



August 14, 2019

REPORT NO.: 2019-13296

FILE NO.: 10545-S0325-GEO

Great Lakes Entertainment Canada Ltd.

41 Pullman Court
Scarborough, ON
M1X 1E4

Email: (7 Pages)

wynnxie@yahoo.com

Attention: Mr. Wynn Xie

**RE: Technical Memorandum - Slope Stability Visual Assessment
Proposed Commercial Development
4745, 4725 and 4709 Bender Street, and 5655 Ontario Avenue, Niagara Falls, Ontario**

Sola Engineering Inc. (herein "*Sola*") was retained by Mr. Wynn Xie (herein "*the Client*") to undertake a Slope Stability Visual Assessment for a slope located to the east side of the proposed commercial development at 4745, 4725 and 4709 Bender Street, and 5655 Ontario Avenue, Niagara Falls, Ontario (herein "*the property*").

It is also understood that the Niagara Peninsula Conservation Authority (herein the "*NPCA*") has requested for the geotechnical comments regarding the stability of the slope/rock-cut along the Highway 420 at the east side of the property.

The purpose of the Technical Memorandum is to provide an opinion on the need of a full-scale geotechnical slope investigation on the basis of the geological review of the site, the understanding of the development, and the summary of the visual inspection during site reconnaissance.

The Technical Memorandum has been prepared in accordance with the Natural Hazards Training Manual (NHTM by MNR 1997), and the Geotechnical Principles for Stable Slopes (1998) developed by the Ministry of Natural Resources.

The Client has provided Sola with the architectural drawings for the proposed Ice Culture Centre (prepared by the client), dated March 2019, showing the approximate locations, statistics of the proposed development, in order to assist with the understanding of the project objectives.

For review purposes, the Client also provided Sola a soft copy of the AutoCAD drawings on July 25, 2019, which includes topographic elevations at the proposed site. The contour levels on the existing slope/rock-cut along Highway 420 have not been provided.



It is understood that the client is planning to develop the site with midrise commercial buildings which include 3 to 4 levels of underground parking.

A Site Reconnaissance was undertaken at the property by Sola on August 7, 2019. During the visit, the nature of the slope and its relationship to the structures located within the tableland was assessed. Details regarding the slope condition, drainage, vegetative cover, other natural features, and existing structural elements were noted. A Slope Stability Rating Chart has been prepared based on NHTM by MNR (1997).

This report has been prepared for the Client, and their nominated engineers and designers. Third-party use or reproduction, in part or in full, of this report, is prohibited without written authorization from Sola. This report is also subject to the Statement of Limitations which forms an integral part of this document.

Desktop Study- Published Geology

The property is located at 4745, 4725 and 4709 Bender Street, and 5655 Ontario Avenue, Niagara Falls, Ontario. Based on the topographical drawings provided by the Client, the ground surface elevation at the southeast side of the property is about 178 m (Geodetic) and on the northwest side, 186 m (Geodetic).

Based on the findings of a preliminary desk study, undertaken as part of the preparatory works for this assignment and the review of available geotechnical data, the subject site is located in a geological setting known as Haldimand (sand) Plain, comprising coarse-textured glaciolacustrine deposits. (shown in **Figure 1**).



Figure 1-Geology

According to the OGS Map M2544 "*Bedrock Geology of Ontario*", the superficial geology is underlain by the bedrock of the Guelph Formation, comprising of Sandstone, Shale, Dolostone, and Siltstone. The OGS Map P2400, "*Niagara and Niagara-on-the-Lake Area*", reports bedrock to sub-crop the site at an elevation of approximately 176 m. With a ground surface elevation at the site of approximately 179 m at its highest, the anticipated depth to bedrock is



approximately 3 m below existing ground level. The borehole / corehole data from Sola's recent geotechnical investigations at the site generally confirm the anticipated geological conditions. The bedrock is found to be dolomite, and encountered at shallow depths.

One (1) groundwater monitoring well was installed by Sola at the north side of the property during the course of the drilling works. The groundwater level in the monitoring well is about 8.55 m below the ground surface (as measured by Sola on August 7, 2019).



Figure 2: A section of the Slope with the Rock Cut

Site Visit on August 7, 2019

The property comprises the existing parking lots and a section of the road (Ontario Avenue which is overcrossing Hwy 420). The ground surface on the southeast side of the property is gradually sloping up towards northwest side over a horizontal length of an approximately 120 m, and the elevation difference is about 7 to 8 m. There is a slope in the local area along the Highway 420 with the maximum level difference of an approximately 8 m at the east side of the property.

The total area is a very gentle valley land slope towards the Niagara River with the overall gradient of an approximately 20H:1V from the southeast end of Bender Street to the River Road.



Figure 3: A Section of the Slope with Retaining Wall

It is believed that some sections of the rock at the east side of the property have been cut for the construction of Highway 420 and the cut is approximately 4 to 5m in height. The exposed rock is found to be a very strong and stable dolostone rock. The overburden soil of an approximately 1 to 2 m is observed on the top of the rock slope, and it is vegetated with grass, and mature and semi-mature trees.

A relatively low retaining wall (approximately 2.0 to 2.5 m) has been built along the slope/rock-cut face at the south side of the Ontario Avenue bridge. Concrete abutment walls have been built in a section of the slope for



bridge construction. No signs of instability were observed on the retaining walls. However, the stability of the retaining walls is beyond scope of this work.

No evidence of historical slope movements, rotational, translational or otherwise was noted in the slope profile or topography at the time of the site visit.

The Physical Top of the Bank (PTOB) has not been identified.

SOLA'S COMMENTS

It appears that the slope/rock-cut in its current condition is in a state of natural stable repose. The absence of any evidence of more recent failure activity, either deep or shallow-seated, supports the natural stable repose of the existing slope.

Based on the site observations, the topographical information and Geomorphological Assessment, Sola completed a Slope Stability Rating based on the MHTM (1997).

The input values are shown in **Table 1**:

Table 1: Input Data for Rating

No.	Category	Condition	Rating Value
1	Slope Inclination	Steeper than 2: 1	16
2	Soil Stratigraphy	Sandstone, Siltstone or Dolostone (Bedrock)	0
3	Seepage from Slope Face	None or Near Bottom Only	0
4	Slope Height	5.1 to 10 m	4
5	Vegetation Cover on Slope Face	Well Vegetated	0
6	Table Land Drainage	Minor Drainage over the slope, no active erosion	2
7	The proximity of Watercourse to Slope Toe	-	0
8	Previous Landslide Activity	No evidence	0
	Total		22



Table 2: Slope Stability Rating Chart

Geotechnical Principles for Stable Slopes
Ontario Ministry of Natural Resources

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November 1997

TABLE 8.1 - SLOPE STABILITY RATING CHART

Site Location: Bender Street, Niagara Falls, Ontario		File No. 10545
Property Owner: Great Lakes Entertainment Canada Ltd.		Inspection Date: August 7, 2019
Inspected By: Dimple		Weather: Cloudy
1. SLOPE INCLINATION		Rating Value
	degrees	horiz. : vert.
a)	18 or less	3 : 1 or flatter
b)	18 - 26	2 : 1 to more than 3 : 1
c)	more than 26	steeper than 2 : 1
		0 6 16
2. SOIL STRATIGRAPHY		
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
3. SEEPAGE FROM SLOPE FACE		
a)	None or Near bottom only	0
b)	Near mid-slope only	6
c)	Near crest only or, From several levels	12
4. SLOPE HEIGHT		
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
5. VEGETATION COVER ON SLOPE FACE		
a)	Well vegetated; heavy shrubs or forested with mature trees	0
b)	Light vegetation; Mostly grass, weeds, occasional trees, shrubs	4
c)	No vegetation, bare	8
6. TABLE LAND DRAINAGE		
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
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE		
a)	15 metres or more from slope toe	0
b)	Less than 15 metres from slope toe	6
8. PREVIOUS LANDSLIDE ACTIVITY		
a)	No	0
b)	Yes	6
SLOPE INSTABILITY RATING	RATING VALUES TOTAL	INVESTIGATION REQUIREMENTS
		TOTAL
		22
1.	<u>Low potential</u>	<u><24</u>
2.	<u>Slight potential</u>	<u>25-35</u>
3.	<u>Moderate potential</u>	<u>> 35</u>
		<u>Site inspection only, confirmation, report letter.</u>
		<u>Site inspection and surveying, preliminary study, detailed report.</u>
		<u>Boreholes, piezometers, lab tests, surveying, detailed report.</u>
NOTES:	a)	Choose only one from each category; compare total rating value with above requirements.
	b)	If there is a water body (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.

Based on the above, we trust that the proposed site development will impose little to no adverse impact on the stability conditions to the slope/rock-cut. A full-scale slope stability assessment may be unnecessary from a geotechnical standpoint.



Further Comments

It is our opinion that this Technical Memorandum is satisfactory from a geotechnical standpoint. However, if NPCA considers that a full geotechnical investigation with drilling boreholes is required based on other merits, Sola can assist to carry out the investigation to satisfy the requirements.

Slope stability conditions may be affected by many factors induced by natural environmental events and human activities. It is therefore important to ensure that appropriate considerations and controls are applied at the construction stage of the proposed development. Controlling surface water and managing soil stockpiles will be necessary to ensure that the crest of the slope is not subjected to increases in water volume or surface loads applied by the stockpiling of soils or other construction materials across the slope crest. As such, it is recommended that a Construction Management Plan is developed to define such controls and to assist the General Contractor in completing the proposed development project.

CLOSURE

This Technical Memorandum is subject to the *Statement of Limitations* which forms an integral part of this document. The *Statement of Limitations* is not intended to reduce the level of responsibility accepted by Sola, but rather to ensure that all parties who have been given reliance for this report are aware of the responsibilities each assumes in so doing.

We trust the above meets your need. Should you have any questions, please contact the Sola office.

Sincerely,

SOLA ENGINEERING INC.

Jasin Arulanantham M.A.Sc.

Bill Feng P.Eng.





STATEMENT OF LIMITATIONS

Standard of Care and Basis of this Report

Sola Engineering Inc. ("Sola Engineering") has prepared this report in a manner consistent with generally accepted engineering and/or environmental practices in the jurisdiction in which the specified services were provided. The information and conclusions set out in this report reflects Sola Engineering's best professional judgment in light of the information available to Sola Engineering at the time of preparation. Sola Engineering disclaims any and all warranties, express or implied, including without limitation any warranty of merchantability and/or fitness for a particular purpose, and makes no representations concerning the legal effect, interpretation or significance of this report or the information, conclusions or recommendations contained in it.

The conclusions and recommendations provided in this report have been prepared in relation to the specified site (the "Site") and the proposed project (the "Project"), as described by the Client to Sola Engineering. Given the nature of the work undertaken by Sola Engineering as part of this report, the Client acknowledges that ground conditions may vary over distances and may change over time. Should there arise any changes to the conditions of the Site or the Project (as to purpose or design), Sola Engineering is to be notified within a reasonable period of time, and in any event within 24 hours of the Client's learning of such changes, so as to give Sola Engineering an opportunity to review and revise this report in light of such changes. Sola Engineering accepts no liability or responsibility for any use of this report or reliance on this report following any changes to the conditions of the Site or the Project.

The scope of professional services provided by Sola Engineering for the Project are as set out in this report. Should such services be limited to those of a geotechnical nature, Sola Engineering shall not be held liable or responsible for any environmental services that may be required, nor shall this report be interpreted to reflect any environmental aspects of the Project. Alternatively, should such services be limited to those of an environmental nature, Sola Engineering shall not be held liable or responsible for any geotechnical services that may be required, nor shall this report be interpreted to reflect any geotechnical aspects of the Project.

This report is not intended to provide recommendations for possible future conditions or use of the Site or adjoining properties. Should the need arise for such recommendations Sola Engineering may need to conduct further investigations.

Use of this Report

This report is intended to be read and used in its entirety. No reliance may be made upon any individual portion or section of this report without reference to the entire report as a whole. In preparing this report, Sola Engineering has relied on information, instructions and communications given by the Client to Sola Engineering, the applicability, truth and accuracy of which is the sole responsibility of the Client.

This report with the information, sampling data, analysis, conclusions and recommendations contained in it (if any), has been prepared for and may only be used by the Client and only for the specific purpose as specified by the Client to Sola Engineering in connection with the Project. Without prior written consent from Sola Engineering, use of this report or any portion thereof by any person or entity other than the Client, or for any purpose other than as communicated by the Client to Sola Engineering, is strictly prohibited. Sola Engineering accepts no liability or responsibility for the unauthorized use of this report. This report and all documents that form part of it are the sole property of Sola Engineering. Sola Engineering relies on and retains any and all intellectual property rights it has in this report, including any copyright to which it is entitled. The Client shall not give, lend or sell this report, or any portion thereof, to any entity, person or association without the express prior written consent of Sola Engineering. This report and the information contained herein shall be treated as strictly confidential.

The contents of this report, inclusive of Sola Engineering's conclusions and recommendations in relation to the Project, are intended only for the guidance of the Client in carrying out the specified services for the Project, as described by the Client to Sola Engineering. Accordingly, Sola Engineering does not accept any liability or responsibility for any inaccuracy contained in this report arising as a result of or in any way connected with any exclusion, oversight or falsification of the information provided to Sola Engineering by the Client. This report, including the effect of the subsurface conditions as described in this report, is to be interpreted at the risk and discretion of the Client and any contractors or others bidding on or undertaking contractual work to be performed as part of the Project who may come into possession of or learn of this report or its contents. It is exigent that all contractors bidding or undertaking the work are to rely on their own interpretations of the data contained in this report in addition to their own investigations and conclusions. Sola Engineering shall not be held liable or responsible for any interpretation of or conclusions that may be drawn from the data or information contained in this report.

The information, recommendations and conclusions presented in this report are based on Sola Engineering's interpretation of conditions revealed through the limited investigation conducted within a defined scope of services. In no event will Sola Engineering be held responsible or liable to the Client or any other person or entity for any special, indirect, incidental, punitive or consequential loss or damage (including, loss of use, lost profits or expenses incurred) resulting from or in any way related to the independent interpretations, interpolations, conclusions or decisions of the Client or any other person or entity, based on the information contained in this report. The restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

Notwithstanding the exclusions of liability contained herein but without in any way limiting their effect or generality, if there is found to be any finding of liability or responsibility whatsoever on the part of Sola Engineering which in any way relates to or arises from this report, or the information, conclusions or recommendations contained in it, such liability and/or responsibility shall cease and forever be extinguished from and after the date which is two (2) years from the date of this report. In no event shall any liability or responsibility of Sola Engineering exceed the fees charged by Sola Engineering to the Client for the preparation of this report (excluding any arms' length disbursements or expenditures made or incurred by Sola Engineering as a result thereof and reimbursed by the Client).

Site Conditions

The material conditions, classifications, conclusions and recommendations contained in this report were based on the site conditions observed or tested by Sola Engineering or otherwise communicated to Sola Engineering by the Client. The description, identification and classification of soils, rocks, chemical contamination and other materials have been made based on limited investigations, sampling and testing of materials performed by Sola Engineering and its qualified representatives in reliance on the use of relevant or applicable equipment, all in accordance with commonly acceptable standards in the geotechnical and/or environmental disciplines. Accordingly, this report may include assumptions of conditions which are based on discrete sample locations and thus some conditions may not have been detected. The Client accepts all liability and risk for the use of this report and the information and data contained in it. Sola Engineering shall not be held liable or responsible for any conditions beyond the scope of tests conducted on samples of the subsurface and soil conditions of the subject property as set out in this report.

For clarity, the Client acknowledges and accepts that unique risks exist whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive sampling and testing program may fail to detect certain conditions. The environmental, geological, geotechnical, geochemical and hydrogeological conditions that Sola Engineering interprets to exist between sampling points may differ from those that actually exist. As a result, the Client acknowledges and accepts that because of the inherent uncertainties in subsurface evaluations, unanticipated underground conditions may occur or become known subsequent to Sola Engineering's investigation that could affect conclusions, recommendations, total Project cost and/or execution.

Indemnification of Risk

Though Sola Engineering adheres to the highest degree of integrity and employs due diligence in limiting the potential release of toxins and hazardous substances, the risk of accidental release of such substances is a possibility when providing geotechnical and environmental services.

In consideration of the provision of services by Sola Engineering, the Client agrees to defend, indemnify and hold Sola Engineering and its employees and agents harmless from and against any and all claims, liabilities, damages, causes of action, judgments, costs or expenses (including reasonable legal fees and disbursements), resulting from or arising by reason of the death or bodily injury to persons, damage to property, or other loss, whether related to an accidental release of pollutants or hazardous substances occurring as a result of carrying out this Project or otherwise, and whether or not resulting from Sola Engineering's negligent actions or omissions. This indemnification shall include and extend to any and all third party claims brought or threatened against Sola Engineering under any federal or provincial law or statute as a result of Sola Engineering conducting work on the Project. In addition to and notwithstanding the foregoing, the Client further agrees to unconditionally and irrevocably release Sola Engineering from, and not to bring any claims against Sola Engineering in connection with, any of the aforementioned claims or causes.

Subconsultants and Contractor Services

In conjunction with the services provided by Sola Engineering's own employees, external services provided by other persons or entities that are specializing in services other than those offered by Sola Engineering, such as drilling, excavation and laboratory testing, are often employed in order to carry out the defined scope of work. If such external services have been employed for this Project, the Client acknowledges that Sola Engineering is not in any way liable or responsible for any costs, claims or damages in relation to the services rendered by such other persons or entities or payment therefor, nor shall Sola Engineering be liable or responsible for damages for errors, omissions or negligence caused by such other persons or entities while providing such external services.

Work and Job Site Safety

Sola Engineering shall be responsible only for its activities and that of its employees on the Site. Sola Engineering shall not direct any of the fieldwork nor the work of any other person or entity on the Project. The presence of Sola Engineering staff on the Site does not relieve the Client or any contractor on the Site from their responsibilities pertaining to site safety. The Client at all times retains any and all responsibility for the safety of those individuals present on the Site and/or working on the Project, including Sola Engineering's employees.

Craig Rohe

From: Neil Stoop <nstoop@npca.ca>
Sent: September 9, 2019 11:58 AM
To: Craig Rohe
Subject: RE: Bender Street

Hi Craig,

The NPCA has reviewed the 'Technical Memorandum - Proposed Commercial Development 4745, 4725, and 4709 Bender Street and 5655 Ontario Avenue, Niagara Falls' (dated August 14, 2019) by Sola Geotechnical Engineering and has have no objection to the report's conclusion that the proposed site development will impose little to no adverse impact on the stability of the adjacent slope/rock-cut.

Sorry for any delay in getting the information to you. If you have any further questions in this matter please do not hesitate to contact me.

Thank-you,

Neil Stoop, MSc.

Watershed Planner

Niagara Peninsula Conservation Authority (NPCA)
250 Thorold Road West, 3rd Floor | Welland, ON L3C 3W2
Tel: 905-788-3135 | ext. 248
nstoop@npca.ca
www.npca.ca

NPCA is conducting a Housekeeping Amendment on our Policy Document. Please visit to review and provide comments by October 7, 2019 at <https://getinvolved.npca.ca/Policy-Document-Housekeeping-Amendment>

From: Craig Rohe <craig@ucc.com>
Sent: September 5, 2019 10:09 AM
To: Neil Stoop <nstoop@npca.ca>
Subject: Bender Street

Hi Neil,

I received your message last week regarding the Bender Geotechnical matter. Can you please provide an update?

Craig A. Rohe, M.Pl., MCIP, RPP

Senior Planner

Upper Canada Consultants

3-30 Hannover Drive
St. Catharines, ON. L2W 1A3

Tel: (905) 688-9400 ext. 506
Mobile: (289) 969-3556
Fax: (905) 688-5274

Email: craig@ucc.com

Web: www.ucc.com

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