



Environmental

Geotechnical

Building Sciences

Construction Testing
& Inspection

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Website

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Mailing Address

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Canada, K9J 6Z3

Locations

Peterborough
Kingston
Barrie
Whitby
Ottawa

Laboratory

Peterborough



December 19, 2024

Lindsay Design Centre
2912 Highway 35 South
Lindsay, Ontario
K9V 4R4

Attn: Kalab Dewar

**Re: Slope Stability Assessment – Proposed Residential Redevelopment,
439 West Diamond Lake Road, Highland Grove, ON**
Cambium Reference: 22031-001

Dear Kalab Dewar,

Cambium Inc. (Cambium) was retained by Lindsay Design Centre (Client) to complete an erosion hazard / slope stability assessment in support of the proposed redevelopment at 439 West Diamond Lake Road, Highland Grove, Ontario (Site). The purpose of this study and summary letter is to determine the erosion hazard limits associated with Diamond Lake and comment on implications for the redevelopment on the site.

SITE DESCRIPTION AND PROPOSAL FOR REDEVELOPMENT

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

The east side of the site exhibits sloping topography associated with Diamond Lake. The toe of the slope is located approximately 8 m below site grade, with steepest inclination approaching about 2.5H:1V. A site plan is appended as Figure 2 of this report.

The proposed redevelopment contemplates a replacement of existing cottage including a deck structure.



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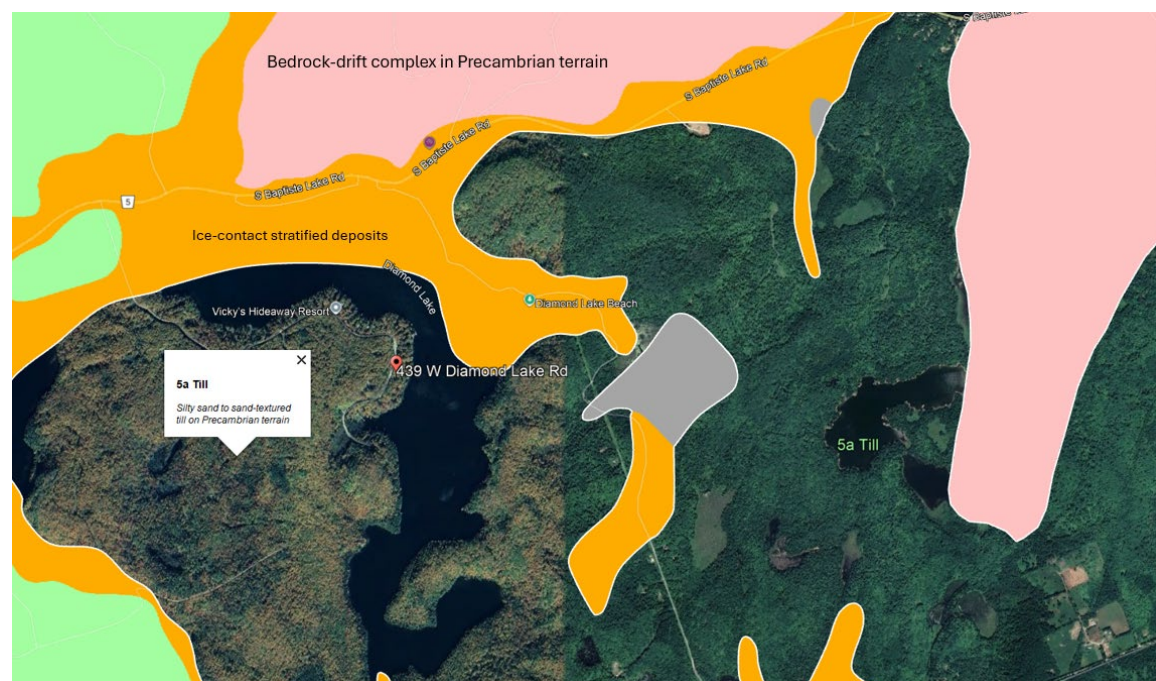
Peterborough



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DESKTOP STUDY - SURFICIAL GEOLOGY

Based on MRD128-REV: Surficial Geology of Southern Ontario, the site is underlain by Till: Silty sand to sand-textured till on Precambrian terrain, Ice-contact stratified deposits: sand and gravel, minor silt, clay and till, and Bedrock drift complex in Precambrian terrain as shown below.



As part of this study, we have also reviewed and compiled MOE well record data for recorded wells surrounding the subject site. Two well records (409 West Diamond Lake Road and 411 West Diamond Lake Road) have been incorporated, representing conditions in the site area (Appendix B). Both records indicate that the site consist of “hardpan” overlaying the granite which is 3.5 to 5.0 m below the ground surface.

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 no evidence of active erosion near the lake. Some large boulders were observed along the existing shoreline.



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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 existing conditions was assessed to be 24, classed as Low Potential.

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.

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 Diamond Lake on this site is classified as a "confined system" according to the MNR Technical Guide. This document defines a confined 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 "Soft Rock (boulders)". 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 2 m, which is naturally achieved provided adequate distance between the shoreline and the toe of the slope.



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Stable Slope Allowance

The stable slope length was using a 2.5H:1V stable slope allowance, in accordance with the observed stable slope inclinations, as per Table 4.3 of the *Ontario Ministry of Natural Resources: Geotechnical Principles for Stable Slopes (MNR, 1997)*. This distance was added to the toe erosion allowance. It should be noted that the 2.5H:1V stable slope allowance is a general guideline and could be refined/reduced through a detailed geotechnical investigation in accordance with MNR Technical Guidelines.

Erosion Access Allowance

Considering there is no active erosion along the toe of the slope at Diamond 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 dense tree vegetation, a gradual inclination, and no active erosion. Given the presence of an existing structure, additional site measures (such as the survey) were obtained during the site visit.

The steepest slope of 2.5H:1V is considered stable in its current condition. Therefore, the long-term stable top of the slope can be considered as the top of the existing 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 building will be built no closer to the top of the slope as the existing structure, with new construction extending away from the slope.



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CONCLUSIONS

It is Cambium's opinion that reconstruction of the cottage will not have an adverse impact on the future performance of the existing slope.

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.





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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

DocuSigned by:

34555F00ED064E9...

Zhaochang Luo, M.Eng., P.Eng.
Senior Project Manager – Team Lead

Signed by:



2024-12-19

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 – Well Records

\\cambiumincstorage.file.core.windows.net\projects\22000 to 22099\22031-001 Lindsay Design -GEO- 437 W Diamond Lake Rd\Deliverables\Report - GEO\Final\2024-12-19 LTR Slope Stability - 439 W Diamond Lake Rd.docx





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CAMBIUM QUALIFICATIONS AND LIMITATIONS

Limited Warranty

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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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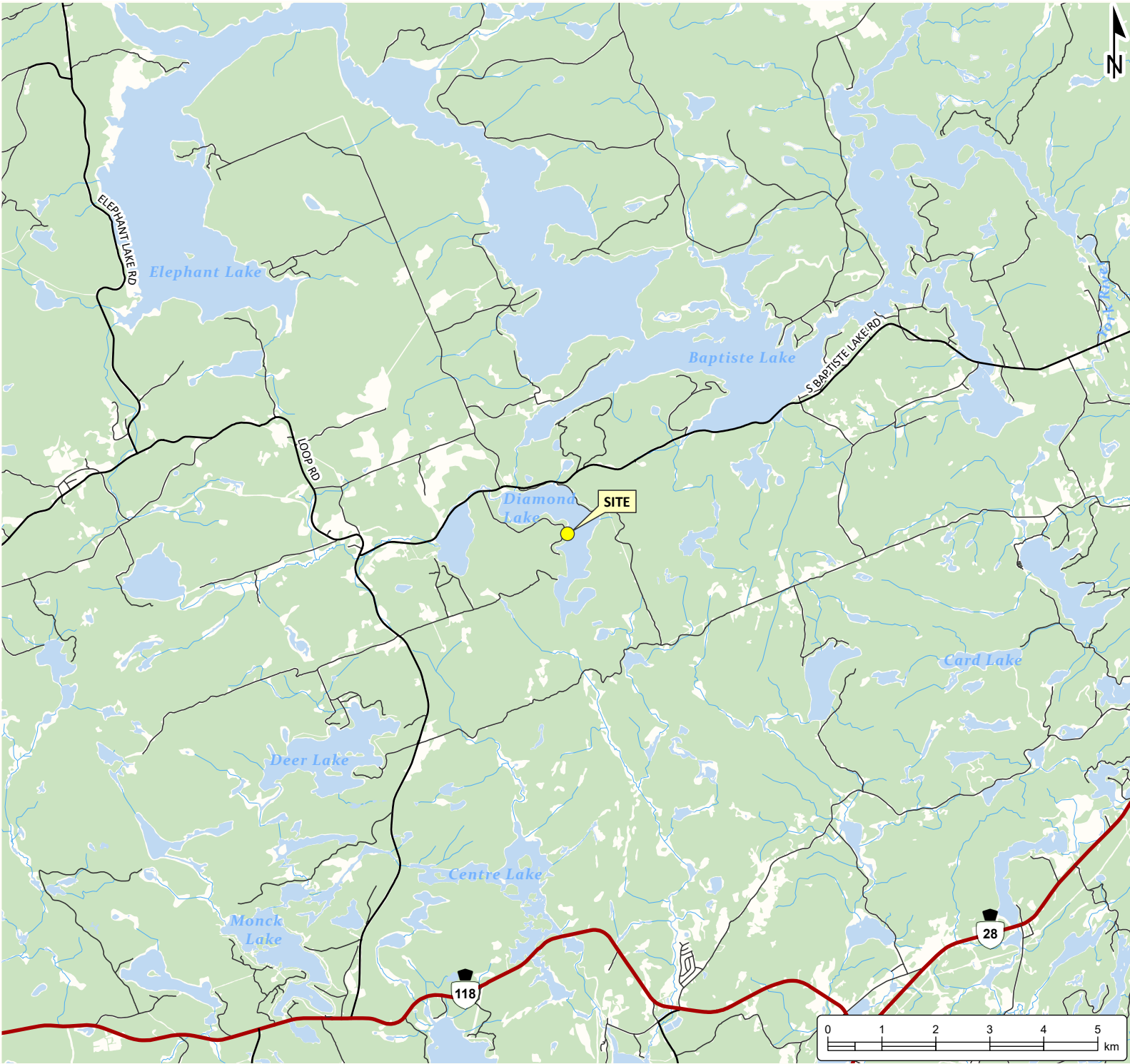
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Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.





**SLOPE STABILITY
ASSESSMENT**
LINDSAY DESIGN
439 West Diamond Lake Road
Highland Grove, Ontario

LEGEND

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

Notes:
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- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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SITE LOCATION PLAN

Project No.: 22031-001	Date: December 2024
Scale: 1:100,000	Projection: NAD 1983 UTM Zone 17N
Created by: MAT	Checked by: ZL
Figure: 1	



**SLOPE STABILITY
ASSESSMENT**
LINDSAY DESIGN
439 West Diamond Lake Road
Highland Grove, Ontario

LEGEND

- 1m Contour
- Cross Section
- Existing Building Footprint
- Proposed Building Footprint
- Site (approximate)

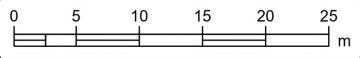
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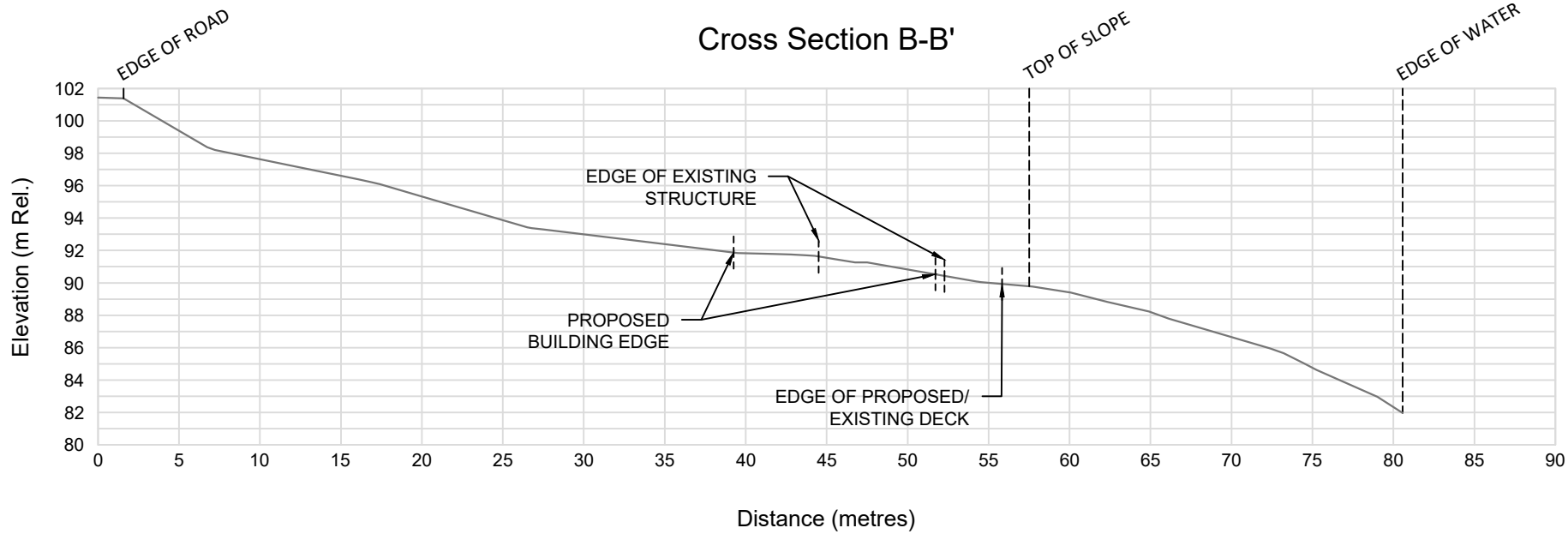
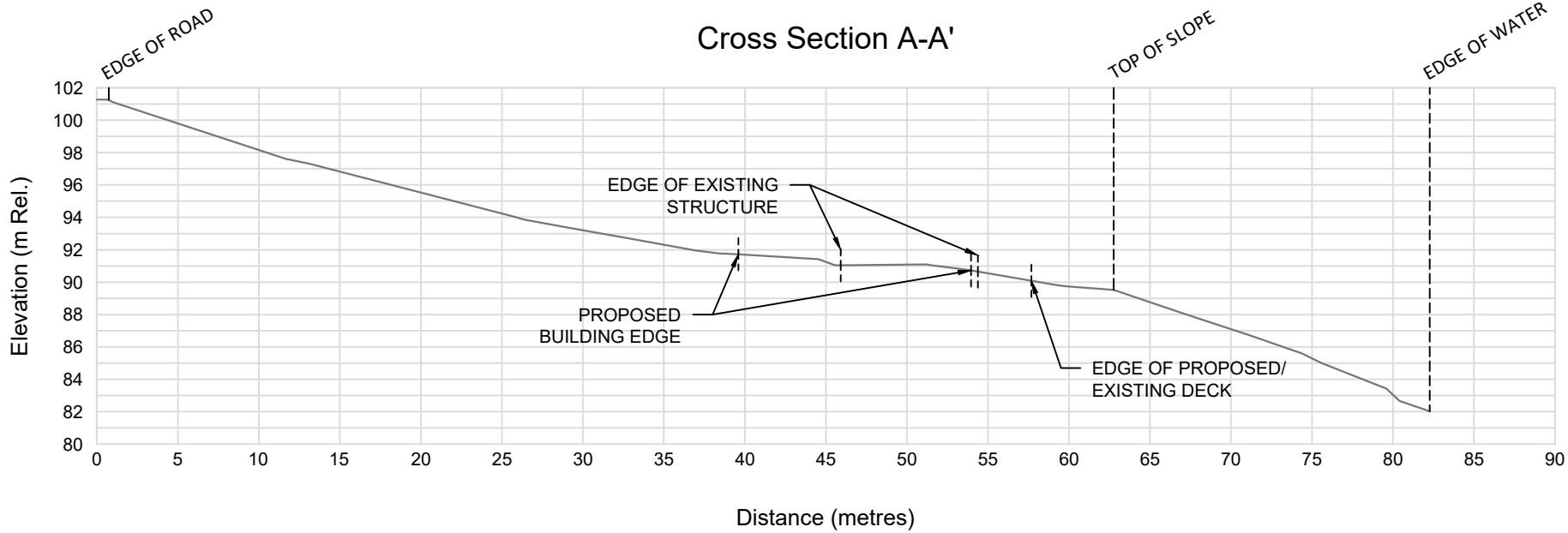
SITE PLAN

Project No.:	22031-001	Date:	December 2024
Scale:	1:600	Rev.:	
Created by:	MAT	Checked by:	ZL
		Figure:	2



SLOPE STABILITY
ASSESSMENT
LINDSAY DESIGN
439 West Diamond Lake Road
Highland Grove, Ontario

LEGEND



- Notes:
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CROSS SECTIONS
A-A' AND B-B'

Project No.:	22031-001	Date:	December 2024
Scale:	See Figure	Rev.:	
Drawn By:	MAT	Checked By:	ZL
Figure:			3



Photo 1 Site overview, looking east from West Diamond Lake Road, showing a residential building, shed, and small building at the top of the investigated slope. Steep decline down the driveway to the residential building. Mixed mature trees are seen across the site. Cross section A-A taken along the south side of the residential structure, Cross section B-B taken along the north side of the residential structure.



Photo 2 Site overview, looking east, showing a residential building and small building at the top of the slope and mixed mature trees.



Photo 3 Site overview, looking northwest, showing a residential building and small building at the top of the slope and mixed mature trees.



Photo 4 Site overview, looking west, from the dock, showing a residential building at the top of slope, staircase along the slope, dock along the base of slope, and mixed mature trees across the site.



Photo 5 View of top of the slope, looking north, showing a residential structure, staircase, and mixed mature trees.



Photo 6 View of top of the slope, looking south, showing a residential structure, staircase, and mixed mature trees.



Photo 7 View of the slope face, looking north, showing mixed mature trees, staircase, dock, and Diamond Lake.



Photo 8 View of the slope face, looking south, showing mixed mature trees, staircase, and a residential structure.



Photo 9 View of the base of the slope, looking north, showing the occasional bent tree, large boulders, mixed mature trees, a dock, staircase, and Diamond Lake.



Photo 10 View of the base of the slope, looking south, showing the occasional bent tree, large boulders, coniferous trees, and Diamond Lake.



Photo 11 View from the dock, looking west towards the base of the slope/shoreline, showing mixed mature trees, a dock, and a staircase. Large boulders exposed along the base of the slope.

SLOPE STABILITY RATING CHART

Site Location: 439 W Diamond Lake, Highland Grove		File No. 22031-001
Property Owner: Kalab Dewar		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		24
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
Notes: a) Choose only one rating value from each category; compare total rating value with above requirements b) If there is a waterbody (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. c) For leda clay and rock slopes, additional evaluation must be carried out		

Tag#:A301964

Measurements recorded in: ☐ Metric ☒ Imperial

Address of Well Location (Street Number/Name)		Township	Lot	Concession
411 WEST DIAMOND LK RD		HERSCHEL		
County/District/Municipality		City/Town/Village	Province	Postal Code
HASTINGS		BANCROFT	Ontario	
UTM Coordinates Zone Easting Northing		Municipal Plan and Sublot Number		
NAD 83 177331974995413				

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)					
General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
GREY	SANDY CLAY	STONES	HARDPAN	0	16
RED	GRANITE	GREY GRANITE	BED ROCK	16	140

Annular Space				Results of Well Yield Testing			
Depth Set at (m/ft)		Type of Sealant Used (Material and Type)		Volume Placed (m³/ft³)		Draw Down	
0 20		BENTONITE SLURRY		5 ft³		Time (min)	Water Level (m/ft)
						Static Level	
						1	18.0
						2	22.3
						3	25.3
						4	27.6
						5	29.5
						10	33.9
						15	35.5
						20	36.4
						25	36.9
						30	37.3
						40	37.9
						50	38.4
						60	38.6

Method of Construction		Well Use	
☐ Cable Tool	☐ Diamond	☐ Public	☐ Commercial
☒ Rotary (Conventional)	☐ Jetting	☒ Domestic	☐ Municipal
☐ Rotary (Reverse)	☐ Driving	☐ Livestock	☐ Test Hole
☐ Boring	☐ Digging	☐ Irrigation	☐ Cooling & Air Conditioning
☒ Air percussion		☐ Industrial	
☐ Other, specify		☐ Other, specify	

Construction Record - Casing				Status of Well	
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		
			From To		
6 1/4	STEEL	.188	12 20		
6	OPEN HOLE		20 140		

Construction Record - Screen				Status of Well	
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)		
			From To		

Water Details		Hole Diameter	
Water found at Depth	Kind of Water: ☐ Fresh ☒ Untested	Depth (m/ft)	Diameter (cm/in)
135 (m/ft) ☐ Gas	☐ Other, specify	From To	
Water found at Depth	Kind of Water: ☐ Fresh ☐ Untested	0 20	9"
(m/ft) ☐ Gas	☐ Other, specify	20 140	6"
Water found at Depth	Kind of Water: ☐ Fresh ☐ Untested		
(m/ft) ☐ Gas	☐ Other, specify		

Well Contractor and Well Technician Information			
Business Name of Well Contractor		Well Contractor's Licence No.	
JOE LEGGE & SONS		7052	
Business Address (Street Number/Name)		Municipality	
Province	Postal Code	Business E-mail Address	
ONT	K0L1C0		
Bus. Telephone No. (inc. area code)		Name of Well Technician (Last Name, First Name)	
6133392025		LEGGES J.T	
Well Technician's Licence No.		Signature of Technician and/or Contractor	
4115		J. Legge	
		Date Submitted	
		Y Y Y Y M M D D	

Map of Well Location

Please provide a map below following instructions on the back.

Comments:

Well owner's information package delivered ☐ Yes ☒ No

Date Package Delivered Y Y Y Y M M D D

Date Work Completed 20200801

Ministry Use Only

Audit No. 2342071

Received SEP 30 2020