CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

March 17, 2021
**File No.:** G20080

Support & Housing Halton
165 Cross Avenue, Suite 201
Oakville, Ontario
L6J 0A9

Attention: Mr. Paul Gregory

**Re:** **Slope Stability Assessment for Proposed Housing Development**
**130 Cornwall Road, Oakville, Ontario**

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by Support & Housing Halton to carry out a slope stability assessment for the proposed housing development. It is understood that the site is located within the regulated zone under the jurisdiction of Conservation Halton.

The methodology presented herein will follow the Conservation Halton policy and the guidelines listed below:

- "Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document April 27, 2006", Conservation Halton, November 26, 2020; and

- "Technical Guide – River and Stream Systems: Erosion Hazard Limit" Ontario Ministry of Natural Resources, 2002.

The purpose of the assessment was to evaluate the stability of the existing slope and determine the setback from the crest of the slope for the proposed redevelopment. Reference is made to the following enclosed information gathered for this project:

Appendix B: Site Plan prepared by INVIZIJ Architects Inc., dated November 6, 2020
Appendix C: Selected Site Photographs
Appendix D: Slope Stability Rating Chart
Appendix E: Slope Stability Analysis Results
Appendix F: Borehole and Slope Section Location Plan, Borehole Logs and Grain Size Charts

## SITE DESCRIPTION

The site is located at 130 Cornwall Road in Oakville, Ontario. The site is occupied by a 2-storey building located near the centre of the site. The existing top of the slope is located approximately 20± m south of the existing building and approximately 16± m from the southern limit of the site. The strip of land between the site and the top of the slope is occupied by park land. The ground surface on site, and between the site and top of the slope is relatively flat laying. Sixteen Mile creek runs along the bottom of the slope. A detailed slope description is given below.

## SLOPE CONDITION INSPECTION

CVD has carried out a slope condition inspection on January 14, 2021. The Ontario Ministry of Natural Resources Technical Guide provides a Slope Stability Rating Chart in Table 4.2, which has been used in assessing the slope condition. The completed Slope Stability Rating Chart which can be found in Appendix D, shows a rating value of 32, indicating slight potential of instability.

The slope topographic information has been obtained from the interactive Topographic Map available on the City of Oakville website. The top and bottom slope elevations are approximately 98.5 and 74.5 m, hence the slope is about 24 m high. The average inclination of the slope is approximately 1.75 H : 1V (29.7 degrees to the horizontal). Slight local variations of slope inclination may exist along the length of the natural slope.

There was a wooden guardrail located near the top of the slope. The slope was vegetated with mature trees. There was no evidence of seepage from the slope face. Most mature tree trunks were straight and there was no evidence of major slumping along the slope.

A corrugated drainpipe has been placed on the slope surface and extended a few meters down the slope where the open end was exposed. No water flow from the pipe was observed at the time of the inspection, and no evidence of active erosion at the end of the pipe was noted. The source of the pipe is unknown.

Minor bedrock outcrops were observed along the slope face. Sixteen Mile Creek runs along the toe of the slope and is approximately 60 m wide. At the time of inspection, the low water level exposed the river channel and the shale bedrock. The exposed riverbank was about 1 m high with no evidence of active erosion. Selected site photographs have been attached in Appendix C.

## SITE BEDROCK GEOLOGY

The Ontario Geological Survey maps, Surficial Geology of Southern Ontario Map issued 2003 and Paleozoic Geology of South Ontario Map issued 2007, show bedrock at ground surface and identify it as part of the Georgian Bay Formation which consists of shale and limestone.

## FIELD AND LABORATORY WORK

To investigate the subsurface conditions at the site, four (4) boreholes were drilled and sampled to depths between 3.35 m and 4.19 m below existing grades at the locations shown on Drawing No. 1, Borehole and Slope Section Location Plan. The field work for this project was carried out on February 12, 2021 under the supervision of a member of our engineering team, who logged the borehole in the field, effected the subsurface sampling and monitored the groundwater conditions.

The boreholes were advanced using a track-mounted drilling rig, supplied and operated by a specialist contractor. The drill rig was equipped with continuous flight augers and standard soil sampling equipment. Standard penetration tests (SPTs) in accordance with ASTM Specification D1586, were carried out at frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or "N"-values. The undrained shear strength of the cohesive soil deposits was determined on the slightly disturbed SPT samples using a field penetrometer. The consistency or compactness condition of the soil strata has been inferred from these test results.

Samples obtained from the in-situ tests were examined in the field and subsequently taken to our laboratory for detailed description and moisture content determination. In addition, three (3) grain size distribution analyses were performed on the major soil deposits to confirm field identification. The results of the grain size distribution analyses can be found in Appendix F.

The location and ground surface elevation of the boreholes were surveyed by CVD for the purpose of this report. The ground surface elevations were referenced to a temporary benchmark (TBM) which is shown on Drawing No. 1 and described below:

TBM: Top of catch basin in parking lot east of existing building, as shown on Drawing No. 1.

Elevation: 98.57 m (geodetic)

## SUBSURFACE CONDITIONS

The subsurface conditions encountered in the boreholes are detailed on the Borehole Log Sheets, Enclosures 1 to 4. The following notes are intended to amplify and comment on the subsurface data.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

The surficial topsoil was underlain by fill materials that extended to depths between 1.52 and 2.44 m. The composition of the fill materials varied from sand and gravel to sandy silt with trace gravel, clay, topsoil, and organics as well as brick fragments. The SPT "N"-values measured within the fill materials ranged from 4 to 11 blows per 300 mm of penetration, indicating a variable loose to compact compactness condition.

The fill materials were underlain by clayey silt till in Boreholes 101 and 103, silty sand in Borehole 102, and sandy clayey silt till in Borehole 104. The silty sand contained some gravel and trace clay, and extended to a depth of 2.13 m. The one SPT "N"-value measured within the silty sand was 39 blows per 300 mm of penetration, indicating a dense compactness condition. The clayey silt till and sandy clayey silt till contained trace gravel and varying amounts of sand. The till deposits extended to depths between 2.6 and 2.9 m. The SPT "N"-values measured within the till deposits ranged from 12 to 40 blows per 300 mm of penetration. The undrained shear strength of the till obtained on the retrieved samples ranged from 120 kPa to over 250 kPa. Based on the above test results and tactile examination, the till deposit is considered to have a stiff to hard consistency.

Weathered shale bedrock was encountered below the overburden soils at depths between 2.13 and 2.90 m (elevation 95.53 to 96.14 m). The SPT "N"-values measured within the weathered shale ranged from 68 blows per 300 mm to 50 blows per 10 mm of penetration, indicating a hard consistency. All four (4) boreholes were terminated within the weathered shale bedrock after approximately 1 m of penetration due to auger refusal.

Groundwater conditions were monitored during and following completion of borehole sampling. All four (4) boreholes were found dry upon completion of drilling.

It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

## DISCUSSION AND RECOMMENDATIONS

### Slope Stability Analysis

A representative failure condition was chosen for the existing slope to perform a slope stability analysis. The soil parameters used in the slope stability analyses were determined based on the field and laboratory test results of the present investigation and our experience with similar soil types. The selected "effective stress - drained condition" soil parameters and groundwater condition were used to perform the stability analyses with the use of modeling software Slide.

The following soil strength parameters were used in the stability analysis:

| Soil Type | Unit Weight ($kN/m^3$) | Friction Angle ($\phi^0$) | Undrained Shear Strength ($C_u$, kPa) |
|---|---|---|---|
| Fill Materials<br>Loose to Compact | 18 | 28 | n/a |
| Clayey Silt Till to Sandy Clayey Silt Till<br>Stiff to Hard | 19 | 32 | 20 |
| Weathered Shale Bedrock | 24 | 45 | n/a |

The results of the analysis are shown graphically on Figures No. 1 and 2 (Appendix E). In the model the top and bottom of the slope were set at elevations 98.5 and 74.5 m and the slope inclination at 1.75 H : 1 V. The stratigraphy was selected to follow Borehole 103, where the overburden thickness is greatest.

The "Technical Guide – River and Stream Systems: Erosion Hazard Limit" by Ontario Ministry of Natural Resources, suggests a minimum factor of safety of 1.5 for the slope.

The analysis shows that the overall slope has a factor greater than 1.5, apart for the top of the slope where the fill materials can be found. Figure No. 1, illustrates the analysis results for the overall slope. The overburden was found to have a factor of safety less than 1.5, as shown in Figure No. 2, where only slip surfaces with a factor of safety of less than 1.5 are shown. The slip surfaces with a factor of safety less than 1.5 extend approximately 0.7 m beyond the top of the slope.

## Setback Considerations for Site Development

The results of the slope stability assessment are applied to determine the setback requirements. Reference is made to the "Policies and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy" by Halton Conservation, Appendix 3, Valley Erosion Hazards – Stable Toe of Slope.

The toe of the slope is stable, and active erosion was not observed at the toe of the slope on the creek bank. The Sixteen Mile Creek is approximately 60 m wide at the site location, and the creek bed is composed of shale bedrock. Reference is made to Table 3 on Page 38 of the "Technical Guide – River and Stream Systems: Erosion Hazard Limit", published in 2002 by the Ontario Ministry of Natural Resources. Potential erosion due to the stream action (over 30 m wide channel, no apparent toe erosion in shale bedrock) is 2 m (Toe Erosion Allowance).

The stable top of slope (bank) was determined to be approximately 0.7 m from the existing top of slope (Stable Slope Allowance, see Figure No. 2, Appendix E) based on stability analysis. Consequently, the long-term stable top of slope is 2.7 m from the present top of slope. It is understood that Halton Conservation will require a 15 m allowance for development adjacent to the stable top of slope (bank).

Given that the existing top of the slope is located approximately 16± m from the southern limit of the site and the proposed building will have a 3 m setback from the south property line, the proposed building will meet the setback requirement from Halton Conversation.

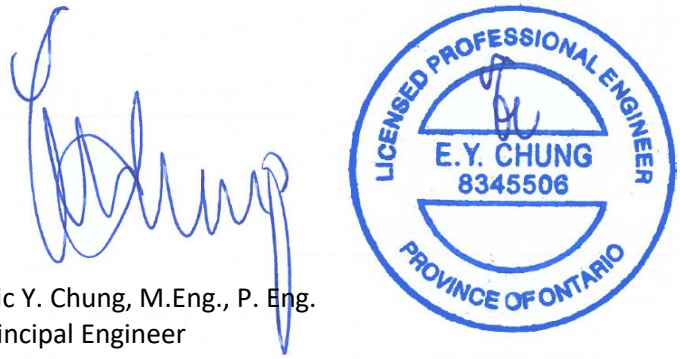
## CLOSURE

The Limitations of Report, as quoted in Appendix "A", is an integral part of this report.

We trust this report is sufficient for your immediate requirements. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,
**CHUNG & VANDER DOELEN ENGINEERING LTD.**


Chris Sternik, P.Eng.
Geotechnical Engineer




Eric Y. Chung, M.Eng., P. Eng.
Principal Engineer

## APPENDIX A

# Limitations of Report

# APPENDIX "A"

## LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

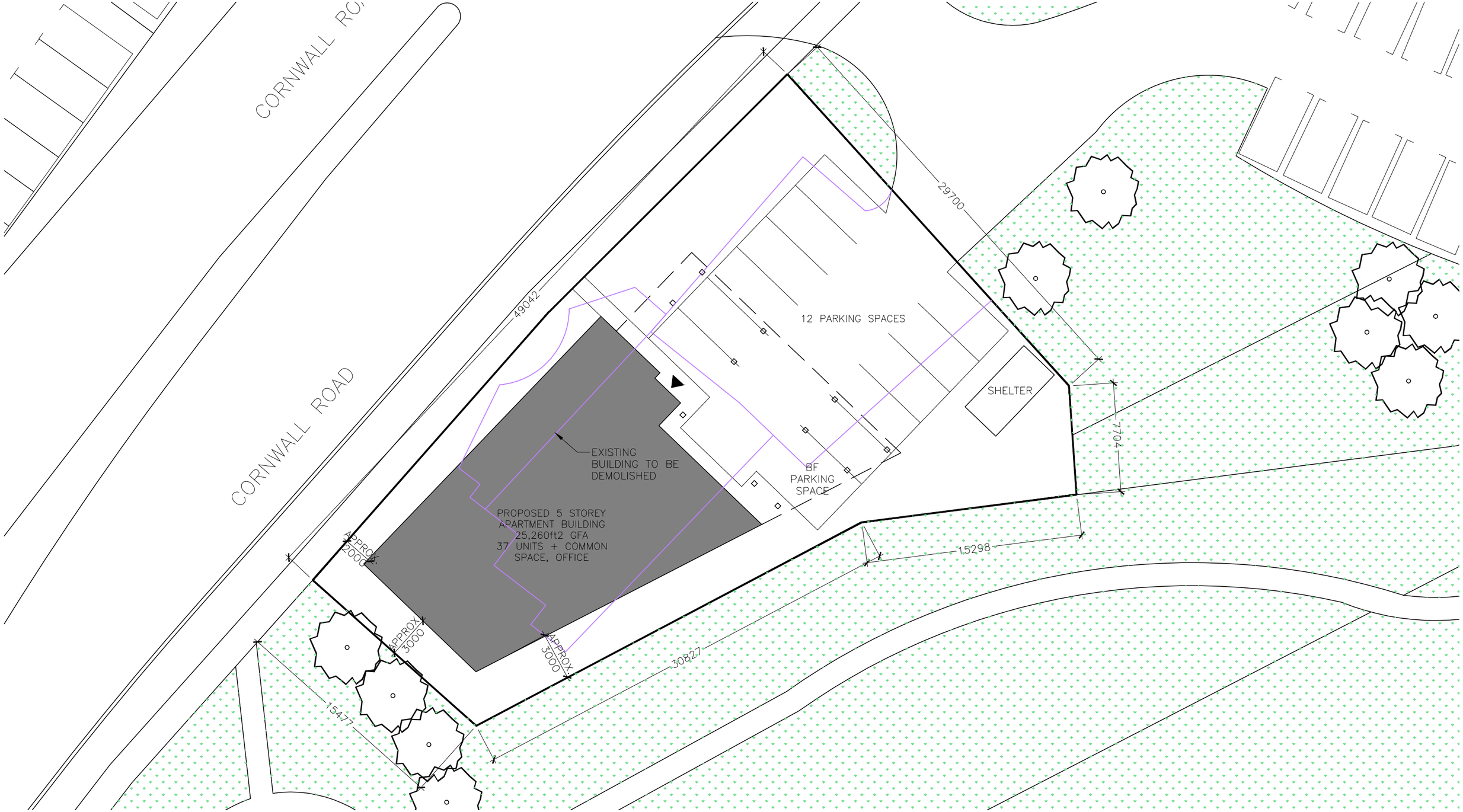
Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. CHUNG & VANDER DOELEN ENGINEERING LIMITED accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

## APPENDIX B

**Site Plan prepared by INVIZIJ Architects Inc., dated November 6, 2020**




INVIZIJ
Architects Inc.

# PROPOSED SITE PLAN

SCALE 1:250

**PROPOSED NEW DEVELOPMENT**
130 CORNWALL ROAD. OAKVILLE, ON
NOVEMBER 6, 2020

# APPENDIX C

## Selected Site Photographs

Figure 1: Top of slope by wooden railing and existing house on site

Figure 2: Slope as seen from the bottom

Figure 3: Typical vegetation on slope

Figure 4: Sixteen Mile Creek at toe of slope with exposed river bad.

Figure 5: Retaining wall at top of slope, just west of site

Figure 6: Storm water drain pipe laying on slope

Figure 7: Minor bedrock outcrops visible in face of slope

# APPENDIX D

## Slope Stability Rating Chart

TABLE 4.2 - SLOPE STABILITY RATING CHART

Site Location: 130 Cornwall Rd., Oakville
File No. G20080
Property Owner: N/A
Inspection Date: January 14, 2021
Inspected By: Chris Sternik
Weather: -1°C, Overcast

| | | | |
|---|---|---|---|
| **1. SLOPE INCLINATION** | **degrees** | **horiz. : vert.** | |
| a) | 18 or less | 3 : 1 or flatter | 0 ○ |
| b) | 18 - 26 | 2 : 1 to more than 3 : 1 | 6 ○ |
| c) | more than 26 | steeper than 2 : 1 | 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 VALUES INVESTIGATION RATING SUMMARY** **TOTAL** 32

## SUMMARY OF RATING VALUES AND RESULTING 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. |

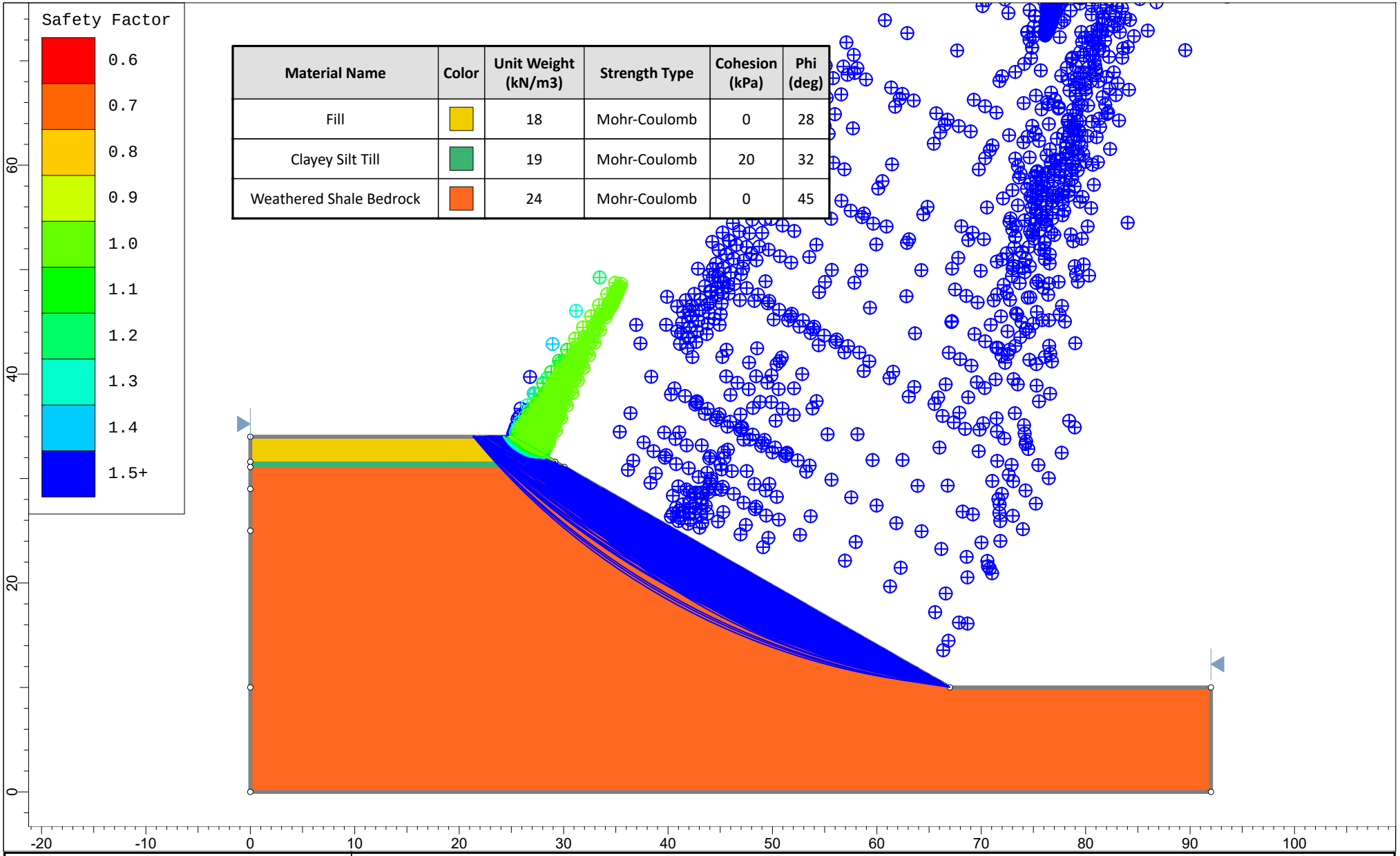
**NOTES:**

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.

# APPENDIX E

## Slope Stability Analysis Results

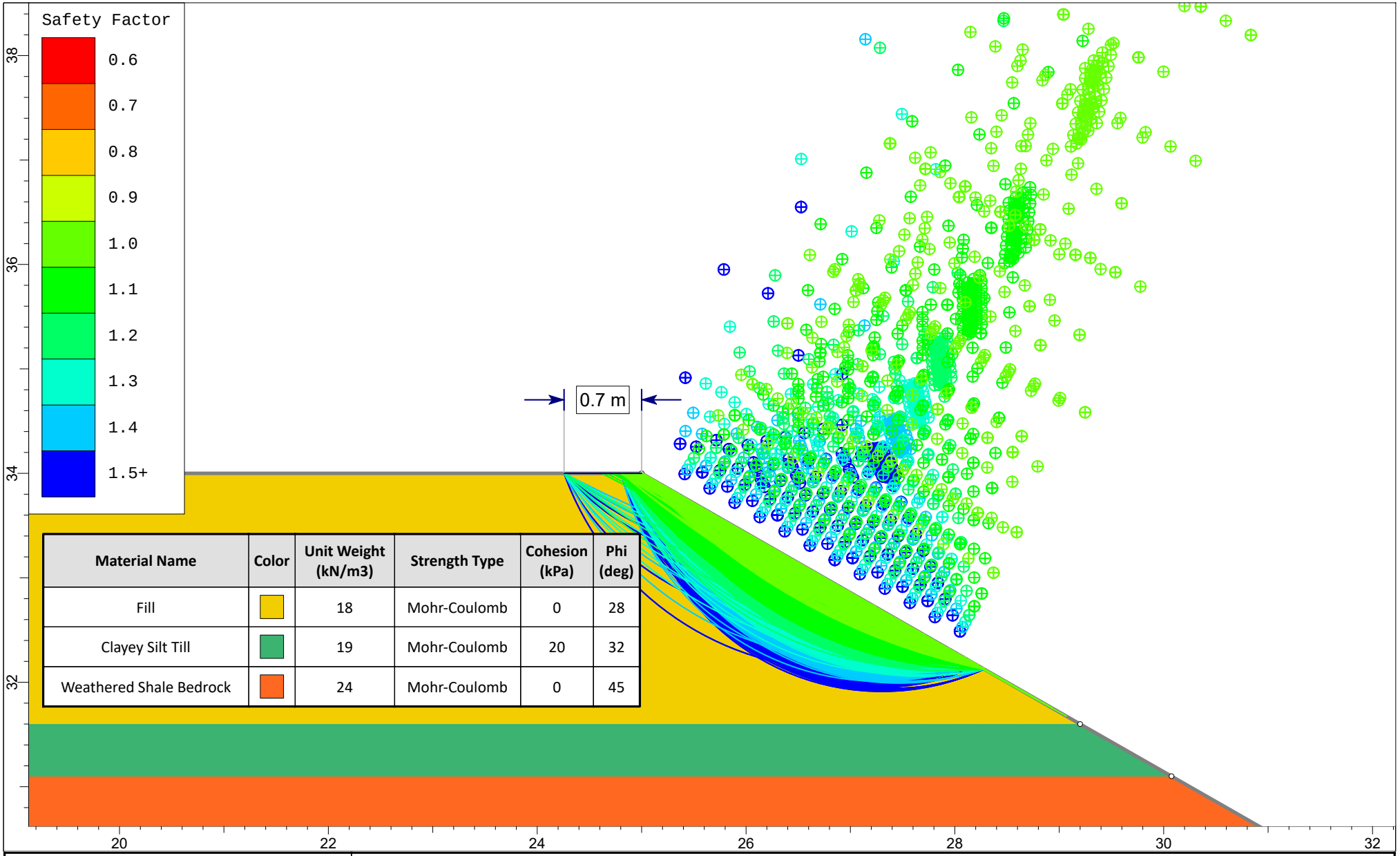



| Material Name | Color | Unit Weight (kN/m3) | Strength Type | Cohesion (kPa) | Phi (deg) |
|---|---|---|---|---|---|
| Fill | | 18 | Mohr-Coulomb | 0 | 28 |
| Clayey Silt Till | | 19 | Mohr-Coulomb | 20 | 32 |
| Weathered Shale Bedrock | | 24 | Mohr-Coulomb | 0 | 45 |

rocscience

SLIDEINTERPRET 8.010

| | | | |
|---|---|---|---|
| *Project* | G20080 - 130 Cornwall Rd,. Oakville | | |
| *Analysis Description* | Long Term Slope Stability - Overall Slope | | |
| *Drawn By* | Chris Sternik | *Scale* 1:500 | *Company* CVD |
| *Date* | 2/25/2021, 11:30:30 AM | | *File Name* Figure No. 1 |



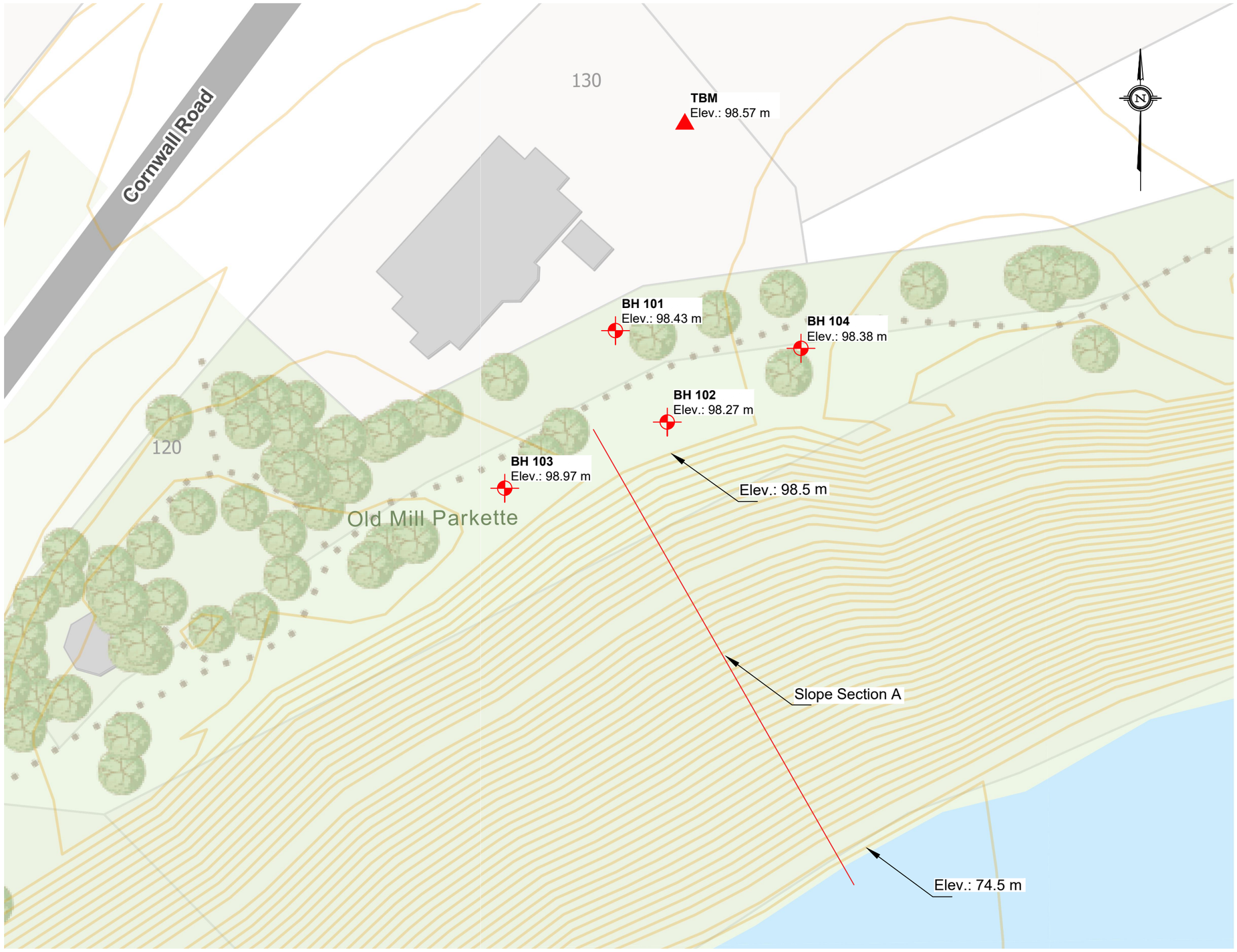

| Material Name | Color | Unit Weight (kN/m3) | Strength Type | Cohesion (kPa) | Phi (deg) |
|---|---|---|---|---|---|
| Fill | | 18 | Mohr-Coulomb | 0 | 28 |
| Clayey Silt Till | | 19 | Mohr-Coulomb | 20 | 32 |
| Weathered Shale Bedrock | | 24 | Mohr-Coulomb | 0 | 45 |

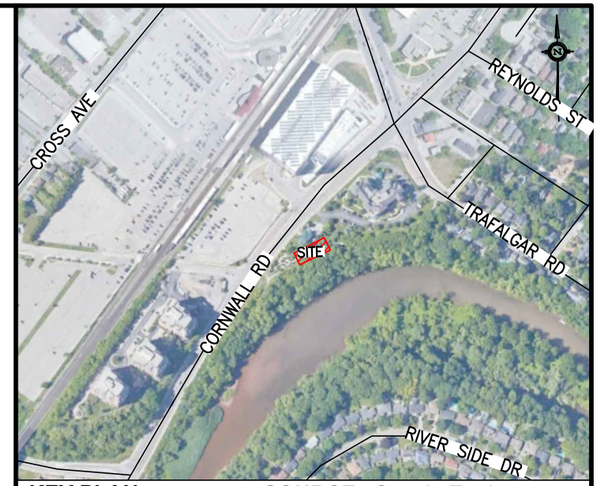
SLIDEINTERPRET 8.010

| | | | |
|---|---|---|---|
| Project | G20080 - 130 Cornwall Rd,. Oakville | | |
| Analysis Description | Long Term Slope Stability - Top of Slope | | |
| Drawn By | Chris Sternik | Scale 1:50 | Company CVD |
| Date | 2/25/2021, 11:30:30 AM | | File Name Figure No. 2 |

# APPENDIX F

## Borehole and Slope Section Location Plan, Borehole Logs, and Grain Size Distribution Chars




**KEY PLAN** **SOURCE:** Google Earth

## LEGEND

**TBM: Top of catch basin in parking lot east of existing building**
**Elev.: 98.57 m (as per Topographic Survey Plan prepared by J. H. Gelbloom Surveying Ltd. dated November 23, 2020)**

**Borehole Location**

**Base Drawing Ref.: Town of Oakville Topographic Data**

# BOREHOLE AND SLOPE SECTION LOCATION PLAN

Slope Stability Assessment

130 Cornwall Road
Oakville, Ontario


CHUNG & VANDER DOELEN ENGINEERING LTD.
311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979


| | | |
|---|---|---|
| Drawn By: NZ | Date: February, 2021 | File No.: G20080 |
| Checked By: CS | Scale: N.T.S | Drawing No.: 2 |

# FILE No: G20080

# BOREHOLE No. 101

Client: **Support & Housing Halton**

Project: **Proposed Housing Development**

Location: **130 Cornwall Road, Oakville, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Feb 12 - 21** TO **Feb 12 - 21**

Ground Elevation: **98.43 m**

| ELEV./ DEPTH (m) | DESCRIPTION | DEPTH (m) | SAMPLE ID | TYPE | N-VALUE | REMARKS |
|---|---|---|---|---|---|---|
| | 150 mm TOPSOIL<br><br>loose<br>dark brown<br>FILL, sandy silt<br>trace gravel, trace clay, trace topsoil/organics<br>moist | 0.5 | | | | |
| | | 1.0 | 1 | SS | 6 | |
| | | 1.5 | | | | |
| 96.75<br>1.68 | | | 2 | SS | 13 | |
| | stiff to hard<br>grey<br>CLAYEY SILT TILL<br>trace to some sand, trace gravel<br>contains shale fragments<br>moist | 2.0 | | | | |
| | | 2.5 | 3 | SS | 40 | |
| 95.53<br>2.90 | | 3.0 | | | | |
| | hard, grey<br>WEATHERD SHALE BEDROCK<br>(Georgian Bay Formation)<br>damp | | 5 | SS | 50/ 125mm | |
| | | 3.5 | | | | |
| 94.62<br>3.81 | End of Borehole<br>Auger Refusal on Inferred Bedrock | | 6 | SS | 50/ 10mm | borehole open and dry upon completion of drilling |
| | | 4.0 | | | | |
| | | 4.5 | | | | |
| | | 5.0 | | | | |
| | | 5.5 | | | | |

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
$W_P$ W $W_L$
10 20 30

WELL DATA

PROJECT MANAGER: **EYC**

CHUNG & VANDER DOELEN ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

Enclosure No.: 2
Sheet 1 of 1

# FILE No: G20080

# BOREHOLE No. 102

Client: **Support & Housing Halton**

Project: **Proposed Housing Development**

Location: **130 Cornwall Road, Oakville, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Feb 12 - 21** TO **Feb 12 - 21**

Ground Elevation: **98.27 m**

| ELEV./ DEPTH (m) | DESCRIPTION | DEPTH (m) | SAMPLE ID | TYPE | N-VALUE |
|---|---|---|---|---|---|
| | 300 mm TOPSOIL | | 1 | AS | |
| | loose dark brown FILL, sand and gravel to sandy silt trace gravel, trace clay, trace topsoil/organics moist | 0.5 | | | |
| | | 1.0 | 2 | SS | 4 |
| 96.75 | | 1.5 | | | |
| 1.52 | dense, grey SILTY SAND, some gravel, trace clay moist | | 3 | SS | 39 |
| 96.14 | | 2.0 | | | |
| 2.13 | hard, grey WEATHERD SHALE BEDROCK (Georgian Bay Formation) damp | 2.5 | 4 | SS | 68 |
| | | 3.0 | 5 | SS | 50/ 25mm |
| 94.92 | | | | | |
| 3.35 | End of Borehole Auger Refusal on Inferred Bedrock | 3.5 | | | |
| | | 4.0 | | | |
| | | 4.5 | | | |
| | | 5.0 | | | |
| | | 5.5 | | | |

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
$W_P$ W $W_L$
10 20 30

WELL DATA

DEPTH (m)

REMARKS

borehole open and dry upon completion of drilling

PROJECT MANAGER: **EYC**


CHUNG & VANDER DOELEN ENGINEERING LTD.
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# FILE No: G20080

# BOREHOLE No. 103

Client: **Support & Housing Halton**

Project: **Proposed Housing Development**

Location: **130 Cornwall Road, Oakville, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Feb 12 - 21** TO **Feb 12 - 21**

Ground Elevation: **98.97 m**

| ELEV./ DEPTH (m) | DESCRIPTION | DEPTH (m) | SYMBOL | SAMPLE ID | TYPE | N-VALUE | REMARKS |
|---|---|---|---|---|---|---|---|
| | 275 mm TOPSOIL<br><br>loose to compact<br>dark brown<br>FILL, sandy silt<br>trace gravel, trace clay, trace topsoil/organics<br>moist | 0.5 | | | | | |
| | | 1.0 | | 1 | SS | 11 | |
| | | 1.5 | | 2 | SS | 6 | |
| | | 2.0 | | | | | |
| 96.53<br>2.44 | stiff, grey<br>CLAYEY SILT TILL<br>trace to some sand, trace gravel<br>contains shale fragments<br>moist | 2.5 | | 3 | SS | 12 | |
| 96.07<br>2.90 | hard, grey<br>WEATHERD SHALE BEDROCK<br>(Georgian Bay Formation)<br>damp | 3.0 | | 4 | SS | 50/ 125mm | |
| | | 3.5 | | | | | |
| | | 4.0 | | 5 | SS | 50/ 10mm | |
| 94.78<br>4.19 | End of Borehole<br>Auger Refusal on Inferred Bedrock | 4.5 | | | | | borehole open and dry upon completion of drilling |
| | | 5.0 | | | | | |
| | | 5.5 | | | | | |

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
$W_P$ W $W_L$
10 20 30

WELL DATA

PROJECT MANAGER: **EYC**

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311 Victoria Street North
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ph. (519) 742-8979, fx. (519) 742-7739

# FILE No: G20080

# BOREHOLE No. 104

Client: **Support & Housing Halton**

Project: **Proposed Housing Development**

Location: **130 Cornwall Road, Oakville, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **107 mm I.D.**
Date: **Feb 12 - 21** TO **Feb 12 - 21**

| ELEV./ DEPTH (m) | DESCRIPTION (Ground Elevation: **98.38 m**) | DEPTH (m) | SYMBOL | SAMPLE ID | TYPE | N-VALUE | SHEAR STRENGTH (kPa) / PENETRATION RESISTANCE | WATER CONTENT (%) | WELL DATA | DEPTH (m) | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 350 mm TOPSOIL<br>loose to compact<br>dark brown<br>FILL, sandy silt<br>trace gravel, trace clay, trace topsoil/organics<br>contains brick fragments<br>moist | 0.5 | | | | | | | | 0.5 | |
| | | 1.0 | | 1 | SS | 5 | | | | 1.0 | |
| 96.86 | | 1.5 | | | | | | | | 1.5 | |
| 1.52 | very stiff to hard<br>grey<br>SANDY CLAYEY SILT TILL<br>trace gravel<br>contains shale fragments<br>moist | | | 2 | SS | 21 | | | | | |
| | | 2.0 | | | | | | | | 2.0 | |
| 95.78 | | 2.5 | | 3 | SS | 41 | | | | 2.5 | |
| 2.60 | hard, grey<br>WEATHERD SHALE BEDROCK<br>(Georgian Bay Formation)<br>damp | 3.0 | | 4 | SS | 50/ 125mm | | | | 3.0 | |
| 94.87 | | 3.5 | | | | | | | | 3.5 | borehole open and dry upon completion of drilling |
| 3.51 | End of Borehole<br>Auger Refusal on Inferred Bedrock | 4.0 | | | | | | | | 4.0 | |
| | | 4.5 | | | | | | | | 4.5 | |
| | | 5.0 | | | | | | | | 5.0 | |
| | | 5.5 | | | | | | | | 5.5 | |

SHEAR STRENGTH (kPa): FIELD VANE: Peak ⊗ Rem. × ; LAB TEST: Unc. ■ P.P. □ ; 50 100 150 200
PENETRATION RESISTANCE: STANDARD ● DYN. CONE ○ ; 20 40 60 80
WATER CONTENT (%): $W_P$ W $W_L$ ; 10 20 30

PROJECT MANAGER: **EYC**

CHUNG & VANDER DOELEN ENGINEERING LTD.
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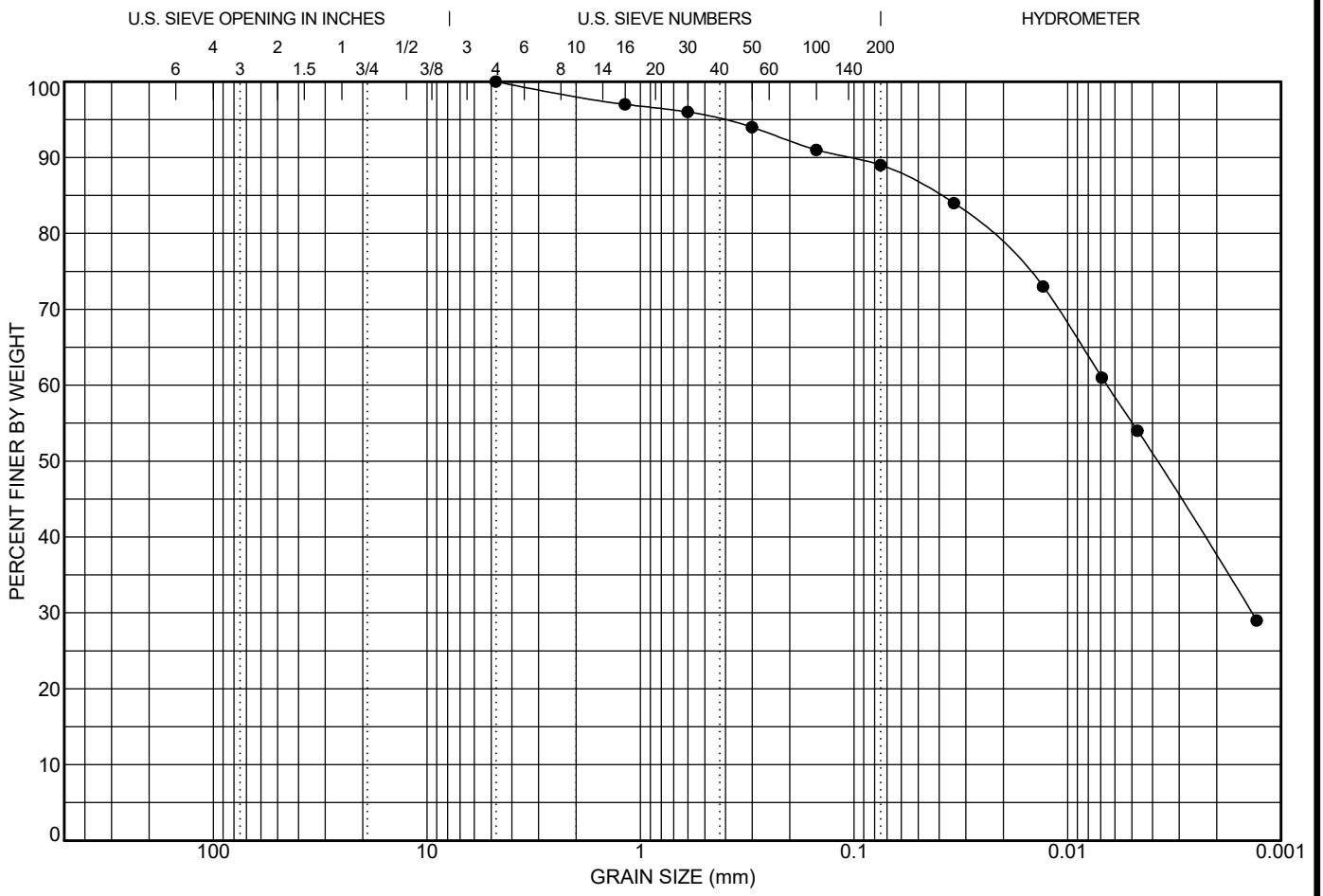


| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| LL | PL | PI | Cc | Cu | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 4.75 | 0.007 | 0.001 | | 0.0 | 11.0 | 89.0 | |

**Date:** Mar. 02 - 2021
**Client:** Support & Housing Halton
**Contractor:**
**Source:**
**Sampled From:** BH 1 - SA 3, 2.29 to 2.74 m depth
**Sample No.:** 1-3
**Date Sampled:** Feb. 12 - 2021
**Sampled By:** NZ
**Lab No.:** 0138
**Date Tested:** Feb. 19 - 2021
**Type of Material:** Clayey Silt Till, some sand

| Sieve Size (mm) | Percent Passing | No Specifications |
|---|---|---|
| | | |

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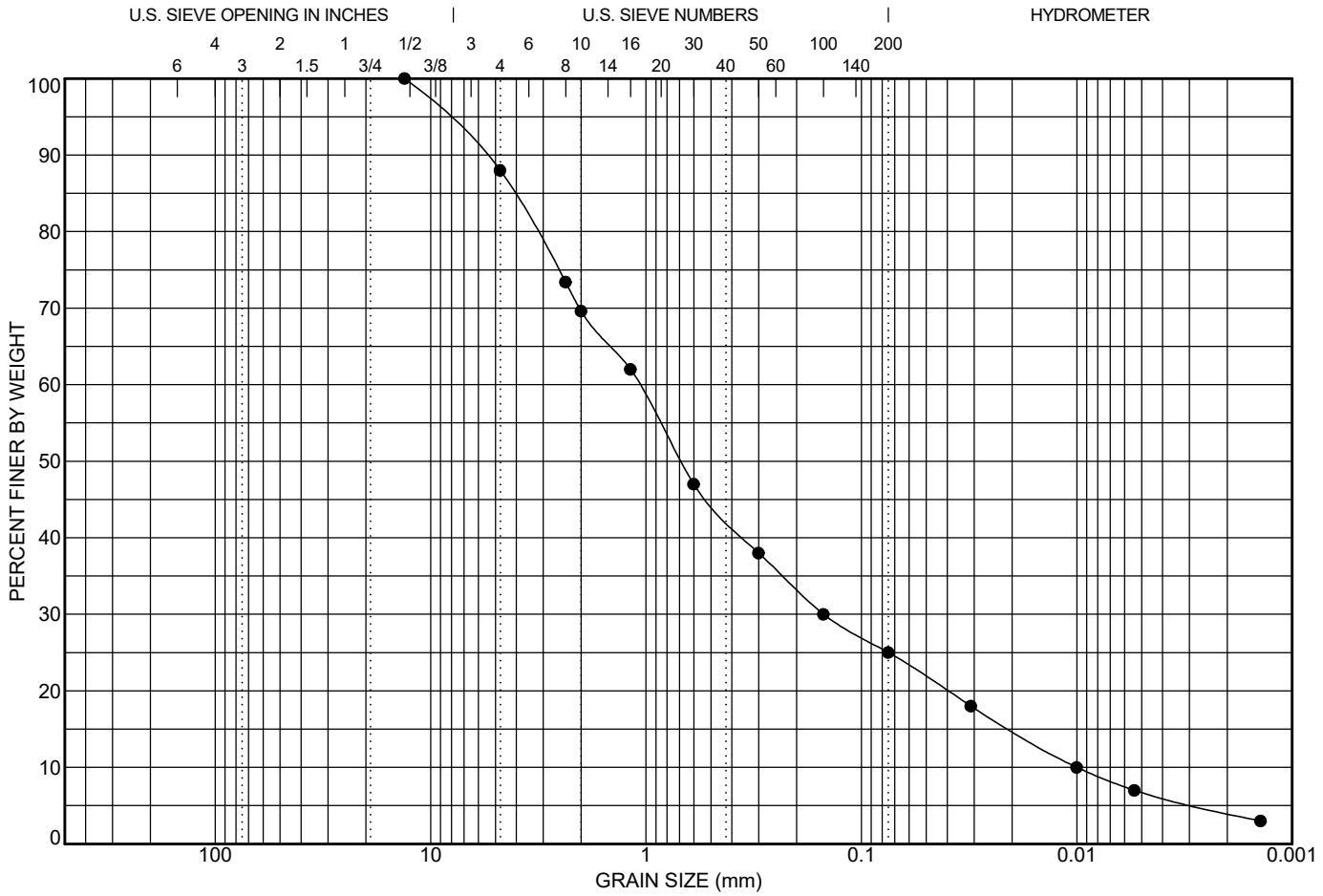
# GRAIN SIZE DISTRIBUTION

Project: Proposed Housing Development

Location: 130 Cornwall Road, Oakville, Ontario

File No.: G20080

Enclosure No.: 5




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| LL | PL | PI | Cc | Cu | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 2.09 | 107.82 | 13.2 | 1.078 | 0.15 | 0.01 | 12.0 | 63.0 | 25.0 | |

**Date:** Mar. 02 - 2021
**Client:** Support & Housing Halton
**Contractor:**
**Source:**
**Sampled From:** BH 2 - SA 3, 1.52 to 1.98 m depth
**Sample No.:** 2-3
**Date Sampled:** Feb. 12 - 2021
**Sampled By:** NZ
**Lab No.:** 0139
**Date Tested:** Feb. 19 - 2021
**Type of Material:** Silty Sand, some gravel, trace clay

| Sieve Size (mm) | Percent Passing | No Specifications |
|---|---|---|
| | | |

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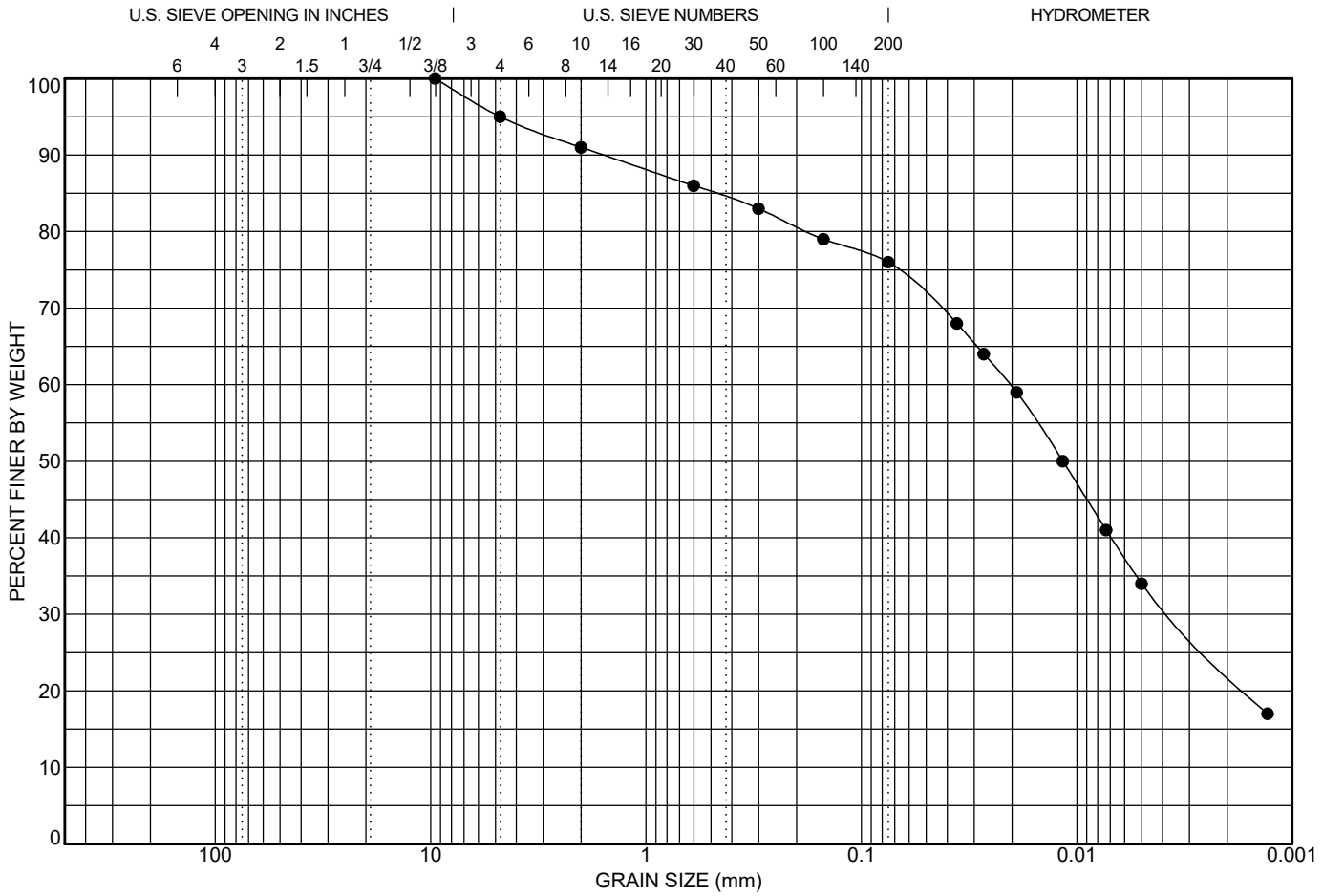
# GRAIN SIZE DISTRIBUTION

Project: Proposed Housing Development

Location: 130 Cornwall Road, Oakville, Ontario

File No.: G20080

Enclosure No.: 6




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| LL | PL | PI | Cc | Cu | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 9.5 | 0.02 | 0.004 | | 5.0 | 19.0 | 76.0 | |

**Date:** Mar. 02 - 2021
**Client:** Support & Housing Halton
**Contractor:**
**Source:**
**Sampled From:** BH 4 - SA 2, 1.52 to 1.98 m depth
**Sample No.:** 4-2
**Date Sampled:** Feb. 12 - 2021
**Sampled By:** NZ
**Lab No.:** 0140
**Date Tested:** Feb. 19 - 2021
**Type of Material:** Sandy Clayey Silt Till, trace gravel

| Sieve Size (mm) | Percent Passing | No Specifications |
|---|---|---|
| | | |

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# GRAIN SIZE DISTRIBUTION

Project: Proposed Housing Development

Location: 130 Cornwall Road, Oakville, Ontario

File No.: G20080

Enclosure No.: 7