



# Erosion Hazard Assessment Picton Terminal Picton, Ontario

Cambium Reference No.: 6824-001

October 17, 2017

Prepared for: G.D. Jewel Engineering



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## **1.0 INTRODUCTION**

Cambium Inc. (Cambium) was retained by G.D. Jewel Engineering Ltd., on behalf of Picton Terminals Ltd. (Client), to complete an erosion hazard limit assessment of the southeast shore of Picton Bay at the site of the Picton Terminals, located at 62 White Chapel Road, just north of Picton, Ontario (Site), as shown in Figure 1.

Cambium understands that the Client wishes to excavate material adjacent to the shoreline, in the area outlined in Figure 1, for the purposes of creating a lower dock or pier which will facilitate more efficient loading and unloading of materials at the site. In order to remove the rock the Client are required to comply with the regulations governed by the Quinte Conservation Authority (QCA). Resultingly the Client required Cambium's expertise to define the erosion hazard limit, up to which the client may safely and responsibly excavate rock material for the construction of the landward portion of the aforementioned dock/pier,

It is Cambiums understanding that the Client may require additional services in the future to support a permit application to the QCA to remove rock within the regulated erosion hazard limit to complete the construction of the dock/pier.

It is Cambiums understanding that the erosion hazard assessment has been requested by the Quinte Conservation Authority in order to define an erosion hazard limit, as per the regulations in place, up to which the Client may responsibly excavate material.



## **2.0 SITE INVESTIGATION & DESCRIPTION**

A Cambium Technician visited the Site on October 3, 2017 to inspect the Site and slope. At the time of investigation the specific site under investigation, outlined in Figure 1, was partially excavated. Material on site consists almost entirely of light grey, massive to slightly blocky, horizontally-bedded limestone bedrock. This bedrock, with minor overburden, results in table land flat topography at the top of the slope, with no apparent drainage over the slope. The excavated area is situated on top of and landward of a limestone bedrock slope, which varies from exposed, steep-faced limestone bedrock to talus covered rock with sparse to light vegetation of shrubs, trees and weeds. The top of the slope and the slope itself was bare to the west, downslope of the ramp, and tree and shrub covered to the east. The toe of the slope ranged from exposed steep-faced bedrock to talus slopes. No evidence of mass failure or apparent seepage was visible on the slope at the time of the investigation. Photographs of the Site are provided in Appendix A.

All of the components of the site investigation have been input into the slope stability rating chart presented in Appendix B.



### **3.0 EROSION HAZARD LIMIT**

Definition of the erosion hazard limit, with respect to the slope on Site, is required to provide a distance from the shoreline to which the Client may safely and responsibly perform excavations. It should be noted that plans of the client do not involve the construction of any structures in proximity to the top of slope at this time, and are merely operational in nature.

Due to the exposed, steep-faced, rocky nature of the slope, it is Cambium's opinion that the erosion hazard limit is dependent on "the predicted long term stable slope projected from the existing stable toe of the slope or from the predicted location of the toe of the slope as that location may have shifted as a result of shoreline erosion over a 100 year period", as per Section 2.1.a.ii of O. Reg. 319/09: Quinte Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

As per Subsection 4.4.1a of Part 4: Erosion Hazard of the Technical Guide for Great Lakes – St. Lawrence River System and Large Inland Lakes, "for shore forms having a submerged toe, for ease of application, the toe of the cliff, bluff or bank shall be taken as the waterline." This is in line with Cambium's opinion, as the slope below the shore line is significantly less prone to erosion and exposure to weather related elements. Also, the water itself provides a lateral pressure which helps retain the slope of the existing submerged slope.

For clarity, we have divided the erosion hazard limit into its two distinct components: stable slope allowance and toe erosion allowance.

#### **3.1 STABLE SLOPE ALLOWANCE**

Based on Cambium's experience with these types of projects and our understanding limestone rock properties and slopes, it is our opinion that any slope equal to or less steep than 0.75H:1V would be a conservative estimate of a stable slope, considering the massive to blocky, horizontally-bedded limestone that forms the slope. As such, the stable slope allowance would be equivalent to 0.75 times the vertical height of the slope itself, measured horizontally landward from the shoreline. It should be noted that the maximum flood elevation for the Bay of Quinte is 75.9 masl. The elevation at the top of the slope is approximately 98 masl, based on the topographic data obtained from the Client. As a result, the elevation differential would be 22.1 m and the stable slope allowance would be 16.4 m at this elevation. Moving west on the Site, the top decreases in elevation, which would result in a proportional reduction in stable slope allowance.

#### **3.2 TOE EROSION ALLOWANCE**

The toe erosion allowance at this Site is based on the annual average recession rate of the shoreline. Two quality images of the area, taken in 1962 and 2013 and acquired from the National Air Photo Library and ERSI ArcGIS Online respectively, were compared in order to assess the recession of the shoreline over the 51 year



period. Figure 2 depicts the 1962 image of the area and its associated shoreline at that time. Figure 3 depicts the 2013 image with its associated shoreline at the time. For comparison purposes, the 1962 shoreline has been superimposed on the 2013 image in Figure 3. In general the lines match quite well with considerable overlap. The most significant change in shorelines appears to be on either side of the point of detrital material that has been shed and protrudes from the bedrock slope. This material takes the shape of an alluvial fan-like form that is constantly being reworked by wave action. The remainder of the shoreline, in areas of exposed bedrock, has very little erosion, which ranges from 0 m to 2.5 m and averages approximately 1 m along the entire shoreline. As this erosion has occurred over 51 years, the annual average rate of recession is calculated to be 0.02 m/year. When the annual average recession rate is projected over a 100 year development horizon, the erosion is calculated to be 2 m. Based on this information and with some conservatism included, Cambium recommends a toe erosion allowance of 3 m be used for the purposes of this project.

### 3.3 EROSION HAZARD LIMIT SETBACK

The erosion hazard limit is defined as the sum of the stable slope allowance (0.75H:1V) and the toe erosion allowance (3 m), plus an additional 15m buffer, as per Section 2.1.a. of O. Reg. 319/09: Quinte Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. Items 2.1.a.i and 2.1.a.iii of O.Reg. 3.9/09 were found to have negligible impact on this site and have thus been excluded from the study. However, all distances are measured from 75.9 masl, the 100 year flood level of the area.

The majority of the slope in the subject area has a vertical height of 22 m, and as such an erosion hazard limit setback of 34.4 m from the shoreline, along this relatively consistent plateau. As the ramp extends to south from the plateau, down to the water's edge, the elevation at the top of the slope decreases, and resultingly the erosion hazard limit is also reduced via the stable slope allowance calculation. This maximum erosion hazard limit setback is illustrated in Figure 4.

Based on the nature of the operation at site and the competency of the rock, the slope, and the overall resistance of the shoreline to erosion, it is Cambium's opinion that the additional 15m buffer is excessive and should not be included in the erosion hazard limit. A second line has been included in Figure 4, which depicts the sum of the stable allowance and the erosion allowance, omitting the 15 m buffer.

It should be noted that in areas where the existing slope is currently less steep than the stable slope 0.75H:1V, due to the progradation of a talus material at the base of the slope, the erosion hazard limit shall be modified to be 3 m landward from the top of the slope.



## 4.0 CLOSING

We trust that the information in this report meets your current needs. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned at (705) 742-7900.

Respectfully submitted,

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Stuart Baird, P.Eng.  
Senior Project Manager

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## **Appended Figures**

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**PICTON TERMINAL  
SLOPE STABILITY**  
GD JEWELL ENGINEERING  
52 White Chapel Road,  
Picton, Ontario

**LEGEND**

- Contour 5m Interval (Major)
- Contour 5m Interval (Minor)
- Lot / Concession
- Area Of Interest

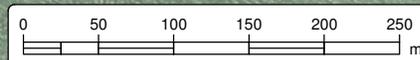
**Notes:**  
 - 2013 aerial imagery obtained October 2017 from ArcGIS Online.  
 - Base mapping features are © Queen's Printer of Ontario, 2017 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).  
 - Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.  
 - 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 PLAN**

Project No.:	6824-001	Date:	October 2017
Scale:	1:5,000	Rev.:	
Created by:	GJM	Projection:	NAD 1983 UTM Zone 18N
Checked by:	BJP	Figure:	<b>1</b>



O:\GIS\project\_L\MC\6800-6899\6824-001 GD Jewell Engineering - Slope Stability - Picton Terminal 588 Scotland Road, Odessa\2017-10-16 FIG 2 1962 Image.mxd



**PICTON TERMINAL  
SLOPE STABILITY**  
GD JEWELL ENGINEERING  
52 White Chapel Road,  
Picton, Ontario

**LEGEND**

— Shoreline (1962)

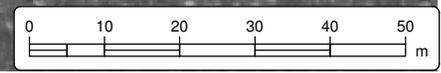
**Notes:**  
- Air Photo obtained from the National Air Photo Library.  
- Base mapping features are © Queen's Printer of Ontario, 2017 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).  
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.  
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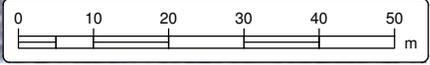
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**SHORELINE  
1962 IMAGE**

Project No.:	6824-001	Date:	October 2017
Scale:	1:1,000	Rev.:	
Created by:	GJM	Projection:	NAD 1983 UTM Zone 17N
Checked by:	BJP	Figure:	<b>2</b>



O:\GIS\project\_L\MC\6800-6899\6824-001 GD Jewell Engineering - Slope Stability - Picton Terminal 588 Scotland Road, Odessa\2017-10-16 FIG.3 Shoreline Comparison.mxd



**PICTON TERMINAL  
SLOPE STABILITY**  
GD JEWELL ENGINEERING  
52 White Chapel Road,  
Picton, Ontario

**LEGEND**

- Shoreline (1962)
- - - Shoreline (2013)

**Notes:**  
 - 2013 aerial imagery obtained October 2017 from ArcGIS Online.  
 - Base mapping features are © Queen's Printer of Ontario, 2017 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).  
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**SHORELINE COMPARISON**

Project No.: 6824-001	Date: October 2017
Scale: 1: 1,000	Rev.: NAD 1983 UTM Zone 18N
Created by: GJM	Checked by: BJP
Figure: <b>3</b>	



**PICTON TERMINAL  
SLOPE STABILITY**  
GD JEWELL ENGINEERING  
52 White Chapel Road,  
Picton, Ontario

**LEGEND**

- - - Stable Slope Allowance +  
Erosion Allowance  
(0.75H:1V+3m)
- - - Maximum Erosion Hazard Limit  
(0.75H:1V+3m+15m)

**Notes:**

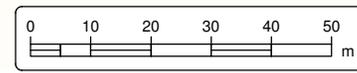
- September 2017 aerial imagery obtained October 2017 from Doorekamp Construction Ltd.
- Base mapping features are © Queen's Printer of Ontario, 2017 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
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**EROSION HAZARD LIMIT**

Project No.: 6824-001	Date: October 2017
Scale: 1: 1,250	Projection: NAD 1983 UTM Zone 18N
Created by: GJM	Checked by: BJP
Figure: <b>4</b>	





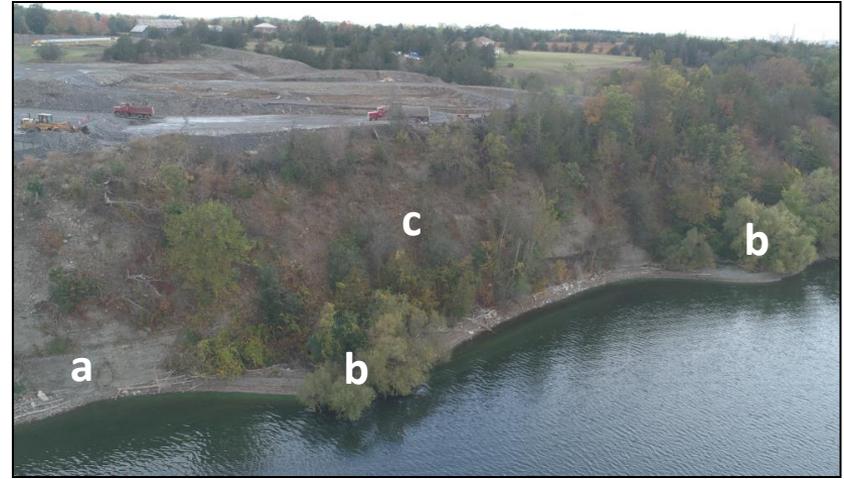
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## **Appendix A**

### **Site Photographs**

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## Site Photos



Pictures showing the subject slope. Above: slope adjacent to existing ramp showing (a) exposed limestone bedrock. Top right: main slope with (b) alluvial talus material at toe and (c) vegetated slope. Right: northeast limit of property and slope with (a) exposed limestone bedrock at base of slope.



## Site Photos



Left: existing cut slope on north side of ramp. Right: view of slope looking NE from the top of slope near the top of ramp





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**Appendix B**  
**Slope Stability Rating Chart**

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## SLOPE STABILITY RATING CHART

Site Location:	Slope Stability Analysis	File No.	6824-001
Client:	Jewell Engineering	Inspection Date:	10/03/17
Inspected By:	K. Thompson - Cambium Inc.	Weather:	Sunny and 20 C
Inspection Task		Rating Value	
		Exterior Slope	
<b>1. SLOPE INCLINATION</b>			
<b>Degrees</b>	<b>Horizontal:Vertical</b>		
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	
<b>2. SOIL STRATIGRAPHY</b>			
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	
<b>3. SEEPAGE FROM SLOPE FACE</b>			
a) None or near bottom only		0	
b) Near mid-slope only		6	
c) Near crest only or from several levels		12	
<b>4. SLOPE HEIGHT</b>			
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	
<b>5. VEGETATION COVER ON SLOPE FACE</b>			
a) Well vegetated, heavy shrubs or forested with mature trees		0	
b) Light Vegetation; Mostly grass, weeds, occasional trees, shrubs		4	
c) No vegetaion, bare		8	
<b>6. TABLE LAND DRAINAGE</b>			
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	
<b>7. PROXIMITY OF WATERCOURSE TO SLOPE TOE</b>			
a) 15 m or more from slope toe		0	
b) Less than 15 m from slope toe		6	
<b>8. PREVIOUS LANDSLIDE ACTIVITY</b>			
a) No		0	
b) Yes		6	
<b>RATING VALUES TOTAL</b>			<b>34</b>
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	
<b>Notes:</b>			
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			