SOIL-MAT ENGINEERS & CONSULTANTS LTD.

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PROJECT NO.: SM 240708-G

September 5, 2024
Revised: November 19, 2024

CHRISTOPHER SIMPSON
3618 Firelane 12
Port Colborne, Ontario
L3K 5V3

Attention: Christopher Simpson

SLOPE STABILITY ASSESSMENT
PROPOSED NEW SINGLE-FAMILY DWELLING
3618 FIRELANE 12
PORT COLBORNE, ONTARIO

Dear Mr. Simpson,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork, slope stability analysis, and report preparation in connection with the above noted project. This slope stability assessment was conducted in general accordance with our email proposal, dated July 25, 2024. Our comments and recommendations, based on our observations and analysis are presented in the following paragraphs.

INTRODUCTION

We understand that it is proposed to construct a new basmentless two storey single family dwelling founded upon helical piers upon the demolition of the existing cottage with a new septic system located at 3618 Firelane 12 in Port Colborne, Ontario. The proposed septic system is to be located to the north of the proposed single family dwelling with a detached garage below the subject slope to the south of the proposed single family dwelling. The purpose of this slope stability assessment was to evaluate the stability of the existing slope, and to provide our comments and recommendations with respect to the design and construction of the proposed new development, from a geotechnical point of view.

This work has been conducted in general accordance with the guideline policies of NPCA, including Natural Hazards Technical Guide by MNR and the supporting document “Geotechnical Principles for Stable Slopes”.

PROCEDURE

The site was visited on August 14, 2024, by a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD. During our site visit representative profiles of the subject slope were measured from the north face of the existing structure down to the toe of the slope and an additional profile from the south face of the existing structure to the toe of the slope. The locations of these slope profiles are illustrated on the attached Drawing No. 1, Slope Profile Location Plan, while the slope profiles themselves are illustrated on the attached Drawing Nos. 2, 3, and 4, Slope Profiles A-A to C-C.

In addition, a Slope Stability Rating Chart as per the Ontario Ministry of Natural Resources publication "Geotechnical Principles for Stable Slopes" [Geotechnical Principles publication] was completed for the slopes which indicated a Rating Value of 32 for the worst case slope indicating a slight potential for slope instability. A copy of the Slope Stability Rating Charts has been attached to this letter report.

The ground surface elevation at the start of the slope profiles, at the corners of the existing dwelling were referenced form the topographic information provided this office [Topographic Survey, Lot 32, Plan 811, Geographic Township of Humberstone, Rash+ Hyde Ltd., Survey 23F096, Dated October 10, 2024]

SLOPE CONDITIONS AND STABILITY ASSESSMENT

The subject property is located at 3618 Firelane 12 in Port Colborne, Ontario. The property is currently occupied by a single-family dwelling, with surrounding landscaped areas. The property consists of table land with the property sloping downhill to the north and south.

A review of available published information [Quaternary Geology of Ontario, Southern Sheet Map 2556] indicate coarse-textured glaciolacustrine subsurface soils that consist of sand and gravel, with minor silt and clay consistent with our experience in the area, and observations in a series of hand dug test pits, as well as an open excavator advanced test pit, while on site.

SLOPE CONDITIONS, STABILITY ASSESSMENT, AND TOP OF STABLE SLOPE LOCATION

Slope Profiles A-A and B-B were measured from the north west and north east corners of the existing dwelling respectively, where Slope Profile C-C was measured from the south face of the existing dwelling, down to the toe of the slope, as illustrated in the Slope Profile Location Plan. The subject slope was measured to be approximately 5 to 6 metres in height to the north of the dwelling, to 5 metres in height to the south of the

dwelling, with an overall inclination of about 1.6 to 1.7 horizontal to 1 vertical from the toe to the crest in the north and 2.6 horizontal to 1 vertical from the toe to the crest in the south. The slope was noted to be well vegetated in the north with mature trees and scrub vegetation. The south facing slope was noted to vary in vegetation cover with areas with limited vegetation with the majority being well vegetated. There was no evidence of significant surficial movements, failure scars, or tension cracks on the majority of the slope.

As with all slopes, there is a reduction in shearing resistance attributed to the effects of freezing and thawing, wetting and drying, burrowing animals, etc. With time, the surface of the slope will degenerate and tend to reach equilibrium within its stress and ambient environment, including vegetative cover. However, this degeneration of the slope angle is a very slow process as is evident by the present condition of the existing slope.

A stability analysis of the subject slope was performed with a computerized modelling program [SLOPE/W 2023] utilizing multiple methods of analysis [Bishop, Janbu, and Morgenstern-Price] and considering different slip planes and centers of rotation, as well as normal and elevated groundwater conditions, to determine the minimum factor of safety for a series of potential trial slip surfaces.

Soil properties for the subsurface soils have been conservatively attributed based on the soil information as noted above, along with our past experience in the area. For the purposes of modeling the slope, the sand soils have been conservatively assigned a unit weight of γ = 18.0 kN/m^3, an angle of internal friction of ϕ = 32 degrees, and cohesion of c = 0 kPa.

The Ministry of Natural Resources “Geotechnical Principles for Stable Slopes” publication, Table 7.2 lists a minimum Factor of Safety of 1.2 to 1.3 for Light Land Use application [unoccupied structures, tile beds, etc.], and minimum Factors of Safety of 1.3 to 1.5 for Active Structures [habitable or occupied structures]. As there is no active water course in close proximity to these slopes, the top of stable slope location is determined strictly through stability analysis, and determining locations where the above criteria is met.

Based on our analyses, using the conservative assumptions noted above, the subject slopes were found to have minimum factors of safety of 1.2 for normal and elevated groundwater conditions, on the north side of the existing structure, locations approximately 4.0 and 9.0 metres north of the existing dwelling, for Profiles A-A and B-B respectively, as illustrated on Drawing No. 1, for the purposes of the proposed septic bed location.

With respect to the house, and using a factor of safety of 1.5 as a starting point, the top of stable slope location was determined to be at a distance of approximately 1.2 and 6.3 metres north of the existing dwelling for Profiles A-A and B-B respectively, and 7.0 metres south of the existing dwelling for Profile C-C, as illustrated on Drawing No. 1. Sample results of these analysis are attached to the end of this report. It is noted that theoretical surficial planes with lower factors of safety would exist, however these insignificant failure planes do not account for the stabilising effect of vegetation, nor would they impact the global stability of the slope.

From the updated drawings provided to our office, as noted above, the proposed septic system and house are noted to be 'uphill' of their respective top of stable slope locations based on the minimum factor of safety required for each type of construction.

It is noted the operation of the septic system consists of two parts; a holding tank, to store the solid waste which is pumped out periodically by a sanitary waste service, and the leaching bed, which is driven by gravity and the moisture infiltrating though the onsite soils to manage the liquid waste. As infiltration is a relatively slow process, much less than a typical storm event, outflow from the septic system is not a concern for slope stability. It is also noted that the proposed septic bed is only marginally closer than the existing septic bed, which has demonstrated no signs of negatively impacting the subject slope.

CONSTRUCTION CONSIDERATIONS

Based on the above, the existing slope is considered stable in the long-term with respect to the top of stable slope locations. As such, it is our opinion that construction of the proposed septic bed and dwelling 'uphill' of each respective top of stable slope location, would have no negative impact on the stability of the subject slope, from a geotechnical point of view.

The following recommendations should be considered in the proposed construction:

- Excavated soil and/or heavy construction equipment should not be places or travel near the top of stable slope location. In this regard it is recommended that a silt fence be placed along, or slightly 'uphill' from, the top of stable slope location for the duration of the construction. This will act as a barrier for construction activity and also prevent sediment runoff during construction

- Any drainage towards the sloe should be in a controlled fashion, such as sheet flow through well established grass or vegetation, so as to not alter the natural drainage over the slope or create concentrated flows onto the slope.

- Vegetation on the slope should be protected during construction and all existing trees on the slope maintained during and following construction. Uphill of the crest of the slope the vegetation should be repaired/improved with the establishment of new deep rooted vegetation post construction, where required.

- As noted above, an area of limited vegetation existed on the south slope, which would be prone to surface erosion if left in its present condition. It is recommended to revegetate this area or provide erosion protection through other means.

- The foundations for the new dwelling should at least be nominally reinforced. Such reinforcement would include the provision of two continuous 15M bars in the footings and the top of the foundation wall, or as otherwise specified by the project structural engineer.

We trust that this slope assessment report is sufficient for your present requirements. Should there be any questions regarding the content or comments within this report please do not hesitate to contact our office.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

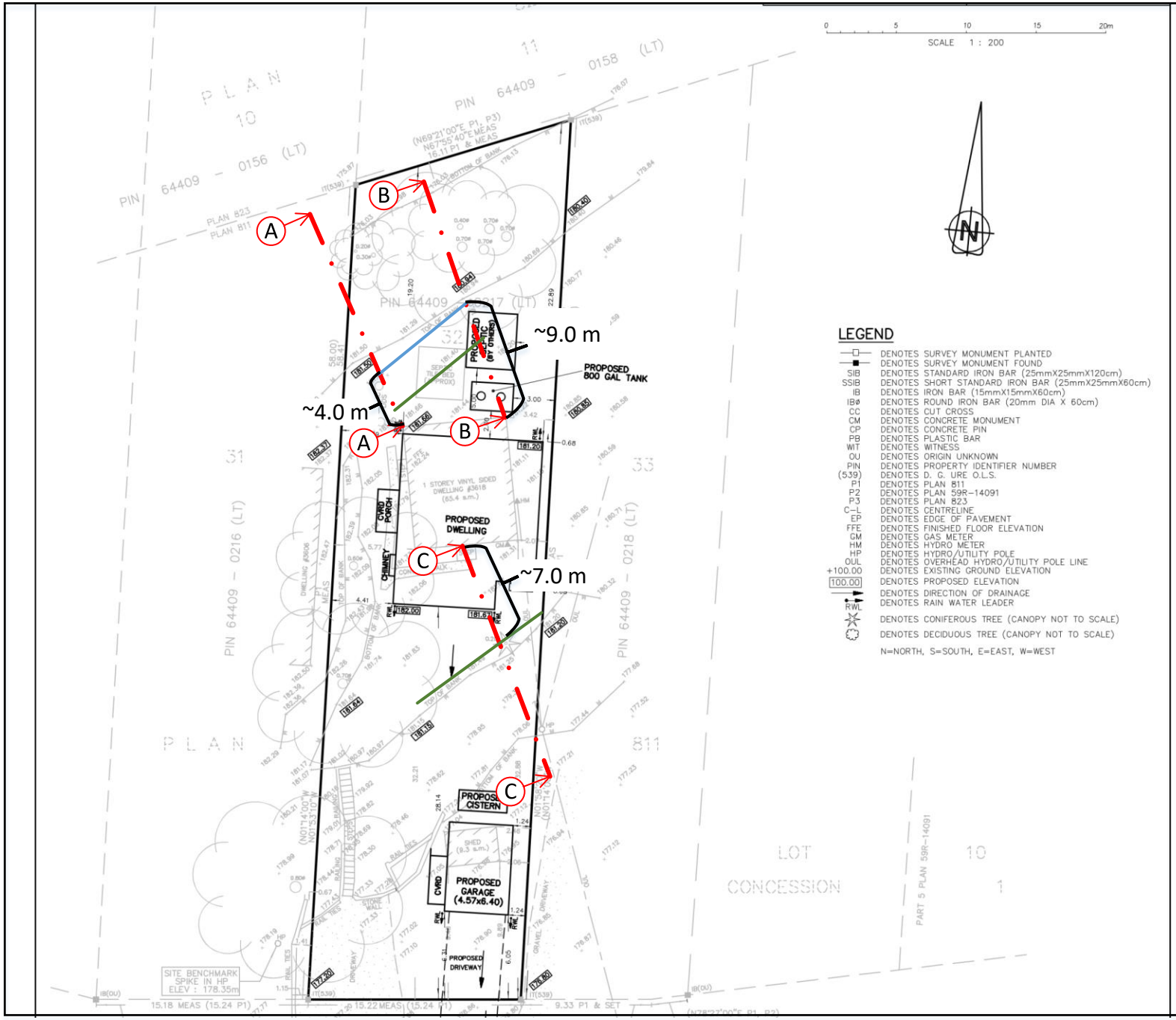
Kevin Reid, B. Eng.
Junior Engineer

LICENSED PROFESSIONAL ENGINEER
Nov 19/24
A. D. ROEMMELE
100212893
PROVINCE OF ONTARIO

Adam Roemmele, P. Eng.
Project Engineer

Enclosures: Drawing No. 1, Slope Profile Location Plan
Drawing No. 2 to 4, Slope Profile A-A to C-C
Slope Stability Rating Charts
Slope Stability Analyses

Distribution: Christopher Simpson [pdf]



LEGEND

Slope Profile Location

1.2 FOS Location

1.5 FOS Location

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 240708-G.

2. Slope profile location and ToSS location are approximate.

3. Drawing Reference : Topographic Survey, Lot 32, Plan 811, Geographic Township of Humberstone, Rash + Hyde Ltd., Survey 23F096, Dated October 10, 2024]

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Slope Stability Assessment
Proposed Septic System
3618 Firelane 12
Port Colborne, Ontario

Slope Profile Location Plan

Project No. SM 240708-G

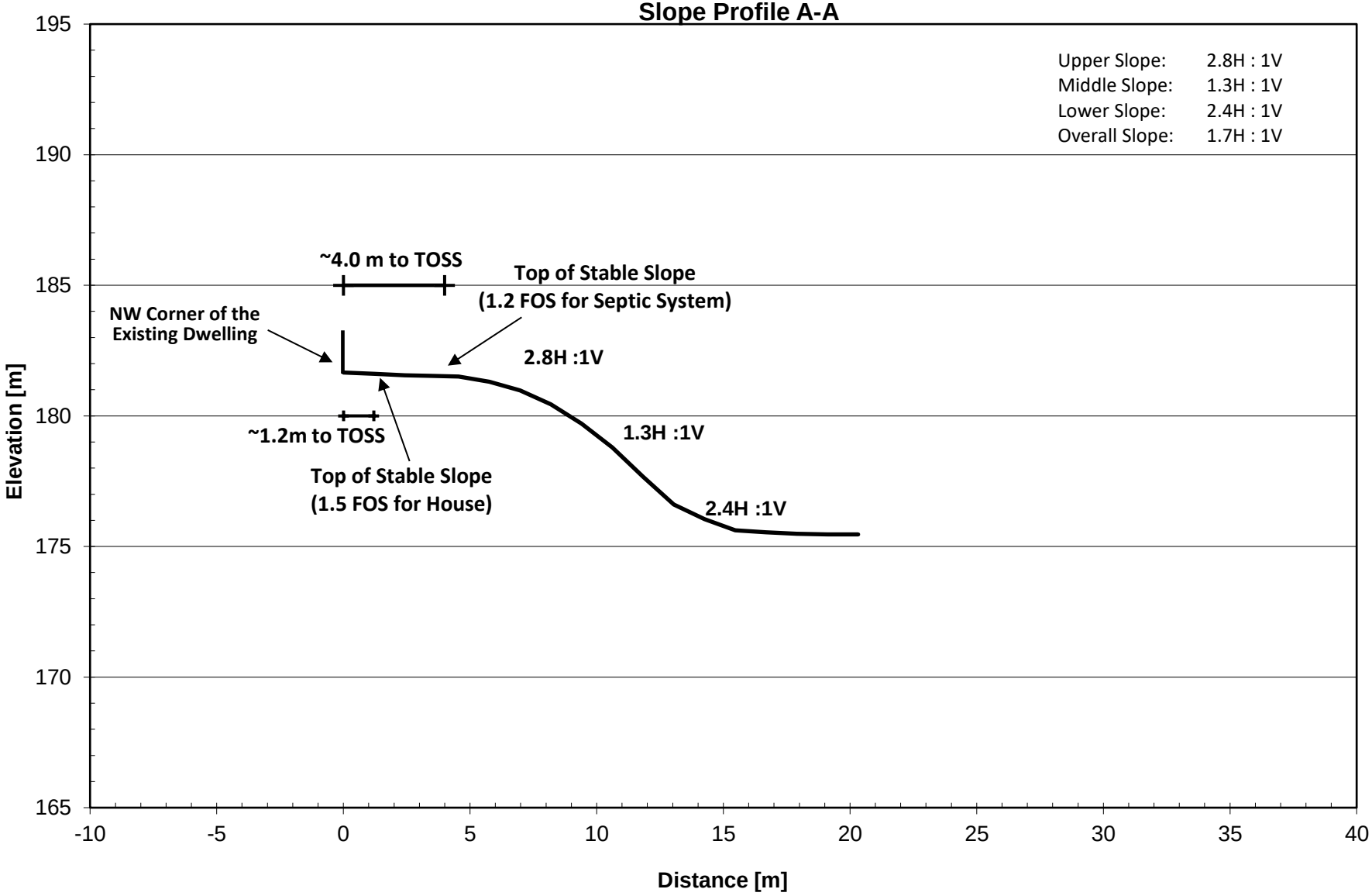
Date:November 2024

Drawn: KJR | Checked: AR

SM 240708-G Slope Profile Location Plan

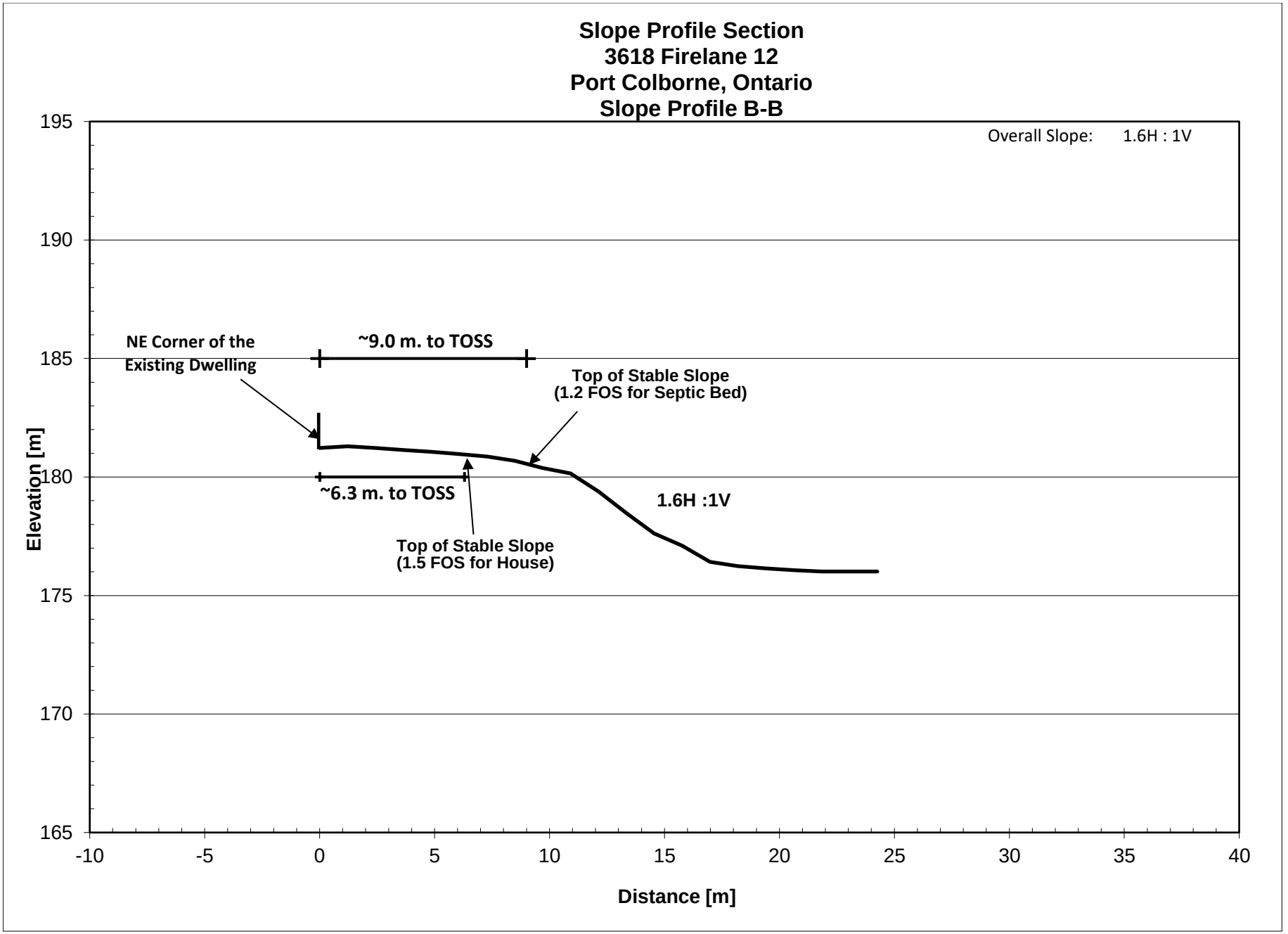
Drawing No. 1

Slope Profile Section
3618 Firelane 12
Port Colborne, Ontario
Slope Profile A-A



Project No.: SM 240708-G

DRAWING No. 2



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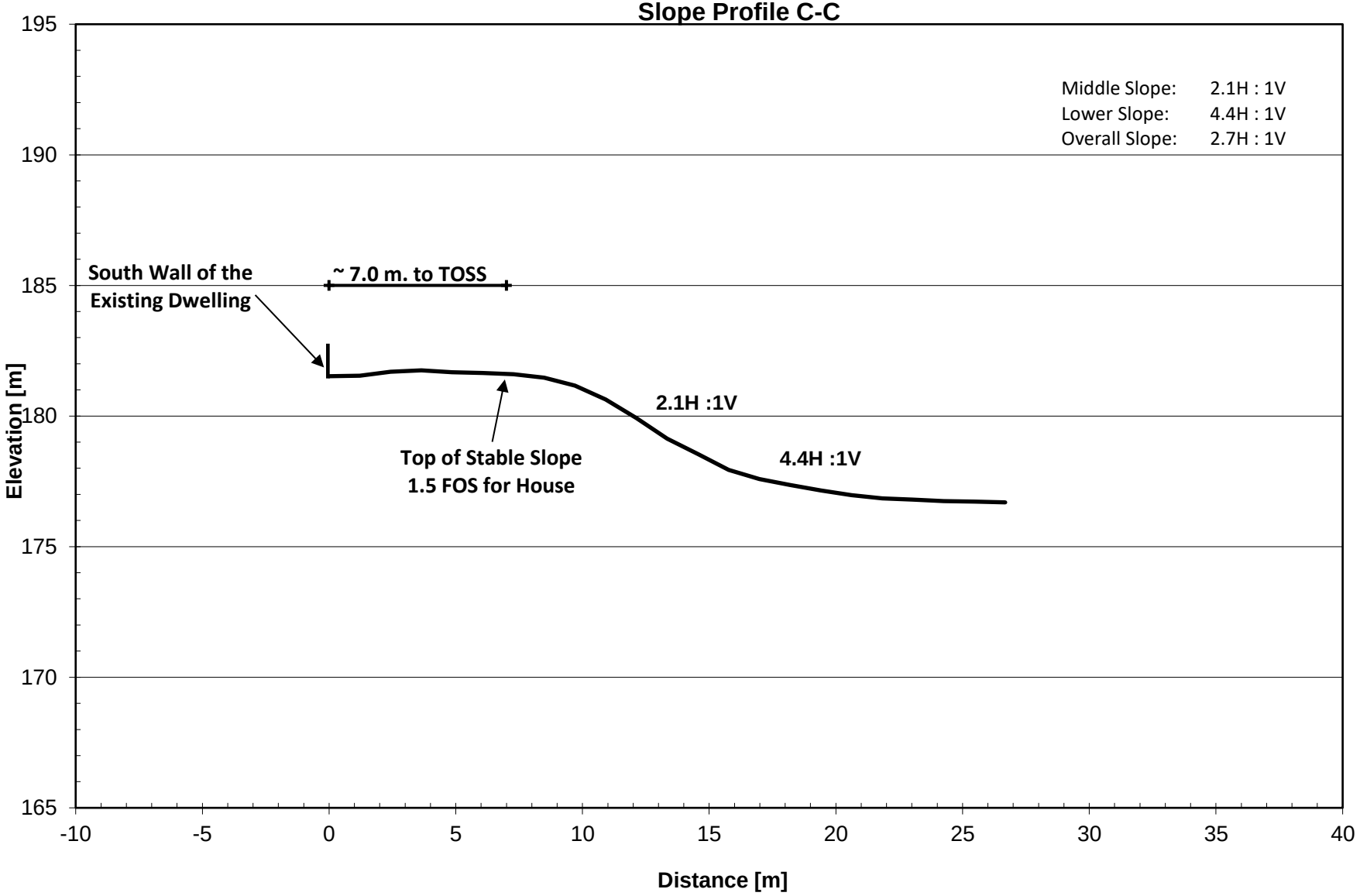
DRAWING No. 3

Slope Profile Section
3618 Firelane 12
Port Colborne, Ontario
Slope Profile C-C



Project No.: SM 240708-G

DRAWING No. 4

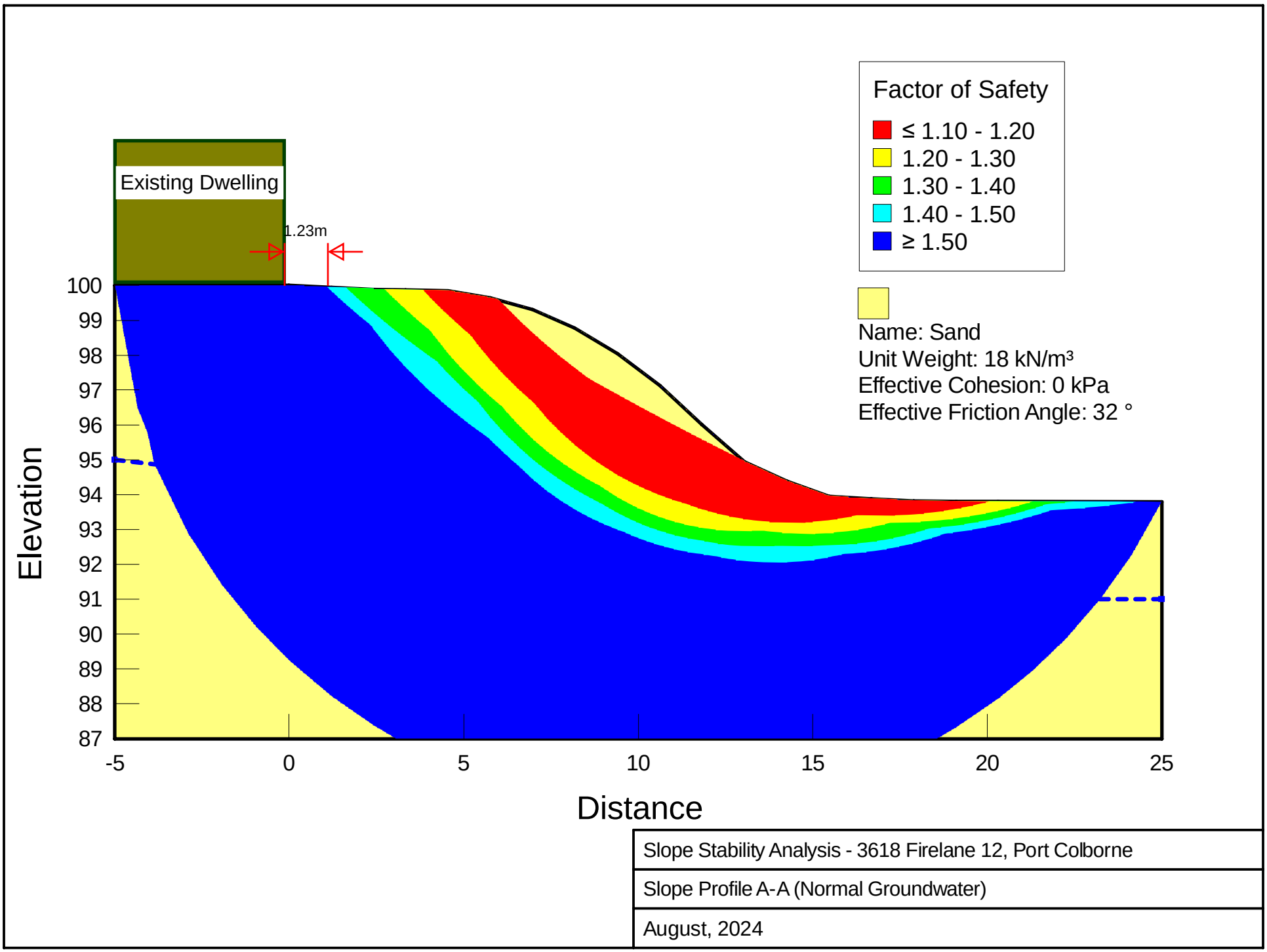
TABLE 8.1 - SLOPE STABILITY RATING CHART

Site Location: 3618 Firelane 12, Port Colborne
Property Owner:
Inspected By: Ishan Chauhan

File No. SM 240708-G
Inspection Date: August 14,2024
Weather:

				Rating Value	
1.	**SLOPE INCLINATION**				
		degrees	**horiz. : vert.**		
	a)	18 or less	3 : 1 or flatter	0	
	b)	18 - 26	2 : 1 to more than 3 : 1	6	16
	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	6
	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	0
	c)	Near crest only or, From several levels		12	
4.	**SLOPE HEIGHT**				
	a)	2 m or less		0	
	b)	2.1 to 5 m		2	4
	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	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	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	0
	b)	Less than 15 metres from slope toe		6	
8.	**PREVIOUS LANDSLIDE ACTIVITY**				
	a)	No		0	0
	b)	Yes		6	
	SLOPE INSTABILITY RATING		**RATING VALUES TOTAL**	**INVESTIGATION REQUIREMENTS**	**TOTAL** 32
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.	

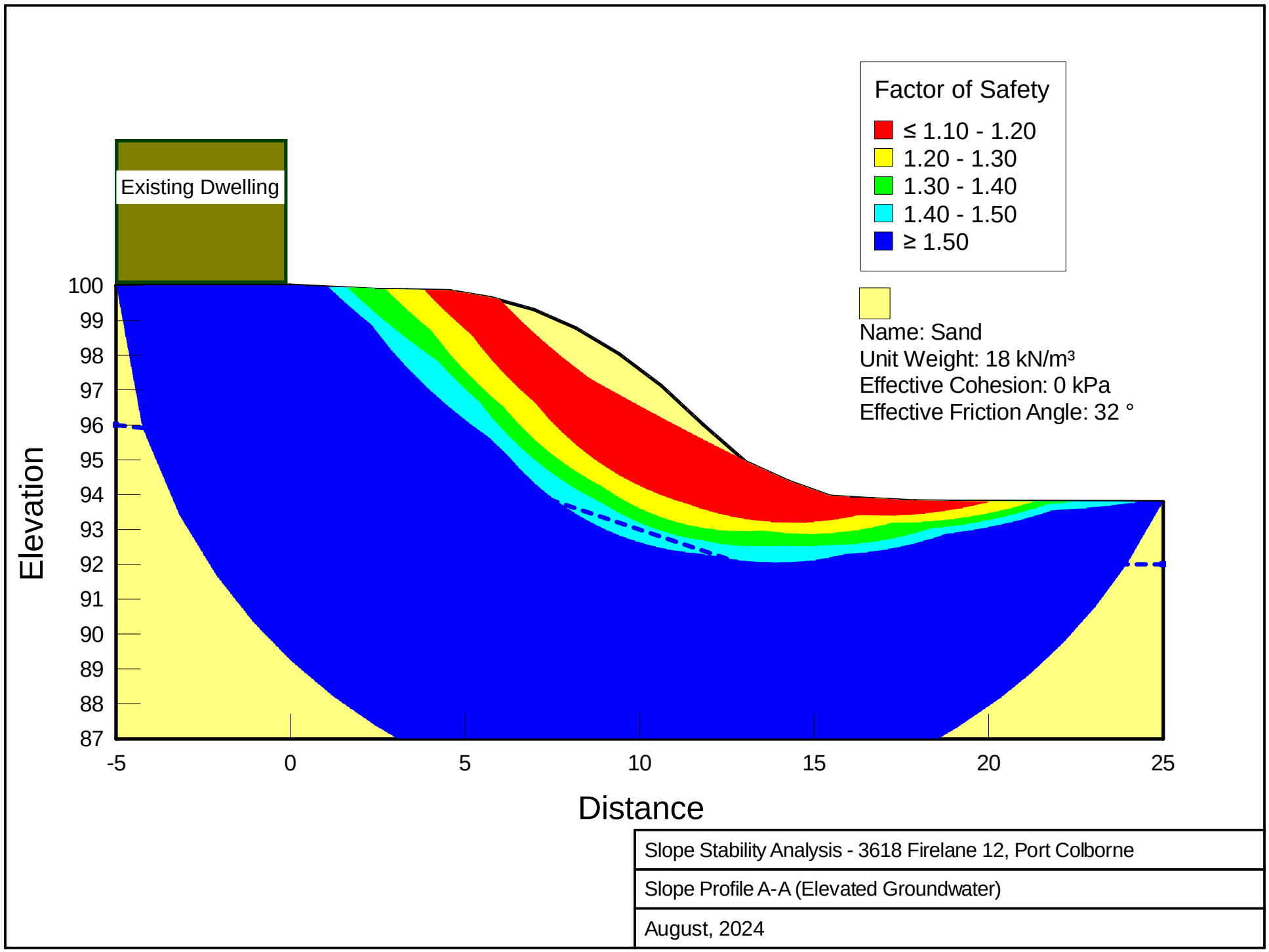
NOTES: a) Choose only one from each category; compare total rating value with above requirements.
b) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe; the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.



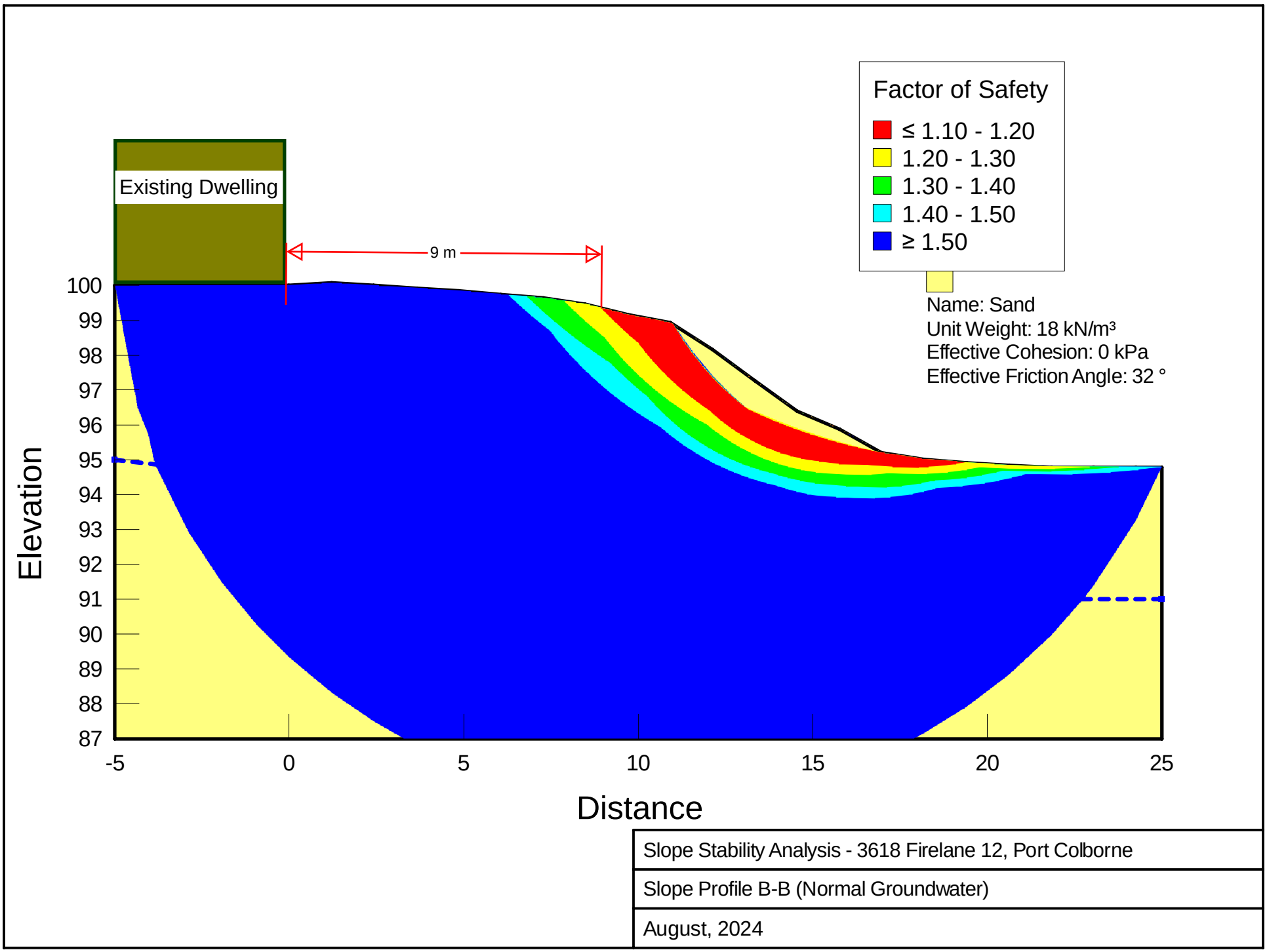
Slope Stability Analysis - 3618 Firelane 12, Port Colborne

Slope Profile A-A (Normal Groundwater)

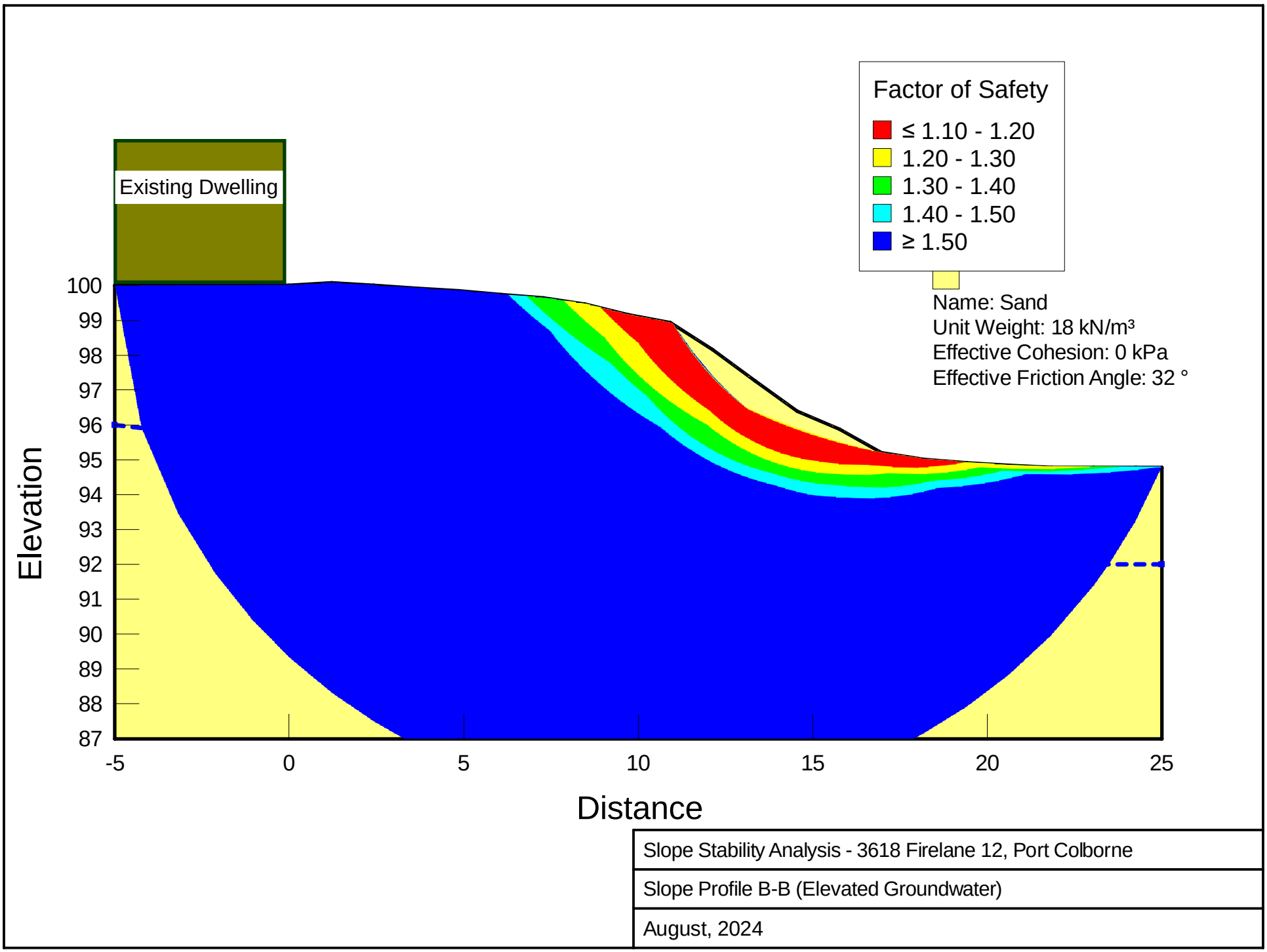
August, 2024



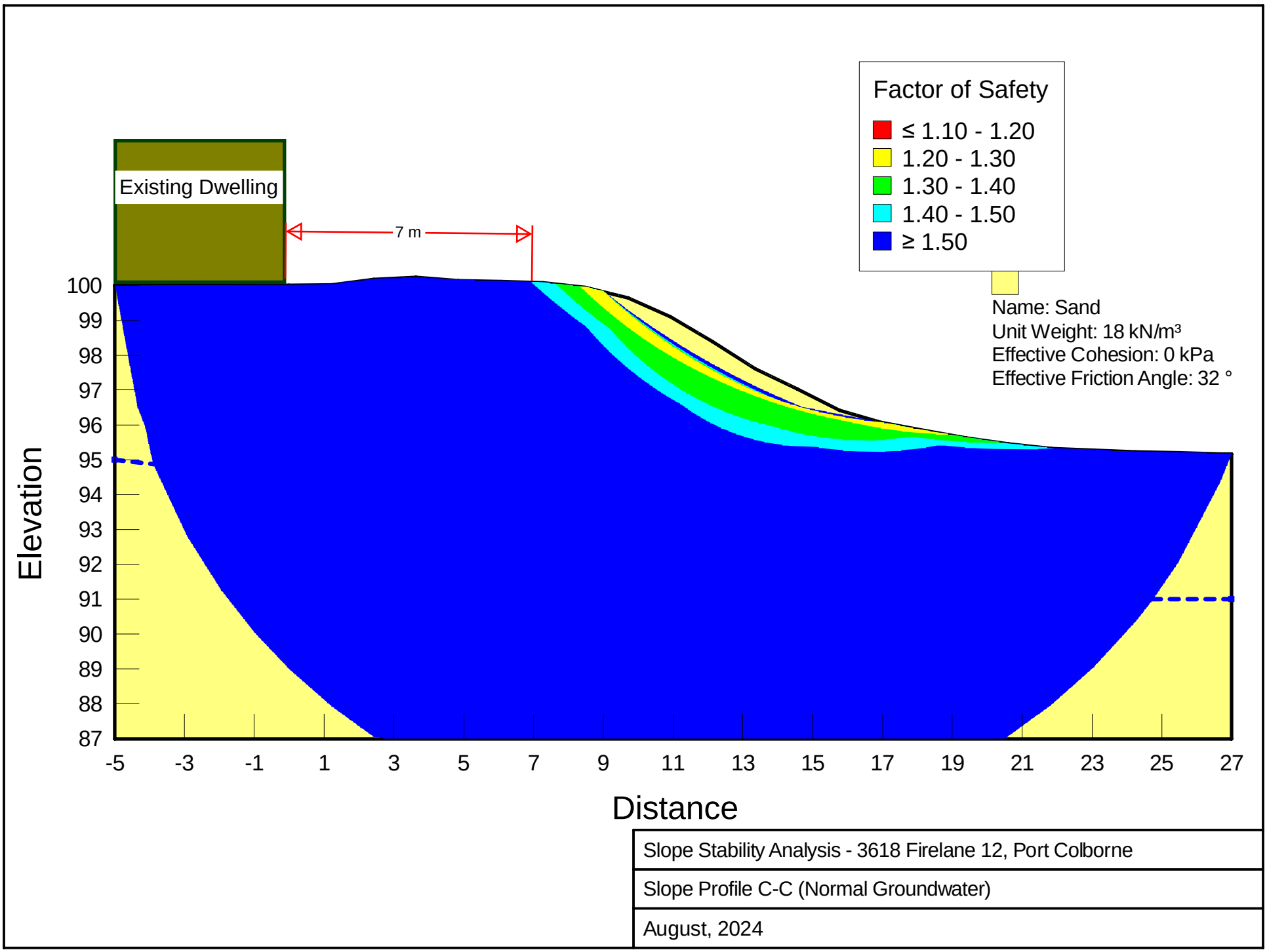
Slope Stability Analysis - 3618 Firelane 12, Port Colborne
Slope Profile A-A (Elevated Groundwater)
August, 2024



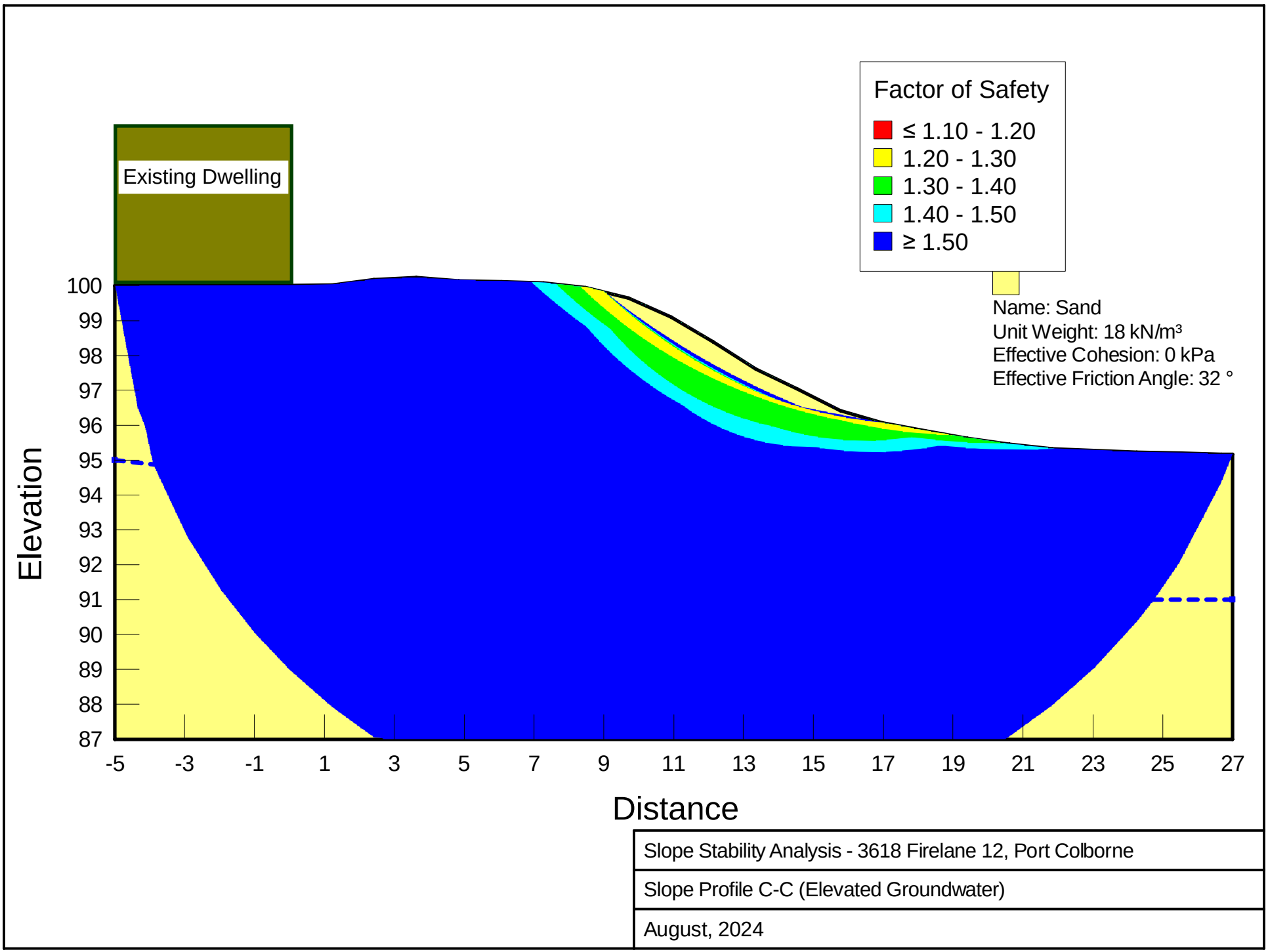
Slope Stability Analysis - 3618 Firelane 12, Port Colborne
Slope Profile B-B (Normal Groundwater)
August, 2024



Slope Stability Analysis - 3618 Firelane 12, Port Colborne
Slope Profile B-B (Elevated Groundwater)
August, 2024



Slope Stability Analysis - 3618 Firelane 12, Port Colborne
Slope Profile C-C (Normal Groundwater)
August, 2024



Slope Stability Analysis - 3618 Firelane 12, Port Colborne

Slope Profile C-C (Elevated Groundwater)

August, 2024