

Subsurface Investigation Report

Enbridge Line 5 Reroute
MP 17 HDD Crossing – Updated Billy Creek Alignment
Location 17-BC, West of Poppe Road, South side of Highway 13
Location 18-BC, South of Highway 13, West Side of Poppe Road
Town of Ashland, Ashland County, Wisconsin

Prepared for

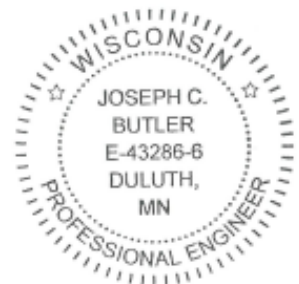
Enbridge Energy

Professional Certification:

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.



Joseph C. Butler, PE
Business Unit Manager / Senior Engineer
License Number: E-43286-6
October 1, 2020



Project B2001991

Braun Intertec Corporation

October 1, 2020

Project B2001991

Mr. Adam Erickson
Enbridge Energy, Limited Partnership
Manulife Place, 10180-101 Street
Edmonton, AB T5J 3S4

Re: Subsurface Investigation
Enbridge Line 5 Reroute
MP 17 HDD Crossing – Updated Billy Creek Alignment
Location 17-BC, West of Poppe Road, South side of Highway 13
Location 18-BC, South of Highway 13, West Side of Poppe Road
Town of Ashland, Ashland County, Wisconsin

Dear Mr. Erickson:

We are pleased to present this Subsurface Investigation Report for the Line 5 Reroute Project at the updated MP 17 HDD Crossing under Billy Creek in Town of Ashland, Ashland County, Wisconsin.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Kyle Warmuth (kwarmuth@braunintertec.com) or David Morrison (dmorrison@braunintertec.com) at 218.624.4967.

Sincerely,

BRAUN INTERTEC CORPORATION



Kyle P. Warmuth
Staff Consultant



David E. Morrison
Project Consultant



Joseph C. Butler, PE
Business Unit Manager / Senior Engineer

Table of Contents

| Description | Page |
|--|------|
| A. Introduction..... | 1 |
| A.1. Project Description | 1 |
| A.2. Purpose..... | 1 |
| A.3. Background Information and Reference Documents..... | 1 |
| A.4. Scope of Services | 2 |
| B. Results | 2 |
| B.1. Geologic Overview | 2 |
| B.2. Geologic Materials..... | 3 |
| B.2.a. Soil and Bedrock Encountered | 3 |
| B.2.b. Bedrock..... | 3 |
| B.3. Estimated Soil Properties | 3 |
| B.4. Groundwater | 4 |
| B.5. Laboratory Test Results..... | 5 |
| C. Procedures..... | 5 |
| C.1. Penetration Test Borings | 5 |
| C.2. Exploration Logs | 5 |
| C.2.a. Log of Boring Sheets..... | 5 |
| C.2.b. Rock Cores | 5 |
| C.2.c. Geologic Origins | 6 |
| C.3. Material Classification and Testing | 6 |
| C.3.a. Visual and Manual Classification..... | 6 |
| C.3.b. Laboratory Testing | 6 |
| C.4. Groundwater Measurements..... | 6 |
| D. Qualifications..... | 7 |
| D.1. Variations in Subsurface Conditions..... | 7 |
| D.1.a. Material Strata | 7 |
| D.1.b. Groundwater Levels | 7 |
| D.2. Continuity of Professional Responsibility..... | 7 |
| D.2.a. Plan Review | 7 |
| D.2.b. Construction Observations and Testing | 8 |
| D.3. Use of Report..... | 8 |
| D.4. Standard of Care..... | 8 |

Table of Contents (continued)

Appendix

Log of Boring Sheets 17-BC and 18-BC

HDD Alignment Profile

Descriptive Terminology of Soil

Descriptive Terminology of Rock

Sieve Analysis Reports: 327704, 327706, 327707, 328497, 328498

Moisture Content Reports: 327704, 327706, 327707, 328497, 328498

Compressive Strengths of Cores: 18-BC

A. Introduction

A.1. Project Description

Enbridge Energy plans to relocate Line 5 around the Bad River Indian Reservation, as part of that project, a geotechnical investigation and evaluation is being completed. We are providing subsurface investigation surfaces as part of this effort.

This report provides a factual data obtained at Borehole Locations 17-BC and 18-BC for the updated HDD crossing under Billy Creek which is located at MP 17 in the proposed pipeline alignment in Town of Ashland, Ashland County, Wisconsin.

A.2. Purpose

The purpose of our subsurface investigation is to characterize subsurface geologic conditions at the selected exploration location.

A.3. Background Information and Reference Documents

We reviewed the following information:

- Wisconsin Geologic Map, "Soils of Wisconsin", prepared by F. D. Hole, M.T Beatty, C.J. Milfred, G.B. Lee, and A.J Klingelhoets, dated 1968.
- "Bedrock Geologic Map of Wisconsin", prepared by M.G. Mudrey, Jr., B.A. Brown, and J.K. Greenberg, dated 1982.
- "Rock Mechanics Properties of Typical Foundation Rock Types", prepared by J.R. Brandon, dated July 1974.
- Aerial photos from Google Earth Pro®.

A.4. Scope of Services

We performed our scope of services for the project in accordance with our Quote to Mr. Jonathan Underland of Enbridge Energy, under the terms of the Work Order (132013839) provided by Enbridge Energy. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.
- Lake Superior Consulting selected and staked the boring location and we cleared the exploration location of underground utilities. The Soil Boring Location Sketch included in the Appendix shows the approximate location of the boring.
- Performing two (2) standard penetration test (SPT) borings, denoted as 17-BC and 18-BC to nominal depths ranging from 139 to 145 1/2 feet below grade across the site.
- Performing laboratory testing on select samples as selected by Lake Superior Consulting.
- Preparing this report containing a boring location sketch, an exploration log, laboratory tests, a summary of the geologic materials encountered.

Our scope of services did not include environmental services or testing and our geotechnical personnel performing this evaluation are not trained to provide environmental services or testing. We can provide environmental services or testing at your request.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Geologic Materials

B.2.a. Soil and Bedrock Encountered

The general geologic profile of the soils encountered between the two (2) borings consisted (proceeding down from the ground surface) of 1 to 4 feet of silty sand and lean clay fill in the borings, underlain by glacial deposits. The soils contained in the layers consisted of silty sands, poorly graded sands with silt, lean clay with sand, and silts to the termination depth of each boring, the encountered soils contained variable amounts of gravel. Table 1 in section B.3 contains more information on each material encountered.

B.2.b. Bedrock

Below the glacial deposits, the boring encountered bedrock extending from an approximate elevation ranging between of 910 1/2 to 889 1/2 feet to the termination depth of the boring. The bedrock generally consisted of reddish gray with brown and white, and brown with pink and white conglomerate associated with the Keweenawan Supergroup: Freda Sandstone. The conglomerate was generally classified as “highly fractured” to “intensely fractured”. The rock was deemed as “moderately hard” to “hard” in terms of the rock hardness scale and ranged from “slightly weathered” to “moderately weathered”.

B.3. Estimated Soil Properties

Estimated soil properties for each significant strata change are presented below in Table 1.

Table 1: Estimated Soil Properties

| Soil Strata and Elevations (ft) | Soil Type | Blow Count per foot Range (BPF) | Dry Unit Weight Range (pcf) | Undrained Unit Weight Range (pcf) | Drained Friction Angle Range (degrees) | Undrained Friction Angle (degrees) | Undrained Cohesion Range (ksf) | Drained Cohesion Range (ksf) | Modulus of Elasticity Range* (tsf) |
|----------------------------------|--------------------------------------|---|-----------------------------|-----------------------------------|--|------------------------------------|--------------------------------|------------------------------|------------------------------------|
| Upper Soils (935 1/2 to 889 1/2) | Lean Clay (CL) | 18 | 100 - 125 | 125 - 130 | 29 - 30 | 10 | 2.5 – 4.5 | 1.6 – 3.0 | 72 - 104 |
| | Poorly Graded Sand with Silt (SP-SM) | 6 - 44 | 83 - 121 | 105 - 127 | 30 - 40 | 30 - 36 | 0 | 0 | 42 - 317 |
| | Silt (ML) | 7 - 31 | 85 - 102 | 105 - 125 | 26 - 33 | 27 - 33 | 0 | 0 | 28 - 134 |
| | Silty Sand (SM) | 43 - 50 blows for 3 inches of penetration | 112 - 116 | 125 - 130 | 35 - 37 | 25 | 2.5 | 4.1+ | 248 - 490 |
| Lower Rock (910 1/2 to 785 1/2) | **Cong. | N/A | 161- 167 | 161 - 167 | 35 - 44 | 35 - 44 | 0 | 0 | 122,400 – 165, 600 |

*Sustained Young's Modulus values

**Conglomerate

B.4. Groundwater

We did not observe groundwater while advancing the borings. Groundwater may take days or longer to reach equilibrium in the boreholes and we immediately backfilled the boreholes, in accordance with our scope of work.

Project planning should anticipate seasonal and annual fluctuations of groundwater. Mud-rotary drilling techniques were used to advance the borings, hindering the ability to observe groundwater.

B.5. Laboratory Test Results

The boring logs show the results of the sieve analysis, moisture testing, and compressive strength of cores that was requested. The Appendix contains the results of these tests.

C. Procedures

C.1. Penetration Test Borings

We drilled the penetration test borings with a floatation tire-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. We collected thin-walled tube samples in general accordance with ASTM D1587 at selected depths. The boring logs show the actual sample intervals and corresponding depths. We also collected bulk samples of auger cuttings at selected locations for laboratory testing.

C.2. Exploration Logs

C.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of laboratory tests performed on penetration test samples, and groundwater measurements.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

C.2.b. Rock Cores

We performed rock cores with an NQ-3 core barrel. First, we lowered the bit and casing to the bottom of the previously advanced borehole. Then we lowered the core barrel into the casing with a wire line, and locked into place. We advanced the bit and barrel by rotating the assembly while applying crowd

pressure. We used bentonite-drilling mud to cool the bit and wash cuttings to the surface. They noted intervals with a rapid rate of advance.

After completing each 5 to 10-foot core run, the drillers unlocked the core barrel from the bit and brought the barrel to the surface. They then extruded the split inner tube from the barrel and opened the tube to reveal the core sample. After field classification and logging, the drillers packed the core into a cardboard storage box, arranged into 2-foot long sections.

C.2.c. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, (4) laboratory test results, and (5) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

C.3. Material Classification and Testing

C.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

C.3.b. Laboratory Testing

The exploration logs in the Appendix note most of the results of the laboratory tests performed on geologic material samples. The remaining laboratory test results follow the exploration logs. We performed the tests in general accordance with ASTM or AASHTO procedures.

C.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes or allowed them to remain open for an extended period of observation, as noted on the boring logs.

D. Qualifications

D.1. Variations in Subsurface Conditions

D.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

D.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

D.2. Continuity of Professional Responsibility

D.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

D.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

D.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

D.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

Appendix

| | | | | | | |
|--|--|--------------------|--------------------|----------------------|-------------------------------|----------------------|
| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 17-BC | |
| | | | | | LOCATION: See attached sketch | |
| | | | | | LATITUDE: 46.38927 | LONGITUDE: -90.76150 |
| DRILLER: EPC | | LOGGED BY: P. Moe | | START DATE: 07/13/20 | END DATE: 07/20/20 | |
| SURFACE ELEVATION: 924.6 ft | | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: | | WEATHER: |

| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | Sample | Blows (N-Value) Recovery | q _p tsf | MC % | Tests or Remarks |
|-----------------|-------------|---|--------|-----------------------------|--------------------|------|---|
| 920.6 | | FILL: LEAN CLAY with SAND (CL), fine to medium-grained, trace organic, trace Gravel, brown, dry | | 2-3-6-6 (9) 24" | | | |
| 4.0 | | | | 3-5-7-9 (12) 24" | | | |
| 918.2 | | SANDY LEAN CLAY (CL), fine to medium-grained, trace Gravel, brown, dry, very stiff (LACUSTRINE) | 5 | 4-10-8-14 (18) 24" | | | |
| 6.5 | | POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, brown, dry, medium dense (GLACIAL OUTWASH) | | 9-11-12-15 (23) 24" | | 5 | Test results are in the attached lab report |
| | | | 10 | 8-11-14-18 (25) 24" | | | Drilling method switched to mud rotary at 10 feet |
| 913.2 | | SANDY SILT (ML), fine to medium-grained, brown, moist, medium dense to dense (GLACIAL TILL) | | 10-14-17-21 (31) 21" | | | |
| 11.5 | | | 15 | 10-13-17-18 (30) 24" | | 23 | Test results are in the attached lab report |
| 907.2 | | SILTY SAND (SM), fine to medium-grained, trace Gravel, rock fragments, brown, moist, dense (GLACIAL TILL) | | 11-15-28 (43) 18" | | | |
| 17.5 | | | 20 | | | | |
| 902.2 | | SILTY SAND with GRAVEL (SM), rock fragments, brown, moist, hard (GLACIAL TILL) | | 38-33-50/4" (REF) 16" | | 12 | Test results are in the attached lab report |
| 22.5 | | | 25 | | | | |
| | | | 30 | 50/3" (REF) 5" | | | |

Continued on next page

| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 17-BC | | | | | |
|--|-------------|---|--------------------|--------------------------------|-------------------------------|------------------------|--|----------------------|----------------|---------|
| | | | | | LOCATION: See attached sketch | | | | | |
| | | | | | LATITUDE: 46.38927 | LONGITUDE: -90.76150 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | START DATE: 07/13/20 | END DATE: 07/20/20 | | | | | |
| SURFACE ELEVATION: 924.6 ft | | RIG: Subcontractor | METHOD: 4 1/4" HSA | SURFACING: | | WEATHER: | | | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | Sample | Blows (N-Value) Recovery | q _p tsf | MC % | Tests or Remarks | | | |
| | | SILTY SAND with GRAVEL (SM), rock fragments, brown, moist, hard (GLACIAL TILL) | | | | | Drilling method switched to rock coring at 35 feet | | | |
| 889.6 | | FREDA SANDSTONE, CONGLOMERATE, dark gray with white, moderately weathered, moderately hard, fine-grained to medium-grained, massive, intensely fractured | 35 | 50/3" (REF) | | | Run 1 MOHs 3, 6.5, 5 | | | |
| 35.0 | | | | 3" | | | | | | |
| 888.6 | | FREDA SANDSTONE, CONGLOMERATE, pinkish white with gray, moderately weathered, hard, fine-grained to medium-grained, massive, highly fractured | 40 | 10 | 33 | | Run 2 MOHs 3 | | | |
| 36.0 | | | | | | | | | | |
| 887.6 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, slightly weathered to moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 45 | 0 | 9 | | Run 3 MOHs 3 | | | |
| 37.0 | | | | | | | | | | |
| | | | 50 | 0 | 18 | | Drilling method switched to mud rotary from 50-53 feet | | | |
| 871.6 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 55 | 14 | 28 | | Run 4 MOHs 3.5 | | | |
| 53.0 | | | | 0 | 33 | | Run 5 MOHs 3, 3.5 | | | |
| | | | 60 | 0 | 33 | | Run 6 MOHs 3 | | | |
| | | | | 0 | 33 | | Run 7 MOHs 3 | | | |
| | | | | | | | Run 8 MOHs 3.5 | | | |
| Continued on next page | | | | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |

| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 17-BC | | | | | |
|--|----------------|--|--------|--------------------|-------------------------------|------------------------------|--------------------------|----------------------------|----------------------|---|
| | | | | | LOCATION: See attached sketch | | | | | |
| | | | | | LATITUDE: 46.38927 | | LONGITUDE: -90.76150 | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | | START DATE: 07/13/20 | | END DATE: 07/20/20 | | | |
| SURFACE ELEVATION: 924.6 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | Sample | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |
| 845.6 | | | 65 | 0 | 17 | | | | | Run 9 MOHs 3.5, 7 |
| 79.0 | | | 70 | 0 | 20 | | | | | |
| 839.6 | | | 75 | 0 | 13 | | | | | |
| 85.0 | | FRED A SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 80 | | | | | | | Gravel and cobbles from 79-85 feet. |
| | | | 85 | 42 | 50 | | | | | Run 11 MOHs 3.5 Run 12 MOHs 6, 3 |
| | | | 90 | 8 | 54 | | | | | Run 13 MOHs 3 |
| 831.6 | | | 95 | 13 | 39 | | | | | Run 14 |
| 93.0 | | | | 0 | 45 | | | | | |
| Continued on next page | | | | | | | | | | |

| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 17-BC | | | | | |
|--|-------------|---|--------|----------------------|-------------------------------|------------------------|--------------------|----------------------|----------------|--------------------|
| | | | | | LOCATION: See attached sketch | | | | | |
| | | | | | LATITUDE: 46.38927 | LONGITUDE: -90.76150 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | START DATE: 07/13/20 | | END DATE: 07/20/20 | | | | |
| SURFACE ELEVATION: 924.6 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | Sample | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |
| 826.6 | | | | | | | | | | |
| 98.0 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 100 | 11 | 26 | | | | | Run 15 MOHs 6.5, 3 |
| | | | 105 | 0 | 29 | | | | | Run 16 MOHs 2.5 |
| | | | 110 | 11 | 30 | | | | | Run 17 MOHs 6 |
| | | | 115 | 0 | 20 | | | | | Run 18 MOHs 3 |
| | | | 120 | 0 | 3 | | | | | Run 19 MOHs 3 |
| 801.6 | | | | 0 | 33 | | | | | Run 20 MOHs 3 |
| 123.0 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 125 | 60 | 100 | | | | | Run 21 MOHs 3, 6 |
| | | | | 53 | 100 | | | | | Run 22 MOHs 3 |
| | | | | | | | | | | Run 23 MOHs 3 |
| Continued on next page | | | | | | | | | | |

| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 17-BC | | | | | |
|--|--|---|--------|----------------------|-------------------------------|------------------------------|--------------------------|----------------------------|----------------------|------------------------------------|
| | | | | | LOCATION: See attached sketch | | | | | |
| | | | | | LATITUDE: 46.38927 | LONGITUDE: -90.76150 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | START DATE: 07/13/20 | | END DATE: 07/20/20 | | | | |
| SURFACE ELEVATION: 924.6 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | Sample | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |
| 795.2 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 130 | 47 | 100 | | | | | Run 24 MOHs 3.5 |
| 129.5 | | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, slightly weathered to moderately weathered, moderately hard to hard, fine-grained to medium-grained, massive, highly fractured to intensely fractured | 135 | 0 | 11 | | | | | |
| | | | | 7 | 20 | | | | | |
| 785.6 | | END OF CORING | 140 | | | | | | | Water not observed while drilling. |
| 139.0 | Boring then backfilled with cement/bentonite grout | | | | | | | | | |
| | | | | | | | | | | |

See Descriptive Terminology sheet for explanation of abbreviations


| | | | | | | | | | | | |
|---|-------------|---|--|--------------------|-------------------------------|----------------------------|------------------------|---|--|----------------------------|--------------|
| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | BORING: 18-BC | | | | | | |
| | | | | | LOCATION: See attached sketch | | | | | | |
| | | | | | LATITUDE: 46.38892 | | LONGITUDE: -90.75856 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | | START DATE: 07/22/20 | | END DATE: 07/28/20 | | | | |
| SURFACE ELEVATION: 936.5 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | | | Sample | Blows (N-Value) Recovery | q _p tsf | MC % | Tests or Remarks | | |
| 935.5 1.0 | | SILTY SAND (SM), fine to medium-grained, with organic, wood debris, brownish black, moist (TOPSOIL FILL) POORLY GRADED SAND with SILT (SP-SM), fine to medium-grained, brown, moist, loose to medium dense (GLACIAL OUTWASH) | | | | 1-2-2-2 (4) 16" | | 26 | Test results are in the attached lab report Drilling method switched to mud rotary at 10 feet | | |
| | | | | | | 2-5-9-8 (14) 24" | | | | | |
| | | | | | | 4-4-2-3 (6) 24" | | | | | |
| | | | | | | 3-4-6-6 (10) 24" | | | | | |
| | | | | | | 2-3-4-6 (7) 24" | | | | | |
| 927.5 9.0 | | SANDY SILT (ML), fine to medium-grained, brown, moist, loose (GLACIAL TILL) | | | | 14-20-24-22 (44) 18" | 10 | Test results are in the attached lab report Casing from 15 to 27', encountered many boulders and cobbles Drilling method switched to rock coring at 26 feet | | | |
| 925.5 11.0 | | | | | | | | | | 15-20-21-22 (41) 18" | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| 910.5 26.0 | | FRED A SANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard, fine-grained to coarse-grained, intensely fractured | | | | 0 | 31 | | | | Run 1 MOHs 3 |
| | | | | | | | | | | | Run 2 MOHs 3 |
| Continued on next page | | | | | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |

B2001991 Braun Intertec Corporation Print Date:10/01/2020 18-BC page 2 of 5

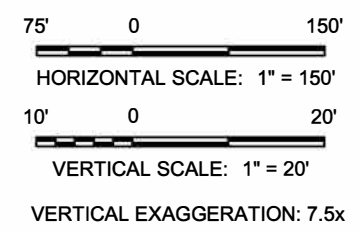
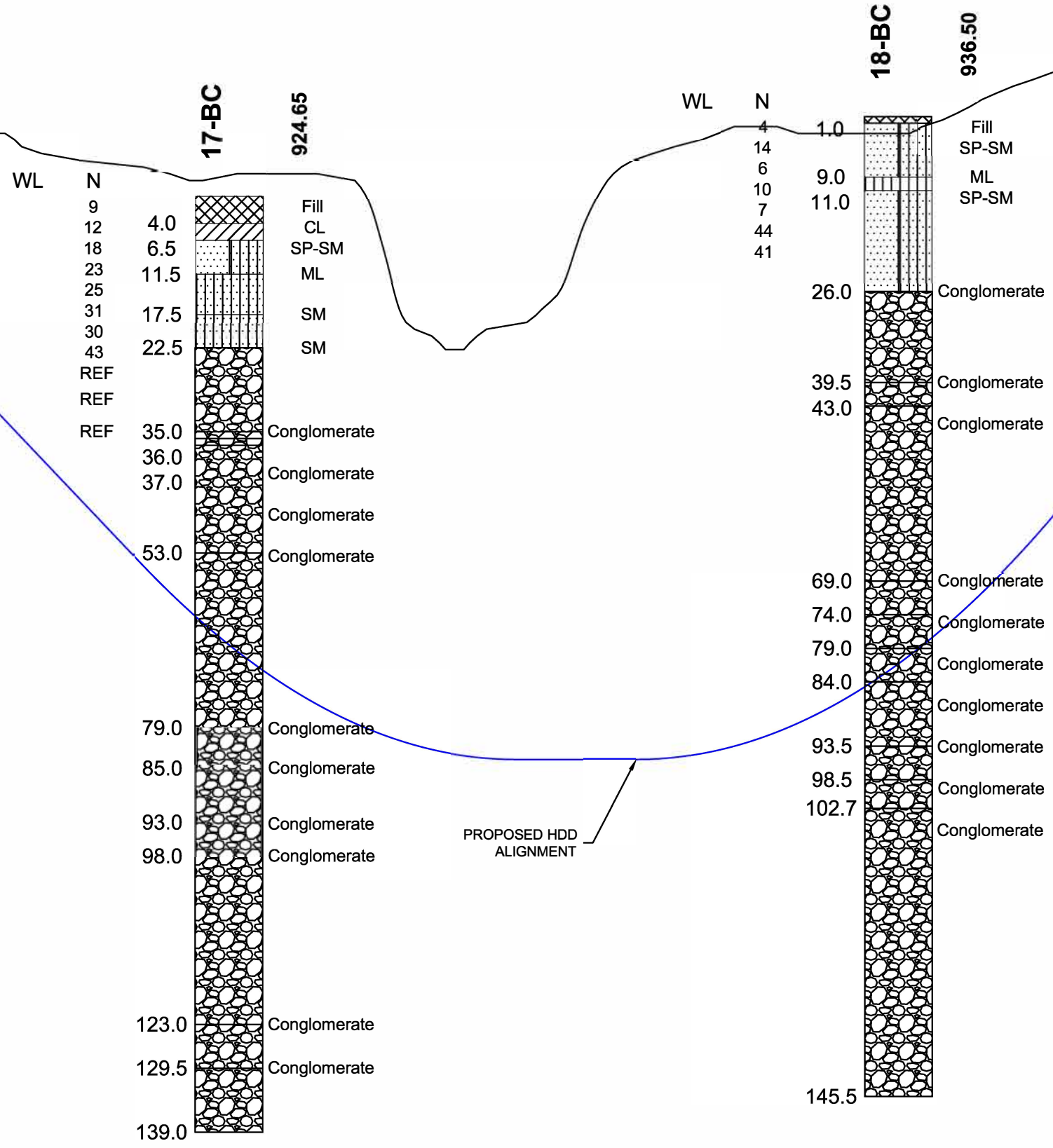
| | | | | | | | | | | | | | |
|---|-------------|--|---|--------------------|--|-------------------------------|-------|--------------------|------------------------|--------------------|----------------------|----------------|---------------|
| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | | BORING: 18-BC | | | | | | | |
| | | | | | | LOCATION: See attached sketch | | | | | | | |
| | | | | | | LATITUDE: 46.38892 | | | LONGITUDE: -90.75856 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | | | START DATE: 07/22/20 | | END DATE: 07/28/20 | | | | | |
| SURFACE ELEVATION: 936.5 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | | | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | | | | Sample | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |
| 867.5 69.0 | | | FREDASANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard, fine-grained to coarse-grained, intensely fractured | 65 | | | 23 | 100 | | | | | Run 13 MOHs 3 |
| | | | | | | | 28 | 100 | | | | | |
| 862.5 74.0 | | | FREDASANDSTONE, CONGLOMERATE, reddish gray with brown, slightly weathered, hard, fine-grained to medium-grained, highly fractured <i>Test results are in the attached lab report</i> | 70 | | | 75 | 100 | | | | | Run 14 MOHs 3 |
| | | | | | | | | | | | | | |
| 857.5 79.0 | | | FREDASANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard, fine-grained to coarse-grained, intensely fractured | 75 | | | 0 | 17 | | | | | Run 15 MOHs 3 |
| | | | | | | | 12 | 100 | | | | | |
| 852.5 84.0 | | | FREDASANDSTONE, CONGLOMERATE, reddish gray with brown, slightly weathered, hard, fine-grained to medium-grained, highly fractured <i>Test results are in the attached lab report</i> | 80 | | | 92 | 100 | | | | | Run 17 MOHs 3 |
| | | | | | | | | | | | | | |
| 843.0 93.5 | | | FREDASANDSTONE, CONGLOMERATE, reddish gray with brown, moderately weathered, moderately hard, fine-grained to coarse-grained, intensely fractured | 85 | | | 19 | 74 | | | | | Run 18 MOHs 3 |
| | | | | | | | | | | | | | |
| | | | | 90 | | | 35 | 100 | | | | | Run 19 MOHs 3 |
| | | | | 95 | | | | | | | | | Run 20 MOHs 3 |
| | | Continued on next page | | | | | | | | | | | |

B2001991 Braun Intertec Corporation Print Date:10/01/2020 18-BC page 4 of 5

See Descriptive Terminology sheet for explanation of abbreviations

| | | | | | | | | | | | | | |
|---|--|--|--|--------------------|--|-------------------------------|-------|--------------------|------------------------|--------------------|----------------------|----------------|------------------------------------|
| Project Number B2001991 Geotechnical Evaluation Enbridge Line 5 Re-Route Various Locations Ashland and Iron Counties, Wisconsin | | | | | | BORING: 18-BC | | | | | | | |
| | | | | | | LOCATION: See attached sketch | | | | | | | |
| | | | | | | LATITUDE: 46.38892 | | | LONGITUDE: -90.75856 | | | | |
| DRILLER: EPC | | LOGGED BY: P. Moe | | | | START DATE: 07/22/20 | | END DATE: 07/28/20 | | | | | |
| SURFACE ELEVATION: 936.5 ft | | RIG: Subcontractor | | METHOD: 4 1/4" HSA | | SURFACING: | | WEATHER: | | | | | |
| Elev./ Depth ft | Water Level | Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908) | | | | Sample | RQD % | Recovery % | Drilling Rate (min/ft) | Bit Pressure (psi) | Water Pressure (psi) | Water Return % | Remarks |
| 791.0 145.5 |  | FREDA SANDSTONE, CONGLOMERATE, reddish gray with brown, slightly weathered, hard, fine-grained to medium-grained, highly fractured | | | | 130 | 45 | 100 | | | | | Run 29 MOHs 3 |
| | | Test results are in the attached lab report | | | | 135 | 67 | 100 | | | | | |
| | | | | | | 140 | 39 | 86 | | | | | |
| | | Test results are in the attached lab report | | | | 145 | 67 | 100 | | | | | |
| | | END OF CORING | | | | | | | | | | | Water not observed while drilling. |
| | | Boring then backfilled with cement/bentonite grout | | | | | | | | | | | |
| | | | | | | | | | | | | | |

F:\2020\B2001991\CAD\MP 17 Billy Creek - New\B2001991_MP17_BILLY-CREEK-NEW.dwg, BLAND, 8/28/2020 3:02:04 PM



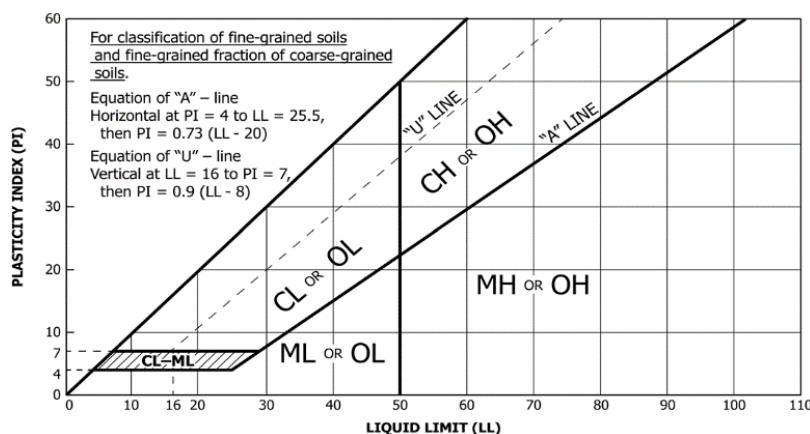
| Drawing Information | |
|---------------------|-------------------------------|
| Project No: | B2001991 |
| Drawing No: | B2001991_MP17_BILLY-CREEK-NEW |
| Drawn By: | BJB |
| Date Drawn: | 6/17/20 |
| Checked By: | DM |
| Last Modified: | 8/28/20 |

Enbridge Line 5 Re-route

MP 17 -
Billy Creek New
Alignment

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A | | | | Group Symbol | Soil Classification |
|--|---|---|---|--------------|--|
| | | | | | Group Name ^B |
| Coarse-grained Soils (more than 50% retained on No. 200 sieve) | Gravels (More than 50% of coarse fraction retained on No. 4 sieve) | Clean Gravels (Less than 5% fines ^C) | $C_u \geq 4$ and $1 \leq C_c \leq 3^D$ | GW | Well-graded gravel ^E |
| | | | $C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$) ^D | GP | Poorly graded gravel ^E |
| | | Gravels with Fines (More than 12% fines ^C) | Fines classify as ML or MH | GM | Silty gravel ^{EFG} |
| | | | Fines Classify as CL or CH | GC | Clayey gravel ^{EFG} |
| | Sands (50% or more coarse fraction passes No. 4 sieve) | Clean Sands (Less than 5% fines ^H) | $C_u \geq 6$ and $1 \leq C_c \leq 3^D$ | SW | Well-graded sand ^I |
| | | | $C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$) ^D | SP | Poorly graded sand ^I |
| | | Sands with Fines (More than 12% fines ^H) | Fines classify as ML or MH | SM | Silty sand ^{FGI} |
| | | | Fines classify as CL or CH | SC | Clayey sand ^{FGI} |
| Fine-grained Soils (50% or more passes the No. 200 sieve) | Silts and Clays (Liquid limit less than 50) | Inorganic | PI > 7 and plots on or above "A" line ^J | CL | Lean clay ^{KLM} |
| | | | PI < 4 or plots below "A" line ^J | ML | Silt ^{KLM} |
| | | Organic | Liquid Limit – oven dried Liquid Limit – not dried <0.75 | OL | Organic clay ^{KLMN} Organic silt ^{KLMQ} |
| | | | | | |
| | Silts and Clays (Liquid limit 50 or more) | Inorganic | PI plots on or above "A" line | CH | Fat clay ^{KLM} |
| | | | PI plots below "A" line | MH | Elastic silt ^{KLM} |
| | | Organic | Liquid Limit – oven dried Liquid Limit – not dried <0.75 | OH | Organic clay ^{KLMP} Organic silt ^{KLMQ} |
| | | | | | |
| Highly Organic Soils | | Primarily organic matter, dark in color, and organic odor | | PT | Peat |

- Based on the material passing the 3-inch (75-mm) sieve.
- If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
- Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay
- $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
- If soil contains $\geq 15\%$ sand, add "with sand" to group name.
- If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
- If fines are organic, add "with organic fines" to group name.
- Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay
- If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
- If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
- If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
- If soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
- If soil contains $\geq 30\%$ plus No. 200 predominantly gravel, add "gravelly" to group name.
- PI ≥ 4 and plots on or above "A" line.
- PI plots on or above "A" line.
- PI plots below "A" line.



DD Dry density, pcf
WD Wet density, pcf
P200 % Passing #200 sieve

Laboratory Tests
OC Organic content, %
q_p Pocket penetrometer strength, tsf
MC Moisture content, %
q_u Unconfined compression test, tsf

LL Liquid limit
PL Plastic limit
PI Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions^{L, M}

trace..... 0 to 5%
little..... 6 to 14%
with..... $\geq 15\%$

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose 0 to 4 BPF
Loose 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils Blows Per Foot Approximate Unconfined Compressive Strength

Very soft..... 0 to 1 BPF..... < 0.25 tsf
Soft..... 2 to 4 BPF..... 0.25 to 0.5 tsf
Medium..... 5 to 8 BPF 0.5 to 1 tsf
Stiff..... 9 to 15 BPF..... 1 to 2 tsf
Very Stiff..... 16 to 30 BPF..... 2 to 4 tsf
Hard..... over 30 BPF..... > 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:




Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

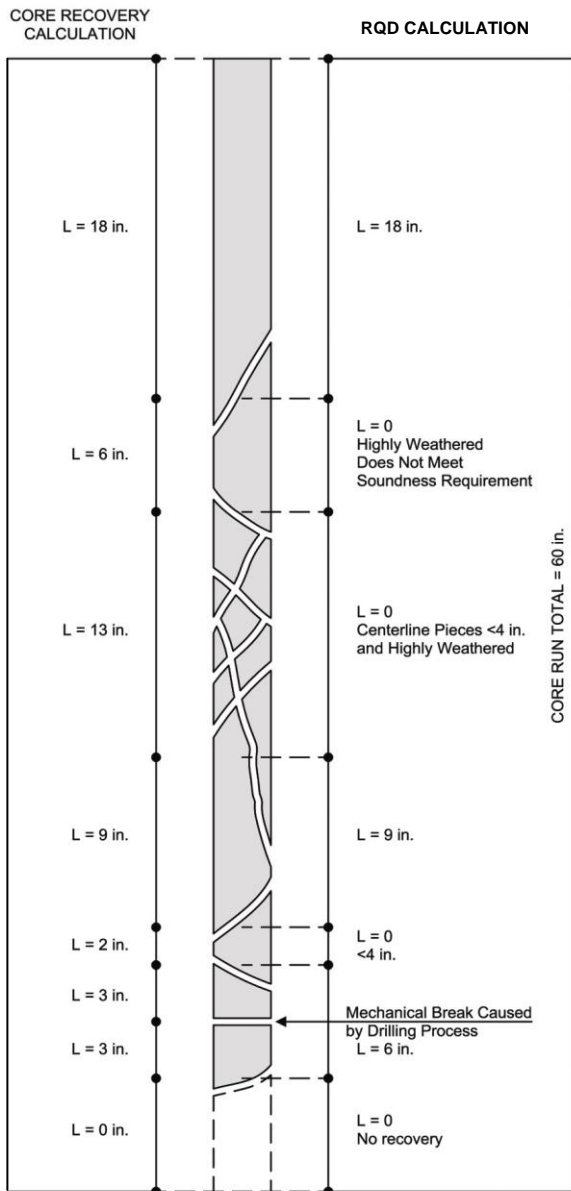
Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (), at the end of drilling (), or at some time after drilling ().



Example Calculations

Core Recovery, CR = $\frac{\text{Total length of rock recovered}}{\text{Total core run length}}$

Example: $CR = \frac{(18 + 6 + 13 + 9 + 2 + 3 + 3)}{(60)}$

$CR = 90\%$

RQD = $\frac{\text{Sum of sound pieces 4 inches or larger}}{\text{Total core run length}}$

| RQD Percent | Rock Quality |
|-------------|--------------|
| < 25 | very poor |
| 25 < 50 | poor |
| 50 < 75 | fair |
| 75 < 90 | good |
| 90 < 100 | excellent |

Example: $RQD = \frac{(18 + 9 + 6)}{(60)}$

$RQD = 55\%$

Weathering

Unweathered: No evidence of chemical or mechanical alteration.

Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of rock volume altered.

Moderately Weathered: Discoloration evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering halos evident, 10% to 50% of the rock altered.

Highly Weathered: Entire mass discolored, alteration pervading nearly all of the rock, with some pockets of slightly weathered rock noticeable, some mineral leached away.

Decomposed: Rock reduced to a soil consistency with relict rock texture, generally molded and crumbled by hand.

Hardness

| | |
|-------------------------|---|
| <i>Very soft:</i> | Can be deformed by hand |
| <i>Soft:</i> | Can be scratched with a fingernail |
| <i>Moderately hard:</i> | Can be scratched easily with a knife |
| <i>Hard:</i> | Can be scratched with difficulty with a knife |
| <i>Very hard:</i> | Cannot be scratched with a knife |

Texture

| Sedimentary Rocks: | Grain Size |
|--------------------|--------------|
| Coarse grained | 2 – 5 mm |
| Medium grained | 0.4 – 2 mm |
| Fine grained | 0.1 – 0.4 mm |
| Very fine grained | < 0.1 mm |

Igneous and Metamorphic Rocks:

| | |
|----------------|------------|
| Coarse grained | 5 mm |
| Medium grained | 1 – 5 mm |
| Fine grained | 0.1 – 1 mm |
| Aphanitic | < 0.1 mm |

Thickness of Bedding

| | |
|-----------------------|------------------------|
| <i>Massive:</i> | 3 ft. thick or greater |
| <i>Thick bedded:</i> | 1 to 3 ft. thick |
| <i>Medium bedded:</i> | 4 in. to 1 ft. thick |
| <i>Thin bedded:</i> | 4 in. thick or less |

Degree of Fracturing (Jointing)

| | |
|------------------------------|---------------------------------|
| <i>Unfractured:</i> | Fracture spacing 6 ft. or more |
| <i>Slightly fractured:</i> | Fracture spacing 2 to 6 ft. |
| <i>Moderately fractured:</i> | Fracture spacing 8 in. to 2 ft. |
| <i>Highly fractured:</i> | Fracture spacing 2 in. to 8 in. |
| <i>Intensely fractured:</i> | Fracture spacing 2 in. or less |

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

| | | | |
|--------------------------|-----------------------------|----------------------|---|
| Sample Number: | 327704 | Alternate ID: | 17-BC 4 7'-9' |
| Sampling Method: | Auger Boring ASTM D1452 | Depth (ft): | 7-9 |
| Boring Number: | 17-BC | Sampled By: | Drill Crew |
| Location: | In-place | | |
| Location Details: | Boring 17-BC Sample 4 7'-9' | | |
| Sample Date: | 07/13/2020 | | |
| Received Date: | 08/06/2020 | Lab: | 4511 West First Street, Suite 4, Duluth, MN |
| Tested Date: | 08/11/2020 | Tested By: | Nelson, Brennan |

Laboratory Data

| Sieve Size | Passing (%) | Specification |
|------------------|-------------|---------------|
| 4.75 mm (No. 4) | 100.0 | |
| 2 mm (No. 10) | 100.0 | |
| 850 µm (No. 20) | 100.0 | |
| 425 µm (No. 40) | 98.3 | |
| 150 µm (No. 100) | 22.4 | |
| 75 µm (No. 200) | 9.8 | |

Sand (%)

90.2

Silt & Clay (%)

9.8

D10

0.075

D30

0.160

D60

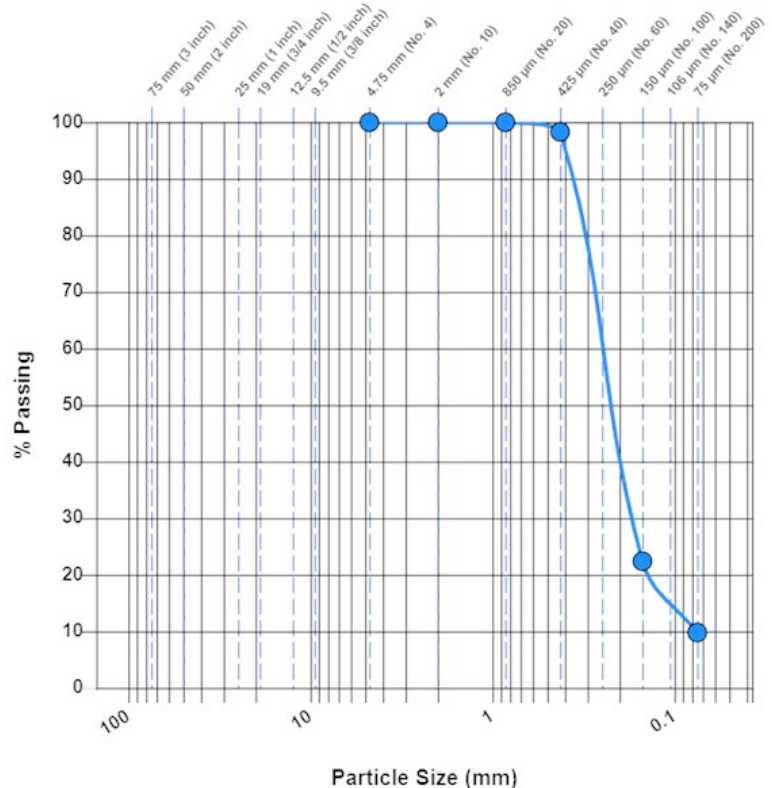
0.200

C_u

2.67

C_c

1.71



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 255.0 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

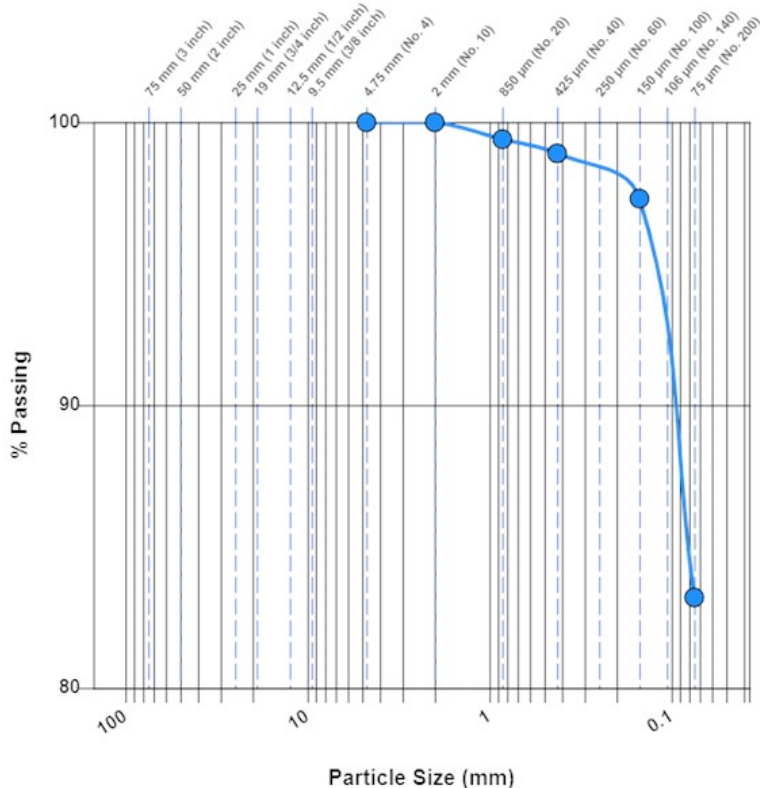
| | | | |
|--------------------------|-----------------------------------|----------------------|---|
| Sample Number: | 327706 | Alternate ID: | 17-BC 7 14.5'-16.5' |
| Sampling Method: | Auger Boring ASTM D1452 | Depth (ft): | 14.5-16.5 |
| Boring Number: | 17-BC | Sampled By: | Drill Crew |
| Location: | In-place | | |
| Location Details: | Boring 17-BC Sample 7 14.5'-16.5' | | |
| Sample Date: | 07/13/2020 | | |
| Received Date: | 08/06/2020 | Lab: | 4511 West First Street, Suite 4, Duluth, MN |
| Tested Date: | 08/11/2020 | Tested By: | Nelson, Brennan |

Laboratory Data

| Sieve Size | Passing (%) | Specification |
|------------------|-------------|---------------|
| 4.75 mm (No. 4) | 100.0 | |
| 2 mm (No. 10) | 100.0 | |
| 850 µm (No. 20) | 99.4 | |
| 425 µm (No. 40) | 98.9 | |
| 150 µm (No. 100) | 97.3 | |
| 75 µm (No. 200) | 83.2 | |

Sand (%)
16.8

Silt & Clay (%)
83.2



Classification: ML Silt with sand

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 218.6 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

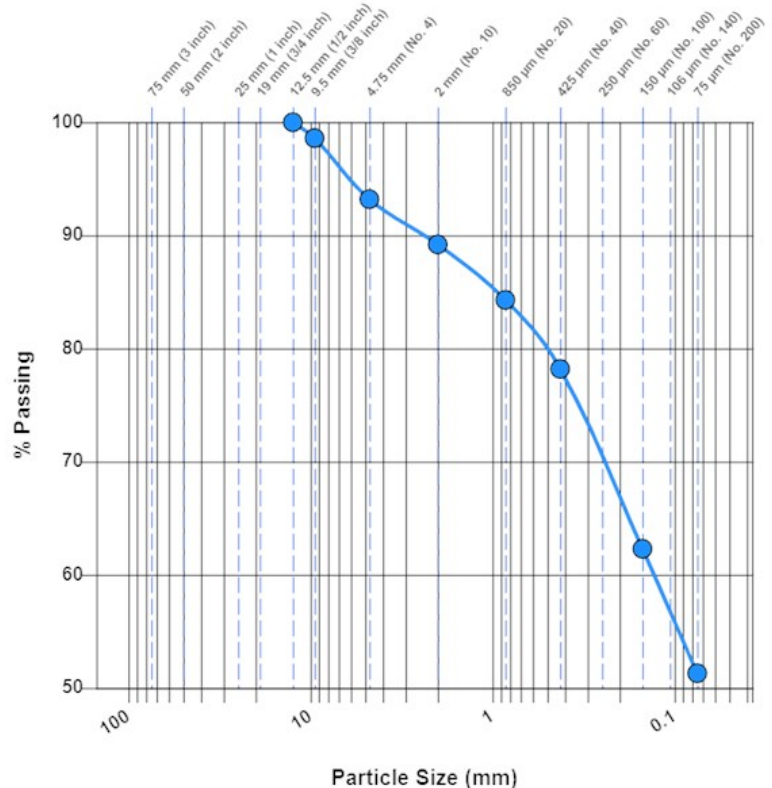
Sample Information

| | | | |
|--------------------------|---------------------------------|----------------------|---|
| Sample Number: | 327707 | Alternate ID: | 17-BC 9 25'-26.5' |
| Sampling Method: | Auger Boring ASTM D1452 | Depth (ft): | 25-26.5 |
| Boring Number: | 17-BC | Sampled By: | Drill Crew |
| Location: | In-place | | |
| Location Details: | Boring 17-BC Sample 9 25'-26.5' | | |
| Sample Date: | 07/13/2020 | | |
| Received Date: | 08/06/2020 | Lab: | 4511 West First Street, Suite 4, Duluth, MN |
| Tested Date: | 08/11/2020 | Tested By: | Nelson, Brennan |

Laboratory Data

| Sieve Size | Passing (%) | Specification |
|--------------------|-------------|---------------|
| 12.5 mm (1/2 inch) | 100.0 | |
| 9.5 mm (3/8 inch) | 98.6 | |
| 4.75 mm (No. 4) | 93.2 | |
| 2 mm (No. 10) | 89.2 | |
| 850 µm (No. 20) | 84.3 | |
| 425 µm (No. 40) | 78.2 | |
| 150 µm (No. 100) | 62.3 | |
| 75 µm (No. 200) | 51.3 | |

| | | |
|-------------------|-----------------|----------------------------|
| Gravel (%) | Sand (%) | Silt & Clay (%) |
| 6.8 | 41.9 | 51.3 |
| D60 | | |
| 0.100 | | |



Classification: SM Silty sand
Specimen Obtained: Oven Dry
Dispersion Apparatus: Shaking

Test Method: Method A (Composite Sieving)

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 235.5 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

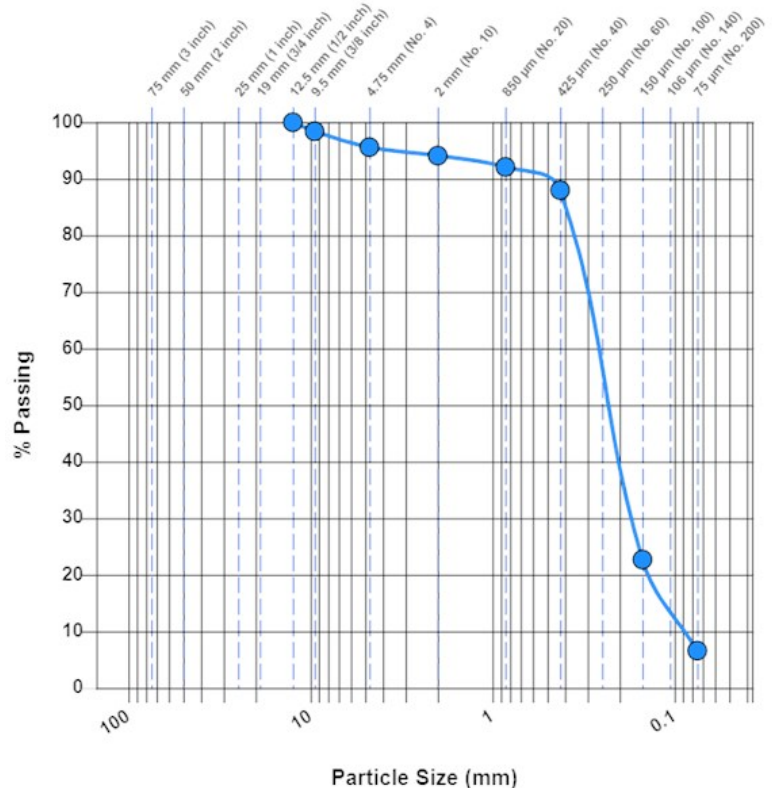
Sample Information

| | | | |
|--------------------------|----------------------------|----------------------|---|
| Sample Number: | 328497 | Alternate ID: | 18BC 4 7'-9' |
| Sampling Method: | Auger Boring ASTM D1452 | Depth (ft): | 7-9 |
| Boring Number: | 18BC | Sampled By: | Drill Crew |
| Location: | In-place | | |
| Location Details: | Boring 18BC Sample 4 7'-9' | | |
| Sample Date: | 07/22/2020 | | |
| Received Date: | 08/07/2020 | Lab: | 4511 West First Street, Suite 4, Duluth, MN |
| Tested Date: | 08/11/2020 | Tested By: | Nelson, Brennan |

Laboratory Data

| Sieve Size | Passing (%) | Specification |
|--------------------|-------------|---------------|
| 12.5 mm (1/2 inch) | 100.0 | |
| 9.5 mm (3/8 inch) | 98.4 | |
| 4.75 mm (No. 4) | 95.6 | |
| 2 mm (No. 10) | 94.1 | |
| 850 µm (No. 20) | 92.1 | |
| 425 µm (No. 40) | 88.0 | |
| 150 µm (No. 100) | 22.7 | |
| 75 µm (No. 200) | 6.6 | |

| | | |
|----------------------|----------------------|----------------------------|
| Gravel (%) | Sand (%) | Silt & Clay (%) |
| 4.4 | 89.0 | 6.6 |
| D10 | D30 | D60 |
| 0.082 | 0.161 | 0.207 |
| C_u | C_c | |
| 2.52 | 1.53 | |



Classification: SP-SM Poorly graded sand with silt

Specimen Obtained: Oven Dry

Test Method: Method A (Composite Sieving)

Dispersion Apparatus: Shaking

General

Results: The test is for informational purposes.

Remarks: Total dry weight of sample is 193.3 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

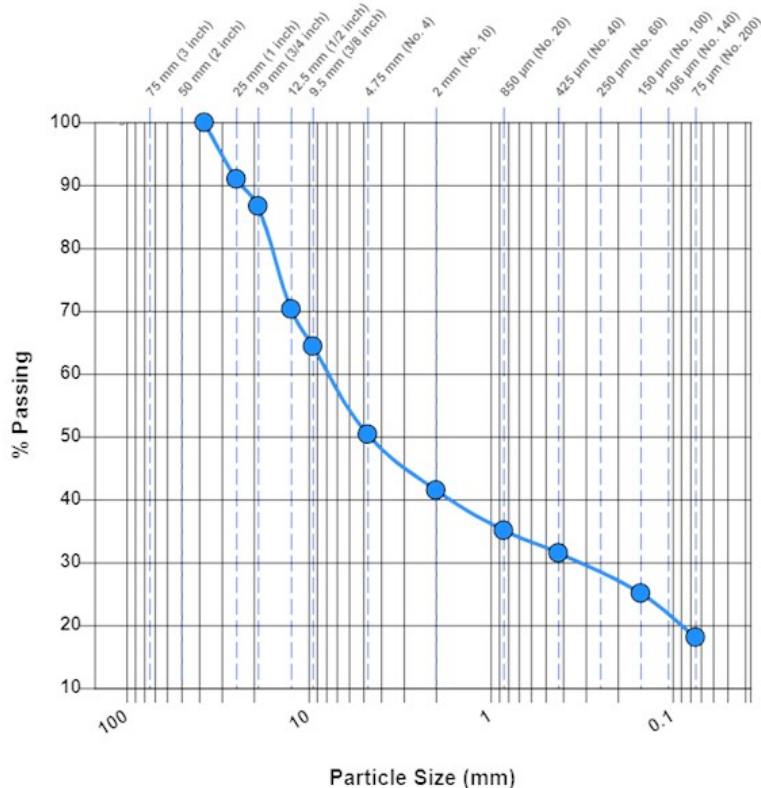
Sample Information

| | | | |
|--------------------------|------------------------------|----------------------|---|
| Sample Number: | 328498 | Alternate ID: | 18BC 6 12'-14' |
| Sampling Method: | Auger Boring ASTM D1452 | Depth (ft): | 12-14 |
| Boring Number: | 18BC | Sampled By: | Drill Crew |
| Location: | In-place | | |
| Location Details: | Boring 18BC Sample 6 12'-14' | | |
| Sample Date: | 07/22/2020 | | |
| Received Date: | 08/07/2020 | Lab: | 4511 West First Street, Suite 4, Duluth, MN |
| Tested Date: | 08/11/2020 | Tested By: | Nelson, Brennan |

Laboratory Data

| Sieve Size | Passing (%) | Specification |
|--------------------|-------------|---------------|
| 37.5 mm (1.5 inch) | 100.0 | |
| 25 mm (1 inch) | 91.0 | |
| 19 mm (3/4 inch) | 86.7 | |
| 12.5 mm (1/2 inch) | 70.3 | |
| 9.5 mm (3/8 inch) | 64.4 | |
| 4.75 mm (No. 4) | 50.4 | |
| 2 mm (No. 10) | 41.5 | |
| 850 µm (No. 20) | 35.1 | |
| 425 µm (No. 40) | 31.5 | |
| 150 µm (No. 100) | 25.1 | |
| 75 µm (No. 200) | 18.1 | |

| | | |
|-------------------|-----------------|----------------------------|
| Gravel (%) | Sand (%) | Silt & Clay (%) |
| 49.6 | 32.3 | 18.1 |
| D30 | D60 | |
| 0.227 | 8.007 | |



| | | | |
|------------------------------|---|---------------------|------------------------------|
| Classification: | SP-SM Poorly graded sand with silt and gravel | | |
| Specimen Obtained: | Oven Dry | Test Method: | Method A (Composite Sieving) |
| Dispersion Apparatus: | Shaking | | |

General

Results: The test is for informational purposes.
Remarks: Total dry weight of sample is 242.5 grams.

[Signature]

4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 327704 **Alternate ID:** 17-BC 4 7'-9'

Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew

Location: In-place

Location Details: Boring 17-BC Sample 4 7'-9'

Sample Date: 07/13/2020

Received Date: 08/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN

Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

| Boring # | Sample # | Depth (ft) | Moisture Content (%) |
|----------|----------|------------|----------------------|
| 17-BC | 4 | 8.0 | 5.1 |

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 327706 **Alternate ID:** 17-BC 7 14.5'-16.5'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 17-BC Sample 7 14.5'-16.5'
Sample Date: 07/13/2020
Received Date: 08/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

| Boring # | Sample # | Depth (ft) | Moisture Content (%) |
|----------|----------|------------|----------------------|
| 17-BC | 7 | 15.0 | 23.1 |

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 327707 **Alternate ID:** 17-BC 9 25'-26.5'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 17-BC Sample 9 25'-26.5'
Sample Date: 07/13/2020
Received Date: 08/06/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

| Boring # | Sample # | Depth (ft) | Moisture Content (%) |
|----------|----------|------------|----------------------|
| 17BC | 9 | 26.0 | 11.7 |

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 328497 **Alternate ID:** 18BC 4 7'-9'

Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew

Location: In-place

Location Details: Boring 18BC Sample 4 7'-9'

Sample Date: 07/22/2020

Received Date: 08/07/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN

Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

| Boring # | Sample # | Depth (ft) | Moisture Content (%) |
|----------|----------|------------|----------------------|
| 18BC | 4 | 8.0 | 26.0 |

General

Results: The test is for informational purposes.



4511 West First Street
Suite 4
Duluth, MN 55807
Phone: 218-624-4967

Client:

Enbridge Energy, Limited Partnership
Attn: Accounts Payable5400 Westheimer Ct
Houston, TX 77056

Project:

B2001991
Enbridge Line 5 Re-route
Enbridge Line 5
near Mellen, WI

Sample Information

Sample Number: 328498 **Alternate ID:** 18BC 6 12'-14'
Sampling Method: Auger Boring ASTM D1452 **Sampled By:** Drill Crew
Location: In-place
Location Details: Boring 18BC Sample 6 12'-14'
Sample Date: 07/22/2020
Received Date: 08/07/2020 **Lab:** 4511 West First Street, Suite 4, Duluth, MN
Tested Date: 08/11/2020 **Tested By:** Nelson, Brennan

Laboratory Data

| Boring # | Sample # | Depth (ft) | Moisture Content (%) |
|----------|----------|------------|----------------------|
| 18BC | 6 | 13.0 | 10.2 |

General

Results: The test is for informational purposes.





Braun Intertec Corporation
4511 West First Street, Suite 4
Duluth, MN 55807

Phone: 218.624.4967
Fax: 218.624.0196
Web: braunintertec.com

**Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core
Specimens under Varying States of Stress and Temperatures (Method C)
ASTM D 7012**

Date: September 29, 2020

Project Number: B2001991

Client: Accounts Payable
Enbridge Energy, Limited Partnership
5400 Westheimer Ct
Houston, TX 77056

Project Description:
Enbridge Line 5 Re-route

Sample Data

Date Sampled: Not Given
Samples Obtained By: Braun
Date Received: 8/10/2020
Sample Preparation: Trim and Polished

Laboratory Data

ASTM D4543 Limits

| | | | | | |
|------------------------------------|------------------|------------------|------------------|------------------|-------------------------|
| Sample Number: | 40-41 | 53-54 | 70-71 | 81-82 | |
| Date Tested: | 9/3/2020 | 9/3/2020 | 9/3/2020 | 9/3/2020 | |
| Rock Type: | Conglomerate | Conglomerate | Conglomerate | Conglomerate | |
| Moisture Condition During Testing: | Dry | Dry | Dry | Dry | |
| Diameter (in.): | 1.95 | 1.95 | 1.95 | 1.95 | |
| Length (in.): | 3.90 | | 4.09 | | |
| Length-to-Diameter Ratio (L/D): | 2.0 | | 2.1 | | $2.0 \leq L/D \leq 2.5$ |
| Side Tolerance, Maximum (in.) | ≤ 0.020 | ≤ 0.020 | ≤ 0.020 | ≤ 0.020 | ≤ 0.020 in. |
| End Tolerance, Maximum (in.) | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. |
| Perpendicularity Deviation (°) | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | $\leq 0.250^\circ$ |
| Parallelism Deviation (°) | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | ≤ 0.001 in. | $\leq 0.25^\circ$ |
| Maximum Load (lbs): | 37,938 | Untestable | 25,409 | Untestable | |
| Area (in ²): | 2.99 | 2.99 | 2.99 | 2.99 | |
| Compressive Strength (psi): | 12,690 | Untestable | 8,500 | Untestable | |
| Compressive Strength (MPa): | 86 | | 58 | | |

Remarks:

18-BC

Reviewed By:
David Morrison

Project Manager



Braun Intertec Corporation
4511 West First Street, Suite 4
Duluth, MN 55807

Phone: 218.624.4967
Fax: 218.624.0196
Web: braunintertec.com

**Standard Test Method for Compressive Strength and Elastic Moduli of Intact Rock Core
Specimens under Varying States of Stress and Temperatures (Method C)
ASTM D 7012**

Date: September 29, 2020

Project Number: B2001991

Client: Accounts Payable
Enbridge Energy, Limited Partnership
5400 Westheimer Ct
Houston, TX 77056

Project Description:
Enbridge Line 5 Re-route

Sample Data

Date Sampled: Not Given
Samples Obtained By: Braun
Date Received: 8/10/2020
Sample Preparation: Trim and Polished

Laboratory Data

ASTM D4543 Limits

| | | | | | | |
|------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------------|
| Sample Number: | 96-97 | 108-109 | 119-120 | 133-134 | 144-145 | |
| Date Tested: | 9/3/2020 | 9/3/2020 | 9/3/2020 | 9/3/2020 | 9/3/2020 | |
| Rock Type: | Conglomerate | Conglomerate | Conglomerate | Conglomerate | Conglomerate | |
| Moisture Condition During Testing: | Dry | Dry | Dry | Dry | Dry | |
| Diameter (in.): | 1.95 | 1.95 | 1.95 | 1.95 | 1.97 | |
| Length (in.): | | | 4.05 | | | |
| Length-to-Diameter Ratio (L/D): | | | 2.1 | | | $2.0 \leq L/D \leq 2.5$ |
| Side Tolerance, Maximum (in.) | ≤ 0.020 | ≤ 0.020 | ≤ 0.020 | ≤ 0.020 | ≤ 0.021 | ≤ 0.020 in. |
| End Tolerance, Maximum (in.) | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in. |
| Perpendicularity Deviation (°) | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | $\leq 0.250^\circ$ |
| Parallelism Deviation (°) | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | ≤ 0.001 in | $\leq 0.25^\circ$ |
| Maximum Load (lbs): | Untestable | Untestable | 25,409 | Untestable | Untestable | |
| Area (in ²): | 2.99 | 2.99 | 2.99 | 2.99 | 3.05 | |
| Compressive Strength (psi): | Untestable | Untestable | 8,500 | Untestable | Untestable | |
| Compressive Strength (MPa): | | | 58 | | | |

Remarks:

18-BC

Reviewed By:
David Morrison

Project Manager