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Re: 2353 County Road 7, North Marysburgh, Prince Edward County, ON
c/o SvN Architects and Planners

Subject: Slope Stability

Project Number: 2136496

Our scope of work included the review of aerial photographs, geological mapping, and an inspection of the site and slope, and observation of drainage and vegetation cover. The following paragraphs provide a description of the site and slope along with an assessment of the slope stability in general accordance with guidelines contained in *Geotechnical Principles for Stable Slopes* (a technical report prepared in 1998 for the Ontario Ministry of Natural Resources by Terraprobe Limited and Aqua Solutions).

Having reviewed the available documents, the following is provided in support of the development application process.

Existing Conditions

The subject property, 2353 County Road 7, is located on the north side of County Road 7 and along the south shoreline of Adolphus Reach of the Bay of Quinte.

A snapshot from the Prince Edward County GIS viewer is provided below.

Figure 1: 2353 County Road 7, North Marysburgh, Prince Edward County.

The subject property is currently sparingly developed. The entrance to County Road 7 is existing. A long gravel driveway runs along the western edge of the property, leading to some existing out-buildings at the top of the escarpment. Approaching the waterfront, the driveway traverses down the slope to a waterfront boat dock.

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Figure 2: Aerial shot of property, looking south from over the Bay of Quinte. Note County Road 7 in the fields in the upper right.

Slope Stability

Most of the property has a thin soil covering. Bedrock consists of brownish grey thinly to medium bedded shaley limestone of the middle Ordovician Lindsay Formation although limestones of the transitional Verulam Formation are exposed on the lake shore. The Lindsay Formation bedrock is considered to have a Geological Strength Index (GSI) in the range of 40 and an unconfined compressive strength of 50 to 80 MPa. The Verulam Formation exposed along the shoreline The bedrock is considered to have a Geological Strength Index (GSI) in the range of 60 and a strength classification (Hoek and Brown, 1997) of R4.

The slope is approximately 47 m in height from the plateau lands bordering County Road 7 to the shore of the Bay of Quinte. The slope itself contains two steeper sections, separated by a more gently sloping interval. This bedrock is resistant to deep-seated rotational or sliding block type failure, but it is friable and susceptible to erosion and disaggregation under freeze-thaw action. The stability of the slope was assessed on-site following the Ontario Ministry of Natural Resources 'Geotechnical Principles for Stable Slopes' (June 1998). As per the appended Slope Stability Rating Chart, the slope stability rating is 20 (low potential for instability).

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Figure 3 - Exposed bedrock (Verulam Formation) at the lake shoreline

The existing retaining wall along the uphill side of the roadway to the boat house embayment shows some signs of deterioration including a section that appears to bow outwards in the downslope direction. No evidence of tiebacks used in the retaining wall construction was observed. Rehabilitation or replacement of this retaining wall is recommended.

Figure 4 - Retaining wall exhibiting outward thrust

Shoreline erosion is active at this site although the rate of regression appears to be slow and no significant (i.e., measurable within constraints of image resolution) change can be observed in comparison of the present shoreline with that visible in 1954 aerial photography for the area. Published data for marine coastal cliff erosion rates (Prémaillon et al., 2018) indicates a mean annual erosion rate of 2.9 cm per

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year for cliffs composed of bedrock having a strength classification of R4 or higher. Since this data is from marine cliffs which are subject to tidal effects and greater wave energy that would likely exceed that experienced by the Lake Ontario shoreline. Examination of channel widths on the lake-exposed portions of the ancestral river that flowed through the Bay of Quinte (i.e., the Kingston shoreline) indicates a long-term average regression of a little less than 2 m per century (calculated by dividing one half the channel width by the 8,500 years since the basin-wide low stand in Lake Ontario between the end of the Pleistocene and approximately 8.5 ka BP). These independent estimates all suggest that a 100-year shoreline regression of 3 m is reasonable and probably slightly conservative.

Figure 5 - Top of slope

Conclusion

The proposed cabins and the clubhouse/restaurant bust be set back a minimum distance of 15 m from the crest of the slope. This portion of the site has a low risk for instability and the 15 m setback is considered sufficient and no erosion allowance is required.

For any structures located on the lower portion of the slope or the plateau area immediately adjacent to the shoreline, a minimum setback of 20 m is recommended from the crest of the scarp bordering the Lake Ontario shore unless stabilization measures are implemented. This setback recommendation is derived based on guidance for the Eastern Lake Ontario and Upper St. Lawrence River and includes an erosional setback of 5 m plus an additional allowance of 15 m. A lesser setback may be suitable depending on the type of structure and mitigation measures proposed and the but would need to be supported by additional study once the development plans for the site are known in better detail. Rehabilitation of the retaining wall bordering the roadway to the lakeshore is recommended.

We note that the root systems of trees are a stabilizing factor. We recommend that tree removal be minimized to the extent practical on the lower scarp bordering the Lake Ontario flood plain and that disturbed areas be revegetated following any

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construction activities.

We trust that this brief letter is sufficient for your purposes and adequately addresses any concerns regarding the slope stability. Please contact me at your convenience if you have any questions or points that require clarification.

Sincerely,

THE GREER GALLOWAY GROUP INC.
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Charles Mitz, M.Eng., Ph.D., P.Geo.
Senior Project Manager

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Table 1: Slope Stability Rating Chart (adapted from MNR, 1997 Geotechnical Principles for Stable Slopes, site conditions for 2353 County Rd 7 in bold type)

Rating value	Rating Value	Cumulative Rating
Slope Inclination		
a) 3:1 or flatter	0	
b) 2:1 or flatter	**6**	6
c) Steeper than 2:1	16	
Soil Stratigraphy		
a) Bedrock	**0**	6
b) Sand, gravel	6	
c) Glacial till	9	
d) Clay, silt	12	
e) Fill	16	
f) Leda Clay	24	
Seepage from Slope Face		
a) None or near bottom only	**0**	6
b) Near mid-slope only	6	
c) Near crest or from several levels		
Slope Height		
a) 2 m or less	0	14
b) 2 to 5 m	2	
c) 5 to 10 m	4	
d) More than 10 m	**8**	
Vegetation Cover on Slope Face		
a) Well vegetated; heavy shrubs or forested with mature trees	**0**	14
b) Light vegetation; grass, weeds, occasional trees, shrubs	4	
c) Mostly bare	8	
Tale Land Drainage		
a) Table land flat, no apparent drainage over slope	**0**	14
b) Minor drainage over slope, no active erosion	2	
c) Drainage over slope, active erosion, gullies	4	
Proximity of Watercourse to Slope Toe		
a) 15 m or more from slope toe	0	20
b) Less than 15 m from slope toe	**6**	
Previous Landslide Activity		
a) No	**0**	20
b) Yes	6	
	Total	**20**

<24:	**Low Potential**	**Site inspection only, confirmation, letter report**
25 - 35	Slight Potential	Site inspection and surveying, preliminary study, detailed report
>35	Moderate Potential	Boreholes, piezometers, lab tests, surveying, detailed report

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