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September 19, 2013

CARACO DEVELOPMENTS CORPORATION
P.O. Box 70
GLENBURNIE, ON K0H 1S0

ATTENTION: MR. KEN DANTZER

RE: SLOPE & EROSION ASSESSMENT
101 – 129 SOUTH STREET
GANANOQUE, ONTARIO
Our Reference No. 13-0808

1.0 INTRODUCTION

This letter reports a geotechnical assessment carried out at the above captioned property to address natural hazards relevant to proposed development of a condominium. The subject property includes waterfront on the Saint Lawrence River and concerns sloping ground overlooking the river. This assessment is intended to assess the risk of slope failure and erosion with regard to the proposed re-development at the property, based on an examination of the slope conducted on August 29th, 2013, and auger holes advanced on September 17th, 2013 as well as an archival and policy review relevant to river and shoreline recession. For the purposes of this report the property is considered to face the Saint Lawrence River to the south.

2.0 BACKGROUND AND OBSERVATIONS

The lot comprises 0.7 ha measuring approximately 215 metres of waterfront. Municipal services are available at the site. The western half of the site is occupied by single family dwellings fronting on South Street. The remainder of the site is occupied by showroom, service, mooring and fueling facilities associated with Gordon Marine, a recreational boating enterprise. **Drawing No. 1/1** outlines the setting and site features.

The shoreline consists of concrete and/or steel seawall with freeboard of 0.4 to 2 metres above 74.75 metres, the water level at the time of the initial site visit. The seawall is abutted by landscaping including lawn and sidewalk. The grade on South Street rises from 81m at Stone Street to 85m near the east limit of the development. The descent to the river is accomplished through landscaped slopes and various retaining walls. The Gordon Marine property features gabion, limestone and modular concrete retaining walls to support two terraces above the riverfront landing. There are a number of trees

of the order of 500mm-diameter at the site including locust and ash; the tree trunks are not inflected in any manner suggesting soil creep.

The area has been filled judging by historical mapping of the area. Between 1.2 and more than 3 metres of sand or sand and gravel fill is reported in five boreholes advanced at the site by Pinchin Environmental on the Gordon Marine Property. The bedrock is mapped as Potsdam sandstone, which is consistent with high outcrop located approximately 30m inland at the east end of Gordon Marine; the bedrock surface was encountered at elevations of between 78.5 to 72.0 metres as outlined on **Drawing No. 1/1**, generally descending toward the river.

To supplement bedrock surface mapping at the site, four section lines were laid out along the slope fall-line and cleared of underground utilities in anticipation of drilling. On September 17th, 2013, a Rig-Kits K40 limited access drill rig was used to advance 16 auger holes to refusal on the surface of inferred bedrock at depths of up to 2.95 metres below existing grade. Test locations and inferred bedrock surface elevations determined from the investigation are presented on **Drawing No. 1/1**. Elevations for the boreholes were referred to site benchmarks established by Hopkins and Cormier Limited, OLS.

Topographic information used to compile the drawings was interpolated from spot elevations on a survey of the property carried out by Hopkins and Cormier Limited, OLS, dated May 7th, 2013. Water levels at the time of the fieldwork were inferred from Canadian Hydrographic Service records for gauges at Kingston Olympic Harbour and Blockhouse Island at Brockville.

3.0 DISCUSSION:

Preliminary sketches for the proposed condominium indicate a six-storey structure plus two levels of underground parking; the finished floor elevation for the lowest level is slated at 77.0 metres. The footprint proposed for the condominium as presented on **Drawing No. 1/1** would negate most of the slope from the site. On the river-side apron below Gordon Marine, there will be minimal grade adjustment; grade work would be limited to a percent or so either way for stormwater management.

It is anticipated that the foundations for the condominium and retaining structures will be availed to the underlying bedrock. Sections were prepared from the results of the subsurface investigations at the site, which indicate that the foundations for the proposed condominium would be constructed on bedrock above normal high water. The sandstone bedrock is considered erosive bedrock, however compared with unconsolidated shoreline (i.e. soil) resistance to erosion is considered ample. Based on a minimum 6-metre setback and the existing/proposed seawall and soil cover to buffer the effect of ice and frost, global slope stability is not considered an issue as regards river processes.

The existing seawall treatment of the waterfront is consistent with nearby development and along these lines improvements associated with the development will include a continuous seawall to define the waterfront. The seawall would be designed based on an event with a given return period, for instance 50 years; given a 100-year service life, the design event is liable to be realised. In this case, the area is subject to a fetch length limited to approximately 6 kilometres to the east and much less in every other direction. Should there be some damage to the seawall, a 6-meter margin would provide an adequate buffer and also means for repair in short order, limiting the progress of any erosion. Aside from stormwater infrastructure, utility and building access will be from Stone or South Streets which are associated with higher ground remote from the river. Based on the foregoing we are not concerned that erosion will affect the access, servicing or stability of the proposed condominium.

4.0 CONCLUSIONS:

The subject property is limited in extent, overlooks waterfront on the Saint Lawrence River and is located in Gananoque in an area of historical development. The proposed development is a multi-storey condominium that would be founded on bedrock above normal high water levels with shoreline protection along the lines of existing seawalls, such that slope stability and erosion are not considered a significant risk to the structural integrity of the proposed structure. The proposed location of the condominium provides a 6-metre setback that is considered an additional buffer for slope and erosion protection of the structure and timely maintenance of seawalls.

The footprint of the condominium would contain most of the sloping topography aside from the slope between the seawall and the west wing. Finished slopes should be limited to 3:1 for slope stability purposes, and 4:1 for landscape maintenance purposes. Where the existing slope would exceed these limits, retaining works will be required and should be backed up with a geotextile lining. Some alteration of grade may be warranted in 6-metre shoreline margin to facilitate access to the waterfront. The grade transition on the west sides would be consistent with the profile of Stone Street, interrupted by a shallow access ramp from Stone Street to the lowest parking level. On the east side retained terraces and stormwater infrastructure may be used to reduce the effect of runoff along the lot line.

During construction, the sloping terrain is considered a risk for erosion. Siltation control measures such as straw bales or silt fencing should be deployed near the base of the slopes behind the terrace and south at the terrace. The performance of these measures should be monitored and any breakthrough warrants secondary and/or subsequent lines of defence up slope. Diffusion of runoff sources using terracing, check dams and similar means should be used to reduce channelization on the slope. Disturbed

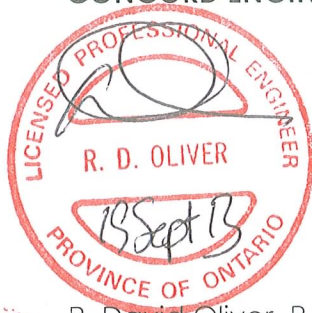
areas should be restored using topsoil and erosion mats as necessary, and seeded to promote re-growth.

Based on the foregoing, development consistent with Section 3.1 of the Provincial Policy Statement is viable at the property.

We trust that this report is to your satisfaction. Should you have any questions or concerns regarding this submission, please contact our office.

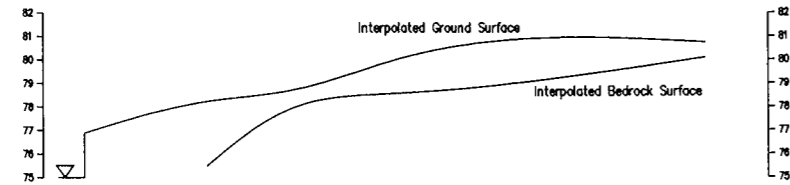
Yours truly,

CONCORD ENGINEERING

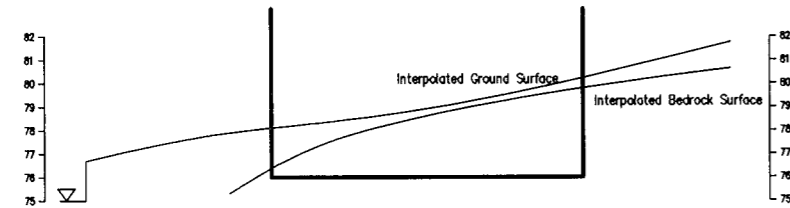


R. David Oliver, P.Eng.

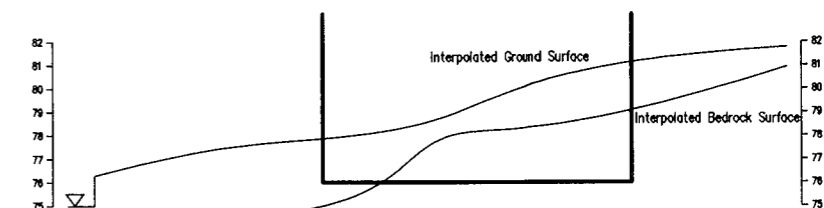
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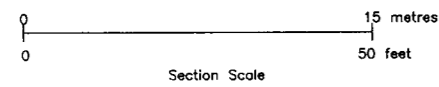
Section BH3 - BH1



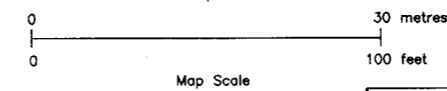
Section BH5 - BH13



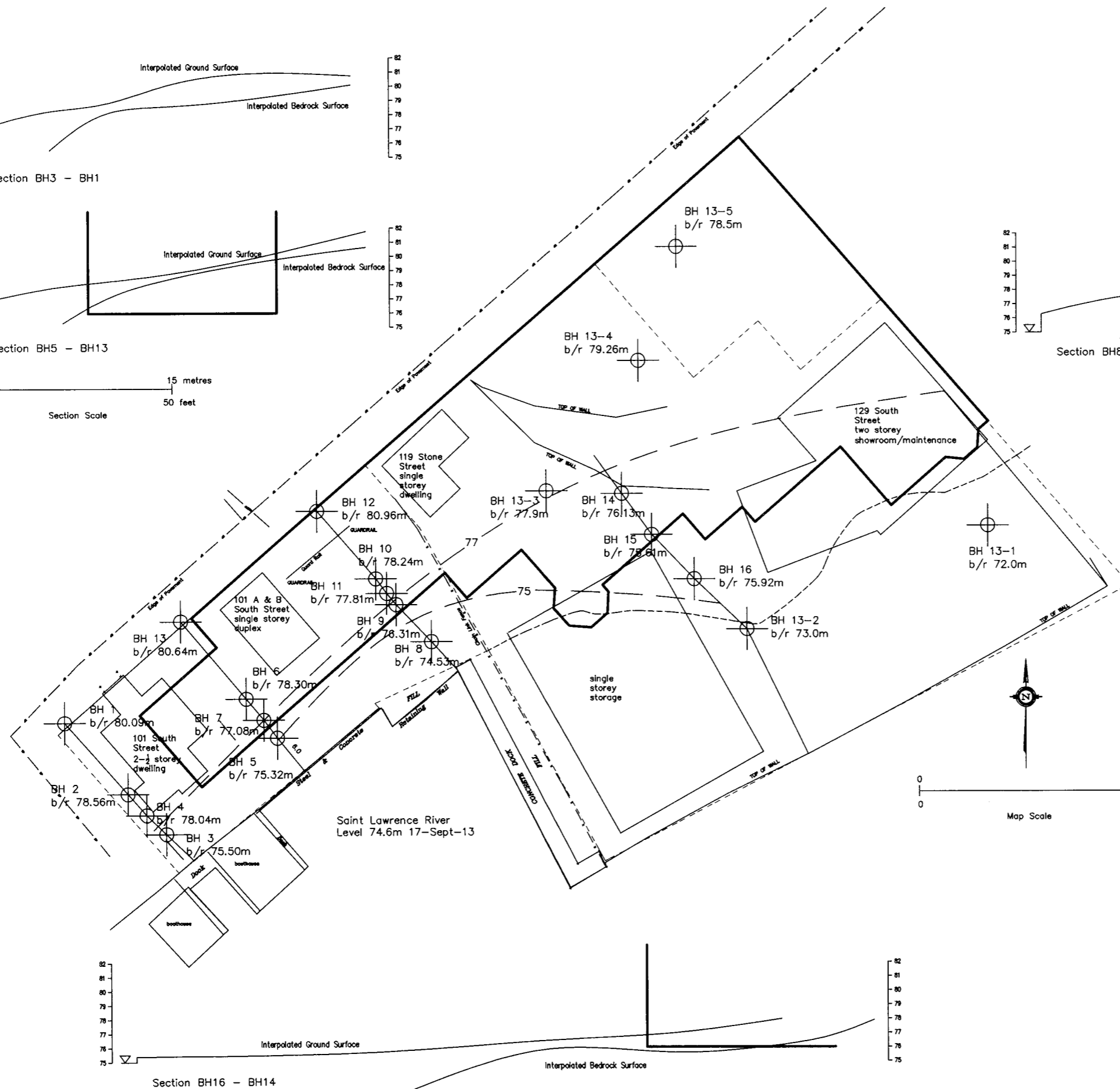
Section BH8 - BH12



Section Scale



Map Scale




LEGEND

- BH 13-1 Borehole by Pinchin Environmental with inferred bedrock elevation. b/r 72.0m
- BH 16 Borehole by Concord Engineering with inferred bedrock elevation. b/r 75.92m
- 75— Inferred bedrock contour (m)
- - - - - Cataraqui Region Conservation Authority Floodline Contour 76.4m



Section BH16 - BH14



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Project: Slope Stability Assessment			
101 - 129 South Street			
Kingston, Ontario			
Drawing: Site Plan			
Client: Caraco Development Corporation			
Designer:	Dwn by: RDO	Chd by:	Date: 19-Sept-13