

**PROJECT NO.: NT21099-S**

December 16, 2022  
Revised Date: November 6, 2023

NPG Planning Solutions  
4999 Victoria Avenue  
Niagara Falls, Ontario  
L2E 4C9

Attention: Mr. Max Fedchyshak, Planner

**SLOPE STABILITY ASSESSMENT  
343 YORK ROAD  
NIAGARA-ON-THE-LAKE, ONTARIO**

Dear Mr. Fedchyshak,

As requested, Niagara Testing and Inspection Ltd. undertook slope stability assessment work at the above noted site. The purpose of this site assessment work was to examine the condition of the slope immediately north of the proposed commercial and residential development and to provide our comments with regard to its long-term stability from a geotechnical point of view. Our comments and recommendations, based on our field evaluation work, are presented in the following paragraphs.

## **Introduction**

We understand that the proposed project will consist of the construction of an eight and ten-storey hotel/condominium towers, a one-storey drive-thru commercial building, and two separate two-storey [5-unit and 6-unit] hotel suites. The subject site is located at 343 York Road in the Town of Niagara-On-The-Lake, Ontario.

## **Procedure**

A slope stability rating chart, Table 8.1 found in the Ontario Ministry of Natural Resources publication "Geotechnical Principle for Stable Slopes [June 1998], was completed as part of the slope stability analysis. The completed slope stability rating chart is attached and found a rating of twenty-six for the subject slope, which indicates a slope instability rating of a slight potential. This rating requires a site inspection and surveying, preliminary study, and detailed report. As part of the fieldwork program nine [9] slope profiles were measured across the subject area at the locations illustrated in Drawing No. 1 and presented in Drawing Nos. 2 through 10 [inclusive] as Slope Profiles A-A through I-I, respectively. In addition, soil information was reviewed from a series of boreholes advanced in November 2021 [Niagara Testing and Inspection Ltd. Project No. NT21099-G dated December 8, 2021], as shown at the locations illustrated in Drawing No. 1, for the proposed commercial and residential development

[Borehole Nos. 1 through 10 from this work have been attached] and from published information. Slope stability analyses were conducted on each slope profile.

All surveying associated with determining the ground surface elevations for Slope Profiles A-A through I-I were extrapolated from a Plan of Survey, Reference No. 21-49-159-00\_1bdytopo, dated November 17, 2021, provided by Kirkup Mascoe Ure Surveying a Division of J.D. Barnes Limited Ontario Land Surveyors.

### **Site Conditions**

The slope profiles were undertaken on October 14, 2021, the recorded overall angle of the subject slopes [between slope 'toe' and physical top of slope] and slope profile heights for each slope profile are summarized in the table below. The area beyond [south] of the Physical Top of Slope is a relatively flat grass covered field extending well past the Top of Stable Slope.

<b>Profile I.D.</b>	<b>Overall Slope Profile Inclination [Horizontal to Vertical]</b>	<b>Slope Profile Height [m]</b>
<b>A-A</b>	3.0 to 1.0	4.1
<b>B-B</b>	3.4 to 1.0	6.3
<b>C-C</b>	3.7 to 1.0	6.1
<b>D-D</b>	4.8 to 1.0	6.2
<b>E-E</b>	2.7 to 1.0	6.8
<b>F-F</b>	4.0 to 1.0	7.4
<b>G-G</b>	3.8 to 1.0	6.9
<b>H-H</b>	3.3 to 1.0	5.6
<b>I-I</b>	4.1 to 1.0	5.8

There were no significant slope failure 'scars' observed across the subject slopes and there were no 'tension' cracks observed near the 'crest' of the slopes. The subject slope has evidently remained stable for a very long period of time with only slow flattening of the slope, associated with natural weathering process, freeze-thaw, wetting-drying, etc. of the exposed silty clay material. This degeneration of the slope is a very slow process spanning multiple years to decades. Deep-seated stability is not a concern in this case. The subject slope is covered with scrub vegetation, as well as some other surficial vegetation.

### **Discussions of Slope Condition and Stability**

We note that a geotechnical investigation undertaken for the proposed site development found a limited depth of fill material, beneath the topsoil layer, overlying a native stiff to very stiff silty clay / clayey silt. In addition, we have reviewed the Quaternary Geology [Niagara Area Map 2496] which indicates that

the subject site is in an area of Glaciolacustrine deeper water clay and silt, as was borne out during the course of the recent borehole investigation on the property.

The Stable Top of Slopes were evaluated following the guidelines in the Ontario Ministry of Natural Resources publication "Geotechnical Principles for Stable Slopes [June 1998] document. Specifically, this involves applying an allowance for toe erosion, and a long-term stable slope inclination. In this case the toe of the slope is in the stiff to very stiff silty clay / clayey silt, which is considered to be rather competent in terms of its strength properties. A conservative toe erosion allowance of between five to sixteen metres has been applied to the slope profiles, so that the inclination does not 'daylight' through the existing slope. An inclination of 2.0 Horizontal to 1 Vertical was used in the stiff to very stiff silty clay / clayey silt and a stable slope inclination of 2.5 Horizontal to 1 Vertical was used in the silty clay fill, to determine the Top of Stable Slope. Applying the erosion allowance and stable slope allowance from the existing 'toe' of the slopes provides the locations for the long-term Top of Stable Slopes at about the location of the Physical Top of Slope at the Slope Profile locations, with the exception of Slope Profile C-C where the location for the long-term Top of Stable Slopes is approximately 1.2 metres inland from the Physical Top of Slope.

Stability analyses of the subject slope was performed with a computerized modeling program [GSlope 2021] for the nine slope profiles. Analyses were conducted considering multiple failure planes, ultimately through the designated Top of Stable Slope. The material parameters assigned to the topsoil were Unit Weight of 15.0 kN/m<sup>3</sup>, Friction Angle of 30 degrees and Cohesion of 0 kPa, the material parameters assigned to the silty clay fill were Unit Weight of 17.0 kN/m<sup>3</sup>, Friction Angle of 30 degrees and Cohesion of 0 kPa, and the material parameters assigned to the native silty clay / clayey silt were Unit Weight of 19.0 kN/m<sup>3</sup>, Friction Angle of 32 degrees and Cohesion of 2 kPa.

The results of the stability analyses indicate applicable factors of safety, as summarized in the table below, for Slope Profiles A-A through I-I [Bishop Modified], respectively.

<b>Profile I.D.</b>	<b>Calculated Factor of Safety</b>
<b>A-A</b>	8.209
<b>B-B</b>	2.684
<b>C-C</b>	2.079
<b>D-D</b>	2.619
<b>E-E</b>	3.261
<b>F-F</b>	2.466
<b>G-G</b>	3.664
<b>H-H</b>	2.219
<b>I-I</b>	2.950

The results of these analyses are attached to this report [Figure Nos. 1 to 9, inclusive]. It is noted that theoretical surficial failure planes would exist with marginally lower calculated factors of safety, however these models do not account for the stabilizing effect of surface vegetation. Further any such shallow surficial movements would not impact the global stability of the slope.

Given the condition of the slope, the slope profiles, and the relative condition of the native stiff to very stiff silty clay / clayey silt of the subject slope, as it exists, is considered to be stable in both the short and long term and more than satisfies the "Active" land use requirement. It is our opinion that the proposed commercial and residential development will not have a negative impact on the subject slope. The Factor of Safety for the subject slopes was found to be well in excess of 1.5 and thereby satisfies the requirements present in the Table 7.2 "Design Minimum Factors of Safety" of the MNR document. The existing vegetation on the subject slopes should be maintained to limit erosion issues.

The following recommendations should be considered in the design and construction of the proposed commercial and residential development.

- Drainage over the slope should not be altered.
- We would recommend that a Silt fence be installed along the northern limit of the construction area to control access and damage to the subject slope.
- Vegetation must be maintained on the slope both during and post construction to limit/minimise erosion from surface runoff.
- Should any surficial damage to the 'face' of the slope be caused during construction it should be repaired with vegetation native to the area and approved by the Niagara Peninsula Conservation Authority. This requirement is best assessed in the field and following comments/recommendations from NPCA.
- The construction staging area [stockpiling of construction materials] should be designated away from the subject slope.
- Construction should be undertaken to limit damage to the existing slope.

We trust that this report satisfies your present requirements. Should you require any additional information or clarification as to the contents of this report, please do not hesitate to contact the undersigned.

Yours very truly,  
Niagara Testing and Inspection Ltd.



John Monkman, P.Eng.  
Project Engineer



Dwayne Neill, P.Eng.  
Review Engineer



Enclosures: Slope Stability Rating Chart  
Drawing No.1, Borehole & Slope Profile Location Plan  
Drawing No. 2 through 10 [inclusive] Slope Profile Sections A-A through I-I [inclusive]  
Figure No. 1 through 9 [inclusive] for Slope Stability Analyses for Slope Profile Sections A-A through I-I  
Borehole Log Nos. 1 through 10 [inclusive] from the Niagara Testing and Inspection Ltd. Report No. NT21099-G, dated December 8, 2021

Distribution: NPG Planning Solutions [pdf copy]

**Table 8.1 SLOPE STABILITY RATING CHART**

Site Location: 343 York Road, Niagara-On-The-Lake, Ontario		File No.: NT21099
Property Owner: NA		Inspection Date: 14-Oct-21
Inspected By: DN		Weather: Overcast, 23 degrees C

1.	SLOPE INCLINATION		Rating Value
	degrees	horiz. : vert.	
a)	18 or less	3 : 1 or flatter	0
b)	18 - 26	2 : 1 to more than 3 : 1	6
c)	more than 26	steeper than 2 : 1	16

2.	SOIL STRATIGRAPHY		
a)	Shale, Limestone, Granite (Bedrock)		0
b)	Sand, Gravel		6
c)	Glacial Till		9
d)	Clay, Silt		12
e)	Fill		16
f)	Leda Clay		24

3.	SEEPAGE FROM SLOPE FACE		
a)	None or Near bottom only		0
b)	Near mid-slope only		6
c)	Near crest only, From several levels		12

4.	SLOPE HEIGHT		
a)	2 m or less		0
b)	2.1 tp 5 m		2
c)	5.1 to 10 m		4
d)	more than 10 m		8

5.	VEGETATION COVER ON SLOPE FACE		
a)	Well vegetated; heavy shrubs or forested with mature trees		0
b)	Light vegetation; Mostly grass, weeds, occasional trees, shrubs		4
c)	No vegetation, bare		8

6.	TABLE LAND DRAINAGE		
a)	Table land flat, no apparent drainage over slope		0
b)	Minor drainage over slope, no active erosion		2
c)	Drainage over slope, active erosion, gullies		4

7.	PROXIMITY OF WATERCOURSE TO SLOPE TOE		
a)	15 metres or more from slope toe		0
b)	Less than 15 metres from slope toe		6

8.	PREVIOUS LANDSLIDE ACTIVITY		
a)	No		0
b)	Yes		6

SLOPE INSTABILITY RATING		RATING VALUES INVESTIGATION TOTAL	REQUIREMENTS	TOTAL
				26

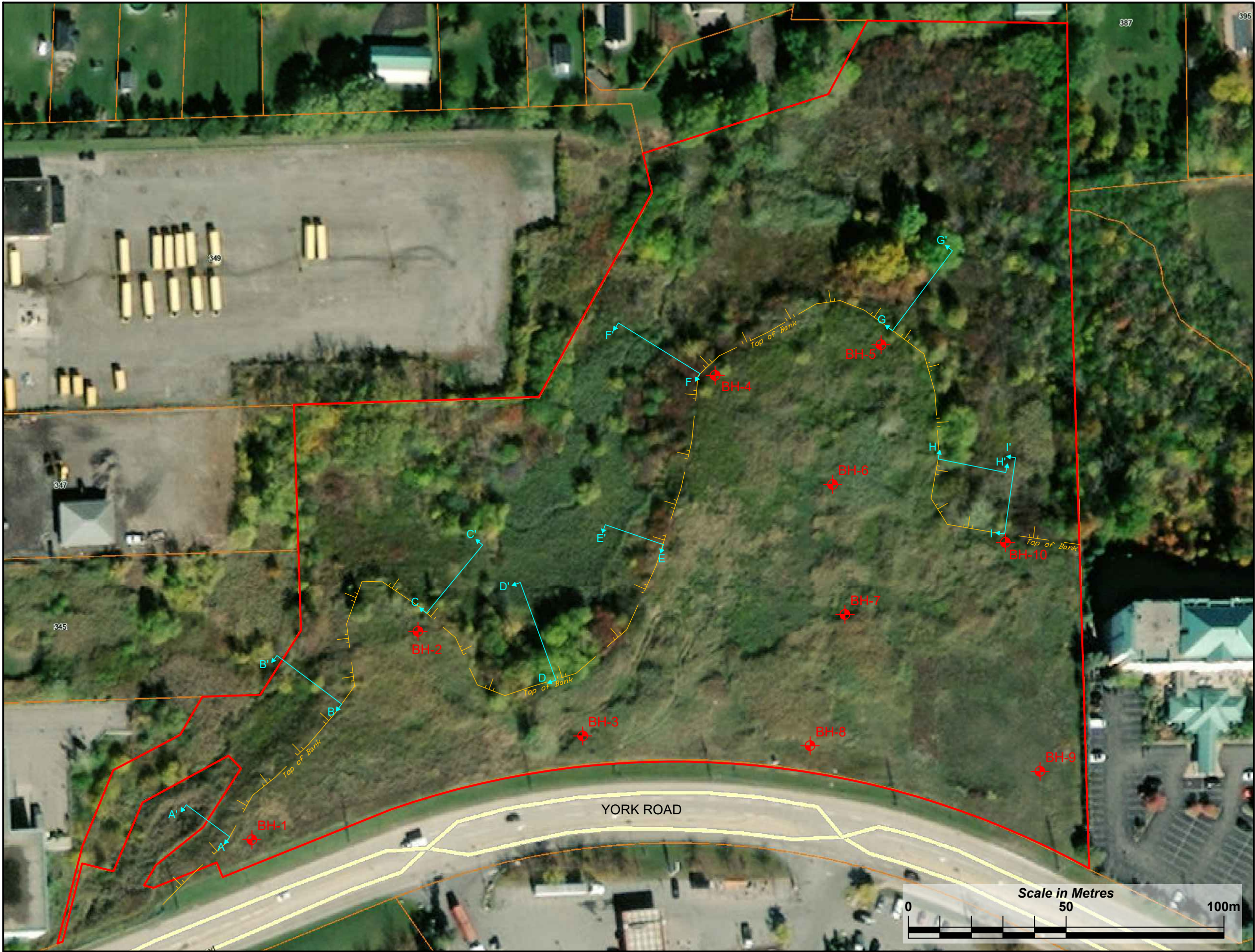
1.	Low potential	<24	Site inspection only, confirmation, report letter.
2.	Slight potential	25 - 35	Site inspection and surveying, preliminary study, detailed report.
3.	Moderate potential	>35	Boreholes, piezometers, lab tests, surveying, detailed report.

**NOTES:**

- a) Choose only one from each category; compare total rating value with above requirements.
- b) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe; the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.





**LEGEND**

Site Boundary

BH-1Borehole Location

Top of Bank

A-A'Slope Profile Location



CLIENT:  
2831113 Ontario Inc.

PROJECT:  
  
PRELIMINARY GEOTECHNICAL &  
SLOPE STABILITY INVESTIGATION  
VACANT LOT, NORTHSIDE YORK  
RD/GLENDALE AVE  
NIAGARA-ON-THE-LAKE, ONTARIO

TITLE:  
**BOREHOLE & SLOPE PROFILE  
LOCATION PLAN**

DRAWN BY:        DN

CHECKED BY:     JM

DATE:            DECEMBER 2021

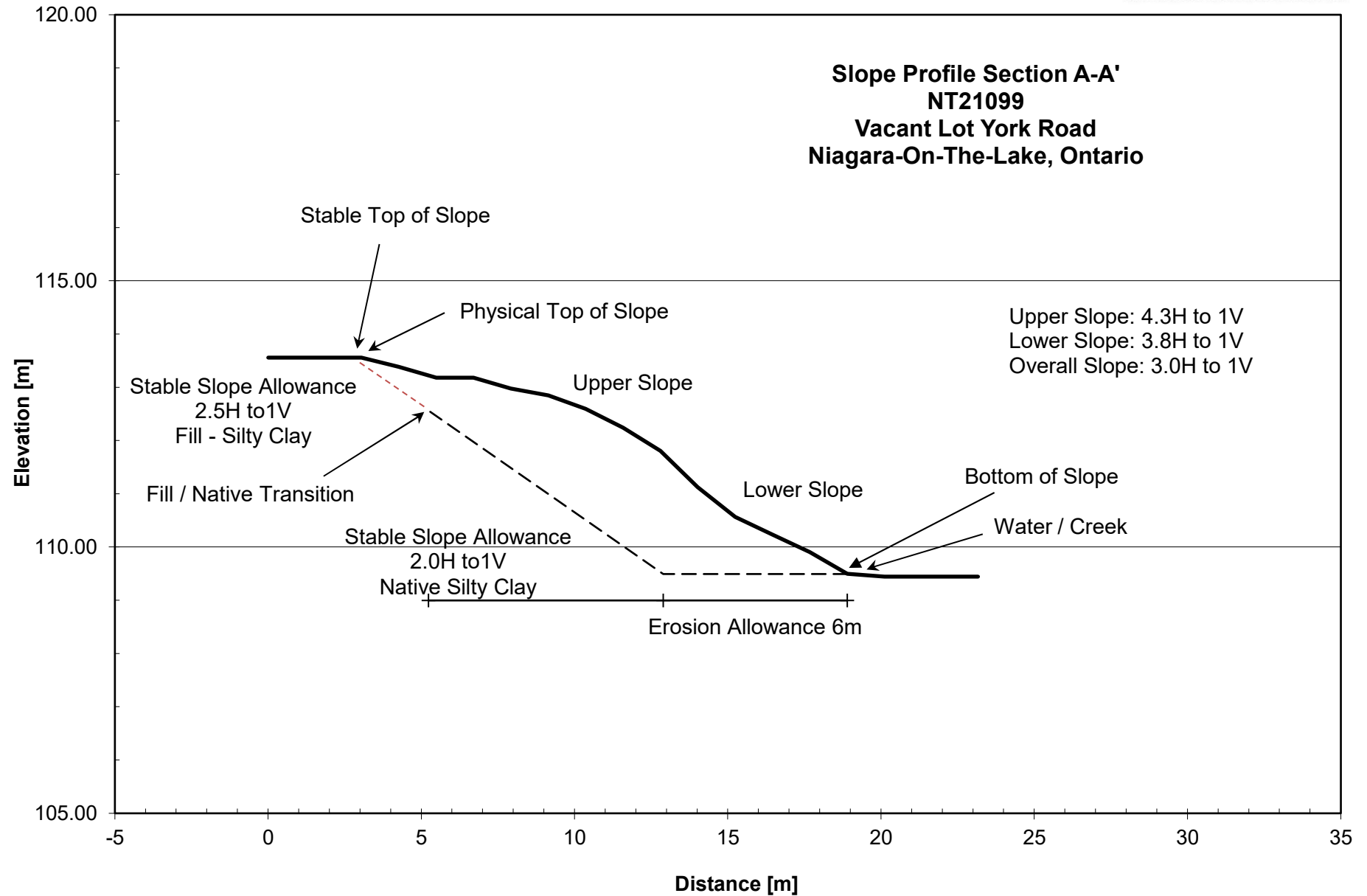
PROJECT NO:     NT21099

SCALE:           AS SHOWN

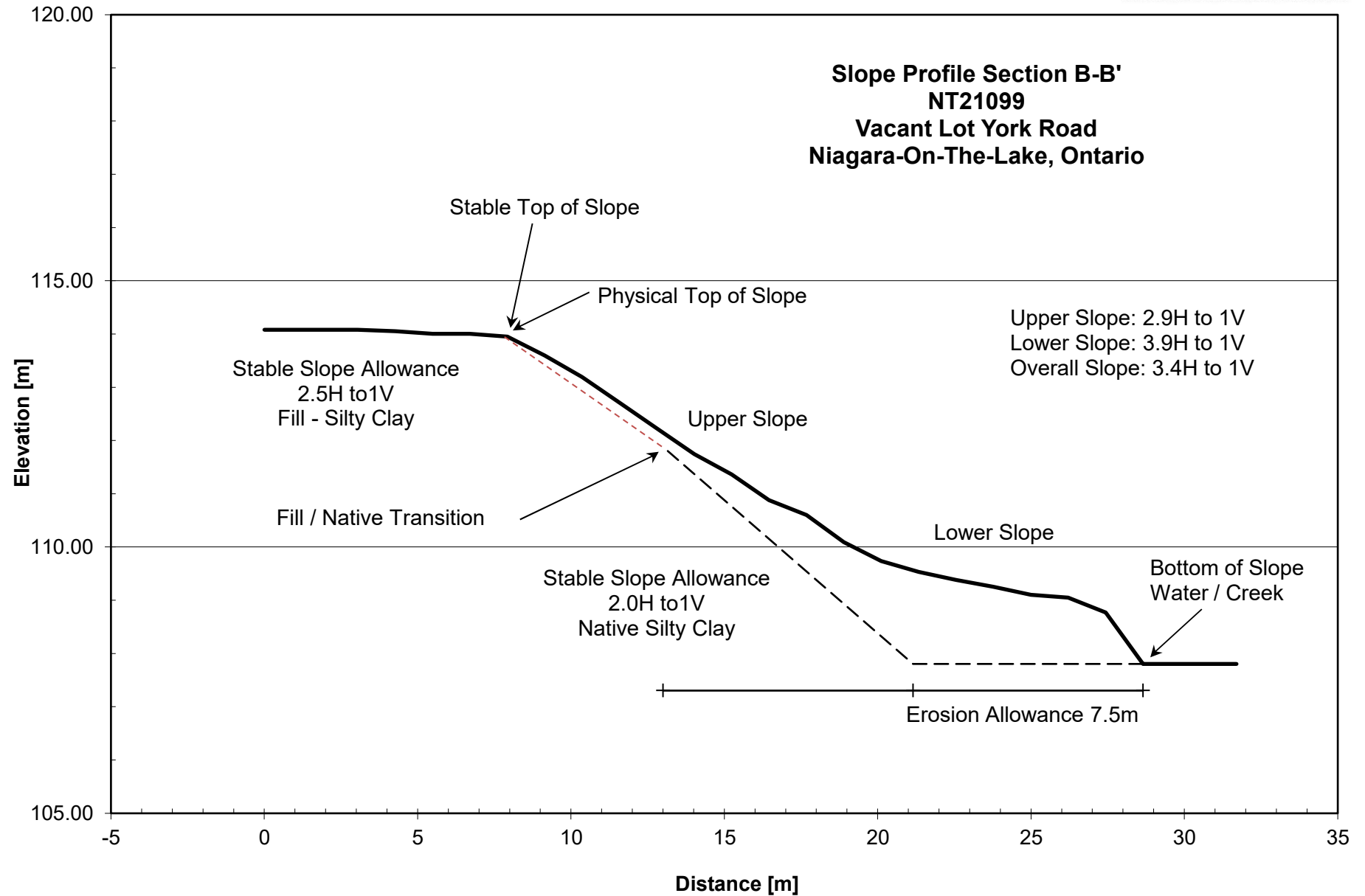
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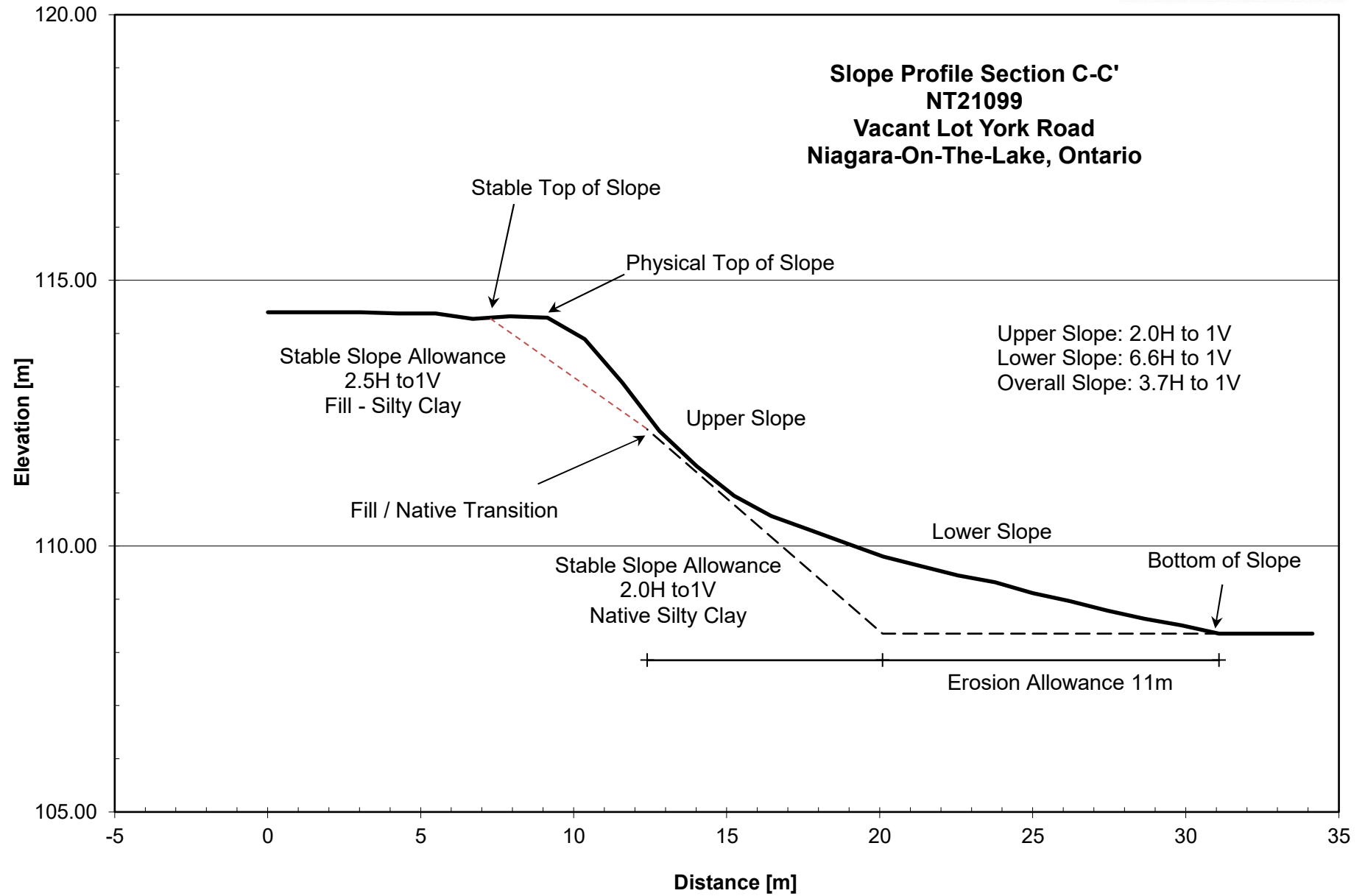
REFERENCE: BASE MAP PROVIDED BY NIAGARA NAVIGATOR, <https://maps-beta.niagararegion.ca/Navigator/>  
NOTE: FOR ILLUSTRATION PURPOSES ONLY, ALL LOCATIONS APPROXIMATE.

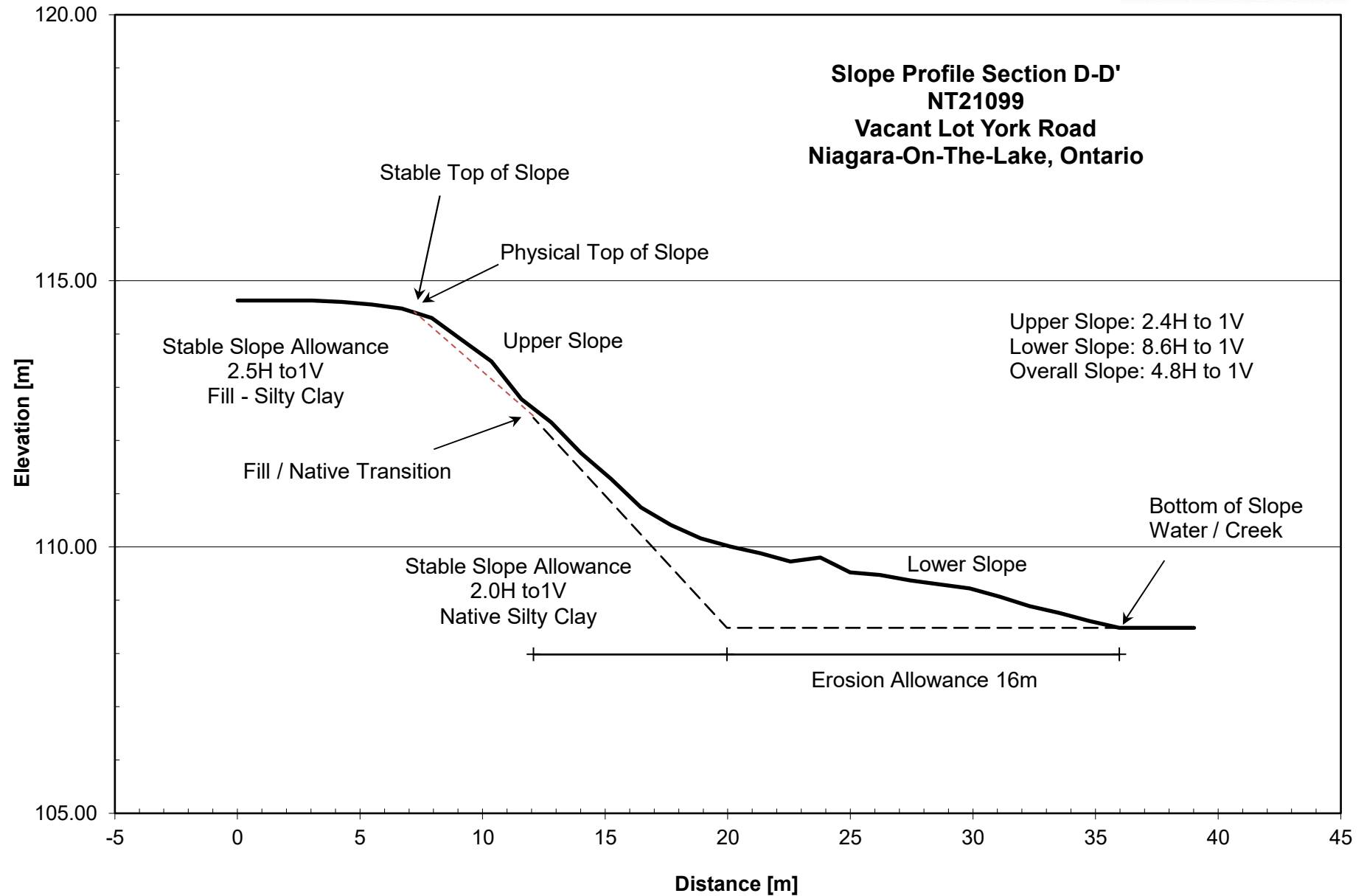


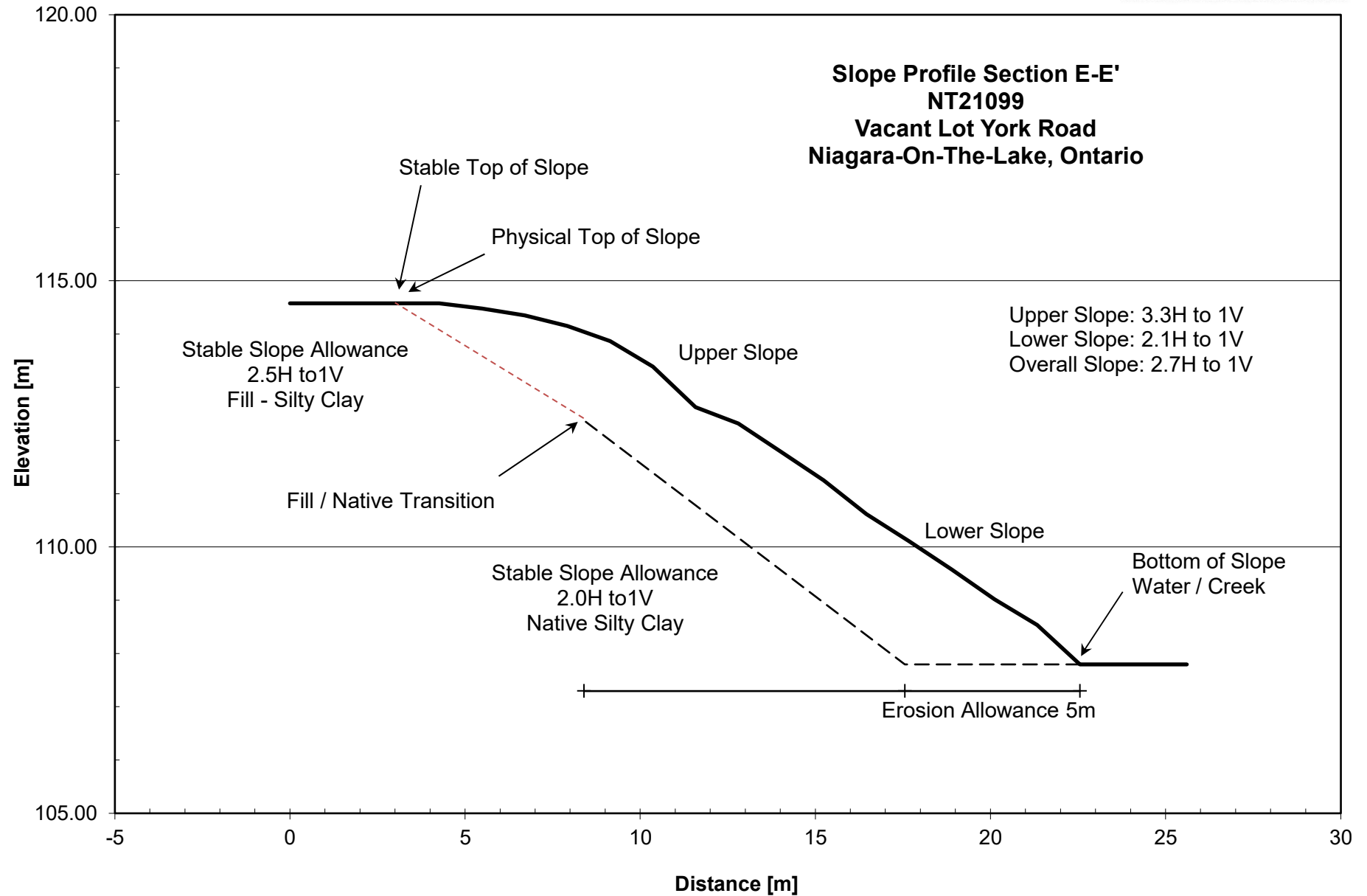




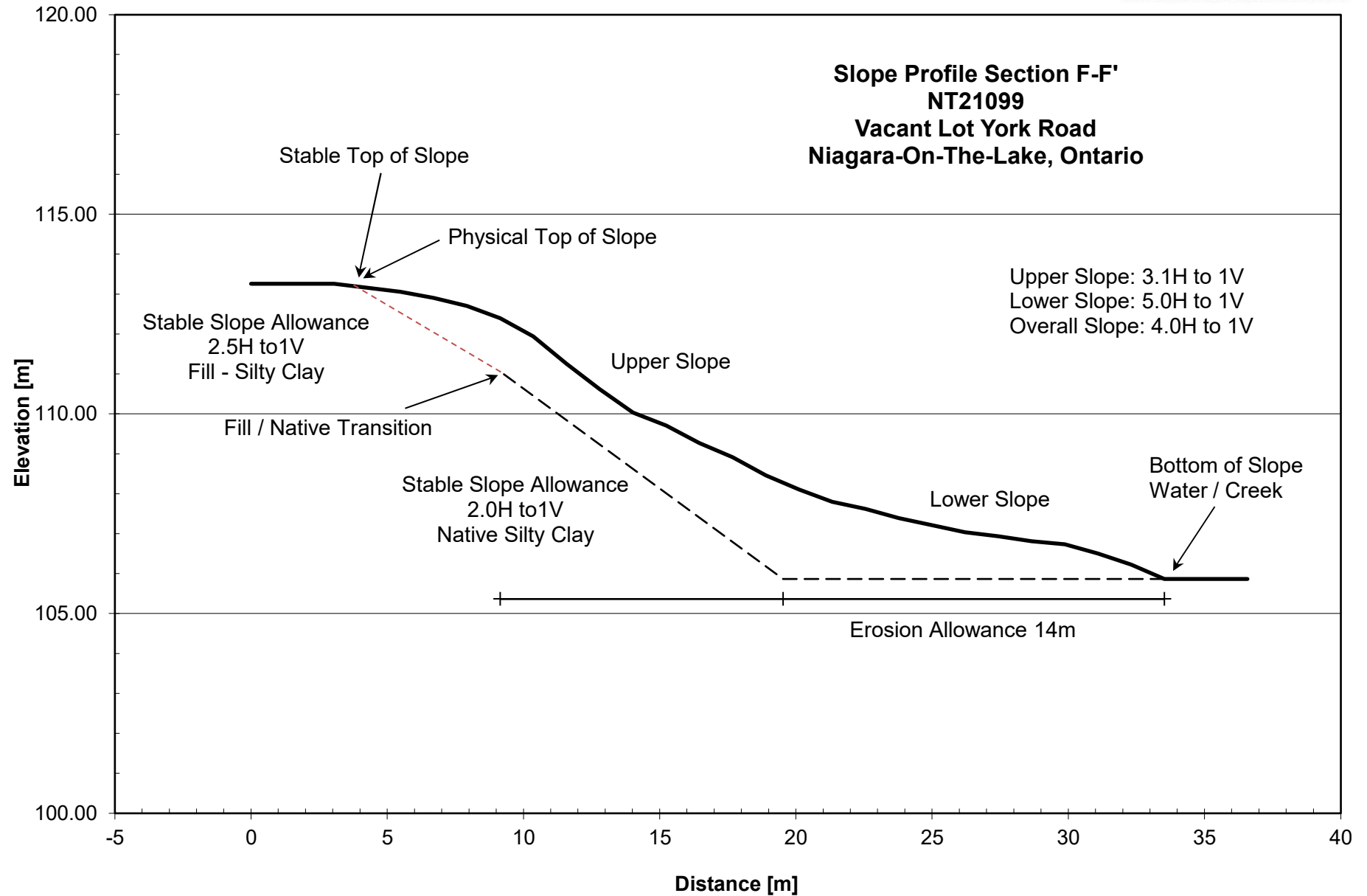


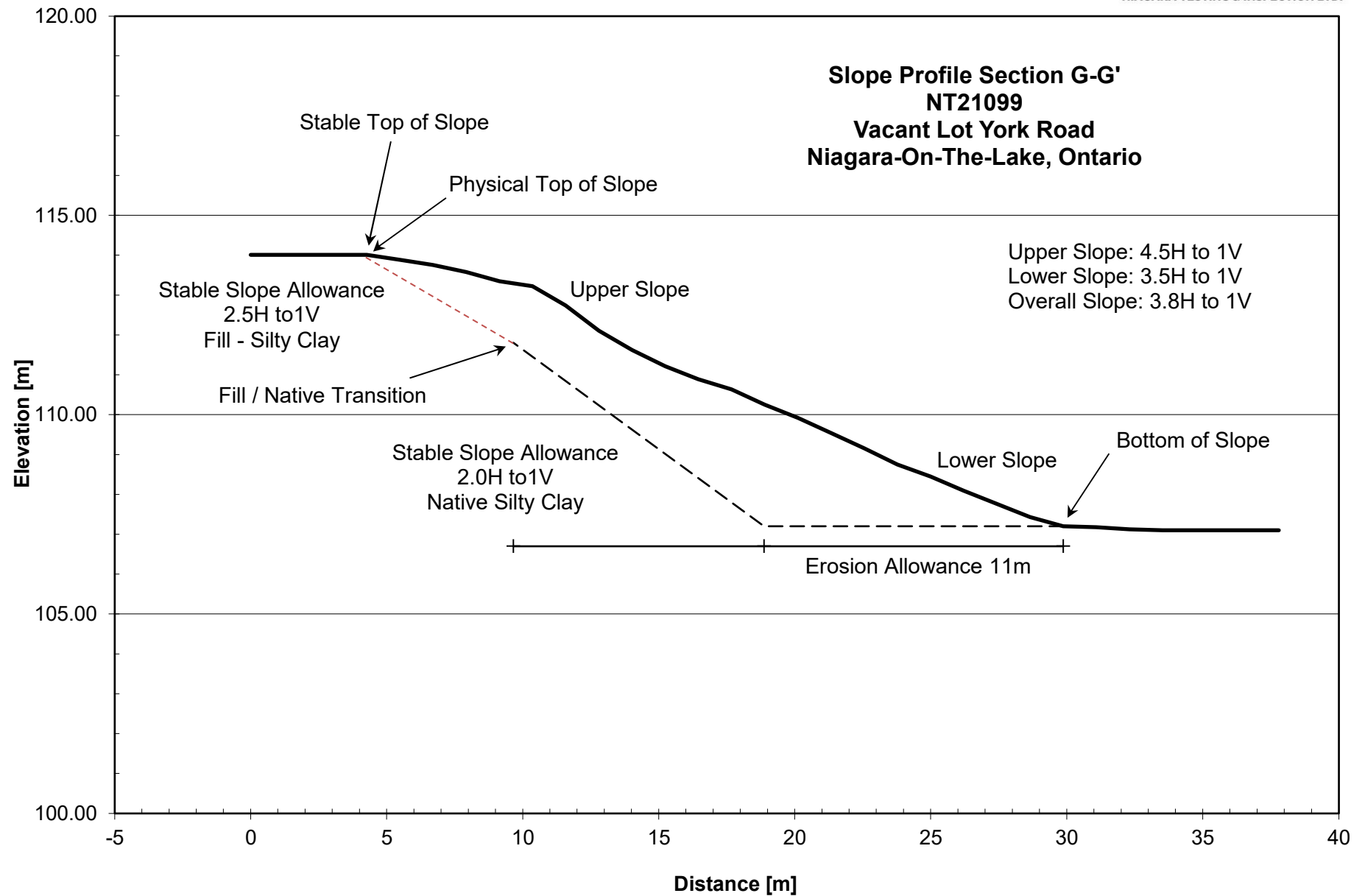


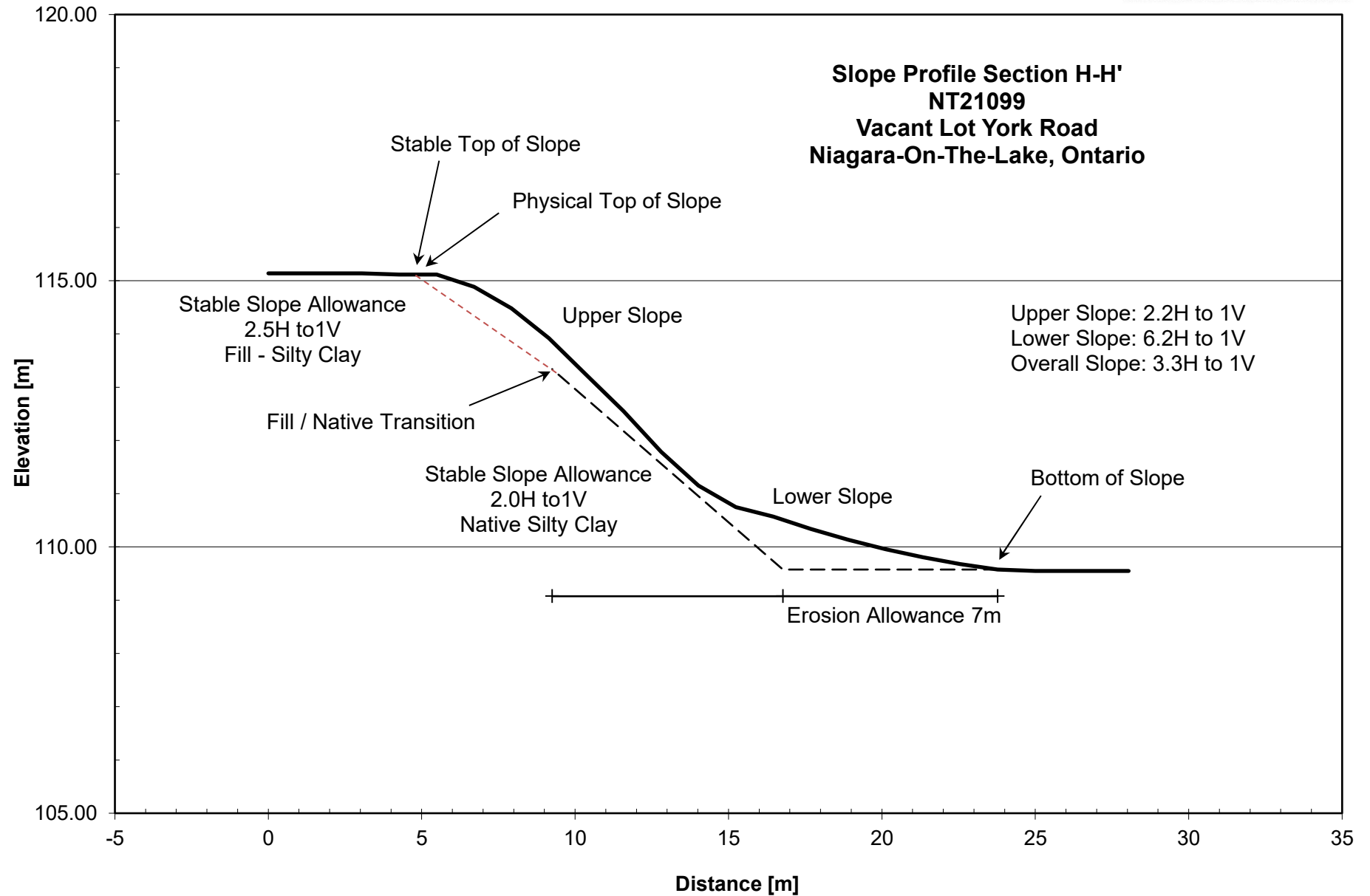


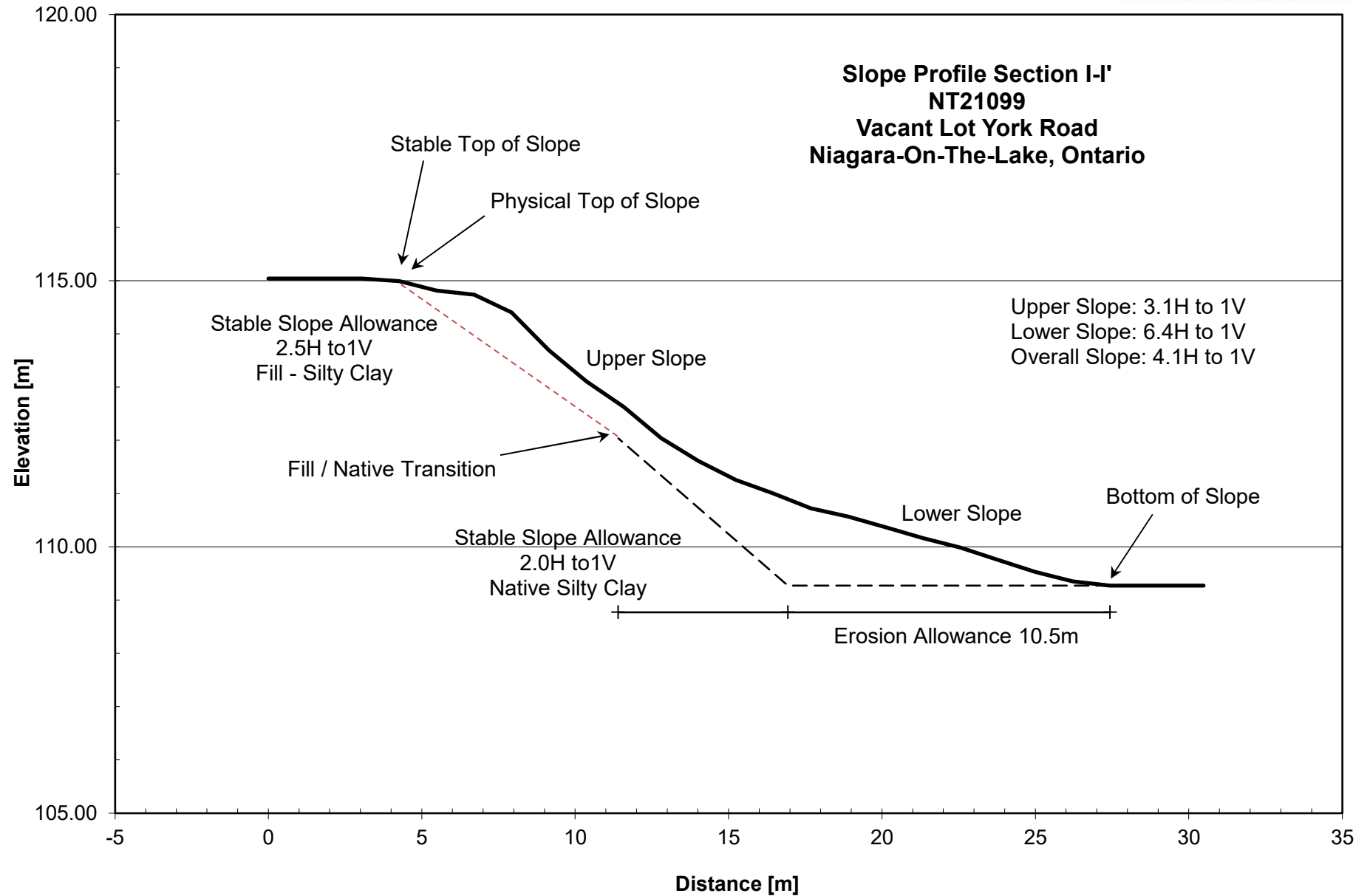






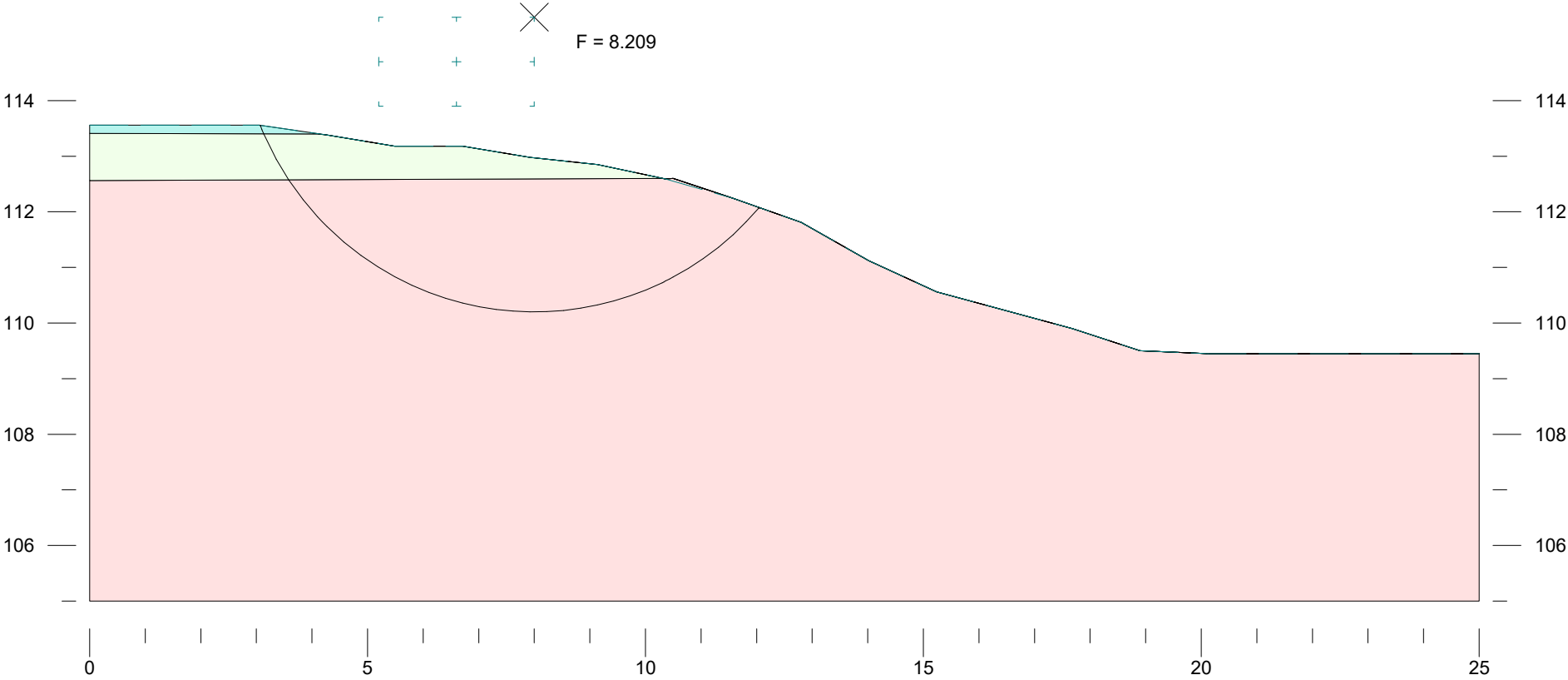




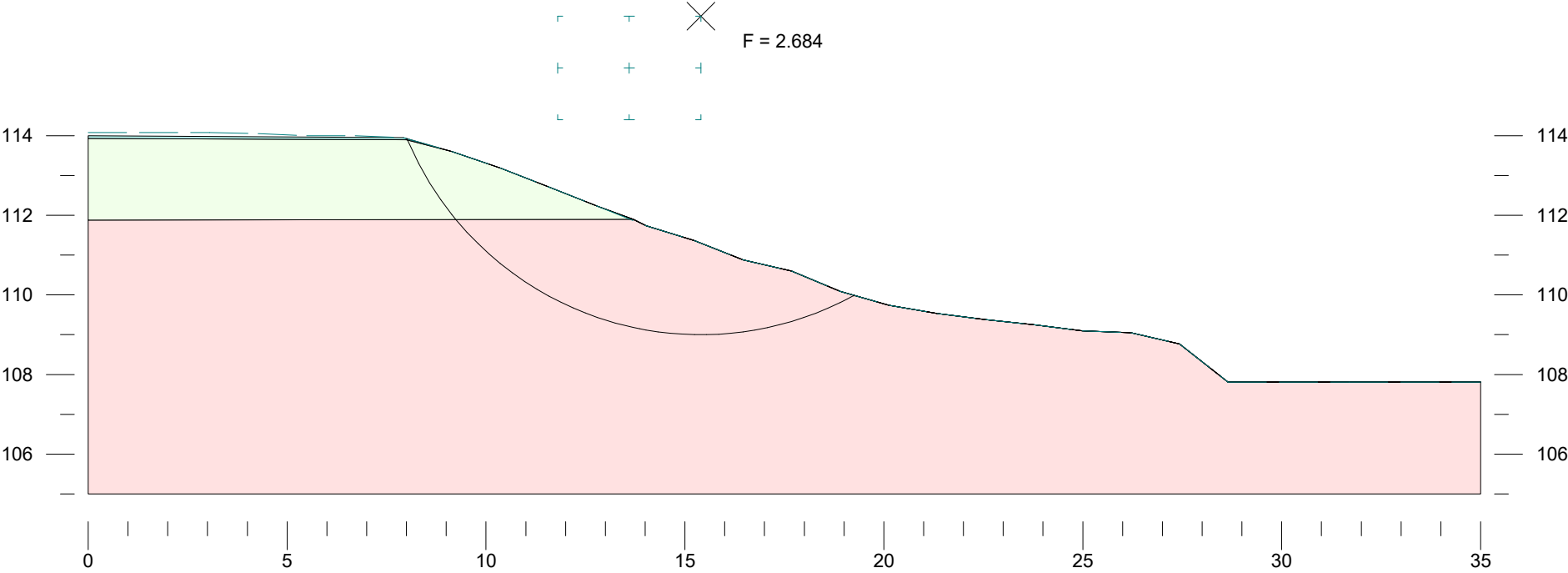




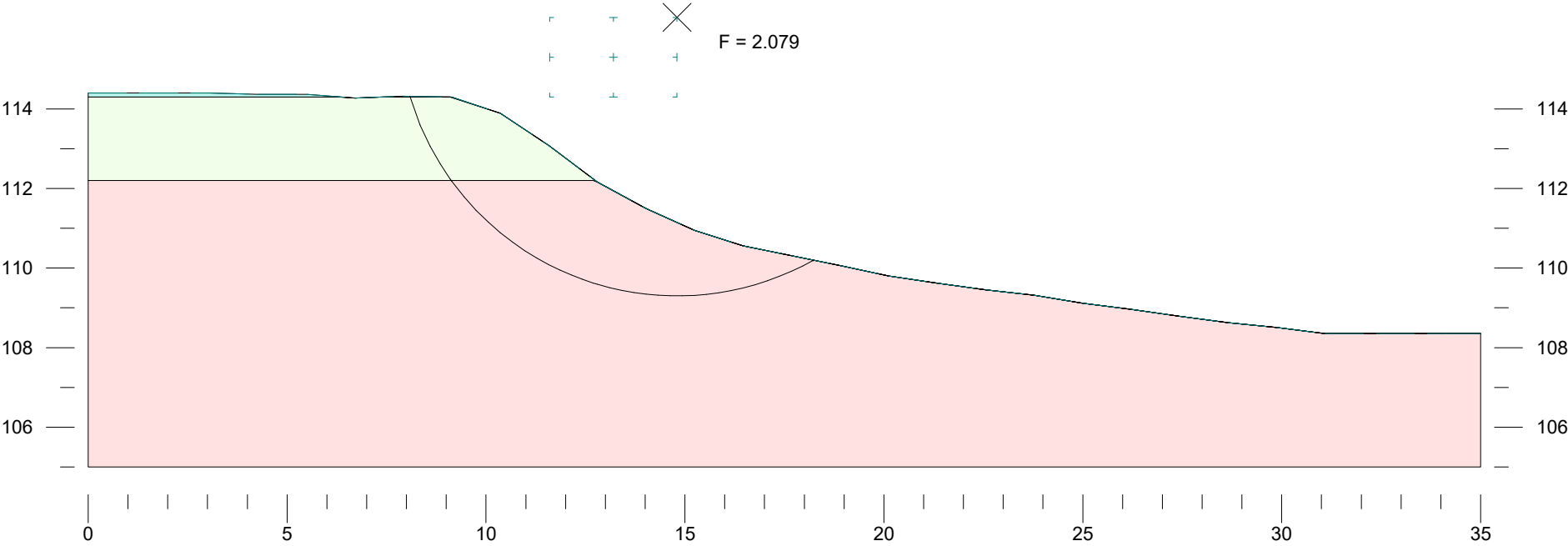
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0



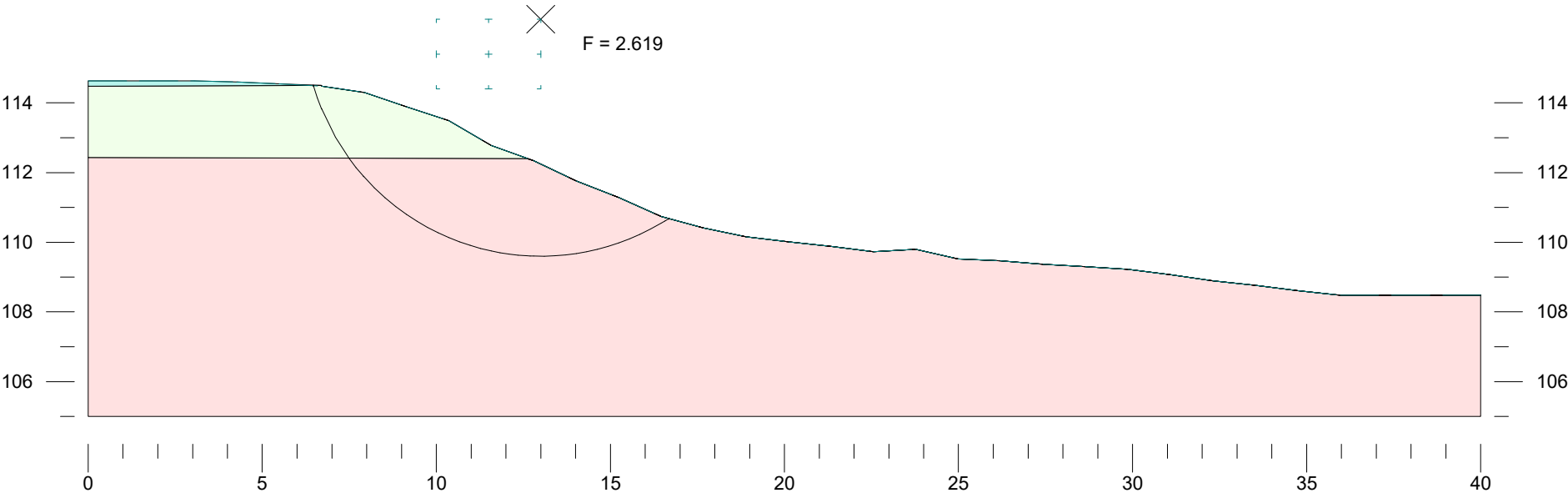
	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0



	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0

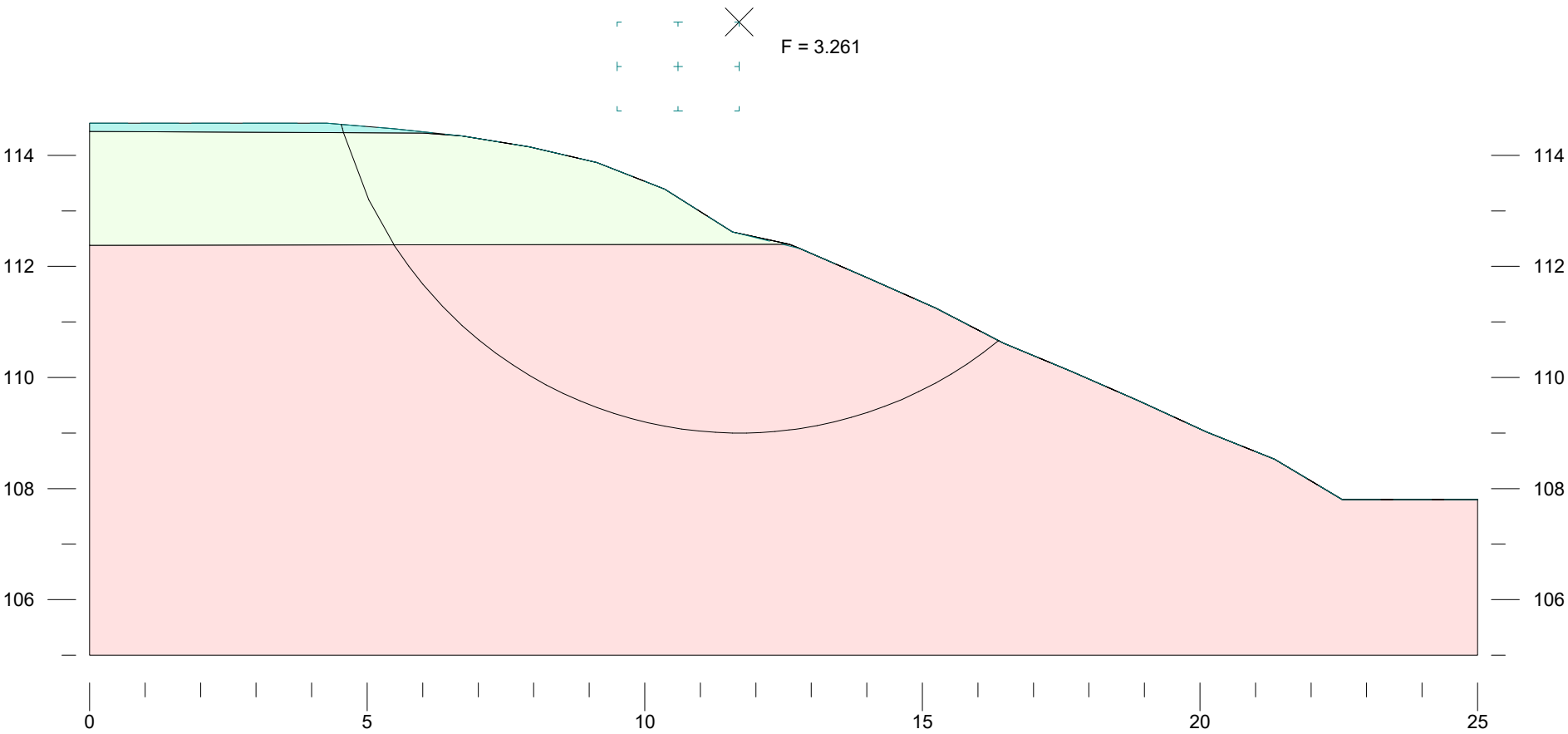


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0



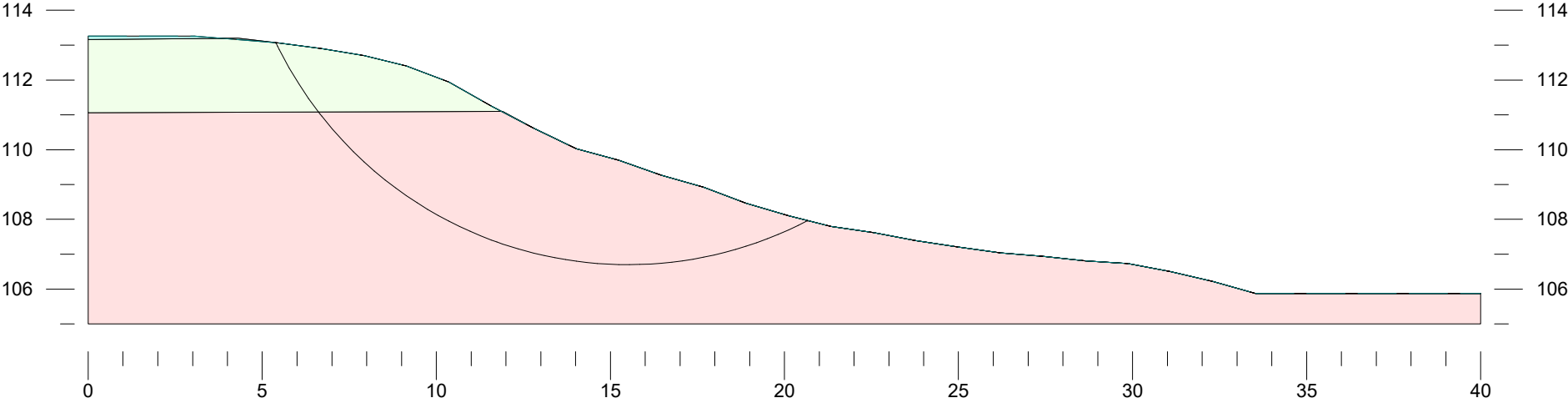


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0

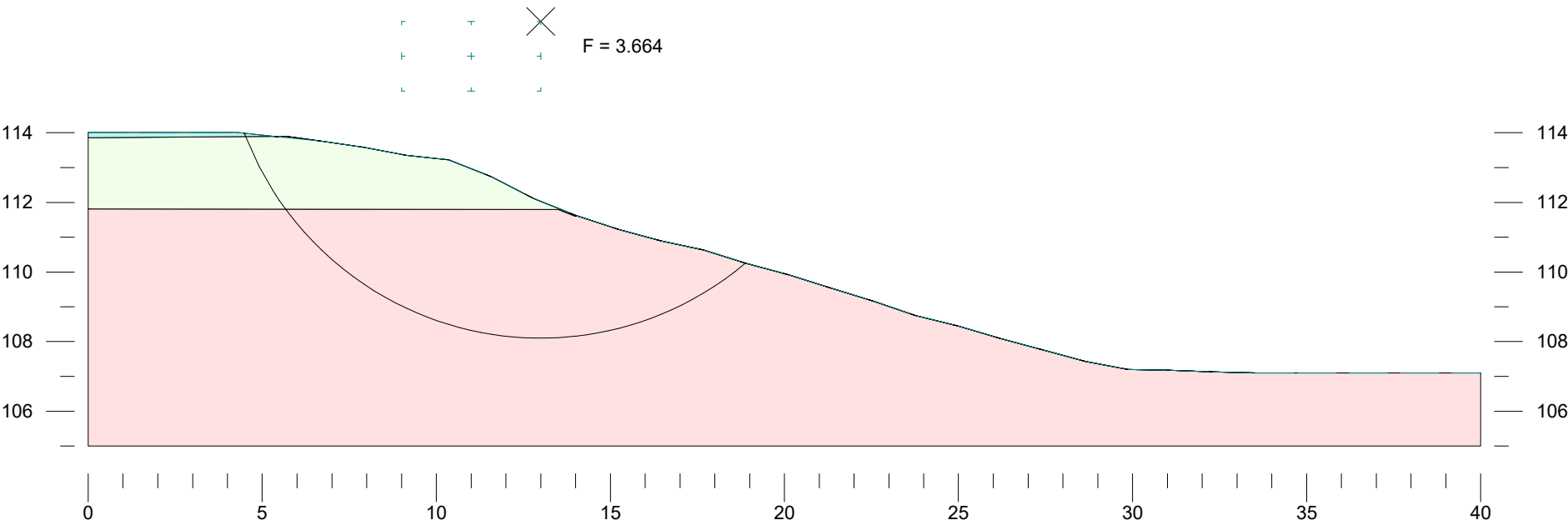


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0

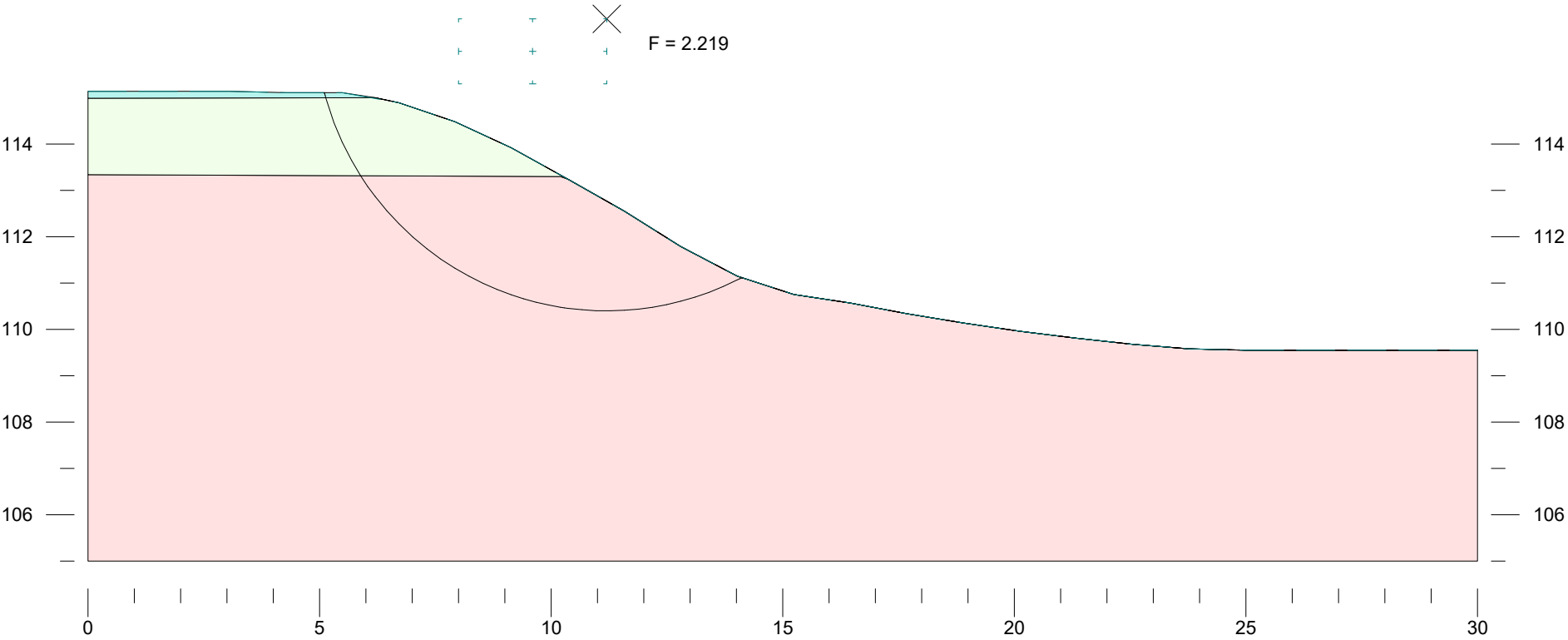
✕  
F = 2.466



	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0

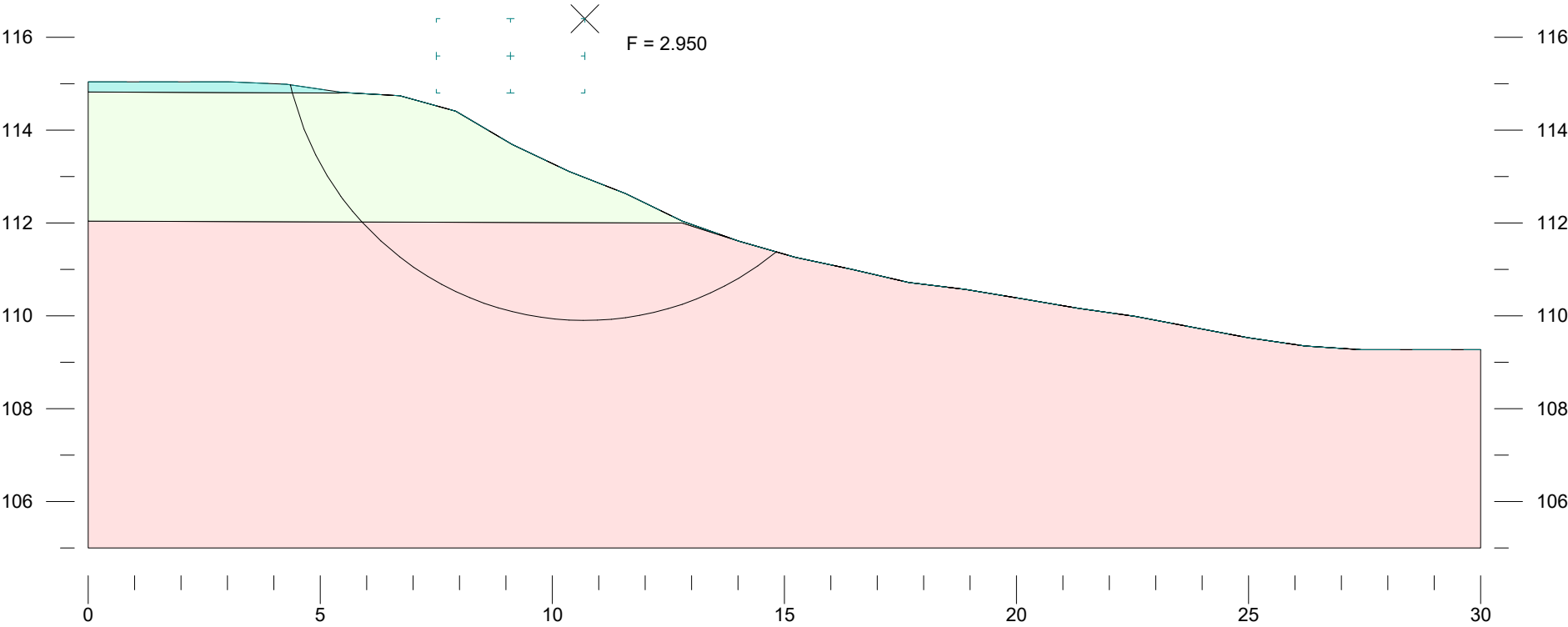


	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0





	Gamma kN/m3	C kPa	Phi deg	Piezo Surf.
Topsoil	15	0	30	0
Fill - Silty Clay	17	0	30	0
Silty Clay	19	2	32	0



# Log of Borehole No. 1

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	114.43						Ground Surface						
	114.28	SS	1	2,2,4,4	6	40	Grass and Topsoil/Organic Material - about 150 millimetres in thickness.						
							Silty Clay/Clayey Silt Fill Material - Brown, trace organics, with black staining, firm.						
1	113.43	SS	2	4,5,8,13	13	60	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.						
2		SS	3	8,8,12,14	20	85							
		SS	4	7,9,12,14	21	85							
3													
		SS	5	4,5,7,9	12	85							
4													
5	109.25	SS	6	5,6,11,12	17	100							
							End of Borehole						
6							Notes: 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 5.18 metres. 2] Borehole was 'open' and 'dry' and backfilled on completion. 3 Soil samples will be discarded after three months unless directed otherwise by client.						
7													

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

**Niagara Testing & Inspection Ltd.**  
 3300 Merrittville Highway Unit #5  
 Thorold, Ontario  
 L2V 4Y6

# Log of Borehole No. 2

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	114.55						Ground Surface						
		SS	1	2,3,3,4	6	80	Grass and Topsoil/Organic Material - about 100 millimetres in thickness.						
1		SS	2	4,6,5,7	11	60	Silty Sand to Silty Clay/Clayey Silt Fill Material - Brown, trace organics and clay in upper level, with black staining, firm to stiff.						
2		SS	3	4,5,4,3	9	25							
	112.35												
		SS	4	5,8,11, 15	19	70	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.						
3													
		SS	5	7,10,12, 14	22	100							
	110.89												
4							End of Borehole						
5													
6													
7													

Notes:  
 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.  
 2] Borehole was 'open' and 'dry' and backfilled on completion.  
 3] Soil samples will be discarded after three months unless directed otherwise by client.

Moisture Content %

SPT (N)

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

Niagara Testing & Inspection Ltd.  
 3300 Merrittville Highway Unit #5  
 Thorold, Ontario  
 L2V 4Y6

# Log of Borehole No. 3

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	115.12						Ground Surface						
	114.97	SS	1	2,3,3,4	6	50	Grass and Topsoil/Organic Material - about 150 millimetres in thickness.		19.3		6		
1		SS	2	3,3,3,2	6	45	Silty Clay/Clayey Silt Fill Material - Brown, with black staining, trace organics, some sand, gravel and cobbles, firm to stiff.		20.2		6		
2		SS	3	2,4,5,6	9	60			24.8		9		
	112.92						Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		20.2		20		
3		SS	4	6,9,11, 14	20	90							
		SS	5	7,9,12, 13	21	100			16.5		21		
	111.46						End of Borehole						
4													
5													
6													
7							Notes: 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres. 2] Borehole was 'open' and 'dry' and backfilled on completion. 3 Soil samples will be discarded after three months unless directed otherwise by client.						

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

**Niagara Testing & Inspection Ltd.**  
 3300 Merrittville Highway Unit #5  
 Thorold, Ontario  
 L2V 4Y6

# Log of Borehole No. 4

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	113.61						Ground Surface						
		SS	1	2,2,2,2	4	50	Grass and Topsoil/Organic Material - about 100 millimetres in thickness.		23.6		4		
1		SS	2	3,2,3,4	5	40	Silty Clay Fill Material - Brown, trace organics, asphaltic concrete, sand and gravel, with black staining, firm to stiff.		25.6		5		
2		SS	3	2,4,5,6	9	70			21.6		9		
	111.41												
		SS	4	3,4,5,7	9	50	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		21.3		9		
3													
		SS	5	4,6,8,10	14	70			25.8		14		
	109.95						End of Borehole						
4													
5													
6													
7													

Notes:  
 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.  
 2] Borehole was 'open' and 'dry' and backfilled on completion.  
 3] Soil samples will be discarded after three months unless directed otherwise by client.

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

**Niagara Testing & Inspection Ltd.**  
 3300 Merrittville Highway Unit #5  
 Thorold, Ontario  
 L2V 4Y6

# Log of Borehole No. 6

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	114.53						Ground Surface						
	114.38	SS	1	1,3,3,5	6	40	Grass and Topsoil/Organic Material - about 150 millimetres in thickness.						
1		SS	2	3,4,3,4	7	75	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, rootlets, sand and gravel, with black staining, firm to stiff.						
2	112.73	SS	3	3,6,9,9	15	70	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.						
3		SS	4	7,10,12,14	22	90							
4	110.87	SS	5	6,10,14,14	24	80							
5							End of Borehole						
6													
7													

Notes:  
 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.  
 2] Borehole was 'open' and 'dry' and backfilled on completion.  
 3 Soil samples will be discarded after three months unless directed otherwise by client.

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Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

# Log of Borehole No. 5

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

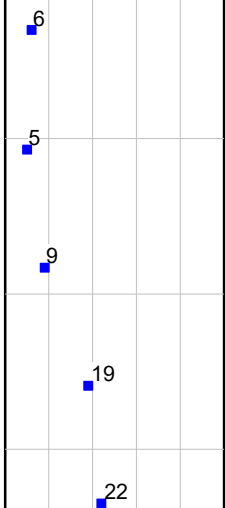
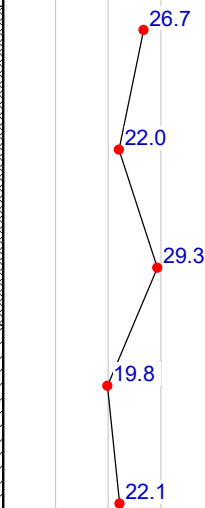
**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	114.38						Ground Surface						
	114.23	SS	1	1,3,3,4	6	50	Grass and Topsoil/Organic Material - about 150 millimetres in thickness.						
1		SS	2	2,2,3,3	5	50	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, rootlets, sand and gravel, with black staining, firm to stiff.						
		SS	3	3,3,6,6	9	60							
2	112.18						Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.						
		SS	4	5,7,10,13	17	75							
3		SS	5	6,10,12,12	22	85							
	110.72						End of Borehole						
4													
5													
6													
7													

Notes:  
 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.  
 2] Borehole was 'open' and 'dry' and backfilled on completion.  
 3] Soil samples will be discarded after three months unless directed otherwise by client.

Moisture Content %

SPT (N)



Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

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# Log of Borehole No. 7

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %				SPT (N)				Well Installation
									10	20	30	40	100	200	300	400	
0	115.49						Ground Surface										
		SS	1	2,2,3,4	5	40	Grass and Topsoil/Organic Material - about 100 millimetres in thickness.		19.6				5				
1		SS	2	4,5,5,6	10	50	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, with black staining, firm.		26.9				10				
	113.99																
2		SS	3	6,9,13, 16	22	85	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		16.6				22				
		SS	4	10,14,20 23	34	80			20.3								
3																	
		SS	5	6,11,13, 17	24	90			22.4				24				
4																	
5		SS	6	5,10,12, 13	22	80	Notes: 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 6.71 metres. 2] Borehole was 'open' and 'dry' and backfilled on completion. 3] Soil samples will be discarded after three months unless directed otherwise by client.		25.2				22				
6																	
		SS	7	4,6,9,10	15	75			27.6				15				
	108.78																
7							End of Borehole										

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

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# Log of Borehole No. 8

Page 1 of 1

**Date Drilled:** November 2, 2021

**Drill Method:** Solid Stem

**Drilling Company:** Elite Drilling Service

**Hole Size:** 150mm

**Hammer Type:** Mechanical

**Project:** Proposed Development

**Location:** York Road

**City:** Niagara-on-the-Lake, Ontario

**Datum:** Geodetic

**Project No.:** NT21099-G

**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10 20 30 40	10 20 30 40	10 20 30 40	100 200 300 400	
0	115.49						Ground Surface						
		SS	1	2,3,3,4	6	40	Grass and Topsoil/Organic Material - about 100 millimetres in thickness.		25.4		6		
1		SS	2	2,4,6,9	10	70	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, rootlets, sand and gravel, with black staining, firm to stiff.		25.6		10		
	113.99												
2		SS	3	5,19,13,15	23	75	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		21.6		23		
		SS	4	6,10,12,15	22	80			22.4		22		
3		SS	5	8,9,13,16	22	85			23.0		22		
	111.83						End of Borehole						
4													
5													
6													
7													

**Notes:**

- 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.
- 2] Borehole was 'open' and 'dry' and backfilled on completion.
- 3] Soil samples will be discarded after three months unless directed otherwise by client.

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

**Niagara Testing & Inspection Ltd.**  
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# Log of Borehole No. 9

Page 1 of 1

**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	115.14						Ground Surface						
	114.99						Grass and Topsoil/Organic Material - about 150 millimetres in thickness.						
		SS	1	2,3,4,5	7	85	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, rootlets, sand and gravel, with black staining, firm to stiff.		21.4		7		
1	114.34						Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		20.2			26	
		SS	2	7,10,16,19	26	75							
									20.4			25	
2		SS	3	8,11,14,17	25	95							
									22.9			22	
		SS	4	6,9,13,15	22	85							
3													
		SS	5	6,8,10,13	18	100			25.1			18	
	111.48												
4							End of Borehole						
5													
6													
7													

Notes:  
 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 3.66 metres.  
 2] Borehole was 'open' and 'dry' and backfilled on completion.  
 3] Soil samples will be discarded after three months unless directed otherwise by client.

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

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# Log of Borehole No. 10

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**Date Drilled:** November 2, 2021  
**Drill Method:** Solid Stem  
**Drilling Company:** Elite Drilling Service  
**Hole Size:** 150mm  
**Hammer Type:** Mechanical

**Project:** Proposed Development  
**Location:** York Road  
**City:** Niagara-on-the-Lake, Ontario  
**Datum:** Geodetic

**Project No.:** NT21099-G  
**Client:** 2821113 Ontario Inc.

Depth (m)	Elev. [m]	Sample Type	Number	Blows/0.15 m	Blows/300 mm	Recovery	DESCRIPTION	Symbol	Moisture Content %		SPT (N)		Well Installation
									10	20	30	40	
0	115.11						Ground Surface						
	114.89	SS	1	2,4,4,4	7	85	Grass and Topsoil/Organic Material - about 225 millimetres in thickness.		22.7		8		
1		SS	2	2,3,2,3	5	75	Silty Clay/Clayey Silt Fill Material - Brown, trace organics, rootlets, sand and gravel, with black staining, firm to stiff.		27.4		5		
2		SS	3	2,3,4,4	7	95			26.2		7		
		SS	4	2,3,3,6	6	85			28.4		6		
3	112.11	SS	5	4,7,9,12	16	100	Silty Clay/Clayey Silt - Greyish brown, 'reworked' appearance in upper level, trace rootlets, trace sand and fine gravel, stiff to very stiff.		24.0		16		
4													
5	109.93	SS	6	5,6,9,9	15				27.4		15		
							End of Borehole						
6							Notes: 1] Borehole advanced using solid stem auger equipment on November 2, 2021 to termination at depth of about 5.18 metres. 2] Borehole was 'open' and 'dry' and backfilled on completion. 3 Soil samples will be discarded after three months unless directed otherwise by client.						
7													

Note: This borehole log has been prepared for geotechnical purposes and does not necessarily contain information suitable for an environmental assessment of the subsurface conditions.

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