Shoreplan Engineering Limited
20 Holly Street, Suite 202
Toronto, ON Canada M4S 3B1
T) 416.487.4756 F) 416.487.5129
E) mail@shoreplan.com

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January 14, 2016

Mr. William Liske
Losani Homes
430 McNeilly Road, Suite 203
Stoney Creek, Ontario, L8E 5E3

Dear Mr. Liske,

RE: Shoreline Hazard Assessment
Fifth Wheel Truck Stop Property, Grimsby, Ontario
Our file 15-2298

This letter presents out assessment of the natural hazards at the above noted property and provides comment on how the hazard limits will affect development setbacks. We have considered the erosion, flooding and dynamic beach hazards at the site, as defined by the Natural Hazards Policy 3.1 of the 2005 Provincial Policy Statement. We have also considered Niagara Peninsula Conservation Authority's (NPCA) policies, procedures and guidelines for the application of Ontario Regulation 155/06. This letter also describes how shoreline protection would affect development of this site. It is our understanding that this letter may be submitted to Niagara Peninsula Conservation Authority (NPCA) in support of an application under their Regulations for site development.

The site was visited by the undersigned on September 15, 2015. A survey of the nearshore was carried out by Shoreplan staff on December 11, 2015. The photographs presented in this letter were taken during the December 11, 2015 survey. The average water level was approximately 74.47 m IGLD 1985, as measured by the Canadian Hydrographic Service at the Port Weller gauge. Our assessment and figures are based on the topographic survey by A.T. McLaren Limited, dated November 4, 2015 (project no. 34802-T) and supplemented with our nearshore survey.

Existing Conditions

The subject site is located in Grimsby on the south shore of Lake Ontario. The property is on North Service Road, to the east of Casablanca Boulevard. Previously, the site was known as Fifth Wheel Truck Stop. The shoreline is

approximately 400 metres long and faces the north-east direction. For the purpose of the descriptions provided in this report, we approximate that the shoreline faces north.

The shoreline of the subject property is fronted by a high till bank. The bank is shown in Photos 1 to 3. The existing top of bank varies between elevations approximately 79.1 and 83.3 m. The existing toe of bank, as identified on the topographic survey, varies in elevation from approximately 74.9 to 76.6 m. The slope of the bank varies from approximately 2h:1v to steeper than 1h:1v. The upper slope is grassed and vegetated in some areas. The lower part of the slope is generally bare earth with exposed concrete rubble and debris in the slope (Photo 4).

Scattered or dumped concrete rubble, stone and other construction debris are located at the toe of the bluff along the entire shoreline. A significant amount of exposed reinforcing bar is intertwined amongst the concrete rubble. Along some parts of the shoreline, the concrete rubble extends partially up the slope and appears unstable at some locations. Sand and cobble material has collected in amongst the concrete rubble along much of the shoreline.

The nearshore consists of till with sand and gravel and scattered concrete. The nearshore slope is in the order of 10h:1v to 15h:1v.

A ravine is located approximately 150 m west of the west property limit. The ravine is illustrated in Photos 5 and 6. The sides of the ravine are vegetated with some scattered concrete rubble visible on the slope. Cobble has collected at the mouth of the ravine. The ravine drains a 2 m diameter storm sewer outlet pipe with an invert elevation of 80.44 m. The outlet is located approximately 70 m up the ravine from the average toe of bank alignment through the adjacent sections of the shoreline.

The shoreline to the west of the subject site is a sand, gravel and cobble beach (Photo 7) backed by a high bank. The beach deposit is anchored by a concrete block wall headland at the end of Casablanca Boulevard. The shoreline to the east of the subject site (Photo 8) consists of a vegetated bank with some concrete rubble and stone at the toe of the bank and in the nearshore. Cobble beach material has collected at the toe of the beach. The cobble beach was approximately 8 metres wide at the property line on the day of the nearshore survey.

The existing concrete rubble shoreline protection provides a low to moderate level of protection at current water levels. Signs of erosion at the exposed toe of the bank were observed. Erosion at the toe will occur at a higher rate at high water levels.

Natural Hazards

The natural hazards considered for this assessment included the dynamic beach hazard, the erosion hazard and the flood hazard as defined in the Natural Hazards Policies (3.1) of the Provincial Policy Statement of the Planning Act (PPS). Each hazard is discussed separately below. Our assessment is consistent with the general methods prescribed in the MNR (2001) technical guidelines published to support the PPS and the Niagara Peninsula Conservation Authority regulation policies under Ontario Regulation 155/06. Our assessment also relied in part on information in the Lake Ontario Shoreline Management Plan Update (LOSMPU) (Baird, 2009).

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Dynamic Beach Hazard

There is no dynamic beach at this site so there is no dynamic beach hazard. The sand and gravel deposits do not meet the definitions of a dynamic beach.

Flood Hazard

The Provincial Policy Statement and accompanying Technical Guides (MNR, 2001) require that uprush and overtopping calculations be undertaken for a 20-year return period storm occurring at the 100-year instantaneous water level. MNR (1989) determined the 100-year instantaneous water level for this part of Lake Ontario to be 76.0 m. This represents the water level that has a 1% probability of occurrence in any year and considers both mean lake levels and wind set-up.

The existing top of bank varies in height from elevation 79.1 to 83.3 m. The toe of bank varies from 74.9 to 76.6 m. Under the 76.0 m 100-year water level, the water depth at the toe of the bank will be up to 1.1 m. Wave uprush calculations were undertaken using a depth limited approach. The design wave will not overtop the bank so the flood hazard limit is located somewhere on the bank. Therefore the flood hazard is not the governing hazard and the erosion hazard will govern with respect to any development setbacks at this site.

Erosion Hazard

The erosion hazard limit consists of two components; an erosion allowance plus a stable slope allowance. The erosion allowance is based on a 100-year time frame and is applied first so that the stable slope allowance can be applied from the point where the shoreline is expected to be in 100 years.

An important step in locating the erosion hazard is determining the position and elevation of the toe of bank. The natural toe of bank is not visible since it is covered by concrete rubble and other debris. We expect that the bottom of slope, surveyed by the OLS, is the break in the concrete rubble slope. The bottom of bank points have an average elevation of 75.8 m and vary in elevation more than we would expect for a natural toe of bank. For this part of Lake Ontario, we would expect that the natural toe of bank would be at an elevation of 75 to 75.5 m. We would also expect that the natural toe of bank would have a somewhat uniform alignment. For our assessment, we have used a smoothed alignment of the surveyed bottom of slope for the natural toe of bank. We have assumed an elevation of 75 m for the natural toe of bank.

The erosion allowance is calculated as 100 times the average annual erosion rate for unprotected shoreline. The technical guide to the PPS describes the parameters to be used to determine site specific erosion rates and provides a provincial wide default to be used in the absence of such data. The subject property is located within Reach 2 of the Lake Ontario Shoreline Management Plan Update (LOSMPU) (Baird, 2009). Within Reach 2, the annualized average recession rate (AAR) reported is 0.76 m/year (Table 4.5, LOSMPU). The average annual recession rate is based on an assessment of aerial photographs from 1954 and 2006. The site in Reach 2 was located at the end of Casablanca Blvd. The method Baird used to determine the AAR takes the mean recession of the profile plus one standard deviation divided by the temporal period. We note that the AAR using only the mean recession for profile Reach 2 reported in Table 4.5 results in an AAR of 0.70 m/year. Using the AAR of 0.76 m/year applied over a 100 year time frame gives an erosion allowance of 76 metres, measured horizontally from the assumed natural toe of bank.

The stable slope allowance is the product of the bluff height and the assumed stable slope. The Technical Guides give a “default” stable slope of 3h:1v (MNR, 2001). The LOSMPU recommended that the default 3h:1v be used the absence of a site specific geotechnical assessment. The tableland is relatively flat on the site. The average elevation of the tablelands in the vicinity of the erosion hazard is approximately 82.8 m. Based on the assumed natural toe of bank elevation, the stable slope allowance is 23.4 m ((82.8 – 75.0)m x 3.0). The erosion hazard is 99.4 m (76.0m + 23.4m). The position of the erosion hazard based on the 3h:1v stable slope is shown on the site plan on Figure 1.

We have been involved with numerous other shoreline projects along this section of Lake Ontario. Based on our experience and other geotechnical investigations, we consider 3h:1v to be a very conservative value for most shorelines along Lake Ontario. It is our opinion that using a stable slope of

2h:1v on the Fifth Wheel Truck Stop property would be a reasonable assumption, but subject to acceptance by NPCA. We have calculated the erosion hazard assuming a 2h:1v stable slope. The stable slope allowance using the 2h:1v stable slope is 15.6 m ((82.8 - 75.0)m x 2.0). The erosion hazard is 91.6 m (76.0m + 15.6m). The position of the erosion based on the 2h:1v stable slope is shown on the site plan on Figure 1. Note that this erosion hazard limit is subject to the acceptance of the 2h:1v stable slope by NPCA. NPCA may request a site specific geotechnical investigation to confirm the stable slope.

Development Setbacks

The possibility of encroachment into a shoreline hazard limit is considered by all relevant documents, including the Provincial Policy Statement, the Technical Guides (MNR, 2001) and the NPCA Planning and Regulation Policies (NPCA, 2008). NPCA includes a provision for development within the erosion allowance. Section 3.26.4.2 (c) of NPCA (2008) states that:

> New Habitable Buildings/Structures, Redevelopment and Additions…
>
> (c) May be permitted within the erosion allowance provided:
>
> i) It meets the requirements of the protection work standard to the maximum extent and level possible based on site-specific conditions;
> ii) It utilizes maximum lot depth and width;
> iii) As a minimum, uses a setback from the stable slope allowance of 7.5 metres.

New shoreline protection that meets the standards could be constructed. Two conceptual shoreline treatments were developed for this site and are described in the following section. The shore protection works would be designed to have a 50 year design life. Any shore protection works would require maintenance over its lifetime and further work to extend their function beyond this period. Access to the protection works for suitable construction equipment needs to be provided. The maintenance access must be at least 5 metres wide from the road to and along the back of the structure, as per NPCA policy guidelines.

Typically development with shore protection works at this site could be located 38 m (50 years x 0.76 m/year) lake ward of the erosion hazard limit. Figure 1 shows the Development Setback lines using the 2h:1v and 3h:1v stable slopes with shoreline protection with a 50 year design life.

Description of Shoreline Protection Concepts

Two conceptual shoreline protection options were prepared and are described below. Concept A is an armour stone revetment. Concept B is an amour stone revetment/wall combination.

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The revetment in Concept A is shown on the cross-section on Figure 2. A revetment is a sloping stone shoreline protection structure commonly used on the Great Lakes. The revetment proposed in Concept A consists of two randomly placed layers of armour stones overlaying a layer of rip rap. The slope of the structure is 2h:1v. The double toe stone will be specially placed at an elevation of approximately 72.0 m in native clay. At the preliminary design stage, a crest elevation of approximately 79.0 m is expected to be appropriate. The revetment essentially follows the existing shoreline. From the back of the structure, the bluff would be regraded to meet the existing grade. The construction cost of Concept A is estimated to be approximately $9,700 per metre of shoreline.

Concept B is an armour stone revetment/wall combination. A typical cross-section for Concept B is shown on Figure 2. The lower part of the structure is a double layer armour stone revetment structure similar to Concept A. The structure has a double toe stone founded at an elevation of 72.0 m. At an elevation of approximately 77.0 m, the structure transitions to a stacked armour stone wall. At the crest of the armour stone revetment and base of the armour stone wall, the width of the armour stone pad could be increased to accommodate seating or access along the shoreline. This would increase the construction cost. The crest of the armour stone wall at the conceptual design phase is 79.0 m. From the back of the amour stone wall, the existing bluff would be regraded to meet the existing grade of the tablelands. The construction cost of Concept B is estimated to be approximately $10,100 per metre of shoreline.

The shoreline protection in the vicinity of the ravine will need to be considered in the detailed design of the shoreline protection. There are two main options for dealing with the storm sewer outfall and the ravine. Either of the two shoreline protection options described above could be continued across the ravine mouth. The 2 m diameter storm sewer pipe would be extended to outlet in the revetment slope and the area behind the revetment filled in and regraded. A second option would be to construct formal channel scour protection in the ravine and a formal armour stone outlet within the shoreline protection structure.

The unit prices used to for the preliminary cost estimates are based on similar projects recently completed in South Ontario. The cost of armour stone may vary depending on the availability of material at the time of construction. The

estimate assumes that the excavated material is clean and can be disposed of offsite without being taken to a licenced landfill. The construction cost estimates noted above do not include any mobilization and demobilization, construction contingencies, taxes (HST) or design costs. We suggest that a construction contingency of 20% of the cost estimates described above are applied at the conceptual design stage.

Approvals

Construction of shore protection will require agency acceptance or review. A permit from NPCA under Ontario Reg. 155/06 would be required. The project must also be reviewed by the Ministry of Natural Resources (MNR) under the Public Lands Act. An MNR work permit is required if the shoreline protection is constructed on public land. It is expected that a portion of the works will be on Crown land and that the MNR permit will be required.

Shoreline protection projects require review by DFO under the Fisheries Act if there is an increase in the footprint below the High Water Mark (HWM). The HWM is elevation 75.3 m which is the 80th percentile high water level for Lake Ontario. It is likely that the construction of shoreline protection will result in an increased footprint below the HWM. DFO looks at the difference between the existing and proposed 75.3 m contour to assess the extent of fish habitat loss. The fish habitat loss will be larger the more lake ward that the structure is positioned. Authorization and an offsetting plan may be required if the loss of fish habitat is significant.

The position of the structure relative to the bluff will influence the "approvability" and construction costs of the shoreline protection. Moving the structure inland will improve the DFO approvability of the shoreline protection. The construction cost of the project will also be increased due to larger excavation of the bluff.

Closing Comments

We trust that these comments will assist you as you develop your plans for these properties. Please do not hesitate to call us if you have any questions regarding this letter.

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Yours truly,

Shoreplan Engineering Limited

J. Graham, P.Eng.

Milo Sturm, P. Eng.

Photos 1-8 and Figures 1-2 follow.

References

Niagara Peninsula Conservation Authority (NPCA) (2011) *Policies, Procedures and Guidelines for the Administration of Ontario Regulation 155/06 and Land Use Planning Policy Document.*

Ontario Ministry of Natural Resources (MNR) 1989. *Great Lakes Flood Levels and Water Related Hazards*, Provincial Shoreline Management Program, Conservation Authorities and Water Management Branch, Ontario Ministry of Natural Resources, February 1989.

Ontario Ministry of Natural Resources (MNR), 2001. *Great Lakes, St. Lawrence River System and Lake Inland Lakes: Technical Guide for Flooding, Erosion and Dynamic Beaches*, in support of Natural Hazards Policies 3.1 of the Provincial Policy Statement.

W. F. Baird and Associates Coastal Engineers Limited (Baird), 2009. *Lake Ontario Shoreline Management Plan Update*, Niagara Peninsula Conservation Authority, November 2009.

Photo 1 Shoreline at west end of subject site

Photo 2 Shoreline of subject site (just west of ravine)

Photo 3 Shoreline at east end of subject site

Photo 4 View of slope from shoreline

Photo 5 View looking up Ravine from shoreline

Photo 6 View of shoreline on east side of ravine

Photo 7 View of shoreline to west of subject site

Photo 8 View of shoreline to east of subject site

25 0m 25 50 75

LAKE ONTARIO

SURVEYED WATERLINE
(November 4, 2015)

ASSUMED LOCATION OF
NATURAL TOE OF BANK

PROPERTY LINE (TYP.)

WINSTON ROAD

DEVELOPMENT SETBACK WITH SHORELINE PROTECTION WITH 50 YEAR DESIGN LIFE (3H:1V STABLE SLOPE)

DEVELOPMENT SETBACK WITH SHORELINE PROTECTION WITH 50 YEAR DESIGN LIFE (2H:1V STABLE SLOPE)

99.4m

91.6m

38.0m

38.0m

EROSION HAZARD (2H:1V STABLE SLOPE)

EROSION HAZARD (3H:1V STABLE SLOPE)

GRAVEL

ASPHALT

NORTH SERVICE ROAD

Note: Site plan based on topographic survey by A.T. McLaren Limited, dated November 4, 2015.

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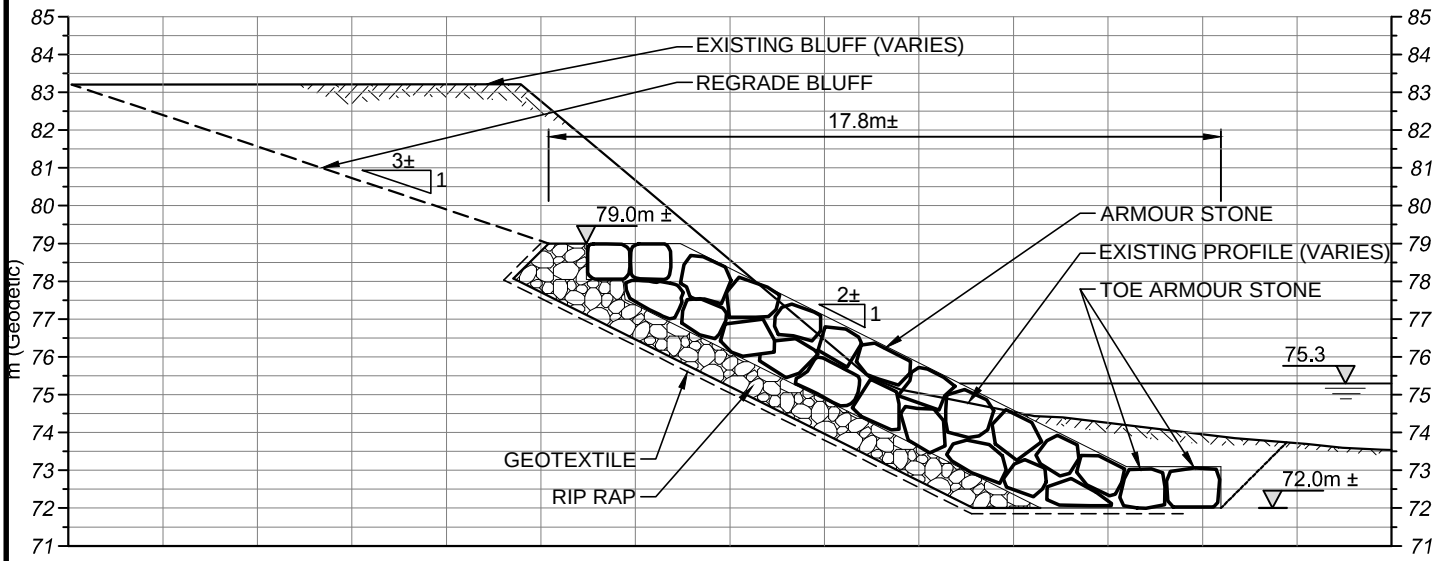
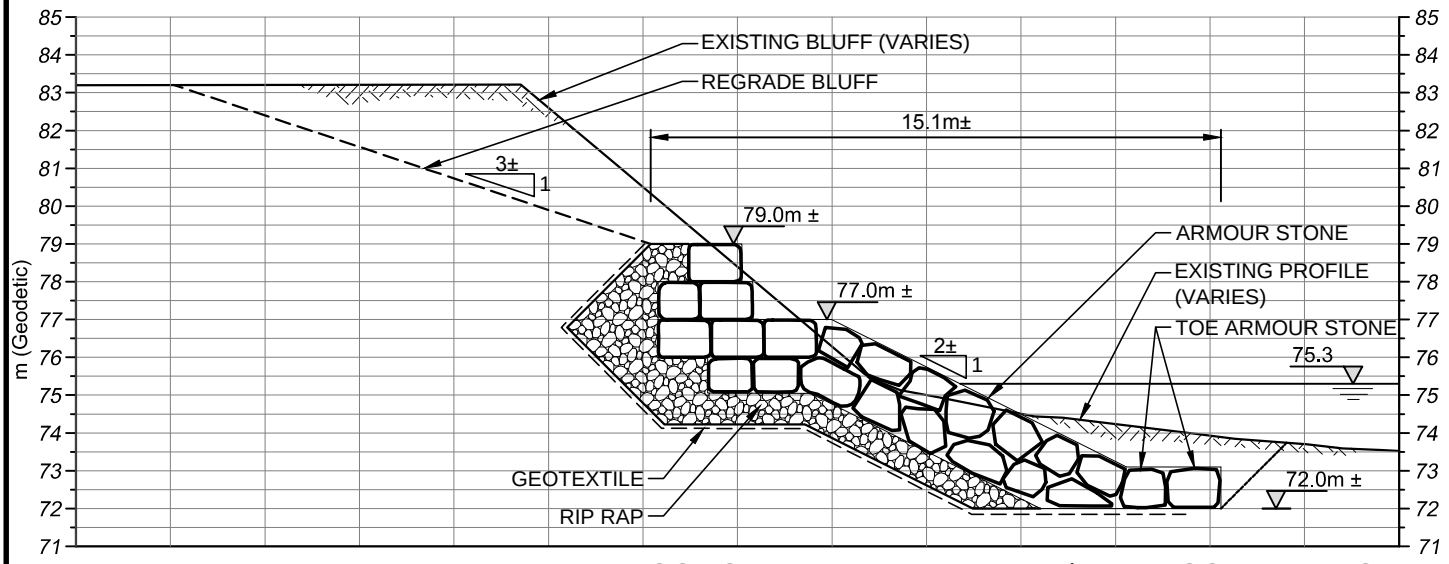
Figure 1
Fifth Wheel Truck Stop, Grimsby
Site Plan with Hazard Limits and Development Setbacks



Scale 1:200

CONCEPT A - REVETMENT



Scale 1:200

CONCEPT B - REVETMENT / WALL COMBINATION

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Figure 2
Fifth Wheel Truck Stop, Grimsby
Shoreline Protection Concepts - Typical Cross-Sections