GEMTEC
Consulting Engineers and Scientists

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March 24, 2021

File: 64913.01 – R01

12213559 Canada Inc.
996-B St Augustin Rd
Embrun, Ontario
K0A 1W0

Attention: Matthew Rochelea, Project Manager

Re: Slope Stability Assessment
5497 Manotick Main Street
Manotick (Ottawa), Ontario

This letter presents the results of a slope stability assessment carried out at 5497 Manotick Main Street in Manotick (Ottawa), Ontario.

PROJECT DESCRIPTION

The purpose of this slope stability assessment was to determine whether there is potential for slope instability at the site and, if so, to establish the "Erosion Hazard Limit" in accordance with the Natural Hazard Policies set forth in Section 3.1 of the Provincial Policy Statements of the Planning Act of Ontario. This limit constitutes a safe setback for development with respect to slope stability. It is noted that the setback related to the slope stability is separate from any required development setback set forth by the Rideau Valley Conservation Authority (RVCA).

DESCRIPTION OF SITE AND SLOPE

The property is located on the north side of Manotick Main Street in Manotick (Ottawa) and slopes downwards towards the west channel of the Rideau River. A commercial building and paved parking area are currently located on the property.

A site reconnaissance was carried out by a member of our engineering staff on April 25, 2019. At that time, the general topography of the site, surficial ground conditions and the current slope were observed and photographed. The geometry of the slope on the subject property was measured at two (2) locations (Sections A-A' and B-B') using our Trimble R10 GPS equipment. The cross sections were positioned at the site by GEMTEC Consulting Engineers and Scientists Limited (GEMTEC) personnel at key locations based on slope inclination and height. The locations of the cross sections are provided on the Site Plan, Figure 1. Cross-sections of the slope at these locations are provided on Figures A1 and A2 in Attachment A. Details of the slopes at Sections A-A' and B-B', inclusive, are provided in Table 1.

Table 1 - Details of the slopes at Sections A-A' and B-B'

Location	Slope Height	Slope Gradient Horizontal : Vertical
A-A'	2 metres	3H:1V (18 degrees)
B-B'	1 metres	5H:1V (11 degrees)

Notes:

1. Slope height and gradient measured from behind existing retaining wall.

It is noted that at the time of the site reconnaissance the Ottawa area was experiencing high water levels and, based on a review of aerial photographs, the river's edge had advanced up the toe of the slope. The approximate location of the river's edge at the time of the site reconnaissance is shown on Figure 1.

The following observations were made at the time of the site reconnaissance:

- The slopes at the property are relatively flat and are vegetated with grass and large trees.
- An existing timber retaining wall is located at the toe of the slope.
- The river's edge was located at the retaining wall at the time of the site reconnaissance and, as a result, the conditions at the toe of the retaining wall could not be observed.
- Based on visual observations, the height of the retaining wall appears to be less than 1 metre.
- No signs of active erosion or instability were observed at the subject site (i.e., tension cracks, rotational failures, etc.) at the time of the site reconnaissance.

Photographs of the site are provided on Figure B1 in Attachment B.

SUBSURFACE CONDITIONS

In order to determine the shallow subsurface conditions at the site, two (2) hand augerholes, numbered AH19-1 and AH19-2, were advanced at the site on April 25, 2019 by GEMTEC personnel. The subsurface conditions encountered in the augerholes were determined based on tactile examination of the material recovered on the flights of the auger. Details of the hand augerholes advanced at the site are as follows:

- Augerhole AH19-1 was advanced at the crest (top) of the slope along Section B-B' and encountered about 100 millimetres of brown, sandy topsoil overlying grey brown sand (possible fill material). Silty clay was encountered at a depth of about 0.3 metres below ground surface. The hand augerhole was terminated at a depth of about 1.4 metres below

ground surface in the silty clay. Groundwater seepage was observed at a depth of about 300 millimetres below ground surface.

- Augerhole AH19-2 was advanced at the toe (bottom) of the slope along Section B-B' and encountered about 100 millimetres of brown, sandy topsoil overlying grey brown silty sand and sand and gravel. Refusal to hand augering was encountered at a depth of about 0.8 metres below ground surface.

Descriptions of the subsurface conditions logged in the hand augerholes are provided on the Record of Test Hole sheets in Attachment C.

Review of Available Geology Maps

Surficial geology maps of the Ottawa area indicate that the site is underlain by silt and clay. Bedrock geology maps indicate that the bedrock is composed of dolostone of the Oxford formation at depths ranging between about 5 to 15 metres below ground surface.

Ministry of the Environment, Conservation and Parks (MECP) Water Well Records in the area indicate that the site is underlain by clay to depths of about 6 to 7 metres.

SLOPE STABILITY ASSESSMENT

Slope Stability Analyses

The slope stability analyses were carried out for Sections A-A' and B-B' using SLIDE, a two dimensional limit equilibrium slope stability program. The locations of the sections were selected for analysis by GEMTEC personnel based on slope geometry and height.

Input Parameters

The soil conditions used in the stability analysis were based on the hand augerholes advanced at the site, our experience in the vicinity of the subject site and surficial geology maps of the area. Based on our experience in the vicinity of the subject site, the surficial geology maps and MECP Water Well Records, and in the absence of relatively deep borehole information, GEMTEC has assumed that the slope is composed entirely of silty clay.

The slope stability analyses were carried out using silty clay strength parameters typical for the Ottawa area. The soil parameters used in the analyses are provided in Table 2.

Table 2 – Soil Parameters

Soil Type	Effective Angle of Internal Friction, ϕ (degrees)	Effective Cohesion, c	Undrained Shear Strength (kPa)	Unit Weight, γ (kN/m^3)
Silty Clay	32	10	50	17.5

As a conservative estimate, we have assumed that the slope is fully saturated with the groundwater level at the ground surface.

Existing Factor of Safety

The slope stability analyses were carried out using soil parameters, groundwater conditions and a slope profile that attempt to model the slope in question, but do not exactly represent the actual conditions. For the purposes of this study, a computed factor of safety of less than 1.0 to 1.3 is considered to represent a slope bordering on failure to marginally stable, respectively; a factor of safety of 1.3 to 1.5 is considered to indicate a slope that is less likely to fail in the long term and provides a degree of confidence against failure ranging from marginal (1.3) to adequate (1.4 and greater) should conditions vary from the assumed conditions. A factor of safety of 1.5, or greater, is considered to indicate adequate long term stability.

The slope stability analyses indicate that the existing slope, in its current configuration, has a factor of safety against overall rotational failure of about 2.1 and 3.1 for Sections A-A' and B-B', respectively. Based on the slope stability analyses, the factors of safety against overall rotational failure for static loading conditions are considered to indicate adequate long term stability. The results of the stability analyses are provided on Figures A1 and A2 in Attachment A.

The slopes at Sections A-A' and B-B' were analysed for pseudo-static (seismic) conditions using the undrained silty clay strength parameters. A seismic coefficient of 0.14 was used in the pseudo-static analyses (i.e., half of the Peak Ground Acceleration for Ottawa (Barrhaven) according to the Ontario Building Code 2015). The slope stability analyses indicate that the existing slopes, in their current configurations, have a factor of safety against failure of greater than 1.1 for pseudo-static (seismic) conditions, which is considered acceptable. The results of the pseudo-static stability analyses are provided on Figures A3 and A4 in Attachment A.

Setback Requirements

For unstable slopes, the distance from the unstable slope to the safe setback line is called the 'Erosion Hazard Limit'. In accordance with the Ministry of Natural Resources (MNR) Technical Guide "Understanding Natural Hazards" dated 2001, the Erosion Hazard Limit consists of three components: (1) Stable Slope Allowance, (2) Toe Erosion Allowance, and (3) Erosion Access Allowance. The following provides a breakdown of these three components.

- The Stable Slope Allowance, as described in the MNR procedures, is the area where a factor of safety of less than 1.5 against overall rotational failure is calculated. The slope stability analyses indicate that the slope has a factor of safety against failure of greater than 1.5 (refer to Figures A1 and A2 in Attachment A). Therefore, the Stable Slope Allowance described in the MNR procedures is not required.

- In accordance with the MNR documents, a minimum Toe Erosion Allowance of between 5 to 8 metres is required for clay soils. No obvious signs of erosion were observed at the time of the site reconnaissance; however, the river's edge had advanced up the toe of the slope (located adjacent to the existing retaining wall) as a result of high water levels in the Ottawa area. In our opinion, a Toe Erosion Allowance of 8 metres should be used at Sections A-A' and B-B' as a conservative approach.

- The MNR procedures also includes the application of a 6 metre wide Erosion Access Allowance to allow for access by equipment to repair a possible failed slope. Based on the existing slope geometry, it is our opinion that the 6 metre Erosion Access Allowance is not required. The existing site layout and slope gradients will allow for equipment access to repair a possible failed slope.

Therefore, the Erosion Hazard Limit for the slope at this site is located about 8 metres from the crest of the existing slopes at Sections A-A' and B-B' (refer to figures A1 and A2). It may be possible to reduce the Toe Erosion Allowance if an additional site visit is carried out when the water levels have receded in order to confirm the state of erosion along the slope toe at the base of the existing retaining wall.

ADDITIONAL CONSIDERATIONS

GEMTEC recommends that the existing vegetation and trees along the slope be maintained, to ensure the stability of the slope is not affected.

Final plans and finished grades for any proposed development adjacent to the slope should be reviewed by GEMTEC to ensure that the guidelines provided in this report have been interpreted as intended.

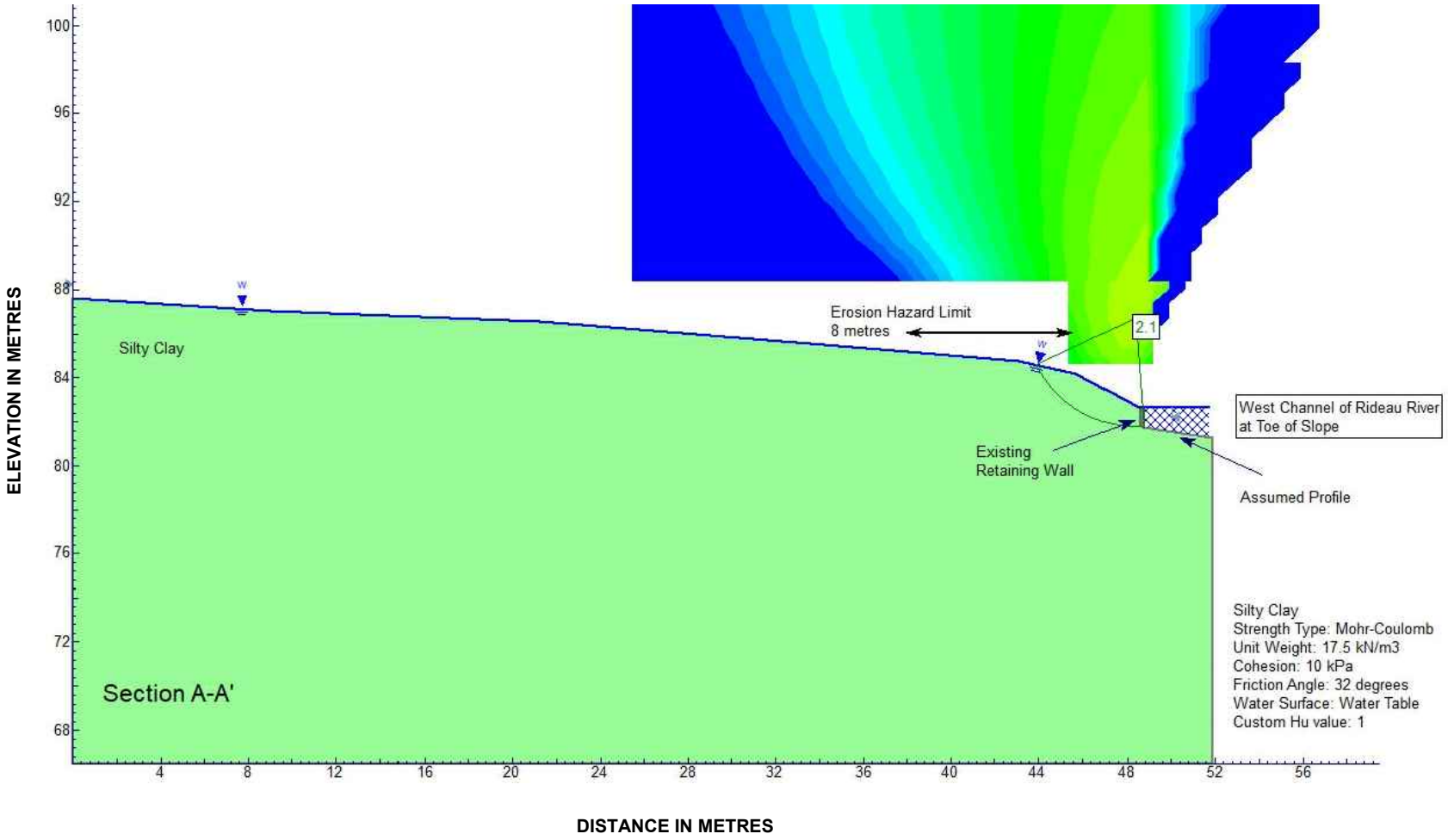
We trust that this letter is sufficient for your purposes. If you have any questions concerning this information or if we can be of further assistance to you on this project, please call.

Lauren Ashe, M.A.Sc., P.Eng.

John Cholewa, Ph.D., P.Eng.
Senior Geotechnical Engineer

ATTACHMENT A

Slope Stability Analyses
Figures A1 to A4, inclusive



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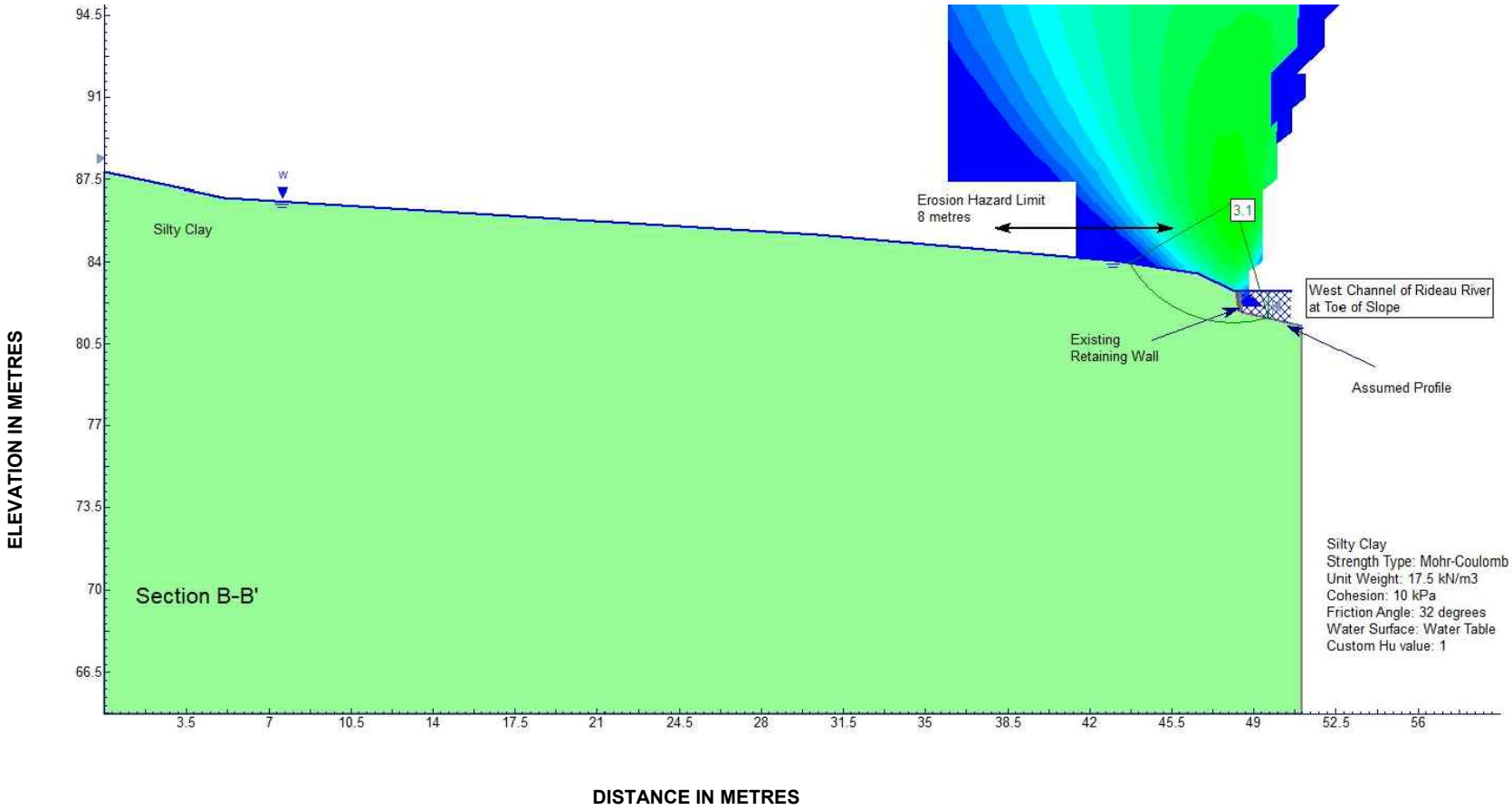
Project	Drwn By	Chkd By	Date	Drawing
SLOPE STABILITY ANALYSIS 5497 MANOTICK MAIN STREET MANOTICK, ONTARIO	P.C.	L.A.	MARCH, 2021	SECTION A-A EXISTING
	File No. 64913.01	Revision No. 0	**FIGURE A1**	



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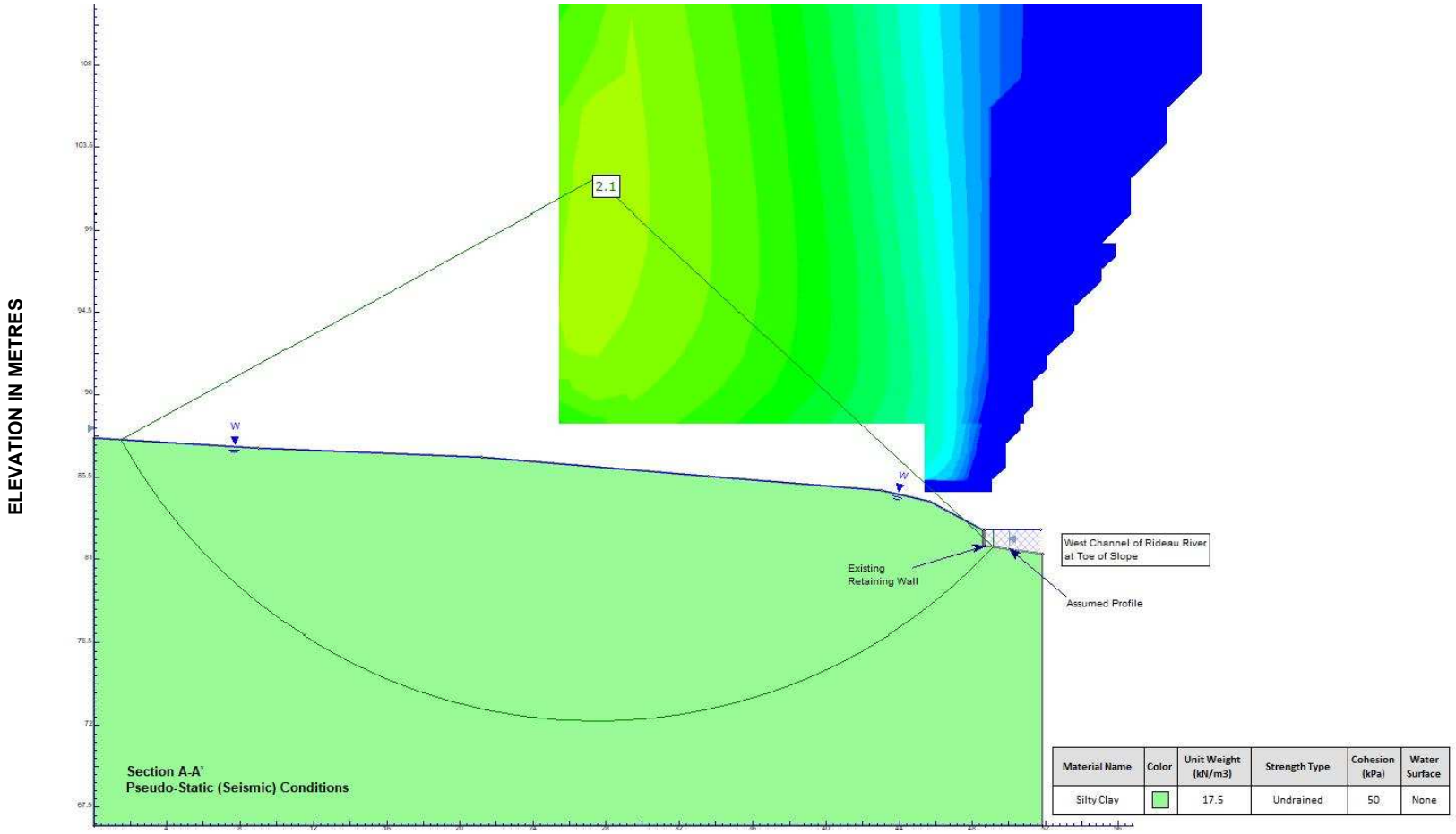
SLOPE STABILITY ANALYSIS 5497 MANOTICK MAIN STREET MANOTICK, ONTARIO	P.C.	L.A.	MARCH, 2021	SECTION B-B EXISTING
	File No. 64913.01	Revision No. 0	**FIGURE A2**	



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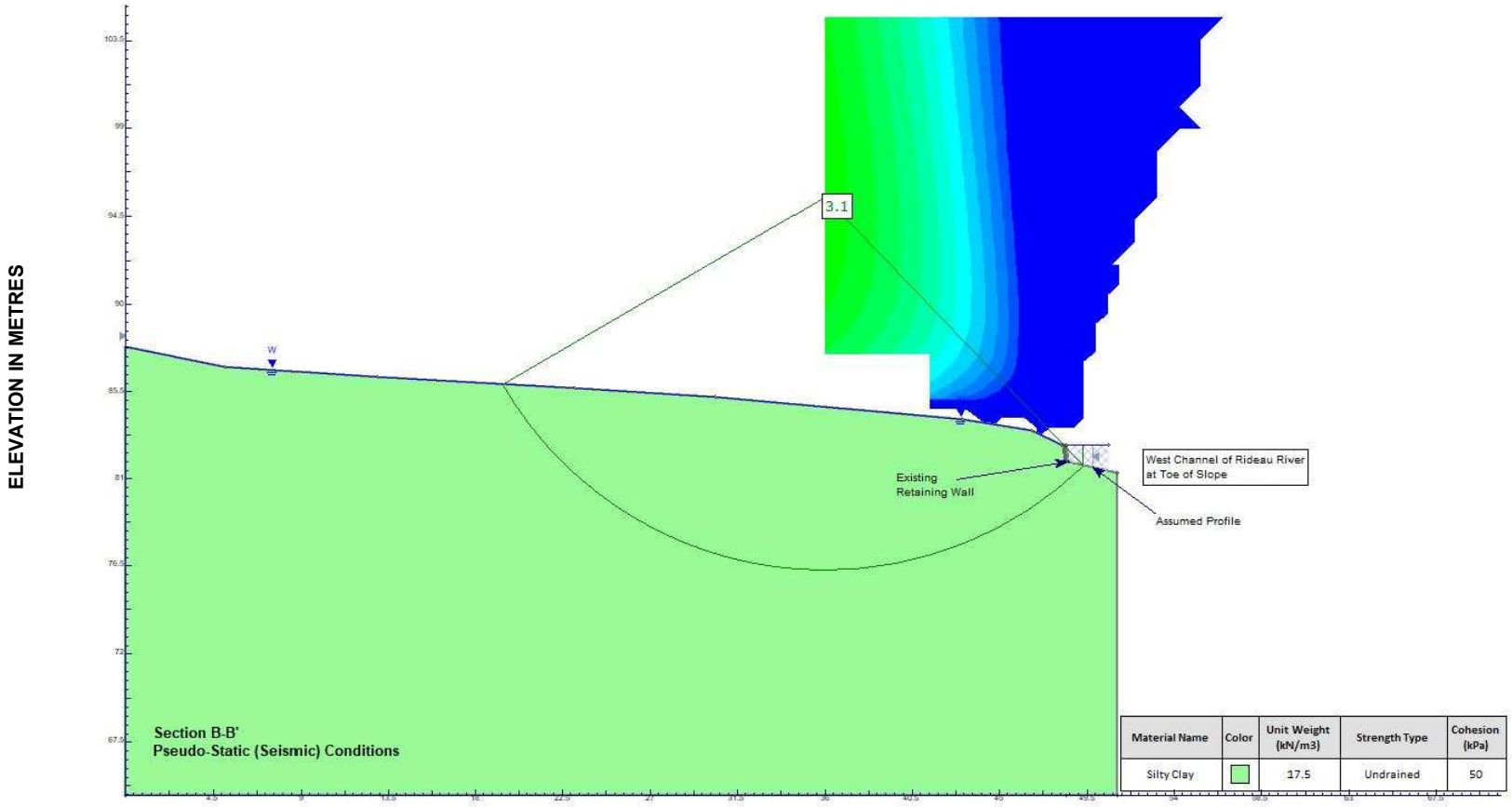
SLOPE STABILITY ANALYSIS 5497 MANOTICK MAIN STREET MANOTICK, ONTARIO	S.L.	L.A.	MARCH, 2021	SECTION A-A SEISMIC
	File No. 64913.01	Revision No. 0	**FIGURE A3**	



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Project	Drwn By	Chkd By	Date	Drawing
SLOPE STABILITY ANALYSIS 5497 MANOTICK MAIN STREET MANOTICK, ONTARIO	S.L.	L.A.	MARCH, 2021	SECTION B-B SEISMIC
	File No. 64913.01	Revision No. 0	**FIGURE A4**	

ATTACHMENT B

Site Photographs
Figure B1

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SITE PHOTOGRAPHS

Project	Project No.	
SLOPE STABILITY ASSESSMENT 5497 MANOTICK MAIN STREET, MANOTICK, ON	64913.01	**FIGURE B1**

ATTACHMENT C

Record of Test Hole Sheets
List of Abbreviations and Terminology

RECORD OF TEST HOLE AH 19-01

CLIENT: Oligo Group Inc.
PROJECT: 5497 Manotick Main Street, Slope Stability Assessment
JOB#: 64913.01
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 25 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, % (W_P, W, W_L)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Hand Auger Manual Auger (32mm OD)	Ground Surface		86.76							
		Brown sand with organic material (TOPSOIL)		86.66							
		Grey brown sand (possible FILL MATERIAL)		0.10 86.46							
		Brown SILTY CLAY		0.30							
1		Grey brown to grey SILTY CLAY		85.86 0.90							
		End of Hand Auger Hole		85.39 1.37							
2											
3											
4											
5											

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LOGGED: ML
CHECKED:

GEO - TESTHOLE LOG 64913.01_GINT_2021 03 23.GPJ GEMTEC 2018.GDT 23/3/21

RECORD OF TEST HOLE AH 19-02

CLIENT: Oligo Group Inc.
PROJECT: 5497 Manotick Main Street, Slope Stability Assessment
JOB#: 64913.01
LOCATION: See Site Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Apr 25 2019

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PENETRATION RESISTANCE (N), BLOWS/0.3m / DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m / SHEAR STRENGTH (Cu), kPA (NATURAL, REMOULDED) / WATER CONTENT, %	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Hand Auger / Manual Auger (32mm OD)	Ground Surface		54.07							
		Brown sand and organic material (TOPSOIL)		53.97							
		Grey brown SILTY SAND, trace clay		0.10							
		Brown SILTY SAND		53.77 0.30							
		SAND and GRAVEL		53.32 0.76							
		End of Hand Augerhole									
1		Practical refusal to manular augering within sand and gravel.									
2											
3											
4											
5											

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL, ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

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CHECKED:

GEO - TESTHOLE LOG 64913.01_GINT_2021 03 23.GPJ GEMTEC 2018.GDT 23/3/21