DEPARTMENT OF NATURAL RESOURCES

CDO # tbd_____
RPN # tbd_____

RESTORATION AND REPLACEMENT ORDER

WHEREAS, in constructing the Line 3 Pipeline Replacement Project ("Project"), Enbridge Energy, Limited Partnership ("Enbridge") caused uncontrolled groundwater discharges at or near the Enbridge Energy-Clearbrook Terminal property;

WHEREAS, Enbridge caused uncontrolled groundwater discharge without a permit for such appropriation and in violation of State law;

WHEREAS, Enbridge's actions in causing uncontrolled groundwater discharges also violated the terms of the No Effect Concurrence for the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens) that the Minnesota Department of Natural Resources ("DNR") granted to Enbridge on November 12, 2020;

Pursuant to Minnesota Statutes, Sections 103G.251 and 103G.2372, the Commissioner of Natural Resources hereby orders: **Enbridge Energy, Limited Partnership,** *(26 E. Superior Street, Suite 125, Duluth, MN 55802*) to **stop the uncontrolled groundwater discharges on pipeline right-of-way at or near the Enbridge Energy-Clearbrook Terminal** located in the **SW ¼ SE ¼ Section 29, T149N, R37W, Leon Township, Clearwater County, and take other actions as identified herein.**

FINDINGS OF FACT:
History of Violation

1. This violation of State law consisting of uncontrolled groundwater discharges (aka "uncontrolled flow") occurred near milepost (MP) 909.1 at or near the Enbridge terminal outside of the city of Clearbrook, Minnesota. The uncontrolled flow is a result of rupturing an aquifer confining layer while completing a horizontal boring under existing pipelines at Enbridge's Clearbrook Terminal.

2. The uncontrolled flow is not authorized by any of Enbridge's water appropriation permits for the Line 3 Pipeline Replacement Project.

3. The work resulting in this violation of State law commenced on or about January 21, 2021, at the Enbridge Terminal near Clearbrook, and below is a summary of information taken from the Independent Environmental Monitors' (IEMs') reports documenting what was observed on site by the IEMs. The IEMs report to several State agencies as to site conditions during construction of the Project.

4. In a report dated January 26, 2021, the IEM states, "the bore pit on [the coming-in-side (west side)] to S-168, and hot line crossing area was backfilled yesterday due to unmanageable dewatering conditions. . . . Clean water is still observed to be flowing out of the ground, across the [right-of-way] on geotextile fabric, and dispersing into vegetated upland area. Currently no water pumping is taking place, although the contractor and EI [environmental inspector hired by Enbridge to ensure compliance] have been keeping track of the pumping volumes and rates. EI Dane F. and Rodney were on site at coming-in-side S-168 to discuss potential ECD [erosion control device] improvements where French drain formed out of geotextile fabric has been created to allow for spring water to drain across the ROW into well vegetated upland area."

5. In a report dated February 2, 2021, the IEM states "Bore #1 attempted excavation of the entry pit near Station 7279+80 adjacent to and with path under W-502. Due to excessive groundwater infiltration the site was backfilled and sheet piling was initiated. Despite backfill, groundwater has flowed to the surface. The low volume surface flow was directed into a plastic lined drainage constructed N [north] across the work site into straw bale and bio roll filters near post pump station ROW Station 2308+10. Discharge is into a well vegetated upland."

6. In a report dated February 8, 2021, the IEM documents, "Sheet piling of the bore entrance under foreign lines within wetland W-502 was completed. Ground flows encountered prior to sheet piling remain active though no information on any change in quantities was obtained. The flows are being pumped from the entrance sheet pile containment into a dewatering bag within a dewatering structure that meets EPP Figure 44 standards."

7. In a report dated February 20, 2021, the IEM observes "turbid water being discharged from five well points that are dewatering the bore entry pit at MP 909.1. Five filter bags are set within a straw bale dewatering structure. The IEM discussed this with the foreman and he did not know the cause of the discoloration. He stated that the filter bags were being changed every 2 hours. The IEM also discussed this with the [lead inspector, environmental monitor] and [Environmental Resources Management Group Inc.] technical director. They agreed that the turbidity was unusual for a well point dewatering."

8. In a report dated March 13, 2021, the IEM documented "fine-clay like sediment outside of the dewatering structures within wetland W-502 near MP 909.1. The sediment was recently noticed due to receding ice in the area. The IEM discussed the issue with the EI team and the EI team responded by saying the sediment would be removed from the wetland. The IEM team will follow up with the issue."

9. On March 15, 2021, the "IEM and [Lead Environmental Inspector] conducted a site review of the area where sediment was observed outside of dewatering structure and within wetland W-502. The dewatering structure was located within an upland, but located immediately adjacent to the wetland. The IEM and EI observed approximately 2 inches of clay/silt material in the wetland, and the material extended approximately 100 feet into the wetland. The water being discharged from the structure was clear at the time of inspection. IEM team recommended immediate cleanup of the area using a vac truck."

10. In a report dated March 16, 2021, the IEM states "Enbridge issued [itself] an unacceptable report for improper dewatering structure maintenance resulting in sediment migration into W-502. . . . The IEM returned to the area following issuance of the problem area report by the IEM team, and no cleanup attempt had been made. Water was continuing to be pumped to a new structure, which was observed to be functioning properly with acceptable clarity being discharged from the structure."

11. In the following months, Enbridge undertook some actions to remove sediment from the wetland and reduce erosion caused by the uncontrolled flow. However, Enbridge did not resolve the problem of uncontrolled flow at the site. Enbridge also failed to inform DNR of the uncontrolled flow at the Clearbrook terminal. Though the IEMs described unmanageable dewatering conditions in their reports to the State agencies, they did not identify the problem as uncontrolled flow or a breach of the artesian aquifer confining layer.

12. On June 15, 2021, the IEMs were meeting with DNR Division of Lands and Minerals staff and the discussion led to the DNR staff identifying the potential of uncontrolled flow at the Clearbrook Terminal. DNR staff were not previously aware of the issue because Enbridge did not notify DNR staff in January, when the uncontrolled flow situation arose, or at any time thereafter. Though the condition generated an Enbridge-issued "unacceptable" report in March, Enbridge did not bring the issue to DNR's attention at that point either.

13. On June 16, 2021, Randall Doneen, Conservation Assistance and Regulations Section Manager, emailed Enbridge staff demanding more information regarding the uncontrolled flow and a plan for how this flow was to be stopped, and outlining actions that the company needed to implement to install monitoring wells at the site. On June 17, 2021, Randall Doneen informed Enbridge that it could not recommence pipeline construction work at the site until DNR approved its plan for stopping the uncontrolled flow.

14. In a letter dated July 14, 2021, Randall Doneen informed Enbridge that DNR would not consider Enbridge's request to resume installation of the pipeline in the area of the uncontrolled flow until Enbridge satisfied the requirements in the June 16, 2021 email.

15. In an email to Randall Doneen dated July 7, 2021, Kristen Lenz of Merjent, Enbridge's consultant, stated that as of March 19, 2021, the quantity of water pumped was estimated at 3.8 million gallons. Enbridge had not taken any flow or volume measurements since March 18. Attachments to the email showed that the depth of the bore pit was 18 feet deep by 45 feet long by 12 feet wide. The sheet piling was 30 feet long with 28 feet installed into the ground. This email contained maps, boring logs and other information about the area. This information was a portion of the information requested by Randall Doneen in his June 16, 2021 email described in Finding of Fact #13.

16. On July 8, 2021, an IEM report notes that "a spring had developed recently in the stabilized area of the completed stream crossing S-168, and two plumes carrying sediment had entered the stream." The report indicates the Lead IEM notified Enbridge's Field Inspection/Compliance Lead and later was informed that erosion control devices were upgraded and turbidity issues were resolved. The location of the second surface emergence of uncontrolled flow is approximately 60 feet to the west of the initial uncontrolled flow location described above and within the same general excavation area. The second surface emergence of uncontrolled flow is likely a direct result of the initial breach of the aquifer confining layer.

17. On July 8, 2021, the Lead IEM, Tim Drake, sent an email to Area Hydrologist Stephanie Klamm that summarized the inspection reports to date. In that email, he noted that "unmanageable dewatering conditions" were first noted in an on-site inspection on January 26, 2021. There was no information in the IEM reports on the quantities of water being pumped but it was noted that Enbridge should have the records. Drake reported that the sheet piling had been pulled upon completion of the bore under the existing pipelines, but the bore pit had not been completely backfilled/restored due to the water issue.

18. On July 8, 2021, Enbridge submitted a Groundwater Investigation Plan (GIP) to DNR. The GIP proposed five test borings for soil evaluation and groundwater pressure monitoring instrumentation installation near the alignment of the pipeline replacement at MP 910.0, located west of the Clearbrook Terminal. Michele Walker, DNR Hydrogeologist reviewed the GIP and provided comments regarding the placement of the borings and piezometers. Enbridge revised the GIP, including the recommended changes, and DNR approved the GIP on July 12, 2021.

19. In accordance with the GIP, Enbridge installed four borings in close proximity to the new pipeline alignment and one boring approximately 2,800 feet east-southeast. Two of the borings penetrated through the confining layer into the likely artesian groundwater conditions, whereas the remaining three borings were placed within the confining layer. Instrumentation, included a vibrating wire piezometer, was installed in the boreholes. On August 3, 2021, Enbridge provided DNR with an estimate of the volume of water discharged by the uncontrolled flow. Enbridge estimates that 21.5 million gallons were discharged between January 21, 2021, and August 2, 2021.

20. On August 15, 2021, Enbridge submitted the initial draft of the Remedial Action Plan (RAP). DNR reviewed this document and provided comments to Enbridge.

21. On August 18, 2021, Enbridge submitted the final RAP. The RAP includes information obtained through the GIP and shows that the uncontrolled flow is under artesian pressure. The flowing groundwater is approximately 4800 feet west-northwest of the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens) located in the area. The RAP showed that the fens are likely fed by upwelling groundwater conditions through confining layers and peat at the fens. The same hydrogeological conditions that support the fens are likely responsible for the flowing conditions at the excavated area. The RAP outlines the needed actions to stop the uncontrolled flow, including installation of high capacity dewatering wells to temporarily reduce the confined aquifer pressure. The wells would be constructed to pump from the underlying confined aquifer at a rate to temporarily stop flow at the ground surface and reduce the upward pressure in the confined aquifer to a level that would allow grout to be injected into the ground and set (see the full RAP attached to this Restoration Order).

22. On September 10, 2021, Enbridge provided DNR an estimate that the volume of water discharged by the uncontrolled flow from January 21, 2021, through September 5, 2021, is 24.2 million gallons.

23. The artesian-like condition of this groundwater release is considered uncontrolled flow. Uncontrolled flow can impact the environment by reducing the pressure head in the aquifer resulting in lowering of groundwater levels.

24. In section 33 of Leon Township, there are two DNR documented calcareous fens. Enbridge has acknowledged these wetlands are calcareous fens and applied to DNR for a no effect concurrence for these fens. Both fens are near the Clearbrook terminal, southeast of the uncontrolled flow location and near Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens). Groundwater flow in this area is from the north to south making the uncontrolled flow area upgradient of the calcareous fens.

25. Since there are two calcareous fens nearby and the uncontrolled flow has reduced groundwater resources in the aquifer supplying the fens, there is potential for the reduced groundwater levels to negatively impact the fens. The aquifer that is the source of the uncontrolled flow also feeds the calcareous fens. Draining, degrading, impacting or otherwise altering a calcareous fen is not allowed under Minn. Stat. § 103G.223 and Minn. R. 8420.0935 unless the DNR Commissioner has authorized some alteration under a calcareous fen management plan. Pursuant to Minn. Stat. § 103G.223, a temporary reduction in groundwater resources for a calcareous fen also requires a calcareous fen management plan.

26. The DNR issued Enbridge a No Effect Concurrence for the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens) on November 12, 2020, as the anticipated work and depth of the pipeline would not impact the fens, based on the planned eight to ten foot deep trench. However, Enbridge did not follow the plans it presented to the DNR and on which the DNR based its No Effect Concurrence. Enbridge dug a bore pit deeper than the trench described in the plans Enbridge submitted to the DNR. This lead to a breach of the confining layer of the artesian aquifer supplying the nearby fens. This uncontrolled flow has the potential to adversely impact the calcareous fens, something that would not have happened had Enbridge followed the plans it submitted to the DNR.

27. Extended monitoring of the aquifer is required to ensure that the uncontrolled flow has not negatively impacted the nearby calcareous fens by reducing water levels to the fens. Adverse impacts to fen plant communities due to groundwater flow disruption can take multiple growing seasons to express themselves. Enbridge is required to restore the fens as described below pursuant to Minn. Stat. §§ 103G.2372 and 103G.223 and Minn. R. 8420.0935, subp. 5 and 7.

28. Other environmental concerns caused by uncontrolled flow include saturating road ditches, adding to the risk of bank sloughing or road overtopping with high water volumes, as well as water quality concerns such as sedimentation entering downstream waterbodies. As recently noted in the July 8, 2021 IEM report, sediment has reached a nearby stream and a second surface emergence of uncontrolled flow has shown up 60 feet from the initial uncontrolled flow location.

29. The uncontrolled flow that is taking place at MP 909.1 to MP 910 by caused Enbridge is a violation of Minnesota Statutes sections 103G.271, 103I.103 and 103G.223 and Minnesota Rules 6115.0710 (B), and 8420.0935.

CONCLUSIONS OF LAW
Statutory and Rule Violations

1. **Minn. Stat. § 103G.271 APPROPRIATION AND USE OF WATER.**

Minn. Stat. § 103G.271 requires a water appropriation permit for the appropriation or use of 10,000 or more gallons per day or more than one million gallons per year of waters of the state. Minn. Stat. § 103G.271, subd. 1 & subd. 4(a).

2. "Appropriating" is defined as "withdrawal, removal or transfer of water from its source regardless of how the water is used." Minn. Stat. § 103G.005, subd. 4. The uncontrolled flow at Clearbrook meets this definition because, by causing the uncontrolled flow, Enbridge is withdrawing or removing water from its source.

3. Enbridge estimates that the uncontrolled flow has caused the appropriation of 24.2 million gallons of water from January 21, 2021, through September 5, 2021, which exceeds the threshold for which a permit is required. Appropriation of this water without a permit violates Minn. Stat. § 103G.271.

4. **Minn. R. 6115.0710 (B) ADDITIONAL REQUIREMENTS AND CONDITIONS FOR DEWATERING.**

"Dewatering, which involves appropriation of water from ground or surface water sources for purpose of removing excess water, shall be subject to water appropriation permit requirements, unless otherwise exempted by these parts. The commissioner shall evaluate and make decisions on such application based on applicable provisions of parts 6115.0660 and 6115.0670 and the following additional requirements: . . . (B) The applicant must show that the excess water can be discharged without adversely affecting the public interest in the receiving waters, and that the carrying capacity of the outlet to which waters are discharged is adequate." Minn. R. 6115.0710.

5. While Enbridge caused an unpermitted uncontrolled flow by its construction activities, Enbridge is nonetheless required to comply with legal requirements for construction dewatering, and Enbridge has failed to do so in its management of the uncontrolled flow. Enbridge has not stopped the excess water from leaving the site but has installed a series of rock check dams in the road ditch to slow down the water. This uncontrolled flow is not in the public's best interest as it is continuously lowering the aquifer water levels, which is not a temporary use for dewatering. Sediment resulting from the uncontrolled flow has also reached a nearby stream and wetland.

6. **Minn. Stat. §. 103I.103 WASTE PREVENTION MAY BE REQUIRED.**

"The commissioner of natural resources may require the owners of wells, especially flowing artesian wells, to prevent waste to conserve the groundwater water supply of the state." Minn. Stat. § 103I.103.

7. The uncontrolled flow from the bore pit and spring is considered waste. This is a violation of Minnesota Statutes section 103I.103, pursuant to which the company must prevent waste of water to conserve the groundwater supply of the state. The company and/or contractors allowed the water to continue to flow without reporting the uncontrolled flow to the DNR until DNR discovered the uncontrolled flow in June 2021. This is a waste of groundwater resources and all prudent and feasible methods to stop the flow must be implemented.

8. **Minn. Stat. § 103G.223 CALCAREOUS FENS.**

"(a) Calcareous fens, as identified by the commissioner by written order published in the State Register, may not be filled, drained, or otherwise degraded, wholly or partially, by any activity, unless the commissioner, under an approved management plan, decides some alteration is necessary or as provided in paragraph (b). Identifications made by the commissioner are not subject to the rulemaking provisions of chapter 14 and section 14.386 does not apply.

(b) The commissioner may allow water appropriations that result in temporary reductions in groundwater resources on a seasonal basis under an approved calcareous fen management plan."

9. The uncontrolled flow has reduced groundwater resources available to the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens) and has the potential to negatively impact the fens by lowering the amount of water discharging at the fens. Draining, degrading, impacting or otherwise altering a calcareous fen is not allowed under Minn. Stat. § 103G.223 and Minn. R. 8420.0935 unless the DNR Commissioner has authorized some alteration under a calcareous fen management plan. Pursuant to Minn. Stat. § 103G.223, a temporary reduction in groundwater resources for a calcareous fen also requires a calcareous fen management plan. By breaching the aquifer supplying the fens, Enbridge has altered the fens and reduced groundwater resources available to the fens, which requires a calcareous fen management plan.

10. DNR has the authority to order restoration and/or replacement of calcareous fens, including ordering appropriate mitigation. Minn. Stat. § 103G.2372, subd. 1(b) ("the commissioner . . . may require restoration or replacement of the wetland or public water"); Minn. R. 8420.0935, subp. 5 ("DNR may approve management plans to restore or upgrade a previously damaged calcareous fen"); Minn. R. 8420.0935, subp. 7 (DNR's calcareous fen enforcement powers include ordering "necessary restoration or replacement").

ORDER:

Enbridge is hereby ordered and directed to undertake the following restoration:

1. **Within 30 days from the date of this order or as otherwise approved by DNR**, complete all restoration work according to the DNR approved Remedial Action Plan dated August 18, 2021 (see the full plan at end of this Restoration Order) to stop the uncontrolled flow. If this plan does not succeed in stopping the uncontrolled flow, additional measures will be required to address conditions at the site.

2. Enbridge must contact the ***DNR Director of Ecological and Water Resources*** within 24 hours of successfully completing the work to stop the uncontrolled flow.

3. **Within 30 days from the date of this order**, Enbridge shall;

    a. Provide the DNR with a revised estimate of water loss from March 19, 2021, to the date of this Order. This estimate must be within +/- 10 percent of actual loss..

    b. Submit to the DNR documentation of the ongoing measurement of discharge rates required under the Remedial Action Plan. These measurements must, include the current flow rate and any changes in flow rates. These measurements must continue until the uncontrolled flow is stopped. Documentation of the method of measurement must also be submitted to DNR. These measurements must be within +/- 10 percent of actual flow rates.

    c. Submit for DNR's approval a plan to continue to monitor groundwater for a 12-month period following cessation of the uncontrolled flow. The plan shall include all pertinent methodological information and a schedule for reporting results to the DNR. The duration of required groundwater monitoring may be extended at the DNR's sole discretion.

    d. Submit for DNR's approval a plan to conduct visual monitoring for break-through groundwater discharges for a 12-month period following cessation of the uncontrolled flow. The plan shall include all pertinent methodological information and a schedule for reporting results to the DNR. The duration of required visual monitoring may be extended at the DNR's sole discretion.

4. **Within 30 days from the date of this order,** Enbridge must submit a draft Calcareous Fen Management Plan (CFMP) for DNR review and approval. This plan must include a description of ongoing monitoring of water levels and the plant communities that will occur to determine if the loss of water has impacted the nearby Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens). The plan must provide site access for the DNR and/or its contractors to conduct and observe onsite fen monitoring activities. The plan must also provide access for Tribal monitors to observe fen monitoring activities if they chose to participate. The results of monitoring after implementation of the Remedial Action Plan and Calcareous Fen Management Plan may result in additional requirements, restoration and/or mitigation as directed by the DNR.

5. **Within 30 days from the date of this order,** Enbridge shall submit to DNR $250,000 in mitigation funds for DNR and/or its contractors to perform ongoing independent monitoring of the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens).

6. **Within 30 days from the date of this order,** Enbridge shall submit to DNR $300,000 in mitigation funds to provide initial mitigation for the direct loss of groundwater resources available to the fens as a result of the uncontrolled flow at the Clearbrook Terminal site.

7. **By November 1, 2021,** Enbridge shall place $2,750,000 into one or more single order instruction escrows for the benefit of DNR to use at its sole discretion to provide a source of funds to perform restoration actions at the Leon 33 calcareous fen (Steenerson Lake and Deep Lake Fens) and/or compensatory mitigation, at the rate of at least double the number of acres impacted, for any identified negative impacts to the fens. DNR will designate the escrow agent at its sole discretion and the parties shall promptly develop the escrow terms (Escrow Agreement), which shall be acceptable to DNR. The Escrow Agreement shall provide that the escrow agent will release funds in escrow to DNR upon demonstration of reasonable costs

for ongoing monitoring of the calcareous fens, if the funds submitted under paragraph 5 above have been exhausted. Upon issuance of a DNR order directing restoration of the fens, the Escrow Agreement shall provide that the escrow agent will release the necessary funds in escrow to DNR to obtain a contractor(s) to design and implement the ordered fen restoration actions. Upon issuance of a DNR order requiring compensatory mitigation for impacts to the fens, the Escrow Agreement shall provide that the escrow agent will release the necessary funds in escrow to DNR for the purpose of implementing mitigation acceptable to the DNR. The Escrow Agreement shall provide for the addition of escrow funds, as deemed necessary by DNR, based upon the results of fen monitoring. All escrow costs shall be borne by Enbridge.

8. By December 1, 2021, Enbridge shall demonstrate to DNR that it has identified and visually reinspected all locations across the entirety of the Line 3 Replacement Project route where Enbridge deviated from planned or permitted construction trench depths. The purpose of the inspections is to verify that there have not been any additional unidentified breaches of aquifer confining layers resulting in uncontrolled flow conditions. Prior to undertaking the inspection, Enbridge must obtain DNR's prior written approval of the inspectors who complete the work and the plan for conducting the inspection.

This Order is final and binding on you, unless within 30 days of the date on which it was served on you, you appeal the terms and conditions of this restoration order to the commissioner by filing a written request for review. Please mail any such request to: DNR Ecological and Water Resources, Violations Coordinator, 500 Lafayette Rd., St. Paul, MN 55155-4032

Violation of this restoration order is a misdemeanor and may result in assessment of civil penalties.

Order Created by

Ann Pierce

Digitally signed by Ann Pierce
Date: 2021.09.16 14:52:27 -05'00'

Ann Pierce, Deputy Director
Ecological and Water Resources Division

Order Served by

Phillip Seefeldt

Digitally signed by Phillip Seefeldt
Date: 2021.09.16 14:53:00 -05'00'

Lieutenant Phillip Seefeldt
District 2 Enforcement Supervisor/Acting Manager
Badge #456

Officer Issuance Record: VIA email to leo.golden@enbridge.com on Sept. 16, 2021
and
VIA Certified Mail, Return Receipt Requested on Sept. 17, 2021

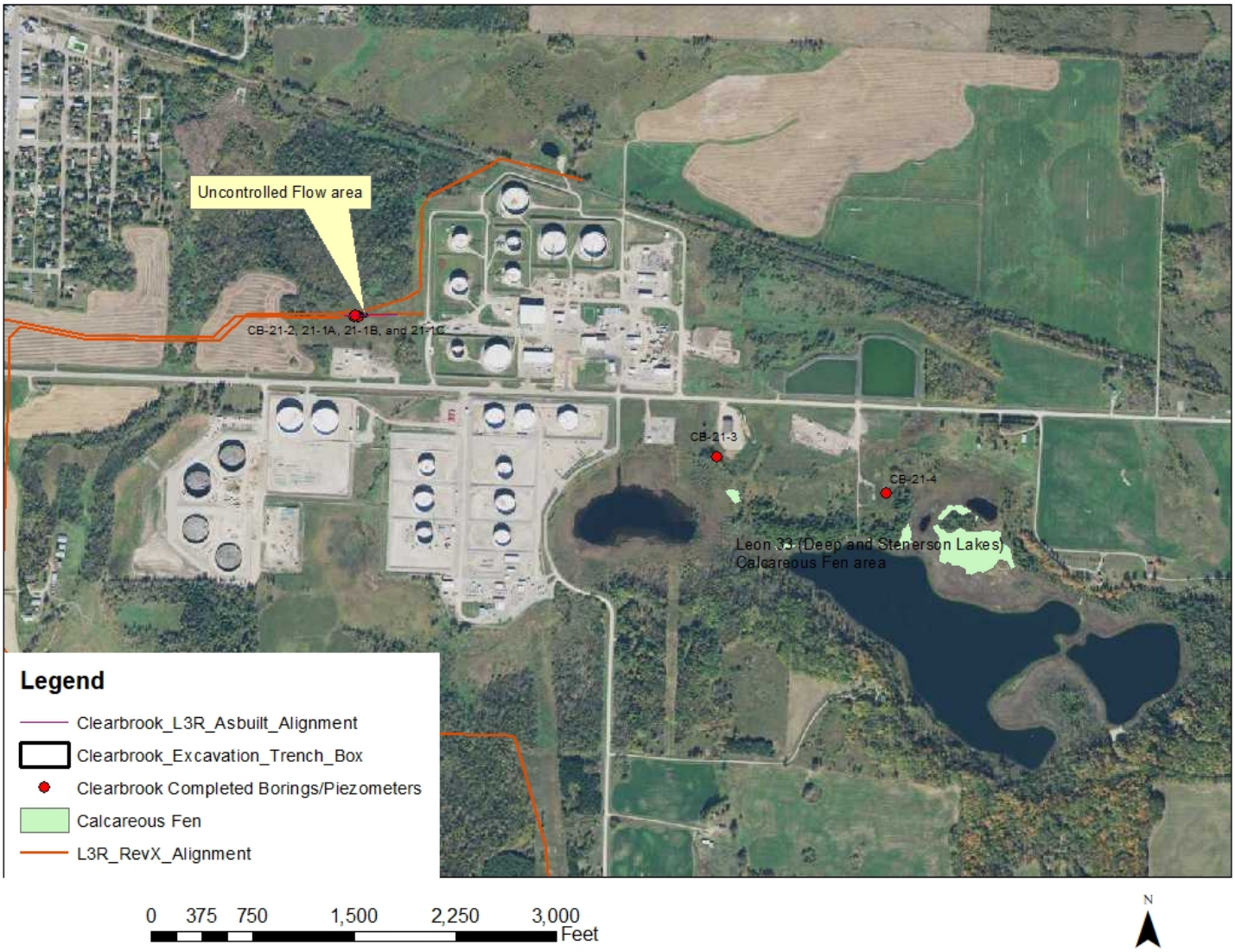
cc: Sherry Enzler, General Counsel
Jill Nguyen, Senior Staff Attorney

Clear Brook Remedial Action

Attachments:

Images:
Map of the area with uncontrolled flows, red circle represents Station 7279+00, blue circle represents location near MP 909.1 (Lat. 47.689587 Long. -95.416958)

Map of the uncontrolled flow near the Clearbrook Terminal along with location of calcareous fens in Leon 33



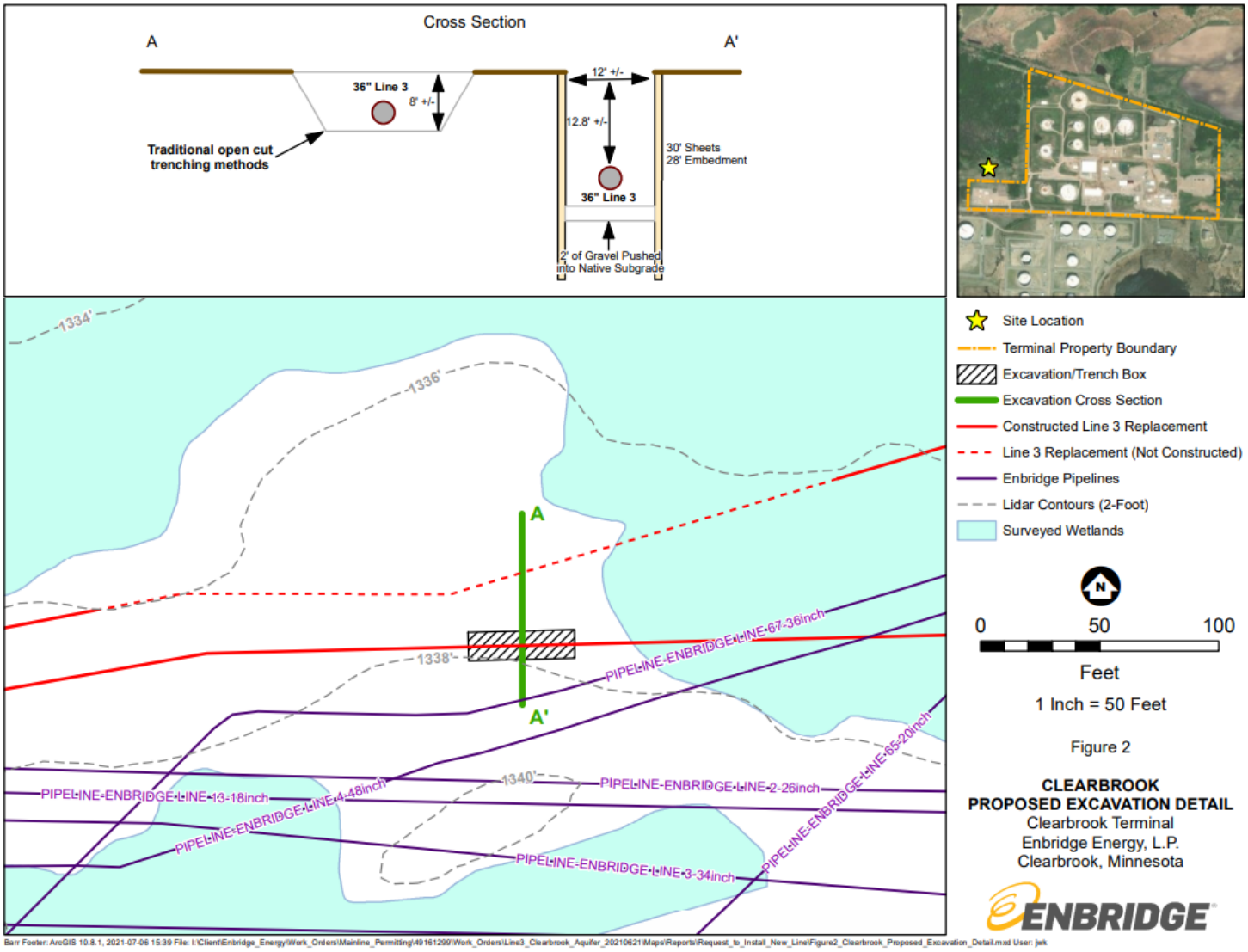
Photos from IEM reports:

January 23, 2021 IEM Report showing bore pit

February 8, 2021 views of sheet piling

Photos from IEM via email on July 29, 2021

Map and diagram from Enbridge showing the cross-section of the initial boring (12+’ deep) under the existing lines vs. the new proposed crossing plan (8’ deep).



MEMO

Date:

August 18, 2021

To:
Randall Doneen, Minnesota Department of Natural Resources
Michele Walker, Minnesota Department of Natural Resources

From:

Bobby Hahn, Enbridge Energy, Limited Partnership

Subject:

Line 3 Replacement Project Uncontrolled Flow MP 910.0 Remedial Action Plan

This memorandum provides additional information requested by the Minnesota Department of Natural Resources ("MDNR") on June 16, 2021, July 14, 2021, August 16, 2021, and August 18, 2021 concerning the uncontrolled flow near milepost ("MP") 910.0 west of the Clearbrook Terminal on Enbridge Energy, Limited Partnership's ("Enbridge's") Line 3 Replacement Project ("L3R" or "Project").

The attached revised Remedial Action Plan prepared by Barr Engineering ("Barr") on behalf of Enbridge describes the plan for installing the second line at this location and the corrective actions to stop the uncontrolled flow. Revisions are noted in red font. This plan has been revised to address the MDNR comments received on August 16, 2021 and August 18, 2021. Enbridge will also prepare and submit a monitoring plan following the implementation of the corrective action to include:

- how the site will be monitored
- frequency of monitoring
- frequency of the submittal of the vibe wire monitoring data to MDNR
- plan for monitoring of the Leon 33 calcareous fen (Steenerson and Deep Lake Fens)

Please do not hesitate to reach out should the MDNR require additional information.

resourceful. naturally.
engineering and environmental consultants

BARR

Technical Work Plan – Rev 1

To: Bobby Hahn, Enbridge, Kristin Lenz, Merjent
From: Ray W. Wuolo, PE, PG; Peter M. Demshar, PE. Travis A. Davidsavor, PE, Kevin Eisen, PE
Subject: Clearbrook Uncontrolled Flow Remediation Plan – Revision 1
Date: August 17, 2021

Introduction

This Work Plan provides the proposed steps for sealing artesian flow that developed during excavation for the Line 3 Replacement project at the Enbridge Clearbrook Terminal near Clearbrook, Minnesota. This Work Plan was prepared at the request of Enbridge and is based on currently available data and information on groundwater pressures, stratigraphy, prior construction sequences and procedures, available sealing technology, and uncontrolled flow location and rates.

It is our understanding that uncontrolled surface flows of groundwater under artesian pressures are associated with a pit excavation to install a new pipeline beneath an existing pipeline at the Clearbrook Terminal. Sheet piling was driven to a depth of approximately 28 feet below grade around the proposed excavation to stabilize soils during construction. During excavation, water was pumped from the excavation base from two gravel sumps. The new pipe was installed, the excavation was backfilled with the previously excavated soil, and the sheet piling was removed. Figure 2 depicts the construction information. Groundwater began to flow to the surface in the backfilled area after completion of construction. The flows appear to have caused quick conditions within portions of the backfilled area, resulting in soil piping and enlargement of a hole, which is presently filled with flowing water.

The flowing groundwater is approximately 4,800 feet west-northwest of a calcareous fen wetland complex, as shown on Figure 1. The calcareous fen is likely fed by upwelling groundwater conditions, through confining clays and peat at the fen. The same hydrogeologic conditions that support the fen are likely responsible for the flowing conditions at the excavated area.

Monitoring Data and Hydrogeologic Conditions

Vibrating wire piezometers (VWPs) were installed at locations shown on Figure 1. The installation details are presented in Attachment 1. The purpose of these piezometers is to collect groundwater pressure data under current conditions (i.e., uncontrolled artesian flow) and to monitor pressures during and after sealing efforts of the flowing conditions. Boring logs and groundwater level data from the piezometers are summarized in Attachment 1. The depths and elevations of the piezometers are tabulated in Table 2 of Attachment 1.

Geologic cross sections are presented in Attachment 1, using data collected from installation of the VWPs and from existing wells and borings installed during previous investigations. These data are interpreted to

show a lower permeability layer of clay and silty clay down to depths of 30 to 50 feet across the Terminal and surrounding area. It is important to note that the confining layer does not appear to be homogenously comprised of low permeability materials – it is likely variable in thickness and both grain size and hydraulic conductivity characteristics because of the glacial and glacio-fluvial environments in which the materials were deposited. Thin layers of permeable sand may be present within the confining layer and may be connected with other sand or layers of higher hydraulic conductivity to varying degrees.

Below the confining unit is a more permeable sand and gravel aquifer that is generally under artesian pressure (i.e., the hydraulic head is above the ground surface). In the vicinity the fen, it appears that the depth to the confined aquifer is shallower than elsewhere, which may explain why the fen formed in that area (i.e., upwelling groundwater flow has less resistance where the confining layer is thinner).

Artesian flow at the excavation is presently estimated to be approximately 90 gallons per minute. Flow measurements are currently being measured by pumping the water from the uncontrolled flow pool with a submersible pump through a flowmeter. The pump discharge rate is being controlled by a valve and a recirculation loop. To maintain accurate flowrate rates, the pump discharge rate is adjusted to maintain a steady pool elevation.

Preliminary Assessment of Artesian Conditions

In the immediate vicinity of the backfilled excavation, the subsurface conditions are estimated by recent and past geotechnical investigation data to include the following:

- Approximate depth to top of confining layer: 18 feet
- General soil type above the confining layer: variable glacial deposits – clay, silty sand, silt.
- Approximate depth to the bottom of the confining layer: 30 feet
- General soil type of the confining layer: lean clay
- General soil type of the confined aquifer: poorly graded gravel with cobbles
- Ground surface elevation: 1338.8 feet
- Elevation of shallow groundwater: not encountered prior to mud rotary drilling methods
- Elevation of pressurized groundwater (i.e., the confined aquifer): 1347.7 feet
- Head above ground surface of the confined aquifer: 8.9 feet
- Estimated depth of the excavation during construction: 19.5 feet
- Estimated depth of temporary construction sheet piling (now removed): 28 feet

It is understood that the excavation was backfilled with native material that was removed during the initial excavation of the pit.

The working hypothesis of how uncontrolled artesian flow developed is that the excavation reduced the overall thickness of the confining layer within the footprint of the excavation and the backfilled material was not able to compensate for the excess pressure at the base of the confining layer. The confining layer became more permeable in the excavated and thinned condition than in its native (unexcavated) thicker condition. Upward hydraulic pressure from the confined aquifer likely resulted in upward flow through the confining layer and into the initial excavation. Once backfilled, the flow concentrated on a path to the surface. Once flow began, soil piping may have enlarged the preferential flow paths, resulting in loss of effective stress in the backfilled materials. This may have taken place in more than one spot within the backfill.

It is also possible that the sheet piling may have also entirely penetrated into the confined aquifer at one or more spots and when removed, created an upward preferential flow path to the surface.

The excavation depth within the sheet pile perimeter for this pipe was approximately 19 feet, rather than the more typical 8 feet for pipe of this size, because it needed to go underneath an existing shallower pipe at this location. This unusually deep excavation is likely the reason similar flowing conditions may not have been encountered in previous pipe installation in the vicinity of the Clearbrook Terminal.

Proposed Method for Controlling Artesian Flow

Prior to initiation of work activities designed to control the artesian flow, it is recommended that the remaining section of the pipeline be installed, which does not have to be installed underneath other existing pipelines and will have a more routine depth of excavation of 8 feet. This recommendation is based on the following:

- Installation of the remaining shallower section of pipe will allow the work activities associated with controlling the artesian flow to be unincumbered with the additional construction activities associated with mainline construction.
- In the unlikely event that the remaining construction encounters artesian flow, the required specialty contractors will already be on site and able to respond in near real time.

It is unlikely that pressure grouting using low mobility grout, alone, will be effective at controlling the artesian flows at the ground surface because the flow rates and pressures in the confining layer where flow is taking place cannot likely be overcome even by injecting quick-set grout. This has been the experience in somewhat similar settings, such as at Toad River, near Detroit Lakes. However, grouting is a reliable remedy if the upward pressures in the confining unit and the underlying confined aquifer can be substantially reduced. Therefore, installing a multi-cased, temporary high-capacity dewatering well to temporarily reduce confined aquifer pressures is required. The wells would be constructed to pump from the underlying confined aquifer adjacent to the excavation area with pumping of these wells at a rate

sufficient to (1) temporarily stop flow at the ground surface and (2) reduce upward pressures in the confined aquifer to a level that will allow for grout to be injected and set, allowing sealing of existing flow paths.

The temporary high-capacity wells are proposed to be drilled near the recently installed pipeline and as close to the main groundwater surface flow zone as practical, while maintaining sufficient distance to not pull placed grout into the well screen. Approximate locations are shown in Attachment 2. The temporary high-capacity dewatering wells are proposed to have the following general characteristics:

- Installed through two casings. The outer casing will be drilled to approximately 10 feet above the top of the confined aquifer and grouted in place. An inner casing will then be advanced into the confined aquifer. The borehole will be advanced approximately 20 feet into the confined aquifer and a 10-foot screen will be installed. The screen and inner casing will have a diameter of 8-12 inches to accommodate a temporary high-capacity submersible pump.
- The temporary submersible pump will be capable of pumping at a sustained rate sufficient to lower the piezometric head in the confined aquifer to the bottom of the confining unit in the immediate vicinity of the wells. This may require pumping rates in excess of 1,000 gpm over short periods of time.
- The screened portion of the wells will be sufficiently deep to prevent placed grout from being pumped into the wells.
- The wells and pump system will be designed to prevent flow up the casing to the ground surface when not pumped.
- Pumped water will be discharged via a temporary discharge line to dewatering structure(s) sited and designed in accordance with Enbridge's Environmental Protection Plan and applicable permits and certifications. This water should be essentially free of sediment due to the artesian aquifer source. Potential dewatering locations are shown on Figure 1.
- Final well construction details will be determined in consultation with the experience and licensed well drilling contractor, who will be selected on the basis of their experience in undertaking similar projects within the region. The drilling contractor may opt for different casing diameters, depths, etc., but with the overall intent of installing wells that will not, itself, become a conduit for groundwater flow and will accomplish the task of depressurizing the confined aquifer at the excavation while not becoming unusable during grout placement.

Surface flows should cease soon after depressurization pumping begins. Pressure and/or permeation grouting through injection points will commence while pumping continues using a quick-set grout. Grouting will focus on the bottom of the confining layer and the gravel unit underlying the confining layer, below the excavation in the area identified in Attachment 2 with the intent of augmenting the existing undisturbed confining layer to reduce and finally stop flow.

Actual site conditions encountered during the grouting process will dictate final grouting methods and locations of the injection points. However, based on site visits and follow-up discussions with the specialty grouting contractor (Keller Group – Hayward Baker) a permeation grouting method will be implemented and is expected to require approximately 400, 2-inch diameter, sleeve-port grout pipes, installed in a 3 ft equilateral triangle spacing. The anticipated effective radius of treatment of each injection point is 18-24 inches. Additional intermediary injection points may be required as the grouting process is underway.

If the permeation grouting is not completely effective and pressure grouting is pursued, Keller anticipates that 8 ft diameter "columns" may be required. Installation details, including the injection point spacing and location(s) will be dependents on the effectiveness of the permeation grouting.

Grouting will take place in the lower portion of the confining layer and the upper portion of the confined unit in order to fill aquifer void volume and connected sand seams (if present). The grouting will be performed over the identified area using a series of drilled injection points and staged injection elevations. When the grout has had sufficient time to set, the pumping rate of the well will be reduced, and areas of remaining flowing conditions will be identified and marked. The well pumping rates will be increased, and these identified areas will be grouted with additional phases of grout placement. This process will be repeated until all flow at the surface is stopped. Once the surface flows have been stopped, the pumping of the dewatering wells will cease. A 48-hour period will begin and conditions at the surface will be observed. If surface seepage is identified, pumping of the dewatering wells will recommence and those areas with surface flows will be grouted with additional phases.

After a 48-hour period has elapsed without any visible surface flows, the temporary pumps will be removed, and the wells will be shut-in. The temporary dewatering wells will not be abandoned for a period of at least one year if seepage at the surface is observed at a later date or that maintenance work to the pipeline is required.

Monitoring and Reporting

Flow rates of the high-capacity pumps in the wells will be recorded using one or more totalizing flow meters. Water levels and water pressures will be monitored in the existing monitoring wells and VWPs during pumping and sealing of the surface seeps. Surface returns of grout, if any, will be noted during grouting and will be contained. Quantities of grout pumped will be recorded.

A memo on the sealing process will be prepared and submitted to the Minnesota DNR upon completion of the grouting program and will include monitoring data.

A monitoring plan will be developed and submitted following the corrective action(s) taken at the site. The monitoring plan will include information on how, where, and how often the area will be visually monitored for breakthrough groundwater discharges. Additionally, the monitoring plan will identify how frequently the vibrating wire data from the piezometers will processed, analyzed, and reported to the Minnesota DNR. The monitoring plan will also include the methodology to assess the health of the nearby calcareous fen near Steenerson and Deep Lakes.

Sincerely,

Ray W. Wuolo
Vice President/Senior Hydrogeologist

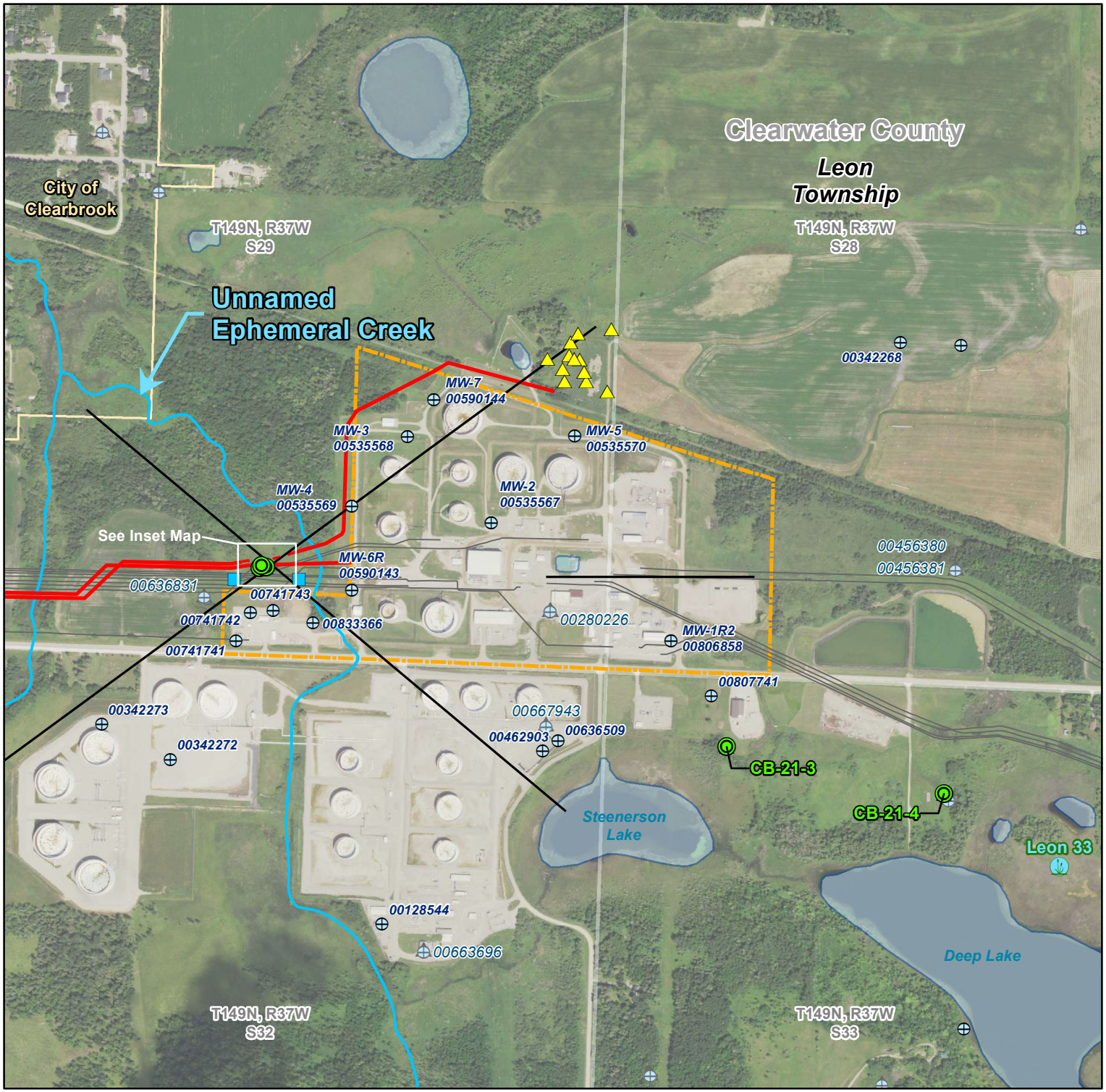
Figures

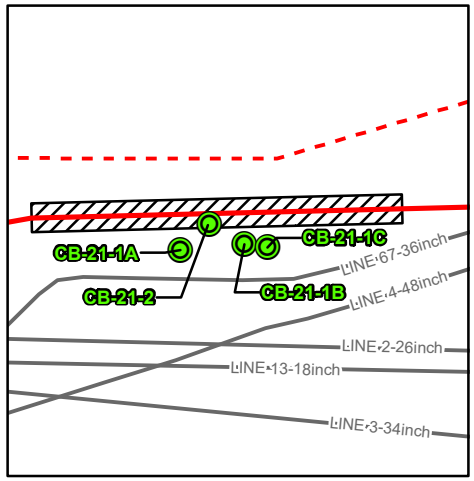
Figure 1 Completed Boring Locations
Figure 2 Clearbrook MP910 Excavation Detail

Attachments

Attachment 1 Clearbrook Groundwater Investigation Data Submittal
Attachment 2 Preliminary Grouting Plan

Figures





- Completed Boring Locations
- Excavation/Trench Box
- Previous Geotechnical Exploration Locations (Completed by Barr)
- Potential Dewatering Location
- Wells - Minnesota Well Index
- Unverified Well - Minnesota Well Index
- Constructed Line 3 Replacement
- Line 3 Replacement (Not Constructed)
- Enbridge Pipelines
- Cross Sections
- Terminal Property Boundary
- Calcareous Fen Location
- Rivers & Streams

N

0 800 1,600

Feet

1 Inch = 800 Feet

Figure 1

CLEARBROOK
COMPLETED BORING LOCATIONS
Clearbrook Terminal
Enbridge Energy, L.P.
Clearbrook, Minnesota

ENBRIDGE

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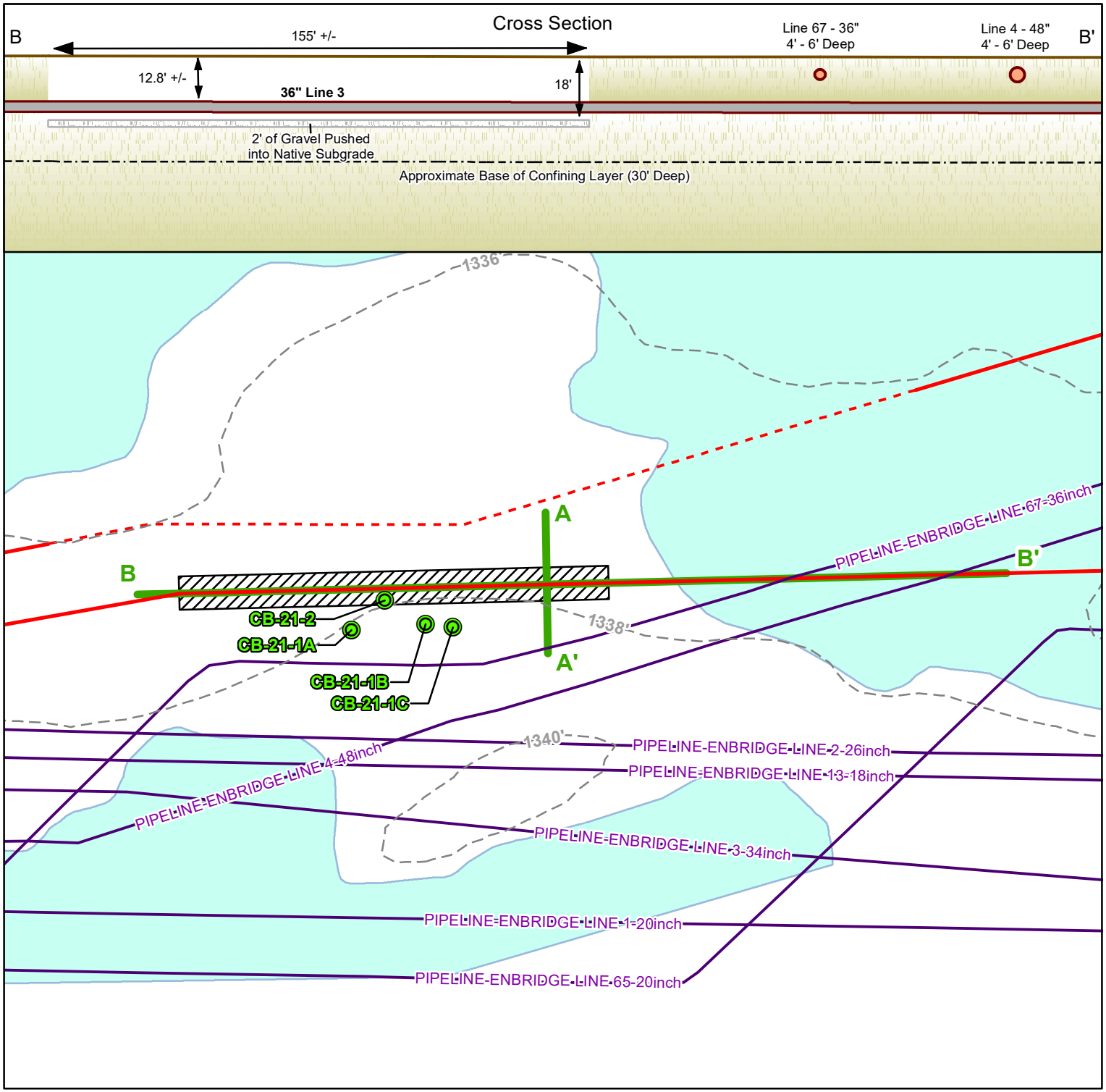
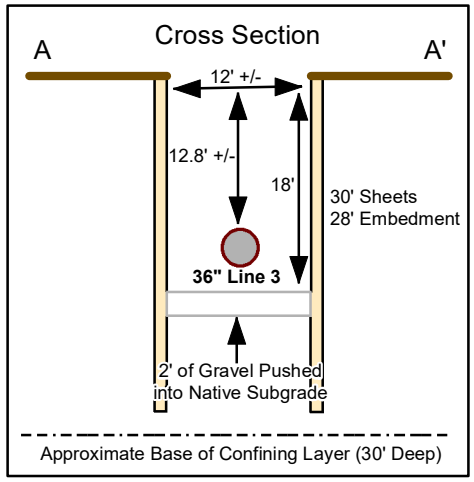




- Completed Boring Locations
- Excavation/Trench Box
- Excavation Cross Section
- Constructed Line 3 Replacement
- Line 3 Replacement (Not Constructed)
- Enbridge Pipelines
- Lidar Contours (2-Foot)
- Surveyed Wetlands

N

0 50 100

Feet

1 Inch = 50 Feet

Figure 2

CLEARBROOK
MP910.0 EXCAVATION DETAIL
Clearbrook Terminal
Enbridge Energy, L.P.
Clearbrook, Minnesota

ENBRIDGE

Barr Footer: ArcGIS 10.8.1, 2021-08-13 06:09 File: I:\Client\Enbridge_Energy\Work_Orders\Mainline_Permitting\49161299\Work_Orders\Line3_Clearbrook_Aquifer_20210621\Maps\Reports\Remedial_Action_Plan\Figure2_Clearbrook_MP910_Excavation_Detail.mxd User: jwk

Attachments

Attachment 1

Clearbrook Groundwater Investigation Data Submittal

resourceful. naturally.
engineering and environmental consultants

BARR

Memorandum

To: Minnesota Department of Natural Resources
From: Peter Demshar (PE) and Ray Wuolo, PE, PG (Barr)
Subject: Clearbrook Groundwater Investigation Data Submittal - Revision 1
Date: August 17, 2021
Project: Line 3 Replacement Project

Barr Engineering Co. (Barr), under contract with Enbridge Energy, Limited Partnership (Enbridge), completed a geotechnical investigation in support of the proposed Line 3 Replacement (L3R) pipeline near the Clearbrook Terminal in Clearbrook, Minnesota. The purpose of this memorandum is to provide the results of the recently completed investigation and out interpretation of the subsurface soil and groundwater conditions.

Six rotosonic borings were performed to investigate the subsurface soil and ground water conditions. The boring locations were submitted to the MDNR on July 10, 2021 and the MDNR approved these locations on July 12, 2021 and July 29, 2021 (for wells CB-21-3 and CB-21-4), indicated on Figure 1. The coordinates and elevations for the boring locations, provided by the project surveyor Northwestern Surveying & Engineering, Inc. of Bemidji, Minnesota, are shown in Table 1 below:

Table 1 Boring Summary

Borehole ID	Northing (ft)	Easting (ft)	Elevation (ft)
CB-21-1A	770502.8	2054029.1	1338.9
CB-21-1B	770505.0	2054055.8	1338.8
CB-21-1C	770503.8	2054065.5	1338.9
CB-21-2	770513.5	2054041.1	1338.9
CB-21-3	769474.1	2056718.5	1353.3
CB-21-4	769204.4	2057970.3	1359.7

Coordinate system FIPS 2201
Minnesota State Plane North, Datum NAD83

The rotosonic borings were completed with equipment owned and operated by Traut Companies (Traut) of Waite Park, Minnesota using a track mounted drill rig. The borings were advanced using a variety of drilling techniques including rotosonic drilling where 8-inch diameter surface casing was installed and a 6-inch outer casing with a 4-inch diameter sampler was used to advance the boring beyond the depth of the surface casing. Additionally, 4 7/8-inch and 3 7/8-inch tricone mud rotary techniques with standard split spoon (SPT) sampling was completed for borings CB-21-1A, CB-21-1B, and CB-21-2 for depths below the surface casing. Because of the potential for pressurized groundwater conditions, the borings were completed using heavy (weighted) drilling mud. To evaluate the presence of confining layers, rotosonic

and SPT sampling was completed continuously to semi-continuously throughout the depths of all borings.

Subsurface Conditions

The results of the geotechnical soil borings were compiled to obtain an understanding of the lithology and groundwater hydrogeology of the study area. Boring logs can be found in Attachment 1. The existing soil conditions generally consist of fill to depths of 2.5 to 13 feet (elevation 1336.3 to 1325.8 feet) for borings CB-21-1 (A,B,C) and CB-21-2. The fill is underlain by lean (CL) to fat (CH) clay with varying amounts of sand to an approximate depth of 29.7 feet (elevation 1309.1) where gravel was encountered. For borings CB-21-3 and CB-21-4 the soil conditions generally consist of lean clay (CL) underlain by poorly graded sand (SP) and well graded gravel (GW) throughout the depths of the soil borings. However, a poorly graded sand layer was encountered much shallower in CB-21-4 tan CB-21-3 at elevation 1344.2 and 1313.1 feet, respectively. A geologic cross section representing the stratigraphy in the region is shown in Figure 2.

Groundwater was not observed in any of the geotechnical borings due to the drilling technique which utilizes a drilling fluid to advance the casing and sampling tools.

Instrumentation

Vibrating wire piezometers were installed in all borings at various depths as indicated in Table 2.

Table 2 Vibrating Wire Piezometer Summary

Piezometer ID	Serial Number	Installation Depth (ft)	Installation Elevation (ft)	Data Location
CB-21-1A-B[1]	1930856	32.7	1306.2	Attachment 3-A
CB-21-1A-T[2]	2003965	30.7	1308.2	NA [3]
CB-21-1B[1]	1912958	23.3	1315.5	Attachment 3-A
CB-21-1C[1]	1912959	19.4	1319.5	Attachment 3-A
CB-21-2-B[2]	2134224	18.4	1320.5	Attachment 3-B
CB-21-2-T[2]	2134696	13.4	1325.5	Attachment 3-B
CB-21-3[2]	2003966	42.4	1309.2	Attachment 3-C
CB-21-4-B[2]	2134222	44.9	1314.8	Attachment 3-D
CB-21-4-T[2]	2129043	17.9	1341.8	Attachment 3-D

1. Vibrating wire piezometer connected to automated logger
2. Vibrating wire piezometer connected to Geokon LC2x4 logger for manual data collection
3. Vibrating wire piezometer installed as backup. Not reported at this time.

Nested vibrating wire piezometers were installed in in CB-21-1A, CB-21-2, and CB-21-4 prior to abandonment while single vibrating wire piezometers were installed in CB-21-1B, CB-21-1C, and CB-21-3. All boreholes were backfilled with neat cement grout and bentonite slurry upon completion of drilling, in accordance with Minnesota Department of Health (MDH) requirements. Piezometer locations and

associated depths/elevations are also shown on the attached Instrumentation Logs provided in Attachment 2.

A fully automated monitoring system was installed following piezometer installation to provide near-real-time monitoring of instrumentation at 15-minute intervals for the piezometers indicated in Table 2. Geokon LC2x4 dataloggers were installed at locations identified in Table 2 to provide data collection on 15-minute intervals with data collected manually from the logger at regular intervals. A weather station was also installed in order to evaluate vibrating wire piezometer data with associated rain events and barometric pressure changes.

Results of the vibrating wire piezometer data indicate that pressurized groundwater conditions are present at the site. The vibrating piezometers installed CB-21-1A-B, CB-21-3, and CB-21-4-T all show piezometric heads above the ground surface at the boring locations. CB-21-1B, CB-21-2-T, and CB-21-2B indicate piezometric heads very near the ground surface. CB-21-1C and CB-21-4-B both indicate that the piezometers are dry and are not showing any piezometric head acting on the sensor. Data from all installed piezometers are shown in Attachment 3.

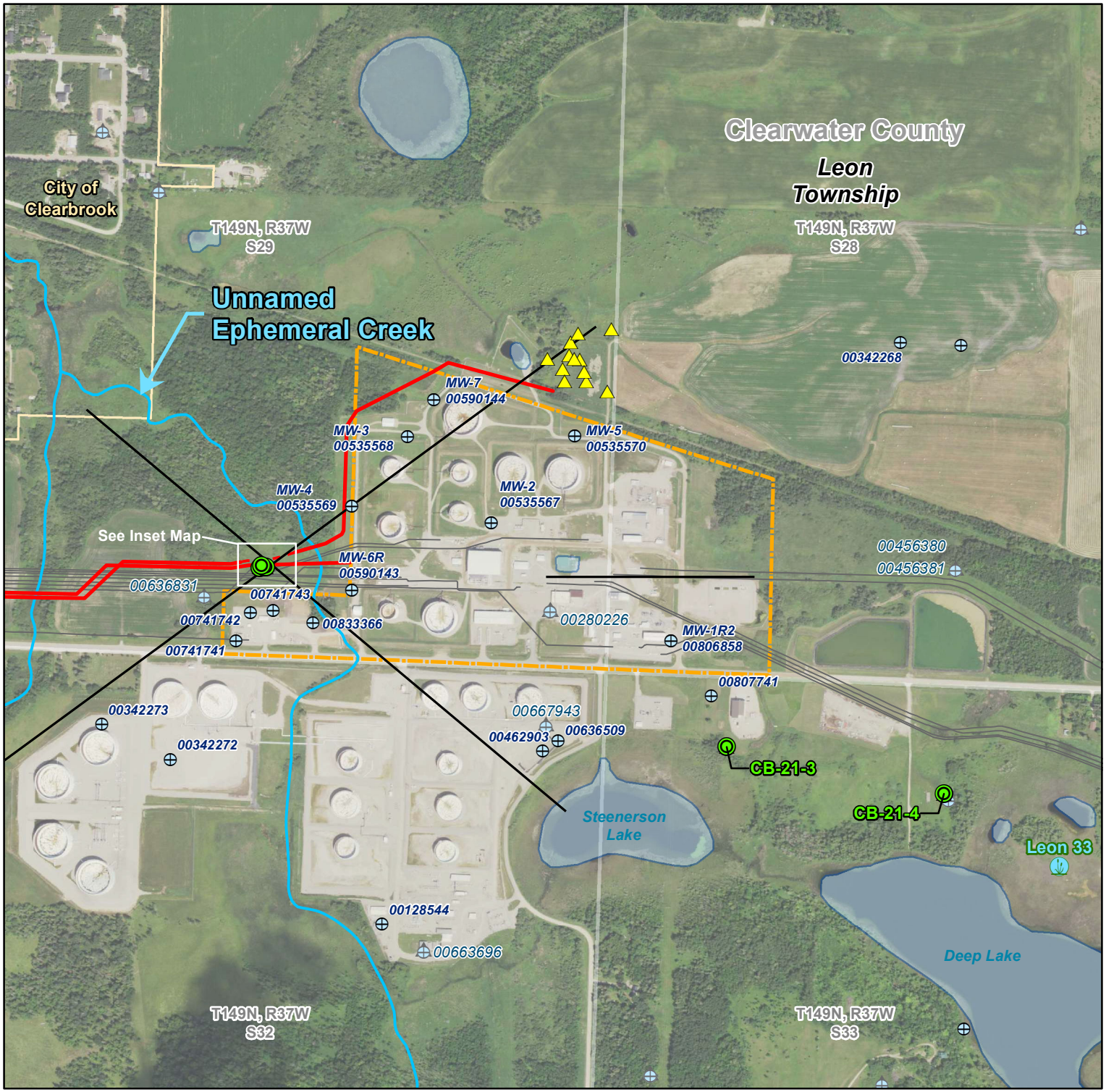
Figures

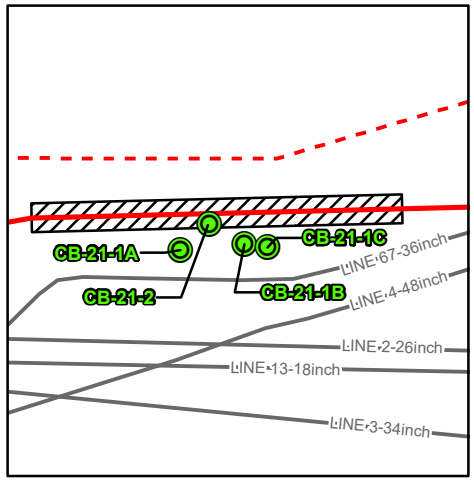
Figure 1Clearbrook Completed Boring Locations
Figure 2Clearbrook Geologic Cross Section

Attachments

Attachment 1 Soil Boring Logs
Attachment 2 Instrumentation Logs
Attachment 3 Vibrating Wire Piezometer Data

Figures





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- Line 3 Replacement (Not Constructed)
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- Cross Sections
- Terminal Property Boundary
- Calcareous Fen Location
- Rivers & Streams

N

0 800 1,600

Feet

1 Inch = 800 Feet

Figure 1

CLEARBROOK
COMPLETED BORING LOCATIONS
Clearbrook Terminal
Enbridge Energy, L.P.
Clearbrook, Minnesota

ENBRIDGE

SW

NE

1400
1350
1300
1250
1200

0+00 2+00 4+00 6+00 8+00 10+00 12+00 14+00 16+00 18+00 20+00 22+00 24+00 26+00 28+00 30+00 32+00 34+00 36+00 38+00 40+00 42+00 44+00 46+00 48+00

00342273
Top of Boring: 1348.0 ft.
SANDY CLAY (CL-ML)
LEAN CLAY WITH SAND (CL)
LEAN CLAY (CL)
GRAVELLY SAND (SP)
Bottom of Boring: 1293.0 ft.

MW-1 - 00741741
Top of Boring: 1345.6 ft.
CLAY FILL (CL)
SILTY CLAY (CL-ML)
CLAY (CL-CH)
Bottom of Boring: 1333.6 ft.

CB-21-1A
Top of Boring: 1338.8 ft.
TOPSOIL
POORLY GRADED SAND WITH CLAY (SP-SC)
LEAN CLAY (CL)
SILTY SAND (SM)
SILT (ML)
LEAN CLAY WITH SAND (CL)
FAT CLAY (CH)
LEAN CLAY (CL)
SILT (ML)
LEAN CLAY (CL)
POORLY GRADED GRAVEL (GP)
Bottom of Boring: 1304.8 ft.

CB-21-2
Top of Boring: 1338.9 ft.
FILL
SANDY LEAN CLAY
WITH GRAVEL FILL (CL)
CLAYEY GRAVEL
WITH SAND FILL (GC)
SANDY LEAN CLAY FILL (CL)
LEAN CLAY (CL)
Bottom of Boring: 1316.4 ft.

Constructed Line 3 Replacement

MW-6R - 00590143
Top of Boring: 1346.4 ft.
CLAY (CL-CH)
SILTY CLAY (CL-ML)
Bottom of Boring: 1328.4 ft.

MW-4 - 00535569
Top of Boring: 1341.8 ft.
CLAY (CL-CH)
Bottom of Boring: 1328.1 ft.

00462903
Top of Boring: 1350.0 ft.
CLAY (CL-CH)
GRAVEL (GP)
GRAVEL/COBBLES (GP)
SAND (SP)
SILTY SAND (SP-SM)
Bottom of Boring: 1275.0 ft.

00667943
Top of Boring: 1352.0 ft.
CLAY (CL-CH)
SAND AND GRAVEL (SP)
Bottom of Boring: 1307.0 ft.

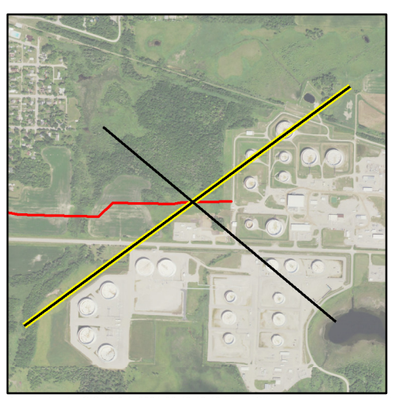
00636509
Top of Boring: 1350.0 ft.
CLAY (CL-CH)
SAND AND GRAVEL (SP)
CLAY (CL-CH)
SAND AND GRAVEL (SP)
SANDY CLAY (CL)
SAND AND GRAVEL (SP)
CLAY (CL-CH)
SAND AND GRAVEL (SP)
SILTY SAND (SP-SM)
SAND AND GRAVEL (SP)
CLAY (CL-CH)
SAND (SP)
Bottom of Boring: 1208.0 ft.

MW-3 - 00535568
Top of Boring: 1343.7 ft.
CLAY (CL-CH)
Bottom of Boring: 1330.7 ft.

CB-21-3
Top of Boring: 1351.6 ft.
TOPSOIL
CLAYEY SAND (SC)
POORLY GRADED SAND (SP)
LEAN CLAY (CL)
LEAN CLAY WITH GRAVEL (CL)
WELL GRADED GRAVEL WITH SAND (GW)
Bottom of Boring: 1301.6 ft.

SB-2
Top of Boring: 1351.5 ft.
TOPSOIL (CL)
LEAN CLAY (CL)
LEAN CLAY (CL)
SANDY LEAN CLAY (CL)
LEAN CLAY (CL)
Bottom of Boring: 1315.5 ft.

B-01-SPT
Top of Boring: 1344.3 ft.
TOPSOIL (CL)
ORGANIC CLAY (OL)
SILTY SAND (SM)
SANDY LEAN CLAY (CL-ML)
LEAN TO FAT CLAY (CL/CH)
SILTY SAND WITH GRAVEL (SM)
Bottom of Boring: 1304.8 ft.



NOTE:
Topographic information depicted based on MnTOPO LiDAR elevation data.

50
SCALE IN FEET
0 200
4x Vertical Exaggeration

Figure 2-1
CLEARBROOK TERMINAL
STRATIGRAPHY
RUNNING SW- NE
Enbridge Energy, L.P.
Clearbrook, Minnesota

ENBRIDGE

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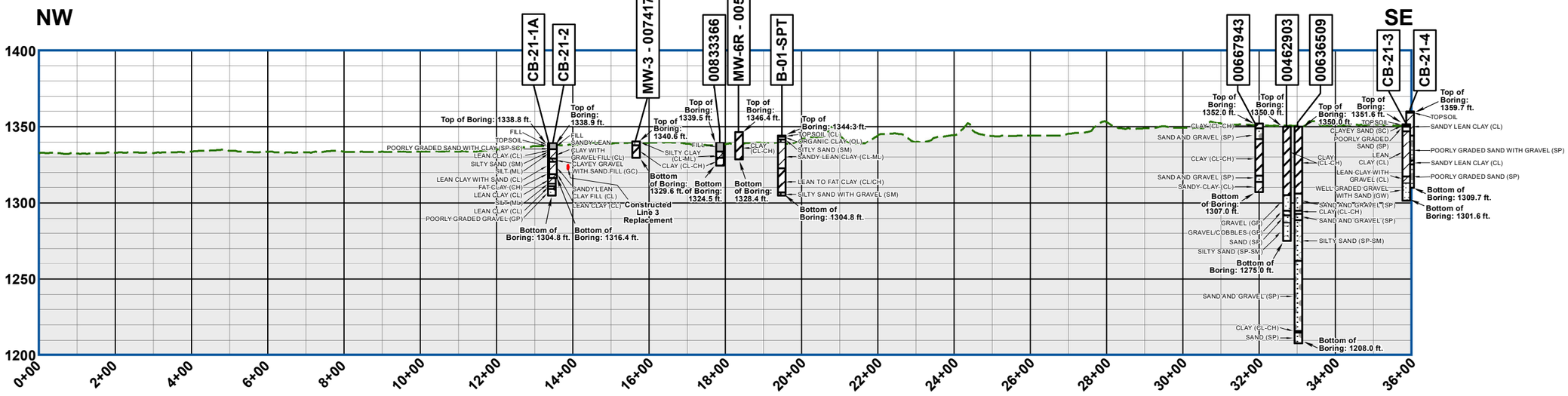

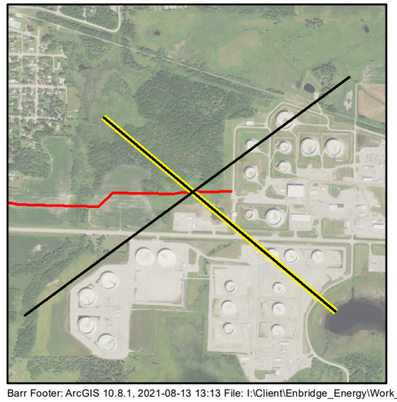

NOTE:
Topographic information depicted based on MnTOPO LiDAR elevation data.

50
SCALE IN FEET
0
200
4x Vertical Exaggeration

Figure 2-2
CLEARBROOK TERMINAL STRATIGRAPHY RUNNING NW - SE
Enbridge Energy, L.P.
Clearbrook, Minnesota

ENBRIDGE

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Attachments

Attachment 1

Soil Boring Logs

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1A

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1338.8 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	0	FILL: lean clay; grey; moist; with sand and silt; historic right of way fill.
1336.3		
1335.8		TOPSOIL: lean clay; black; moist; with roots. 2.5
1335	3.0	POORLY GRADED SAND WITH CLAY (SP-SC): fine to coarse grained; multicolored; moist; trace gravel and lean clay.
1333.8	5	5.0
1332.3		LEAN CLAY (CL): grey; moist; with sand; 6.5
1331.3		oxidation staining. 7.5
1330.8		SILTY SAND (SM): fine to coarse grained; multicolored; moist to wet. 8.0
1330	10	SILT (ML): grey; moist.
		LEAN CLAY WITH SAND (CL): grey; moist. 11' oxidation staining.
1325	15	14' trace gravel.
		16'-18' no recovery from thinwall. Advanced split spoon sampler. Blow counts disturbed..
1320.8		FAT CLAY (CH): grey; moist; trace sand. 18.0
1320	20	
1316.8		LEAN CLAY (CL): grey; moist; trace sand. 22.0
1315	25	
1312.5		SILT (ML): fine grained; grey; moist to wet; first blow through pushed tube. 26.3
1310.8		LEAN CLAY (CL): grey; moist to wet; silty. 28.0
1310	30	
1309.1		

Continued Next Page

STANDARD PENETRATION TEST DATA — N in blows/ft: 13, 9, 3, 10, 8, 29, >>54

WATER CONTENT % — PL, LL: 16, 37; 20, 52; 18, 45; 21

SIEVE ANALYSIS — GRAVEL, SAND, SILT, CLAY, FINES: 0, 24.5, 68.15; 0.3, 10.9; 1.3, 14.6, 64.05; (4.7

Physical Properties

WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
				0.75		
				1.5		
				3.25		
21.8	105.2			2.5		
23.3	103.1					
				1.5		
22.5	103.9					
				1.75		
22.4						

Completion Depth:	34.0
Date Boring Started:	7/27/21
Date Boring Completed:	7/30/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut; Coleman Engineering
Drilling Method:	Rotosonic; mud rotary
Ground Surface Elevation:	1338.822
Coordinates:	N 770,503.0 ft E 2,054,029.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 10' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 11' with 8" diameter steel casing. The boring was completed through the casing to 34' using mud rotary drilling methods and a 4-7/8" diameter tricone and NW drill rod. Drilling mud was approximately 15.2 PPG.

SAMPLE TYPES: ROTOSONIC SOIL CORE; GRAB SAMPLE; SPLIT SPOON; 3-inch Shelby Tube

WATER LEVELS (ft): At Time of Drilling — Not encountered prior to mud rotary

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

O:\GINT\PROJECTS\49161299 LINE 3 REPLACEMENT GEOTECH SURVEY\49161299.13_L3_CLEARBROOK_GIP.GPJ_BARRLIBRARY.GLB_HORIZONTAL LOG REPORT_BARR GEOTECH TEMPLATE.GDT

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1A

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES)	Physical Properties: WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
	30	POORLY GRADED GRAVEL (GP): coarse grained; grey; moist; apparent cobble from 29.7'-32'. *(Continued)*												
		29.7												
1305		1304.8				>>80/0.6'								
	35	Bottom of Boring at 34.0 feet Abandoned with neat cement grout; Installed vibrating wire piezometers				>>50/0.3								
		34.0												
	40													
	45													
	50													
	55													
	60													

Completion Depth:	34.0
Date Boring Started:	7/27/21
Date Boring Completed:	7/30/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut; Coleman Engineering
Drilling Method:	Rotosonic; mud rotary
Ground Surface Elevation:	1338.822
Coordinates:	N 770,503.0 ft E 2,054,029.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 10' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 11' with 8" diameter steel casing. The boring was completed through the casing to 34' using mud rotary drilling methods and a 4-7/8" diameter tricone and NW drill rod. Drilling mud was approximately 15.2 PPG.

SAMPLE TYPES

- ROTOSONIC SOIL CORE
- GRAB SAMPLE
- SPLIT SPOON
- 3-inch Shelby Tube

WATER LEVELS (ft)

- At Time of Drilling
- Not encountered prior to mud rotary

LEGEND

- MC Moisture Content
- γ Dry Unit Weight
- ϕ Friction Angle
- Q_u Unconfined Compression
- Q_p Hand Penetrometer UC
- Gs Specific Gravity
- RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1B

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1338.8 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	0	FILL: lean clay; grey; moist to wet; trace wood debris; trace sand and gravel.
1335	5	4.5' black fibrous organics; organic smell.
		5'-7' increased sand.
1330		5'-10' very soft.
	10	
		1325.8
1325		LEAN CLAY (CL): grey; with redish-brown mottle; moist to wet; trace sand. 13.0
	15	16.3' thinwall attempted with no recovery; then attempted split spoon with no recovery.
1320		
	20	21.8' - 3" sand seam.
1315		
	25	24.3' thinwall attempted with no recovery.
		1312.5
		Bottom of Boring at 26.3 feet 26.3 Abandoned with neat cement grout; Installed vibrating wire piezometers
	30	

Graphic Log | Sample Type & Rec.

STANDARD PENETRATION TEST DATA — N in blows/ft: 10 20 30 40

WATER CONTENT % — PL LL: 20 40 60

SIEVE ANALYSIS — GRAVEL SAND SILT CLAY FINES: 20 40 60 80

Physical Properties

WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
				1		

Completion Depth:	26.3
Date Boring Started:	7/29/21
Date Boring Completed:	8/1/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut; Coleman Engineering
Drilling Method:	Rotosonic; mud rotary
Ground Surface Elevation:	1338.764
Coordinates:	N 770,505.0 ft E 2,054,056.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 15' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 16' with 8" diameter steel casing. The boring was completed through the casing to 26.3' using mud rotary drilling methods with a 4-7/8" diameter tricone and NW drill rod. Drilling mud was approximately 15.2 PPG.

SAMPLE TYPES: ROTOSONIC SOIL CORE; GRAB SAMPLE; 3-inch Shelby Tube; SPLIT SPOON

WATER LEVELS (ft): At Time of Drilling — not encountered prior to mud rotary drilling

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1C

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1338.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL, LL)	SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES)	WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
	0	FILL: lean clay; grey to tan to redish-brown; moist; trace vegetation and grass; trace sand and gravel. 2' black organic seam.												
1335	5													
1331.9														
		LEAN CLAY (CL): grey to tan to redish-brown; moist; stiff; trace rounded gravel; trace to with sand.				PL 19, LL 45	1, 19	22.3	104			2		
1330	10				7, 9							2.5		
												3		
1325	15					PL 19, LL 49	2.1, 13.3	23.3	102.8			3.5		
1320	20					PL 19, LL 48	0.5, 57.9	17.5	112.9					
1318.1						PL 16, LL 48	1, 11.8	21.5	105.7					
1317.4		CLAYEY SAND (SC): fine to medium grained; grey; moist.												
1317.1		LEAN CLAY (CL): grey; moist; trace sand.												
	25	Bottom of Boring at 21.8 feet Abandoned with neat cement grout; Installed vibrating wire piezometers												
	30													

Completion Depth:	21.8
Date Boring Started:	7/30/21
Date Boring Completed:	8/2/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut; Coleman Engineering
Drilling Method:	Rotosonic; mud rotary
Ground Surface Elevation:	1338.923
Coordinates:	N 770,504.0 ft E 2,054,066.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 10' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 11' with 8" diameter steel casing. The boring was completed through the casing to 21.8' using mud rotary drilling methods and a 4-7/8" diameter tricone and NW drill rod. Drilling mud was approximately 15.2 PPG.

SAMPLE TYPES: ROTOSONIC SOIL CORE; GRAB SAMPLE; SPLIT SPOON; 3-inch Shelby Tube

WATER LEVELS (ft): At Time of Drilling

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-2

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1338.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	0	FILL: lean clay; grey; moist; with grass; historic trench fill.
1334.9		
1335	5	FILL: sandy lean clay with gravel; grey; wet.
	4.0	SS through 3T sample.
1330	10	8'-10' and 10'-12' thinwall samples attempted with little recovery; drove split spoon sampler; SPT N-values disturbed.
1328.9		
	10.0	FILL: clayey gravel with sand; grey; moist to wet. 10' lost return.
1326.9		
	12.0	FILL: sandy lean clay; grey; moist; trace gravel. 12' Mud return started again.
1325	15	
		17.5' thinwall attempted with no recovery; drove split spoon sampler; SPT N-values disturbed.
1320	20	
1318.9		
	20.0	LEAN CLAY (CL): grey; moist; trace sand.
1316.4		
	22.5	Bottom of Boring at 22.5 feet Abandoned with neat cement grout; Installed vibrating wire piezometers
	25	

Graphic Log | Sample Type & Rec. | STANDARD PENETRATION TEST DATA (N in blows/ft: 10 20 30 40) | WATER CONTENT % (PL, LL; 20 40 60) | SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES; 20 40 60 80)

Physical Properties	WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
0							
4.0							
10.0	20.9						
12.0							
20.0	26.6	99.3					
22.5	26	101.7			2		

Completion Depth:	22.5
Date Boring Started:	8/2/21
Date Boring Completed:	8/3/21
Logged By:	PMD
Drilling Contractor:	Coleman Engineering
Drilling Method:	Mud Rotary
Ground Surface Elevation:	1338.933
Coordinates:	N 770,513.5 ft E 2,054,041.1 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 22.5' using mud rotary drilling methods and a 4-7/8" diameter tricone with NW drill rod. Drilling mud was approximately 14.9 PPG.

SAMPLE TYPES: SPLIT SPOON

WATER LEVELS (ft): At Time of Drilling not encountered prior to mud rotary

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

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Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-3

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1351.6 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL — LL)	SIEVE ANALYSIS (GRAVEL / SAND / SILT / CLAY / FINES)	WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
1350.6	0	TOPSOIL: black; moist; with roots.												
1350.1	1.0	CLAYEY SAND (SC): grey; moist.												
	1.5	POORLY GRADED SAND (SP): fine to coarse grained; grey; dry to moist; with fine to medium grained gravel.												
1347.1	4.5	LEAN CLAY (CL): grey; moist; with fine grained sand and fine grained gravel.										3		
												2.5		
												1.25		
1333.6	18.0	LEAN CLAY (CL): grey; moist; trace fine grained sand and gravel.										1.5		
												0.75		
		30' start rotosonic drilling with weighted mud.				17 — 43	0.4 8.9	20.4	108.1			1		

Continued Next Page

Completion Depth:	50.0
Date Boring Started:	7/27/21
Date Boring Completed:	8/3/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Ground Surface Elevation:	1351.614
Coordinates:	N 769,474.0 ft E 2,056,719.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 15' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 16' with 8" diameter steel casing. The boring was then completed through the casing to 50' using rotosonic drilling methods. Drilling mud was approximately 13 PPG.

SAMPLE TYPES: ROTOSONIC SOIL CORE; GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling — not encountered prior to drilling with mud

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

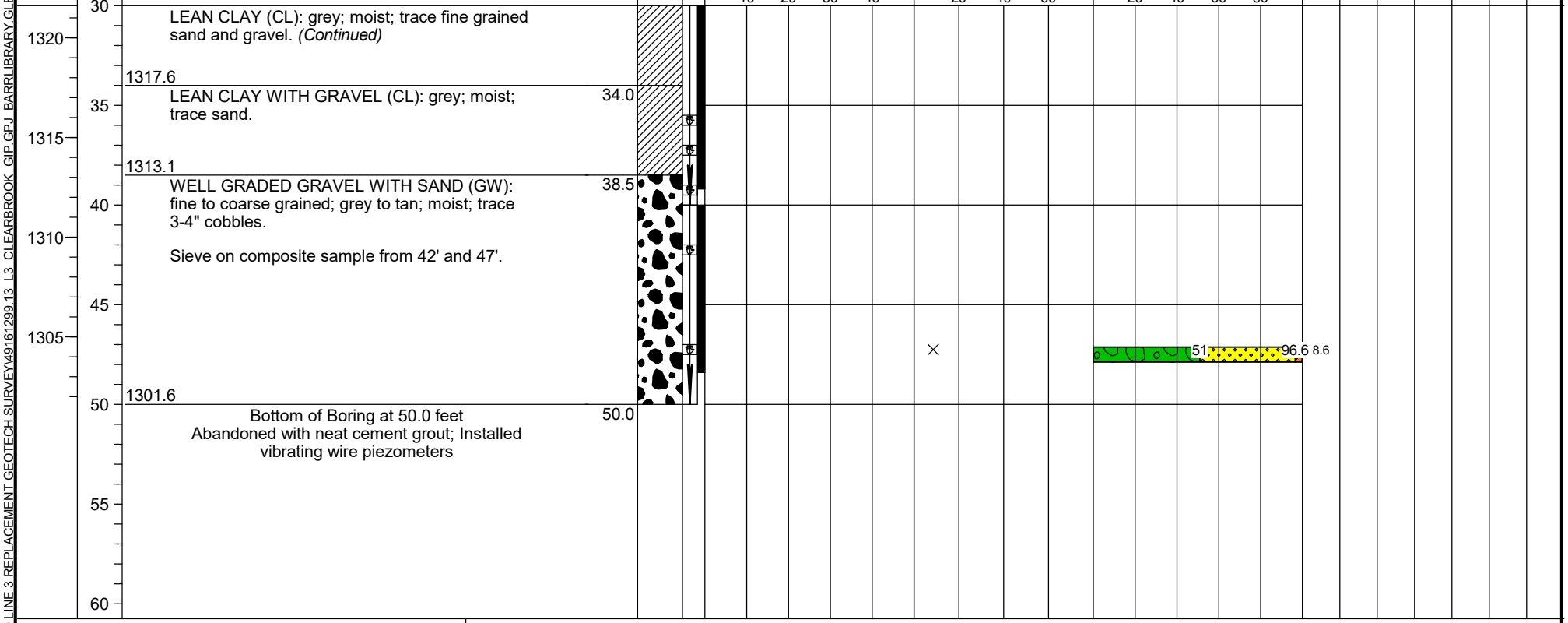
The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-3

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13



Completion Depth:	50.0
Date Boring Started:	7/27/21
Date Boring Completed:	8/3/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Ground Surface Elevation:	1351.614
Coordinates:	N 769,474.0 ft E 2,056,719.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 15' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 16' with 8" diameter steel casing. The boring was then completed through the casing to 50' using rotosonic drilling methods. Drilling mud was approximately 13 PPG.

SAMPLE TYPES

ROTOSONIC SOIL CORE | GRAB SAMPLE

WATER LEVELS (ft)

At Time of Drilling — not encountered prior to drilling with mud

LEGEND

MC Moisture Content
γ Dry Unit Weight
ϕ Friction Angle
Q_u Unconfined Compression
Q_p Hand Penetrometer UC
Gs Specific Gravity
RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

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Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-4

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge

Barr Project Number: 49161299.13

Surface Elev.: 1359.7 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Depth	Graphic Log	Sample Type & Rec.	Standard Penetration Test Data (N in blows/ft)	Water Content % (PL / LL)	Sieve Analysis (Gravel / Sand / Silt / Clay / Fines)	WC %	γd pcf	ϕ °	Qu tsf	Qp tsf	Gs	RQD %
1359.0	0	TOPSOIL: brown; moist; roots.	0.7												
		SANDY LEAN CLAY (CL): tan to grey; moist; trace subrounded gravel; some red-brown mottling; glacial till.											0.5		
1355	5						15, 31	2.2, 33.1	17.8	112.4			1.75		
1350	10												3.5		
													4.25		
1344.2 (1345)	15	POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; tan; moist; trace silt; gravel is subrounded and fine to coarse grained; glacial outwash.	15.5				×	46.9, 99.0, 5.1.3							
1340	20	Slight artesian flow of water noted after advancing 6" override casing to 20'.													
		20' start rotosonic drilling with weighted mud.													
1335	25	20-30' no recovery; possibly pushed a rock with core barrel.													
1330	30														

Continued Next Page

Completion Depth:	50.0
Date Boring Started:	8/2/21
Date Boring Completed:	8/4/21
Logged By:	JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Ground Surface Elevation:	1359.67
Coordinates:	N 769,204.0 ft E 2,057,970.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 10' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 11' with 8" diameter steel casing. The boring was completed through the casing to 50' using rotosonic drilling methods. Drilling mud was approximately 14 PPG.

SAMPLE TYPES	WATER LEVELS (ft)	LEGEND
ROTOSONIC SOIL CORE; GRAB SAMPLE	At Time of Drilling: not encountered prior to drilling with mud	MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-4

Project: L3 Replacement - Clearbrook GIP | Location: Clearbrook, MN | Client: Enbridge

Barr Project Number: 49161299.13

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.	STANDARD PENETRATION TEST DATA (N in blows/ft)	WATER CONTENT % (PL, LL)	SIEVE ANALYSIS (GRAVEL, SAND, SILT, CLAY, FINES)	WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
1327.7	30	SANDY LEAN CLAY (CL): grey; moist. 32.0				PL 14, LL 26	GRAVEL 1.8, SAND 33.9, SILT 85.6	16.1	118.7			0.5		
1325.2	35	POORLY GRADED SAND (SP): fine to medium grained; tan; moist; trace fine grained rounded gravel. 34.5												
1320	40													
1315	45						GRAVEL 0.7, FINES 96.5	16.5						
1309.7	50	Bottom of Boring at 50.0 feet 50.0 Abandoned with neat cement grout; Installed vibrating wire piezometers												
	55													
	60													

Completion Depth:	50.0
Date Boring Started:	8/2/21
Date Boring Completed:	8/4/21
Logged By:	JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Ground Surface Elevation:	1359.67
Coordinates:	N 769,204.0 ft E 2,057,970.0 ft
Datum:	MN State Plane N, NAD83, NAVD88

Remarks: Boring was advanced from 0 to 10' with a 4" diameter rotosonic core barrel and 6" diameter override casing. The boring was then cased to 11' with 8" diameter steel casing. The boring was completed through the casing to 50' using rotosonic drilling methods. Drilling mud was approximately 14 PPG.

SAMPLE TYPES: ROTOSONIC SOIL CORE; GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling — not encountered prior to drilling with mud

LEGEND: MC Moisture Content; γ Dry Unit Weight; ϕ Friction Angle; Q_u Unconfined Compression; Q_p Hand Penetrometer UC; Gs Specific Gravity; RQD Rock Quality Designation

The stratification lines represent approximate boundaries. The transition may be gradual.

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Attachment 2

Instrumentation Logs

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1A

Associated Boring #: CB-21-1A

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1338.8 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	1338.8
FILL: lean clay; grey; moist; with sand and silt; historic right of way fill. 1336.3 ft	0					
TOPSOIL: lean clay; black; moist; with roots. 1335.8 ft						
POORLY GRADED SAND WITH CLAY (SP-SC): fine to coarse grained; multicolored; moist; trace gravel and lean clay. 1333.8 ft	5					
LEAN CLAY (CL): grey; moist; with sand; oxidation staining. 1332.3 ft						
SILTY SAND (SM): fine to coarse grained; multicolored; moist to wet. 1331.3 ft	10			11.0		1327.8
SILT (ML): grey; moist. 1330.8 ft						
LEAN CLAY WITH SAND (CL): grey; moist. 1320.8 ft	15					
FAT CLAY (CH): grey; moist; trace sand. 1316.8 ft	20					
LEAN CLAY (CL): grey; moist; trace sand. 1312.5 ft	25					
SILT (ML): fine grained; grey; moist to wet; first blow through pushed tube. 1310.8 ft						
LEAN CLAY (CL): grey; moist to wet; silty. 1309.1 ft	30			29.7	TVT	1309.2
POORLY GRADED GRAVEL (GP): coarse grained; grey; moist; apparent cobble from 29.7'-32'. 1304.8 ft				30.7	BVT	1308.2
				31.7	TVT	1307.2
				32.7	BVT	1306.2
				34.0		1304.8
Bottom of Boring at 34.0 feet						

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **-0.75' to 11'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 34'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **T: 2003965(700 kPa)**
B: 1930856 (700 kPa)

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth: 34.0 ft
Date Started: 7/27/21
Date Completed: 7/30/21
Logged By: PMD/JEE
Drilling Contractor: Traut; Coleman Engineering
Drilling Method: Rotosonic; mud rotary
Datum: MN State Plane N, NAD83, NAVD88
Coordinates: N 770,503.0 ft E 2,054,029.0 ft

LEGEND

FILTER PACK
BENTONITE
CEMENT GROUT
CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

At Time of Drilling
Not encountered prior to mud rotary

The stratification lines represent approximate boundaries. The transition may be gradual.

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Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1B

Associated Boring #: CB-21-1B

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1338.8 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	**1338.8**
FILL: lean clay; grey; moist to wet; trace wood debris; trace sand and gravel.	0					
	5					
	10					
1325.8 ft						
LEAN CLAY (CL): grey; with redish-brown mottle; moist to wet; trace sand.	15			16.0		1322.8
	20			22.3	TVT	1316.5
				23.3	BVT	1315.5
	25					
1312.5 ft				26.3		1312.5
Bottom of Boring at 26.3 feet						

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **0' to 16'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 26.3'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **1912958 (350 kPa)**

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth: 26.3 ft
Date Started: 7/29/21
Date Completed: 8/1/21
Logged By: PMD/JEE
Drilling Contractor: Traut; Coleman Engineering
Drilling Method: Rotosonic; mud rotary
Datum: MN State Plane N, NAD83, NAVD88
Coordinates: N 770,505.0 ft E 2,054,056.0 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

At Time of Drilling
not encountered prior to mud rotary drilling

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-1C

Associated Boring #: CB-21-1C

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1338.9 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	**1338.9**
FILL: lean clay; grey to tan to redish-brown; moist; trace vegetation and grass; trace sand and gravel.	0					
	5					
1331.9 ft LEAN CLAY (CL): grey to tan to redish-brown; moist; stiff; trace rounded gravel; trace to with sand.						
	10			11.0		1327.9
	15			18.5	TVT	1320.5
				19.5	BVT	1319.5
1318.1 ft CLAYEY SAND (SC): fine to medium grained; grey; moist.	20			21.8		1317.1
1317.4 ft LEAN CLAY (CL): grey; moist; trace sand. 1317.1 ft						
Bottom of Boring at 21.8 feet						

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **0' to 11'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 21.8'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **1912959 (350 kPa)**

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth:	21.8 ft
Date Started:	7/30/21
Date Completed:	8/2/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut; Coleman Engineering
Drilling Method:	Rotosonic; mud rotary
Datum:	MN State Plane N, NAD83, NAVD88
Coordinates:	N 770,504.0 ft E 2,054,066.0 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

At Time of Drilling

The stratification lines represent approximate boundaries. The transition may be gradual.

O:\GINT\PROJECTS\49161299 LINE 3 REPLACEMENT GEOTECH SURVEY\49161299.13_L3_CLEARBROOK_GIP.GPJ BARRLIBRARY.GLB INST LOG REPORT WIDER LITH BARR TEMPLATE.GDT

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-2

Associated Boring #: CB-21-2

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1338.9 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	**1338.9**
FILL: lean clay; grey; moist; with grass; historic trench fill.	0					
1334.9 ft						
FILL: sandy lean clay with gravel; grey; wet.	5					
1328.9 ft						
FILL: clayey gravel with sand; grey; moist to wet.	10					
1326.9 ft						
FILL: sandy lean clay; grey; moist; trace gravel.				12.4	TVT	1326.5
				13.4	BVT	1325.5
	15					
				17.4	TVT	1321.5
				18.4	BVT	1320.5
1318.9 ft						
LEAN CLAY (CL): grey; moist; trace sand.	20					
1316.4 ft				22.5		1316.4
Bottom of Boring at 22.5 feet						

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **N/A**
Type: **N/A**
Interval: **N/A**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 22.5'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **T: 2134696 (350 kPa)**
B: 2134224(350 kPa)

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth: 22.5 ft
Date Started: 8/2/21
Date Completed: 8/3/21
Logged By: PMD
Drilling Contractor: Coleman Engineering
Drilling Method: Mud Rotary
Datum: MN State Plane N, NAD83, NAVD88
Coordinates: N 770,513.5 ft E 2,054,041.1 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

At Time of Drilling
not encountered prior to mud rotary

The stratification lines represent approximate boundaries. The transition may be gradual.

O:\GINT\PROJECTS\49161299 LINE 3 REPLACEMENT GEOTECH SURVEY\49161299.13_L3_CLEARBROOK_GIP.GPJ BARRLIBRARY.GLB INST LOG REPORT WIDER LITH BARR TEMPLATE.GDT

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-3

Associated Boring #: CB-21-3

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1351.6 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
TOPSOIL: black; moist; with roots. 1350.6 ft	0			0.0	GS	1351.6
CLAYEY SAND (SC): grey; moist. 1350.1 ft						
POORLY GRADED SAND (SP): fine to coarse grained; grey; dry to moist; with fine to medium grained gravel. 1347.1 ft	5					
LEAN CLAY (CL): grey; moist; with fine grained sand and fine grained gravel.	10					
	15			16.0		1335.6
1333.6 ft LEAN CLAY (CL): grey; moist; trace fine grained sand and gravel.	20					
	25					

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **-1.66' to 16'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 50'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **2003966 (700 kPa)**

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth:	50.0 ft
Date Started:	7/27/21
Date Completed:	8/3/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Datum:	MN State Plane N, NAD83, NAVD88
Coordinates:	N 769,474.0 ft E 2,056,719.0 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

At Time of Drilling
not encountered prior to drilling with mud

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-3

Associated Boring #: CB-21-3

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1351.6 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
LEAN CLAY (CL): grey; moist; trace fine grained sand and gravel. *(Continued)*	30					
1317.6 ft						
LEAN CLAY WITH GRAVEL (CL): grey; moist; trace sand.	35					
1313.1 ft						
WELL GRADED GRAVEL WITH SAND (GW): fine to coarse grained; grey to tan; moist; trace 3-4" cobbles.	40			41.4	TVT	1310.2
				42.4	BVT	1309.2
	45					
1301.6 ft				50.0		1301.6
Bottom of Boring at 50.0 feet	50					

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **-1.66' to 16'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 50'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **2003966 (700 kPa)**

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth:	50.0 ft
Date Started:	7/27/21
Date Completed:	8/3/21
Logged By:	PMD/JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Datum:	MN State Plane N, NAD83, NAVD88
Coordinates:	N 769,474.0 ft E 2,056,719.0 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

▼ At Time of Drilling

not encountered prior to drilling with mud

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
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Telephone: 218-529-8200

LOG OF BORING CB-21-4

Associated Boring #: CB-21-4

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1359.7 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
TOPSOIL: brown; moist; roots. 1359.0 ft	0			0.0	GS	1359.7
SANDY LEAN CLAY (CL): tan to grey; moist; trace subrounded gravel; some red-brown mottling; glacial till.	5					
	10			11.0		1348.7
1344.2 ft	15					
POORLY GRADED SAND WITH GRAVEL (SP): fine to coarse grained; tan; moist; trace silt; gravel is subrounded and fine to coarse grained; glacial outwash.				16.9	TVT	1342.8
				17.9	BVT	1341.8
	20					
	25					

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **0' to 11'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 50'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **T: 2134222 (350 kPa)**
B: 2129043 (700 kPa)

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth:	50.0 ft
Date Started:	8/2/21
Date Completed:	8/4/21
Logged By:	JEE
Drilling Contractor:	Traut
Drilling Method:	Rotosonic
Datum:	MN State Plane N, NAD83, NAVD88
Coordinates:	N 769,204.0 ft E 2,057,970.0 ft

LEGEND

- FILTER PACK
- BENTONITE
- CEMENT GROUT
- CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

▼ At Time of Drilling

not encountered prior to drilling with mud

The stratification lines represent approximate boundaries. The transition may be gradual.

Barr Engineering Company
325 South Lake Avenue, Suite 700
Duluth, MN 55802
Telephone: 218-529-8200

LOG OF BORING CB-21-4

Associated Boring #: CB-21-4

Project: L3 Replacement - Clearbrook GIP	Location: Clearbrook, MN	Client: Enbridge
Barr Project Number: 49161299.13	Surface Elevation: 1359.7 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
1327.7 ft SANDY LEAN CLAY (CL): grey; moist. 1325.2 ft POORLY GRADED SAND (SP): fine to medium grained; tan; moist; trace fine grained rounded gravel.	30 35 40 45			43.9 44.9	TVT BVT	1315.8 1314.8
1309.7 ft Bottom of Boring at 50.0 feet	50			50.0		1309.7

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **8"**
Type: **Steel**
Interval: **0' to 11'**

GROUT
Type: **neat cement grout**
Mix: **see below**
Interval: **0' to 50'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 4500S**
Serial No.: **T: 2134222 (350 kPa)**
B: 2129043 (700 kPa)

Remarks: Grout Mix: 94 lbs portland cement, 6 gals. water, 5% bentonite by weight of cement

Completion Depth: 50.0 ft
Date Started: 8/2/21
Date Completed: 8/4/21
Logged By: JEE
Drilling Contractor: Traut
Drilling Method: Rotosonic
Datum: MN State Plane N, NAD83, NAVD88
Coordinates: N 769,204.0 ft E 2,057,970.0 ft

LEGEND

FILTER PACK
BENTONITE
CEMENT GROUT
CUTTINGS / BACKFILL

TPC	TOP OF PROTECTIVE CASING
TRC	TOP OF RISER CASING
BPC	BASE PROTECTIVE CASING
GS	GROUND SURFACE
TVT	TOP VIBRATING-WIRE TIP
BVT	BOTTOM VIBRATING-WIRE TIP
TD	TOTAL DEPTH

WATER LEVELS(ft)

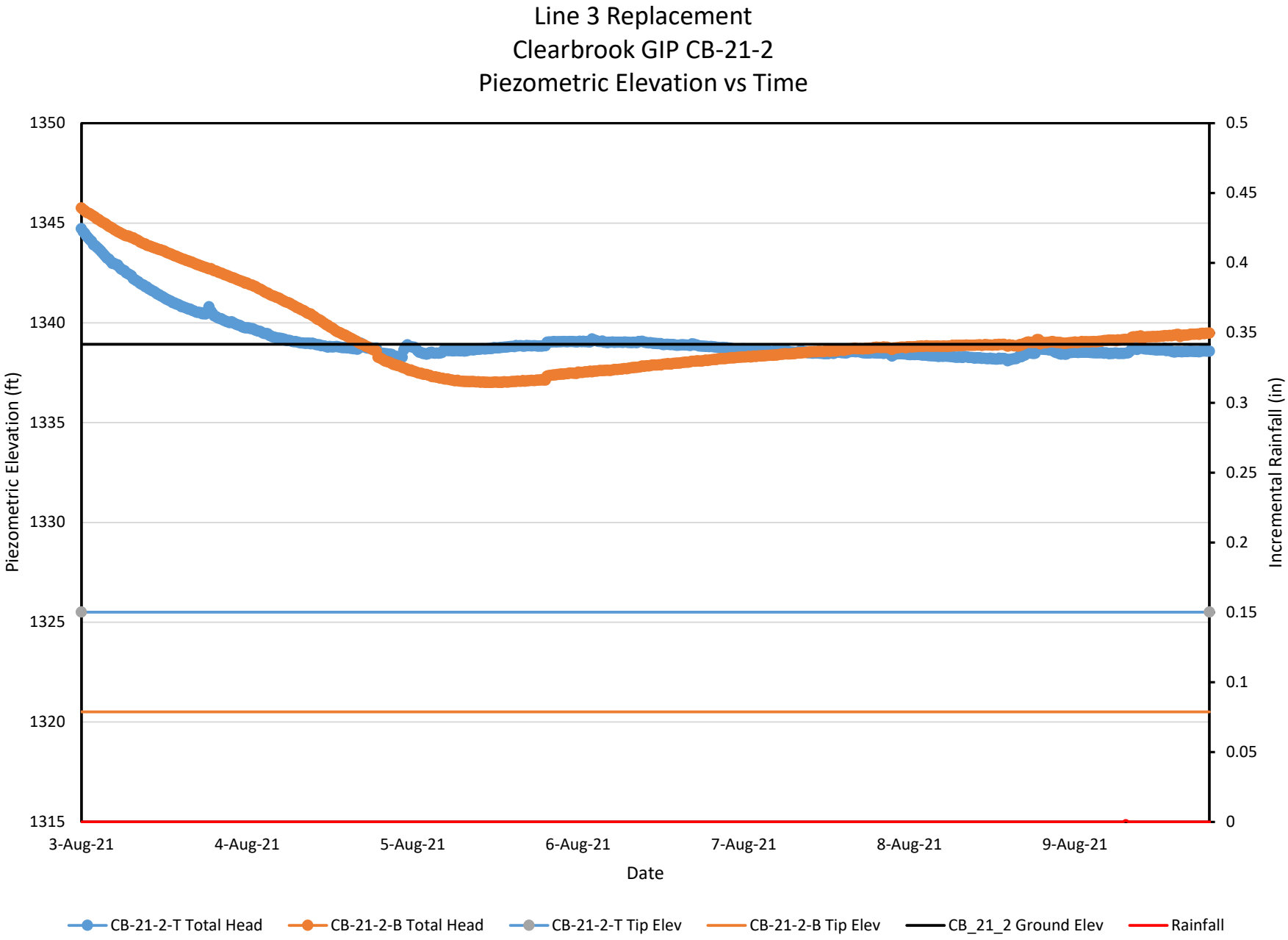
At Time of Drilling
not encountered prior to drilling with mud

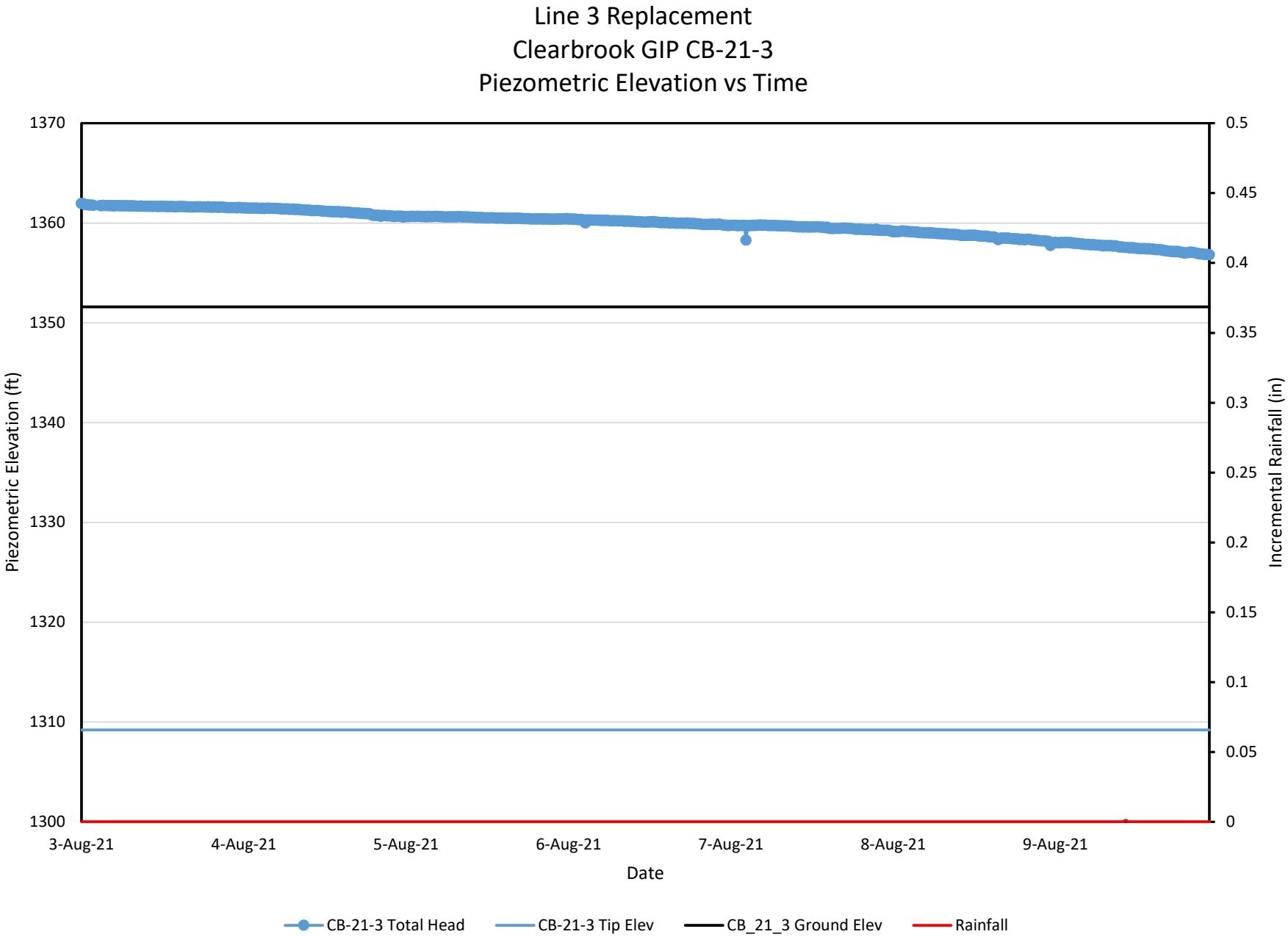
The stratification lines represent approximate boundaries. The transition may be gradual.

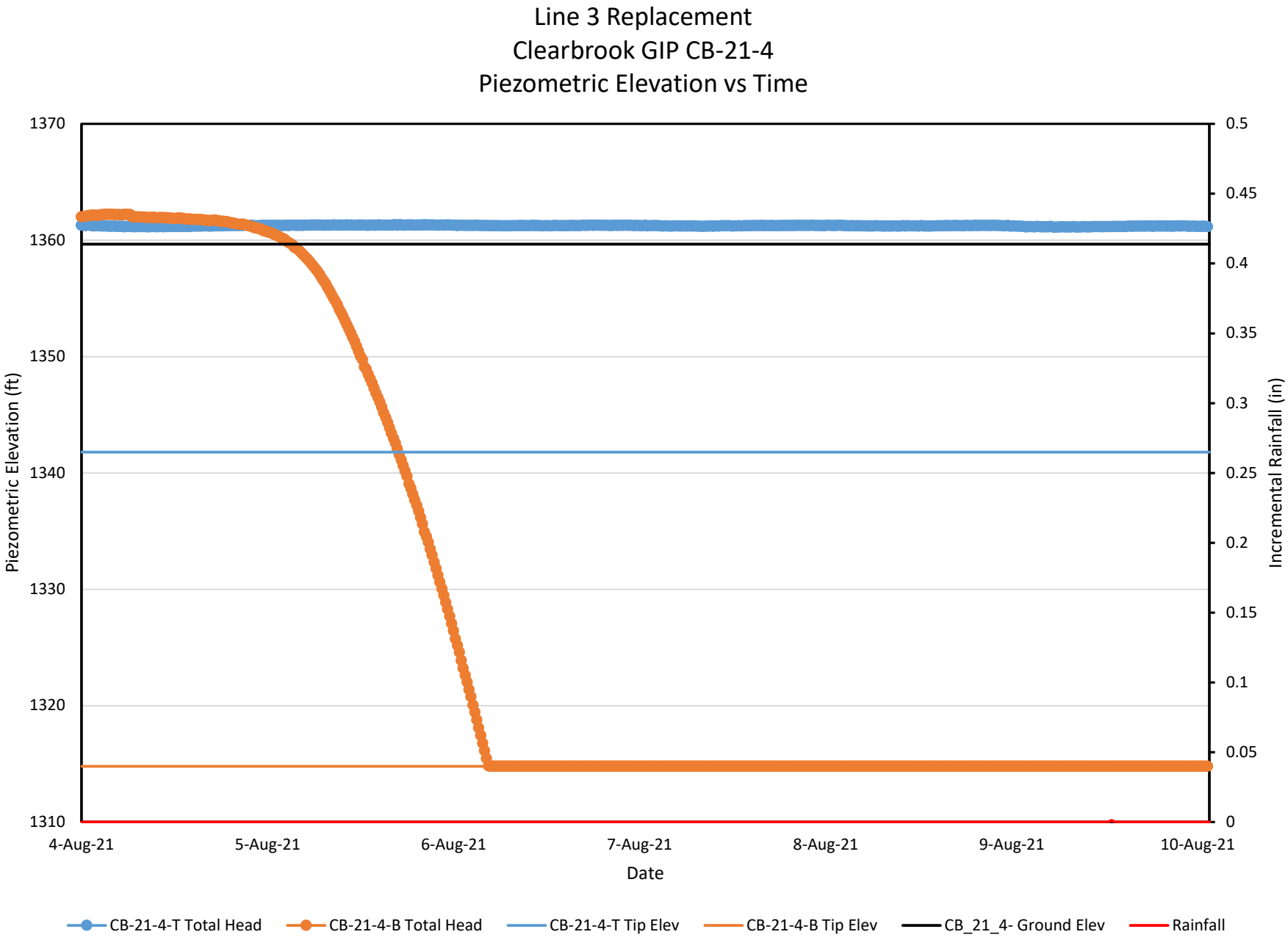
Attachment 3

Vibrating Wire Piezometer Data

Attachment 3-A

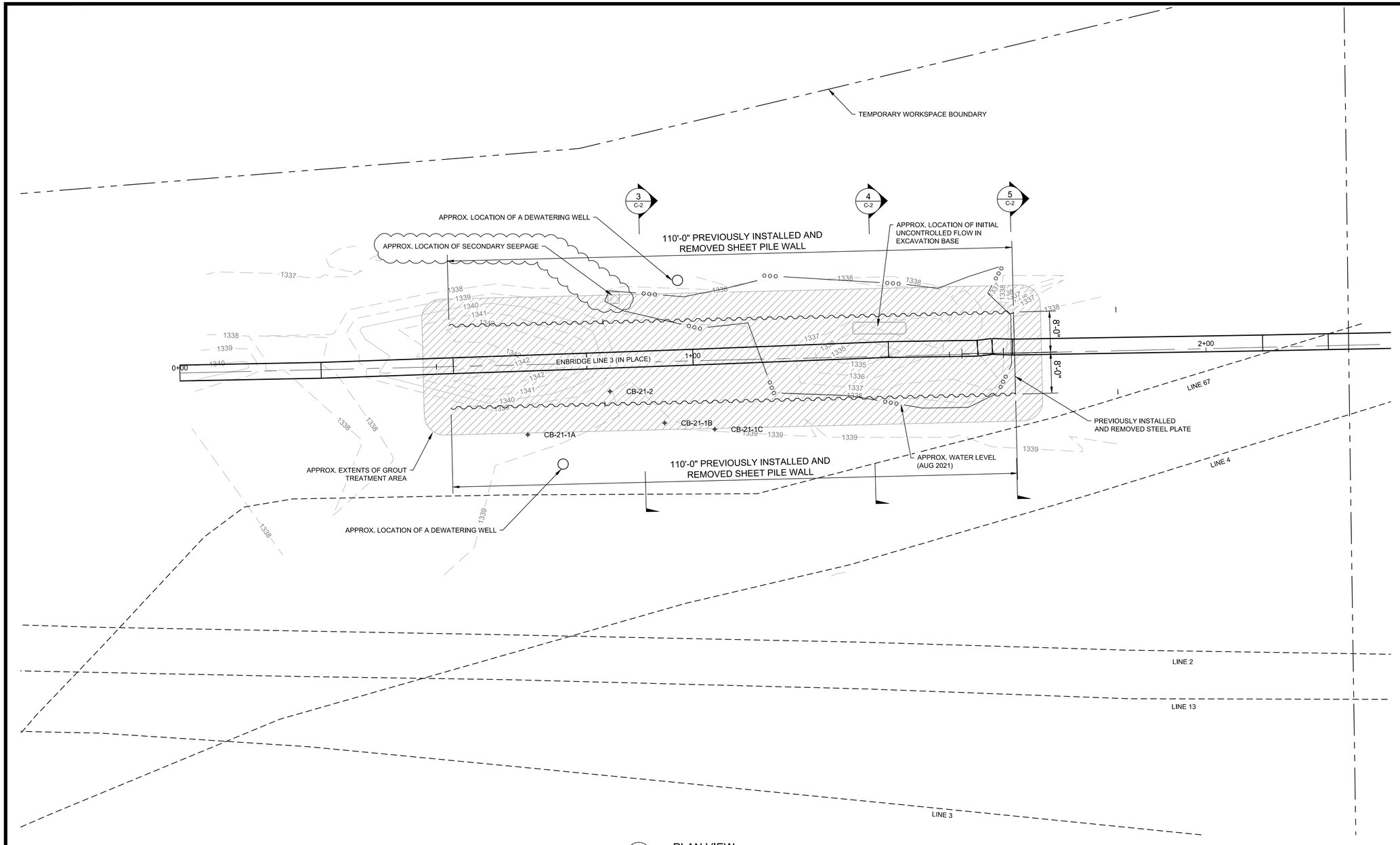

Line 3 Replacement
Clearbrook GIP CB-21-2
Piezometric Elevation vs Time
Piezometric Elevation (ft)
Incremental Rainfall (in)
1350
1345
1340
1335
1330
1325
1320
1315
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
3-Aug-21
4-Aug-21
5-Aug-21
6-Aug-21
7-Aug-21
8-Aug-21
9-Aug-21
Date
CB-21-2-T Total Head
CB-21-2-B Total Head
CB-21-2-T Tip Elev
CB-21-2-B Tip Elev
CB_21_2 Ground Elev
Rainfall


Line 3 Replacement
Clearbrook GIP CB-21-3
Piezometric Elevation vs Time
Piezometric Elevation (ft)
Incremental Rainfall (in)
1370
1360
1350
1340
1330
1320
1310
1300
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
3-Aug-21
4-Aug-21
5-Aug-21
6-Aug-21
7-Aug-21
8-Aug-21
9-Aug-21
Date
CB-21-3 Total Head
CB-21-3 Tip Elev
CB_21_3 Ground Elev
Rainfall


Line 3 Replacement
Clearbrook GIP CB-21-4
Piezometric Elevation vs Time
Piezometric Elevation (ft)
Incremental Rainfall (in)
1370
1360
1350
1340
1330
1320
1310
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
4-Aug-21
5-Aug-21
6-Aug-21
7-Aug-21
8-Aug-21
9-Aug-21
10-Aug-21
Date
CB-21-4-T Total Head
CB-21-4-B Total Head
CB-21-4-T Tip Elev
CB-21-4-B Tip Elev
CB_21_4- Ground Elev
Rainfall

Attachment 2

Preliminary Grouting Plan



1 PLAN VIEW
1"=10'-0"

0 10 20 30
1" = 10'-0"

30% REVIEW ISSUE

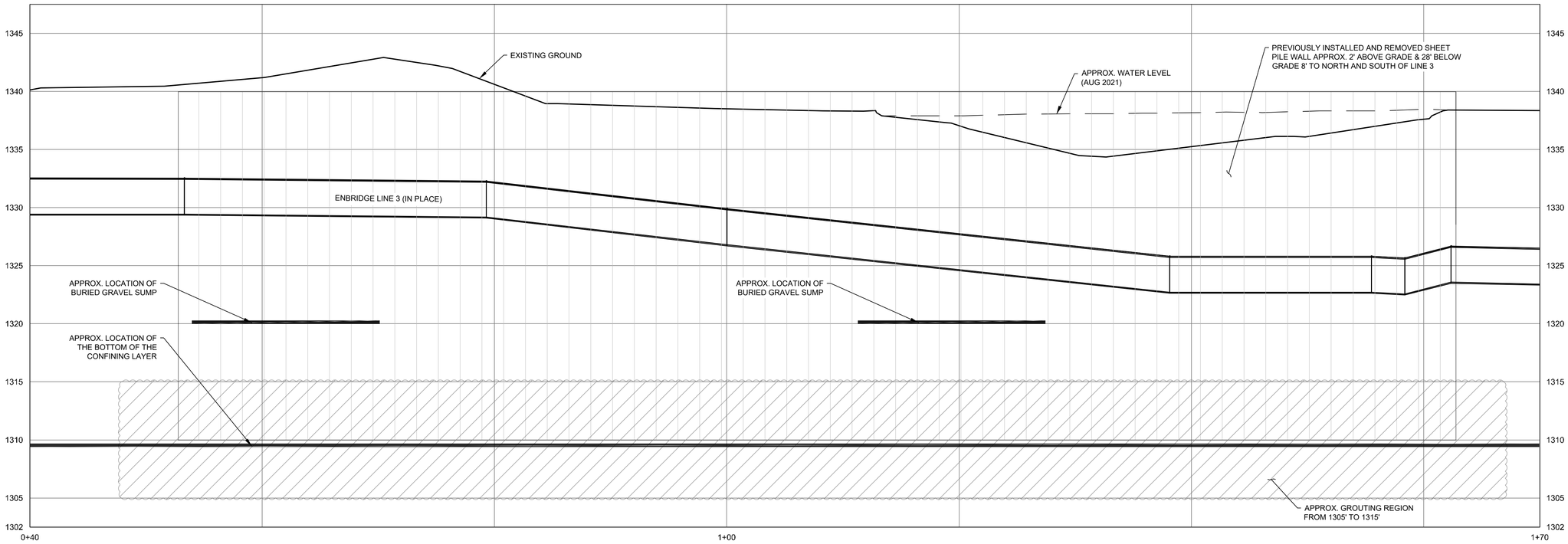
REFERENCE DRAWINGS

REV NO	REVISION DESCRIPTION	DATE BY	CHK	APPR

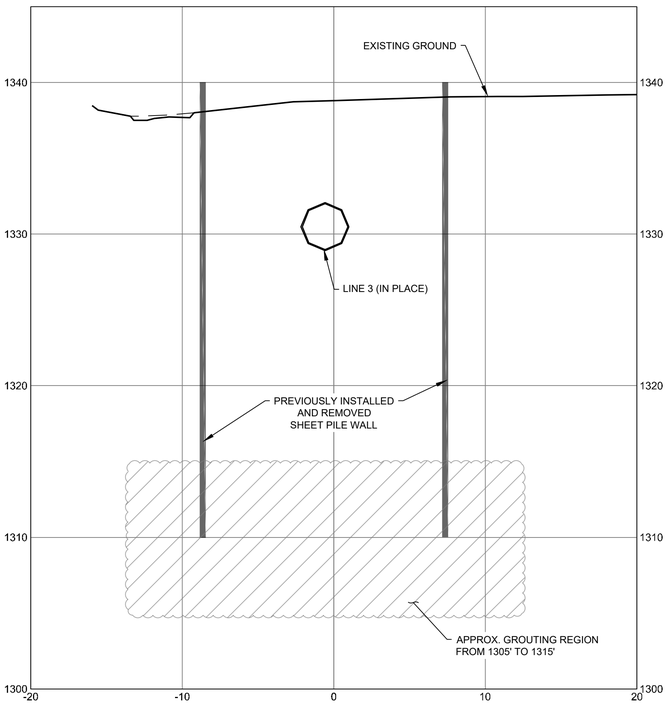
ENBRIDGE

LINE 3
MP 910.0
CLEARBROOK SHEET PILE WALL
PLAN VIEW

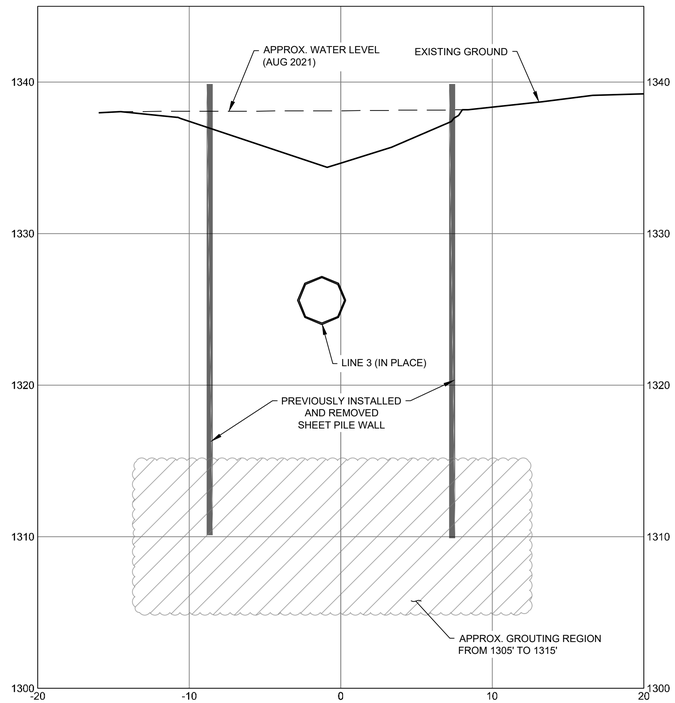
BY: JMD	CHK:	ENG. :	ENB APPR:
DATE:		SCALE:	STATUS:
DWG NO.: C-1			REV NO: 0.A



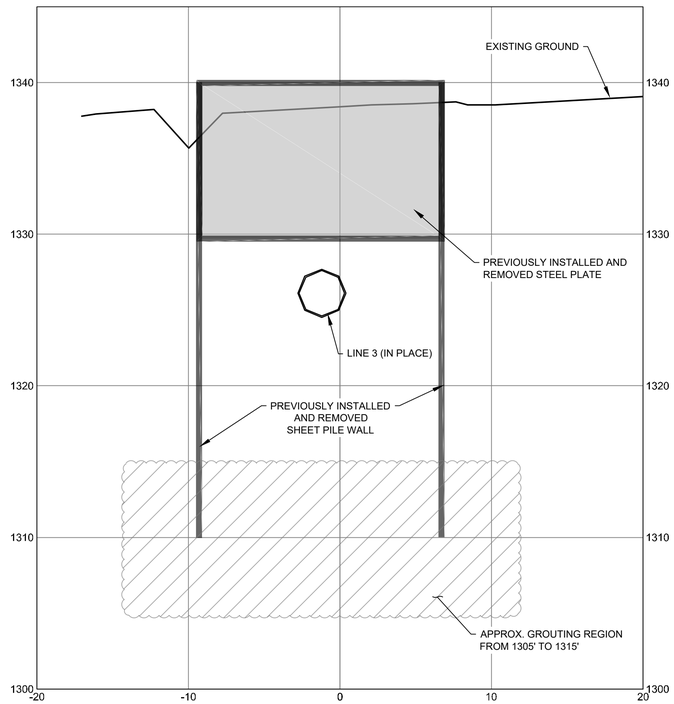
2 LINE 3 PROFILE VIEW
1"=5'-0"



3 STA. 0+90 SECTION
1"=5'-0"



4 STA. 1+35 SECTION
1"=5'-0"



5 STA. 1+63 SECTION
1"=5'-0"

0 5 10 15
1" = 5'-0"

30% REVIEW ISSUE

REFERENCE DRAWINGS				
REV NO	REVISION DESCRIPTION	DATE BY	CHK	APPR

ENBRIDGE

LINE 3
MP 910.0
CLEARBROOK SHEET PILE WALL
SECTIONS

BY: JMD	CHK:	ENG. :	ENB APPR:
DATE:		SCALE:	STATUS:
DWG NO.: C-2			REV NO: 0.A