Geotechnical Engineering Report

Slope Stability Assessment
Proposed Harrington Pit
316829 31st Line,
Zorra Township, Ontario

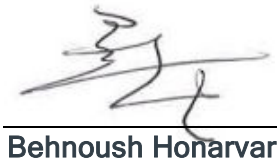
Harrington McAvan Ltd.
Final Report

December 4, 2024
04-02410737.000-GS-R-0002-00

ENGLOBE

Harrington McAvan Ltd.

Prepared by:



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Property and Confidentiality

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APPENDICES

1 Introduction

Englobe Corp. (Englobe) was retained by Harrington McAvan Ltd. (hereinafter referred to as the "Client") to undertake a geotechnical investigation and slope stability assessment for the Proposed Harrington Pit located at 316829 31st Line, Zorra Township, Ontario. The location of the site is shown on Location Plan - Drawing 1 in Appendix A. A proposal and cost estimate to carry out the work were outlined in our letter, reference number P2410737.000, dated October 28, 2024.

The purpose of the work was to investigate and report on the subsurface soil and groundwater conditions in a series of boreholes drilled at the site. Based on this information, a slope stability assessment was completed to evaluate the long-term stability of the subject slopes. The geotechnical assessment was completed to satisfy the intents of the guidelines outlined in the document entitled '*Technical Guide – River and Stream Systems: Erosion Hazard Limits*' (Ministry of Natural Resources, 2001) and Upper Thames River Conservation Authority (UTRCA) document entitled '*Ontario Regulation 157/06: Development, Interference with Wetlands and Alterations to Shorelines and Water Courses*'.

2 Site and Project Description

2.1 Existing Site Conditions

The site was examined by Englobe's senior geotechnical staff on November 8, 2024, in order to obtain general information regarding the existing slope features such as slope profile, slope drainage, watercourse features, vegetation cover and structures in the vicinity of the slopes. Photographs illustrating the various features of the study area are provided in Appendix D. The general arrangement of the site is shown in Appendix A, Drawing 2.

The site is generally located at the top of the slopes, adjacent to (west of) 31st Line in Zorra Township, Ontario, and near Missouri Creek at the toe of the slopes. Based on the elevation contours in the site plan drawing provided by the Client, the slopes range from approximately 21 to 25 m in height and are inclined at approximately 3.8 to 8.2 horizontal and one vertical (3.8H:1V to 8.2H:1V). However, due to the excavation, the height of the slope will decrease by approximately 10 m.

At the time of visual inspection, the plateau was covered with grass, and the slopes were light to well-vegetated, with mainly grass to mature trees. No scarps or erosion gullies were observed on the slope's face, and active erosion along the slope's toe was not observed. At the toe of the slope, there is a shallow watercourse approximately less than 1 m wide. The flow of the creek was observed to be relatively shallow at the time of our site inspection.

2.2 Slope Stability Rating

The site inspection results and the general site setting, described above were used to complete the Slope Stability Rating Chart, as detailed in Table 4.2 of the Technical Guide of the River and Stream Systems: Erosion and Hazard Limit by the Ontario Ministry of Natural Resources (MNR Guide). The rating results are shown in Appendix F and summarized in Table 1.

Table 1: Slope Stability Rating Chart Values as Observed in Sections A, B and C

Location	Embankment Slope	Slope Inclination (estimated)	Slope Height (estimated)	Slope Stability Rating Chart Value
Section A-A'	East-West	3.8:1	23 m	22
Section B-B'	East-West	2.8:1 to 9.7:1	25 m	22

In summary, a slope stability rating of 16 to 22 has been defined for slope Sections A, and B which suggests a low potential for slope instability. The guideline indicates that slopes with this rating should be assessed with inspection and a report. This level of effort described in this investigation is consistent with the approach outlined in the Ministry of Natural Resources (MNR) policy guidelines.

2.3 Proposed Development

Based on the information provided, Englobe understands that an Aggregate Assessment Report has been conducted for the potential use of aggregate from the property located at 316829 31st Line, Zorra Township, Ontario, as detailed in report reference 04-04-02206651.000-GS-R-0001-00. The report addresses the extraction of sand and gravel on-site, including a significant portion of the west-facing slope, which will reduce its height. Accordingly, there are concerns from the UTRCA regarding potential impacts on slope stability due to the proposed excavation.

2.4 Investigation Procedure

The fieldwork for this investigation was carried out on August 1, 2022, during which time two (2) boreholes were drilled to depths of about 14.2 to 17.7 metres below the existing ground surface (m BGS). The locations of the boreholes are shown on the Borehole and Section Location Plan in Appendix A Drawing 2. The results of the boreholes are shown on the Log of Borehole sheets presented in Appendix B.

The field investigation was carried out in general conformance with the professional standards set out in the Canadian Foundation Engineering Manual (CFEM 2023, 5th Edition), applicable Ontario Regulations, and the ASTM International. The following is a summary of field investigation tasks:

- Public and private utility companies were contacted prior to the start of drilling activities in order to demarcate underground utilities on the site.
- The boreholes were advanced using a Diedrich D50 tracked drill rig equipped with continuous flight solid and hollow stem augers supplied and operated by London Soil Test under the supervision of an Englobe drilling supervisor. The boreholes were logged by our geotechnical supervisor.
- The boreholes were surveyed for coordinates and geodetic elevation.

- Soil samples were recovered from the boreholes at regular depth intervals using a 50 mm outside diameter split spoon sampler in accordance with ASTM D1586 Standard Penetration Test (SPT), and the results are provided on the borehole logs (Appendix B).
- One (1) temporary monitoring well was installed at BH-01-22. Details of the temporary monitoring well as well as the groundwater observations are also provided in the Borehole logs attached in Appendix B.
- Groundwater measurements were taken in the open boreholes and are provided on the borehole logs (Appendix B).
- The boreholes were backfilled with bentonite in accordance with Ontario Regulation 903 as amended, under the Ontario Water Resources Act.

2.5 Laboratory Testing

All soil samples recovered during the investigation were returned to our laboratory for visual examination and moisture content testing. A total of twelve moisture content tests were conducted, whereas particle size analyses were conducted on two of the selected soil samples, respectively. The moisture content values, and the test results of the particle size analyses are also shown on the appended borehole logs. A detailed description and the results of the laboratory tests are provided in Appendix C and Section 3 of this report.

3 Subsurface Conditions

The subsurface soil and groundwater conditions encountered in the boreholes, and the results of the field and laboratory testing, are shown on the Log of Borehole sheets in Appendix B. A list of abbreviations and symbols are provided to assist in the interpretation of the borehole logs. It should be noted that the boundaries between the strata have been inferred from drilling observations and noncontinuous samples. These boundaries generally represent a transition from one soil type to another and should not be inferred to represent exact planes of geological change. The conditions will vary between and beyond the locations investigated.

3.1 Soil Conditions

The following discussion has been simplified in terms of the major soil strata encountered on the site. In general, the reported subsurface conditions indicated that the boreholes penetrated topsoil, fill overlying sand and gravel deposits.

3.1.1 Topsoil

A surface layer of topsoil was encountered at ground surface in both boreholes. The topsoil thickness was around 305 to 455 mm and consisted of sand and some silt. It is important to note that the topsoil thickness might differ significantly beyond the areas where the boreholes were drilled. Variations in topsoil thickness could also be attributed to prior earthwork activities conducted on-site.

3.1.2 Fill

Fill was encountered below the topsoil in both boreholes and extended to a depth of 1.5 m BGS. The fill material's composition varied, ranging from clayey silt to sand and gravel.

3.1.3 Sand and Gravel

Sand and gravel were found in both boreholes and extended to the termination depth of the boreholes. The SPT 'N' values determined in the sand and gravel deposits ranged from 40 to over 50 blows per 0.3 m, indicating a dense to very dense state of packing. The natural moisture content of the samples of sand and gravel deposits ranged from about 3 to 9 percent.

3.2 Groundwater Conditions

Groundwater observations were made in each of the boreholes as they were drilled and upon completion of drilling. In addition, a 50 mm monitoring well was installed in BH-01-22 to assess groundwater level. In summary, BH-01-22 had an unstabilized water level and was measured at 6.96 m BGS upon completion of the drilling, while the other borehole remained dry. The groundwater observations are presented in the table below.

Table 2: Summary of Groundwater Level Readings Recorded

Borehole Identification Number	Ground Surface Elevation (m)	Groundwater Level (m BGS) / Elevation (m)	
		Upon Completion	November 8, 2024
BH-01-22/MW	347.2	6.96/340.24	6.4/340.8
BH-02-22	367.7	_	_

It is important to note that the groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These elevations and conditions may vary locally due to seasonal fluctuations, groundwater regimes encountered at the site or as a consequence of construction activities on the site or adjacent sites.

4 Erosion Hazard Limit

An erosion hazard means the potential loss of land caused by human or natural process, that pose a threat to life and property. The erosion hazard limit for river and stream systems is determined based on the potential for creek bank erosion to impact on the stability of the slope (toe erosion allowance), the stability of the slopes (stable slope allowance), and a need for access during emergencies (erosion access allowance). The following sections present an assessment of each component to determine the erosion hazard limit.

4.1 Toe Erosion Allowance

A toe erosion allowance is recommended in areas where the watercourse position is within 15 m of the slope toe. Table 3 provides recommended guidelines for estimating the erosion allowance.

Table 3: Minimum Toe Erosion Allowance - River within 15 m of Slope Toe*

Type of Material	Evidence of active erosion** or bankfull flow velocity>competent flow velocity***	No evidence of active erosion**or flow velocity<competent flow velocity***		
		Bankfull Width		
		< 5 m	5-30 m	> 30 m
Hard Rock (granite)	0 - 2 m	0 m	0 m	1 m
Soft Rock (shale, limestone), Cobbles, Boulders	2 - 5 m	0 m	1 m	2 m
Stiff / Hard Cohesive Soil (clays, clayey silt)	5 - 8 m	1 m	2 m	4 m
Soft/Firm Cohesive Soil Fine Granular (sand, silt) Fills	8 - 15 m	1 - 2 m	5 m	7 m

Notes:

** Active Erosion is defined as: bank material is bare and exposed directly to stream flow under normal or flood flow conditions and, where undercutting, over steepening, slumping of a bank or high down stream sediment loading is occurring. An area may be exposed to river flow but may not display "active erosion" (i.e., is not bare or undercut) either as a result of well rooted vegetation or as a result of shifting of the channel or because flows are relatively low velocity. The toe erosion allowances presented in the right half of Table 2 are suggested for sites with this condition.

*** Competent Flow velocity; the flow velocity that the bed material in the stream can support without resulting in erosion or scour.

Consideration must also be given to potential future meandering of the watercourse channel.

Source: '*Geotechnical Principles for Stable Slopes'* (Terraprobe, June 1998), prepared for: Ontario Ministry of Natural Resources, Lands and Natural Heritage Branch.

The toe of the slope was assessed, and observations indicate that there is no active toe erosion at this site. Photographs of the toe of the slope are provided in Appendix D. In consideration of the prevailing site conditions (River at the toe of the slope and bankfull width of 5-30 m) and exiting subsurface soil conditions, a minimum erosion allowance of 1 to 2 m is recommended.

4.2 Stable Slope Allowance

The client provided a site plan showing the proposed development and the elevation contours at slope sections A-A', and B-B'(as shown in Drawing 3, Appendix A) to conduct slope stability analyses at the time of writing this report.

A detailed engineering analysis of slope stability was carried out utilizing a commercially available slope stability program i.e., slope/W from GeoStudio version 2023.1. The slope stability assessment was conducted based on the effective stress-limit equilibrium analysis for long-term slope stability. The analysis methods allow for the calculation of Factors of Safety for hypothetical or assumed failure surfaces through the slope. The analysis method is used to assess the potential for movements of large soil masses over a specific failure surface, which is often curved or circular.

For a specific failure surface, the Factor of Safety is defined as the ratio of available strength resisting movement divided by the gravitational forces tending to cause movement. The Factor of Safety of 1.0 represents a 'limit equilibrium' condition where the slope is at the point of pending failure where the soil resistance equals the forces tending to cause movement. The analysis involves dividing the sliding mass into many thin slices and calculating the forces on each slice. The normal and shear forces acting on the slides and base of each slice are calculated. It is an iterative process that converges on a solution.

The typical Factor of Safety used for the engineering design of slopes for stability in building applications ranges from about 1.3 to 1.5. The Ministry of Natural Resources (MNR) Policy Guidelines specifies the following minimum Factor of Safety requirements for slope stability:

Table 4: Design Minimum Factor of Safety

Type	Land Uses	Design Minimum Factor of Safety
A	PASSIVE: no buildings near slope; farm field, bush, forest, timberland, woods, wasteland, badlands, tundra	1.1
B	LIGHT: no habitable structures near slope; recreational parks, golf courses, buried small utilities, tile beds, barns, garages, swimming pools, sheds, decks, satellite dishes, dog houses	1.20 to 1.30
C	ACTIVE: habitable or occupied structures near slopes; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances	1.30 to 1.50
D	INFRASTRUCTURE and PUBLIC USE: public use structures and buildings (i.e., hospitals, schools, stadiums), cemeteries, bridges, high voltage power transmission lines, towers, storage/warehousing of hazardous materials, waste management areas	1.40 to 1.50

The Upper Thames River Conservation Authority (UTRCA) policies require a minimum Factor of Safety of 1.5 for all development applications and 1.3 for infrequent short-term elevated groundwater conditions.

The soil strength parameters were selected based on the observed site conditions, Standard Penetration Test (SPT) values, laboratory test results, empirical correlations, and other references for drained (long-term) conditions in similar soils. These parameters are provided in Table 5 below.

Table 5: Soil Strength Parameters for Drained (long term) Conditions

Soil	Unit Weight, γ(kN/m3)	Effective Cohesion, c' (kPa)	Angle of Internal Friction, ϕ'
Sand and Gravel, dense to very dense	19	0	34
Silty Clay Till-hard	18	5	34

The above soil strength parameters were based on effective stress analysis for long-term slope stability. Graphical depictions of the slope stability analysis results are presented in Appendix E. Based on the results of the analyses; it is our opinion that the slopes will remain stable under long-term condition after excavation and a height reduction of 10 m, provided that the excavation sides are sloped at 3H:1V or gentler. Drawings 2 and 3 in Appendix A present the cross-sections and relevant details of the cross-sections analyzed for determination of the stability of slopes. Based on the results of the analyses, the proposed slope of 3H:1V will be stable and the vegetation cover is needed to protect it against erosion. Considering the drawings and the cross section sent by the client, the proposed excavation works are estimated to be around 660,000 m^3 and can be safely constructed without adversely affecting the long-term stability of the slopes.

4.3 Erosion Access Allowance

The third setback component is a spatial allowance for controlling the top-of-bank land use that could potentially impact slope stability and ensure that future development is not impacted by slope deformations. This setback also provides a means of access to the slope. The intent is that no filling or structural development would be allowed to take place in this zone. Policies for this component of the setback have been established by the Upper Thames River Conservation Authority in the document entitled '*Environmental Planning Policy Manual for The Upper Thames River Conservation Authority*' (Upper Thames River Conservation Authority, October 2017). Based on policy # 2.2.7.2.2 (d), the Upper Thames River Conservation Authority requires a minimum erosion access allowance of 6 m.

4.4 Regulatory Setback

UTRCA may require an additional setback from the long-term stable top of the slope. The intent is to control top-of-bank land use that could potentially impact slope stability and to ensure that future development is not impacted by slope deformations. This setback also provides a means of access to the slope. Policies for this setback have been established by UTRCA in the UTRCA document.

5 Statement of Limitations

The geotechnical recommendations provided 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 at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, Englobe should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its agent and may not be used by a Third Party without the expressed written consent of Englobe and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. Englobe accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It should be noted that the soil boundaries indicated on the borehole log are inferred from noncontinuous sampling and observations during drilling and should not be interpreted as exact planes of geological change. These boundaries are intended to reflect approximate transition zones for the purpose of geotechnical design. Also, the subsoil and groundwater conditions have been determined at the borehole locations only.

It is further noted that, depending on the time of year the field work was completed, water levels should be expected to vary, perhaps significantly from those observed at the time of this investigation.

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental, and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also, such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions. Englobe will not be responsible to any party for damages incurred as a result of failing to notify Englobe that differing site or subsurface conditions are present upon becoming aware of such conditions.

The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated, specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made. The Englobe recommendations are contingent upon provision of a consistently competent, stable subgrade, which is properly drained and free of soft spots and objectionable materials such as organics.

Appendix A
Drawings

Drawing 1: Site Location Plan
Drawing 2: Borehole and Slope Section Location Plan
Drawing 3: Detailed Cross Sections

ENGLOBE

NOTES:

1-REFERENCES: © OpenStreetMap contributors (2023).

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 200 400 600 800 1000 m

SCALE 1:20000

Project

Proposed Harrington Pit

(Aggregate Assessment)

316829 31st Line, Zorra Harrington, Ontario

Title

Site Location Plan

eNGLOBe

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
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Prepared	N.Raj	Discipline	GEOTECHNICAL	Project manager	R.Helwig
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Checked	Z.Babar	Date	2023-06-20		

M. dept.	Project	Disc.	Dwg no.	Rev.
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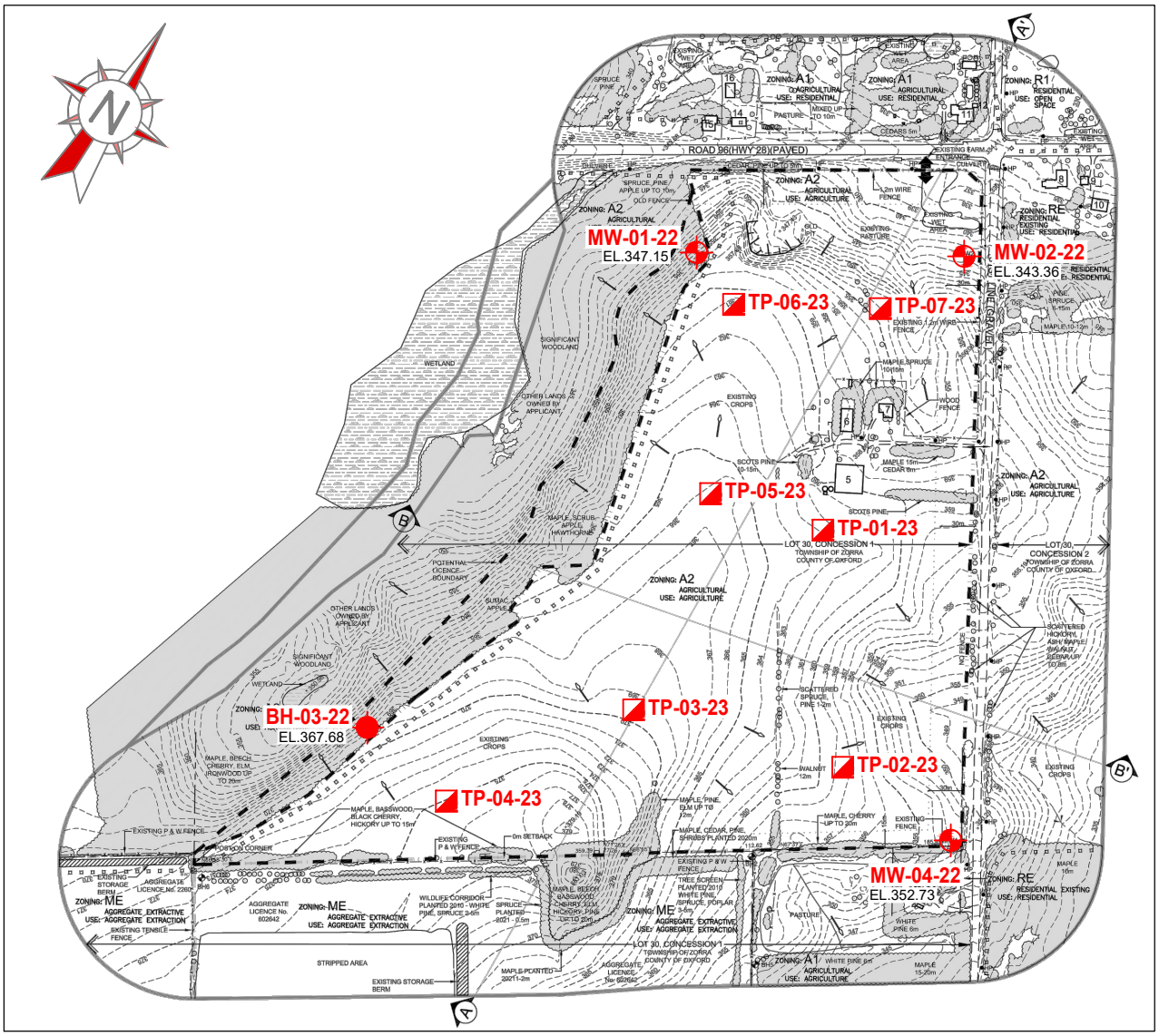

NOTES:

1-REFERENCES: MICHAEL WILHELM EXCAVATING LTD, HARRINGTON PIT, EXISTING FEATURES PLAN, Project No: 22-15, Dwg No: 1 of 5, Scale 1:2000 .

2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 50 100 150 200 250 m

SCALE 1:6000

LEGEND :

MW-01-22	MONITORING WELL LOCATION
EL.347.15	GROUND SURFACE ELEVATION (m)
BH-03-22	BOREHOLE LOCATION
EL.352.73	GROUND SURFACE ELEVATION (m)
TP-01-23	TEST PIT LOCATION

Project

Proposed Harrington Pit

(Aggregate Assessment)

316829 31st Line, Zorra Harrington, Ontario

Title

Borehole Location Plan

eNGLOBe

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
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Prepared	N.Raj	Discipline	GEOTECHNICAL	Project manager	R.Helwig
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Checked	Z.Babar	Date	2023-06-26		

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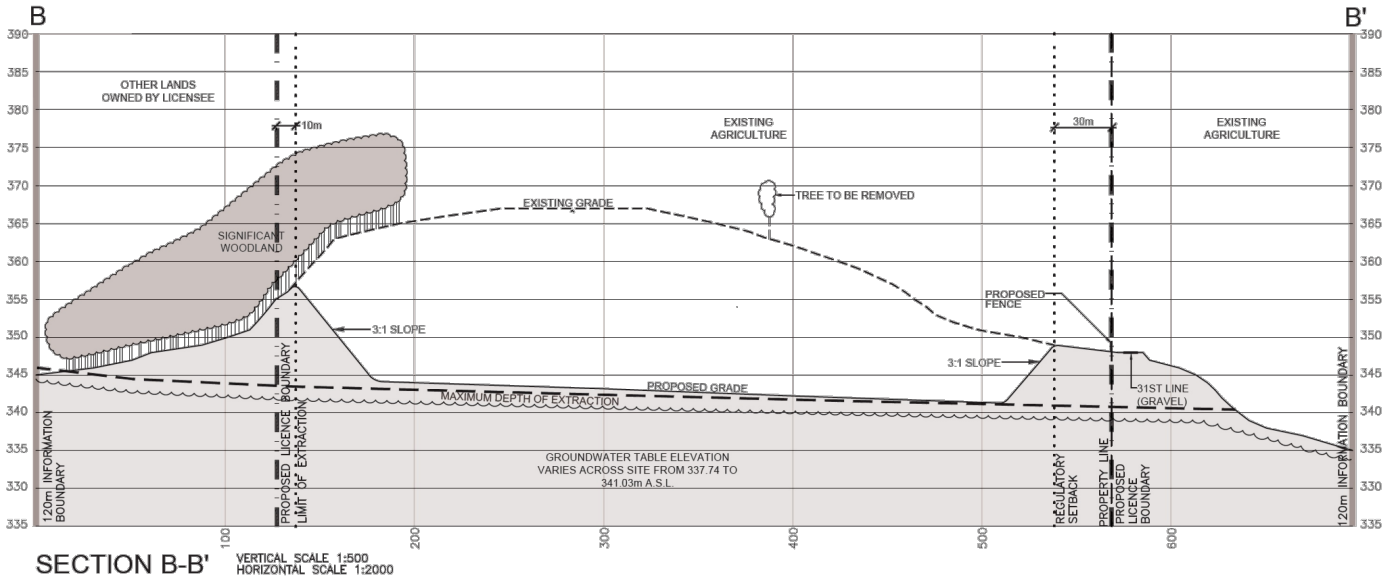
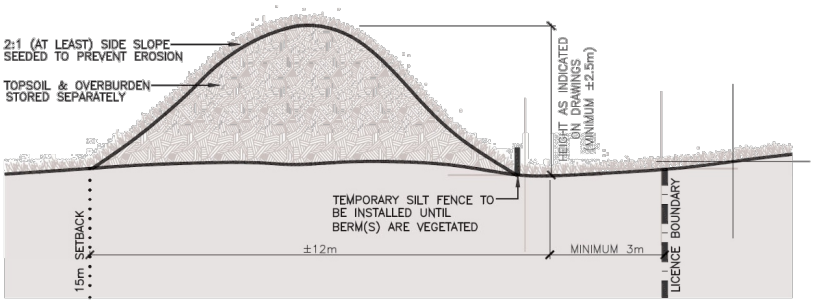


SECTION B-B' VERTICAL SCALE 1:500 HORIZONTAL SCALE 1:2000



TYPICAL BERM SECTION N.T.S.

NOTES:

1. **REFERENCES: Plan by Harrington McAvan Ltd., Harrington Pit, Sections and Details, July 2024.**
2. **Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.**

This document must be used jointly with the recommendations formulated in the geotechnical study report

Client

Harrington McAvan Ltd.

Project

Slope Stability Assessment
Proposed Harrington Pit

316829 31st Line, Zorra Township, Ontario

Title

Sections

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Scale: 1:1 500		Drawn by: LK	Approved by: ZB
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Appendix B
Borehole Logs

List of Abbreviations

Boreholes BH-01-24 to BH-04-24

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List of Abbreviations

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Test and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Core Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic Limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_L	Liquid Limit
WC	Water Content Sample	I_L	Liquidity Index
TP	Thinwall, Piston	I_p	Plastic Index
		PP	Pocket Penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60˚ cone a distance 300 mm (12 in.) The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	Sampler advanced by weight of hammer
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure

Soil Description		
Cohesionless Soils Compactness Condition	**SPT N-Value** (blows per 0.3 m)	**Relative Density (D_r** (%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	Over 50	80 to 100
Cohesive Soils Consistency	**Undrained Shear Strength (C_u kPa**	**psf**
Very Soft	Less than 12	Less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000
DTPL	Drier than plastic limit	Low Plasticity, W_L<30
APL	About plastic limit	Medium Plasticity, 30< W_L<50
WTPL	Wetter than plastic limit	High Plasticity, W_L>50

LOG OF BOREHOLE MW01-22

Project No. : 02206651 | Client : Michael Wilhelm Excavating Ltd. | Originated by : ED

Date started : August 16, 2022 | Project : Proposed Harrington Pit (Aggregate Assessment) | Compiled by : ZB

Sheet No. : 1 of 1 | Location : 316829 31st Line, Zorra Herrington, Ontario | Checked by : RH

Position : E: 8100023, N: 4323903 (UTM 17T) | Elevation Datum : Geodetic

Rig type : D50 | Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value
	347.2	**GROUND SURFACE**				
0	346.9 / 0.3	305mm **TOPSOIL**, sand some silt, with rootlets, dark brown			AS	
		FILL, clayey silt, brown				
1	346.1 / 1.1	**FILL**, sand, some gravel				
	345.7 / 1.5	**SAND AND GRAVEL**dense, brown, moist		1	SS	40
2		...cobbles				
3		...very dense		2	SS	100+
4						
5				3	SS	100+
6		...some silt		4	SS	100+
7						
		...saturated		5	SS	96+
8						
9		...sand, some gravel, dense		6	SS	35
10						
				7	SS	45
11						
12		...grey		8	SS	45
13						
14		...some silt		9	SS	42
	333.0 / 14.2					

Elevation Scale (m): 347, 346, 345, 344, 343, 342, 341, 340, 339, 338, 337, 336, 335, 334, 333

Penetration Test Values (Blows / 0.3m): Dynamic Cone (10, 20, 30, 40)

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane (40, 80, 120, 160)

Moisture / Plasticity: Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL) (10, 20, 30)

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

END OF BOREHOLE

stabilized water level at 6.96m
Wet Caved at 6.4m
Stickup, 0.80m

50 mm dia. monitoring well installed.

file: 02206651 bh logs.gpj

LOG OF BOREHOLE MW02-22

Project No. : 02206651	Client : Michael Wilhelm Excavating Ltd.	Originated by : ED
Date started : August 16, 2022	Project : Proposed Harrington Pit (Aggregate Assessment)	Compiled by : ZB
Sheet No. : 1 of 1	Location : 316829 31st Line, Zorra Herrington, Ontario	Checked by : RH

Position : E: 8099714, N: 4323942 (UTM 17T) Elevation Datum : Geodetic

Rig type : D50 Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Sample Number	Sample Type	SPT 'N' Value
0	343.4	**GROUND SURFACE**				
	343.0 / 0.4	365mm **TOPSOIL**, sand, some silt, with rootlets, dark brown			AS	
1	341.9 / 1.5	**FILL**, gravel and sand, brown				
2		**SAND AND GRAVEL**, dense, brown, moist		1	SS	41
3		...saturated		2	SS	44
4		...very dense		3	SS	60+
5	337.5 / 5.9	**SILTY CLAY**, till, hard, grey		4	SS	100+
6	336.8 / 6.6	**END OF BOREHOLE**				

Elevation Scale (m): 343, 342, 341, 340, 339, 338, 337

Penetration Test Values (Blows / 0.3m) — Dynamic Cone: 10, 20, 30, 40

Undrained Shear Strength (kPa) — Unconfined, Pocket Penetrometer, Field Vane, Lab Vane: 40, 80, 120, 160

Moisture / Plasticity — Plastic Limit (PL), Natural Water Content (MC), Liquid Limit (LL): 10, 20, 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) — GR SA SI CL

stabilized water level at 3.77m
Stickup, 0.89m

file: 02206651 bh logs.gpj

LOG OF BH03-22

Project No. : 02206651	Client : Michael Wilhelm Excavating Ltd.	Originated by : ED
Date started : August 17, 2022	Project : Proposed Harrington Pit (Aggregate Assessment)	Compiled by : ZB
Sheet No. : 1 of 1	Location : 316829 31st Line, Zorra Herrington, Ontario	Checked by : RH

Position : E: 8100409, N: 4323435 (UTM 17T) Elevation Datum : Geodetic

Rig type : D50 Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
	367.7	**GROUND SURFACE**					
0	367.2	455mm **TOPSOIL**, sand, some silt, dark brown			AS		367
	0.5	**FILL**, sand and gravel, brown					
1	366.2						
	1.5	**SAND AND GRAVEL**, very dense, brown, moist		1	SS	53	366
2							
				2	SS	61	365
3							
							364
4							
		...presumed cobbles		3	SS	100+	363
5							
							362
6				4	SS	100+	
							361
7							
				5	SS	100+	360
8							
							359
9				6	SS	100+	
							358
10							
				7	SS	100+	357
11							
							356
12				8	SS	100+	
							355
13							
				9	SS	100+	354
14							
							353
15							
							352
16							
							351
17				10	SS	84	
	350.0						
	17.7	**END OF BOREHOLE**					

Dry Caved at 9.45m
Auger refusal at 17.68m

Penetration Test Values (Blows / 0.3m)
× Dynamic Cone
10 20 30 40
Undrained Shear Strength (kPa)
○ Unconfined + Field Vane
● Pocket Penetrometer ■ Lab Vane
40 80 120 160

Moisture / Plasticity
Plastic Limit | Natural Water Content | Liquid Limit
PL MC LL
10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT)
GR SA SI CL

file: 02206651 bh logs.gpj

LOG OF BOREHOLE MW04-22

Project No. : 02206651	Client : Michael Wilhelm Excavating Ltd.	Originated by : ED
Date started : August 18, 2022	Project : Proposed Harrington Pit (Aggregate Assessment)	Compiled by : ZB
Sheet No. : 1 of 1	Location : 316829 31st Line, Zorra Herrington, Ontario	Checked by : RH

Position : E: 8099498, N: 4323434 (UTM 17T) Elevation Datum : Geodetic

Rig type : D50 Drilling Method : Hollow stem augers

Depth Scale (m)	Elev Depth (m)	Description	Graphic Log	Number	Type	SPT 'N' Value	Elevation Scale (m)
0	352.7	**GROUND SURFACE**					352
	352.4 / 0.3	305mm **TOPSOIL**, silty sand, dark brown			AS		
1		**FILL**, sand, some gravel, brown					
	351.2 / 1.5	**SAND**, some gravel, very dense, brown, moist		1	SS	66	351
2				2	SS	59	350
3							349
4		...silty fine sand		3	SS	57	348
5							347
6				4	SS	52	
		...clayey silt portion					346
7							
		...slightly dilatant		5	SS	52	345
8							
9				6	SS	100+	344
10							343
		...some silt, trace clay		7	SS	100+	342
11							
12				8	SS	88	341
13							340
14				9	SS	77	339
15		...saturated		10	SS	78	338
16							337
17				11	SS	63	336
18	334.4 / 18.3	...brown to grey, silty sand to sandy silt		12	SS	100+	335

END OF BOREHOLE

stabilized water level at 15.16m
Stickup, 0.7m

Penetration Test Values (Blows / 0.3m): Dynamic Cone 10 20 30 40

Undrained Shear Strength (kPa): Unconfined, Pocket Penetrometer, Field Vane, Lab Vane — 40 80 120 160

Moisture / Plasticity: Plastic Limit (PL) Natural Water Content (MC) Liquid Limit (LL) — 10 20 30

Headspace Vapour (ppm)

Instrument Details

Unstabilized Water Level

Lab Data and Comments

GRAIN SIZE DISTRIBUTION (%) (MIT) GR SA SI CL

file: 02206651 bh logs.gpj

Appendix C
Geotechnical Lab Testing Results

ENGLOBE

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER:	04-02206651.000	**PROJECT NAME:**	36829 31st Line, Zorra Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	S-695	**SAMPLE ID:**	BH 1 SS 1 to 8 Composite	**SAMPLE DEPTH:**	1.1m - 12.7m
SAMPLED BY:	Englobe	**DATE RECEIVED:**	September 22, 2022	**DATE COMPLETED:**	October 4, 2022

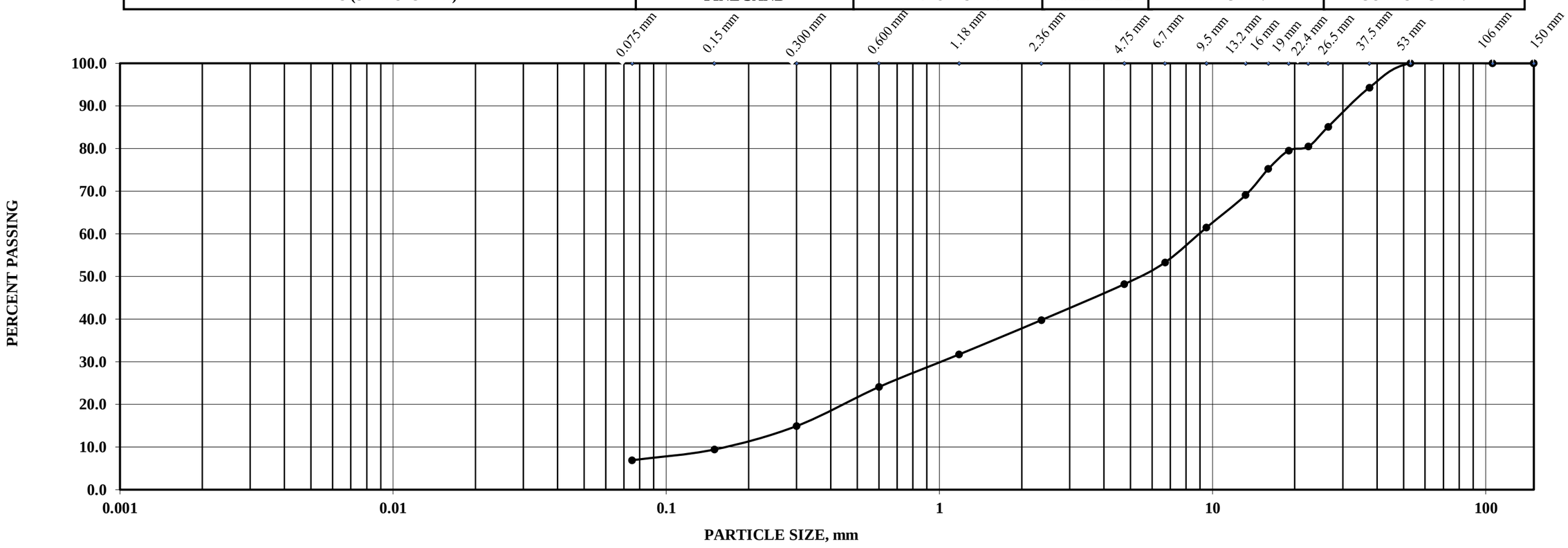
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS

D60	8.990	**D30**	1.050	**D10**	0.166	**Cc**	0.739	**Cu**	54.23

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	100.0
53	100.0
37.5	94.3
26.5	85.1
22.4	80.5
19	79.5
16	75.2
13.2	69.1
9.5	61.5
6.7	53.3
4.75	48.2
2.36	39.8
1.18	31.7
0.6	24.1
0.3	14.9
0.15	9.4
0.075	6.9

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):	51.8	
% SAND (75 µm to 4.75 mm):	41.3	
% SILT (2 µm to 75 µm):	6.9	
% CLAY (<2 µm):	-	
SOIL DESCRIPTION:		SAND and GRAVEL, trace Silt

REMARKS

Figure: 1

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER: 02206651.000 **PROJECT NAME:** Township of Zorra Herrington **CLIENT:** Michael Wilhelm Excavating Ltd.

LAB NUMBER: 966 **SAMPLE ID:** TP-1 / Sample 3 **SAMPLE DEPTH:** 4.5 to 7 m

SAMPLED BY: Ed VanPuymbroech, BSc **DATE RECEIVED:** January 23, 2023 **DATE COMPLETED:** February 2, 2023

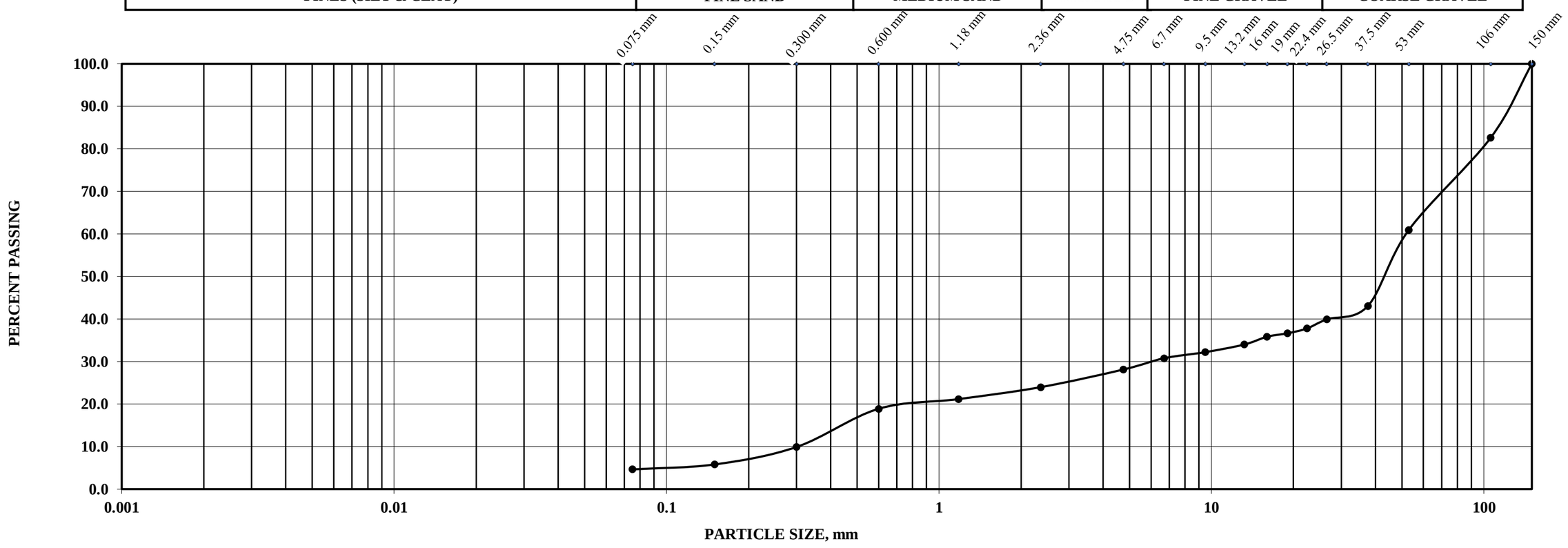
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS									
D60	52.190	**D30**	6.129	**D10**	0.303	**Cc**	2.377	**Cu**	172.32

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	82.6
53	60.9
37.5	43.1
26.5	39.9
22.4	37.8
19	36.6
16	35.8
13.2	34.0
9.5	32.2
6.7	30.8
4.75	28.1
2.36	24.0
1.18	21.2
0.6	18.9
0.3	9.9
0.15	5.8
0.075	4.6

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	71.9
% SAND (75 µm to 4.75 mm):	23.5
% SILT (2 µm to 75 µm):	4.6
% CLAY (<2 µm):	-

SOIL DESCRIPTION: Sandy Gravel, trace Silt

REMARKS

Approximately 10% Oversize

Figure: 1

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE AND HYDROMETER ANALYSIS REPORT
LS-602, 702 & 703/704

PROJECT NUMBER:	02206651.000	**PROJECT NAME:**	Township of Zorra Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	967	**SAMPLE ID:**	TP-2 / Sample 1	**SAMPLE DEPTH:**	1.2 to 5.5 m
SAMPLED BY:	Englobe	**DATE RECEIVED:**	February 22, 2023	**DATE COMPLETED:**	March 2, 2023

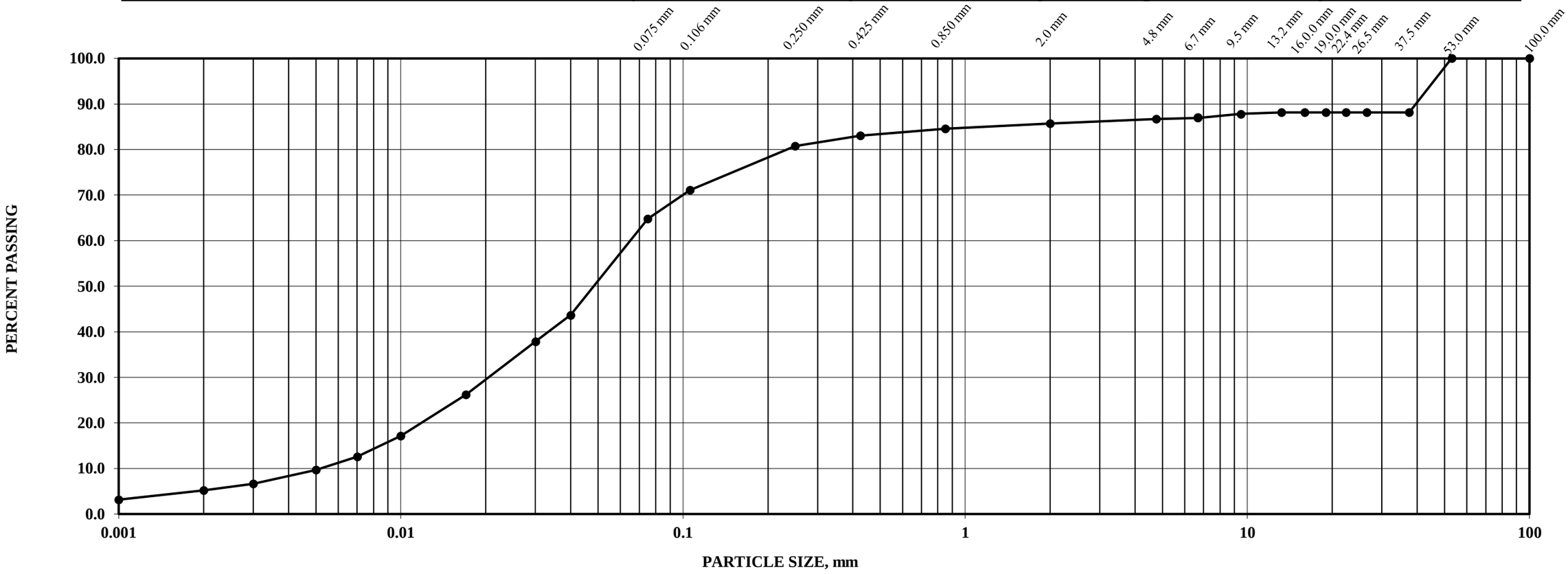
PARTICLE SIZE DISTRIBUTION, MTO LS-702

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS

D60	0.067	**D30**	0.021	**D10**	0.005	**Cc**	1.286	**Cu**	12.83

GRAIN SIZE ANALYSIS		HYDROMETER ANALYSIS	
SIEVE SIZE mm	**% PASSING**	**DIAMETER mm**	**% PASSING**
53	100.0	0.040	43.7
37.5	88.1	0.030	37.8
26.5	88.1	0.017	26.2
22.4	88.1	0.010	17.2
19	88.1	0.007	12.6
16	88.1	0.005	9.7
13.2	88.1	0.002	5.2
9.5	87.8	0.001	3.2
6.7	87.0	**ATTERBERG LIMITS**	
4.75	86.7		
2.00	85.7	Liquid Limit	
0.850	84.6		
0.425	83.0	Plastic Limit	
0.250	80.8		
0.106	71.1	Plastic Index	
0.075	64.8		

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	13.3
% SAND (75 µm to 4.75 mm):	21.9
% SILT (2 µm to 75 µm):	59.6
% CLAY (<2 µm):	5.2
SOIL DESCRIPTION:	Sandy SILT, some Gravel, trace Clay

REMARKS

Figure: 2

TESTED BY: YG — Laboratory Technician

REVIEWED BY David McBay, CET. — Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER: 02206651.000 **PROJECT NAME:** Township of Zorra Herrington **CLIENT:** Michael Wilhelm Excavating Ltd.

LAB NUMBER: 968 **SAMPLE ID:** TP- 3 / Sample-1 **SAMPLE DEPTH:** 3.0 to 5.2 m

SAMPLED BY: Ed VanPuymbroech, BSc **DATE RECEIVED:** January 23, 2023 **DATE COMPLETED:** February 2, 2023

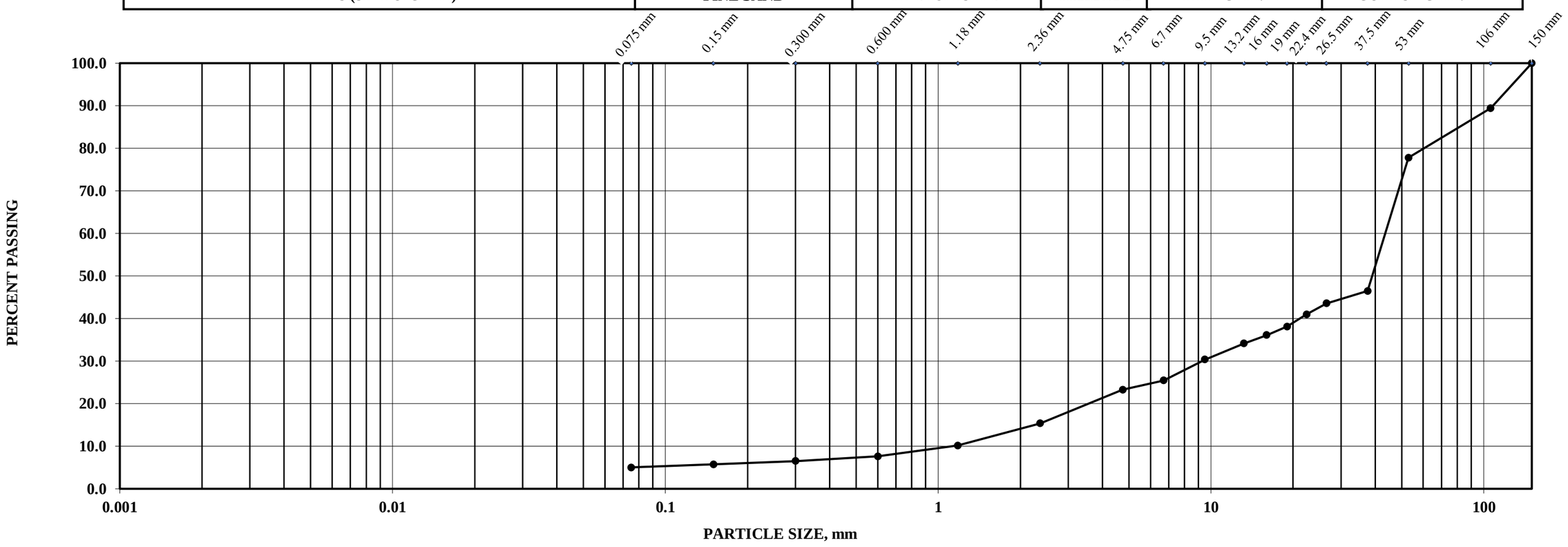
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS									
D60	44.177	**D30**	9.288	**D10**	1.147	**Cc**	1.702	**Cu**	38.51

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	89.4
53	77.8
37.5	46.5
26.5	43.6
22.4	41.0
19	38.1
16	36.1
13.2	34.2
9.5	30.4
6.7	25.5
4.75	23.3
2.36	15.4
1.18	10.1
0.6	7.6
0.3	6.5
0.15	5.8
0.075	5.0

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	76.7
% SAND (75 µm to 4.75 mm):	18.3
% SILT (2 µm to 75 µm):	5.0
% CLAY (<2 µm):	-

SOIL DESCRIPTION: GRAVEL, some Sand, trace Silt

REMARKS

Approximately 30% Oversize

Figure: 3

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

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GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER:	02206651.000	**PROJECT NAME:**	Township of Zora Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	969	**SAMPLE ID:**	TP 4 / Sample 1	**SAMPLE DEPTH:**	**0.6 to 5.8 m**
SAMPLED BY:	Ed VanPuymbroech, BSc	**DATE RECEIVED:**	January 23, 2023	**DATE COMPLETED:**	February 2, 2023

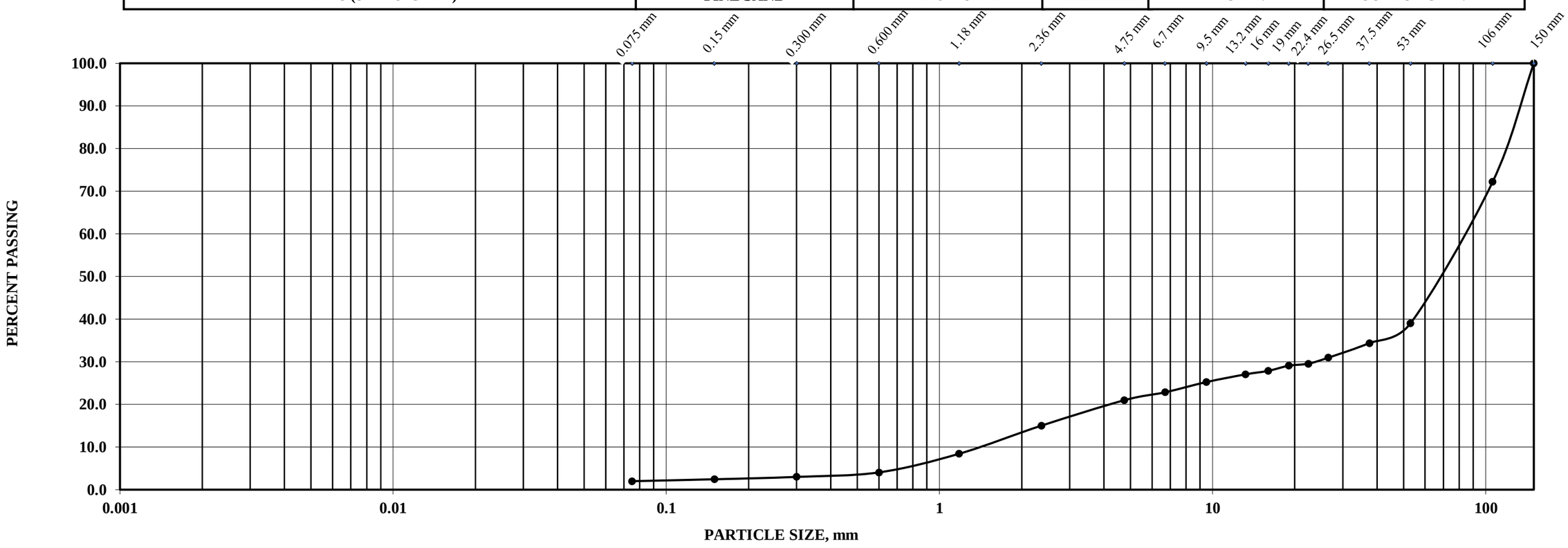
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS

D60	86.533	**D30**	23.715	**D10**	1.463	**Cc**	4.442	**Cu**	59.15

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	72.2
53	39.0
37.5	34.4
26.5	31.0
22.4	29.6
19	29.1
16	27.9
13.2	27.0
9.5	25.2
6.7	22.8
4.75	21.0
2.36	15.0
1.18	8.4
0.6	4.0
0.3	3.0
0.15	2.4
0.075	2.0

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	79.0
% SAND (75 µm to 4.75 mm):	19.0
% SILT (2 µm to 75 µm):	2.0
% CLAY (<2 µm):	-

SOIL DESCRIPTION:		GRAVEL, some Sand, trace Silt

REMARKS

Approximately 30% Oversize

Figure: 4

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER:	02206651.000	**PROJECT NAME:**	Township of Zora Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	970	**SAMPLE ID:**	TP 5 / Sample 1	**SAMPLE DEPTH:**	1.5 to 6.0 m
SAMPLED BY:	Ed VanPuymbroech, BSc	**DATE RECEIVED:**	January 23, 2023	**DATE COMPLETED:**	February 2, 2023

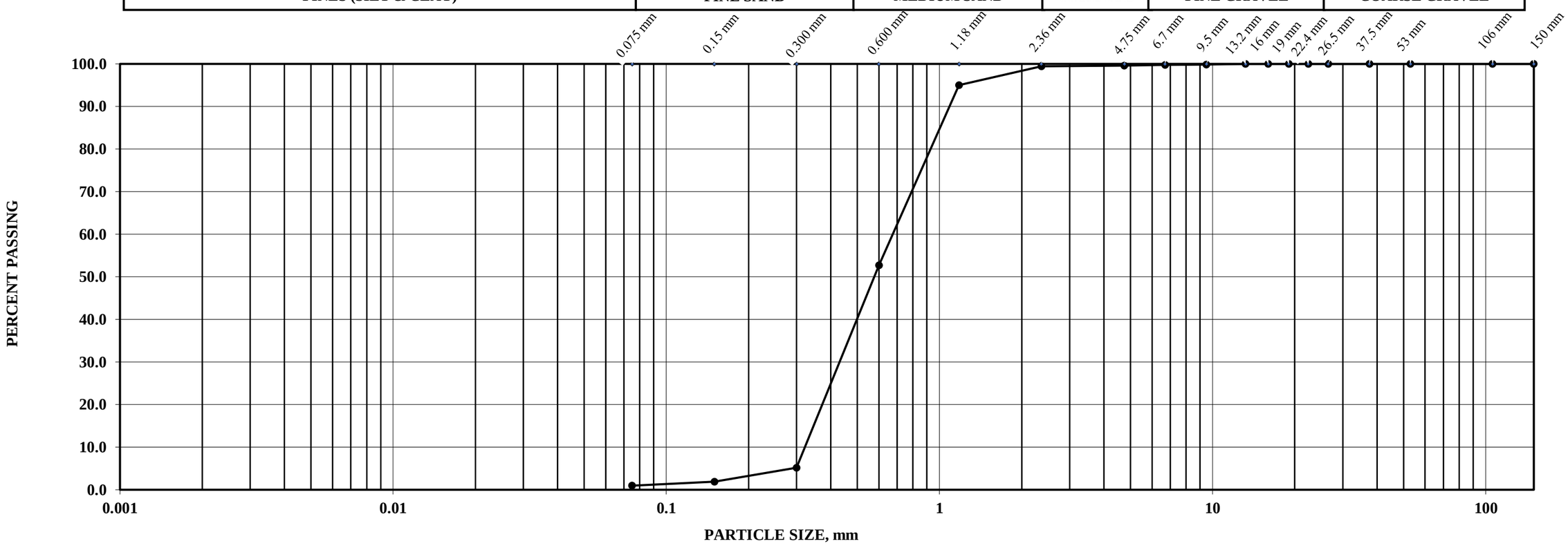
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS									
D60	0.700	**D30**	0.457	**D10**	0.331	**Cc**	0.901	**Cu**	2.12

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	100.0
53	100.0
37.5	100.0
26.5	100.0
22.4	100.0
19	100.0
16	100.0
13.2	100.0
9.5	99.8
6.7	99.8
4.75	99.6
2.36	99.5
1.18	95.0
0.6	52.7
0.3	5.1
0.15	1.9
0.075	1.0

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):	0.4	
% SAND (75 µm to 4.75 mm):	98.6	
% SILT (2 µm to 75 µm):	1.0	
% CLAY (<2 µm):	-	
SOIL DESCRIPTION:		SAND, trace Silt

REMARKS

Approximately 30% Oversize

Figure: 5

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER:	02206651	**PROJECT NAME:**	Township of Zora Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	971	**SAMPLE ID:**	TP -6 / Sample-2	**SAMPLE DEPTH:**	1.0 to 6.7 m
SAMPLED BY:	Ed VanPuymbroech, BSc	**DATE RECEIVED:**	January 23, 2023	**DATE COMPLETED:**	February 2, 2023

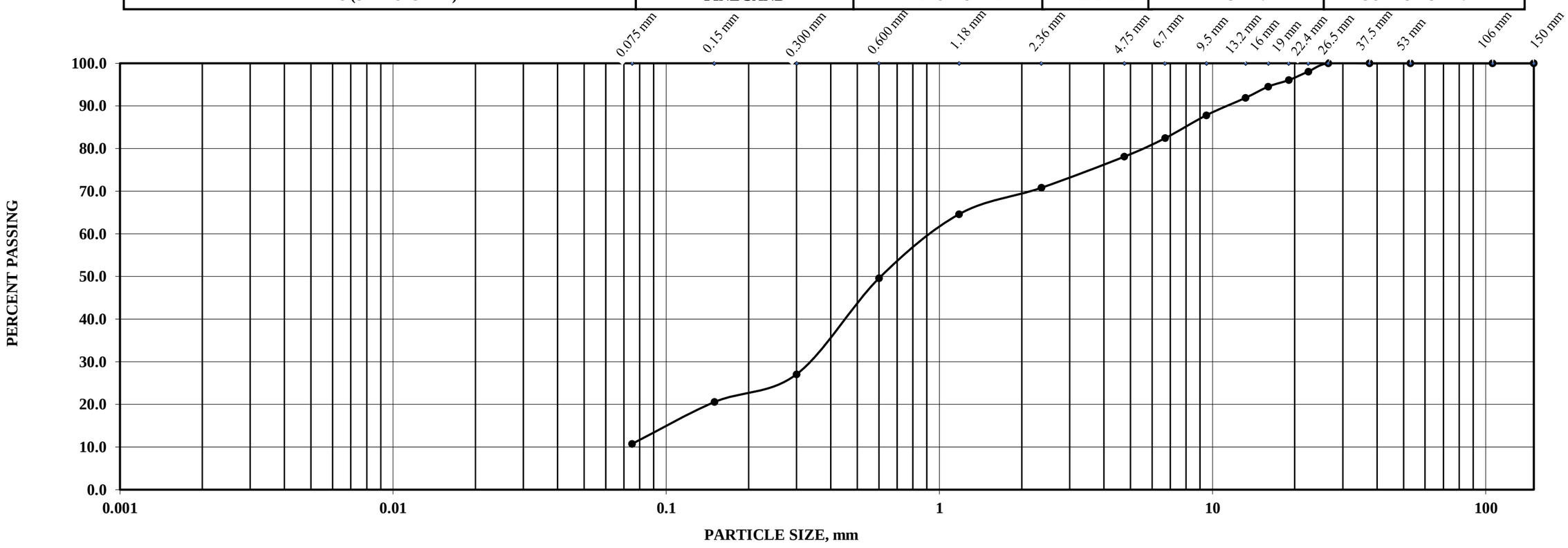
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS

D60	1.002	**D30**	0.339	**D10**		**Cc**		**Cu**	

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	100.0
53	100.0
37.5	100.0
26.5	100.0
22.4	98.1
19	96.1
16	94.5
13.2	91.9
9.5	87.8
6.7	82.4
4.75	78.1
2.36	70.8
1.18	64.6
0.6	49.6
0.3	27.1
0.15	20.5
0.075	10.8

GRAIN SIZE PROPORTIONS, %	
% GRAVEL (> 4.75 mm):	21.9
% SAND (75 µm to 4.75 mm):	67.3
% SILT (2 µm to 75 µm):	10.8
% CLAY (<2 µm):	-

SOIL DESCRIPTION:		Gravelly SAND, some Silt

REMARKS

Figure: 6

TESTED BY: Diego Augusto De Arruda
Laboratory Technician

REVIEWED BY David McBay, CET.
Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

GRAIN SIZE ANALYSIS REPORT
LS-602

PROJECT NUMBER:	02206651.000	**PROJECT NAME:**	Township of Zorra Herrington	**CLIENT:**	Michael Wilhelm Excavating Ltd.
LAB NUMBER:	972	**SAMPLE ID:**	TP - 7 / Sample-1	**SAMPLE DEPTH:**	1.0 to 6.4 m
SAMPLED BY:	Ed VanPuymbroech, BSc	**DATE RECEIVED:**	January 23, 2023	**DATE COMPLETED:**	February 2, 2023

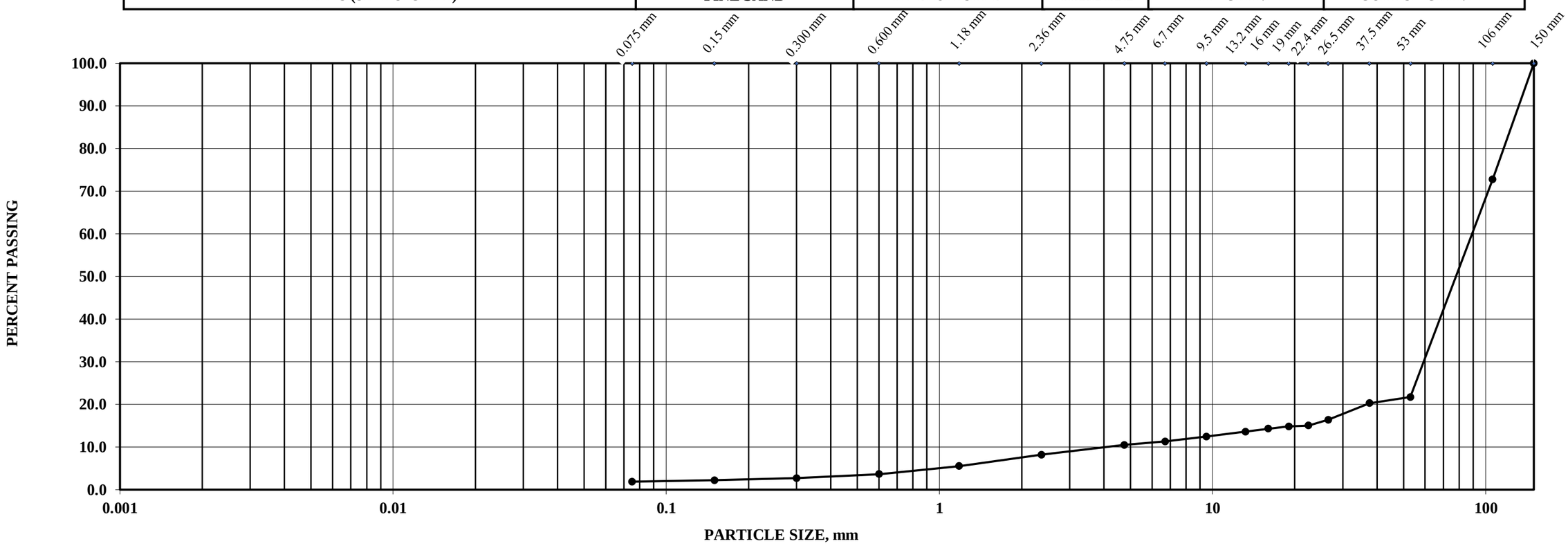
PARTICLE SIZE DISTRIBUTION, MTO LS-602

U.S. BUREAU OF SOILS CLASSIFICATION (AS USED IN MINISTRY OF TRANSPORTATION OF ONTARIO PAVEMENT DESIGNS)

CLAY	SILT	VERY FINE SAND	FINE SAND	MEDIUM	COARSE	FINE	GRAVEL

UNIFIED SOILS CLASSIFICATION ASTM D 2487

FINES (SILT & CLAY)	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	COARSE GRAVEL



COEFFICIENTS									
D60	92.745	**D30**	61.590	**D10**	4.238	**Cc**	9.650	**Cu**	21.88

GRAIN SIZE ANALYSIS	
SIEVE SIZE mm	**% PASSING**
150	100.0
106	72.8
53	21.7
37.5	20.3
26.5	16.4
22.4	15.0
19	14.8
16	14.3
13.2	13.6
9.5	12.5
6.7	11.3
4.75	10.5
2.36	8.2
1.18	5.5
0.6	3.6
0.3	2.7
0.15	2.2
0.075	1.9

GRAIN SIZE PROPORTIONS, %		
% GRAVEL (> 4.75 mm):	89.5	
% SAND (75 µm to 4.75 mm):	8.6	
% SILT (2 µm to 75 µm):	1.9	
% CLAY (<2 µm):	-	
SOIL DESCRIPTION:		GRAVEL, traces of Sand and Silt

REMARKS

Approximately 50% Oversize

Figure: 7

TESTED BY: Diego Augusto De Arruda, Laboratory Technician

REVIEWED BY David McBay, CET., Laboratory Supervisor

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of test results is provided only on written request.

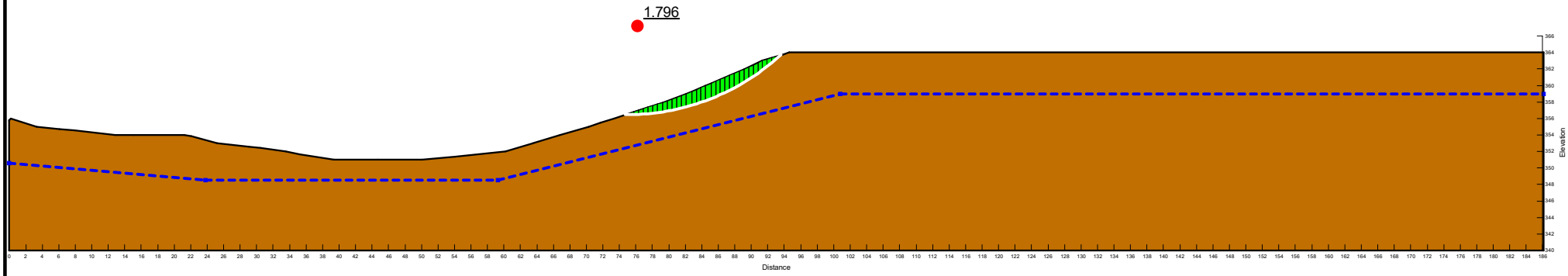
Appendix D
Site Photographs

ENGLOBE

Appendix E
Slope Stability Analyses

ENGLOBE

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34

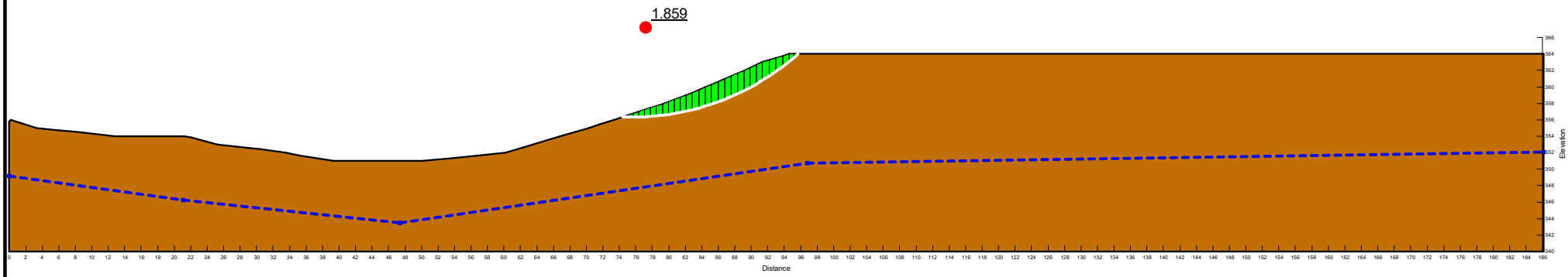


Existing Slope A-elevated water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:711

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34

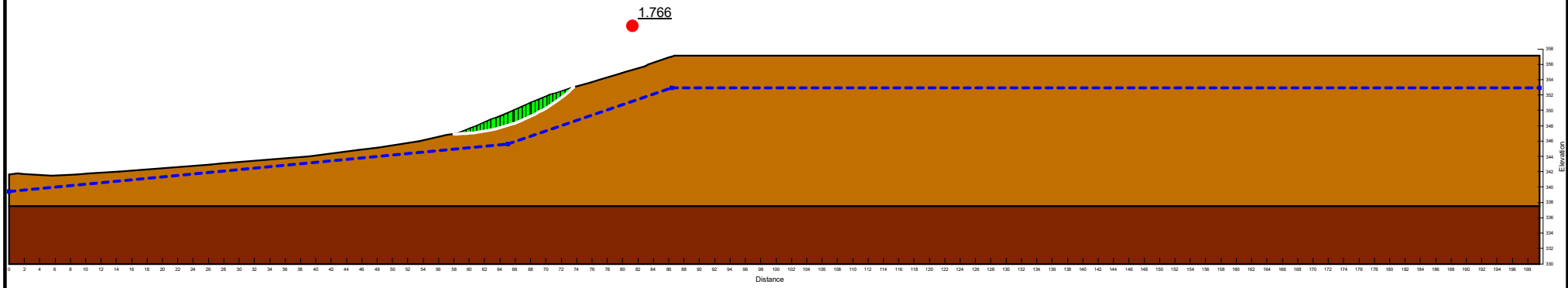


Existing Slope A-encountered water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:711

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34
	Silty Clay Till, hard	Mohr-Coulomb	18	5	34

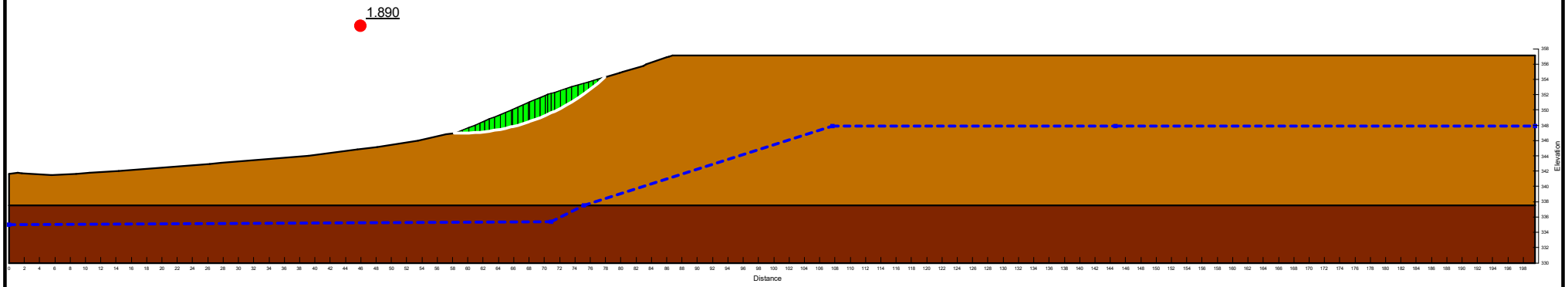


Existing Slope B-Elevated water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:763

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34
	Silty Clay Till, hard	Mohr-Coulomb	18	5	34

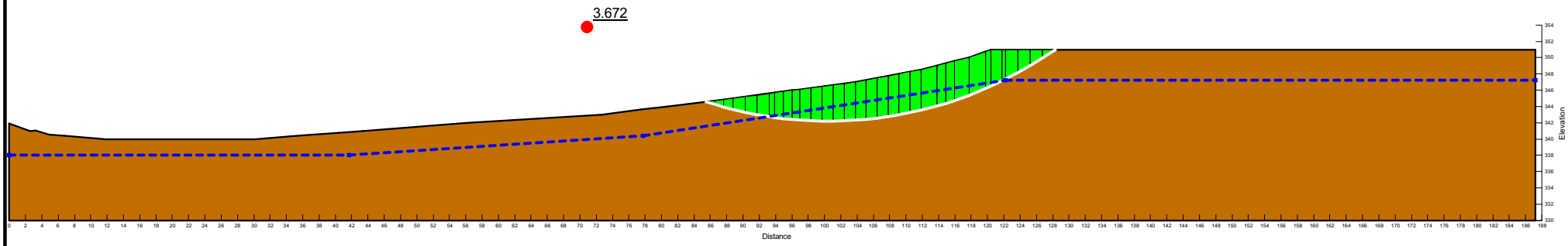


Existing Slope B-encountered water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:763

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34

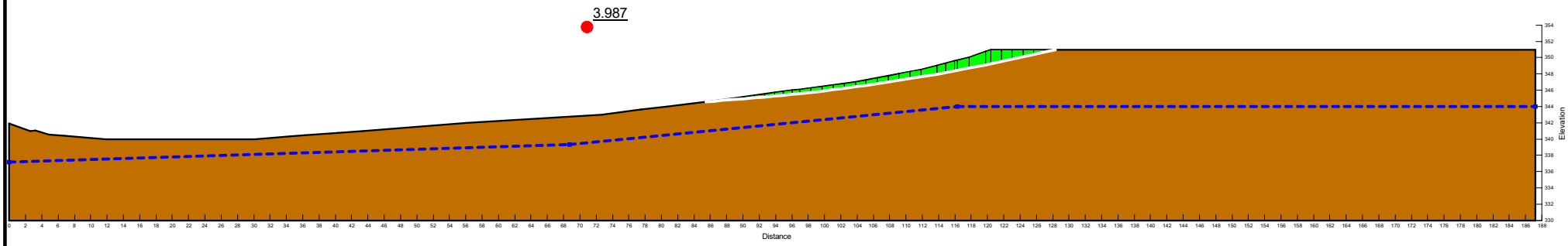


Existing Slope C-Elevated water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:719

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Sand and Gravel, very dense	Mohr-Coulomb	19	0	34



Existing Slope C-encountered water

02410737.000 - Slope Assessment, Wilhelm, 31st Line, Harrington, ON.gsz

11/20/2024 1:719

Appendix F
Slope Stability Rating Chart

ENGLOBE

TABLE I - SLOPE STABILITY RATING CHART - VALLEY SLOPE

Site Location:	316829 31st Line, Zorra Township, Ontario	File No. 02410737.000
Property Owner:	Harrington McAvan Ltd.	
Inspection Date:	November 25, 2024	
Inspected By:	Mike Arthur	

		Selected Slope Section(s) A-A'	B-B'	C-C'
1. SLOPE INCLINATION				
Degrees	Horizontal / Vertical			
a) 18 or less	3:1 or flatter	0	0	0 ✓
b) 18 - 26	2:1 to more than 3:1	6* ✓	6* ✓	6*
c) > 26	Steeper than 2:1	16	16	16
2. SOIL STRATIGRAPHY				
a) Shale Limestone, Granite (Bedrock)		0	0	0
b) Sand, Gravel		6 ✓	6 ✓	6 ✓
c) Glacial Till		9	9	9
d) Clay, Silt		12*	12*	12*
e) Fill		16	16	16
f) Leda clay		24	24	24
3. SEEPAGE FROM SLOPE FACE				
a) None or Near bottom only		0* ✓	0* ✓	0* ✓
b) Near mid-slope only		6	6	6
c) Near crest only or, From several levels		12	12	12
4. SLOPE HEIGHT				
a) 2 m or less		0	0	0
b) 2.1 to 5 m		2	2	2
c) 5.1 to 10m		8* ✓	8* ✓	8* ✓
5. VEGETATION COVER ON SLOPE FACE				
a) Well vegetated; heavy shrubs or forested with mature trees		0* ✓	0* ✓	0* ✓
b) Light vegetation; mostly grass, weeds, occasional trees		4	4	4
c) No vegetation, bare		8	8	8
6. TABLE LAND DRAINAGE				
a) Table land flat, no apparent drainage over slope		0*	0*	0*
b) Minor drainage over slope, no active erosion		2 ✓	2 ✓	2 ✓
c) Drainage over slope, active erosion, gullies		4	4	4
7. PROXIMITY OF WATERCOURSE AT SLOPE TOE				
a) 15 metres or more from slope toe		0* ✓	0* ✓	0* ✓
b) Less than 15 metres from slope toe		6	6	6
8. PREVIOUS LANDSLIDE ACTIVITY				
a) No		0* ✓	0* ✓	0* ✓
b) Yes		6	6	6
SLOPE STABILITY RATING VALUE				
INVESTIGATION RATING SUMMARY	**TOTAL**	**22**	**22**	**16**

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	Site inspection, boreholes, surveying, detailed report

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