Slope Stability Assessment

Kilbourne Developments Inc.

Project Name:
Bostwick Corridor Study
Bostwick Road
London, Ontario

Project Number:
LON-21008854-A0

Prepared By:

EXP Services Inc.
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London, Ontario, N5V 0A5

Date Submitted:
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Geotechnical Investigation

Kilbourne Developments Inc.

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Final Report

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Date Submitted:

February 2022

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1. Introduction and Background

1.1 Introduction

EXP Services Inc. (EXP) was retained by **Kilbourne Developments Inc c/o York Developments** to carry out a Slope Stability Assessment and prepare a report relating to the proposed subdivision development along the Bostwick Corridor. The section of slope analyzed is located along the Thornicroft Drain between Bostwick Road and Wonderland Road South in London, Ontario, hereinafter referred to as the 'Site'.

A critical section of the drain slope located west of 3341 Wonderland Road South, on the east side of the drain has been analyzed as part of this assessment having a length of approximately 225 m.

It is understood that the Client is proposing to develop the Site as a residential subdivision. As illustrated on **Drawing 1**, attached, the proposed development area is located at the top of a slope that bisects the Site.

Based on an interpretation of the factual test hole data and a review of soil and groundwater information from test holes advanced at the site, EXP has provided geotechnical engineering guidelines to support the construction of the proposed development, and an assessment of the stability of the slope, once construction is complete.

The proposed development is within an area regulated by the Upper Thames River Conservation Authority (UTRCA). As a result, consent from the Conservation Authority is required prior to construction of the proposed development.

1.2 Terms of Reference

The purpose of the assessment was to examine the subsoil and groundwater conditions at the Site, assess the slope stability along the on-site slopes in the requested section and determine the recommended development setback limit, in accordance with the Ontario Ministry of Natural Resources (MNR) Technical Guide – River & Streams Systems: Erosion Hazard Limit and the Upper Thames River Conservation Authority guidelines.

Based on an interpretation of the factual borehole data, and a review of soil and groundwater information from test holes excavated at the site, EXP has provided geotechnical comments and recommendations on slope stability and Development Setback.

This report is provided on the basis of the terms of reference presented above, and on the assumption that the design will be in accordance with applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning geotechnical aspects of the codes and standards, this office should be contacted to review the design.

The information in this report in no way reflects on the environmental aspects of the soil. Should specific information in this regard be needed, additional testing may be required.

1.3 Review of Previous Investigations

EXP has been collecting geotechnical data from this property since 2017. EXP has been involved in multiple rounds of consultations and discussions with the City of London and the Upper Thames River Conservation Authority (UTRCA). EXP completed two geotechnical investigations along this section of the Site in April 2017 (EXP Project No. LON-00015340-GE and LON-00015341-GE). The geotechnical drilling program and subsurface investigation included the completion of twenty-four (24) boreholes across the property. The relevant borehole logs (BH15 and BH16 from LON-00015340-GE, and BH6 from LON-00015341-GE) from this 2017 geotechnical drilling programs are included in **Appendix A**.

The relevant information from these reports has been reviewed and incorporated into the current investigation.

2. Methodology

2.1 Site Reconnaissance

A site reconnaissance survey was carried out on November 24, 2021. The purpose of the site visit was to examine the existing conditions of the site slopes which includes the critical slope section located west of 3341 Wonderland Road South, on the east side of the drain. The survey included detailed observations such as slope vegetation, old slump scars and seepage.

During the site reconnaissance, the 'Slope Stability Rating Chart', which was developed by MNR, was used to score a number of site characteristics and to determine the potential for slope instability. Site conditions which were reviewed include: slope height and inclination, soil stratigraphy, the presence and location of seepage zones, vegetative cover, overland drainage, and evidence of previous instability or landslide activity. A summary of the rating charts for each slope section and technical guide are attached. The location where slope stability rating charts were completed can be seen on **Drawing 1**.

At the time of the investigation, the slope surface was typically well vegetated with heavy shrubs and mature trees, with no apparent drainage over the slope. No previous surficial sliding failures or seepage areas were observed.

2.2 Field Work

In addition to the site reconnaissance, twenty-four (24) boreholes were advanced by EXP between in conjunction with previous studies to provide information on the soil stratigraphy in relation to the proposed development and servicing at the Site (reported under separate cover). Boreholes BH15, BH16 and BH6 were utilized to provide data relevant to the slope stability assessment.

The boreholes were advanced using a locally subcontracted track-mounted drilling unit equipped with continuous flight hollow stem augers, soil sampling and soil testing equipment. In the boreholes, disturbed soil samples were recovered at depth intervals of 0.75 and 1.5 metres using conventional split spoon sampling equipment and Standard Penetration Test (SPT) methods.

During the sampling, the stratigraphy in the test holes was examined and logged in the field by EXP geotechnical personnel.

Short-term groundwater level observations within the open boreholes and observations pertaining to groundwater conditions at the test hole locations are recorded in the relevant borehole logs found in **Appendix A**. Following the drilling, the water level was measured in the open boreholes, and then was backfilled with the excavated materials and bentonite, to satisfy the requirements of O.Reg. 903.

Representative samples of the various soil strata encountered at the test locations were taken to our laboratory in London for further examination by a Geotechnical Engineer and laboratory classification testing. Laboratory testing for this investigation comprised moisture content determinations with moisture content results presented on the relevant borehole logs found in **Appendix A**.

2.3 Review of Topographic Data

Topographic mapping completed by Callon Dietze Ontario Land Surveyors Ltd. Combined with information from EXP's site survey was used to create the cross sections for establishing the location of the Development Setback. Using engineering judgement and technical experience, the various cross sections (which are considered to be representative of typical site conditions) have been reviewed.

Examination of factors of safety using Morgenstern Price methods were carried out and analyzed by computer methods utilizing the Slope/W computer program. A detailed slope survey carried out by EXP combined with contour information from the topographic plan provided by York Developements was utilized to create the cross sections for use in establishing the location of the Erosion Hazard Limit. Using engineering judgement and technical experience, various cross sections (which are considered to be representative of typical site conditions) have been reviewed. Consideration has also been given to incorporate potential slope sections which have a higher potential for slope instability which may be indicated by the presence of more steeply inclined slopes or the localized presence of seepage zones. Soil strength parameters used in the analyses were based on our observations and experience with similar soil and groundwater conditions and are consistent with typical values in literature sources.

3. Site and Subsurface Condition

3.1 Site Description

The Site is located on the east side of the Thornicroft Drain between Bostwick Road and Wonderland Road South. The critical section is west of 3341 Wonderland Road South and 1875 Wharncliffe Road South.

A map of the site location (taken from Google Maps), is provided below.

The slope in the critical portion of the site generally follows the tree line along the Thornicroft Drain. The slope has an overall inclination ranging between about 1.1 horizontal to 1 vertical (1.1H:1V) and 1.6 horizontal to 1 vertical (1.6H:1V).

The slope has a height of approximately 4 m, is well vegetated throughout, and the mature trees do not show any signs of rotational movement or failure. There were also no signs of water seepage along the slope face throughout the investigation area.

The following sections provide a summary of the soil conditions and groundwater conditions.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in relevant boreholes are summarized in the following paragraphs. It must be noted that the boundaries of the soil indicated on the borehole log are inferred from non-continuous sampling and observations during drilling. These boundaries are intended to reflect transition zones for geotechnical design and should not be interpreted as exact planes of geological change.

Topsoil

Topsoil was penetrated at the ground surface measuring about 75 - 100 mm in thickness.

It should be noted that topsoil quantities should not be established from the information provided at the borehole locations only. If required, a more detailed analysis (involving additional shallow test pits) is recommended to accurately quantify the amount of topsoil to be removed for construction purposes.

Fill

Fill was observed below the topsoil at Borehole BH16. The fill extended to a depth of about 1.5 m below ground surface (bgs). The fill was generally described as brown clayey silt with trace to some topsoil and or topsoil layers, and trace sand and trace gravel. It was in a loose to compact relative density (based on tactile observations, observed drill resistance). Laboratory *in situ* moisture contents of the fill were 9 to 14 percent, generally indicative of moist soil conditions.

Borehole BH6 was surfaced with a 25 mm thick layer of recycled asphalt over a layer of fill. The fill consisted of a sand and gravel intermixed with recycled asphalt overlying clayey silt fill. The fill extended to depth of about 3.0 m bgs. The fill was brown or dark brown/black in colour and was determined to be in a loose to compact state (based on tactile observations, observed drill resistance). Laboratory testing of the fill revealed in situ moisture contents of 8 to 18 percent, indicative of moist conditions.

Clayey Silt

Clayey silt was found below the surficial topsoil/fill at Boreholes BH15, BH16, and BH6. The clayey silt was generally described as brown, soft to stiff (based on tactical observations, observed drill resistance and SPT N-values of 3 and 10). In situ moisture contents of the clayey silt ranged between 17 to 40 percent, generally indicative of moist to wet soil conditions.

It should be noted that the clayey silt encountered at Borehole BH16 and BH6 was alluvial and contained trace shells, decaying wood fragments and occasional peat seams.

Clayey Silt Till

The predominant soil encountered at the boreholes was clayey silt till. All boreholes were terminated in the till. The till was generally described as brown and becoming grey from 2.5 to 4.0 m bgs. It contained trace to some sand, and trace to some gravel, and possible cobbles. It was stiff to very stiff (based on tactical observations, observed drill resistance and SPT N-values of 12 to 24). In situ moisture contents of the clayey silt till ranged between 14 and 23 percent, generally indicative of moist soil conditions. The relative bulk densities of two samples of the till from Borehole BH16 near depths of 5.0 m bgs and 5.5 m bgs were 21.6 kN/m3 and 22.4 kN/m3 respectively.

3.3 Groundwater Conditions

Details of the groundwater conditions observed within the boreholes are provided on the attached borehole logs. Moisture contents of selected samples are also recorded on the attached borehole logs.

Upon completion of drilling, the open borehole excavation was examined for the presence of groundwater and groundwater seepage. Boreholes BH16, BH17 and BH6 were dry upon completion of drilling.

It should be noted that insufficient time was available for the measurement of the depth to the stabilized groundwater table prior to backfilling the borehole. The depth to the groundwater table may vary in response to climatic or seasonal conditions, and, as such, may differ with high levels occurring in wet seasons. Capillary rise effects should also be anticipated in fine-grained soil deposits.

4. Slope Stability

4.1 General

The purpose of this investigation was to determine a safe setback distance from the existing critical slope profiles that border the investigated area of the site using the information which is currently available.

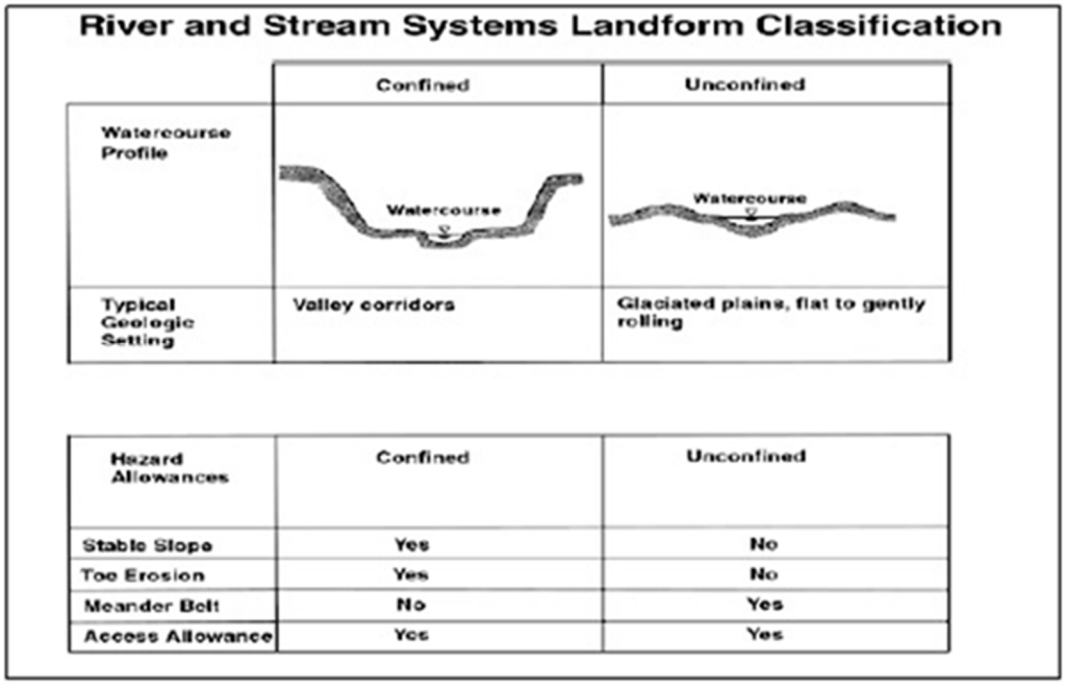
The slope was evaluated using the method prescribed by Ministry of Natural Resources in the Technical Guide for Assessing the Erosion Hazard Limit for River and Stream Systems.

The overall Erosion Hazard Limit (Development Setback) for the site slope is determined by evaluating the slope stability, considering surficial seepage and shallow failures, allowance for potential flooding hazards, and an erosion allowance.

Slope Stability Rating Charts have been completed for the referenced cross sections and are attached, see **Appendix B**. Based on the values recorded on the Slope Stability Rating Charts, the ratings suggest that a moderate potential of slope instability exists.

4.2 Erosion Hazard Limit

As defined by the MNR Technical Guide, based on the type of river and stream system landform (confined or unconfined) the following figure provides guidance on which factors (hazard allowances) should be used in defining the erosion hazard limits.



River and Stream Systems Landform Classification

	Confined	Unconfined
Watercourse Profile		
Typical Geologic Setting	Valley corridors	Glaciated plains, flat to gently rolling

Hazard Allowances	Confined	Unconfined
Stable Slope	Yes	No
Toe Erosion	Yes	No
Meander Belt	No	Yes
Access Allowance	Yes	Yes

Figure obtained from page 35 of Guide – River and Stream Systems: Erosion Hazard Limit MNR Technical

As defined by the MNR Technical Guide, confined river and stream systems are ones in which the physical presence of a valley corridor containing a river or stream channel, which may or may not contain flowing water, is visibly discernable form the surrounding landscape by either field investigations, aerial photography and or map interpretation. The Erosion Hazard Limit for a confined system consists of the following hazard allowances:

- Toe Erosion Allowance
- Stable Slope Allowance
- Access Allowance

Additional setbacks may also be required based on local Municipal and Conservation Authority requirements.

The setback distance from the slope crest varies slightly along the slope, based on the overall slope height and inclination. Surveyed cross sections shown on **Drawings 2** to **6** were used for establishing the location of the Erosion Hazard Limit. Additionally, the location of the top of slope line and top of stable slope line are also provided on **Drawing 1** and on cross sectional **Drawings 2** to **6**.

4.3 Toe Erosion Allowance

The extent of potential erosion damage is a function of the competence of the natural subgrade soils, the type and quality of vegetative cover, and the frequency with which the slope is subject to erosive forces. Active erosion of the soil on the face of the drainage channel slope is most likely caused by normal or increased flow volumes and velocities moving through the drainage creek. The figure below provides guidance on how to determine a minimum toe erosion allowance for a confined system.

MINIMUM TOE EROSION ALLOWANCE - River Within 15 m of Slope Toe*

Type of Material Native Soil Structure	**Evidence** of Active Erosion** OR Bankfull Flow Velocity > Competent Flow Velocity*** RANGE OF SUGGESTED TOE **EROSION ALLOWANCES**	**No evidence** of Active Erosion** OR Bankfull Flow Velocity <Competent Flow Velocity*** Bankfull Width		
		< 5m	5-30m	> 30m
1.Hard Rock (granite) *	0 - 2 m	0 m	0 m	1 m
2.Soft Rock (shale, limestone) Cobbles, Boulders *	2 - 5 m	0 m	1 m	2 m
3.Stiff/Hard Cohesive Soil (clays, clay silt), Coarse Granular (gravels) Tills *	5 - 8 m	1 m	2 m	4 m
4.Soft/Firm Cohesive Soil, loose granular, (sand, silt) Fill *	8 - 15 m	1-2 m	5 m	7 m

*Where a combination of different native soil structures occurs, the greater or largest range of applicable toe erosion allowances for the materials found at the site should be applied

****Active Erosion** is defined as: bank material is exposed directly to stream flow under normal or flood flow conditions where undercutting, oversteepening, slumping of a bank or down stream sediment loading is occurring. An area may have erosion but there may not be evidence of 'active erosion' either as a result of well rooted vegetation or as a result of a condition of net sediment deposition. The area may still suffer erosion at some point in the future as a result of shifting of the channel. The toe erosion allowances presented in the right half of Table 3 are suggested for sites with this condition. See Step 3.

*****Competent Flow Velocity** is the flow velocity that the bed material in the stream can support without resulting in erosion or scour. For *bankfull width* and *bankfull flow velocity*, see Section 3.1.2.

Figure obtained from page 38 of MNR Technical Guide – River and Stream Systems: Erosion Hazard Limit

A detailed study completed by Matrix Solutions Inc., Thornicroft Drain Hydrology, Floodline and Erosion Hazard Constraints Study (February 2022) recommends a minimum toe erosion allowance of 5 m based on evidence of active erosion into mostly cohesive materials with reference to the MNR (2002) Table 3 guideline (and supported by channel erosion rates from historical aerial photo analysis).

The predominant soils near the base of the slope are expected to comprise of cohesive glacial till deposits. Based on our review of site mapping, previous and current site observations, historical aerial photo analysis, it is recommended that a 5 m erosion allowance be applied to the edge of the Thornicroft Drain watercourse.

4.4 Stable Slope Geometry

The stability of the slope was investigated for a number of conditions. The examinations involve an assessment of the section of slope with and without the influence of perched groundwater the effects of possible construction in proximity to the site slopes. The various types of failures analyzed include shallow slumping failures, medium depth rotational failures, and deep rotational failures through the entire height of the slope. The analyses were undertaken by computer methods utilizing the Slope/W computer program.

The soil parameters used were conservative to build in an added safety factor for the analyses. The following table summarizes the parameters for the predominant soils which were used in EXP's evaluation of the stable slope configuration:

Table 1 – Soil Parameters

Soil Type	Density	Cohesion	Angle of Internal Friction
Fill – Clayey Silt	17.0 kN/m^3	2 kPa	26°
Clayey Silt	17.0 kN/m^3	10 kPa	28°
Alluvial Clayey Silt	14.0 kN/m^3	2 kPa	17°
Clayey Silt Till	22.0 kN/m^3	15 kPa	32°

Minimum Factors of Safety (FOS) are provided in the report "Geotechnical Principles for Stable Slopes" prepared for the Ministry of Natural Resources, for infrastructure and public use (Section 4.3.3.1 in the MNR Technical Guide).

In order to determine a stable slope, a minimum factor of safety of 1.40 was used during the computerized for long term stable slope analyses. The following table from the MNR Technical Guide provides guidance on how to select a minimum factor of safety based on the intended land use above or below the slope.

Table 2 – Design Minimum Factor of Safety

	LAND-USES	FACTOR OF SAFETY
A	**PASSIVE**; no buildings near slope; farm field, bush, forest, timberland, woods, wasteland, badlands, tundra	1.10
B	**LIGHT**; no habitable structures near slope; recreational parks, golf courses, buried small utilities, tile beds, barns, garages, swimming pools, sheds, satellite dishes, dog houses	1.20 to 1.30
C	**ACTIVE**; habitable or occupied structures near slope; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances	1.30 to 1.50
D	**INFRASTRUCTURE and PUBLIC USE**; public use structures or buildings (i.e., hospitals, schools, stadiums), cemeteries, bridges, high voltage power transmission lines, towers, storage/warehousing of hazardous materials, waste management areas	1.40 to 1.50

Table obtained from page 60 of MNR Technical Guide – River and Stream Systems: Erosion Hazard Limit

Five (5) cross sections were assessed and provide adequate coverage of the critical slope at the site. The sections evaluated were selected to represent the worst-case-scenario of the slope. The 5 cross section locations are shown on **Drawing 1** and the profiles are provided on **Drawings 2 to 6**. The information plotted in the cross sections was based on EXP's detailed slope survey and Callon Dietze's topographic mapping. The toe and top of slope at these cross sections are defined as the points of transition to an inclination of 4H:1V or shallower.

The failures at the cross sections consisted of shallow/moderate and deep failures throughout the depth of the slope. After completing the computerized stable slope analysis on each cross section, the minimum calculated factor of safety (FOS) under the existing conditions was 1.15 at Cross Section A-A', 1.21 at Cross Section B-B', 2.15 at Cross Section C-C', 2.16 at Cross Section D-D', and 1.12 at Cross Section E-E'.

These FOS are an indication of long-term safe slope conditions. Summarized results are provided in the following table:

Table 3 – Summary of Pertinent Slope Stability Analyses

Cross Section Condition	Description of Failure Mode	Computer Factor of Safety
Cross Section A-A'	Shallow to Moderate Depth Failure (< 2-4 m deep)	1.15
	Deep Failure (> 4 m deep)	2.23
Cross Section B-B'	Shallow to Moderate Depth Failure (< 2-4 m deep)	1.21
	Deep Failure (> 4 m deep)	3.45
Cross Section C-C'	Shallow to Moderate Depth Failure (< 2-4 m deep)	2.15
	Deep Failure (> 4 m deep)	2.44
Cross Section D-D'	Shallow to Moderate Depth Failure (< 2-4 m deep)	2.20
	Deep Failure (> 4 m deep)	2.16
Cross Section E-E'	Shallow to Moderate Depth Failure (< 2-4 m deep)	1.12
	Deep Failure (> 4 m deep)	2.16

The findings were in general agreement with observations of the local slope (vegetated and treed slope which is beneficial for protection against shallow slides). The soil conditions encountered in the boreholes were generally found to comprise of surficial fill, clayey silt and alluvial clayey silt over stiff to very stiff glacial till deposits. In determining suitable input soil and groundwater parameters, consideration has been given to incorporating the presence of groundwater within the subsurface soil strata. Local changes and variations in the groundwater level were also considered when carrying out the analyses, to examine possible post-development effects. Changes in the groundwater level may result from a number of causes, included (but not limited to) possible site grading activities, changes to site drainage, use of at-source infiltration, or types of surface cover.

The average inclinations along the existing slope profiles at the investigated cross sections range between about 1.1H:1V to 1.5H:1V. Based on the soil conditions encountered during the field investigation and based on the results of the computerized slope stability analysis a stable slope line of 2H:1V has been applied and should be considered suitable based on the results of the current geotechnical study.

It should be noted that the theoretical calculations for FOS are conservative. Based on the site reconnaissance conducted by EXP, it was observed that the slope face is covered by vegetation (mature trees and heavy shrubs). The trees were generally in an upright state. The deep roots of mature trees assist to reinforce and to enhance the stabilization of slopes.

The stable slope allowance of 2.0H:1V has been applied based on a conservative evaluation and to exceed the target FOS of 1.40. In addition to the stable slope geometry, an emergency access allowance should also be applied. This is described in the following section.

4.5 Erosion Access Allowance

The Ontario Government provides planning guidelines for development adjacent to slopes. The 2005 Provincial Policy Statement (PPS Section 3.1.3) requires that an access allowance be included as part of the Erosion Hazard Limit. In accordance with PPS, a 6 to 15 m setback is required in addition to the erosion and stability setbacks, which are discussed in the following sections. It is understood that this access allowance is required to ensure that there is a large enough safety zone for people and vehicles to enter and exit an area during an emergency.

Since the subsurface conditions within the study area are generally considered to be geologically stable, we recommend that at a minimum, a planning setback of 6 m be applied to existing slopes.

4.6 Erosion Hazard Limit (Development Setback Limit)

As defined by the MNR Technical Guide, the Erosion Hazard Limit for confined systems includes the following three elements in determining the setback limits from a geotechnical standpoint:

- Emergency Access Allowance
- Stable Slope Setback
- Toe Erosion Allowance

The table below summarizes the 3 components to the Recommended Development Limit Setback.

Table 4 – Erosion Hazard Limit Components

Cross Section	Toe Erosion Allowance (m)	Stable Slope Allowance (From Top of Slope, m)	Emergency Access Allowance (m)	Erosion Hazard Limit (From Top of Slope)
A-A'	5	7.5	6	13.5
B-B'	5	1.5	6	7.5
C-C'	5	8.0	6	14.0
D-D'	5	8.0	6	14.0
E-E'	5	9.7	6	15.7

Ultimately, the Erosion Hazard Limit also defines the development limit for the Site. Additional setbacks may also be required based on EIS or studies prepared by others.

The setback distance from the slope crest varies slightly along the slope, based on the overall slope height and inclination. The Stable Slope Setback and Erosion Hazard Limit are shown on **Drawings 1** to **6**. Any proposed development should not encroach on the Erosion Hazard Limit.

4.7 UTRCA Generic Regulation

In May 2006, Ontario Regulation 157/06 came into effect in the Upper Thames River Conservation Authority (UTRCA) watershed, which locally implements the Generic Regulation (Development, Interference with Wetlands and Alterations to Shoreline and Watercourses). This regulation replaces the former Fill, Construction and Alteration to Waterways regulations, and is intended to ensure public safety, prevent property damage and social disruption, due to natural hazards such as flooding and erosion. Ontario Regulation 157/06 is implemented by the local Conservation Authority, by means of permit issuance for works in or near watercourses, valleys, wetlands, or shorelines, when required.

Property owners must obtain permission from the UTRCA before beginning any development, site alteration, construction, or placement of fill within the regulated area. Permits are also required for any wetland interference, or for altering, straightening, diverting or interfering in any way with the existing channel of a creek, stream or river. Proposed development within the study area will be subject to the above referenced Regulation. Consultation with the local Conservation Authority for review of site-specific development plans is recommended in this regard.

4.8 General Comments for Site Works

It is imperative that future development generally not occur within the Erosion Hazard Limit identified at the site. To this end, the following comments are provided, and measures are recommended.

1. The surficial soils on the face of the slope experience minor long-term erosion due to weathering (wetting/drying and freezing/thawing cycles). The extent of potential erosion damage is a function of the competence of the natural subgrade soils, the type and quality of vegetative cover, and the frequency with which the slope is subject to erosive forces. Surficial erosion of the soil on the face of the slope could be caused by run-off water washing over the face of the slope, such as tile drains or redirected surface water which is directed onto existing slopes. Where possible, uncontrolled surface water flows over the face of the slope should be minimized, to reduce the risk of surface erosion. Erosion control measures may be required during construction, to reduce the risk of surface water flows from washing out non-vegetated surfaces.

2. Indiscriminate stockpiling of fill or construction materials should be avoided. If stockpiling of material is proposed near the slope crest, a review by the Geotechnical consultant is required.

3. Any buildings and permanent structures associated with the proposed site development must be located outside of the Erosion Hazard Limit, which is identified on the Site Plan. The cross-section drawings help identify the location of this line.

4. Water from downspouts and perimeter weeping tile etc. must also be collected in a controlled manner and re-directed away from the slope.

5. Existing vegetation on the slope should be maintained. A regular maintenance program should be implemented such as tree preservation, grading, and drainage control.

Final design drawings including building locations, services etc. should be reviewed by a geotechnical consultant to ensure that the Erosion Hazard Limit is properly interpreted. Geotechnical inspection and testing are recommended during construction to confirm that all recommendations set out will be followed.

5. General Comments

The information presented in this report is based on a limited investigation designed to provide information to support an assessment of the current geotechnical conditions within the subject property. The conclusions and recommendations presented in this report reflect site conditions existing at the time of the investigation. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent. Should this occur, EXP Services Inc. should be contacted to assess the situation, and the need for additional testing and reporting. EXP has qualified personnel to provide assistance in regards to any future geotechnical and environmental issues related to this property.

Our undertaking at EXP, therefore, is to perform our work within limits prescribed by our clients, with the usual thoroughness and competence of the engineering profession.

The comments given in this report are intended only for the guidance of design engineers. The number of test holes required to determine the localized underground conditions between test holes affecting construction costs, techniques, sequencing, equipment, scheduling, etc. would be much greater than has been carried out for design purposes. Contractors bidding on or undertaking the works should in this light, decide on their own investigations, as well as their own interpretations of the factual borehole results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report.

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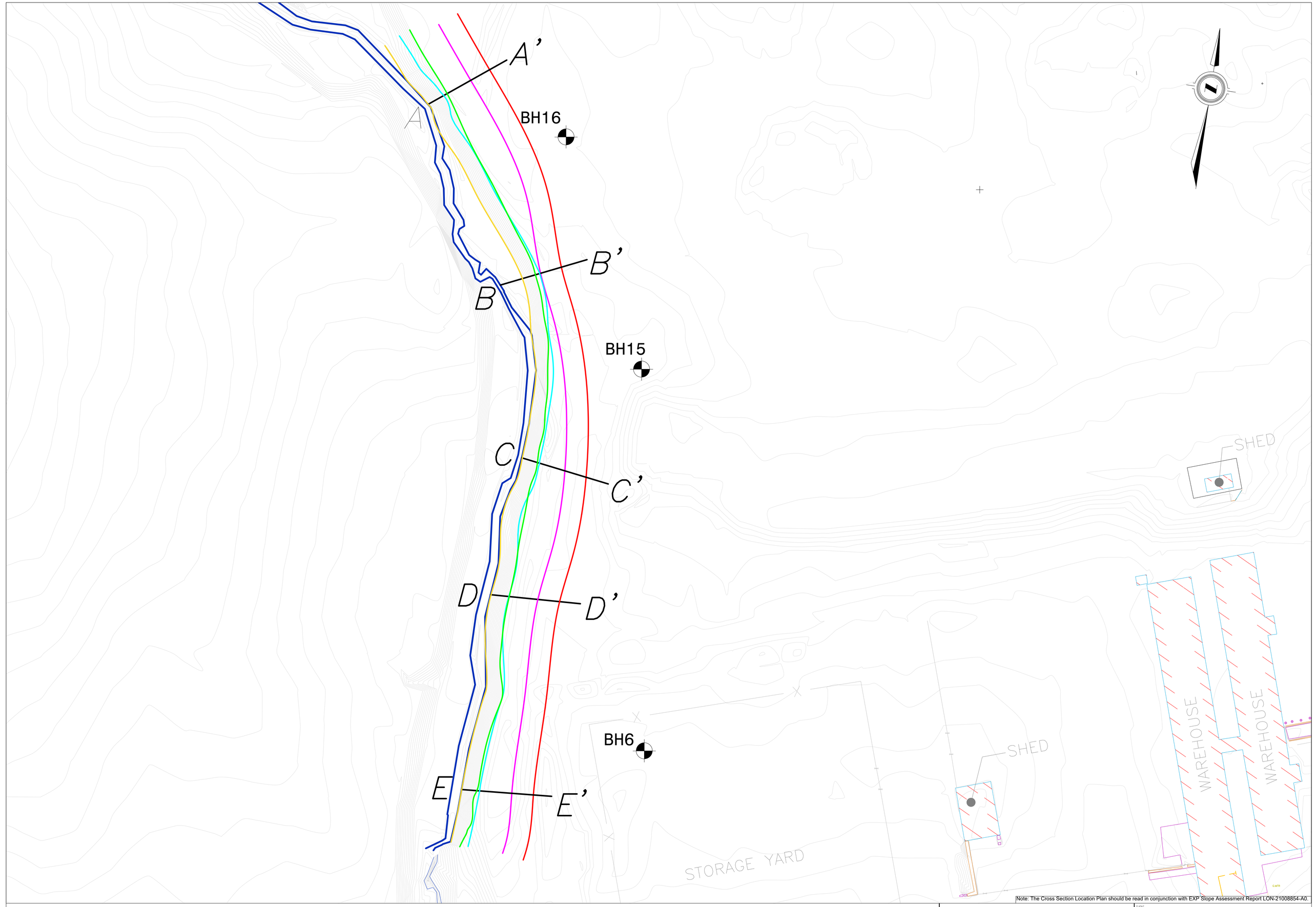
We trust that this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Drawings



Note: The Cross Section Location Plan should be read in conjunction with EXP Slope Assessment Report LON-21008854-A0.

LEGEND

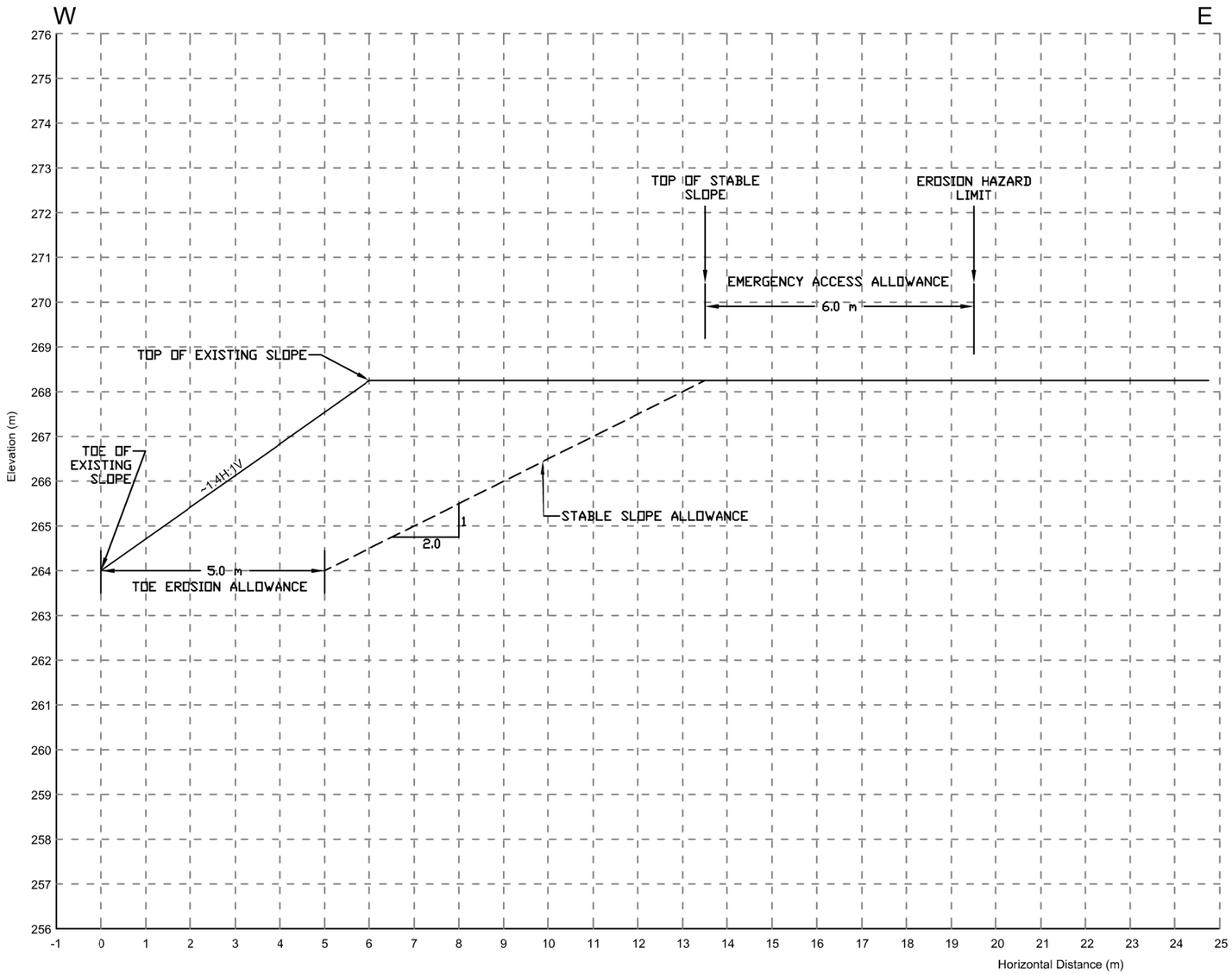
- BH6 — Approximate Borehole Location
- Top of Slope
- Toe of Slope
- Approximate Stable Slope Allowance, 2.0H:1V
- Toe Erosion Allowance
- Approximate Erosion Hazard Limit

Slope Stability Assessment

Bostwick Corridor Study
London, Ontario

CLIENT	Kilbourne Developments Inc.
TITLE	Cross Section Location Plan
Prepared By: C.S.	Reviewed By: B.C.
exp.	EXP Services Inc. 15701 Robin's Hill Road, London, ON, N5V 0A5
DATE: FEBRUARY 2022	SCALE: 1:300
PROJECT NO.: LON-21008854-A0	DWG.: 1

Cross Section A - A'



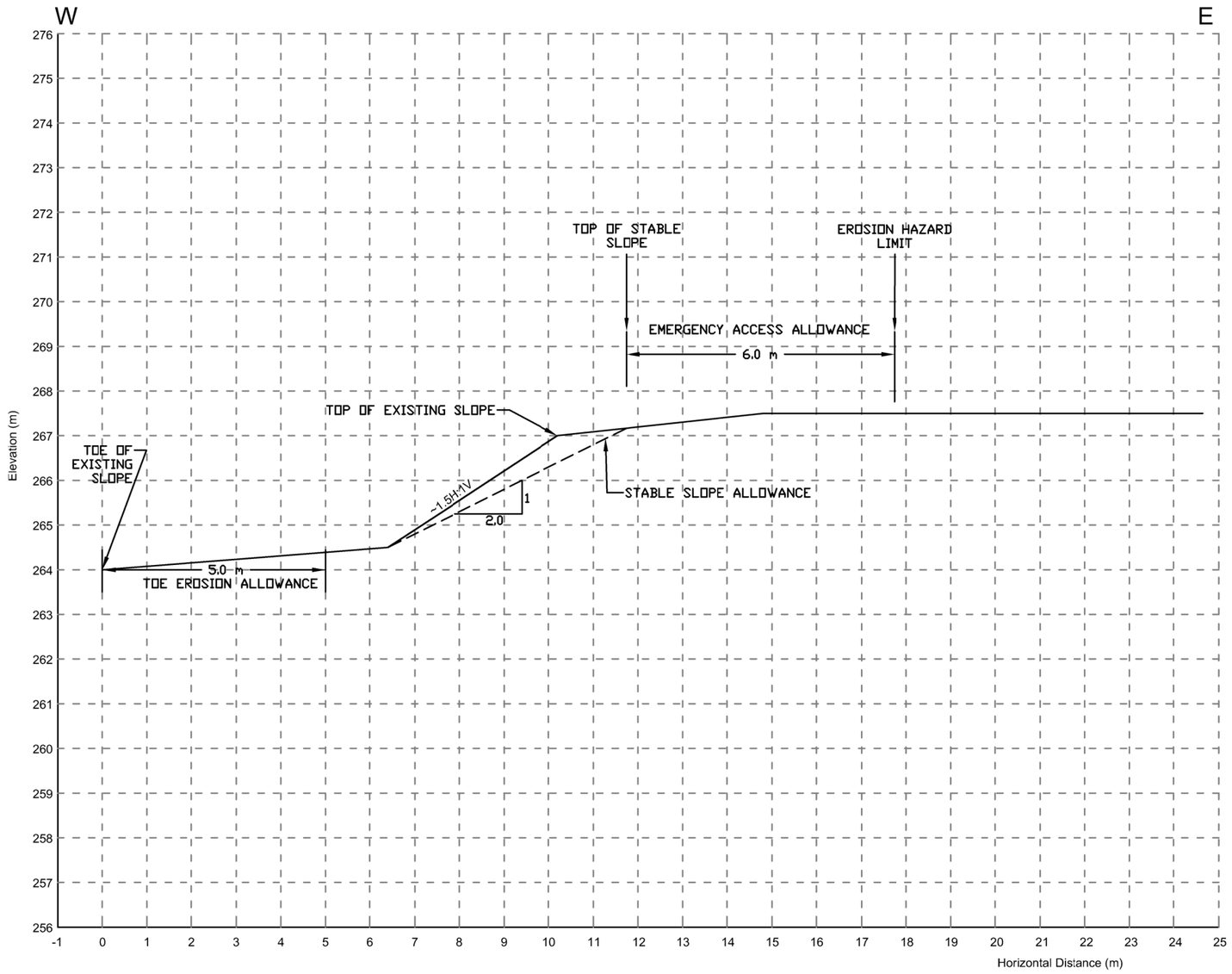
-NOTES-

Slope Stability Assessment

Bostwick Corridor Development
London, Ontario

CLIENT	KILBOURNE DEVELOPMENTS INC.
TITLE	CROSS SECTION A - A'
DRAWN BY: C.S. / REVIEWED BY: B.C. / DATE: JANUARY 2022	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:115 / PROJECT NO.: LON-21008654-A0 / DWG.: 2	

Cross Section B - B'



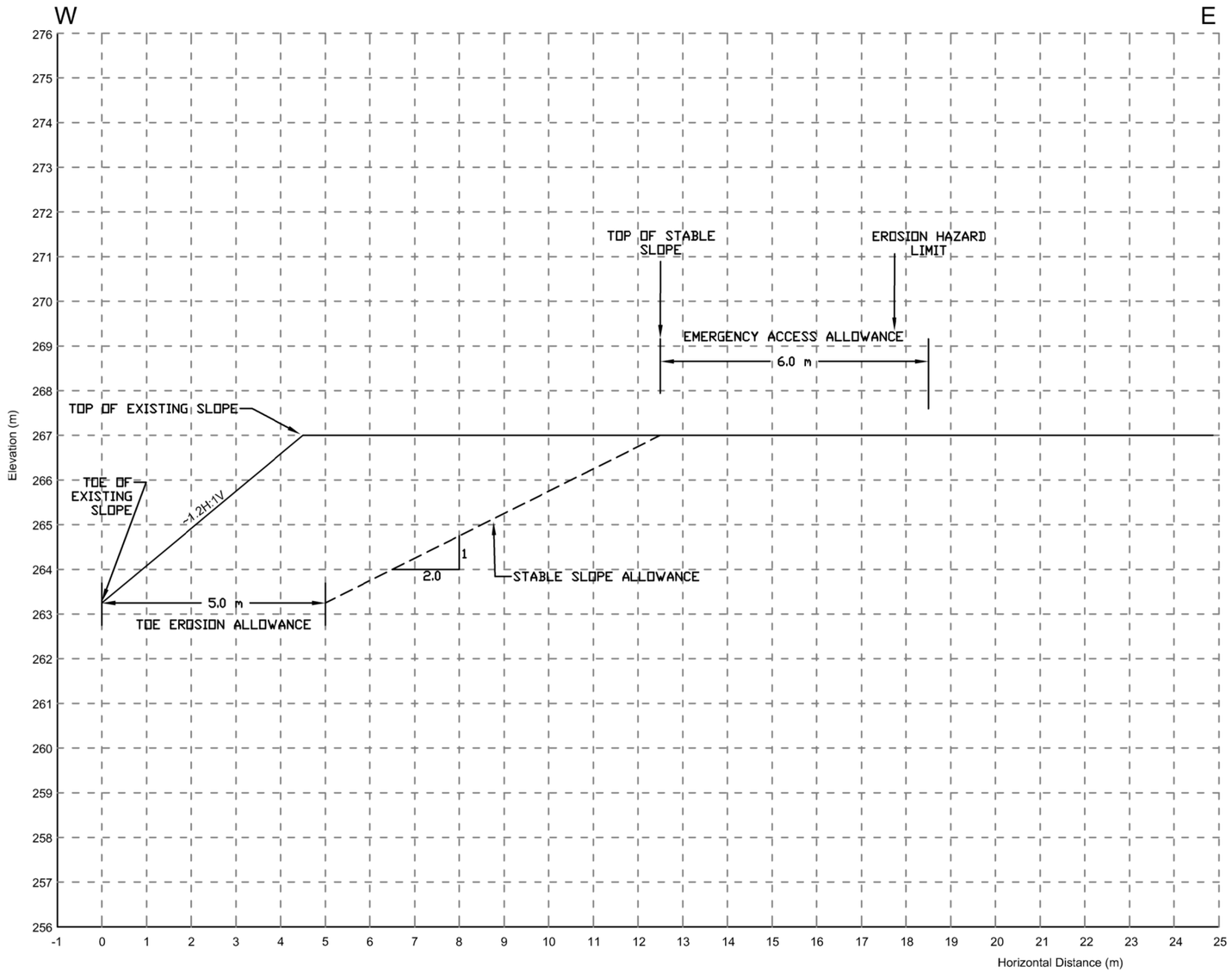
-NOTES-

Slope Stability Assessment

Bostwick Corridor Development
London, Ontario

CLIENT	KILBOURNE DEVELOPMENTS INC.
TITLE	CROSS SECTION B - B'
DRAWN BY: C.S. / REVIEWED BY: B.C. / DATE: JANUARY 2022	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:115 / PROJECT NO.: LON-21008654-A0 / DWG.: 3	

Cross Section C - C'



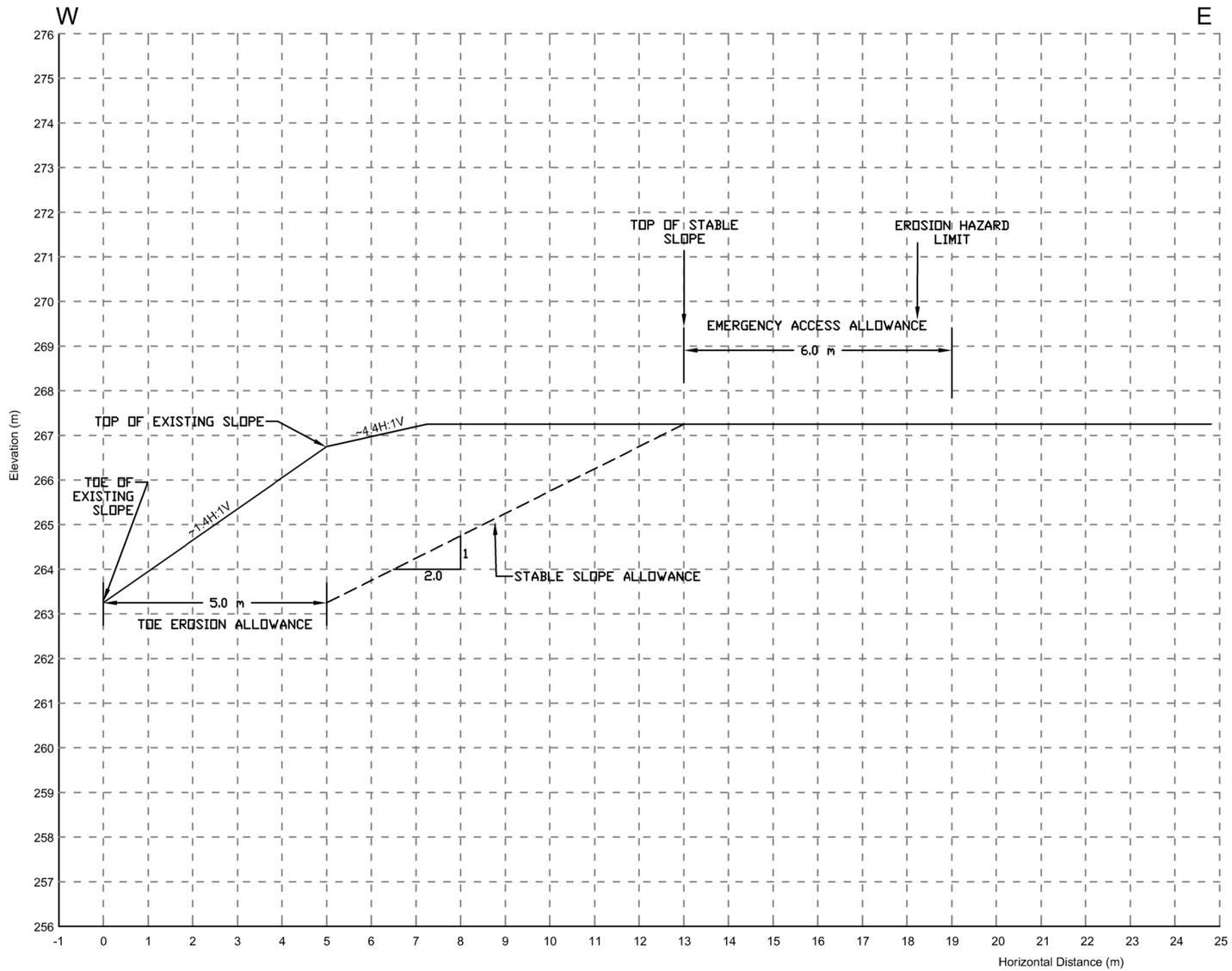
-NOTES-

Slope Stability Assessment

Bostwick Corridor Development
London, Ontario

CLIENT	KILBOURNE DEVELOPMENTS INC.
TITLE	CROSS SECTION C - C'
DRAWN BY: C.S. / REVIEWED BY: B.C. / DATE: JANUARY 2022	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:115 / PROJECT NO.: LON-21008654-A0 / DWG.: 4	

Cross Section D - D'



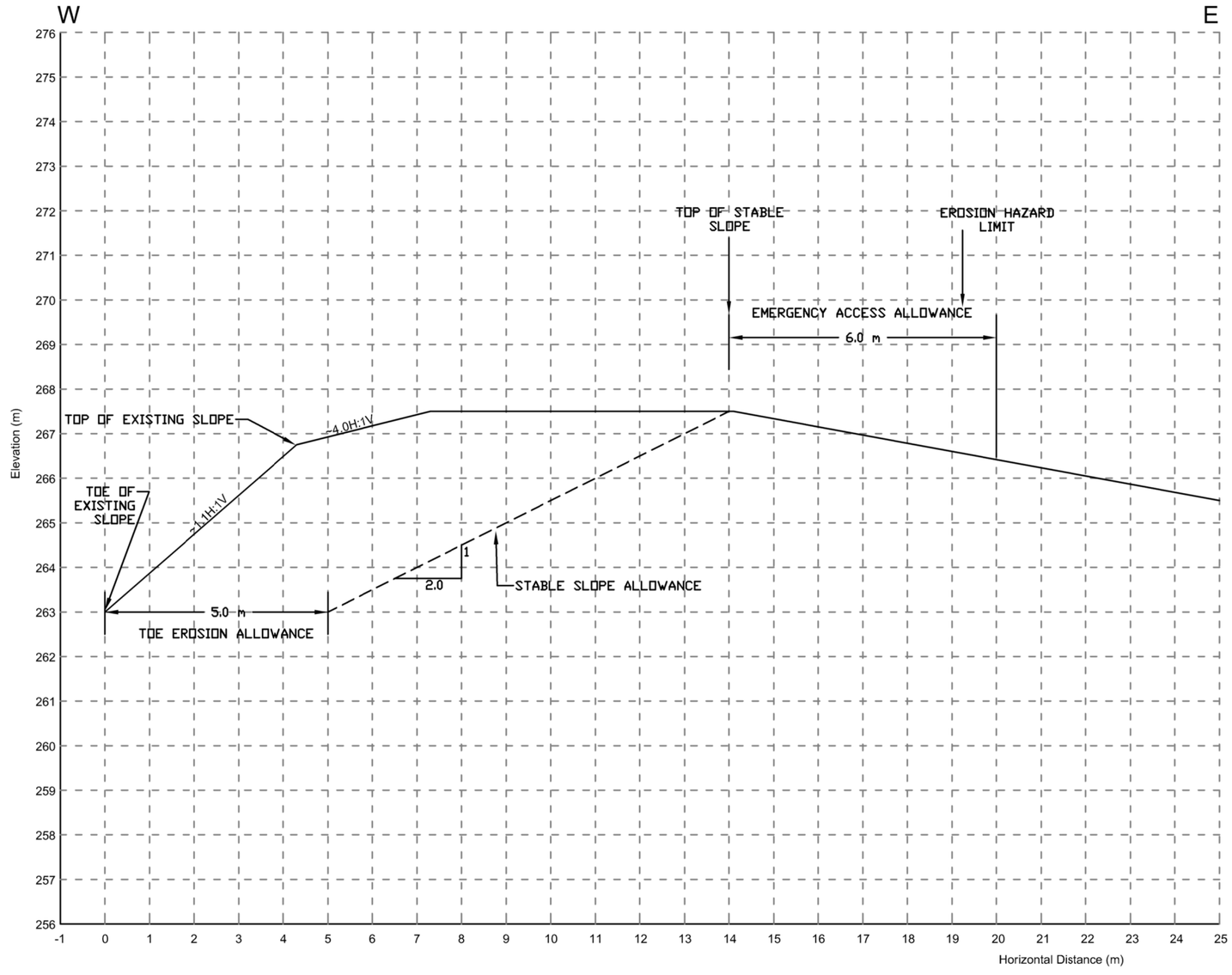
-NOTES-

Slope Stability Assessment

Bostwick Corridor Development
London, Ontario

CLIENT	KILBOURNE DEVELOPMENTS INC.
TITLE	CROSS SECTION D - D'
DRAWN BY: C.S. / REVIEWED BY: B.C. / DATE: JANUARY 2022	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:115	PROJECT NO.: LON-21008554-A0 / DWG.: 5

Cross Section E - E'



-NOTES-

Slope Stability Assessment

Bostwick Corridor Development
London, Ontario

CLIENT	KILBOURNE DEVELOPMENTS INC.
TITLE	CROSS SECTION E - E'
DRAWN BY: C.S. / REVIEWED BY: B.C. / DATE: JANUARY 2022	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:115	PROJECT NO.: LON-21008554-A0 / DWG.: 6

Appendix A

– Borehole Logs, and Factors of Safety Analysis

BOREHOLE LOG

BH15
Sheet 1 of 1

CLIENT **York Developments (London) Inc.** PROJECT NO. **LON-00015341-GE**

PROJECT **Proposed Residential Development** DATUM **Geodetic**

LOCATION **3341 Wonderland Road, London, ON** DATES: Boring **March 29, 2017** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	268.3								
	268.2	**TOPSOIL** - 100 mm							
		CLAYEY SILT - brown, trace sand, trace gravel, trace topsoil inclusions within 0.7 m bgs, firm to stiff, moist			SS	SA1		6	17
1					SS	SA2		10	19
		- becoming soft to firm near 1.4 m bgs			SS	SA3		3	
2									
					SS	SA4		5	17
	265.4	- sand seam encountered near 2.7 m bgs							
3		**CLAYEY SILT TILL** - brown/grey, trace sand, trace gravel, stiff to very stiff, moist			SS	SA5		12	17
4					SS	SA6		24	14
					SS	SA7		23	16
5	263.2								
		End of Borehole at 5.0 metres bgs.							
6									
7									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
SPT N Value Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00015341-GE.
2) Borehole open to 1.5 m bgs and dry upon completion of drilling.
3) bgs denotes below ground surface.
4) DP denotes Direct Push.
5) No significant methane gas concentration was detected upon completion of drilling.
6) Elevation infered from Callon-Dietze topographic survey.

SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

BOREHOLE LOG

BH16
Sheet 1 of 1

CLIENT **York Developments (London) Inc.** PROJECT NO. **LON-00015341-GE**
PROJECT **Proposed Residential Development** DATUM **Geodetic**
LOCATION **3341 Wonderland Road, London, ON** DATES: Boring **March 29, 2017** Water Level

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	268.0								
	267.9	**TOPSOIL** - 75 mm							
		FILL - clayey silt to sand and gravel, brown/dark brown, trace topsoil inclusions in upper 0.7 m bgs, moist			DP	SA1			14
1					DP	SA2			9
	266.5								
		ALLUVIAL CLAYEY SILT - dark grey, some sand, trace shells and decaying wood fragments, occasional peat seams, very moist			DP	SA3			18
2									
					DP	SA4			19
3									
					DP	SA5			20
4					DP	SA6			40
		- wet sand and gravel layer encountered near 4.3 m bgs							
	263.4								
		CLAYEY SILT TILL - grey, trace sand, trace gravel, very stiff, moist Bulk Density: 21.6 kN/cu.m			DP	SA7			23
5									
		Bulk Density: 22.4 kN/cu.m			DP	SA8			15
6	261.9								
		End of Borehole at 6.1 metres bgs.							
7									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
▲ Penetrometer ■ Torvane
100 200 kPa

Atterberg Limits and Moisture
W_P W W_L
● SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00015341-GE.
2) Borehole open to 6.1 m bgs and dry upon completion of sampling.
3) bgs denotes below ground surface.
4) DP denotes Direct Push.
5) No significant methane gas concentration was detected upon completion of drilling.
6) Elevation infered from Callon-Dietze topographic survey.

SAMPLE LEGEND
☒ AS Auger Sample ▨ SS Split Spoon ■ ST Shelby Tube
▥ Rock Core (eg. BQ, NQ, etc.) ▥ VN Vane Sample

OTHER TESTS

G Specific Gravity	C Consolidation
H Hydrometer	CD Consolidated Drained Triaxial
S Sieve Analysis	CU Consolidated Undrained Triaxial
γ Unit Weight	UU Unconsolidated Undrained Triaxial
P Field Permeability	UC Unconfined Compression
K Lab Permeability	DS Direct Shear

WATER LEVELS
▽ Apparent ▼ Measured ▲ Artesian (see Notes)

BOREHOLE LOG

BH6
Sheet 1 of 1

CLIENT **York Developments (London) Inc.** PROJECT NO. **LON-00015341-GE**
PROJECT **Proposed Industrial Development** DATUM **Geodetic**
LOCATION **1875 Wharncliffe Road South, London, ON** DATES: Boring **March 10, 2017** Water Level **N/A**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	**267.0**								
	267.0	**RECYCLED ASPHALT** - 25 mm							
		FILL - sand and gravel intermixed with recycled asphalt, dark brown/black, some silt, moist			DP	SA1			8
	266.1								
1		**FILL** - clayey silt, grey to brown, trace sand, trace gravel, trace organics and wood fragments, moist			DP	SA2			16
		- 150 mm thick sand and gravel fill layer encountered near 1.5 m bgs							
2					DP	SA3			18
					DP	SA4			10
3	264.0								
		ALLUVIAL CLAYEY SILT - dark grey, trace to some sand, soft to firm, moist - 75 mm layer of peat/organics encountered near 3.0 m bgs			DP	SA5			17
4		- becoming dark grey near 4.0 m bgs							
	262.8				DP	SA6			24
	262.4	**CLAYEY SILT TILL** - grey, trace sand, trace gravel, very stiff, moist							
		End of Borehole at 4.6 metres bgs.							
5									
6									
7									

SHEAR STRENGTH
S Field Vane Test (#=Sensitivity)
Penetrometer Torvane
100 200 kPa
Atterberg Limits and Moisture
W_P W W_L
SPT N Value × Dynamic Cone
10 20 30 40

NOTES

1) Borehole interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00015246-GE.
2) Borehole open and dry upon completion of sampling.
3) bgs denotes below ground surface.
4) DP denotes Direct Push.
5) No significant methane gas concentration was detected upon completion of sampling.
6) Elevation infered from Callon-Dietze topographic survey.

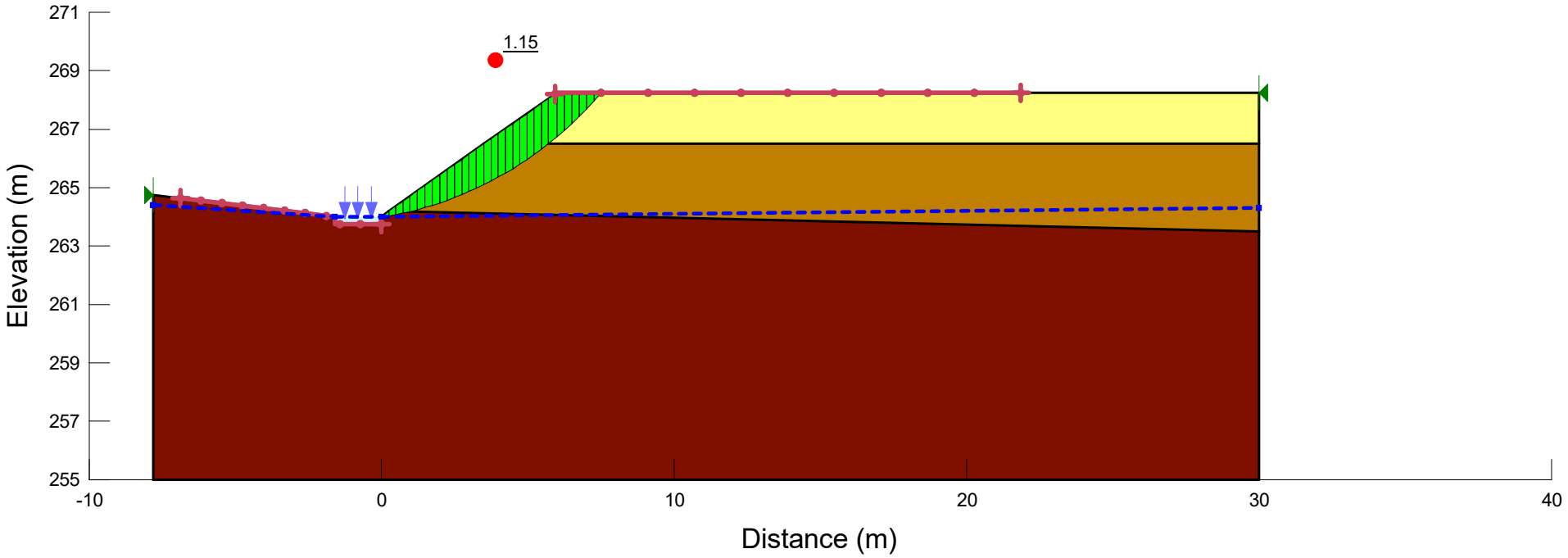
SAMPLE LEGEND
AS Auger Sample SS Split Spoon ST Shelby Tube
Rock Core (eg. BQ, NQ, etc.) VN Vane Sample

OTHER TESTS
G Specific Gravity C Consolidation
H Hydrometer CD Consolidated Drained Triaxial
S Sieve Analysis CU Consolidated Undrained Triaxial
γ Unit Weight UU Unconsolidated Undrained Triaxial
P Field Permeability UC Unconfined Compression
K Lab Permeability DS Direct Shear

WATER LEVELS
Apparent Measured Artesian (see Notes)

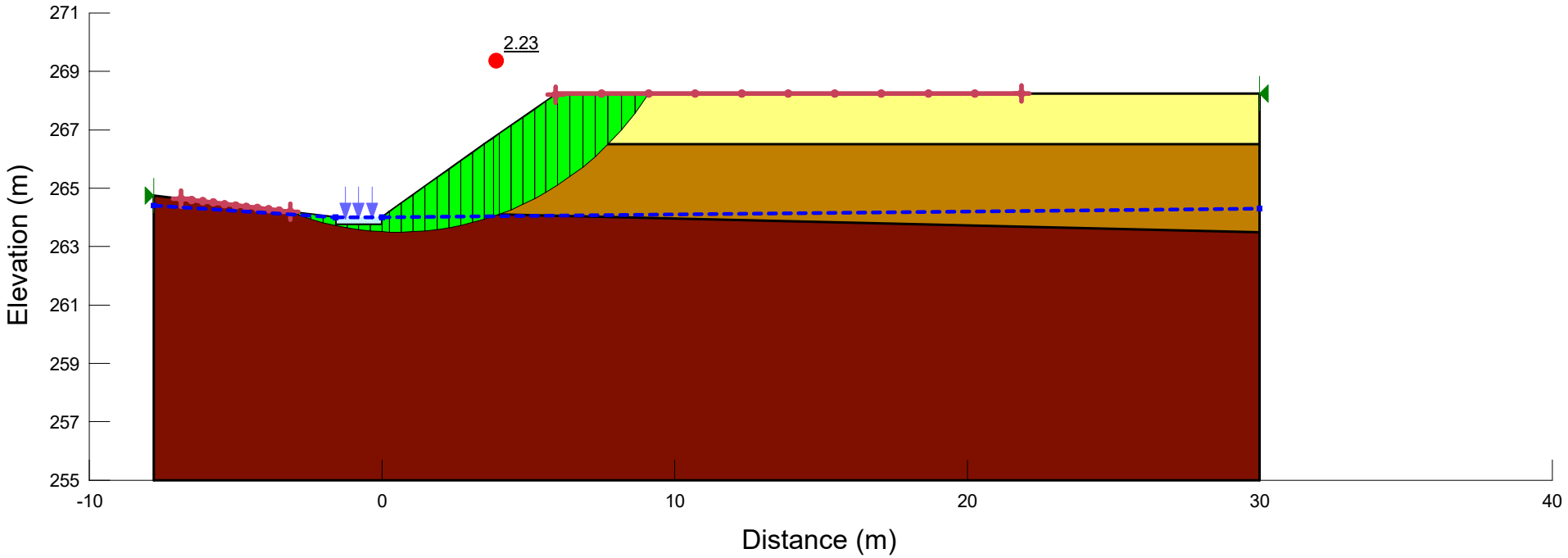
Cross Section A-A'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1
	Fill- Clayey Silt	17	2	26	1



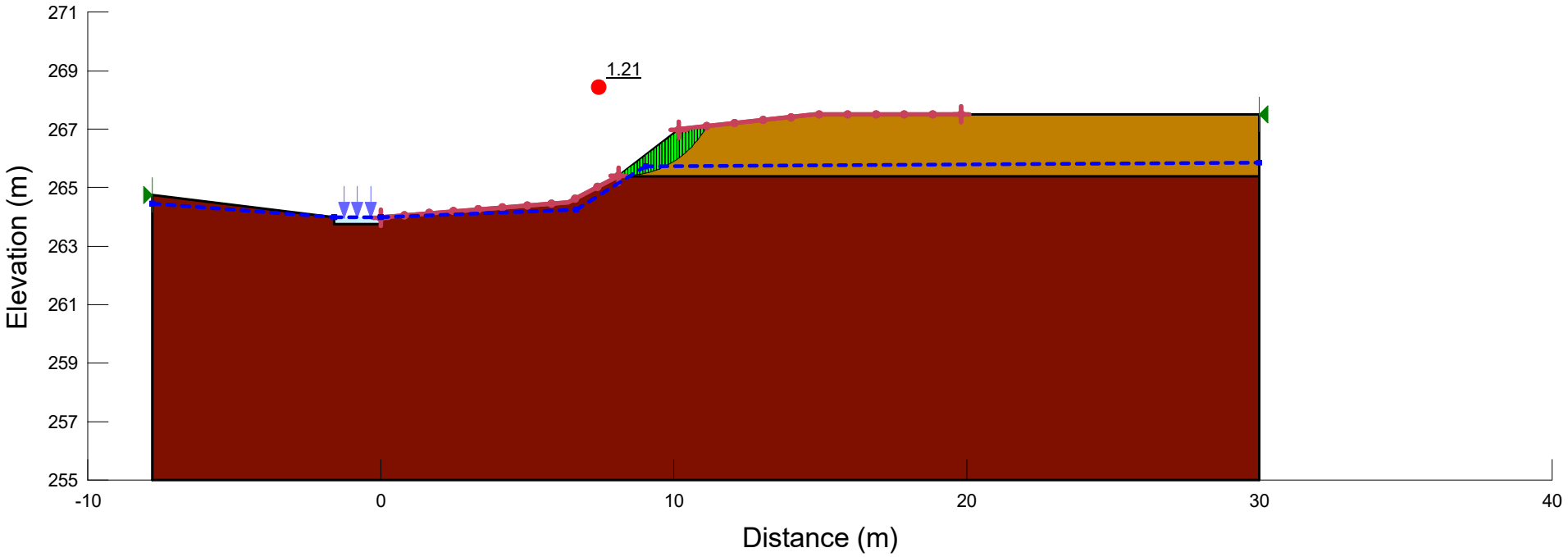
Cross Section A-A'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1
	Fill- Clayey Silt	17	2	26	1



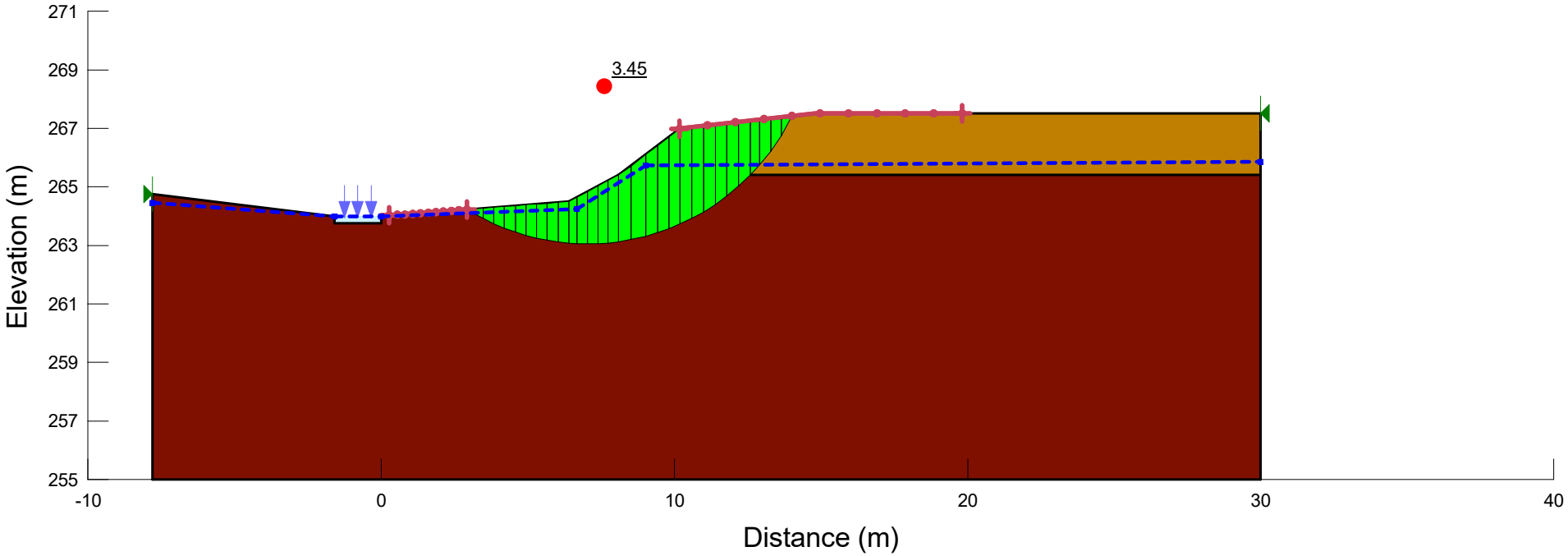
Cross Section B-B'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1



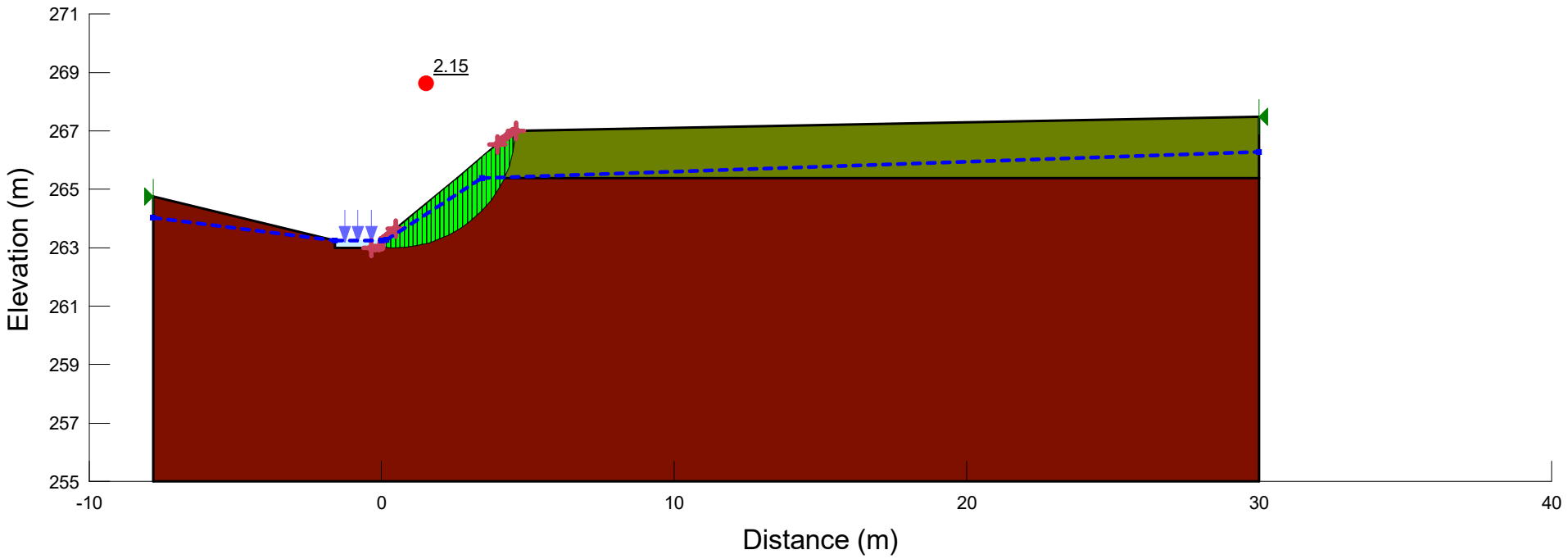
Cross Section B-B'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1



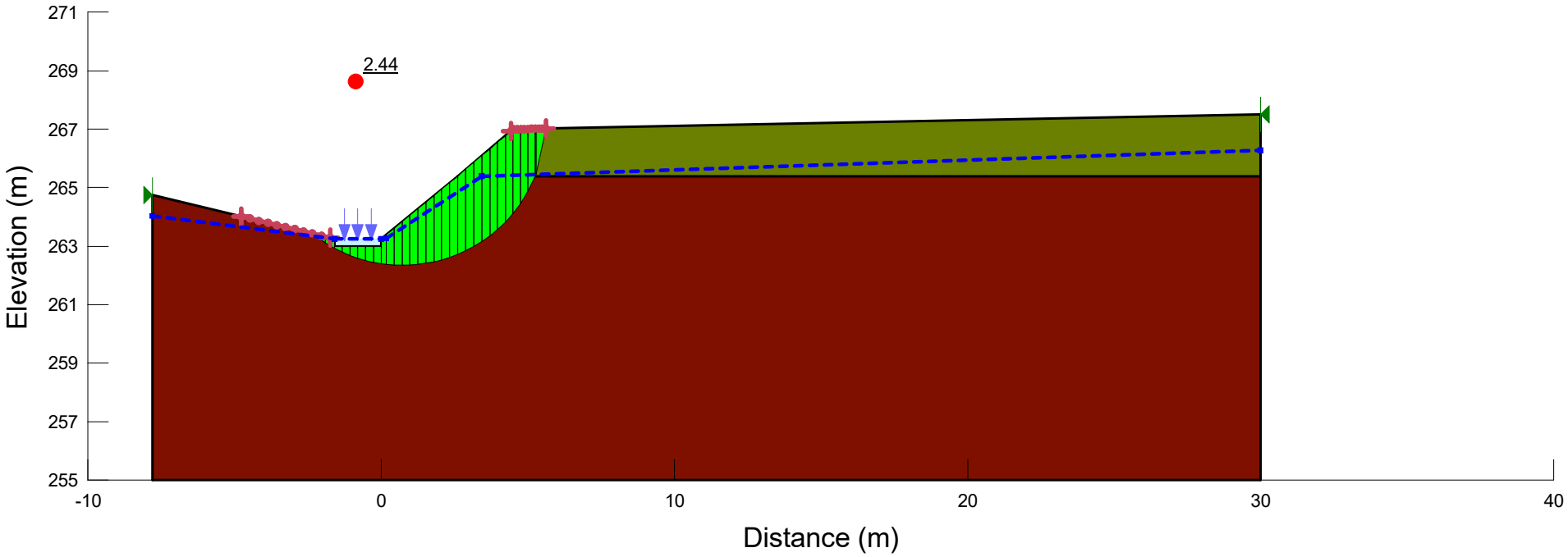
Cross Section C-C'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Clayey Silt	17	10	28	1
	Clayey Silt Till	22	15	32	1



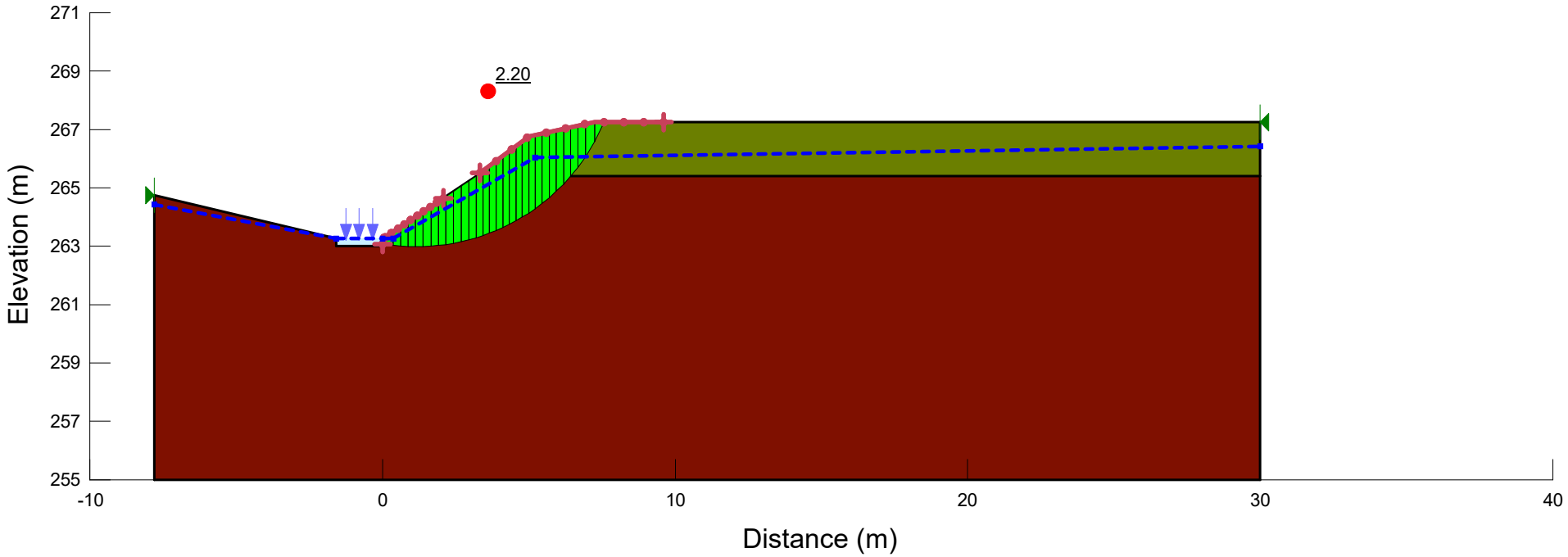
Cross Section C-C'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Clayey Silt	17	10	28	1
	Clayey Silt Till	22	15	32	1



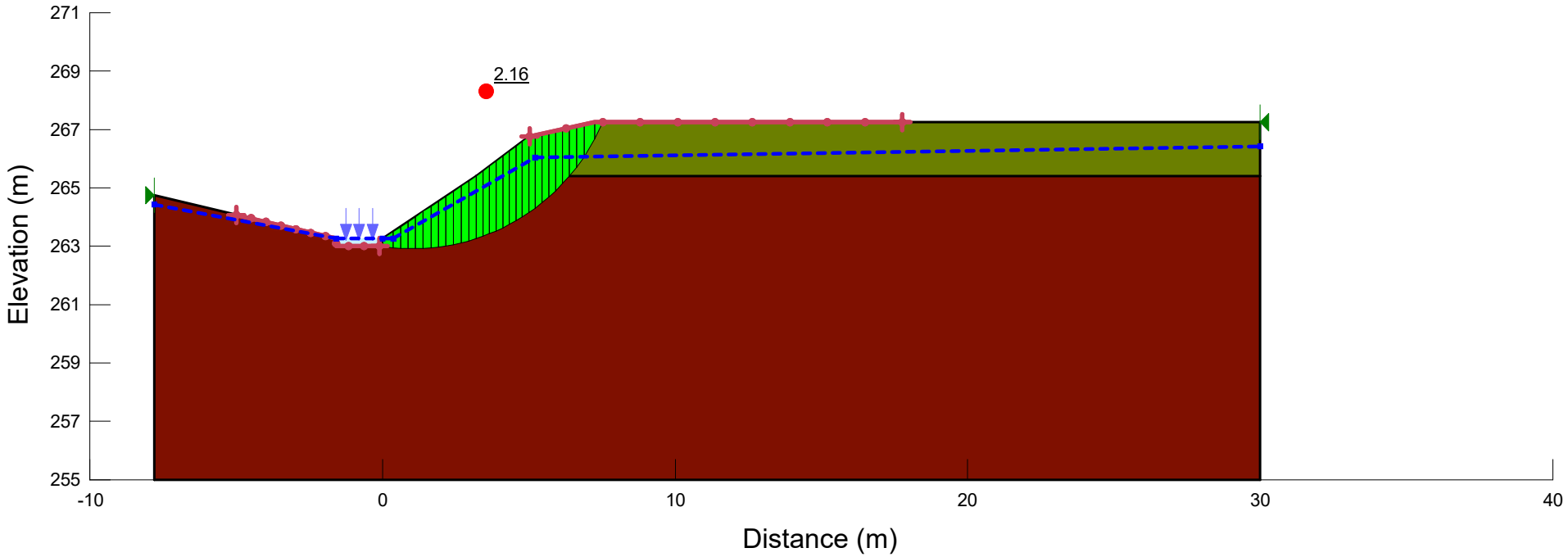
Cross Section D-D'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Clayey Silt	17	10	28	1
	Clayey Silt Till	22	15	32	1



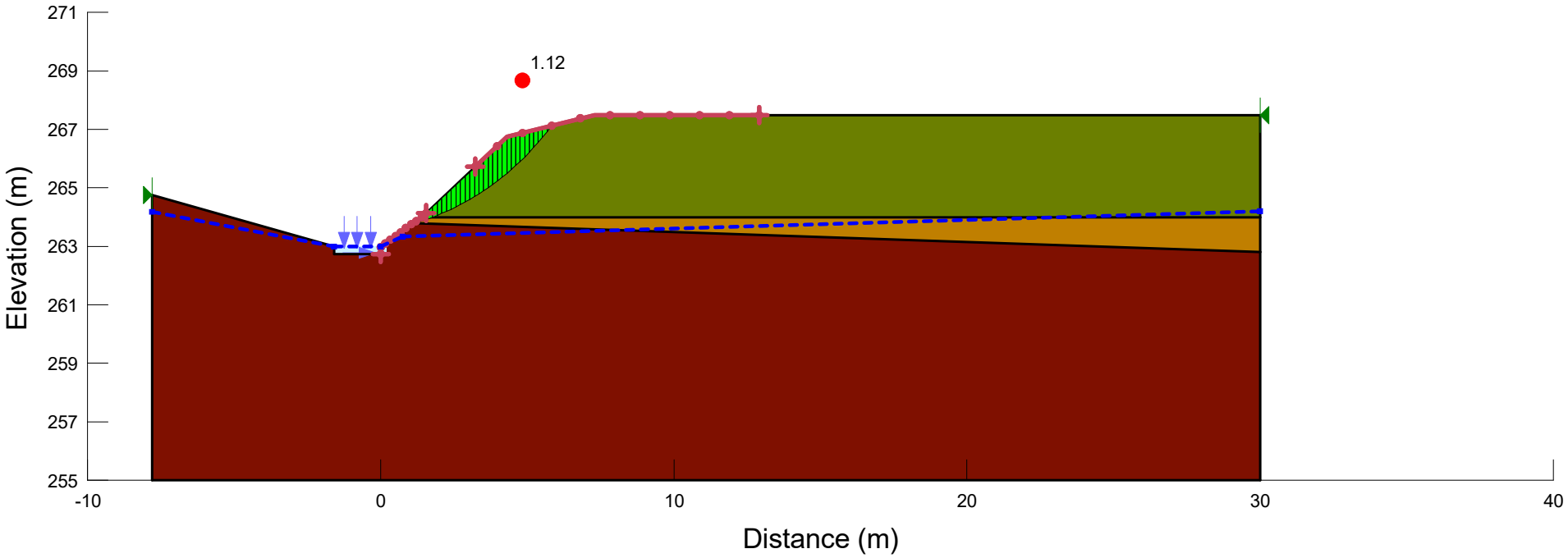
Cross Section D-D'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Clayey Silt	17	10	28	1
	Clayey Silt Till	22	15	32	1



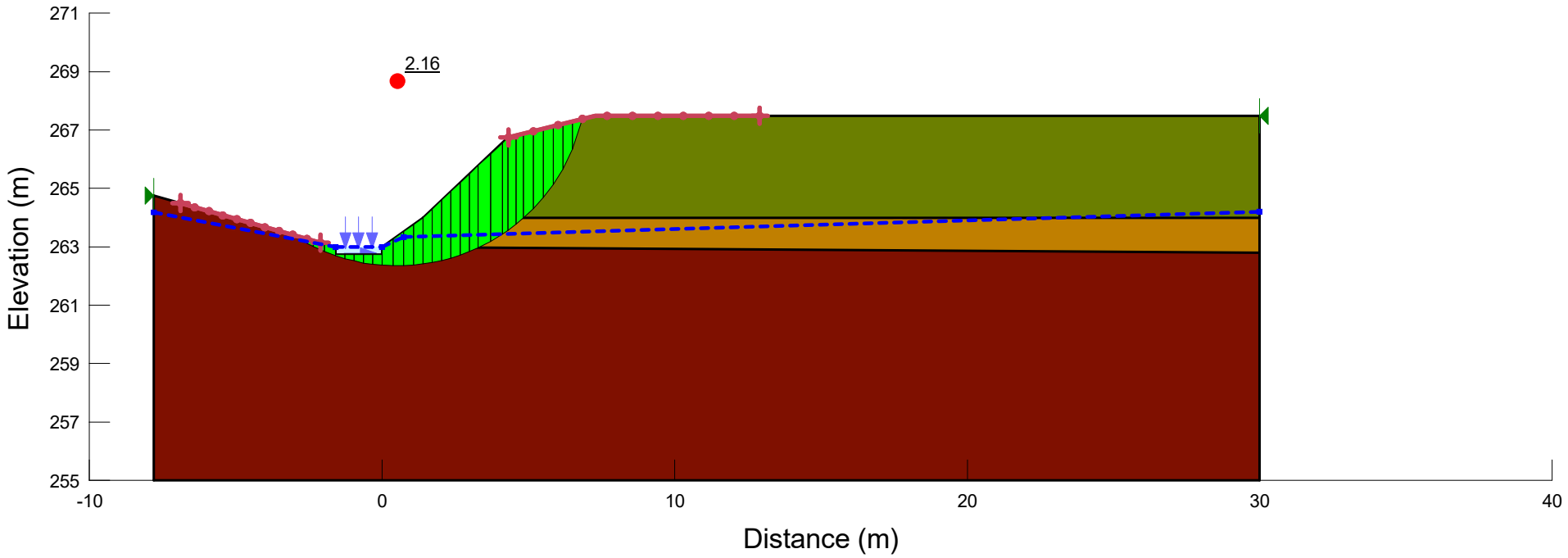
Cross Section E-E'

Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1
	Fill - Clayey Silt	17	2	26	1



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)	Piezometric Line
	Alluvial Clayey Silt	14	2	17	1
	Clayey Silt Till	22	15	32	1
	Fill - Clayey Silt	17	2	26	1

Cross Section E-E'



Appendix B

– Slope Rating Charts

Slope Stability Rating Chart, A-A

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Site Location: Bostwick Corridor Study	**Project No.: LON-0015313-GE**
Town/City: London, Ontario	**Inspection Date: November 24, 2021**
	Weather: Overcast, 5 C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	
degrees or more (steeper than 2H:1V)	16	**16**
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	
clay, silt	12	**12**
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	**0**
near mid-slope only	6	
near crest only, or from several levels	12	
Slope Height		
2 m or less	0	
2.1 to 5 m	2	**2**
5.1 to 10 m	4	
more than 10 m	8	
Vegetation Cover on Slope Face		
well vegetated: heavy shrubs or forested with mature trees	0	**0**
light vegetation: grass, weeds, occasional trees, shrubs	4	
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**2**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	
Less than 15 m from slope toe	6	**6**
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**38**

Low Potential	< 24	Site Inspection only, confirmation, report letter
Slight Potential	25-35	Site Inspection and surveying, preliminary study, detailed report
Moderate Potential	> 35	BH Investigation, piezometers, lab tests, surveying, detailed report

Notes:
Is there is a water body (stream, creek, river, pond, bay, lake) at the toe of slope? No
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart, B-B

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Site Location: Bostwick Corridor Study	**Project No.: LON-0015313-GE**
Town/City: London, Ontario	**Inspection Date: November 24, 2021**
	Weather: Overcast, 5 C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	
degrees or more (steeper than 2H:1V)	16	**16**
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	
clay, silt	12	**12**
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	**0**
near mid-slope only	6	
near crest only, or from several levels	12	
Slope Height		
2 m or less	0	
2.1 to 5 m	2	**2**
5.1 to 10 m	4	
more than 10 m	8	
Vegetation Cover on Slope Face		
well vegetated: heavy shrubs or forested with mature trees	0	**0**
light vegetation: grass, weeds, occasional trees, shrubs	4	
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**2**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	
Less than 15 m from slope toe	6	**6**
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**38**

Low Potential	< 24	Site Inspection only, confirmation, report letter
Slight Potential	25-35	Site Inspection and surveying, preliminary study, detailed report
Moderate Potential	> 35	BH Investigation, piezometers, lab tests, surveying, detailed report

Notes:
Is there is a water body (stream, creek, river, pond, bay, lake) at the toe of slope? No
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart, C-C

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Site Location: Bostwick Corridor Study	**Project No.: LON-0015313-GE**
Town/City: London, Ontario	**Inspection Date: November 24, 2021**
	Weather: Overcast, 5 C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	
degrees or more (steeper than 2H:1V)	16	**16**
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	
clay, silt	12	**12**
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	**0**
near mid-slope only	6	
near crest only, or from several levels	12	
Slope Height		
2 m or less	0	
2.1 to 5 m	2	**2**
5.1 to 10 m	4	
more than 10 m	8	
Vegetation Cover on Slope Face		
well vegetated: heavy shrubs or forested with mature trees	0	**0**
light vegetation: grass, weeds, occasional trees, shrubs	4	
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**2**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	
Less than 15 m from slope toe	6	**6**
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**38**

Low Potential	< 24	Site Inspection only, confirmation, report letter
Slight Potential	25-35	Site Inspection and surveying, preliminary study, detailed report
Moderate Potential	> 35	BH Investigation, piezometers, lab tests, surveying, detailed report

Notes:
Is there is a water body (stream, creek, river, pond, bay, lake) at the toe of slope? No
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart, D-D

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Site Location: Bostwick Corridor Study	**Project No.: LON-0015313-GE**
Town/City: London, Ontario	**Inspection Date: November 24, 2021**
	Weather: Overcast, 5 C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	
degrees or more (steeper than 2H:1V)	16	**16**
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	
clay, silt	12	**12**
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	**0**
near mid-slope only	6	
near crest only, or from several levels	12	
Slope Height		
2 m or less	0	
2.1 to 5 m	2	**2**
5.1 to 10 m	4	
more than 10 m	8	
Vegetation Cover on Slope Face		
well vegetated: heavy shrubs or forested with mature trees	0	**0**
light vegetation: grass, weeds, occasional trees, shrubs	4	
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**2**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	
Less than 15 m from slope toe	6	**6**
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**38**

Low Potential	< 24	Site Inspection only, confirmation, report letter
Slight Potential	25-35	Site Inspection and surveying, preliminary study, detailed report
Moderate Potential	> 35	BH Investigation, piezometers, lab tests, surveying, detailed report

Notes:
Is there is a water body (stream, creek, river, pond, bay, lake) at the toe of slope? No
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart, E-E

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Site Location: Bostwick Corridor Study	**Project No.: LON-0015313-GE**
Town/City: London, Ontario	**Inspection Date: November 24, 2021**
	Weather: Overcast, 5 C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	
degrees or more (steeper than 2H:1V)	16	**16**
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	
clay, silt	12	**12**
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	**0**
near mid-slope only	6	
near crest only, or from several levels	12	
Slope Height		
2 m or less	0	
2.1 to 5 m	2	**2**
5.1 to 10 m	4	
more than 10 m	8	
Vegetation Cover on Slope Face		
well vegetated: heavy shrubs or forested with mature trees	0	**0**
light vegetation: grass, weeds, occasional trees, shrubs	4	
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**2**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	
Less than 15 m from slope toe	6	**6**
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**38**

Low Potential	< 24	Site Inspection only, confirmation, report letter
Slight Potential	25-35	Site Inspection and surveying, preliminary study, detailed report
Moderate Potential	> 35	BH Investigation, piezometers, lab tests, surveying, detailed report

Notes:
Is there is a water body (stream, creek, river, pond, bay, lake) at the toe of slope? No
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Appendix C

– Limitations and Use of Report

LIMITATIONS AND USE OF REPORT

BASIS OF REPORT

This report ("Report") is based on site conditions known or inferred by the geotechnical investigation undertaken as of the date of the Report. Should changes occur which potentially impact the geotechnical condition of the site, or if construction is implemented more than one year following the date of the Report, the recommendations of EXP may require re-evaluation.

The Report is provided solely for the guidance of design engineers and on the assumption that the design will be in accordance with applicable codes and standards. Any changes in the design features which potentially impact the geotechnical analyses or issues concerning the geotechnical aspects of applicable codes and standards will necessitate a review of the design by EXP. Additional field work and reporting may also be required.

Where applicable, recommended field services are the minimum necessary to ascertain that construction is being carried out in general conformity with building code guidelines, generally accepted practices and EXP's recommendations. Any reduction in the level of services recommended will result in EXP providing qualified opinions regarding the adequacy of the work. EXP can assist design professionals or contractors retained by the Client to review applicable plans, drawings, and specifications as they relate to the Report or to conduct field reviews during construction.

Contractors contemplating work on the site are responsible for conducting an independent investigation and interpretation of the borehole results contained in the Report. The number of boreholes necessary to determine the localized underground conditions as they impact construction costs, techniques, sequencing, equipment and scheduling may be greater than those carried out for the purpose of the Report.

Classification and identification of soils, rocks, geological units, contaminant materials, building envelopment assessments, and engineering estimates are based on investigations performed in accordance with the standard of care set out below and require the exercise of judgment. As a result, even comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations or building envelope descriptions involve an inherent risk that some conditions will not be detected. All documents or records summarizing investigations are based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated. Some conditions are subject to change over time. The Report presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, these should be disclosed to EXP to allow for additional or special investigations to be undertaken not otherwise within the scope of investigation conducted for the purpose of the Report.

RELIANCE ON INFORMATION PROVIDED

The evaluation and conclusions contained in the Report are based on conditions in evidence at the time of site inspections and information provided to EXP by the Client and others. The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose as communicated by the Client. EXP has relied in good faith upon such representations, information and instructions and accepts no responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of any misstatements, omissions, misrepresentation or fraudulent acts of persons providing information. Unless specifically stated otherwise, the applicability and reliability of the findings, recommendations, suggestions or opinions expressed in the Report are only valid to the extent that there has been no material alteration to or variation from any of the information provided to EXP.

STANDARD OF CARE

The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances and locale. No other warranty, expressed or implied, is made. Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment form part of the Report. This material includes, but is not limited to, the terms of reference given to EXP by its client ("Client"), communications between EXP and the Client, other reports, proposals or documents prepared by EXP for the Client in connection with the site described in the Report. In order to properly understand the suggestions, recommendations and opinions expressed in the Report, reference must be made to the Report in its entirety. EXP is not responsible for use by any party of portions of the Report.

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