THURBER ENGINEERING LTD.

# FOUNDATION INVESTIGATION AND DESIGN REPORT
# HIDDEN GLEN ROAD ACCELERATION LANE
# HIGHWAY 400 SOUTHBOUND LANES, DISTRICT OF MUSKOKA, ONTARIO
# ASSIGNMENT NO. 5019-E-0016
# G.W.P. 5191-18-00

**LATITUDE: 44.900886°, LONGITUDE: -79.769238°**

**GEOCRES No.: 31D13-001**

**Report**

to

**LEA Consulting Ltd.**

Date: April 3, 2024
File: 28317

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## PART 1: FACTUAL INFORMATION

### 1. INTRODUCTION

This section of the report presents the factual findings obtained from a field investigation completed to support the design of the embankment widening related to the proposed 650 m long acceleration lane on Highway 400 Southbound (SB) from Hidden Glen Road to 650 m southerly in the Township of Georgian Bay within the District of Muskoka, Ontario.

The purpose of the investigation was to explore the surface and shallow sub-surface conditions at the site, and based on the data obtained, to provide detailed inspection notes and a written description of the surface and subsurface conditions.

Thurber carried out the investigation as a sub-consultant to LEA Consulting Ltd. (LEA), under Ministry of Transportation Ontario (MTO) Agreement Number 5019-E-0016.

It is a condition of this report that Thurber's performance of its professional services is subject to the attached Statement of Limitations and Conditions.

### 2. SITE DESCRIPTION

The Highway 400 SB and Hidden Glen Rd. intersection is located 2.3 km south of the Crooked Bay Rd. interchange in Georgian Bay Township, Ontario. Hidden Glen Rd. extends westward from Highway 400 SB toward Georgian Bay. The existing intersection provides access to and from Highway 400 SB. Access from Hidden Glen Rd. to Highway 400 SB is controlled with a stop sign. A deceleration lane is located north of Hidden Glen Rd.

Highway 400 is a divided highway within the project limits. The existing SB highway is two lanes with an approximately 3 m wide paved shoulder on the west side and 1.5 m paved shoulder on the east side.

The base plan provided by LEA indicates the presence of a low-lying area west of the highway from Hidden Glen Rd. to approximately 50 m southerly and a swampy area located between Stations 22+450 and 22+300. Two box culverts cross under the SB lanes of the highway from the median ditch at approximate Stations 22+790 and 22+475. Most of the remaining areas along the proposed widening area consist of rock outcrops that are visible at the ground surface. Photographs of the Highway 400 SB and Hidden Glen Rd. intersection and the surrounding area are presented in Appendix B.

Based on the Ontario Geological Survey's Open File Map 194 titled "Quaternary Geology of the Penetanguishene and Christian Island Areas", dated 1992, the project area is located at the boundary of areas mapped as exposed Precambrian bedrock to very thin drift cover over Precambrian bedrock and swamp and organic deposits. Bedrock mapping indicates the local bedrock consists of igneous rock classified as monzogranite.

## 3. SITE INSPECTION AND FIELD TESTING

### 3.1 Current Investigation

The site inspection and field testing for this project was carried out between May 16th and 18th, 2023. The site inspection and field testing included the following components:

- Visual inspection of the entire widening area including taking site photographs and preparing site sketches.
- Manual probing of accessible areas within the widening footprint using a metal rod.
- Completion of Dynamic Cone Penetration Tests (DCPT) using a miniature, portable DCPT unit in areas where manual probing did not reach refusal.

Field sketches including the approximate locations of the DCPTs, a table of the manual probing findings and DCPT logs are attached in Appendix A. Site photographs are attached in Appendix B. A probe hole and DCPT location plan is attached in Appendix D.

### 3.2 Pavement Investigation

The pavement investigation carried out as part of this overall assignment included boreholes for the Hidden Glen Road Acceleration Lane. The pavement boreholes were advanced through the embankment and west of the embankment in ditch. Relevant borehole logs are reproduced in Appendix C of this report. A full description of the pavement investigations and full results can be found in the pavement design report referenced below:

- "Pavement Design Report, Rehabilitation of Highway 400 and 10 Bridge Structures, G.W.P. 5191-18-00, Northeastern Region, Port Severn, Ontario, Agreement Number 5019-E-0016", dated May 19, 2023.

## 4. DESCRIPTION OF FIELD INVESTIGATION RESULTS

The project area has been split into six areas based on the results of the investigation. The following subsections summarize the results of the investigations in each of these six areas.

### 4.1 Area #1 (Station 22+200 to Station 22+370)

Area #1 extends from the south end of the widening area north to the swamp.

Manual probing with a steel rod was carried out at approximately 10 m intervals along the ditch and 5 m west of the ditch. Results of the probing are included in Table A1 in Appendix A. The depth to refusal varied from 0 mm to approximately 750 mm. Between Stations 22+265 to 22+300 bedrock was often exposed at the ground surface.

### 4.2 Area #2 (Station 22+370 to 22+420)

The area between Station 22+370 and 22+420 west of the embankment was noted as a swamp with standing water. The area could not be accessed at the time of the current investigation due to standing water and safety concerns with working in the water.

Three boreholes were attempted/advanced as part of the pavement investigation at the west toe of the embankment/ditch line within the station limits. Two of the three boreholes noted 600 mm of surface water and the third borehole noted 600 mm of peat. This third borehole met refusal below the peat at a depth of 600 mm.

### 4.3 Area #3 – (Station 22+420 to 22+480)

Area #3 extends from the north edge of the inaccessible area of the swamp near Station 22+420 north to approximately Station 22+480 where bedrock was noted at the ground surface or below a thin layer of topsoil. It includes the west end of a 1.25 m square concrete box culvert. The south end of this area was noted to be wet, and the vegetation was consistent with swampy terrain.

This area was investigated by advancing five DCPTs (DCPT-01 to DCPT-05). The results of the DCPTs are included in Appendix A. Refusal in the DCTPs was encountered at depths ranging from 0.7 m to 1.1 m below ground surface on assumed bedrock. N-values ranged from 0 to 3 (excluding the refusal values at the bottom of each DCPT) indicating a very loose/very soft relative density/consistency.

As part of the pavement investigation three boreholes were advanced in the ditch west of the embankment. The boreholes encountered 100 mm to 800 mm of peat/topsoil at the ground surface. Refusal on presumed bedrock/cobbles and boulders was noted in all boreholes below the peat/topsoil.

### 4.4 Area #4 (Station 22+480 to 22+770)

During the current investigation it was noted that bedrock was exposed at the ground surface or was below a thin layer of topsoil/soil within this area. Additional investigation was not carried out during the current investigation.

As part of the pavement investigation, 15 boreholes were advanced in the ditch along the west side of the embankment. The boreholes encountered up to 300 mm of topsoil at the ground surface. Below the topsoil all the boreholes encountered refusal.

### 4.5 Area #5 (Station 22+770 to 22+795)

This area extends north from the north end of bedrock outcrop / shallow bedrock which characterized Area #4 to another area of exposed / shallow bedrock. The west end of a second 1.25 m square concrete box culvert is located within this area.

During the current investigation, this area was investigated by carrying out five DCPTs (DCPT-06 to DCPT-10). The DCPTs were located 3 m to approximately 12 m west of the toe of the embankment slope as shown on the sketch in Appendix A. Refusal was encountered at depths ranging from 0.6 m to 3.4 m below the ground surface. The depth to refusal was greatest near the end of the box culvert and decreased to the north, south and west. N-values ranged from 0 to

83 (typically 8 to 30) in the upper 1.2 m and from 1 to 15 (typically 2 to 4) below 1.2 m (excluding the refusal values at the bottom of each DCPT) indicating a compact/stiff to very stiff relative density/consistency in the upper 1.2 m and a very loose/soft relative density/consistency below 1.2m, respectively.

### 4.6 Area #6 (Station 22+795 to 22+850)

This area extends from the low area near the end of the culvert to Hidden Glen Road at Station 22+850. Based on observations made during the current investigation, within this area the bedrock was exposed at ground surface or below a thin layer of topsoil.

As part of the pavement investigation, two boreholes were advanced in the ditch west of the current embankment. The boreholes encountered 225 mm to 250 mm of topsoil at the ground surface. Both boreholes encountered refusal below the topsoil.

### 4.7 Pavement Structure and Embankment

The scope of the current investigation did not include any investigation of the existing pavement structure or embankment materials.

As part of the pavement investigation a total of 11 boreholes were advanced through the southbound lanes and an additional 10 boreholes were advanced through either the inside or outside shoulder of the southbound lanes.

The boreholes drilled through the travelled lanes encountered 175 mm to 235 mm of asphalt overlying approximately 0.5 m to 1.2 m of granular fill. In all 11 boreholes refusal was encountered at the bottom of the granular fill layer on assumed rockfill.

The boreholes drilled through the shoulders encountered 80 mm to 110 mm of asphalt overlying approximately 0.5 m to 1.1 m of granular fill. In all ten boreholes drilled through the west shoulders refusal was encountered at the bottom of the granular fill layer on assumed rockfill.

## 5. MISCELLANEOUS

The report was prepared by Mr. Scott Gittens, E.I.T. and Mr. Rod de Castro, P.Eng., and reviewed by Mr. Matthew Boucher, P.Eng. and Mr. Jason Lee, P.Eng., a Designated Contact for MTO Foundations Projects.

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## PART 2: ENGINEERING DISCUSSION AND RECOMMENDATIONS

### 6. GENERAL

This report presents interpretation of the geotechnical data in the factual report and provides foundation recommendations for the design and construction of the proposed embankment widening to accommodate a new acceleration lane and the associated culvert extension.

Our understanding of the existing embankment profile and the proposed widening details are based on the following drawings provided by LEA:

- Archival plan and profiles prepared by Totten Sims and Hubicki Associates from Station 22+700 to 23+400 for Contract No. 93-95, WP No. 214-89-00.
- Preliminary design plan and section drawings prepared by LEA for the current contract.

The proposed acceleration lane will extend south from the existing intersection with Hidden Glen Road (Station 22+850) for a distance of approximately 650 m to Station 22+200 and will be approximately 3.5 m wide, with a 2.5 m shoulder. The embankment carrying the southbound lanes will be widened by approximately 2.5 m to accommodate the new acceleration lane. No alignment or profile changes are planned.

A 1.25 m square concrete box culvert at Station 22+475 will be extended by approximately 4 m to accommodate the widened embankment. A second culvert near Station 22+790 will not be extended.

Area #4 (Station 22+480 to 22+770) and Area #6 (22+795 to 22+850) were noted to have exposed bedrock or a very thin layer of topsoil over bedrock and are not discussed further in the sections below.

During a call with LEA and the MTO Foundations Representative on June 20, 2023, the results of the current field investigation were provided. The inability to probe / carry out DCPTs in the wet/swampy in Area #2 (Station 22+370 to 22+420) and the depth of soft/loose material in Area #5 (Station 22+770 to 22+795) near the end of the culvert at Station 22+790 were highlighted. Additional investigation techniques such as boreholes and/or test pits with an excavator were discussed. It was collectively decided that the information from the current investigation was sufficient for current design purposes and that additional investigation was not warranted.

This foundation investigation and design report with the interpretation and recommendations is intended for the use of LEA and the Ministry of Transportation, and shall not be used or relied upon for any other purposes or by any other parties including the construction or design-build contractor. The contractors must make their own interpretations based on the factual data in Part 1 of the report. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project. Contractors must make their own interpretation of the factual information provided as it may affect equipment selection, proposed construction methods and scheduling.

The stability of the proposed embankment widening has been analyzed in the critical area where the embankment is highest and is discussed below. Design and construction considerations for the embankment widening and the culvert extension are also discussed.

The discussion and recommendations presented below are based on the information provided by LEA and factual geotechnical data obtained and observations made during the investigation by Thurber.

## 7. ENGINEERING ANALYSIS

### 7.1 General

The surface and subsurface conditions in the proposed embankment widening area were investigated as described in Part 1 of this report. Stability analyses were carried at the critical embankment section.

For the purposes of carrying out the analyses and preparing foundation recommendations, a number of assumptions have been made that are consistent with MTO’s standard highway practices. These assumptions include the following:

- With exception of Area #5, all peat, topsoil, organic deposits, and other deleterious material will be stripped prior to widening the embankment (OPSS.PROV 206).
- All embankment widening will be constructed with rock fill.
- Embankments will be constructed with side slopes not steeper than 1.5H:1H for rock fill and 2H:1V for granular fill.
- The extended culvert will be constructed along a similar alignment, with a similar size and invert elevation as the existing culvert.
- The existing embankment is constructed with rock fill.

### 7.2 Stability Analyses

Slope stability analyses were conducted using Limit equilibrium analyses using a commercially available computer program SLOPE/W, developed by GEO-SLOPE International Ltd. Due to the limited investigation, assumptions were made with regards to the soil stratigraphy, the soil type and the soil properties for the purposes of carrying out the slope stability analyses. The analyses were carried out at Station 22+790, at the location of the of the existing culvert. This location was selected for analysis as the embankment is highest and the depth to refusal encountered during the investigation was the greatest.

Soil parameters for the slope stability model were developed by back analysis assuming a factor of safety in the range of 1.3 to 1.4 for the current embankment/slope configuration. The resulting back calculated parameters were then used in slope stability analyses for the proposed embankment widening.

Based on the assumed soil stratigraphy and back calculated parameters, slope stability analyses were carried out for the embankment widening using rock fill overlain by granular fill of the pavement structure.

The results of the analyses are presented graphically on Figures 1 to 3 in Appendix D and summarized in the following table:

| Case | Factor of Safety | Figure |
|---|---|---|
| Existing Embankment – Used to back calculate soil parameters | 1.34 | 1 |
| Widened Embankment with Berm – Drained parameters, short term scenario with generation of excess pore pressure due to new load from embankment widening | 1.25 | 2 |
| Widened Embankment with Berm – Drained parameters, long term scenario after excess pore pressure has dissipated. | 1.60 | 3 |

Analyses were run using drained parameters both in the short term condition with excess pore water pressure caused by the load of the widened embankment and in the long term condition once excess pore water pressure has dissipated. In order to achieve an acceptable overall factor of safety of approximately 1.25 with excess pore pressure due to the embankment widening a berm 3.5 m wide is required. The top of the berm should be at approximately Elevation 203 m. Once the berm is constructed, the embankment above can be widened using rockfill. The slope of the berm and slope of the embankment above the berm must be no steeper than 1.5H:1V. The berm should extend for the entire length of Area #5 where the base elevation of the embankment extends below Elevation 203 m (where the embankment is higher than 5m).

The analysis shows that an acceptable factor of safety of greater than 1.5 is achieved for the long term scenario (drained parameter, after excess pore pressure has dissipated).

At the end of the culvert at Station 22+790 a ‘notch’ can be left in the rockfill widened embankment / berm to avoid blocking water flow to the culvert. The side slopes of the berm sloping down towards the culvert/watercourse (‘notch’) should be constructed no steeper than 1.5H:1V.

To avoid the need to extend the culvert at Station 22+790, the widened embankment slope directly above the culvert (i.e. perpendicular to the culvert alignment) can be construction slightly steeper than 1.5H:1V but not steeper than 1.25H:1V.

In all other Areas where the embankment is understood to be less than 5 m in height, a berm is not required.

## 8. DESIGN AND CONSTRUCTION CONSIDERATIONS

### 8.1 Embankment Widening

Widened embankments are anticipated to be constructed with rock fill. Embankment widening construction should be carried out in accordance with OPSS.PROV 206. Rock size should be controlled in accordance with OPSS.PROV 206.

Topsoil and/or organic soils encountered with the embankment widening footprint should be stripped and grubbed in accordance with OPSS.PROV 201 and OPSS.PROV 206. The estimated depth of stripping based on the results of the investigation is as listed below:

- Area #1 (22+200 to 22+370): Depth of stripping is estimated to vary between 0 m and 0.75 m.
- Area #2 (22+370 to 22+420): This is area is treated as a swamp and recommendations/discussion are provided below.
- Area #3 (22+420 to 22+480): Depth of stripping is estimated to vary between 0.7 m and 1.1 m.
- Area #5 (22+770 to 22+795): Stripping is not required. A berm is recommended as discussed above in Section 7.2.

Surface drainage and sump pumps are considered appropriate for unwatering where required outside of the swamp areas.

Rock fill placed above the water table should be constructed in a controlled manner (not end dumped) including blading, dozing and chinking of the rock to minimize voids and bridging. Rock fill must be compacted as per OPSS.PROV 206. Rock fill used to backfill sub-excavated areas below the water table may be placed by end dumping.

At the pavement subgrade level or where granular fill is to be placed over rock fill, the rock fill subgrade must be blinded with spall material and rock fill chinking should be in accordance with OPSS.PROV 206. All granular fill must be compacted as per OPSS.PROV 501.

Construction of embankment widening over swamps (Area #2 (Station 22+370 to 22+420)) should be carried out in accordance with OPSS.PROV 209, with specific reference to OPSD 203.030. The OPSD shows a variable temporary slope at the edge of the excavation. An initial assumption of this slope could be approximately 1H:1V; however, some areas may need to be flatter due to the weak nature of the peat.

In order to reduce the potential for post-construction settlements, it is recommended that a waiting period of approximately 2 months be implemented between completion of embankment widening and highway paving.

### 8.2 Culvert Extension

Based on information provided by LEA the culvert near Station 22+475 will be extended by approximately 4 m and the extension will consist of 1.25 m x 1.25 m concrete precast box culvert.

The DCPT advanced nearest the west end of the existing culvert (DCPT-04) encountered refusal at a depth of 0.9 m below ground surface. Blow counts above refusal at 0.9 m depth ranged from 0 to 7 indicating a very soft to firm / very loose to loose consistency / relative density.

All loose, soft, organic, or deleterious materials within the culvert extension footprint should be removed. Based on the results of the DCPT it should be assumed that the material will need to be sub-excavated to a depth of approximately 0.9 m below ground surface. The limits of the area of sub-excavation in plan should extend 0.3 m beyond each side of the extension (north and south) and 0.3 m beyond the end of the culvert (west). Care should be taken to avoid undermining the existing culvert.

The existing soils within the culvert extension footprint are classified as Type 4 soils as per OSHA requirements. Type 4 soils can be excavated with sides slopes of 3H:1V or flatter.

Surface water control and effective unwatering will be required to maintain a dry excavation for subgrade and bedding preparation.

The sub-excavated area should then be backfilled with granular material meeting OPSS.PROV 1010 Granular A or Granular B Type II requirements and compacted as per OPSS.PROV 501.

As the end of culvert is located just north of the swamp, dewatering may not be practical and construction in the wet may be necessary. In this case the granular material should be replaced with 19 mm clear stone below the water level.

Excavation, bedding, backfilling and compaction for the culvert extension must be carried out in accordance with OPSS.PROV 902 and OPSD 803.010. Surface water control and unwatering is the responsibility of the contractor.

Culvert backfill should consist of free-draining, non-frost susceptible rock fill or granular material. All fills should be placed in regular lifts and be compacted in accordance with OPSS.PROV 501 for granular and OPSS.PROV 206 for rock fill. The backfill should be placed and compacted in simultaneous lifts on both sides of the culvert at all times. Heavy compaction equipment should not be used adjacent to the walls and the roof of the culvert.

## 9. SCOUR AND EROSION PROTECTION

Erosion protection should be provided at the end of the culverts. Design of the erosion protection measures should consider hydrologic and hydraulic factors and should be carried out by specialists experienced in this field in accordance with OPSD 810.010, OPSS.PROV 511 and OPSS.PROV 1004.

Typically, rock protection should be provided over all surfaces with which water is likely to be in contact.

## 10. CONSTRUCTION CONCERNS

During construction, qualified geotechnical staff should be retained to observe activities related to subgrade preparation of embankment widening and culvert construction and advise the Contract Administrator on construction concerns or issues related to embankment stability or settlement.

Potential construction concerns include, but are not necessarily limited to:

- Bedrock depth at test locations were inferred, no rock coring or open excavations to expose the bedrock were performed. Bedrock may vary from the inferred depths, and may vary between test locations.

- The presence of topsoil and organic deposits were limited to manual probing, DCPTs and visual observations at surface. Thickness of topsoil and organic deposits may vary between and beyond the test locations..

- Contractor must be alerted to the presence of swamp conditions which were observed between Station 22+370 and 22+420. Control of groundwater seepage and surface drainage during construction is the responsibility of the Contractor.

- There is a risk of settlement especially near the culvert at Station 22+790 where the berm is specified. We recommend a waiting period of approximately 2 months after completion

of rockfill placement for embankment widening and prior to paving. If any settlement of the existing pavement is noted in any area due to construction of the widening, maintenance measures such as placement of asphalt overlay may be required to compensate for the settlement.

## 11. CLOSURE

Engineering analysis and preparation of the foundation design report were carried out by Mr. Rod de Castro, P.Eng and Mr. Matthew Boucher, P.Eng. The report was reviewed by Mr. Jason Lee, P.Eng., a Designated Contact for MTO Foundations Projects.

Thurber Engineering Ltd.


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# STATEMENT OF LIMITATIONS AND CONDITIONS

## 1. STANDARD OF CARE

This Report has been prepared in accordance with generally accepted engineering or environmental consulting practices in the applicable jurisdiction. No other warranty, expressed or implied, is intended or made.

## 2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report, which is of a summary nature and is not intended to stand alone without reference to the instructions given to Thurber by the Client, communications between Thurber and the Client, and any other reports, proposals or documents prepared by Thurber for the Client relative to the specific site described herein, all of which together constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. THURBER IS NOT RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

## 3. BASIS OF REPORT

The Report has been prepared for the specific site, development, design objectives and purposes that were described to Thurber by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the Report, subject to the limitations provided herein, are only valid to the extent that the Report expressly addresses proposed development, design objectives and purposes, and then only to the extent that there has been no material alteration to or variation from any of the said descriptions provided to Thurber, unless Thurber is specifically requested by the Client to review and revise the Report in light of such alteration or variation.

## 4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming part of the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT THURBER'S WRITTEN CONSENT AND SUCH USE SHALL BE ON SUCH TERMS AND CONDITIONS AS THURBER MAY EXPRESSLY APPROVE. Ownership in and copyright for the contents of the Report belong to Thurber. Any use which a third party makes of the Report, is the sole responsibility of such third party. Thurber accepts no responsibility whatsoever for damages suffered by any third party resulting from use of the Report without Thurber's express written permission.

## 5. INTERPRETATION OF THE REPORT

a) Nature and Exactness of Soil and Contaminant Description: Classification and identification of soils, rocks, geological units, contaminant materials and quantities have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature. Comprehensive sampling and testing programs implemented with the appropriate equipment by experienced personnel may fail to locate some conditions. All investigations utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarizing such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and the Client and all other persons making use of such documents or records with our express written consent should be aware of this risk and the Report is delivered subject to the express condition that such risk is accepted by the Client and such other persons. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. If special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.

b) Reliance on Provided Information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to Thurber. Thurber has relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, Thurber does not accept responsibility for any deficiency, misstatement or inaccuracy contained in the Report as a result of misstatements, omissions, misrepresentations, or fraudulent acts of the Client or other persons providing information relied on by Thurber. Thurber is entitled to rely on such representations, information and instructions and is not required to carry out investigations to determine the truth or accuracy of such representations, information and instructions.

c) Design Services: The Report may form part of design and construction documents for information purposes even though it may have been issued prior to final design being completed. Thurber should be retained to review final design, project plans and related documents prior to construction to confirm that they are consistent with the intent of the Report. Any differences that may exist between the Report's recommendations and the final design detailed in the contract documents should be reported to Thurber immediately so that Thurber can address potential conflicts.

d) Construction Services: During construction Thurber should be retained to provide field reviews. Field reviews consist of performing sufficient and timely observations of encountered conditions in order to confirm and document that the site conditions do not materially differ from those interpreted conditions considered in the preparation of the report. Adequate field reviews are necessary for Thurber to provide letters of assurance, in accordance with the requirements of many regulatory authorities.

## 6. RELEASE OF POLLUTANTS OR HAZARDOUS SUBSTANCES

Geotechnical engineering and environmental consulting projects often have the potential to encounter pollutants or hazardous substances and the potential to cause the escape, release or dispersal of those substances. Thurber shall have no liability to the Client under any circumstances, for the escape, release or dispersal of pollutants or hazardous substances, unless such pollutants or hazardous substances have been specifically and accurately identified to Thurber by the Client prior to the commencement of Thurber's professional services.

## 7. INDEPENDENT JUDGEMENTS OF CLIENT

The information, interpretations and conclusions in the Report are based on Thurber's interpretation of conditions revealed through limited investigation conducted within a defined scope of services. Thurber does not accept responsibility for independent conclusions, interpretations, interpolations and/or decisions of the Client, or others who may come into possession of the Report, or any part thereof, which may be based on information contained in the Report. This restriction of liability includes but is not limited to decisions made to develop, purchase or sell land.

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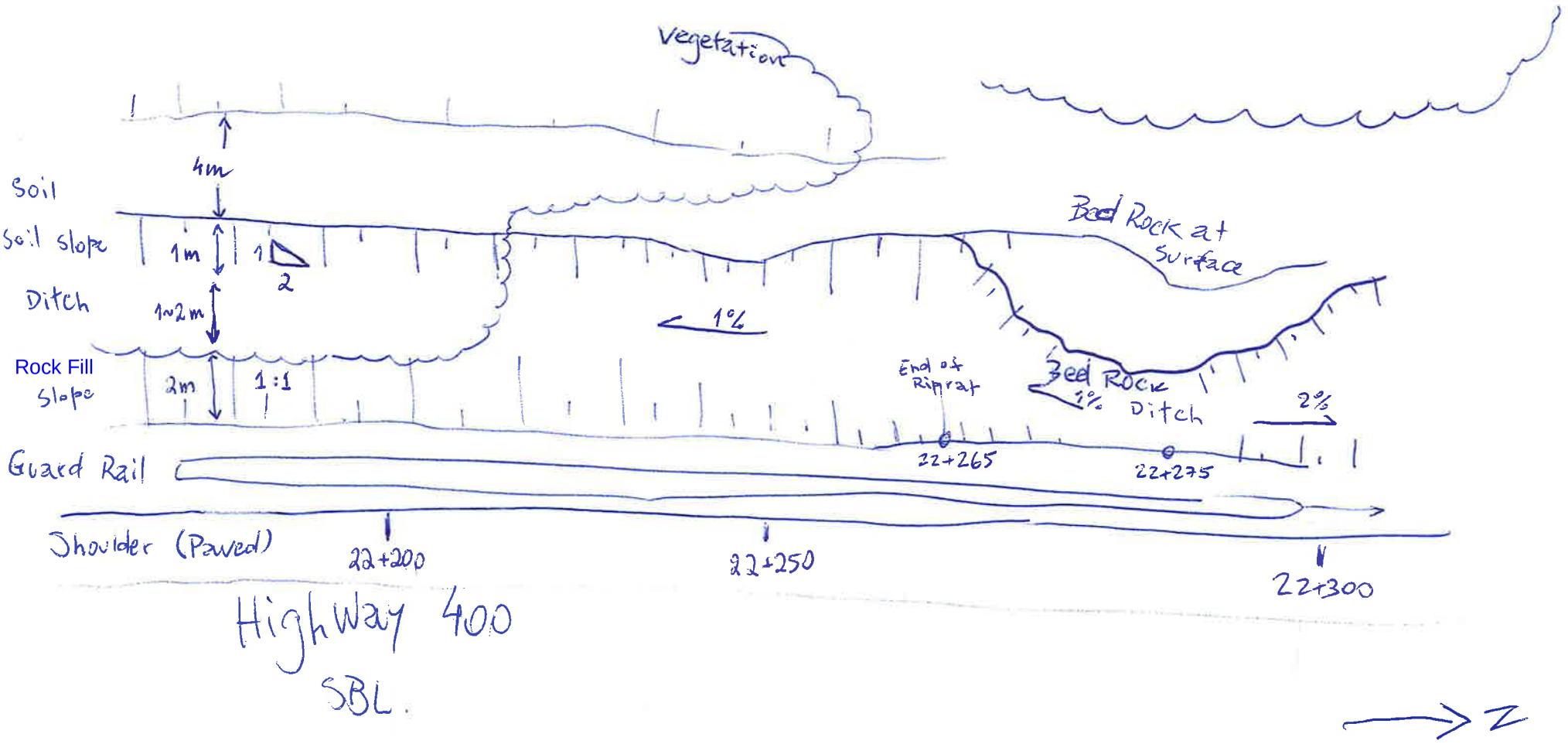
# Appendix A

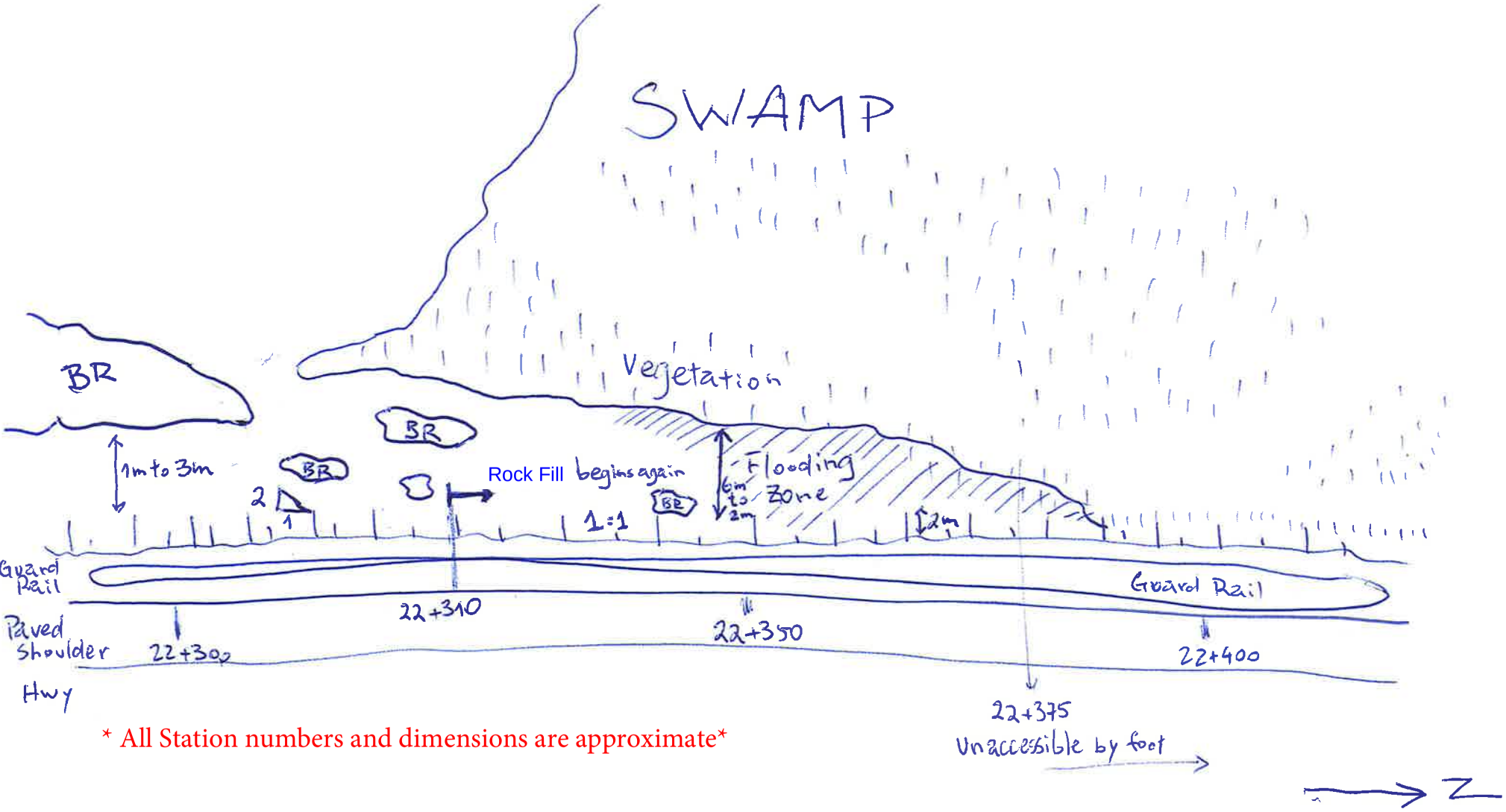
## Field Sketches, Dynamic Cone Penetration and Manual Probing Results

Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Field Sketch, Station 22+200 to 22+300




* All Station numbers and dimensions are approximate*

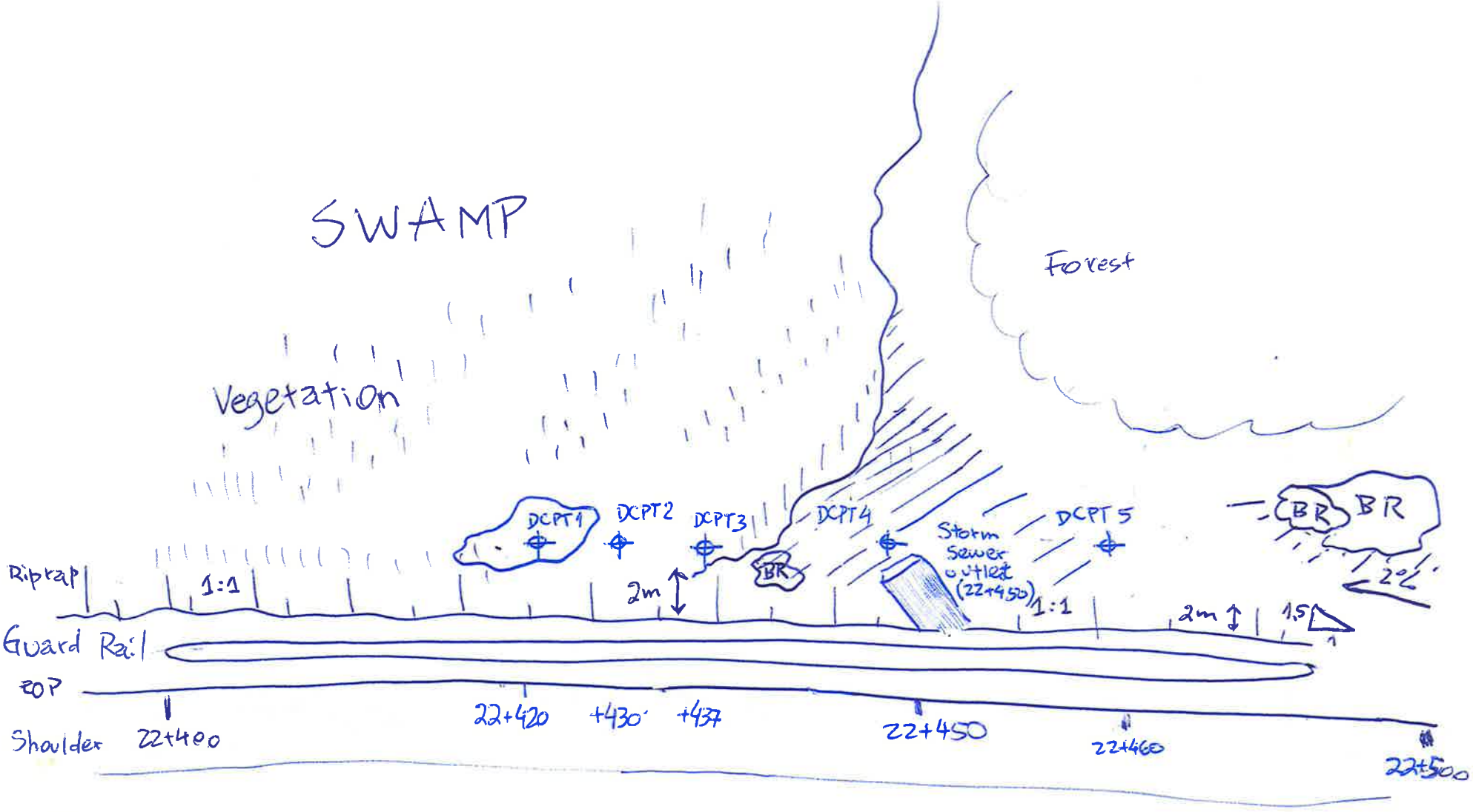
Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Field Sketch, Station 22+300 to 22+400




* All Station numbers and dimensions are approximate*

(13)

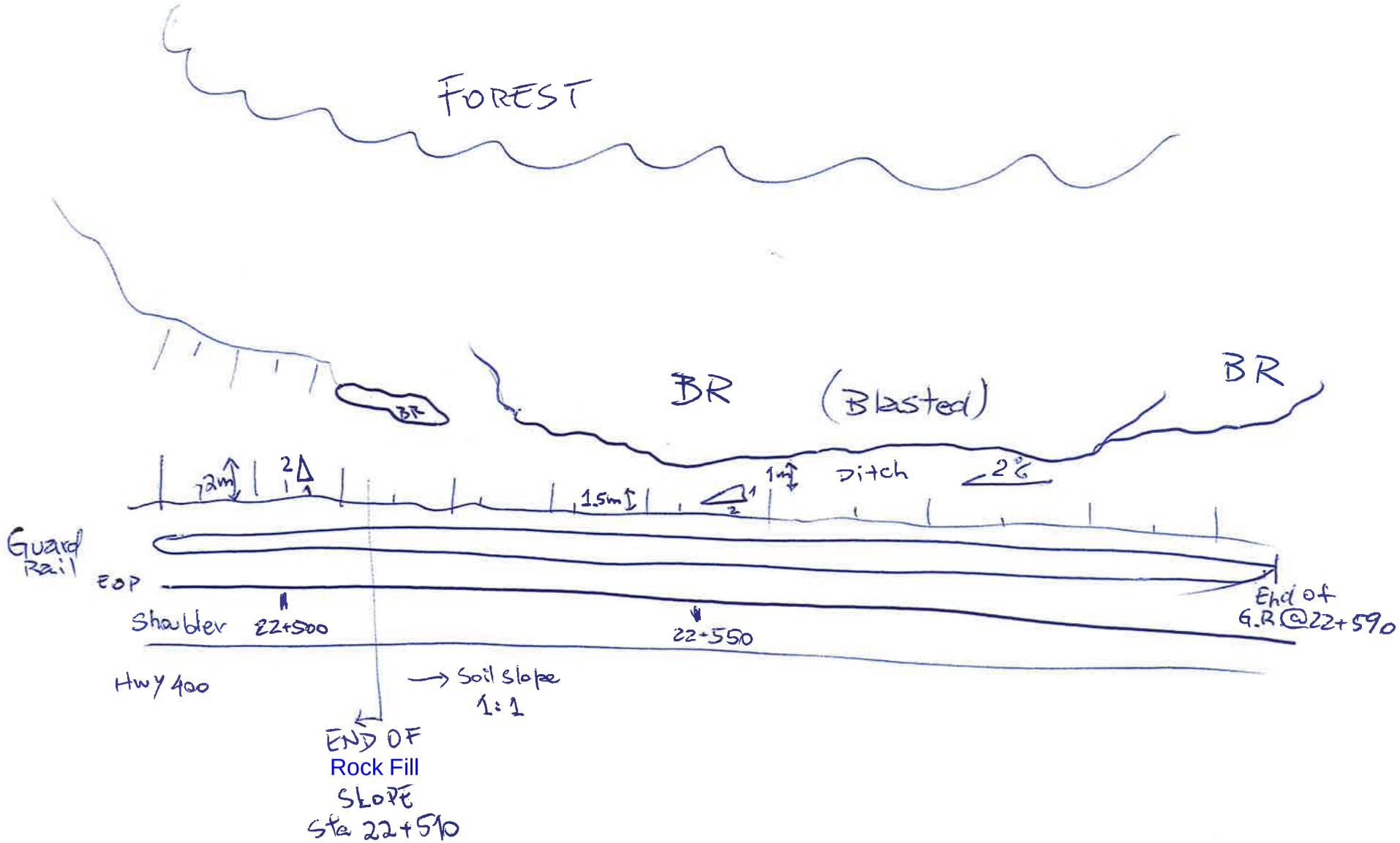
# Hidden Glen Acceleration Lane
## Highway 400, District of Muskoka
## Field Sketch, Station 22+400 to 22+500




* All Station numbers and dimensions are approximate*

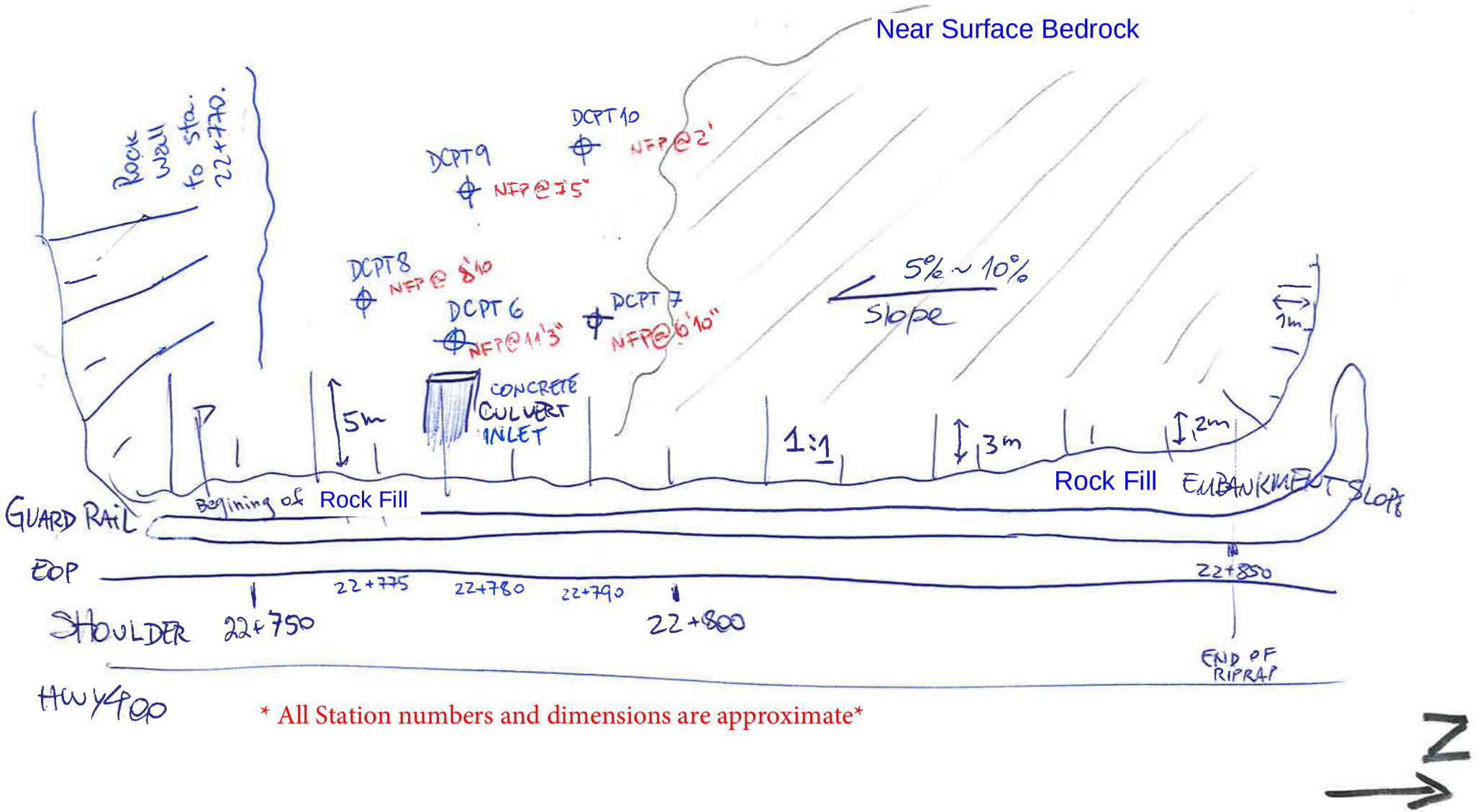
(4)

Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Field Sketch, Station 22+500 to 22+590



Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Field Sketch, Station 22+750 to 22+850

*Please refer to table on page 2 of the field notes document for further details.



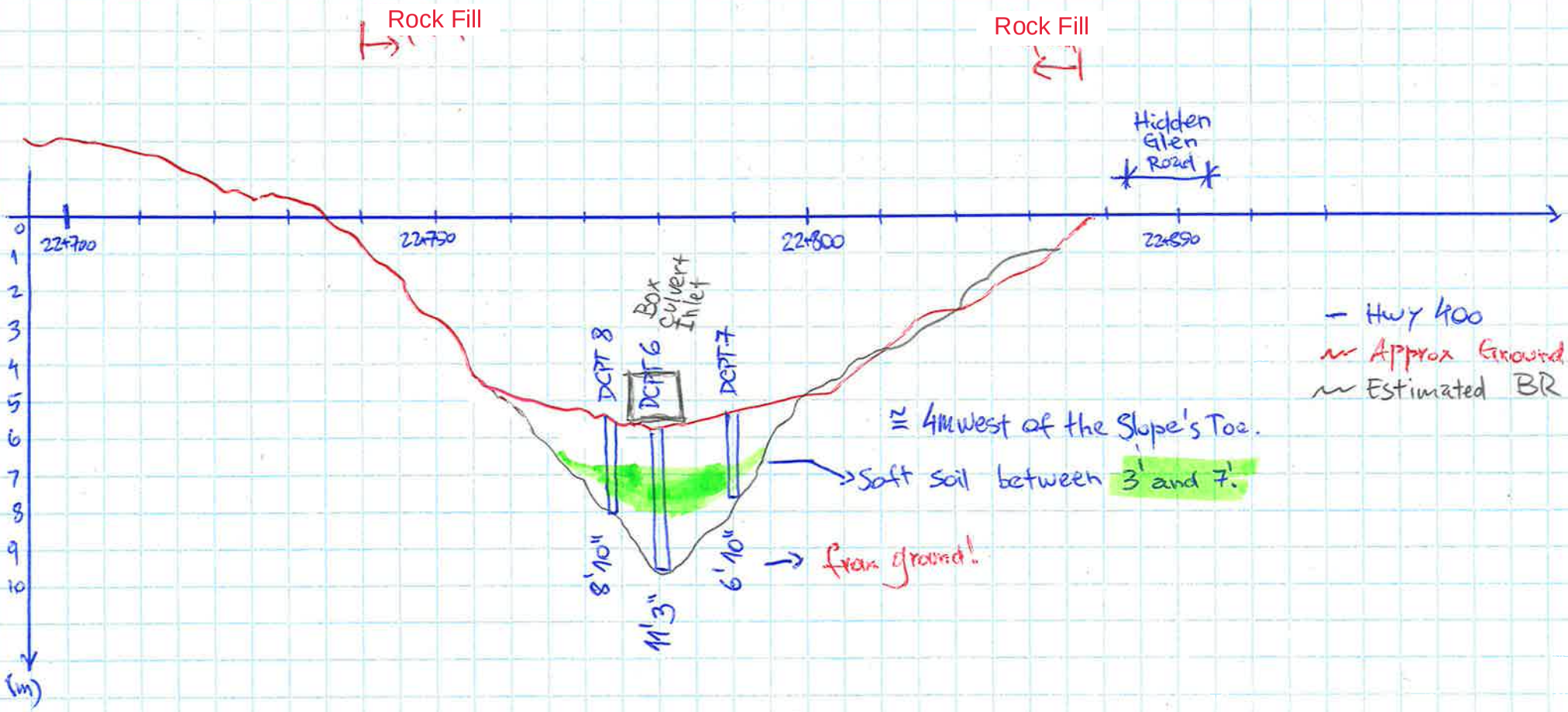

* All Station numbers and dimensions are approximate*

Hwy 400 Acc. Lane Expansion

Job # 28 317

N

CROSS SECTION




Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Profile, Station 22+700 to 22+840

* All Station numbers and dimensions are approximate*

F. K.

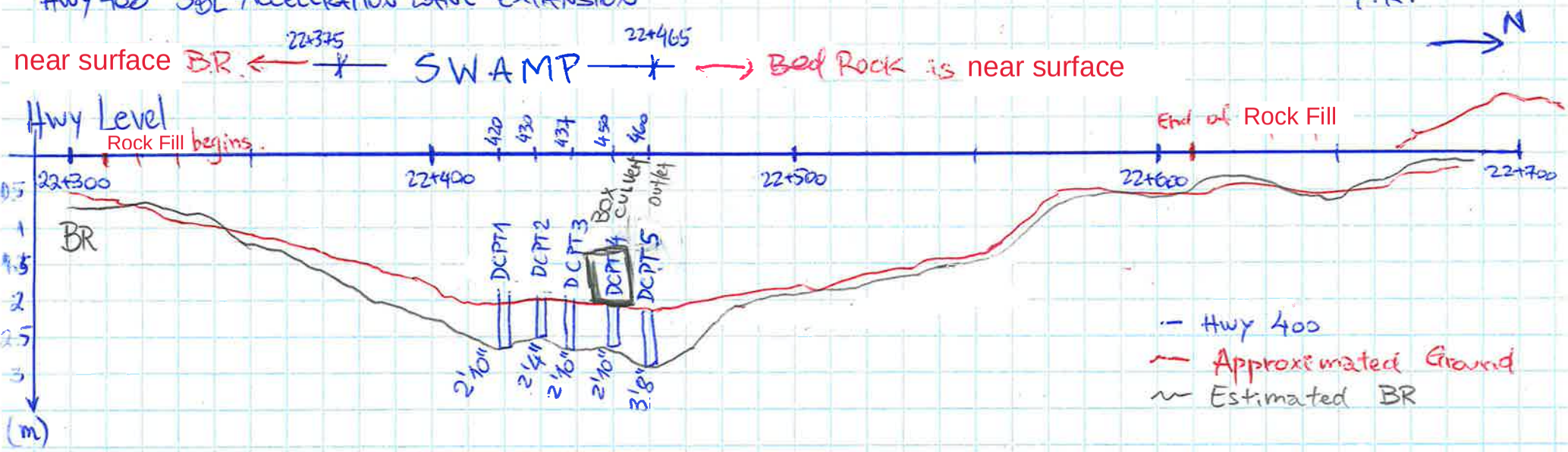
2

CROSS SECTION

Hwy 400 SBL ACCELERATION LANE EXPANSION

Job #28317

F.K.




* Swamp inaccessible from 22+375 to 22+410.
* DCPTs 2 and 3 in the swamp (underwater - 1'~2').
* Riprap 1:1, varies from 0.5m to 2m height.

Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Profile, Station 22+300 to 22+700

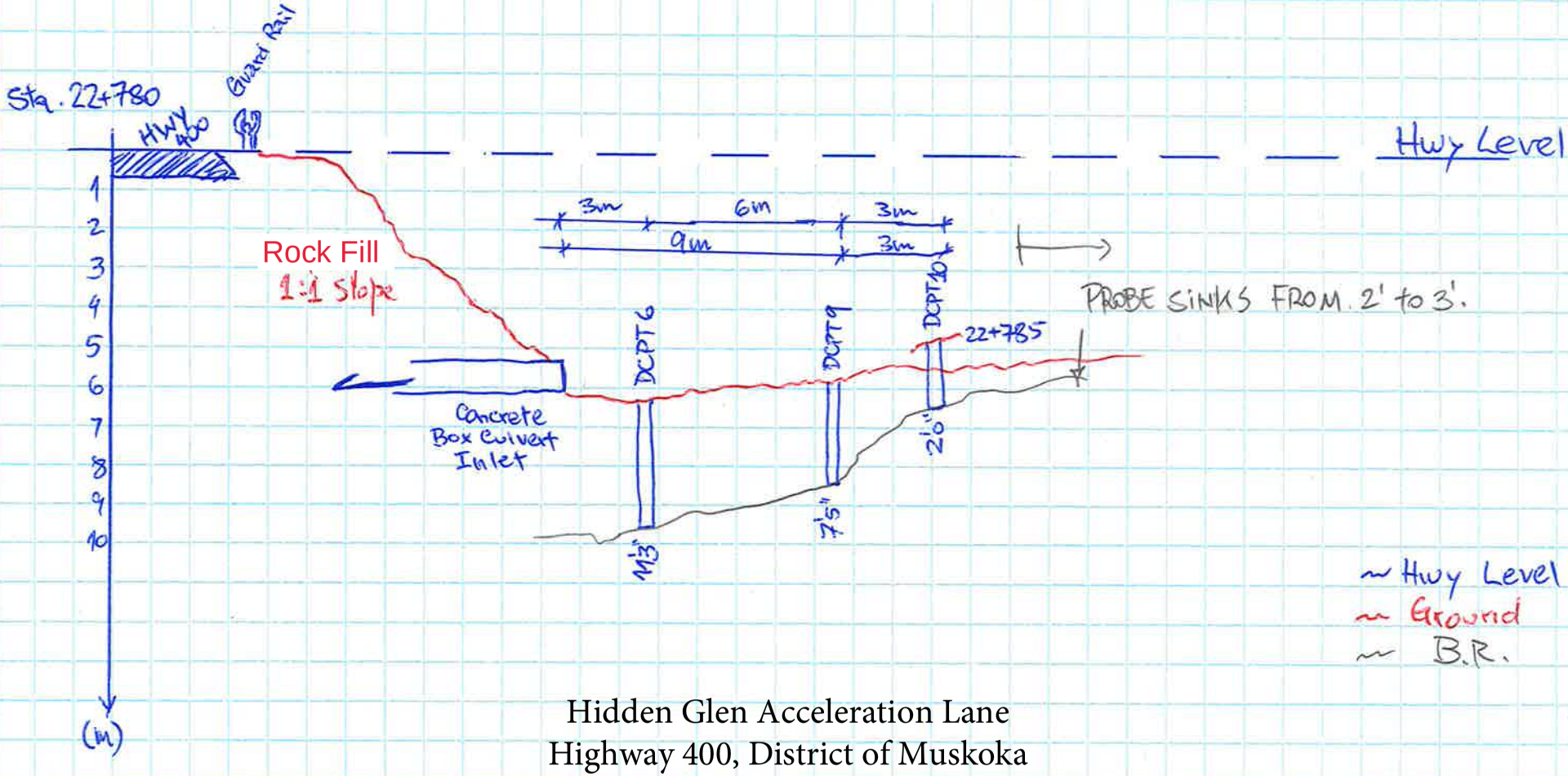
* All Station numbers and dimensions are approximate*

F.K.

(1)

Transversal Section at Sta. 22+780.

Job # 28317




Hidden Glen Acceleration Lane
Highway 400, District of Muskoka
Section at Station 22+780

* All Station numbers and dimensions are approximate*

F.K.

3

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-01 (Sta.22+420) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+420 o/s 4m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.17 - 2023.05.17 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$ WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| | GROUND SURFACE | | | | | | | | | | |
| 0.0 | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 2 | | | | | | |
| | | | | DCPT | 12/ | | | | | | |
| 0.9 | End of DCPT at 0.9 m upon practical refusal and no further penetration (NFP) | | | | 0.250 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-02 (Sta.22+430) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+430 o/s 3m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.17 - 2023.05.17 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$ WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| 0.0 | GROUND SURFACE<br>Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 10/ | | | | | | |
| 0.7 | End of DCPT at 0.7 m upon practical refusal and no further penetration (NFP) | | | | 0.100 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-03 (Sta.22+437) OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+437 o/s 5m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.17 - 2023.05.17 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$ / WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| | GROUND SURFACE | | | | | | | | | | |
| 0.0 | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 5/ | | | | | | |
| 0.9 | End of DCPT at 0.9 m upon practical refusal and no further penetration (NFP) | | | | 0.250 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-04 (Sta.22+450) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+450 o/s 2m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.17 - 2023.05.17 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 | PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE 20 40 60 80 100 | $w_P$ $w$ $w_L$ WATER CONTENT (%) 20 40 60 | $\gamma$ kN/m$^3$ | GR SA SI CL |
| 0.0 GROUND SURFACE | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 3 | | | | | | |
| | | | | DCPT | 7/ | | | | | | |
| 0.9 | End of DCPT at 0.9 m upon practical refusal and no further penetration (NFP) | | | | 0.250 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-05 (Sta.22+460) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+460 o/s 2m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.17 - 2023.05.17 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa: O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$ / WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| 0.0 | GROUND SURFACE<br>Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 2 | | | | | | |
| | | | | DCPT | 19/ | | | | | | |
| 1.1 | End of DCPT at 1.1 m upon practical refusal and no further penetration (NFP) | | | | 0.200 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-06 (Sta.22+780) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+780 o/s 3m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.18 - 2023.05.18 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa 20 40 60 80 100 (O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE) | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| 0.0 | GROUND SURFACE<br>Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 15 | | | | | | |
| | | | | DCPT | 20 | | | | | | |
| | | | | DCPT | 11 | | | | | | |
| | | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 2 | | | | | | |
| | | | | DCPT | 3 | | | | | | |
| | | | | DCPT | 4 | | | | | | |
| | | | | DCPT | 4 | | | | | | |
| | | | | DCPT | 16 | | | | | | |
| | | | | DCPT | 18/ | | | | | | |
| 3.4 | End of DCPT at 3.4 m upon practical refusal and no further penetration (NFP) | | | | 0.08 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-07 (Sta.22+790) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+790 o/s 5m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.18 - 2023.05.18 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100 | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ WATER CONTENT (%) 20 40 60 | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | | | | GR SA SI CL |
| 0.0 | GROUND SURFACE<br>Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 10 | | | | | | |
| | | | | DCPT | 29 | | | | | | |
| | | | | DCPT | 7 | | | | | | |
| | | | | DCPT | 7 | | | | | | |
| | | | | DCPT | 8 | | | | | | |
| | | | | DCPT | 43/ | | | | | | |
| 2.1 | End of DCPT at 2.1 m upon practical refusal and no further penetration (NFP) | | | | 0.250 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-08 (Sta.22+775) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+775 o/s 3m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.18 - 2023.05.18 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa | PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%) | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | $w_P$ $w$ $w_L$ | $\gamma$ kN/m$^3$ | GR SA SI CL |
| | GROUND SURFACE | | | | | | | SHEAR STRENGTH kPa: O UNCONFINED, + FIELD VANE, ● QUICK TRIAXIAL, × LAB VANE | 20 40 60 | | |
| 0.0 | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 8 | | | | | | |
| | | | | DCPT | 30 | | | | | | |
| | | | | DCPT | 83 | | | | | | |
| | | | | DCPT | 15 | | | | | | |
| | | | | DCPT | 3 | | | | | | |
| | | | | DCPT | 3 | | | | | | |
| | | | | DCPT | 4 | | | | | | |
| | | | | DCPT | 14/ | | | | | | |
| 2.7 | End of DCPT at 2.7 m upon practical refusal and no further penetration (NFP) | | | | 0.250 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-09 (Sta.22+780) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+780 o/s 9m W of toe) ORIGINATED BY FK

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY RdC

DATUM Geodetic DATE 2023.05.18 - 2023.05.18 CHECKED BY RdC

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa | PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%) | UNIT WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | $w_P$ $w$ $w_L$ | $\gamma$ kN/m$^3$ | GR SA SI CL |
| | GROUND SURFACE | | | | | | | O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | 20 40 60 | | |
| 0.0 | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 1 | | | | | | |
| | | | | DCPT | 17 | | | | | | |
| | | | | DCPT | 58 | | | | | | |
| | | | | DCPT | 15 | | | | | | |
| | | | | DCPT | 10 | | | | | | |
| | | | | DCPT | 5 | | | | | | |
| | | | | DCPT | 5 | | | | | | |
| | | | | DCPT | 16/ | | | | | | |
| 2.3 | End of DCPT at 2.3 m upon practical refusal and no further penetration (NFP) | | | | 0.125 | | | | | | |

$+^3$, $\times^3$: Numbers refer to Sensitivity

20 / 15 / 10 / 5 (%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

Ministry of Transportation
Ontario

# RECORD OF BOREHOLE No DCPT-10 (Sta.22+785) 1 OF 1 METRIC

W.P. 5191-18-00 LOCATION (Sta.22+785 o/s 12m W of toe) ORIGINATED BY

HWY 400 BOREHOLE TYPE Miniature Dynamic Cone Penetration Testing COMPILED BY

DATUM Geodetic DATE 2023.05.18 - 2023.05.18 CHECKED BY

| ELEV / DEPTH | DESCRIPTION | STRAT PLOT | SAMPLES NUMBER | SAMPLES TYPE | SAMPLES "N" VALUES | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$ / WATER CONTENT (%) | UNIT WEIGHT $\gamma$ kN/m$^3$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | GROUND SURFACE | | | | | | | 20 40 60 80 100 | 20 40 60 | | |
| 0.0 | Dynamic Cone Penetration Testing (DCPT) | | | DCPT | 0 | | | | | | |
| | | | | DCPT | 26/ 0.100 | | | | | | |
| 0.6 | End of DCPT at 0.6 m upon practical refusal and no further penetration (NFP) | | | | | | | | | | |

O UNCONFINED + FIELD VANE
● QUICK TRIAXIAL × LAB VANE

$+^3$, $\times^3$: Numbers refer to Sensitivity

(%) STRAIN AT FAILURE

ONTMT4S MTO-28317_DCPT HIDDEN GLEN.GPJ 2017TEMPLATE(MTO).GDT 11-10-23

**TABLE A1 - Summary of Manual Probing Results Between Station 22+200 and Station 22+370**

| Probe Hole No. | Approximate Station | Approximate Offset | Approximate Depth To No Further Penetration (mm) | Comments |
|---|---|---|---|---|
| AR02-01A | 22+200 | Ditch | 250 | Topsoil at ground surface |
| AR02-01B | 22+200 | 5 m west of Ditch | 500 | Sand, some silt, trace gravel, frequent rootlets and organics. Cobbles at 450 mm. |
| AR02-02A | 22+210 | Ditch | 450 | 75 mm of topsoil over sand, some silt, trace gravel with frequent organics. Water at ground surface. |
| AR02-02B | 22+210 | 5 m west of Ditch | 450 to 750 | Sand, some silt, trace gravel, frequent rootlets and organics. Cobbles at 450 mm. |
| AR02-03A | 22+220 | Ditch | 0 to 150 | Bedrock at surface to topsoil over bedrock. |
| AR02-03B | 22+220 | 5 m west of Ditch | 0 to 300 | Bedrock at surface to sand, some silt, trace gravel, frequent rootlets and organics. |
| AR02-04A | 22+230 | Dictch | 0 - 50 | Bedrock at surfcace to thin topsoil over bedrock. |
| AR02-04B | 22+230 | 5 m west of Ditch | 0 - 250 | Bedrock at surface to sand, some silt, trace gravel, frequent rootlets and organics. |
| AR02-05A | 22+240 | Ditch | 0 - 175 | Bedrock at surface to topsoil over bedrock. |
| AR02-05B | 22+240 | 5 m west of Ditch | 200 | Sand, some silt, trace gravel, frequent rootlets and organics. |
| AR02-06A | 22+250 | Ditch | 0 | Bedrock at surface. |
| AR02-06B | 22+250 | 5 m west of Ditch | 100 - 250 | Sand, some silt, trace gravel, frequent rootlets and organics. |
| AR02-07A | 22+260 | Ditch | 0 | Bedrock at surface. |
| AR02-07B | 22+260 | 5 m west of Ditch | 0 - 150 | Bedrock at surface to sand, some silt, trace gravel, frequent rootlets and organics. Frequent cobbles at 150 mm. |
| AR02-08A | 22+270 | Ditch | 0 - 150 | Bedrock to topsoil over bedrock. |
| AR02-08B | 22+270 | 5 m west of Ditch | 200 - 250 | Bedrock to topsoil over bedrock. |
| AR02-09A | 22+280 | Ditch | 300 | Sand, silty some gravel, frequent cobbles and rootlets. |
| AR02-09B | 22+280 | 5 m west of Ditch | 0 - 50 | Bedrock to topsoil over bedrock. |
| AR02-10A | 22+290 | Ditch | 150 | Topsoil over bedrock. |
| AR02-10B | 22+290 | 5 m west of Ditch | 0 | Bedrock at surface. |
| AR02-11A | 22+300 | Ditch | 150 | Topsoil over bedrock. |
| AR02-11B | 22+300 | 5 m west of Ditch | 0 - 300 | Bedrock to topsoil over bedrock. |
| AR02-12A | 22+310 | Ditch | 0 - 150 | Bedrock to topsoil over bedrock. |
| AR02-12B | 22+310 | 5 m west of Ditch | 250 - 300 | Topsoil over bedrock. |
| AR02-13A | 22+320 | Toe of embankment | 0 - 150 | Bedrock to topsoil over bedrock. |
| AR02-13B | 22+320 | 5 m west of embankment toe | 0 - 200 | Bedrock to topsoil over bedrock. |
| AR02-14A | 22+330 | Toe of embankment | 0 | Bedrock at surface. |
| AR02-14B | 22+330 | 5 m west of embankment toe | 150 - 300 | Topsoil over bedrock. |
| AR02-15A | 22+340 | Toe of embankment | 0 - 100 | Bedrock to topsoil over bedrock. |
| AR02-15B | 22+340 | 5 m west of embankment toe | 150 - 250 | Topsoil over bedrock. |
| AR02-16A | 22+360 | Toe of embankment | 300 - 600 | Organics over bedrock. |
| AR02-17B | 22+370 | 2 m west of embankment toe | - | Swamp starts. |

THURBER

# Appendix B

## Site Photographs

**Photograph #1: Looking south from the top of the embankment slope at Sta. 22+460.**

**Photograph #2: Looking north from the top of the embankment slope at Sta. 22+400.**

**Photograph #3: Looking south at base of embankment slope of Highway 400 southbound Sta. 22+820.**

**Photograph #3: Looking north from the top of the embankment slope at Sta. 22+750.**

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# Appendix C

## Boreholes from Pavement Investigation

# Rehabilitation of Highway 400 (GWP 5191-18-00)
## Port Severn, ON
# Borehole Logs

**Station 22+150 NB 2.4m LT CL Lane 1**

| | | |
|---|---|---|
| 0- 395 | Asph | |
| 395- 590 | Br Cr Gr(y) Sa Some Si | Moist |
| 590- 1.1 | Br Sa Some Si Some Gr Tr Cl | Moist |
| 1.1- | NFP (RF) | |

**Station 22+150 NB 4.8m RT CL OSH**

| | | |
|---|---|---|
| 0- 185 | Asph | |
| 185- 420 | Br Sa and Cr Gr Tr Si | Moist |
| 420- 1.2 | Br Sa Some Gr Some Si | Moist |
| 1.2- | NFP (RF) | |

**Station 22+150 NB 18m LT CL Ditch D-3**

| | | |
|---|---|---|
| 0- 100 | Tps | |
| 100- | NFP (Cob) | |

**Station 22+200 NB 2.4m LT CL Lane 1**

| | | |
|---|---|---|
| 0- 385 | Asph | |
| 385- 510 | Br Sa and Cr Gr Tr Si | Moist |
| 510- 750 | Br Sa Some Gr Some Si | Moist |
| 750- | NFP (RF) | |

**Station 22+200 NB 4.8m RT CL OSH**

| | | |
|---|---|---|
| 0- 165 | Asph | |
| 165- 570 | Br Sa and Cr Gr Tr Si | Moist |
| 570- 900 | Br Sa Some Gr Some Si | Moist |
| 900- | NFP (RF) | |

**Station 22+200 NB 15m LT CL Ditch D 0**

| | | |
|---|---|---|
| 0- 150 | Tps | |
| 150- | NFP (Cob) | |

**Station 22+250 NB 2.6m LT CL Lane 1**

| | | |
|---|---|---|
| 0- 350 | Asph | |
| 350- 630 | Br Sa and Cr Gr Tr Si | Moist |
| 630- 750 | Br Sa Some Gr Some Si | Moist |
| 750- | NFP (RF) | |

**Station 22+250 NB 2.6m RT CL Lane 2**

| | | |
|---|---|---|
| 0- 210 | Asph | |
| | | RWP Core=205 mm |
| 210- 480 | Br Sa and Cr Gr Tr Si | Moist |
| 480- 900 | Br Sa Some Gr Some Si | Moist |
| 900- | NFP (RF) | Moist |

**Station 22+250 NB 5.5m RT CL OSH**

| | | |
|---|---|---|
| 0- 200 | Asph | |
| 200- 640 | Br Sa and Cr Gr Tr Si | Moist |
| 640- 1.1 | Br Sa Some Gr Some Si | Moist |
| 1.1- | NFP (RF) | |

**Station 22+250 NB -.6m LT CL Ditch**

| | | |
|---|---|---|
| 0- 200 | Tps | |
| 200- | NFP (Cob) | |

**Station 22+300 NB 2.7m LT CL Lane 1**

| | | |
|---|---|---|
| 0- 405 | Asph | |
| 405- 590 | Br Sa and Cr Gr Tr Si | Moist |
| 590- 900 | Br Sa Some Gr Some Si | Moist |
| 900- | NFP (RF) | |

**Station 22+300 NB 6.1m RT CL OSH**

| | | |
|---|---|---|
| 0- 180 | Asph | |
| 180- 390 | Br Sa and Cr Gr Tr Si | Moist |
| | | w @ 0.3m = 3% |
| | | Percent Passing 4.75 mm = 55% |
| | | 75 µm = 5% |
| | | Slightly Finer Than Granular A |
| 390- 1.2 | Br Sa Some Gr Some Si | Moist |
| | | w @ 0.8m = 7% |
| | | Percent Passing 4.75 mm = 85% |
| | | 75 µm = 11% |
| | | Slightly Finer Than Granular B, Type I |
| 1.2- | NFP (RF) | Moist |

**Station 22+300 NB 15m LT CL Ditch D-0.9**

| | | |
|---|---|---|
| 0- | RF | |

### Hidden Glen Road Acceleration

**Station 22+380 SB 14m LT CL Ditch D-3.7**

| | | |
|---|---|---|
| 0- 600 | Surf Wat | Wet |

**Station 22+400 SB 2.5m LT CL Lane 2**

| | | |
|---|---|---|
| 0- 175 | Asph | |
| 175- 340 | Br Sa(y) Cr Gr Tr Si | Moist |
| 340- 750 | Br Sa and Gr Some Si | Moist |
| 750- | NFP (RF) | |

**Station 22+400 SB 5.3m LT CL OSH**

| | | |
|---|---|---|
| 0- 85 | Asph | |
| 85- 180 | Br Sa(y) Cr Gr Tr Si | Moist |
| 180- 400 | Br Sa and Gr Some Si | Moist |
| 400- 750 | Br Sa W Gr Some Si | Moist |
| 750- | NFP (BR) | |

**Station 22+400 SB 14m LT CL Ditch D-3.5**

| | | |
|---|---|---|
| 0- 600 | Surf Wat | |
| | | Swamp bed beyond 300 mm |
| 600- | NFP (Cob or Blds) | |
| | | Swamp |

**Station 22+420 SB 14m LT CL Ditch D-3.5**

| | | |
|---|---|---|
| 0- 600 | Peat | Wet |
| 600- | NFP (Cob or Blds) | Wet |
| | | Swamp |

**Station 22+440 SB 14m LT CL Ditch D-3.5**

| | | |
|---|---|---|
| 0- 350 | Peat | Wet |
| 350- | NFP (Cob or Blds) | |

Note: Boreholes offsets referenced from directional centreline.

# Borehole Logs

**Station 22+450 SB 2.5m LT CL Lane 2**

| | | |
|---|---|---|
| 0 - 180 | Asph | |
| 180 - 355 | Br Sa(y) Cr Gr Tr Si | Moist |
| 355 - 455 | Br Sa and Gr Some Si | Moist |
| 455 - 700 | Br Sa W Gr Some Si | Moist |
| 700 - | NFP (RF) | |

**Station 22+450 SB 5.4m LT CL OSH**

| | | |
|---|---|---|
| 0 - 90 | Asph | |
| 90 - 260 | Br Sa(y) Cr Gr Tr Si | Moist |
| 260 - 400 | Br Sa and Gr Some Si | Moist |
| 400 - 700 | Br Sa W Gr Some Si | Moist |
| 700 - | NFP (RF) | |

**Station 22+460 SB 12m LT CL Ditch D-3.5**

| | | |
|---|---|---|
| 0 - 800 | Tps | Moist |
| 800 - | NFP (Cob) | |

**Station 22+480 SB 11.5m LT CL Ditch D-2.2**

| | | |
|---|---|---|
| 0 - 100 | Tps | |
| 100 - | NFP (Cob) | |

**Station 22+500 SB 4.8m RT CL ISH**

| | | |
|---|---|---|
| 0 - 110 | Asph | |

**Station 22+500 SB 2.5m RT CL Lane 1**

| | | |
|---|---|---|
| 0 - 225 | Asph | |
| | | RWP Core=150 mm recovery only |
| 225 - 410 | Br Sa(y) Cr Gr Tr Si | Moist |
| | | Percent Passing 4.75 mm = 48% |
| | | 75 µm = 10% |
| | | Slightly Finer Than Granular A |
| 410 - 830 | Br Sa and Gr Some Si | Moist |
| | | Percent Passing 4.75 mm = 60% |
| | | 75 µm = 15% |
| | | Finer Than Granular B, Type I |
| 830 - 1.4 | Br Sa W Gr Some Si | Moist |
| | | Percent Passing 4.75 mm = 77% |
| | | 75 µm = 16% |
| | | Finer Than Granular B, Type I |
| 1.4 - | NFP (RF) | |

**Station 22+500 SB 2.8m LT CL Lane 2**

| | | |
|---|---|---|
| 0 - 200 | Asph | |
| 200 - 460 | Br Sa(y) Cr Gr Tr Si | Moist |
| 460 - 700 | Br Sa W Gr Some Si | Moist |
| 700 - | NFP (RF) | |

**Station 22+500 SB 5.5m LT CL OSH**

| | | |
|---|---|---|
| 0 - 80 | Asph | |
| 80 - 250 | Br Sa(y) Cr Gr Tr Si | Moist |
| 250 - 490 | Br Sa and Gr Some Si | Moist |
| 490 - 800 | Br Sa W Gr Some Si | Moist |
| 800 - | NFP (RF) | |

**Station 22+500 SB 11.5m LT CL Ditch D-2.4**

| | | |
|---|---|---|
| 0 - 200 | Tps | Moist |
| 200 - 300 | Br/Red Si(y) Sa Tr Org | Moist |
| 300 - | NFP (Cob) | |

**Station 22+520 SB 12.3m LT CL Ditch D-1.7**

| | | |
|---|---|---|
| 0 - 250 | Tps | |
| 250 - | NFP (Cob) | |

**Station 22+540 SB 11m LT CL Ditch D-1.5**

| | | |
|---|---|---|
| 0 - 100 | Tps | Moist |
| 100 - | NFP (Cob) | |

**Station 22+550 SB 2.8m LT CL Lane 2**

| | | |
|---|---|---|
| 0 - 210 | Asph | |
| 210 - 395 | Br Sa(y) Cr Gr Tr Si | Moist |
| 395 - 625 | Br Sa and Gr Some Si | Moist |
| 625 - 900 | Br Sa W Gr Some Si | Moist |
| 900 - | NFP (RF) | |

**Station 22+550 SB 5.3m LT CL OSH**

| | | |
|---|---|---|
| 0 - 100 | Asph | |
| 100 - 250 | Br Sa(y) Cr Gr Tr Si | Moist |
| 250 - 530 | Br Sa and Gr Some Si | Moist |
| 530 - 1.1 | Br Sa W Gr Some Si | Moist |
| 1.1 - | NFP (RF) | |

**Station 22+560 SB 11m LT CL Ditch D-1.6**

| | | |
|---|---|---|
| 0 - 150 | Tps | |
| 150 - | NFP (Cob) | |

**Station 22+600 SB 2.9m LT CL Lane 2**

| | | |
|---|---|---|
| 0 - 215 | Asph | |
| 215 - 435 | Br Sa(y) Cr Gr Tr Si | Moist |
| 435 - 725 | Br Sa and Gr Some Si | Moist |
| 725 - 1.1 | Br Sa W Gr Some Si | Moist |
| 1.1 - | NFP (RF) | |

**Station 22+600 SB 5.3m LT CL OSH**

| | | |
|---|---|---|
| 0 - 90 | Asph | |
| 90 - 225 | Br Sa(y) Cr Gr Tr Si | Moist |
| 225 - 770 | Br Sa and Gr Some Si | Moist |
| 770 - 1 | Br Sa W Gr Some Si | Moist |
| 1 - | NFP (RF) | |

**Station 22+600 SB 12.3m LT CL Ditch D-1.5**

| | | |
|---|---|---|
| 0 - 100 | Tps | |
| 100 - | NFP (Cob) | Moist |

**Station 22+640 SB 11.5m LT CL Ditch D-0.8**

| | | |
|---|---|---|
| 0 - 200 | Tps | |
| 200 - | NFP (Cob) | |

Note: Boreholes offsets referenced from directional centreline.

# Rehabilitation of Highway 400 (GWP 5191-18-00)
## Port Severn, ON
# Borehole Logs

**Station 22+650 SB 2.4m LT CL Lane 2**

| | | |
|---|---|---|
| 0- 215 | Asph | |
| 215- 405 | Br Sa(y) Cr Gr Tr Si | Moist |
| 405- 875 | Br Sa and Gr Some Si | Moist |
| 875- 1.2 | Br Sa W Gr Some Si | Moist |
| 1.2- | NFP (RF) | |

**Station 22+650 SB 5.6m LT CL OSH**

| | | |
|---|---|---|
| 0- 100 | Asph | |
| 100- 260 | Br Sa(y) Cr Gr Tr Si | Moist |
| 260- 910 | Br Sa and Gr Some Si | Moist |
| 910- 1.2 | Br Sa W Gr Some Si | Moist |
| 1.2- | NFP (RF) | |

**Station 22+650 SB 11.4m LT CL Ditch D-0.8**

| | | |
|---|---|---|
| 0- 100 | Tps | |
| 100- | NFP (Cob) | |

**Station 22+660 SB 10.5m LT CL Ditch D-0.9**

| | | |
|---|---|---|
| 0- 150 | Tps | |
| 150- | NFP (Cob) | |

**Station 22+680 SB 11m LT CL Ditch D-0.8**

| | | |
|---|---|---|
| 0- 150 | Tps | |
| 150- | NFP (Cob) | |

**Station 22+680 SB 10m LT CL Ditch D-1.5**

| | | |
|---|---|---|
| 0- 300 | Tps | |
| 300- | NFP (Cob) | |

**Station 22+700 SB 2.8m LT CL Lane 2**

| | | |
|---|---|---|
| 0- 225 | Asph | |
| 225- 405 | Br Sa(y) Cr Gr Tr Si | Moist |
| 405- 600 | Br Sa and Gr Some Si | Moist |
| 600- | NFP (Cob) | |

**Station 22+700 SB 5.5m LT CL OSH**

| | | |
|---|---|---|
| 0- 85 | Asph | |
| 85- 300 | Br Sa(y) Cr Gr Tr Si | Moist |
| 300- 600 | Br Sa and Gr Some Si | Moist |
| 600- | NFP (RF) | |

**Station 22+700 SB 6m LT CL Ditch**

| | | |
|---|---|---|
| 0- 150 | Tps | Moist |
| 150- | NFP (Cob) | |

**Station 22+720 SB 12m LT CL Ditch D-1.1**

| | | |
|---|---|---|
| 0- 200 | Tps | |
| 200- | NFP (Cob) | |

**Station 22+740 SB 11.5m LT CL Ditch D-1.5**

| | | |
|---|---|---|
| 0- 100 | Tps | |
| 100- | NFP (Cob) | |

**Station 22+750 SB 2.5m LT CL Lane 2**

| | | |
|---|---|---|
| 0- 210 | Asph | |
| | | RWP Core=205 mm |
| 210- 500 | Br Sa(y) Cr Gr Tr Si | Moist |
| 500- 760 | Br Sa and Gr Some Si | Moist |
| 760- | NFP (RF) | |

**Station 22+750 SB 5.6m LT CL OSH**

| | | |
|---|---|---|
| 0- 95 | Asph | |
| 95- 340 | Br Sa(y) Cr Gr Tr Si | Moist |
| 340- 700 | Br Sa and Gr Some Si | Moist |
| 700- | NFP (RF) | |

**Station 22+760 SB 10m LT CL Ditch D-1.5**

| | | |
|---|---|---|
| 0- 250 | Tps | |
| 250- | NFP (Cob) | |

**Station 22+780 SB 20m LT CL Ditch D-9**

| | | |
|---|---|---|
| 0- | RF | Moist |

**Station 22+800 SB 2.5m LT CL Lane 2**

| | | |
|---|---|---|
| 0- 235 | Asph | |
| 235- 500 | Br Sa(y) Cr Gr Tr Si | Moist |
| 500- 900 | Br Sa and Gr Some Si | Moist |
| 900- | NFP (RF) | |

**Station 22+800 SB 2.5m LT CL OSH**

| | | |
|---|---|---|
| 0- 90 | Asph | |
| 90- 250 | Br Sa(y) Cr Gr Tr Si | Moist |
| 250- 800 | Br Sa and Gr Some Si | Moist |
| 800- | NFP (RF) | |

**Station 22+820 SB 16m LT CL Ditch D-6**

| | | |
|---|---|---|
| 0- 250 | Tps | Moist |
| 250- | NFP (Cob) | |

**Station 22+825 SB 2.5m RT CL Lane 1**

| | | |
|---|---|---|
| 0- 210 | Asph | |
| 210- 430 | Br Sa(y) Cr Gr Tr Si | Moist |
| 430- 800 | Br Sa and Gr Some Si | Moist |
| 800- | NFP (RF) | |

**Station 22+825 SB 14.7m LT CL Ditch D-5.5**

| | | |
|---|---|---|
| 0- 225 | Tps | |
| 225- | NFP (Cob) | |

## Hidden Glen Road Deceleration

**Station 22+860 SB 16.5m LT CL Ditch D-0.6**

| | | |
|---|---|---|
| 0- 300 | Tps | |
| 300- | NFP (Cob) | |

**Station 22+880 SB 15.3m LT CL Ditch D-0.9**

| | | |
|---|---|---|
| 0- 250 | Tps | |
| 250- | NFP (Cob) | |

Note: Boreholes offsets referenced from directional centreline.

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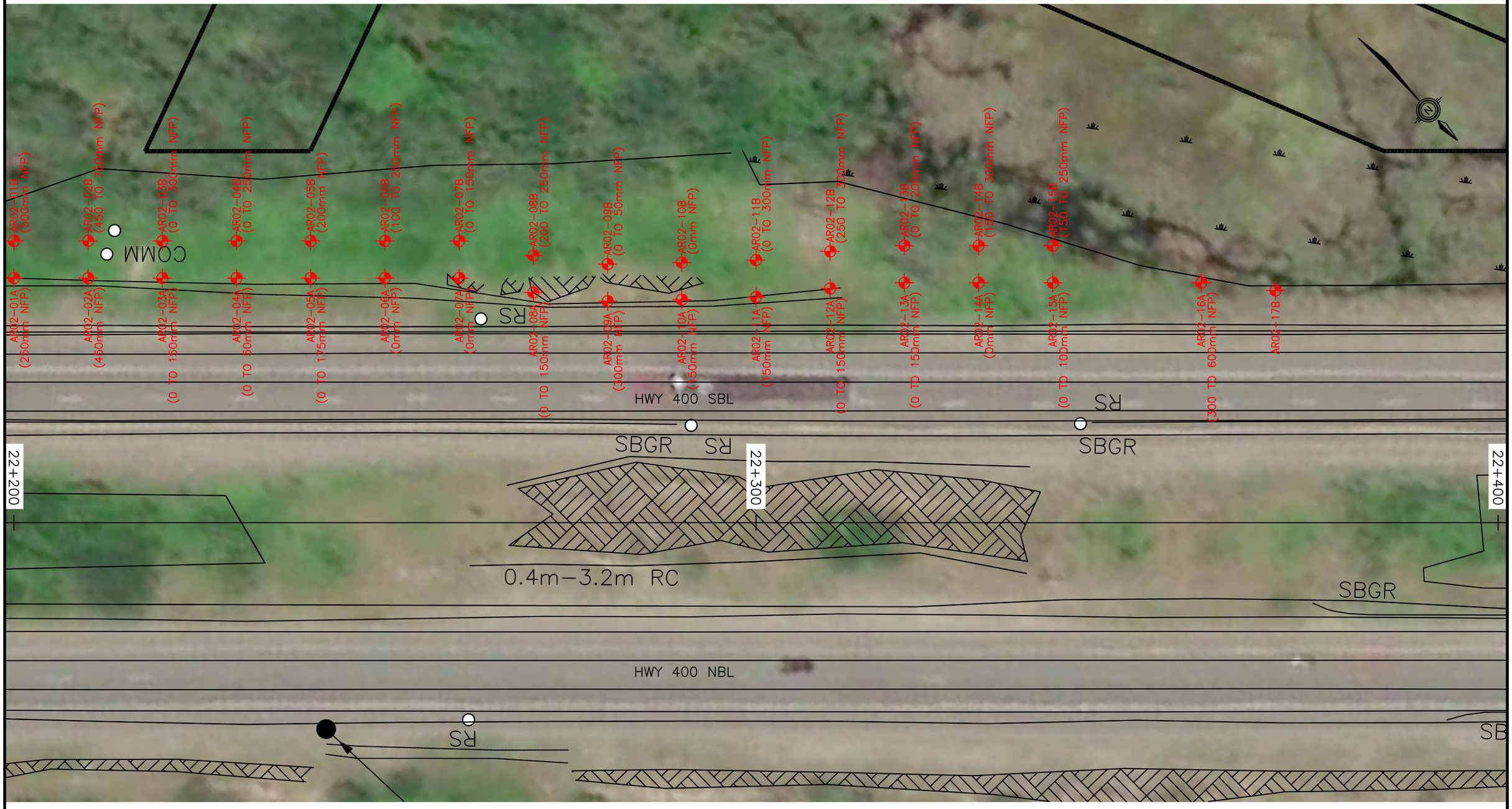
# Appendix D

## Probe Hole and DCPT Location Plan




LEGEND:

- APPROX. PROBE HOLE LOCATION
- APPROX. DYNAMIC CONE PENETRATION TEST LOCATION
- NFP NO FURTHER PENETRATION

10 0 10 20m

SCALE 1:500

LEA CONSULTING LTD.

# HIDDEN GLEN ROAD ACCELERATION LANE
# HIGHWAY 400, DISTRICT OF MUSKOKA
# STATION 22+200 TO 22+400

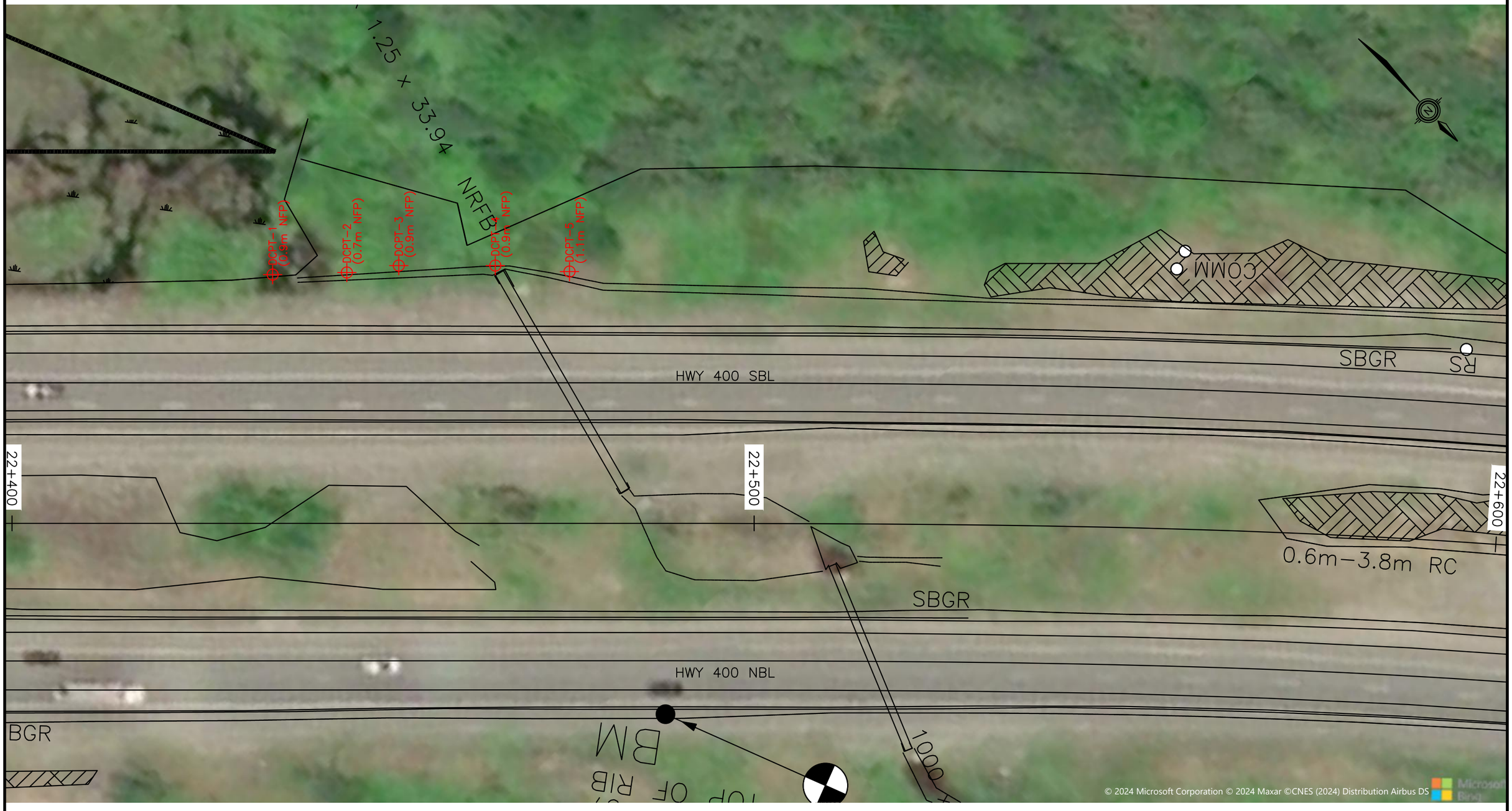
## PROBE HOLE AND DCPT LOCATION PLAN

JOB# 28317

THURBER ENGINEERING LTD.

| ENGINEER : | DRAWN : | APPROVED : |
|---|---|---|
| RdC | AN | MTB |
| DATE : | SCALE : | DRAWING No. |
| MARCH 2024 | AS SHOWN | FIGURE 1 |

FILENAME: H:\Drafting\28000\28317\TED-28317-PROBE PLAN.dwg
PLOTDATE: Apr 3, 2024 - 3:10 PM




LEGEND:

- APPROX. PROBE HOLE LOCATION
- APPROX. DYNAMIC CONE PENETRATION TEST LOCATION

NFP NO FURTHER PENETRATION

10 0 10 20m

SCALE 1:500

LEA CONSULTING LTD.

# HIDDEN GLEN ROAD ACCELERATION LANE
# HIGHWAY 400, DISTRICT OF MUSKOKA
# STATION 22+400 TO 22+600

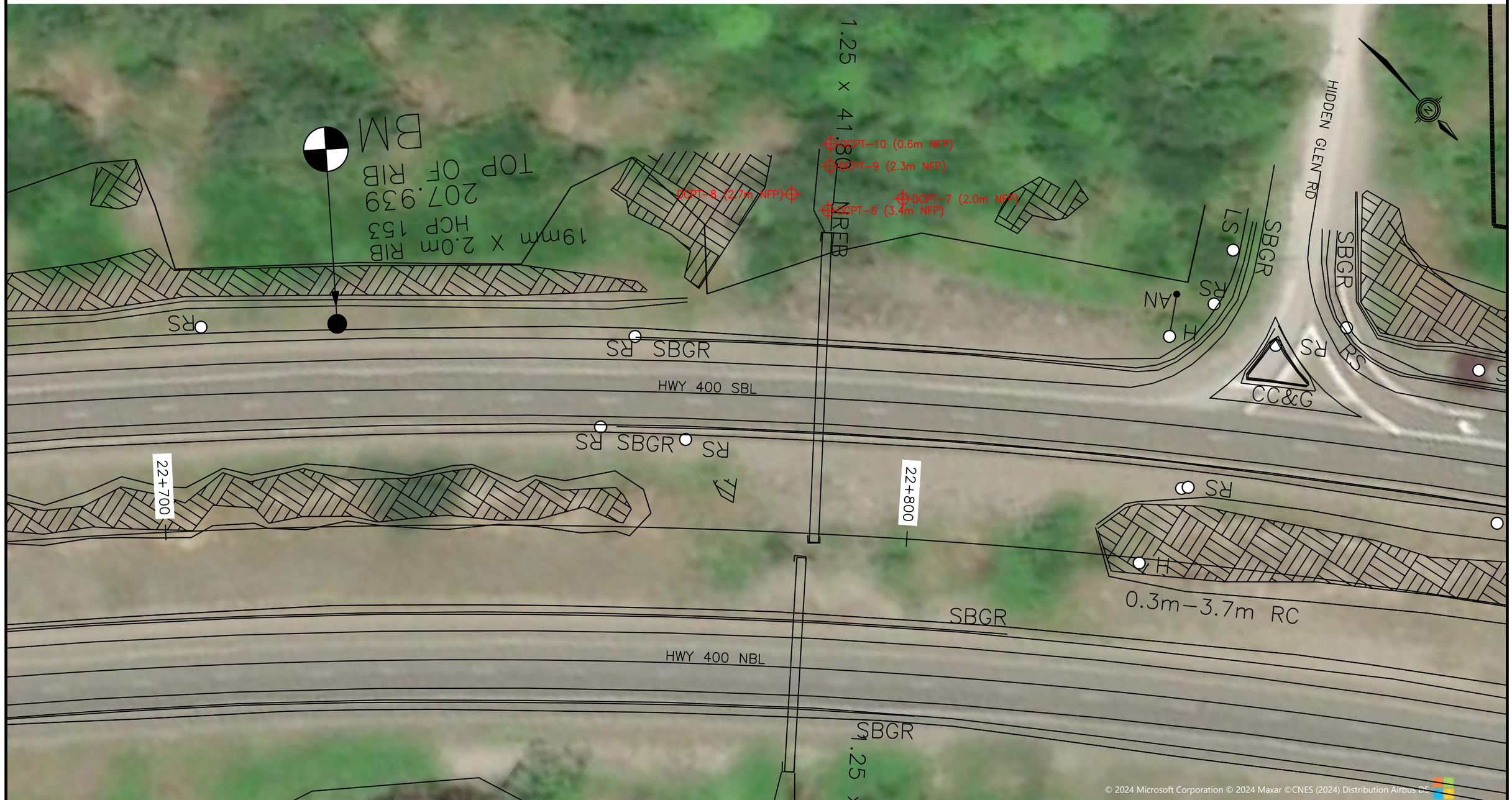
## PROBE HOLE AND DCPT LOCATION PLAN

JOB# 28317

THURBER ENGINEERING LTD.

| ENGINEER : | DRAWN : | APPROVED : |
|---|---|---|
| RdC | AN | MTB |
| DATE : | SCALE : | DRAWING No. |
| MARCH 2024 | AS SHOWN | FIGURE 2 |

FILENAME: H:\Drafting\28000\28317\TED-28317-PROBE PLAN.dwg
PLOTDATE: Apr 3, 2024 - 3:10 PM




LEGEND:

- APPROX. PROBE HOLE LOCATION
- APPROX. DYNAMIC CONE PENETRATION TEST LOCATION

NFP NO FURTHER PENETRATION

10 0 10 20m

SCALE 1:500

LEA CONSULTING LTD.

HIDDEN GLEN ROAD ACCELERATION LANE
HIGHWAY 400, DISTRICT OF MUSKOKA
STATION 22+700 TO 22+850

PROBE HOLE AND DCPT LOCATION PLAN

JOB# 28317

THURBER ENGINEERING LTD.

| ENGINEER : | DRAWN : | APPROVED : |
|---|---|---|
| RdC | AN | MTB |
| DATE : | SCALE : | DRAWING No. |
| MARCH 2024 | AS SHOWN | FIGURE 3 |

FILENAME: H:\Drafting\28000\28317\TED-28317-PROBE PLAN.dwg
PLOTDATE: Apr 3, 2024 - 3:10 PM

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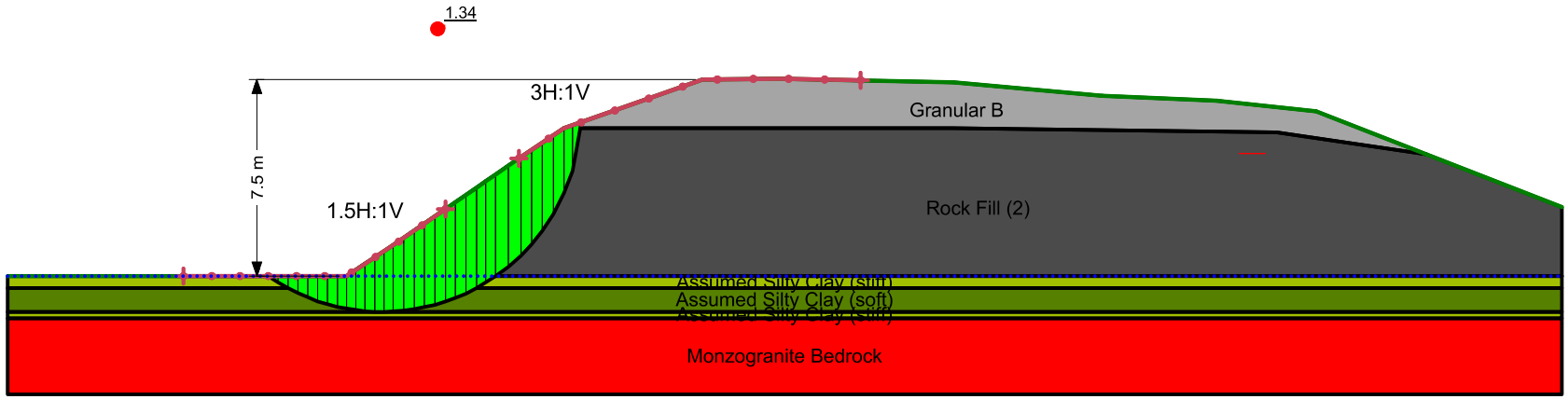
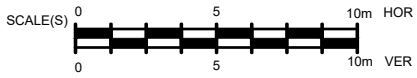
# Appendix E

## Slope Stability Analyses Figures

| Color | Name | Slope Stability Material Model | Unit Weight (kN/m³) | Effective Cohesion (kPa) | Effective Friction Angle (°) | Phi-B (°) | Piezometric Surface | B-bar | Add Weight |
|---|---|---|---|---|---|---|---|---|---|
| | Assumed Silty Clay (soft) | Mohr-Coulomb | 18 | 0 | 25 | 0 | 1 | 1 | No |
| | Assumed Silty Clay (stiff) | Mohr-Coulomb | 18 | 5 | 25 | 0 | 1 | 0.5 | No |
| | Granular B | Mohr-Coulomb | 22.8 | 0 | 35 | 0 | | 0 | No |
| | Monzogranite Bedrock | Bedrock (Impenetrable) | | | | | 1 | 0 | No |
| | Rock Fill (2) | Mohr-Coulomb | 19 | 0 | 42 | 0 | | 0 | No |




THURBER

Project
Rehab of Hwy 400&10 Bridges

Analysis
Plastic (Drained)

Seismic Coefficient
H: 0g, V: 0g

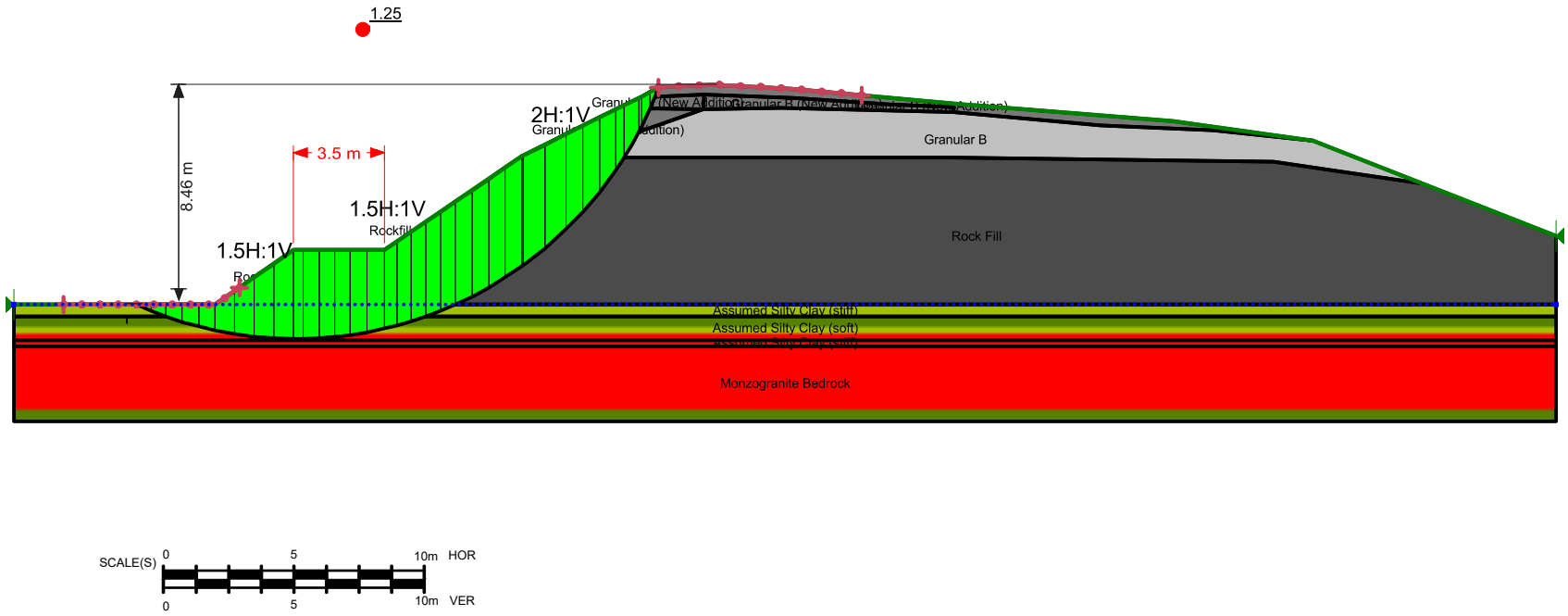
Last Run
2024-04-03, 04:28:10 PM

Scale
1:269

Additional Details
Name: Sta. 22+780
Comments:
Method: Morgenstern-Price, Half-Sine
Minimum Slip Surface Depth: 1 m
Entry: (-15.074607, -7.5) m, Exit: (-3.1711997, -1.628844) m
Center: (-10.740702, -1.2844347) m, Radius: 7.5773337 m

**Figure 1**

| Color | Name | Slope Stability Material Model | Unit Weight (kN/m³) | Effective Cohesion (kPa) | Effective Friction Angle (°) | Phi-B (°) | Piezometric Surface | B-bar | Add Weight |
|---|---|---|---|---|---|---|---|---|---|
| | Assumed Silty Clay (soft) | Mohr-Coulomb | 18 | 0 | 25 | 0 | 1 | 1 | No |
| | Assumed Silty Clay (stiff) | Mohr-Coulomb | 18 | 5 | 25 | 0 | 1 | 0.5 | No |
| | Granular B | Mohr-Coulomb | 22.8 | 0 | 35 | 0 | | 0 | No |
| | Granular B (New Addition) | Mohr-Coulomb | 22.8 | 0 | 35 | 0 | 1 | 0 | Yes |
| | Monzogranite Bedrock | Bedrock (Impenetrable) | | | | | 1 | 0 | No |
| | Rock Fill | Mohr-Coulomb | 19 | 0 | 42 | 0 | | 0 | No |
| | Rockfill (New Addition) | Mohr-Coulomb | 19 | 0 | 42 | 0 | | 0 | Yes |




THURBER

Project
Rehab of Hwy 400&10 Bridges

Analysis
Plastic (Drained) (Widening) (2)

Seismic Coefficient
H: 0g, V: 0g

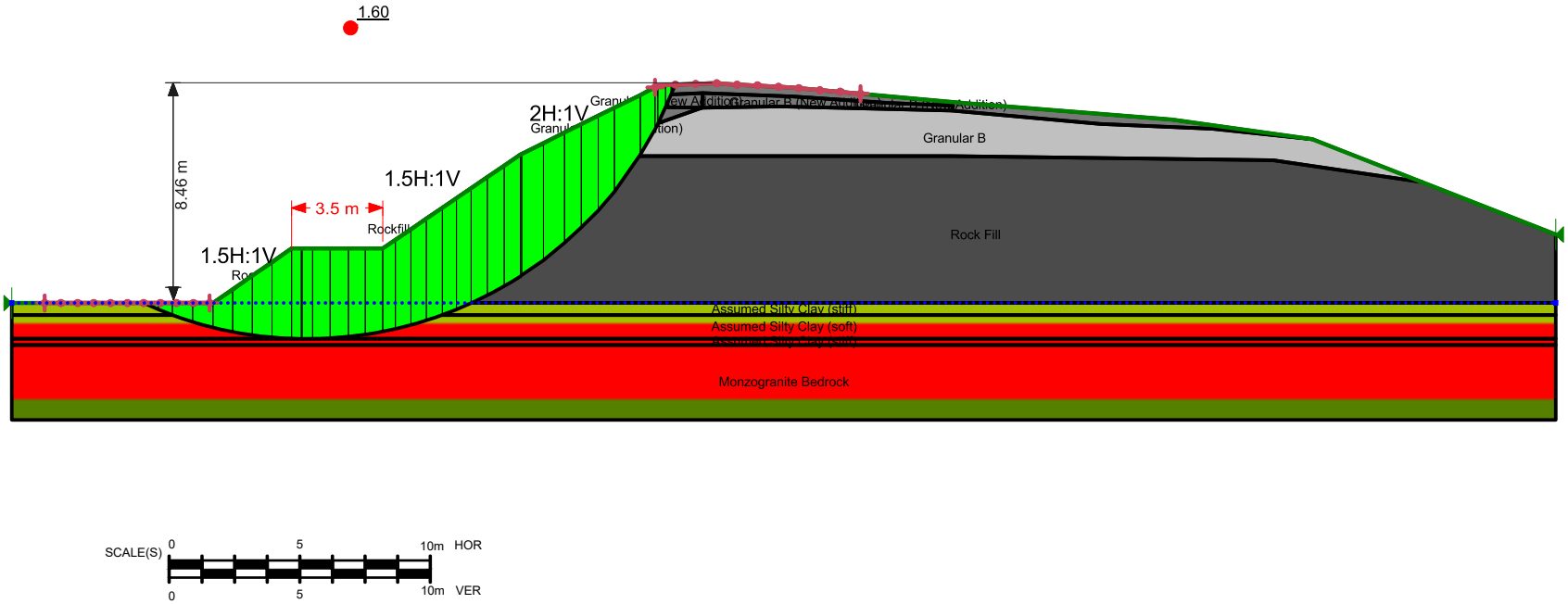
Last Run
2024-04-03, 05:27:35 PM

Scale
1:269

Additional Details
Name: Sta. 22+780
Comments:
Method: Morgenstern-Price, Half-Sine
Minimum Slip Surface Depth: 1 m
Entry: (-20.31415, -7.5) m, Exit: (-0.24861102, 0.85000005) m
Center: (-14.191304, 6.0707752) m, Radius: 14.888088 m

**Figure 2**

| Color | Name | Slope Stability Material Model | Unit Weight (kN/m³) | Effective Cohesion (kPa) | Effective Friction Angle (°) | Phi-B (°) | Piezometric Surface | B-bar | Add Weight |
|---|---|---|---|---|---|---|---|---|---|
| | Assumed Silty Clay (soft) | Mohr-Coulomb | 18 | 0 | 25 | 0 | 1 | 1 | No |
| | Assumed Silty Clay (stiff) | Mohr-Coulomb | 18 | 5 | 25 | 0 | 1 | 0.5 | No |
| | Granular B | Mohr-Coulomb | 22.8 | 0 | 35 | 0 | | 0 | No |
| | Granular B (New Addition) | Mohr-Coulomb | 22.8 | 0 | 35 | 0 | 1 | 0 | No |
| | Monzogranite Bedrock | Bedrock (Impenetrable) | | | | | 1 | 0 | No |
| | Rock Fill | Mohr-Coulomb | 19 | 0 | 42 | 0 | | 0 | No |
| | Rockfill (New Addition) | Mohr-Coulomb | 19 | 0 | 42 | 0 | | 0 | No |

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| | |
|---|---|
| Project | Rehab of Hwy 400&10 Bridges |
| Analysis | Plastic (Drained) (Widening) (2) |
| Seismic Coefficient | H: 0g, V: 0g |
| Last Run | 2024-04-03, 05:27:49 PM |
| Scale | 1:269 |

Additional Details
Name: Sta. 22+780
Comments:
Method: Morgenstern-Price, Half-Sine
Minimum Slip Surface Depth: 1 m
Entry: (-19.948545, -7.5) m, Exit: (0.42653806, 0.89156433) m
Center: (-13.667677, 6.1813552) m, Radius: 15.054195 m

**Figure 3**

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# Appendix F

## List of Standard Specifications and Drawings

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1. **List of OPSS and OPSD Documents Relevant to this Project**

- OPSS.PROV 201 (Construction Specification for Clearing, Grubbing, and Removal of Surface and Piled Boulders)
- OPSS.PROV 206 (Construction Specification for Grading)
- OPSS.PROV 209 (Construction Specification for Embankments over Swamps and Compressible Soils)
- OPSS.PROV 501 (Construction Specification for Compacting)
- OPSS.PROV 511 (Construction Specification for Rip-Rap, Rock Protection and Granular Sheeting)
- OPSS.PROV 902 (Specification for Excavating and Backfilling – Structures)
- OPSS.PROV 1004 (Material Specification for Aggregates - Miscellaneous)
- OPSS.PROV 1010 (Material Specification for Aggregates – Base, Subbase Select Subgrade, and Backfill Material)
- OPSS.PROV 1860 (Material Specification for Geotextiles)
- OPSD 203.030 (Embankments over Swamp, Existing Slope Maintained)
- OPSD 803.010 (Backfill and Cover for Concrete Culverts with Spans Less than or Equal to 3.0M)
- OPSD 810.010 (General Rip-Rap Layout for Sewer and Culvert Outlets)