Springer Pond

Springer Pond Development Inc.

Slope Stability Assessment

Project Name
Slope Stability Assessment – 45 Springer Street
Komoka, ON

Project Number
LON-00016454-GE

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5
Canada

Date Submitted:
October 17, 2018
Updated April 9, 2019
Updated August 27, 2020

45 Springer Street

Springer Pond Development Inc.

Type of Document:
Slope Stability Assessment

Project Name:
Slope Stability Assessment
45 Springer Street
Komoka, ON

Project Number:
LON-00016454-GE

Prepared By:
EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5
Canada
T: +519.963.3000
F: +519.963.1152
www.exp.com

Mark Bertens, E.I.T.
Geotechnical Services

Adeeb Sadoun, M.Sc., P. Eng.
Senior Engineer, Geotechnical Services

Date Submitted:
October 17, 2018
Updated April 9, 2019
Updated August 27, 2020

Legal Notification

This report was prepared by EXP Services Inc. for the exclusive use of **Springer Pond Development Inc.** and may not be reproduced in whole or in part or used or relied upon in whole or in part by any party other than **Springer Pond Development Inc.** for any purpose whatsoever without the express permission of **Springer Pond Development Inc.** in writing.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this project.

Table of Contents

1.0 Introduction

1.1 Introduction

As requested, EXP Services Inc. (EXP) has conducted a slope stability assessment in conjunction with the proposed residential developments at 45 Springer Street in Komoka, Ontario. It is understood that the residential development will consist of 8 lots within Block 1 located on the southwest side of the pond. It is understood that each lot will consist of a single-family residence. This report summarizes the results of the assessment and provides geotechnical comments and recommendations with regards to the slope stability assessment.

The Upper Thames River Conservation Authority (UTRCA) requested to adhere to guidelines of Section 3.2.1 of the Provincial Policy Statement (2014). As a result, consent from the Conservation Authority is required prior to establishing the limits of the potential lots.

1.2 Terms of Reference

Authorization to proceed with this investigation was received from Mr. Bryan Snyder on July 23, 2018.

The purpose of the assessment was to determine the Recommended Development Setback Limit, in accordance with the Ministry of Natural Resources Technical Guide – River & Streams Systems: Erosion Hazard Limit and the UTRCA guidelines.

Based on a reconnaissance site visit on August 10th, 2018, borehole drilling on November 7th, 2016 and test pits advanced by Golder Associates Ltd. On April 24th, 1998, this report provides geotechnical comments and recommendations on slope stability, backfilling of lots, sediment and erosion controls and lot drainage.

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.

2.0 Methodology

2.1 Site Reconnaissance

Site reconnaissance was conducted on August 10th, 2018 to examine the condition of the slope on the southwest side of Springer Pond (Block 1). Also, on August 10th, 2018, the slope profile was surveyed by AGM Engineering (AGM) at four (4) locations along Block 1, selected by EXP. The slope was reviewed using the 'Slope Stability Rating Chart' (created by MNR), which summarizes the site observations and empirically scores various elements of the slope profile which contribute to slope stability, to provide an assessment of the potential for slope instabilities at the site. A rating chart was completed at three locations (indicated as Cross Section A-A', B-B' and D-D' on **Drawing 1**) along the existing slope of Block 1 at the Site. Rating charts for the cross sections examined are provided for review and consideration.

2.2 Field Work

In addition to the site reconnaissance, four (4) monitoring wells were advanced on the property on November 7th, 2016 as part of a Hydrogeological Assessment completed by EXP to provide information on the soil stratigraphy and water table elevation. Two of these wells (BH101/MW & BH102/MW) are located on the southwest side of the pond in the general area where the slope assessment was conducted. Data from these two wells was used in the analysis. Seven (7) test pits were advanced by Golder Associates Ltd. on April 24, 1998 along the southwest side of the pond. AGM surveyed four lines extending perpendicular to the slope within Block 1 to create profiles of the slope.

The stability of each representative slope section was analyzed by computer methods utilizing the Slope/W computer program for the slope profiles. Soil strength parameters used in the analyses were obtained from typical values in literature sources and from the monitoring wells and test pits. Groundwater table elevations measured in monitoring wells (BH101/MW and BH102/MW) were also used in the analysis. The monitoring well elevations were also surveyed by AGM on August 10th, 2018 and previously measured groundwater elevations were calculated based on the provided surveyed elevations.

2.2 Review of Topographic Data

Topographic mapping provided by AGM Engineering Ltd. was utilized to create the cross sections used in establishing the location of the Erosion Hazard Limit. EXP selected four locations to be surveyed by AGM, these four locations were selected to represent the worst-case scenarios of the existing slope on Site. The slope was surveyed above and below the surface of the pond to create a full profile of the slope.

3.0 Site and Subsurface Conditions

3.1 Site Description

The Site is located in Komoka, Ontario, northeast of Springer Street and is bound by Glendon Drive on the southeast, Queen Street on the northeast and residences on the northwest. The site contains a human-made pond that occupies a majority of the Site and is approximately in the centre of the Site. The Pond originated from aggregate mining operations that previously took place on the Site.

The slope on Site being assessed is located in Block 1 of the Site. Block 1 is located on the southwest side of the pond along Springer Street (**Drawing 1**). There are eight (8) residential lots proposed for Block 1, all backing onto the pond. A two-storey residence exists to the south of Block 1. The lots are generally level leading up to the top of slope, grass covered, with occasional trees and bushes. The slope is well vegetated with shrubs and occasional trees.

It is understood that all the lots will be extended to be the same length by backfilling the pond.

3.2 Soil Stratigraphy

The detailed stratigraphy encountered in the test holes is shown in the monitoring well and test pit logs found in Appendix A and summarized in the following paragraphs. It must be noted that boundaries of soil indicated in the borehole logs are inferred from non-continuous sampling and observations during drilling and excavation. These boundaries are intended to reflect transition zones for the purposes of geotechnical design and should not be interpreted as exact planes of geological change.

3.2.1 Topsoil

A 15 mm thick layer of topsoil was observed in both BH101/MW and BH102/MW. No topsoil was recorded at any of the test pit locations.

3.2.2 Fill

Underlying the topsoil in both boreholes and surfacing all of the test pits was a layer of fill. The fill was generally described as sand or silty sand was brown and grey or black in colour, contained trace to some silt, trace to some gravel, trace to some topsoil and occasional construction debris. The fill was generally in a very loose to compact state (based on monitoring well SPT N-values in the range of 0 to 15 blows per 300 mm penetration of the split-spoon sampler). *In situ* moisture contents of the monitoring well samples of the fill were between 9 and 20 percent, indicative of moist to wet conditions. The fill extended to a depth ranging from 0.8 to 4.3 m and BH101/MW was terminated in the fill.

3.2.3 Natural Soils

Underlying the fill in all boreholes and test pits (except BH101, which was terminated in fill) was natural soils. The natural soils generally consisted of sand/silty sand/sandy silt and Sand and gravel. The sand was generally described as having some silt to being silty, trace gravel, and containing some black organic sediment. The silty sand was described as containing trace gravel and trace to some organic sediment. The sand and gravel was described as brown/grey and generally contained occasional cobbles and boulders. The

natural material was generally in a loose to compact state. The natural soils were described as being in a moist to wet condition.

3.3 Groundwater Conditions

Details of the groundwater conditions measured within the monitoring wells are provided in the Table below. Measurement of the water level and moisture contents of selected samples are also recorded on the attached Borehole Logs.

The groundwater table is considered as an unconfined system within granular deposits. The groundwater elevation of the pond was surveyed on August 10th, 2018 by AGM and was 239.1 masl.

Table 1: Groundwater Elevation Measurements

Well ID	Ground Surface Elevation (m AMSL)	Groundwater Elevation (m AMSL)						
		4-Apr-17	29-May-17	8-Aug-17	25-Jan-18	17-Apr-18	10-Aug-18	22-Mar-19
BH101/MW	241.0	238.7	238.9	238.7	238.6	239.7	238.9	239.3
BH102/MW	240.4	238.2	238.6	238.2	238.1	239.2	238.6	238.9
BH103/MW	243.6	238.2	238.6	238.2	238.1	238.7	---	238.8
BH104/MW	243.0	238.6	239.0	238.7	238.5	239.1	---	239.0
Pond Water Surface	---	---	---	---	---	---	239.1	

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. Moderate variation in elevation can be expected due to the high permeability of the unconfined aquifer over low permeability soils. Capillary rise effects should also be anticipated in fine-grained soil deposits.

4.0 Slope Stability

It is understood that the pond along the lots will be backfilled to extend the length of all the lots 5 to 17m. The slope stability analyses were completed for two scenarios; the existing condition and the proposed backfilled lots. Computer analysis using Slope/W was performed on four cross sections (A-A' to D-D') to determine the stable slope. After Stable slope was determined Erosion Hazard Limit was determined for each section.

4.1 Slope Geometry

The stability of the existing slope was investigated for a number of different Factors of Safety (FOS). The various types of failures resulting include shallow slumping failures, moderate 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 for select slope profiles.

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:

Soil Type	Density (kN/m^3)	Cohesion (kPa)	Angle of Internal Friction (°)
Fill	17	0	26
Sand/sandy silt	18	0	30
Sand and Gravel	19	0	31
Granular Fill	21	0	31

Groundwater level measurement from April 17, 2018 in BH101/MW was used in a majority of the analyses (elevation of 239.7 masl). Additional analyses were completed for groundwater/surface water at an elevation of 240.0 m for additional safety.

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

In order to determine an appropriate Erosion Hazard Limit setback from the crest of the slope, a minimum factor of safety of 1.4 was used during the computerized stable slope

analysis. The previous 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.

Four cross sections were assessed, they are labelled Cross Section A-A' through Cross Section D-D'. The four cross section locations are shown on **Drawing 1** and the profiles provided on **Drawing 4** through **Drawing 7**. The sections evaluated were selected to represent the worst-case-scenario of each section of the slope. The slope angles throughout the profiles gradually become shallower towards the toe of slope. The toe of slope at these cross sections is defined as the point of transition to an inclination of 4H:1V or shallower.

4.2 Existing Slope Assessment

After completing the computerized stable slope analysis on each cross section, the calculated factor of safety (FOS) under the existing conditions for shallow failure was 1.05 to 1.42 at. However, the FOS for overall moderate and deep rotational failure was between 1.45 and 2.38 which were above the recommended minimum FOS value of 1.4. The slope stability analyses, and corresponding failures can be found in Appendix C. Summarized results are provided in the following table:

Table 3 - Summary of Existing Slope Stability Analyses

Cross-Section	Description of Failure Mode	Computed Factor of Safety
Slope Section, A-A':	Shallow Depth Failure	1.05
	Moderate Depth Failure	1.45
	Rotational Failure	1.97
Slope Section, B-B':	Shallow Depth Failure	1.09
	Moderate Depth Failure	1.51
	Rotational Failure	2.19
Slope Section, C-C':	Shallow Depth Failure	1.07
	Moderate Depth Failure	1.52
	Rotational Failure	2.01
Slope Section, D-D':	Shallow Depth Failure	1.42
	Moderate Depth Failure	1.72
	Rotational Failure	2.38

Due to the presence of many mature trees with deep established root systems, and an abundance of other vegetation situated on the slope, shallow failures should not be

anticipated along the existing slope. The overall slope stability should be considered for a rotational failure mode. The FOS for all sections are above the desirable factor of 1.40.

The computed results suggest that a 2.2H:1V slope is required in determining the stable slope setback. For the purposes of establishing an appropriate setback distance, the stable slope setback line should be drawn from the toe erosion allowance line to the top of the slope when the slope is steeper than 2.2H:1V. Stable slope setback distances for each cross section are listed in Table 4 below.

The soil conditions encountered in the boreholes comprise of fill materials and natural loose to compact sand, sand and gravel or silty sand. The stable slope geometry is defined by a line which extends upwards from the point of transition, at an inclination of approximately 2.2 horizontal to 1 vertical through the fill and natural sand, sand and gravel or silty sand soils.

4.2.1 Toe Erosion Component

Based on Site reconnaissance performed by EXP personnel, no evidence of slope movement or toe erosion is observed to have taken place above the surface of the pond. The human-made pond located at the toe of the slope is expected to induce minimal erosion along the slope due to the shallow nature of the pond and extensive vegetation coverage of the slope. A toe erosion allowance of 2 m was allotted along the entire slope to account for possible erosion at the toe of the slope.

4.2.2 Emergency Access Allowance

The Emergency Access Allowance as specified in Section 3.4 of the MNR Technical Guide is a distance of 6.0 m from the top of the slope. This allowance is required in order to provide access for repairs to the slope from the top of the slope. EXP recommends that a distance of 6 m for the erosion access allowance be provided on the table land. No permanent structures should be constructed within the erosion access allowance.

4.2.3 Erosion Hazard Limit

The erosion hazard limit (Recommended Development Limit Setback) is defined by the sum of the Stable Safe Slope Line plus the Toe Erosion Component plus the Erosion Access Allowance. The table below summarizes the components and the total distance back from the existing top of slope to the Recommended Development Limit Setback.

Table 4 - Summary of Existing Slope Erosion Hazard Limits

Cross Section	**Toe Erosion Allowance, m**	**Stable Slope Allowance, m**	**Emergency Access Allowance, m**	**Erosion Hazard Allowance, m** *(measured from toe of slope)*	**Erosion Hazard Allowance, m** *(measured from top of slope)*	**Applied Erosion Hazard Allowance, m** *(measured from top of slope)*
A-A’	2.0	3.9	6.0	11.9	9.4	9.5
B-B’	2.0	7.4	6.0	15.4	7.6	9.5
C-C’	2.0	6.4	6.0	14.4	8.6	9.5
D-D’	2.0	6.4	6.0	14.4	7.1	9.5

If the lots are not backfilled and extended, the setbacks above should be used. The Stable Slope Allowance and Erosions Hazard Limit is shown on **Drawing 4** through **Drawing 7**. An Erosion Hazard Limit of 9.5 m measured from the top of slope was applied to the entire slope for uniformity and additional safety (**Drawing 2**).

4.3 Backfilled Slope Stable Slope Geometry

The second scenario evaluated was backfilling of the pond along all the lots to extend each lot length. It is understood that Lots will be extended by 5 to 17 m and the backfill will be sloped at 3.0H:1V based on the drawings provided by SBM and dated March 9, 2020. It is understood that the top of the backfilled slope will be at an elevation of 241.0 m and the rear yards of the lots will be sloped towards the pond. It is probable that filling of the lots will consist of end dumping with minimal control of fill placement. The stable slope inclination of the fill will ultimately depend on the properties of the fill material used but a conservative value of 3.0H:1V was determined to be suitable for the backfilled material.

One cross section was assessed at Cross Section D-D using a computerized stable slope software (Slope/W) which is anticipated to reflect the worst case scenario. Results of the computer analysis are provided in the Table below. The minimum FOS was 1.65 for a shallow failure, which is above the recommended FOS of 1.4.

Table 5 - Summary of Backfilled Lot Slope Stability Analyses

Backfilled Slope Section, D-D':	Shallow Depth Failure	1.65
	Moderate Depth Failure	1.69
	Rotational Failure	2.10

The cross section locations are shown on **Drawing 6** and the profiles provided on **Drawing 7** to **Drawing 10** which show the proposed development setback for the backfilled lots. These slope sections were modified from the existing slopes surveyed based on the proposed grading for the development provided in the drawing from SBM.

4.3.1 Toe Erosion Component

Based on Site reconnaissance performed by EXP personnel, no evidence of slope movement or toe erosion is observed to have taken place above the surface of the pond. The human-made pond located at the toe of the slope is expected to induce minimal erosion along the slope due to the shallow nature of the pond and extensive vegetation coverage of the slope. A toe erosion allowance of 2 m was allotted along the entire slope to account for possible erosion at the toe of the slope.

4.3.2 Emergency Access Allowance

The Emergency Access Allowance as specified in Section 3.4 of the MNR Technical Guide is a distance of 6.0 m from the top of the slope. This allowance is required in order to provide access for repairs to the slope from the top of the slope. EXP recommends that a distance of 6 m for the erosion access allowance be provided on the table land. No permanent structures should be constructed within the erosion access allowance.

4.3.3 Backfilled Lots Erosion Hazard Limit

The erosion hazard limit (Recommended Development Limit Setback) is defined by the sum of the Stable Safe Slope Line plus the Toe Erosion Component plus the Erosion Access Allowance. The table below summarizes the components and the total distance back from the existing top of slope to the Recommended Development Limit Setback for the backfilled lots.

Table 6 - Summary of Backfilled Lots Erosion Hazard Limits

Cross Section	**Toe Erosion Allowance, m**	**Stable Slope Allowance, m**	**Emergency Access Allowance, m**	**Erosion Hazard Allowance, m** *(measured from toe of slope)*	**Erosion Hazard Allowance, m** *(measured from top of slope)*
A-A’	2.0	9.0	6.0	17.0	8.0
B-B’	2.0	12.5	6.0	20.5	8.0
C-C’	2.0	14.6	6.0	22.6	8.0
D-D’	2.0	13.0	6.0	21.0	8.0

The Stable Slope Allowance and Erosions Hazard Limit for the extended lots is shown on **Drawing 7**. An Erosion Hazard Limit of 8.0 m measured from the top of slope was applied to the entire slope.

4.3.4 Backfill Considerations

It is recommended Granular “B” material be used to backfill the lots. The fill material should be benched into the existing slope where possible. Below the water surface of the pond, it is recommended to occasionally ‘notch’ the existing slope to interlock the new fill material with the existing soils. After backfilling the lots, the slopes should be revegetated. End dumping placement of the fill will induce uncontrolled long-term consolidation of the fill. No buildings should be founded on top of the backfilled lots unless founded on a properly design foundation.

It is understood that the rear yards will be slope towards the pond and that surface water will likely drain over the backfilled slope. It is recommended that the runoff be collected and discharged over the slope via an engineered drainage chute.

5.0 Additional Comments

The site should be graded such that surface water is directed away from the slope, where possible. If surface water is to be directed towards the slope, the water should be collected and discharged over the slope in an engineered drainage chute or drainage pipe.

Water from downspouts and perimeter weeping tile etc. should be collected in a controlled manner and directed away from the slope or collected and transported into the pond via a closed tile or engineered drainage chute. The tile should be outletted deep into the pond and not located near the slope.

Spoils from any excavation should be removed from the site. Excavated soils should not be placed over the table land near the crest of slope, unless the soil is placed as engineered structural fill.

During construction, stockpiles of materials, supplies and construction debris should be located away from the slope crest. Additional loading from stockpiled materials should be avoided in proximity to the slope crest.

The backfilled slope should be vegetated to with trees and shrubbery to improve long term stability.

Debris littering the slope should be removed and vegetation on the slope should be maintained.

Any bare spot or cracks observed at the slope should be revegetated.

A regular maintenance program should be implemented such as tree preservation, grading, and drainage control.

Sediment and erosion control plan should be applied to maintain the existing stability and avoid erosion of the slope in the future.

6.0 General Comments

The comments given in this report are intended only for the guidance of design engineers; and should be read in conjunction with the complete package of design documents, when used during construction.

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.

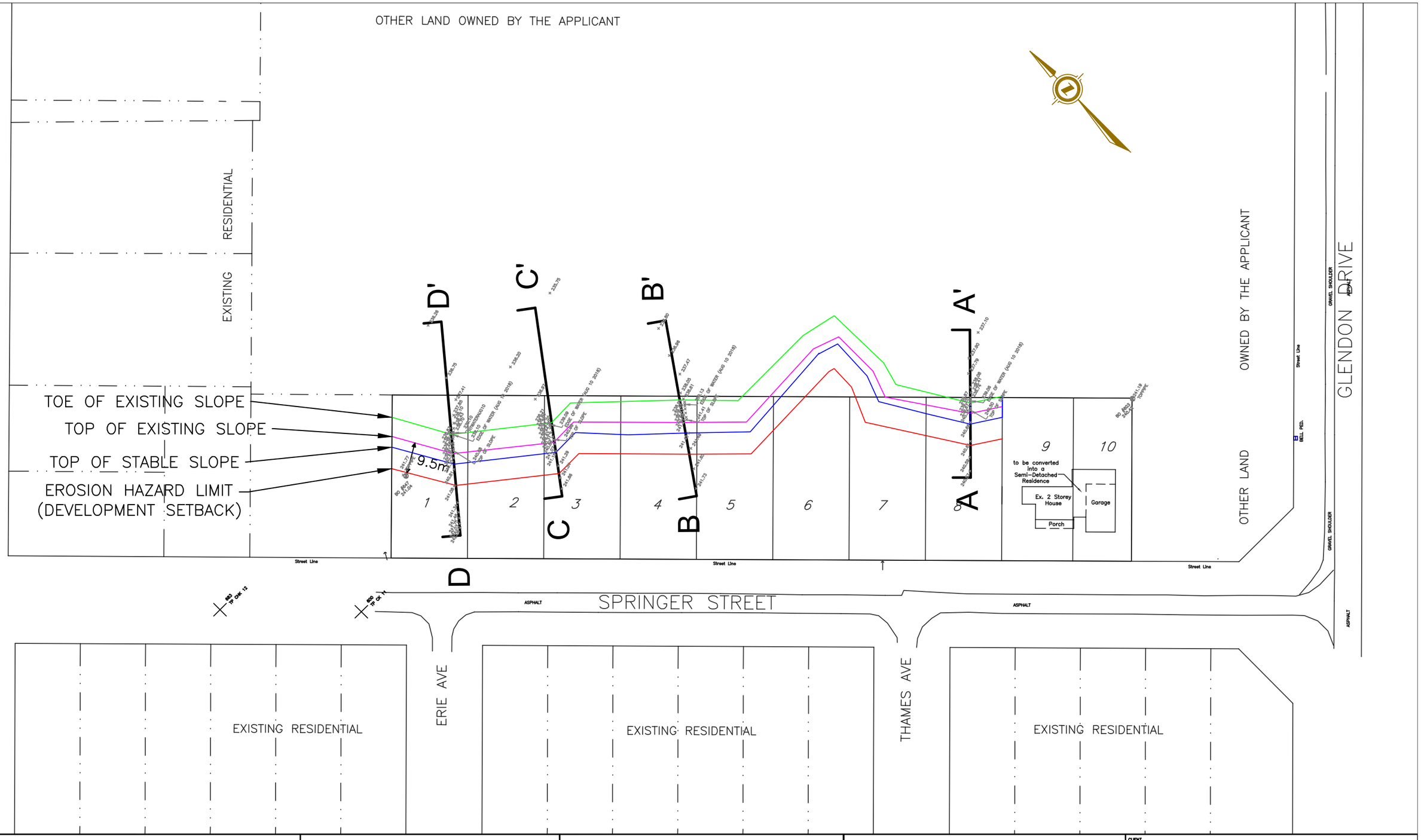
EXP Services Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not afforded the privilege of making this review, EXP Services Inc. will assume no responsibility for interpretation of the recommendations in this report. In the event that variations in soil or groundwater conditions are encountered onsite, it is recommended that EXP be contacted to review the findings and confirm the suitability of recommendations provided in this report.

We trust that this report is satisfactory to your present requirements and we look forward to assisting you in the completion of this project. Should you have any questions, please contact the office at your convenience.

All the foregoing and attachments respectfully submitted,

EXP Services Inc.

Drawings



-LEGEND-

D D' Cross Section Location

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Assessment Report LON-00016454-GE.

Slope Stability Assessment

Springer Pond Development

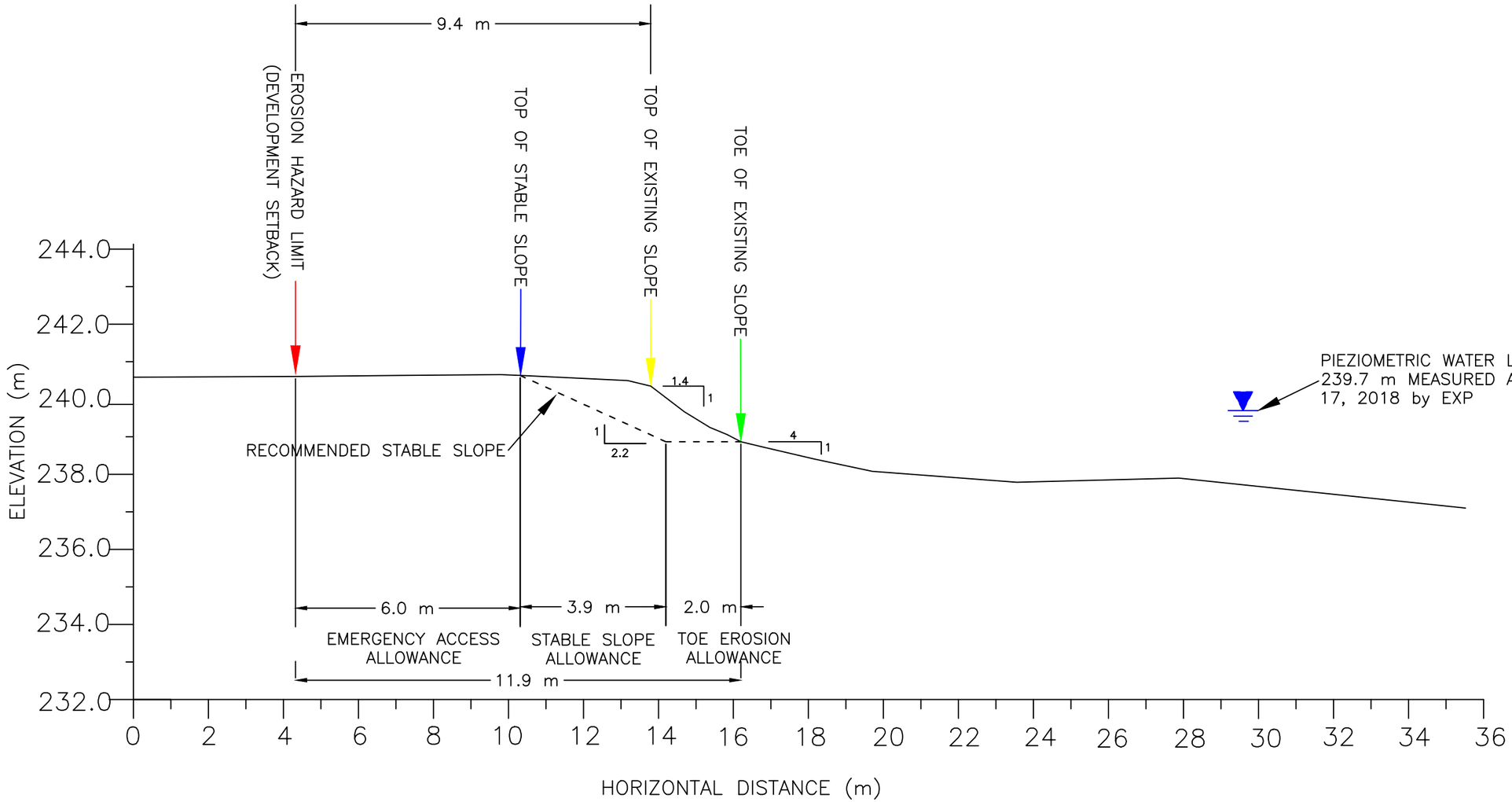
45 Springer Street, Komoka, Ontario

CLIENT	Springer Pond Development Inc.
TITLE	Existing Slope Development Setback
Prepared By: M.B.	Reviewed By: I.S.

EXP Services Inc.
15701 Robin's Hill Road, London, ON, N5V 0A5

DATE	SCALE	PROJECT NO.	DWG.
SEPTEMBER 2018	1:1000	LON-00016454-GE	1

Existing Slope Cross Section A - A'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	3.9	6.0	11.9	9.4

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.
2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

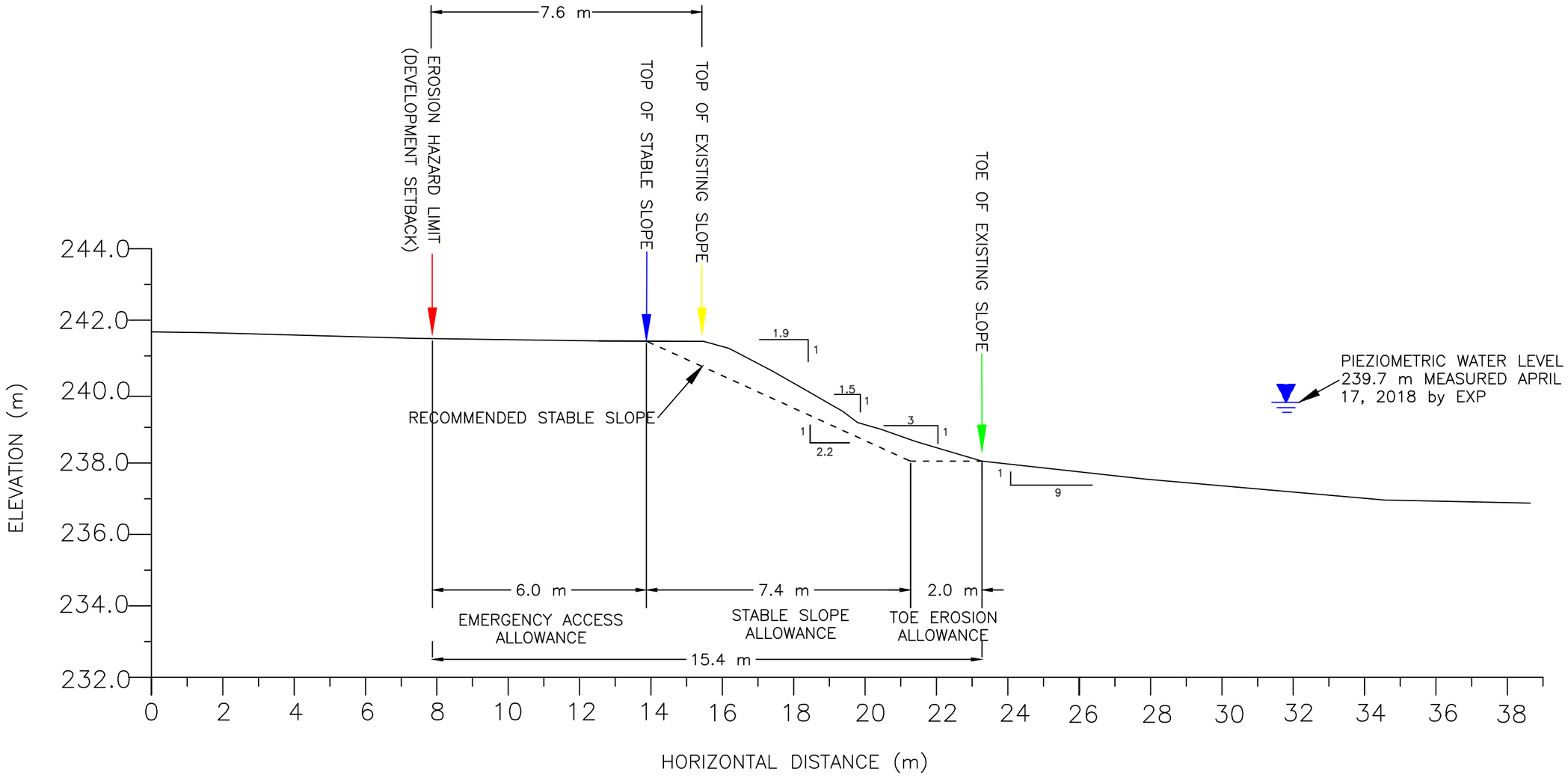
TITLE: Existing Slope Cross Section A - A'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	I.S.	SEPTEMBER 2018

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	2

Existing Slope Cross Section B - B'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	7.4	6.0	15.4	7.6

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.

2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

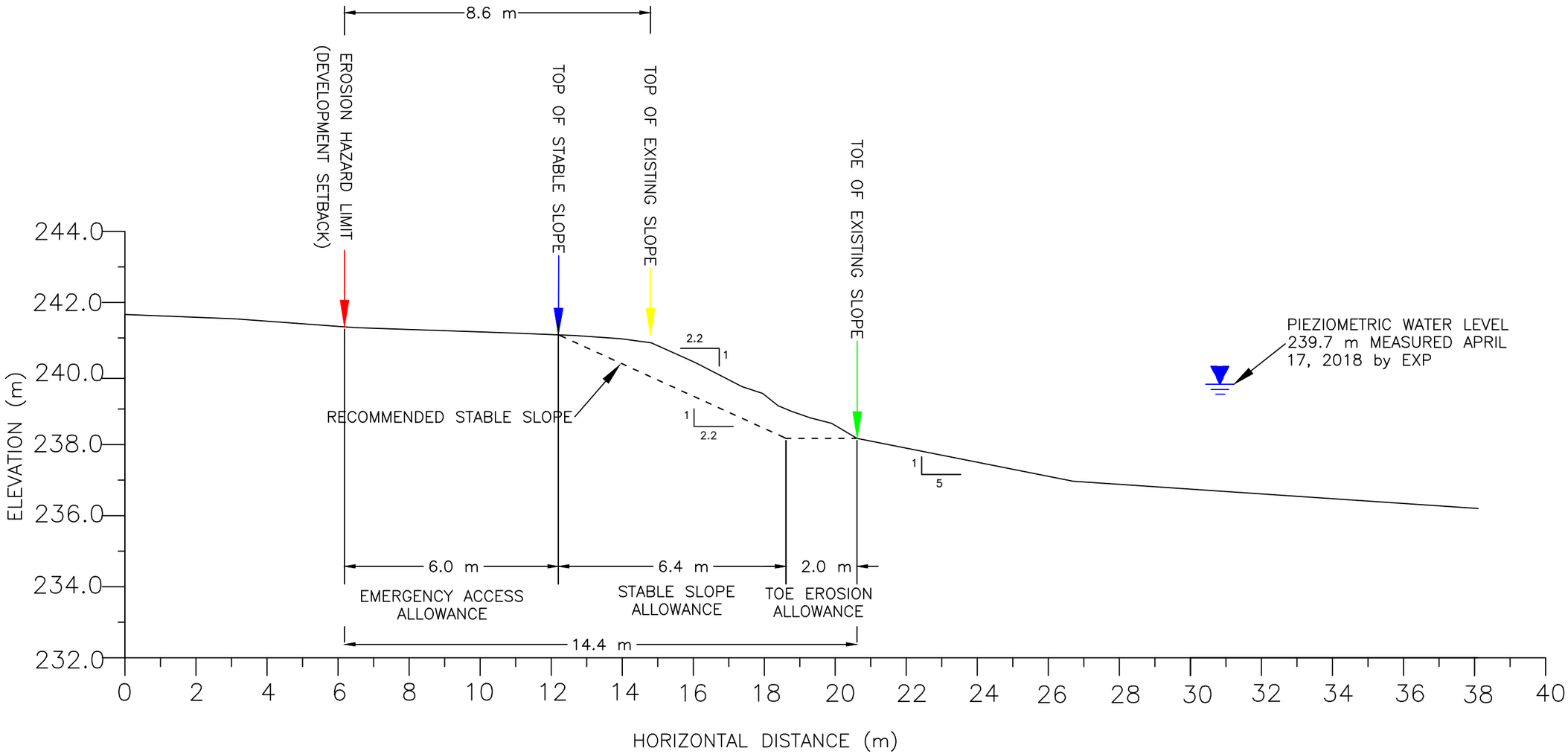
TITLE: Existing Slope Cross Section B - B'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	I.S.	SEPTEMBER 2018

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	3

Existing Slope Cross Section C - C'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	6.4	6.0	14.4	8.6

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.

2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

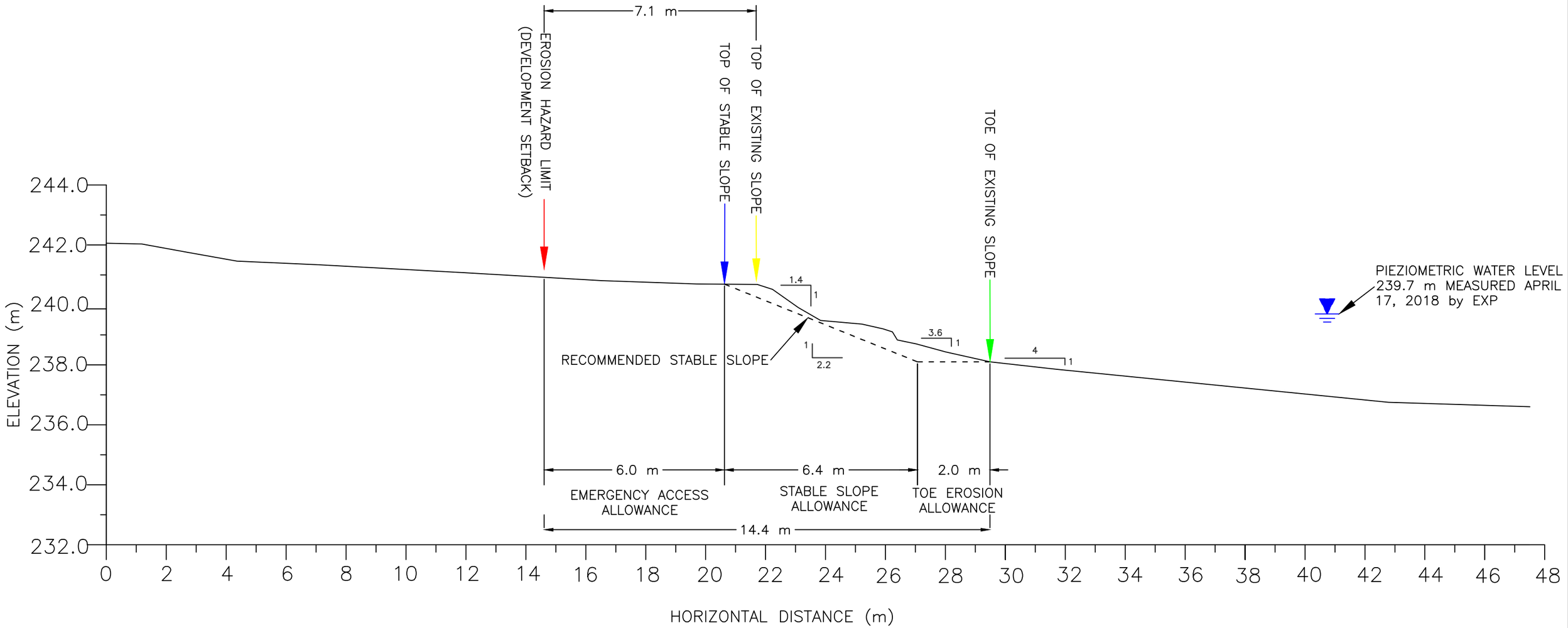
TITLE: Existing Slope Cross Section C - C'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	I.S.	SEPTEMBER 2018

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	4

Existing Slope Cross Section D - D'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	6.4	6.0	14.4	7.1

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.
2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

TITLE: Existing Slope Cross Section D - D'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	I.S.	SEPTEMBER 2018

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	5

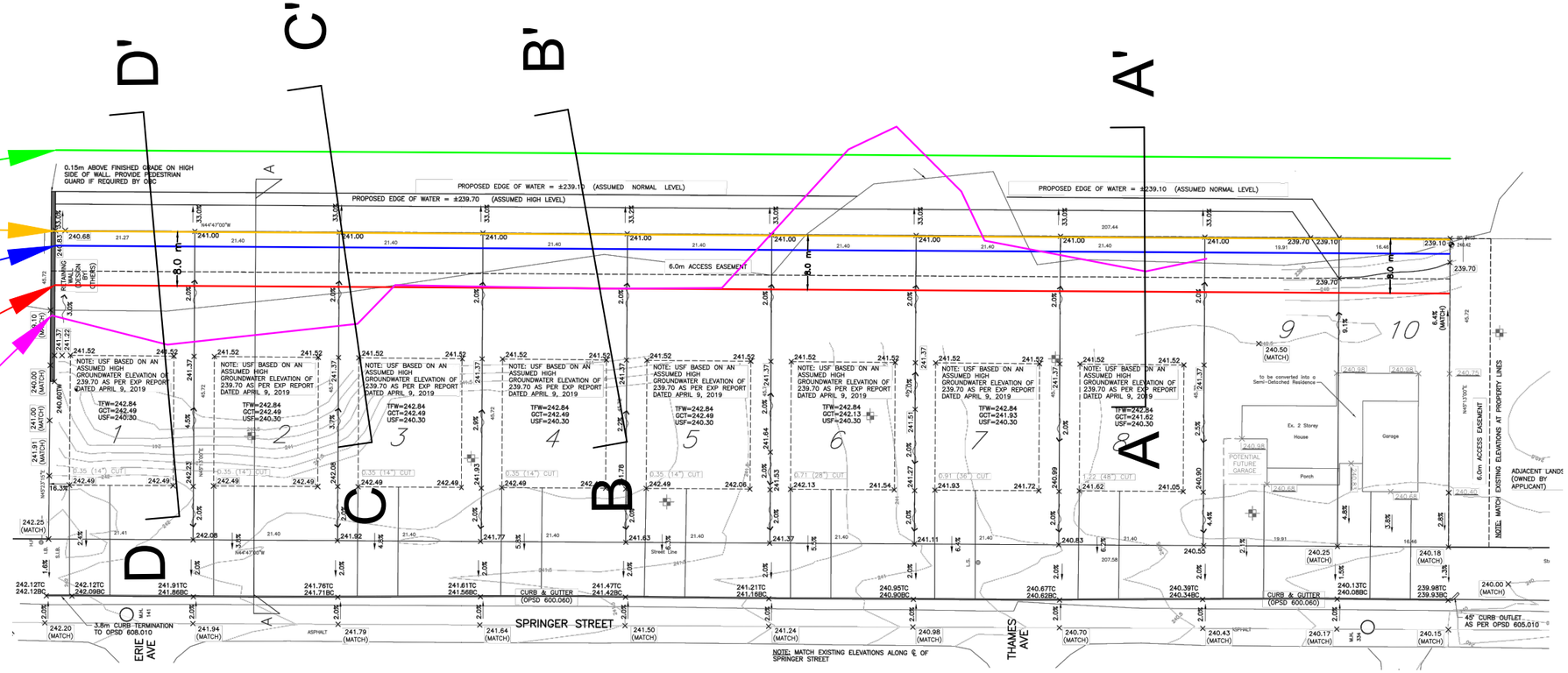
APPROXIMATE PROPOSED TOE OF BACKFILLED SLOPE

PROPOSED TOP OF BACKFILLED SLOPE

TOP OF STABLE SLOPE

EROSION HAZARD LIMIT (DEVELOPMENT SETBACK)

APPROXIMATE EXISTING TOP OF SLOPE



-LEGEND-

D ___ D' Cross Section Location

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Assessment Report LON-00016454-GE.
2. The drawing was modified from a drawing provided by SBM dated March 9, 2020.

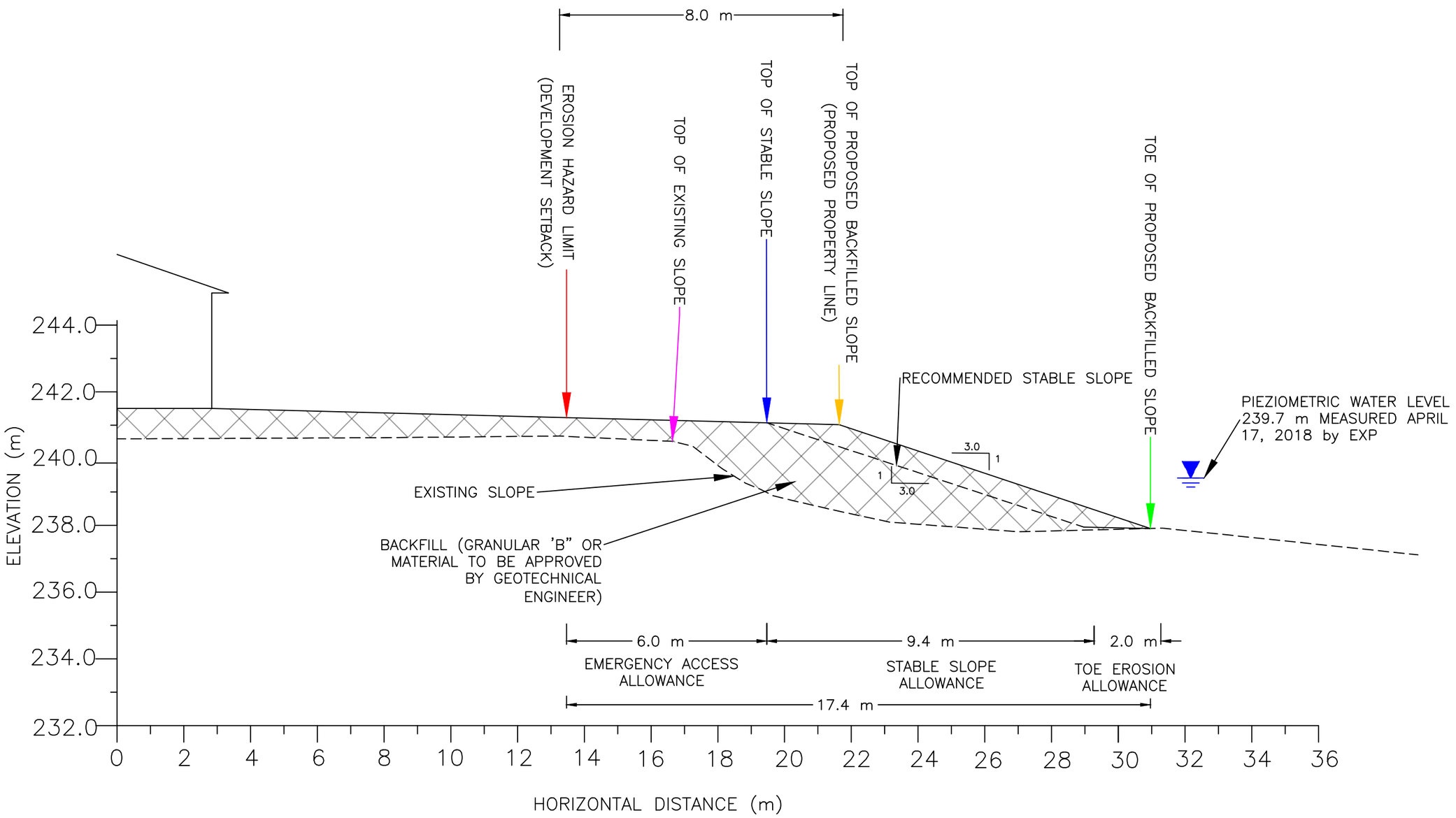
Slope Stability Assessment

Springer Pond Development

45 Springer Street, Komoka, Ontario

CLIENT	Springer Pond Development Inc.
TITLE	Cross Section Location Plan
Prepared By: M.B.	Reviewed By: A.S.
	EXP Services Inc. 15701 Robin's Hill Road, London, ON, N5V 0A5
DATE: AUGUST 2020	SCALE: NTS
PROJECT NO.: LON-00016454-GE	DWG.: 6

Proposed Backfilled Lot Cross Section A - A'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	9.0	6.0	17.0	8.0

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.
2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

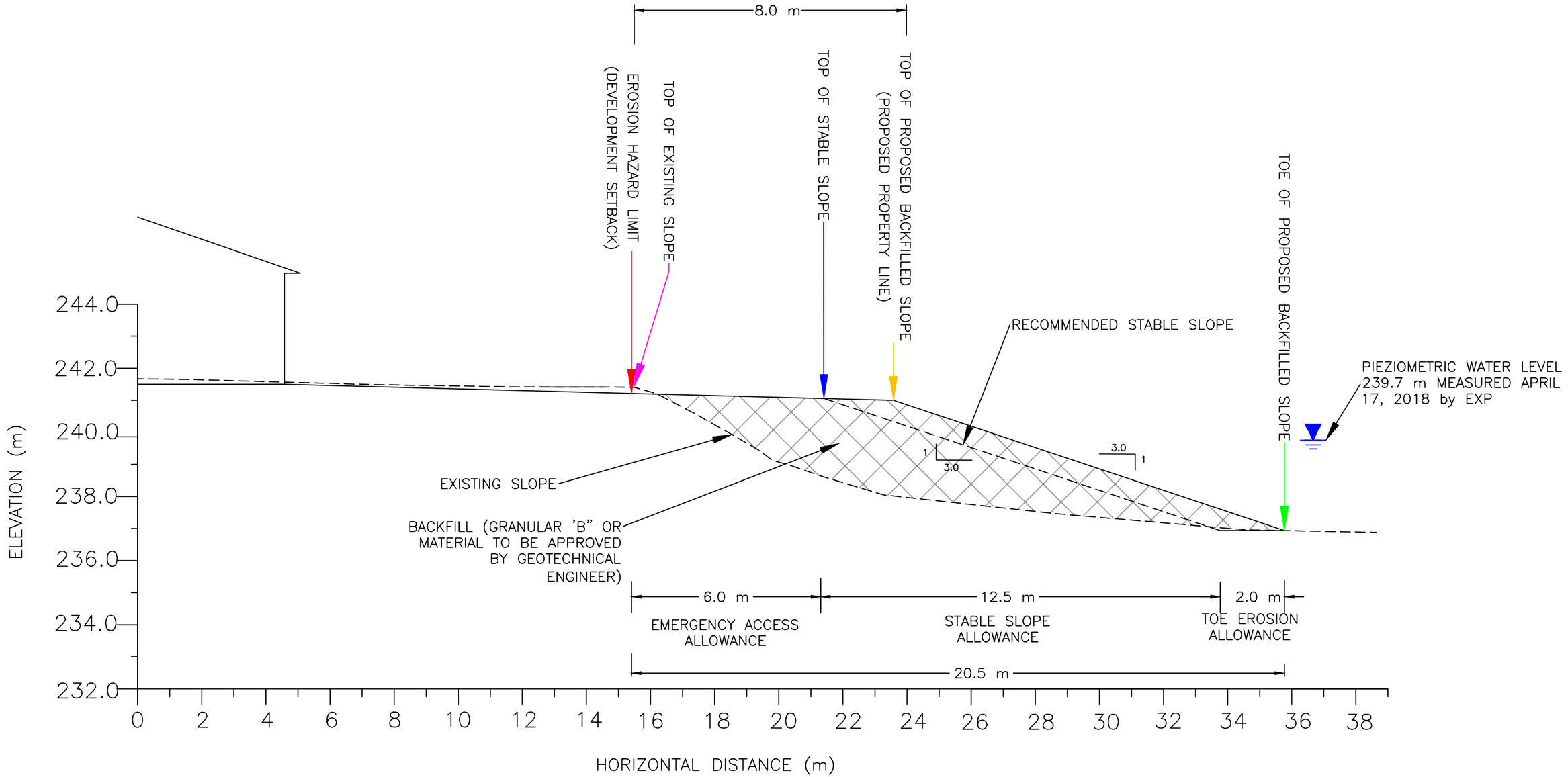
TITLE: Proposed Backfilled Lot Cross Section A-A'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	A.S.	AUGUST 2020

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	7

Proposed Backfilled Lot Cross Section B - B'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	12.5	6.0	20.5	8.0

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.

2. Refer to Drawing 1 for cross section location.

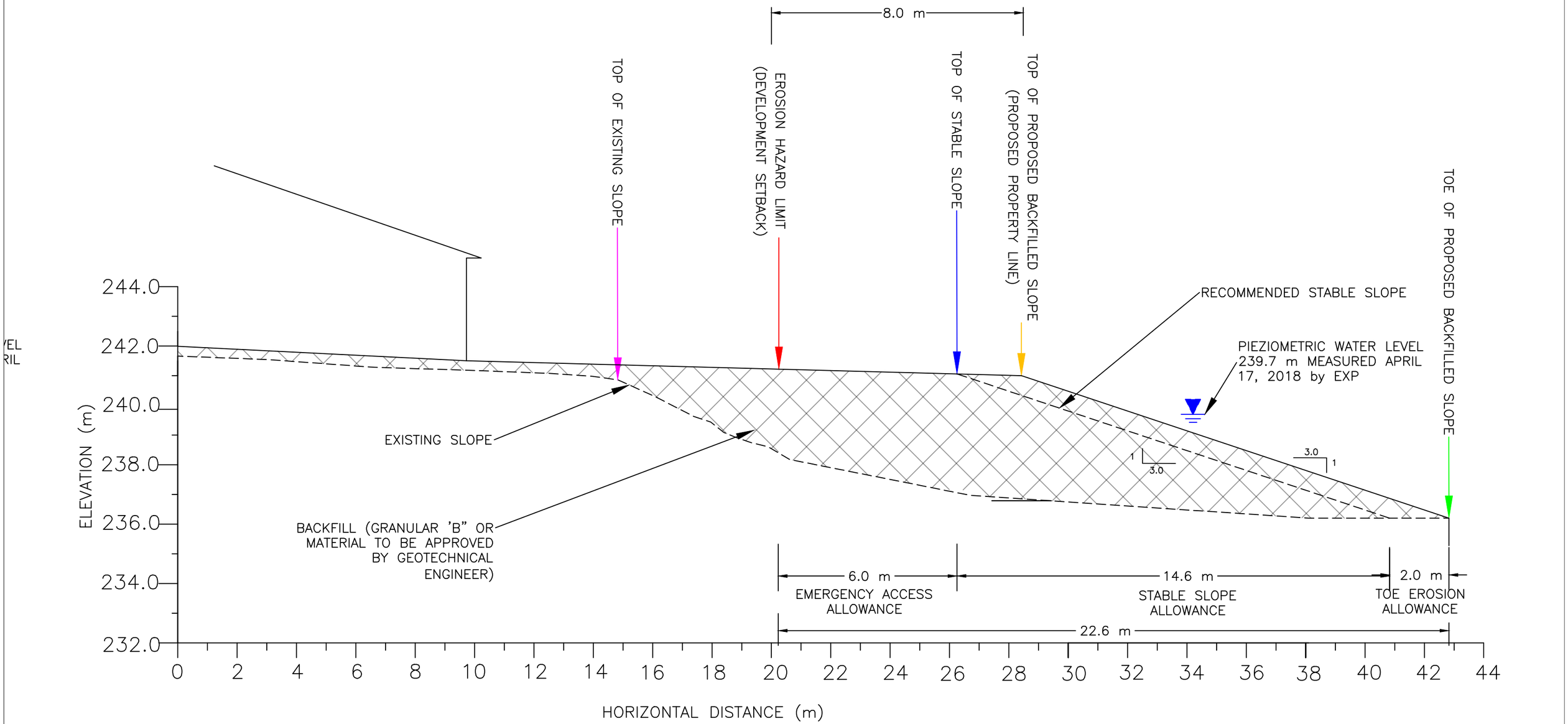
Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT	Springer Pond Development Inc.
TITLE	Proposed Backfilled Lot Cross Section B-B'
DRAWN BY: M.B. / REVIEWED BY: A.S. / DATE: AUGUST 2020	
	EXP Services Inc. 15701 Robin's Hill Road London, ON, N5V 0A5
SCALE: 1:125 / PROJECT NO.: LON-00016454-GE / DWG.: 8	

Proposed Backfilled Lot Cross Section C - C'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	14.6	6.0	22.6	8.0

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.

2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

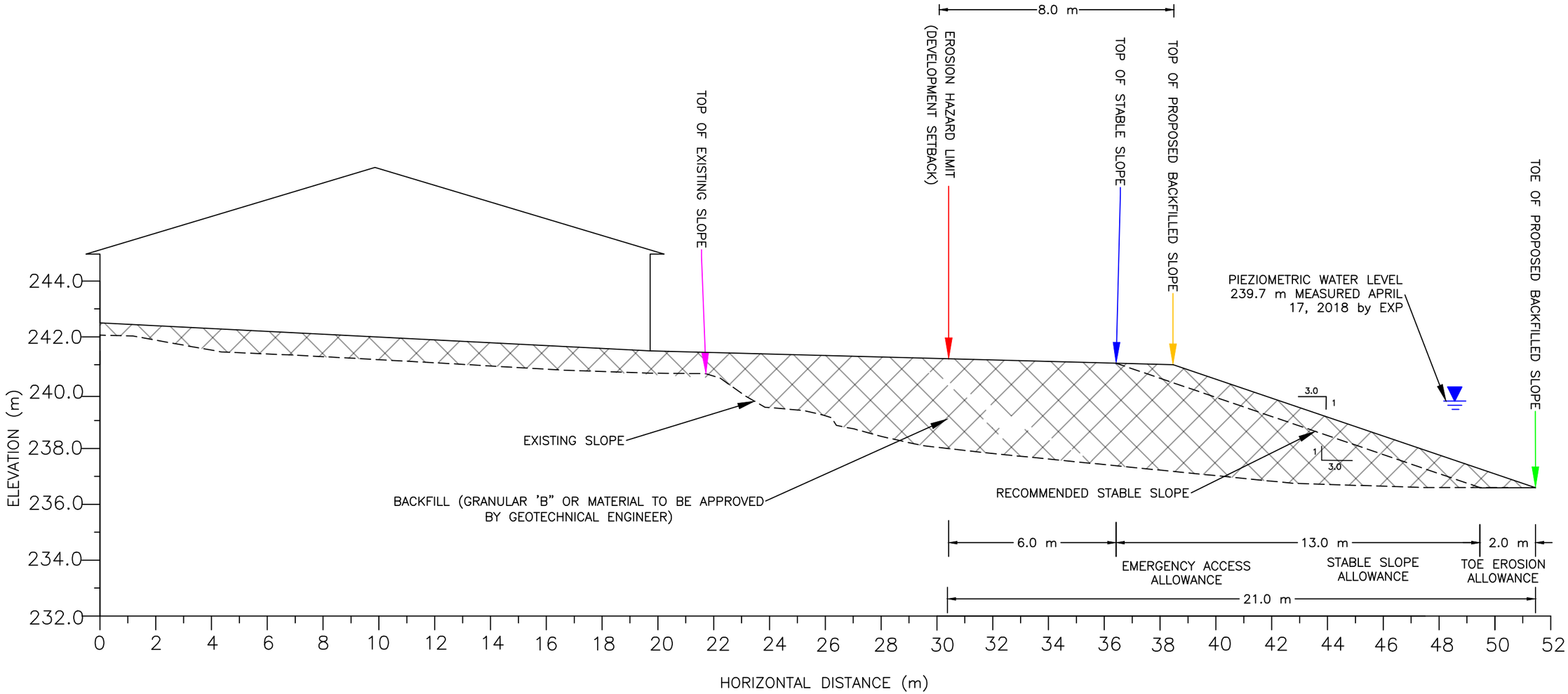
TITLE: Proposed Backfilled Lot Cross Section C-C'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	A.S.	AUGUST 2020

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:125	LON-00016454-GE	9

Proposed Backfilled Lot Cross Section D - D'



SUMMARY OF DEVELOPMENT SETBACK

TOE EROSION ALLOWANCE (m)	STABLE SLOPE ALLOWANCE (m)	EMERGENCY ACCESS ALLOWANCE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOE OF SLOPE (m)	EROSION HAZARD LIMITS (DEVELOPMENT SETBACK) FROM TOP OF SLOPE (m)
2.0	13.0	6.0	21.0	8.0

-NOTES-

1. The cross section diagram should be read in conjunction with EXP Slope Stability Assessment Report LON-00016454-GE.
2. Refer to Drawing 1 for cross section location.

Slope Stability Assessment

Proposed Development

45 Spinger Street, Komoka, ON

CLIENT: Springer Pond Development Inc.

TITLE: Proposed Backfilled Lot Cross Section D - D'

DRAWN BY:	REVIEWED BY:	DATE
M.B.	I.S.	AUGUST 2020

EXP Services Inc.
15701 Robin's Hill Road
London, ON, N5V 0A5

SCALE	PROJECT NO.	DWG.
1:150	LON-00016454-GE	10

Appendix A – Borehole & Test Pit Logs

BOREHOLE LOG

BH101/MW
Sheet 1 of 1

CLIENT **Springer Pond Development Inc.** PROJECT NO. **LON-00014641-GE**
PROJECT **Proposed Residential Subdivision** DATUM **Assumed**
LOCATION **45 Springer Street, Komoka, ON** DATES: Boring **November 7, 2016** Water Level **Nov. 11/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	98.5	**TOPSOIL** - 15 mm **FILL** - silty sand, brown/grey, trace to some gravel, trace to some topsoil inclusions, very loose to compact, moist to wet							
1					SS	S1	70	15	8
		- some clayey silt lumps encountered near 1.5 m bgs			SS	S2	50	9	12
2					SS	S3	50	0	20
3					SS	S4	10	3	10
4	94.2				SS	S5	40	2	17
		End of Borehole at 4.3 m bgs.							
5									
6									
7									
8									
9									

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 Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014641-GE. For definition of terms used on logs, see sheet prior to logs.
2) Borehole open to full depth and groundwater measured at 2.3 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.
5) Water Level Readings:
November 11, 2016 - 2.5 m bgs, 96.0 m ASL (assumed)

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

BH102/MW
Sheet 1 of 1

CLIENT **Springer Pond Development Inc.** PROJECT NO. **LON-00014641-GE**
PROJECT **Proposed Residential Subdivision** DATUM **Assumed**
LOCATION **45 Springer Street, Komoka, ON** DATES: Boring **November 7, 2016** Water Level **Nov. 11/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	STRATA PLOT	WELL LOG	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	97.9	**TOPSOIL** - 15 mm							
		FILL - silty sand, brown/grey, trace to some gravel, trace to some topsoil inclusions, very loose to compact, moist to wet							
1	96.5				SS	S1	60	11	9
		SAND - brown, medium grained, some silt to silty, trace gravel, very loose to compact, moist to wet			SS	S2	70	13	8
2									
					SS	S3	40	1	21
3									
					SS	S4	70	0	24
		- becoming grey with organic and organic silt lenses near 3.7 m bgs							
4	93.6				AS	S5	0	0	15
		End of Borehole at 4.3 m bgs.							
5									
6									
7									
8									
9									

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 Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014641-GE. For definition of terms used on logs, see sheet prior to logs.
2) Borehole open to full depth and groundwater measured at 2.3 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.
5) Water Level Readings:
November 11, 2016 - 2.3 m bgs, 95.6 m ASL (assumed)

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

BH103/MW
Sheet 1 of 1

CLIENT **Springer Pond Development Inc.** PROJECT NO. **LON-00014641-GE**
PROJECT **Proposed Residential Subdivision** DATUM **Assumed**
LOCATION **45 Springer Street, Komoka, ON** DATES: Boring **November 7, 2016** Water Level **Nov. 11/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
0	101.5						
	101.1	**TOPSOIL** - 380 mm					
		FILL - silty sand, brown, some gravel, loose to very dense, moist to wet					
1			SS	S1	50	5	8
		- trace asphalt encountered near 1.5 m bgs	SS	S2	40	15	7
2							
		- concrete pieces encountered near 2.3 m bgs	SS	S3	30	50*	8
3							
			SS	S4	50	27	4
4							
		- some topsoil inclusions encountered near 4.6 m bgs	SS	S5	50	15	10
5							
	95.9						
		SAND - grey, medium grained, trace gravel, compact, wet					
6		- possible cobbles encountered near 6.1 m bgs	SS	S6	50	16	11
7							
			SS	S7	60	17	18
8	93.4						
		End of Borehole at 8.1 m bgs.					
9							

STRATA PLOT / WELL LOG

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 Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014641-GE. For definition of terms used on logs, see sheet prior to logs.
2) Borehole open to full depth and groundwater measured at 5.9 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.
5) * denotes 50 blows per 140 mm split spoon penetration.
6) Water Level Readings:
November 11, 2016 - 5.8 m bgs, 95.7 m ASL (assumed)

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

BH104/MW
Sheet 1 of 1

CLIENT **Springer Pond Development Inc.** PROJECT NO. **LON-00014641-GE**
PROJECT **Proposed Residential Subdivision** DATUM **Assumed**
LOCATION **45 Springer Street, Komoka, ON** DATES: Boring **November 7, 2016** Water Level **Nov. 11/16**

DEPTH (m bgs)	ELEVATION (~m)	STRATA DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (%)	SAMPLES N VALUE (blows)	MOISTURE CONTENT (%)
	100.9						
0	100.9	**TOPSOIL** - 50 mm **FILL** - sandy silt, brown, trace gravel, trace to some organics, compact, moist					
1			SS	S1	80	12	12
2			SS	S2	30	18	8
			SS	S3	30	20	9
	98.0						
3		**SAND AND GRAVEL** - grey, trace to some silt, possible cobbles throughout, compact to dense, moist to wet	SS	S4	30	25	3
4							
5			SS	S5	20	28	7
	95.3						
6		**SAND** - grey, medium to coarse grained, some gravel, dense, wet					
	94.4		SS	S6	80	31	10
7		**End of Borehole at 6.6 m bgs.**					
8							
9							

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 Log interpretation requires assistance by exp before use by others. Borehole Logs must be read in conjunction with exp Report LON-00014641-GE. For definition of terms used on logs, see sheet prior to logs.
2) Borehole open to full depth and groundwater measured at 4.6 m bgs upon completion of drilling.
3) bgs denotes below ground surface.
4) No significant methane gas concentration was detected upon completion of drilling.
5) Water Level Readings:
November 11, 2016 - 4.7 m bgs, 96.2 m ASL

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)

RECORD OF TEST PIT 1

Data File No: 3066

DBT-3066

SHEET 1 OF 1

LOCATION: - REFER TO LOCATION PLAN

EXCAVATION DATE: APR. 24, 1998

DATUM: LOCAL

DEPTH SCALE METRES	METHOD / SIZE	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + / PENETROMETER ●	HYDRAULIC CONDUCTIVITY, k, cm/s — WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
0		GROUND SURFACE		97.88 0.00						
1	Backhoe Dug 0.5m x 0.8m x 3.3m	Brown sand some gravel & silt occasional topsoil lumps (FILL)			1	GS				
2				95.48 2.40						TEST PIT WET BELOW ELEV. 95.70 DURING EXCAVATION APR. 24, 1998.
3		Grey SILTY SAND occasional gravel trace to some black organic sediment			2	GS				TEST PIT WALLS CAVING
				94.58 3.30						
4		END OF TEST PIT								
5										
6										
7										
8										
9										

DEPTH SCALE
1 : 60

Golder Associates

LOGGED: AMH
CHECKED:

RECORD OF TEST PIT 2

SHEET 1 OF 1

981-1066

EXCAVATION DATE: APR. 24, 1998

DATUM: LOCAL

CATION: REFER TO LOCATION PLAN

DEPTH SCALE METRES	METHOD / SIZE	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SHEAR STRENGTH Cu, kPa (VANE TEST +, PENETROMETER ●)	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
0		GROUND SURFACE		97.65 0.00							
1	Backhoe Dug 3.5m x 2.2m x 4.5m	Brown sand some gravel occasional concrete blocks (FILL)			1	CS			O		
2											
3				94.65 3.00	2	CS			O		
4		Grey SAND AND GRAVEL occasional cobbles & boulders									▽ SEEPAGE INTO TEST PIT AT ELEV. 93.65 DURING EXCAVATION APR. 24, 1998
		END OF TEST PIT		93.35 4.30							

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: AMH

CHECKED:

Data File No.: 98

DATA INPUT: WOF

TP RLGJ

981-3068

RECORD OF TEST PIT 3

SHEET 1 OF 1

ATION: REFER TO LOCATION PLAN

EXCAVATION DATE: APR. 24, 1998

DATUM: LOCAL

DEPTH SCALE METRES	METHOD / SIZE	DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + PENETROMETER ●	HYDRAULIC CONDUCTIVITY, K, cm/s — WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
-1										
0		GROUND SURFACE		97.94 0.00						
1	Backhoe Dug 1.0m x 7.3m x 3.8m	Brown sand some gravel & silt trace topsoil, occasional pieces of concrete (FILL)			1	GS				TEST PIT WET BELOW ELEV. 95.74 DURING EXCAVATION APR. 24, 1998.
2										
3		Grey SAND some silt trace black organic sediment		94.94 3.00	2	GS				TEST PIT WALLS CAVING
4		END OF TEST PIT (Sand & Gravel material at 3.8m depth - Unable to sample due to caving)		94.14 3.80						
5										
6										
7										
8										
9										

DATA ENTRY: WDF

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: AMH

CHECKED:

RECORD OF TEST PIT 4

SHEET 1 OF 1

PROJECT: 961-3068

LOCATION: - REFER TO LOCATION PLAN

EXCAVATION DATE: APR. 24, 1998

DATUM: LOCAL

DEPTH SCALE METERS	METHOD / SIZE	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + / PENETROMETER ●	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp — W — Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
0	Backhoe Dug 3.5m ø 4.5m	GROUND SURFACE		98.54 (98.54) 0.00							
		Brown sand some gravel & silt trace topsoil, occasional cobbles (FILL)		97.74 0.80	1	CS					
1					2	CS					
2		Brown SAND occasional gravel									
3				94.64 3.90							
4		Brown / grey SAND AND GRAVEL	0.6 0.6 0.6	94.34 4.20	3	CS					
		Brown SANDY SILT		94.04 4.50	4	CS					
		TE									TE
5											
6											
7											
8											
9											

Golder Associates

1-3086

REFER TO LOCATION PLAN

EXCAVATION DATE: APR. 24, 1998

DATUM: LOCAL

DEPTH SCALE METRES	METHOD / SIZE	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + PENETROMETER ●	HYDRAULIC CONDUCTIVITY, k, cm/s	WATER CONTENT, PERCENT Wp — W — Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
-1											
0	Backhoe Dug 3.5m x 2.6m x 4.8m	GROUND SURFACE		98.05 / 0.00							
1					1	CS			○		
2		Brown and black sand, some gravel, silt and topsoil (FILL)									
3											
4				94.75							▽ SEEPAGE INTO TEST PIT AT ELEV. 94.75 DURING EXCAVATION APR. 24, 1998. MINOR CAVING OF TEST PIT WALLS
		Brown / grey SAND AND GRAVEL		4.30	2	CS			○		
5		END OF TEST PIT		94.25 / 4.80							
6											
7											
8											
9											

DATA INPUT: WDF

TYPLOG

DEPTH SCALE 1 : 30

Golder Associates

LOGGED: AMH

CHECKED:

1-3066 — HEL D — TEST PIT 6 — SHEET 1 OF 1

REFER TO LOCATION PLAN — EXCAVATION CONTRACTOR: CAVA — DATE: APR. 24, 1998 — DATUM: LOCAL

DEPTH SCALE METRES	METHOD / SIZE	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + / PENETROMETER ●	HYDRAULIC CONDUCTIVITY, k, cm/s — WATER CONTENT, PERCENT Wp, W, Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
0		GROUND SURFACE		99.26 / 0.00						
1	Backhoe Bkt 3.5m x 0.6m x 4.5m	Brown sand some gravel and silt trace topsoil (FILL)			1	GS		o		
2										
3				95.56 / 3.70						SEEPAGE INTO TEST PIT AT ELEV. 95.56 DURING EXCAVATION APR. 24, 1998.
4		Grey SAND AND GRAVEL		94.96 / 4.30	2	GS		o		MINOR CAVING OF TEST PIT WALLS
		Brown SANDY SILT		94.76 / 4.50	3	GS		o		
		END OF TEST PIT								
5										
6										
7										
8										
9										

DEPTH SCALE 1" = 50

Golder Associates

LOGGED: AMH

CHECKED:

DATA INPUT: WDF

RECORD OF TEST PIT 7

F: 951-3006

LOCATION: REFER TO LOCATION PLAN

EXCAVATION DATE: APR. 24, 1998

SHEET 1 OF 1

DATUM: LOCAL

DEPTH SCALE METRES	METHOD / SIZE	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SHEAR STRENGTH Cu, kPa — VANE TEST + PENETROMETER ●	HYDRAULIC CONDUCTIVITY, k, cm/s — WATER CONTENT, PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	GROUND WATER CONDITIONS AND INSTALLATION
0		GROUND SURFACE		97.65 / 0.00						
1	Backhoe D-sp 3.5m x 1.4m x 3.6m	Brown silty sand trace topsoil (FILL)			1	GB		O		TEST PIT WET BELOW ELEV. 95.65 DURING EXCAVATION APR. 24, 1998. TEST PIT WALLS CAVING
2				95.05 / 2.60	2	GB		O		
3		Grey SAND some black organic sediments		94.05 / 3.60						
		END OF TEST PIT								
4										
5										
6										
7										
8										
9										

Appendix B – Slope Rating Charts

Slope Stability Rating Chart

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Cross Section A-A'

Site Location: 45 Springer Street	**Project No.:** LON-00016454-GE
Town/City: Komoka, ON	**Inspection Date:** August 10, 2018
Inspected by: M. Bertens	**Weather:** Sunny, 24°C

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	**16**
degrees or more (steeper than 2H:1V)	16	
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	**18**
clay, silt	12	
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	
near mid-slope only	6	**0**
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	
light vegetation: grass, weeds, occasional trees, shrubs	4	**0**
no vegetation: bare	8	
Table Land Drainage		
table land flat, no apparent drainage over slope	0	
minor drainage over slope, no active erosion	2	**0**
drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
15 m or more from slope toe	0	**6**
Less than 15 m from slope toe	6	
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**42**

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? **Yes, Pond.**
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Cross Section B-B'

Site Location:	**45 Springer Street**	**Project No.:**	**LON-00016454-GE**
Town/City:	**Komoka, ON**	**Inspection Date:**	**August 10, 2018**
Inspected by:	**M. Bertens**	**Weather:**	**Sunny, 24°C**

	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	**16**
degrees or more (steeper than 2H:1V)	16	
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	**18**
clay, silt	12	
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	
near mid-slope only	6	**0**
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	
light vegetation: grass, weeds, occasional trees, shrubs	4	**0**
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	**6**
Less than 15 m from slope toe	6	
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**44**

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? **Yes, Pond.**
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

Slope Stability Rating Chart

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

Cross Section D-D'

Site Location: 45 Springer Street	**Project No.:** LON-00016454-GE
Town/City: Komoka, ON	**Inspection Date:** August 10, 2018
Inspected by: M. Bertens	**Weather:** Sunny, 24°C

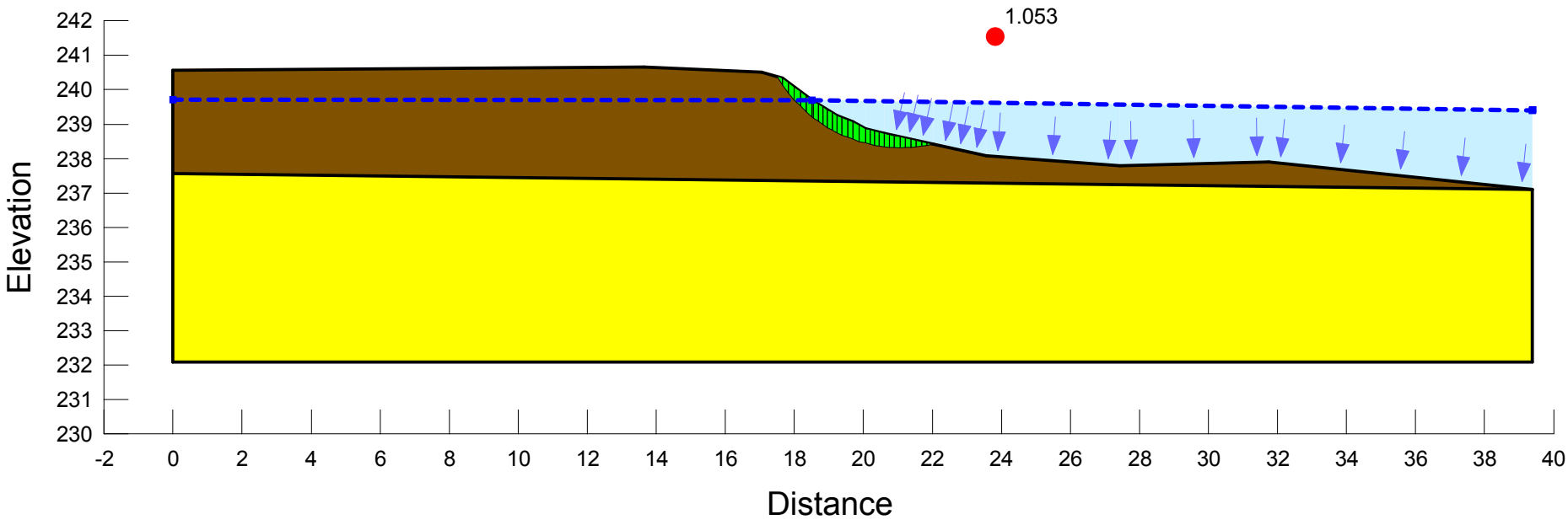
	Rating Value	Slope Rating
Slope Inclination		
degrees or less (3H:1V or flatter)	0	
to 28 degrees (2H:1V to 3H:1V)	6	**16**
degrees or more (steeper than 2H:1V)	16	
Soil Stratigraphy		
shale / limestone	0	
sand, gravel	6	
till	9	**18**
clay, silt	12	
fill	18	
leda clay	24	
Seepage from Slope Face		
none, or near bottom only	0	
near mid-slope only	6	**0**
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	
light vegetation: grass, weeds, occasional trees, shrubs	4	**0**
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	**6**
Less than 15 m from slope toe	6	
Previous Landslide Activity		
No	0	**0**
Yes	6	
Slope Instability Rating		**44**

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? **Yes, Pond.**
If YES - the potential for toe erosion and undercutting should be evaluated in detail.

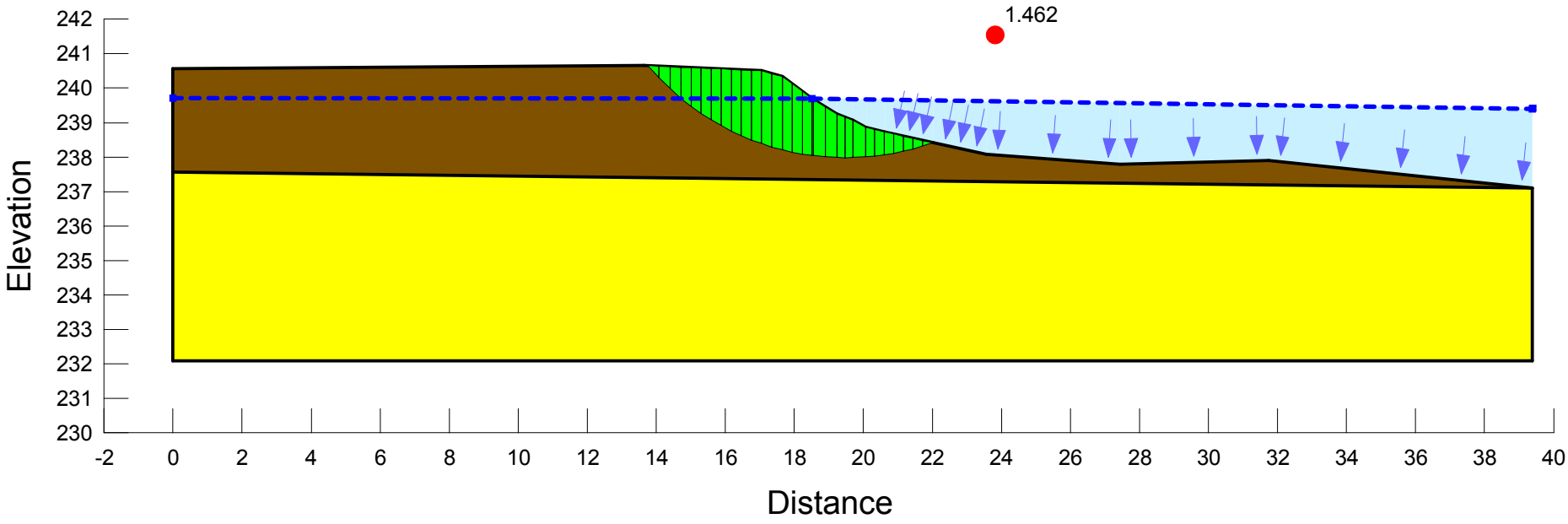
Appendix C - Stable Slope Analyses

Cross Section A- A' - Shallow Failure



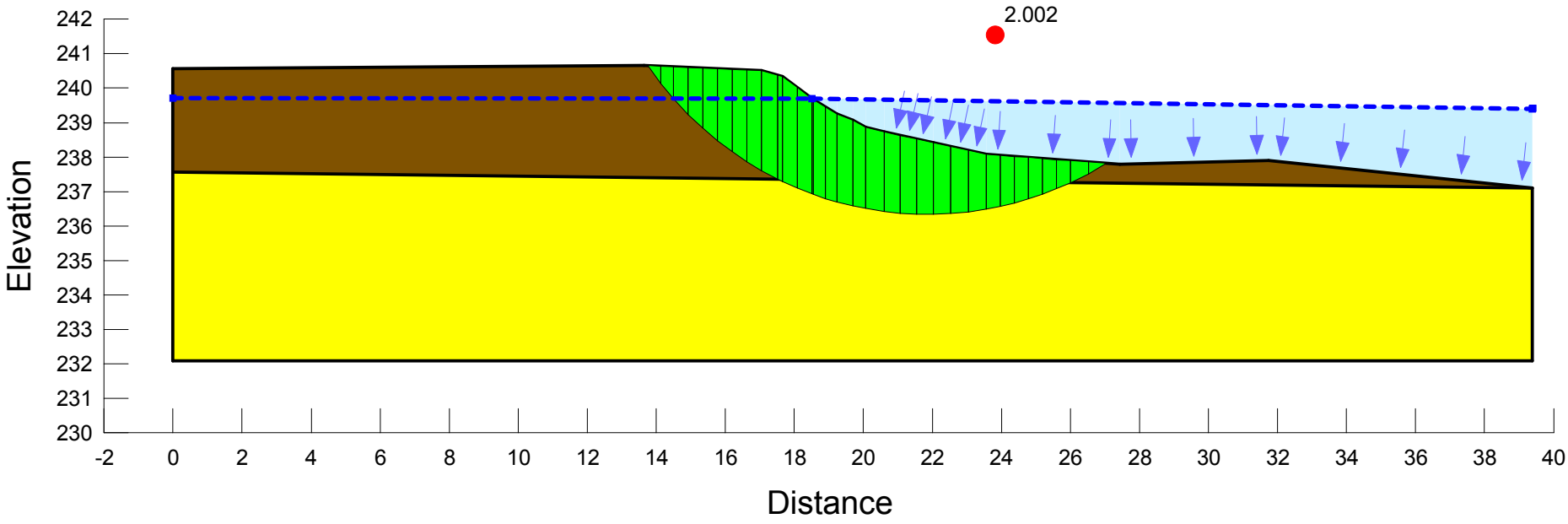
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section A-A' - Moderate Failure



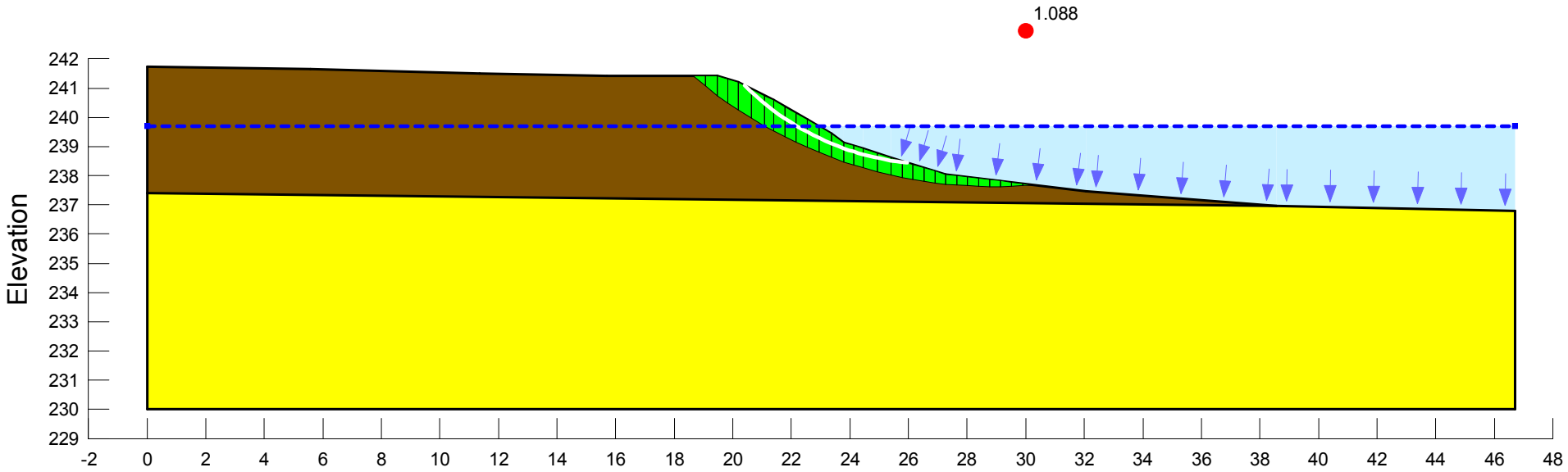
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section A-A' - Deep Failure



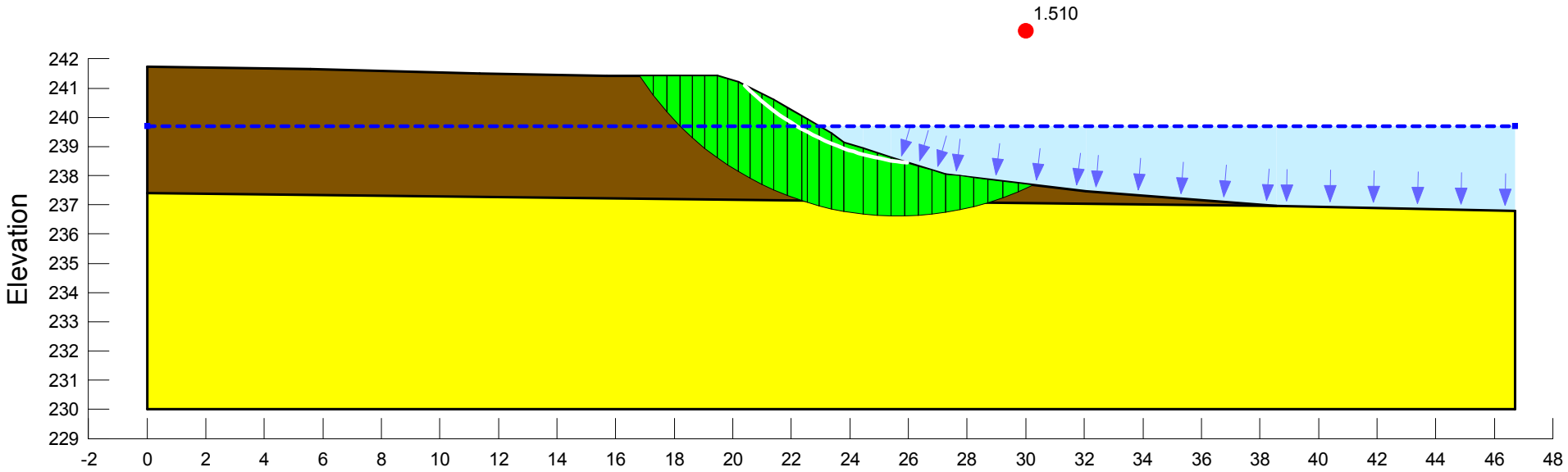
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section B- B' - Shallow Failure



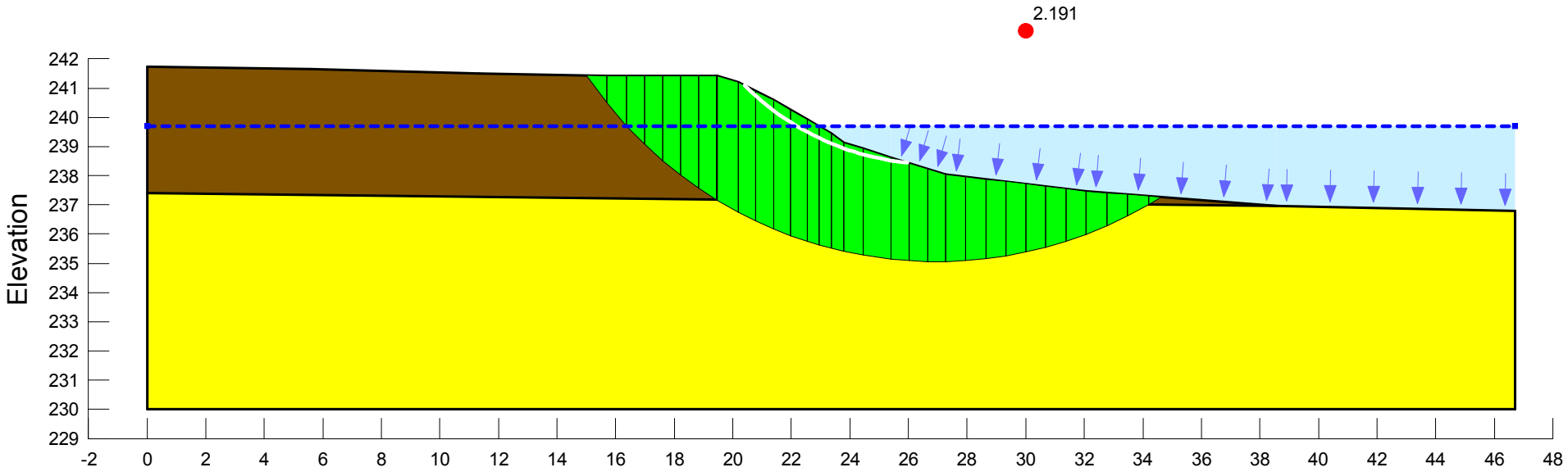
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section B-B' - Moderate Failure



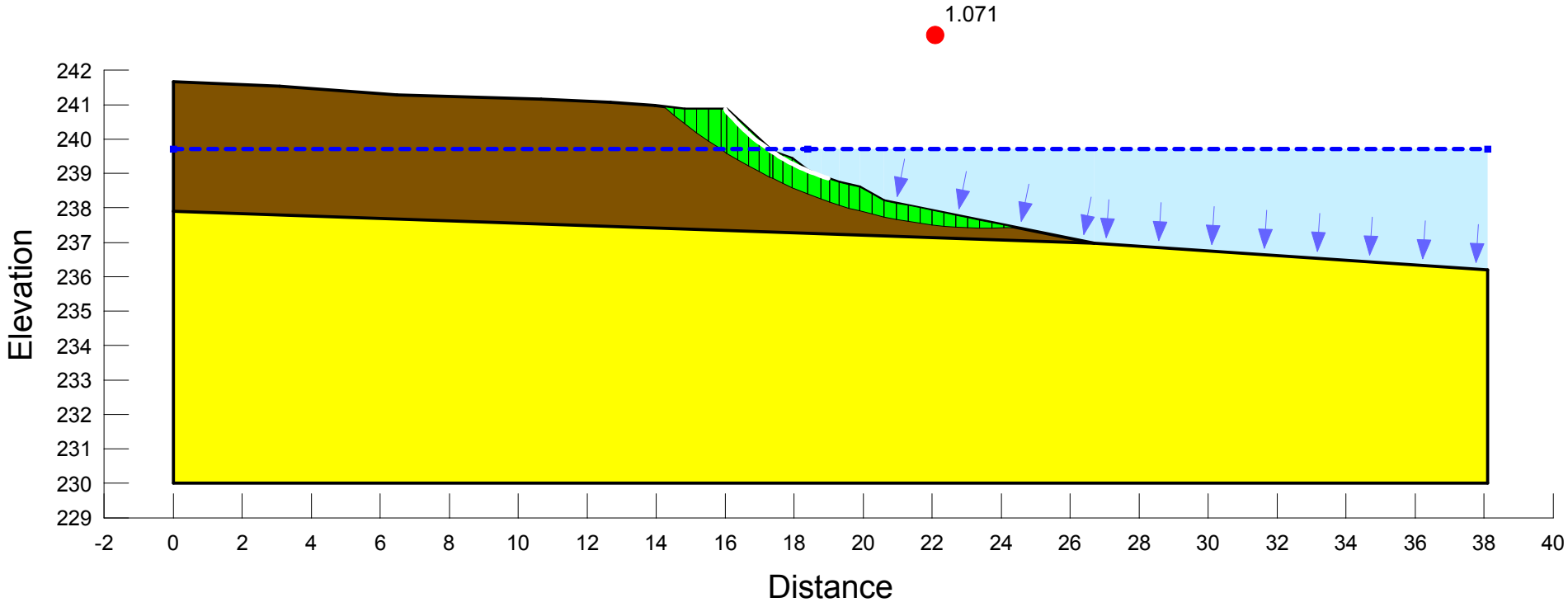
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section B-B' - Deep Failure



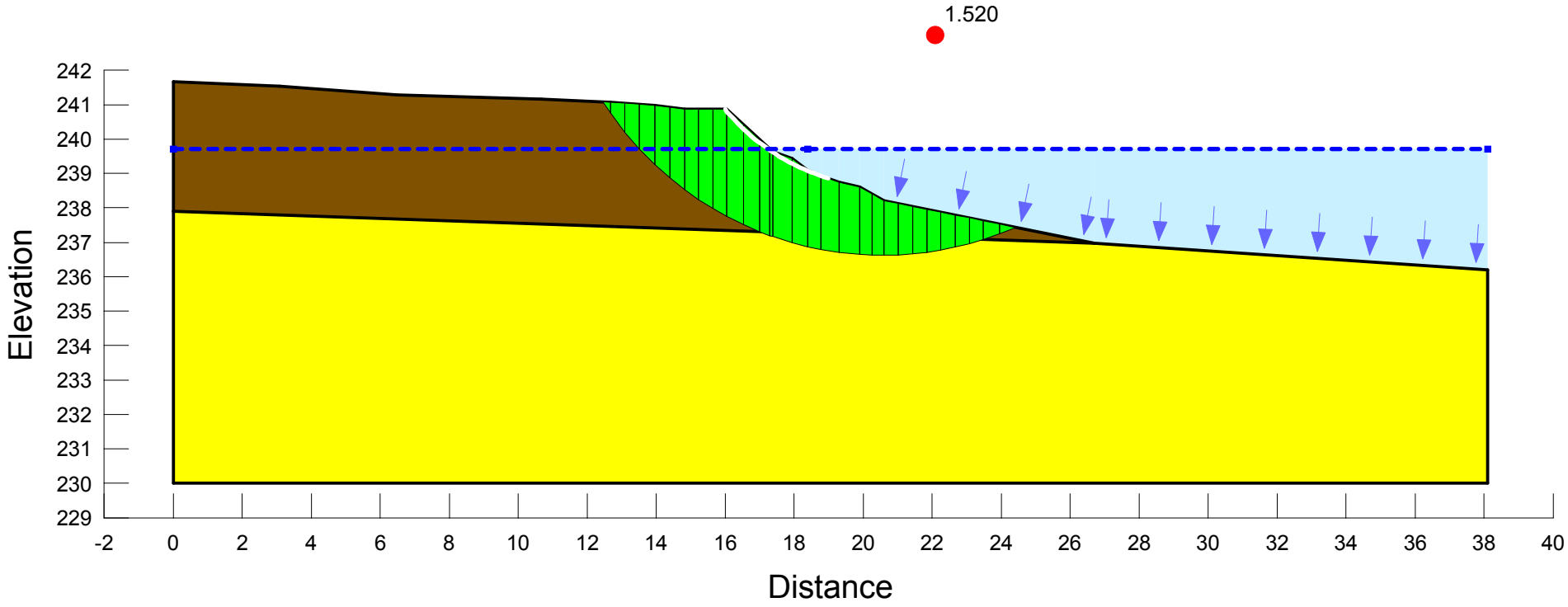
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section C-C' - Shallow Failure



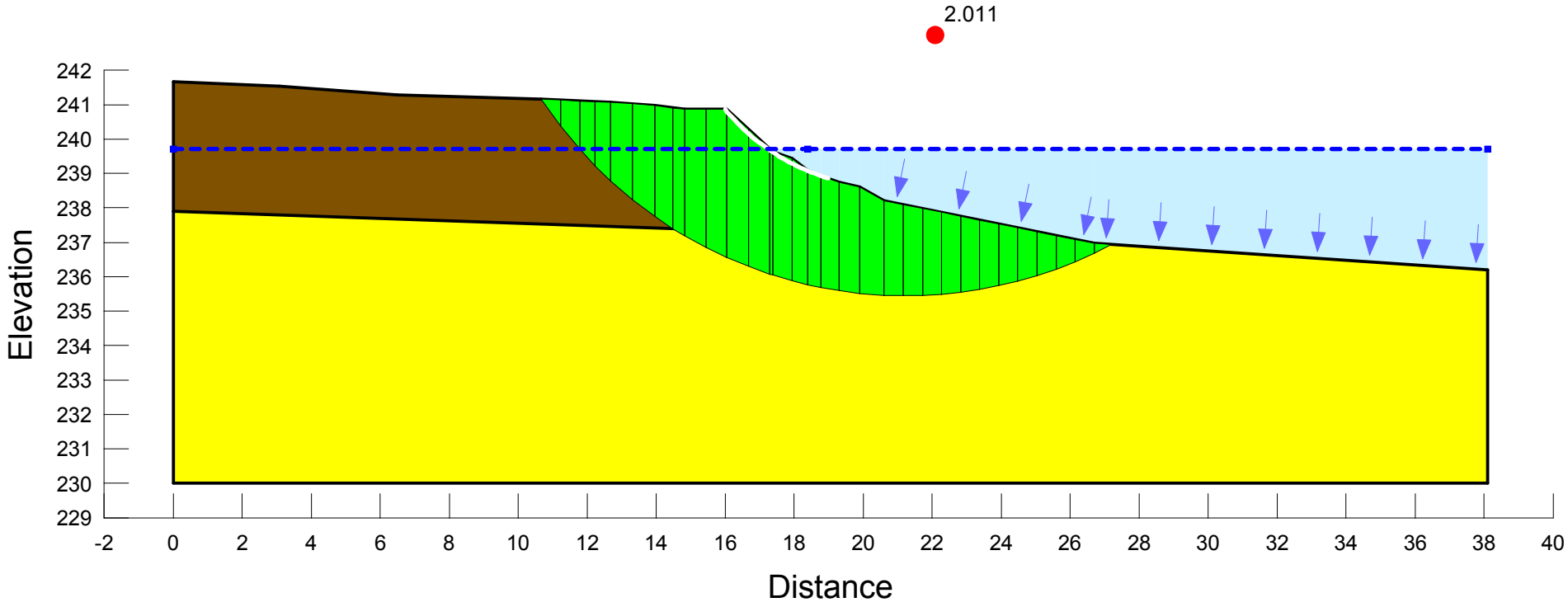
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section C-C' - Moderate Failure



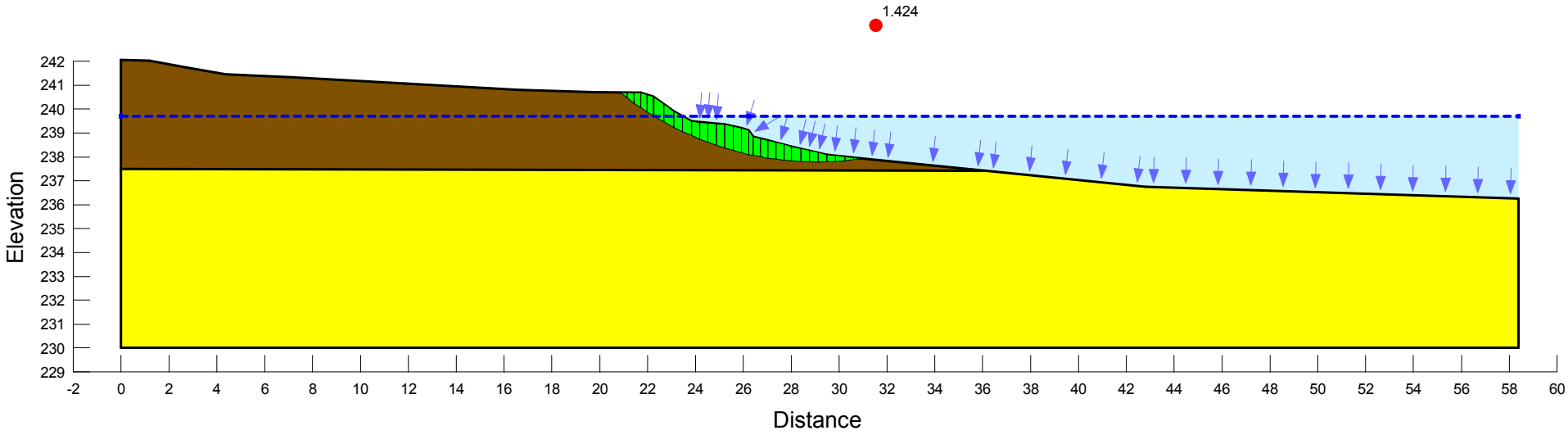
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section C-C' - Deep Failure



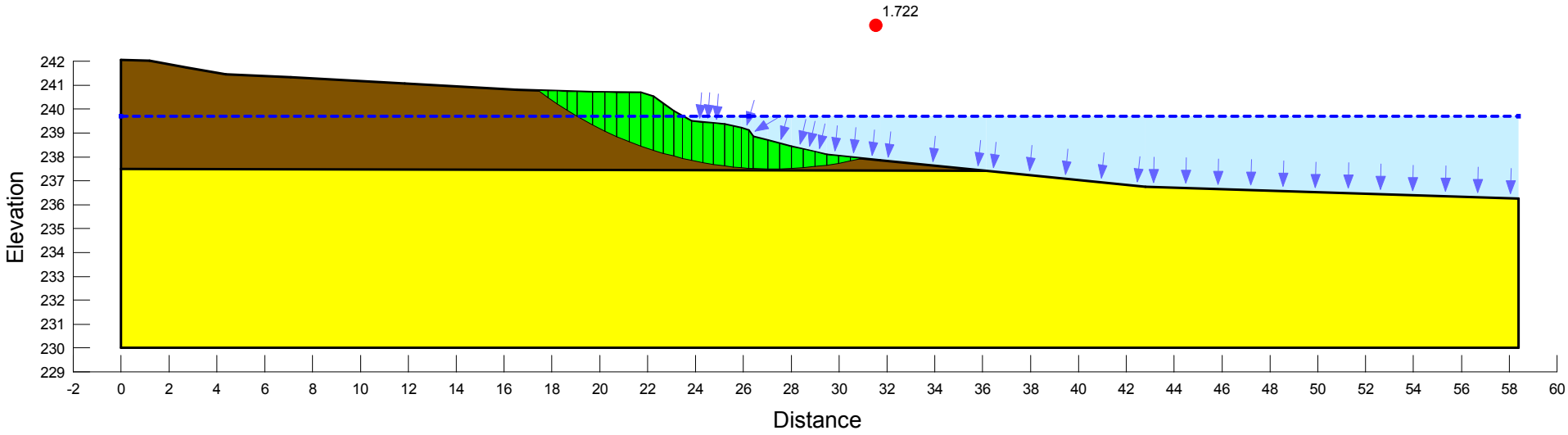
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand and Gravel	19	0	31

Cross Section D-D' - Shallow Failure



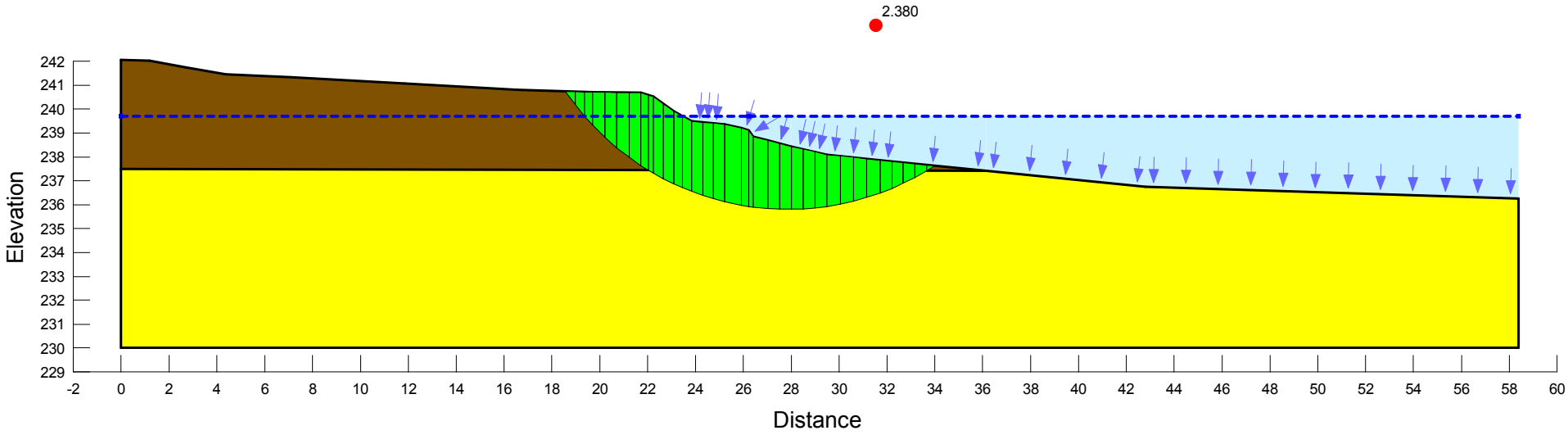
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section D- D' - Moderate Failure



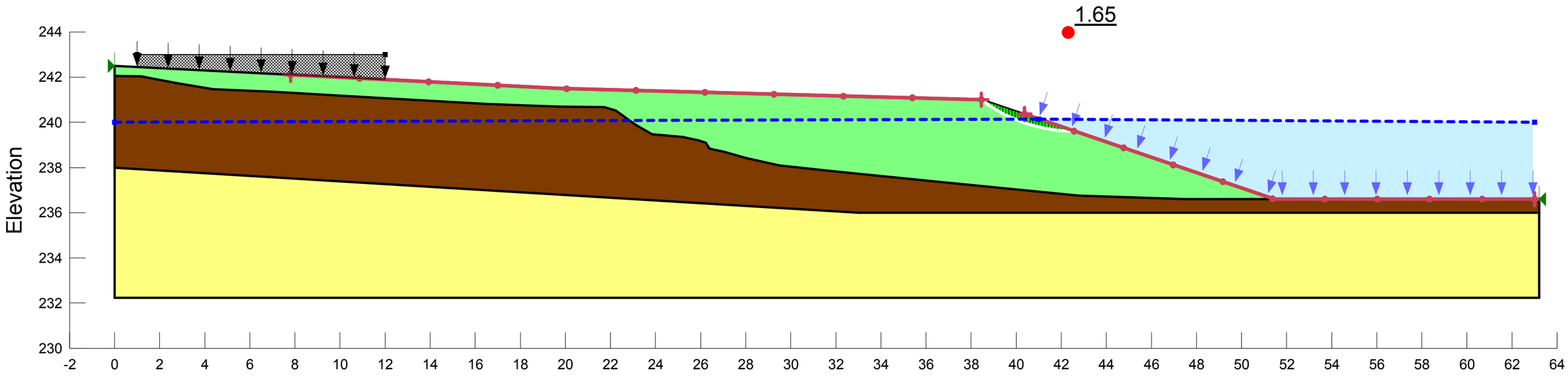
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section D-D' - Deep Failure



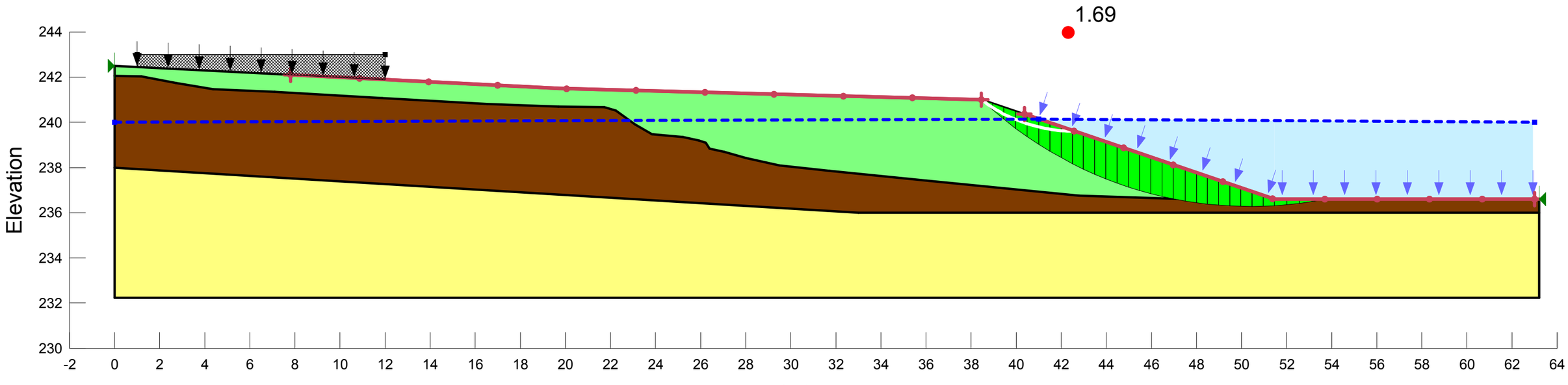
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Sand	18	0	30

Cross Section D-D' Extended Lot - Shallow Failure



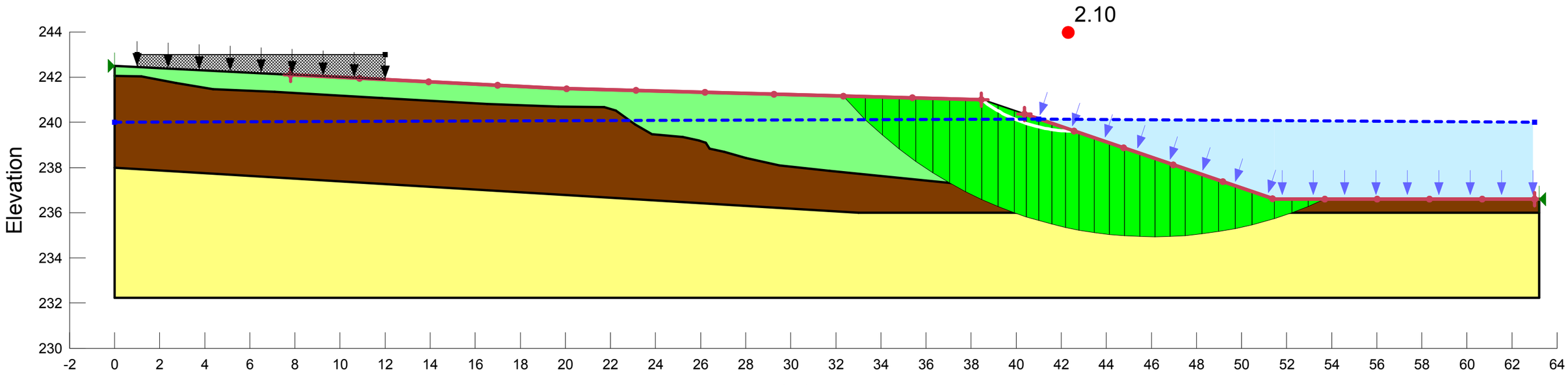
Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Granular Backfill	21	0	31
	Sand	18	0	30

Cross Section D-D' Extended Lot - Moderate Failure



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Granular Backfill	21	0	31
	Sand	18	0	30

Cross Section D-D' Extended Lot - Deep Failure



Color	Name	Unit Weight (kN/m³)	Cohesion' (kPa)	Phi' (°)
	Fill	17	0	26
	Granular Backfill	21	0	31
	Sand	18	0	30

Appendix D – 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 test pit results contained in the Report. The number of test pits 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 theReport.

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.

USE OF REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the written consent of EXP. Any use of the Report, or any portion of the Report, by a third party are the sole responsibility of such third party. EXP is not responsible for damages suffered by any third party resulting from unauthorized use of the Report.

REPORT FORMAT

Where EXP has submitted both electronic file and a hard copy of the Report, or any document forming part of the Report, only the signed and sealed hard copy shall be the original documents for record and working purposes. In the event of a dispute or discrepancy, the hard copy shall govern. Electronic files transmitted by EXP have utilize specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems. Regardless of format, the documents described herein are EXP's instruments of professional service and shall not be altered without the written consent of EXP.

Legal Notification

This report was prepared by EXP Services Inc. for the exclusive use of **Springer Pond Development Inc.** and may not be reproduced in whole or in part, or used or relied upon in whole or in part by any party other than **Springer Pond Development Inc.** for any purpose whatsoever without the express permission of **Springer Pond Development Inc.** in writing.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. EXP Services Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.