PATERSON GROUP

Geotechnical Desktop Review

Proposed Three-Storey Building

180 Main Street
Ottawa, Ontario

Prepared for Mr. Andrew Lay

Report PG6472-1 dated November 7, 2022

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Mr. Andrew Lay to prepare a geotechnical desktop review report based on existing information for the proposed three-storey building to be located at 180 Main Street, Ottawa, Ontario (refer to Figure 1 - Key Plan presented in Appendix 1).

The objectives of the geotechnical desktop review were to:

- determine the subsoil and groundwater conditions at the site by means of nearby test holes taken from previous investigations conducted by this firm and others for adjacent developments.

- provide preliminary geotechnical recommendations for the design of the proposed development based on the results of the boreholes and other soil information available. These recommendations include preliminary construction considerations which may affect its design.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes geotechnical recommendations pertaining to the design and construction of the proposed three-storey building as it is understood at the time of writing this report.

It should be noted that the recommendations contained in this report are considered preliminary based on available existing information and our knowledge of the area. The recommendations and information provided herein are subject to change based on the results of the geotechnical field investigation.

2.0 Proposed Development

Based on the site plan drawings prepared by Rosaline J. Hill Architect Inc., the proposed mixed-used three-storey building at the subject site will consist of a mixed-use building with a restaurant on the ground floor, residential units in above floors and a one basement level. It is also anticipated that the subject site will be municipally serviced.

3.0 Existing Geotechnical Information

3.1 Surface Conditions

Currently, the subject site is occupied by an existing two-storey building which will be demolished and replaced by the proposed three-storey building. An existing parking area is located along the rear side of the existing building along with landscaped and hardscaped areas. Based on current geographical mapping, the ground surface across the subject site is expected to be relatively flat and at grade with Main Street.

3.2 Subsurface Profile

Overburden

Based on the existing soils information from nearby sites, and our knowledge of the subsurface profile within the neighboring properties, the subsurface profile of the site generally consists cultivated topsoil/organic layer followed by a loose to very loose, silty sand with trace to some clay overlying a silty clay deposit. Based on the undrained shear strength values obtained, the consistency of the silty clay deposit varies between stiff to very stiff. A fill layer is expected to be encountered within the upper 1 m within the footprint of the existing building and surroundings.

Bedrock

Based on available geological mapping, the subject site is located in an area where the bedrock consists of interbedded shale of the Billings Formation with an overburden drift thickness ranging between 25 to 50 m.

3.3 Groundwater

Based on the existing groundwater information and our knowledge of the groundwater within the neighboring properties, the long-term groundwater table can be expected within the silty clay deposit throughout the subject site at an approximate depth ranging from **2 to 4 m** below existing grade. It should be noted that groundwater levels are subject to seasonal fluctuations. Therefore, the groundwater levels could be different at the time of construction.

4.0 Discussion

4.1 Geotechnical Assessment

The subject site is considered suitable for the proposed development. It is expected that the proposed building addition be founded using conventional shallow footings placed over an undisturbed, stiff to very stiff silty clay bearing surface.

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

The design parameters provided herein are conservative and are based on investigations completed within nearby sites. Higher soil parameters can be provided if a site-specific investigation is completed within the subject site.

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

4.2 Site Grading and Preparation

Stripping Depth

Topsoil and deleterious fill, such as those containing organic materials, tree roots, branches, stumps, sludge, metals, or farming debris, should be stripped from under any buildings, paved areas, pipe bedding and other settlement sensitive structures.

Fill Placement

Fill used for grading beneath the building areas should consist, unless otherwise specified, of clean imported granular fill, such as Ontario Provincial Standard Specifications (OPSS) Granular A, Granular B Type II. This material should be tested and approved prior to delivery to the site. The fill should be placed in lifts no greater than 300 mm thick and compacted using suitable compaction equipment for the lift thickness. Fill placed beneath the building areas should be compacted to at least 98% of its standard Proctor maximum dry density (SPMDD).

Non-specified existing fill along with site-excavated soil can be used as general landscaping fill where the settlement of the ground surface is of minor concern. These materials should be spread in thin lifts and at least compacted by the tracks of the spreading equipment to minimize voids. If excavated brown silty clay, free of organics and deleterious materials, is to be used to build up the subgrade level for areas to be paved, the silty clay, under dry conditions and in above freezing temperatures, should be compacted in thin lifts using a sheepsfoot roller making several passes and approved by the geotechnical consultant.

Provided the silty clay is adequately compacted and approved by the geotechnical consultant, fines loss mitigation, such as a geotextile liner, is not required. Also, frost mitigation measures are not required provided the subgrade materials are consistent. Non-specified existing fill and site-excavated soils are not suitable for use as backfill against foundation walls unless a composite drainage blanket connected to a perimeter drainage system is provided.

Protection of Subgrade and Bearing Surfaces

It is expected that site grading and preparation will consist of stripping of the soils containing significant amounts of organic materials. The contractor should take appropriate precautions to avoid disturbing the subgrade and bearing surfaces from construction and worker traffic. Disturbance of the subgrade may result in having to sub-excavate the disturbed material and the placement of additional fill. Typically, exposed subgrade surfaces should be protected using a sufficient thickness of select subgrade material, engineered fill or lean concrete mud slab that can sustain vehicle traffic based on the weather conditions at the time of construction.

4.3 Foundation Design

Bearing Resistance Values

Strip footings, up to 3 m wide, and pad footings, up to 5 m wide, placed on an undisturbed, stiff to firm silty clay, or engineered fill placed over a silty clay bearing surface can be designed using a bearing resistance value at serviceability limit states (SLS) of **90 kPa** and a factored bearing resistance value at ultimate limit states (ULS) of **180 kPa**. A higher bearing resistance value can be provided, if a site-specific geotechnical investigation is provided for the subject site.

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.

Bearing resistance values for footing design should be determined on a per lot basis at the time of construction.

Settlement

Consideration must be given to potential settlements which could occur due to the presence of the silty clay deposit and the combined loads from the proposed footings, any groundwater lowering effects, and grade raise fill. The foundation loads to be considered for the settlement case are the continuously applied loads which consist of the unfactored dead loads and the portion of the unfactored live load that is considered to be continuously applied. For dwellings, a minimum value of 50% of the live load is recommended by Paterson.

The total and differential settlements will be dependent on characteristics of the proposed buildings. For design purposes, the total and differential settlements are estimated to be 25 and 20 mm, respectively. A post-development groundwater lowering of 1 m was assumed.

The potential post construction total and differential settlements are dependent on the position of the long-term groundwater level when building are situated over deposits of compressible silty clay. Efforts can be made to reduce the impacts of the proposed development on the long-term groundwater level by placing clay dykes in the service trenches, reducing the sizes of paved areas, leaving green spaces to allow for groundwater recharge or limiting planting of trees to areas away from the buildings. However, it is not economically possible to control the groundwater level.

To reduce potential long term liabilities, consideration should be given to accounting for a larger groundwater lowering and to provide means to reduce long term groundwater lowering (e.g. clay dykes, restriction on planting around the dwellings, etc). Buildings on silty clay deposits increases the likelihood of movements and therefore of cracking. The use of steel reinforcement in foundations placed at key structural locations will tend to reduce foundation cracking compared to unreinforced foundations

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 sand above the groundwater table when a plane extending down and out from the bottom edge of the footing at a minimum of 1.5H:1V passes only through in situ soil of the same or higher capacity as the bearing medium soil.

Permissible Grade Raise Recommendations

Based on the undrained shear strength values of the silty clay deposit encountered within the vicinity of the subject site, the preliminary permissible grade raise restriction of **0.5 m** is recommended below underside of footing level. It should be noted that this permissible grade raise recommendation is considered preliminary and may be subject to changed based on the results of site-specific test hole information. A higher permissible grade raise restriction may be provided if a site-specific geotechnical investigation is completed.

4.4 Slab-on-Grade and Basement Slab

With the removal of all topsoil and deleterious fill, containing organic matter, within the footprints of the proposed buildings, undisturbed native soil surface will be considered acceptable subgrade on which to commence backfilling for floor slab construction. Any soft areas should be removed and backfilled with appropriate backfill material. OPSS Granular B Type II, with a maximum particle size of 50 mm, are recommended for backfilling below the floor slab. It is recommended that the upper 200 mm of sub-slab fill consist of 19 mm clear crushed stone.

4.5 Pavement Design

For design purposes, the pavement structure presented in the following tables could be used for the design of car only parking areas, access lanes and heavy truck loading areas.

Table 1 - Recommended Pavement Structure - Driveways

Thickness (mm)	Material Description
50	**Wear Course** - HL 3 or Superpave 12.5 Asphaltic Concrete
150	**BASE** - OPSS Granular A Crushed Stone
300	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.	

Table 2 - Recommended Pavement Structure - Access Lanes and Heavy Truck Loading Areas	
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
375	**SUBBASE** - OPSS Granular B Type II
SUBGRADE - Either fill, in situ soil or OPSS Granular B Type I or II material placed over in situ soil or fill.	

Minimum Performance Graded (PG) 58-34 asphalt cement should be used for this project. 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.

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.

4.6 Retaining Wall Design

It is understood that the north and south foundation walls of the existing dwelling may be used as temporary retaining walls during excavation (as a shoring system). The soil parameters presented in Tables 3 and 4 on the following pages should be used for the design of the retaining walls.

Paterson has reviewed the existing site conditions and and has evaluated the factor of safety against global stability to be over 1.5 for static conditions and greater than 1.1 under seismic conditions. It should be noted that based on discussions with the client, the existing foundation wall is expected to a be a concrete wall within the existing building.

Global Stability Analysis

The global stability analysis was modeled in SLIDE, a computer program which permits a two-dimensional slope stability analysis calculating several methods including the Bishop's method, which is a widely accepted slope analysis method. The program calculates a factor of safety, which represents the ratio of the forces resisting failure to forces 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 subsurface soil and groundwater conditions, a factor of safety greater than 1.0 is generally required for the failure risk to be considered acceptable.

A minimum factor of safety of 1.5 is generally recommended for conditions where the slope failure would comprise permanent structures. An analysis considering seismic loading was also completed. A horizontal acceleration of 0.16 g was considered for the sections for the seismic loading condition. A factor of safety of 1.1 is considered to be satisfactory for stability analyses including seismic loading. The retaining wall cross-section was studied as the worst-case scenario.

The following parameters were used for the slope stability analysis under static and seismic conditions:

Table 3 - Effective Soil Parameters for Static Analysis

Soil Layer	Unit Weight (kN/m^3)	Friction Angle (degrees)	Cohesion (kPa)
Unspecified Fill (Backfill)	16	33	1
Brown Silty Clay	17	33	5
Grey Silty Clay	18	35	7
Silty Sand to Sandy Silt	18	33	0
Bedrock	24	-	-

The total strength parameters for seismic analysis were chosen based on the in situ, undrained shear strengths recovered within the open test holes completed at the time of our geotechnical investigation and based on our general knowledge of the geology in the area. The strength parameters used for seismic analysis under undrained conditions at the slope cross-section are presented in Table 4.

Table 4 - Effective Soil Parameters for Seismic Analysis			
Soil Layer	**Unit Weight (kN/m^3)**	**Friction Angle (degrees)**	**Cohesion (kPa)**
Unspecified Fill (Backfill)	16	33	1
Brown Silty Clay	17	-	80
Grey Silty Clay	18	-	120
Silty Sand to Sandy Silt	18	33	0
Bedrock	24	-	-

Analysis Results

The factor of safety for each retaining wall section was greater than 1.5 for static conditions. Similarly, the results under seismic loading yielded a factor of safety for this section greater than 1.1. The results from the Retaining Wall ‘A’ and ‘B’ static and seismic analyses are presented in Figures 2 to 4 presented in Appendix 1. Reference should be made so Sub-Section 5.3 for a discussion regarding the temporary retaining wall shoring system implementation.

Based on these results, the global stability of the existing foundation walls used as a retaining wall system is considered to be stable under static and seismic loading.

5.0 Design and Construction Precautions

5.1 Foundation Drainage and Backfill

It is recommended that a perimeter foundation drainage system be provided for proposed structures. The system should consist of a 150 mm diameter, geotextile-wrapped, perforated, corrugated, plastic pipe, surrounded on all sides by 150 mm of 10 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 or sump pit.

Based on existing soils information from nearby sites, the long-term groundwater table is expected to be below the proposed bottom of excavation. However, if groundwater table is encountered during excavation, waterproofing of the proposed foundation walls will be required to be provided by Paterson.

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 (such as system Platon or Miradrain G100N) connected to a drainage system is provided.

5.2 Protection Against Frost Action

Perimeter footings of heated structures are required to be insulated against the deleterious effect of frost action. A minimum 1.5 m thick soil cover (or equivalent) should be provided in this regard. Exterior (unheated) footings should be provided with a minimum 2.1 m thick soil cover (or equivalent).

5.3 Excavation Side Slopes

The side slopes of excavations in the soil and fill overburden materials should either be cut back at acceptable slopes or should be retained by shoring systems from the start of the excavation until the structure is backfilled. It is assumed that sufficient room will be available for the greater part of the 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 Type 3 soil according to the Occupational Health and Safety Act and Regulations for Construction Projects.

It is expected that temporary shoring will be required due to the proposed founding depth for the basement and the presence of a building in the adjacent property to the south.

Temporary Shoring

Temporary shoring may be required for the overburden soil to complete the required excavations where insufficient room is available for open cut methods. The shoring requirements designed by a structural engineer specializing in those works will depend on the depth of the excavation, the proximity of the adjacent structures and the elevation of the adjacent building foundations and underground services. The design and implementation of these temporary systems will be the responsibility of the excavation contractor and their design team. Inspections and approval of the temporary system will also be the responsibility of the designer.

Geotechnical information provided below is to assist the designer in completing a suitable and safe shoring system. The designer should take into account the impact of a significant precipitation event and designate design measures to ensure that a precipitation will not negatively impact the shoring system or soils supported by the system. Any changes to the approved shoring design system should be reported immediately to the owner's structural design prior to implementation.

The temporary system could consist of soldier pile and lagging system or interlocking steel sheet piling. Any additional loading due to street traffic, construction equipment, adjacent structures and facilities, etc., should be included to the earth pressures described below. These systems could be cantilevered, anchored or braced. Generally, it is expected that the shoring systems will be provided with tie-back rock anchors to ensure their stability. The shoring system is recommended to be adequately supported to resist toe failure and inspected to ensure that the sheet piles extend well below the excavation base. It should be noted if consideration is being given to utilizing a raker style support for the shoring system that lateral movements can occur and the structural engineer should ensure that the design selected minimizes these movements to tolerable levels.

The earth pressures acting on the shoring system may be calculated with the following parameters.

Table 5 - Soil Parameters

Parameters	Values
Active Earth Pressure Coefficient (K_a)	0.33
Passive Earth Pressure Coefficient (K_p)	3
At-Rest Earth Pressure Coefficient (K_o)	0.5
Unit Weight , kN/m3	20
Submerged Unit Weight , kN/m3	13

The active earth pressure should be calculated where wall movements are permissible while the at-rest pressure should be calculated if no movement is permissible. The dry unit weight should be calculated above the groundwater level while the effective unit weight should be calculated below the groundwater level.

The hydrostatic groundwater pressure should be included to the earth pressure distribution wherever the effective unit weight are calculated for earth pressures. If the groundwater level is lowered, the dry unit weight for the soil/bedrock should be calculated full weight, with no hydrostatic groundwater pressure component.

For design purposes, the minimum factor of safety of 1.5 should be calculated.

Temporary Shoring Retaining Walls

Upon discussions with the design team, based on the dimensions of the proposed building, the use of the existing foundation walls was discussed to be used as an alternative temporary shoring measure. Based on our analysis of this setup, the factor of safety was found to be greater than 1.5 and 1.1 for static and seismic loadings which is considered acceptable from a geotechnical perspective. However, the following recommendations should be implemented to ensure that this shoring system is safe and applicable:

- In order to protect the neighbouring buildings, the lateral support zone of 1.5H:1V of the existing neighbouring foundations must be protected. Therefore, it is highly recommended that a test pit be completed along the foundation wall of the neighbouring buildings to daylight the existing footings and confirm the depth of footings prior to the commencement of site excavations.
- During the demolition of the existing building, the concrete foundation walls should be protected from excessive damage. The backfill material against the foundation walls should be left in place during the excavation work.
- Considerations may be given to installing tie-backs on the existing foundation walls, if the condition of the walls is deemed unacceptable during the excavation work.

- Care should be taken not to undermine the existing footings of the existing building until the proposed footings are placed with the new foundation walls poured. This can be accomplished by protecting the 1.5H:1V lateral support zone of the existing footing as shown on Figure 1.
- Once the drainage boards and the perimeter drainage system of the new building are installed on the exterior side of the new foundation walls, the existing walls can be removed in stages to provide the contractor with additional time to properly reinstate the voids left by the removal of the old foundation walls without impacting the neighbouring buildings. A maximum of 5 m horizontal stretches along the new foundation wall should be removed at a given time until fully reinstated and backfilled.
- It is highly recommended that periodic inspections be completed by Paterson at the time of construction to ensure that the temporary retaining wall shoring system is well maintained and sufficiently performing.
- If signs of cracking of the retained soils are observed, Paterson should be notified immediately to provide on site recommendations to reinstate the retained soil and ensure the existing neighbouring properties are intact.
- Reference should be made to Figure 1 – Temporary Retaining Wall Shoring System below:

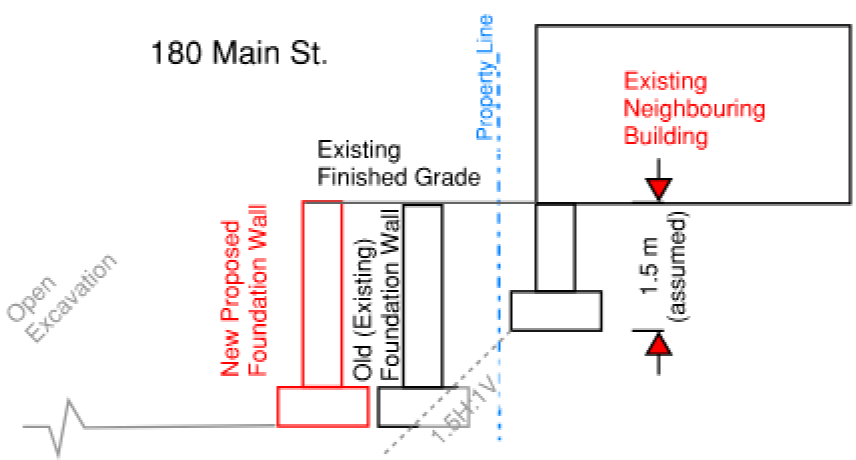

Figure 1 - Temporary Retaining Wall Shoring System

- For the rear side of the excavation, where the existing foundation wall ends, a temporary retaining wall system such as recycled concrete blocks can be designed and provided by Paterson, if requested. Open excavation may also be acceptable, provided the existing footings are exposed and analyzed by Paterson.

5.4 Groundwater Control

Groundwater Control for Building Construction

It is anticipated that groundwater infiltration into the excavations should be controllable using open sumps. 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.

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

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.

Long-Term Groundwater Control

Any groundwater encountered along the perimeter or sub-slab drainage system will be directed to the proposed buildings' sump pits. Provided that the selected groundwater infiltration control system is properly implemented and approved by Paterson at the time of construction, it is expected that groundwater flow will be low (i.e. less than 25,000 L/day) with peak periods noted after rain events. It is anticipated that the groundwater flow will be controllable using conventional open sumps.

Adverse Impacts on Neighbouring Structures

Based on the estimated long-term groundwater table, the proximity of the existing buildings and the proposed depth of excavation for the proposed building, minimal groundwater lowering may take place temporarily within the immediate footprint of the proposed building during construction. It should be noted that no issues are expected with respect to groundwater lowering that would cause long term damage to adjacent structures surrounding the proposed buildings.

5.5 Winter Construction

The subsoil conditions at this site mostly consist of frost susceptible materials. In presence of water and freezing conditions ice could form within the soil mass. Heaving and settlement upon thawing could occur. Precautions should be taken if winter construction is considered for this project.

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.

The trench excavations should be carried out in a manner that will avoid the introduction of frozen materials into the trenches. As well, pavement construction is difficult during winter. The subgrade consists of frost susceptible soils which will experience total and differential frost heaving as the work takes place. In addition, the introduction of frost, snow or ice into the pavement materials, which is difficult to avoid, could adversely affect the performance of the pavement structure. Additional information could be provided, if required.

5.6 Landscaping Considerations

Tree Planting Restrictions

The proposed building is located in a moderate sensitivity area with respect to tree plantings over a silty clay deposit. Due to the proposed basement level of the proposed multi storey building, it is recommended that trees placed within 4.5 m of the foundation wall consist of low water demanding trees with shallow roots systems that extend less than 1.5 m below ground surface. Trees placed greater than 4.5 m from the foundation wall may consist of typical street trees, which are typically moderate water demand species with roots extending to a maximum 2 m depth.

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.

Installation of Decks or Additions

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

6.0 Recommendations

It is a requirement for the foundation design data provided herein to be applicable that the following material testing and observation program be performed by the geotechnical consultant.

- ❑ A Review of the grading plan from a geotechnical perspective, once available.
- ❑ Exposing the existing footings of the neighbouring structures by means of test pits to ensure that the proposed excavation and shoring recommendations are applicable.
- ❑ A review of the excavation and shoring plans, from a geotechnical perspective, once available.
- ❑ Observation of all bearing surfaces prior to the placement of concrete.
- ❑ Sampling and testing of the concrete and fill materials.
- ❑ 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 soils, with the exception of engineered crushed stone fill, generated by construction activities that will be transported on-site or off-site should be handled as per *Ontario Regulation 406/19: On-Site and Excess Soil Management.*

7.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review the grading plan once available and our recommendations when the drawings and specifications are complete.

A geotechnical investigation of this nature is a limited sampling of a site. The recommendations are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around the test locations. The extent of the limited area depends on the soil, bedrock, and groundwater conditions, as well the history of the site reflecting natural, construction, and other activities. Should any conditions at the site be encountered which differ from those at the test locations, we request notification immediately in order to permit reassessment of our recommendations.

The recommendations provided in this report are intended for the use of design professionals associated with this project. They are not intended for contractors bidding on or undertaking the work. The latter should evaluate the information contained in this report and the site conditions, satisfy themselves as to the adequacy of the information provided for construction purposes, supplement the factual information if required, and develop their own interpretation of the factual information based on both their and their subcontractor's construction methods, equipment capabilities and schedules.

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 Mr. Andrew Lay or their agent(s) is not authorized without review by Paterson Group for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.

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Report Distribution:

- ❑ Mr. Andrew Lay (1 copy)
- ❑ Paterson Group (1 copy)

APPENDIX 1

FIGURE 1 – KEY PLAN

FIGURE 2 – RETAINING WALL ‘A’ – STATIC ANALYSIS

FIGURE 3 – RETAINING WALL ‘A’ – SEISMIC ANALYSIS – 0.16g

FIGURE 4 – RETAINING WALL ‘B’ – STATIC ANALYSIS

FIGURE 5 – RETAINING WALL ‘B’ – SEISMIC ANALYSIS – 0.16g

DRAWING PG6472-1 – Site Plan

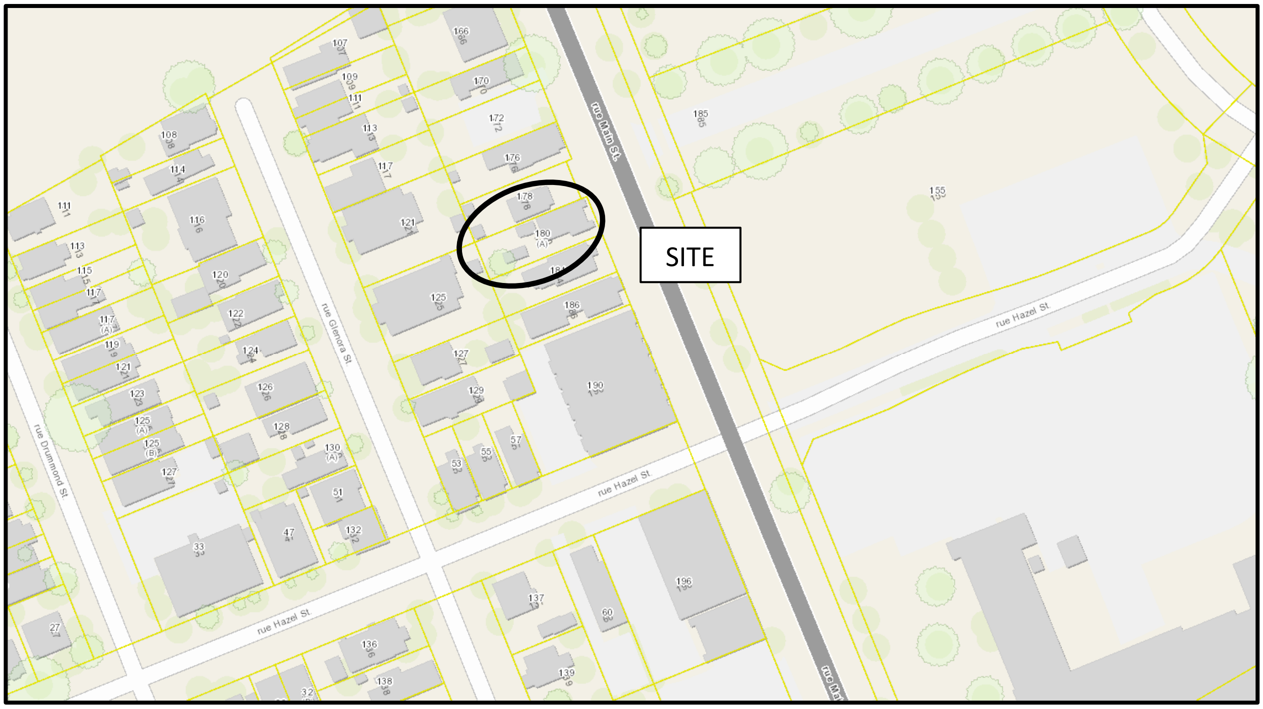


FIGURE 1

KEY PLAN

PATERSON GROUP

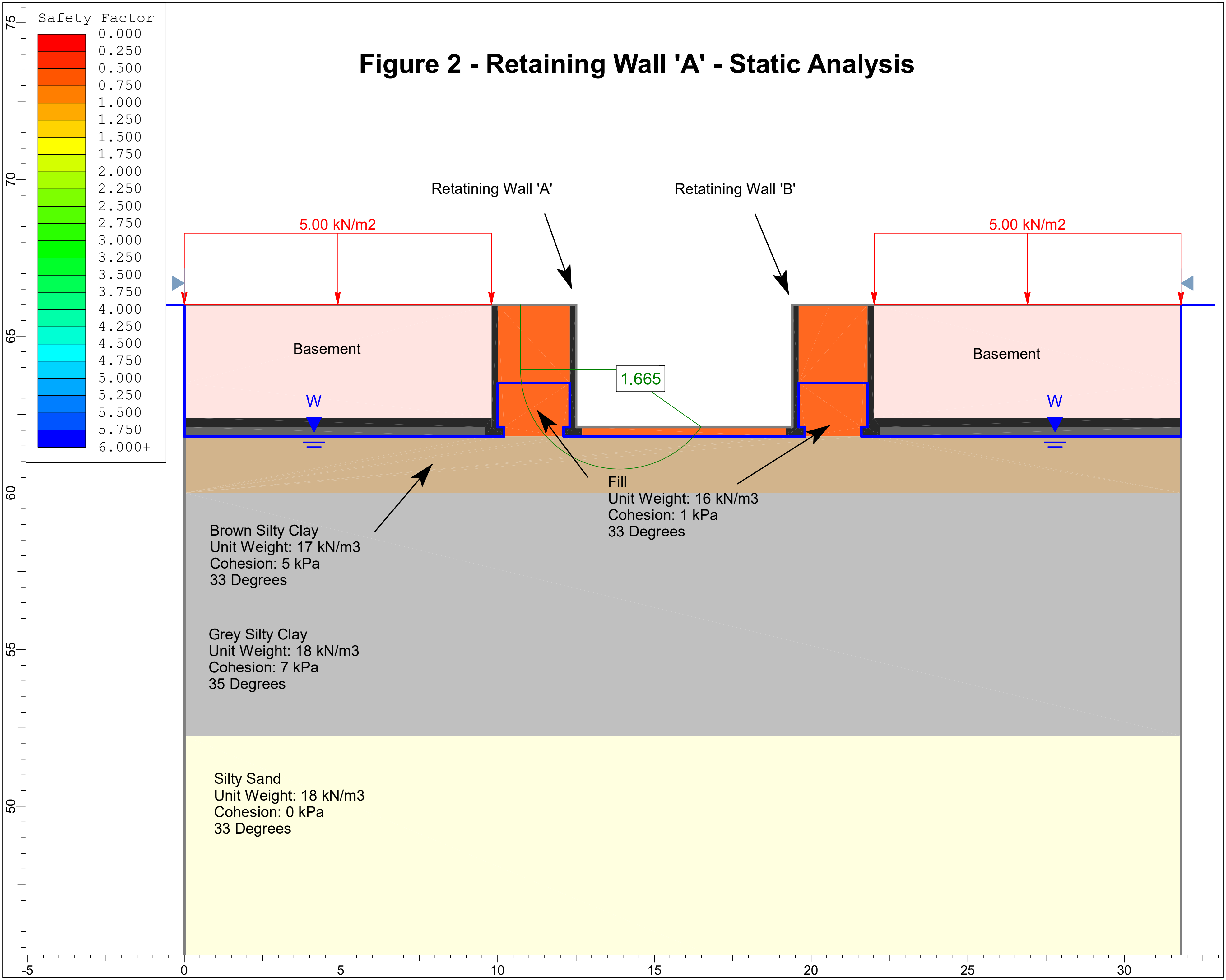


Figure 2 - Retaining Wall 'A' - Static Analysis
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
Retaining Wall 'A'
Retaining Wall 'B'
5.00 kN/m2
5.00 kN/m2
Basement
Basement
W
W
1.665
Fill
Unit Weight: 16 kN/m3
Cohesion: 1 kPa
33 Degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Cohesion: 5 kPa
33 Degrees
Grey Silty Clay
Unit Weight: 18 kN/m3
Cohesion: 7 kPa
35 Degrees
Silty Sand
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
33 Degrees
75
70
65
60
55
50
-5
0
5
10
15
20
25
30

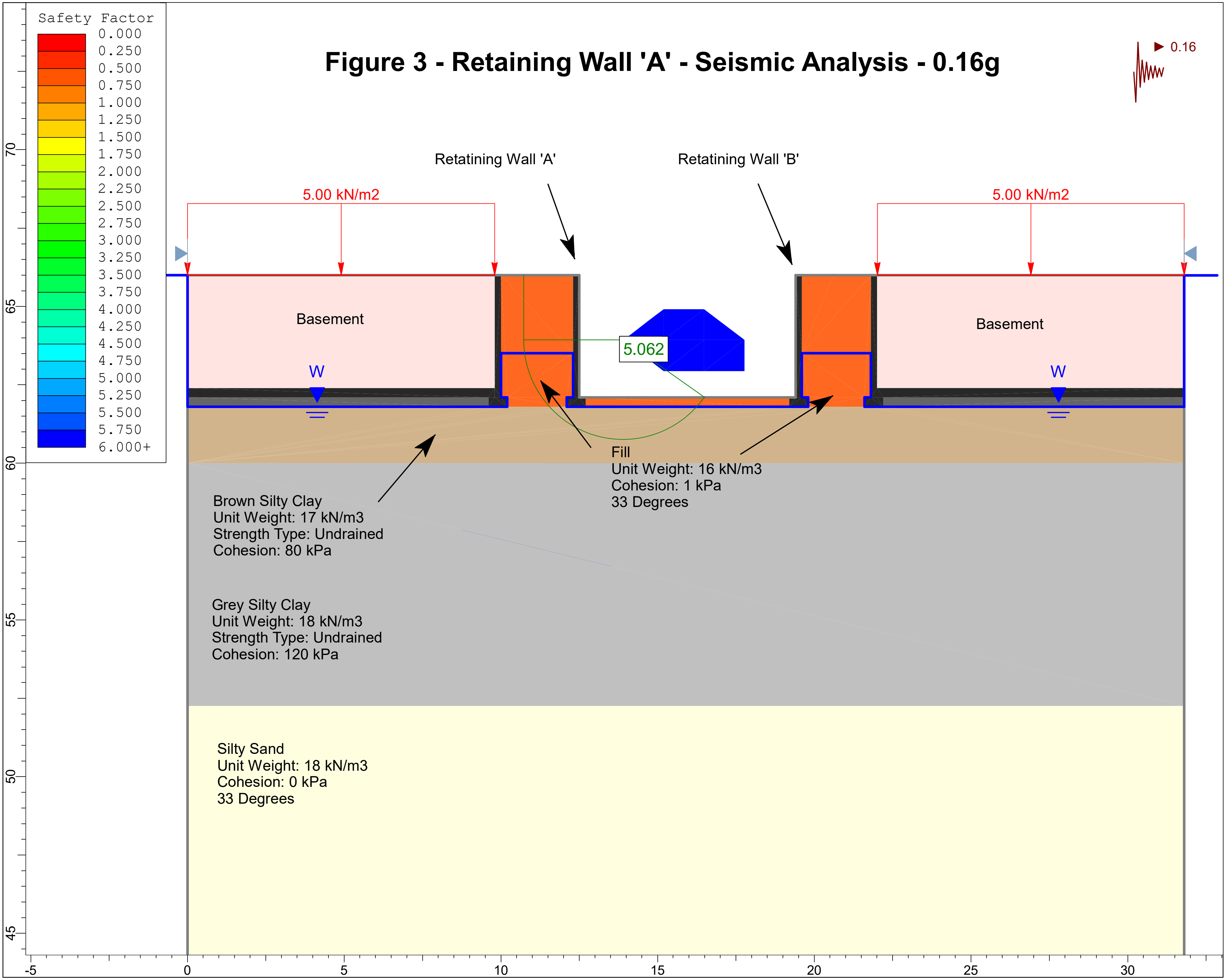


Figure 3 - Retaining Wall 'A' - Seismic Analysis - 0.16g
Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
0.16
Retaining Wall 'A'
Retaining Wall 'B'
5.00 kN/m2
5.00 kN/m2
Basement
Basement
W
W
5.062
Fill
Unit Weight: 16 kN/m3
Cohesion: 1 kPa
33 Degrees
Brown Silty Clay
Unit Weight: 17 kN/m3
Strength Type: Undrained
Cohesion: 80 kPa
Grey Silty Clay
Unit Weight: 18 kN/m3
Strength Type: Undrained
Cohesion: 120 kPa
Silty Sand
Unit Weight: 18 kN/m3
Cohesion: 0 kPa
33 Degrees
70
65
60
55
50
45
-5
0
5
10
15
20
25
30

Figure 4 - Retaining Wall 'B' - Static Analysis

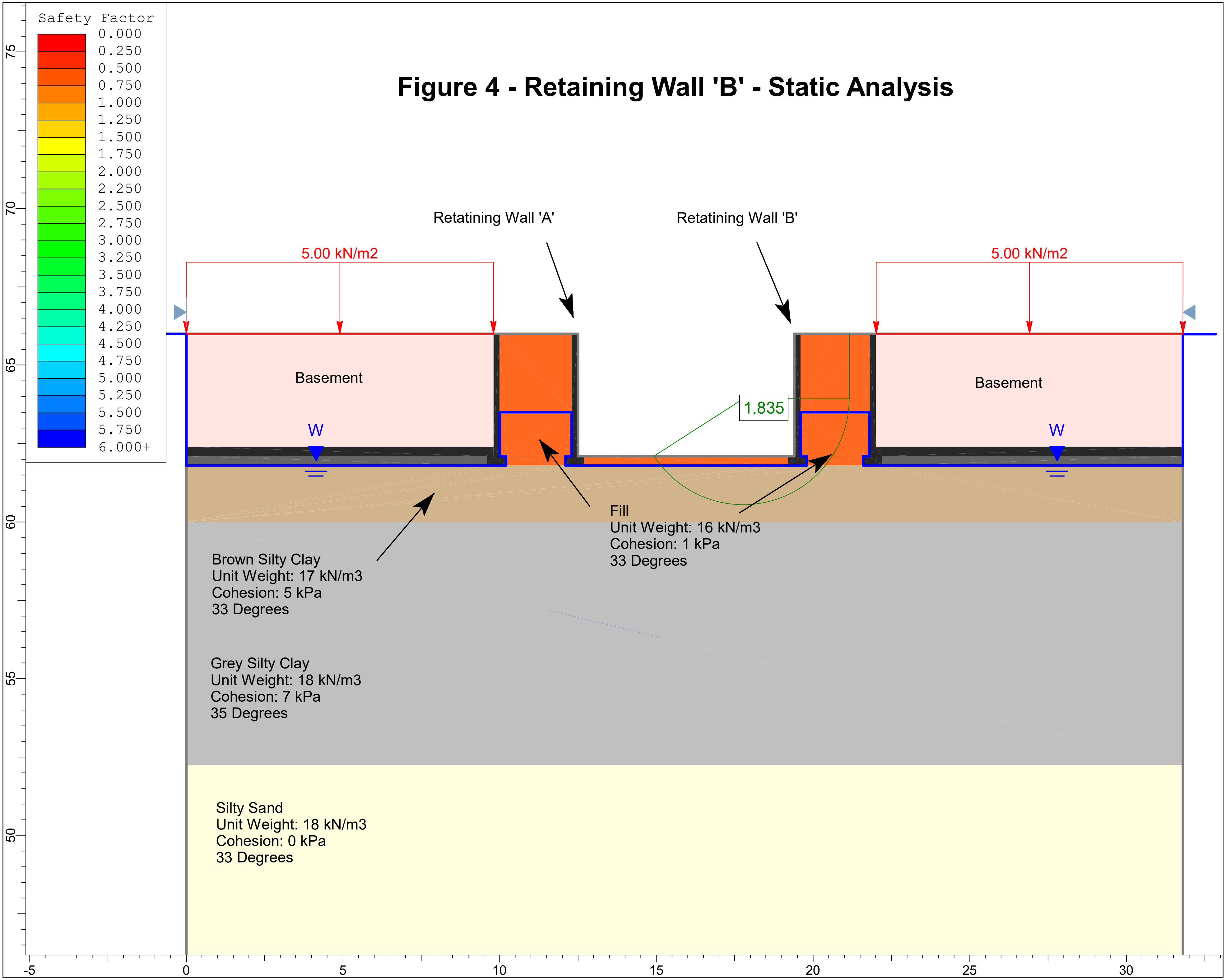
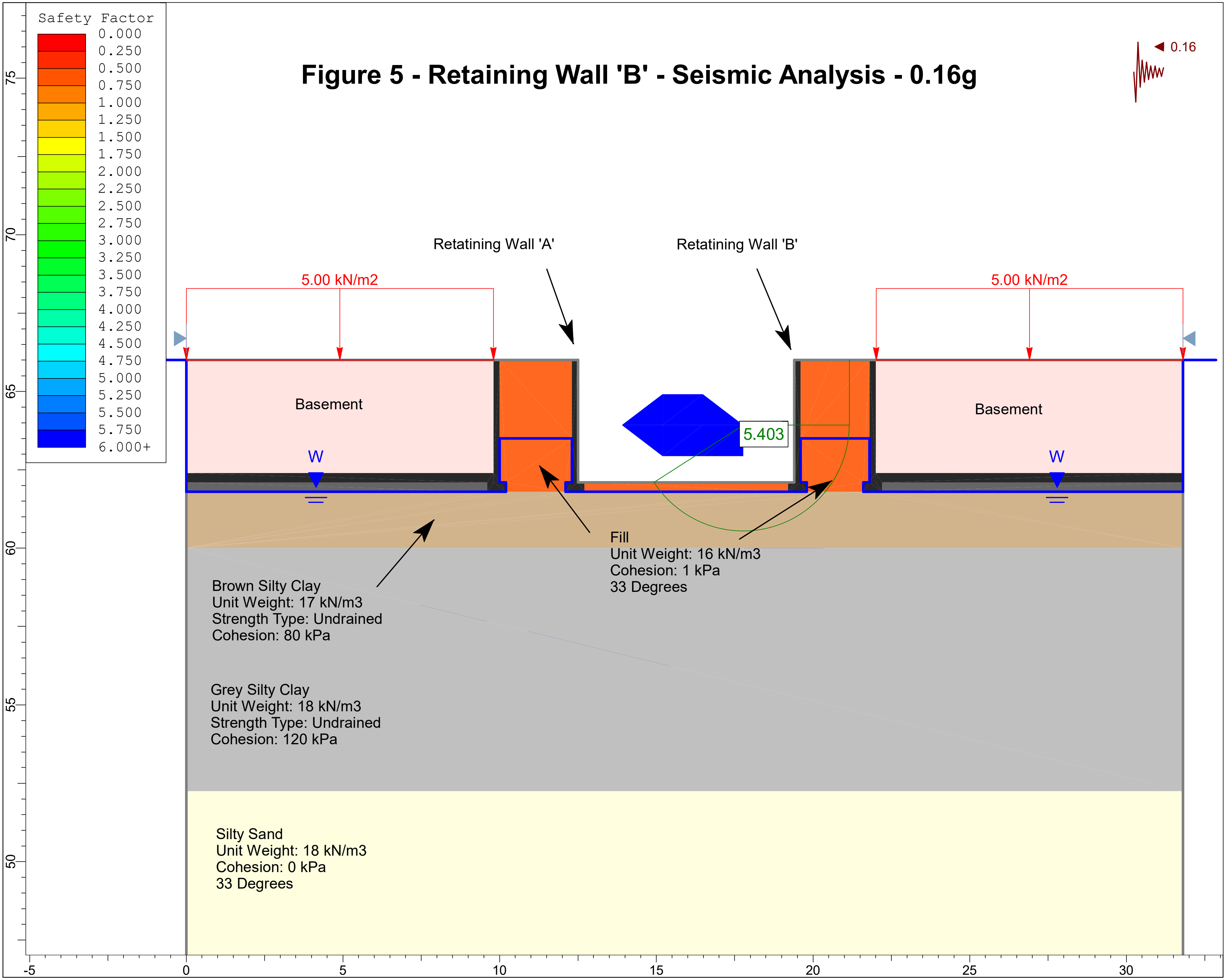
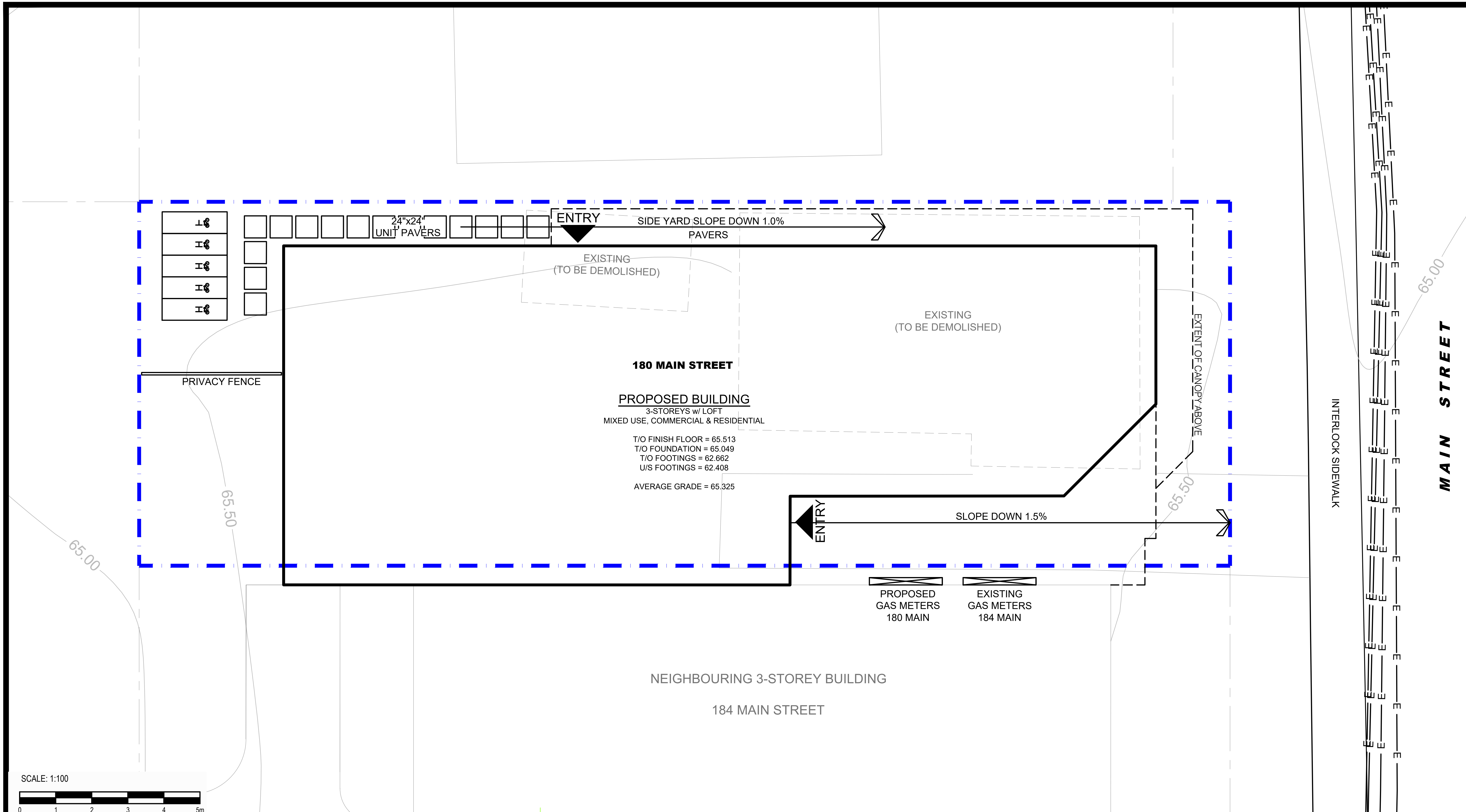


Figure 5 - Retaining Wall 'B' - Seismic Analysis - 0.16g





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NO.	REVISIONS	DATE	INITIAL

MR. ANDREW LAY

GEOTECHNICAL DESKTOP REVIEW
180 MAIN STREET

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:100
Date: 11/2022
Drawn by: JM
Report No.: PG6472-1
Checked by: OC
Dwg. No.: PG6472-1
Approved by: FAS
Revision No.:

11x17

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