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APGO

January 6, 2025

Roberta & Oleh Stasyszyn
141 Marina Road
Hastings Highlands, ON
K0L 1C0

Attn: Joan Philips
Agent

Re: Slope Stability Assessment – Proposed Residential Redevelopment, 141 Marina Road, Hastings Highlands, ON
Cambium Reference: 22175-001

Dear Ms. Philips,

Cambium Inc. (Cambium) was retained by Roberta and Oleh Stasyszyn (Client) to complete an erosion hazard / slope stability assessment in support of the proposed additions and redevelopment at 141 Marina Road, Hastings Highlands, Ontario (Site). The purpose of this study and summary letter is to determine the erosion hazard limits associated with Baptiste Lake and comment on implications for the additions to the existing building on the site.

SITE DESCRIPTION AND PROPOSAL FOR REDEVELOPMENT

The subject property is bounded by Marina Road to the south, Baptiste Lake to the north, and existing residential homes to the east and west. A site location plan is appended as Figure 1 of this report.

The north side of the site exhibits sloping topography associated with Baptiste Lake. The toe of the slope is located approximately 13 m below site grade, with steepest inclination approaching about 2.2H:1V. A site plan is appended as Figure 2 of this report.

The proposed redevelopment contemplates the addition of a garage structure on the west side of the existing cottage, a mud room structure on the east side of the existing cottage, and a screened-in room beneath the existing deck structure.

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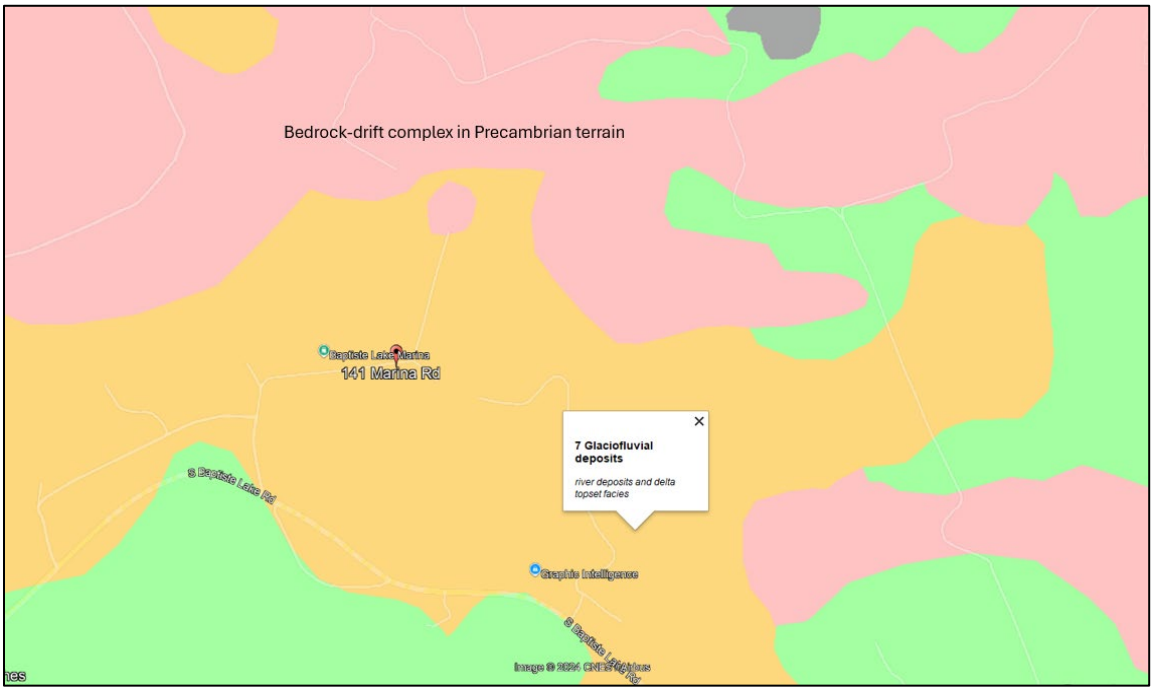
DESKTOP STUDY - SURFICIAL GEOLOGY

Based on MRD128-REV: Surficial Geology of Southern Ontario, the site is underlain by Glaciofluvial deposits: river deposits and delta topset facies and Bedrock drift complex in Precambrian terrain as shown below.



SITE VISIT

The stability of the slope was assessed by the observational method. Cambium staff attended the subject property to undertake field observation of the site and the slope characteristics. The slope is generally vegetated with a mixture of mature deciduous and coniferous trees. There is some evidence of active erosion in the form of undercutting, occurring near the lake along the shoreline.

Pertinent details of the slope configuration and related factors to be considered during the stability assessment are documented on Appendix A: Site Photos, Inspection Record & Slope Rating Chart. The slope stability rating value for current conditions was assessed to be 26, classed as “Slight Potential” (Site inspection and surveying, preliminary study, detailed report).

Cambium also conducted a limited slope survey by using a Real-Time Kinematic (RTK) survey equipment, to illustrate cross sections (as shown on Figure 3) of the existing slope for discussion.

DYNAMIC CONE PENETRATION TESTS (DCPTS)

A newly constructed septic area was utilized as test pit for inspection purpose. The soils exposed on the sides of the excavation were classified by visual and tactile examination while the septic area has not been backfilled. Within the exposed excavation, the material appears to be sand or silty sand down to the termination depth (as shown in Appendix A - photo 12). No soil sample was retrieved during investigation.

Dynamic Cone Penetration Tests (DCPTs) were completed with a WILDCAT Dynamic Cone Penetrometer at bottom the test pit location as well as near the slope bottom (HA101-24 and HA102-24) to maximum depth of 3.0 mbgs. The DCPT values were recorded as the number of blows required to drive a cone of 10 cm^2 project area into the soil 100 mm with a 16 kg hammer falling 380 mm. The DCPT values were corrected to equivalent Standard Penetration Test (SPT) values as per ASTM D4633 and used to assess consistency or relative density of the soils.

The converted SPT N values are largely greater than 10 below 1 m, indicating medium dense to dense relative density. DCPT logs are provided in Appendix B.

REGULATORY REQUIREMENTS

We understand that the site is not within regulated area of any conservation authorities. This study describes the erosion assessment conducted generally in accordance with the methodology outlined in the *Ministry of Natural Resources Technical Guideline River and Stream Systems: Erosion Hazard Limit (MNR, 2002)*.

EROSION HAZARD ASSESSMENT

The valley land of Baptiste Lake on this site is classified as a "confined system" according to the MNR Technical Guide. This document defines a confined

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system as those systems where the watercourse is located within a valley corridor with discernable slopes and is confined by valley walls. This is consistent with the characteristics of the study area. Accordingly, the erosion hazard limit associated with confined systems is defined by the toe erosion allowance, stable slope allowance and erosion access allowance.

Toe Erosion Allowance

The toe erosion allowance is defined by the recession of the toe of the valley slope (MNR, 2002). Based on site observation, the type of material of the toe can be described as " Coarse Granular Tills". No active erosion was observed at slope across the entire site. As per Table 3 of the MNR Technical Guidelines, the toe erosion allowance is considered to be 4 m, which is naturally achieved provided adequate distance between the shoreline and the physical toe of the slope.

Stable Slope Allowance

A preliminary engineering analysis of slope stability was carried out for one interpreted cross-section (Section A-A) by utilizing Slope/W (Version 23.1.0), an industry standard two-dimensional limit equilibrium slope modelling program.

Inputs required for the Slope/W program include soil stratigraphy, geotechnical design parameters and groundwater conditions. Cambium has provided geotechnical consulting services in the Highland East and surrounding area in the past and during this time acquired knowledge of the local geology. Additionally, the results from Dynamic Cone Penetration Tests (DCPTs) were interpretated. For this preliminary slope stability analysis, a sand or silty sand material was used for the subsurface conditions. The geotechnical parameters used to evaluate the stability of the slope are presented in Table 1.

Table 1 Soil Parameters for Slope Stability Analyses

Soil Type	Unit Weight (kN/m^3)	Shear Strength	
		Cohesion C' (kPa)	Friction Angle ϕ' (º)
Sand / Silty Sand	19.5	0	33

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A piezometric line defining the pore-water pressure condition was illustrated on the model. The stability assessment was based on a limit equilibrium analysis for long term slope stability using Morgenstern–Price method.

Cognizant of the observed satisfactory performance of the existing slope and the vegetation cover (grass, weeds, shrubs, and trees), the analysis has not considered the cases for shallow slip plane. The analysis results indicate a factor of safety (FOS) of 1.63, which is greater than 1.5 with respect to the industry standards as well as *MNR technical guidelines*.

Erosion Access Allowance

Considering there is no active erosion along the toe of the slope at the Lake, and it appears access can be provided through west edge of the property line instead of the existing slope crest, we do not foresee the requirement for Erosion Access Allowance. The existing top of slope line will be the defined erosion hazard limit line.

DISCUSSION

Based on the visual assessment, the condition of the slope subgrade, and the specific site conditions present, the slope is considered to be in a stable condition. This is a result of the existing slope showing no evidence of previous or potential failure with vegetation, a gradual inclination, and no active erosion.

Also, the preliminary analysis indicates that the steepest slope of 2.2H:1V is stable in its current condition. Therefore, the existing top of slope can be considered as long-term stable top of the slope, provided no structures will be developed closer to the slope crest than the existing structures on site. Based on information provided by the Client, the proposed structures will be built no closer to the top of the slope as the existing structure, with new construction (garage and mud room structure) extending away from the slope.

CONCLUSIONS

It is Cambium's opinion that the proposed redevelopment and additions will not have an adverse impact on the future performance of the slope.

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Site development and construction activities should be conducted in a manner without resulting in surface erosion of the slope. Additional comments related to any future construction at this property, and in terms of slope stability at the site are as follows:

1. To reduce the risks of soil erosion on the slope surface, care must be taken to minimize damage to the existing vegetation in and adjacent to the slope (trees, tree roots, grass cover).
2. Site grading and drainage should be designed to prevent downspouts or channelized surface runoff from flowing directly over the slope.
3. A sediment control fence must be erected and maintained during construction to isolate work area from the adjoining slope and lake shore.
4. The configuration of the slope should not be altered without prior consultation with a geotechnical engineer.
5. The slope must not be steepened.
6. Any construction materials must not be stockpiled on the slope.

FOUNDATION DESIGN

For the proposed additions, the structure can be supported on conventional strip or spread foundations on the native soil or approved engineered fill using a bearing pressure of 75 kPa at Serviceability Limit State (SLS) and factored bearing resistance of 110 kPa at Ultimate Limit State (ULS). To avoid adfreeze and possible jacking (heaving) of the foundation walls, the interior and exterior of the garage foundation walls should be backfilled with free draining, non-frost susceptible sand or sand and gravel such as that meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type I or II. The backfill within the garage should be compacted in maximum 300 mm thick lifts to at least 95% of the standard Proctor maximum dry density (SPMDD) using suitable vibratory compaction equipment. All exterior footings and footings in unheated areas must be protected with a minimum 1.4 m of earth cover or equivalent insulation for frost protection.

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January 6, 2025

CLOSING

Cambium trusts that this report meets with your expectations. If you have any questions or require clarification of any aspect of this submission, please do not hesitate to contact the undersigned.

Best regards,

Cambium Inc.

DocuSigned by:
7FDF31DDD18E4AA...
Josh Riseling, EIT.
Coordinator

Signed by:

2025-01-06

DocuSigned by:
34555F00ED064E9...
Zhaochang Luo, M.Eng., P.Eng.
Senior Project Manager – Team Lead

Encl. *Cambium Qualifications and Limitations*
Figure 1 Site Location Plan
Figure 2 Site Plan
Figure 3 Cross Sections
Appendix A Site Photos, Inspection Record & Slope Rating Chart
Appendix B DCPT logs
Appendix C Slope Analysis

\\cambiumincstorage.file.core.windows.net\projects\22100 to 22199\22175-001 Roberta & Oleh -GEO- 141 Marina Rd\Deliverables\Report - GEO\Final\2025-01-06 RPT – Slope Stability – 141 Marina Rd.docx

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January 6, 2025

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Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

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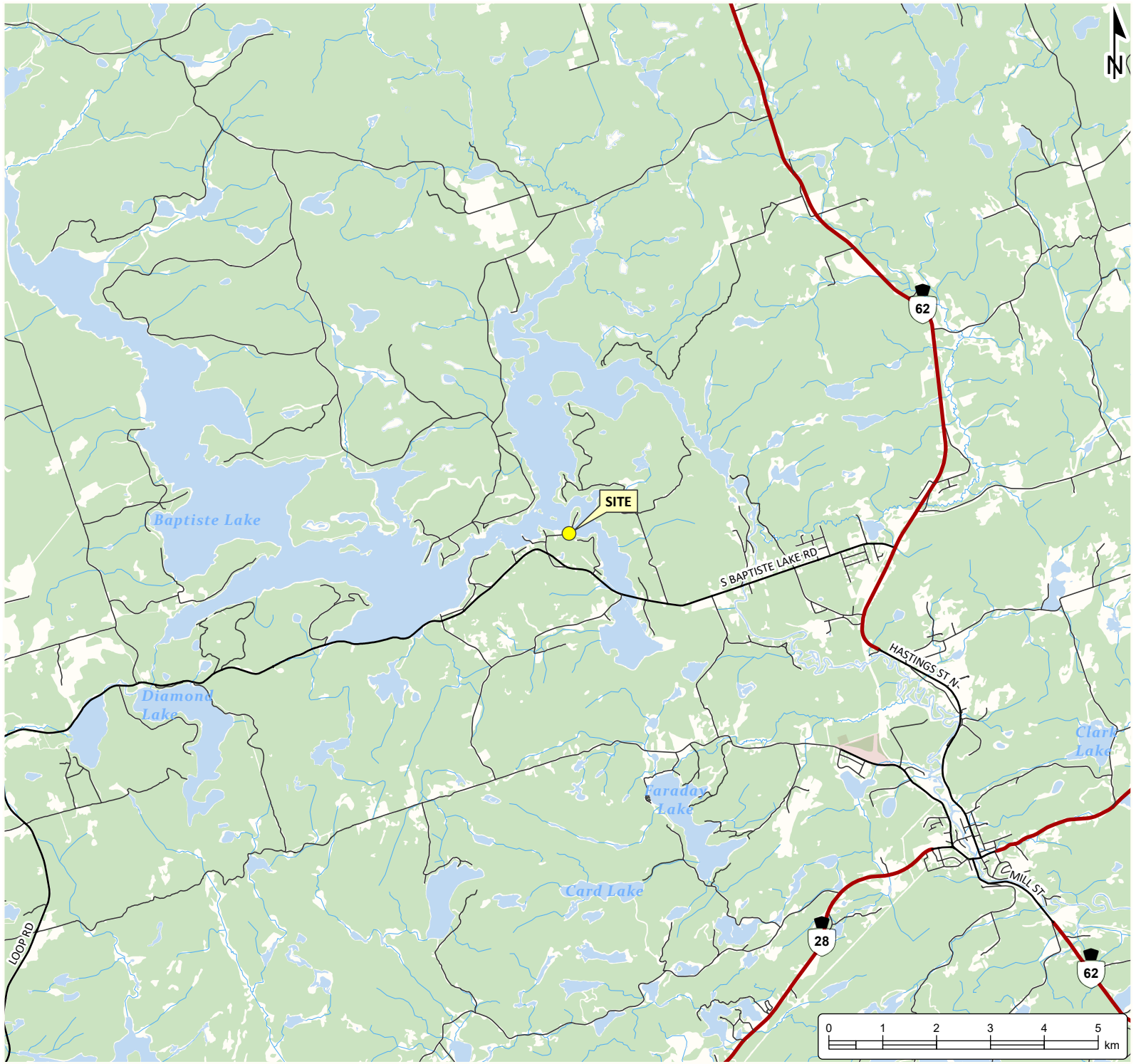

SLOPE STABILITY ASSESSMENT

ROBERTA & OLEH STASYSZYN
141 Marina Road
Hastings Highlands, Ontario

LEGEND

- Highway
- Major Road
- Minor Road
- Watercourse
- Water Area
- Wooded Area

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- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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SITE LOCATION PLAN

Project No.: 22175-001		Date: December 2024	Rev.:
Scale: 1:100,000		Projection: NAD 1983 UTM Zone 18N	
Created by: MAT	Checked by: ZL	Figure: 1	

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SLOPE STABILITY ASSESSMENT

ROBERTA & OLEH STASYSZYN
141 Marina Road
Hastings Highlands, Ontario

LEGEND

- Hand Auger
- Cross_Section
- Contour (1m intervals)
- Existing Building Footprint
- Proposed Building Footprint
- Site (approximate)

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SITE PLAN

Project No.: 22175-001		Date: December 2024	Rev.:
Scale: 1:500		Projection: NAD 1983 UTM Zone 18N	
Created by: MAT	Checked by: ZL	Figure: 2	

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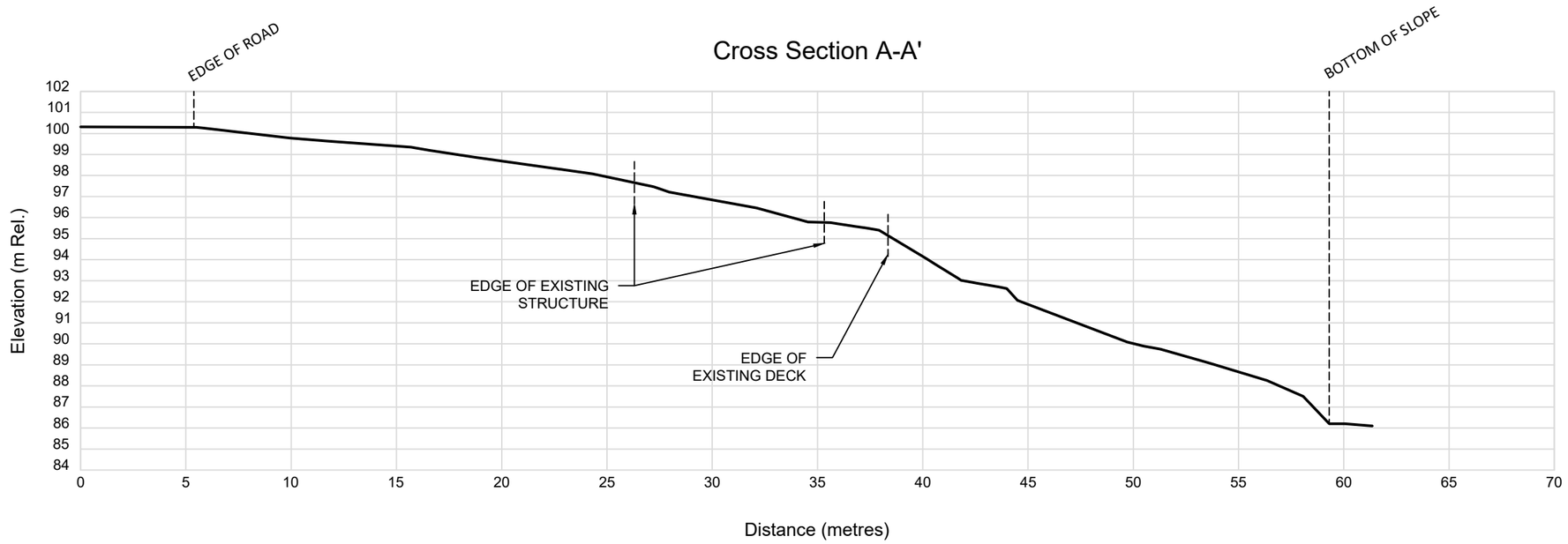

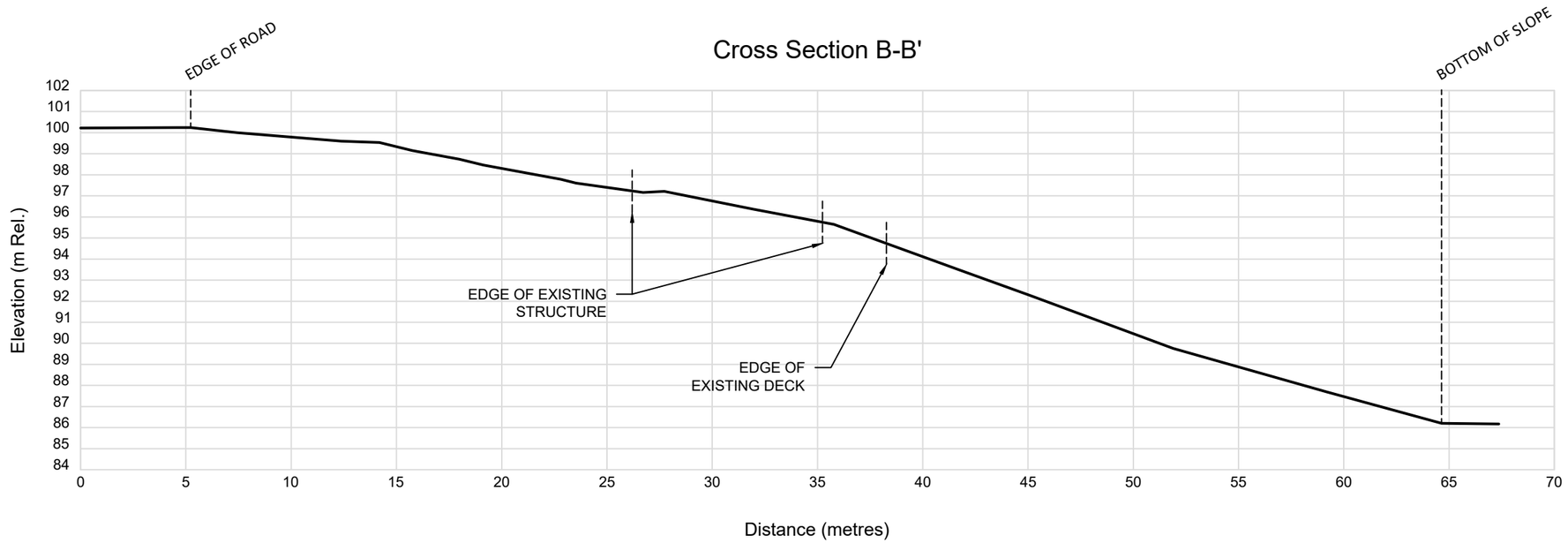

SLOPE STABILITY ANALYSIS

ROBERTA & OLEH STASYSZYN
141 Marina Road
Hastings Highlands, Ontario

LEGEND

Notes:
1. Measurements on this plan are in metres and can be converted to feet by dividing by 0.3048.

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CROSS SECTION A-A' AND B-B'

Project No.: 22175-001		Date: December 2024	Rev.:
Scale: See Figure		Projection:	
Drawn By: MAT	Checked By: ZL	Figure: 3	

Photo 1 Site overview, looking east along Marina Road, showing the road, table land, and mixed mature trees.

Photo 2 Site overview, looking northeast, showing a residential building, driveway area, septic area, proposed mudroom area, and mixed mature trees.

Photo 3 Site overview, looking south, showing a residential building and small building near the top of the slope and mixed mature trees. Cross section A-A taken along the west side of the residential structure, Cross section B-B taken along the east side of the residential structure.

Photo 4 View of top of the slope, looking east, showing driveway area, Marina Road, and mixed mature trees.

Photo 5 View of the slope, looking east, showing a residential structure, septic area, proposed garage area, and mixed mature trees.

Photo 6 View of the slope, looking west, showing a residential structure, proposed deck enclosure area, proposed mudroom area, and mixed mature trees.

Photo 7 View of the slope, looking east, showing a residential structure, proposed deck enclosure area, and mixed mature trees.

Photo 8 View of the slope, looking east, showing a residential structure, proposed garage area, proposed deck enclosure area, and mixed mature trees.

Photo 9 View of the slope, looking west, showing Baptiste Lake and mixed mature trees.

Photo 10 View of the base of the slope, looking east, showing the shoreline of Baptiste Lake and mixed mature trees.

Photo 11 View of the base of the slope, looking west, showing the shoreline of Baptiste Lake and mixed mature trees.

Photo 12 View of the newly constructed septic area, immediately south of the residential structure.

SLOPE STABILITY RATING CHART

Site Location:	141 Marina Road, Hastings Highlands	File No.	22175-001
Property Owner:	Roberta & Oleh Stasyszyn	Inspection Date:	2024-11-27
Inspected By:	Josh Riseling	Weather:	Snowy

Inspection Task		Rating Value
1. SLOPE INCLINATION		
Degrees	**Horizontal:Vertical**	
a) 18 or less	3:1 or flatter	0
b) 18 to 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 or from several levels		12
4. SLOPE HEIGHT		
a) 2 m or less		0
b) 2.1 to 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 m or more from slope toe		0
b) Less than 15 m from slope toe		6
8. PREVIOUS LANDSLIDE ACTIVITY		
a) No		0
b) Yes		6
	RATING VALUES TOTAL	**26**

SLOPE INSTABILITY RATING		INVESTIGATION REQUIREMENTS
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

Source: Table 8.1 Geotechnical Principles for Stable Slopes (June 1998), Ontario Ministry of Natural Resources

WILDCAT DYNAMIC CONE LOG

Cambium

PROJECT NUMBER: 22175-001
DATE STARTED: 11-27-2024
DATE COMPLETED: 11-27-2024

HOLE #: HA101-24
CREW: Josh
PROJECT: Slope Stablity Assessment
ADDRESS: 141 Marina Rd,
LOCATION: Hasting Highlands, ON

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 2 ft	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
-	18	79.9	••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	30	133.2	••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 3 ft	22	97.7	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 1 m	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 4 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
- 5 ft	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 6 ft	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
- 2 m	12	46.3	••••••••••••••	13	MEDIUM DENSE	STIFF
- 7 ft	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
- 8 ft	14	47.9	••••••••••••••	13	MEDIUM DENSE	STIFF
-	16	54.7	•••••••••••••••	15	MEDIUM DENSE	STIFF
-	16	54.7	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 9 ft	17	58.1	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	17	58.1	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	18	61.6	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Cambium

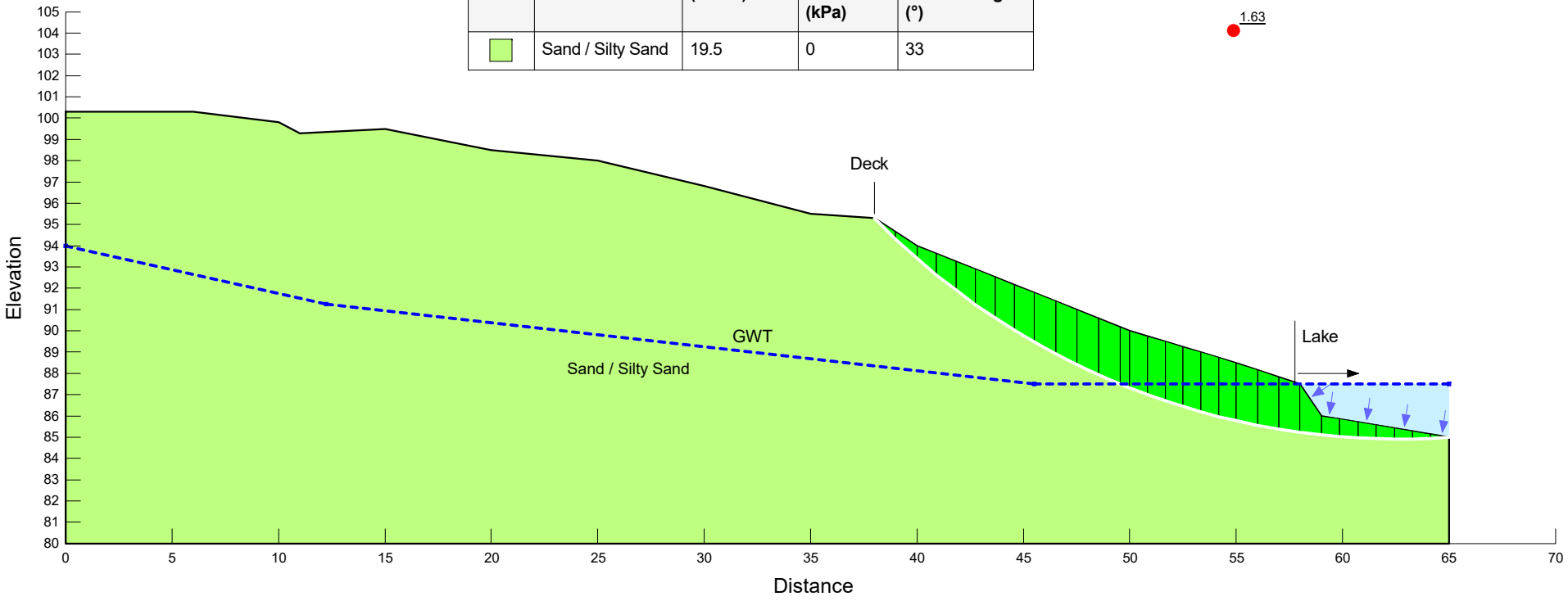
PROJECT NUMBER: 22175-001
DATE STARTED: 11-27-2024
DATE COMPLETED: 11-27-2024

HOLE #: HA102-24
CREW: Josh
PROJECT: Slope Stablity Assessment
ADDRESS: 141 Marina Rd,
LOCATION: Hasting Highlands, ON

SURFACE ELEVATION:
WATER ON COMPLETION:
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	TESTED CONSISTENCY COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 2 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	31.1	•••••••••	8	LOOSE	MEDIUM STIFF
- 3 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
- 1 m	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	7	27.0	•••••••	7	LOOSE	MEDIUM STIFF
- 4 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	23	88.8	••••••••••••••••••••••••	25	MEDIUM DENSE	VERY STIFF
-	27	104.2	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 5 ft	29	111.9	•••••••••••••••••••••••••••••	25+	DENSE	HARD
-	29	111.9	•••••••••••••••••••••••••••••	25+	DENSE	HARD
-	35	135.1	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 6 ft	27	104.2	••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	35	135.1	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 2 m	40	154.4	••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 7 ft	40	136.8	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	47	160.7	••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	42	143.6	••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 8 ft	40	136.8	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	35	119.7	••••••••••••••••••••••••••••	25+	DENSE	HARD
-	39	133.4	••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 9 ft	35	119.7	••••••••••••••••••••••••••••	25+	DENSE	HARD
-	36	123.1	••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	37	126.5	••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 3 m 10 ft	35	119.7	••••••••••••••••••••••••••••	25+	DENSE	HARD
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand / Silty Sand	19.5	0	33



Section A-A, Existing Conditions