MDNR ID No. 29: MP 946; LaSalle Creek (M-163)





LaSalle Creek Construction and Restoration Plan

Enbridge Energy, Limited Partnership • Line 3 Replacement Project

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ACRONYMS AND ABBREVIATIONS

ATWS	additional temporary workspace
Barr	Barr Engineering Company
bgs	below ground surface
BMPs	best management practices
BWSR	Minnesota Board of Water & Soil Resources
ECDs	erosion control devices
EI	Environmental Inspector
Enbridge	Enbridge Energy, Limited Partnership
EPP	Environmental Protection Plan
HA	hand-auger
L3R or Project	Line 3 Replacement Project
MDNR	Minnesota Department of Natural Resources
MP	milepost
MPCA	Minnesota Pollution Control Agency
OHWM	ordinary high-water mark
PCMP	Post-Construction Wetland and Waterbody Monitoring Plan
Plan	LaSalle Creek Construction and Restoration Plan
SSCP	Site-Specific Crossing Plan
SSRP	Site-Specific Restoration Plan
SWPPP	Stormwater Pollution Prevention Plan

INTRODUCTION

Enbridge Energy, Limited Partnership ("Enbridge") has coordinated with the Minnesota Department of Natural Resources ("MDNR") and Minnesota Pollution Control Agency ("MPCA") regarding the Line 3 Replacement Project ("L3R" or "Project") and the crossing of LaSalle Creek. Enbridge has applied for a License to Cross Public Waters and a Work in Public Waters Permit from the MDNR for the passage of utilities[1] under public waters[2] related to the construction and operation of the Project. Enbridge has prepared this LaSalle Creek Construction and Restoration Plan ("Plan") to address the crossing of LaSalle Creek, a Minnesota public water watercourse.

L3R crosses LaSalle Creek near milepost ("MP") 946.0 in Hubbard County in a general west to south/southeast alignment approximately 0.5 mile south of Big LaSalle Lake. LaSalle Creek is located within a tunnel valley. From approximately MP 945.9, the pipeline crosses a black spruce (*Picea marinana*)-Balsam fir (*Abies balsamea*)-tamarack (*Larix larcina*) dominated coniferous swamp forested wetland located on the western hillslope, which transitions to a fresh (wet) meadow wetland dominated by tussock sedge (*Carex stricta*), lake sedge (*Carex lacustris*), and Canada blue joint grass (*Calamagrostis canadensis*) at the bottom of the valley on either side of LaSalle Creek, extending until approximately MP 946.0. From there, wetlands moving up the eastern slope transition to Balsam popular (*Populus balsamifera*)-black ash (*Fraxinus negra*) and speckled alder (*Alnus incana*) shrub-carr communities, and then to a black ash-dominated hardwood swamp forested wetland.

Enbridge will cross the western hillslope relatively perpendicular to the slope to avoid paralleling LaSalle Creek, ensure sufficient workspace, and provide a shorter crossing of the waterbody. Enbridge is proposing to cross LaSalle Creek using the dry crossing method, following prior consultation with the MDNR that revealed past issues with use of the horizontal directional drill method. The crossing is located on county-administered land. LaSalle Creek is a coldwater trout stream that is approximately 15 feet wide from top-of-bank to top-of-bank. The stream is low-gradient, with nearly vertical banks and features a sinuous channel with sand-dominated bottom. The average flow velocity is approximately 0.8 foot per second. The Site-Specific Crossing Plan ("SSCP") is contained within Appendix A and the Site-Specific Restoration Plan ("SSRP") is contained within Appendix B).

Enbridge and MDNR met to discuss the LaSalle Creek crossing on April 2, 2020. MDNR was concerned about potential artesian conditions and water management in the vicinity of LaSalle Creek, and how these conditions might impact construction and operation of the Project. Following that meeting, Enbridge provided MDNR with results of a 2014 geotechnical evaluation on April 6, 2020[3] and then notified MDNR that it would gather additional hydrogeologic data at LaSalle Creek on April 14, 2020.[4] Enbridge provided MDNR with a Geotechnical Data Report for the LaSalle Creek crossing on May 13, 2020 that summarized the results of the fieldwork (the "2020 geotechnical investigation;" Barr Engineering Company ("Barr"), 2020; see Appendix C).[5]

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1 Utilities means lines, cables, and conduits for telephone, telegraph, or electric power, and pipelines for gases, liquids, or solids in suspension, and any other such item covered by the licensing requirements of Minnesota Statues, section 84.415 (Minnesota Rules 6135.0200, Subp. 3).

2 Public water or public waters means those waters of the state identified under Minnesota Statutes, section 103G.005, subdivision 15 or 15a, or 103G.201, as shown on the public water inventory maps.

3 Email from J. Motis to V. Perry on April 6, 2020 ("LaSalle Creek Data Request") at 12:57pm.

4 Email from J. Motis to V. Perry and M. Walker on April 14, 2020 ("LaSalle Creek Crossing") at 10:29am.

5 Email from J. Motis to M. Walker and V. Perry on May 13, 2020 ("LaSalle Creek Report") at 10:24am.

On June 8, 2020 MDNR provided feedback regarding its review of the LaSalle Creek hydrogeologic data[6]. Notably, MDNR found that no additional data collection was needed but that Enbridge should prepare dewatering estimates and be prepared to encounter a water table near the land surface during construction. MDNR submitted the first version of this Plan to MDNR in August 2020. This version was prepared following discussions with MDNR and MPCA in October 2020.

In addition, this Plan contains techniques to manage water encountered during pipeline construction and operation within MPs 945.9 to 946.5, or approximately between the hand-auger ("HA") locations LS-20-HA-3 to LS-20-HA-11 from the 2020 geotechnical investigation (see Appendix C). Section 1.0 provides a summary of data collected during Enbridge's 2020 geotechnical investigation at LaSalle Creek. Section 2.0 of the Plan addresses site preparation and pipeline installation activities as well as post-construction restoration measures, considering the data presented in Section 1.0.

To summarize, field data supports that Enbridge can successfully complete the crossing and manage groundwater flow using sheet piling at the crossing location and planning for additional pumping capacity for use as needed. Enbridge has also planned for additional trench breakers and scattered woody vegetation "slope breakers" to manage post-construction groundwater flow.

1.0 SUMMARY OF DATA COLLECTED

Enbridge engaged its environmental consultant, Barr, to conduct a geotechnical analysis in April 2020. Barr advanced 2 borings and 12 HA borings proximal to the L3R pipeline alignment for the LaSalle Creek crossing and collected soil samples for laboratory testing. One vibrating wire piezometer was installed in four HA borings prior to abandonment.

As determined from field and laboratory data, the existing soil conditions generally consist of topsoil/organic deposits overlying glacial outwash silt and sand deposits to a depth of at least 91.9 feet below ground surface ("bgs") (elevation 1338.9 feet), which was the approximate termination depth of the deepest boring (MP 407-North). Bedrock was not encountered within the depths of exploration of the borings. Artesian groundwater conditions were observed at boring MP 407-South upon reaching a depth of approximately 57 feet bgs (elevation 1376.6 feet). Water levels were measured in HA borings LS-20-HA-3 through LS-20-HA-11 during drilling at depths ranging from at the ground surface to approximately 2.5 feet bgs, which ranges in elevation from 1412.6 to 1441.0 feet. Results of the vibrating wire piezometer data indicate that groundwater is at the ground surface in elevations ranging from 1413.6 to 1431.2 feet. The range of horizontal hydraulic conductivity values were characteristic of a fine silt to clayey sand and are representative of deposits with moderately low permeability. This suggests that seepage inflows during construction will not be significant.

The sand and silty sand materials observed are considered to be moderately permeable; however, these higher permeability soils were generally encountered above the water-table elevation and are not expected to be a factor in the rate of groundwater seepage during construction. The organics, silt, and clay soils encountered lower in the valley (at the crossing location) are considered to have low permeability. Excavations through the lower permeability soils should have low seepage inflow rates. Moderately permeable sandy soils were encountered in LS-20-HA-7 through LS-20-HA-10, on the east side of the crossing. Higher rates of groundwater

[6] Email from V. Perry to J. Motis on June 8, 2020 ("Re: La Salle Creek Crossing") at 11:20am.

inflow through the permeable sand soils and unstable excavations should be anticipated, which could require higher dewatering pumping rates and/or shoring.

2.0 CONSTRUCTION PLAN

Appendix A presents a SSCP prepared for the LaSalle Creek crossing and the surrounding areas that were subject to the 2020 geotechnical investigation. Enbridge is proposing to cross LaSalle Creek using the dry crossing, dam-and-pump method. All work will be subject to applicable Enbridge construction plans, including the Environmental Protection Plan ("EPP"). However, where material within this Plan exceeds standard construction measures presented in the EPP, this Plan supersedes the EPP.

2.1 SITE PREPARATION

Prior to construction, the boundaries of the construction right-of-way and additional temporary workspace ("ATWS") will be clearly marked with flagging by professional surveyors. The construction workspace and ATWS will then be cleared of woody vegetation. Clearing will occur prior to Enbridge's work in this area consistent with mainline clearing operations. Enbridge will grind tree stumps to the ground surface, leaving the existing root systems intact to promote soil stability. Stumps will be removed from only the trenchline for pipeline installation. Merchantable timber will not be encountered within the scope of this Plan. Brush will be ground or chipped and scattered outside of the ordinary high-water mark ("OHWM"). Clearing equipment will not be allowed to ford LaSalle Creek at any time.

Enbridge will install a construction mat travel lane on the working side (the north side of the construction workspace) on both the east and west sides of the waterbody. These mats will be left in place until restoration is complete. Construction mats help avoid rutting,[7] minimize disturbance to soils and vegetation, and ensure safe and stable working surfaces for construction equipment and personnel. The construction mat travel lane will be approximately 18 feet wide and will be installed through the adjacent wetlands. The construction mat travel lane will likely be a single layer (see Figure 30 of the EPP); however, Enbridge may need to use more than one layer of mats if saturated conditions are encountered so as to provide a stable working surface (see Figure 32 of the EPP). If a flume must be installed anywhere under the mat road to convey flow, it will be installed as outlined in Figure 49 of the EPP based on site-specific conditions.

Enbridge will install a span bridge with an in-stream support at the LaSalle Creek crossing during the installation of the construction mat travel lane. The in-stream support will be a flume pipe to allow for fish passage. The flume will be slightly offset from the thalweg so that the main flow path of the waterbody is not funneled through the flume. This will support bridge and bank stability. The span bridge will be left in place until restoration is complete. As stated in the Bridge Memo provided to MDNR on July 2, 2020, bank migration potential is low at LaSalle Creek and the primary flow is located in the center of the channel. Enbridge is planning to place the construction mats directly on top of existing vegetation to avoid or minimize disturbance of vegetation on the channel banks and at the top of the banks. The bridge setting is shown on the bridge cross-section

[7] Rutting is defined as creation of linear depressions made by tire tracks of machinery 6 inches or greater in depth that results in the mixing of topsoil and subsoil per MDNR State Land Rutting Guidelines and Erosion and Sediment Control Decision Tree.

in Appendix A. Bridge headers have been placed perpendicular to the construction mat travel lane for equipment travel safety.

Enbridge will install erosion and sediment best management practices ("BMPs") prior to or at the same time as ground-disturbing activities (e.g., grading) in accordance with the requirements of the MPCA Construction Stormwater General Permit.[8] Enbridge Environmental Inspectors ("EIs") will maintain erosion and sediment control BMPs as required in the Project construction documents and as required by all applicable permits, including the Stormwater Pollution Prevention Plan ("SWPPP"). Enbridge requires inspections of temporary erosion control devices ("ECDs") at least once every 7 calendar days and within 24 hours after a rainfall event of 0.5 inch. Non-functional ECDs will be repaired, replaced, or supplemented with functional materials within 24 hours after discovery, or as otherwise specified in project permits. The following bullet list presents the proposed erosion and sediment control BMPs for this site:

- Redundant erosion prevention and sediment control BMPs consisting of two courses of silt fence or a combination of strawbale-reinforced or filter log-reinforced silt fence will be installed at the edge of LaSalle Creek once construction activities encroaches within 100 feet of LaSalle Creek to prevent construction-related sediment from entering the waterbody. The 100-foot-wide buffer will be identified in Enbridge's Environmental Plan Sheets prepared as part of Enbridge's SWPPP, which is currently in preparation in coordination with the MPCA. Redundant and reinforced (as necessary) BMPs will also be installed at the toe of the slope on either side of LaSalle Creek to prevent sediment discharge to the waterbody (see Section 2.2.2 of the EPP).

- The temporary bridge across LaSalle Creek will be maintained to prevent soil from entering the waterbody (refer to Figure 4 of the EPP). Soil that accumulates on the bridge decking will be removed daily, or as deemed necessary by the EI.

- Temporary ECDs will also be installed at the edge of the construction workspace, and/or in other areas determined by the EI to slow water leaving the site and prevent siltation of waterbodies and wetlands downslope or outside of the construction workspace (e.g., swales and side slopes).

- Temporary erosion and sediment control BMPs will be placed across the entire construction workspace at the base of slopes greater than 3 percent and at site-specific locations identified in the SWPPP until permanent cover[9] is established and there is no potential scouring of, or sediment transport to surface waters.

- Temporary erosion and sediment control BMPs installed across the travel lane may be removed during active daytime construction; however, ECDs will be properly reinstalled after equipment passage, or activities in the area are completed for the day.

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[8] LaSalle Creek is a trout stream, which is a considered a "Special or Impaired Water" in the MPCA Construction Stormwater General Permit.

[9] Permanent cover means surface types that will prevent soil failure under erosive conditions. Examples include: gravel, concrete, perennial cover, or other landscaped material that will permanently arrest soil erosion. Permittees must establish a uniform perennial vegetative cover (i.e., evenly distributed, without large bare areas) with a density of 70 percent of the native background vegetative cover on all areas not covered by permanent structures, or equivalent permanent stabilization measures. Permanent cover does not include temporary BMPs such as wood fiber blanket, mulch, and rolled erosion control products (Minnesota Rules 7090).

- Temporary erosion and sediment control BMPs will also be installed within the wetlands to prevent sedimentation off the construction workspace into the adjacent wetlands in accordance with the Section 401 Water Quality Certification.

- Temporary slope breakers also will be installed across the construction workspace after grading to minimize the potential for sediment runoff, prevent erosion, and maintain slope stability, as described in Section 1.9.4 of the EPP. The outfall of temporary slope breakers will be directed off the construction workspace into a stable well-vegetated upland area or into an appropriate energy-dissipating sediment control device (e.g., filter sock, silt fence, straw bales, rock aprons, sumps) to prevent the discharge of sediments (refer to EPP, Figure 11) and the area will be inspected to ensure stabilization. J-hook sediment traps will be installed at the perimeter of the erosion control zones on the downslope side of the construction workspace.

Enbridge is planning to remove an approximately 300-foot-long beaver dam located near MP 946.5, about 0.5 mile away from the Project's crossing of LaSalle Creek. The beaver dam is not located within LaSalle Creek. The location of the beaver dam is shown in Appendix A. Removal of the beaver dam will occur prior to, and separately from, construction at LaSalle Creek so as to allow water to drain from the construction workspace near that location prior to construction. Enbridge will conduct dam removal activities carefully to prevent downstream sedimentation and scouring impacts. The following BMPs will be implemented during removal of beaver dams:

- Enbridge will obtain landowner permission and will contact downstream landowners prior to removal activities;

- Enbridge will monitor weather conditions prior to removal;

- Removal will be limited to the removal of the debris that comprises the dam structure;

- Waterbody bed and bank material will not be removed or disturbed during debris removal;

- Materials will be removed incrementally by hand using hand tools to minimize the adverse effects of sudden water release on downstream waters/landowners;

- Ponded water will be released slowly to minimize potential downstream sedimentation. After each drop in dam height, Enbridge will allow the water level and sediment plume to stabilize;

- Downstream conditions will be monitored by construction staff to ensure incremental release of water; and

- Work will be halted, and the situation reassessed should removal result in unexpected conditions (e.g. ponding).

2.2 PIPELINE INSTALLATION

This section generally introduces the order in which the pipeline will be installed. These procedures are based on pipeline installation during non-frozen conditions. It is preferable to construct during non-frozen conditions within the LaSalle Creek Valley as Enbridge will be able to more effectively manage trench dewatering efforts associated with the crossing. However,

MDNR has waived a portion of its trout stream fisheries restriction at this crossing so as to allow for winter work between November 1 to March 31 should Enbridge's construction schedule allow. The standard trout stream restriction would normally prohibit in-water work between September 15 to April 15; Section 2.1 of the EPP extends these timing restrictions between September 1 and June 30.

Enbridge's construction contractor and EIs will monitor upcoming weather forecasts to determine if significant rainfall (greater than 0.5 inch) is predicted during installation of the crossing. Enbridge will appropriately plan work considering for the potential for wet conditions and will be prepared to implement mitigation measures in the event of wet weather conditions and/or excessive waterbody flow.

2.2.1 LaSalle Creek and Adjacent Fresh (Wet) Meadow Wetlands Crossing

Enbridge will use a specialized and experienced waterbody crossing crew to install the waterbody crossing; this crew will work independently from the mainline crews. By using a crew specifically devoted to the crossing location, Enbridge will minimize the total construction time in the area, allowing restoration to commence as soon as all construction activity is completed.

All pipe for the waterbody crossing and the adjacent wetland segments will be staged prior to excavating across LaSalle Creek so that it may be installed efficiently. Based on the results of the 2020 geotechnical investigation (see Appendix C), Enbridge expects that groundwater will be encountered within 0 to 2.5 feet bgs and will accumulate in the trench. Enbridge utilized the information gathered during the 2020 geotechnical investigations to estimate the amount of water which might be encountered during the crossing. Enbridge calculated seepage rates into the proposed pipeline excavation assuming that sheet piling/steel plate is used, assuming a conservative trench depth of 10 feet bgs. The estimated maximum volume of water seepage, based on an average seepage rate of 0.025 gallon per minute per linear foot of open trench, is 3,600 gallons of water. This volume is based on 200 feet of linear open trench excavated to a depth of 10 feet requiring dewatering for pipe installation over a 12-hour period at the LaSalle Creek crossing. Seepage rates were estimated based on in-situ slug test results collected at hand auger locations, actual flow into the trench may be marginally higher due to variations in stratigraphy or other conditions not encountered during the investigation. The use of sheet piling/ steel plate will reduce seepage into the pipeline trench excavation by approximately one-half, as compared to the use of no sheet piling/steel plate. External factors, such as water entering the excavation on the open ends of the sheet-piled ditch may impact this estimate. Enbridge may also install horseshoe-shaped steel plate perpendicular to the trench and over the pipe at either end of the pipe segment and sheet piling/steel plate to prevent water from laterally flowing along the trench during installation. The use of sheet piling/steel plate will allow Enbridge to adequately manage the volume of water using the pumps and equipment that Enbridge will have on-hand as part of the specialty crossing crew.

The LaSalle Creek crossing will be completed first, and pipe segments will be progressively welded to either side of the creek crossing at a rate and in a manner that allows effective water management. Acknowledging that site-specific conditions may differ from than 3,600 gallons of water per minute anticipated, Enbridge will modify the length of open trench that will excavated at the stream and the adjacent wetland crossings to be responsive to the water conditions observed at the time of construction. Prior to excavation, Enbridge will dig small test pits along the trenchline near the LaSalle Creek crossing and adjacent wetlands; this will help determine the length of pipe segments to be pre-fabricated and installed while managing water levels. If water levels are high,

Enbridge will excavate smaller segments, which will require less open trench at a time. After installation is complete, creek and adjacent wetland crossings will then be tied into the mainline segments on either side.

After the site is prepared as described in Section 2.1, Enbridge will then install sheet piling or steel plates (as ground conditions allow) to an estimated depth of 20 feet bgs flush to the stream bed surface. The sheet piling/steel plate will be supported by anchors to support structural integrity. The estimated extent of sheet piling/steel plate is shown in Appendix A; however, site-specific conditions at the time of construction will dictate the amount of sheet piling/steel plate needed to successfully complete the crossing. Sheet piling/steel plates creates a secure and effective water dam, which reduces the potential for surface and ground water flowing into the excavation. Reducing water inflow into the excavation area then reduces the need to dewater the excavation and potential for sediment loss off-site. Sheet piling/steel plates also provides stability to the excavated trench, resulting in a smaller excavation size and limited ground disturbance. Sheet piling/steel plate is advantageous in this specific situation as less trench spoil (the soil excavated from the pipeline ditch) will need to be excavated and the potential for ditch wall collapse is eliminated. Additionally, excavating less material will reduce erosion and sediment loss concerns as the temporary spoil piles will be smaller. Smaller spoil piles reduce the potential for equipment congestion and the potential for materials to leave the construction workspace. The portions of the sheet piling/steel plates within the waterbody will be driven down to allow for flow to continue until the waterbody crossing can be completed.

Enbridge will cross LaSalle Creek using a dry crossing, dam-and-pump method, which reduces potential sediment and erosion concerns and associated potential impacts on aquatic organisms. Due to the size of LaSalle Creek, Enbridge anticipates that it will complete this stream crossing within 48 hours. Completing the crossing in 48 hours or less reduces the amount of time that stream flow will be diverted as part of the crossing. Once the waterbody crossing crew is ready to execute the crossing, Enbridge will set up pumps and hoses to move flowing water around the upstream and downstream sheet piling/steel plate dams. The positioning of the creek pump-around pumps and hose are shown on the SSCP in Appendix A. This will allow LaSalle Creek to continue flowing around the work area and will prevent upstream water from mixing with water at the construction site, minimizing the potential for sedimentation. Pump hoses will connect to a discharge structure on the downstream side.

Enbridge will then pull up the sections of the sheet piling/steel plate within the waterbody that was previously driven down, creating a dam on either side of the crossing. Pumping will begin before the sheet piling is pulled back up or the plate is installed to serve as dams in order to maintain constant downstream flow throughout the process. Energy dissipation devices, such as plywood boards and/or plastic sheeting, will be placed under the discharge hose on the downstream side to prevent streambed scour and sediment discharge. Pump intake hoses will be fitted with 3/16-inch screens to prevent entrainment of fish and other aquatic organisms. Backup pumps, hoses, and fittings will be available on site at all times, in the event a primary pump or any other pumping components fail, for immediate deployment to maintain consistent streamflow.

The pre-fabricated crossing section of pipe for installation at the waterbody will be staged in a nearby ATWS and will have been designed to accommodate the ground contours and maintain the prescribed depth-of-cover over the pipeline at the crossing location. Installing a pre-fabricated section of pipe allows for a more efficient waterbody installation with less potential variables which could delay or prolong the installation effort.

To complete the waterbody crossing, excavators will then excavate a trench across the dry stream section between the dams for placement of the pre-fabricated stream crossing segment. Trench width excavation will vary depending on topography and soil conditions. The trench will be excavated to approximately 8.5 to 9 feet bgs to provide for 5.2 feet of cover over the top of the pipe at the LaSalle Creek crossing location as shown on Appendix A and as requested by the MDNR. Equipment will separate the upper 12 inches of the stream bed material and store it separately from the subsoil (below the 12 inches of stream bed material). All spoil will be stored outside of the stream bed and within the construction workspace.

Earthen (hard) trench plugs will be maintained undisturbed between the waterbody and adjacent wetland trench to prevent stream flow from flowing into the trench, and also to prevent water that may have accumulated in the adjacent trench from flowing into the waterbody. These plugs will be removed immediately prior to the installation of the pipe. Water that accumulates in the working trench will need to be periodically pumped out. The bottom of the trench must be able to be inspected for rocks, debris, and other items that could dent the pipe or otherwise compromise the protective pipe coating. Trench water will be pumped out of the trench using hoses and pumps placed near the pipeline trench. Additional pumps will be available on-site to ensure adequate pumping capacity. Trench water will then be discharged into one of two energy dissipating sediment filtration devices located away from the water's edge. Appendix A shows the two anticipated dewatering locations, one on each side of the crossing. The western location is positioned within an upland, and the eastern location is positioned within an ATWS located away from LaSalle Creek. Enbridge will use one or both of these discharge locations depending on site conditions. At no time will trench water be discharged to or mix with water from LaSalle Creek.

Spoil excavated from the trench will be stored within the ATWS on either side of the crossing. MDNR requested that Enbridge store sod from the banks of LaSalle Creek to aid in restoration efforts. Therefore, Enbridge will maintain the sod layer along with 9 to 12 inches of topsoil within the trench line from the bank (approximately 10 to 20 feet in width). Depending on the level of saturation at the time of removal, it may be difficult to obtain intact consolidated material, but generally the native vegetation will be retained and captured. The sod layer will be placed along the trenchline on the spoil side so that it is not covered up by subsoil and can be replaced last.

Once the trench is suitably excavated and inspected, the welded pipe segment will be lowered-in to the excavation. The trench breakers adjacent to the stream crossing segment will be installed. Trench breakers are permanent devices installed to prevent subsurface water flow along the installed pipeline. Preventing subsurface water flow is important for the structural integrity of the pipeline as well as preventing alteration of the existing environmental hydrologic conditions. The number and location of trench breakers adjacent to the waterbody crossing are depicted on the SSCP in Appendix A. Trench breakers will also be identified on construction alignment sheets with a note to "Field Verify." The precise location of trench breakers will be determined through coordination between Enbridge's EIs, Enbridge's Craft Inspectors, and the Contractor's Foreman. The trench breakers may be moved short distances in either direction from the location shown on Appendix A to find more stable soils, or to avoid other site-specific conditions. The excavation at the stream crossing will then be backfilled and the streambed contours restored, starting with the subsoil material and then the top 12 inches of parent streambed material.

Once waterbody crossing activities are complete, Enbridge will begin to remove all installed sheet piling/steel plate. The pumps will continue to divert water around the work area as Enbridge removes the portion of the sheet piling/steel plate within the waterbody to re-establish flow. After the flow is re-established, Enbridge will shut off the pumps to allow normal flow to resume.

Materials and equipment used specifically for the operation (e.g., pumps, hoses, dissipation devices) will be removed from the streambank and approaches. Enbridge will remove all remaining sheet piling/steel plate outside of the waterbody crossing and temporary bank stabilization[10] efforts will begin.

2.2.2 Adjacent Hillslope Construction

The pace and progress of construction will dictate the sequencing of the stream crossing segment tie-ins to the mainline pipe on either side of the stream crossing within the scrub-shrub and forested wetland communities on the valley hillslopes. Enbridge and its construction contractor will confirm the need for sheet piling/steel plate in the wetland areas to the west and east of the LaSalle Creek crossing generally between LS-20-HA-3 and LS-20-HA-11 (see Figure 1 in Appendix C) during construction activities, depending on site-specific conditions. Surficial groundwater is expected to be encountered during excavation of the trench in these areas. Based on the results of the 2020 geotechnical investigation and groundwater analysis Enbridge can adequately manage water encountered in the pipeline trench on either side of the stream crossing using the pumps and equipment that Enbridge will have on-hand as part of the mainline construction crews.

If the mainline pipeline has been installed up to the stream crossing on the eastern side, a tie-in crew will weld the stream crossing segment to the mainline before the stream is backfilled. This operation may require the tie-in excavations to be dewatered to provide a dry and safe working area. If water seeps into the tie-in excavation, it will be pumped out of the excavation to a sediment containment structure at one of two trench dewatering locations as shown in Appendix A. At no time will tie-in excavation water be discharged to or mix with water from LaSalle Creek. If the mainline pipeline has not been installed on the eastern side of the stream, the crossing segment will not be tied into the eastern mainline pipeline until a later date. If that situation occurs, tie-in excavations located outside of the bank of the stream feature will remain open until the tie-in has been completed. Temporary erosion and sediment BMPs will be maintained at the waterbody crossing to prevent sediment discharge to the stream until the tie-in is complete and permanent stabilization measures are completed.

The western side of the valley may be constructed before or after the stream crossing by the mainline or the tie-in crew. Based on environmental site conditions present at the time of the installation, Enbridge could install the pipe in one or multiple segments. The method selected would be based on the site-specific conditions encountered at the time of the construction, while taking into consideration environmental and construction feasibility concerns. The amount of water and/or saturated conditions will be the primary conditions that would drive decisions around construction methods.

At this time, Enbridge is proposing to install the pipe on the eastern and western hillslope wetlands in one segment; however, this is dependent upon site conditions and water levels at the time of the crossing. This will require that the excavation of the trench on the hillslopes be completed before lowering the pre-welded pipe into position, but it would result in a shorter duration of time for completion, thereby reducing the time the hillslopes will be disturbed. The erosion and sediment control BMPs described in Section 2.1 will also be installed. Alternatively, Enbridge

[10] Stabilization means that the exposed ground surface has been covered by appropriate materials such as mulch, staked sod, erosion control blanket, mats or other material that prevents erosion from occurring. Grass seeding, agricultural crop seeding or other seeding alone is not stabilization. Mulch materials must achieve approximately 90 percent ground coverage (Minnesota Rules 7090).

could excavate the hillslope in shorter segments and weld the segments as backfilling progresses. This method would reduce the amount of excavated trench, and overall area of exposed soil and spoil storage necessary; however, this method would require more time and would increase the duration of construction activity and slope disturbance.

Excavated trench spoils from upland areas will remain segregated from wetland soils and will be stored within the construction workspace. Once trenching is complete, the joined section of pipe will be lowered-in to the trench and trench breakers will be installed by an individual crew as shown on Appendix A. Trench breakers will be the most effective measure for preventing subsurface draining effects along the pipeline trench. Enbridge reviewed the location of trench breakers following completion of the 2020 geotechnical study and added additional trench breakers to address MDNR water management concerns. Backfilling will follow installation of the trench breakers but may not occur immediately after the trench breakers are installed. Backfilling may not occur immediately due to pending tie-in with the adjoining mainline segments of pipe, depending on the progress of construction. Any sheet piling that was installed will be removed. Enbridge will scatter woody debris along the forested and scrub-shrub hillslope wetlands on the western hillslope as described in Section 3.2.

3.0 RESTORATION MEASURES

3.1 STABILIZATION

Restoration of the stream bank and bed contours will be initiated prior to restoring flow at the waterbody crossing after the installation of the dam and pump method is complete, unless site and permit conditions delay permanent installation (see Section 2.6 of the EPP). Cleanup and rough grading of the hillslope construction area will begin as soon as practicable after the pipe sections are tied in and the trench is backfilled.

As required by the MPCA National Pollutant Discharge Elimination System/State Disposal System Construction Stormwater General Permit, stabilization will be initiated immediately[11] and completed within 7 calendar days whenever construction activity has permanently or temporarily ceased on any portion of this site, as this site is within 1 mile of and drains to a trout stream, which is defined as a special water. The process to install the western hillslope will take approximately 3 to 7 days to install. In addition, all exposed soil areas within 200 feet of the water's edge of LaSalle Creek, and that drain to that water, will be stabilized within 24 hours during the applicable "work in water restrictions" for Public Waters. Stabilization of all exposed soils within 200 feet of the public water's edge, and that drain to that water, will be initiated immediately and completed within 7 calendar days whenever construction activity has permanently or temporarily ceased on any portion of the site outside of the restriction period. Upon completion, Enbridge will stabilize the upland hillslope using hydro-mulch or erosion control blankets. Enbridge will install permanent slope breakers lined with erosion blankets as shown on in Appendix B. Although permanent slope breakers are not typically installed in wetlands, Enbridge, will scatter coarse woody debris not to exceed 2 feet deep to act as a natural "slope breaker" on the western hillslope, where the pipeline will cross the slope at a more perpendicular angle. The coarse woody debris would mimic the

[11] Initiated immediately means taking an action to commence soil stabilization as soon as practicable, but no later than the end of the work day, following the day when the land-disturbing activities temporarily or permanently cease (Minnesota Rules 7090).

roughness of the area and would help to hold water on the western hillslope (see locations on the SSRP in Appendix B).

The travel lane portion of the construction workspace and the temporary bridge will remain in place until final cleanup activities have occurred on both sides of LaSalle Creek. Construction mats will be removed from wetlands during final cleanup operations. The temporary bridge will be removed after final cleanup, seeding, mulching, and other construction workspace restoration activities have been completed. Appropriate temporary erosion and sediment BMPs will remain installed until permanent cover is achieved.

3.2 REVEGETATION

Enbridge will conduct permanent site restoration efforts at the LaSalle Creek crossing in accordance with the SSRP presented as Appendix B. Enbridge's restoration approach to-date has been informed by data collected during its wetland and waterbody field surveys and the SSRP site visits conducted in June 2020. Enbridge and MDNR will complete a site visit to confirm the restoration methodology as presented on the SSRP. No groundwater springs were located as part of the 2020 geotechnical survey; therefore, remediation will not be required. Enbridge is working with MPCA and MDNR to plan for long-term groundwater monitoring as described in Section 3.3.

As outlined in the SSRP in Appendix B, regardless of season of construction, Enbridge will also replace the top layer of soil with the sod mat that was removed from the trenchline as the last step when backfilling the trench. If construction occurs during winter conditions, Enbridge will attempt to fill voids between frozen segments with topsoil. A restoration specialist will be on-site during construction of the pipeline to ensure effective implementation of construction-related restoration methods.

Enbridge is proposing to restore the stream banks using a natural fiber erosion control blanket[12] (no ultraviolet biodegradable polyester materials). The adjacent fresh (wet) meadow is saturated with standing water (levels likely vary throughout the year). Remnant seed banks can sometimes be relied upon for some species in these communities. The natural revegetation process will be encouraged by the seeds and rhizomes in the topsoil spread back over the construction workspace after pipe installation. If there is no standing water at the time of restoration, Enbridge will seed the permanent right-of-way with the Minnesota Board of Water & Soil Resources ("BWSR") Wetland Rehabilitation (34-171) seed mix where native vegetation is expected to come back from the seedbank as outlined in the SSRP and will also consider the use of Wet Meadow Northeast (34-371). Enbridge proposes to allow natural reforestation of the construction workspace through the forested and scrub-shrub wetland communities via stump sprouting, root sprouting, and natural recruitment. The upland western hillslope area to the west of LaSalle Creek will be seeded with BWSR Woodland Edge Northeast (36-311) or Native Construction (32-241). This information will also be incorporated into the Planting Plan as part of the Post-Construction Vegetation Management Plan for Public Lands and Waters. Mulch will be applied as needed on approaches. No fertilizer, lime, or mulch will be applied in wetlands. Appropriate temporary

[12] Category 3N or 4N as described in Table 3885-2 (3885.2A Erosion Control Blanket Requirements) in Minnesota Department of Transportation Standard Specifications for Construction, 2018 Edition (http://www.dot.state.mn.us/pre-letting/spec/2018/2018-spec-book-final.pdf).

erosion and sediment BMPs described in Section 2.1 will remain installed until permanent cover[13] is achieved.

3.3 MONITORING

Enbridge has developed a Post-Construction Wetland and Waterbody Monitoring Plan ("PCMP") for aquatic resources affected by the Project, including the LaSalle Creek crossing. The PCMP was developed with input from the U.S. Army Corps of Engineers, MPCA, and MDNR. Section 2.4 of the PCMP contains information on post-construction monitoring for topography and stabilization of all wetland crossings. Section 3.0 of the PCMP contains performance standards for hydrology and wetland and riparian vegetation, including invasive and noxious species, compared to the baseline conditions observed during pre-construction surveys. Currently, Enbridge is proposing to conduct post-construction monitoring of the LaSalle Creek crossing immediately after restoration work is complete. Follow-up monitoring will occur in years 1, 2, 3, and 5 following construction.

A formal Monitoring Report will be submitted to applicable agencies, including the MDNR, by December 31 of each monitoring year. Enbridge will meet with the applicable agencies at the end of each monitoring year to review the results of the Monitoring Report and to determine if additional actions are required to complete restoration.

Enbridge has worked with the MDNR and MPCA to develop a long-term groundwater data collection effort around the LaSalle Creek crossing. Prior to construction, Enbridge will complete two hand auger borings adjacent to the construction workspace, one on each side of the LaSalle Creek crossing. Enbridge will install two nested vibrating wire piezometers in each boring. One of the vibrating wire piezometers will be installed in the surficial organic deposits and one in the deeper mineral deposits. These piezometers will be monitored with data loggers with built in telemetry systems to transmit data back from the field. The long-term monitoring locations were determined in coordination with MPCA and MDNR and will be completed as shown in Appendix D. Enbridge will report data back to MDNR and MPCA on a bi-annual basis.

4.0 REFERENCES

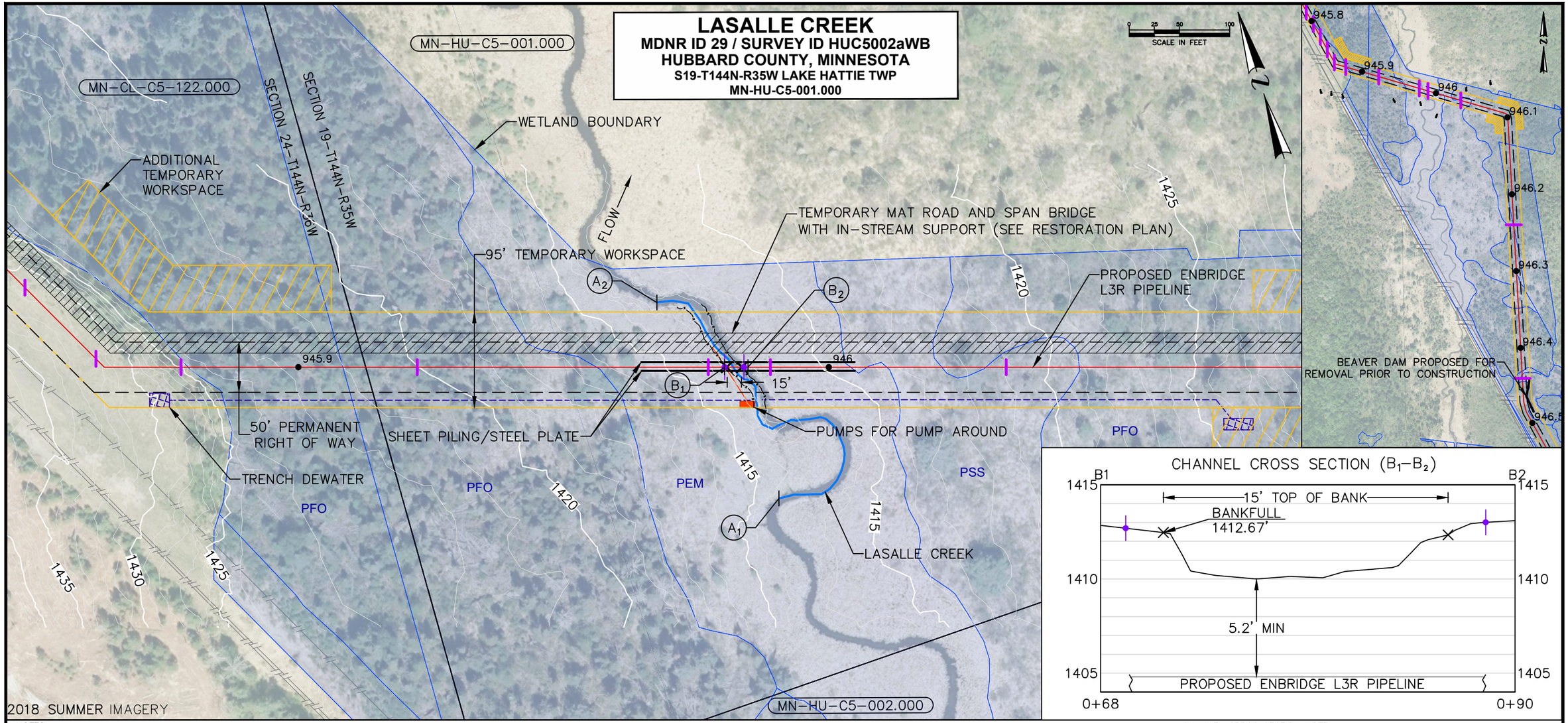
Barr Engineering Company. 2020. Geotechnical Data Report, Line 3 Replacement, LaSalle Creek Crossing; Clearwater and Hubbard County, Minnesota. May 2020.

[13] Permanent cover means surface types that will prevent soil failure under erosive conditions. Examples include: gravel, concrete, perennial cover, or other landscaped material that will permanently arrest soil erosion. Permittees must establish a uniform perennial vegetative cover (i.e., evenly distributed, without large bare areas) with a density of 70 percent of the native background vegetative cover on all areas not covered by permanent structures, or equivalent permanent stabilization measures. Permanent cover does not include temporary BMPs such as wood fiber blanket, mulch, and rolled erosion control products (Minnesota Rules 7090).

Appendix A

Site-Specific Crossing Plan

LASALLE CREEK
MDNR ID 29 / SURVEY ID HUC5002aWB
HUBBARD COUNTY, MINNESOTA
S19-T144N-R35W LAKE HATTIE TWP
MN-HU-C5-001.000



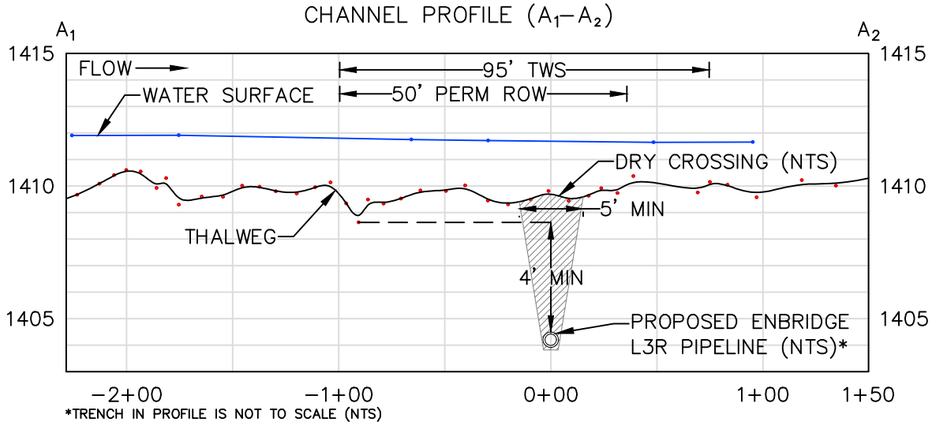
NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. SOBS (O/H) OR NPC (S1–3): HIGH SOBS
3. MDNR FISHERIES TROUT EXEMPTION (GRANTED 9/18/20): NO IN-CHANNEL WORK FROM SEPTEMBER 1 – OCTOBER 31 AND APRIL 1 – JUNE 30. 24-HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET.
4. WHEN WORKING WITHIN 'WORK IN WATER RESTRICTIONS', STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

LEGEND

- PROPOSED ENBRIDGE L3R PIPELINE
- OTHER PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY (ROSGEN SURVEY – THALWEG)
- TRACT BOUNDARY
- TEMPORARY MAT ROAD AND SPAN BRIDGE
- WETLAND
- ADDITIONAL TEMPORARY WORKSPACE
- MN-XX-XX-XXX.XXX — TRACT ID
- ROSGEN SURVEY POINT – WATER SURFACE
- ROSGEN SURVEY POINT – RIVER BOTTOM (THALWEG)
- PROPOSED INCREASED DEPTH OF COVER EXTENT
- TOP OF BANK
- TRENCH BREAKER (LOCATIONS ARE APPROXIMATE)

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY

CHANNEL PROFILE (A_1–A_2)



*TRENCH IN PROFILE IS NOT TO SCALE (NTS)

CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2020 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.
2. DEPTH OF COVER AT CENTERLINE WAS DEVELOPED USING THE BOTTOM ELEVATION OF THE DEEPEST UPSTREAM OR DOWNSTREAM POOL WITHIN THE SURVEYED REACH, UNLESS OTHERWISE NOTED IN APPLICATION MATERIALS.
3. MEAN MEANDER BELT WIDTH: 80'
4. MEANDER WIDTH RATIO: 8.38
5. TRENCH BREAKER AND DEWATER STRUCTURE LOCATIONS ARE APPROXIMATE.

NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

ENBRIDGE

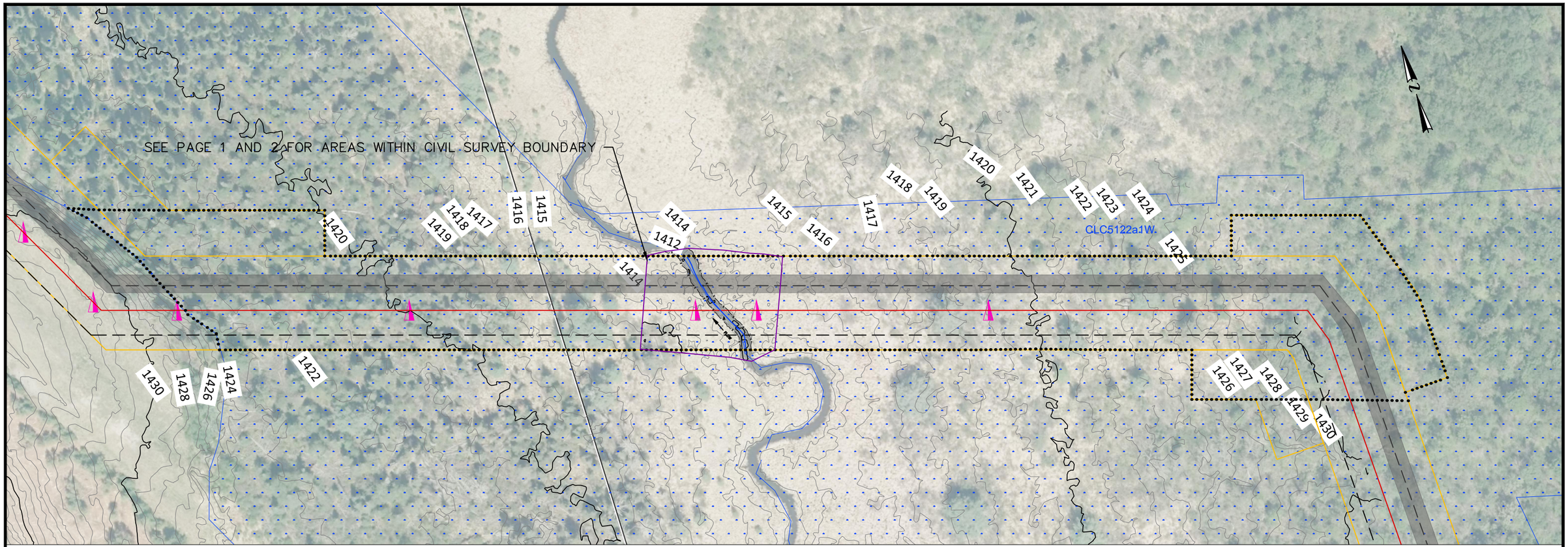
DWN. BY: AJJ	DATE 10/2020
CHK.	
PROJ. ENGR.	
PROJ. MGR.	
CLIENT APP.	

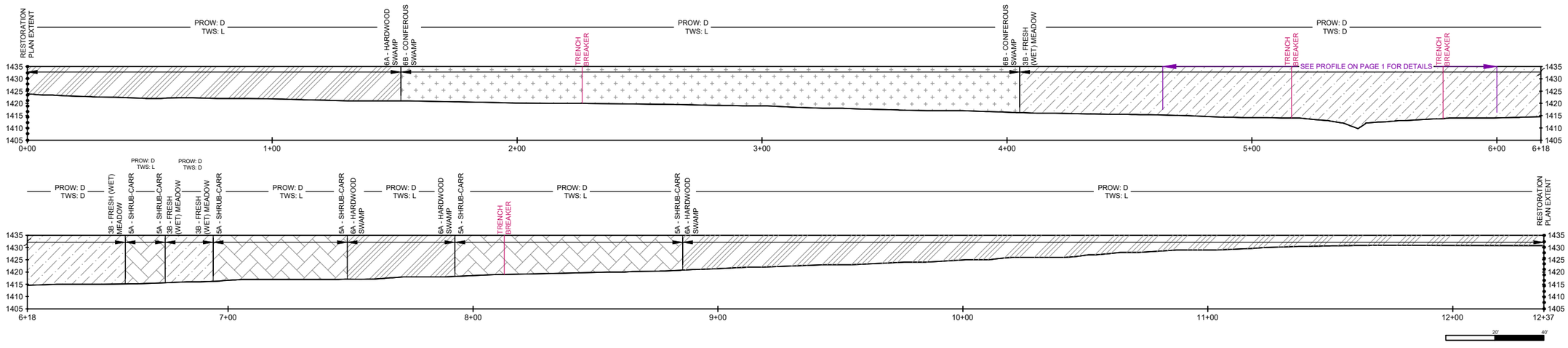
PROPOSED ENBRIDGE L3R PIPELINE
PRIMARY METHOD – DRY CROSSING
CROSSING OF LASALLE CREEK
ENBRIDGE MP 946.0
HUBBARD COUNTY, MINNESOTA

SCALE	DWG. NO.
NOTED	B-93-5.84-MDNR-29-0

Appendix B

Site-Specific Restoration Plan





BWSR SEED MIX	D: WET MEADOW NE (34–371); F:Wetland Rehab (34-171), L: Natural Revegetation
SOBS (O/H) or NPC (S1-3)	HIGH SOBS; NO (NOT S1–S3)

1. ELEVATIONS OUTSIDE OF THE AREA WITHIN CIVIL SURVEY BOUNDARY ARE DERIVED FROM LIDAR. ENBRIDGE WILL RESTORE THE AREAS ADJACENT TO THE PUBLIC WATER WITHIN THE MDNR EXPANDED RESTORATION BOUNDARY TO PRE–CONSTRUCTION CONDITIONS.
2. MDNR FISHERIES TROUT EXEMPTION (GRANTED 9/18/20): NO IN–CHANNEL WORK FROM SEPTEMBER 1 – OCTOBER 31 AND APRIL 1 – JUNE 30. 24–HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET.
3. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
4. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
5. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.
6. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
7. SEE THE PLANTING PLAN FOR ADDITIONAL DETAIL REGARDING SEEDING PRACTICES AND SEED MIXES AT PUBLIC WATER CROSSINGS.
8. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 & 2.6.1 OF THE EPP).
9. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

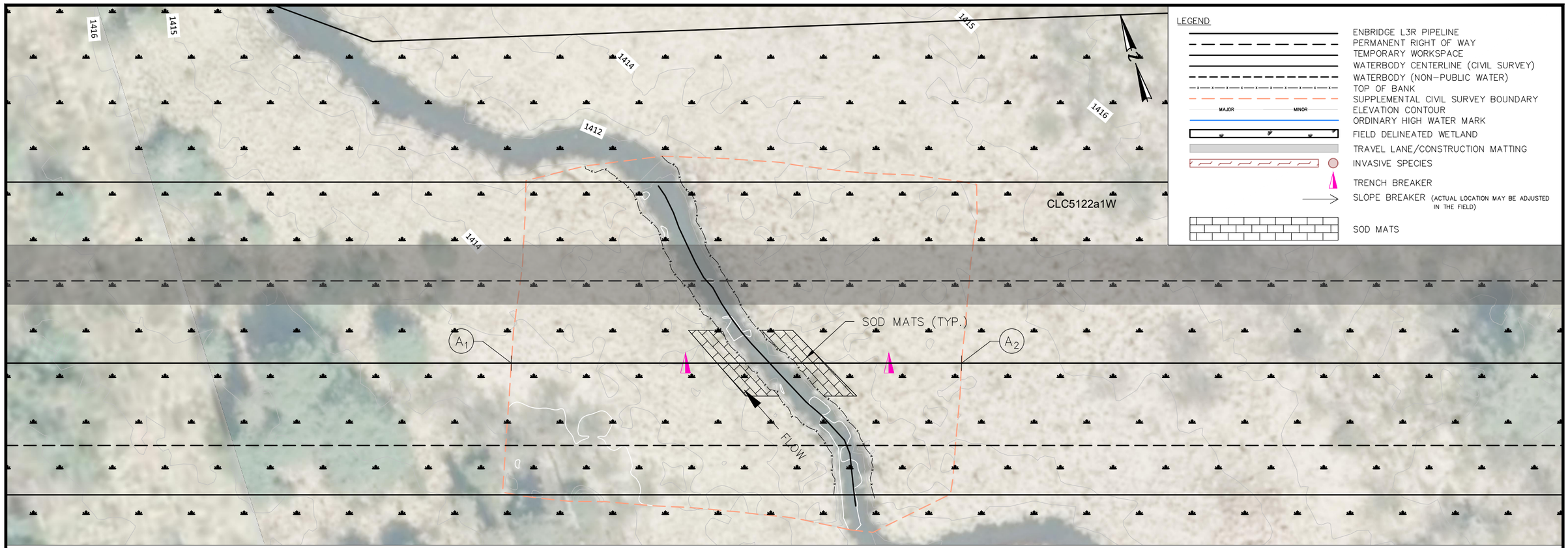
LEGEND

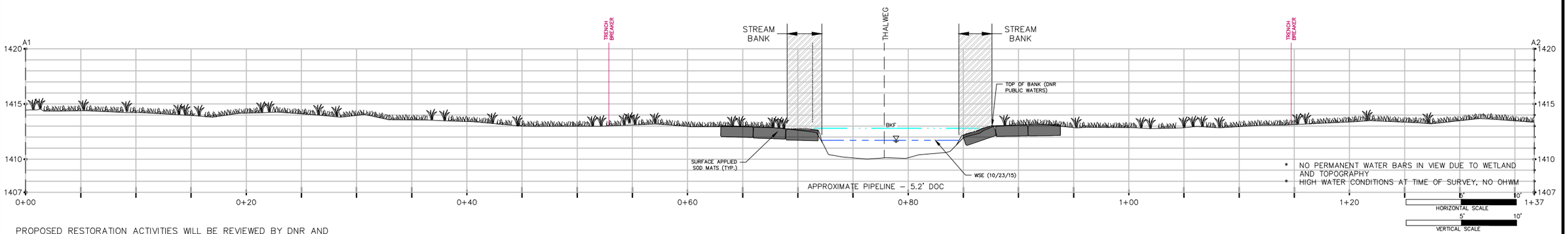
- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY CENTERLINE (CIVIL SURVEY)
- WATERBODY (NON–PUBLIC WATER)
- PUBLIC WATER CIVIL SURVEY BOUNDARY
- MDNR EXPANDED RESTORATION BOUNDARY
- TOP OF BANK
- ELEVATION CONTOUR (MAJOR / MINOR)
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- INVASIVE SPECIES
- TRENCH BREAKER
- Scattered Woody Vegetation (ACTUAL LOCATION MAY BE ADJUSTED IN THE FIELD)
- 1 – SHALLOW, OPEN WATER
- 2B – SHALLOW MARSH
- 3A – SEDGE MEADOW
- 3B – FRESH (WET) MEADOW
- 5A – SHRUB–CARR
- 5B – ALDER THICKET
- 6A – HARDWOOD SWAMP
- 6B – CONIFEROUS SWAMP

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		
A	ISSUED FOR REVIEW	MJT	09/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
RE–VEGETATION PLAN: EXPANDED EXTENT

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–946.0–001A	1A/6





PROPOSED RESTORATION ACTIVITIES WILL BE REVIEWED BY DNR AND ENBRIDGE DURING SITE VISIT AND MAY BE CHANGED TO REFLECT SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

FEATURE ID	HUC5002aWB; IFC ID: S-195.0
CROSSING TYPE	DRY CROSSING
PROPOSED RESTORATION (SEE DETAILS FOR LIVE STAKING, TRANSPLANTS, AND SHRUB SPECIES IF APPLICABLE)	SOD MATS
WITHIN OR ADJACENT WETLAND	FRESH WET MEADOW
BWSR SEED MIX	WET MEADOW NE (34-371), WETLAND REHAB (34-171)
DOMINANT WETLAND VEGETATION	1. CAREX STRICTA 3. CALAMAGROSTIS CANADENSIS 2. CAREX LACUSTRIS
SOBS (O/H) or NPC (S1-3)	HIGH SOBS; NO (NOT S1-S3)

NOTES

1. CONSTRUCTION TIMING RESTRICTIONS
   1.1.MDNR REGION 1 PWI – COLD WATER FISHERY·
   1.2. WHEN WORK OCCURS WITHIN "WORK IN WATER RESTRICTIONS", ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD
2. WORK SHALL BE CONDUCTED IN ACCORDANCE WITH APPLICABLE STANDARDS IN ENBRIDGE'S EPP AND VMP FOR PUBLIC LANDS AND WATERS. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE THESE STANDARDS.
3. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
4. INFORMATION REGARDING SEEDING SPECIFICATIONS, SEED BED PREPARATION TECHNIQUES, ETC. ARE DESCRIBED IN THE PLANTING PLAN CONTAINED WITHIN THE VMP.
5. TRENCH BREAKER LOCATION IS APPROXIMATE PENDING FIELD VERIFICATION (EPP SECTION 1.13)

ENBRIDGE

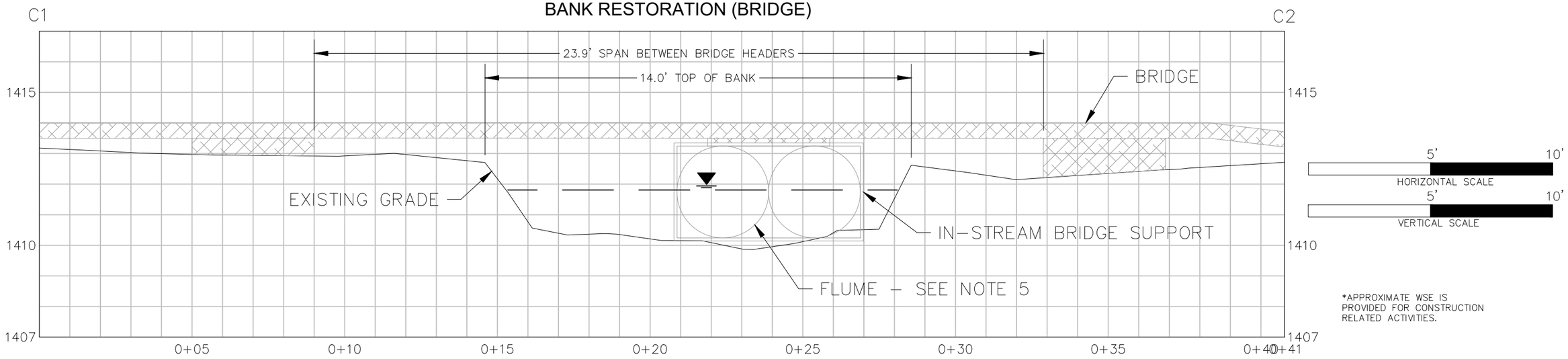
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
RE-VEGETATION PLAN

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-946.0-001	1/6

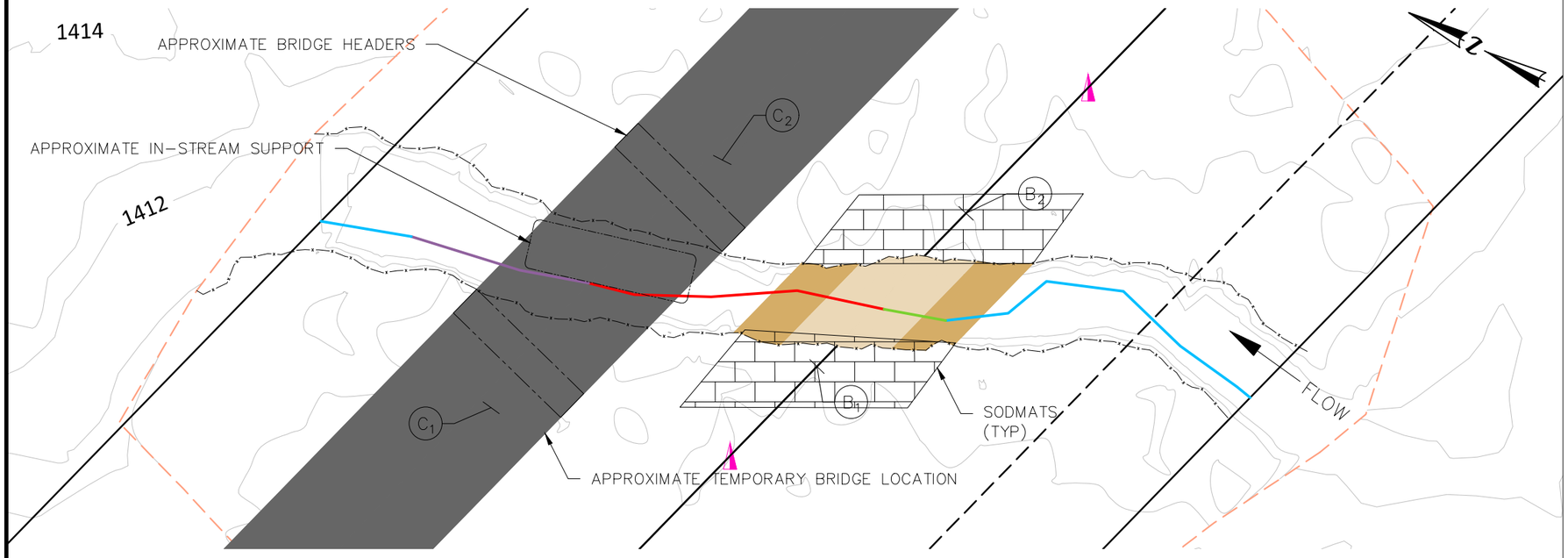
PLOTTED SIZE: ANSI FULL BLEED B (17x11)

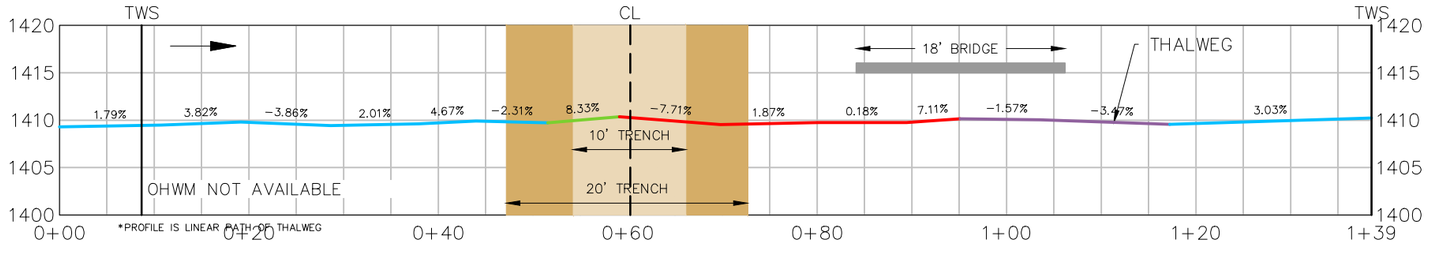
BANK RESTORATION (BRIDGE)



*APPROXIMATE WSE IS PROVIDED FOR CONSTRUCTION RELATED ACTIVITIES.

STREAMBED RESTORATION





*PROFILE IS LINEAR PATH OF THALWEG

NOTES

1. ENBRIDGE WILL RESTORE THE BANKS TO PRE-CONSTRUCTION CONDITIONS, WITH ANTICIPATING RECLAMATION TOLERANCES AS DEPICTED IN BANK RESTORATION PROFILES.
2. BANK MIGRATION POTENTIAL IS LOW. PRIMARY FLOW IS LOCATED IN THE CENTER OF THE CHANNEL.
3. PLACE MATS DIRECTLY ON TOP OF EXISTING VEGETATION TO AVOID OR MINIMIZE DISTURBANCE OF VEGETATION ON THE CHANNEL BANKS AND AT THE TOP OF THE STREAM BANK.
4. SEE DETAIL SHEET FOR SPECIFIC RESTORATION METHODS AND DETAILS.
5. FLUME SIZE MAY VARY BETWEEN 18-48 INCHES BASED ON SITE-SPECIFIC CONDITIONS AT THE TIME OF CONSTRUCTION, BUT MUST ALWAYS EXTEND ABOVE OHWM OR SURFACE WATER AT TIME OF CONSTRUCTION, WHICHEVER IS GREATER.

LEGEND

- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY - RIFFLE (ROSGEN SURVEY)
- WATERBODY - POOL (ROSGEN SURVEY)
- WATERBODY - RUN (ROSGEN SURVEY)
- WATERBODY - GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH - 10'
- TRENCH - 20'

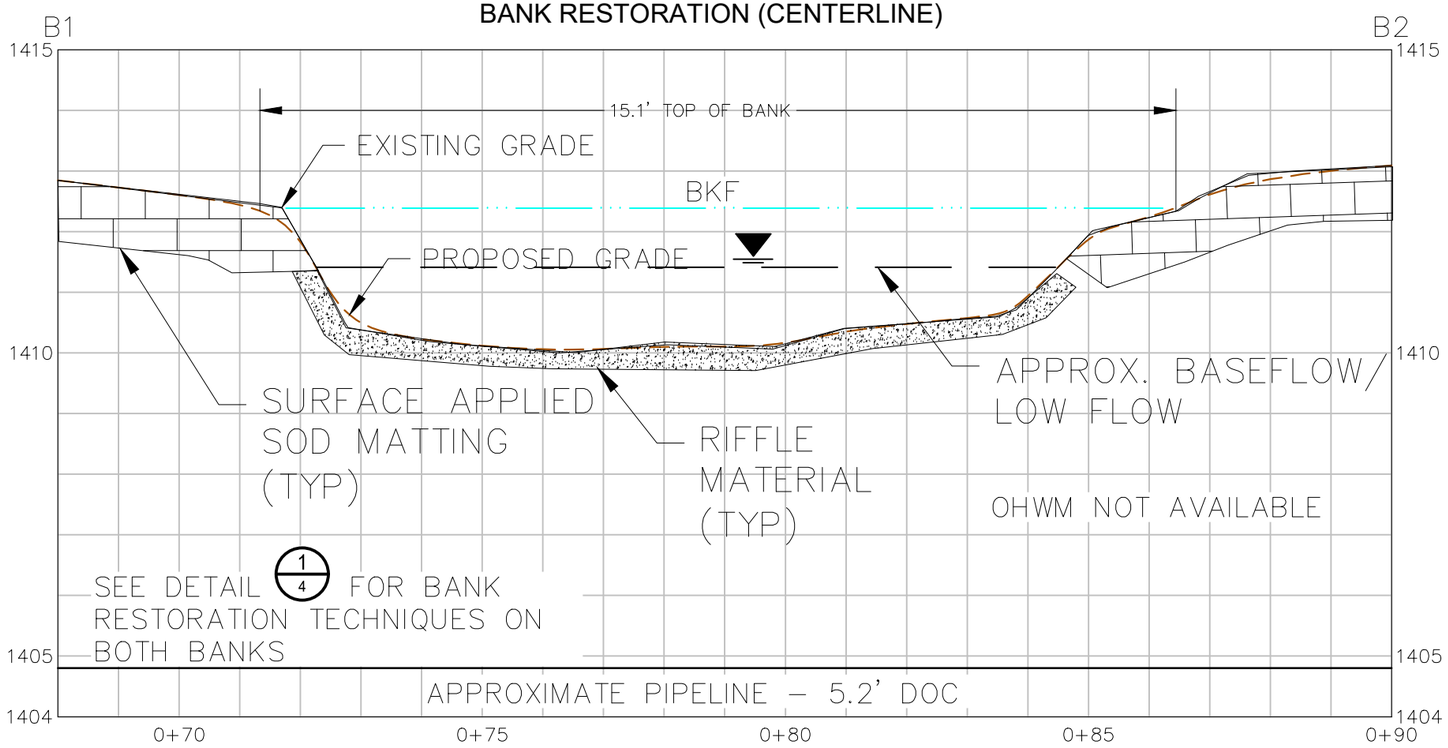
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

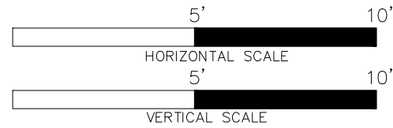
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
LASALLE CREEK - MP 946.0 - MDNR ID 29
STABILIZATION PLAN

SCALE	DWG. NO.	PAGE NO.
	SSRP-946.0-002	2/6

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (CENTERLINE)





RESTORATION NOTES:

GENERAL

1. REFER TO RESTORATION DETAIL SHEETS FOR ADDITIONAL INFORMATION RELATED TO PROPOSED RESTORATION MEASURES.
2. REFER TO SITE PHOTOS FOR INFORMATION ON PRE-CONSTRUCTION CROSSING CONDITIONS AND TO PROVIDE ADDITIONAL GUIDANCE FOR RESTORATION EFFORTS.
3. TRENCH IS LOCATED WITHIN AN EXISTING RIFFLE, AS SUCH, THE BED MATERIAL SHALL BE EXCAVATED AND TEMPORARILY STOCKPILED TO BE REINSTALLED AS PART OF CHANNEL BED AND TOE OF BANK RESTORATION EFFORTS. REFER TO RESTORATION CROSS SECTION AND BED PROFILE SHEET 2 TO MAINTAIN THE EXISTING BED FEATURE GRADE CONTROL.
4. RIFFLE MATERIAL IS NATURALLY COMMINGLED WITH A VARIETY OF PARTICLE SIZES TO PROMOTE CHANNEL SURFACE FLOWS. MATERIAL THICKNESS GENERALLY EXTENDS TO A DEPTH OF 1.5 TO 2 TIMES THE LARGEST SURFACE PARTICLE. RESTORED CHANNEL RIFFLE SECTION SHALL INCLUDE RANDOMLY SORTED MATERIALS.

SOD MATTING

1. REMOVE 10 LINEAR FEET OF VEGETATED MATS ON EITHER SIDE OF THE STREAM CROSSING USING ONSITE EQUIPMENT WHICH CAN UNDERCUT THE VEGETATION FOR REMOVAL. SMALL SHRUBS AND/ OR TREES WITHIN THE SOD MATS ARE ACCEPTABLE AND SHOULD NOT BE REMOVED.
2. DEPENDING ON THE LEVEL OF SATURATION AT THE TIME OF REMOVAL, IT MAY BE DIFFICULT TO OBTAIN INTACT CONSOLIDATED MATS, BUT GENERALLY THE NATIVE VEGETATION WILL BE RETAINED AND CAPTURED FOR PLACEMENT.
3. SOD MATS CAN BE TRANSPLANTED DURING ANY SEASON.
4. SOD MAT WILL BE PLACED ON CLEAR GROUND OR MATS WITHIN THE WORKSPACE.
5. MONITOR MATS TO SUPPORT SURVIVABILITY; WATERING MAY BE NEEDED.
6. PRIOR TO PLACEMENT OF SOD MATS FINISH GRADE CHANNEL BANK AND ADJACENT FLOODPLAIN APPLICATION AREA TO PROVIDE A SMOOTH AND EVEN SURFACE. SUBGRADE ELEVATION SHOULD ALLOW FOR THE FINISHED SOD SURFACE TO TRANSITION EVENLY WITH THE CHANNEL BANKS UPSTREAM AND DOWNSTREAM OF THE INSTALLATION AREA. AVOID ABRUPT CHANGES IN GRADE.
7. RETURN THE VEGETATED MATS
   a. SURFACE APPLIED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PERPENDICULAR TO THE CHANNEL / FLOW.
   b. STACKED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PARALLEL TO THE CHANNEL / FLOW.
8. WHEN PLACING SOD MATS, DO NOT LEAVE LARGE GAPS BETWEEN EACH SOD MAT AS NON-NATIVE VEGETATION WILL QUICKLY ATTEMPT TO COLONIZE THESE VOIDS.
9. WATER SOD MATS AFTER REPLACEMENT IF CONDITIONS ARE HOT AND DRY. DAMP AND/OR FROZEN SOD MATS DO NOT REQUIRE WATERING.
10. THE TOP MAT AND/OR OTHER MATS CAN BE ANCHORED WITH A LIVE AND/OR DEAD STOUT STAKE TO ENSURE THAT IT DOES NOT MOBILIZE DURING A FLOOD EVENT BEFORE THE ROOTS HAVE ESTABLISHED.
11. THE VEGETATED MATS WILL BE REPLACED AS SOON AS PRACTICAL FOLLOWING BACKFILLING OF THE TRENCH AND STABILIZED PER THE TIMING REQUIREMENTS DESCRIBED IN SECTION 1.9.1 OF THE EPP

LEGEND

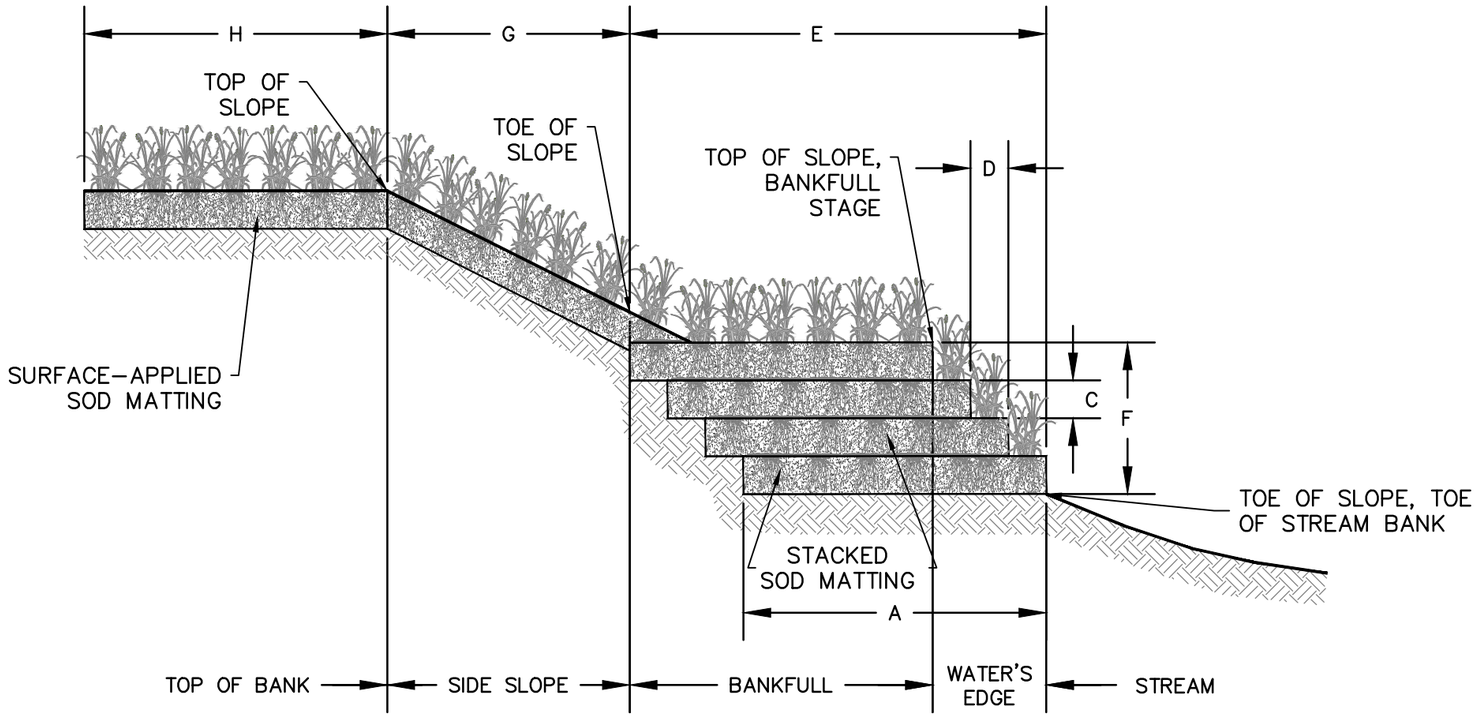
- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY – RIFFLE (ROSGEN SURVEY)
- WATERBODY – POOL (ROSGEN SURVEY)
- WATERBODY – RUN (ROSGEN SURVEY)
- WATERBODY – GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH – 10'
- TRENCH – 20'

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

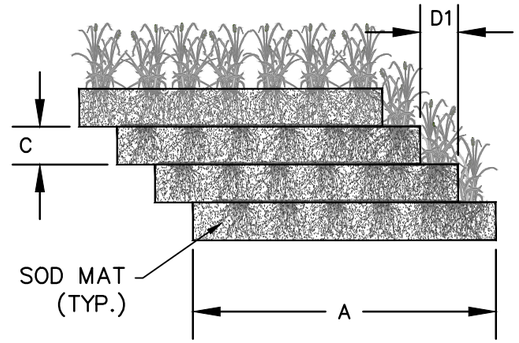
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
STABILIZATION PLAN

SCALE	DWG. NO.	PAGE NO.
	SSRP–946.0–002	3/6

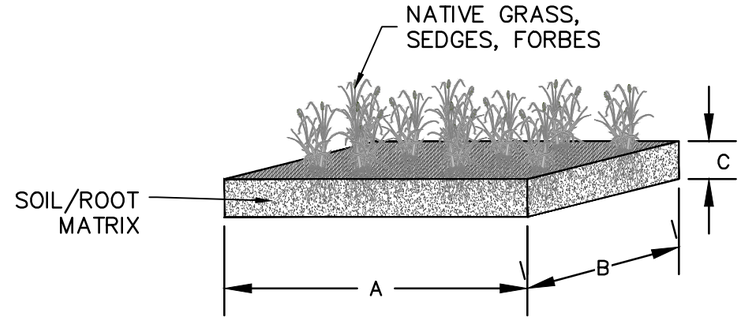
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



CROSS SECTION



STACKED SOD MATTING DETAIL



SOD MAT DETAIL

DIMENSION[1]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	SOD MAT WIDTH	FEET	3-4	WIDTH OF INDIVIDUAL SOD MAT.
B	SOD MAT LENGTH	FEET	3-6	LENGTH OF INDIVIDUAL SOD MAT.
C	SOD MAT THICKNESS	INCHES	12(min)	THICKNESS OF INDIVIDUAL SOD MAT.
D	STACKED SOD MAT SETBACK	FEET, INCHES	N/A	THE DISTANCE BETWEEN THE EDGES OF SOD MATS STACKED TO FORM A SLOPE
E	WIDTH OF STACKED SOD MATS	FEET, INCHES	N/A	WIDTH OF A BANK CREATED BY STACKED SOD MATS
F	HEIGHT OF STACKED SOD MATS	FEET, INCHES	N/A	HEIGHT OF A SLOPE CREATED BY STACKED SOD MATS
G	WIDTH OF SURFACE- APPLIED SOD MATS	FEET	10-20	WIDTH OF A SLOPE STABILIZED WITH SURFACE-APPLIED SOD MATS
H	TOP OF BANK SOD MATTING DISTANCE	FEET	10	DISTANCE SOD MATTING IS INSTALLED ON THE TOP OF BANK
NOTES:				
1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.				

SOD MATTING DETAIL

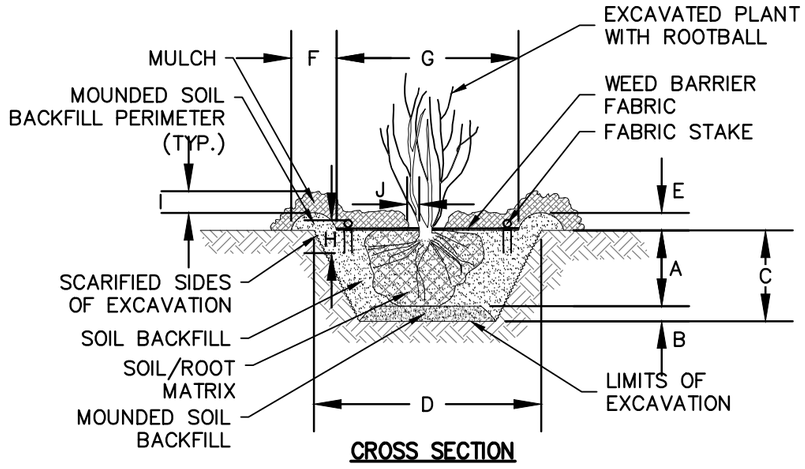
SOD MAT EXAMPLES

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–946.0–004	4/6

PLOTTED SIZE: ANSI FULL BLEED B (17x11)



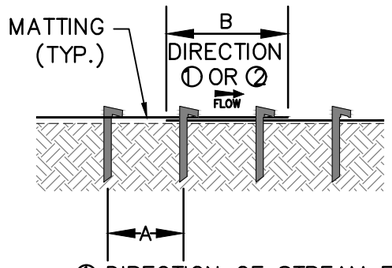
CROSS SECTION

DIMENSION[2]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	PLANTING DEPTH	VARIES	N/A	PLANTING DEPTH OF THE TRANSPLANT.
B	HEIGHT OF MOUNDED SOIL BACKFILL	INCHES	N/A	HEIGHT OF MOUNDED LOOSE SOIL PLACED INTO OVER-EXCAVATED PLANTING PIT.
C	DEPTH OF PLANTING PIT	VARIES	N/A	DEPTH OF THE PLANTING PIT; ACCOMMODATES DIMENSION OF SOIL AND EXCAVATED ROOTS AS WELL AS MOUNDED LOOSE SOIL AT BOTTOM OF PIT.
D	WIDTH OF PLANTING PIT	VARIES	N/A	OVER-EXCAVATED WIDTH OF THE PLANTING PIT; ACCOMMODATES THE WIDTH OF THE EXCAVATED SOIL AND ROOTS.
E	HEIGHT OF MOUNDED SOIL PERIMETER	INCHES	N/A	HEIGHT OF SOIL BERM CONSTRUCTED ALONG THE PERIMETER OF THE PLANTING PIT; HELPS RETAIN WATER.
F	WIDTH OF MOUNDED SOIL PERIMETER	INCHES	N/A	WIDTH OF SOIL BERM CONSTRUCTED ALONG THE PERIMETER OF THE PLANTING PIT; HELPS RETAIN WATER.
G	WIDTH OF WEED BARRIER FABRIC (OPTIONAL)	INCHES	N/A	WIDTH OF FABRIC PLACED ON SURFACE TO CONTROL WEEDS WITHIN THE MOUNDED SOIL PERIMETER; TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED AND DO NOT REQUIRE WEED BARRIER FABRIC.
H	FABRIC STAKE LENGTH (OPTIONAL)	INCHES	N/A	LENGTH OF STAPLES/SPIKES USED TO SECURE WEED BARRIER FABRIC
I	THICKNESS OF MULCH (OPTIONAL)	INCHES	N/A	THICKNESS OF MULCH, IF NECESSARY. TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED AND DO NOT REQUIRE MULCH.
J	GAP BETWEEN MULCH AND PLANT STEM/TRUNK (OPTIONAL)	INCHES	N/A	ROOM BETWEEN PLANT STEM/TRUNK AND MULCH. TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED

NOTES:
1. DATA ARE FOR TRANSPLANTED VEGETATION.
2. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.

TRANSPLANTS EXAMPLES

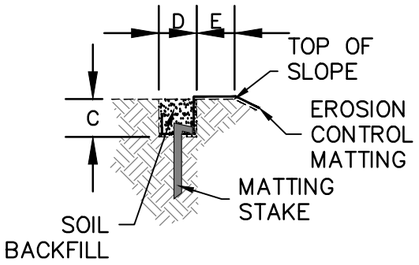
TRANSPLANTING DETAIL



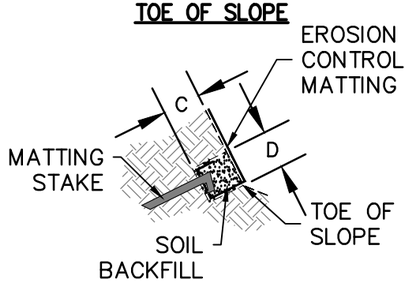
① DIRECTION OF STREAM FLOW
② DIRECTION DOWN THE BANK SLOPE

MATTING OVERLAP DETAIL

MATTING STAKE DETAIL

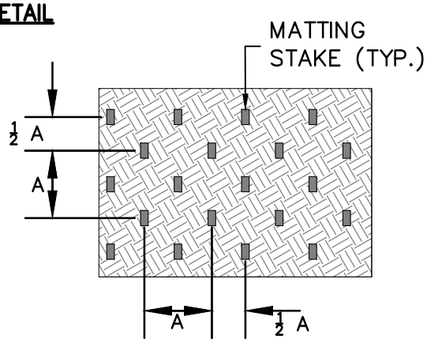


TOP OF SLOPE



TOE OF SLOPE

MATTING ANCHOR DETAIL



MATTING STAKE PATTERN DETAIL

DIMENSION[1]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	MATTING STAKE SPACING	FEET	3.0.C	SPACING BETWEEN EROSION CONTROL MATTING STAKES USED TO FASTEN THE MATTING TO THE SOIL
B	MATTING OVERLAP	INCHES	18	AMOUNT OF EROSION CONTROL MATTING OVERLAP IF MULTIPLE PIECES AND/OR ROLLS OF MATTING ARE USED. OVERLAP VARIES DEPENDING ON THE LOCATION OF THE OVERLAP WITH RESPECT TO POSITION ON THE SLOPE, LOCATION OF THE MATTING (EDGE OR END), AND PRODUCT SPECIFICATIONS.
C	MATTING ANCHOR TRENCH DEPTH	INCHES	6(MIN)	DEPTH OF TRENCH INTO WHICH EDGE OF EROSION CONTROL MATTING IS ANCHORED AT THE TOP AND/OR TOE OF A SLOPE.
D	MATTING ANCHOR TRENCH WIDTH	INCHES	12	WIDTH OF TRENCH INTO WHICH EDGE OF EROSION CONTROL MATTING IS ANCHORED AT THE TOP AND/OR TOE OF A SLOPE.
E	TOP OF SLOPE ANCHOR TRENCH SETBACK	INCHES	12	TOP OF SLOPE ANCHOR TRENCH DISTANCE FROM THE TOP OF SLOPE. TOP OF SLOPE REFERS TO TOP OF SIDE SLOPE, BANK SLOPE, TERRACE SLOPE, BANKFULL, ETC.
F	MATTING STAKE LENGTH	INCHES	12	LENGTH OF EROSION CONTROL MATTING STAKES USED TO FASTEN THE MATTING TO THE SOIL

NOTES:
1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.
2. O.C ON CENTER.
3. STAKES ARE NOT PERMITTED.

EROSION CONTROL MATTING DETAIL

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–946.0–005	5/6

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

1 CENTERLINE – FACING WEST BANK

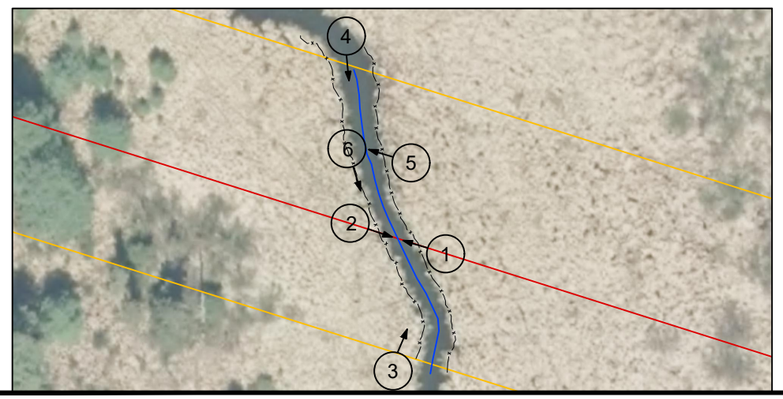
2 CENTERLINE – FACING EAST BANK

3 EDGE OF WORKSPACE – FACING DOWNSTREAM

4 EDGE OF WORKSPACE – FACING UPSTREAM

5 BRIDGE – FACING WEST BANK

6 BRIDGE – FACING SOUTH



NOTES:

1. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
2. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
3. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
LASALLE CREEK – MP 946.0 – MDNR ID 29
PHOTO PAGE

SCALE	DWG. NO.	PAGE NO.
	SSRP–946.0–005	6/6

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

GENERAL

1. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE PROJECT–WIDE STANDARDS PRESENTED IN THE EPP. WHERE MATERIAL WITHIN THESE SSRPS EXCEEDS STANDARD CONSTRUCTION MEASURES IN THE EPP, THESE SSRPS SUPERSEDE THE EPP.

2. CONSTRUCTION AND RESTORATION OF WATERBODY CROSSINGS WILL FOLLOW THESE GENERAL STEPS:

   A. SITE CLEARING
   B. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES ("BMPS")
   C. BRIDGE INSTALLATION
   D. EXCAVATION/BACKFILLING OF THE WATERBODY INCLUDING:
      - SOD SAVING TOPSOIL SEGREGATION AT NON–WOODED SITES
      - STREAMBED MATERIAL SEGREGATION
      - PIPE INSTALLATION
      - BACKFILL, INCLUDING IMPLEMENTATION OF CONSTRUCTION–RELATED RESTORATION METHODS (I.E., TOE WOOD)
   E. REPLACEMENT OF STREAMBED MATERIAL AND TOPSOIL/SOD LAYER
   F. RESTORATION OF STREAM BANKS TO PRE–CONSTRUCTION CONTOURS
   G. IF FINAL GRADING NOT POSSIBLE AT THE TIME, TEMPORARY STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   H. AFTER FINAL GRADING, PERMANENT SEEDING AND/OR WOODY VEGETATION RESTORATION, STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   I. BRIDGE REMOVAL DURING FINAL RESTORATION AFTER STABILIZATION AND PERMANENT SEEDING
   J. POST–CONSTRUCTION MONITORING

CROSSING METHODS

1. ALL WATERBODY AND WETLAND CROSSINGS WILL BE CONDUCTED IN COMPLIANCE WITH SECTION 2.0 AND SECTION 3.0 OF THE ENVIRONMENTAL PROTECTION PLAN ("EPP"), RESPECTIVELY. SECTION 2.0 AND 3.0 OF THE WINTER CONSTRUCTION PLAN PRESENTS MODIFICATIONS FOR WATERBODY AND WETLAND CONSTRUCTION METHODS, RESPECTIVELY, IN WINTER CONDITIONS.

2. ENBRIDGE'S SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES (THE "PROCEDURES," APPENDIX A OF THE EPP) OUTLINES THE VARIOUS CONSTRUCTION METHODS THAT ENBRIDGE MAY UTILIZE TO CONSTRUCT THROUGH WATERBODIES AND WETLANDS/BASINS AS PRESENTED ON THESE SITE–SPECIFIC RESTORATION PLANS ("SSRPS").

   A. DRY CROSSING (ISOLATED) METHODS (INCLUDING THE DRY CROSSING AND MODIFIED DRY CROSSING METHOD) ARE DESCRIBED SECTIONS 4.3 OF THE PROCEDURES, AND IN SECTIONS 2.5.2 AND 2.5.3 AND FIGURES 23 AND 24 OF THE EPP.
   B. THE BORE METHOD (NON–PRESSURIZED) IS DESCRIBED IN SECTION 3.5 OF THE PROCEDURES, AND SECTION 4.0 OF THE EPP.
   C. THE MODIFIED UPLAND CONSTRUCTION (WETLAND) METHOD IS DESCRIBED IN SECTION 3.3 OF THE PROCEDURES, AND SECTION 3.0 AND FIGURES 30 TO 34 OF THE EPP.
   D. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE OPEN CUT (NON–ISOLATED) WATERBODY CROSSING METHOD IS DESCRIBED IN SECTION 4.1 OF THE PROCEDURES, AND SECTION 2.5.1 AND FIGURE 24 OF THE EPP.
   E. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE PUSH–PULL METHOD IS DESCRIBED IN SECTION 3.4 OF THE PROCEDURES, AND SECTION 3.7.1 AND FIGURES 35 AND 36 OF THE EPP.

CLEARING/VEGETATION REMOVAL

1. STUMPS WITHIN THE TRENCH LINE WILL BE COMPLETELY REMOVED, GROUND, AND/OR HAULED OFF–SITE TO AN APPROVED LOCATION. TREE STUMPS OUTSIDE THE TRENCH LINE WILL BE GROUND BELOW NORMAL GROUND SURFACE TO FACILITATE A SAFE WORK AREA AND TO ALLOW TOPSOIL REMOVAL, IF NECESSARY. IN SOME CIRCUMSTANCES, TREE STUMPS OUTSIDE THE TRENCH LINE MAY BE COMPLETELY REMOVED TO ALLOW FOR A SAFE WORK AREA AND HAULED OFF–SITE TO AN APPROVED LOCATION AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

2. CLEARING WILL BE CONDUCTED IN WATERBODIES AND WETLANDS AS OUTLINED IN SECTION 2.2 AND 3.2 OF THE EPP, RESPECTIVELY. CHIPS, MULCH, OR MECHANICALLY CUT WOODY DEBRIS SHALL NOT BE STOCKPILED IN A WETLAND. HYDRO–AX DEBRIS, OR SIMILAR CAN BE LEFT IN THE WETLAND IF SPREAD EVENLY IN THE CONSTRUCTION WORKSPACE TO A DEPTH THAT WILL ALLOW FOR NORMAL REVEGETATION, AS DETERMINED BY THE EI. CHIPPING IS NOT ALLOWED ON PUBLIC LANDS. ON PUBLIC LANDS, MULCH AND MECHANICALLY CUT WOODY DEBRIS MUST BE UNIFORMLY BROADCAST TO LESS THAN 2–INCH THICKNESS AND IN A MANNER THAT MAINTAINS VISIBLE GROUND.

3. ENBRIDGE WILL PROPERLY INSTALL AND MAINTAIN REDUNDANT SEDIMENT CONTROL MEASURES IMMEDIATELY AFTER CLEARING AND PRIOR TO INITIAL GROUND DISTURBANCE AT SURFACE WATERS LOCATED WITHIN 50 FEET OF THE PROJECT AND WHERE STORMWATER FLOWS TO THE SURFACE WATER (REFER TO THE ENVIRONMENTAL PLAN SHEETS IN THE SWPPP), AND WITHIN 100 FEET OF SPECIAL AND IMPAIRED WATERS, INCLUDING TROUT STREAMS.

4. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).

TEMPORARY STABILIZATION

1. ON PORTIONS OF THE PROJECT WHERE WORK WILL BE OCCURRING DURING APPLICABLE "WORK IN WATER RESTRICTIONS" FOR PUBLIC WATERS (REFER TO SECTION 2.1), ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD. THESE AREAS WILL BE IDENTIFIED ON THE ENVIRONMENTAL PLAN SHEETS ACCOMPANYING THE SWPPP.

2. HYDRO–MULCH AND LIQUID TACKIFIER CAN BE USED IN PLACE OF CERTIFIED WEED–FREE STRAW OR HAY MULCH WITH PRIOR APPROVAL FROM ENBRIDGE. ALL HYDROMULCH AND LIQUID TACKIFIER PRODUCTS USED WILL BE ON THE APPLICABLE STATE DOT PRODUCT LIST. HYDRO–MULCH AND LIQUID TACKIFIER PRODUCTS CONTAINING PLASTIC/POLYPROPYLENE FIBER ADDITIVES AND MALACHITE GREEN (COLORANT) WILL NOT BE UTILIZED ON THIS PROJECT. APPLICATION RATES WILL BE AT THE MANUFACTURER'S RECOMMENDED RATE. ENBRIDGE WILL AVOID THE USE OF HYDROMULCH ON PUBLIC LANDS; HOWEVER, ENBRIDGE MAY USE HYDROMULCH ON STEEP SLOPES TO PREVENT EROSION UNTIL PERMANENT COVER HAS BEEN ESTABLISHED AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

RESTORATION AND STABILIZATION

1. ENBRIDGE WILL RESTORE THE STREAM BANKS AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS UNLESS THAT SLOPE IS DETERMINED TO BE UNSTABLE. IF THE SLOPE IS CONSIDERED UNSTABLE, ENBRIDGE WILL RESHAPE THE BANKS TO PREVENT SLUMPING. FOR PUBLIC WATERS, ENBRIDGE WILL RETURN THE BANK TO PRE–CONSTRUCTION CONTOURS, UNLESS OTHERWISE DIRECTED BY THE SITE–SPECIFIC RESTORATION PLAN. IF ENBRIDGE CANNOT RESTORE TO PRE–CONSTRUCTION CONTOURS AT A PUBLIC WATER, ENBRIDGE WILL CONSULT WITH THE MDNR BEFORE PROCEEDING FURTHER AS OUTLINED IN SECTION 2.6 OF THE EPP.

2. UNSTABLE SOILS AND/OR SITE–SPECIFIC FACTORS SUCH AS STREAM VELOCITY AND FLOW DIRECTION MAY REQUIRE ADDITIONAL RESTORATION EFFORTS, SUCH AS INSTALLATION OF WOODY VEGETATION, GEOTEXTILE FABRIC, OR TREE, LOG, ROOTWAD, OR BOULDER REVETMENTS TO STABILIZE DISTURBED STREAM BANKS (SEE FIGURE 29) AS OUTLINED IN SECTION 2.6.2 OF THE EPP. ENBRIDGE WILL WORK WITH THE MDNR TO ENSURE ALL WORK/ADJUSTMENTS ARE APPROVED AND ARE CONDUCTED WITHIN APPLICABLE TIMING RESTRICTIONS.

3. IN UPLAND AND WETLAND AREAS, CLEANUP AND ROUGH GRADING WILL OCCUR AS OUTLINED IN SECTIONS 1.16 AND 3.9 OF THE EPP. ENBRIDGE WILL BACKFILL THE TRENCH TO AN ELEVATION SIMILAR TO THE ADJACENT AREAS OUTSIDE THE TRENCH LINE AND WILL ADD A SLIGHT CROWN OF APPROXIMATELY 3 TO 6 INCHES (DEPENDING ON SOIL TYPE) OVER THE BACKFILLED TRENCH TO ALLOW FOR SUBSIDENCE. GENERALLY, EXCESS SUBSOIL DISPLACED BY THE PIPE INSTALLATION WILL BE SPREAD ACROSS THE PORTION OF THE CONSTRUCTION WORKSPACE WHERE TOPSOIL REMOVAL HAS OCCURRED. ANY REMAINING EXCESS SUBSOIL WILL BE REMOVED AND DISPOSED OF AT AN APPROVED OFF–SITE LOCATION AS NEEDED TO ENSURE CONTOURS ARE RESTORED TO AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS.

4. REVEGETATION ACTIVITIES WILL OCCUR AS OUTLINED IN SECTION 7.0 OF THE EPP. SEED MIXES AT PUBLIC WATERS WILL BE SELECTED AND APPLIED AS INDICATED IN THE PLANTING PLAN, WHICH IS APPENDIX A OF THE POST–CONSTRUCTION VEGETATION MANAGEMENT PLAN FOR PUBLIC LANDS AND WATERS ("VMP"). SEED MIXES RELATIVE TO THESE SSRP CROSSINGS ARE CODED AS FOLLOWS:

A	EMERGENT (34–181)	G	DRY PRAIRIE GENERAL (35–221)
B	RIPARIAN NE (34–361)	H	MESIC PRAIRIE GENERAL (35–241)
C	RIPARIAN S&W (34–261)	I	MESIC PRAIRIE NW (35–441)
D	WET MEADOW NE (34–371)	J	DRY PRAIRIE NORTHWEST (35–421)
E	WET MEADOW S&W (34–271)	K	WOODLAND EDGE NE (36–311)
F	WETLAND REHABILITATION (34–171)	L	NATURAL REVEGETATION

5. ENBRIDGE WILL NOT SEED STANDING WATER OR WOODED (PSS AND PFO) WETLAND COMMUNITIES. NATURAL REVEGETATION WILL TAKE PLACE FROM EXISTING PLANT MATERIAL AND ROOT STOCK IN THESE COMMUNITIES.

6. ALL MATERIALS USED FOR CONSTRUCTION OF THE PROJECT MUST BE REMOVED FROM THE SITE.

7. ENBRIDGE WILL CONDUCT POST–CONSTRUCTION MONITORING IN ACCORDANCE WITH THE POST–CONSTRUCTION MONITORING PLAN FOR WETLANDS AND WATERBODIES, AND IN ACCORDANCE WITH THE VMP FOR THE UPLAND PORTIONS OF THE PROJECT ON PUBLIC LANDS.

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN

CONSTRUCTION NOTES

SCALE	DWG. NO.	PAGE NO.
	SSRP–NOTES	

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

Appendix C

Geotechnical Data Report, Line 3 Replacement, LaSalle Creek Crossing; Clearwater and Hubbard County, Minnesota

Geotechnical Data Report

Line 3 Replacement
LaSalle Creek Crossing

Clearwater and Hubbard County, Minnesota

Prepared for
Enbridge Energy, Limited Partnership

May 2020

Geotechnical Data Report

Line 3 Replacement
LaSalle Creek Crossing

Clearwater and Hubbard County, Minnesota

Prepared for
Enbridge Energy, Limited Partnership

May 2020

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Geotechnical Data Report
Line 3 Replacement
LaSalle Creek Crossing
May 2020

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Appendix B	Laboratory Test Results
Appendix C	Drawdown Test Results

Certifications

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Minnesota.

Peter M. Demshar, P.E.
Minnesota License No. 57139

5/7/2020
Date

Reviewed by:

Robert W. Olah, P.E.
Minnesota License No. 50619

5/7/2020
Date

1.0 Introduction

Barr Engineering Company (Barr), under contract with Enbridge Energy, Limited Partnership (Enbridge), completed a geotechnical evaluation for a section of the proposed Line 3 Replacement (L3R) Pipeline crossing LaSalle Creek, located approximately 26 miles southwest of Bemidji, Minnesota.

Barr performed two geotechnical investigations to evaluate site conditions. A subsurface investigation was completed in July and August 2014 which consisted of two standard penetration test borings. An additional investigation was completed in April 2020 that consisted of hand auger borings to evaluate the near surface soil conditions. This report describes the investigations and testing performed, presents the results of this work, and provides geotechnical analyses and conclusions to aid in the design of the pipeline alignment and prepare for pipeline construction.

1.1 Project Information

The planned L3R pipeline will cross LaSalle Creek and adjacent wetlands (defined by others) at this site. The LaSalle Creek pipeline crossing is to be located approximately 26 miles southwest of Bemidji, Minnesota in southeast Clearwater County, in Section 24 of Township 144 North, Range 36 West, and in northwest Hubbard County, in Section 19 of Township 144 North, Range 35 West as shown on Figure 1. The L3R project design and permitting is ongoing, but the pipeline is anticipated to be a 36-inch diameter carbon steel pipe for transmission of crude oil.

1.2 Site Geology

A review of the regional geology indicates that the underlying site conditions consist of topsoil and/or organic deposits over glacial outwash that is underlain by Late Archean rock. The upper bedrock unit at the site is mapped as granite and granodiorite of the Vermillion Granitic Complex, although bedrock was not encountered in subsurface exploration. The glacial outwash generally consists of a mixture of clay, silt, sand, and gravel with some cobbles and boulders and was deposited and/or sorted by glacial meltwater. Surficial and bedrock site geology maps are provided as Figure 2 and Figure 3. A geologic cross-section is also provided in Figure 4.

1.3 Surface Observations

The following observations were made during an initial site visit in October 2013, as well as during drilling in July and August 2014 and during hand auger drilling in April 2020. The proposed crossing site is located adjacent to the east side of an existing Koch Pipeline ROW. Test boring MP 407-North was advanced west of LaSalle Creek. The ground surface was relative flat in the immediate vicinity of the boring, then slopes gradually down towards LaSalle Creek. Test boring MP 407-South was advanced east of LaSalle Creek. Test borings LS-20-HA-1 through LS-20-HA-5 were performed west of LaSalle Creek. Test borings LS-20-HA-1 to LS-20-HA-3 were advanced at the edge of the existing ROW, LS-20-HA-4 and LS-20-HA-5 were advanced in a wooded area between the existing ROW and the creek, and LS-20-HA-5-A was advanced in a wetland area in close proximity to the creek. Test borings LS-20-HA-6 through LS-20-HA-11 were performed east of LaSalle Creek. Test boring LS-20-HA-6 was advanced in a

wetland that is in close proximity to the creek and LS-20-HA-7 through LS-20-HA-11 were advanced in wooded areas between the creek and the existing pipeline ROW.

1.4 Previous Investigations

As discussed above, a geotechnical investigation was completed by Barr in July and August 2014. Two standard penetration test (SPT) borings were completed in the immediate vicinity of the site. Test boring MP 407-North was completed to a termination depth of 91.9 feet below existing grade (elevation 1338.9 feet) and test boring MP 407-South was completed to a termination depth of 57.0 feet below existing grade (elevation 1376.6 feet). The results of this geotechnical investigation are included in this report.

2.0 Geotechnical Investigation Methods

2.1 Geotechnical Investigation

Two SPT borings and twelve (12) hand auger (HA) borings were performed proximal to the L3R pipeline alignment for the LaSalle Creek crossing. The boring locations were selected by Enbridge, field adjusted by Barr, and are indicated on Figure 1. The coordinates and elevations for the boring locations are shown in Table 2-1. These coordinates and elevations were obtained using a hand-held GPS, unless otherwise noted.

Table 2-1 Soil Boring Locations

Borehole ID	Northing[4]	Easting[4]	Elevation [ft][3]
MP 407-North	618321.6	2110843.4	1430.8[1]
MP 407-South	616036.2	2112030.6	1433.6[1]
LS-20-HA-1	619673.5	2110082.1	1432.0[1]
LS-20-HA-2	619020.6	2110488.7	1433.0[1]
LS-20-HA-3	618354.2	2110895.8	1425.9[1]
LS-20-HA-4	618294.9	2111086.8	1420.9[1]
LS-20-HA-5	618235.6	2111277.8	1417.1[1]
LS-20-HA-5-A	618212.3	2111374.3	1413.6[2]
LS-20-HA-6	618176.3	2111468.8	1414.2[1]
LS-20-HA-7	618117.0	2111659.8	1418.5[1]
LS-20-HA-8	618057.7	2111850.8	1424.0[1]
LS-20-HA-9	617965.3	2112006.7	1431.2[1]
LS-20-HA-10	617165.9	2112036.7	1431.6[1]
LS-20-HA-11	616366.4	2112066.7	1441.0[1]

1. Elevations reference Northwestern Survey from 4-way sweeps
2. Elevations reference Barr Handheld GPS Data
3. Elevations reference NAVD88
4. Minnesota State Plane North, Coordinate System FIPS 2201 NAD83 (US feet)

The two (2) SPT borings were performed under subcontract to Barr by Coleman Engineering Company (CEC) of Iron Mountain, Michigan. Test borings were performed with a tracked Diedrich D-120 all-terrain drill rig using 4-1/4 inch inside-diameter hollow-stem-auger (HSA) and mud-rotary drilling techniques with a tricone roller bit with diameter of 3-7/8 inches. The drill rig was equipped with an automatic drop hammer for collection of split spoon samples.

To document the relative density of the formation and collect soil samples for laboratory testing, sampling with a standard split-spoon sampler was performed at 5-foot intervals. The SPT borings were

performed in general accordance with ASTM D1586 "Standard Methods for Penetration Test and Split-Barrel Sampling of Soils". The boreholes were backfilled with neat cement grout and bentonite slurry upon completion of drilling.

Samples were reviewed by Barr field staff during collection and were then sealed and labeled in glass jars. The samples were again reviewed by a Barr geotechnical engineer in Duluth and then delivered to American Engineering Testing, Inc. (AET) of Duluth, Minnesota for laboratory testing.

The twelve (12) hand auger borings were completed using a 3-1/4 inch diameter bucket auger and a 2-1/2 inch diameter bucket auger by both Barr and Coleman. The borings were sampled continuously and bulk samples were retrieved for laboratory testing.

One vibrating wire piezometer was installed in hand augers LS-20-HA-4, LS-20-HA-5-A, LS-20-HA-7, and LS-20-HA-9 prior to abandonment. All boreholes were backfilled with neat cement grout and bentonite slurry upon completion of drilling. Samples were reviewed by Barr field staff during collection and were then sealed in labeled zip top plastic bags. The samples were again reviewed by a Barr geotechnical engineer in Duluth, and then delivered to Twin Ports Testing II, Inc. (TPT) of Superior, Wisconsin for laboratory testing. Soil boring logs are in Appendix A.

2.2 Soil Testing

Laboratory testing was performed to document soil properties for the LaSalle Creek crossing site. Soil samples that were not submitted to TPT have been retained to allow the contractor(s) to perform additional testing as they require. Soil testing results, in combination with boring logs and site observations, may assist the contractor with installation. The soil samples will be stored for 12 months after the issuance of this report until they are discarded, unless written direction is otherwise provided.

Laboratory test results are provided in Appendix B.

- Moisture content was determined in accordance with ASTM D2216, "Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass"
- Unit weight of soil samples was determined in accordance with ASTM D7263, "Standard Test Methods for Laboratory Determination of Density (Unit Weight) of Soil Specimens"
- The soil particle size distribution was determined in accordance with ASTM D422, "Standard Test Method for Particle Size Analysis of Soils"
- Finer than No. 200 Sieve was determined in accordance with ASTM D1140, "Standard Test Method for Amount of Material in Soils Finer than No. 200 (75µm) Sieve"
- Atterberg Limits tests were performed in accordance with ASTM D-4318, "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils" "Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing"

- Visual soil classification was conducted in accordance with ASTM D-2488, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)."
- Unconfined compressive strength was determined in accordance with ASTM D2166, "Standard Test Method for Unconfined Compressive Strength of Cohesive Soil"
- Organic content was determined in accordance with ASTM D2974 "Standard Test Methods For Moisture, Ash, And Organic Matter Of Peat And Other Organic Soils"
- Soil pH was determined according to ASTM D4972, "Standard Test Method for pH of Soils" or per EPA method 9045D
- Sulfate and chloride content were determined in accordance with EPA method 300 Rev. 2.1 or 9056MOD
- The results of moisture content, Atterberg Limits, dry unit weight, unconfined compressive strength, and grain size distribution tests of the soils, are included on the test boring logs adjacent to the tested sample. Table 2-2 provides a summary of the laboratory test results for the site.

Table 2-2 **Laboratory Test Results**

Boring ID	Top of Sample Depth (ft)	USCS Soil Type	Atterberg Limits			Unc. Comp. Strength (tsf)	Moisture Content (%)	Grain Size Analyses					Organic Content (%)	pH	Chloride (mg/kg)	Sulfate (mg/kg)	Dry Density (pcf)	Moist Density (pcf)
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)			Gravel Content (%)	Sand Content (%)	% Passing #200 Sieve	Silt Content (%)	Clay Content (%)						
MP 407-North	9.5	SP-SM	-	-	-	-	22.9	-	-	11.5	-	-	-	-	-	-	-	-
	19.9	SP-SM	-	-	-	-	24.5	-	-	3.7	-	-	-	-	-	-	-	-
	31.4	SM	-	-	-	-	13.6	-	-	-	-	-	-				110.8	125.9
	39.9	SM	-	-	-	-	22.8	-	-	44.4	-	-	-	-	-	-	-	-
	44.9	-	-	-	-	-	-	-	-	-	-	-	-	9.5	<2	39	-	-
	49.9	SM	-	-	-	-	21.6	-	-	18.1	-	-	-	-	-	-	-	-
	56.4	SM	-	-	-	-	16.2	-	-	-	-	-	-	-	-	-	102.0	118.5
	71.4	SM	-	-	-	-	18.2	-	-	-	-	-	-	-	-	-	112.6	133.1
	79.9	SM	-	-	-	-	22.2	-	-	20.0	-	-	-	-	-	-	-	-
MP 407-South	15	SP-SM	-	-	-	-	13.9	48.9	44.8	6.3	-	-	-	-	-	-	-	-
	30	ML	-	-	-	-	19.9	0.0	12.6	87.4	73.7	13.7	-	-	-	-	112.5	134.9
	35	CL	25	17	8	-	22.7	-	-	-	-	-	-	-	-	-	-	-
	40	SM	-	-	-	0.45	23.0	-	-	-	-	-	-				109.2	134.3
	45	-	-	-	-	-	-	-	-	-	-	-	-	9.5	<2	340	-	-
	55	SM	-	-	-	-	10.2	10.3	72.0	17.7	-	-	-	-	-	-	-	-
LS-20-HA-1	1.5	SP-SM	-	-	-	-	5.8	8.0	84.4	7.6	-	-	-	-	-	-	-	-
	7.0	SP-SM	-	-	-	-	10.3	3.7	88.8	7.5	-	-	-	-	-	-	-	-
LS-20-HA-2	3.0	SP-SM	-	-	-	-	5.3	3.1	90.8	6.1	-	-	-	-	-	-	-	-
	7.5	SP-SM	-	-	-	-	5.6	7.9	86.2	5.9	-	-	-	-	-	-	-	-
LS-20-HA-3	1.5	SP	-	-	-	-	10.1	0.0	95.1	4.9	-	-	-	-	-	-	-	-
	8.5	SP	-	-	-	-	22.4	0.0	96.8	3.2	-	-	-	-	-	-	-	-
LS-20-HA-4	2.5	PT	-	-	-	-	595.8	-	-	-	-	-	82.5	-	-	-	-	-
	11.5	OH	179	107	66	-	158.8	0.0	18.5	81.5	62.4	19.1	36.0	-	-	-	-	-
LS-20-HA-5	5.5	PT	-	-	-	-	564.9	-	-	-	-	-	56.8	-	-	-	-	-
	8.5	OH	181	103	78	-	185.2	0.0	21.7	78.3	59.8	18.5	42.4	-	-	-	-	-
LS-20-HA-5-A	7.0	OH	173	101	72	-	182.1	0.0	13.7	86.3	68.5	17.8	26.4	-	-	-	-	-
	11.0	OH	-	-	-	-	159.0	-	-	-	-	-	27.8	-	-	-	-	-
	13.5	OH	-	-	-	-	137.4	-	-	-	-	-	22.4	-	-	-	-	-
LS-20-HA-6	10.0	MH	63	50	13	-	41.9	0.0	27.1	72.9	58.9	14.0	9.7	-	-	-	-	-
	13.0	ML	20	18	2	-	27.5	0.0	27.0	73.0	55.4	17.6	6.9	-	-	-	-	-

Boring ID	Top of Sample Depth (ft)	USCS Soil Type	Atterberg Limits			Unc. Comp. Strength (tsf)	Moisture Content (%)	Grain Size Analyses					Organic Content (%)	pH	Chloride (mg/kg)	Sulfate (mg/kg)	Dry Density (pcf)	Moist Density (pcf)
			Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)			Gravel Content (%)	Sand Content (%)	% Passing #200 Sieve	Silt Content (%)	Clay Content (%)						
LS-20-HA-7	1.5	PT	-	-	-	-	429.6	-	-	-	-	-	76.3	-	-	-	-	-
	7.5	OH	120	93	27	-	110.2	-	-	-	-	-	30.7	-	-	-	-	-
	14	CL-ML	23	17	6	-	26.4	0.0	12.5	87.5	63.8	23.7	8.3	-	-	-	-	-
LS-20-HA-8	5.5	ML	21	19	2	-	27.0	0.0	22.1	77.8	62.6	15.2	-	-	-	-	-	-
	10.0	SM	-	-	-	-	17.6	0.0	72.4	27.6	20.7	6.9	-	-	-	-	-	-
LS-20-HA-9	3.0	ML	-	-	-	-	24.3	0.0	47.4	52.6	40.5	12.1	-	-	-	-	-	-
	8.5	SM	-	-	-	-	16.1	0.0	52.9	47.1	-	-	-	-	-	-	-	-
LS-20-HA-10	5.0	SM	-	-	-	-	25.0	0.2	63.1	36.8	-	-	-	-	-	-	-	-
	9.0	ML	-	-	-	-	25.8	0.0	27.1	72.9	64.8	8.1	-	-	-	-	-	-
LS-20-HA-11	1.5	PT	-	-	-	-	520.3	-	-	-	-	-	80.7	-	-	-	-	-
	11.0	PT	-	-	-	-	292.9	-	-	-	-	-	32.8	-	-	-	-	-

3.0 Results

3.1 Soil Lithology

The results of the geotechnical soil borings and laboratory tests were compiled to obtain an understanding of the lithology of the study area. As determined from field and laboratory data, the existing soil conditions generally consist of topsoil/organic deposits overlying glacial outwash silt and sand deposits to a depth of at least 91.9 feet below ground surface (bgs) (elevation 1338.9 feet), which was the approximate termination depth of the deepest boring (MP 407-North).

Detailed information for soil strata and groundwater conditions are contained in the following sections. Complete laboratory testing results for samples from the recently performed test borings are in Appendix B. A cross section for the crossing is provided in Figure 4.

3.1.1 Topsoil/Organics

Topsoil or organics was encountered in all test borings except LS-20-HA-3 at the ground surface extending to depths ranging from 2 inches (LS-20-HA-2) to at least 14.9 feet (LS-20-HA-11) bgs. The topsoil encountered in the 2 SPT borings and LS-20-HA-1 through LS-20-HA-3 is primarily composed of organic clays and silts (OH) and silty sand (SM). Topsoil and organics thickness should be expected to vary across the site with differing vegetation cover, topography, and depositional environment.

The remaining hand augers indicate that organic-rich soils at the ground surface extends to depths ranging from 2 (LS-20-HA-9) feet to at least 14.9 (LS-20-HA-11) feet bgs. The organics consisted of fibric, hemic, and sapric peat (PT) and organic silts and clays (OH). A total of three grain size distribution analyses were performed on the samples of the organic plastic silt. The results of the testing indicated that gravel is not present. Sand contents ranged from 13.7 to 21.7 percent and percent fines (passing the #200 sieve) ranged from 78.3 to 86.3. Atterberg limits testing on the organic plastic silts indicated liquid limits ranging from 120 to 181 and plastic limits ranging from 93 to 107. Laboratory testing indicated moisture content in the organic plastic silts ranging from 101.2 to 185.2 percent, and moisture content in the peat ranging from 292.9 to 595.8 percent.

3.1.2 Glacial Outwash

Glacial outwash soils were encountered below the topsoil and organic deposits and extended to the termination depths of the SPT borings. The outwash is composed mainly of poorly graded sand (SP), gravely sand with silt (SP-SM), sandy silt (ML), and silty sand (SM). An 8-foot thick layer of lean clay was encountered in MP 407-South at a depth of 32 feet.

Grain-size distribution analyses were completed on samples obtained from the SPT and HA borings at various depths. The laboratory results for the granular outwash soils indicated gravel contents ranging from 0.0 to 48.9 percent, sand contents ranging from 12.6 to 44.8 percent, and percent fines (passing the #200 sieve) ranging from 3.2 to 47.1 percent. Moisture contents for the granular outwash soils ranged from 5.3 to 24.5 percent. The laboratory results for the cohesive outwash soils indicated no gravel content, sand contents ranging from 12.5 to 47.4, and percent fines (passing the #200 sieve) ranging from 52.6 to

87.5 percent. Moisture contents for the cohesive outwash soils ranged from 19.9 to 41.9 percent. Atterberg limits testing on the cohesive outwash soils indicated liquid limits ranging from 20 to 63 and plastic limits ranging from 17 to 50.

N-values in the outwash were generally between 1 and 42 blows per foot (bpf) with the majority between 5 to 15 bpf. The SPT results indicate that the granular soils vary in relative density between loose and medium dense. Cohesive samples of the outwash deposit generally have a soft to stiff consistency.

3.1.3 Bedrock

Bedrock was not encountered within the depths of exploration of the borings. Based on publicly available published data by the U.S. Geologic Survey (USGS), the bedrock at the site consists of granite and granodiorite of the Vermillion Granitic Complex. The USGS data indicates the depth to bedrock in this area is generally over 400 feet below the ground surface.

3.2 Soil Corrosivity

Soil electrical resistivity, pH, and soluble sulfates and chlorides are some of the primary factors in evaluating the rate and amount of corrosion of buried structures. It should be noted that soil corrosivity is also influenced by other variables including the amount of moisture, drainage, and soil particle size/oxygen content. Laboratory pH, soluble sulfates, and chloride testing was performed on samples taken from both SPT test borings and indicated a pH of 9.5, or mildly basic. Chloride was less than 2 mg/kg and sulfate ranged from 39 to 340 mg/kg.

3.3 Groundwater Conditions

Water levels in the SPT borings were measured while drilling MP 407-North and MP 407-South at 8 feet bgs (elevation 1422.8 feet) and 3.7 feet bgs (elevation 1429.9 feet), respectively. Upon reaching a depth of approximately 57 feet, artesian groundwater conditions were observed at boring MP 407-South at which point the boring was abandoned with cement grout and the flowing conditions were stopped.

Water levels were measured in HA borings LS-20-HA-3 through LS-20-HA-11 during drilling at depths ranging from at the ground surface to approximately 2.5 feet bgs, which ranges in elevation from 1412.6 to 1441.0 feet. Results of the vibrating wire piezometer data indicate that groundwater is at the ground surface in elevations ranging from 1413.6 to 1431.2 feet, shown in Figure 5 and Figure 6. Due to variations in barometric pressure and resolution of instruments, total head is fluctuating around the ground surface which is consistent with conditions observed during drilling.

Additional water-level readings and cave-in depths upon completion of the boreholes could not be obtained due to the addition of drilling fluid for borehole stability during advancement with mud rotary drilling methods. Many factors, such as heavy rainfall events, dry periods, and differences in soil permeability contribute to water level fluctuations. Groundwater levels should be expected to fluctuate over time. Groundwater levels encountered during the investigation are shown on Figure 5 and Figure 6.

Pump-down tests were conducted on LS-20-HA-3 through LS-20-HA-11. Pump-down tests were treated as slug tests and the results were analyzed using the program AQTESOLV. Relatively slow water-level recovery rates indicate that the pump-down process evacuated the borehole without substantially inducing instantaneous drawdown in the surrounding soils – a condition which permits analyzing the tests using conventional slug-out analytical methods. The results and analyses for the ten borings are included in Appendix C. The analyses were performed using the Bouwer and Rice (1976) method for slug tests, which accounts for partial penetration of the aquifer and unconfined conditions with the phreatic surface intersecting the screen. An anisotropy ratio of 0.1 was assumed. The range of horizontal hydraulic conductivity values calculated for the 10 borings is 0.0087 ft/day (LS-20-HA-8) to 0.3611 ft/day (LS-20-HA-3), with a mean value of 0.100 ft/day. These values are characteristic of a fine silt to clayey sand and are representative of deposits with moderately low permeability. This suggests that seepage inflows during construction will not be very significant along this stretch.

4.0 Results

Results of the field and laboratory investigation have been presented in Section 3.0. Based on these results, Section 4.0 provides design and construction considerations for the project.

4.1 Soil Parameters

The soil parameters presented in Table 4-1, Table 4-2, and Table 4-3 can be considered for design of the crossing as well as other contractor-designed excavations. These parameters are applicable to undisturbed soils.

Table 4-1 Estimated Unit Weight and Strength Parameters

Soil Type ₸	N-Value Range *	Moist Unit Weight [pcf]	Submerged Unit Weight [pcf]	Angle of Internal Friction, Undrained ** [degrees]	Cohesion, Undrained [psf]
Organic Soils	All	90	28	0	250 - 500
Lean Clay	4	105 - 120	42 - 56	0	250 - 500
Sand	1 - 42	115 - 135	51 - 71	28 - 34	0

Note(s):
*N-Values not likely influenced by the presence of cobbles and boulders
**Estimate from Peck, et al, 1974
₸ Sand refers to poorly graded sand, poorly graded sand with silt, and silty sand.

Table 4-2 Estimated Poisson's Ratio and Modulus of Elasticity Parameters

Soil Type ₸	N-Value Range	Poisson's Ratio, ν*		Modulus of Elasticity, E_s * [psi]
		Drained**	Undrained**	
Organic Soils	All	0.15 - 0.25	0.5	250 - 500
Lean Clay	4	0.15 - 0.25	0.5	250 - 500
Sand	1 - 42	0.25 - 0.40		2,000 - 5,000

Note(s):
₸ Sand refers to poorly graded sand, poorly graded sand with silt, and silty sand.
* Estimate from Das (1997) and (1998
** Undrained applies to short-term construction conditions and drained applies to long-term conditions.

Table 4-3 Lateral Earth Pressure Coefficients

Soil Type ₸	N-Value Range	Coefficients of Lateral Earth Pressure*		
		Active [K_a]	At Rest [K_O]**	Passive [K_p]
Organic Soils	All	1	1	1
Lean Clay	4	1	1	1
Sand	1 - 42	0.28 - 0.36	0.44 - 0.53	2.77 - 3.53

Note(s):
₸ Sand refers to poorly graded sand, poorly graded sand with silt, and silty sand.
* Ultimate Values
** Estimation of at-rest coefficients of lateral earth pressure is very difficult due to the unknown overconsolidation ratios of the soil unit. The values provided in the table are based on estimation of the undrained friction angle and the assumption that the overconsolidation ratio is no less than 1 (the soil is normally consolidated), and is less than 3 to 5, and that pore pressures in the estimated soil are not in excess of the earth pressure. If this soil parameter value is required with more certainty, additional in-situ testing is required.

4.2 Permeability and Dewatering

Field measurements of surface soil permeability completed during the investigation indicated that the average permeability was moderately low. The sand and silty sand materials are considered to be moderately permeable, however these higher permeability soils were generally encountered above the water-table elevation and are not expected to be a factor in the rate of groundwater seepage during construction. The organics, silt, and clay soils encountered lower in the valley are considered to have low permeability and could even be considered impermeable for engineering purposes. Excavations through the lower permeability soils should have low seepage inflow rates. Moderately permeable sandy soils were encountered in LS-20-HA-7 through LS-20-HA-10. Higher rates of groundwater inflow through the permeable sand soils and unstable excavations should be anticipated, which may require higher dewatering pumping rates and/or shoring. Side sloping and shoring of excavations should meet OSHA guidelines.

5.0 Limitations

The recommendations provided in this report are based on the results of fieldwork which focused on investigation of the area near the proposed pipeline alignment. Barr's evaluation, analyses, and recommendations were developed from limited site and subsurface information. It is not standard engineering practice to retrieve material samples from borings continuously with depth, and therefore strata boundaries and thicknesses must be inferred to some extent. Strata boundaries may also be gradual transitions, and can be expected to vary in depth, elevation, and thickness away from the boring locations. Boulders and cobbles also cannot be recovered with typical geotechnical drilling equipment.

Variations in subsurface conditions between boring locations may not be revealed until additional exploration work is completed, or construction commences. If any such variations are revealed, our recommendations should be re-evaluated. Such variations could increase construction costs, and a contingency should be provided to accommodate them.

The analysis and conclusions provided are based on the results of fieldwork from recent investigations. Using generally accepted engineering methods and practices, the investigations performed have made every reasonable effort to characterize the site. However, the likelihood that conditions may vary from any specific location tested is still possible, and careful attention to soil conditions should be undertaken during the time of construction by qualified personnel.

6.0 Standard of Care

This report is for the exclusive use of the parties to which it has been addressed. Without written approval, Barr assumes no responsibility to other parties regarding this report. The evaluation, analyses, and recommendations may not be appropriate for other parties or projects.

Barr Engineering Company's services for this project were performed in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area under similar budget and time restraints. No warranty, expressed or implied, is made.

7.0 References

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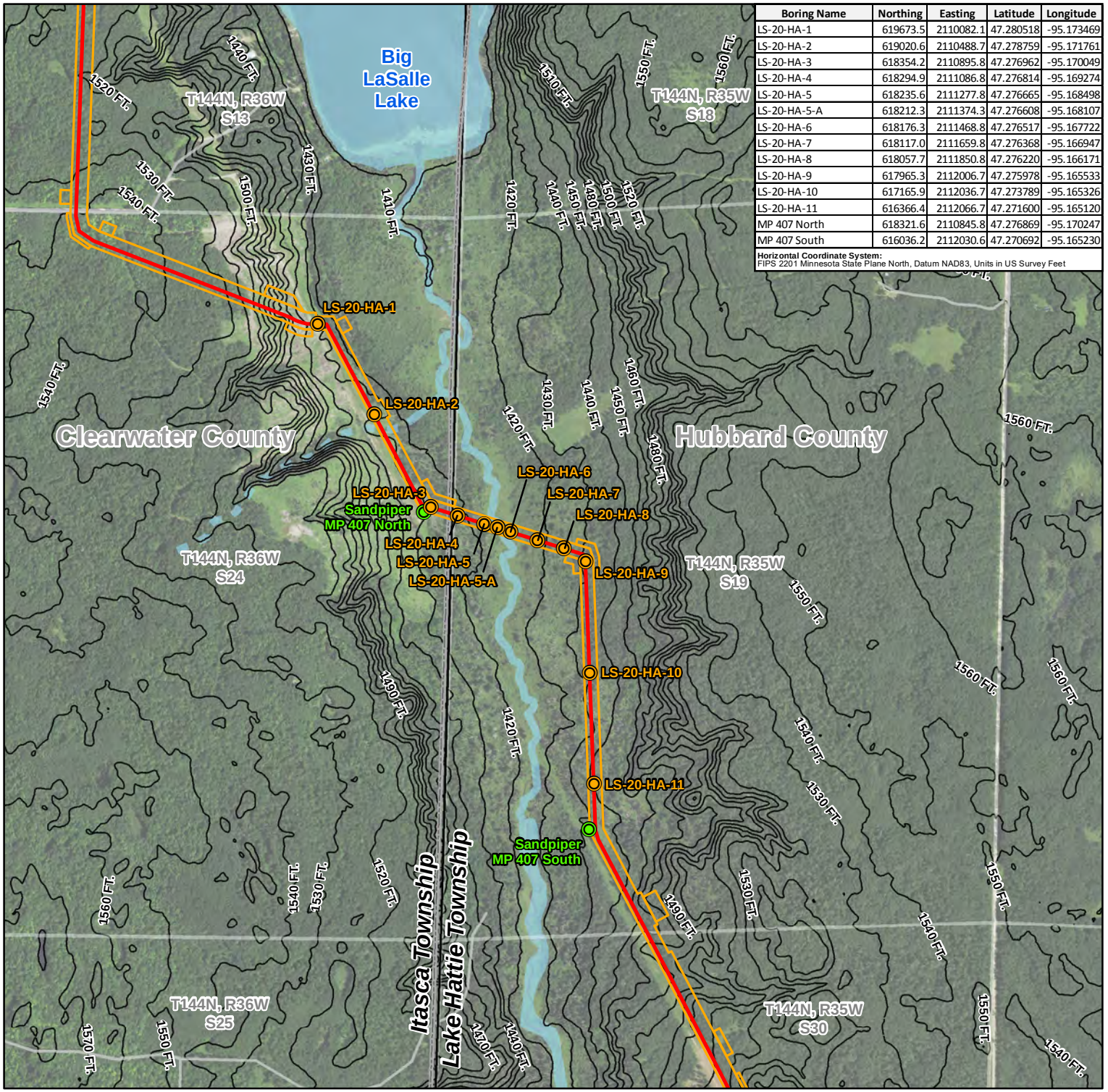
Figures



Boring Name	Northing	Easting	Latitude	Longitude
LS-20-HA-1	619673.5	2110082.1	47.280518	-95.173469
LS-20-HA-2	619020.6	2110488.7	47.278759	-95.171761
LS-20-HA-3	618354.2	2110895.8	47.276962	-95.170049
LS-20-HA-4	618294.9	2111086.8	47.276814	-95.169274
LS-20-HA-5	618235.6	2111277.8	47.276665	-95.168498
LS-20-HA-5-A	618212.3	2111374.3	47.276608	-95.168107
LS-20-HA-6	618176.3	2111468.8	47.276517	-95.167722
LS-20-HA-7	618117.0	2111659.8	47.276368	-95.166947
LS-20-HA-8	618057.7	2111850.8	47.276220	-95.166171
LS-20-HA-9	617965.3	2112006.7	47.275978	-95.165533
LS-20-HA-10	617165.9	2112036.7	47.273789	-95.165326
LS-20-HA-11	616366.4	2112066.7	47.271600	-95.165120
MP 407 North	618321.6	2110845.8	47.276869	-95.170247
MP 407 South	616036.2	2112030.6	47.270692	-95.165230

Horizontal Coordinate System:
FIPS 2201 Minnesota State Plane North, Datum NAD83, Units in US Survey Feet

- Hand Auger Locations (Completed by Barr)
- Previous Sandpiper Geotechnical Exploration Locations (Completed by Barr)
- Line 3 Replacement Project
- Line 3 Construction Workspace
- Waterbody
- Perennial Stream
- Intermittent Stream

Elevation Contours

- Index (10 ft. Interval)

N

0 1,000 2,000

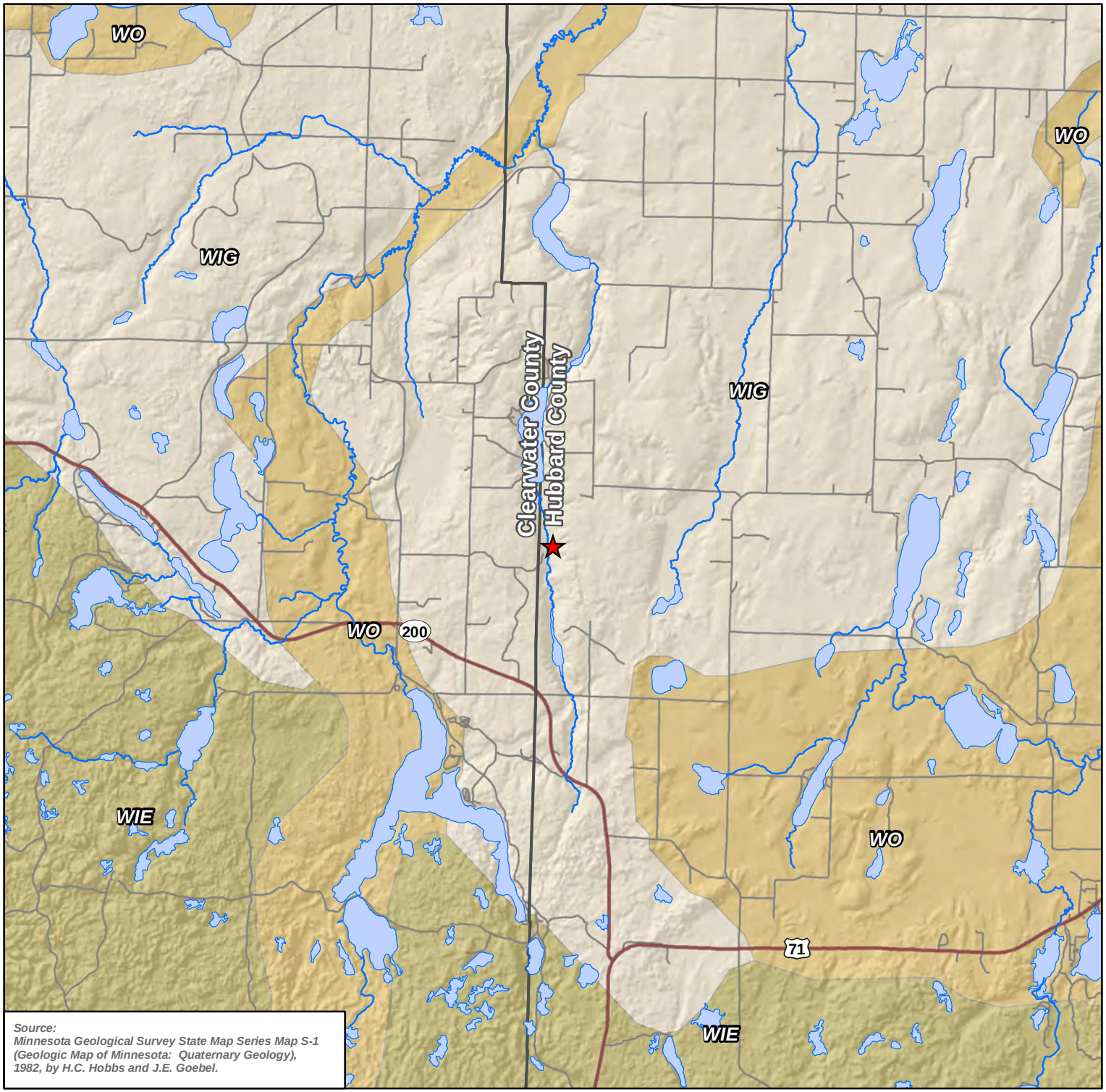
Feet

1 Inch = 1,000 Feet

Aerial Imagery: FSA NAIP 2019

Figure 1
SITE LOCATION
LaSalle Creek
Line 3 Mainline Replacement
Clearwater & Hubbard Counties, MN

ENBRIDGE



Source:
Minnesota Geological Survey State Map Series Map S-1 (Geologic Map of Minnesota: Quaternary Geology), 1982, by H.C. Hobbs and J.E. Goebel.

Site Location

Public Water Inventory Basins

Public Water Inventory

Major Roads

Minor Roads

Quaternary Geology

WIE- END MORAINE (WADENA LOBE--ITASCA MORAINE)

WIG- GROUND MORAINE (WADENA LOBE--ITASCA MORAINE)

WO - OUTWASH-UNDIVIDED AS TO MORAINE ASSOCIATION

N

0 2 4

Miles

1 Inch = 2 Miles

Figure 2

SURFICIAL GEOLOGY

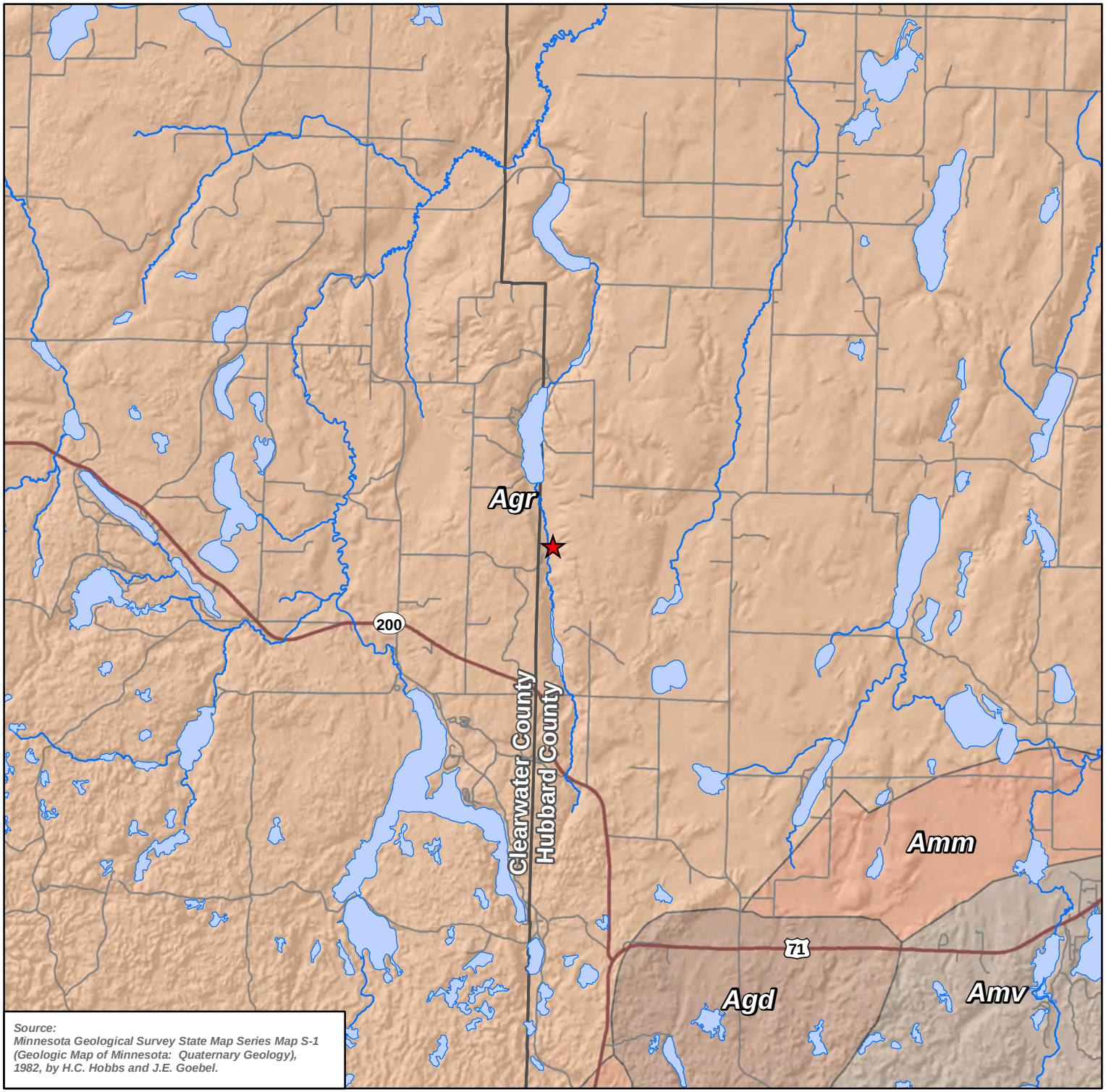
LaSalle Creek

Line 3 Mainline Replacement

Clearwater & Hubbard Counties, MN

ENBRIDGE

Barr Footer: ArcGIS 10.7.1, 2020-04-29 13:27 File: I:\Client\Enbridge_Energy\Work_Orders\Mainline_Permitting\49161244\Maps\Report_Maps\MP_407_2020\Report\Figure2_LaSalleCreek_SurficialGeology.mxd User: MAC2



Source:
Minnesota Geological Survey State Map Series Map S-1 (Geologic Map of Minnesota: Quaternary Geology), 1982, by H.C. Hobbs and J.E. Goebel.

Site Location

Public Water Inventory Basins

Public Water Inventory

Major Roads

Minor Roads

Bedrock Geology

Agd, post-Algoman intermed. intrus.

Agr, syn to pre-Algoman granitoids

Amm, L.Archean- mixed metavolcanics

Amv, L. Archean mafic metavolcanics

N

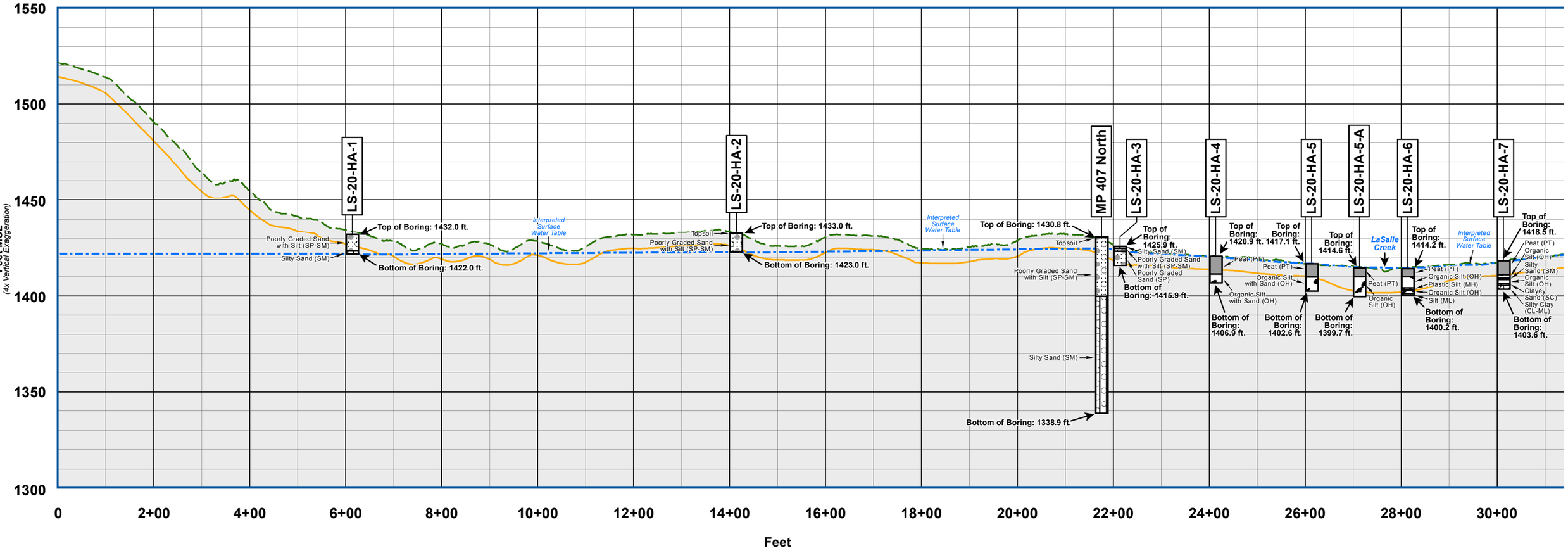
0 2 4

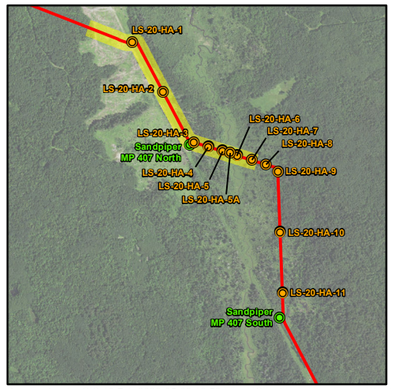
Miles

1 Inch = 2 Miles

Figure 3
BEDROCK GEOLOGY
LaSalle Creek
Line 3 Mainline Replacement
Clearwater & Hubbard Counties, MN

ENBRIDGE





Approximate Ground Surface

Interpreted Surface Water Table

Proposed L3R Estimated Trench Depth

Completed Geotechnical Exploration Location (by Barr)

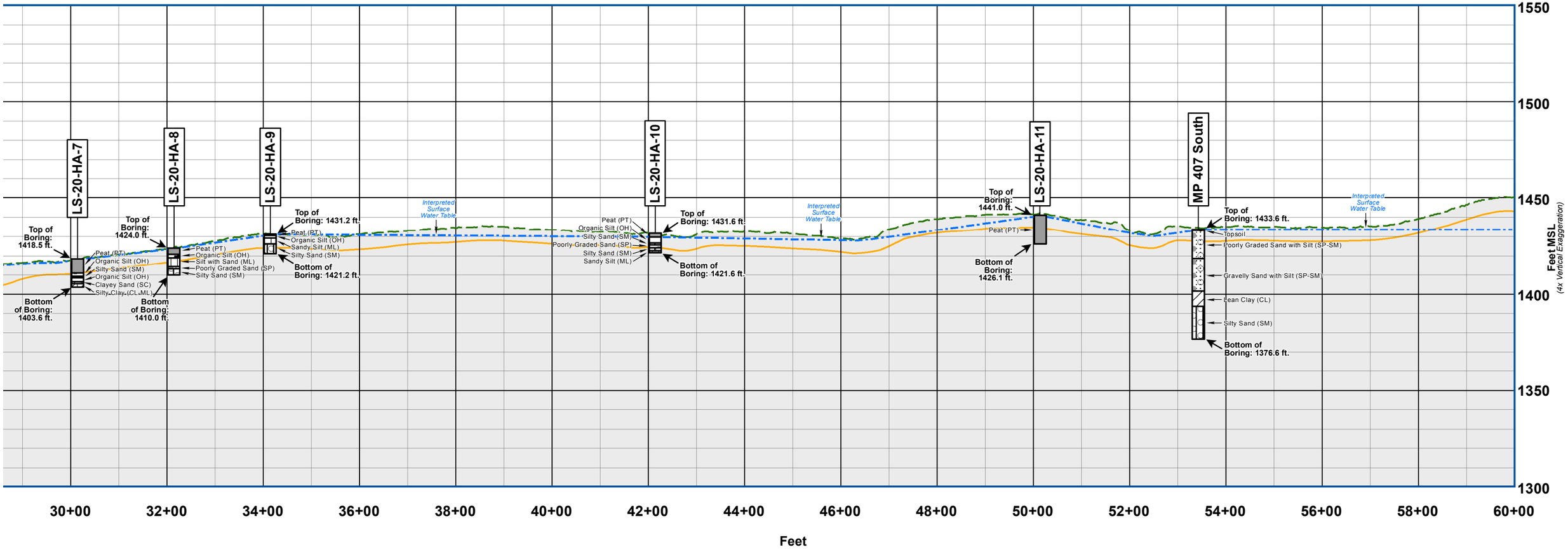
25
SCALE IN FEET
0
100
4x Vertical Exaggeration

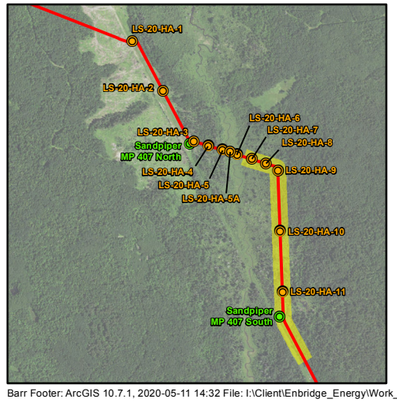
Figure 4-1
CROSS SECTION
LaSalle Creek
Line 3 Mainline Replacement
Clearwater & Hubbard Counties, MN

ENBRIDGE

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

Barr Footer: ArcGIS 10.7.1, 2020-05-06 10:50 File: I:\Client\Enbridge_Energy\Work_Orders\Mainline_Permitting\49161244\Maps\Report_Maps\MP_407_2020\Report\Figure4_1_LaSalleCreek_CrossSection.mxd User: MAC2





Approximate Ground Surface

Interpreted Surface Water Table

Proposed L3R Estimated Trench Depth

Completed Geotechnical Exploration Location (by Barr)

25
SCALE IN FEET
0
100
4x Vertical Exaggeration

Figure 4-2
CROSS SECTION
LaSalle Creek
Line 3 Mainline Replacement
Clearwater & Hubbard Counties, MN

ENBRIDGE

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

Barr Footer: ArcGIS 10.7.1, 2020-05-11 14:32 File: I:\Client\Enbridge_Energy\Work_Orders\Mainline_Permitting\49161244\Maps\Report_Maps\MP_407_2020\Report\Figure4_2_LaSalleCreek_CrossSection.mxd User: MAC2

Figure 5
Line 3 Replacement
LaSalle Creek West
Total Head versus Time

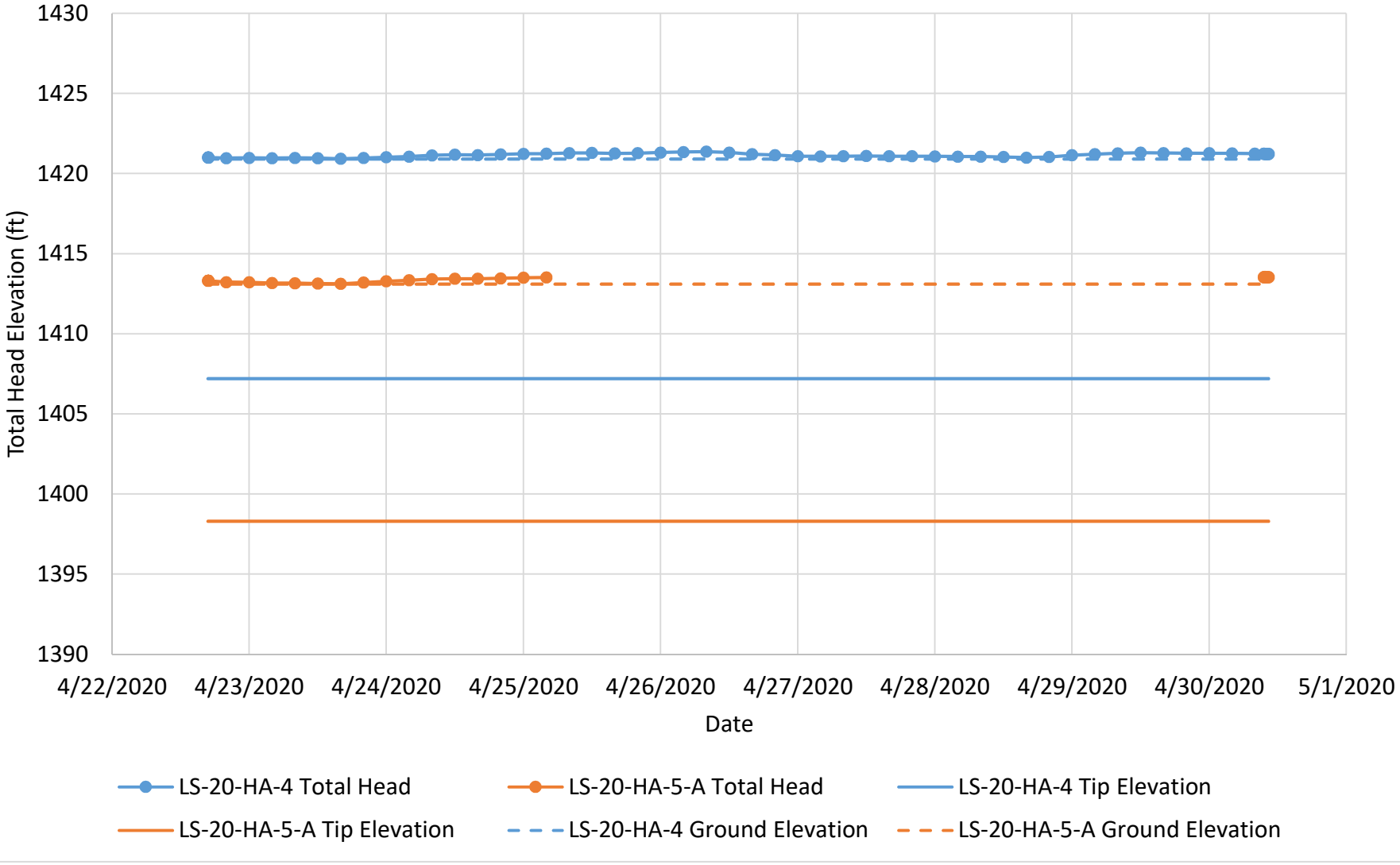
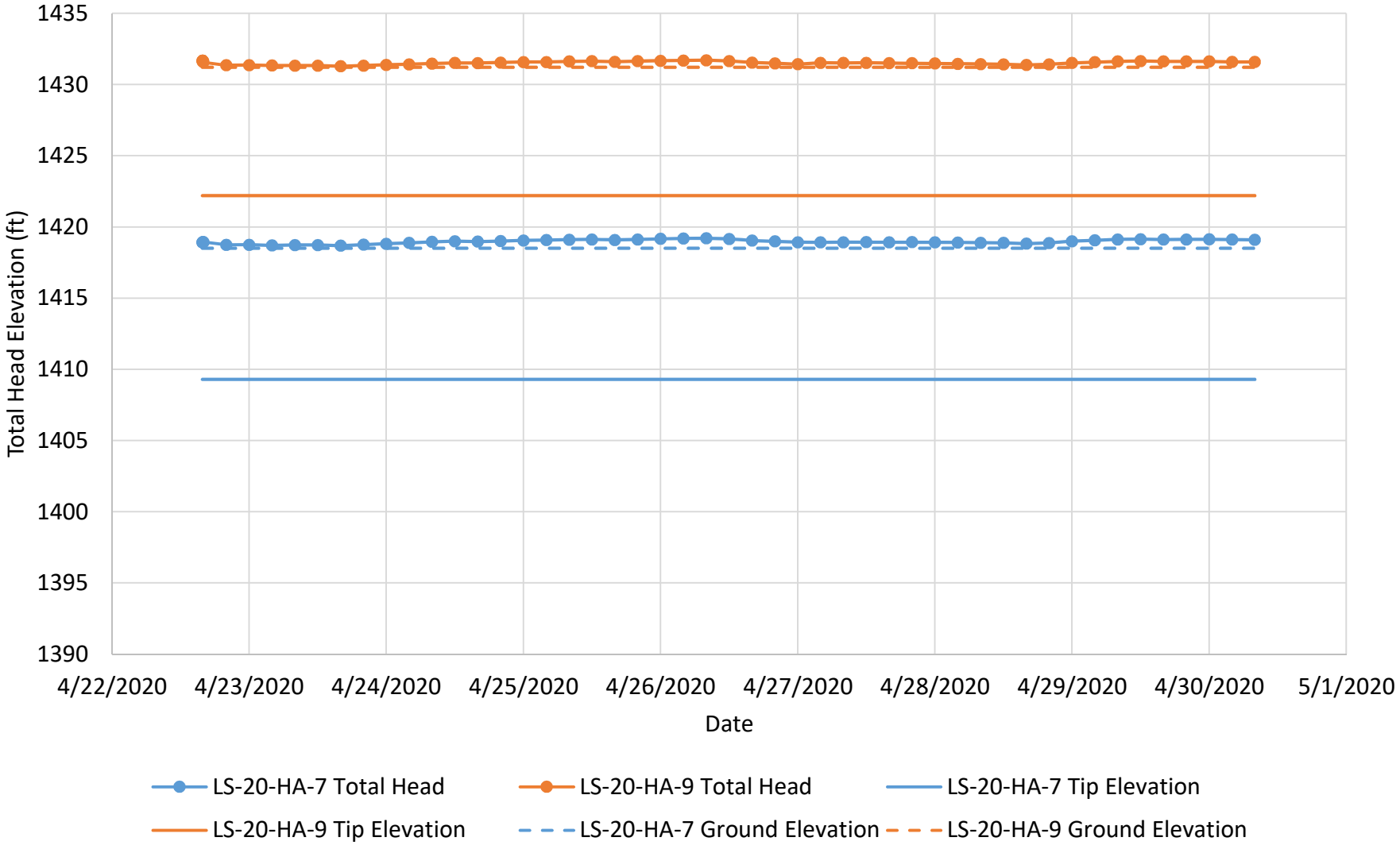


Figure 6
Line 3 Replacement
LaSalle Creek East
Total Head versus Time



Appendices

Appendix A

Soil Boring Logs

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

LOG OF BORING Sandpiper MP 407-N

Project: Sandpiper Mainline Geotech Survey | Location: Sandpiper Mainline | Client: North Dakota Pipeline Co., LLC

Barr Project Number: 49/16-1244

Surface Elev.: 1430.8 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1430.8	0	Dark brown; moist; organic sand with silt.
1430.3	0.5	POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; light brown to light gray; wet; very loose to loose; dark brown to reddish brown mottling between 10 and 21 feet.
		20 gallon mud loss between 0 and 37 feet.
1399.8	31.0	SILTY SAND (SM): light gray to gray; wet; loose to medium dense.

Continued Next Page

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

Depth, feet	N (blows/ft)	Sieve: % Fines	WC %	γ_d pcf
0	5			
5	5			
10	3	88.5	22.9	
15	6			
20	6	96.3	24.5	
25	6			
30	6		13.6	110.8
35	9			
40	5	55.6	22.8	
45	11			

Completion Depth:	91.9
Date Boring Started:	7/23/14
Date Boring Completed:	7/24/14
Logged By:	TTB
Drilling Contractor:	Coleman
Drilling Method:	HSA
Ground Surface Elevation:	1430.8
Coordinates:	N 618,321.6 ft E 2,110,845.8 ft
Datum:	MN State Plane North NAD83; NAVD88

Remarks: 4-1/4 inch HSA 0 to 14.5 feet. Mud rotary with 3-7/8 inch tricone from 14.5 to 89.9 feet. Borehole was backfilled with neat cement grout and bentonite slurry.

SAMPLE TYPES: SPLIT SPOON; BRASS LINERS

WATER LEVELS (ft): At Time of Drilling 8.0

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\2019-2020 HDD\LASALLE CREEK.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 Sandpiper MP 407-N

Project: Sandpiper Mainline Geotech Survey | Location: Sandpiper Mainline | Client: North Dakota Pipeline Co., LLC

Barr Project Number: 49/16-1244

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1380	50	SILTY SAND (SM): light gray to gray; wet; loose to medium dense. *(Continued)*
1375	55	
1370	60	
1365	65	
1360	70	
1355	75	
1350	80	
1345	85	
1340	90	
1338.9		Bottom of Boring at 91.9 feet
	91.9	

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 %
50							
55	16.2	102					
60							
65							
70	18.2	112.6					
75							
80	22.2						
85							
90							

SPT N values: 15, 18, 17, 18, 20, 18, 20, 17, 19

Sieve: 81.9 (50), 80 (80)

Completion Depth:	91.9
Date Boring Started:	7/23/14
Date Boring Completed:	7/24/14
Logged By:	TTB
Drilling Contractor:	Coleman
Drilling Method:	HSA
Ground Surface Elevation:	1430.8
Coordinates:	N 618,321.6 ft E 2,110,845.8 ft
Datum:	MN State Plane North NAD83; NAVD88

Remarks: 4-1/4 inch HSA 0 to 14.5 feet. Mud rotary with 3-7/8 inch tricone from 14.5 to 89.9 feet. Borehole was backfilled with neat cement grout and bentonite slurry.

SAMPLE TYPES: SPLIT SPOON; BRASS LINERS

WATER LEVELS (ft): At Time of Drilling 8.0

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 Sandpiper MP 407-S

Project: Sandpiper Mainline Geotech Survey | Location: Sandpiper Mainline | Client: North Dakota Pipeline Co., LLC

Barr Project Number: 49/16-1244

Surface Elev.: 1433.6 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1433.6	0	Dark brown; moist; organic sandy clay.
		POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; gray; wet; loose.
1430	5	
		2" thick lean clay layer at 6.5 feet.
1425	10	
1420	15	
1418.6		GRAVELLY SAND WITH SILT (SP-SM): medium to coarse grained; gray; wet; medium dense to dense.
1415	20	
1410	25	
1405	30	

Continued Next Page

Graphic Log: 0.5 | 15.0

Sample Type & Rec.

STANDARD PENETRATION TEST DATA — N in blows/ft (10 20 30 40): 3, 7, 8, 27, 42, 13

WATER CONTENT % — PL, LL (20 40 60)

SIEVE ANALYSIS — GRAVEL, SAND, SILT, CLAY, FINES (20 40 60 80): 48.9, 93.7

Physical Properties

WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
13.9						

Completion Depth:	57.0
Date Boring Started:	8/4/14
Date Boring Completed:	8/5/14
Logged By:	IGM
Drilling Contractor:	Coleman
Drilling Method:	HSA
Ground Surface Elevation:	1433.6
Coordinates:	N 616,036.2 ft E 2,112,030.6 ft
Datum:	MN State Plane North NAD83; NAVD88

Remarks: 4-1/4 inch HSA 0 to 25 feet. Mud rotary with 3-7/8 inch tricone from 25 to 57 feet. Borehole was backfilled with neat cement grout slurry.

SAMPLE TYPES

SPLIT SPOON — 3-inch Shelby Tube

WATER LEVELS (ft)

At Time of Drilling 3.7

After Drilling 0.0 Pressurized groundwater

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

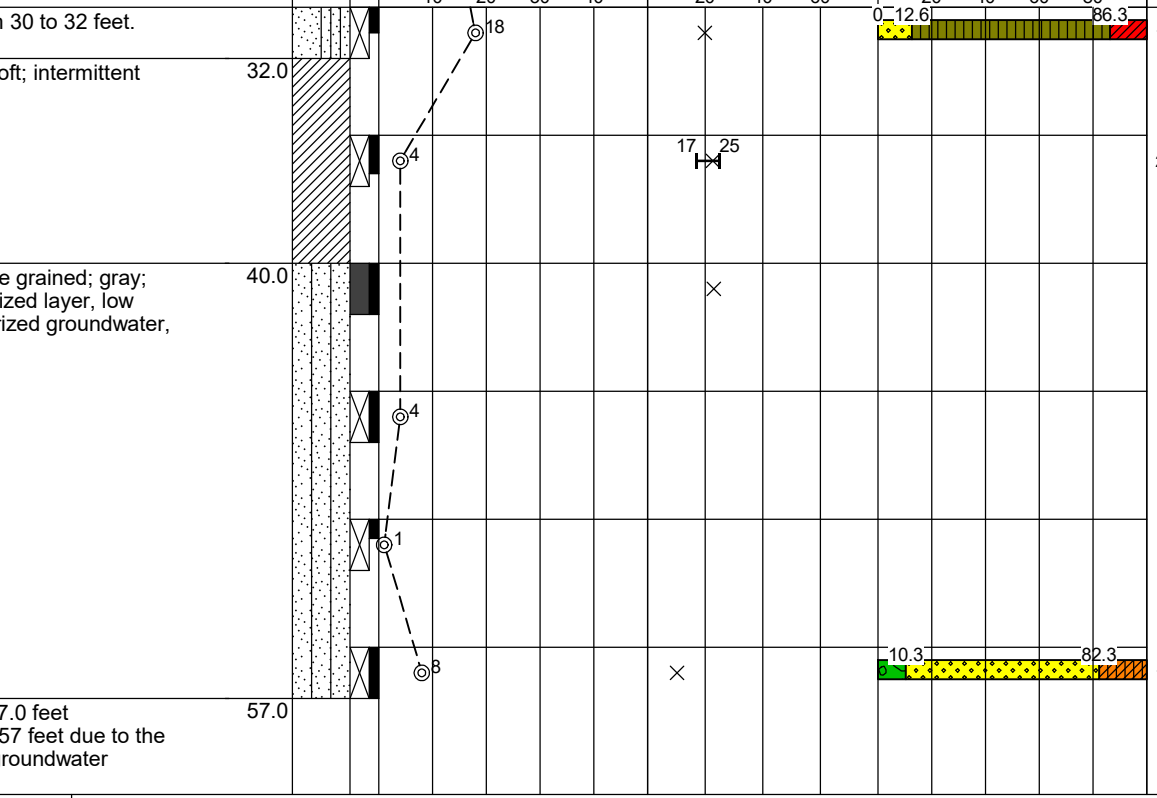
LOG OF BORING Sandpiper MP 407-S

Project: Sandpiper Mainline Geotech Survey | Location: Sandpiper Mainline | Client: North Dakota Pipeline Co., LLC

Barr Project Number: 49/16-1244

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	30	Transition to sandy silt (ML) from 30 to 32 feet.
1401.6		
		LEAN CLAY (CL): gray; moist; soft; intermittent fine sand laminations.
1400	32.0	
	35	
1395		
1393.6	40	
		SILTY SAND (SM): fine to coarse grained; gray; wet; very loose to loose; pressurized layer, low blow counts likely due to pressurized groundwater, with a little gravel.
1390	40.0	
	45	
1385		
	50	
1380		
	55	Little gravel at 55 feet.
1376.6		
		Bottom of Boring at 57.0 feet Boring terminated at a depth of 57 feet due to the presence of pressurized groundwater
	57.0	
	60	

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 %
	19.9	112.5					
	22.7				0.25		
	23	109.2		0.45			
	10.2						

Completion Depth:	57.0
Date Boring Started:	8/4/14
Date Boring Completed:	8/5/14
Logged By:	IGM
Drilling Contractor:	Coleman
Drilling Method:	HSA
Ground Surface Elevation:	1433.6
Coordinates:	N 616,036.2 ft E 2,112,030.6 ft
Datum:	MN State Plane North NAD83; NAVD88

Remarks: 4-1/4 inch HSA 0 to 25 feet. Mud rotary with 3-7/8 inch tricone from 25 to 57 feet. Borehole was backfilled with neat cement grout slurry.

SAMPLE TYPES
SPLIT SPOON
3-inch Shelby Tube

WATER LEVELS (ft)
At Time of Drilling 3.7
After Drilling 0.0
Pressurized groundwater

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 LS-20-HA-1

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1432.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1430.0	0.0	POORLY GRADED SAND WITH SILT (SP-SM): fine to coarse grained; brown; moist to wet; 2" topsoil, trace roots, trace gravel, some black mottle, and cobble at 2 feet.
1427.5	2.5	
1425.0	5.0	
1423.5	7.5	
1422.5	8.5	SILTY SAND (SM): fine to coarse grained; light brown; wet; trace gravel and some black mottle.
1422.0	10.0	Bottom of Boring at 10.0 feet
	12.5	
	15.0	
	17.5	
	20.0	

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 %
0.0–2.5	5.8						
5.0–7.5	10.3						

SIEVE ANALYSIS: 8 — 92.4; 4 — 92.5

Completion Depth:	10.0
Date Boring Started:	4/20/20
Date Boring Completed:	4/20/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1432.0
Coordinates:	N 61,973.5 ft E 2,110,082.1 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a grassy field using a 2-1/2 inch bucket auger from a depth of 0 to 10 feet. Boring was backfilled with neat cement grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling — Dry

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.

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-2

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1433.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1432.5	0.0	TOPSOIL: fine to medium grained; dark brown; moist; 2" topsoil, trace roots, trace gravel.
	0.5	POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; brown to light brown; moist to wet; trace gravel, trace roots and fibers to 2 feet, wet below 9.5 feet.
1430.0	2.5	
1427.5	5.0	
1425.0	7.5	
1423.0	10.0	Bottom of Boring at 10.0 feet
	12.5	
	15.0	
	17.5	
	20.0	

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	ϕ	Q_u	Q_p	Gs	RQD
	%	pcf	°	tsf	tsf		%
1432.5							
1430.0	5.3						
1427.5							
1425.0	5.6						

3 93.9 — 8 94.1

Completion Depth:	10.0
Date Boring Started:	4/20/20
Date Boring Completed:	4/20/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1433.0
Coordinates:	N 619,020.6 ft E 2,110,488.7 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a grassy field using a 2-1/2 inch bucket auger from a depth of 0 to 10 feet. Boring was backfilled with neat cement grout.

SAMPLE TYPES
GRAB SAMPLE

WATER LEVELS (ft)
At Time of Drilling: Dry

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.

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-3

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1425.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.
1425.0	0.0	1424.9 SILTY SAND (SM): fine to medium grained; brown; moist; trace roots and fibers, trace gravel.		
		1.0 POORLY GRADED SAND WITH SILT (SP-SM): fine to medium grained; brown; moist; trace gravel.		
1422.5	2.5	1423.4 2.5 POORLY GRADED SAND (SP): fine to medium grained; light brown; wet to saturated; caving hole at 9 feet.		
1420.0	5.0			
1417.5	7.5			
	10.0	1415.9 Bottom of Boring at 10.0 feet	10.0	
	12.5			
	15.0			
	17.5			
	20.0			

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 %
10.1						
22.4						

SIEVE ANALYSIS: 0 – 95.1 (10.1); 0 – 96.8 (22.4)

Completion Depth:	10.0
Date Boring Started:	4/20/20
Date Boring Completed:	4/20/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1425.9
Coordinates:	N 618,354.2 ft E 2,110,895.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a grassy field using a 2-1/2 inch bucket auger from a depth of 0 to 10 feet. 3-inch diameter PVC casing advanced to 9 feet, 4 feet of blowup in the casing. Boring was backfilled with neat cement grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 3.0

LEGEND

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

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

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-4

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1420.9 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1420.9	0.0	PEAT (PT): black; saturated; fibric.
1414.9	6.0	PEAT (PT): dark brown; saturated; hemic.
1411.4	9.5	ORGANIC SILT WITH SAND (OH): gray to brown; saturated; with shells.
1406.9	14.0	Interbedded with dark brown fibric peat.
		Bottom of Boring at 14.0 feet

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)

595.8

0 — 18.5 — 80.9

Physical Properties	WC	γ_d	ϕ	Q_u	Q_p	Gs	RQD
	%	pcf	°	tsf	tsf		%
595.8	595.8						

Completion Depth:	14.0
Date Boring Started:	4/21/20
Date Boring Completed:	4/21/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1420.9
Coordinates:	N 618,294.9 ft E 2,111,086.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 2-1/2 inch bucket auger from a depth of 0 to 14 feet. Boring was backfilled with a cement and bentonite grout. See Table 2-2 in report for results of Atterberg Limits and water content testing for the grab sample collected at 11.5 feet.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 0.0

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 LS-20-HA-5

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1417.1 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	0.0	PEAT (PT): black; saturated; fibric.
1415.0	2.5	Pieces of wood.
1412.6		
1412.5	5.0	PEAT (PT): brown; saturated; hemic. 4.5
1409.8		
1410.0	7.5	ORGANIC SILT WITH SAND (OH): gray; saturated; with shells. 7.3
1407.5	10.0	
1405.0	12.5	Interbedded with brown hemic peat.
1402.6		
	15.0	Bottom of Boring at 14.5 feet 14.5
	17.5	
	20.0	

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

564.9

0 21.7 81.5

Physical Properties

WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
564.9						

Completion Depth:	14.5
Date Boring Started:	4/21/20
Date Boring Completed:	4/21/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1417.1
Coordinates:	N 618,235.6 ft E 2,111,277.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 3-1/4 inch bucket auger from a depth of 0 to 14.9 feet. Boring was backfilled with a neat cement grout. See Table 2-2 in report for results of Atterberg Limits and water content testing for the grab sample collected at 8.5 feet.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 1.0

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.

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-5-A

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1414.2 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1412.5	0.0	PEAT (PT): black; saturated; fibric, no recovery 2 to 2.5 feet.
1410.0	2.5	
1409.7	4.5	ORGANIC SILT (OH): gray; saturated; with shells, wood in sample at 13 and 14.5 feet.
1407.5	5.0	
1405.0	7.5	
1402.5	10.0	
1400.0	12.5	
1399.3	15.0	Bottom of Boring at 14.9 feet
	14.9	
	17.5	
	20.0	

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

0 13.7 82.2

159

137.4

Physical Properties

WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
159						
137.4						

Completion Depth:	14.9
Date Boring Started:	4/22/20
Date Boring Completed:	4/22/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1414.2
Coordinates:	N 618,212.3 ft E 2,111,374.3 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wetland area immediately adjacent to LaSalle Creek using a 3-1/4 inch bucket auger from a depth of 0 to 14.9 feet. Boring was backfilled with a cement and bentonite grout. See Table 2-2 in report for results of Atterberg Limits and water content testing for the grab sample collected at 7.0 feet.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 1.0

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 LS-20-HA-6

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1414.2 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1414.2	0.0	PEAT (PT): dark brown; saturated; fibric.
1410.0	4.2	ORGANIC SILT (OH): gray; saturated; trace shells, harder drilling at 6 feet.
1404.2	10.0	PLASTIC SILT (MH): gray; moist; hard drilling, trace roots and fibers.
1403.7	10.5	ORGANIC SILT (OH): gray; wet; sand lense at 12 feet.
1401.2	13.0	SILT (ML): gray; wet.
1400.2	14.0	Bottom of Boring at 14.0 feet

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 %
10.0	50	65	0	27.1	86		41.9
13.0	18	20	0	27	82.4		27.5

Completion Depth:	14.0
Date Boring Started:	4/21/20
Date Boring Completed:	4/21/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1414.2
Coordinates:	N 618,176.3 ft E 2,111,468.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wetland area immediately adjacent to LaSalle Creek using a 2-1/2 inch bucket auger from a depth of 0 to 14 feet. Boring was backfilled using a neat cement grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 0.0

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 LS-20-HA-7

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1418.5 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	
1417.5	0.0	PEAT (PT): black; saturated; fibric.	
1417.0		PEAT (PT): black; saturated; hemic.	1.5
1415.0	2.5		
1412.5	5.0		
1411.0	7.5	ORGANIC SILT (OH): gray; saturated.	7.5
1410.0			
1409.3		SILTY SAND (SM): very fine to fine grained; gray; wet.	9.2
1408.5	10.0	ORGANIC SILT (OH): gray; saturated.	10.0
1407.5			
1406.5		CLAYEY SAND (SC): fine grained; greenish blue; wet; hard drilling.	12.0
1405.5	12.5	SILTY CLAY (CL-ML): gray; saturated.	13.0
1405.0			
1403.6	15.0	Bottom of Boring at 14.9 feet	14.9
	17.5		
	20.0		

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 %
429.5						
26.4						

17 23

0 12.5 76.3

Completion Depth:	14.9
Date Boring Started:	4/21/20
Date Boring Completed:	4/21/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1418.5
Coordinates:	N 618,177.0 ft E 2,111,659.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 3-1/4 inch bucket auger from a depth of 0 to 14.9 feet. Boring was backfilled with a cement and bentonite grout. See Table 2-2 in report for results of Atterberg Limits and water content testing for the grab sample collected at 7.5 feet.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 0.0

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 LS-20-HA-8

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1424.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
1424.0	0.0	PEAT (PT): black; saturated; fibric.
1422.5	2.5	
1420.8	3.2	ORGANIC SILT (OH): gray; saturated.
1420.0	5.0	
1419.0	5.0	SILT WITH SAND (ML): gray; wet; hard drilling, clayey at 7 feet with easier drilling.
1417.5	7.5	
1414.3	9.7	POORLY GRADED SAND (SP): fine grained; gray; wet.
1415.0	10.0	
1413.2	10.8	SILTY SAND (SM): very fine to fine grained; gray; saturated.
1412.5	12.5	
1410.0	14.0	Bottom of Boring at 14.0 feet
	15.0	
	17.5	
	20.0	

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	ϕ	Q_u	Q_p	Gs	RQD
	%	pcf	°	tsf	tsf		%
19 21							
0 22.1 84.7	27						
0 72.4 93.1	17.6						

Completion Depth:	14.0
Date Boring Started:	4/22/20
Date Boring Completed:	4/22/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1424.0
Coordinates:	N 618,057.7 ft E 2,111,850.8 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 2-1/2 inch bucket auger from a depth of 0 to 14 feet. Boring was backfilled with a neat cement grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 0.0

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.

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-9

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1431.2 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)	Graphic Log	Sample Type & Rec.
1430.5	0.0	PEAT (PT): dark brown; saturated; fibric.		
1430.0				
1429.2	0.7	ORGANIC SILT (OH): gray; wet; some sand and trace roots.		
	2.5			
1427.5	2.0	SANDY SILT (ML): gray; wet.		
1426.2	5.0	SILTY SAND (SM): fine to medium grained; gray; wet; SP sand lense 5.5 to 6.0 feet, with iron staining.		
1425.0				
	7.5			
1422.5				
1421.2	10.0	Bottom of Boring at 10.0 feet		
	12.5			
	15.0			
	17.5			
	20.0			

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 %
2.5	24.3						
7.5	16.1						

SIEVE ANALYSIS: 2.5 — 0 / 47.4 / 87.9; 7.5 — 0 / 53

Completion Depth:	10.0
Date Boring Started:	4/22/20
Date Boring Completed:	4/22/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1431.2
Coordinates:	N 617,965.3 ft E 2,112,006.7 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 2-1/2 inch bucket auger from a depth of 0 to 10 feet. Boring was backfilled with a cement and bentonite grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 1.0

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 LS-20-HA-10

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1431.6 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)	Physical Properties: WC %	γ_d pcf	ϕ °	Q_u tsf	Q_p tsf	Gs	RQD %
1430.0	0.0	PEAT (PT): black; moist; fibric with roots.												
		1429.6												
	2.5	ORGANIC SILT (OH): black; wet. 2.0												
1427.5														
		1426.6												
	5.0	SILTY SAND (SM): fine grained; gray; wet. 5.0				×	0 / 63	25						
		1425.6												
1425.0		POORLY GRADED SAND (SP): fine grained; brown; saturated. 6.0												
		1424.1												
	7.5	SILTY SAND (SM): fine grained; gray; saturated. 7.5												
		1422.6												
1422.5		SANDY SILT (ML): gray; saturated. 9.0				×	0 / 27.1 / 91.9	25.8						
		1421.6												
	10.0	Bottom of Boring at 10.0 feet 10.0												
	12.5													
	15.0													
	17.5													
	20.0													

Completion Depth:	10.0
Date Boring Started:	4/23/20
Date Boring Completed:	4/23/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1431.6
Coordinates:	N 617,165.9 ft E 2,112,036.7 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 2-1/2 inch bucket auger from a depth of 0 to 10 feet. Boring was backfilled with a neat cement grout.

SAMPLE TYPES

GRAB SAMPLE

WATER LEVELS (ft)

At Time of Drilling 2.0

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.

C:\49\161299 LINE3 LASALLE CREEK(FIXED).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 LS-20-HA-11

Project: Line 3 Replacement LaSalle Creek | Location: Hubbard and Clearwater County, MN | Client: Enbridge Energy

Barr Project Number: 49/16-1299.11

Surface Elev.: 1441.0 ft

Elevation, feet	Depth, feet	MATERIAL DESCRIPTION (ASTM D2488)
	0.0	PEAT (PT): black to brown; saturated; fibric.
1440.0	2.5	
1438.0		PEAT (PT): black to dark brown; saturated; hemic. 3.0
1437.5	5.0	
1435.0		PEAT (PT): dark gray; saturated; with shells, interbedded sand and shells starting at 13.5 feet, black mottling. 6.5
1434.5	7.5	
1432.5	10.0	
1430.0	12.5	
1427.5	15.0	
1426.1		Bottom of Boring at 14.9 feet 14.9
	17.5	
	20.0	

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 %
520.3						
292.9						

520.3 and 292.9 are water content values plotted in the water content column.

Completion Depth:	14.9
Date Boring Started:	4/22/20
Date Boring Completed:	4/22/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Ground Surface Elevation:	1441.0
Coordinates:	N 616,366.4 ft E 2,112,066.7 ft
Datum:	MN State Plane NAD83; NAVD88

Remarks: Boring was completed in a wooded area using a 3-1/4 inch bucket auger from a depth of 0 to 14.9 feet. Boring was backfilled with a neat cement grout.

SAMPLE TYPES: GRAB SAMPLE

WATER LEVELS (ft): At Time of Drilling 0.0

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 LS-20-HA-4

Project: Line 3 Replacement LaSalle Creek	Location: Hubbard and Clearwater County, MN	Client: Enbridge Energy
Barr Project Number: 49/16-1299.11	Surface Elevation: 1420.9 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
PEAT (PT): black; saturated; fibric.	0.0			0.0	GS	1420.9
	2.5					
	5.0					
1414.9 ft PEAT (PT): dark brown; saturated; hemic.						
	7.5					
1411.4 ft ORGANIC SILT WITH SAND (OH): gray to brown; saturated; with shells.	10.0					
	12.5					
1406.9 ft				13.7	TVT	1407.2
Bottom of Boring at 14.0 feet				14.0	BVT	1406.9

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **None**
Type:
Interval:

GROUT
Type: **Bentonite Cement Grout**
Mix:
Interval: **0-14'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 170 kPa**
Serial No.: **2009097**

Remarks:

Completion Depth:	14.0 ft
Date Started:	4/21/20
Date Completed:	4/21/20
Logged By:	MLH2
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Datum:	MN State Plane NAD83; NAVD88
Coordinates:	N 618,294.9 ft E 2,111,086.8 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 0.0

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 LS-20-HA-5-A

Project: Line 3 Replacement LaSalle Creek	Location: Hubbard and Clearwater County, MN	Client: Enbridge Energy
Barr Project Number: 49/16-1299.11	Surface Elevation: 1414.2 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	**1414.2**
PEAT (PT): black; saturated; fibric, no recovery 2 to 2.5 feet.	0.0					
	2.5					
1409.7 ft						
ORGANIC SILT (OH): gray; saturated; with shells, wood in sample at 13 and 14.5 feet.	5.0					
	7.5					
	10.0					
	12.5			13.0	TVT	1401.2
				14.5	BVT	1399.7
1399.3 ft				14.9		1399.3
Bottom of Boring at 14.9 feet						

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **None**
Type:
Interval:

GROUT
Type: **Bentonite Cement Grout**
Mix:
Interval: **0-14.9'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 170 kPa**
Serial No.: **2009096**

Remarks:

Completion Depth:	14.9 ft
Date Started:	4/22/20
Date Completed:	4/22/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Datum:	MN State Plane NAD83; NAVD88
Coordinates:	N 618,212.3 ft E 2,111,374.3 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)

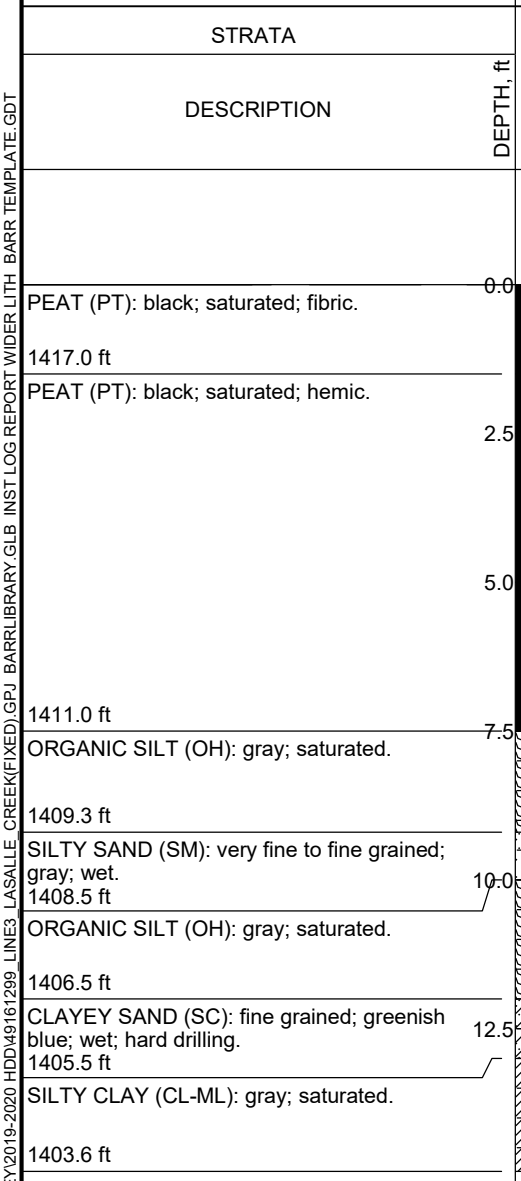
At Time of Drilling 1.0

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 LS-20-HA-7

Project: Line 3 Replacement LaSalle Creek	Location: Hubbard and Clearwater County, MN	Client: Enbridge Energy
Barr Project Number: 49/16-1299.11	Surface Elevation: 1418.5 ft	Top of Casing Elevation:



DEPTH, ft		ELEVATION, ft
0.0	GS	**1418.5**
9.2	TVT	1409.3
9.7	BVT	1408.8
14.9		1403.6

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **None**
Type:
Interval:

GROUT
Type: **Bentonite Cement Grout**
Mix:
Interval: **0-14.9'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 170 kPa**
Serial No.: **2009098**

Remarks:

Completion Depth:	14.9 ft
Date Started:	4/21/20
Date Completed:	4/21/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Datum:	MN State Plane NAD83; NAVD88
Coordinates:	N 618,177.0 ft E 2,111,659.8 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 0.0

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 LS-20-HA-9

Project: Line 3 Replacement LaSalle Creek	Location: Hubbard and Clearwater County, MN	Client: Enbridge Energy
Barr Project Number: 49/16-1299.11	Surface Elevation: 1431.2 ft	Top of Casing Elevation:

STRATA DESCRIPTION	DEPTH, ft	SYMBOL	WELL OR PIEZOMETER CONSTRUCTION DETAILS	DEPTH, ft		ELEVATION, ft
				0.0	GS	**1431.2**
PEAT (PT): dark brown; saturated; fibric.	0.0					
1430.5 ft						
ORGANIC SILT (OH): gray; wet; some sand and trace roots.						
1429.2 ft						
SANDY SILT (ML): gray; wet.	2.5					
1426.2 ft						
SILTY SAND (SM): fine to medium grained; gray; wet; SP sand lense 5.5 to 6.0 feet, with iron staining.	5.0					
	7.5			9.0	TVT	1422.2
				9.5	BVT	1421.7
1421.2 ft				10.0		1421.2
Bottom of Boring at 10.0 feet	10.0					

PIEZOMETER CONSTRUCTION DETAILS FOR FULLY GROUTED VIBRATING-WIRE SENSOR

PROTECTIVE CASING
Diameter: **None**
Type:
Interval:

GROUT
Type: **Bentonite Cement Grout**
Mix:
Interval: **0-10'**

VIBRATING-WIRE TIP
Diameter: **0.75"**
Type: **Geokon 170 kPa**
Serial No.: **2009094**

Remarks:

Completion Depth:	10.0 ft
Date Started:	4/22/20
Date Completed:	4/22/20
Logged By:	DAP
Drilling Contractor:	Barr/Coleman
Drilling Method:	Hand Auger
Datum:	MN State Plane NAD83; NAVD88
Coordinates:	N 617,965.3 ft E 2,112,006.7 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 1.0

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

Appendix B

Laboratory Test Results

Twin Ports Testing, Inc.
1301 North 3rd Street
Superior, WI 54880
p: 715-392-7114
p: 800-373-2562
f: 715-392-7163
www.twinportstesting.com

Material Test Report

Report No: MAT:W320-0145-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0145-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0145-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-1
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

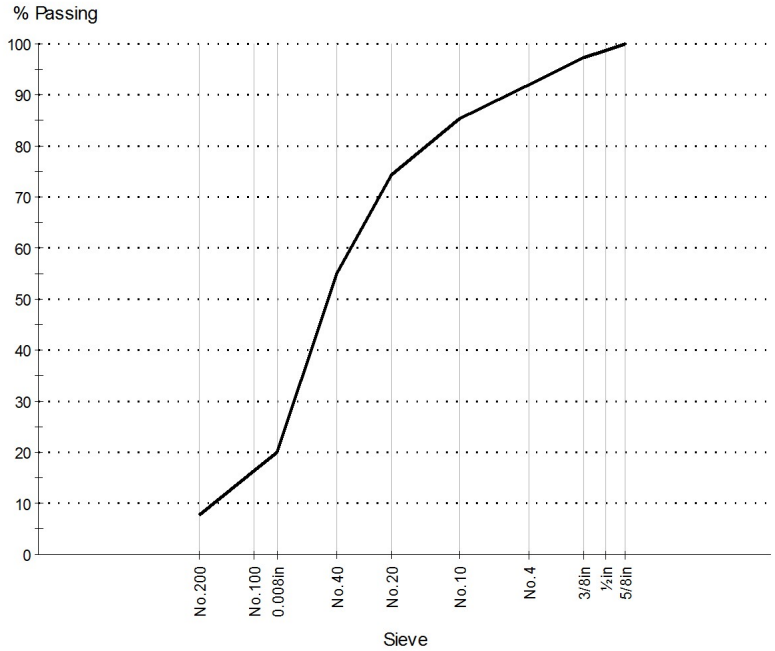
Sample Description:

(SP-SM) Poorly graded sand with silt

Particle Size Distribution

Grading: ASTM D 422 - 07

Drying by: Oven



Sieve Size	% Passing
5/8in	100
½in	99
3/8in	97
No.4	92
No.10	85
No.20	74
No.40	55
0.008in	20
No.100	16
No.200	7.6

FINES (7.6%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (47.4%)	Medium (30.3%)	Coarse (6.7%)	Fine (8.0%)	Coarse (0.0%)	(0.0%)

D85: 1.9525 D60: 0.5086 D50: 0.3818
D30: 0.2481 D15: 0.1355 D10: 0.0907
Cu: 5.60 Cc: 1.33

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Material Test Report

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Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0145-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-1
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	5.8
Method		Method B

Comments

N/A

Twin Ports Testing, Inc.
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Material Test Report

Report No: MAT:W320-0145-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0145-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

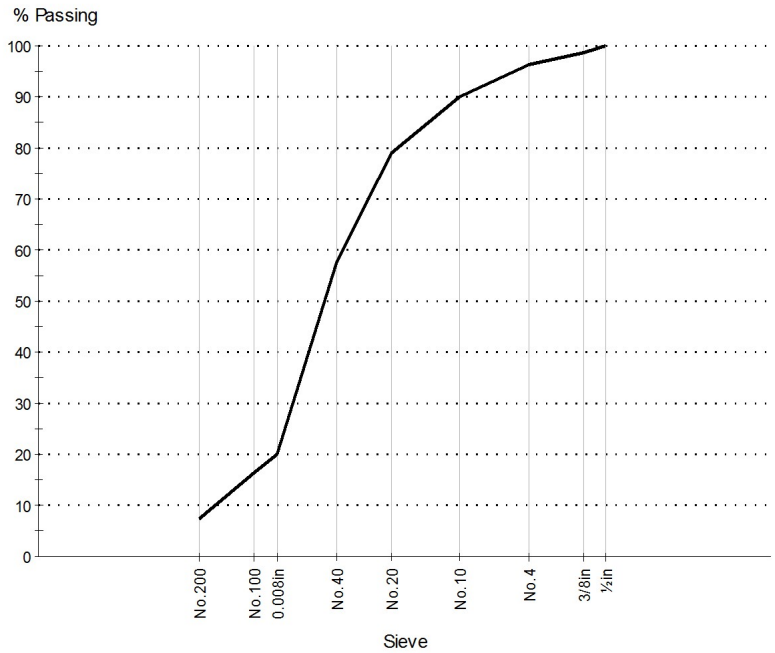
Sample Details

Sample ID:	W320-0145-S2
Field Sample:	7'-7.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-1
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SP-SM) Poorly graded sand with silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
½in	100
3/8in	99
No.4	96
No.10	90
No.20	79
No.40	58
0.008in	20
No.100	16
No.200	7.5

FINES (7.5%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (50.3%)	Medium (32.4%)	Coarse (6.2%)	Fine (3.7%)	Coarse (0.0%)	(0.0%)

D85: 1.3528 D60: 0.4573 D50: 0.3638
D30: 0.2438 D15: 0.1342 D10: 0.0911
Cu: 5.02 Cc: 1.43

Twin Ports Testing, Inc.
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Material Test Report

Report No: MAT:W320-0145-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0145-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0145-S2
Field Sample:	7'-7.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-1
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	10.3
Method		Method B

Comments

N/A

Twin Ports Testing, Inc.
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Material Test Report

Report No: MAT:W320-0146-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0146-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

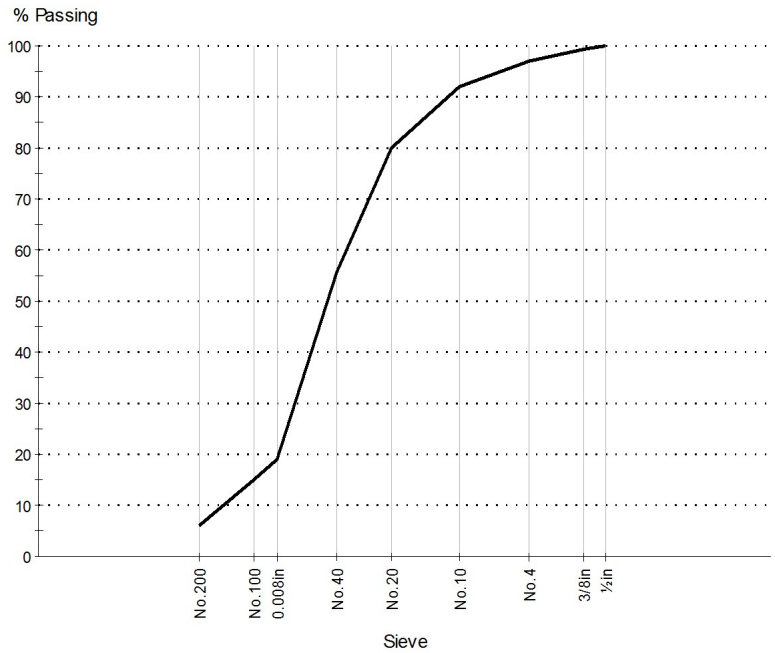
Sample Details

Sample ID:	W320-0146-S1
Field Sample:	3'-3.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-2
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SP-SM) Poorly graded sand with silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
½in	100
3/8in	99
No.4	97
No.10	92
No.20	80
No.40	56
0.008in	19
No.100	15
No.200	6.1

FINES (6.1%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (49.6%)	Medium (36.4%)	Coarse (4.8%)	Fine (3.1%)	Coarse (0.0%)	(0.0%)

D85: 1.2059 D60: 0.4797 D50: 0.3777
D30: 0.2505 D15: 0.1500 D10: 0.1015
Cu: 4.73 Cc: 1.29

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Material Test Report

Report No: MAT:W320-0146-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0146-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0146-S1
Field Sample:	3'-3.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-2
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	5.3
Method		Method B

Comments

N/A

Twin Ports Testing, Inc.
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Material Test Report

Report No: MAT:W320-0146-S2
Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

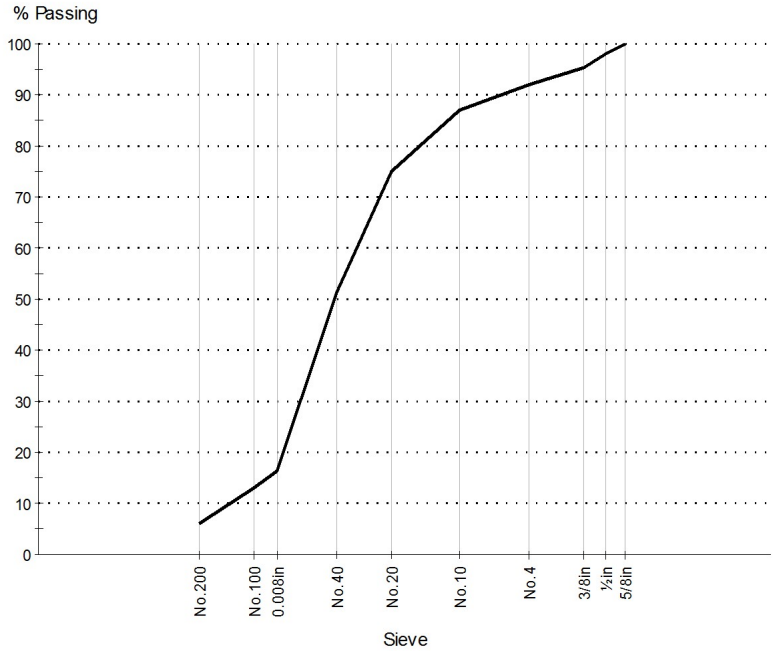
Sample Details

Sample ID:	W320-0146-S2
Field Sample:	7.5'-8'
Date Sampled:	4/20/2020
Source:	LS-20-HA-2
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SP-SM) Poorly graded sand with silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
5/8in	100
½in	98
3/8in	95
No.4	92
No.10	87
No.20	75
No.40	51
0.008in	16
No.100	13
No.200	5.9

FINES (5.9%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (45.4%)	Medium (35.5%)	Coarse (5.2%)	Fine (7.9%)	Coarse (0.0%)	(0.0%)

D85: 1.7492 D60: 0.5487 D50: 0.4130
D30: 0.2689 D15: 0.1804 D10: 0.1126
Cu: 4.87 Cc: 1.17

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Material Test Report

Report No: MAT:W320-0146-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0146-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0146-S2
Field Sample:	7.5'-8'
Date Sampled:	4/20/2020
Source:	LS-20-HA-2
Material:	(SP-SM) Poorly graded sand with silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	5.6
Method		Method B

Comments

N/A

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Material Test Report

Report No: MAT:W320-0147-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0147-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0147-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-3
Material:	(SP) Poorly graded sand
Specification:	Informational
Sampling Method:	Hand Auger

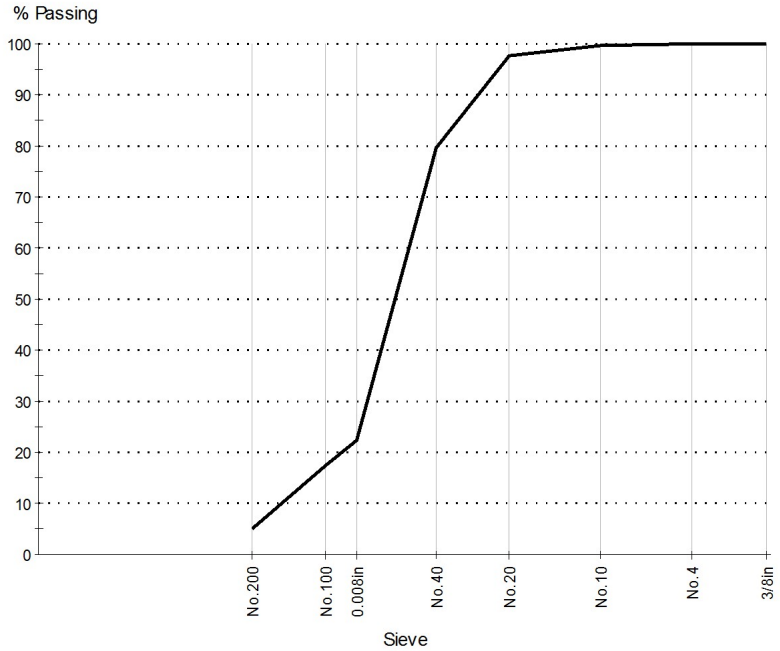
Sample Description:

(SP) Poorly graded sand

Particle Size Distribution

Grading: ASTM D 422 - 07

Drying by: Oven



Sieve Size	% Passing
3/8in	100
No.4	100
No.10	100
No.20	98
No.40	80
0.008in	22
No.100	17
No.200	4.9

FINES (4.9%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (74.6%)	Medium (20.1%)	Coarse (0.3%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.5239 D60: 0.3283 D50: 0.2878
D30: 0.2211 D15: 0.1317 D10: 0.0995
Cu: 3.30 Cc: 1.50

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Material Test Report

Report No: MAT:W320-0147-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0147-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0147-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-3
Material:	(SP) Poorly graded sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	10.1
Method		Method B

Comments

N/A

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Material Test Report

Report No: MAT:W320-0147-S2
Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

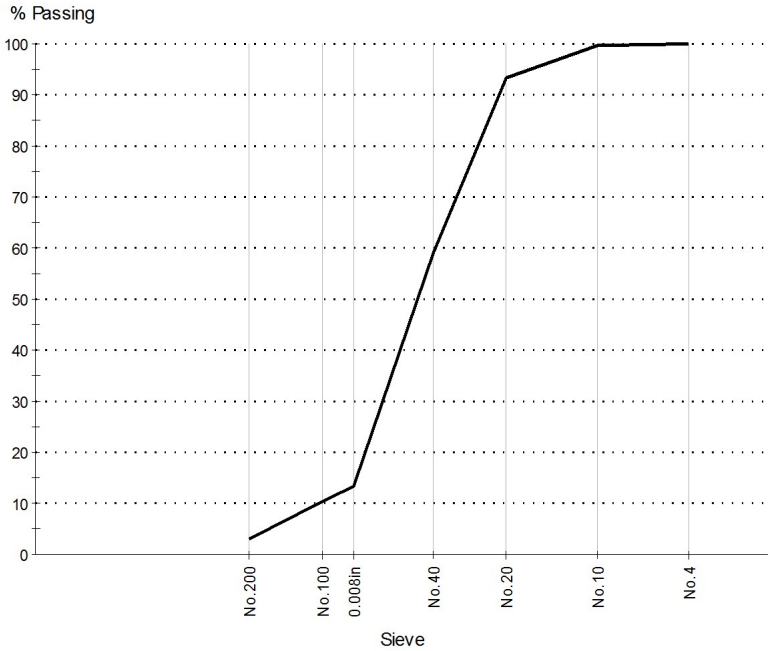
Sample Details

Sample ID:	W320-0147-S2
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-3
Material:	(SP) Poorly graded sand
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SP) Poorly graded sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.4	100
No.10	100
No.20	93
No.40	59
0.008in	13
No.100	10
No.200	3.2

FINES (3.2%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (55.9%)	Medium (40.6%)	Coarse (0.4%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.7167 D60: 0.4335 D50: 0.3661
D30: 0.2629 D15: 0.2052 D10: 0.1466
Cu: 2.96 Cc: 1.09

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Material Test Report

Report No: MAT:W320-0147-S2
Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0147-S2
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-3
Material:	(SP) Poorly graded sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	22.4
Method		Method B

Comments

N/A

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Material Test Report

Report No: MAT:W320-0148-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0148-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

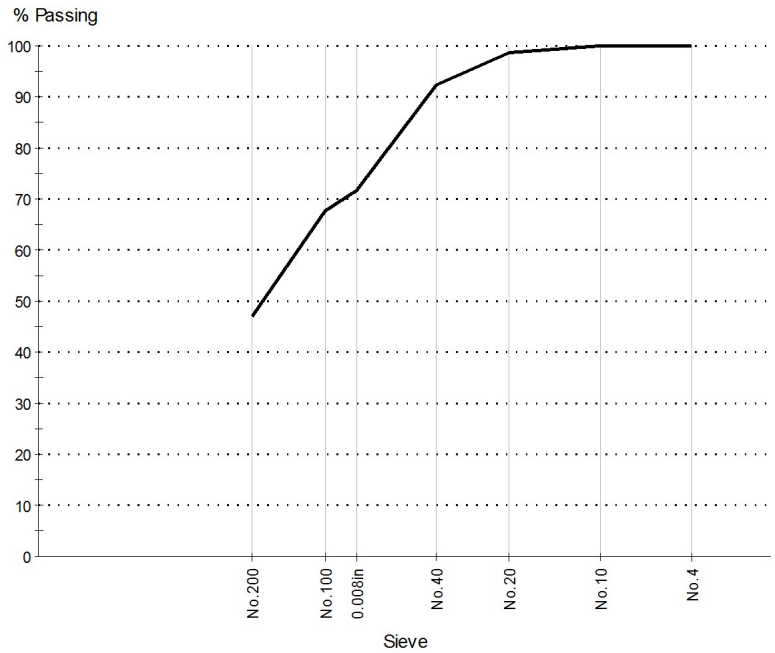
Sample Details

Sample ID:	W320-0148-S1
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-9
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SM) Silty sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.4	100
No.10	100
No.20	99
No.40	92
0.008in	72
No.100	68
No.200	47

FINES (47.1%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (45.2%)	Medium (7.7%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.3260 D60: 0.1160 D50: 0.0828
D30: 0.0421 D15: 0.0254 D10: 0.0215

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Material Test Report

Report No: MAT:W320-0148-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0148-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0148-S1
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-9
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	16.1
Method		Method B

Comments

N/A

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Material Test Report

Report No: MAT:W320-0148-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0148-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project:

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0148-S2
Field Sample:	5'-5.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-10
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

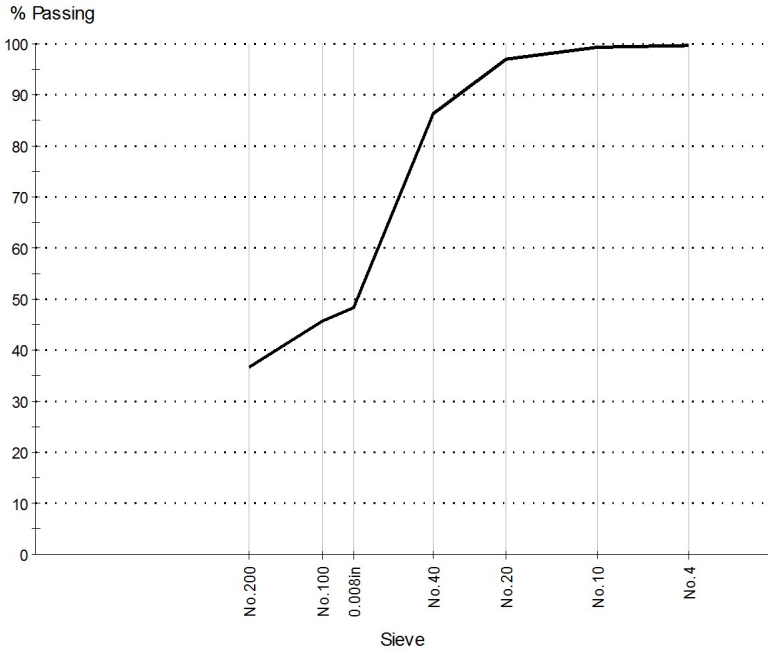
Sample Description:

(SM) Silty sand

Particle Size Distribution

Grading: ASTM D 422 - 07

Drying by: Oven



Sieve Size	% Passing
No.4	100
No.10	99
No.20	97
No.40	86
0.008in	48
No.100	46
No.200	37

FINES (36.8%)		SAND			GRAVEL		COBBLES
Clay	Silt	Fine (49.5%)	Medium (13.0%)	Coarse (0.6%)	Fine (0.2%)	Coarse (0.0%)	(0.0%)

D85: 0.4143 D60: 0.2526 D50: 0.2072
D30: 0.0442 D15: 0.0137 D10: 0.0093

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Material Test Report

Report No: MAT:W320-0148-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0148-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project:

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Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0148-S2
Field Sample:	5'-5.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-10
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	25.0
Method		Method B

Comments

N/A

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Material Test Report

Report No: MAT:W320-0149-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0149-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0149-S1
Field Sample:	2.5'-3'
Date Sampled:	4/20/2020
Source:	LS-20-HA-4
Material:	(PT) Peat
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	595.8
Method		Method B

Comments

Organic Content per ASTM D2974 = 82.5%

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Material Test Report

Report No: MAT:W320-0149-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0149-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

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Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0149-S2
Field Sample:	11.5'-12'
Date Sampled:	4/20/2020
Source:	LS-20-HA-4
Material:	(OH) Organic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

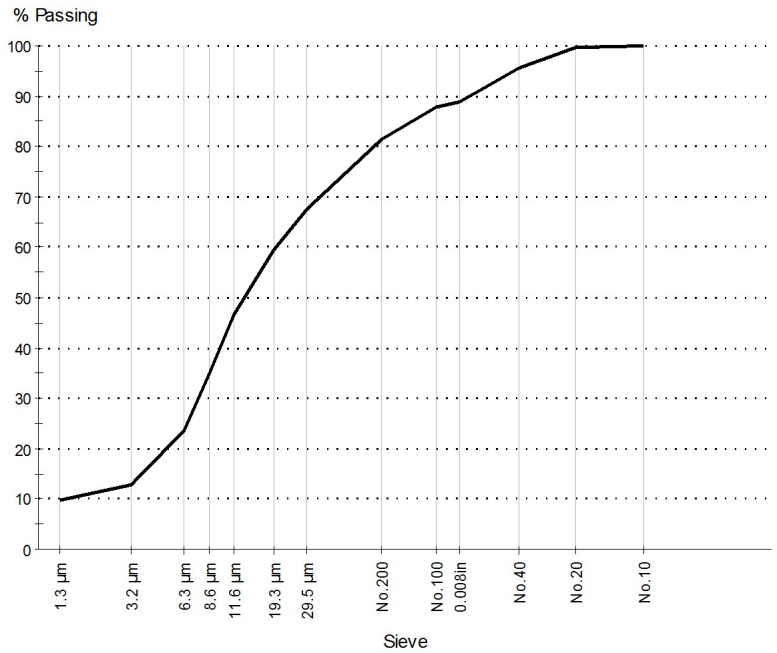
Atterberg Limit:

Liquid Limit:	173
Plastic Limit:	107
Plasticity Index:	66
Linear Shrinkage (%):	N/A

Sample Description:

(OH) Organic silt with sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	100
No.40	96
0.008in	89
No.100	88
No.200	81
29.5 µm	67.5
19.3 µm	59.6
11.6 µm	46.6
8.6 µm	34.7
6.3 µm	23.7
3.2 µm	12.7
1.3 µm	9.8

FINES		SAND			GRAVEL		COBBLES
Clay (19.1%)	Silt (62.4%)	Fine (14.2%)	Medium (4.3%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1103 D60: 0.0197 D50: 0.0133
D30: 0.0075 D15: 0.0037 D10: 0.0014
Cu: 14.25 Cc: 2.08

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Material Test Report

Report No: MAT:W320-0149-S2
Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0149-S2
Field Sample:	11.5'-12'
Date Sampled:	4/20/2020
Source:	LS-20-HA-4
Material:	(OH) Organic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	158.8
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	173
Method		Method A
Plastic Limit		107
Plasticity Index		66
Sample history		Natural state
Material retained on 425µm (No. 40) (%)		4.0

Comments

Organic Content per ASTM D2974 = 36.0%
Ovendried LL (79) / In-Situ LL (173) = .46

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Material Test Report

Report No: MAT:W320-0150-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0150-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0150-S1
Field Sample:	5.5'-6'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5
Material:	(PT) Peat
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	564.9
Method		Method B

Comments

Organic Content per ASTM D2974 = 56.8%

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Material Test Report

Report No: MAT:W320-0150-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0150-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0150-S2
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5
Material:	(OH) Organic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

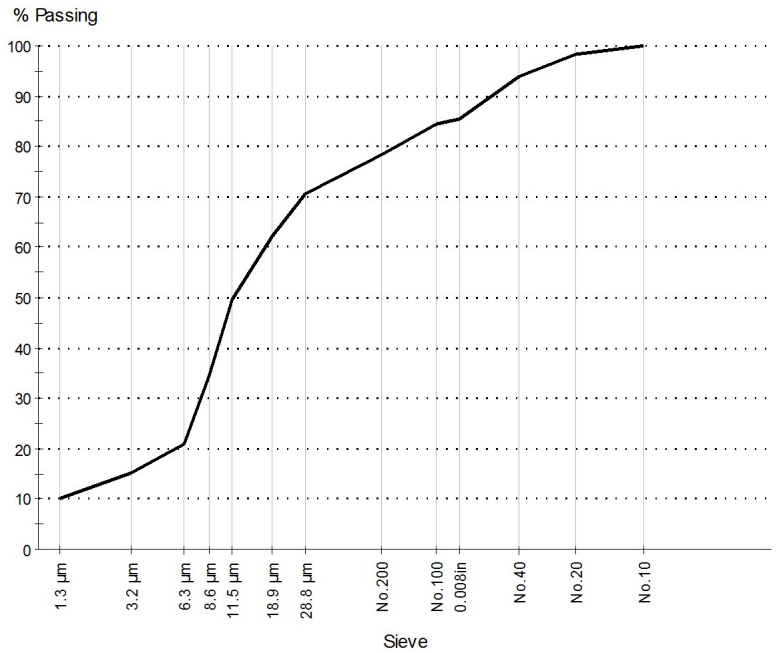
Atterberg Limit:

Liquid Limit:	181
Plastic Limit:	103
Plasticity Index:	78
Linear Shrinkage (%):	N/A

Sample Description:

(OH) Organic silt with sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	98
No.40	94
0.008in	86
No.100	84
No.200	78
28.8 µm	70.6
18.9 µm	62.0
11.5 µm	49.6
8.6 µm	34.3
6.3 µm	20.9
3.2 µm	15.1
1.3 µm	10.3

FINES		SAND			GRAVEL		COBBLES
Clay (18.5%)	Silt (59.8%)	Fine (15.7%)	Medium (6.0%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1737 D60: 0.0174 D50: 0.0117
D30: 0.0078 D15: 0.0031 D10: 0.0012
Cu: 14.20 Cc: 2.83

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Material Test Report

Report No: MAT:W320-0150-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0150-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0150-S2
Field Sample:	8.5'-9'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5
Material:	(OH) Organic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	185.2
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	181
Method		Method A
Plastic Limit		103
Plasticity Index		78
Sample history		Natural state
Material retained on 425µm (No. 40) (%)		6.0

Comments

Organic Content per ASTM D2974 = 42.4
Ovendried LL (86) / In-Situ LL (181) = .48

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Material Test Report

Report No: MAT:W320-0151-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0151-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0151-S1
Field Sample:	7'-7.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5A
Material:	(OH) Organic silt
Specification:	Informational
Sampling Method:	Hand Auger

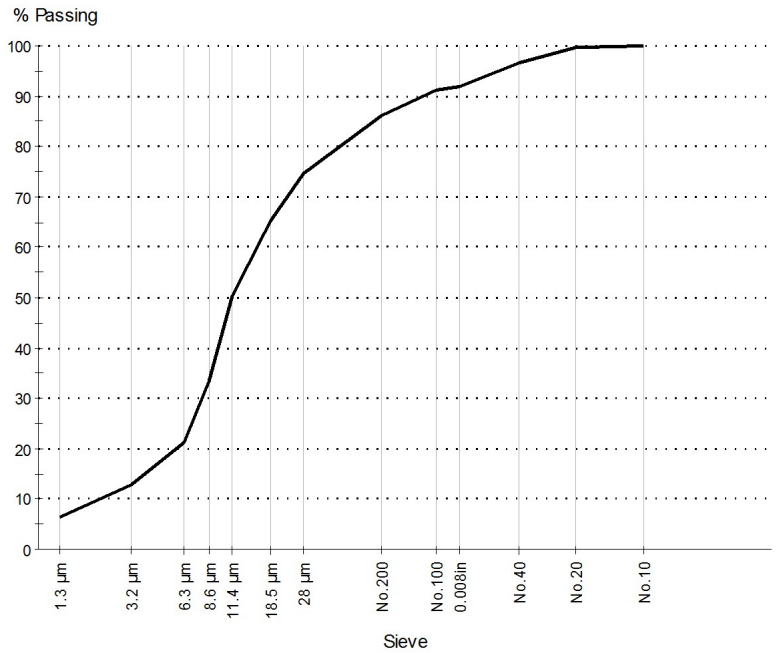
Atterberg Limit:

Liquid Limit:	173
Plastic Limit:	101
Plasticity Index:	72
Linear Shrinkage (%):	N/A

Sample Description:

(OH) Organic silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	100
No.40	97
0.008in	92
No.100	91
No.200	86
28.0 µm	74.7
18.5 µm	65.3
11.4 µm	50.4
8.6 µm	33.5
6.3 µm	21.3
3.2 µm	12.9
1.3 µm	6.4

FINES		SAND			GRAVEL		COBBLES
Clay (17.8%)	Silt (68.5%)	Fine (10.3%)	Medium (3.4%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.0672 D60: 0.0156 D50: 0.0113
D30: 0.0079 D15: 0.0038 D10: 0.0021
Cu: 7.27 Cc: 1.86

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Material Test Report

Report No: MAT:W320-0151-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0151-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0151-S1
Field Sample:	7'-7.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5A
Material:	(OH) Organic silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	182.1
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard to Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	173
Method		Method A
Plastic Limit		101
Plasticity Index		72
Sample history		Natural state
Material retained on 425µm (No. 40) (%)		0.0

Comments

Organic Content per ASTM D2974 = 26.4%
Ovendried LL (89) / In-situ LL (173) = .51

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Material Test Report

Report No: MAT:W320-0151-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0151-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0151-S2
Field Sample:	11'-11.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-5A
Material:	(OH) Organic silt
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	159.0
Method		Method B

Comments

Organic Content per ASTM D2974 = 27.8%

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Material Test Report

Report No: MAT:W320-0151-S3
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0151-S3'.

Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0151-S3
Field Sample:	13.5'-14
Date Sampled:	4/20/2020
Source:	LS-20-HA-5A
Material:	(OH) Organic silt
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	137.4
Method		Method B

Comments

Organic Content per ASTM D2974 = 22.4%

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Material Test Report

Report No: MAT:W320-0152-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0152-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0152-S1
Field Sample:	10'-10.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-6
Material:	(MH) Elastic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

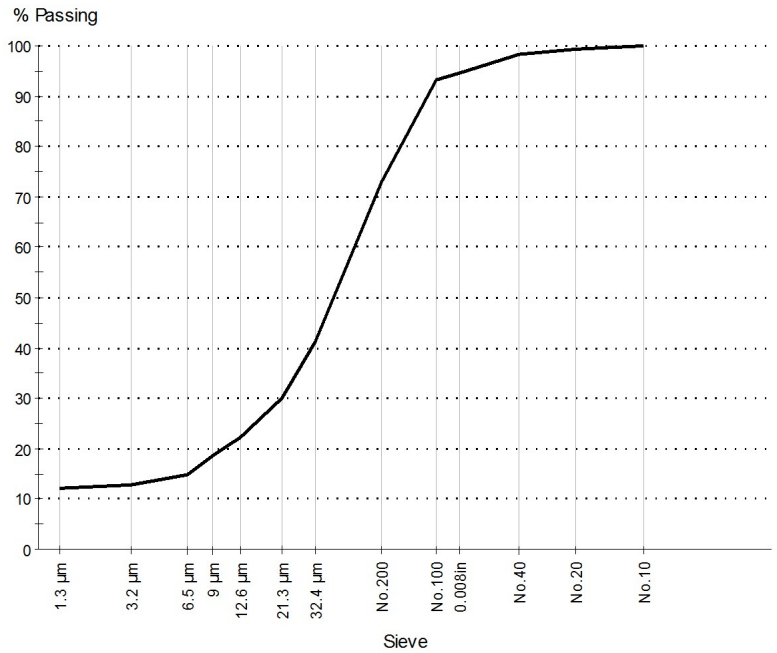
Atterberg Limit:

Liquid Limit:	63
Plastic Limit:	50
Plasticity Index:	13
Linear Shrinkage (%):	N/A

Sample Description:

(MH) Elastic silt with sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	99
No.40	98
0.008in	95
No.100	93
No.200	73
32.4 µm	41.3
21.3 µm	30.0
12.6 µm	22.4
9.0 µm	18.7
6.5 µm	14.9
3.2 µm	13.0
1.3 µm	12.1

FINES		SAND			GRAVEL		COBBLES
Clay (14.0%)	Silt (58.9%)	Fine (25.3%)	Medium (1.8%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1132 D60: 0.0532 D50: 0.0408
D30: 0.0213 D15: 0.0066 D10: 0.0002

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Material Test Report

Report No: MAT:W320-0152-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0152-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0152-S1
Field Sample:	10'-10.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-6
Material:	(MH) Elastic silt with sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	41.9
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	63
Method		Method A
Plastic Limit		50
Plasticity Index		13
Sample history		Natural state
Material retained on 425µm (No. 40) (%)		1.8

Comments

Organic Content per ASTM D2974 = 9.7%
Ovendried LL (76) / In-situ LL (63) = 1.21

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Material Test Report

Report No: MAT:W320-0152-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0152-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0152-S2
Field Sample:	13'-13.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-6
Material:	(ML) Silt with Sand
Specification:	Informational
Sampling Method:	Hand Auger

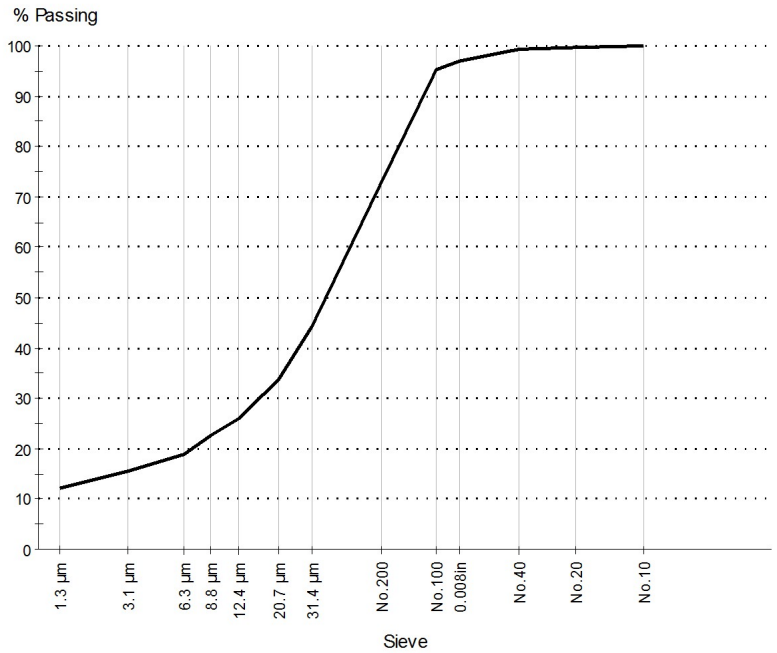
Atterberg Limit:

Liquid Limit:	20
Plastic Limit:	18
Plasticity Index:	2
Linear Shrinkage (%):	N/A

Sample Description:

(ML) Silt with Sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	100
No.40	99
0.008in	97
No.100	95
No.200	73
31.4 µm	44.4
20.7 µm	33.9
12.4 µm	26.0
8.8 µm	22.5
6.3 µm	19.0
3.1 µm	15.5
1.3 µm	12.0

FINES		SAND			GRAVEL		COBBLES
Clay (17.6%)	Silt (55.4%)	Fine (26.4%)	Medium (0.6%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1088 D60: 0.0505 D50: 0.0372
D30: 0.0161 D15: 0.0027 D10: 0.0008
Cu: 63.81 Cc: 6.47

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Material Test Report

Report No: MAT:W320-0152-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0152-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0152-S2
Field Sample:	13'-13.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-6
Material:	(ML) Silt with Sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	27.5
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	20
Method		Method A
Plastic Limit		18
Plasticity Index		2
Sample history		Oven-dried
Material retained on 425µm (No. 40) (%)		0.0

Comments

Organic Content per ASTM D2974 = 6.9%

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Material Test Report

Report No: MAT:W320-0153-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0153-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0153-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-7
Material:	(PT) Peat
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	429.6
Method		Method B

Comments

Organic Content per ASTM D2974 = 76.3%

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Material Test Report

Report No: MAT:W320-0153-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0153-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 5/4/2020

Sample Details

Sample ID:	W320-0153-S2
Field Sample:	7.5'-8'
Date Sampled:	4/20/2020
Source:	LS-20-HA-7
Material:	(OH) Organic silt
Specification:	Informational Atterberg
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	110.2
Method		Method B
Liquid Limit	ASTM D 4318 - 05	120
Method		Method A
Plastic Limit		93
Plasticity Index		27
Sample history		Natural state
Material retained on 425µm (No. 40) (%)		0.0

Comments

Organic Content per ASTM D2974 = 30.7%
Ovendried LL (26) / In-situ LL (120) = .22

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Material Test Report

Report No: MAT:W320-0153-S3
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0153-S3'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0153-S3
Field Sample:	14'-14.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-7
Material:	(CL-ML) Silty clay
Specification:	Informational
Sampling Method:	Hand Auger

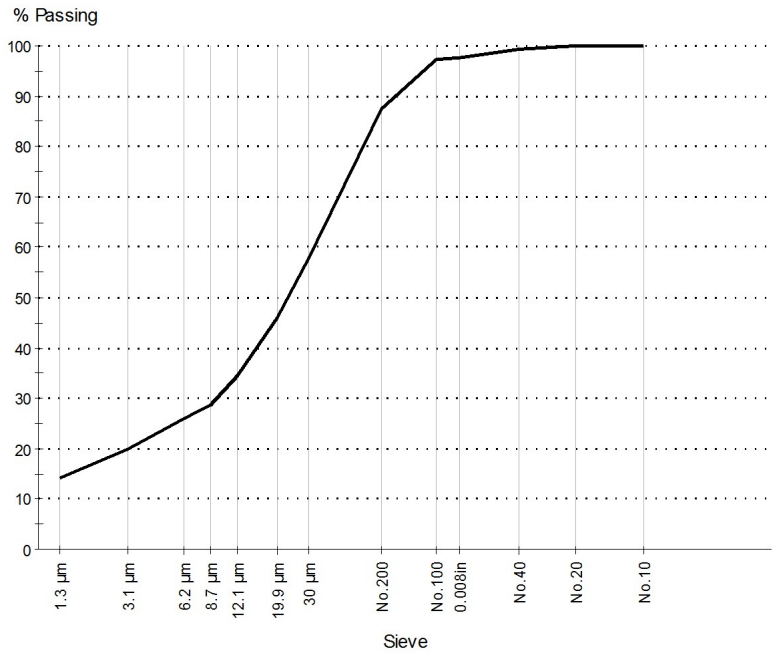
Atterberg Limit:

Liquid Limit:	23
Plastic Limit:	17
Plasticity Index:	6
Linear Shrinkage (%):	N/A

Sample Description:

(CL-ML) Silty clay

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	100
No.40	99
0.008in	98
No.100	97
No.200	87
30.0 µm	57.9
19.9 µm	46.1
12.1 µm	34.3
8.7 µm	28.8
6.2 µm	26.1
3.1 µm	19.8
1.3 µm	14.3

FINES		SAND			GRAVEL		COBBLES
Clay (23.7%)	Silt (63.8%)	Fine (12.0%)	Medium (0.5%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.0695 D60: 0.0320 D50: 0.0228
D30: 0.0093 D15: 0.0015 D10: 0.0007

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Material Test Report

Report No: MAT:W320-0153-S3
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0153-S3'.

Client: Barr Engineering Company
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0153-S3
Field Sample:	14'-14.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-7
Material:	(CL-ML) Silty clay
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	26.4
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	23
Method		Method A
Plastic Limit		17
Plasticity Index		6
Sample history		Oven-dried
Material retained on 425µm (No. 40) (%)		0.0

Comments

Organic Content per ASTM D2974 = 8.3%

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Material Test Report

Report No: MAT:W320-0154-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0154-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0154-S1
Field Sample:	5.5'-6'
Date Sampled:	4/20/2020
Source:	LS-20-HA-8
Material:	(ML) Silt with Sand
Specification:	Informational
Sampling Method:	Hand Auger

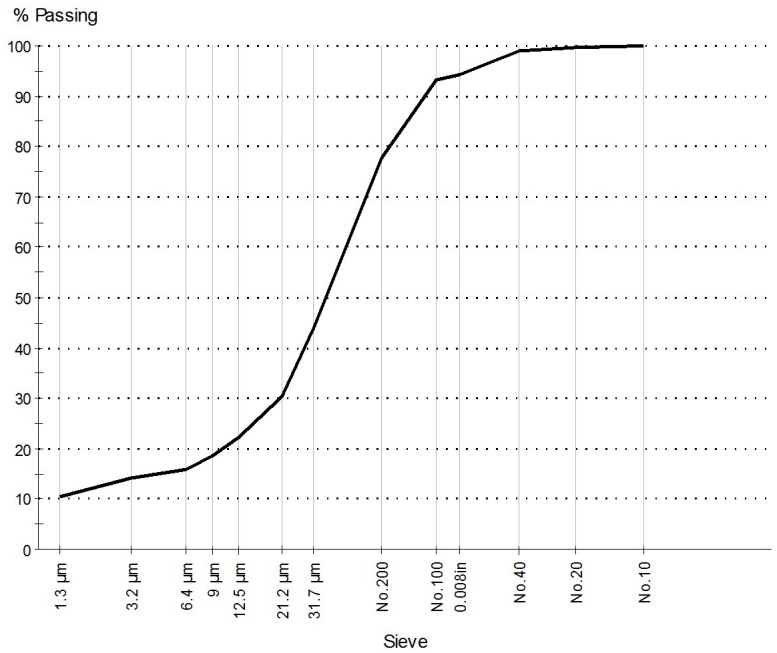
Atterberg Limit:

Liquid Limit:	21
Plastic Limit:	19
Plasticity Index:	2
Linear Shrinkage (%):	N/A

Sample Description:

(ML) Silt with Sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	100
No.40	99
0.008in	94
No.100	93
No.200	78
31.7 µm	43.8
21.2 µm	30.4
12.5 µm	22.3
9.0 µm	18.7
6.4 µm	16.0
3.2 µm	14.2
1.3 µm	10.6

FINES		SAND			GRAVEL		COBBLES
Clay (15.2%)	Silt (62.6%)	Fine (21.0%)	Medium (1.1%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1034 D60: 0.0478 D50: 0.0371
D30: 0.0207 D15: 0.0044 D10: 0.0011
Cu: 42.68 Cc: 7.98

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Material Test Report

Report No: MAT:W320-0154-S1
Issue No: 1
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Client: Barr Engineering Company
325 South Lake Avenue
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Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0154-S1
Field Sample:	5.5'-6'
Date Sampled:	4/20/2020
Source:	LS-20-HA-8
Material:	(ML) Silt with Sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	27.0
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse
Liquid Limit	ASTM D 4318 - 05	21
Method		Method A
Plastic Limit		19
Plasticity Index		2
Sample history		Oven-dried
Material retained on 425µm (No. 40) (%)		0.0

Comments

N/A

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Material Test Report

Report No: MAT:W320-0154-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0154-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

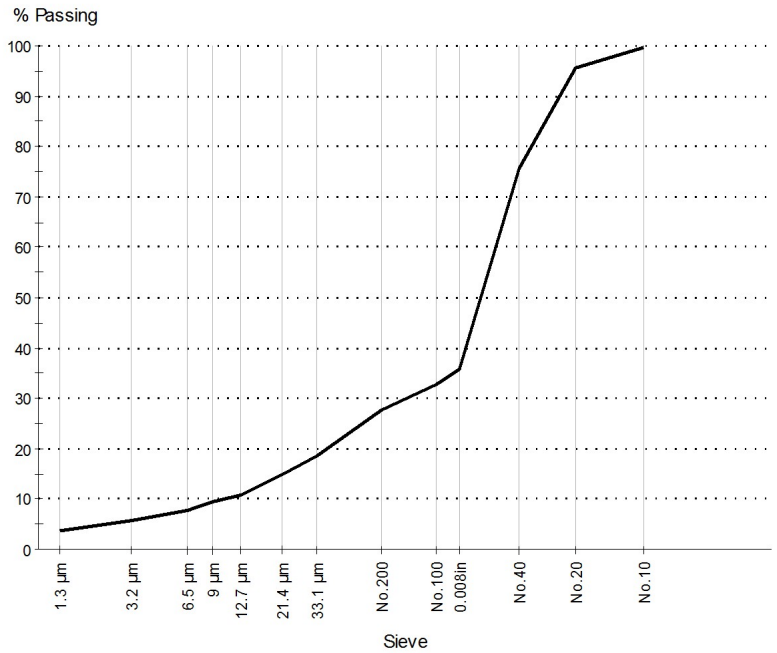
Sample Details

Sample ID:	W320-0154-S2
Field Sample:	10'-10.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-8
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(SM) Silty sand

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	95
No.40	76
0.008in	36
No.100	33
No.200	28
33.1 µm	18.7
21.4 µm	14.7
12.7 µm	10.8
9.0 µm	9.3
6.5 µm	7.8
3.2 µm	5.8
1.3 µm	3.8

FINES		SAND			GRAVEL		COBBLES
Clay (6.9%)	Silt (20.7%)	Fine (48.1%)	Medium (24.1%)	Coarse (0.2%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.5896 D60: 0.3159 D50: 0.2613
D30: 0.1031 D15: 0.0221 D10: 0.0106
Cu: 29.89 Cc: 3.18

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Material Test Report

Report No: MAT:W320-0154-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0154-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0154-S2
Field Sample:	10'-10.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-8
Material:	(SM) Silty sand
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	17.6
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to coarse

Comments

N/A

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Material Test Report

Report No: MAT:W320-0155-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0155-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/28/2020

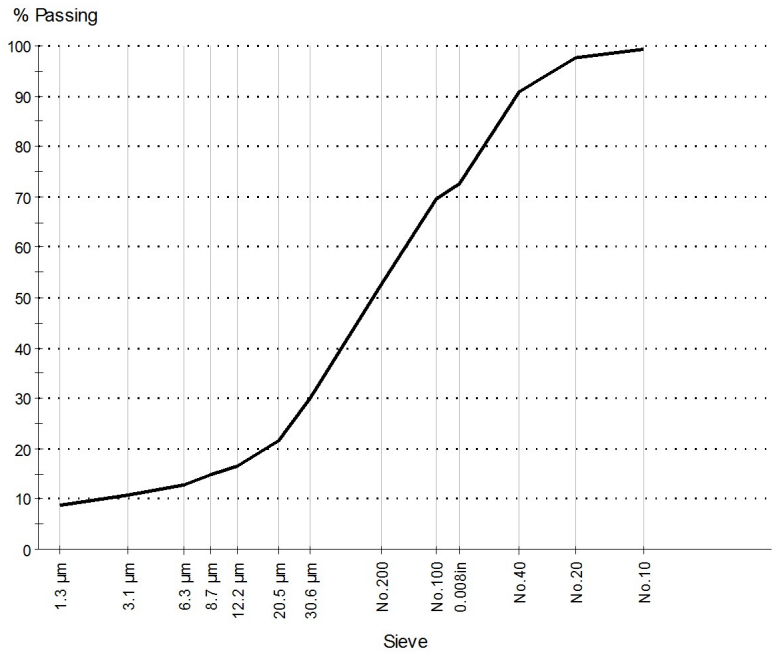
Sample Details

Sample ID:	W320-0155-S1
Field Sample:	3'-3.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-9
Material:	(ML) Sandy Silt
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(ML) Sandy Silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	99
No.20	98
No.40	91
0.008in	73
No.100	70
No.200	53
30.6 µm	30.0
20.5 µm	21.5
12.2 µm	16.5
8.7 µm	15.0
6.3 µm	13.0
3.1 µm	10.9
1.3 µm	8.9

FINES		SAND			GRAVEL		COBBLES
Clay (12.1%)	Silt (40.5%)	Fine (38.3%)	Medium (8.5%)	Coarse (0.6%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.3334 D60: 0.1012 D50: 0.0676
D30: 0.0306 D15: 0.0087 D10: 0.0021
Cu: 48.26 Cc: 4.41

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Material Test Report

Report No: MAT:W320-0155-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0155-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/28/2020

Sample Details

Sample ID:	W320-0155-S1
Field Sample:	3'-3.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-9
Material:	(ML) Sandy Silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	24.3
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine to Coarse

Comments

N/A

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Material Test Report

Report No: MAT:W320-0155-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0155-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/28/2020

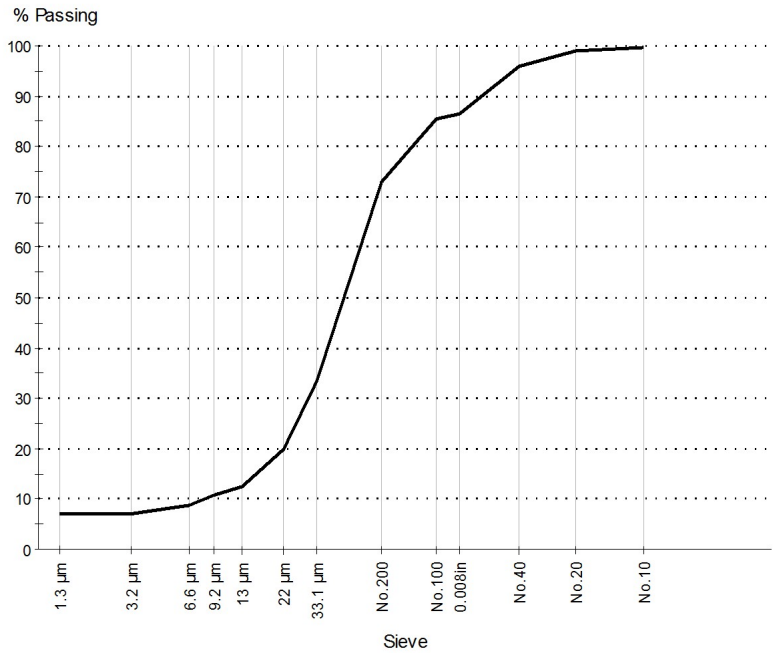
Sample Details

Sample ID:	W320-0155-S2
Field Sample:	9'-9.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-10
Material:	(ML) Sandy Silt
Specification:	Informational
Sampling Method:	Hand Auger

Sample Description:

(ML) Sandy Silt

Particle Size Distribution



Grading: ASTM D 422 - 07

Drying by: Oven

Sieve Size	% Passing
No.10	100
No.20	99
No.40	96
0.008in	87
No.100	85
No.200	73
33.1 µm	33.6
22.0 µm	19.9
13.0 µm	12.6
9.2 µm	10.8
6.6 µm	8.9
3.2 µm	7.1
1.3 µm	7.1

FINES		SAND			GRAVEL		COBBLES
Clay (8.1%)	Silt (64.8%)	Fine (23.0%)	Medium (3.8%)	Coarse (0.3%)	Fine (0.0%)	Coarse (0.0%)	(0.0%)

D85: 0.1471 D60: 0.0574 D50: 0.0466
D30: 0.0297 D15: 0.0155 D10: 0.0080
Cu: 7.17 Cc: 1.93

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Material Test Report

Report No: MAT:W320-0155-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0155-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/28/2020

Sample Details

Sample ID:	W320-0155-S2
Field Sample:	9'-9.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-10
Material:	(ML) Sandy Silt
Specification:	Informational
Sampling Method:	Hand Auger

Other Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	25.8
Method		Method B
Dispersion device	ASTM D 422 - 07	Mechanical
Dispersion time (min)		1
Shape		Angular
Hardness		Hard and Durable
Sand/gravel description		Fine To Coarse

Comments

N/A

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Material Test Report

Report No: MAT:W320-0156-S1
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0156-S1'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0156-S1
Field Sample:	1.5'-2'
Date Sampled:	4/20/2020
Source:	LS-20-HA-11
Material:	(PT) Peat
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	520.3
Method		Method B

Comments

Organic Content per ASTM D2974 = 80.7%

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Material Test Report

Report No: MAT:W320-0156-S2
Issue No: 1
This report replaces all previous issues of report no 'MAT:W320-0156-S2'.

Client: Barr Engineering Company
325 South Lake Avenue
Duluth MN 55802

Project: 20M8580 L3R LaSalle Creek

This laboratory is accredited in accordance with AASHTO.

Approved Signatory: Joe Berger (Laboratory Supervisor)
Date of Issue: 4/27/2020

Sample Details

Sample ID:	W320-0156-S2
Field Sample:	11'-11.5'
Date Sampled:	4/20/2020
Source:	LS-20-HA-11
Material:	(PT) Peat
Specification:	Moisture Content
Sampling Method:	Hand Auger

Test Results

Description	Method	Result
Moisture content (%)	ASTM D 2216 - 05	292.9
Method		Method B

Comments

Organic Content per ASTM D2974 = 32.8%

Report of Moisture Content, Dry Density, and P200

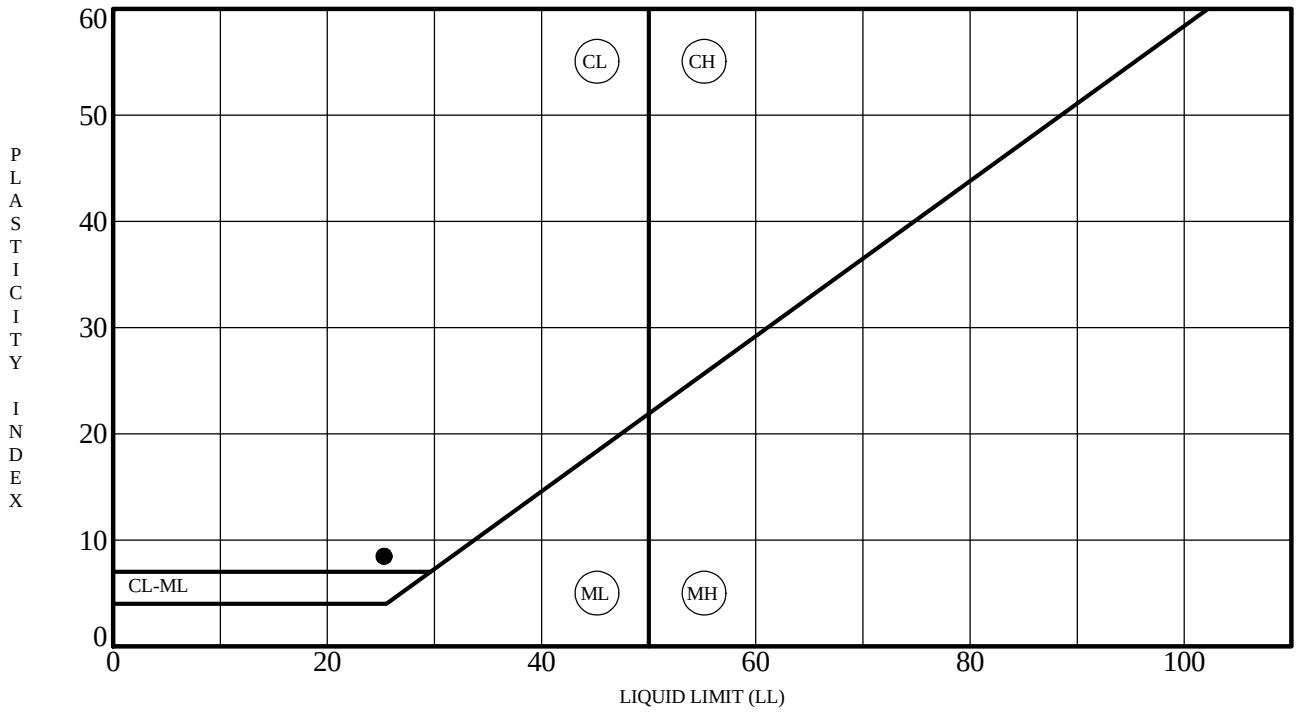
SANDPIPER MAINLINE PHASE II
BARR PROJECT NO. 49/16-1244
ND, MN, WI

BARR ENGINEERING
ATTN: ROB OLAH

AET FIELDWORK NO: 01-05986
AET LABORATORY NO: 07-05937

SEPTEMBER 25, 2014

Boring Number	Depth (feet)	Moisture Content	Dry Density	Hand Penetrometer	P200	Classification
MP 407N	9.5-11.5	22.9	--	--	11.5	SP-SM
MP 407N	19.9-21.9	24.5	--	--	3.7	SP
MP 407N	31.4-31.9	13.6	110.8	--	--	SM
MP 407N	39.9-41.9	22.8	--	--	44.4	SM
MP 407N	49.9-51.9	21.6	--	--	18.1	SM
MP 407N	56.4-56.9	16.2	102.0	--	--	SM
MP 407N	59.9-61.9	23.5	--	--	26.4	SM
MP 407N	71.4-71.9	18.2	112.6	--	--	SM
MP 407N	79.9-81.9	22.2	--	--	20.0	SM
MP 407S	15-17	13.9	--	--	6.2	SP-SM
MP 407S	30-32	19.9	112.5	--	87.4	Sandy ML
MP 407S	35-37	22.7	--	--	--	CL
MP 407S	40-42	23.0	109.2	1.25	--	SM
MP 407S	55-57	10.2	--	--	17.7	SM



	Specimen Identification		LL	PL	PI	MC	Classification
●	**MP 407S**	**35.0**	**25**	**17**	**8**	**23**	**Lean Clay (CL)**

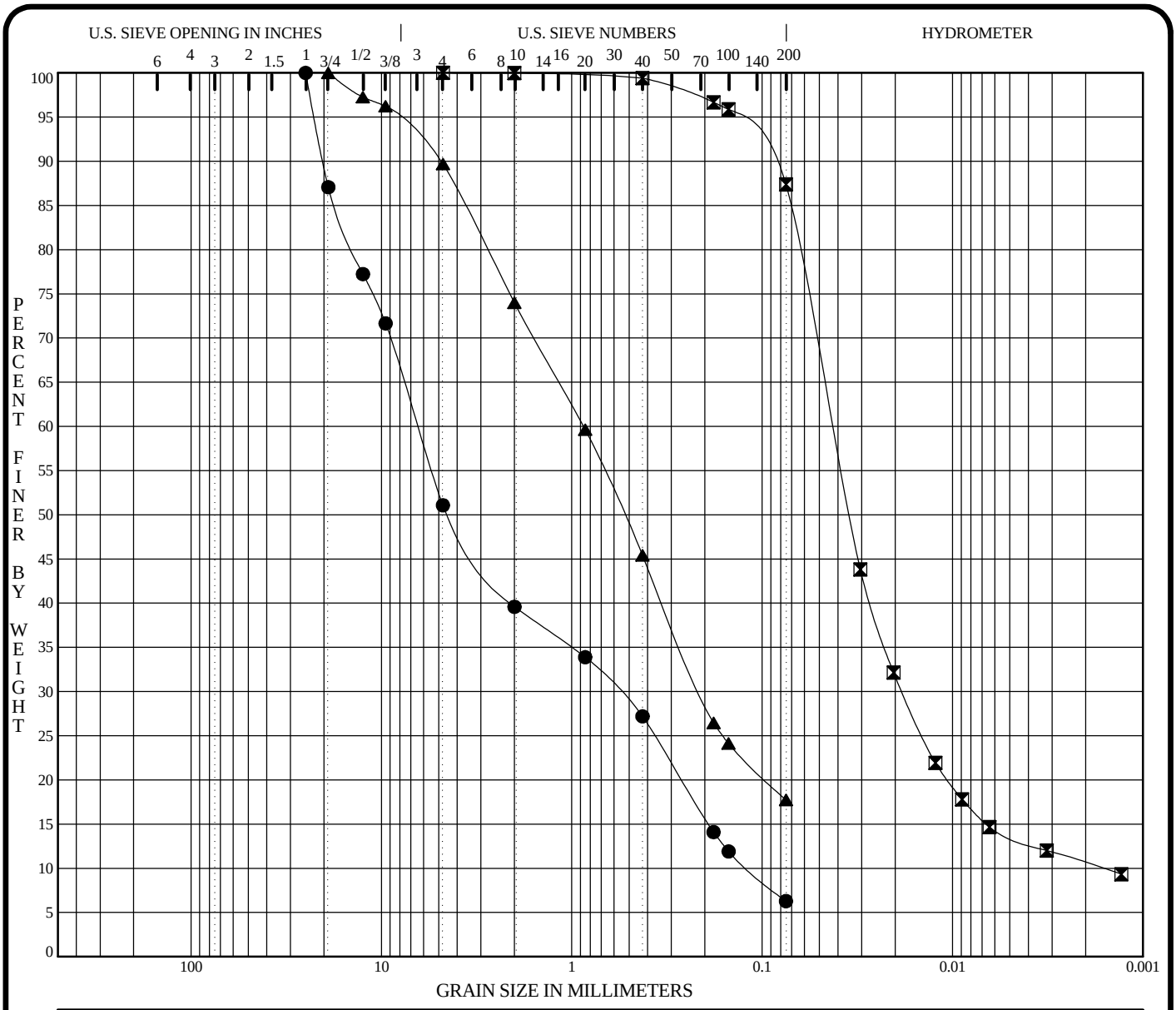
PROJECT **Sandpiper Mainline Phase II; Barr Project No. 49/16-1244; North Dakota, Minnesota, Wisconsin**

JOB NO. **01-05986/07-05937**

DATE **9/5/14**

AMERICAN ENGINEERING TESTING, INC.

ATTERBERG LIMITS' RESULTS



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	MC%	LL	PL	PI	Cc	Cu
●	**MP 407S**	**15.0**	**Gravelly Sand with Silt (SP-SM)**	**14**				**0.42**	**54.1**
⊠	**MP 407S**	**30.0**	**Sandy Silt (ML)**	**20**				**4.85**	**26.2**
▲	**MP 407S**	**55.0**	**Silty Sand, a little gravel (SM)**	**10**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**MP 407S**	**15.0**	**25.00**	**6.42**	**0.569**	**0.1187**	**48.9**	**44.8**	**6.3**	
⊠	**MP 407S**	**30.0**	**4.75**	**0.04**	**0.018**	**0.0016**	**0.0**	**12.6**	**73.7**	**13.7**
▲	**MP 407S**	**55.0**	**19.00**	**0.87**	**0.211**		**10.3**	**72.0**	**17.7**	

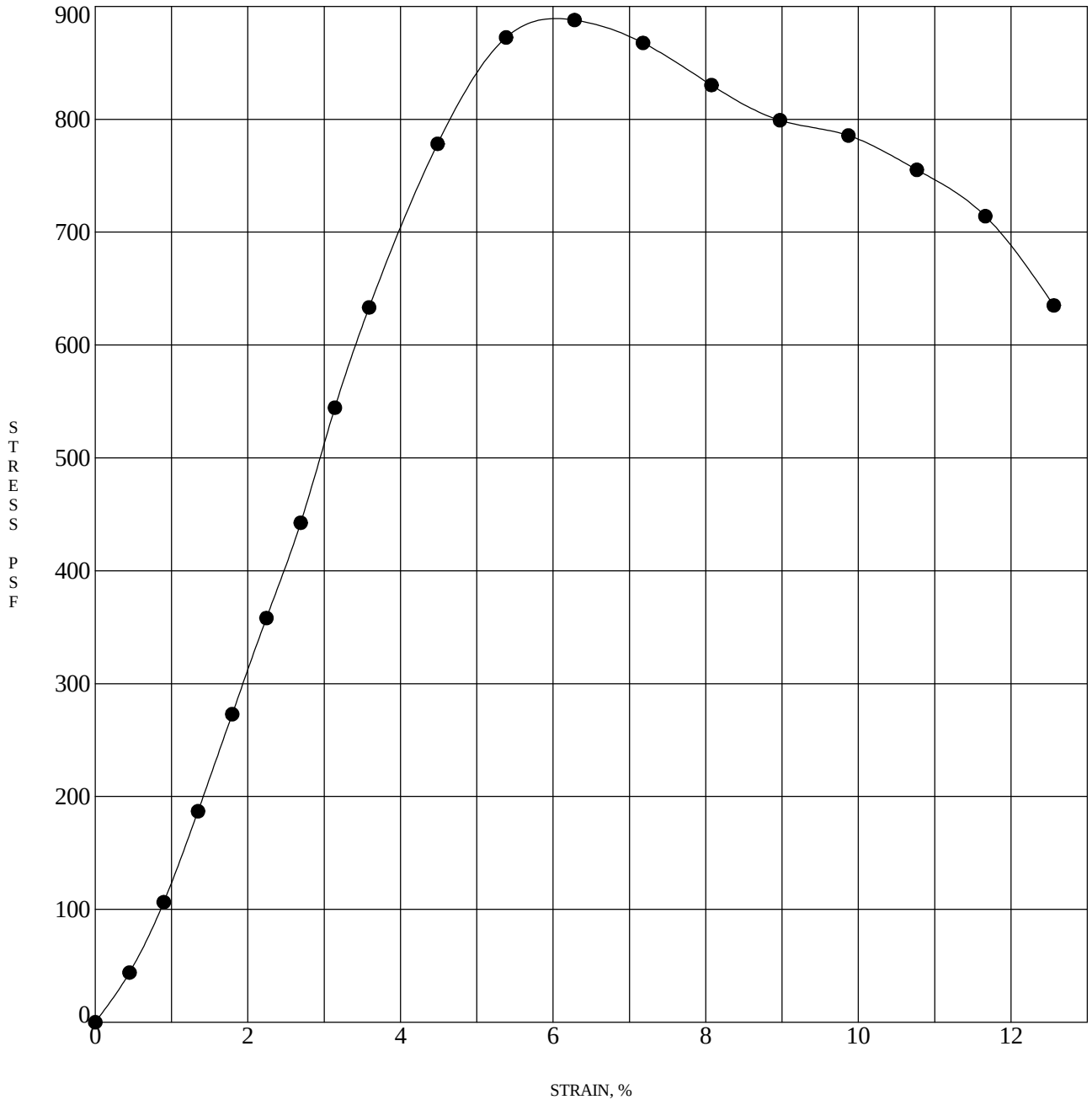
PROJECT **Sandpiper Mainline Phase II; Barr Project No. 49/16-1244; North Dakota, Minnesota, Wisconsin**

JOB NO. **01-05986/07-05937**

DATE **9/5/14**

AMERICAN ENGINEERING TESTING, INC.

GRADATION CURVES



Specimen Identification		Classification	DD	MC%
●	**MP 407S 40.0**	**Silty Sand (SM)**	**109**	**23**

PROJECT **Sandpiper Mainline Phase II; Barr Project No. 49/16-1244; North Dakota, Minnesota, Wisconsin**

JOB NO. **01-05986/07-05937**

DATE **9/5/14**

AMERICAN ENGINEERING TESTING, INC.

UNCONFINED COMPRESSION TEST

Summary of Laboratory Chemical Analysis

SANDPIPER MAINLINE
BARR PROJECT NO. 49/16-1244
ND, MN, WI

BARR ENGINEERING
ATTN: ROB OLAH

AET FIELDWORK NO: 01-5986
AET LABORATOY NO: 07-05937

SEPTEMBER 19, 2014

The following test results for pH, sulfate, and chloride were provided to AET by ERA Laboratory for the requested soil samples. The ERA Laboratory report has been attached for your reference.

Boring Number	Depth (ft)	pH	Sulfate (mg/Kg)	Chloride (mg/Kg)
MP 407N	44.9-46.9	9.5	39	<2
MP 407S	45-47	9.5	340	<2

Era LABS Era Laboratories, Inc.
4730 Oneota Street Duluth MN 55807 Telephone: (218)727-6380 Fax: (218)727-3049

Laboratory Report

Project Number: 081504
COC Number: 081504
Date Received: 9/2/2014
Report Date: 9/18/2014
ReportNumber: 127718

Client: JONATHAN GABRIEL
AMERICAN ENGINEERING TESTING, INC
P O BOX 16008
DULUTH MN 55816

Sample ID: SANDPIPER 07-05937 MP 407 N 44.9'-46.9' Grab **Sample Date:** 8/27/2014 **SampleTime:** 13:40 **Matrix:** Solids
Era Project Number: 081504-1

Parameter:		Results:	Units:	Analysis Date/Time:		Method:	DF:	LOD:	LOQ:	QC Comments:
Chloride	<	2	mg/Kg DWB	9/16/2014	17:28	EPA 300.0 Rev. 2.1	10	2	6	
pH - Lab		9.5	SU	9/2/2014	15:25	EPA 9045D	1			
Sulfate		39	mg/Kg DWB	9/16/2014	17:28	EPA 300.0 Rev 2.1	10	5	15	

Sample ID: SANDPIPER 07-05937 MP 407 S 45'-47' Grab **Sample Date:** 8/27/2014 **SampleTime:** 13:40 **Matrix:** Solids
Era Project Number: 081504-2

Parameter:		Results:	Units:	Analysis Date/Time:		Method:	DF:	LOD:	LOQ:	QC Comments:
Chloride	<	2	mg/Kg DWB	9/16/2014	18:54	EPA 300.0 Rev. 2.1	10	2	6	
pH - Lab		9.5	SU	9/2/2014	15:25	EPA 9045D	1			
Sulfate		340	mg/Kg DWB	9/16/2014	18:54	EPA 300.0 Rev 2.1	10	5	15	

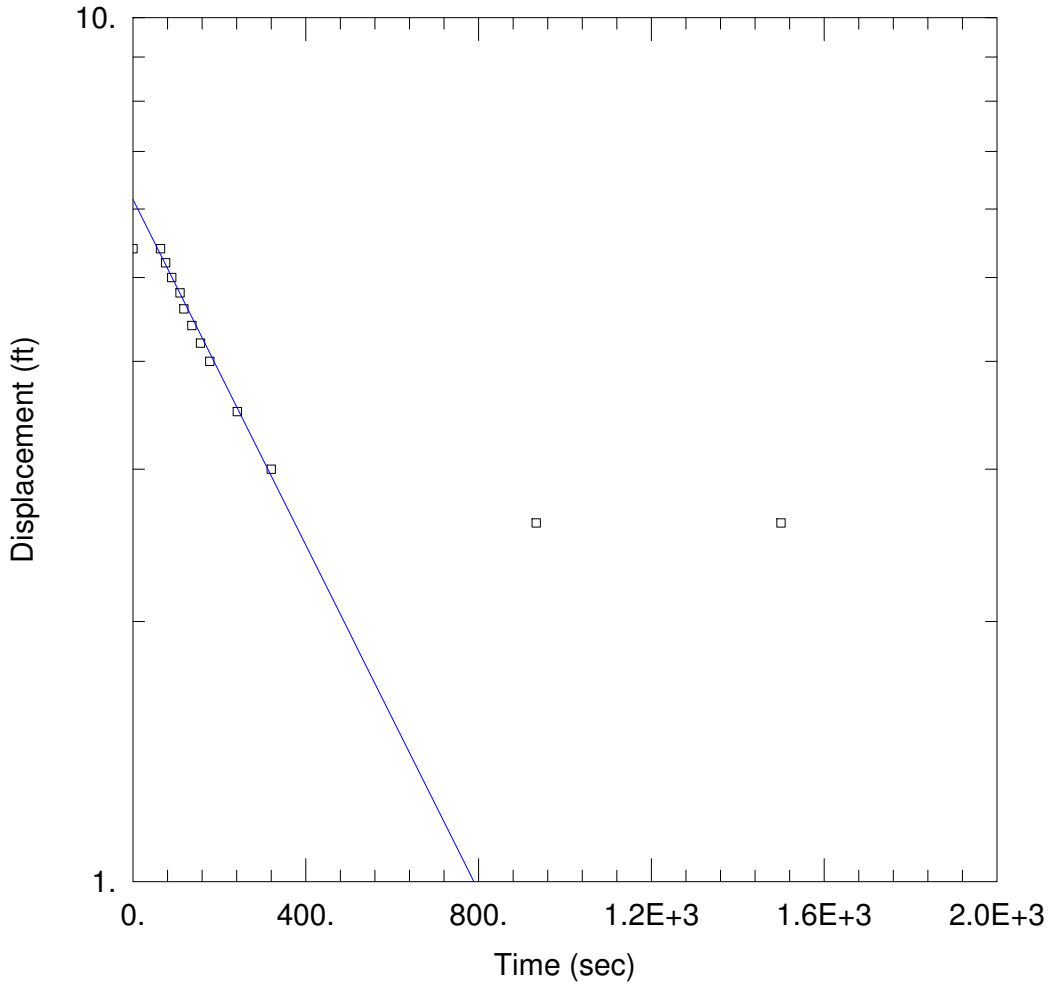
DWB = Dry weight basis. < Not detected. Less than LOD.

Report Approved By:
For Robert D. Magnuson
Lab Director
MN Certification # 027-137-152

Temperature upon arrival (°C): 24.5

Appendix C

Drawdown Test Results



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-3.aqt
Date: 04/30/20 Time: 09:07:09

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-3
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.1

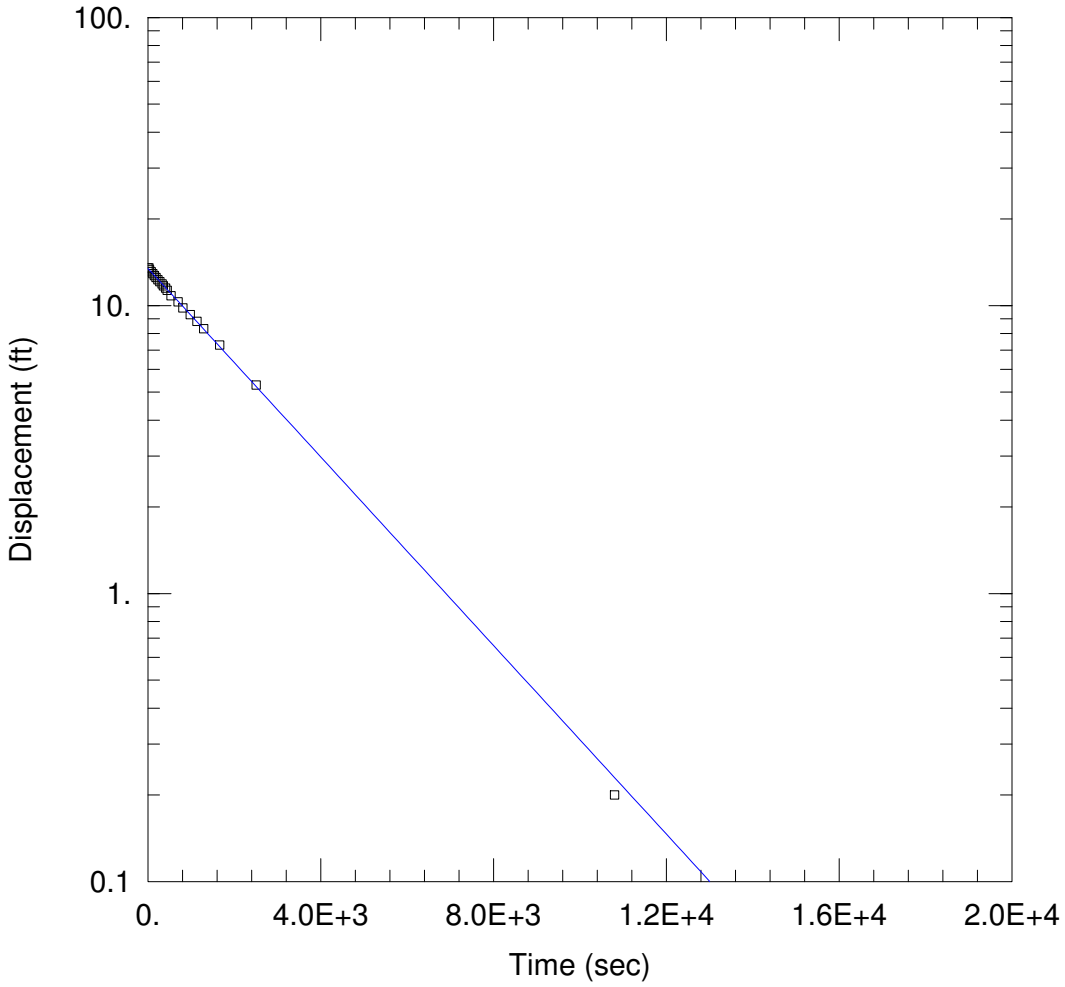
WELL DATA (LS-20-HA-3)

Initial Displacement: 5.4 ft
Total Well Penetration Depth: 7. ft
Casing Radius: 0.083 ft
Static Water Column Height: 7. ft
Screen Length: 7. ft
Well Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.3611 ft/day y0 = 6.157 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-4.aqt
Date: 04/30/20 Time: 09:42:44

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-4
Test Date: 04-20-2020

AQUIFER DATA

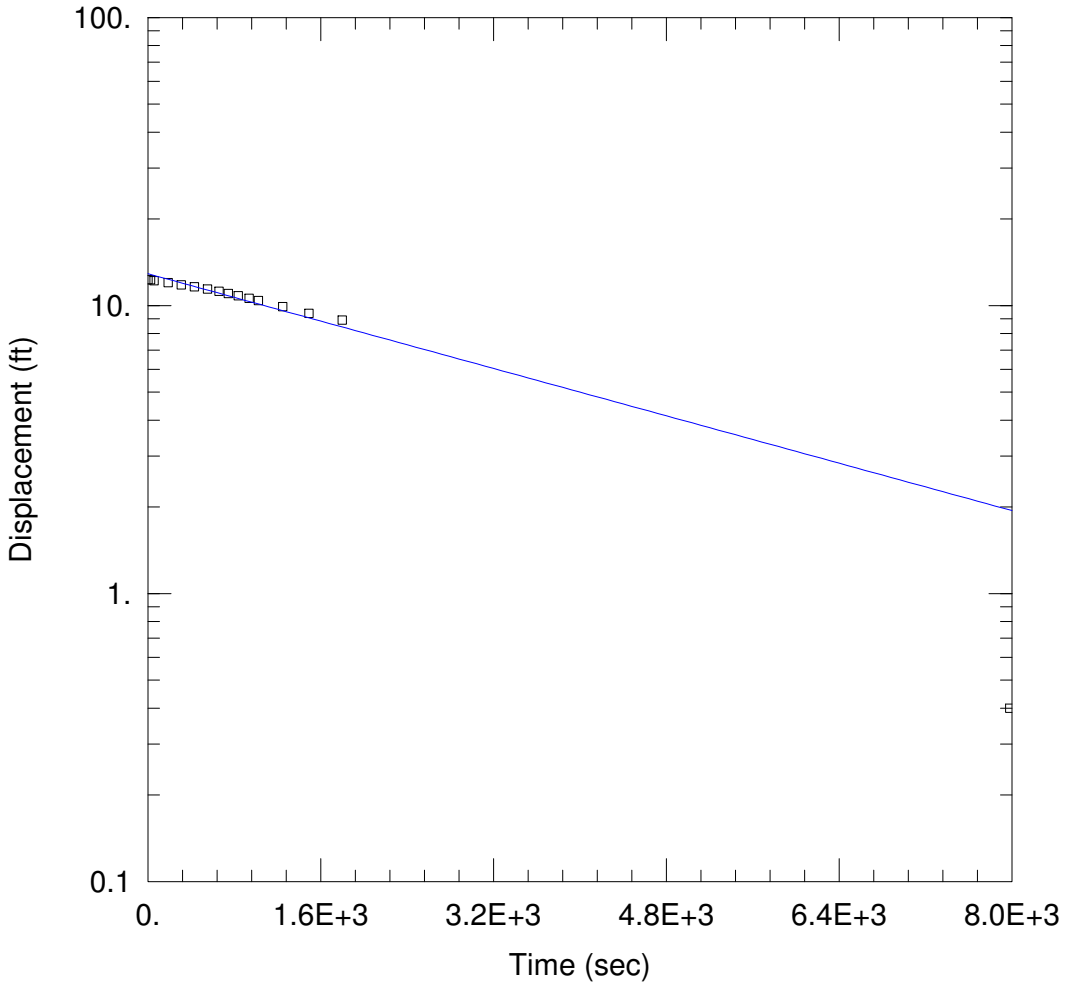
Saturated Thickness: 14. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (LS-20-HA-4)

Initial Displacement: 13.5 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 14. ft
Screen Length: 14. ft
Well Radius: 0.084 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.03179 ft/day
y0 = 13.45 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-5.aqt
Date: 04/30/20 Time: 09:49:41

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-5
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 0.1

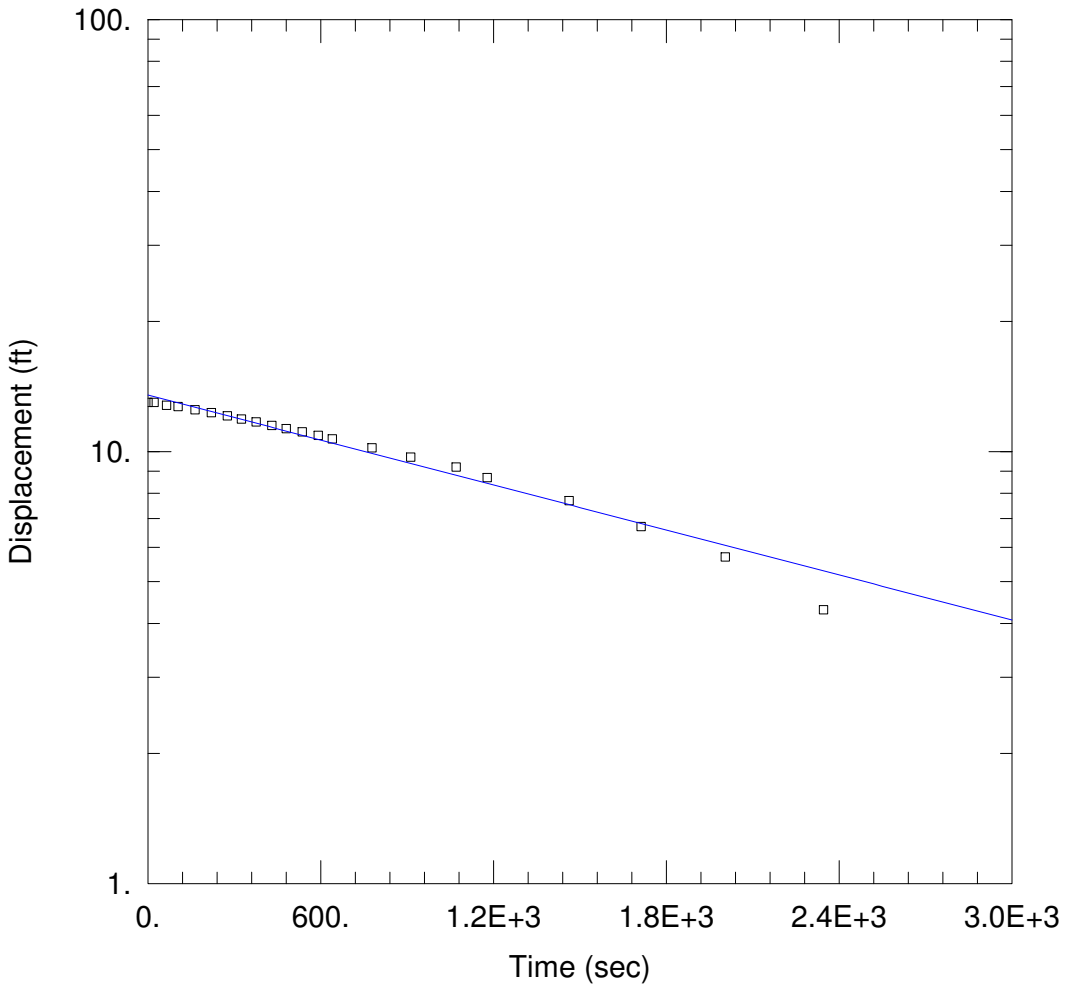
WELL DATA (LS-20-HA-5)

Initial Displacement: 12.3 ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 15. ft
Well Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.01734 ft/day y0 = 12.89 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-5A.aqt
Date: 04/30/20 Time: 09:58:13

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-5-A
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 0.1

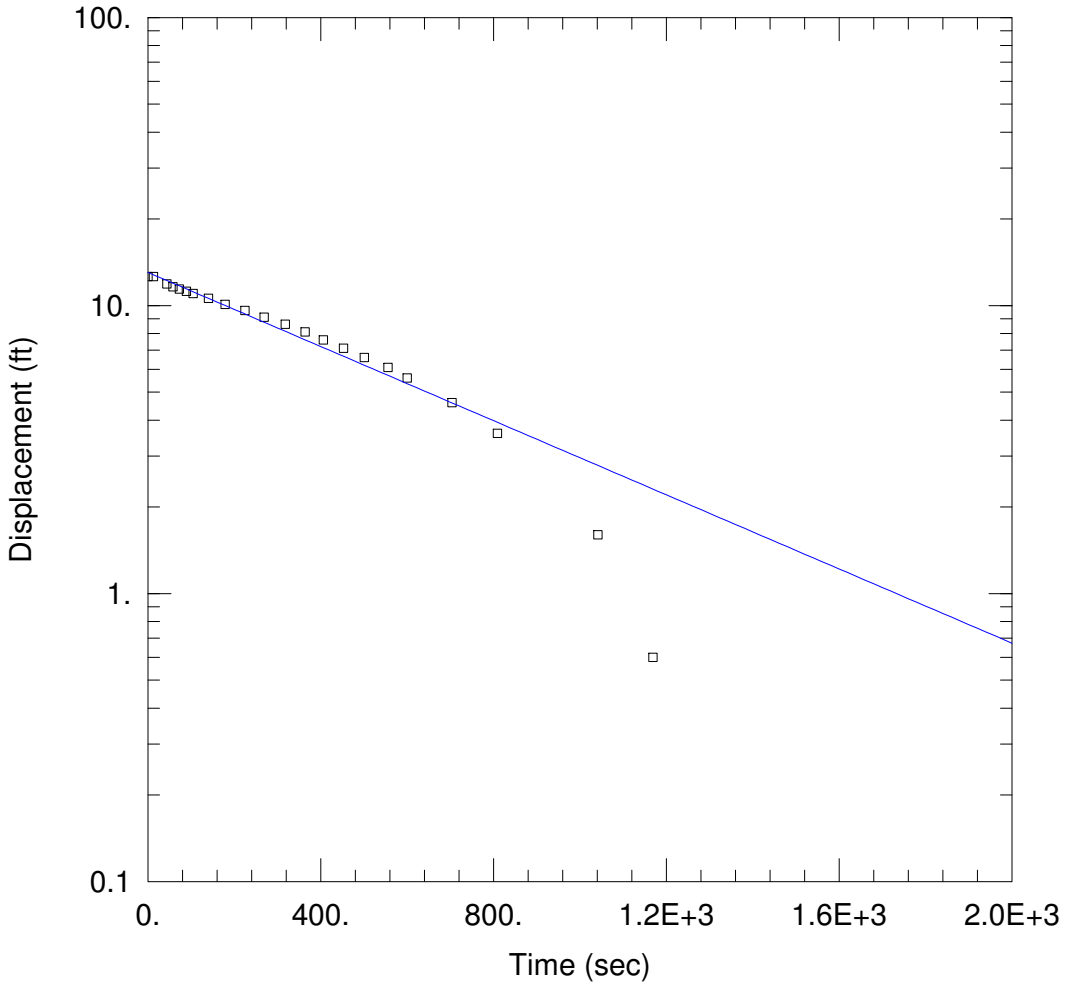
WELL DATA (LS-20-HA-5A)

Initial Displacement: 13. ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 15. ft
Well Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.02927 ft/day
y0 = 13.51 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-6.aqt
Date: 04/30/20 Time: 10:02:38

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-6
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 14. ft Anisotropy Ratio (Kz/Kr): 0.1

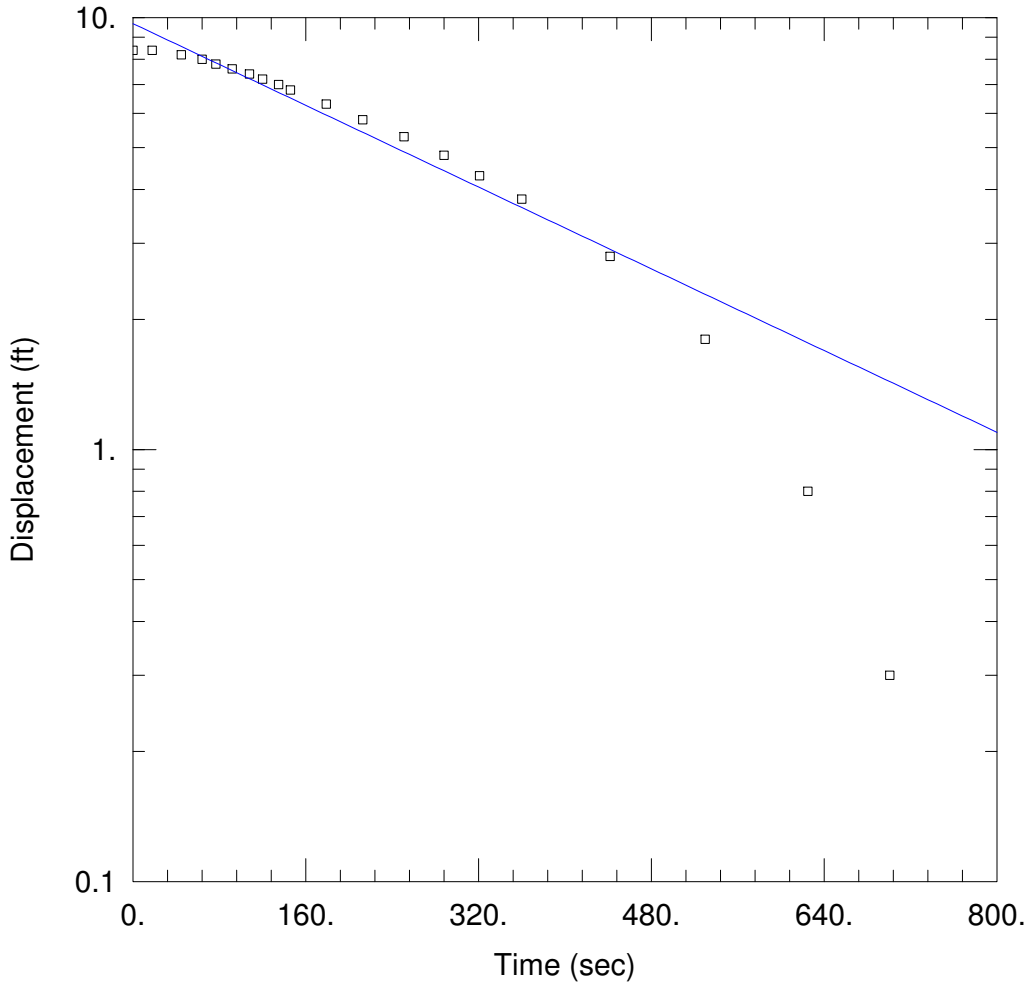
WELL DATA (LS-20-HA-6)

Initial Displacement: 12.6 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 14. ft
Screen Length: 14. ft
Well Radius: 0.084 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.125 ft/day
y0 = 13.03 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-7.aqt
Date: 04/30/20 Time: 10:09:38

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-7
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.1

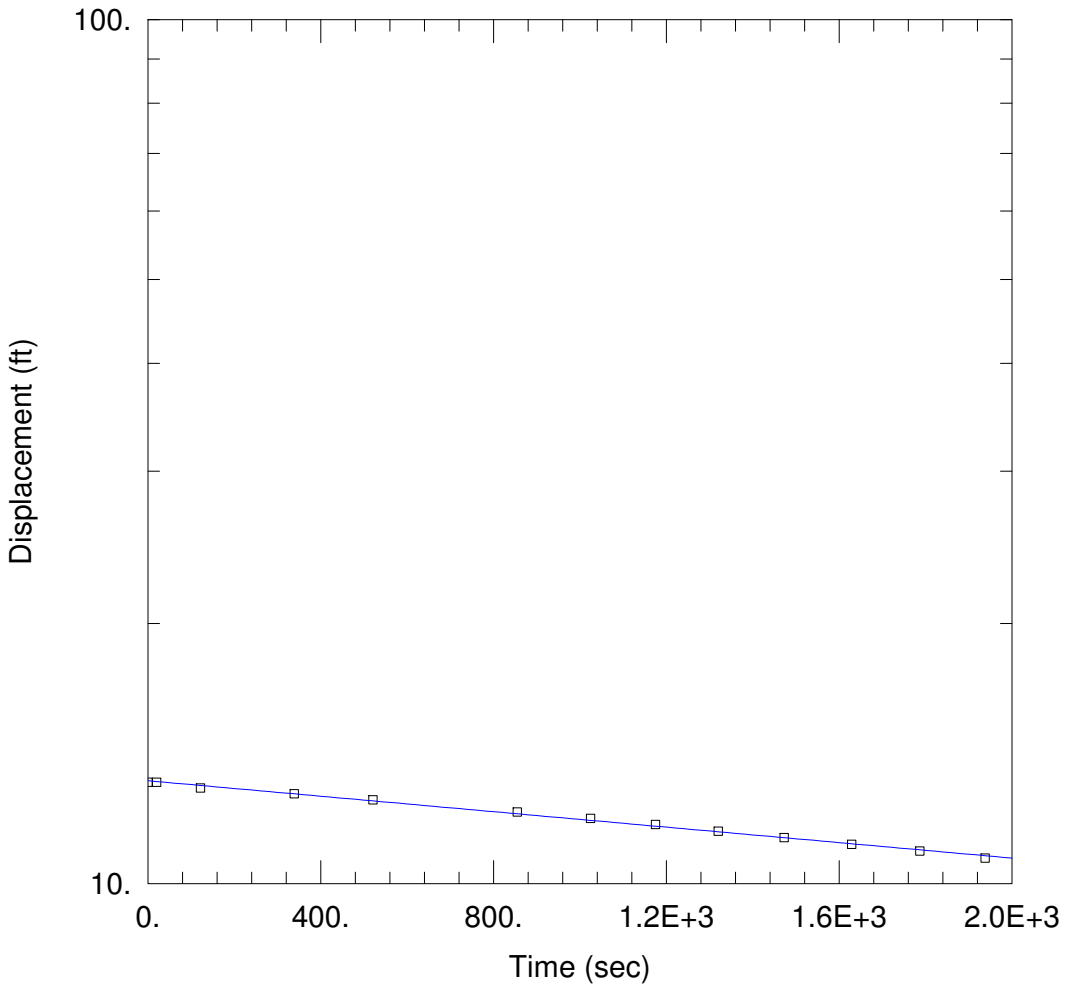
WELL DATA (LS-20-HA-7)

Initial Displacement: 8.4 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.2728 ft/day y0 = 9.679 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-8.aqt
Date: 04/30/20 Time: 10:14:06

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-8
Test Date: 04-20-2020

AQUIFER DATA

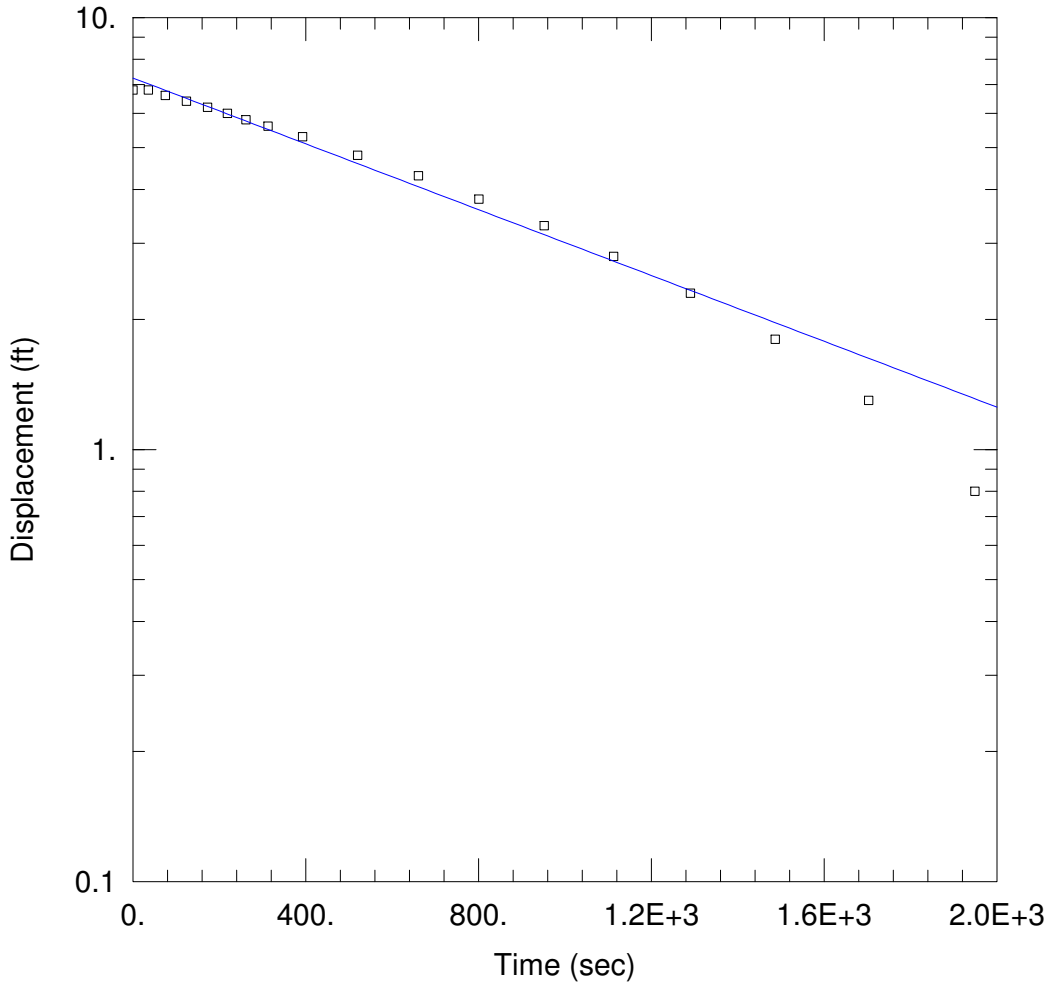
Saturated Thickness: 14. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (LS-20-HA-8)

Initial Displacement: 13.1 ft
Total Well Penetration Depth: 14. ft
Casing Radius: 0.083 ft
Static Water Column Height: 14. ft
Screen Length: 14. ft
Well Radius: 0.084 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.008693 ft/day
y0 = 13.15 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-9.aqt
Date: 04/30/20 Time: 10:18:17

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-9
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 0.1

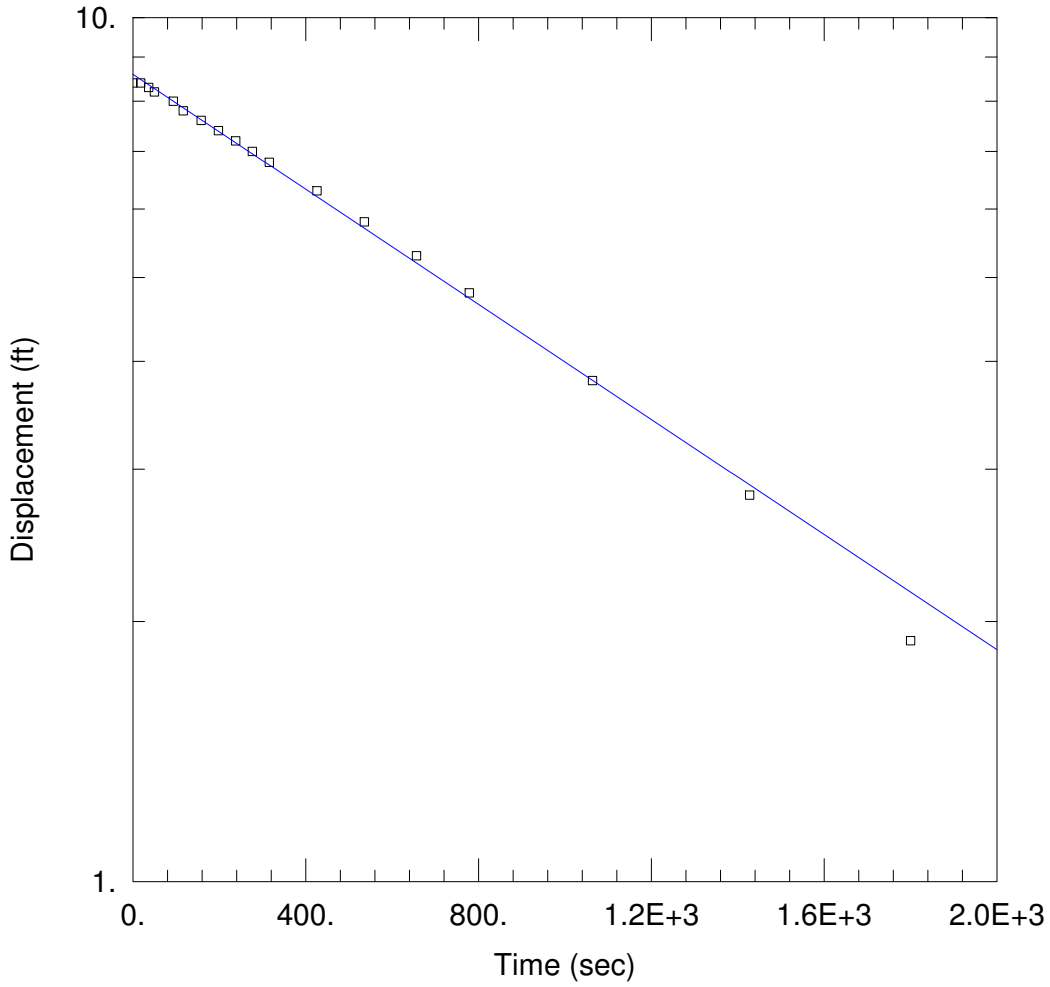
WELL DATA (LS-20-HA-9)

Initial Displacement: 6.8 ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 15. ft
Well Radius: 0.125 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.06425 ft/day y0 = 7.244 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-10.aqt
Date: 04/30/20 Time: 10:21:34

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-10
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 10. ft Anisotropy Ratio (Kz/Kr): 0.1

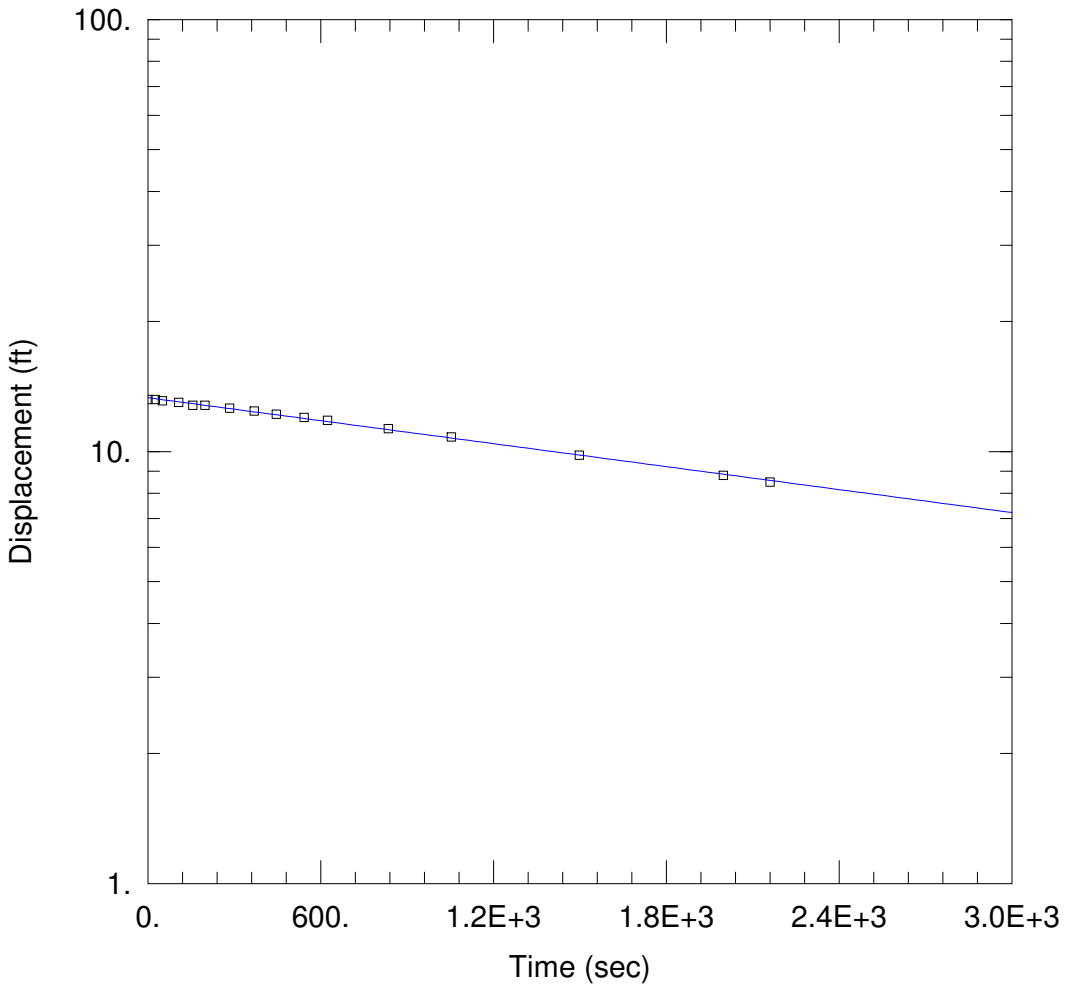
WELL DATA (LS-20-HA-10)

Initial Displacement: 8.4 ft
Total Well Penetration Depth: 10. ft
Casing Radius: 0.083 ft
Static Water Column Height: 10. ft
Screen Length: 10. ft
Well Radius: 0.084 ft

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.08409 ft/day y0 = 8.597 ft



WELL TEST ANALYSIS

Data Set: P:\...\LS-20-HA-11.aqt
Date: 04/30/20 Time: 10:25:40

PROJECT INFORMATION

Company: Barr
Client: Enbridge
Project: 49161299
Location: LaSalle Crossing
Test Well: LS-20-HA-11
Test Date: 04-20-2020

AQUIFER DATA

Saturated Thickness: 15. ft Anisotropy Ratio (Kz/Kr): 0.1

WELL DATA (LS-20-HA-11)

Initial Displacement: 13.2 ft
Total Well Penetration Depth: 15. ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 15. ft
Well Radius: 0.125 ft

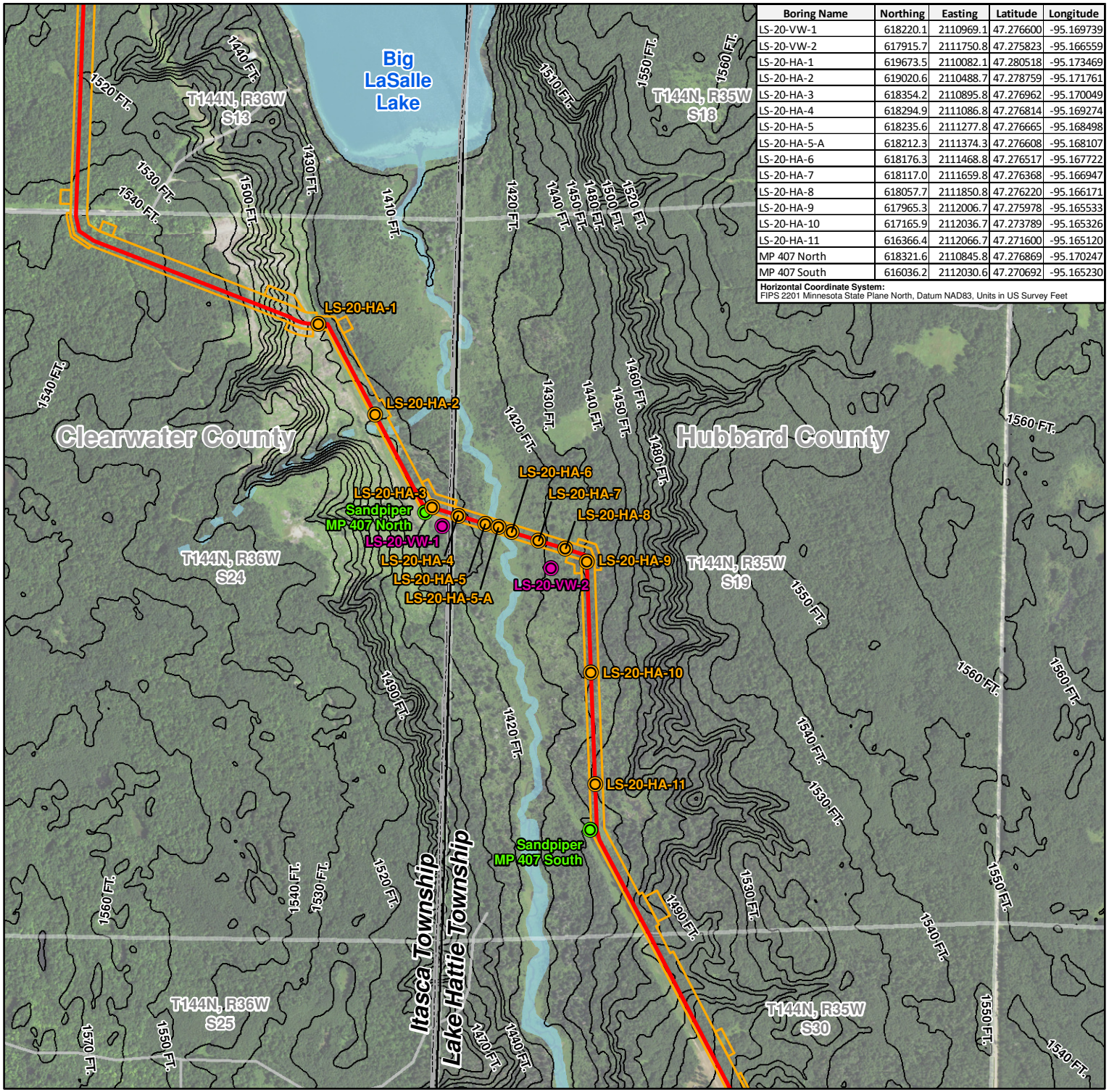
SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 0.01494 ft/day y0 = 13.32 ft

Appendix D

LaSalle Creek Groundwater Monitoring Locations



Boring Name	Northing	Easting	Latitude	Longitude
LS-20-VW-1	618220.1	2110969.1	47.276600	-95.169739
LS-20-VW-2	617915.7	2111750.8	47.275823	-95.166559
LS-20-HA-1	619673.5	2110082.1	47.280518	-95.173469
LS-20-HA-2	619020.6	2110488.7	47.278759	-95.171761
LS-20-HA-3	618354.2	2110895.8	47.276962	-95.170049
LS-20-HA-4	618294.9	2111086.8	47.276814	-95.169274
LS-20-HA-5	618235.6	2111277.8	47.276665	-95.168498
LS-20-HA-5-A	618212.3	2111374.3	47.276608	-95.168107
LS-20-HA-6	618176.3	2111468.8	47.276517	-95.167722
LS-20-HA-7	618117.0	2111659.8	47.276368	-95.166947
LS-20-HA-8	618057.7	2111850.8	47.276220	-95.166171
LS-20-HA-9	617965.3	2112006.7	47.275978	-95.165533
LS-20-HA-10	617165.9	2112036.7	47.273789	-95.165326
LS-20-HA-11	616366.4	2112066.7	47.271600	-95.165120
MP 407 North	618321.6	2110845.8	47.276869	-95.170247
MP 407 South	616036.2	2112030.6	47.270692	-95.165230

Horizontal Coordinate System:
FIPS 2201 Minnesota State Plane North, Datum NAD83, Units in US Survey Feet

- Proposed Longterm Monitoring Locations
- Hand Auger Locations (Completed by Barr)
- Previous Sandpiper Geotechnical Exploration Locations (Completed by Barr)
- Line 3 Replacement Project
- Line 3 Construction Workspace
- Waterbody
- Perennial Stream
- Intermittent Stream

Elevation Contours

- Index (10 ft. Interval)

0 1,000 2,000

Feet

1 Inch = 1,000 Feet

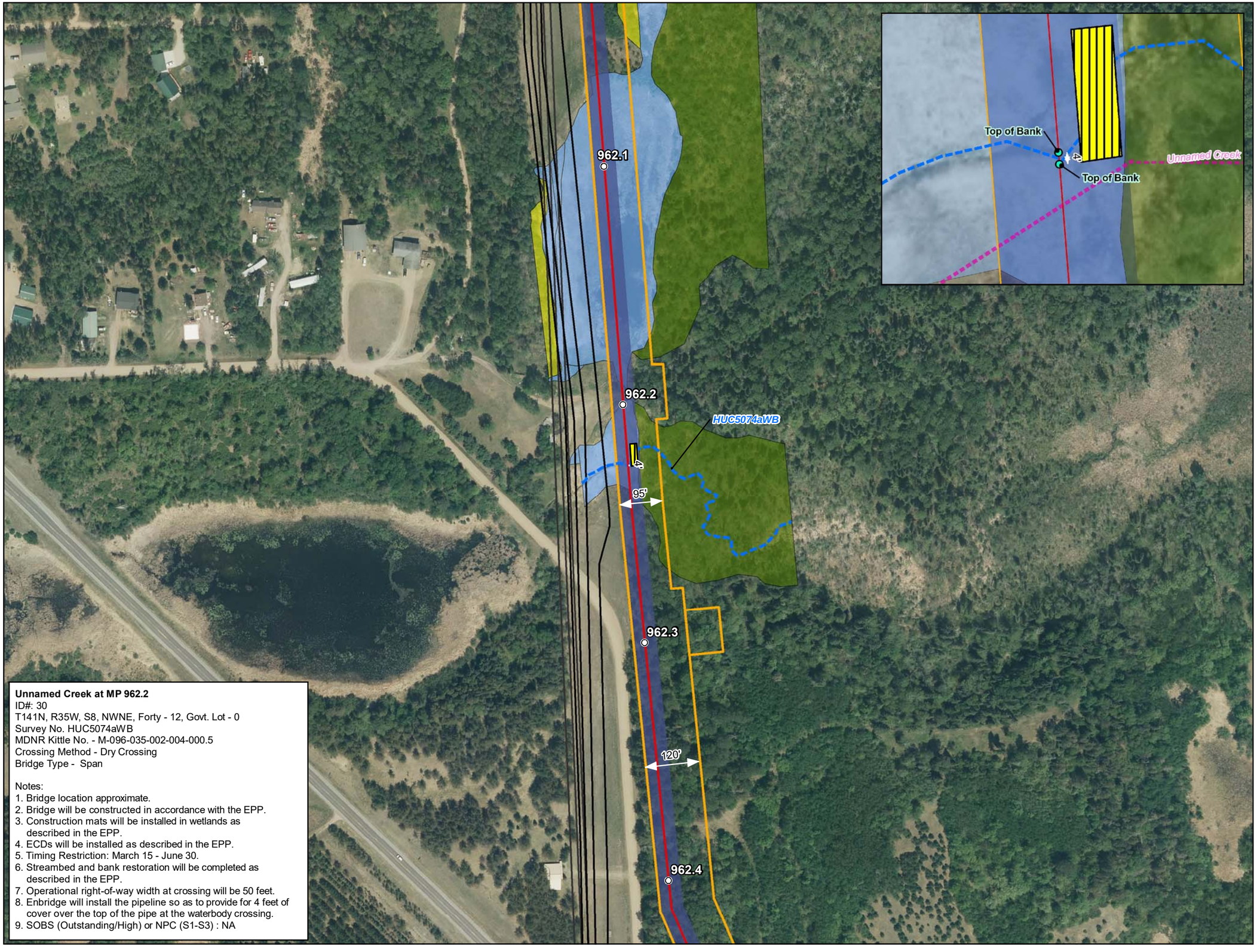
Aerial Imagery: FSA NAIP 2019

Figure 1
SITE LOCATION
LaSalle Creek
Line 3 Mainline Replacement
Clearwater & Hubbard Counties, MN

ENBRIDGE

Barr Footer: ArcGIS 10.7.1, 2020-10-12 11:46 File: I:\Client\Enbridge_Energy\Work_Orders\Mainline_Permitting\49161244\Maps\Report_Maps\MP_407_2020\Report\Figure1_LaSalleCreek_SiteLocation_20201005.mxd User: MAC2

MDNR ID No. 30: MP 962.2; Unnamed Creek (M-096-035-002-004-000.5)



Unnamed Creek at MP 962.2
ID#: 30
T141N, R35W, S8, NWNE, Forty - 12, Govt. Lot - 0
Survey No. HUC5074aWB
MDNR Kittle No. - M-096-035-002-004-000.5
Crossing Method - Dry Crossing
Bridge Type - Span

Notes:
1. Bridge location approximate.
2. Bridge will be constructed in accordance with the EPP.
3. Construction mats will be installed in wetlands as described in the EPP.
4. ECDs will be installed as described in the EPP.
5. Timing Restriction: March 15 - June 30.
6. Streambed and bank restoration will be completed as described in the EPP.
7. Operational right-of-way width at crossing will be 50 feet.
8. Enbridge will install the pipeline so as to provide for 4 feet of cover over the top of the pipe at the waterbody crossing.
9. SOBS (Outstanding/High) or NPC (S1-S3) : NA

0 100 200 Feet
1 inch = 200 feet

N W E S

- Milepost
- Proposed L3R Centerline
- Existing Utility
- Existing Utility
- Permanent Right-of-Way
- Construction Right-of-Way/ATWS
- Bridge
- Field Delineated Waterbody

Delineated Wetlands
- PEM
- PFO
- PSS

Line 3 Replacement Project

Crossing Plan

ID# 30
Survey No. HUC5074aWB

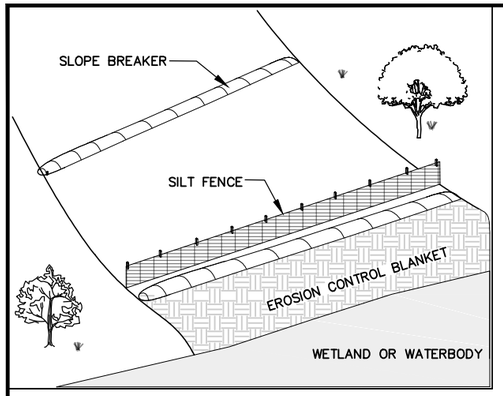
Unnamed Creek

Hubbard County, Minnesota

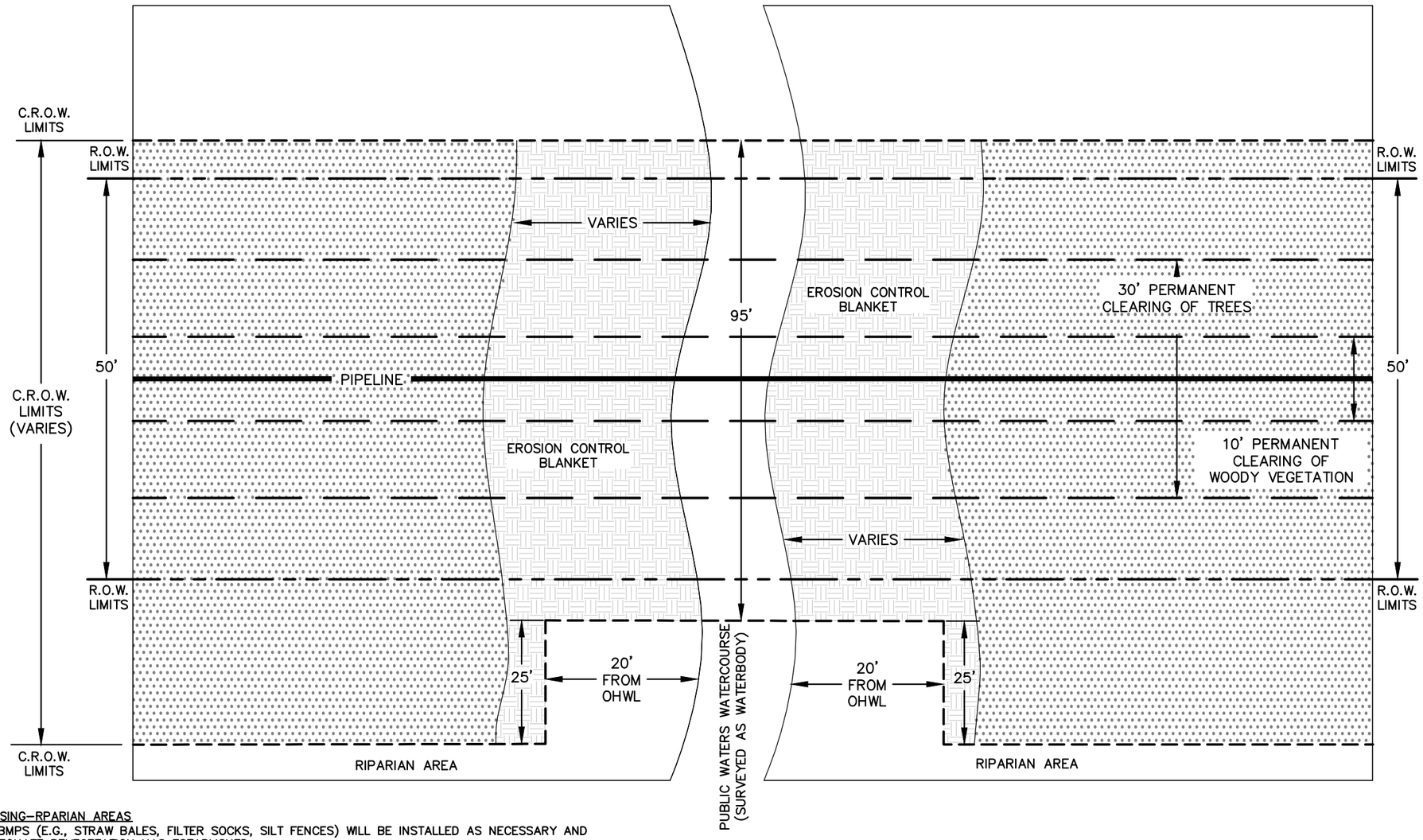
ENBRIDGE
October 2020

For Environmental Review Purposes Only

Source: Z:\Clients\E_H\Enbridge\Line_3_Full_Replacement\Permitting\StatePublic_Waters\2020_09\Figures\L3R_Waters_App_Dry_Crossing_Mod_Dry_2020_09.mxd
Date: (10/7/2020)



SEEDING AREA



PUBLIC WATERS WATERCOURSE (SURVEYED AS WATERBODY) CROSSING–RPARIAN AREAS

1) PRIOR TO DISTURBANCE, EROSION AND SEDIMENT CONTROL BMPS (E.G., STRAW BALES, FILTER SOCKS, SILT FENCES) WILL BE INSTALLED AS NECESSARY AND WILL REMAIN IN PLACE UNTIL THE AREA HAS STABILIZED AND ADEQUATE REVEGETATION HAS ESTABLISHED.

2) ENBRIDGE WILL RESTORE THE BANKS AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS UNLESS THE SLOPE IS DETERMINED BY TO BE UNSTABLE. WHERE THE SLOPE OF THE BANKS IS DETERMINED TO BE UNSTABLE OR HAS THE POTENTIAL TO ERODE OR FAIL, THE BANKS WILL BE RESHAPED TO TRANSITION THE DISTURBED AREAS INTO THE NATURAL STREAM BANK WITH THE INTENT TO STABILIZE THE BANK AND CREATE A BLENDED, NATURAL APPEARANCE.

3) SOIL STABILIZATION WILL BE INITIATED WITHIN 24 HOURS AFTER INSTALLATION OF THE CROSSING USING THE OPEN CUT TRENCH METHOD AND PRIOR TO RESTORING FLOW USING THE DAM AND PUMP OR FLUME METHOD, UNLESS SITE AND PERMIT CONDITIONS DELAY PERMANENT INSTALLATION.

4) PERMANENT SLOPE BREAKERS WILL BE INSTALLED AT THE BASE OF SLOPED APPROACHES TO PREVENT SEDIMENT FLOW INTO WATERBODIES AS DESCRIBED IN THE EPP (FIGURE 20):

a. PERMANENT SLOPE BREAKERS WILL BE INSTALLED TO MINIMIZE CONCENTRATED OR SHEET FLOW RUNOFF IN DISTURBED AREAS IN ACCORDANCE WITH THE FOLLOWING MAXIMUM ALLOWABLE SPACING UNLESS OTHERWISE SPECIFIED IN PERMIT CONDITIONS.

i.

SLOPE (%)	APPROXIMATE SPACING (FT)
1. <5	250
2. >5–15	200
3. 15–25	150
4 >25	<100

5) WATERBODY BANKS WILL BE SEEDED WITH AN APPROPRIATE SEED MIX AS SPECIFIED IN THE EPP (SECTION 7.8) AND COVERED WITH AN EROSION CONTROL BLANKET.

6) WHERE A WATERBODY IS LOCATED WITHIN A WETLAND, ENBRIDGE WILL RE–SEED THE BANKS WITH THE APPLICABLE WETLAND SEED MIX DESCRIBED IN THE EPP (SECTION 7.7).

7) ADDITIONAL VEGETATION REQUIREMENTS MAY ALSO BE CONTAINED WITHIN PROJECT–SPECIFIC PERMITS

ISSUED FOR PERMIT 12/13/19

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMIT	AJM	12/13/19	KEH	KD
A	ISSUED FOR REVIEW	AJM	12/10/19	KEH	KD

DWN. BY: AJM	DATE 12/10/19
CHK. KEH	
PROJ. ENGR. DG	
PROJ. MGR. KD	
CLIENT APP.	

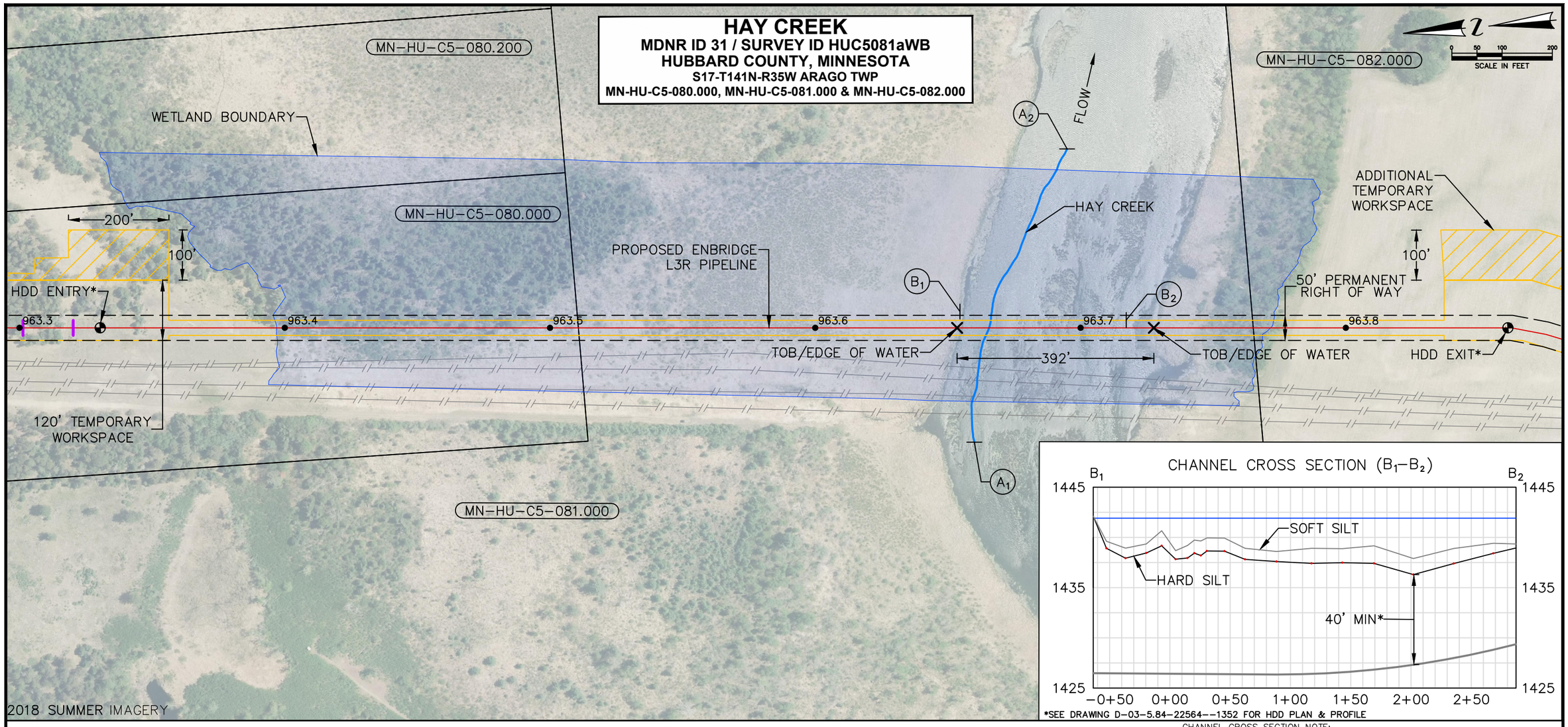
ENBRIDGE

LINE 3 REPLACEMENT
PUBLIC WATERS WATERCOURSE (SURVEYED AS WATERBODY) CROSSING TYPICAL FINAL STREAM BANK STABILIZATION & EROSION CONTROL

SCALE NTS | DWG. NO.

MDNR ID No. 31: MP 963.7; Hay Creek (M-096-035-002)

HAY CREEK
MDNR ID 31 / SURVEY ID HUC5081aWB
HUBBARD COUNTY, MINNESOTA
S17-T141N-R35W ARAGO TWP
MN-HU-C5-080.000, MN-HU-C5-081.000 & MN-HU-C5-082.000



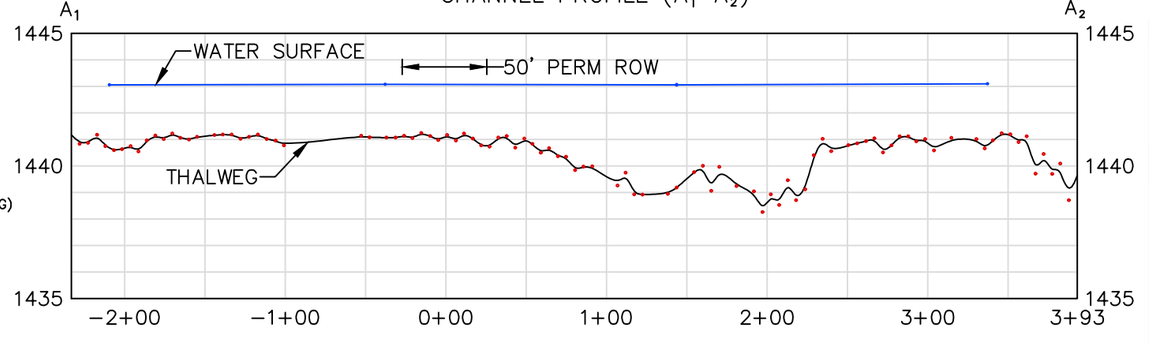
*SEE DRAWING D-03-5.84-22564--1352 FOR HDD PLAN & PROFILE

NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. BANKFULL ELEVATION NOT AVAILABLE
3. SOBS (O/H) OR NPC (S1-3): N/A
4. MDNR REGION 1 PWI – COOL/WARM WATER FISHERY: MARCH 15 – JUNE 30. 24-HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
5. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2015 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.

LEGEND
- PROPOSED ENBRIDGE L3R PIPELINE
- OTHER PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY (ROSGEN SURVEY – THALWEG)
- TRACT BOUNDARY
- WETLAND
- ADDITIONAL TEMPORARY WORKSPACE
- MN-XX-XX-XXX.XXX — TRACT ID
- ROSGEN SURVEY POINT – WATER SURFACE
- ROSGEN SURVEY POINT – RIVER BOTTOM (THALWEG)
- HDD ENTRY EXIT POINT
- TOP OF BANK
- TRENCH BREAKER (LOCATIONS ARE APPROXIMATE)

CHANNEL PROFILE (A1–A2)



NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

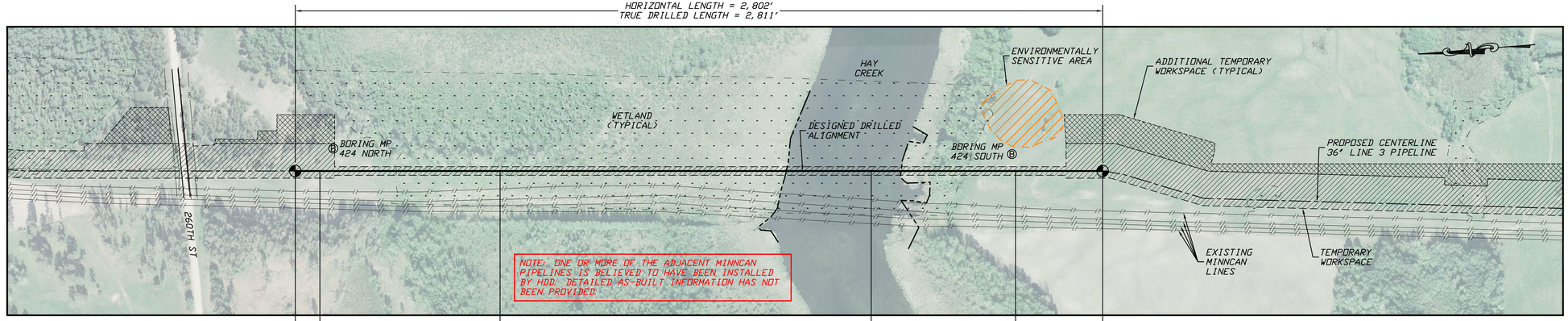
ENBRIDGE

DWN. BY: AJJ	DATE 10/2020
CHK.	
PROJ. ENGR.	
PROJ. MGR.	
CLIENT APP.	

PROPOSED ENBRIDGE L3R PIPELINE
PRIMARY METHOD – HDD
CROSSING OF HAY CREEK
ENBRIDGE MP 963.7
HUBBARD COUNTY, MINNESOTA

SCALE: NOTED
DWG. NO.: B-93-5.84-MDNR-31-0

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY



PLAN

SCALE: 1"=200'

ENTRY POINT @ 10°
0+00.00, 1461.29
N 530245.07, E 2114880.10

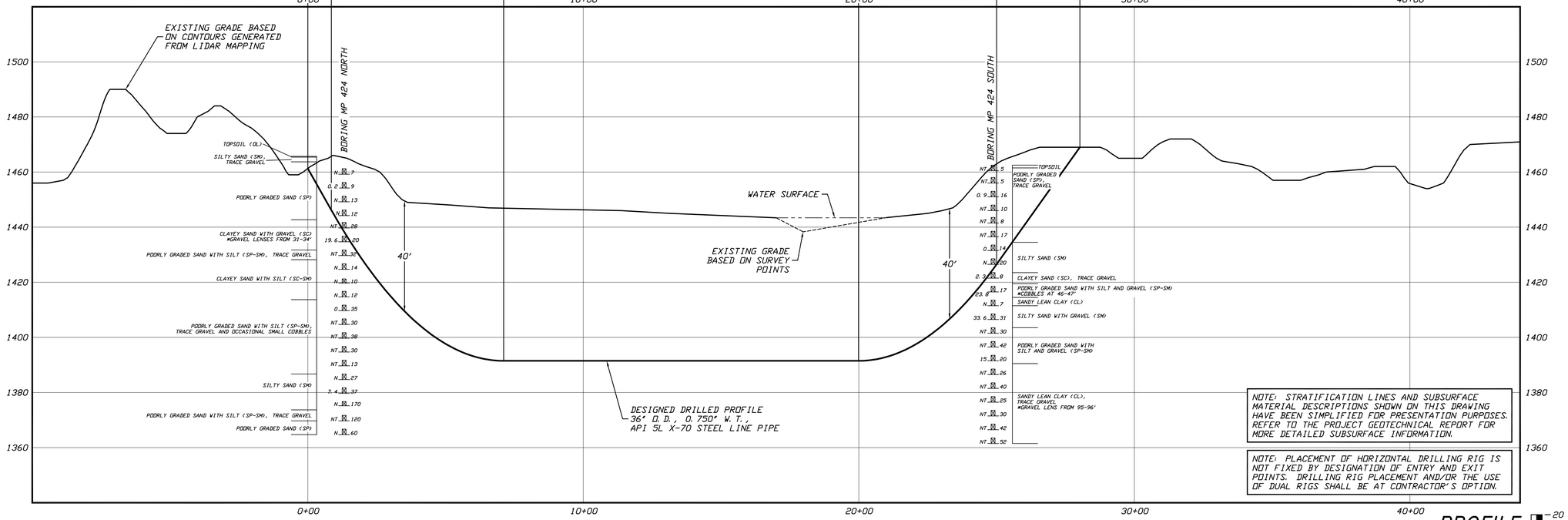
P.C. 10° SAG BEND
0+85.62, 1446.19
RADIUS = 3,600'

P.T. 10° SAG BEND
7+10.75, 1391.50

P.C. 8° SAG BEND
19+98.97, 1391.50
RADIUS = 3,600'

P.T. 8° SAG BEND
24+99.99, 1426.53

EXIT POINT @ 8°
28+02.15, 1469.00
N 527452.53, E 2114648.22



NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE PROJECT GEOTECHNICAL REPORT FOR MORE DETAILED SUBSURFACE INFORMATION.

NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL

20 10 0
400 200 100 0

GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
└ PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

SHELBY TUBE SAMPLE

53 T
└ PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY BARR ENGINEERING COMPANY, DULUTH, MN. REFER TO THE PROJECT GEOTECHNICAL REPORT DATED SEPTEMBER, 2014 FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, SUPERIOR, WISCONSIN.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO MINNESOTA STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: AS STAKED BY COMPANY
2. EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

LINE 3 PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF HAY CREEK
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: HUBBARD COUNTY, MINNESOTA

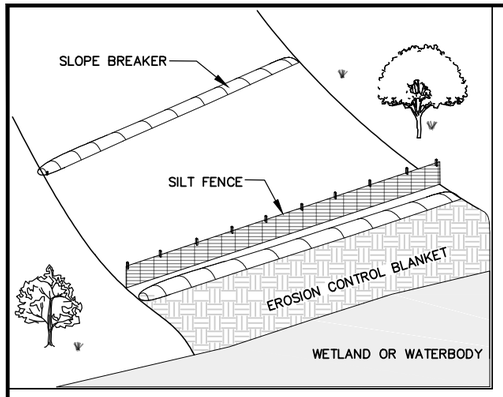
DRAWN	DATE	CHECKED	APPROVED	DRAWING NUMBER	REVISION
ACM	07/25/17	DMP	JSP	D-03-5.84-22564-C-1352	C

NO.	DATE	REVISION DESCRIPTION	BY	(CHK'D)	APP.
A	07/25/17	ISSUE FOR CONSTRUCTION	ACM	DMP	JSP
B	09/29/17	UPDATE WORKSPACE AND ESA LABEL	LKB	JSP	JSP
C	10/27/19	UPDATE WETLAND BOUNDARIES AND WORKSPACE	KWW	JSP	JSP

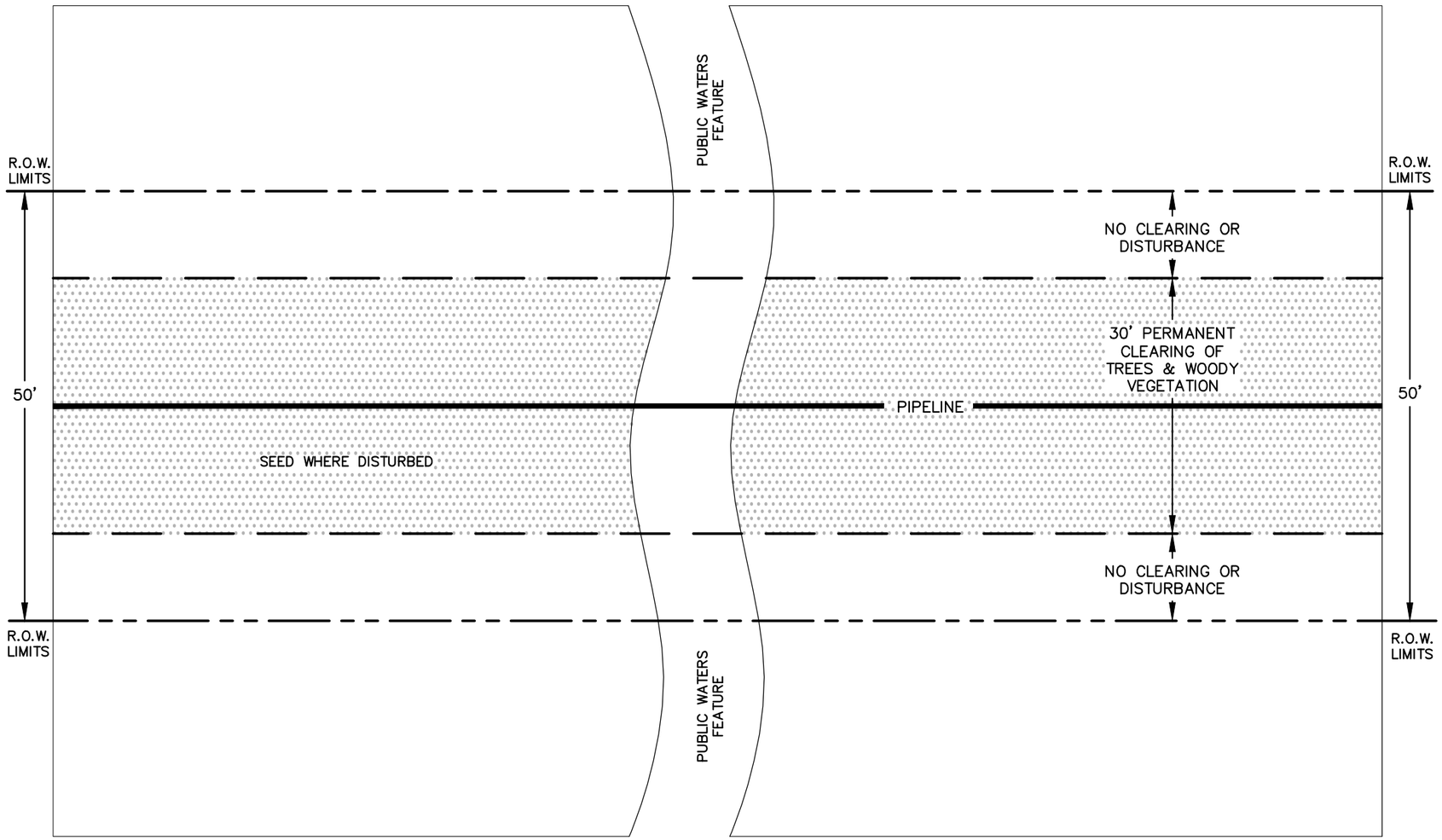
J.D.Hair&Associates,Inc.
Consulting Engineers
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Enbridge\1404

MILEPOST
D963



SEEDING AREA



PUBLIC WATERS FEATURE - HDD CROSSING

1) DISTURBANCE OF THE ROW IS LIMITED TO THE 30-FOOT-WIDE CLEARING OF TREES AND WOODY VEGETATION AND IMPACTS RESULTING FROM TRAVEL LANES AND/OR BRIDGES.
2) ANY WETLAND OR WATERBODY BANK THAT IS DISTURBED WILL BE STABILIZED WITH EROSION AND SEDIMENT CONTROL BMP AND RESTORED TO AS NEAR AS PRACTICABLE TO PRE-CONSTRUCTION CONDITIONS.
3) PERMANENT REVEGETATION SEEDING OF DISTURBED WATERBODY BANKS WILL UTILIZE THE BWSR RIPARIAN SEED MIXES IN ACCORDANCE WITH THE EPP (SECTION 7.8).
4) PERMANENT REVEGETATION SEEDING OF DISTURBED WETLANDS WILL TAKE PLACE IN ACCORDANCE WITH THE EPP (SECTION 7.7). 7) IN DISTURBED WETLAND AREAS, THE APPROPRIATE SEED MIX WILL BE DETERMINED USING THE RESULTS OF PRE-CONSTRUCTION WETLAND IN DISTURBED WETLAND AREAS, HYDROLOGICAL CHARACTERISTICS, AND SITE-SPECIFIC CONDITIONS.

ISSUED FOR PERMIT 12/13/19

NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMIT	AJM	12/13/19	KEH	KD
A	ISSUED FOR REVIEW	AJM	12/10/19	KEH	KD

DWN. BY: AJM	DATE 12/10/19	
CHK. KEH		
PROJ. ENGR. DG		
PROJ. MGR. KD		
CLIENT APP.		

ENBRIDGE

LINE 3 REPLACEMENT
PUBLIC WATERS HDD CROSSING TYPICAL
FINAL STREAM STABILIZATION & EROSION CONTROL

SCALE NTS | DWG. NO.

MDNR ID No. 32: MP 967.7; Portage Lake - Public Water Basin

PORTAGE LAKE
MDNR ID 32 / SURVEY ID HUC5098a1W
HUBBARD COUNTY, MINNESOTA
S6-T140N-R35W TODD TWP
MN-HU-C5-098.000 & MN-HU-C5-097.000

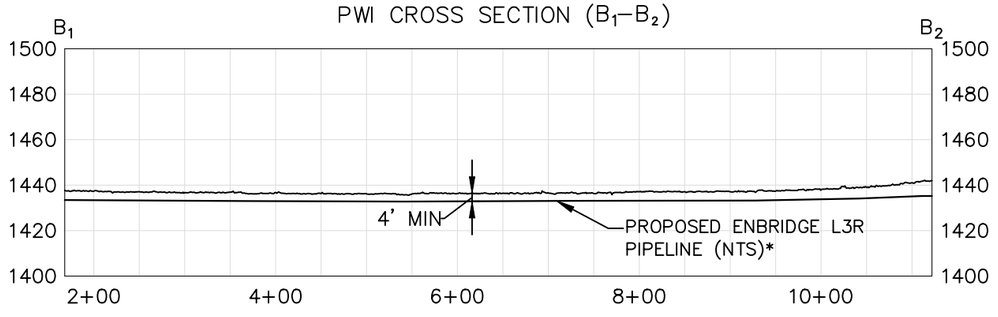
SCALE IN FEET 0 25 50 100

WETLAND BOUNDARY
MN-HU-C5-098.000
ADDITIONAL TEMPORARY WORKSPACE
PWI BOUNDARY
TEMPORARY MAT ROAD (SEE RESTORATION PLAN)
PROPOSED ENBRIDGE L3R PIPELINE
120' TEMPORARY WORKSPACE
95' TEMPORARY WORKSPACE
967.6
967.7
967.8
B_1
B_2
MN-HU-C5-097.000
50' PERMANENT RIGHT OF WAY
2018 SUMMER IMAGERY

NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. NO ROSGEN DATA AVAILABLE
3. SOBS (O/H) OR NPC (S1-3): PARTIAL OVERLAP OF S1-S3
4. MDNR FISHERIES EXEMPTION (GRANTED 8/27/2020)

LEGEND
- PROPOSED ENBRIDGE L3R PIPELINE
- OTHER PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY
- TRACT BOUNDARY
- TEMPORARY MAT ROAD
- WETLAND
- ADDITIONAL TEMPORARY WORKSPACE
- MN-XX-XX-XXX.XXX — TRACT ID
- TRENCH BREAKER (LOCATIONS ARE APPROXIMATE)

PWI CROSS SECTION (B_1-B_2)



CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2020 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.
2. DEPTH OF COVER AT CENTERLINE WAS DEVELOPED USING THE BOTTOM ELEVATION OF THE DEEPEST UPSTREAM OR DOWNSTREAM POOL WITHIN THE SURVEYED REACH, UNLESS OTHERWISE NOTED IN APPLICATION MATERIALS.
3. MEAN MEANDER BELT WIDTH: N/A
4. MEANDER WIDTH RATIO: N/A

NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

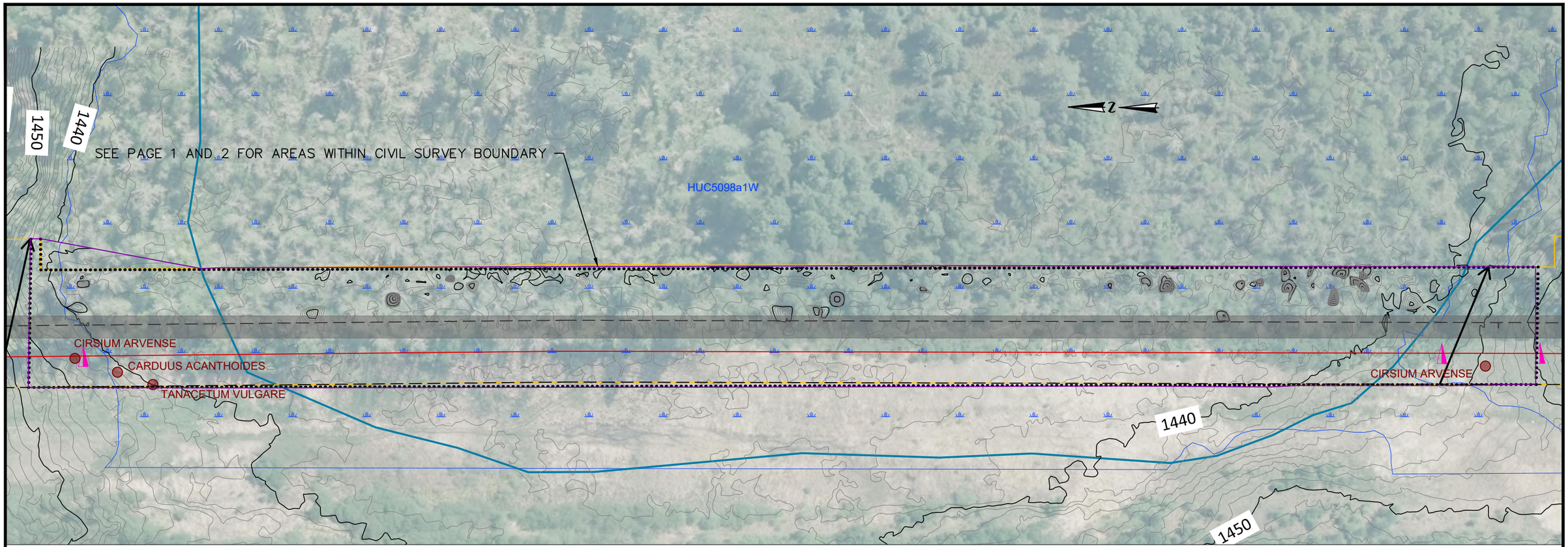
ENBRIDGE

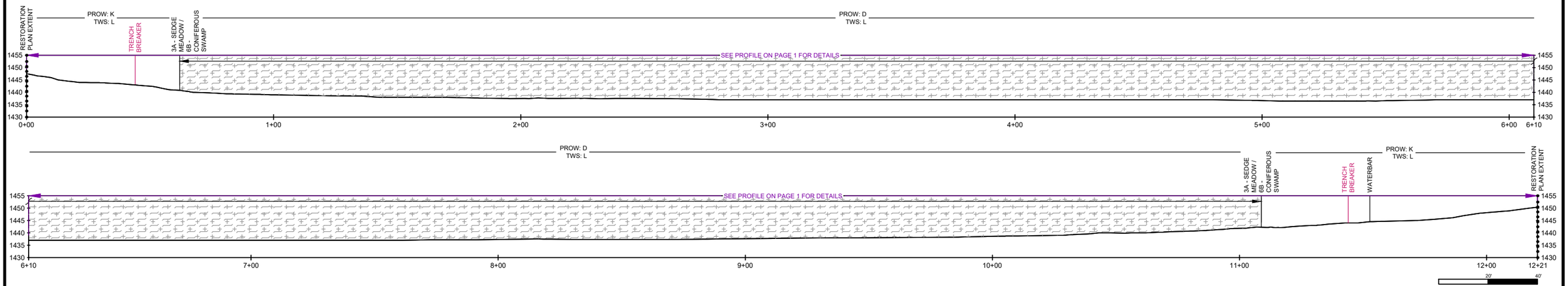
DWN. BY: AJJ	DATE 10/2020
CHK.	
PROJ. ENGR.	
PROJ. MGR.	
CLIENT APP.	

PROPOSED ENBRIDGE L3R PIPELINE
PRIMARY METHOD - WETLAND OPEN CUT
CROSSING OF PORTAGE LAKE
ENBRIDGE MP 967.7
HUBBARD COUNTY, MINNESOTA

SCALE: NOTED
DWG. NO.: B-93-5.84-MDNR-32-0

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY





BWSR SEED MIX	D: WET MEADOW NE (34–371); K: WOODLAND EDGE NE (36–311); L: NATURAL REVEGETATION
SOBS (O/H) or NPC (S1-3)	NO (MODERATE); PARTIAL OVERLAP OF S1–S3

1. ELEVATIONS OUTSIDE OF THE AREA WITHIN CIVIL SURVEY BOUNDARY ARE DERIVED FROM LIDAR. ENBRIDGE WILL RESTORE THE AREAS ADJACENT TO THE PUBLIC WATER WITHIN THE MDNR EXPANDED RESTORATION BOUNDARY TO PRE–CONSTRUCTION CONDITIONS.
2. MDNR FISHERIES EXEMPTION (GRANTED 8/27/2020)
3. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
4. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
5. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.
6. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
7. SEE THE PLANTING PLAN FOR ADDITIONAL DETAIL REGARDING SEEDING PRACTICES AND SEED MIXES AT PUBLIC WATER CROSSINGS.
8. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).

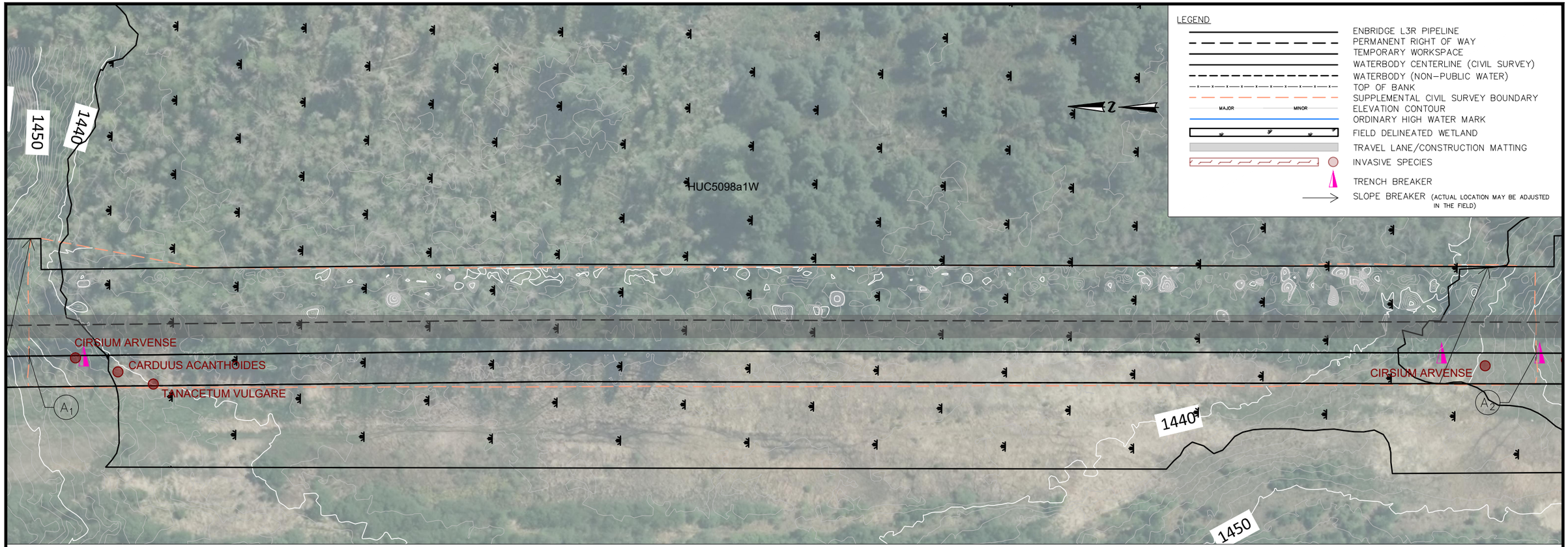
LEGEND

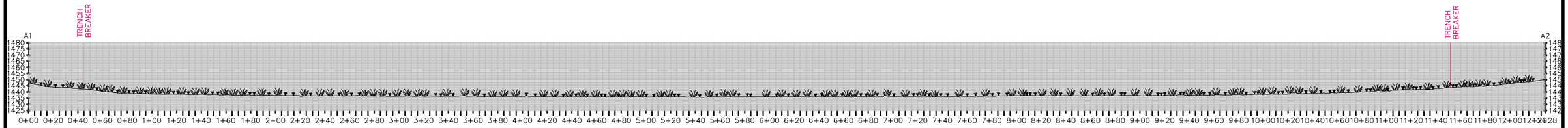
- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY CENTERLINE (CIVIL SURVEY)
- WATERBODY (NON–PUBLIC WATER)
- PUBLIC WATER CIVIL SURVEY BOUNDARY
- MDNR EXPANDED RESTORATION BOUNDARY
- TOP OF BANK
- ELEVATION CONTOUR (MAJOR / MINOR)
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- INVASIVE SPECIES
- TRENCH BREAKER
- PERMANENT SLOPE BREAKER (ACTUAL LOCATION MAY BE ADJUSTED IN THE FIELD)
- 1 – SHALLOW, OPEN WATER
- 2B – SHALLOW MARSH
- 3A – SEDGE MEADOW
- 3B – FRESH (WET) MEADOW
- 5A – SHRUB–CARR
- 5B – ALDER THICKET
- 6A – HARDWOOD SWAMP
- 6B – CONIFEROUS SWAMP

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		
A	ISSUED FOR REVIEW	MJT	09/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
PORTAGE LAKE – MP 967.7 – MDNR ID 32
RE–VEGETATION PLAN: EXPANDED EXTENT

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–967.7–001A	1A/5





PROPOSED RESTORATION ACTIVITIES WILL BE REVIEWED BY DNR AND ENBRIDGE DURING SITE VISIT AND MAY BE CHANGED TO REFLECT SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

* NO PERMANENT WATER BARS IN VIEW DUE TO WETLAND AND TOPOGRAPHY

HORIZONTAL SCALE 25' 50'

VERTICAL SCALE 25' 50'

FEATURE ID	HUC5098a1W; IFC ID: W-880.0
CROSSING TYPE	MODIFIED UPLAND (WETLAND)
PROPOSED RESTORATION (SEE DETAILS FOR LIVE STAKING, TRANSPLANTS, AND SHRUB SPECIES IF APPLICABLE)	SEEDING WITH BWSR SEED MIX UNLESS INUNDATED AT TIME OF CONSTRUCTION
WITHIN OR ADJACENT WETLAND	SEDGE MEADOW / CONIFEROUS SWAMP
BWSR SEED MIX	WET MEADOW NE (34-371)
DOMINANT WETLAND VEGETATION	1. CALTHA PALUSTRIS 3. ALNUS INCANA 2. EQUISETUM ARVENSE 4. LARIX LARICINA
SOBS (O/H) or NPC (S1-3)	NO (MODERATE); PARTIAL OVERLAP OF S1-S3

NOTES

1. CONSTRUCTION TIMING RESTRICTIONS
   1.1.N/A – DELINEATED AS WETLAND (SEDGE MEADOW / CONIFEROUS SWAMP)
   1.2. ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD: MARCH 15 – JUNE 30.
2. WORK SHALL BE CONDUCTED IN ACCORDANCE WITH APPLICABLE STANDARDS IN ENBRIDGE'S EPP AND VMP FOR PUBLIC LANDS AND WATERS. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE THESE STANDARDS.
3. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
4. INFORMATION REGARDING SEEDING SPECIFICATIONS, SEED BED PREPARATION TECHNIQUES, ETC. ARE DESCRIBED IN THE PLANTING PLAN CONTAINED WITHIN THE VMP.
5. TRENCH BREAKER LOCATION IS APPROXIMATE PENDING FIELD VERIFICATION (EPP SECTION 1.13)

ENBRIDGE

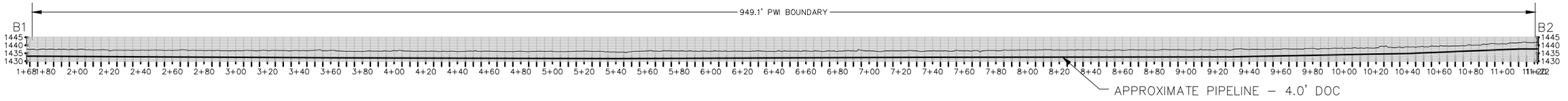
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

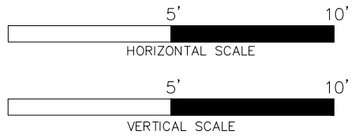
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
PORTAGE LAKE – MP 967.7 – MDNR ID 32
RE-VEGETATION PLAN

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-967.7-001	1/5

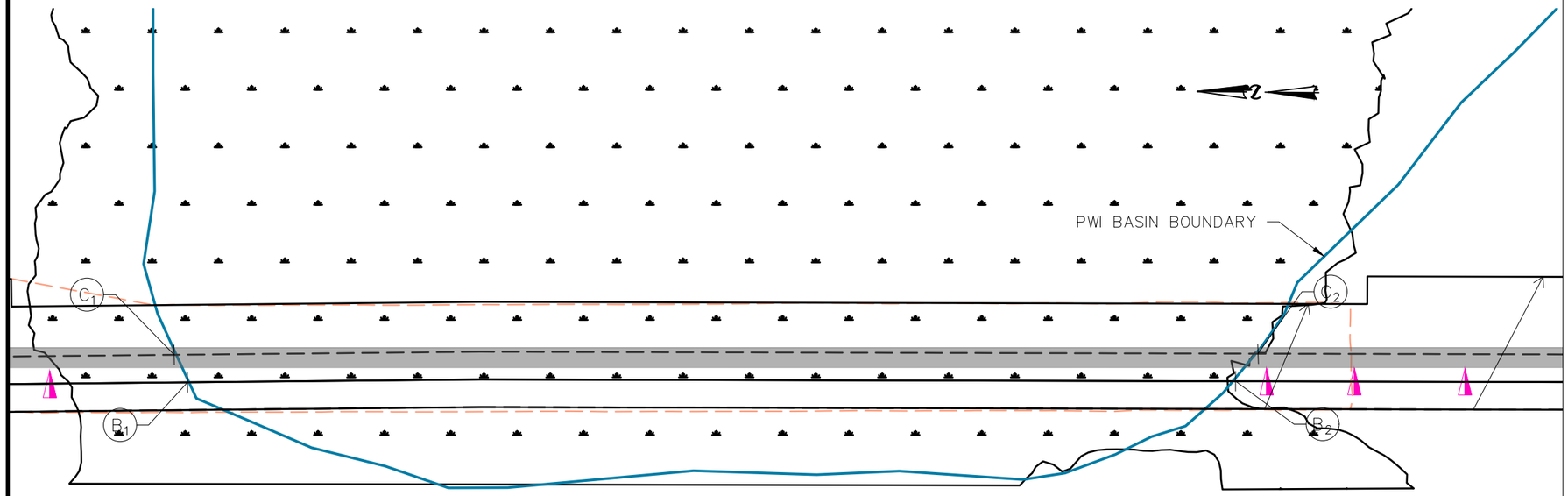
PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (CENTERLINE)





STREAMBED RESTORATION



THALWEG PROFILE N/A

NOTES

1. IF CONCENTRATED FLOW WITH A DEFINED BED AND BANKS IS OBSERVED DURING CONSTRUCTION:
   - 1.1. TRANSITIONS BETWEEN EXISTING CHANNEL FEATURES (BED, BANK, FLOODPLAIN) AND PROPOSED RESTORED TRENCH CROSSING WILL BE SMOOTH AND EVENLY GRADED WITHOUT ABRUPT OR PROTRUDING OBSTRUCTIONS.
   - 1.2. MINIMIZE DISTURBANCE OF BED MATERIALS AND FEATURES DURING CONSTRUCTION OF THE TRENCH AND INSTALLATION AND REMOVAL OF IN–STREAM SUPPORT
   - 1.3. BED AND/OR BANK MATERIALS TEMPORARILY ADJUSTED OR REMOVED DURING CONSTRUCTION SHALL BE PLACED IN THE APPROXIMATE ORIGINAL LOCATION DURING RESTORATION. MATERIALS SHALL BE FIELD ADJUSTED DURING PLACEMENT BASE ON THE OBSERVED FLOW PATH AT THE TIME OF CONSTRUCTION.
   - 1.4. RESTORE CHANNEL BANKS USING SOD MATS.
2. SEE RESTORATION SHEET FOR B1–B2 CROSS SECTION

LEGEND

- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY – RIFFLE (ROSGEN SURVEY)
- WATERBODY – POOL (ROSGEN SURVEY)
- WATERBODY – RUN (ROSGEN SURVEY)
- WATERBODY – GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH – 10'
- TRENCH – 20'

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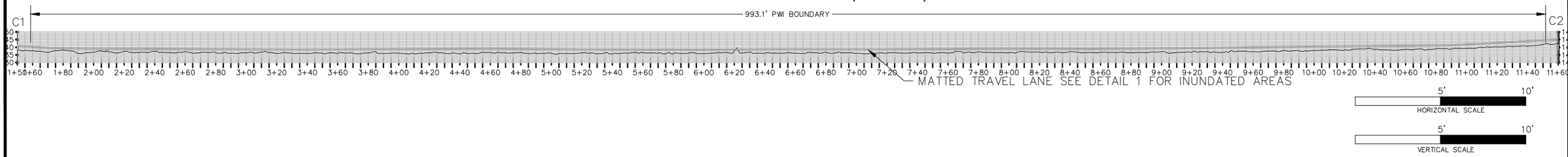
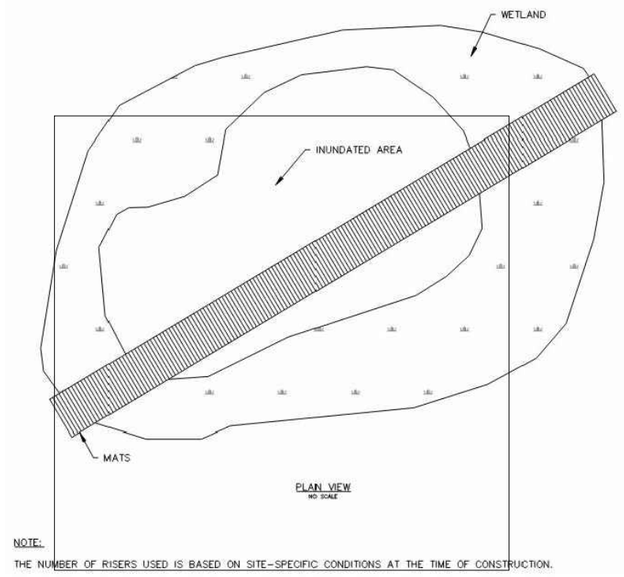
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
PORTAGE LAKE – MP 967.7 – MDNR ID 32
STABILIZATION PLAN

SCALE	DWG. NO.	PAGE NO.
	SSRP–967.7–002	2/5

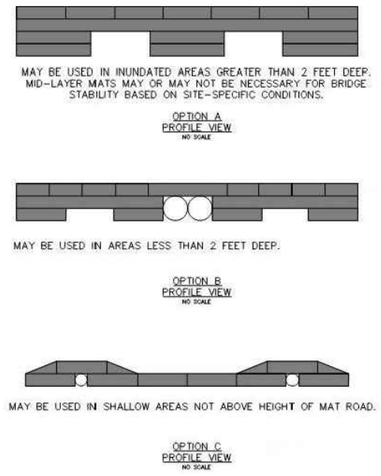
PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (BRIDGE)





WETLAND BRIDGE MATTING DETAIL PLAN VIEW



WETLAND BRIDGE MATTING DETAIL PROFILE VIEW

RESTORATION NOTES:
GENERAL

1. REFER TO RESTORATION DETAIL SHEETS FOR ADDITIONAL INFORMATION RELATED TO PROPOSED RESTORATION MEASURES.
2. REFER TO SITE PHOTOS FOR INFORMATION ON PRE-CONSTRUCTION CROSSING CONDITIONS AND TO PROVIDE ADDITIONAL GUIDANCE FOR RESTORATION EFFORTS.

SOD MATTING

1. REMOVE VEGETATED MATS ON EITHER SIDE OF THE STREAM CROSSING USING ONSITE EQUIPMENT WHICH CAN UNDERCUT THE VEGETATION FOR REMOVAL. SMALL SHRUBS AND/OR TREES WITHIN THE SOD MATS ARE ACCEPTABLE AND SHOULD NOT BE REMOVED.
2. DEPENDING ON THE LEVEL OF SATURATION AT THE TIME OF REMOVAL, IT MAY BE DIFFICULT TO OBTAIN INTACT CONSOLIDATED MATS, BUT GENERALLY THE NATIVE VEGETATION WILL BE RETAINED AND CAPTURED FOR PLACEMENT.
3. SOD MATS CAN BE TRANSPLANTED DURING ANY SEASON.
4. SOD MAT WILL BE PLACED ON CLEAR GROUND OR MATS WITHIN THE WORKSPACE.
5. MONITOR MATS TO SUPPORT SURVIVABILITY; WATERING MAY BE NEEDED.
6. PRIOR TO PLACEMENT OF SOD MATS FINISH GRADE CHANNEL BANK AND ADJACENT FLOODPLAIN APPLICATION AREA TO PROVIDE A SMOOTH AND EVEN SURFACE. SUBGRADE ELEVATION SHOULD ALLOW FOR THE FINISHED SOD SURFACE TO TRANSITION EVENLY WITH THE CHANNEL BANKS UPSTREAM AND DOWNSTREAM OF THE INSTALLATION AREA. AVOID ABRUPT CHANGES IN GRADE.
7. VEGETATED MATS WILL BE RETURNED/SET IN PLACE WITH ONSITE EQUIPMENT.
   a. SURFACE APPLIED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PERPENDICULAR TO THE CHANNEL / FLOW.
   b. STACKED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PARALLEL TO THE CHANNEL / FLOW.
8. WHEN PLACING SOD MATS, DO NOT LEAVE LARGE GAPS BETWEEN EACH SOD MAT AS NON-NATIVE VEGETATION WILL QUICKLY ATTEMPT TO COLONIZE THESE VOIDS.
9. WATER SOD MATS AFTER REPLACEMENT IF CONDITIONS ARE HOT AND DRY. DAMP AND/OR FROZEN SOD MATS DO NOT REQUIRE WATERING.
10. THE TOP MAT AND/OR OTHER MATS CAN BE ANCHORED WITH A LIVE AND/OR DEAD STOUT STAKE TO ENSURE THAT IT DOES NOT MOBILIZE DURING A FLOOD EVENT BEFORE THE ROOTS HAVE ESTABLISHED.
11. THE VEGETATED MATS WILL BE REPLACED AS SOON AS PRACTICAL FOLLOWING BACKFILLING OF THE TRENCH AND STABILIZED PER THE TIMING REQUIREMENTS DESCRIBED IN SECTION 1.9.1 OF THE EPP.

(1) WETLAND BRIDGE MATTING DETAIL

1. SITE CLEARING / BMP AND BRIDGE INSTALLATION
2. STREAM BED AND BANK SEGREGATION / PIPE INSTALLATION
3. BACKFILL AND BANK STABILIZATION / TEMPORARY BMP INSTALLATION (WITHIN 24 HOURS OF PIPE INSTALLATION OR AS REQUIRED BY PERMIT CONDITIONS)
4. BRIDGE REMOVAL / PERMANENT SEEDING / BANK CONTOURING (FOLLOWING MECHANICAL COMPLETION OF PIPELINE)
5. POST CONSTRUCTION MONITORING (UP TO 5 YEARS)

(2) SEQUENCING

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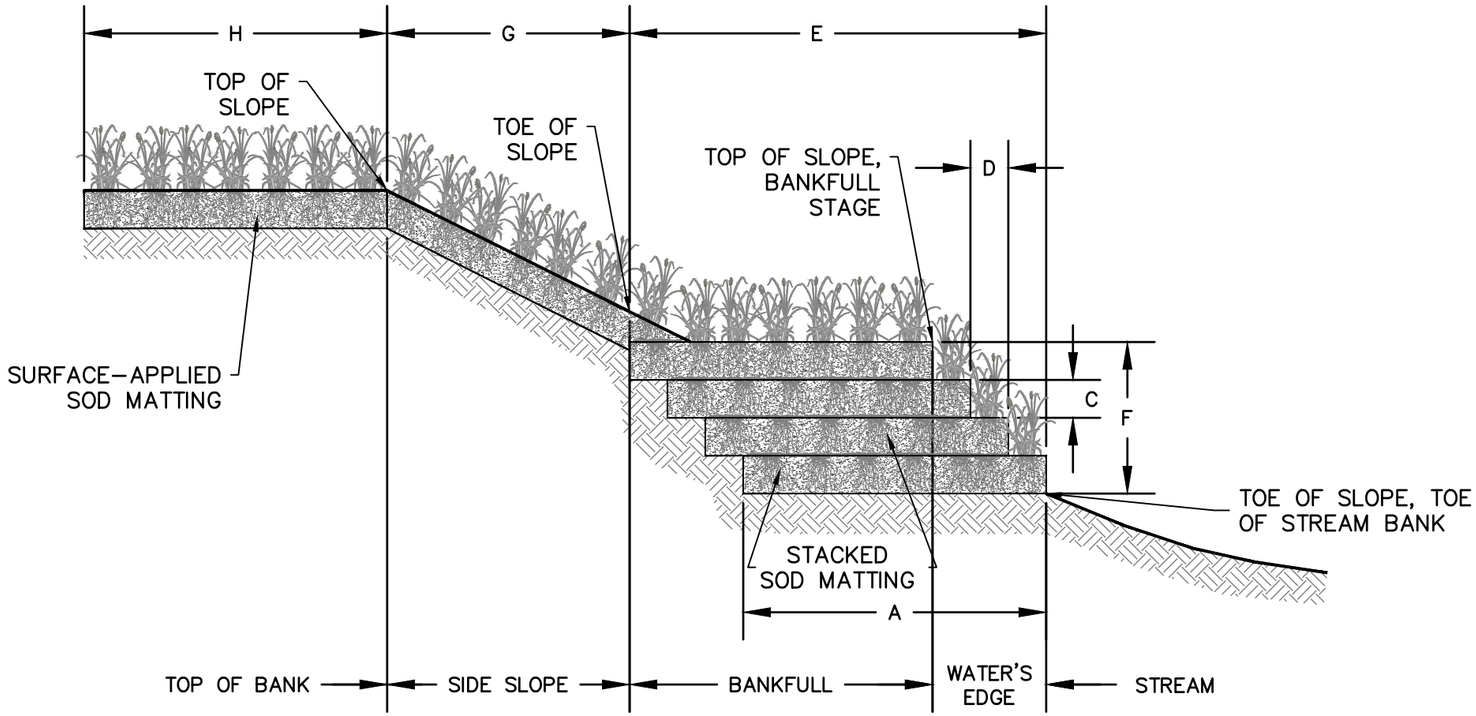
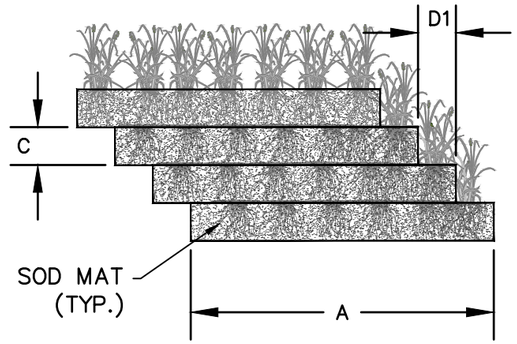
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
PORTAGE LAKE – MP 967.7– MDNR ID 32
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-967.7-004	3/5

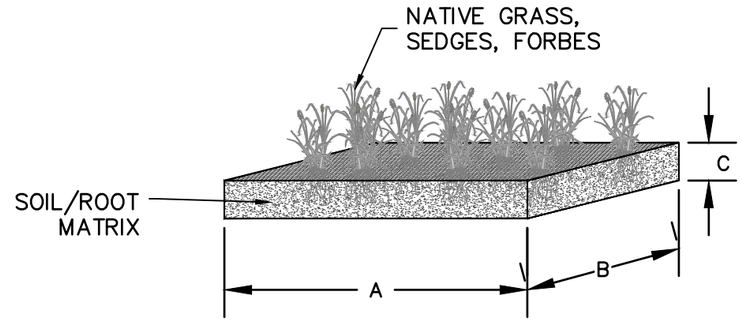
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



CROSS SECTION



STACKED SOD MATTING DETAIL



SOD MAT DETAIL

DIMENSION[1]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	SOD MAT WIDTH	FEET	3 – 4	WIDTH OF INDIVIDUAL SOD MAT.
B	SOD MAT LENGTH	FEET	3 – 6	LENGTH OF INDIVIDUAL SOD MAT.
C	SOD MAT THICKNESS	INCHES	12	THICKNESS OF INDIVIDUAL SOD MAT.
D	STACKED SOD MAT SETBACK	FEET	N/A	THE DISTANCE BETWEEN THE EDGES OF SOD MATS STACKED TO FORM A SLOPE
E	WIDTH OF STACKED SOD MATS	FEET	N/A	WIDTH OF A BANK CREATED BY STACKED SOD MATS
F	HEIGHT OF STACKED SOD MATS	FEET	N/A	HEIGHT OF A SLOPE CREATED BY STACKED SOD MATS
G	WIDTH OF SURFACE- APPLIED SOD MATS	FEET	10 – 20	WIDTH OF A SLOPE STABILIZED WITH SURFACE-APPLIED SOD MATS
H	TOP OF BANK SOD MATTING DISTANCE	FEET	10	DISTANCE SOD MATTING IS INSTALLED ON THE TOP OF BANK
NOTES:				
1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.				

SOD MATTING DETAIL

SOD MAT EXAMPLES

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
PORTAGE LAKE – MP 967.7– MDNR ID 32
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–967.7–004	4/5

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

1 CENTERLINE – FACING NORTH

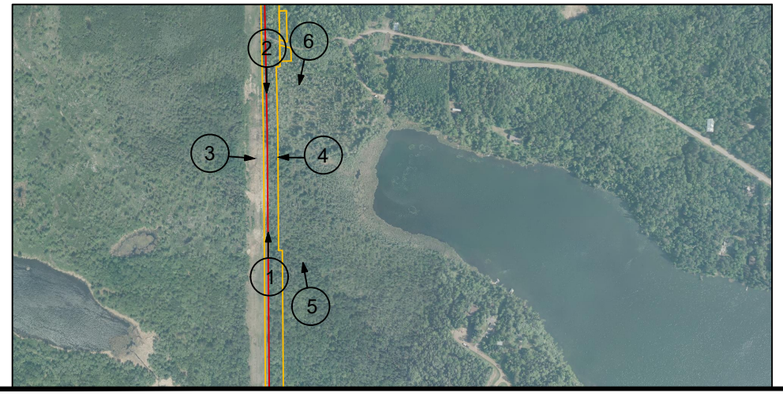
2 CENTERLINE – FACING SOUTH

3 EDGE OF WORKSPACE – FACING EAST

4 EDGE OF WORKSPACE – FACING WEST

5 BRIDGE – FACING NORTH

6 BRIDGE – FACING SOUTH



NOTES:

1. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
2. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
3. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
PORTAGE LAKE–PUBLIC WATER BASIN – MP 976.7 – MDNR ID 32
PHOTO PAGE

SCALE	DWG. NO.	PAGE NO.
	SSRP–976.7–005	5/5

ENBRIDGE

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

GENERAL

1. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE PROJECT–WIDE STANDARDS PRESENTED IN THE EPP. WHERE MATERIAL WITHIN THESE SSRPS EXCEEDS STANDARD CONSTRUCTION MEASURES IN THE EPP, THESE SSRPS SUPERSEDE THE EPP.

2. CONSTRUCTION AND RESTORATION OF WATERBODY CROSSINGS WILL FOLLOW THESE GENERAL STEPS:

   A. SITE CLEARING
   B. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES ("BMPS")
   C. BRIDGE INSTALLATION
   D. EXCAVATION/BACKFILLING OF THE WATERBODY INCLUDING:
      - SOD SAVING TOPSOIL SEGREGATION AT NON–WOODED SITES
      - STREAMBED MATERIAL SEGREGATION
      - PIPE INSTALLATION
      - BACKFILL, INCLUDING IMPLEMENTATION OF CONSTRUCTION–RELATED RESTORATION METHODS (I.E., TOE WOOD)
   E. REPLACEMENT OF STREAMBED MATERIAL AND TOPSOIL/SOD LAYER
   F. RESTORATION OF STREAM BANKS TO PRE–CONSTRUCTION CONTOURS
   G. IF FINAL GRADING NOT POSSIBLE AT THE TIME, TEMPORARY STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   H. AFTER FINAL GRADING, PERMANENT SEEDING AND/OR WOODY VEGETATION RESTORATION, STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   I. BRIDGE REMOVAL DURING FINAL RESTORATION AFTER STABILIZATION AND PERMANENT SEEDING
   J. POST–CONSTRUCTION MONITORING

CROSSING METHODS

1. ALL WATERBODY AND WETLAND CROSSINGS WILL BE CONDUCTED IN COMPLIANCE WITH SECTION 2.0 AND SECTION 3.0 OF THE ENVIRONMENTAL PROTECTION PLAN ("EPP"), RESPECTIVELY. SECTION 2.0 AND 3.0 OF THE WINTER CONSTRUCTION PLAN PRESENTS MODIFICATIONS FOR WATERBODY AND WETLAND CONSTRUCTION METHODS, RESPECTIVELY, IN WINTER CONDITIONS.

2. ENBRIDGE'S SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES (THE "PROCEDURES," APPENDIX A OF THE EPP) OUTLINES THE VARIOUS CONSTRUCTION METHODS THAT ENBRIDGE MAY UTILIZE TO CONSTRUCT THROUGH WATERBODIES AND WETLANDS/BASINS AS PRESENTED ON THESE SITE–SPECIFIC RESTORATION PLANS ("SSRPS").

   A. DRY CROSSING (ISOLATED) METHODS (INCLUDING THE DRY CROSSING AND MODIFIED DRY CROSSING METHOD) ARE DESCRIBED SECTIONS 4.3 OF THE PROCEDURES, AND IN SECTIONS 2.5.2 AND 2.5.3 AND FIGURES 23 AND 24 OF THE EPP.
   B. THE BORE METHOD (NON–PRESSURIZED) IS DESCRIBED IN SECTION 3.5 OF THE PROCEDURES, AND SECTION 4.0 OF THE EPP.
   C. THE MODIFIED UPLAND CONSTRUCTION (WETLAND) METHOD IS DESCRIBED IN SECTION 3.3 OF THE PROCEDURES, AND SECTION 3.0 AND FIGURES 30 TO 34 OF THE EPP.
   D. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE OPEN CUT (NON–ISOLATED) WATERBODY CROSSING METHOD IS DESCRIBED IN SECTION 4.1 OF THE PROCEDURES, AND SECTION 2.5.1 AND FIGURE 24 OF THE EPP.
   E. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE PUSH–PULL METHOD IS DESCRIBED IN SECTION 3.4 OF THE PROCEDURES, AND SECTION 3.7.1 AND FIGURES 35 AND 36 OF THE EPP.

CLEARING/VEGETATION REMOVAL

1. STUMPS WITHIN THE TRENCH LINE WILL BE COMPLETELY REMOVED, GROUND, AND/OR HAULED OFF–SITE TO AN APPROVED LOCATION. TREE STUMPS OUTSIDE THE TRENCH LINE WILL BE GROUND BELOW NORMAL GROUND SURFACE TO FACILITATE A SAFE WORK AREA AND TO ALLOW TOPSOIL REMOVAL, IF NECESSARY. IN SOME CIRCUMSTANCES, TREE STUMPS OUTSIDE THE TRENCH LINE MAY BE COMPLETELY REMOVED TO ALLOW FOR A SAFE WORK AREA AND HAULED OFF–SITE TO AN APPROVED LOCATION AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

2. CLEARING WILL BE CONDUCTED IN WATERBODIES AND WETLANDS AS OUTLINED IN SECTION 2.2 AND 3.2 OF THE EPP, RESPECTIVELY. CHIPS, MULCH, OR MECHANICALLY CUT WOODY DEBRIS SHALL NOT BE STOCKPILED IN A WETLAND. HYDRO–AX DEBRIS, OR SIMILAR CAN BE LEFT IN THE WETLAND IF SPREAD EVENLY IN THE CONSTRUCTION WORKSPACE TO A DEPTH THAT WILL ALLOW FOR NORMAL REVEGETATION, AS DETERMINED BY THE EI. CHIPPING IS NOT ALLOWED ON PUBLIC LANDS. ON PUBLIC LANDS, MULCH AND MECHANICALLY CUT WOODY DEBRIS MUST BE UNIFORMLY BROADCAST TO LESS THAN 2–INCH THICKNESS AND IN A MANNER THAT MAINTAINS VISIBLE GROUND.

3. ENBRIDGE WILL PROPERLY INSTALL AND MAINTAIN REDUNDANT SEDIMENT CONTROL MEASURES IMMEDIATELY AFTER CLEARING AND PRIOR TO INITIAL GROUND DISTURBANCE AT SURFACE WATERS LOCATED WITHIN 50 FEET OF THE PROJECT AND WHERE STORMWATER FLOWS TO THE SURFACE WATER (REFER TO THE ENVIRONMENTAL PLAN SHEETS IN THE SWPPP), AND WITHIN 100 FEET OF SPECIAL AND IMPAIRED WATERS, INCLUDING TROUT STREAMS.

4. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).

TEMPORARY STABILIZATION

1. ON PORTIONS OF THE PROJECT WHERE WORK WILL BE OCCURRING DURING APPLICABLE "WORK IN WATER RESTRICTIONS" FOR PUBLIC WATERS (REFER TO SECTION 2.1), ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD. THESE AREAS WILL BE IDENTIFIED ON THE ENVIRONMENTAL PLAN SHEETS ACCOMPANYING THE SWPPP.

2. HYDRO–MULCH AND LIQUID TACKIFIER CAN BE USED IN PLACE OF CERTIFIED WEED–FREE STRAW OR HAY MULCH WITH PRIOR APPROVAL FROM ENBRIDGE. ALL HYDROMULCH AND LIQUID TACKIFIER PRODUCTS USED WILL BE ON THE APPLICABLE STATE DOT PRODUCT LIST. HYDRO–MULCH AND LIQUID TACKIFIER PRODUCTS CONTAINING PLASTIC/POLYPROPYLENE FIBER ADDITIVES AND MALACHITE GREEN (COLORANT) WILL NOT BE UTILIZED ON THIS PROJECT. APPLICATION RATES WILL BE AT THE MANUFACTURER'S RECOMMENDED RATE. ENBRIDGE WILL AVOID THE USE OF HYDROMULCH ON PUBLIC LANDS; HOWEVER, ENBRIDGE MAY USE HYDROMULCH ON STEEP SLOPES TO PREVENT EROSION UNTIL PERMANENT COVER HAS BEEN ESTABLISHED AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

RESTORATION AND STABILIZATION

1. ENBRIDGE WILL RESTORE THE STREAM BANKS AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS UNLESS THAT SLOPE IS DETERMINED TO BE UNSTABLE. IF THE SLOPE IS CONSIDERED UNSTABLE, ENBRIDGE WILL RESHAPE THE BANKS TO PREVENT SLUMPING. FOR PUBLIC WATERS, ENBRIDGE WILL RETURN THE BANK TO PRE–CONSTRUCTION CONTOURS, UNLESS OTHERWISE DIRECTED BY THE SITE–SPECIFIC RESTORATION PLAN. IF ENBRIDGE CANNOT RESTORE TO PRE–CONSTRUCTION CONTOURS AT A PUBLIC WATER, ENBRIDGE WILL CONSULT WITH THE MDNR BEFORE PROCEEDING FURTHER AS OUTLINED IN SECTION 2.6 OF THE EPP.

2. UNSTABLE SOILS AND/OR SITE–SPECIFIC FACTORS SUCH AS STREAM VELOCITY AND FLOW DIRECTION MAY REQUIRE ADDITIONAL RESTORATION EFFORTS, SUCH AS INSTALLATION OF WOODY VEGETATION, GEOTEXTILE FABRIC, OR TREE, LOG, ROOTWAD, OR BOULDER REVETMENTS TO STABILIZE DISTURBED STREAM BANKS (SEE FIGURE 29) AS OUTLINED IN SECTION 2.6.2 OF THE EPP. ENBRIDGE WILL WORK WITH THE MDNR TO ENSURE ALL WORK/ADJUSTMENTS ARE APPROVED AND ARE CONDUCTED WITHIN APPLICABLE TIMING RESTRICTIONS.

3. IN UPLAND AND WETLAND AREAS, CLEANUP AND ROUGH GRADING WILL OCCUR AS OUTLINED IN SECTIONS 1.16 AND 3.9 OF THE EPP. ENBRIDGE WILL BACKFILL THE TRENCH TO AN ELEVATION SIMILAR TO THE ADJACENT AREAS OUTSIDE THE TRENCH LINE AND WILL ADD A SLIGHT CROWN OF APPROXIMATELY 3 TO 6 INCHES (DEPENDING ON SOIL TYPE) OVER THE BACKFILLED TRENCH TO ALLOW FOR SUBSIDENCE. GENERALLY, EXCESS SUBSOIL DISPLACED BY THE PIPE INSTALLATION WILL BE SPREAD ACROSS THE PORTION OF THE CONSTRUCTION WORKSPACE WHERE TOPSOIL REMOVAL HAS OCCURRED. ANY REMAINING EXCESS SUBSOIL WILL BE REMOVED AND DISPOSED OF AT AN APPROVED OFF–SITE LOCATION AS NEEDED TO ENSURE CONTOURS ARE RESTORED TO AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS.

4. REVEGETATION ACTIVITIES WILL OCCUR AS OUTLINED IN SECTION 7.0 OF THE EPP. SEED MIXES AT PUBLIC WATERS WILL BE SELECTED AND APPLIED AS INDICATED IN THE PLANTING PLAN, WHICH IS APPENDIX A OF THE POST–CONSTRUCTION VEGETATION MANAGEMENT PLAN FOR PUBLIC LANDS AND WATERS ("VMP"). SEED MIXES RELATIVE TO THESE SSRP CROSSINGS ARE CODED AS FOLLOWS:

A	EMERGENT (34–181)	G	DRY PRAIRIE GENERAL (35–221)
B	RIPARIAN NE (34–361)	H	MESIC PRAIRIE GENERAL (35–241)
C	RIPARIAN S&W (34–261)	I	MESIC PRAIRIE NW (35–441)
D	WET MEADOW NE (34–371)	J	DRY PRAIRIE NORTHWEST (35–421)
E	WET MEADOW S&W (34–271)	K	WOODLAND EDGE NE (36–311)
F	WETLAND REHABILITATION (34–171)	L	NATURAL REVEGETATION

5. ENBRIDGE WILL NOT SEED STANDING WATER OR WOODED (PSS AND PFO) WETLAND COMMUNITIES. NATURAL REVEGETATION WILL TAKE PLACE FROM EXISTING PLANT MATERIAL AND ROOT STOCK IN THESE COMMUNITIES.

6. ALL MATERIALS USED FOR CONSTRUCTION OF THE PROJECT MUST BE REMOVED FROM THE SITE.

7. ENBRIDGE WILL CONDUCT POST–CONSTRUCTION MONITORING IN ACCORDANCE WITH THE POST–CONSTRUCTION MONITORING PLAN FOR WETLANDS AND WATERBODIES, AND IN ACCORDANCE WITH THE VMP FOR THE UPLAND PORTIONS OF THE PROJECT ON PUBLIC LANDS.

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN

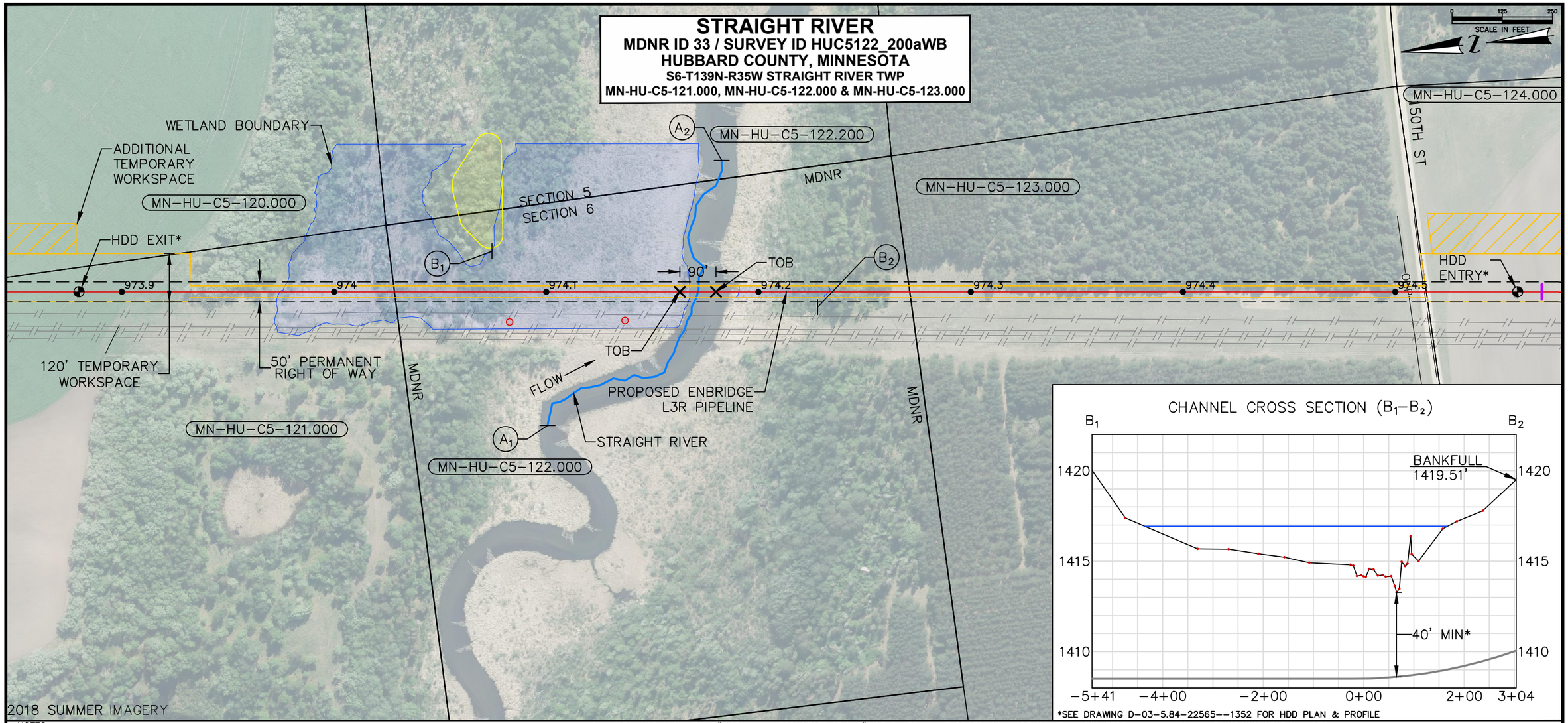
CONSTRUCTION NOTES

SCALE	DWG. NO.	PAGE NO.
	SSRP–NOTES	

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

MDNR ID No. 33: MP 974.2; Straight River (M-096-035-002-002)

STRAIGHT RIVER
MDNR ID 33 / SURVEY ID HUC5122_200aWB
HUBBARD COUNTY, MINNESOTA
S6-T139N-R35W STRAIGHT RIVER TWP
MN-HU-C5-121.000, MN-HU-C5-122.000 & MN-HU-C5-123.000



*SEE DRAWING D-03-5.84-22565--1352 FOR HDD PLAN & PROFILE

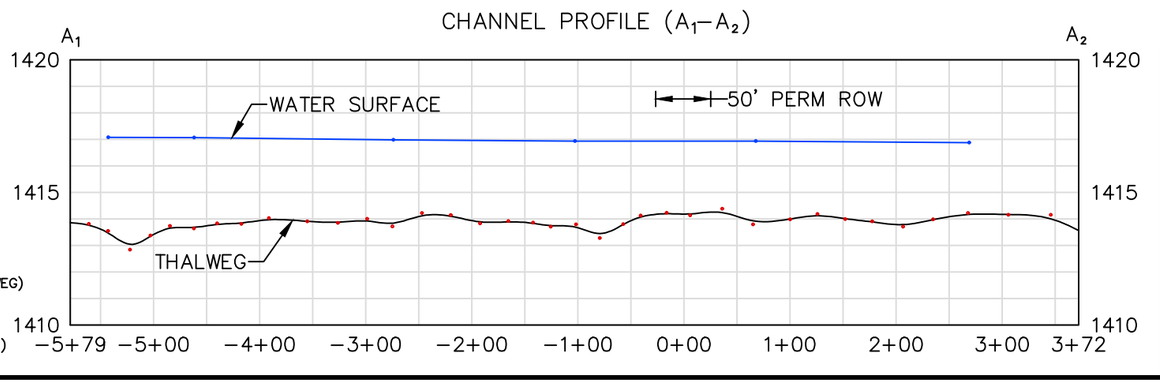
NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. SOBS (O/H) OR NPC (S1-3): N/A
3. MDNR REGION 1 PWI – COLDWATER FISHERY: SEPTEMBER 1 – JUNE 30. 24-HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
4. MDNR LAND – SEE UTILITY LICENSE FOR PUBLIC LANDS. NO CLEARING: JUNE-JULY.
5. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2015 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.

LEGEND

	PROPOSED ENBRIDGE L3R PIPELINE
	OTHER PIPELINE
	PERMANENT RIGHT OF WAY
	TEMPORARY WORKSPACE
	WATERBODY (ROSGEN SURVEY – THALWEG)
OHP	OVERHEAD POWER
	TRACT BOUNDARY
MDNR	MINNESOTA DEPARTMENT OF NATURAL RESOURCES (MDNR) BOUNDARY
	ENVIRONMENTALLY SENSITIVE AREA
	WETLAND
	ADDITIONAL TEMPORARY WORKSPACE
MN-XX-XX-XXX.XXX	TRACT ID
	ROSGEN SURVEY POINT – WATER SURFACE
	ROSGEN SURVEY POINT – RIVER BOTTOM (THALWEG)
	HDD ENTRY EXIT POINT
	INVASIVE SPECIES POINT
	TOP OF BANK
	TRENCH BREAKER (LOCATIONS ARE APPROXIMATE)

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY



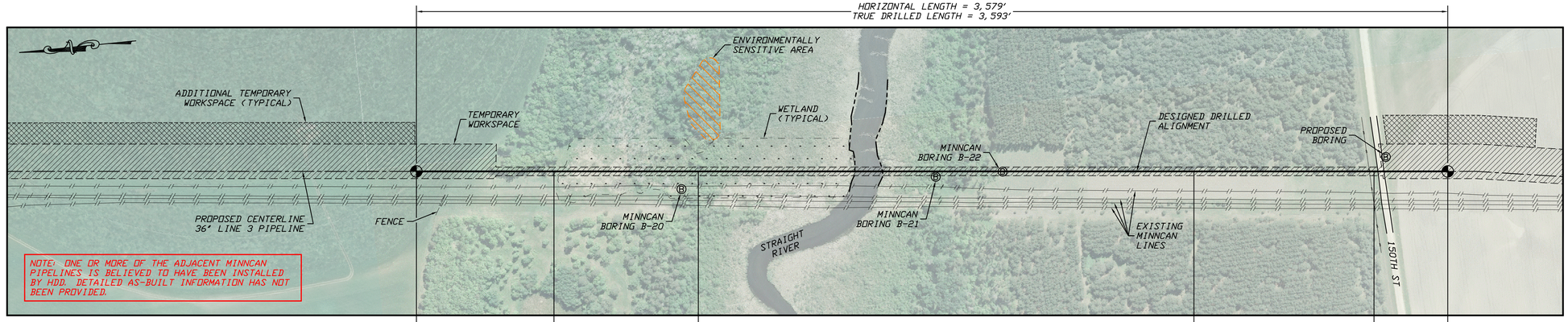
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

ENBRIDGE

DWN. BY: AJJ	DATE 10/2020
CHK.	
PROJ. ENGR.	
PROJ. MGR.	
CLIENT APP.	

PROPOSED ENBRIDGE L3R PIPELINE
PRIMARY METHOD – HDD
CROSSING OF STRAIGHT RIVER
ENBRIDGE MP 974.2
HUBBARD COUNTY, MINNESOTA

SCALE: NOTED
DWG. NO.: B-93-5.84-MDNR-33-0



PLAN

SCALE: 1"=200'

EXIT POINT @ 8°
35+79.43, 1451.31
N 475858.32, E 2113954.11

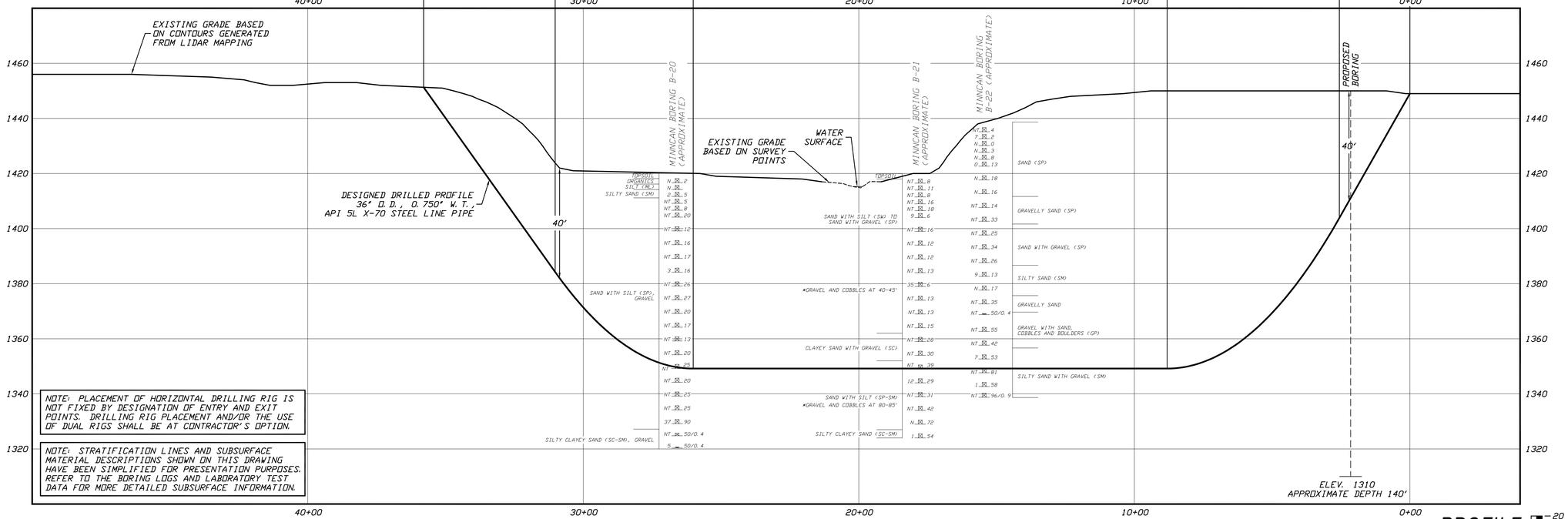
P.T. 8° SAG BEND
31+02.05, 1384.21

P.C. 8° SAG BEND
26+01.02, 1349.18
RADIUS = 3,600'

P.T. 10° SAG BEND
8+81.06, 1349.18

P.C. 10° SAG BEND
2+55.93, 1403.87
RADIUS = 3,600'

ENTRY POINT @ 10°
0+00.00, 1449.00
N 472297.80, E 2113586.72

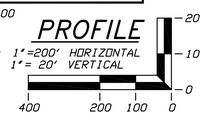


NOTE: PLACEMENT OF HORIZONTAL DRILLING RIG IS NOT FIXED BY DESIGNATION OF ENTRY AND EXIT POINTS. DRILLING RIG PLACEMENT AND/OR THE USE OF DUAL RIGS SHALL BE AT CONTRACTOR'S OPTION.

NOTE: STRATIFICATION LINES AND SUBSURFACE MATERIAL DESCRIPTIONS SHOWN ON THIS DRAWING HAVE BEEN SIMPLIFIED FOR PRESENTATION PURPOSES. REFER TO THE BORING LOGS AND LABORATORY TEST DATA FOR MORE DETAILED SUBSURFACE INFORMATION.

PROFILE

SCALE: 1"=200' HORIZONTAL
1"= 20' VERTICAL



GENERAL LEGEND

DRILLED PATH ENTRY/EXIT POINT

GEOTECHNICAL LEGEND

B BORING LOCATION

SPLIT SPOON SAMPLE

53 N 23 — PENETRATION RESISTANCE IN BLOWS PER FOOT FOR A 140 POUND HAMMER FALLING 30 INCHES
PERCENTAGE OF GRAVEL BY WEIGHT FOR SAMPLES CONTAINING GRAVEL

CORE BARREL SAMPLE

UCS 6,250 — UNCONFINED COMPRESSIVE STRENGTH (PSI)
53 6 — MOHS HARDNESS
ROCK QUALITY DESIGNATION (PERCENT)

GEOTECHNICAL NOTES

1. GEOTECHNICAL DATA PROVIDED BY MINNESOTA PIPELINE COMPANY, ST. PAUL, MN. REFER TO THE BORING LOGS AND LABORATORY TEST DATA FOR MORE DETAILED SUBSURFACE INFORMATION.
2. THE LETTER "N" TO THE LEFT OF A SAMPLE INDICATES THAT NO GRAVEL WAS OBSERVED IN THE SAMPLE. THE LETTERS "NT" INDICATE THAT GRAVEL WAS OBSERVED BUT NO GRADATION TEST WAS PERFORMED.
3. THE GEOTECHNICAL DATA IS ONLY DESCRIPTIVE OF THE LOCATIONS ACTUALLY SAMPLED. EXTENSION OF THIS DATA OUTSIDE OF THE ORIGINAL BORINGS MAY BE DONE TO CHARACTERIZE THE SOIL CONDITIONS, HOWEVER, COMPANY DOES NOT GUARANTEE THESE CHARACTERIZATIONS TO BE ACCURATE. CONTRACTOR MUST USE HIS OWN EXPERIENCE AND JUDGMENT IN INTERPRETING THIS DATA.

TOPOGRAPHIC SURVEY NOTES

1. TOPOGRAPHIC SURVEY DATA PROVIDED BY ENBRIDGE, SUPERIOR, WISCONSIN.
2. NORTHINGS AND EASTINGS ARE IN U.S. SURVEY FEET REFERENCED TO MINNESOTA STATE PLANE COORDINATES, NORTH ZONE, NAD 83.
3. ELEVATIONS ARE IN FEET REFERENCED TO NAVD 88.

DRILLED PATH NOTES

1. DRILLED PATH STATIONING IS IN FEET BY HORIZONTAL MEASUREMENT AND IS REFERENCED TO CONTROL ESTABLISHED FOR THE DRILLED SEGMENT.
2. DRILLED PATH COORDINATES REFER TO CENTERLINE OF PILOT HOLE AS OPPOSED TO TOP OF INSTALLED PIPE.

PILOT HOLE TOLERANCES

THE PILOT HOLE SHALL BE DRILLED TO THE TOLERANCES LISTED BELOW. HOWEVER, IN ALL CASES, RIGHT-OF-WAY RESTRICTIONS AND CONCERN FOR ADJACENT FACILITIES SHALL TAKE PRECEDENCE OVER THESE TOLERANCES.

1. ENTRY POINT: AS STAKED BY COMPANY
2. EXIT POINT: UP TO 10 FEET SHORT OR 20 FEET LONG RELATIVE TO THE DESIGNED EXIT POINT; UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
3. ELEVATION: UP TO 2 FEET ABOVE AND 10 FEET BELOW THE DESIGNED PROFILE
4. ALIGNMENT: UP TO 5 FEET RIGHT OR LEFT OF THE DESIGNED ALIGNMENT
5. CURVE RADIUS: NO LESS THAN 2,400 FEET BASED ON A 3-JOINT AVERAGE (ASSUMING RANGE 2 DRILL PIPE)

PROTECTION OF EXISTING FACILITIES

CONTRACTOR SHALL UNDERTAKE THE FOLLOWING STEPS PRIOR TO COMMENCING DRILLING OPERATIONS.

1. CONTACT THE UTILITY LOCATION/NOTIFICATION SERVICE FOR THE CONSTRUCTION AREA.
2. POSITIVELY LOCATE AND STAKE ALL EXISTING UNDERGROUND FACILITIES. ANY FACILITIES LOCATED WITHIN 10 FEET OF THE DESIGNED DRILLED PATH SHALL BE EXPOSED.
3. MODIFY DRILLING PRACTICES AND DOWNHOLE ASSEMBLIES AS NECESSARY TO PREVENT DAMAGE TO EXISTING FACILITIES.

LINE 3 PIPELINE PROJECT

PLAN AND PROFILE
36-INCH PIPELINE CROSSING OF THE STRAIGHT RIVER
BY HORIZONTAL DIRECTIONAL DRILLING

LOCATION: HUBBARD COUNTY, MINNESOTA

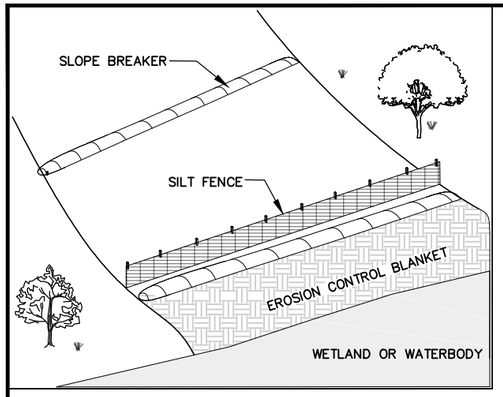
DRAWN	DATE	CHECKED	APPROVED	DRAWING NUMBER	REVISION
ACM	07/25/17	DMP	JSP	D-03-5.84-22565-D-1352	D

NO.	DATE	REVISION DESCRIPTION	BY	CHK'D	APP.
D	09/30/20	UPDATE WETLANDS	JSP	JSP	JSP
C	10/25/19	RELOCATE ENTRY POINT AS DIRECTED BY ENBRIDGE	JSP	DMP	JSP
B	09/29/17	UPDATE WORKSPACE AND ESA LABEL	LKB	JSP	JSP
A	07/25/17	ISSUE FOR CONSTRUCTION	ACM	DMP	JSP

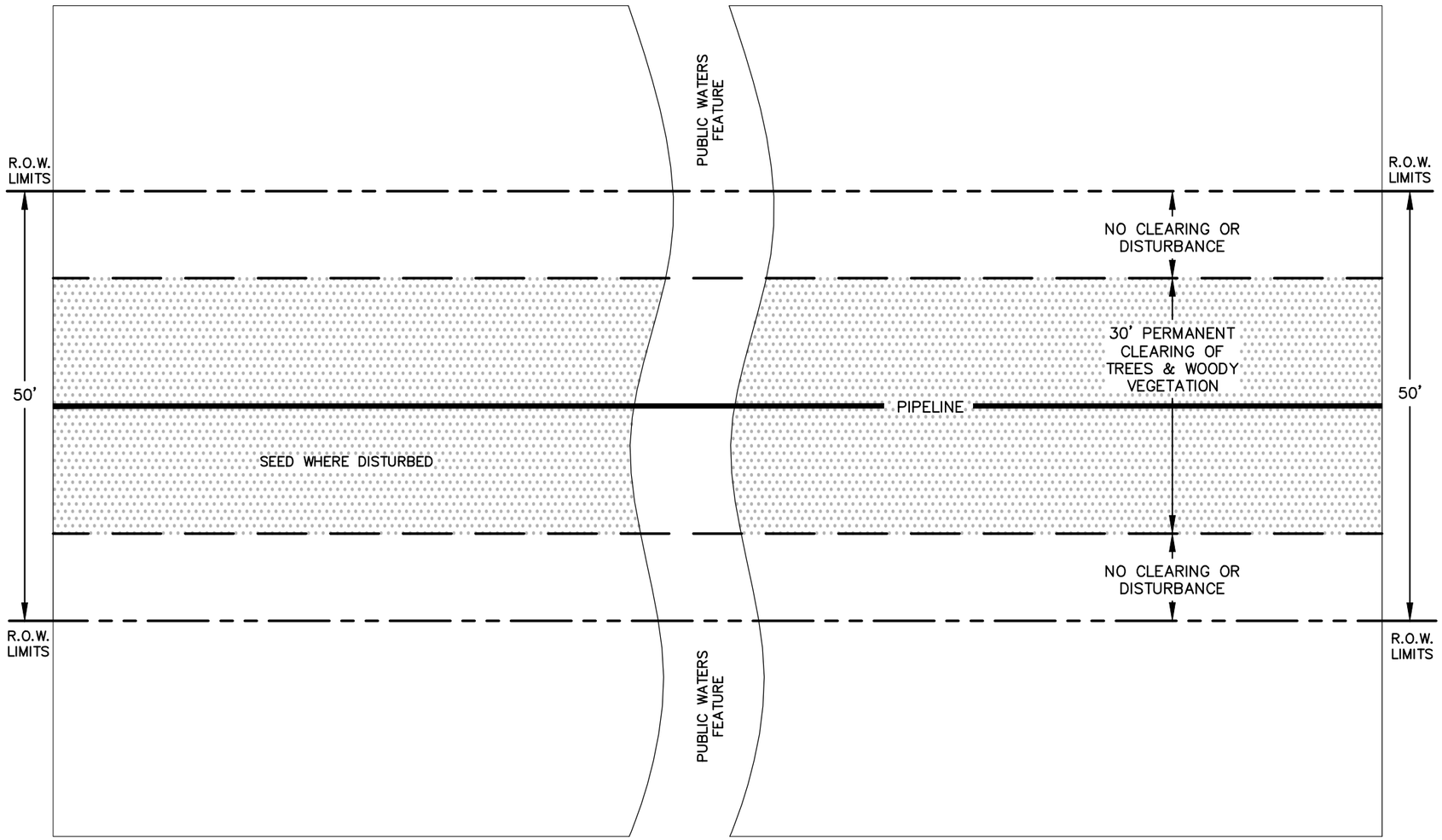
J.D. Hair & Associates, Inc.
Consulting Engineers
2424 East 21st Street
Suite 510
Tulsa, Oklahoma 74114

PROJECT NO.
Enbridge\1404

MILEPOST
D974



SEEDING AREA



PUBLIC WATERS FEATURE - HDD CROSSING

1) DISTURBANCE OF THE ROW IS LIMITED TO THE 30-FOOT-WIDE CLEARING OF TREES AND WOODY VEGETATION AND IMPACTS RESULTING FROM TRAVEL LANES AND/OR BRIDGES.
2) ANY WETLAND OR WATERBODY BANK THAT IS DISTURBED WILL BE STABILIZED WITH EROSION AND SEDIMENT CONTROL BMP AND RESTORED TO AS NEAR AS PRACTICABLE TO PRE-CONSTRUCTION CONDITIONS.
3) PERMANENT REVEGETATION SEEDING OF DISTURBED WATERBODY BANKS WILL UTILIZE THE BWSR RIPARIAN SEED MIXES IN ACCORDANCE WITH THE EPP (SECTION 7.8).
4) PERMANENT REVEGETATION SEEDING OF DISTURBED WETLANDS WILL TAKE PLACE IN ACCORDANCE WITH THE EPP (SECTION 7.7). 7) IN DISTURBED WETLAND AREAS, THE APPROPRIATE SEED MIX WILL BE DETERMINED USING THE RESULTS OF PRE-CONSTRUCTION WETLAND IN DISTURBED WETLAND AREAS, HYDROLOGICAL CHARACTERISTICS, AND SITE-SPECIFIC CONDITIONS.

ISSUED FOR PERMIT 12/13/19

NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMIT	AJM	12/13/19	KEH	KD
A	ISSUED FOR REVIEW	AJM	12/10/19	KEH	KD

DWN. BY: AJM	DATE 12/10/19	
CHK. KEH		
PROJ. ENGR. DG		
PROJ. MGR. KD		
CLIENT APP.		

ENBRIDGE

LINE 3 REPLACEMENT
PUBLIC WATERS HDD CROSSING TYPICAL
FINAL STREAM STABILIZATION & EROSION CONTROL

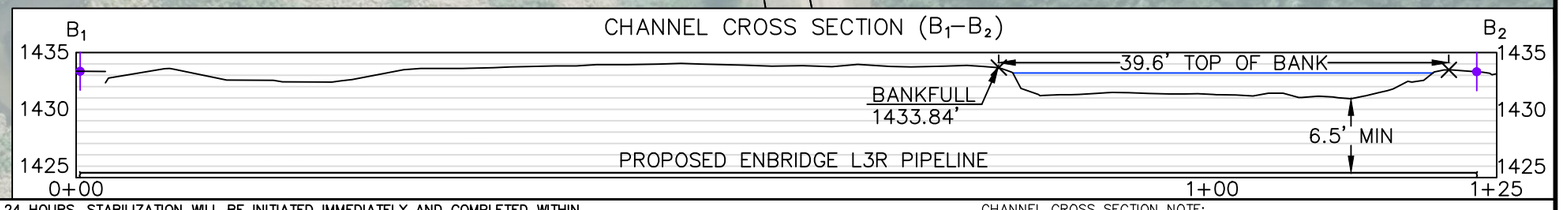
SCALE NTS | DWG. NO.

MDNR ID No. 34: MP 976.6; Shell River (M-096-035-004)

SHELL RIVER
MDNR ID 34 / SURVEY ID HUC5130aWB
HUBBARD COUNTY, MINNESOTA
S19-T139N-R35W STRAIGHT RIVER TWP
MN-HU-C5-130.000

MN-HU-C5-130.000-RX
MN-HU-C5-133.000
SCALE IN FEET 0 25 50 100
18-T139N-R35W
19-T139N-R35W
A2
A1
BEAVER DAM
400'
75'
TEMPORARY MAT ROAD AND SPAN BRIDGE WITH IN-STREAM SUPPORT (SEE RESTORATION PLAN)
TOP OF BANK
95' TEMPORARY WORKSPACE
125'
75'
ADDITIONAL TEMPORARY WORKSPACE
89'
117'
75'
50' PERMANENT RIGHT OF WAY
120' TEMPORARY WORKSPACE
TOB
TOB
976.5
976.6
976.7
40'
B1
B2
BEAVER DAM
WETLAND BOUNDARY
PROPOSED ENBRIDGE L3R PIPELINE
SAND DEPOSITS
SHELL RIVER
FLOW
2018 SUMMER IMAGERY

CHANNEL CROSS SECTION (B1-B2)

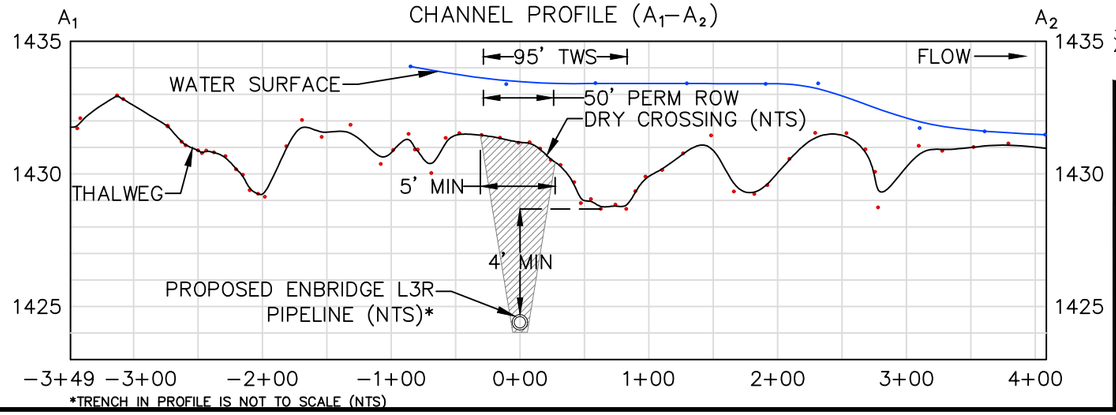


NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. SOBS (O/H) OR NPC (S1-3): N/A
3. MDNR REGION 1 PWI - COOL/WARM WATER FISHERY: MARCH 15 - JUNE 30. 24-HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
4. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

LEGEND
- PROPOSED ENBRIDGE L3R PIPELINE
- OTHER PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY (ROSGEN SURVEY - THALWEG)
- CENTERLINE OF ROAD
- TRACT BOUNDARY
- TEMPORARY MAT ROAD AND SPAN BRIDGE
- BEAVER DAM
- SAND DEPOSITS
- WETLAND
- ADDITIONAL TEMPORARY WORKSPACE
- MN-XX-XX-XXX.XXX — TRACT ID
- ROSGEN SURVEY POINT - WATER SURFACE
- ROSGEN SURVEY POINT - RIVER BOTTOM (THALWEG)
- PROPOSED INCREASED DEPTH OF COVER EXTENT
- TOP OF BANK

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY

CHANNEL PROFILE (A1-A2)



*TRENCH IN PROFILE IS NOT TO SCALE (NTS)

CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2020 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.
2. DEPTH OF COVER AT CENTERLINE WAS DEVELOPED USING THE BOTTOM ELEVATION OF THE DEEPEST UPSTREAM OR DOWNSTREAM POOL WITHIN THE SURVEYED REACH, UNLESS OTHERWISE NOTED IN APPLICATION MATERIALS.
3. MEAN MEANDER BELT WIDTH: 139'
4. MEANDER WIDTH RATIO: 2.59

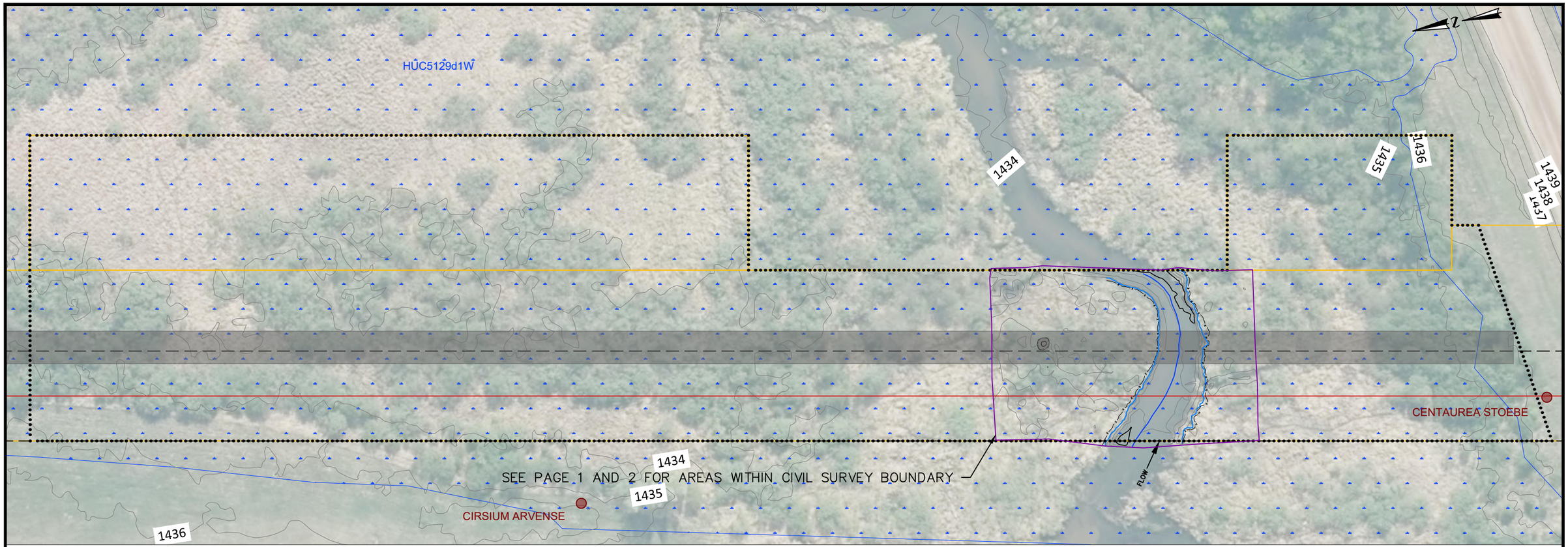
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

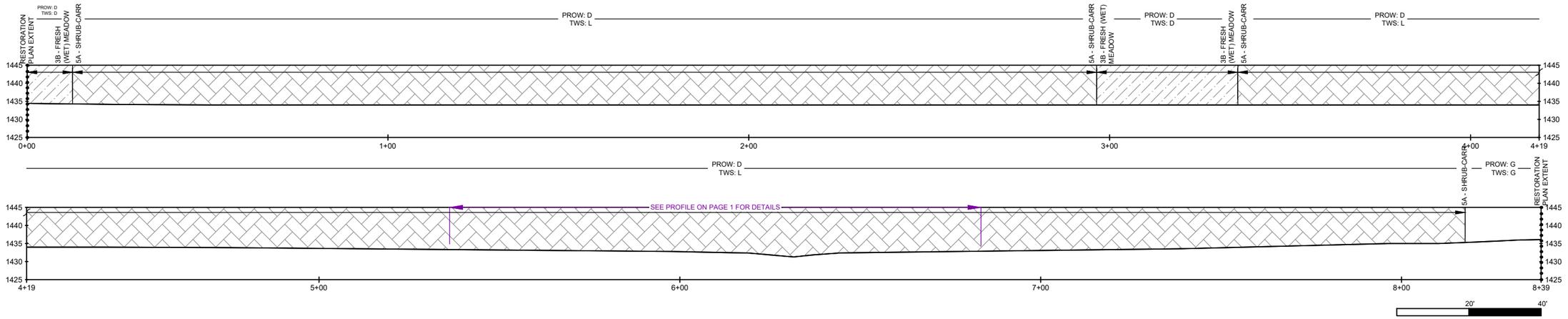
ENBRIDGE

DWN. BY: AJJ	DATE 10/2020
CHK.	
PROJ. ENGR.	
PROJ. MGR.	
CLIENT APP.	

PROPOSED ENBRIDGE L3R PIPELINE
PRIMARY METHOD - DRY CROSSING
CROSSING OF SHELL RIVER
ENBRIDGE MP 976.6
HUBBARD COUNTY, MINNESOTA

SCALE: NOTED
DWG. NO.: B-93-5.84-MDNR-34-0





BWSR SEED MIX	D: WET MEADOW NE (34–371); G: DRY PRAIRIE GENERAL (35–221); L: NATURAL REVEGETATION
SOBS (O/H) or NPC (S1-3)	N/A

1. ELEVATIONS OUTSIDE OF THE AREA WITHIN CIVIL SURVEY BOUNDARY ARE DERIVED FROM LIDAR. ENBRIDGE WILL RESTORE THE AREAS ADJACENT TO THE PUBLIC WATER WITHIN THE MDNR EXPANDED RESTORATION BOUNDARY TO PRE–CONSTRUCTION CONDITIONS.
2. MDNR REGION 1 PWI – COOL/WARM WATER FISHERY: MARCH 15 – JUNE 30. 24–HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
3. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
4. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
5. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.
6. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
7. SEE THE PLANTING PLAN FOR ADDITIONAL DETAIL REGARDING SEEDING PRACTICES AND SEED MIXES AT PUBLIC WATER CROSSINGS.
8. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).
9. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

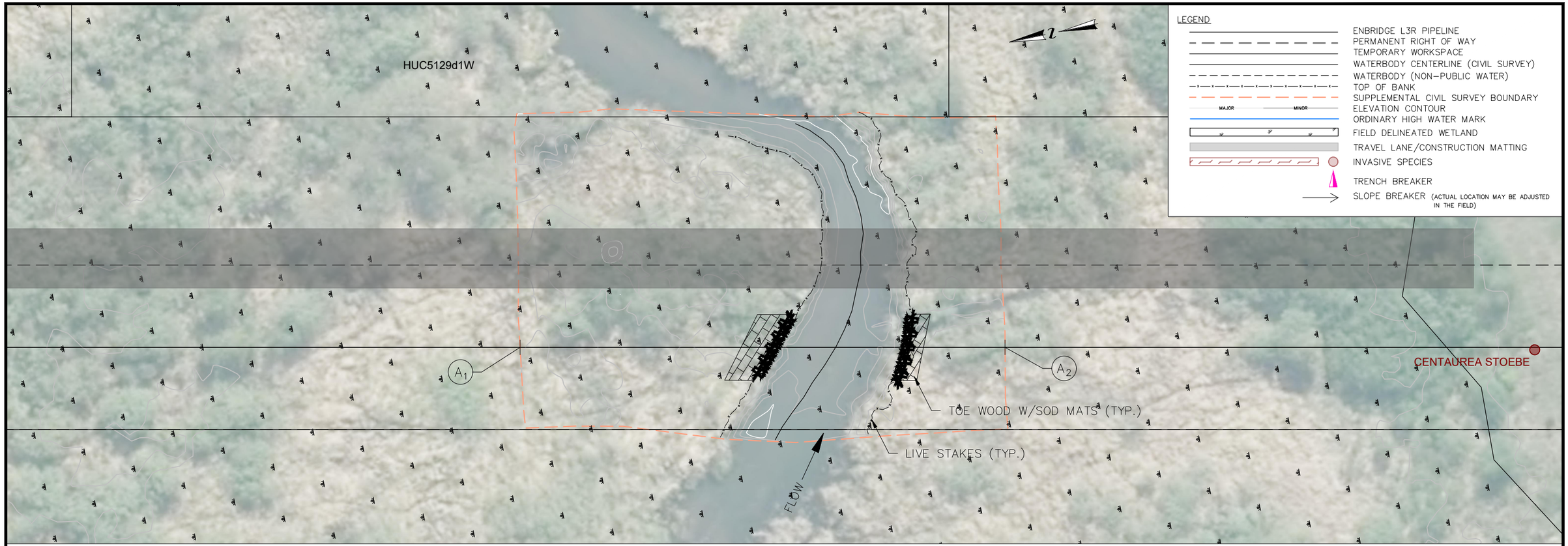
LEGEND

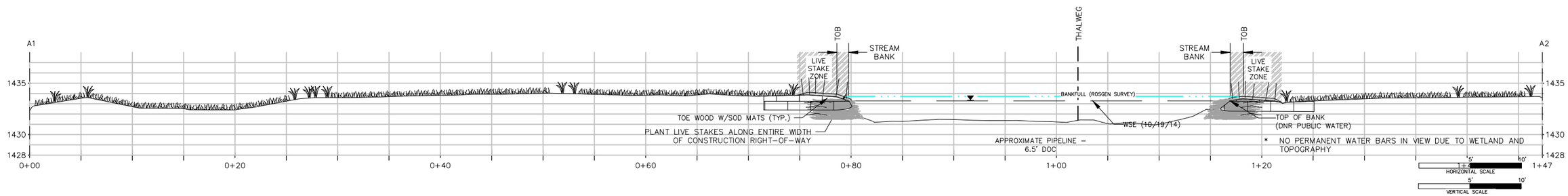
- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY CENTERLINE (CIVIL SURVEY)
- WATERBODY (NON–PUBLIC WATER)
- PUBLIC WATER CIVIL SURVEY BOUNDARY
- MDNR EXPANDED RESTORATION BOUNDARY
- TOP OF BANK
- ELEVATION CONTOUR (MAJOR / MINOR)
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- INVASIVE SPECIES
- TRENCH BREAKER
- PERMANENT SLOPE BREAKER (ACTUAL LOCATION MAY BE ADJUSTED IN THE FIELD)
- 1 – SHALLOW, OPEN WATER
- 2B – SHALLOW MARSH
- 3A – SEDGE MEADOW
- 3B – FRESH (WET) MEADOW
- 5A – SHRUB–CARR
- 5B – ALDER THICKET
- 6A – HARDWOOD SWAMP
- 6B – CONIFEROUS SWAMP

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		
A	ISSUED FOR REVIEW	MJT	09/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
RE–VEGETATION PLAN: EXPANDED EXTENT

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–001A	1A/5





PROPOSED RESTORATION ACTIVITIES WILL BE REVIEWED BY DNR AND ENBRIDGE DURING SITE VISIT AND MAY BE CHANGED TO REFLECT SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

FEATURE ID	HUC5130aWB; IFC ID: S-200.0
CROSSING TYPE	DRY CROSSING
PROPOSED RESTORATION (SEE DETAILS FOR LIVE STAKING, TRANSPLANTS, AND SHRUB SPECIES IF APPLICABLE)	BRUSH - TOE WOOD AND SOD MATS
WITHIN OR ADJACENT WETLAND	SHRUB-CARR
BWSR SEED MIX	WET MEADOW NE (34-371)
DOMINANT WETLAND VEGETATION	1. CAREX LACUSTRIS 3. SALIX PETIOLARIS 2. PHALARIS ARUNDINACEA 4. SALIX DISCOLOR
SOBS (O/H) or NPC (S1-3)	N/A

NOTES

1. CONSTRUCTION TIMING RESTRICTIONS
   - 1.1. MDNR REGION 1 PWI - COOL/WARM WATER FISHERY: MARCH 15 - JUNE 30.
   - 1.2. WHEN WORK OCCURS WITHIN "WORK IN WATER RESTRICTIONS", ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD
   - 1.3. WILD RICE: APRIL 1 - JULY 15
2. WORK SHALL BE CONDUCTED IN ACCORDANCE WITH APPLICABLE STANDARDS IN ENBRIDGE'S EPP AND VMP FOR PUBLIC LANDS AND WATERS. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE THESE STANDARDS.
3. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
4. INFORMATION REGARDING SEEDING SPECIFICATIONS, SEED BED PREPARATION TECHNIQUES, ETC. ARE DESCRIBED IN THE PLANTING PLAN CONTAINED WITHIN THE VMP.
5. TRENCH BREAKER LOCATION IS APPROXIMATE PENDING FIELD VERIFICATION (EPP SECTION 1.13)

ENBRIDGE

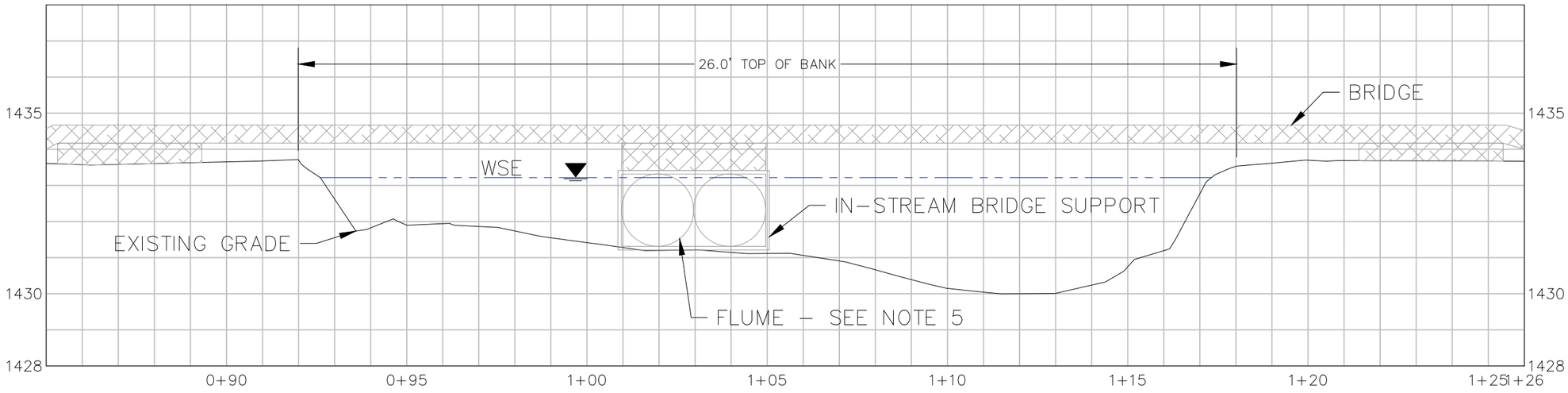
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
SHELL RIVER - MP 976.6 - MDNR ID 34
RE-VEGETATION PLAN

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-976.6-001	1/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (BRIDGE)

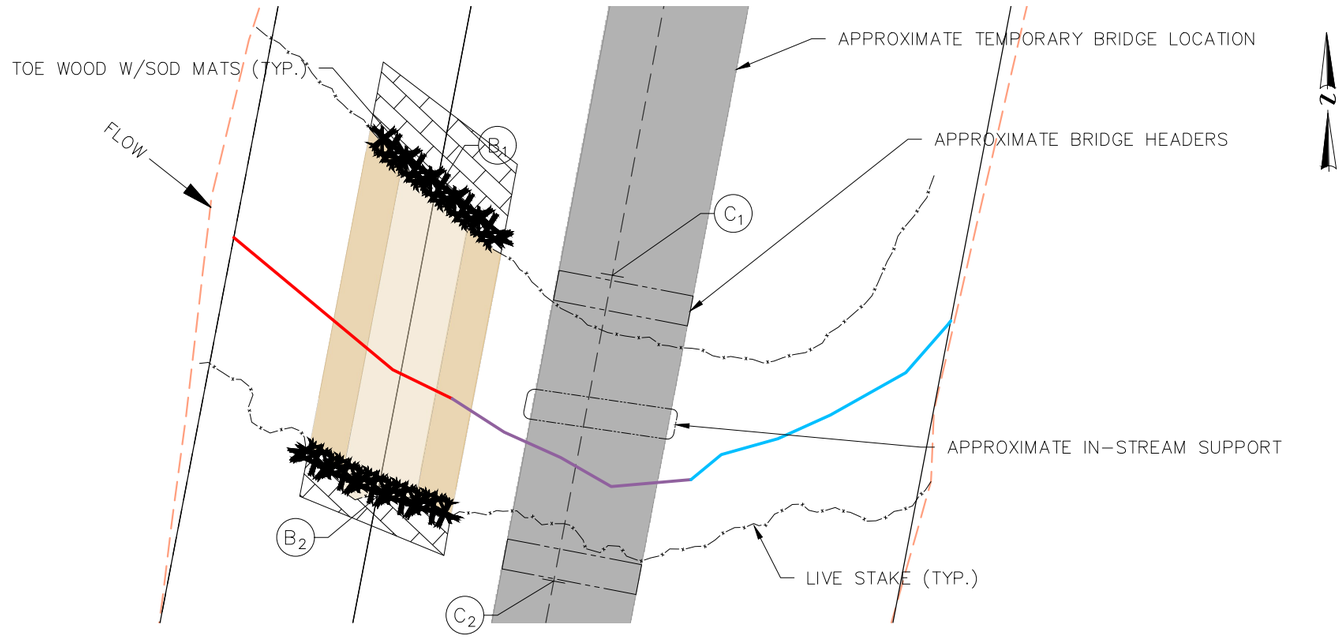


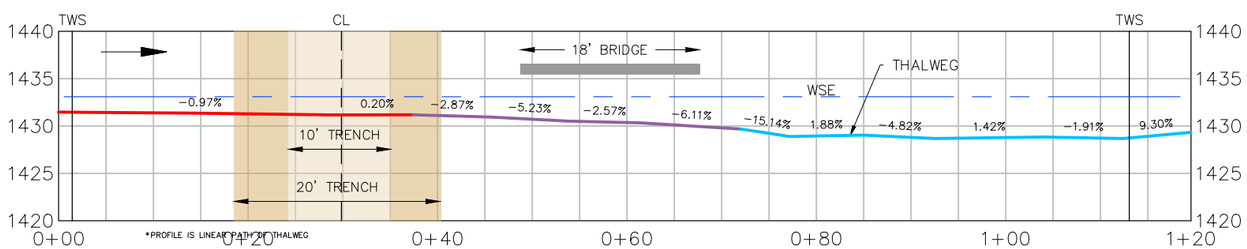
*APPROXIMATE WSE IS PROVIDED FOR CONSTRUCTION RELATED ACTIVITIES.

5' 10'
HORIZONTAL SCALE

5' 10'
VERTICAL SCALE

STREAMBED RESTORATION





*PROFILE IS LINEAR PATH OF THALWEG

NOTES

1. TRANSITIONS BETWEEN EXISTING CHANNEL FEATURES (BED, BANK, FLOODPLAIN) AND PROPOSED RESTORED TRENCH CROSSING WILL BE SMOOTH AND EVENLY GRADED WITHOUT ABRUPT OR PROTRUDING OBSTRUCTIONS.
2.
3. MINIMIZE DISTURBANCE OF BED MATERIALS AND FEATURES DURING CONSTRUCTION OF THE TRENCH AND INSTALLATION AND REMOVAL OF IN-STREAM SUPPORT
4. BED AND/OR BANK MATERIALS TEMPORARILY ADJUSTED OR REMOVED DURING CONSTRUCTION SHALL BE PLACED IN THE APPROXIMATE ORIGINAL LOCATION DURING RESTORATION. MATERIALS SHALL BE FIELD ADJUSTED DURING PLACEMENT BASE ON THE OBSERVED FLOW PATH AT THE TIME OF CONSTRUCTION.
5. ALIGNMENT OF IN-STREAM SUPPORT SHALL BE FIELD ADJUSTED BASED ON FLOW PATH TO PROTECT CHANNEL BANKS.
6. SEE RESTORATION SHEET FOR B1-B2 CROSS SECTION.

LEGEND

- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY - RIFFLE (ROSGEN SURVEY)
- WATERBODY - POOL (ROSGEN SURVEY)
- WATERBODY - RUN (ROSGEN SURVEY)
- WATERBODY - GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH - 10'
- TRENCH - 20'

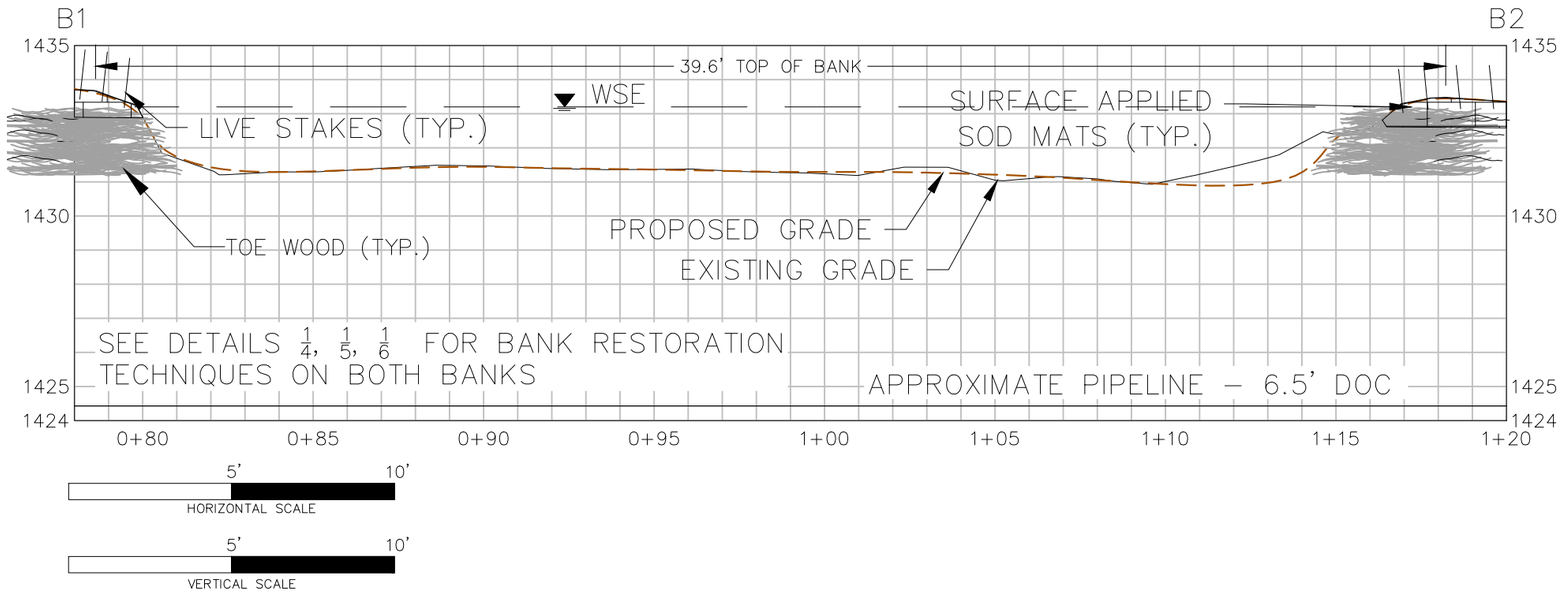
NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
SHELL RIVER - MP 976.6 - MDNR ID 34
STABILIZATION PLAN

SCALE	DWG. NO.	PAGE NO.
	SSRP-976.6-002	2/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (CENTERLINE)



5' 10'
HORIZONTAL SCALE

5' 10'
VERTICAL SCALE

	COMMON NAME	SCIENTIFIC NAME
LIVE STAKE SPECIES	ELDERBERRY	SAMBUCUS CANADENSIS
	HIGH BUSH CRANBERRY	VIBURNUM OPOLUS (TRILOBUM)
	RED-OSIER DOGWOOD	CORNUS STOLONIFERA
	SILKY DOGWOOD	CORNUS AMOMUM
TRANSPLANTS	SPECKELD ALDER	ALNUS INCANA
	WILLOW	SALIX SPP.
	DOGWOOD	CORNUS SPP.
SHRUB	NONE	NONE

1. PRELIMINARY SPECIES. PRIOR TO RESTORATION ACTIVITIES, ALL SPECIES WILL BE REQUIRED TO BE VERIFIED AS NATIVE AND FOUND WITHIN THE COUNTY WHERE PLANTED ON MNTAXA.
2. LIVE STAKE SPECIES SELECTION: USE AT LEAST THREE (3) SPECIES WITH NO MORE THAN 60% OF ANY ONE (1) SPECIES; ALTERNATIVE SPECIES MAY BE SELECTED BASED ON SITE CONDITIONS AND AVAILABILITY. ALTERNATIVE SPECIES SHOULD BE REVIEWED AGAINST USDA DATA BASE FOR MN NATIVE SPECIES.
3. (WHERE APPLICABLE) TRANSPLANTS AND/OR CONTAINER SHRUBS MAY BE SUBSTITUTED FOR LIVE STAKES BASED ON SITE SPECIFIC CONDITIONS.
   - 3.1. CONTAINER PLANTED SHRUBS ARE RECOMMENDED TO BE 18"– 24" IN SIZE.
   - 3.2. CONTAINER PLANTED SHRUBS SPACING: 1 SHRUB PER 3 LINEAR FEET OF BANK, ADDITIONAL ROWS SPACED 3 FEET APART, AND 3–5 SHRUBS OF THE SAME SPECIES.
4. (WHERE APPLICABLE) TRANSPLANTS SHOULD BE EXCAVATED WITH A MINIMUM OF 12" SOIL, DIAMETER EQUAL TO PLANT DRIP LINE, AND LOOSE UNBOUND BALL.
5. LIVE STAKE SPACING (WHERE APPLICABLE): STAGGER 1 STAKE PER 3 LINEAR FEET OF STREAM BANK IN 2 – 3 ROWS SPACED 1 FOOT APART. PLACE FIRST ROW ALONG TOP OF BANK (BANKFULL) AND THE LOWER ROW(S) BETWEEN THE TOP OF BANK AND OHWM

GENERAL
1. REFER TO RESTORATION DETAIL SHEETS FOR ADDITIONAL INFORMATION RELATED TO PROPOSED RESTORATION MEASURES.
2. REFER TO SITE PHOTOS FOR INFORMATION ON PRE-CONSTRUCTION CROSSING CONDITIONS AND TO PROVIDE ADDITIONAL GUIDANCE FOR RESTORATION EFFORTS.

TOE WOOD
1. ROUGH GRADE CHANNEL BED FEATURES INCLUDING POOLS AND PLACEMENT OF SUBSTRATE.
2. INSTALL FOOTER LOG(S) ALONG PROPOSED TOE OF SLOPE. FOOTER LOGS SHOULD BE ANGLED TO ALLOW FOR TOE ALIGNMENT TO GENERALLY MATCH THE EXISTING CURVE AND EVENLY TRANSITION FROM UPSTREAM TO DOWNSTREAM.
3. PUSH FOOTER LOG INTO SOIL APPLY A SMALL AMOUNT OF GRAVEL OR STONE AS NEEDED TO PREVENT FLOATATION OF FOOTER LOG PRIOR TO PLACING WOODY DEBRIS.
4. PLACE A LAYER WOODY DEBRIS IN 6" TO 8" LIFTS, APPLY 3"-4" GRAVEL AND/OR SOIL FILL AND COMPACT WITH EXCAVATOR BUCKET. WASH FILL MATERIAL INTO WOODY DEBRIS MATRIX WITH WATER FROM CHANNEL. APPLY ADDITIONAL LAYERS "AS NEEDED" TO REACH THE SPECIFIED TOE WOOD HEIGHT.
5. PLACE STACKED SOD MATS ABOVE TOE WOOD. THE USE OF TRANSPLANTS OR FABRIC LIFTS MAY BE FIELD APPROVED BY ENBRIDGE IN CONSULTATION WITH MN DNR.

SOD MATTING
1. REMOVE VEGETATED MATS ON EITHER SIDE OF THE STREAM CROSSING USING ONSITE EQUIPMENT WHICH CAN UNDERCUT THE VEGETATION FOR REMOVAL. SMALL SHRUBS AND/OR TREES WITHIN THE SOD MATS ARE ACCEPTABLE AND SHOULD NOT BE REMOVED. DEPENDING ON THE LEVEL OF SATURATION AT THE TIME OF REMOVAL, IT MAY BE DIFFICULT TO OBTAIN INTACT CONSOLIDATED MATS, BUT GENERALLY THE NATIVE VEGETATION WILL BE RETAINED AND CAPTURED FOR PLACEMENT.
2. SOD MATS CAN BE TRANSPLANTED DURING ANY SEASON.
3. SOD MAT WILL BE PLACED ON CLEAR GROUND OR MATS WITHIN THE WORKSPACE.
4. MONITOR MATS TO SUPPORT SURVIVABILITY; WATERING MAY BE NEEDED.
5. RIOR TO PLACEMENT OF SOD MATS FINISH GRADE CHANNEL BANK AND ADJACENT FLOODPLAIN APPLICATION AREA TO PROVIDE A SMOOTH AND EVEN SURFACE. SUBGRADE ELEVATION SHOULD ALLOW FOR THE FINISHED SOD SURFACE TO TRANSITION EVENLY WITH THE CHANNEL BANKS UPSTREAM AND DOWNSTREAM OF THE INSTALLATION AREA. AVOID ABRUPT CHANGES IN GRADE.
6. 7EGETATED MATS WILL BE RETURNED/SET IN PLACE WITH ONSITE EQUIPMENT.
7. SURFACE APPLIED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PERPENDICULAR TO THE CHANNEL / FLOW.
8. STACKED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PARALLEL TO THE CHANNEL / FLOW.
9. WHEN PLACING SOD MATS, DO NOT LEAVE LARGE GAPS BETWEEN EACH SOD MAT AS NON-NATIVE VEGETATION WILL QUICKLY ATTEMPT TO COLONIZE THESE VOIDS.
10. WATER SOD MATS AFTER REPLACEMENT IF CONDITIONS ARE HOT AND DRY. DAMP AND/OR FROZEN SOD MATS DO NOT REQUIRE WATERING.
11. THE TOP MAT AND/OR OTHER MATS CAN BE ANCHORED WITH A LIVE AND/OR DEAD STOUT STAKE TO ENSURE THAT IT DOES NOT MOBILIZE DURING A FLOOD EVENT BEFORE THE ROOTS HAVE ESTABLISHED.
12. 1THE VEGETATED MATS WILL BE REPLACED AS SOON AS PRACTICAL FOLLOWING BACKFILLING OF THE TRENCH AND STABILIZED PER THE TIMING REQUIREMENTS DESCRIBED IN SECTION 1.9.1 OF THE EPP.

LIVE STAKING
1. CLEANLY REMOVE ALL SIDE BRANCHES AND THE TOP GROWTH, AND FASHION THE CUTTINGS INTO LIVE STAKES AS DEPICTED IN THE DETAIL DRAWING. AN OPTION DURING PREPARATION IS TO PAINT AND SEAL THE TOP OF THE LIVE STAKE BY DIPPING THE TOP 1-2 INCHES INTO A 50-50 MIX OF LIGHT-COLORED LATEX PAINT AND WATER. SEALING THE TOP OF STAKE WILL REDUCE THE POSSIBILITY OF DESICCATION, ASSURE THE STAKES ARE PLANTED WITH THE TOP UP, AND MAKES THE STAKES MORE VISIBLE FOR SUBSEQUENT PLANTING EVALUATIONS.
2. USE A PUNCH BAR OR HAND AUGER TO CREATE A NARROW PILOT HOLE, PERPENDICULAR TO THE SLOPE, THROUGH ANY EROSION CONTROL MATTING, RIP RAP, OR OTHER REVETMENT, FILTER FABRIC, ETC., IF PRESENT, AND DEEP ENOUGH TO INTERCEPT THE WATER TABLE. THE HOLE SHOULD BE ONLY AS LARGE AS NECESSARY TO INSTALL THE LIVE STAKE WITHOUT DAMAGE WHILE ENSURING THE HIGHEST AMOUNT OF STAKE-SOIL CONTACT.
3. INSERT THE POINTED END OF THE LIVE STAKE INTO THE PILOT HOLE. TAMP INTO THE GROUND WITH A DEAD BLOW HAMMER TAKING CARE NOT TO SPLIT OR OTHERWISE DAMAGE THE LIVE STAKE. USE WATER, SOIL BACKFILL, TAMPING, ETC. TO ACHIEVE GOOD SOIL-TO-STEM CONTACT AND REMOVE AIR POCKETS.
4. USE ONSITE EQUIPMENT TO APPLY WATER FROM THE CHANNEL AFTER INSTALLATION.
5. ALL CUTS SHOULD BE CLEAN AND SMOOTH. NO CRACKED OR SPLIT LIVE STAKES SHOULD BE USED. IF THEY SPLIT DURING TAMPING, THEY SHOULD BE CUT BELOW THE CRACK OR REPLACED.
6. THE SPECIFIED NUMBER OF LIVE STAKES SHOULD BE INSTALLED INTO THE SOIL AND PROTRUDE ABOVE THE SOIL AND ANY SOD MATTING, MULCHING, EROSION CONTROL MATTING, RIP RAP, OR OTHER REVETMENT.
7. LIVE STAKE SHOULD NOT MOVE AFTER INSTALLATION; ENSURING IT IS IN FIRM CONTACT WITH THE SOIL.
8. IT IS IMPORTANT TO ENSURE THAT THE UPSTREAM AND DOWNSTREAM ENDS OF THE LIVE STAKING A MERGE SMOOTHLY INTO THE UNDISTURBED BANK BEYOND THE PROJECT AREA. THE RATE OF INSTALLING LIVE STAKES SHOULD TAPER OFF GRADUALLY TO BLEND IN WITH THE EXISTING VEGETATION.

LEGEND

- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY – RIFFLE (ROSGEN SURVEY)
- WATERBODY – POOL (ROSGEN SURVEY)
- WATERBODY – RUN (ROSGEN SURVEY)
- WATERBODY – GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH – 10'
- TRENCH – 20'

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
SITE SPECIFIC DETAILS

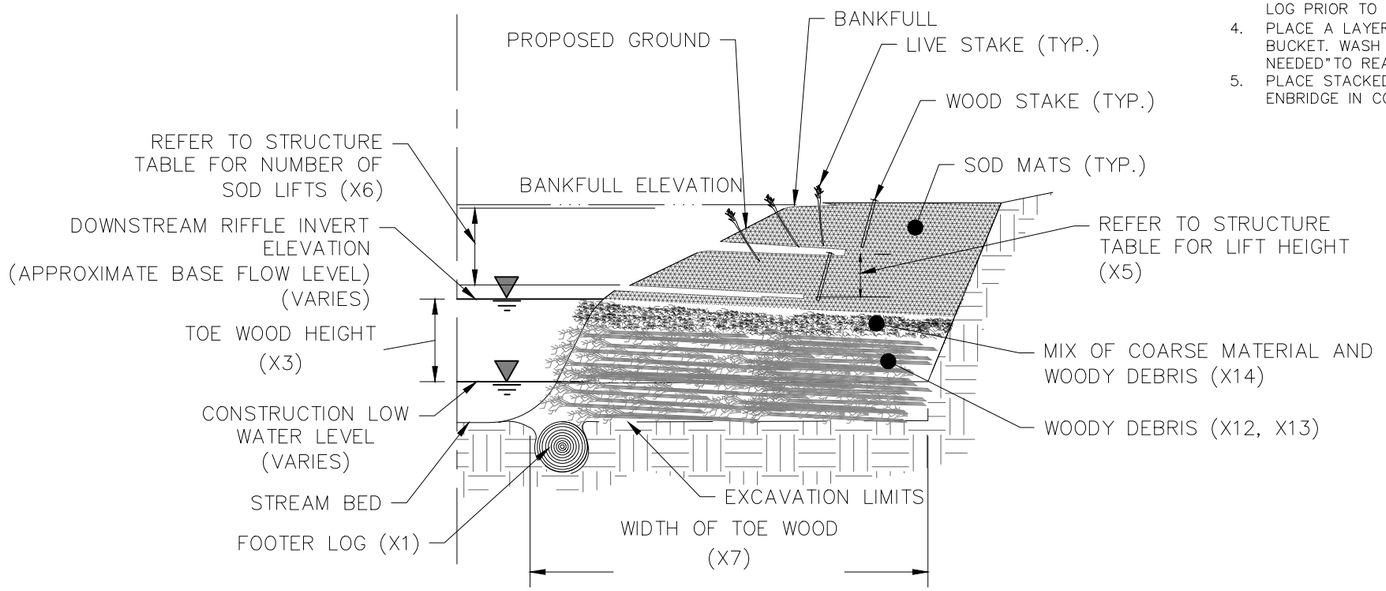
SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–004	3/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

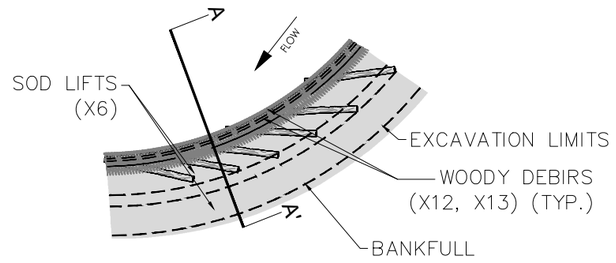
TOE WOOD DIMENSIONS			
VARIABLE	**VALUE**	**TYPICAL UNIT**	**DESCRIPTION**
X1	6.0 - 10.0	IN.	FOOTER LOG DIAMETER
X2	8.0 - 12.0	FT.	FOOTER LOG LENGTH
X3	18.0	IN.	TOE WOOD HEIGHT
X4	SEE SHEET 3	N/A	MATCH TYPICAL SECTION
X5	SEE SHEET 5	FT.	SOD LIFT HEIGHT
X6	3.0	#	SOD LIFTS
X7	8.0 - 10.0	FT.	TOE WOOD WIDTH
X8	3.0 - 6.0	FT.	SOD LIFT WIDTH
X9	24.0	IN.	WOOD STAKE LENGTH
X10	4.0	IN.	WOOD STAKE WIDTH (TOP)
X11	0.5	IN.	WOOD STAKE WIDTH (BOTTOM)
X12	1/2 - 3.0	IN.	WOODY DEBRIS DIAMETER
X13	8.0 - 12.0	FT.	WOODY DEBRIS LENGTH
X14	3" MINING GRAVEL WITH FINES	%	SELECT COARSE MATERIAL BACKFILL (BY VOLUME)

TOE WOOD EXAMPLE

NOTES:
1. ROUGH GRADE CHANNEL BED FEATURES INCLUDING POOLS AND PLACEMENT OF SUBSTRATE.
2. INSTALL FOOTER LOG(S) ALONG PROPOSED TOE OF SLOPE. FOOTER LOGS SHOULD BE ANGLED TO ALLOW FOR TOE ALIGNMENT TO GENERALLY MATCH THE EXISTING CURVE AND EVENLY TRANSITION FROM UPSTREAM TO DOWNSTREAM.
3. PUSH FOOTER LOG INTO SOIL APPLY A SMALL AMOUNT OF GRAVEL OR STONE AS NEEDED TO PREVENT FLOATATION OF FOOTER LOG PRIOR TO PLACING WOODY DEBRIS.
4. PLACE A LAYER WOODY DEBRIS IN 6"TO 8"LIFTS, APPLY 3"–4"GRAVEL AND/OR SOIL FILL AND COMPACT WITH EXCAVATOR BUCKET. WASH FILL MATERIAL INTO WOODY DEBRIS MATRIX WITH WATER FROM CHANNEL. APPLY ADDITIONAL LAYERS "AS NEEDED"TO REACH THE SPECIFIED TOE WOOD HEIGHT.
5. PLACE STACKED SOD MATS ABOVE TOE WOOD. THE USE OF TRANSPLANTS OR FABRIC LIFTS MAY BE FIELD APPROVED BY ENBRIDGE IN CONSULTATION WITH MN DNR.



SECTION A-A'



PLAN VIEW AT BANKFULL ELEVATION

1 TOE WOOD DETAIL

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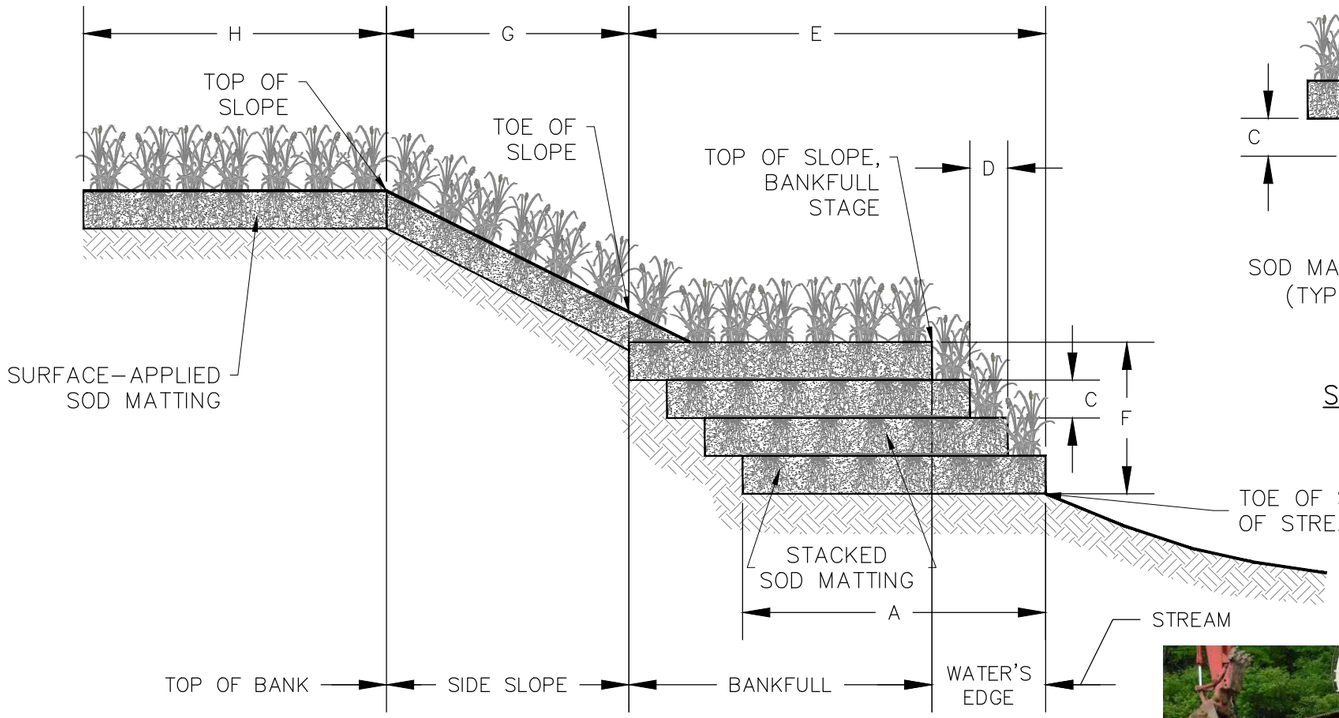
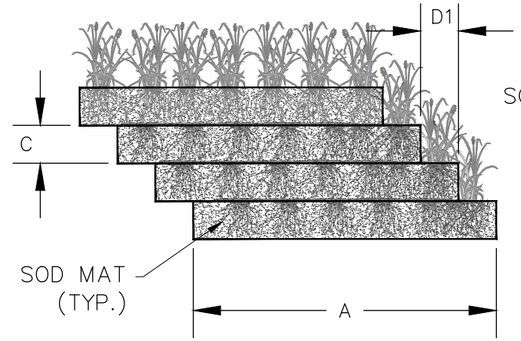
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–004	4/7

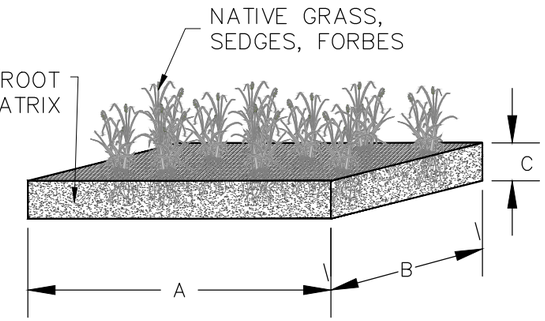
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



CROSS SECTION



STACKED SOD MATTING DETAIL



SOD MAT DETAIL

DIMENSION[2]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	SOD MAT WIDTH	FEET	3–4	WIDTH OF INDIVIDUAL SOD MAT.
B	SOD MAT LENGTH	FEET	3–6	LENGTH OF INDIVIDUAL SOD MAT.
C	SOD MAT THICKNESS	INCHES	12	THICKNESS OF INDIVIDUAL SOD MAT.
D	STACKED SOD MAT SETBACK	FEET	N/A	THE DISTANCE BETWEEN THE EDGES OF SOD MATS STACKED TO FORM A SLOPE
E	WIDTH OF STACKED SOD MATS	FEET	N/A	WIDTH OF A BANK CREATED BY STACKED SOD MATS
F	HEIGHT OF STACKED SOD MATS	FEET	N/A	HEIGHT OF A SLOPE CREATED BY STACKED SOD MATS
G	WIDTH OF SURFACE-APPLIED SOD MATS	FEET	10–20	WIDTH OF A SLOPE STABILIZED WITH SURFACE-APPLIED SOD MATS
H	TOP OF BANK SOD MATTING DISTANCE	FEET	15	DISTANCE SOD MATTING IS INSTALLED ON THE TOP OF BANK
NOTES:				
1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.				

SOD MATTING DETAIL

SOD MATTING

1. REMOVE VEGETATED MATS ON EITHER SIDE OF THE STREAM CROSSING USING AN EXCAVATOR WHICH CAN UNDERCUT THE VEGETATION FOR REMOVAL. SMALL SHRUBS AND/OR TREES WITHIN THE SOD MATS ARE ACCEPTABLE AND SHOULD NOT BE REMOVED.
2. DEPENDING ON THE LEVEL OF SATURATION AT THE TIME OF REMOVAL, IT MAY BE DIFFICULT TO OBTAIN INTACT CONSOLIDATED MATS, BUT GENERALLY THE NATIVE VEGETATION WILL BE RETAINED AND CAPTURED FOR PLACEMENT.
3. SOD MATS CAN BE TRANSPLANTED DURING ANY SEASON IF THERE IS SUFFICIENT MOISTURE IN THE SOIL WHERE THEY WILL BE PLACED. IF CONDITIONS ARE DRY, USE THE EXCAVATOR BUCKET OR PUMP TO APPLY WATER FROM THE CHANNEL PRIOR TO CUTTING.
4. PLACE THE VEGETATED MATS ON TIMBER MATS OR CLEAR GROUND AREA LOCATED IN THE ATWS USING SKID STEER OR FRONT–END LOADER.
5. MONITOR MATS TO SUPPORT SURVIVABILITY; WATERING MAY BE NEEDED.
6. PRIOR TO PLACEMENT OF SOD MATS FINISH GRADE CHANNEL BANK AND ADJACENT FLOODPLAIN APPLICATION AREA TO PROVIDE A SMOOTH AND EVEN SURFACE. SUBGRADE ELEVATION SHOULD ALLOW FOR THE FINISHED SOD SURFACE TO TRANSITION EVENLY WITH THE CHANNEL BANKS UPSTREAM AND DOWNSTREAM OF THE INSTALLATION AREA. AVOID ABRUPT CHANGES IN GRADE.
7. RETURN THE VEGETATED MATS USING A SKID STEER OR FRONT–END LOADER.
8. SURFACE APPLIED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PERPENDICULAR TO THE CHANNEL / FLOW.
9. STACKED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PARALLEL TO THE CHANNEL / FLOW.
10. WHEN PLACING SOD MATS, DO NOT LEAVE LARGE GAPS BETWEEN EACH SOD MAT AS NON–NATIVE VEGETATION WILL QUICKLY ATTEMPT TO COLONIZE THESE VOIDS.
11. WATER SOD MATS AFTER REPLACEMENT.
12. THE TOP MAT AND/OR OTHER MATS CAN BE ANCHORED WITH A LIVE AND/OR DEAD STOUT STAKE TO ENSURE THAT IT DOES NOT MOBILIZE DURING A FLOOD EVENT BEFORE THE ROOTS HAVE ESTABLISHED.
13. VEGETATED MATS WILL BE REPLACED WITHIN 7 DAYS AS REQUIRED BY THE CONSTRUCTION SWPPP OR AS SOON AS PRACTICAL FOLLOWING BACKFILLING OF THE TRENCH.

SOD MAT EXAMPLES

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B	ISSUED FOR PERMITTING		10/2020		
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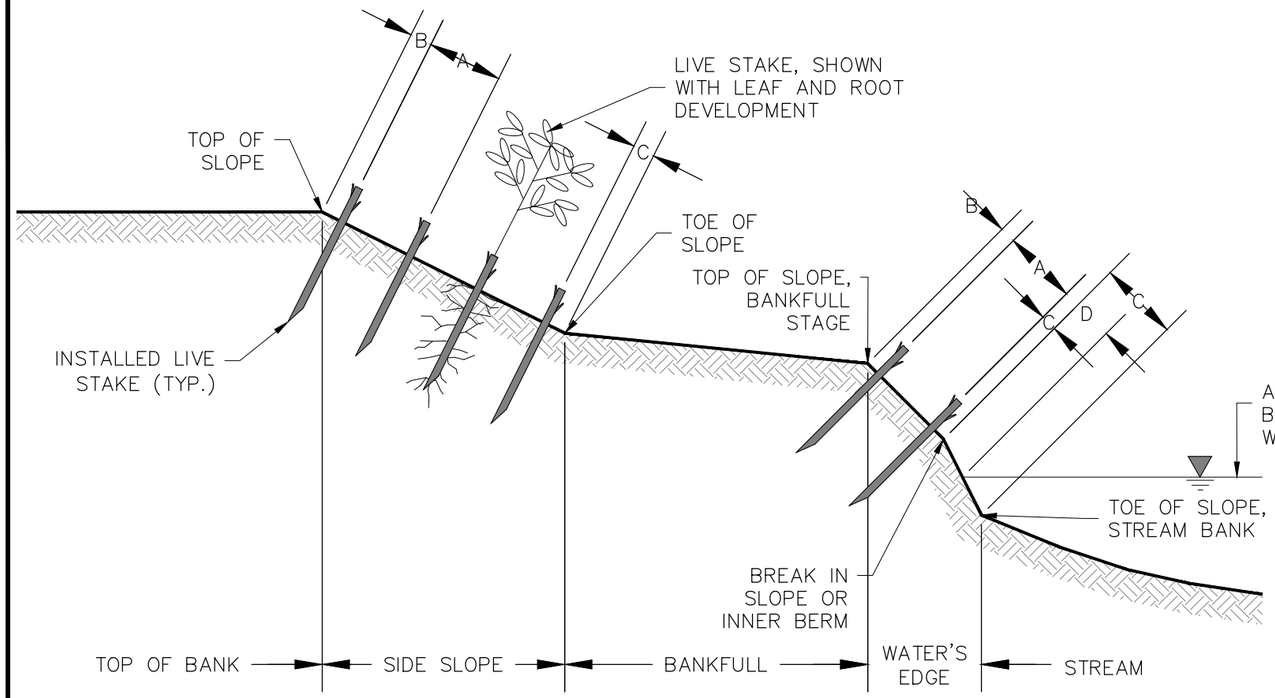
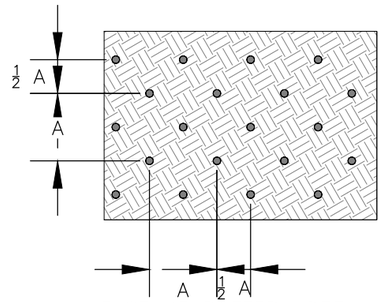
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–004	5/7

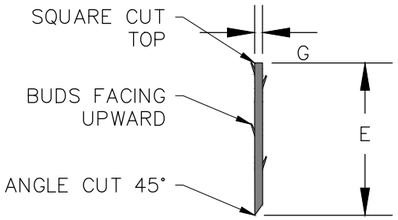
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



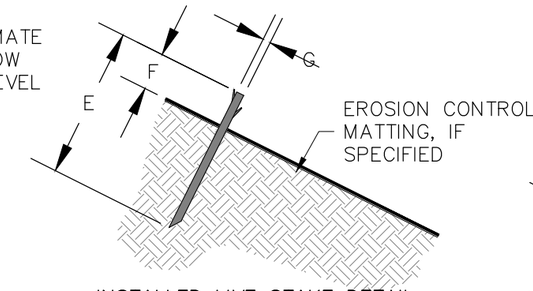
CROSS SECTION



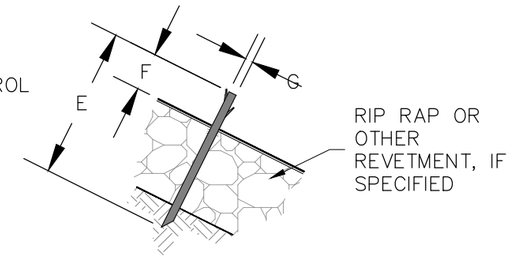
LIVE STAKE PATTERN DETAIL



LIVE STAKE DETAIL



INSTALLED LIVE STAKE DETAIL



INSTALLED JOINT PLANTING DETAIL

DIMENSION[2]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	LIVE STAKE SPACING	FEET	3.00	SPACING BETWEEN INDIVIDUALLY INSTALLED LIVE STAKES. STAKES CAN BE PLACED IN A TRIANGULAR GRID (NRCS 2007A) OR RANDOMLY (NRCS 2007A, IOWA DNR 2006). RECOMMEND SPECIES DIVERSITY THROUGHOUT PROJECT AREA.
B	LIVE STAKE – TOP OF SLOPE PLACEMENT	FEET	0 – 3	POSITION OF LIVE STAKE RELATIVE TO THE TOP OF A SLOPE
C	LIVE STAKE – TOE OF SLOPE PLACEMENT	FEET	0 – 3	POSITION OF LIVE STAKE RELATIVE TO THE TOE OF A SLOPE
D	LIVE STAKE – BASE FLOW RELATIONSHIP	FEET	1433.2+/–	PLACEMENT OF LOWER ROW OF LIVE STAKES RELATIVE TO THE APPROXIMATE BASE FLOW WATER LEVEL WITH CONSIDERATION GIVEN TO DURATION OF INUNDATION DURING BANKFULL AND OTHER HIGH FLOW EVENTS.
E	LIVE STAKE LENGTH	FEET	24–36	LENGTH OF PREPARED DORMANT LIVE CUTTING FROM WOODY PLANT TO BE USED AS LIVE STAKE. LENGTH SHOULD BE SUFFICIENT TO REACH LOW-FLOW WATER TABLE ELEVATION.
F	LIVE STAKE PROTRUSION	FEET	3–4	DISTANCE INSTALLED LIVE STAKE SHOULD PROTRUDE ABOUT 20% FROM THE GROUND. AT LEAST TWO BUDS OR BUD SCARS SHOULD BE PRESENT ABOVE THE GROUND IN THE FINAL INSTALLATION, DEPENDING ON THE SURROUNDING VEGETATION HEIGHT.
G	LIVE STAKE DIAMETER	INCHES	½ – 1 ½	DIAMETER OF PREPARED DORMANT LIVE CUTTING FROM WOODY PLANT TO BE USED AS LIVE STAKE – TYPICALLY CITE A PERMISSIBLE MINIMUM AND MAXIMUM DIAMETER.

NOTES:

1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.

LIVE STAKE PLANTINGS DETAIL

LIVE STAKE EXAMPLE

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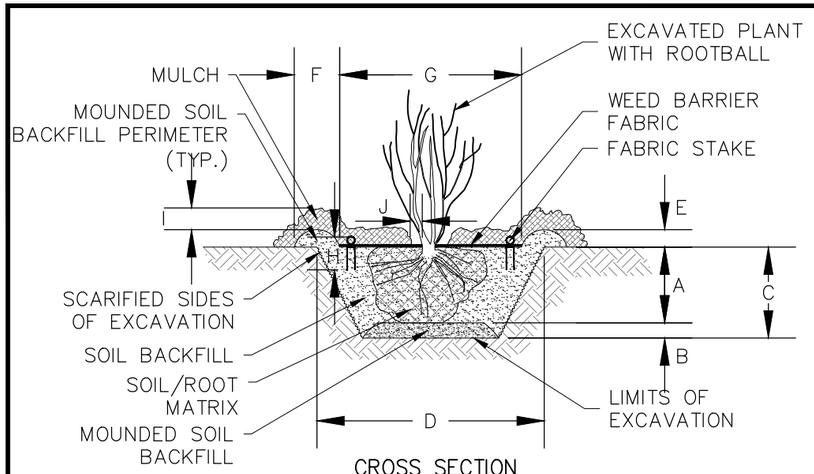
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–004	6/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)



CROSS SECTION

DIMENSION[2]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	PLANTING DEPTH	VARIES		PLANTING DEPTH OF THE TRANSPLANT.
B	HEIGHT OF MOUNDED SOIL BACKFILL	INCHES		HEIGHT OF MOUNDED LOOSE SOIL PLACED INTO OVER-EXCAVATED PLANTING PIT.
C	DEPTH OF PLANTING PIT	VARIES		DEPTH OF THE PLANTING PIT; ACCOMMODATES DIMENSION OF SOIL AND EXCAVATED ROOTS AS WELL AS MOUNDED LOOSE SOIL AT BOTTOM OF PIT.
D	WIDTH OF PLANTING PIT	VARIES		OVER-EXCAVATED WIDTH OF THE PLANTING PIT; ACCOMMODATES THE WIDTH OF THE EXCAVATED SOIL AND ROOTS.
E	HEIGHT OF MOUNDED SOIL PERIMETER	INCHES		HEIGHT OF SOIL BERM CONSTRUCTED ALONG THE PERIMETER OF THE PLANTING PIT; HELPS RETAIN WATER.
F	WIDTH OF MOUNDED SOIL PERIMETER	INCHES		WIDTH OF SOIL BERM CONSTRUCTED ALONG THE PERIMETER OF THE PLANTING PIT; HELPS RETAIN WATER.
G	WIDTH OF WEED BARRIER FABRIC (OPTIONAL)	INCHES		WIDTH OF FABRIC PLACED ON SURFACE TO CONTROL WEEDS WITHIN THE MOUNDED SOIL PERIMETER; TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED AND DO NOT REQUIRE WEED BARRIER FABRIC.
H	FABRIC STAKE LENGTH (OPTIONAL)	INCHES		LENGTH OF STAPLES/SPIKES USED TO SECURE WEED BARRIER FABRIC
I	THICKNESS OF MULCH (OPTIONAL)	INCHES		THICKNESS OF MULCH, IF NECESSARY. TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED AND DO NOT REQUIRE MULCH.
J	GAP BETWEEN MULCH AND PLANT STEM/TRUNK (OPTIONAL)	INCHES		ROOM BETWEEN PLANT STEM/TRUNK AND MULCH. TRANSPLANTS TYPICALLY HAVE GRASSES, LEAF MATTER, ETC. ATTACHED

NOTES:
1. DATA ARE FOR TRANSPLANTED VEGETATION.
2. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.

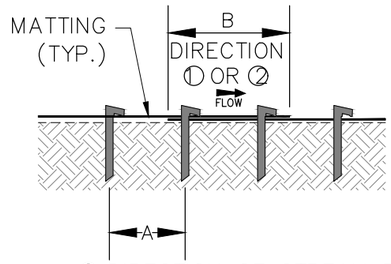
TRANSPLANTS EXAMPLES

TRANSPLANTING DETAIL

DIMENSION[2]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	MATTING STAKE SPACING	FEET, INCHES		SPACING BETWEEN EROSION CONTROL MATTING STAKES USED TO FASTEN THE MATTING TO THE SOIL
B	MATTING OVERLAP	FEET, INCHES		AMOUNT OF EROSION CONTROL MATTING OVERLAP IF MULTIPLE PIECES AND/OR ROLLS OF MATTING ARE USED. OVERLAP VARIES DEPENDING ON THE LOCATION OF THE OVERLAP WITH RESPECT TO POSITION ON THE SLOPE, LOCATION OF THE MATTING (EDGE OR END), AND PRODUCT SPECIFICATIONS.
C	MATTING ANCHOR TRENCH DEPTH	FEET, INCHES		DEPTH OF TRENCH INTO WHICH EDGE OF EROSION CONTROL MATTING IS ANCHORED AT THE TOP AND/OR TOE OF A SLOPE.
D	MATTING ANCHOR TRENCH WIDTH	FEET, INCHES		WIDTH OF TRENCH INTO WHICH EDGE OF EROSION CONTROL MATTING IS ANCHORED AT THE TOP AND/OR TOE OF A SLOPE.
E	TOP OF SLOPE ANCHOR TRENCH SETBACK	FEET, INCHES		TOP OF SLOPE ANCHOR TRENCH DISTANCE FROM THE TOP OF SLOPE. TOP OF SLOPE REFERS TO TOP OF SIDE SLOPE, BANK SLOPE, TERRACE SLOPE, BANKFULL, ETC.
F	MATTING STAKE LENGTH	INCHES		LENGTH OF EROSION CONTROL MATTING STAKES OR STAPLES USED TO FASTEN THE MATTING TO THE SOIL

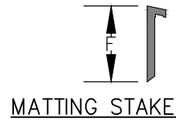
NOTES:
1. DATA ARE FOR EROSION CONTROL MATTING APPLIED TO STREAM BANK SLOPES.
2. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.

EROSION CONTROL MATTING DETAIL

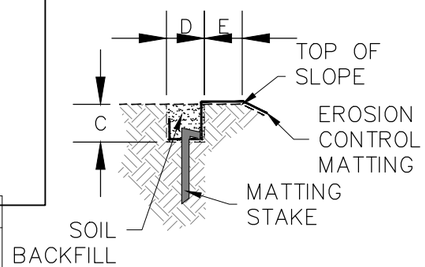


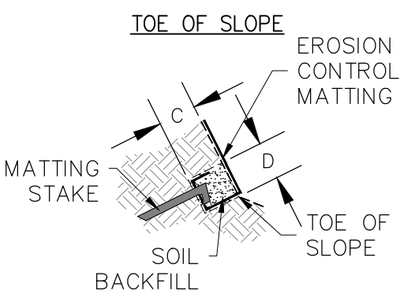
① DIRECTION OF STREAM FLOW
② DIRECTION DOWN THE BANK SLOPE

MATTING OVERLAP DETAIL

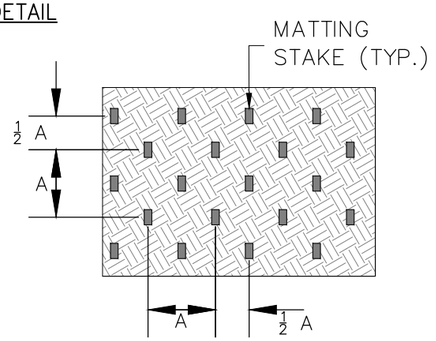


MATTING STAKE DETAIL





MATTING ANCHOR DETAIL



MATTING STAKE PATTERN DETAIL

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–976.6–004	7/7

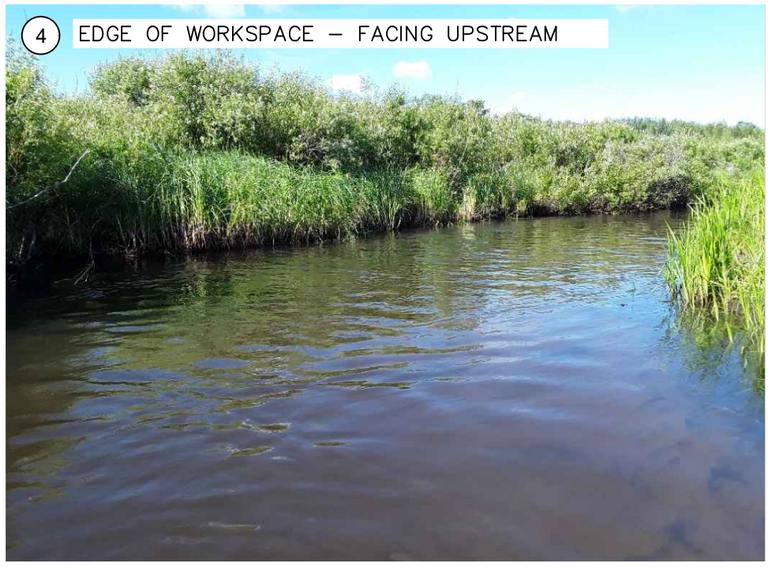
PLOTTED SIZE: ANSI FULL BLEED B (17x11)

1 CENTERLINE – FACING NORTH BANK

2 CENTERLINE – FACING SOUTH BANK

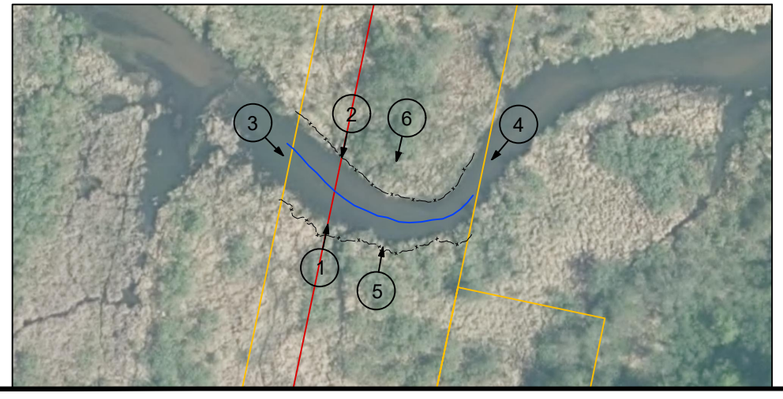
3 EDGE OF WORKSPACE – FACING DOWNSTREAM

4 EDGE OF WORKSPACE – FACING UPSTREAM



5 BRIDGE – FACING NORTH BANK

6 BRIDGE – FACING SOUTH BANK



NOTES:

1. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
2. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
3. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 976.6 – MDNR ID 34
PHOTO PAGE

SCALE	DWG. NO.	PAGE NO.
	SSRP–976.6–005	5/5

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

GENERAL

1. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE PROJECT–WIDE STANDARDS PRESENTED IN THE EPP. WHERE MATERIAL WITHIN THESE SSRPS EXCEEDS STANDARD CONSTRUCTION MEASURES IN THE EPP, THESE SSRPS SUPERSEDE THE EPP.

2. CONSTRUCTION AND RESTORATION OF WATERBODY CROSSINGS WILL FOLLOW THESE GENERAL STEPS:

   A. SITE CLEARING
   B. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES ("BMPS")
   C. BRIDGE INSTALLATION
   D. EXCAVATION/BACKFILLING OF THE WATERBODY INCLUDING:
      - SOD SAVING TOPSOIL SEGREGATION AT NON–WOODED SITES
      - STREAMBED MATERIAL SEGREGATION
      - PIPE INSTALLATION
      - BACKFILL, INCLUDING IMPLEMENTATION OF CONSTRUCTION–RELATED RESTORATION METHODS (I.E., TOE WOOD)
   E. REPLACEMENT OF STREAMBED MATERIAL AND TOPSOIL/SOD LAYER
   F. RESTORATION OF STREAM BANKS TO PRE–CONSTRUCTION CONTOURS
   G. IF FINAL GRADING NOT POSSIBLE AT THE TIME, TEMPORARY STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   H. AFTER FINAL GRADING, PERMANENT SEEDING AND/OR WOODY VEGETATION RESTORATION, STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   I. BRIDGE REMOVAL DURING FINAL RESTORATION AFTER STABILIZATION AND PERMANENT SEEDING
   J. POST–CONSTRUCTION MONITORING

CROSSING METHODS

1. ALL WATERBODY AND WETLAND CROSSINGS WILL BE CONDUCTED IN COMPLIANCE WITH SECTION 2.0 AND SECTION 3.0 OF THE ENVIRONMENTAL PROTECTION PLAN ("EPP"), RESPECTIVELY. SECTION 2.0 AND 3.0 OF THE WINTER CONSTRUCTION PLAN PRESENTS MODIFICATIONS FOR WATERBODY AND WETLAND CONSTRUCTION METHODS, RESPECTIVELY, IN WINTER CONDITIONS.

2. ENBRIDGE'S SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES (THE "PROCEDURES," APPENDIX A OF THE EPP) OUTLINES THE VARIOUS CONSTRUCTION METHODS THAT ENBRIDGE MAY UTILIZE TO CONSTRUCT THROUGH WATERBODIES AND WETLANDS/BASINS AS PRESENTED ON THESE SITE–SPECIFIC RESTORATION PLANS ("SSRPS").

   A. DRY CROSSING (ISOLATED) METHODS (INCLUDING THE DRY CROSSING AND MODIFIED DRY CROSSING METHOD) ARE DESCRIBED SECTIONS 4.3 OF THE PROCEDURES, AND IN SECTIONS 2.5.2 AND 2.5.3 AND FIGURES 23 AND 24 OF THE EPP.
   B. THE BORE METHOD (NON–PRESSURIZED) IS DESCRIBED IN SECTION 3.5 OF THE PROCEDURES, AND SECTION 4.0 OF THE EPP.
   C. THE MODIFIED UPLAND CONSTRUCTION (WETLAND) METHOD IS DESCRIBED IN SECTION 3.3 OF THE PROCEDURES, AND SECTION 3.0 AND FIGURES 30 TO 34 OF THE EPP.
   D. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE OPEN CUT (NON–ISOLATED) WATERBODY CROSSING METHOD IS DESCRIBED IN SECTION 4.1 OF THE PROCEDURES, AND SECTION 2.5.1 AND FIGURE 24 OF THE EPP.
   E. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE PUSH–PULL METHOD IS DESCRIBED IN SECTION 3.4 OF THE PROCEDURES, AND SECTION 3.7.1 AND FIGURES 35 AND 36 OF THE EPP.

CLEARING/VEGETATION REMOVAL

1. STUMPS WITHIN THE TRENCH LINE WILL BE COMPLETELY REMOVED, GROUND, AND/OR HAULED OFF–SITE TO AN APPROVED LOCATION. TREE STUMPS OUTSIDE THE TRENCH LINE WILL BE GROUND BELOW NORMAL GROUND SURFACE TO FACILITATE A SAFE WORK AREA AND TO ALLOW TOPSOIL REMOVAL, IF NECESSARY. IN SOME CIRCUMSTANCES, TREE STUMPS OUTSIDE THE TRENCH LINE MAY BE COMPLETELY REMOVED TO ALLOW FOR A SAFE WORK AREA AND HAULED OFF–SITE TO AN APPROVED LOCATION AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

2. CLEARING WILL BE CONDUCTED IN WATERBODIES AND WETLANDS AS OUTLINED IN SECTION 2.2 AND 3.2 OF THE EPP, RESPECTIVELY. CHIPS, MULCH, OR MECHANICALLY CUT WOODY DEBRIS SHALL NOT BE STOCKPILED IN A WETLAND. HYDRO–AX DEBRIS, OR SIMILAR CAN BE LEFT IN THE WETLAND IF SPREAD EVENLY IN THE CONSTRUCTION WORKSPACE TO A DEPTH THAT WILL ALLOW FOR NORMAL REVEGETATION, AS DETERMINED BY THE EI. CHIPPING IS NOT ALLOWED ON PUBLIC LANDS. ON PUBLIC LANDS, MULCH AND MECHANICALLY CUT WOODY DEBRIS MUST BE UNIFORMLY BROADCAST TO LESS THAN 2–INCH THICKNESS AND IN A MANNER THAT MAINTAINS VISIBLE GROUND.

3. ENBRIDGE WILL PROPERLY INSTALL AND MAINTAIN REDUNDANT SEDIMENT CONTROL MEASURES IMMEDIATELY AFTER CLEARING AND PRIOR TO INITIAL GROUND DISTURBANCE AT SURFACE WATERS LOCATED WITHIN 50 FEET OF THE PROJECT AND WHERE STORMWATER FLOWS TO THE SURFACE WATER (REFER TO THE ENVIRONMENTAL PLAN SHEETS IN THE SWPPP), AND WITHIN 100 FEET OF SPECIAL AND IMPAIRED WATERS, INCLUDING TROUT STREAMS.

4. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).

TEMPORARY STABILIZATION

1. ON PORTIONS OF THE PROJECT WHERE WORK WILL BE OCCURRING DURING APPLICABLE "WORK IN WATER RESTRICTIONS" FOR PUBLIC WATERS (REFER TO SECTION 2.1), ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD. THESE AREAS WILL BE IDENTIFIED ON THE ENVIRONMENTAL PLAN SHEETS ACCOMPANYING THE SWPPP.

2. HYDRO–MULCH AND LIQUID TACKIFIER CAN BE USED IN PLACE OF CERTIFIED WEED–FREE STRAW OR HAY MULCH WITH PRIOR APPROVAL FROM ENBRIDGE. ALL HYDROMULCH AND LIQUID TACKIFIER PRODUCTS USED WILL BE ON THE APPLICABLE STATE DOT PRODUCT LIST. HYDRO–MULCH AND LIQUID TACKIFIER PRODUCTS CONTAINING PLASTIC/POLYPROPYLENE FIBER ADDITIVES AND MALACHITE GREEN (COLORANT) WILL NOT BE UTILIZED ON THIS PROJECT. APPLICATION RATES WILL BE AT THE MANUFACTURER'S RECOMMENDED RATE. ENBRIDGE WILL AVOID THE USE OF HYDROMULCH ON PUBLIC LANDS; HOWEVER, ENBRIDGE MAY USE HYDROMULCH ON STEEP SLOPES TO PREVENT EROSION UNTIL PERMANENT COVER HAS BEEN ESTABLISHED AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

RESTORATION AND STABILIZATION

1. ENBRIDGE WILL RESTORE THE STREAM BANKS AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS UNLESS THAT SLOPE IS DETERMINED TO BE UNSTABLE. IF THE SLOPE IS CONSIDERED UNSTABLE, ENBRIDGE WILL RESHAPE THE BANKS TO PREVENT SLUMPING. FOR PUBLIC WATERS, ENBRIDGE WILL RETURN THE BANK TO PRE–CONSTRUCTION CONTOURS, UNLESS OTHERWISE DIRECTED BY THE SITE–SPECIFIC RESTORATION PLAN. IF ENBRIDGE CANNOT RESTORE TO PRE–CONSTRUCTION CONTOURS AT A PUBLIC WATER, ENBRIDGE WILL CONSULT WITH THE MDNR BEFORE PROCEEDING FURTHER AS OUTLINED IN SECTION 2.6 OF THE EPP.

2. UNSTABLE SOILS AND/OR SITE–SPECIFIC FACTORS SUCH AS STREAM VELOCITY AND FLOW DIRECTION MAY REQUIRE ADDITIONAL RESTORATION EFFORTS, SUCH AS INSTALLATION OF WOODY VEGETATION, GEOTEXTILE FABRIC, OR TREE, LOG, ROOTWAD, OR BOULDER REVETMENTS TO STABILIZE DISTURBED STREAM BANKS (SEE FIGURE 29) AS OUTLINED IN SECTION 2.6.2 OF THE EPP. ENBRIDGE WILL WORK WITH THE MDNR TO ENSURE ALL WORK/ADJUSTMENTS ARE APPROVED AND ARE CONDUCTED WITHIN APPLICABLE TIMING RESTRICTIONS.

3. IN UPLAND AND WETLAND AREAS, CLEANUP AND ROUGH GRADING WILL OCCUR AS OUTLINED IN SECTIONS 1.16 AND 3.9 OF THE EPP. ENBRIDGE WILL BACKFILL THE TRENCH TO AN ELEVATION SIMILAR TO THE ADJACENT AREAS OUTSIDE THE TRENCH LINE AND WILL ADD A SLIGHT CROWN OF APPROXIMATELY 3 TO 6 INCHES (DEPENDING ON SOIL TYPE) OVER THE BACKFILLED TRENCH TO ALLOW FOR SUBSIDENCE. GENERALLY, EXCESS SUBSOIL DISPLACED BY THE PIPE INSTALLATION WILL BE SPREAD ACROSS THE PORTION OF THE CONSTRUCTION WORKSPACE WHERE TOPSOIL REMOVAL HAS OCCURRED. ANY REMAINING EXCESS SUBSOIL WILL BE REMOVED AND DISPOSED OF AT AN APPROVED OFF–SITE LOCATION AS NEEDED TO ENSURE CONTOURS ARE RESTORED TO AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS.

4. REVEGETATION ACTIVITIES WILL OCCUR AS OUTLINED IN SECTION 7.0 OF THE EPP. SEED MIXES AT PUBLIC WATERS WILL BE SELECTED AND APPLIED AS INDICATED IN THE PLANTING PLAN, WHICH IS APPENDIX A OF THE POST–CONSTRUCTION VEGETATION MANAGEMENT PLAN FOR PUBLIC LANDS AND WATERS ("VMP"). SEED MIXES RELATIVE TO THESE SSRP CROSSINGS ARE CODED AS FOLLOWS:

A	EMERGENT (34–181)	G	DRY PRAIRIE GENERAL (35–221)
B	RIPARIAN NE (34–361)	H	MESIC PRAIRIE GENERAL (35–241)
C	RIPARIAN S&W (34–261)	I	MESIC PRAIRIE NW (35–441)
D	WET MEADOW NE (34–371)	J	DRY PRAIRIE NORTHWEST (35–421)
E	WET MEADOW S&W (34–271)	K	WOODLAND EDGE NE (36–311)
F	WETLAND REHABILITATION (34–171)	L	NATURAL REVEGETATION

5. ENBRIDGE WILL NOT SEED STANDING WATER OR WOODED (PSS AND PFO) WETLAND COMMUNITIES. NATURAL REVEGETATION WILL TAKE PLACE FROM EXISTING PLANT MATERIAL AND ROOT STOCK IN THESE COMMUNITIES.

6. ALL MATERIALS USED FOR CONSTRUCTION OF THE PROJECT MUST BE REMOVED FROM THE SITE.

7. ENBRIDGE WILL CONDUCT POST–CONSTRUCTION MONITORING IN ACCORDANCE WITH THE POST–CONSTRUCTION MONITORING PLAN FOR WETLANDS AND WATERBODIES, AND IN ACCORDANCE WITH THE VMP FOR THE UPLAND PORTIONS OF THE PROJECT ON PUBLIC LANDS.

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN

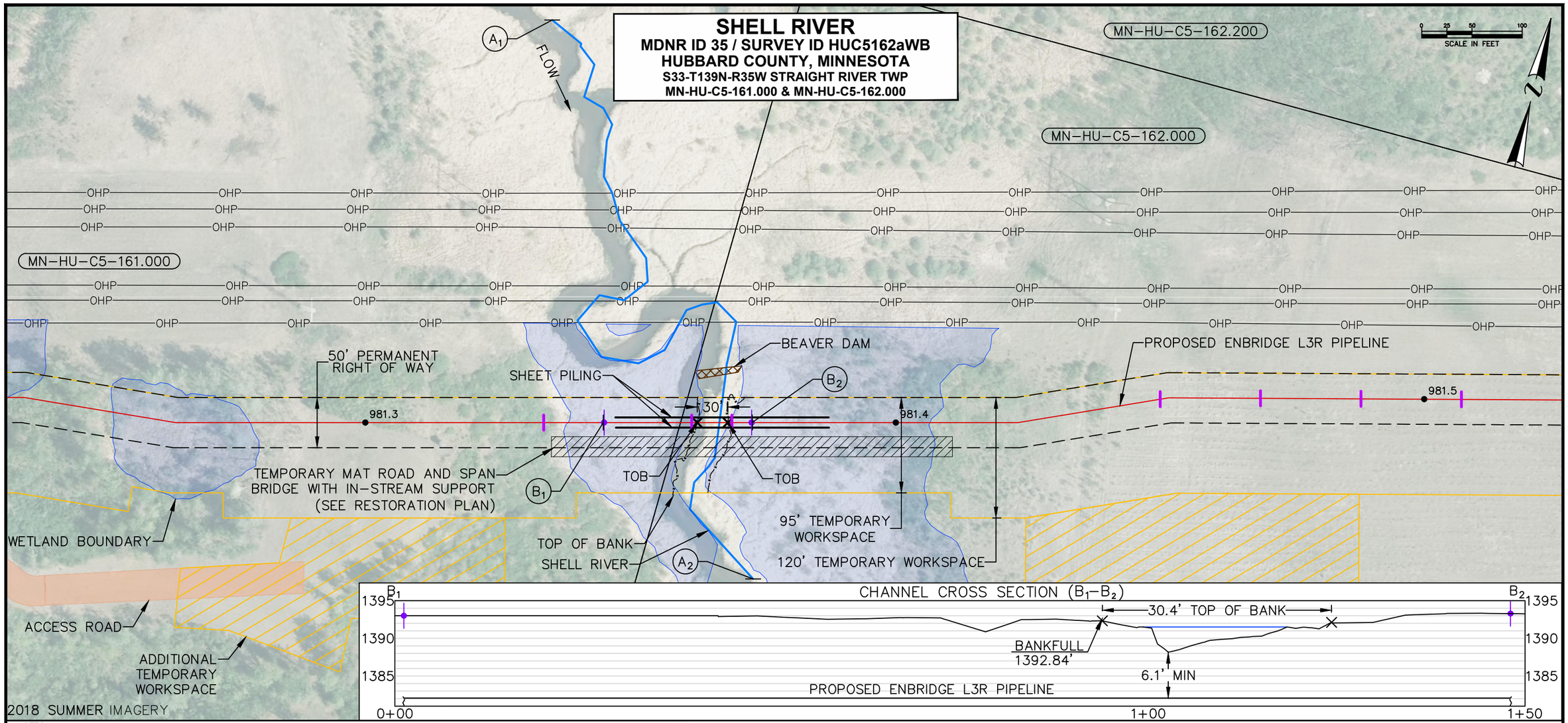
CONSTRUCTION NOTES

SCALE	DWG. NO.	PAGE NO.
	SSRP–NOTES	

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

MDNR ID No. 35: MP 981.4; Shell River (M-096-035-004)

SHELL RIVER
MDNR ID 35 / SURVEY ID HUC5162aWB
HUBBARD COUNTY, MINNESOTA
S33-T139N-R35W STRAIGHT RIVER TWP
MN-HU-C5-161.000 & MN-HU-C5-162.000



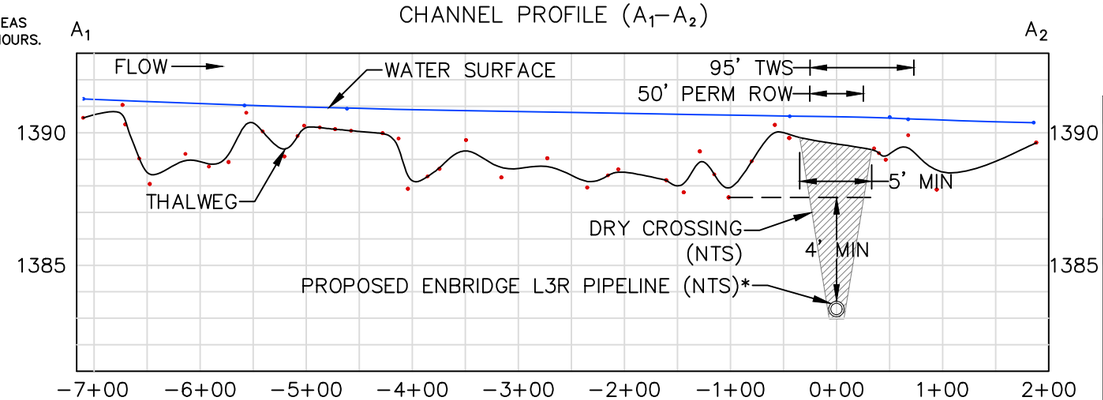
NOTES
1. NO FEMA DIGITAL FLOODPLAIN DATA AVAILABLE
2. SOBS (O/H) OR NPC (S1–3): N/A
3. MDNR REGION 1 PWI – COOL/WARM WATER FISHERY: MARCH 15 – JUNE 30. 24-HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
4. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS.

LEGEND
- PROPOSED ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY (ROSGEN SURVEY – THALWEG)
- OHP — OVERHEAD POWER
- TRACT BOUNDARY
- TEMPORARY MAT ROAD AND SPAN BRIDGE
- BEAVER DAM
- ACCESS ROAD
- WETLAND
- ADDITIONAL TEMPORARY WORKSPACE
- MN-XX-XX-XXX.XXX — TRACT ID
- ROSGEN SURVEY POINT – WATER SURFACE
- ROSGEN SURVEY POINT – RIVER BOTTOM (THALWEG)
- PROPOSED INCREASED DEPTH OF COVER EXTENT
- TOP OF BANK
- TRENCH BREAKER (LOCATIONS ARE APPROXIMATE)

FOR ENVIRONMENTAL REVIEW PURPOSES ONLY

STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

CHANNEL PROFILE (A_1–A_2)



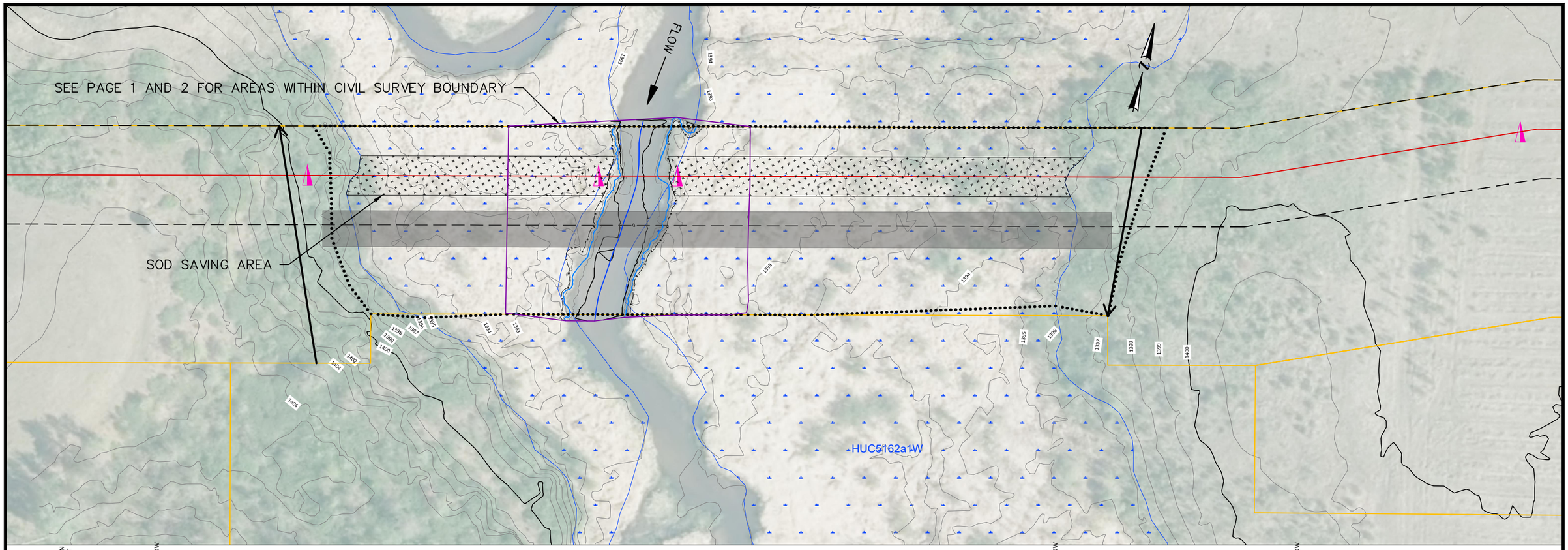
*TRENCH IN PROFILE IS NOT TO SCALE (NTS)

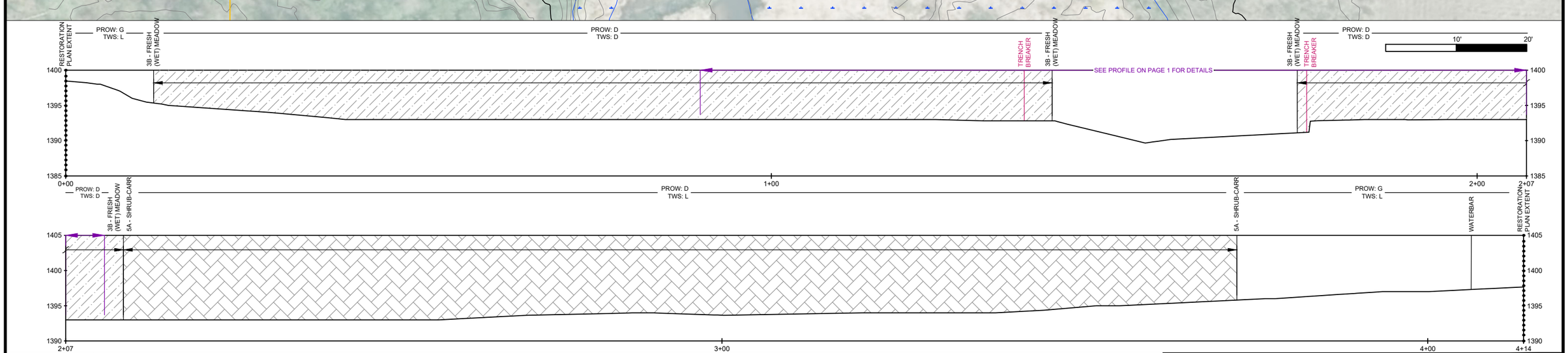
CHANNEL CROSS SECTION NOTE:
1. CHANNEL LOCATIONS, DIMENSIONS, AND/OR ELEVATIONS ARE BASED ON 2020 TOPOGRAPHIC/BATHYMETRIC SURVEY(S), AND AS SUCH DO NOT REFLECT CHANGES TO THE CHANNEL THAT MAY HAVE OCCURRED SINCE THAT TIME.
2. DEPTH OF COVER AT CENTERLINE WAS DEVELOPED USING THE BOTTOM ELEVATION OF THE DEEPEST UPSTREAM OR DOWNSTREAM POOL WITHIN THE SURVEYED REACH, UNLESS OTHERWISE NOTED IN APPLICATION MATERIALS.
3. MEAN MEANDER BELT WIDTH: 128'
4. MEANDER WIDTH RATIO: 4.41

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
0	ISSUED FOR PERMIT APPLICATION	AJJ	10/2020	BAB	BAB

ENBRIDGE

DWN. BY: AJJ	DATE 10/2020	PROPOSED ENBRIDGE L3R PIPELINE PRIMARY METHOD – DRY CROSSING CROSSING OF SHELL RIVER ENBRIDGE MP 981.4 HUBBARD COUNTY, MINNESOTA	
CHK.			
PROJ. ENGR.			
PROJ. MGR.			
CLIENT APP.		SCALE NOTED	DWG. NO. B-93-5.84-MDNR-35-0





BWSR SEED MIX	D: WET MEADOW NE (34–371); G: DRY PRAIRIE GENERAL (35–221); L: NATURAL REVEGETATION
SOBS (O/H) or NPC (S1-3)	N/A

1. ELEVATIONS OUTSIDE OF THE AREA WITHIN CIVIL SURVEY BOUNDARY ARE DERIVED FROM LIDAR. ENBRIDGE WILL RESTORE THE AREAS ADJACENT TO THE PUBLIC WATER WITHIN THE MDNR EXPANDED RESTORATION BOUNDARY TO PRE–CONSTRUCTION CONDITIONS.
2. MDNR REGION 1 PWI – COOL/WARM WATER FISHERY: MARCH 15 – JUNE 30. 24–HOUR SOIL STABILIZATION REQUIRED WITHIN 200 FEET DURING RESTRICTION.
3. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
4. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
5. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.
6. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
7. SEE THE PLANTING PLAN FOR ADDITIONAL DETAIL REGARDING SEEDING PRACTICES AND SEED MIXES AT PUBLIC WATER CROSSINGS.
8. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).
9. WHEN WORKING WITHIN "WORK IN WATER RESTRICTIONS", STABILIZE ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WITHIN 24 HOURS. STABILIZATION WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY/ TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD.

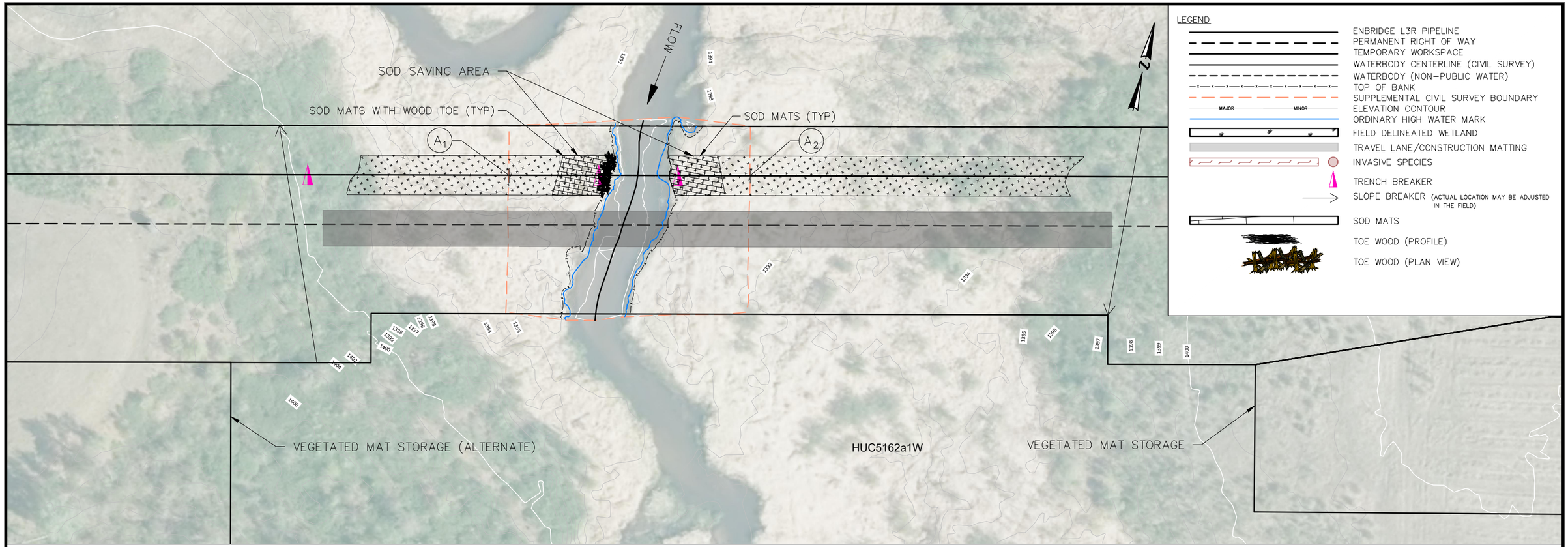
LEGEND

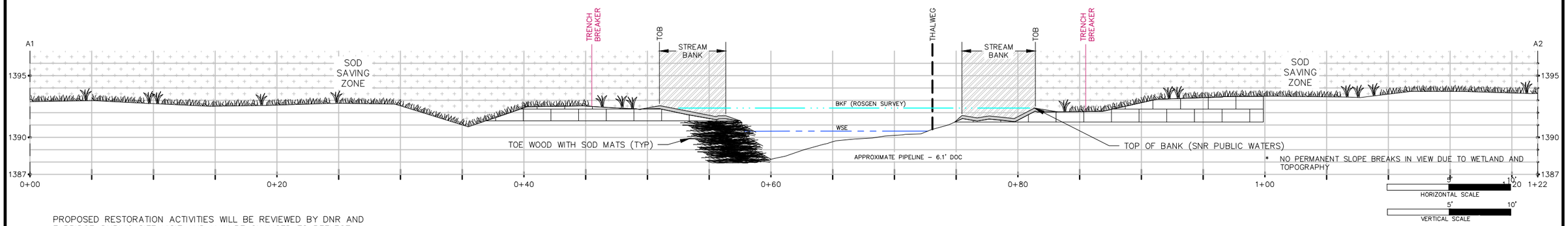
- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY CENTERLINE (CIVIL SURVEY)
- WATERBODY (NON–PUBLIC WATER)
- PUBLIC WATER CIVIL SURVEY BOUNDARY
- MDNR EXPANDED RESTORATION BOUNDARY
- TOP OF BANK
- ELEVATION CONTOUR (MAJOR / MINOR)
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- INVASIVE SPECIES
- TRENCH BREAKER
- PERMANENT SLOPE BREAKER (ACTUAL LOCATION MAY BE ADJUSTED IN THE FIELD)
- 1 – SHALLOW, OPEN WATER
- 2B – SHALLOW MARSH
- 3A – SEDGE MEADOW
- 3B – FRESH (WET) MEADOW
- 5A – SHRUB–CARR
- 5B – ALDER THICKET
- 6A – HARDWOOD SWAMP
- 6B – CONIFEROUS SWAMP

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		
A	ISSUED FOR REVIEW	MJT	09/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
RE–VEGETATION PLAN: EXPANDED EXTENT

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–981.4–001A	1A/5





PROPOSED RESTORATION ACTIVITIES WILL BE REVIEWED BY DNR AND ENBRIDGE DURING SITE VISIT AND MAY BE CHANGED TO REFLECT SITE CONDITIONS AT THE TIME OF CONSTRUCTION.

FEATURE ID	HUC5162aWB; IFC ID: S-201.0
CROSSING TYPE	DRY CROSSING
PROPOSED RESTORATION (SEE DETAILS FOR LIVE STAKING, TRANSPLANTS, AND SHRUB SPECIES IF APPLICABLE)	BRUSH – TOE WOOD; SOD MATS
WITHIN OR ADJACENT WETLAND	FRESH WET MEADOW
BWSR SEED MIX	WET MEADOW NE (34-371)
DOMINANT WETLAND VEGETATION	1. PHALARIS ARUNDINACEA 2. CAREX LACUSTRIS
SOBS (O/H) or NPC (S1-3)	N/A

NOTES:

1. CONSTRUCTION TIMING RESTRICTIONS
   - 1.1. MDNR REGION 1 PWI - COOL/WARM WATER FISHERY: MARCH 15 - JUNE 30.
   - 1.2. WHEN WORK OCCURS WITHIN "WORK IN WATER RESTRICTIONS", ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD
   - 1.3. WILD RICE: APRIL 1 - JULY 15
2. WORK SHALL BE CONDUCTED IN ACCORDANCE WITH APPLICABLE STANDARDS IN ENBRIDGE'S EPP AND VMP FOR PUBLIC LANDS AND WATERS. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE THESE STANDARDS.
3. SEE GENERAL NOTES PAGE FOR ADDITIONAL DETAIL.
4. INFORMATION REGARDING SEEDING SPECIFICATIONS, SEED BED PREPARATION TECHNIQUES, ETC. ARE DESCRIBED IN THE PLANTING PLAN CONTAINED WITHIN THE VMP.
5. TRENCH BREAKER LOCATION IS APPROXIMATE PENDING FIELD VERIFICATION (EPP SECTION 1.13)
6. VEGETATED "SOD" MATS WILL BE PLACED ON TIMBER MATS LOCATED IN THE TWS AND/OR ATWS.

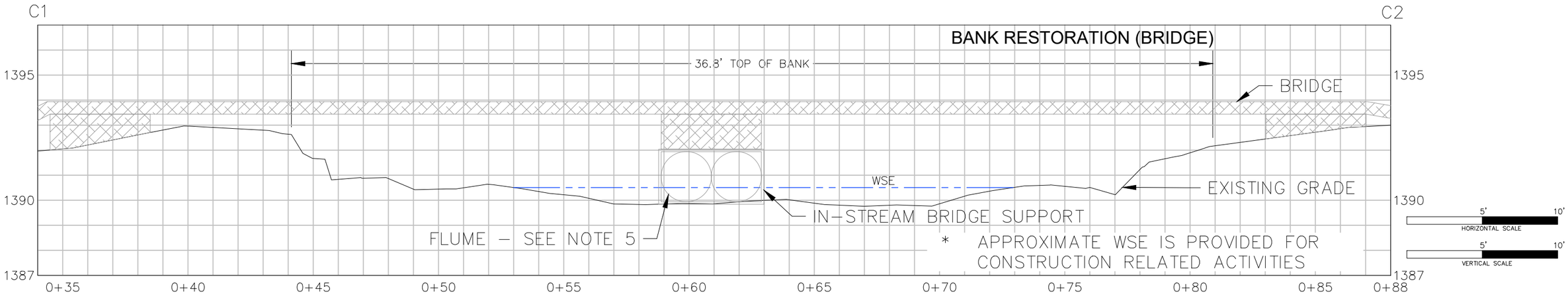
ENBRIDGE

NO.	REVISION-DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING		10/2020		
A	ISSUED FOR REVIEW	MJT	08/2020		

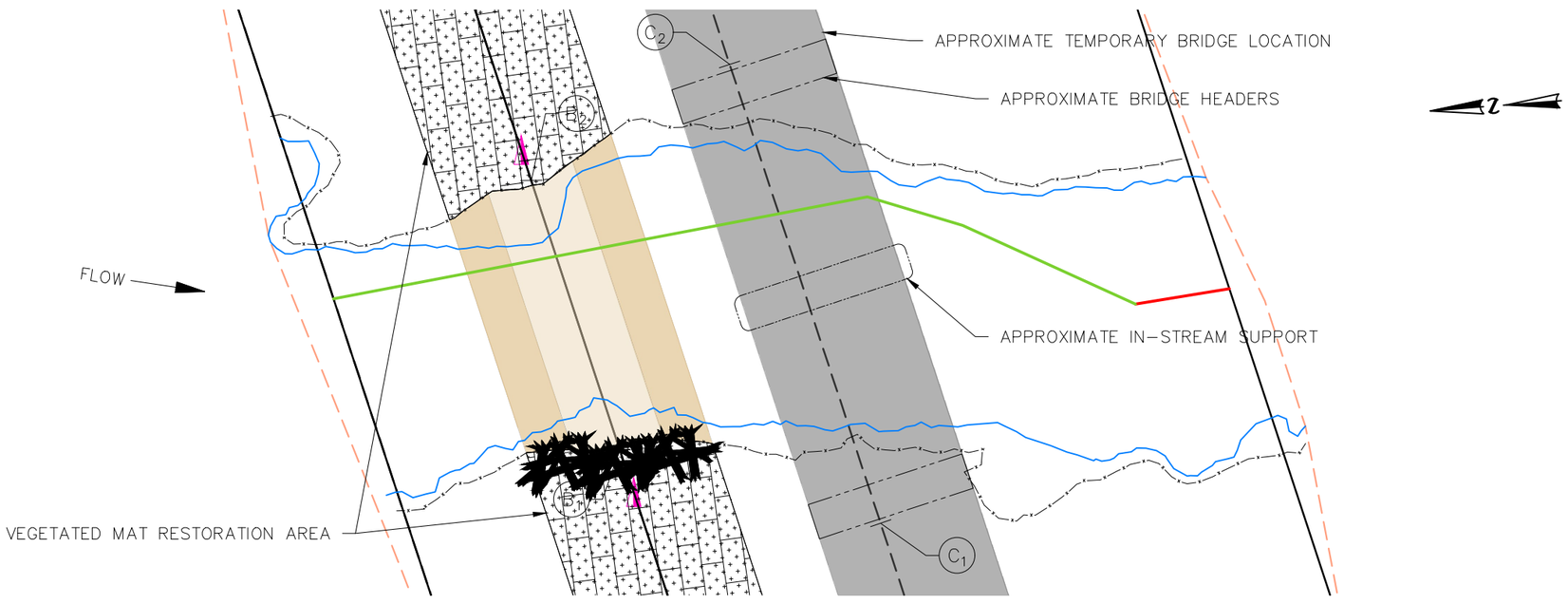
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
RE-VEGETATION PLAN

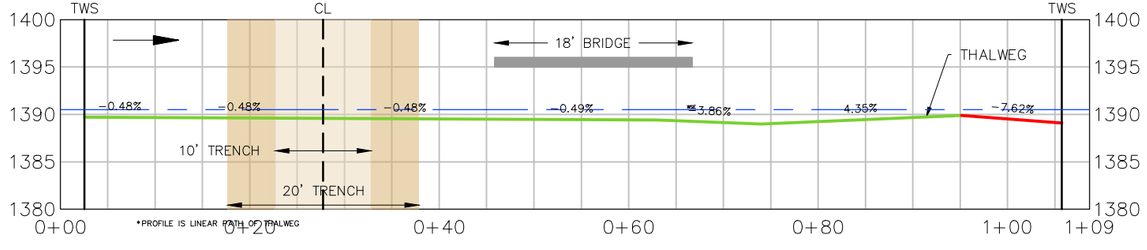
SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-981.4-001	1/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)



STREAMBED RESTORATION





NOTES:

1. TRANSITIONS BETWEEN EXISTING CHANNEL FEATURES (BED, BANK, FLOODPLAIN) AND PROPOSED RESTORED TRENCH CROSSING WILL BE SMOOTH AND EVENLY GRADED WITHOUT ABRUPT OR PROTRUDING OBSTRUCTIONS.
6. MINIMIZE DISTURBANCE OF BED MATERIALS AND FEATURES DURING CONSTRUCTION OF THE TRENCH AND INSTALLATION AND REMOVAL OF IN-STREAM SUPPORT
7. BED AND/OR BANK MATERIALS TEMPORARILY ADJUSTED OR REMOVED DURING CONSTRUCTION SHALL BE PLACED IN THE APPROXIMATE ORIGINAL LOCATION DURING RESTORATION. MATERIALS SHALL BE FIELD ADJUSTED DURING PLACEMENT BASE ON THE OBSERVED FLOW PATH AT THE TIME OF CONSTRUCTION.
8. ALIGNMENT OF IN-STREAM SUPPORT SHALL BE FIELD ADJUSTED BASED ON FLOW PATH TO PROTECT CHANNEL BANKS.
9. SEE RESTORATION SHEET FOR B1-B2 CROSS SECTION.

LEGEND

- ENBRIDGE L3R PIPELINE
- PERMANENT RIGHT OF WAY
- TEMPORARY WORKSPACE
- WATERBODY – RIFFLE (ROSGEN SURVEY)
- WATERBODY – POOL (ROSGEN SURVEY)
- WATERBODY – RUN (ROSGEN SURVEY)
- WATERBODY – GLIDE (ROSGEN SURVEY)
- CONTOUR (1' INTERVAL) (MAJOR / MINOR)
- TOP OF BANK
- ORDINARY HIGH WATER MARK
- FIELD DELINEATED WETLAND
- TRAVEL LANE/CONSTRUCTION MATTING
- TRENCH – 10'
- TRENCH – 20'

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
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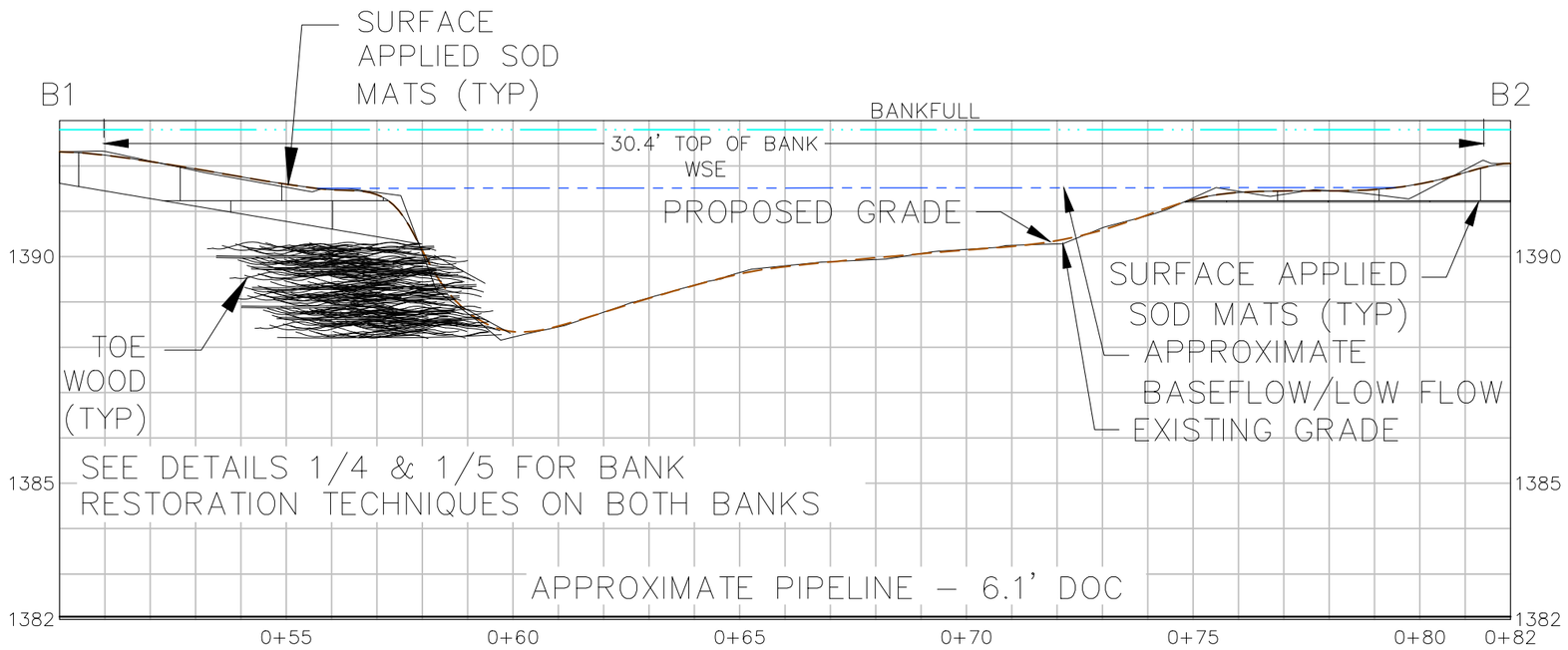
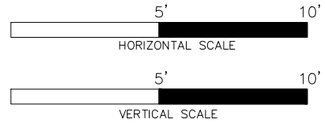
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
STABILIZATION PLAN

SCALE	DWG. NO.	PAGE NO.
	SSRP–981.4–002	2/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

BANK RESTORATION (CENTERLINE)





RESTORATION NOTES:

GENERAL

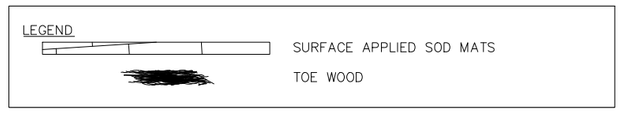
1. REFER TO RESTORATION DETAIL SHEETS FOR ADDITIONAL INFORMATION RELATED TO PROPOSED RESTORATION MEASURES.
2. REFER TO SITE PHOTOS FOR INFORMATION ON PRE-CONSTRUCTION CROSSING CONDITIONS AND TO PROVIDE ADDITIONAL GUIDANCE FOR RESTORATION EFFORTS.

TOE WOOD

1. ROUGH GRADE CHANNEL BED FEATURES INCLUDING POOLS AND PLACEMENT OF SUBSTRATE.
2. INSTALL FOOTER LOG(S) ALONG PROPOSED TOE OF SLOPE. FOOTER LOGS SHOULD BE ANGLED TO ALLOW FOR TOE ALIGNMENT TO GENERALLY MATCH THE EXISTING CURVE AND EVENLY TRANSITION FROM UPSTREAM TO DOWNSTREAM.
3. PUSH FOOTER LOG INTO SOIL APPLY A SMALL AMOUNT OF GRAVEL OR STONE AS NEEDED TO PREVENT FLOATATION OF FOOTER LOG PRIOR TO PLACING WOODY DEBRIS.
4. PLACE A LAYER WOODY DEBRIS IN 6" TO 8" LIFTS, APPLY 3"-4" GRAVEL AND/OR SOIL FILL AND COMPACT WITH EXCAVATOR BUCKET. WASH FILL MATERIAL INTO WOODY DEBRIS MATRIX WITH WATER FROM CHANNEL. APPLY ADDITIONAL LAYERS "AS NEEDED" TO REACH THE SPECIFIED TOE WOOD HEIGHT.
5. PLACE STACKED SOD MATS ABOVE TOE WOOD. THE USE OF TRANSPLANTS OR FABRIC LIFTS MAY BE FIELD APPROVED BY ENBRIDGE IN CONSULTATION WITH MN DNR.

SOD MATTING

1. REMOVE VEGETATED MATS ON EITHER SIDE OF THE STREAM CROSSING USING ONSITE EQUIPMENT WHICH CAN UNDERCUT THE VEGETATION FOR REMOVAL. SMALL SHRUBS AND/OR TREES WITHIN THE SOD MATS ARE ACCEPTABLE AND SHOULD NOT BE REMOVED.
2. DEPENDING ON THE LEVEL OF SATURATION AT THE TIME OF REMOVAL, IT MAY BE DIFFICULT TO OBTAIN INTACT CONSOLIDATED MATS, BUT GENERALLY THE NATIVE VEGETATION WILL BE RETAINED AND CAPTURED FOR PLACEMENT.
3. SOD MATS CAN BE TRANSPLANTED DURING ANY SEASON.
4. PLACE THE VEGETATED MATS ON TIMBER MATS OR CLEAR GROUND AREA LOCATED IN THE ATWS USING SKID STEER OR FRONT-END LOADER.
5. MONITOR MATS TO SUPPORT SURVIVABILITY; WATERING MAY BE NEEDED.
6. PRIOR TO PLACEMENT OF SOD MATS FINISH GRADE CHANNEL BANK AND ADJACENT FLOODPLAIN APPLICATION AREA TO PROVIDE A SMOOTH AND EVEN SURFACE. SUBGRADE ELEVATION SHOULD ALLOW FOR THE FINISHED SOD SURFACE TO TRANSITION EVENLY WITH THE CHANNEL BANKS UPSTREAM AND DOWNSTREAM OF THE INSTALLATION AREA. AVOID ABRUPT CHANGES IN GRADE.
7. RETURN THE VEGETATED MATS USING ONSITE EQUIPMENT.
   a. SURFACE APPLIED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PERPENDICULAR TO THE CHANNEL / FLOW.
   b. STACKED SOD MATTING SHOULD BE PLACED WITH THE LONG SIDE PARALLEL TO THE CHANNEL / FLOW.
8. WHEN PLACING SOD MATS, DO NOT LEAVE LARGE GAPS BETWEEN EACH SOD MAT AS NON-NATIVE VEGETATION WILL QUICKLY ATTEMPT TO COLONIZE THESE VOIDS.
9. WATER SOD MATS AFTER REPLACEMENT IF CONDITIONS ARE HOT AND DRY. DAMP AND/OR FROZEN SOD MATS DO NOT REQUIRE WATERING.
10. THE TOP MAT AND/OR OTHER MATS CAN BE ANCHORED WITH A LIVE AND/OR DEAD STOUT STAKE TO ENSURE THAT IT DOES NOT MOBILIZE DURING A FLOOD EVENT BEFORE THE ROOTS HAVE ESTABLISHED.
11. THE VEGETATED MATS WILL BE REPLACED AS SOON AS PRACTICAL FOLLOWING BACKFILLING OF THE TRENCH AND STABILIZED PER THE TIMING REQUIREMENTS DESCRIBED IN SECTION 1.9.1 OF THE EPP.



NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
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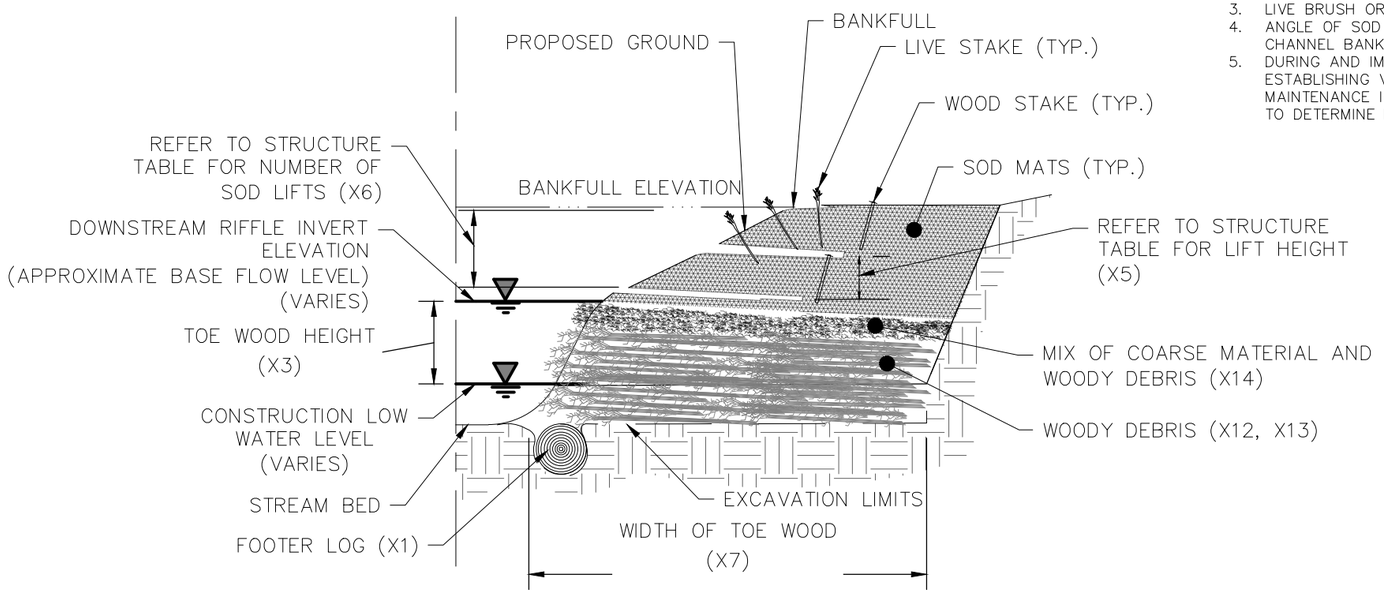
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–981.4–004	3/7

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

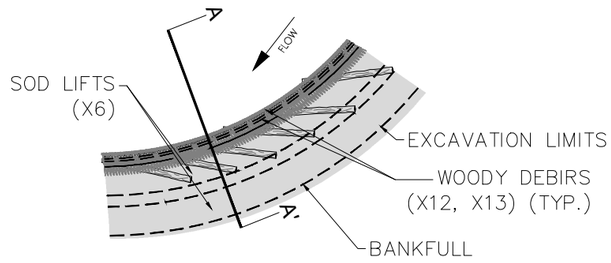
TOE WOOD DIMENSIONS			
VARIABLE	**VALUE**	**TYPICAL UNIT**	**DESCRIPTION**
X1	6.0 - 10.0	IN.	FOOTER LOG DIAMETER
X2	8.0 - 12.0	FT.	FOOTER LOG LENGTH
X3	18.0	IN.	TOE WOOD HEIGHT
X4	SEE SHEET 3	N/A	MATCH TYPICAL SECTION
X5	SEE SHEET 5	FT.	SOD LIFT HEIGHT
X6	3.0	#	SOD LIFTS
X7	8.0 - 10.0	FT.	TOE WOOD WIDTH
X8	3.0 - 6.0	FT.	SOD LIFT WIDTH
X9	24.0	IN.	WOOD STAKE LENGTH
X10	4.0	IN.	WOOD STAKE WIDTH (TOP)
X11	0.5	IN.	WOOD STAKE WIDTH (BOTTOM)
X12	1/2 - 3.0	IN.	WOODY DEBRIS DIAMETER
X13	8.0 - 12.0	FT.	WOODY DEBRIS LENGTH
X14	3" MINING GRAVEL WITH FINES	%	SELECT COARSE MATERIAL BACKFILL (BY VOLUME)



SECTION A-A'

TOE WOOD EXAMPLE

NOTES:
1. WOODY MATERIAL OF APPROPRIATE SIZE CONSISTING OF LOGS, TRUNKS, LIMBS, BRANCHES, AND SMALLER WOODY DEBRIS INCLUDING TOPS OR SLASH. ON-SITE WOODY MATERIAL IS PREFERRED.
2. WOODY DEBRIS SHOULD BE GREEN OR RELATIVELY GREEN AND MAY CONSIST OF HARDWOODS, CONIFERS, OR A COMBINATION OF BOTH.
3. LIVE BRUSH OR OTHER BANK VEGETATION MAY BE INCORPORATED.
4. ANGLE OF SOD MAT SURFACE SHALL MATCH THE PROPOSED CHANNEL CROSS SECTION AND PROVIDE A SMOOTH AND EVEN CHANNEL BANK SURFACE BETWEEN UPSTREAM AND DOWNSTREAM BANKS.
5. DURING AND IMMEDIATELY AFTER CONSTRUCTION, BANK SLOPES ABOVE THE WOOD TOE ARE VULNERABLE TO EROSION. ESTABLISHING VEGETATION OR OTHER COVER MATERIAL AS SOON AS POSSIBLE WILL HELP REDUCE EROSION. ADDITIONAL MAINTENANCE IS NOT EXPECTED ONCE VEGETATION ESTABLISHES. INSPECTION AFTER LARGE FLOW EVENTS MAY BE ADVISABLE TO DETERMINE IF ANY MATERIAL MOVEMENT OR UNEXPECTED SCOUR HAS OCCURRED.



PLAN VIEW AT BANKFULL ELEVATION

1 TOE WOOD DETAIL

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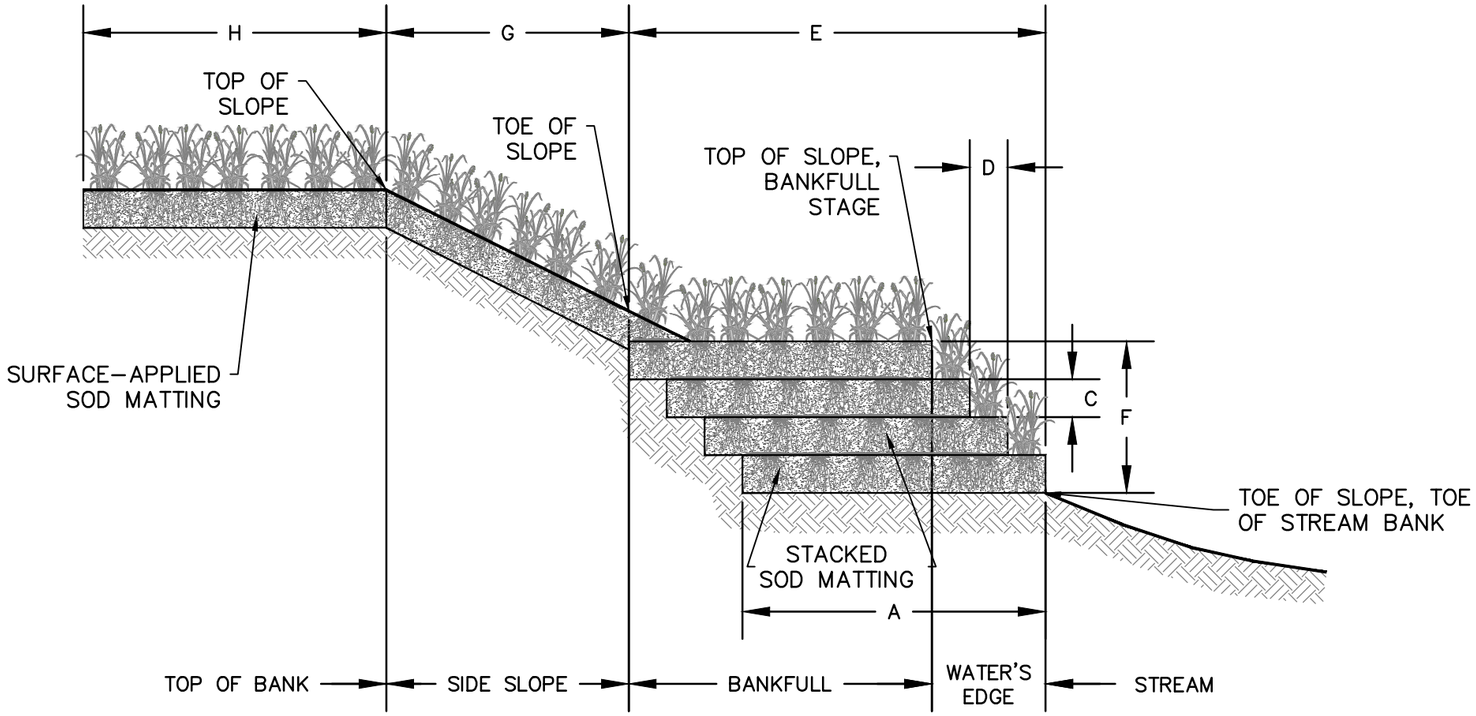
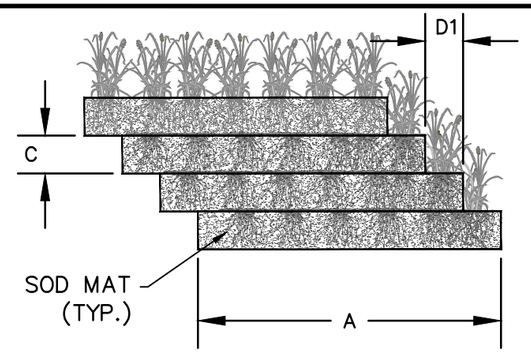
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE-SPECIFIC RESTORATION PLAN
SHELL RIVER - MP 981.4 - MDNR ID 35
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP-981.4-004	4/7

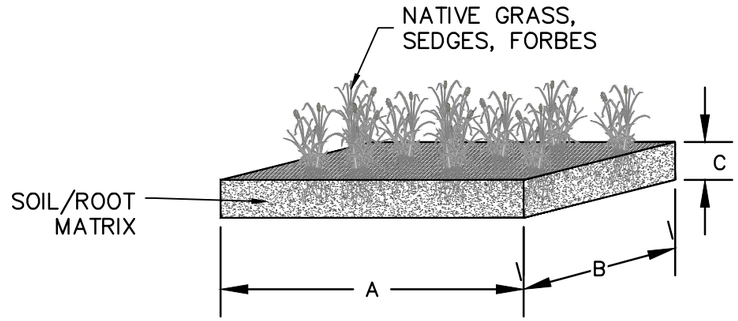
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



CROSS SECTION



STACKED SOD MATTING DETAIL



SOD MAT DETAIL

DIMENSION[1]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	SOD MAT WIDTH	FEET	3–4	WIDTH OF INDIVIDUAL SOD MAT.
B	SOD MAT LENGTH	FEET	3–6	LENGTH OF INDIVIDUAL SOD MAT.
C	SOD MAT THICKNESS	INCHES	12	THICKNESS OF INDIVIDUAL SOD MAT.
D	STACKED SOD MAT SETBACK	FEET, INCHES	N/A	THE DISTANCE BETWEEN THE EDGES OF SOD MATS STACKED TO FORM A SLOPE
E	WIDTH OF STACKED SOD MATS	FEET, INCHES	N/A	WIDTH OF A BANK CREATED BY STACKED SOD MATS
F	HEIGHT OF STACKED SOD MATS	FEET, INCHES	N/A	HEIGHT OF A SLOPE CREATED BY STACKED SOD MATS
G	WIDTH OF SURFACE- APPLIED SOD MATS	FEET, INCHES	10–20	WIDTH OF A SLOPE STABILIZED WITH SURFACE-APPLIED SOD MATS
H	TOP OF BANK SOD MATTING DISTANCE	FEET	25	DISTANCE SOD MATTING IS INSTALLED ON THE TOP OF BANK
NOTES:				
1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.				

SOD MATTING DETAIL

SOD MAT EXAMPLES

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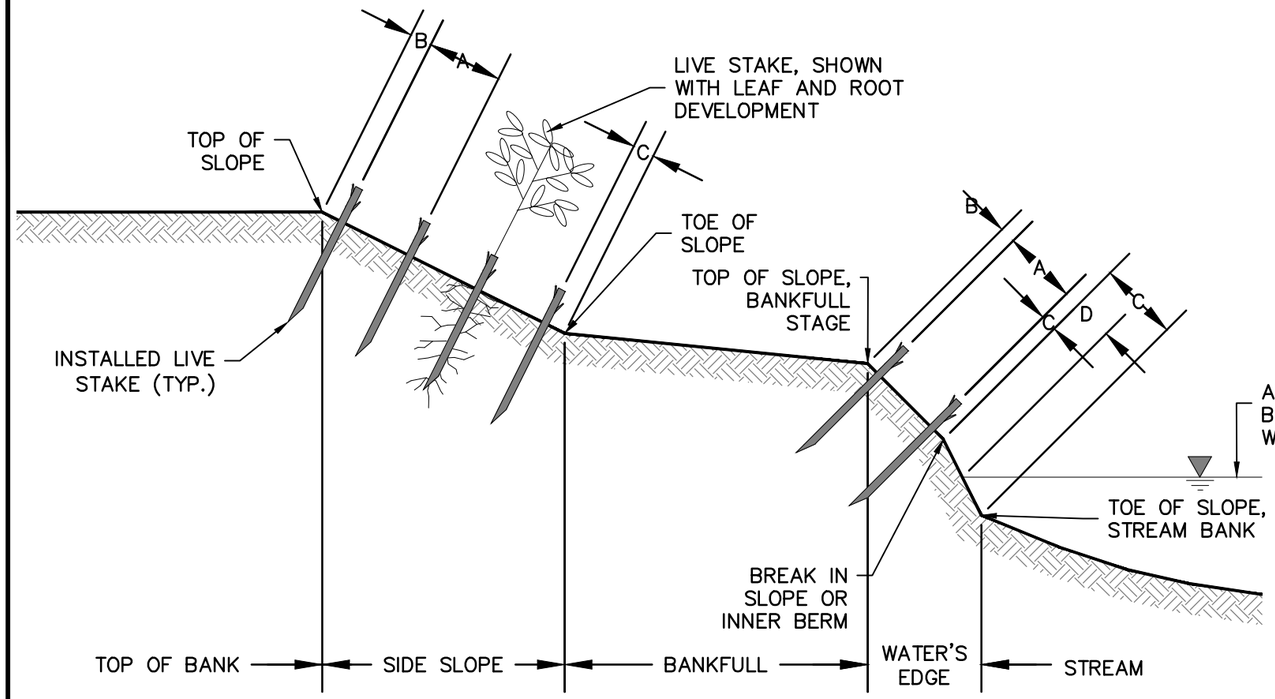
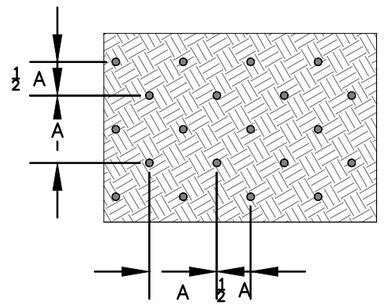
ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–981.4–004	5/7

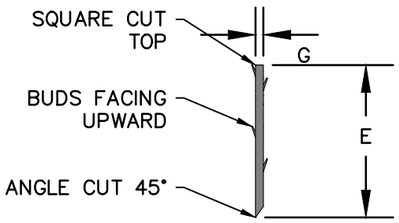
PLOTTED SIZE: ANSI FULL BLEED B (17x11)



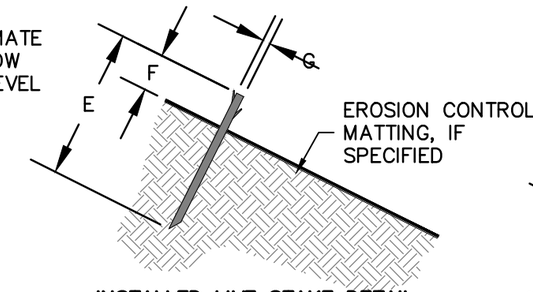
CROSS SECTION



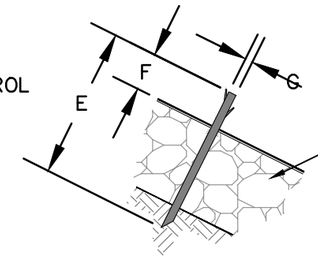
LIVE STAKE PATTERN DETAIL



LIVE STAKE DETAIL



INSTALLED LIVE STAKE DETAIL



INSTALLED JOINT PLANTING DETAIL

DIMENSION[1]	NAME	TYPICAL UNIT	VALUE	DESCRIPTION
A	LIVE STAKE SPACING	FEET	3 OC	SPACING BETWEEN INDIVIDUALLY INSTALLED LIVE STAKES. STAKES CAN BE PLACED IN A TRIANGULAR GRID (NRCS 2007A) OR RANDOMLY (NRCS 2007A, IOWA DNR 2006). RECOMMEND SPECIES DIVERSITY THROUGHOUT PROJECT AREA.
B	LIVE STAKE – TOP OF SLOPE PLACEMENT	INCHES	0–3	POSITION OF LIVE STAKE RELATIVE TO THE TOP OF A SLOPE
C	LIVE STAKE – TOE OF SLOPE PLACEMENT	INCHES	0–3	POSITION OF LIVE STAKE RELATIVE TO THE TOE OF A SLOPE
D	LIVE STAKE – BASE FLOW RELATIONSHIP	INCHES	1390.5±	PLACEMENT OF LOWER ROW OF LIVE STAKES RELATIVE TO THE APPROXIMATE BASE FLOW WATER LEVEL WITH CONSIDERATION GIVEN TO DURATION OF INUNDATION DURING BANKFULL AND OTHER HIGH FLOW EVENTS.
E	LIVE STAKE LENGTH	INCHES	24–36	LENGTH OF PREPARED DORMANT LIVE CUTTING FROM WOODY PLANT TO BE USED AS LIVE STAKE. LENGTH SHOULD BE SUFFICIENT TO REACH LOW-FLOW WATER TABLE ELEVATION.
F	LIVE STAKE PROTRUSION	INCHES	3–4	DISTANCE INSTALLED LIVE STAKE SHOULD PROTRUDE ABOUT 20% FROM THE GROUND. AT LEAST TWO BUDS OR BUD SCARS SHOULD BE PRESENT ABOVE THE GROUND IN THE FINAL INSTALLATION, DEPENDING ON THE SURROUNDING VEGETATION HEIGHT.
G	LIVE STAKE DIAMETER	INCHES	½–1½	DIAMETER OF PREPARED DORMANT LIVE CUTTING FROM WOODY PLANT TO BE USED AS LIVE STAKE – TYPICALLY CITE A PERMISSIBLE MINIMUM AND MAXIMUM DIAMETER.

NOTES:

1. DIMENSION LABELS ARE REFERENCED IN THE DETAIL DRAWINGS.

LIVE STAKE PLANTINGS DETAIL

LIVE STAKE EXAMPLE

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
SITE SPECIFIC DETAILS

SCALE	DWG. NO.	PAGE NO.
NOTED	SSRP–981.4–004	6/7

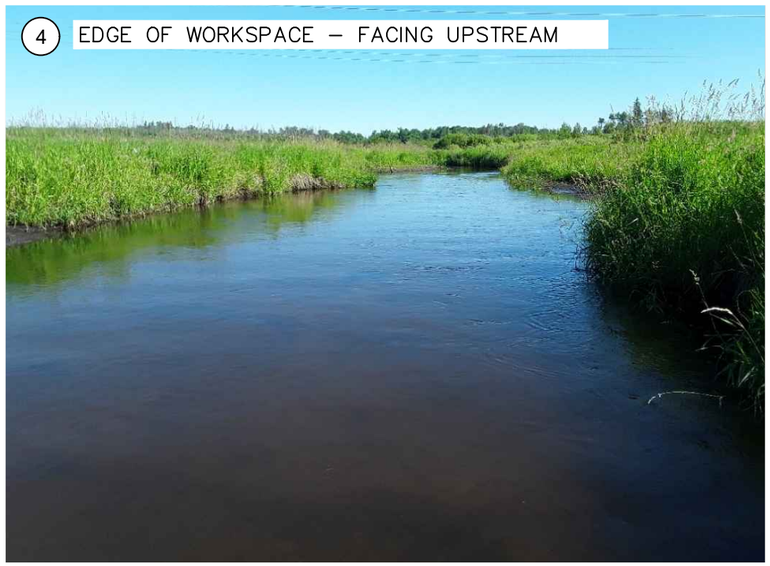
PLOTTED SIZE: ANSI FULL BLEED B (17x11)

1 CENTERLINE – FACING WEST BANK

2 CENTERLINE – FACING EAST BANK

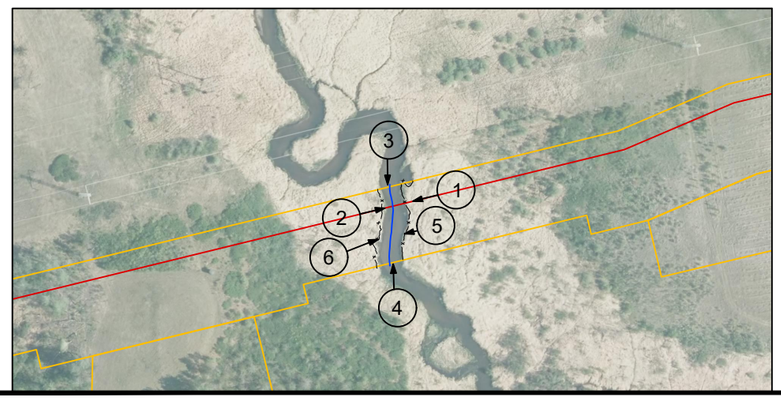
3 EDGE OF WORKSPACE – FACING DOWNSTREAM

4 EDGE OF WORKSPACE – FACING UPSTREAM



5 BRIDGE – FACING WEST BANK

6 BRIDGE – FACING EAST BANK



NOTES:

1. AIR PHOTOS ARE FROM 2018 ENBRIDGE AERIAL PHOTOGRAPHY.
2. ADDITIONAL ON–THE GROUND PHOTOS MAY BE TAKEN PRIOR TO CONSTRUCTION AT MDNR REQUEST.
3. PRE–CONSTRUCTION PHOTOS WILL BE USED TO AID IN RESTORATION.

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ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN
SHELL RIVER – MP 981.4 – MDNR ID 35
PHOTO PAGE

SCALE	DWG. NO.	PAGE NO.
	SSRP–981.4–005	5/5

ENBRIDGE

PLOTTED SIZE: ANSI FULL BLEED B (17x11)

GENERAL

1. THE SPECIFICATIONS WITHIN THIS SSRP MAY MODIFY OR REPLACE PROJECT–WIDE STANDARDS PRESENTED IN THE EPP. WHERE MATERIAL WITHIN THESE SSRPS EXCEEDS STANDARD CONSTRUCTION MEASURES IN THE EPP, THESE SSRPS SUPERSEDE THE EPP.

2. CONSTRUCTION AND RESTORATION OF WATERBODY CROSSINGS WILL FOLLOW THESE GENERAL STEPS:

   A. SITE CLEARING
   B. INSTALLATION OF TEMPORARY EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES ("BMPS")
   C. BRIDGE INSTALLATION
   D. EXCAVATION/BACKFILLING OF THE WATERBODY INCLUDING:
      - SOD SAVING TOPSOIL SEGREGATION AT NON–WOODED SITES
      - STREAMBED MATERIAL SEGREGATION
      - PIPE INSTALLATION
      - BACKFILL, INCLUDING IMPLEMENTATION OF CONSTRUCTION–RELATED RESTORATION METHODS (I.E., TOE WOOD)
   E. REPLACEMENT OF STREAMBED MATERIAL AND TOPSOIL/SOD LAYER
   F. RESTORATION OF STREAM BANKS TO PRE–CONSTRUCTION CONTOURS
   G. IF FINAL GRADING NOT POSSIBLE AT THE TIME, TEMPORARY STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   H. AFTER FINAL GRADING, PERMANENT SEEDING AND/OR WOODY VEGETATION RESTORATION, STABILIZATION AND REPLACEMENT/REINFORCEMENT OF TEMPORARY BMPS
   I. BRIDGE REMOVAL DURING FINAL RESTORATION AFTER STABILIZATION AND PERMANENT SEEDING
   J. POST–CONSTRUCTION MONITORING

CROSSING METHODS

1. ALL WATERBODY AND WETLAND CROSSINGS WILL BE CONDUCTED IN COMPLIANCE WITH SECTION 2.0 AND SECTION 3.0 OF THE ENVIRONMENTAL PROTECTION PLAN ("EPP"), RESPECTIVELY. SECTION 2.0 AND 3.0 OF THE WINTER CONSTRUCTION PLAN PRESENTS MODIFICATIONS FOR WATERBODY AND WETLAND CONSTRUCTION METHODS, RESPECTIVELY, IN WINTER CONDITIONS.

2. ENBRIDGE'S SUMMARY OF CONSTRUCTION METHODS AND PROCEDURES (THE "PROCEDURES," APPENDIX A OF THE EPP) OUTLINES THE VARIOUS CONSTRUCTION METHODS THAT ENBRIDGE MAY UTILIZE TO CONSTRUCT THROUGH WATERBODIES AND WETLANDS/BASINS AS PRESENTED ON THESE SITE–SPECIFIC RESTORATION PLANS ("SSRPS").

   A. DRY CROSSING (ISOLATED) METHODS (INCLUDING THE DRY CROSSING AND MODIFIED DRY CROSSING METHOD) ARE DESCRIBED SECTIONS 4.3 OF THE PROCEDURES, AND IN SECTIONS 2.5.2 AND 2.5.3 AND FIGURES 23 AND 24 OF THE EPP.
   B. THE BORE METHOD (NON–PRESSURIZED) IS DESCRIBED IN SECTION 3.5 OF THE PROCEDURES, AND SECTION 4.0 OF THE EPP.
   C. THE MODIFIED UPLAND CONSTRUCTION (WETLAND) METHOD IS DESCRIBED IN SECTION 3.3 OF THE PROCEDURES, AND SECTION 3.0 AND FIGURES 30 TO 34 OF THE EPP.
   D. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE OPEN CUT (NON–ISOLATED) WATERBODY CROSSING METHOD IS DESCRIBED IN SECTION 4.1 OF THE PROCEDURES, AND SECTION 2.5.1 AND FIGURE 24 OF THE EPP.
   E. ALTHOUGH NOT PROPOSED AS A PRIMARY METHOD AT THESE SSRP WATERBODIES, THE PUSH–PULL METHOD IS DESCRIBED IN SECTION 3.4 OF THE PROCEDURES, AND SECTION 3.7.1 AND FIGURES 35 AND 36 OF THE EPP.

CLEARING/VEGETATION REMOVAL

1. STUMPS WITHIN THE TRENCH LINE WILL BE COMPLETELY REMOVED, GROUND, AND/OR HAULED OFF–SITE TO AN APPROVED LOCATION. TREE STUMPS OUTSIDE THE TRENCH LINE WILL BE GROUND BELOW NORMAL GROUND SURFACE TO FACILITATE A SAFE WORK AREA AND TO ALLOW TOPSOIL REMOVAL, IF NECESSARY. IN SOME CIRCUMSTANCES, TREE STUMPS OUTSIDE THE TRENCH LINE MAY BE COMPLETELY REMOVED TO ALLOW FOR A SAFE WORK AREA AND HAULED OFF–SITE TO AN APPROVED LOCATION AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

2. CLEARING WILL BE CONDUCTED IN WATERBODIES AND WETLANDS AS OUTLINED IN SECTION 2.2 AND 3.2 OF THE EPP, RESPECTIVELY. CHIPS, MULCH, OR MECHANICALLY CUT WOODY DEBRIS SHALL NOT BE STOCKPILED IN A WETLAND. HYDRO–AX DEBRIS, OR SIMILAR CAN BE LEFT IN THE WETLAND IF SPREAD EVENLY IN THE CONSTRUCTION WORKSPACE TO A DEPTH THAT WILL ALLOW FOR NORMAL REVEGETATION, AS DETERMINED BY THE EI. CHIPPING IS NOT ALLOWED ON PUBLIC LANDS. ON PUBLIC LANDS, MULCH AND MECHANICALLY CUT WOODY DEBRIS MUST BE UNIFORMLY BROADCAST TO LESS THAN 2–INCH THICKNESS AND IN A MANNER THAT MAINTAINS VISIBLE GROUND.

3. ENBRIDGE WILL PROPERLY INSTALL AND MAINTAIN REDUNDANT SEDIMENT CONTROL MEASURES IMMEDIATELY AFTER CLEARING AND PRIOR TO INITIAL GROUND DISTURBANCE AT SURFACE WATERS LOCATED WITHIN 50 FEET OF THE PROJECT AND WHERE STORMWATER FLOWS TO THE SURFACE WATER (REFER TO THE ENVIRONMENTAL PLAN SHEETS IN THE SWPPP), AND WITHIN 100 FEET OF SPECIAL AND IMPAIRED WATERS, INCLUDING TROUT STREAMS.

4. ON PUBLIC LANDS AND WHEREVER PRACTICABLE AT WATERBODY CROSSINGS, ENBRIDGE WILL USE WILDLIFE–FRIENDLY EROSION AND SEDIMENT CONTROL BMPS THAT CONTAIN BIODEGRADABLE NETTING (CATEGORY 3N OR 4N NATURAL FIBER) AND WILL AVOID THE USE OF PLASTIC MESH (SECTIONS 1.17.1 AND 2.6.1 OF THE EPP).

TEMPORARY STABILIZATION

1. ON PORTIONS OF THE PROJECT WHERE WORK WILL BE OCCURRING DURING APPLICABLE "WORK IN WATER RESTRICTIONS" FOR PUBLIC WATERS (REFER TO SECTION 2.1), ALL EXPOSED SOIL AREAS WITHIN 200 FEET OF THE WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE STABILIZED WITHIN 24 HOURS DURING THE RESTRICTION PERIOD. STABILIZATION OF ALL EXPOSED SOILS WITHIN 200 FEET OF THE PUBLIC WATER'S EDGE, AND THAT DRAIN TO THAT WATER, WILL BE INITIATED IMMEDIATELY AND COMPLETED WITHIN 7 CALENDAR DAYS WHENEVER CONSTRUCTION ACTIVITY HAS PERMANENTLY OR TEMPORARILY CEASED ON ANY PORTION OF THE SITE OUTSIDE OF THE RESTRICTION PERIOD. THESE AREAS WILL BE IDENTIFIED ON THE ENVIRONMENTAL PLAN SHEETS ACCOMPANYING THE SWPPP.

2. HYDRO–MULCH AND LIQUID TACKIFIER CAN BE USED IN PLACE OF CERTIFIED WEED–FREE STRAW OR HAY MULCH WITH PRIOR APPROVAL FROM ENBRIDGE. ALL HYDROMULCH AND LIQUID TACKIFIER PRODUCTS USED WILL BE ON THE APPLICABLE STATE DOT PRODUCT LIST. HYDRO–MULCH AND LIQUID TACKIFIER PRODUCTS CONTAINING PLASTIC/POLYPROPYLENE FIBER ADDITIVES AND MALACHITE GREEN (COLORANT) WILL NOT BE UTILIZED ON THIS PROJECT. APPLICATION RATES WILL BE AT THE MANUFACTURER'S RECOMMENDED RATE. ENBRIDGE WILL AVOID THE USE OF HYDROMULCH ON PUBLIC LANDS; HOWEVER, ENBRIDGE MAY USE HYDROMULCH ON STEEP SLOPES TO PREVENT EROSION UNTIL PERMANENT COVER HAS BEEN ESTABLISHED AS OUTLINED IN SECTION 1.8.3 OF THE EPP.

RESTORATION AND STABILIZATION

1. ENBRIDGE WILL RESTORE THE STREAM BANKS AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS UNLESS THAT SLOPE IS DETERMINED TO BE UNSTABLE. IF THE SLOPE IS CONSIDERED UNSTABLE, ENBRIDGE WILL RESHAPE THE BANKS TO PREVENT SLUMPING. FOR PUBLIC WATERS, ENBRIDGE WILL RETURN THE BANK TO PRE–CONSTRUCTION CONTOURS, UNLESS OTHERWISE DIRECTED BY THE SITE–SPECIFIC RESTORATION PLAN. IF ENBRIDGE CANNOT RESTORE TO PRE–CONSTRUCTION CONTOURS AT A PUBLIC WATER, ENBRIDGE WILL CONSULT WITH THE MDNR BEFORE PROCEEDING FURTHER AS OUTLINED IN SECTION 2.6 OF THE EPP.

2. UNSTABLE SOILS AND/OR SITE–SPECIFIC FACTORS SUCH AS STREAM VELOCITY AND FLOW DIRECTION MAY REQUIRE ADDITIONAL RESTORATION EFFORTS, SUCH AS INSTALLATION OF WOODY VEGETATION, GEOTEXTILE FABRIC, OR TREE, LOG, ROOTWAD, OR BOULDER REVETMENTS TO STABILIZE DISTURBED STREAM BANKS (SEE FIGURE 29) AS OUTLINED IN SECTION 2.6.2 OF THE EPP. ENBRIDGE WILL WORK WITH THE MDNR TO ENSURE ALL WORK/ADJUSTMENTS ARE APPROVED AND ARE CONDUCTED WITHIN APPLICABLE TIMING RESTRICTIONS.

3. IN UPLAND AND WETLAND AREAS, CLEANUP AND ROUGH GRADING WILL OCCUR AS OUTLINED IN SECTIONS 1.16 AND 3.9 OF THE EPP. ENBRIDGE WILL BACKFILL THE TRENCH TO AN ELEVATION SIMILAR TO THE ADJACENT AREAS OUTSIDE THE TRENCH LINE AND WILL ADD A SLIGHT CROWN OF APPROXIMATELY 3 TO 6 INCHES (DEPENDING ON SOIL TYPE) OVER THE BACKFILLED TRENCH TO ALLOW FOR SUBSIDENCE. GENERALLY, EXCESS SUBSOIL DISPLACED BY THE PIPE INSTALLATION WILL BE SPREAD ACROSS THE PORTION OF THE CONSTRUCTION WORKSPACE WHERE TOPSOIL REMOVAL HAS OCCURRED. ANY REMAINING EXCESS SUBSOIL WILL BE REMOVED AND DISPOSED OF AT AN APPROVED OFF–SITE LOCATION AS NEEDED TO ENSURE CONTOURS ARE RESTORED TO AS NEAR AS PRACTICABLE TO PRE–CONSTRUCTION CONDITIONS.

4. REVEGETATION ACTIVITIES WILL OCCUR AS OUTLINED IN SECTION 7.0 OF THE EPP. SEED MIXES AT PUBLIC WATERS WILL BE SELECTED AND APPLIED AS INDICATED IN THE PLANTING PLAN, WHICH IS APPENDIX A OF THE POST–CONSTRUCTION VEGETATION MANAGEMENT PLAN FOR PUBLIC LANDS AND WATERS ("VMP"). SEED MIXES RELATIVE TO THESE SSRP CROSSINGS ARE CODED AS FOLLOWS:

A	EMERGENT (34–181)	G	DRY PRAIRIE GENERAL (35–221)
B	RIPARIAN NE (34–361)	H	MESIC PRAIRIE GENERAL (35–241)
C	RIPARIAN S&W (34–261)	I	MESIC PRAIRIE NW (35–441)
D	WET MEADOW NE (34–371)	J	DRY PRAIRIE NORTHWEST (35–421)
E	WET MEADOW S&W (34–271)	K	WOODLAND EDGE NE (36–311)
F	WETLAND REHABILITATION (34–171)	L	NATURAL REVEGETATION

5. ENBRIDGE WILL NOT SEED STANDING WATER OR WOODED (PSS AND PFO) WETLAND COMMUNITIES. NATURAL REVEGETATION WILL TAKE PLACE FROM EXISTING PLANT MATERIAL AND ROOT STOCK IN THESE COMMUNITIES.

6. ALL MATERIALS USED FOR CONSTRUCTION OF THE PROJECT MUST BE REMOVED FROM THE SITE.

7. ENBRIDGE WILL CONDUCT POST–CONSTRUCTION MONITORING IN ACCORDANCE WITH THE POST–CONSTRUCTION MONITORING PLAN FOR WETLANDS AND WATERBODIES, AND IN ACCORDANCE WITH THE VMP FOR THE UPLAND PORTIONS OF THE PROJECT ON PUBLIC LANDS.

NO.	REVISION–DESCRIPTION	BY	DATE	CHK'D	APP'D
B	ISSUED FOR PERMITTING	MJT	10/2020		

ENBRIDGE LINE 3 REPLACEMENT PROJECT
SITE–SPECIFIC RESTORATION PLAN

CONSTRUCTION NOTES

SCALE	DWG. NO.	PAGE NO.
	SSRP–NOTES	

PLOTTED SIZE: ANSI FULL BLEED B (17x11)