TECHNICAL MEMORANDUM

DATE May 5, 2022 **Project No.** 18112570

TO 2652508 Ontario Limited, C/O Mara Micevic

CC

FROM Ted Beadle, P.Eng. **EMAIL tbeadle@golder.com**

REVISED HAZARD LIMIT SETBACK ASSESSMENT TO SUPPORT RESIDENTIAL TOWER DEVELOPMENT (REVISION 1)
627 LYONS LANE, OAKVILLE, ONTARIO

Golder Associates Ltd. (Golder) has been retained by MGM Development (MGM) on behalf of 2652508 Ontario Limited to provide geotechnical consulting services in support of the design of a proposed 26-storey residential tower development to be located at 627 Lyons Lane in Oakville, Ontario, at the location shown on Figure 1 – Key Plan. A geotechnical investigation and slope setback assessment was previously carried out by Golder in January 2019 and the results outlined in a report titled "Geotechnical Investigation and Setback Assessment to Support Residential Tower Development, 627 Lyons Lane, Oakville, Ontario", dated June 17, 2019 submitted to 2652508 Ontario Limited. The setback assessment was revised to include more details based on comments from Conservation Halton and a technical memorandum submitted on August 20, 2021.

Based on additional comments by Conservation Halton and at the request of 2652508 Ontario Limited, this technical memorandum provides additional revisions to the erosion hazard limit setback assessment and supersedes the August 20,2021 memorandum. This revised technical memorandum provides the results of the additional analysis to refine the erosion hazard limit setback as outlined in our Change Order No. 3 approved by 2652508 Ontario Limited on May 2, 2022.

1.0 SITE AND PROJECT DESCRIPTION

The proposed project has a municipal address of 627 Lyons Lane and is located south of the Queen Elizabeth Way (QEW) and South Service Road, east of Lyons Lane Garden Plots, north of Sixteen Mile Creek and Lyons Lane and west of a commercial plaza in Oakville, Ontario. Currently the site is occupied by a four-storey Oakville Professional Building, of rectangular shape, with associated parking lot and driveways. The site is located on the tableland of Sixteen Mile Creek. The tableland is generally flat and slopes gently towards the slope crest (located on the south side of Lyons Lane) with elevations ranging from approximately 107 m to 106 m, about 25 m higher than the creek level. The existing valley slope is vegetated and is sloped at about 35 to 40 degrees down to the creek.

At the time of preparing this memorandum, it is understood that the existing building structure will be demolished, and a new proposed residential development will consist of a 26-storey tower with three levels of underground parking and associated access road and parking area at ground surface.

2.0 EROSION HAZARD LIMIT SETBACK ASSESSMENT

The site is located within the tableland of the Sixteen Mile Creek valley, which is regulated by Conservation Halton. The definition of the erosion hazard limit is described in "O.Reg. 162/06– *Halton Region Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*" dated February 8, 2013 and the "*Technical Guide – River and Stream Systems: Erosion Hazard Limit", Ontario Ministry of Natural Resources (MNR), 2002*. The geotechnical setback criterion as outlined below is based on the subsurface conditions derived from the borehole investigation advanced during the January 2019 geotechnical investigation, slope geometry from the survey plan provided by 2652508 Ontario Limited, and supplemental visual observations of the existing slope, creek bed and creek water level conditions on September 25, 2020.

The overall setback distance (Erosion Hazard Limit) is comprised of three components:

1) Toe Erosion Allowance;

2) Geotechnical Stable Slope Allowance; and

3) Erosion Access Allowance.

The setback required for safety against flood conditions or preservation of vegetation or wildlife is independent of the geotechnical setback criteria proposed. The following sections provide more detailed descriptions of the three components which comprise the overall Erosion Hazard Limit (EHL). It is noted that the most recent site plan provided for reference (revised February 6, 2020) includes the surveyed Top of Bank line as staked by Conservation Halton on February 6, 2020 which will be used as the reference benchmark for the erosion hazard assessment.

2.1 Toe Erosion Allowance (TEA)

The erosion component is dictated by the proximity of the valley slope toe to a watercourse and the susceptibility of the slope or bank materials to erosion. The magnitude of the erosion component is typically the estimated recession of the slope toe due to erosion over the design life of the development at the crest of the slope and is measured as a horizontal distance from the toe of the creek bank.

For the Sixteen Mile Creek watercourse, Conservation Halton considers this to be a "major valley system". Based on correspondence with Conservation Halton and a meeting held on March 23, 2022, it is understood that a Toe Erosion Allowance of 5 m shall be used for this project, as per the MNR Guide, Table 3: Determination of Toe Erosion Allowance for "Soft Rock (Shale, Limestone)". The toe of slope is estimated to range from about 4.5 m to 0 m from the toe of the creek bank along this section of Sixteen Mile Creek (between Section A-A' and B-B' on Figure 2) depending on the season. Given that this distance is less than 15 m, the toe erosion allowance will need to be considered at the tableland for the total setback distance.

Based on representative cross-sections through the site (Section A-A' and B-B' on Figure 2), the creek bed is at approximately Elevation 79 m, the toe of slope at Elevation 81 m, and existing top of slope at approximately Elevation 106 m. Based on the results of Borehole BH18-1 and BH18-3 advanced during the January 2019 geotechnical investigation, shale bedrock is expected to be present along the creek bed and the majority of the valley slope. A site visit performed on December 17, 2018 confirmed the steep slope valley and edge of creek bed appear to consist of weathered shale bedrock at Section A-A'. An additional site visit and visual slope assessment was performed by Golder on September 25, 2020 and confirmed the presence of shale bedrock along the lower portion of the valley slope near Section B-B’.

2.2 Geotechnical Stable Slope Allowance

The stability component of the geotechnical setback is dictated by the existing surface and subsurface conditions of the slope such as slope geometry, soil strength, groundwater conditions, presence of vegetation, and the loading at the crest of the slope. The stability component may be derived based on generalized guidelines involving a setback gradient line which is dependent on soil stratigraphy and is drawn upward from the toe of the slope (or in this case the top of bedrock) to intersect the tableland. If site-specific subsurface information is obtained to define the soil stratigraphy and design parameters, as is the case for this site based on the geotechnical investigation carried out in January 2019, the stability component may be derived from a detailed stability analysis using appropriate analytical methods (as was carried out for representative Sections A-A’ and B-B’).

The valley slope geometry is generally consistent along the width of property at the tableland running parallel to the creek, thus, cross-sections A-A’ and B-B’ located near the east and west limits of the site were selected as representative sections (see Figure 2). The interpreted soil and bedrock stratigraphy was based on the results of the 2019 borehole investigation and are shown in Figure 3 and Figure 4. A stabilized groundwater level at Elevation 89 m was modelled at the building site and the creek water level was estimated to be at about Elevation 81 m based on the topography contours provided and visual observation of the creek relative to the toe of slope in September 2020. The geotechnical parameters used in the stability analysis are included in the 2019 geotechnical investigation report.

The MNR (2002) Erosion Hazard Limit Guide provides recommendations for minimum factors of safety for design of stable slopes on the basis of land-use above or below the slope. A target design minimum Factor of Safety (FOS) between 1.3 and 1.5 for short-term (undrained) and long-term (drained) analysis was used for this site as requested by CH.

The results of the stability analysis for Sections A-A’ and B-B’ are shown on Figures 3 and 4 and indicate the setback where a minimum factor of safety equal to 1.5 is calculated against global instability for the long-term condition. Short-term (undrained) analysis was also carried out as a check; however, the long-term condition is considered to be more conservative and is more applicable to the proposed development. Therefore, the long-term condition is used to develop the top of stable slope. The long term top of stable slope (LTTOSS) is shown on Figure 2 and on the cross-sections in Figures 3, 4 and 5. Given that the slip surface passes through the overburden soils (above the more competent bedrock), a setback gradient line for the overburden soil was measured to be about 1.9H:1V and 2.0H:1V above the bedrock level for Section A-A’ and B-B’, respectively. As recommended by CH and consistent with the MNR Guide, a setback gradient line of 1.4H:1V was modelled for the bedrock and the corresponding LTTOSS limit for Section A-A’ and B-B’ is shown in profile on Figures 3, 4 and 5 accordingly. Referring to Figures 3, 4 and 5, the calculated LTTOSS is slightly further setback compared to the staked top of bank by Conservation Halton, thus, the LTTOSS line should be used for the stability component of the erosion hazard limit.

2.3 Erosion Access Allowance

An additional allowance is specified by Conservation Halton from the long-term top of stable slope (LTTOSS) to provide emergency access, construction access for maintenance and for providing protection against unforeseen or unpredicted external conditions which could have adverse effects on the natural conditions or processes on or within erosion prone areas.

It is understood that an Erosion Access Allowance (EAA) of 15 m should be considered according to Conservation Halton guidelines. An Erosion Access Allowance (EAA) of 15 m is shown on Figures 3, 4 and 5.

2.4 Erosion Hazard Limit (EHL)

The following table is a summary of the measured and calculated setback components along the typical Cross-Sections A-A’ and B-B’, resulting in the total geotechnical setback allowance or Erosion Hazard Limit referenced to the surveyed Top of Bank line as determined by Conservation Halton and shown on Figures 3, 4 and 5.

Table 1: Summary of Setback Components to determine Erosion Hazard Limit

Cross-Section	Existing Average Inclination		Toe Erosion Allowance (m)	TOSS Setback[1] (m)	LTTOSS Setback[1] (m)	Erosion Access Allowance[2] (m)	Erosion Hazard Limit[1] (m)
	Degrees	H:V					
A-A’	37°	1.3H:1V	5	2.8	7.8	15	**22.8**
B-B’	40°	1.1H:1V	5	10.2	15.2	15	**30.2**

Notes: [1] Measured / referenced from surveyed Top of Bank (Conservation Halton, Feb. 6, 2020)
[2] Per Conservation Halton Guidelines

3.0 CLOSURE

We trust that this revised technical memorandum provides sufficient geotechnical and slope assessment information to facilitate the planning and design of this project. If you have any questions regarding the contents of this memorandum or require additional information, please do not hesitate to contact this office.

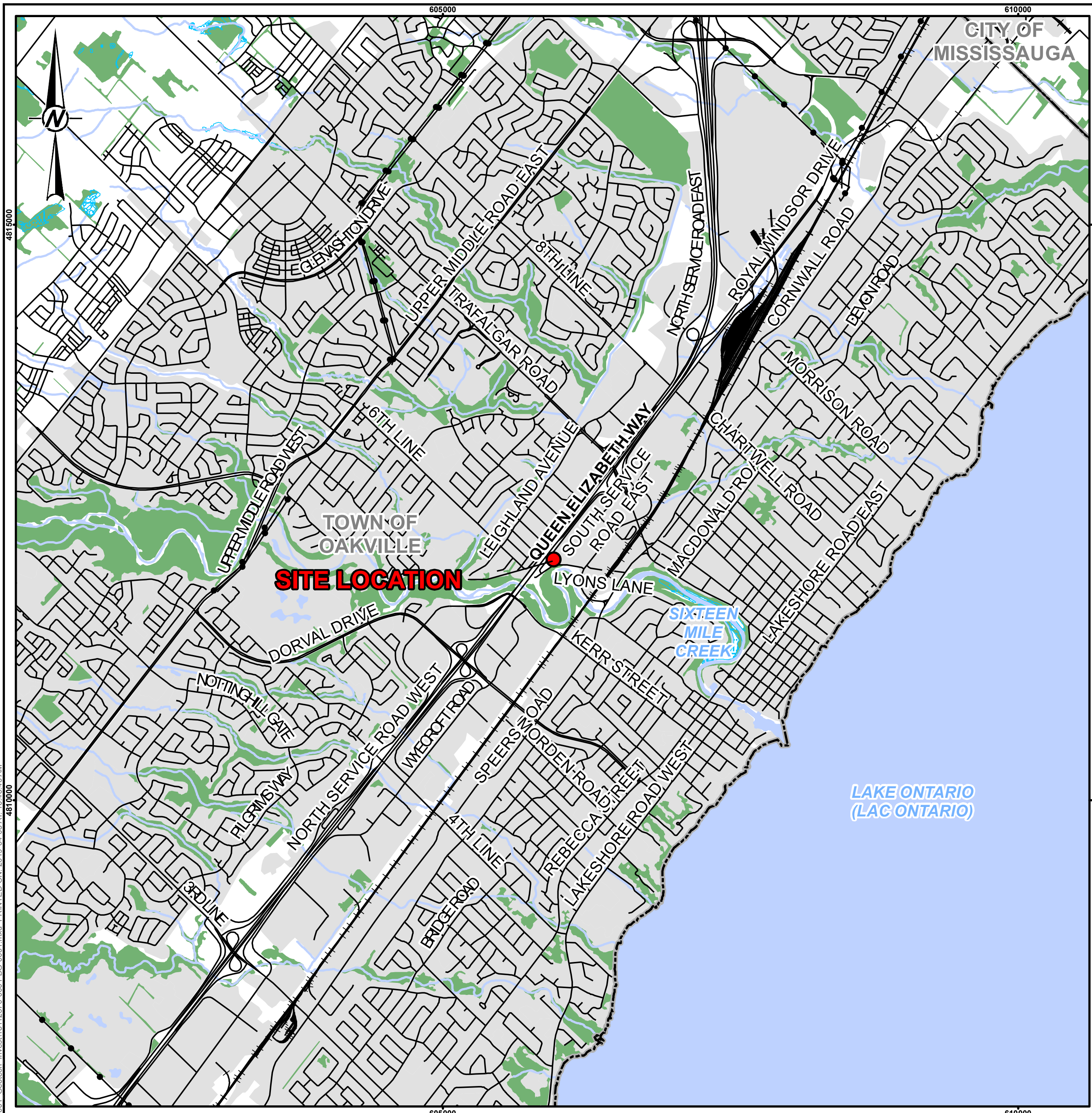
Ted Beadle, P.Eng.
Geotechnical Engineer

Kevin J. Bentley, M.E.Sc., P.Eng.
Senior Geotechnical Engineer

TWB/KJB/twb

Attachments: Figures 1 to 5

https://golderassociates.sharepoint.com/sites/100422/deliverables/revised report 2020/final/rev1/18112570 - 627 lyons lane - tech memo - geotechnical setback assessment 6may_2022.docx



LEGEND

- RAILWAY
- ROAD
- UTILITY LINE
- WATERCOURSE
- BUILT UP AREA
- MUNICIPAL BOUNDARY
- WATER BODY
- WETLAND
- WOODED AREA

0 1,000 2,000

1:50,000 METRES

NOTE(S)

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2018
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018
PROJECTION: PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 1983 UTM ZONE 17N

CLIENT
2652508 ONTARIO LIMITED

PROJECT
REVISED HAZARD LIMIT ASSESSMENT TO SUPPORT RESIDENTIAL TOWER DEVELOPMENT
627 LYONS LANE, OAKVILLE, ON

TITLE
KEY PLAN

CONSULTANT

WSP GOLDER

YYYY-MM-DD	2019-04-03
DESIGNED	LMM
PREPARED	LMM
REVIEWED	DU
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
18112570	-	1	1

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LEGEND

- BOREHOLE LOCATION
- EXISTING SLOPE CONTOUR (m)
- TOP OF BANK (CH, FEB 6, 2020)
- EROSION HAZARD LIMIT (EHL)
- LONG TERM TOP OF STABLE SLOPE (LTTOSS)
- DISTANCE FROM TOP OF BANK TO EROSION HAZARD LIMIT
- FEATURE DIMENSIONS
- CROSS SECTION LINE
- PROPERTY BOUNDARY
- EAA EROSION ACCESS ALLOWANCE

0 20 40

1:600 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE
2. ALL DISTANCE MEASURMENTS WERE TAKEN ALONG THE CROSS SECTION LINES

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2018
PRODUCED BY GOLDER ASSOCIATES LTD UNDER LICENCE FROM ONTARIO MINISTRY OF NATURAL RESOURCES, © QUEENS PRINTER 2018
PROJECTION: PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 1983 MTM 10
IMAGERY:

CLIENT
2652508 ONTARIO LTD.

PROJECT
GEOTECHNICAL INVESTIGATION TO SUPPORT RESIDENTIAL TOWER DEVELOPMENT AND SLOPE SETBACK ASSESSMENT
627 LYONS LANE, OAKVILLE, ON

TITLE
BOREHOLE LOCATION PLAN

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-05-02
DESIGNED	LMM
PREPARED	LMM
REVIEWED	DU
APPROVED	KB

PROJECT NO.	CONTROL	REV.	FIGURE
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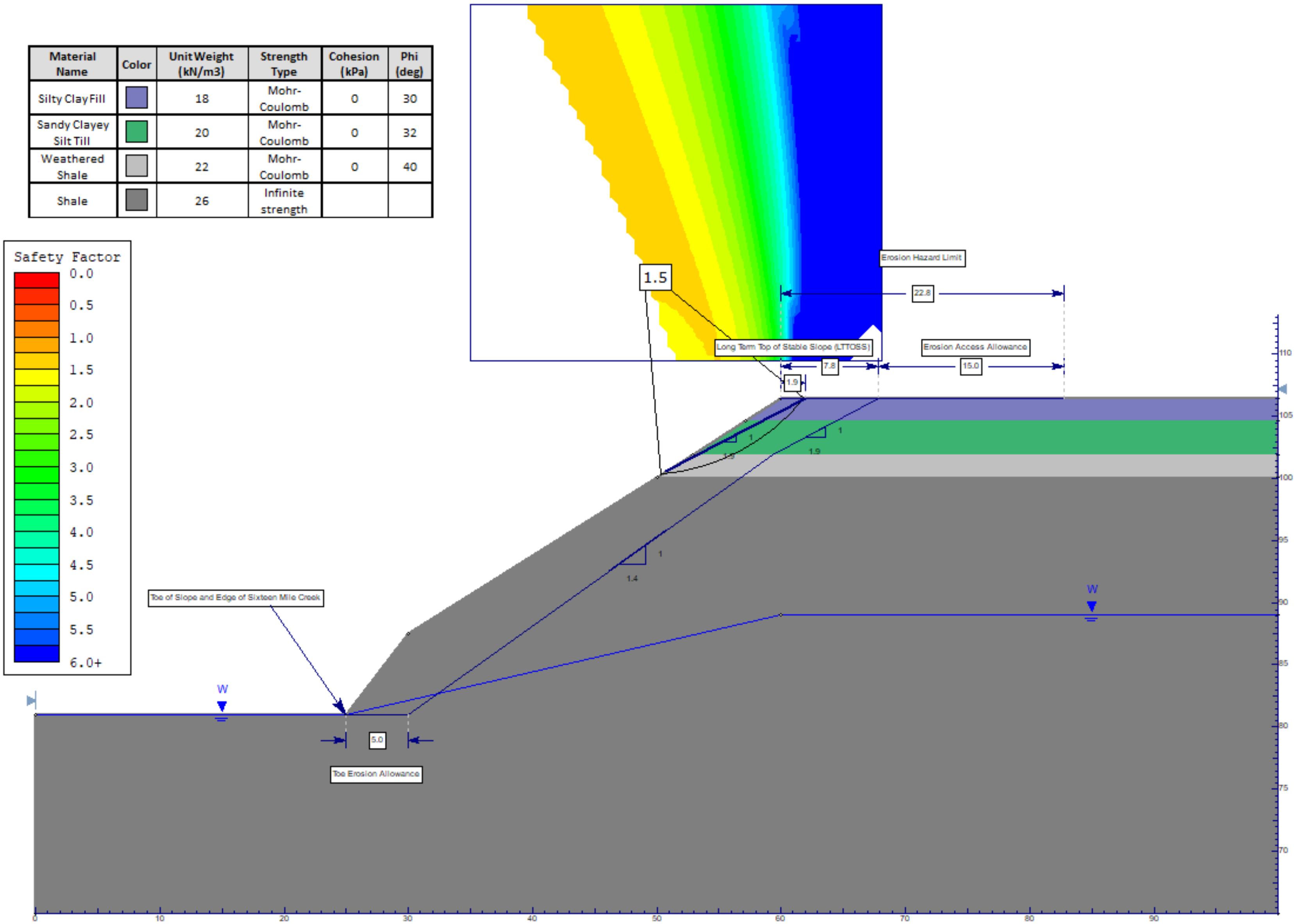
WSP GOLDER

627 Lyons Lane, Oakville, ON
Section A-A'
Global Slope Stability

Figure 3

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Silty Clay Fill		18	Mohr-Coulomb	0	30
Sandy Clayey Silt Till		20	Mohr-Coulomb	0	32
Weathered Shale		22	Mohr-Coulomb	0	40
Shale		26	Infinite strength		

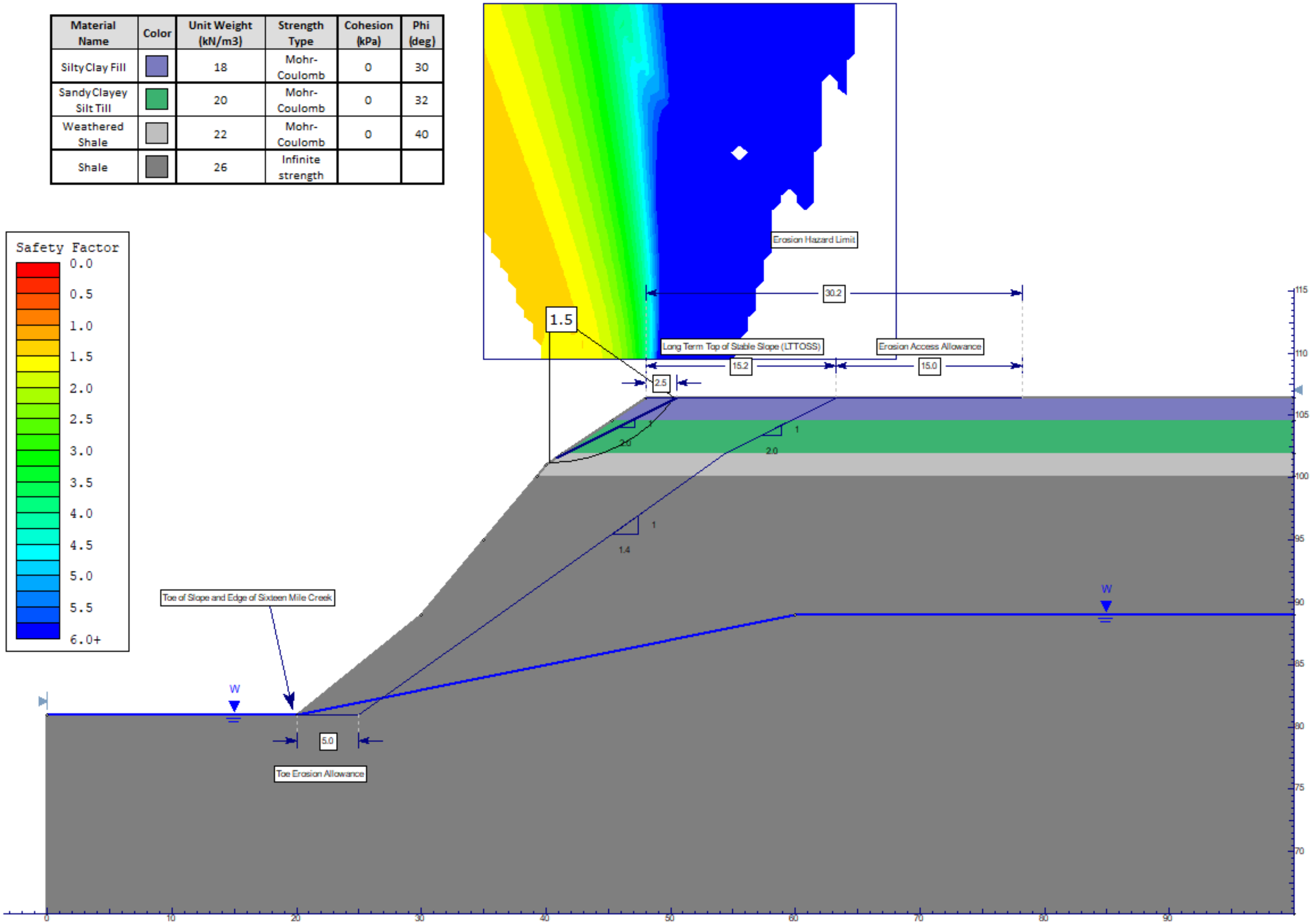


Date: May 2022 **Analysis By:** TWB **Reviewed By:** KJB
Project No: 18112570

627 Lyons Lane, Oakville, ON
Section B-B’
Global Slope Stability

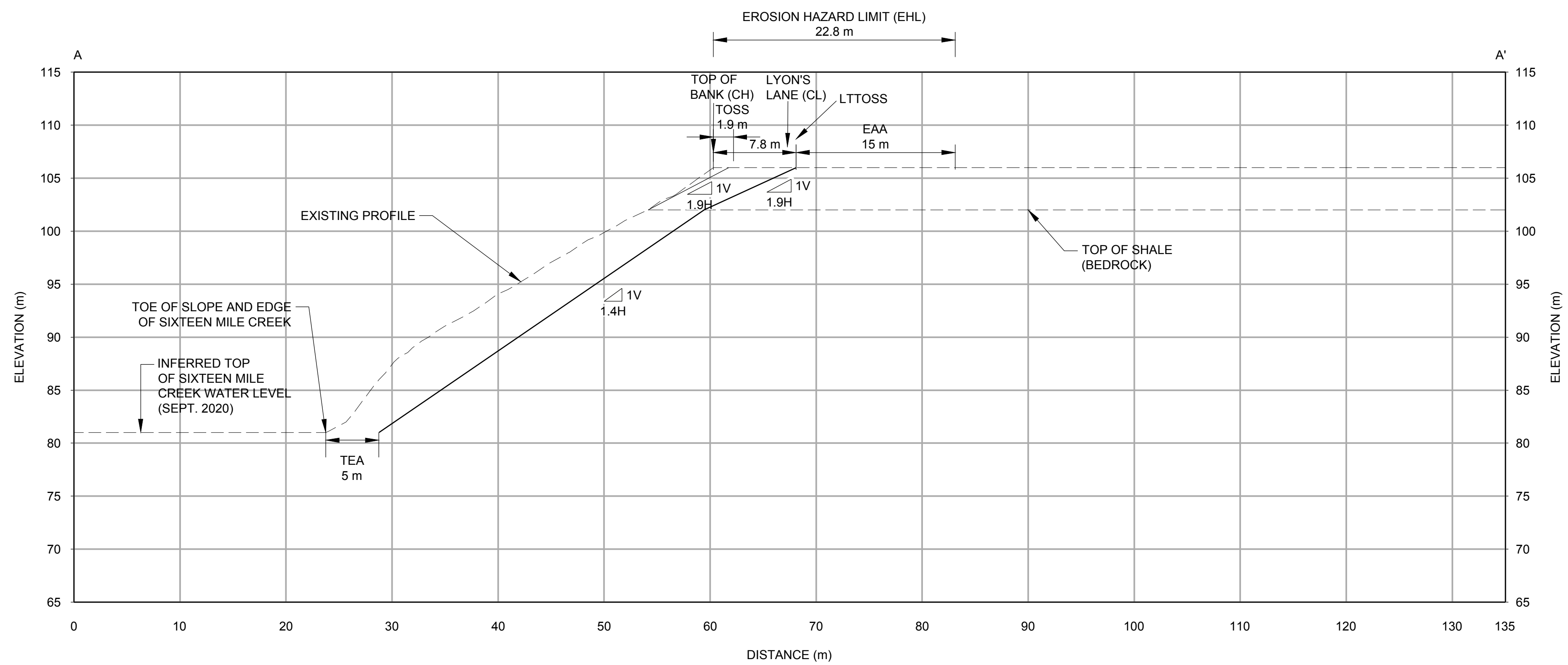
Figure 4

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Silty Clay Fill		18	Mohr-Coulomb	0	30
Sandy Clayey Silt Till		20	Mohr-Coulomb	0	32
Weathered Shale		22	Mohr-Coulomb	0	40
Shale		26	Infinite strength		

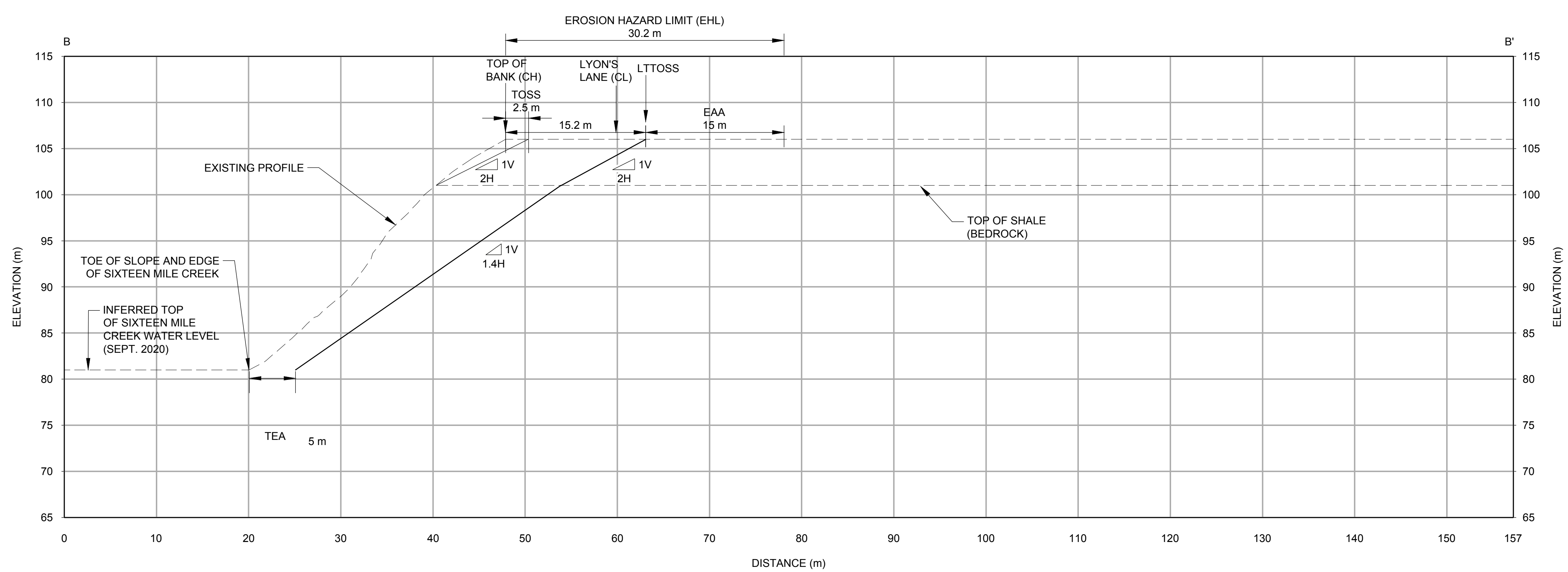


Date: May 2022
Project No: 18112570

Analysis By: TWB **Reviewed By:** KJB



SECTION A-A'



SECTION B-B'

REFERENCE(S)

1. EXISTING GROUND CONTOURS PROVIDED BY 2652508 ONTARIO LIMITED, FILE NO. 114-18-1.DWG, RECEIVED AUGUST 27, 2020.

0 10 20
1:600 METRES

CLIENT
2652508 ONTARIO LIMITED

PROJECT
REVISED HAZARD LIMIT ASSESSMENT TO SUPPORT RESIDENTIAL TOWER DEVELOPMENT
627 LYONS LANE, OAKVILLE, ON

TITLE
CROSS SECTION A-A' AND B-B'

CONSULTANT		
WSP GOLDER	YYYY-MM-DD	2020-10-09
	DESIGNED	
	PREPARED	DD
	REVIEWED	TWB
	APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
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