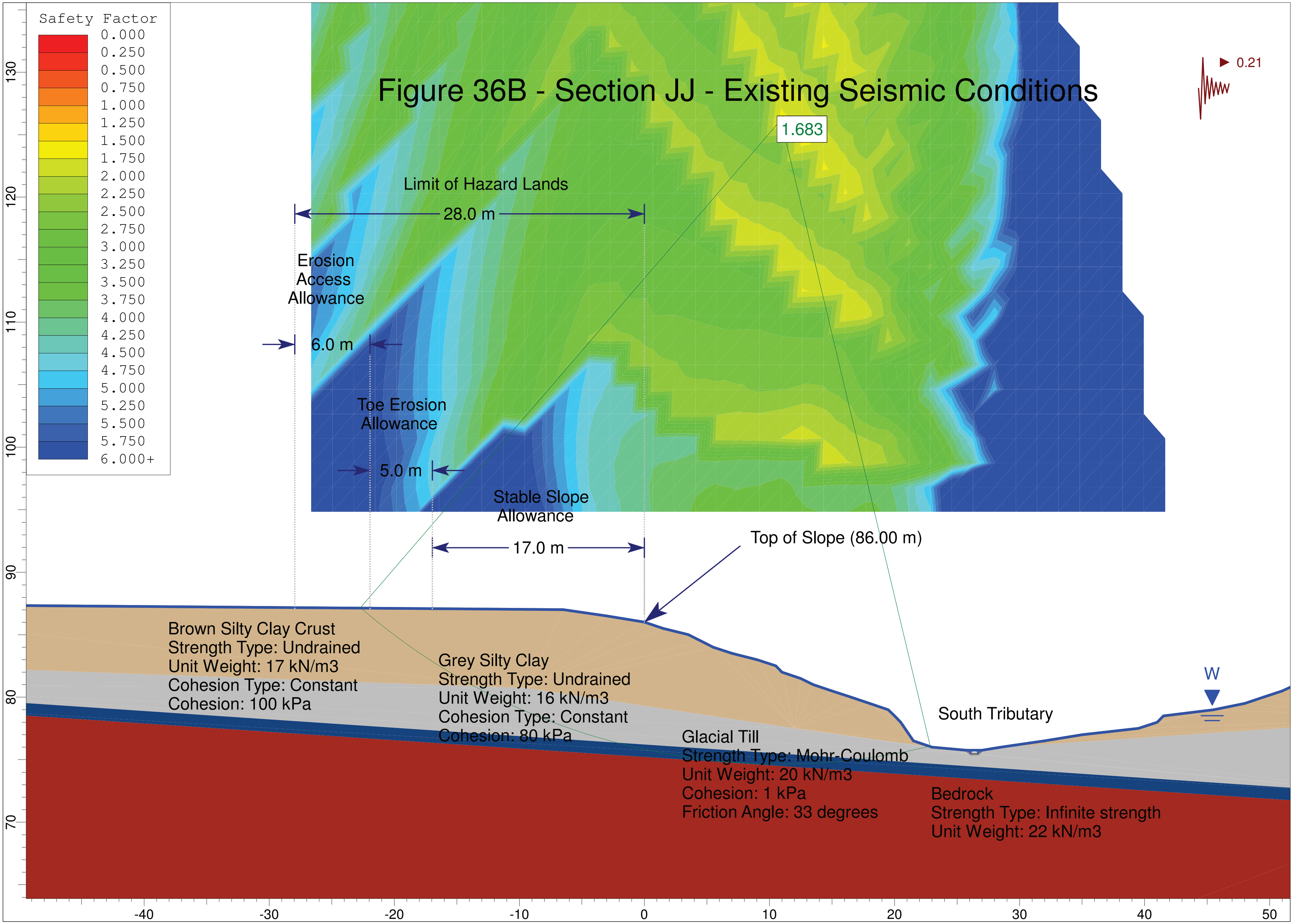


Figure 36B - Section JJ - Existing Seismic Conditions

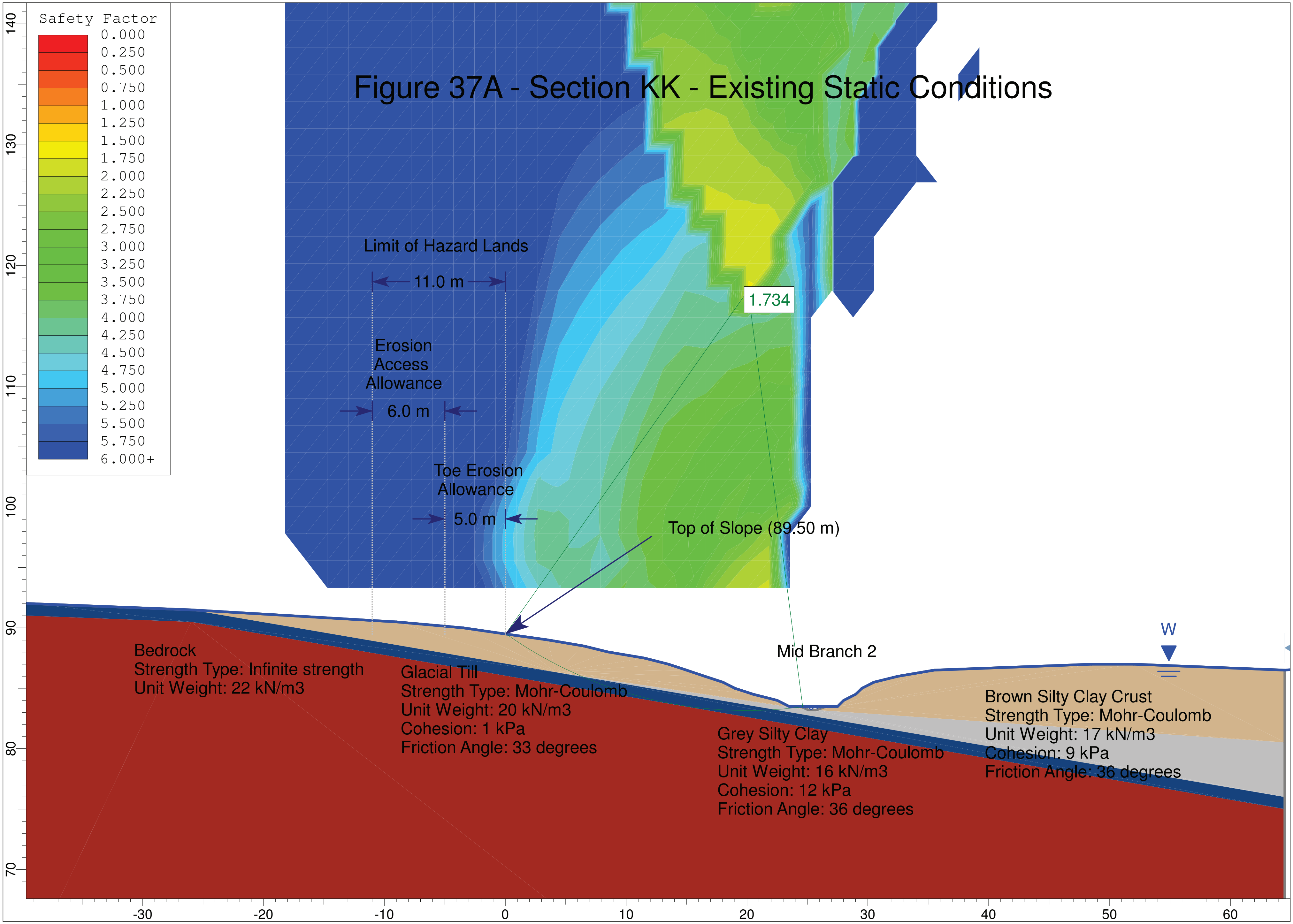
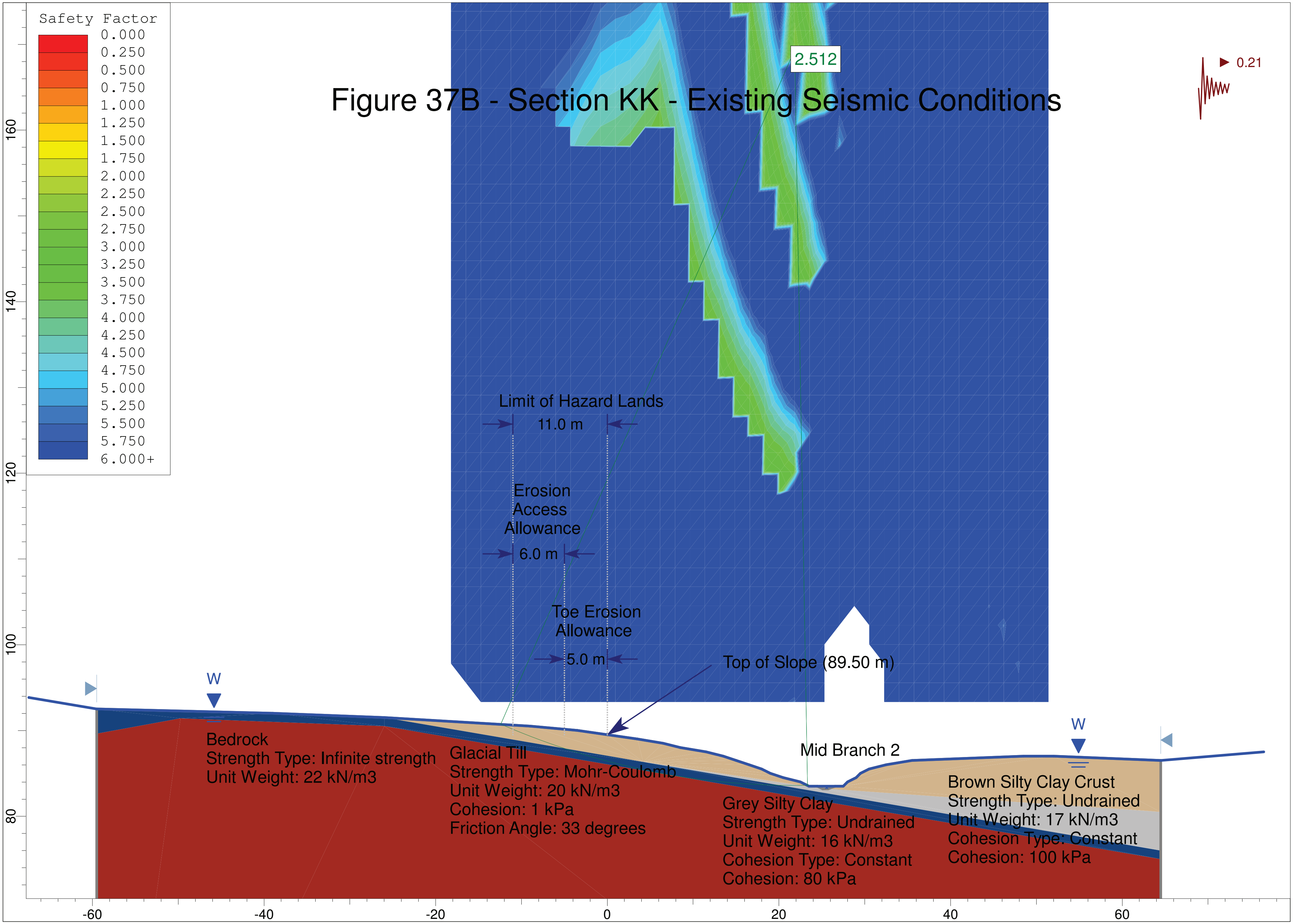


Figure 37A - Section KK - Existing Static Conditions

Figure 37B - Section KK - Existing Seismic Conditions



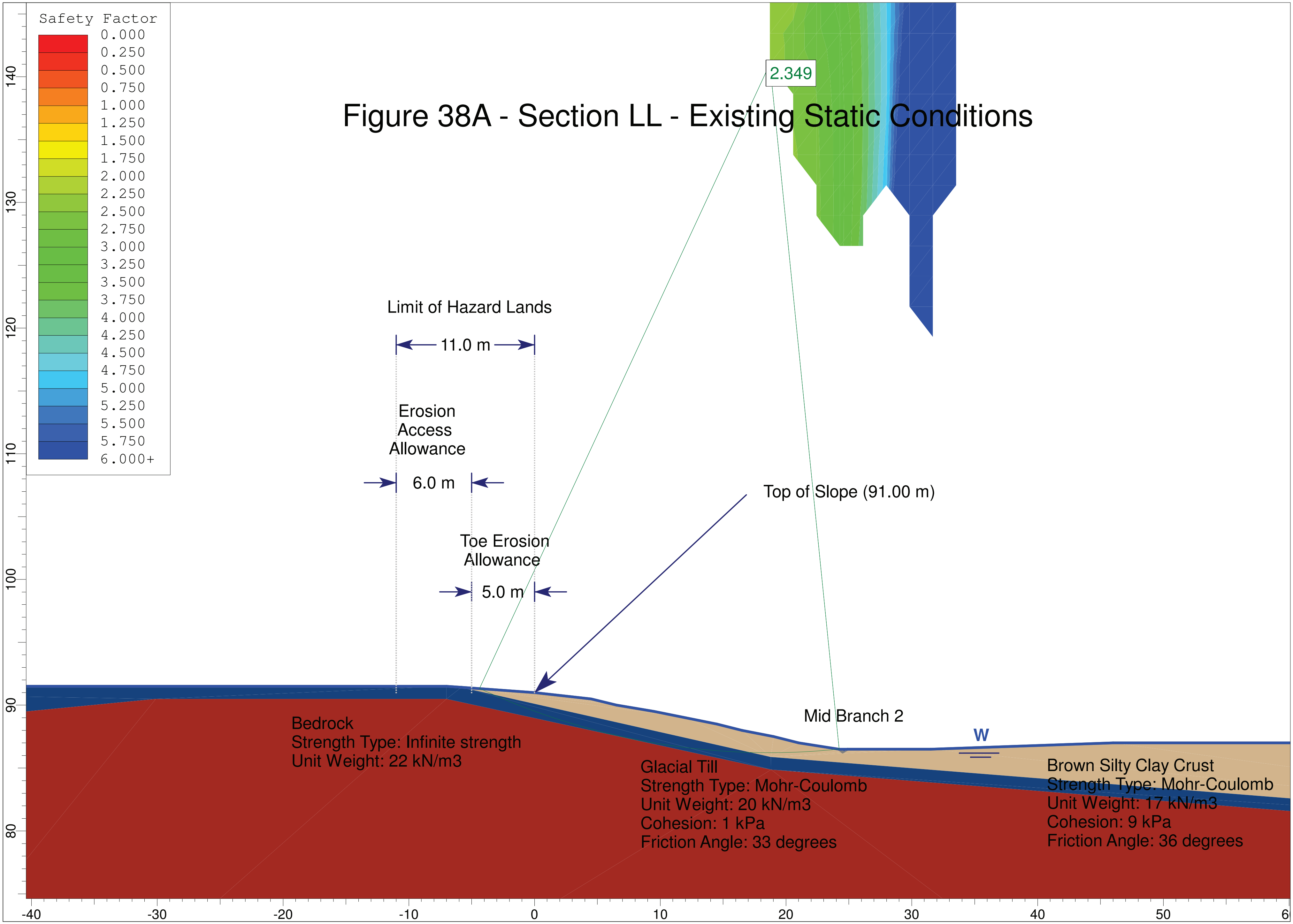


Figure 38A - Section LL - Existing Static Conditions

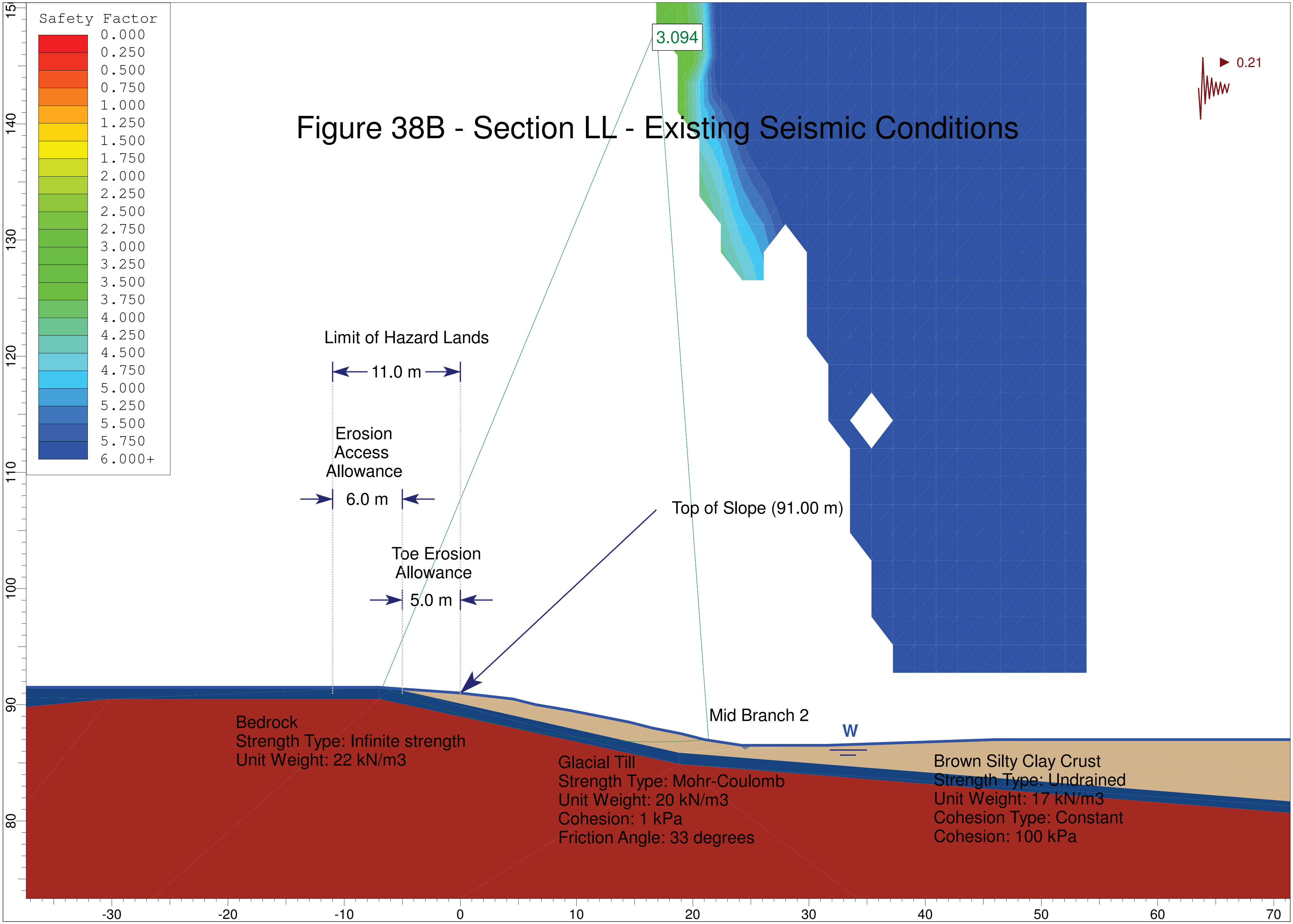


Figure 38B - Section LL - Existing Seismic Conditions

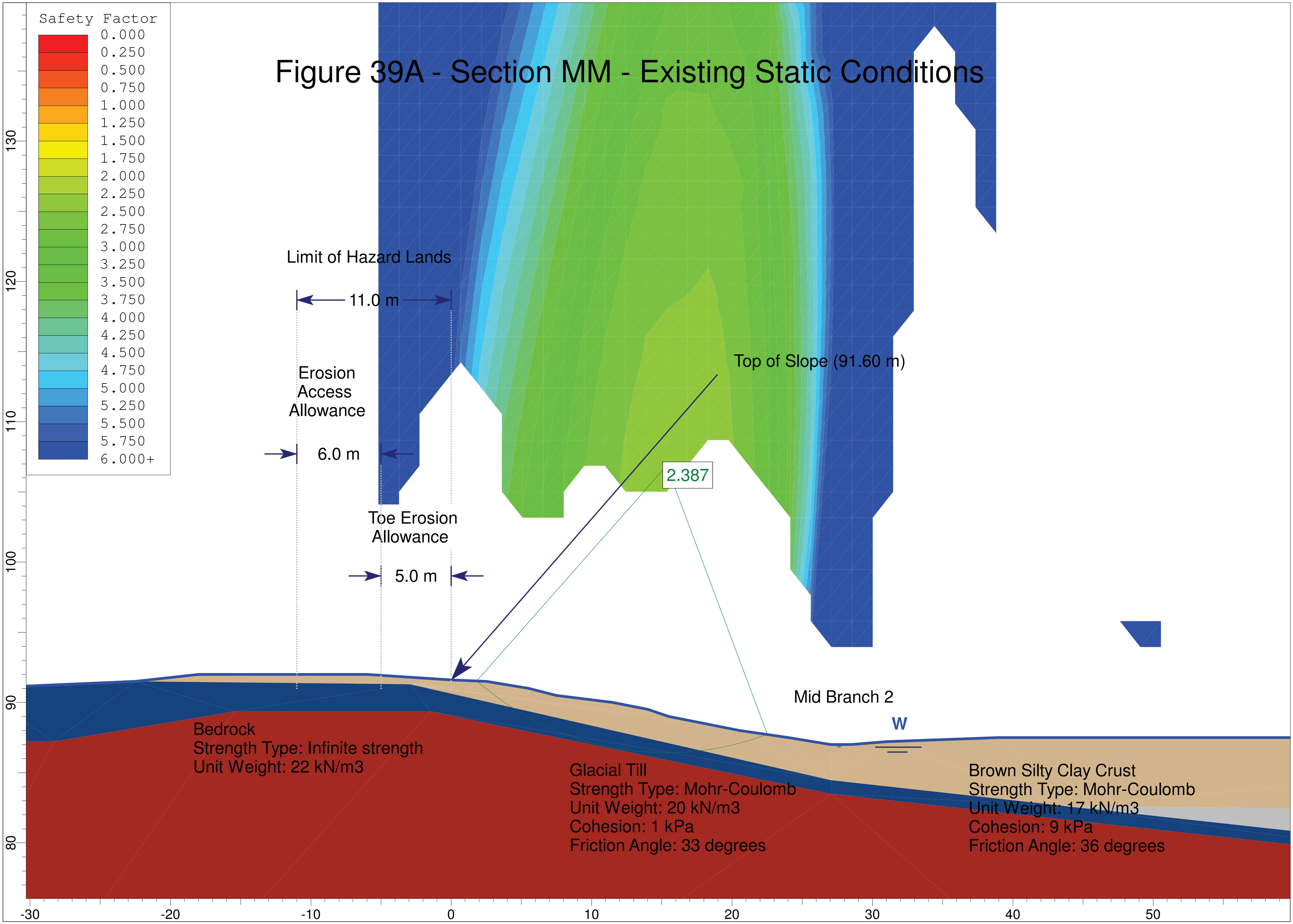


Figure 39A - Section MM - Existing Static Conditions

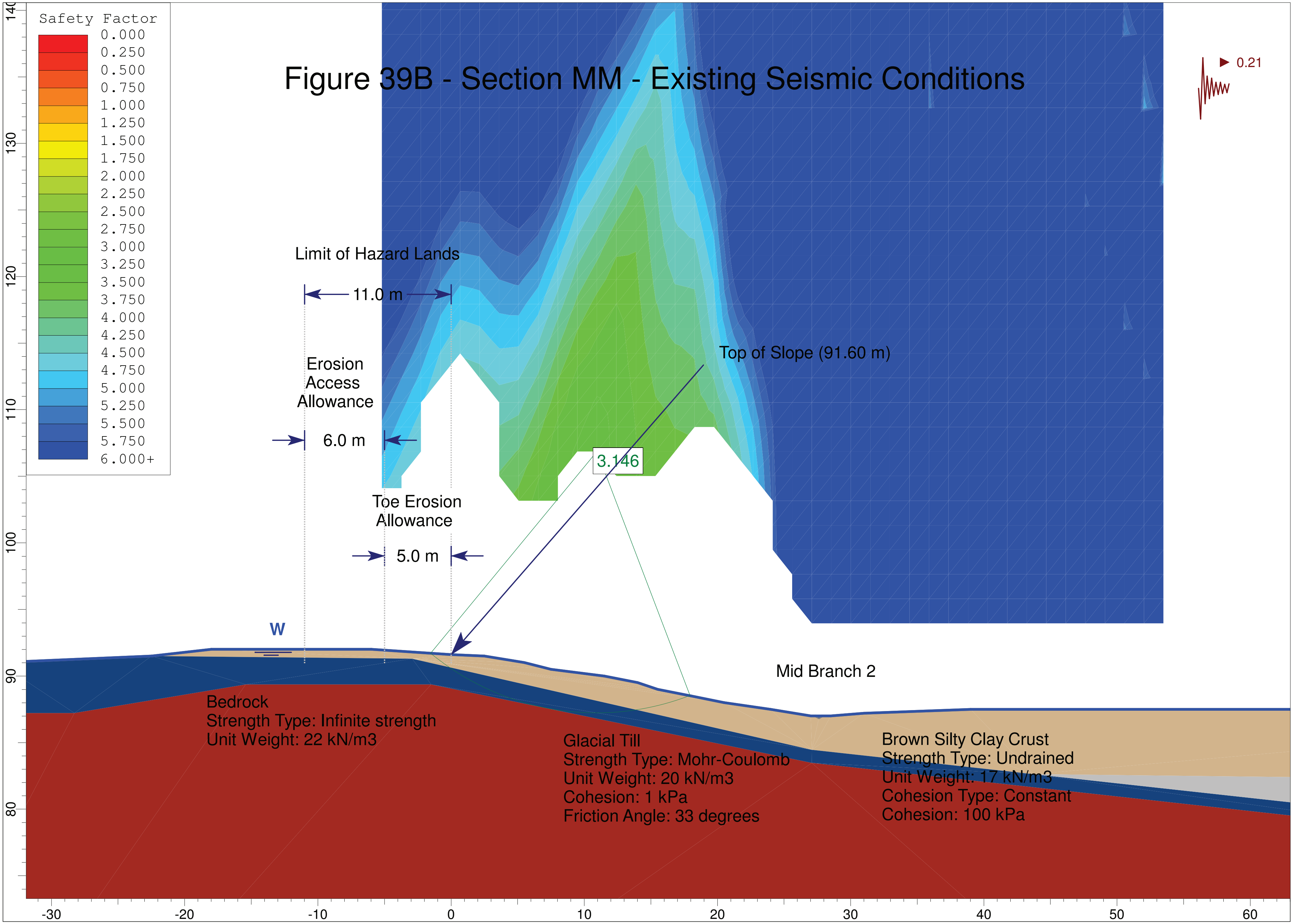


Figure 39B - Section MM - Existing Seismic Conditions

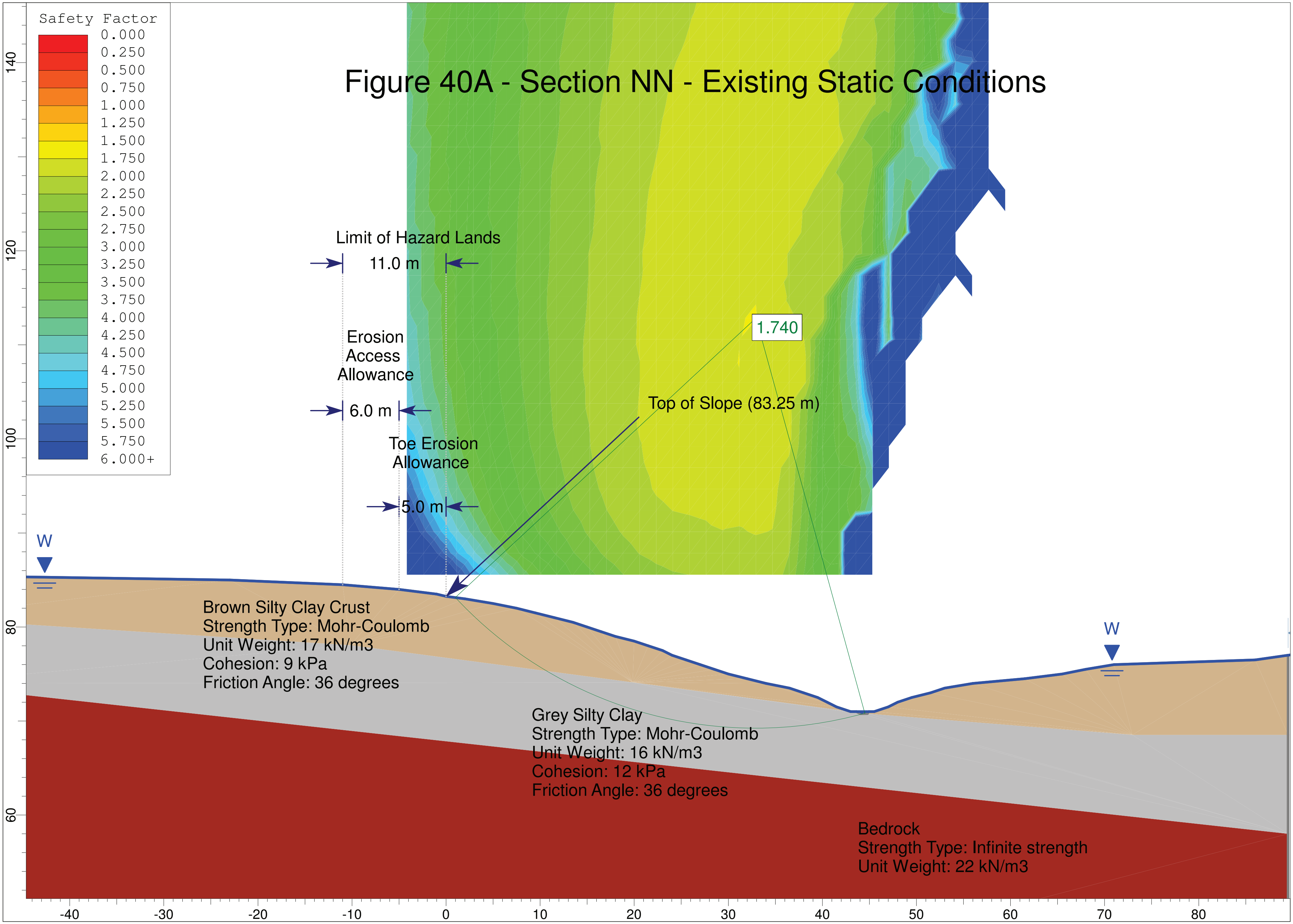


Figure 40A - Section NN - Existing Static Conditions

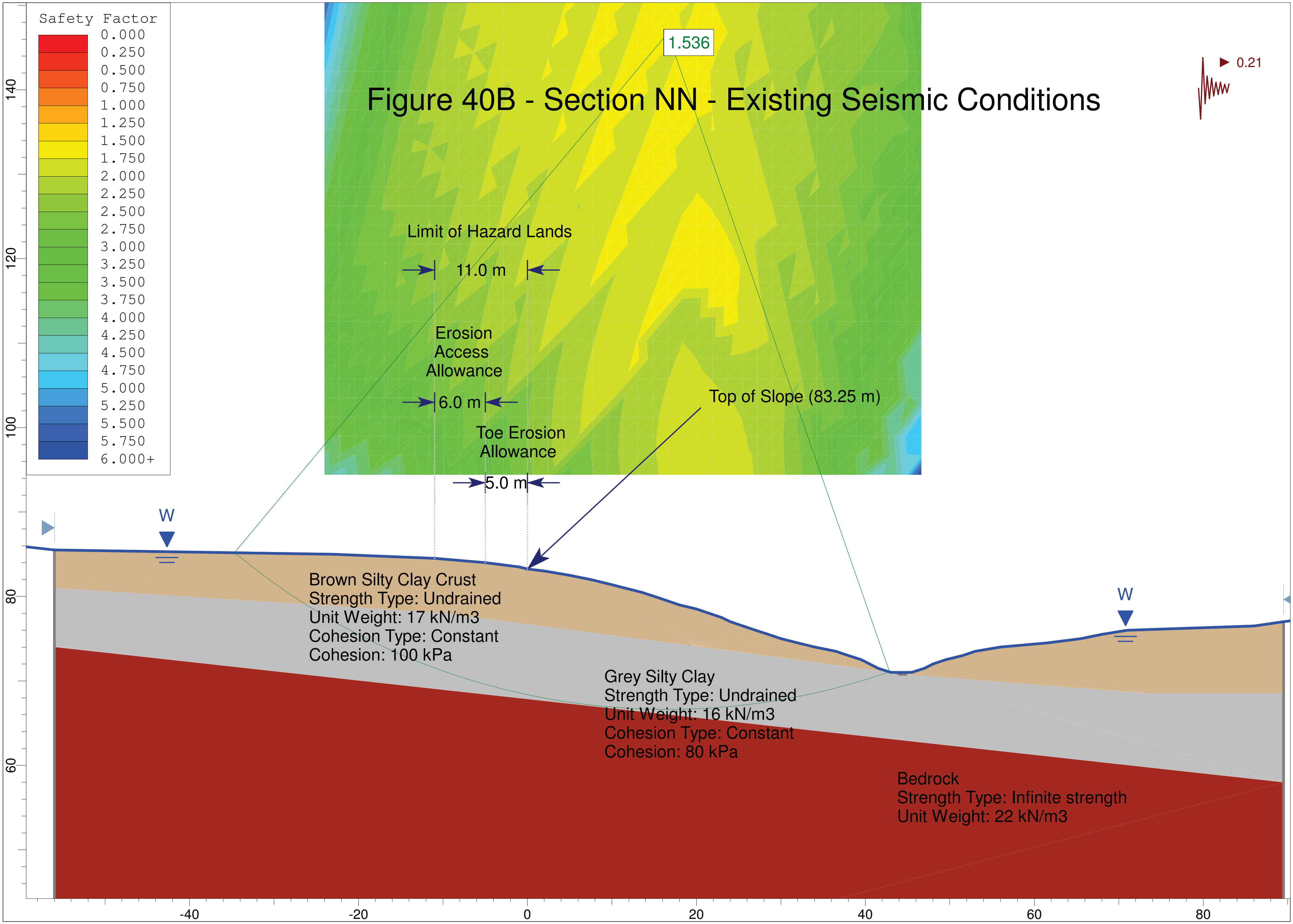


Figure 40B - Section NN - Existing Seismic Conditions

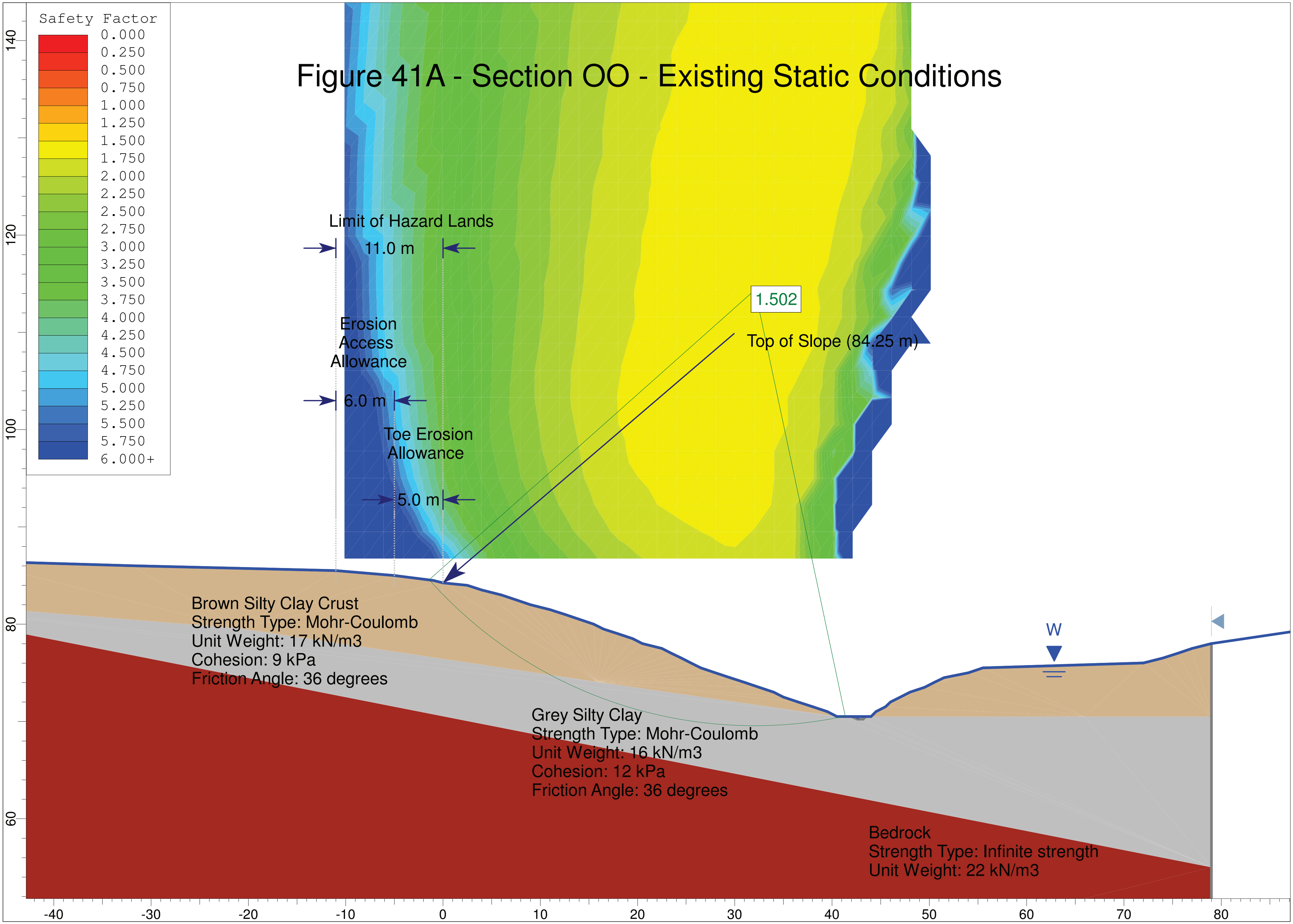


Figure 41A - Section OO - Existing Static Conditions

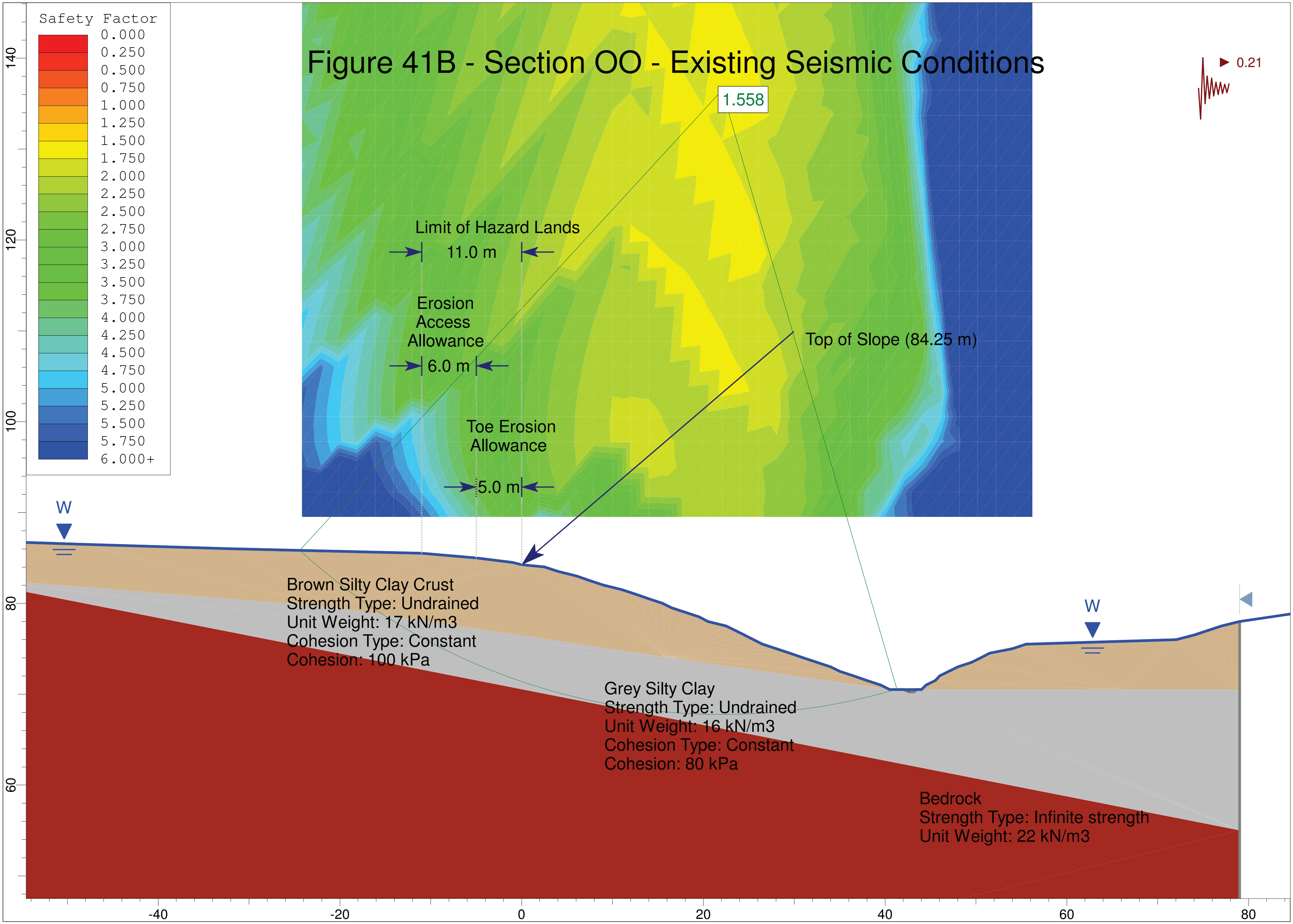
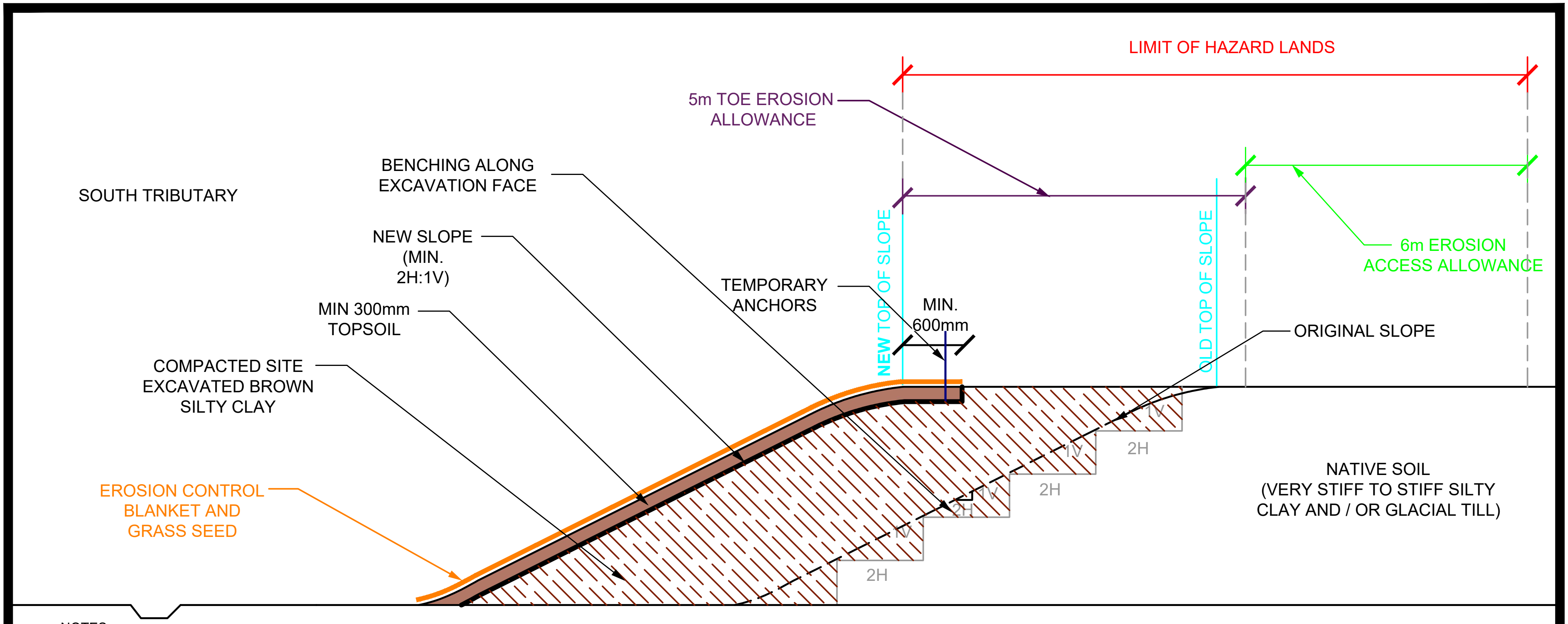


Figure 41B - Section OO - Existing Seismic Conditions



NOTES:

- SITE EXCAVATED MATERIAL SUCH AS WORKABLE, BROWN SILTY SAND OR ANY APPROVED SITE EXCAVATED MATERIAL, FREE OF DELETERIOUS FILL SUCH AS ORGANICS OR CONSTRUCTION DEBRIS, CAN BE USED AS BACKFILL MATERIAL TO IN-FILL CURRENT SLOPE AND EXTEND THE SLOPE FACE TO MATCH THE EXISTING ADJACENT SLOPES.
- THE EXISTING SLOPE SHOULD BE EXCAVATED IN A BENCHING STYLE WHERE EACH "BENCH" SHOULD BE EXCAVATED WITH A MINIMUM 1.2m LONG HORIZONTAL LEDGE AND MAXIMUM VERTICAL CUT OF 600mm.
- THE BACKFILL MATERIAL SHOULD BE PLACED IN MAXIMUM 300mm THICK LOSE LIFTS AND COMPACTED TO A MINIMUM 98% OF THE MATERIAL'S SPMDD USING SUITABLE COMPACTION EQUIPMENT. THE PLACEMENT OF THE BACKFILL MATERIAL SHOULD BE COMPLETED UNDER DRY CONDITIONS AND ABOVE FREEZING TEMPERATURES TO ACHIEVE OPTIMUM COMPACTION LEVELS.
- THE BACKFILL MATERIAL SHOULD BE TOPPED WITH A MINIMUM 300mm THICK LAYER OF TOPSOIL FOLLOWED BY AN EROSION CONTROL BLANKET (COCO MAT) AND HARDY GRASS SEED. THE EROSION CONTROL BLANKET SHOULD BE ANCHORED TO THE TOP OF THE SLOPE USING STEEL PINS PENETRATING THE TOP OF SLOPE BY A MINIMUM 600mm TO KEEP THE EROSION CONTROL BLANKET STABLE UNTIL VEGETATION IS ESTABLISHED.
- IT IS IMPORTANT THAT THE PROPOSED SLOPE FACE BE FINISHED TO MATCH THE ADJACENT SLOPE FACES MATERIAL AND INCLINATION. PLANTING TREES ALONG THE SLOPE FACE CAN BE BENEFICIAL TO INCREASE THE STABILITY OF THE SLOPE FACE AND MINIMIZE EROSION, IF APPLICABLE.
- ALL WORK WITHIN THE SLOPE FACE SHOULD BE REVIEWED AND APPROVED BY PATERSON AT THE TIME OF CONSTRUCTION TO ENSURE THE WORK IS BEING COMPLETED IN ACCORDANCE TO THE RECOMMENDATIONS PROVIDED HEREIN.

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344
www.patersongroup.ca

TAGGART INVESTMENTS

GEOTECHINCAL INVESTIGATION
CARDINAL CREEK VILLAGE SOUTH

OTTAWA, ONTARIO

Title:

SLOPE INFILLING DETAIL

Scale: N.T.S.
Date: 04/2021
Drawn by: YA
Report No.: PG5201
Checked by: FA
Drawing No.: FIG. 42
Approved by: FA
Revision No.:

LEGEND:

⊕	BOREHOLE LOCATION (PREVIOUS INVESTIGATION)
⊕	PROBEHOLE LOCATION (CURRENT INVESTIGATION)
●	BOREHOLE LOCATION BY OTHERS (EXP)
97.47	GROUND SURFACE ELEVATION(m)
(94.78)	PRACTICAL REFUSAL TO AUGERING ELEV.(m)
[83.46]	BEDROCK SURFACE ELEVATION(m)
94.00	BEDROCK CONTOUR (m)

TOPOGRAPHIC MAPPING FOR CITY OF OTTAWA (2005)

SCALE: 1:3000

0 25 50 75 100 125 150 200m

NOTE:

THE BEDROCK CONTOURS ARE BASED ON PROBE HOLES COMPLETED AT AN APPROXIMATE SPACING OF 100m CENTRE TO CENTRE. BEDROCK MAY VARY IN DEPTH IN SOME AREAS. THE MAJORITY OF THE PROBE HOLES WERE TERMINATED AT A DEPTH OF 6.5m (DEEPER THAN THE PROPOSED SERVICES). BEDROCK DEEPER THAN 6.5m MAY RANGE FROM 7 TO 12m IN DEPTH. AT SOME LOCATIONS WHERE BEDROCK WAS NOT ENCOUNTERED WITHIN THE UPPER 6.5 m BELOW EXISTING GRADE, THE PROBEHOLES WERE ADVANCED UNTIL PRACTICAL REFUSAL TO DRILLING.

PATERSON GROUP
9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
3	UPDATED TO LATEST CONCEPTUAL PLAN	17/10/2024	FC
2	AS PER REVISED CONCEPTUAL PLAN	07/09/2023	DP
1	UPDATED TO INCLUDE BOREHOLES BY OTHERS (EXP)	05/21/2021	FA

TAGGART INVESTMENTS

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
CARDINAL CREEK VILLAGE SOUTH
OTTAWA, ONTARIO

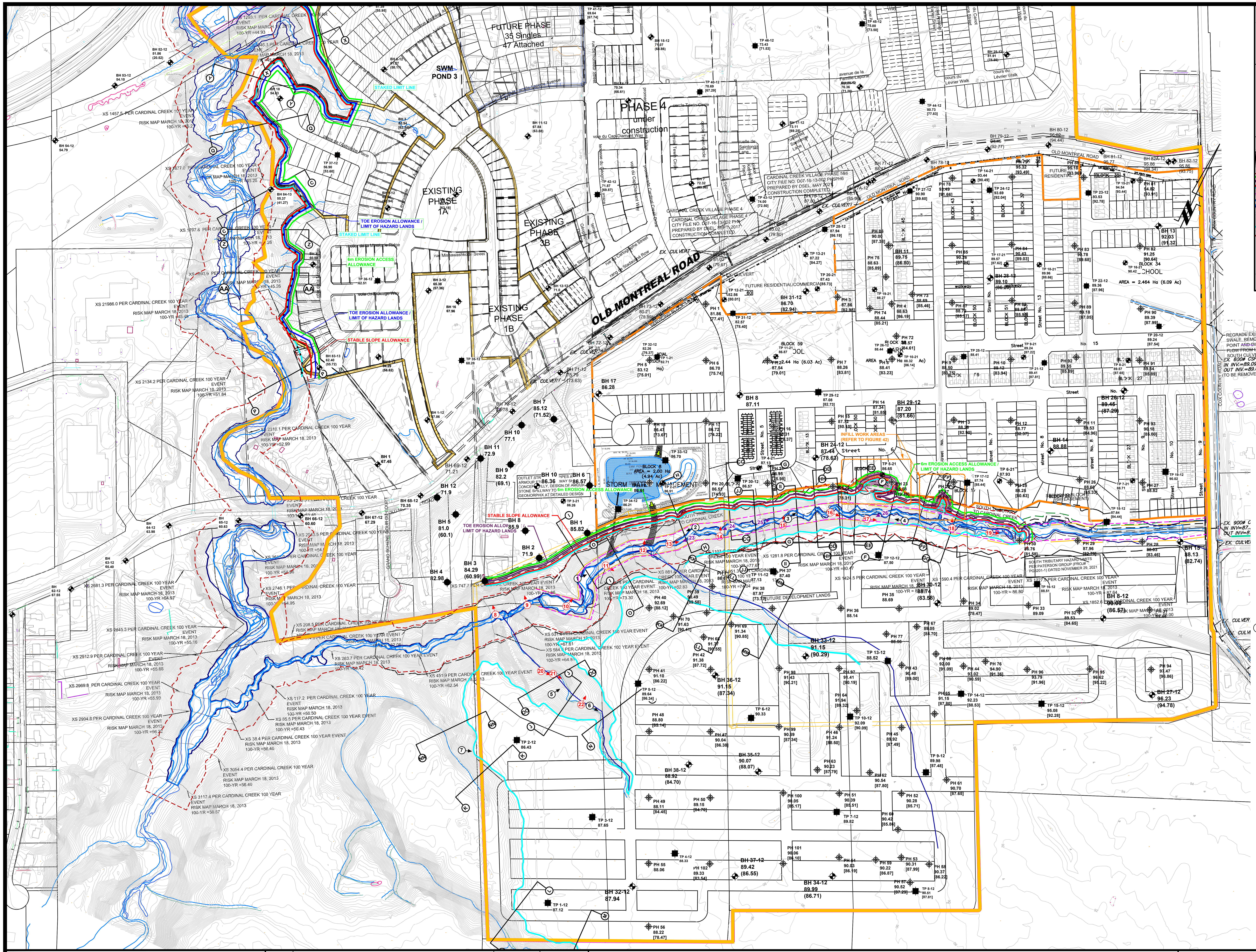
Title:

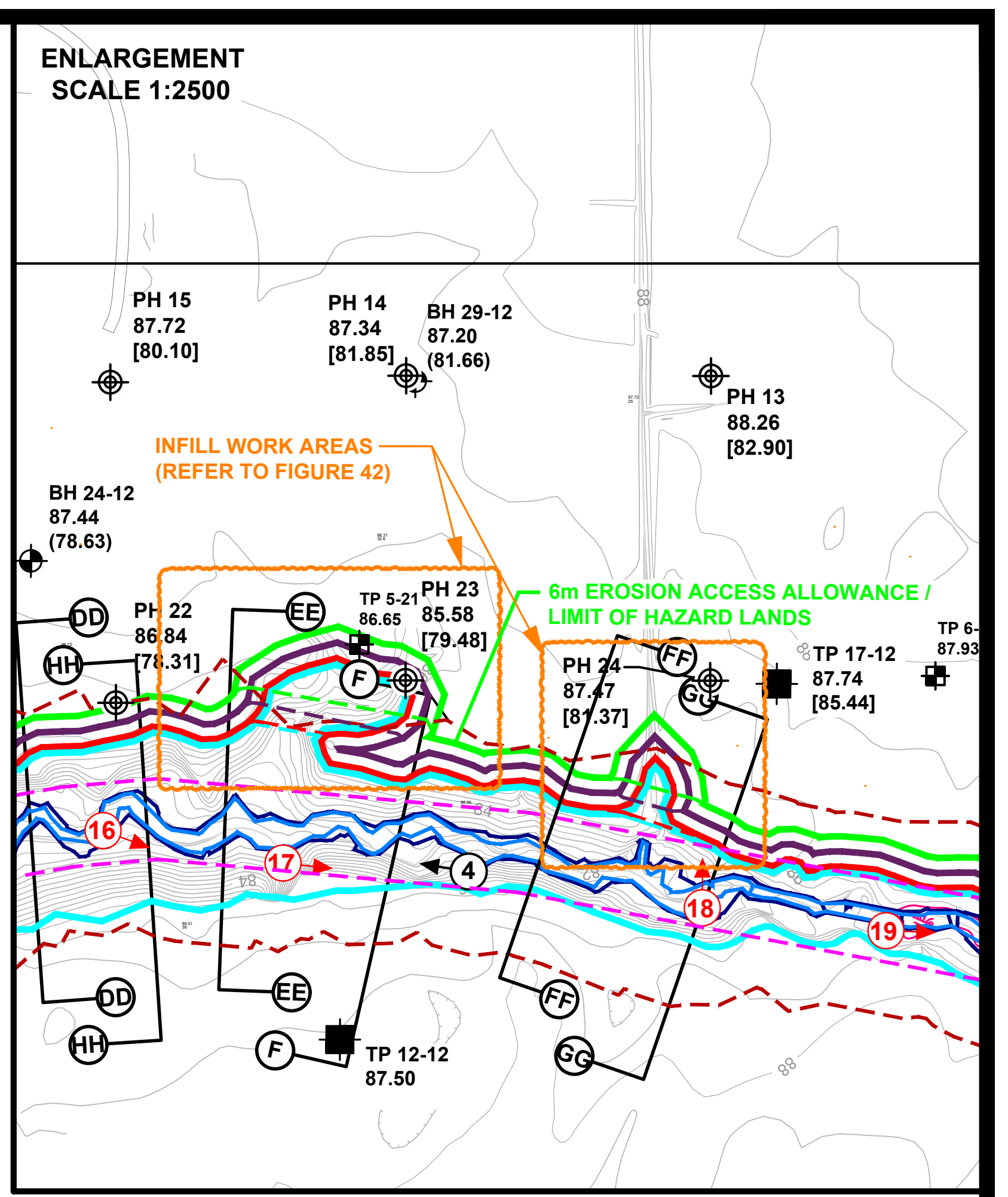
BEDROCK CONTOUR PLAN

Stamp:

Scale: 1:3000
Drawn by: RCG
Checked by: FA
Approved by: FA
Date: 03/2020
Report No.: PG5201-1
Drawing No.: PG5201-1
Revision No.: 3

p:\autocad drawings\geotechnical\pg52xx\pg5201\from rob c drive\pg5201\pg5201-2- pgr and br contour plans rev.3.dwg





LEGEND:

✚	TEST PIT LOCATION (CURRENT INVESTIGATION)
◐	BOREHOLE LOCATION (PREVIOUS INVESTIGATION)
⊕	PROBEHOLE LOCATION (CURRENT INVESTIGATION)
■	TEST PIT LOCATION (PREVIOUS INVESTIGATION)
97.47	GROUND SURFACE ELEVATION(m)
(94.78)	PRACTICAL REFUSAL TO AUGERING ELEV.(m)
[83.46]	BEDROCK SURFACE ELEVATION(m)

TOPOGRAPHIC MAPPING FOR CITY OF OTTAWA (2005)

F F	SLOPE CROSS-SECTION FOR SLOPE STABILITY ANALYSIS
5	PHOTOGRAPH TAKEN DURING SITE VISIT - APRIL 18, 2012
20	PHOTOGRAPH TAKEN DURING SITE VISIT - SEPT. 10, 2020
24	PHOTOGRAPH TAKEN DURING SITE VISIT - JULY 25, 2023
🟧	URBAN GROWTH BOUNDARY
🟦	TOP OF SLOPE
🟩	6m EROSION ACCESS ALLOWANCE
🟪	TOE EROSION ALLOWANCE / LIMIT OF HAZARD LANDS
🟥	STABLE SLOPE ALLOWANCE
🟦	APPROX. 100 YEAR WATER LEVEL (JFSA, MARCH 2013)
🟦	APPROX. NHWM (2 YR WATER LEVEL) (JFSA, MARCH 2013)
🟥	30m SETBACK FROM NHWM (DSEL, MARCH 2013)
🟪	MEANDER BELT WIDTH (PARISH, MARCH 2013 - CARDINAL CREEK BASED ON VALUES FROM GEOMORPHIC SOLUTIONS, 2007)
🟦	POTENTIAL TOP OF SLOPE IF INFILL IS COMPLETED
🟩	POTENTIAL 6m EROSION ACCESS ALLOWANCE IF INFILL IS COMPLETED
🟪	POTENTIAL TOE EROSION ALLOWANCE / LIMIT OF HAZARD LANDS IF INFILL IS COMPLETED
🟥	POTENTIAL STABLE SLOPE ALLOWANCE IF INFILL IS COMPLETED

SCALE: 1:3000

0 25 50 75 100 125 150 200m

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DD/MM/YYYY	INITIAL
5	UPDATED TO LATEST CONCEPTUAL PLAN	17/10/2024	FC
4	AS PER REVISED CONCEPTUAL PLAN	07/09/2023	FA
3	UPDATED POTENTIAL INFILL WORK AREAS	31/03/2021	FA
2	TEST PITS TP 1-21 TO TP 20-21 ADDED	05/03/2021	OM
1	NEW PHOTO LOCATION ADDED TO PLAN	14/09/2020	KP

TAGGART INVESTMENTS

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
CARDINAL CREEK VILLAGE SOUTH
OTTAWA, ONTARIO

Title:

TEST HOLE LOCATION PLAN

Stamp:

Scale: 1:3000
Drawn by: RCG
Checked by: FA
Approved by: FA
Date: 08/2020
Report No.: PG5201-1
Drawing No.: PG5201-2
Revision No.: 5

p:\autocad drawings\geotechnical\pg52xx\pg5201\pg5201-2- thlp(rev.11).dwg

LEGEND:

⊕	BOREHOLE LOCAITON (PREVIOUS INVESTIGATION)
⌖	PROBEHOLE LOCATION (CURRENT INVESTIGATION)
●	BOREHOLE BY OTHERS LOCATION (EXP)
97.47	GROUND SURFACE ELEVATION(m)
(94.78)	PRACTICAL REFUSAL TO AUGERING ELEV.(m)
[83.46]	BEDROCK SURFACE ELEVATION(m)
▨	2.0m PERMISSIBLE GRADE RAISE AREA

TOPOGRAPHIC MAPPING FOR CITY OF OTTAWA (2005)

SCALE: 1:3000

0 25 50 75 100 125 150 200m

PATERSON GROUP

9 AURIGA DRIVE
OTTAWA, ON
K2E 7T9
TEL: (613) 226-7381

NO.	REVISIONS	DATE	INITIAL
2	UPDATED TO LATEST CONCEPTUAL PLAN	17/10/2024	FC
1	AS PER REVISED CONCEPTUAL PLAN	07/09/2023	DP

TAGGART INVESTMENTS

GEOTECHNICAL INVESTIGATION - PROPOSED RESIDENTIAL DEVELOPMENT
CARDINAL CREEK VILLAGE SOUTH
OTTAWA, ONTARIO

Title:

PERMISSIBLE GRADE RAISE PLAN

Stamp:

Scale: 1:3000
Drawn by: RCG
Checked by: FA
Approved by: FA
Date: 03/2020
Report No.: PG5201-1
Drawing No.: PG5201-3
Revision No.: 2

g52xx\pg5201\from rob c drive\pg5201\pg5201-2- pgr and br contour plans rev.3.dwg