Enbridge Line 5 Wisconsin Segment Relocation Project
Responses to U.S. Army Corps of Engineers Data Request dated December 9, 2022
Regulatory File # 2020-00260-WMS

Data Request Question 1: *The location of the proposed horizontal direction drill (HDD) of the White River is remote and access appears to be difficult. Please provide an evaluation of alternative installation methods and locations, which clearly addresses the practicability of the alternative crossing method(s) and locations and provides a comparison of environmental considerations. Describe measures to reduce the potential for an inadvertent release of drilling fluid at this location and describe specific measures that you would employ to respond in the event of an inadvertent release of drilling fluid. We further ask that you address other measures suggested by the public or other agencies and indicate your rationale for including or excluding them.*

Data Request Question 1 Response:

EVALUATION OF ALTERNATIVE CROSSING METHODS AT THE WHITE RIVER

While somewhat remote, Enbridge has determined that the proposed horizontal directional drill (“HDD”) location for the White River is accessible via the proposed right-of-way and temporary access roads and that the location can be reached by the equipment necessary for large diameter pipe installation, including drilling equipment. As described in Enbridge’s application and subsequent filings, two advantages of the HDD method are that most of the workspace for the drill operation is set back from the water’s edge and that the pipeline can be installed under the waterbody without disturbing its bed or banks. However, to be successful, an HDD operation requires large additional temporary workspaces at the drill entry and exit locations for staging and equipment. It also requires suitable subsurface geology conductive to drilling; relatively flat topography for pipe fabrication; and a relatively straight cleared area of right-of-way on the drill exit side to fabricate the pipe segments to be pulled back under the river. All of these conditions exist at the proposed White River crossing location, making the proposed HDD a feasible crossing technique. The primary concern with an HDD drilled crossing is the potential for an inadvertent return surfacing at some location other than the drill entry and exit locations. Changing the location will not mitigate this risk, and the geology at the proposed White River crossing location has been determined to be suitable for an HDD.

Enbridge has evaluated other crossing techniques along the proposed pipeline alignment at the White River. Those methods include open cut (wet trench), dry crossing (dam and pump or flume), coffer-dam, and direct pipe. Enbridge does not propose to use a cofferdam system to cross any waterbodies as this method introduces higher safety risks with having personnel in an open excavation within the streambed to complete tie-in welds.

The use of open cut or dry crossing methods are not practicable and would require increased impacts to the aquatic and natural environment (e.g., sedimentation) if used at the White River crossing for installation of the Relocation pipe. The primary methods other than HDD that Enbridge proposes to use for flowing waterbodies are the dam and pump method and the flume method. Both of these methods, which are described in Enbridge's application and supplemental materials, use dams to temporarily isolate the construction workspace from the flow of the waterbody, but unlike the HDD method require excavation of the surface of the waterbody bed and banks to create the trench into which the pipe is installed. However, because the stream flow is isolated from the work area, the dam and pump and flume pipe methods only result in a temporary small release of sediment when the upstream and downstream dams are installed/removed and the streamflow is restored to the bed of the waterbody. This sedimentation is minor, of short duration, and generally localized to the crossing area. Given the width and flow of the White River, it is impractical to use either the dam and pump or flume pipe methods at the proposed crossing location. Thus if Enbridge does not use the HDD method, it would likely propose an open-cut (wet trench) crossing of the river. An open cut (wet trench) crossing would require not only the excavation of the bed and banks of the river but also would result in much higher concentrations of suspended sediments in the waterway than either the HDD or other dry crossing methods, both in terms of total amount of sediment suspended and transported as well as the duration of the sedimentation event. Additionally, unlike the proposed HDD, both the open cut (wet trench) and dry crossing methods described above would require significant workspace within the forested floodplain of the White River to accommodate equipment, materials, and spoil storage, resulting in greater environmental disturbance. For these reasons, the HDD method is the environmentally-preferred crossing method for the White River.

ALTERNATIVE WHITE RIVER CROSSING LOCATIONS

Enbridge initially evaluated an alternative White River crossing location that would have placed the pipeline beneath the reservoir upstream of the hydroelectric dam on the White River located on State Highway 112. Although technically feasible as an HDD crossing, this location would place the pipeline in close proximity to the dam and would pass beneath wild rice waters, which could be affected in the event of an inadvertent release of drilling mud. Use of a dry crossing method would not be feasible at this location due to water depth, flow rates, and distance across the feature. However, it would be technically feasible, as an alternative to the HDD method, to cross the reservoir using an open cut technique with barge mounted equipment (depending on the depth of the reservoir at the time of construction); however, this method would result in increased sediment suspension in wild rice waters. Regardless of how it would be crossed, any crossing of this reservoir at this location would also require approval from the Federal Energy Regulatory Commission ("FERC") because the location falls within the federally-permitted hydroelectric project regulated by FERC. Based on these factors, Enbridge determined that there was no technical or environmental advantage to crossing the White River at the reservoir location.

Enbridge also evaluated a crossing of the White River further upstream of the proposed location along proposed Route Alternative RA-02. Information for RA-02 was provided in Enbridge's original permit application and supplemental filings. Any crossing of the river on this alignment would use either the HDD or open cut technique and would have advantages and disadvantages similar to those described for alternative crossing methods along the proposed route (e.g., risk of an inadvertent return for an HDD and increased sedimentation for an open cut). Most river crossing locations between RA-02 and the proposed crossing location would have the potential to impact the White River Fishery Area, which is owned by the State of Wisconsin and managed as a multiple use area for trout fishing, hunting, canoeing, and similar outdoor recreational and educational opportunities. Use of the open cut (wet trench) method or dry crossing method could result in sediment transport into the White River Fishery Area. Similarly, an inadvertent release of drilling mud could potentially impact the White River Fishery Area.

Enbridge did not evaluate a crossing location between Highway 112 and Highway 13. This area was excluded from further review after Enbridge determined that any alternative locations between these highways would not take advantage of co-location with the existing utility corridor, would place the route closer to the Bad River Reservation, and would be more difficult to access, as the area is remote as compared to the proposed route. However, Enbridge did evaluate one potential route located east of Highway 13. This route was presented in the route alternatives section of the application materials as Route Alternative RA-01. Although RA-01 follows an existing utility line and therefore benefits from co-location with existing right-of-way, analysis of the White River crossing along the RA-01 alignment places the pipeline route closer to the Bad River Reservation border and would require crossing of the Wild River Wildlife Area, a State Wildlife Management Area.

MEASURES TO REDUCE THE POTENTIAL FOR INADVERTENT RETURNS AND THE IMPACT OF INADVERTENT RETURNS

Enbridge has internal construction standards that are used in conjunction with experience from specialized HDD design firms to develop site-specific plans for each HDD. The primary measure to prevent inadvertent releases during an HDD operation is to carefully assess geotechnical data for a crossing and to develop a crossing design taking that data into account. Enbridge's designs incorporate and consider geotechnical information documenting subsurface geology, topography between the entry and exit locations as well as workspace for pipe fabrication, required depth below river bottom, pipe diameter and associated installation radius and drilling mud hydraulics. For this Project, Enbridge conducted preconstruction geotechnical investigations to design and confirm the suitability of the subsurface material for HDD. In concert with those carefully-developed designs, Enbridge will use a highly experienced HDD company with years of experience successfully completing drills to help plan, design and execute each drill. These plans will include all requirements set forth in Wisconsin Technical Standard 1072 for Horizontal Directional Drilling. Enbridge further evaluated the designs and events of the recent Line 3 Replacement Project in Minnesota with its HDD design engineering firm to assess modifications to the Project designs to further reduce the likelihood of an inadvertent return. Enbridge made modifications to the Project HDD designs as appropriate.

Enbridge will also complete a pre-construction visit at the site at least 2 weeks prior to initiating HDD setup and operations to determine if additional materials and equipment will be needed. This will reduce the potential for surprises including inadvertent returns and improve the speed and effectiveness of the contractor response to any inadvertent return that may occur.

Lastly, Enbridge will implement Inadvertent Release Response Plans that provide site-specific information regarding features crossed by each HDD and containment and recovery response measures tailored to site-specific conditions. These plans require the continuous monitoring and control of drilling mud consistency, drilling mud injection pressures, alignment of the bit, qualifications of individuals on site, and inspection staff on site. As part of the drilling process, the drilling contractor will continuously monitor drilling mud pressures, drilling mud volume being pumped, and drilling mud volume returning (drilling mud circulation). Changes or discrepancies in these reading can indicate that an inadvertent return is occurring. If the HDD operator identifies a sustained loss of fluid pressure or circulation, the contractor will: (1) shut down drilling progress; (2) immediately notify the construction inspector of the assumed position of the drill tool; and (3) increase monitoring along the drill path to look for signs of an inadvertent release to the surface.

Enbridge's Drilling Fluid Response, Containment, and Notification Procedures

The information below elaborates on measures to be implemented if an inadvertent release of drilling fluid occurs despite best efforts to prevent that occurrence. Prior to the commencement of drilling operations, construction personnel involved will be informed as to the responsible party or parties for release containment and response. Enbridge will verify that the contractor has the appropriate response personnel and containment equipment on site for each drill prior to initiating the drill and throughout the drilling process.

<u>Use of Safe and Approved Materials</u>

The HDD drilling fluids/mud consists primarily of water mixed with inert bentonite clay. Under certain conditions, an additive may need to be mixed with the drilling fluids/mud for viscosity or lubricating reasons. Only agency-approved additives will be used and a Safety Data Sheet for the drilling fluid additives will be maintained on-site at each active HDD.

<u>On-Site Inspection during Construction</u>

Early detection is key to minimizing the area of potential impact from an inadvertent release. During construction of a drilled crossing, Enbridge will monitor the drill by implementing the following best management practices ("BMPs") that allow for the early detection of drilling fluid loss and cessation of operations until such loss can be located and remedied. This procedure will occur regardless of seasonality. If fluid loss has been detected, physical surveys as described below will be conducted to determine if the fluid has migrated to the surface, and the appropriate corrective actions will be implemented. Specifically, the HDD operator will:

- Maintain 24-hour operations, which can help maintain consistent drilling fluid circulation and monitoring.
- Continuously monitor and maintain a log of drilling mud volume balance (mud in = mud out).
- Maintain drilling fluid circulation at entry and exit endpoints to ensure that cuttings are:
  - Being carried out of the hole and
  - Properly segregated from the re-used drilling fluid.
- Monitor in real-time the annular drilling fluid pressures during drilling, and record pressures every minute.

If a sustained loss in fluid pressure or loss of circulation occurs, the HDD operator will:

- Shutdown the drilling progress promptly;
- Notify the construction inspectors of the assumed position of the drill tool; and
- Visually inspect by walking or using a boat the appropriate portion of the drill path where the drill tool is located to determine if an inadvertent return occurred.

Additionally:

- Enbridge will inform construction inspectors on what to watch for and will make them aware of the importance of timely detection and response actions for any release of drilling fluid.
- Construction inspectors will have appropriate, operational communication equipment (e.g., radio and cell phones) available at all times during installation of the HDD crossing, with the ability to communicate directly with the HDD operator.
- At least one full-time personnel will continuously monitor the drill path by inspecting land surfaces and the waterbodies for surface releases of drilling fluid during drilling, reaming, and pipe installation procedures. The inspector will also walk the drill path to monitor for surface seepage, sinkholes, and settlement. In addition, flowing streams shall be monitored both upstream and downstream of the drill path. If an inspector notices inadvertent return

conditions, shutdown will occur immediately. Enbridge will provide adequate lighting of the drill path to allow for monitoring during 24-hour continuous operation.

- Construction inspectors, Environmental Inspectors, and Enbridge HDD on-site personnel have the authority to order installation of containment structures, if needed, and to require additional response measures if deemed appropriate.
- Enbridge will promptly contact the appropriate agencies, including the Wisconsin spill hotline, promptly of a surface inadvertent release.

Containment, Response, and Cleanup Equipment

Containment, response, and cleanup equipment will be available on both sides of an HDD crossing location prior to commencement to assure a timely response in the event of an inadvertent release of drilling fluid. Containment and response equipment will include, but not be limited to:

- straw bales and staking;
- pre-filled sandbags;
- turbidity curtain (type to be specified in the site-specific Inadvertent Release Response
- Plans);
- silt fence;
- plastic sheeting and/or geotextile fabric;
- shovels, brooms, buckets, and other appropriate hand tools;
- pumps and sufficient hose;
- fluid storage tanks;
- vacuum truck on-site prior to and throughout the drill execution;
- one small boat (type/motorization to be specified in site-specific Inadvertent Release Response Plans);
- light plant/generator; and,
- any other equipment specified by Enbridge based on site visit and specified in the site specific Inadvertent Release Response Plans.

Actions in Response to Inadvertent Returns

In the event an inadvertent drilling fluid release is observed, Enbridge will assess to determine the amount of fluid being released and potential for the release to reach sensitive resource areas (e.g., wetlands and waterbodies). Response measures will vary based on location of inadvertent release as discussed below. The location of the inadvertent release will be documented by the Environmental Inspector ("EI") with the site name, size of release, initial date of release, and Global Positioning System ("GPS") location. The EI will photograph the release site and include it with the daily inspection report. Enbridge will coordinate containment, response, cleanup and reporting activities with the applicable agencies.

If a release occurs outside of the authorized construction workspace, Enbridge will mobilize on foot lightweight containment materials (e.g., straw bales, silt fence, sand bags) to the release location to promptly isolate the drilling fluid. Once drilling fluid has been contained, Enbridge will determine if equipment access is necessary to aid in the response, and will initiate agency consultations for developing alternate access, as necessary.

<u>Upland Locations</u>

Response measures in the event of a drilling fluid release in upland locations include the following:

- The EI will evaluate the release to determine if containment structures are warranted and if they will effectively contain the release.
- If the amount of the surface release is not great enough to allow the practical physical collection from the affected area, it will be diluted with clean water and/or the fluid will be allowed to dry and dissipate naturally.
- Earthen or sandbag berms, silt fence, and/or hay bales will be installed to contain small releases and prevent migration of drilling fluid.
- Enbridge will remove excess fluid at a rate sufficient to prevent an uncontrolled release.

<u>Wetland Locations</u>

(This section also applies to areas immediately adjacent to wetlands and waterbodies, such as stream banks or steep slopes, where drilling fluid releases could quickly reach surface waters.)

In the event of a drilling fluid release in wetlands or adjacent areas:

- The EI will evaluate the release, and the appropriate containment measures will be implemented.
- Enbridge will evaluate the recovery measures to determine the most effective collection method.
- If the amount of the surface release exceeds that which can be contained with hand-placed barriers, small collection sumps (less than 5 cubic yards) may be utilized to collect released drilling fluid for removal by the use of portable pumps and hoses.
- Low ground pressure equipment (e.g., UTV, argo, morooka) will conduct limited passes to assist personnel carrying containment materials to the release location.
- Temporary access will be supported by construction matting installed during clearing within the wetland areas.
- If the amount of the surface release is not great enough to allow the practical physical collection from the affected area without causing additional impacts, with approval from both Enbridge Environment and Construction Management, the drilling fluid may be diluted with clean water and/or the fluid will be allowed to dry and dissipate naturally.
- Excess fluid will be held within the containment area and removed using pumps or other appropriate measures at a rate sufficient to maintain secure containment.
- Recovered fluid will be stored in a temporary holding tank or other suitable structure out of the floodplain and/or wetland for reuse or eventual disposal in an approved off-site location.

Waterbody Locations

In the event of a drilling fluid release in a waterbody:

- The EI will evaluate the release, and the appropriate containment measures will be implemented.
- Enbridge will evaluate the recovery measures to determine the most effective collection method.

The containment methods utilized will depend on the size of release, water depth, flow velocity, and location of the release. In aquatic environments, bentonite may harden, effectively sealing the inadvertent release location. In this event, response activities will be limited or unnecessary.

However, if drilling mud were to enter the water column, the typical response tactic will be to erect an isolation containment environment using the materials identified in Table 1-1, or their equivalent, to facilitate a spill response team's ability to contain and collect excess drilling mud. Containment is not always feasible for in-stream releases, especially in waterbodies with significant currents.

Drilling fluid recovery methodology in waterbodies is not as variable as containment measures. When such measures effectively isolate the release from the stream flow, pumps or other appropriate measures are used to recover drilling fluid. When the release location cannot be isolated after initial in-stream containment installation, drilling fluid that has settled from the water column typically collects in the acute upstream angle of the containment tool, and recovery efforts will be localized to that location.

Table 1-1
Inadvertent Return Containment Methods for Variable In-Stream Conditions

Water Conditions		**Distance from Water's Edge**		
Flow Velocity	**Water Depth**	**0 - 10 Feet**	**10 - 20 Feet**	**Greater Than 20 Feet**
Still/Slow (Less Than 1 ft/sec)	0 - 2 feet	Sandbag isolation structure; vertical culvert	Sandbag isolation structure; vertical culvert	Sandbag isolation and structure; vertical culvert
	2 - 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers and plastic sheeting	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers and plastic sheeting	Turbidity curtain; vertical culvert; bladder dams
	Greater than 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers	Turbidity curtain; vertical culvert; bladder dams
Slow/Moderate (1 - 3 ft/sec)	0 - 2 feet	Sandbag cofferdam; vertical culvert	Sandbag cofferdam; vertical culvert; geotextile pipeline weights cofferdam; jersey barriers with plastic sheeting	Sandbag cofferdam; vertical culvert; geotextile pipeline weights; bladder dams
	2 - 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers and plastic sheeting	Turbidity curtain; geotextile pipeline weights cofferdam; vertical culvert; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; bladder dams; water gates (as upstream diversion aid)

	Greater than 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; geotextile pipeline weights; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; bladder dams; water gates (as upstream diversion aid)
Moderate/Rapid (Greater Than 3 ft/sec)	0 - 2 feet	geotextile pipeline weights cofferdam; vertical culvert; jersey barriers and plastic sheeting	geotextile pipeline weights cofferdam; vertical culvert; jersey barriers and plastic sheeting	Turbidity curtain; sand bags, bladder dams; water gates (as upstream diversion aid)
	2 - 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; jersey barriers and plastic sheeting	Turbidity curtain; geotextile pipeline weights; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; bladder dams; water gates (as upstream diversion aid)
	Greater than 5 feet	Turbidity curtain; Geotextile pipeline weights cofferdam; vertical culvert; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; geotextile pipeline weights; bladder dams; water gates (as upstream diversion aid)	Turbidity curtain; geotextile pipeline weights; bladder dams; water gates (as upstream diversion aid)

<u>Agency Notification and Resumption of Suspended HDD Operations</u>

The EI will be promptly notified of all drilling fluid releases, who will then immediately notify Enbridge Environment and Construction Management. The EI, Construction Management, and Enbridge Environment will coordinate communications with all appropriate regulatory agencies.

If notifications are necessary during non-business hours, they will be conducted according to prior arrangements made between Enbridge and the regulatory agencies. Follow-up notifications will be made as necessary and practicable.

If containment measures are functioning, and the circumstances and potential impacts of the release are understood, Enbridge will resume HDD operations.

<u>Cleanup</u>

The following measures will be adhered to/implemented as appropriate:

- Drilling fluid will be cleaned up by hand using hand shovels, buckets, and soft-bristled brooms as possible without causing extensive ancillary damage to existing vegetation.
- Clean water washes may also be employed if deemed beneficial and feasible.
- Containment structures will be pumped out and the ground surface scraped to bare topsoil without causing undue loss of topsoil or ancillary damage to existing and adjacent vegetation.
- Material will be collected for temporary storage prior to removal from the site to an Enbridge-approved disposal location or a licensed disposal facility.
- The EI will regularly evaluate the potential for secondary impact from the cleanup process and cleanup activities will be terminated if physical damage to the site is deemed to exceed the benefits of removal activities. This decision will be made in consultation with the appropriate regulatory agencies and/or Enbridge in conformance with the required regulatory authorizations and all applicable federal, state and local regulations governing this activity.

Restoration and Post-Construction Monitoring

Following cleanup, restoration and revegetation of affected areas will be completed according to all applicable local, state, and federal permits and Enbridge's Environmental Protection Plan ("EPP"). Enbridge will monitor the release site as appropriate to assure adequate restoration.

Reporting and Documentation

Enbridge will record the following information in the event of an inadvertent release:

- Date and time of the release;
- Name of Contractor executing the HDD and names of personnel on-site and their roles, including EIs and Independent Environmental Monitors;
- Stage of the HDD operation (e.g., pilot hole, ream pass number, type of reamer);
- Description of site-specific conditions at release site (e.g., upland, wetland, vegetation, slope, sensitive features);
- GPS coordinates as close as possible to the center of the inadvertent release;
- Photograph of the inadvertent release location, and photographs of the release;
- Description of the size of the release (volume and area);
- Identification of any drilling mud additives present in the release;
- Description of how the release was contained, including how access was achieved;
- Description of how the release was cleaned up, the volume of the recovered material, and the area that was completely cleaned up, including description of how access was achieved;
- Description of any released material that was not cleaned up, including why access was not achieved, the volume of the material that could not be recovered, and the area that was not accessible to clean up;
- Description of corrective actions implemented to avoid additional inadvertent release (e.g., complete pilot hole, incorporation of additives); and
- Description of additional monitoring efforts taken to detect additional potential releases (e.g., additional monitor on site).

Enbridge has also developed staging and site-specific erosion control plans for HDD entry and exit locations. These include perimeter controls around the HDD work areas. Additional perimeter controls may be added or proposed perimeter controls modified as directed by the Enbridge EI at the time of site development. Implementation of the site-specific erosion and sediment controls will minimize the risk of sediment migrating from the work site into the White River following storm events.

Data Request Question 2: *Please provide site-specific inadvertent release response plans for all waterways proposed to be crossed by HDD or direct bore methods of pipeline installation. These plans must discuss measures taken to reduce potential for an inadvertent release and describe specific measures that you would employ to respond in the event of an inadvertent release of drilling fluid.*

Data Request Question 2 Response:

Enbridge has worked with its HDD contractor to develop site-specific inadvertent release response plans for the proposed trenchless crossings (HDD and Direct Pipe). Those plans are included as Attachment 2-A.

Data Request Question 3: *Please provide additional information to allow our agency to better understand the alternatives considered for crossing several specific waterbodies, as well as any potential risks or adverse effects which may occur within these resources. This information should describe how the waterbodies would be monitored, and how you propose to identify the need for and methods to address any remedial activities which may be identified.*

a. *Please provide an evaluation of alternative trenchless installation methods for the following resources when proposed to be crossed by open cut methods: designated trout streams, tributaries to designated perennial trout streams, 303(d) listed waters, Area of Special National Resource Interest (ASNRI) streams, and waters that flow downstream to the Bad River Reservation and are listed as Exceptional and Outstanding Resource Waters (ERWs & ORWs). As part of this evaluation, please include an assessment which describes the practicability of the alternative crossing method(s) and provides a comparison of anticipated environmental effects. Please pay careful attention to the designations for listing these waterbodies and how the proposed construction activities could potentially impair designations for these waters.*
b. *Please provide an updated plan for monitoring construction-related risks that may impair the waterways listed in 2.a. at a minimum. We have received a draft water quality monitoring plan from you and appreciate your proposal to monitor perennial waterways. However, additional information is still required. Please define, and provide the rationale for, proposed baseline monitoring timeframes and post-construction monitoring timeframes. Additional details and rationale about the monitoring distance from the crossings should be included, as well information describing your consideration of monitoring locations at downstream connection points where effects may be aggregated. Many of the waterways along the route include fine grain substrates which may have the potential to affect benthic macroinvertebrate communities when suspended sediment settles out of the water column. Please describe how the monitoring would establish a baseline for parameters of concern, and what deviations measured would be considered outside a normal fluctuation. Lastly, describe what actions would be taken to address monitoring results which suggest a need for remedial action. We strongly recommend additional coordination with our agency prior to submittal of a final document.*

Data Request Question 3.a. Response:

Enbridge identified 15 locations at which a trenched crossing is proposed for waterways designated as one or more of the following: designated trout streams, tributaries to designated perennial trout streams, 303(d) listed waters, Area of Special Natural Resource Interest ("ASNRI") streams, and waters that flow downstream to the Bad River Reservation and are listed as Exceptional and Outstanding Resource Waters ("ERWs" & "ORWs"). Both the Marengo River and Trout Brook will be crossed by the Project and are classified as 303(d) listed waters; however, they will be crossed by horizontal directional drill (HDD) or Direct Pipe, so were therefore omitted from this response.

A summary of each crossing and an explanation why the HDD or Direct Pipe method is not appropriate or preferred are presented in table 3-1 below. Use of either method would have the potential to avoid instream and riparian impacts adjacent to the waterbodies but as noted on the table, the additional workspace required for use of trenchless methods may impact other wetlands and waterbodies. It should also be noted that Enbridge has not conducted geotechnical studies for any of the waterbodies listed on the table since these have not been proposed as HDD or Direct Pipe crossings. As such, the suitability of the subsurface geology for trenchless construction at these locations is unknown; if unsuitable, could be another reason against the use of a trenchless method.

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
Bay City Creek	Sase006p	0.63	DC	303(d) impaired for total phosphorus	12 ft; 14 ft; sand	The Project does not cross any other waterbodies within the Bay City Creek watershed.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route crosses the creek under a powerline and then bends away from the crossing alignment on both sides of the creek to parallel the existing powerline corridor. An HDD would require a modification to the Project route that would require addition forest clearing. Additonal temporary right-of-way (ROW) would be necessary for pipe fabrication, which could impact new wetlands. Additionally, there are two existing pipeline corridors on the north side of the crossing that would restrict workspace availability. The proposed dry crossing method will not increase phosporous impairment and will minimze in-stream sedimentation. Any of the sandy substrate that is disturbed will settle out quickly. Based on literature, modelling results, and the sandy substrate, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality. Bay City Creek is listed as impaired for phosporous. The specific source of the impairment is unknown, but it is likely that the exceedance of total phosphorus in Bay City Creek is due to application of fertilizers on agricultural fields along the creek and/or from other land use practices and runoff entering the stream as it flows through the City of Ashland, downstream of Enbridge's proposed crossing location. Installation of the proposed pipeline will not be an increased source of phosporous and runoff will be controlled by instllation of extensive erosion controls per Enbridge's EPP.

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
Beartrap Creek	sasb007i	2.91	OC/DC	ASNRI-PNW; ORW	6; 10; gravel, sand, silt/clay	The Project does not cross any unnamed tributaries to Beartrap Creek but it crosses Little Beartrap Creek(sasa047i) and several Little Beartrap Creek tributaries, which collectively flow into Beartrap Creek approximately 5.9 miles downstream of the proposed Beartrap Creek crossing . Little Beartrap Creek all of the Little Beartrap Creek tributaries are either intermittent or ephemeral at the proposed crossing locations and will be crossed using a dry crossing methods if there is any flow.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The flow is intermittent at the proposed crossing location and it is likely there will be no flow at time of crossing. The workspace required for an HDD would likely increase the impact on some wetlands including forested wetlands and the pipe fabrication area could increase the activies in and duration of construction in some wetlands. The proposed crossing method (either crossing when there is no flow or using a dry crossing method if there is flow) will minimize in-stream sedimentation and most of the substrates that are disturbed will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated ASNRI-PNW or ORW status of waterbody.
UNT of Marengo River	sasd011p	7.99	DC	*Perennial tributary of trout stream*	9, 15, sand, silt/clay	This unnamed tributary to the Marengo River(sasd011p) joins the Marengo River approximately 4.2 miles downstream of the proposed sasd011p crossing. The Marengo River will be crossed using a trenchless method.	The narrow width of the waterbody is unsuitable for a long HDD crossing. Extra workspace would be required for an HDD, which could increase wetland impacts on the north side of the crossing. If drilled from this side, additional wetland area would likely be impacted; if pipe fabrication is performed on the north side, it would increase the activities in and duration of construction in some wetlands. There is also a residence close to the crossing location. Residents of this home would be subjected to a prolonged period of HDD noise during drilling. The proposed dry crossing method will minimize in-stream sedimentation and most of the

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Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
							substrates that are disturbed will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Brunsweiler River	sasc1006p	14.73	DC	*Perennial tributary of trout stream*	8; 30; sand	This unnamed tributary to the Brunsweiler River (sasc1006p) joins the Brunsweiler River approximately 2.19 miles downstream of the proposed sasc1006p crossing. Two other waterbodies that are crossed by the pipeline, an ephemeral stream (sasc1009e_x2) and an intermittent waterbody (sasa1028i), join and then flow into sasc1006p approximately 0.35 miles downstream of the sasc1006p crossing and approximately 1.84 miles upstream of the combined confluence of these streams with the Brunsweiler River. Both of these waterbodies will be crossed using a dry crossing method if they are flowing. The Brunsweiler River will be crossed using a trenchless method approximately 3.53 miles upstream of the confluence of sasc1006p and the Brunsweiler River .	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional temporary ROW for an HDD could impact one or more waterbodies depending on whether it is located north or south of the crossing. It may also impact areas of upland forest and if located on the north side the fabrication of the pipeline string for the HDD could require a temporary road closure. The proposed dry crossing method will minimize in-stream sedimentation and any disturbance of the sandy substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
UNT of Trout Brook	sasc1003p_x1	15.86	DC	*Perennial tributary of trout stream*	8; 50; sand	This unnamed tributary to Trout Brook (sasc1003p_x1) joins Trout Brook approximately 1.24 miles downstream of the proposed sasc1003p_xl crossing. Trout Brook will be crossed using a trenchless method and this crossing is 1.76 miles upstream of the confluence of the sasc1003p_x1 and Trout Brook.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional temporary ROW for an HDD would impact upland forest, a waterbody and wetlands, including possibly forested wetlands. Additionally, if the fabrication of the pipe string was located on the south side of the crossing, the HDD would likely require a temporary road closure. There is also a residence close to the crossing location. Residents of this home would be subjected to a prolonged period of HDD noise during drilling. The proposed dry crossing method will minimize in-stream sedimentation and any disturbance of the sandy substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Silver Creek	sasd1015p	19.83	DC	*Perennial tributary of trout stream*	8;15; cobble, sand	This unnamed tributary to Silver Creek (sasd1015p) flows into Silver Creek approximately 0.66 mile downstream of the proposed sasd1015p crossing. Silver Creek will be crossed using a trenchless method.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional ROW necessary for an HDD would impact upland forest and temporarily block several trails. It could also impact wetlands if the pipe string fabrication was on the north side of the crossing.

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
							The proposed dry crossing method will minimize in-stream sedimentation and any disturbance of the sandy and cobbly substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Silver Creek	sase005p_x2	20.61	DC	*Perennial tributary of trout stream*	9; 9; Gravel, sand	This unnamed tributary to Silver Creek (sase005p_x2) flow into sasd1015p. The sase005p_x2 crossing is approximately 1.88 miles upstream of the proposed sasd1050p crossing. As such it is approximately 2.54 miles upstream of where the combined tributaries flow into Silver Creek. Silver Creek will be crossed using a trenchless method.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional ROW necessary for HDD drilling operation and pipe fabrication could impact forested wetlands and additional upland forest. The proposed dry crossing method will minimize in-stream sedimentation and any disturbance of the sandy and gravelly substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Silver Creek	sasv004p	21.28	DC	*Perennial tributary of trout stream*	5; 5.5; Cobble, gravel, organic	This unnamed tributary to Silver Creek (sasv004p) flows into sase005p_x2 approximately 0.84 miles upstream of the proposed sase005p_x2 crossing. As such it is approximately 2.92 miles upstream of where the combined tributaries flow into Silver Creek will be crossed using a trenchless method.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on the north side of the creek and there is no suitable HDD pipe string fabrication area on that side of the proposed ROW. The additional ROW necessary for HDD drilling and pipe fabrication, depending on which sides they are located on could impact new wetlands on the north side or increase the activities and duration of impacts on the south

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
							side of the crossing. There is also a residence close to the crossing location. Residents of this home would be subjected to a prolonged period of HDD noise during drilling. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Krause Creek	sasv020p	22.01	DC	*Perennial tributary of trout stream*	6; 8; Cobble, gravel, sand, silt/clay	This unnamed tributary to Krause Creek (sasv020p) converges with Krause Creek approximately 0.3 mile downstream of the proposed sasv020p crossing. However, there does not appear to be direct channel flow between the two as they are separated by a wetland. Additionally, Krause Creek will be crossed using a trenchless method upstream of the confluence of sasv020p and Krause Creek.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional ROW necessary for HDD drilling could impact forested wetlands if it is located on the south side of the crossing. Locating the pipe string fabrication area on the south side could also impact forested wetlands. If located on the north side, it would require a temporary road closure. There is also a residence close to the crossing location. Residents of this home would be subjected to a prolonged period of HDD noise during drilling. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
							water quality or the designated trout status of waterbody.
UNT of Bad River	sasa008p	23.72	DC	*Perennial tributary of trout stream*	5; 7; Organic	This unnamed tributary to the Bad River (sasa008p) flows into the Bad River approximately 0.5 mile downstream of the proposed sasa008p crossing and approximately 1.0 mile downstream of the proposed Bad River crossing. The Bad River will be crossed using a trenchless method approximately 1.0 mile upstream of the confluence of sasa008p and the Bad River.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The area of available workspace on the south side of the waterbody is limited due to steep and side-sloping terrain and may be insufficient to conduct an HDD. The additional ROW necessary for HDD drilling and pipe string fabrication could impact forested wetlands and riparian habitat. A temporary road closure would also likely be required to fabricate the pipe string for the HDD. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
UNT of Gehrman Creek	sasa004p	28.39	DC	*Perennial tributary of trout stream*	8; 10; Cobble, gravel, sand	This unnamed tributary to Gehrman Creek (sasa004p) flows into Gehrman Creek approximately 1.1 miles downstream of the proposed sasa004p crossing. Gehrman Creek will not be crossed by the Project.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline alignment also bends west side of the crossing and the pipe string fabrication area could not be located on the proposed ROW on this side. The additional workspace for the HDD would require the clearing of upland forest and a temporary road closure would also likely be required to fabricate the pipe string for the HDD. The proposed dry crossing method will minimize in-stream sedimentation and any disturbance of the cobbly, gravelly, sandy substrate will settle out quickly. Based on literature and modelling results,

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
							the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
Camp Four Creek	sasw005	29.81	OC/DC	Class II Trout, ASNRI-PNW	6; 12; Cobble, gravel, silt/clay, organic	Camp Four Creek (sasw005) flows into Tyler Forks. The Camp Four Creek crossing is approximately 2.68 miles upstream of its confluence with Tyler Fork. Camp Four Creek will be crossed using a dry crossing if there is flow. Tyler Forks will be crossed using a trenchless method approximately 6.45 miles upstream of the Camp Four confluence with Tyler Forks.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline alignment also bends west side of the crossing and the pipe string fabrication area could not be located on the proposed ROW on this side. The flow of the waterbody is intermittent at proposed crossing location and there will likely be no flow at time of crossing. The workspace required for an HDD would likely impact and increase activities and the duration of construction in some wetlands including forested wetlands, and some waterbodies. The proposed crossing method (either crossing when there is no flow or using a dry crossing method if there is flow) will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated ASNRI-PNW or trout status of waterbody.
UNT of Feldcher Creek	sirb010p	30.67	DC	*Perennial tributary of trout stream*	5; 10; Cobble, gravel, silt/clay	This unnamed tributary to Feldcher Creek (sirb010p) flows into Feldcher Creek approximately 1.53 miles downstream of the proposed sirb010p crossing. However, it is unclear if there is direct channel flow between the two as they	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline alignment also bends east side of the crossing and the pipe string fabrication area could not be located on the proposed ROW on this side. The additional workspace required for an HDD would impact forested uplands and could impact forested

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
						appear to be separated by a wetland. Approximately 1.0 mile downstream of the confluence of the tributary and Feldcher Creek, Feldcher Creek flows into Tyler Forks. Tyler Forks will be crossed using a dry crossing method. . Tyler Forks will be crossed using a trenchless method approximately 5.5 miles upstream of the confluence of Feldcher Creek and Tyler Forks.	wetlands. The fabrication of the pipe string could also require a temporary road closure. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.
Feldcher Creek	WDH-103	31.76	DC	Class II Trout, ASNRI-PNW	<10; <10; Cobble, gravel, silt/clay	Feldcher Creek (WDH-103) flows into Tyler Forks approximately 2.16 miles downstream of the proposed pipeline crossing of Feldcher Creek. Tyler Forks will be crossed using a trenchless method approximately 5.5 miles upstream of the confluence of Feldcher Creek and Tyler Forks.	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline alignment also bends on the west side of the crossing, and the pipe string fabrication area could not be located on the proposed ROW on this side. The additional workspace required for an HDD would impact forested uplands and would likely impact forested wetland if the pipe string fabrication area was located on the west side of the crossing. The remote and isolated location of the crossing area could increase the difficulty of access for an HDD. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated ASNRI-PNW or trout status of waterbody.
UNT of Vaughn Creek	sird009p	39.00	DC	*Perennial tributary of trout stream*	2; 2.5; Sand, silt/clay	This unnamed tributary to Vaughn Creek (sird009p) flows into Vaughn Creek	The narrow width of the waterbody is unsuitable for a long HDD crossing. The pipeline route bends away from the crossing alignment on both sides of

Table 3-1
Special Designation Waterways with Trenched Crossings

USGS Name	Feature ID	Milepost	Crossing method	Agency classification	OHWM width; bank width; substrate	Confluence with other waterbodies crossed by Project	Reason trenchless method was rejected
						approximately 1.48 miles downstream of the proposed sird009p crossing. Vaughn Creek will be crossed using a trenchless method approximately 1.22 miles upstream of the confluence of sird009p and Vaughn Creek. .	the creek and there is no suitable HDD pipe string fabrication area on the proposed ROW. The additional ROW necessary for HDD drilling operation and pipe fabrication could impact wetlands including forested wetlands. There is also a residence close to the crossing location. Residents of this home would be subjected to a prolonged period of HDD noise during drilling. The presence of a powerline and railroad in the vicinity could also complicate an HDD crossing. The proposed dry crossing method will minimize in-stream sedimentation and most of the disturbed substrate will settle out quickly. Based on literature and modelling results, the proposed crossing method will have only a minor and localized effect, and will not impact stream-wide water quality or the designated trout status of waterbody.

OHWM = Ordinary High Water Mark; ORW = Outstanding Resource Water; ASNRI-PNW = Area of Special Natural Resource Interest – Priority Navigable Waterways; OC = Open Cut (wet trench); DC = Dry Crossing (flume or dam-and-pump); 303(d) = Water listed as impaired under Section 303(d) of the Clean Water Act

Enbridge's response to Data Request 5 provides a comparative assessment of the suitability and impacts of the proposed trench and trenchless crossing methods, and explains the process Enbridge followed to select a crossing method. As indicated in that response, Enbridge believes the open cut (wet trench) crossing method would result in the greatest environmental impact if flowing water is present. To avoid the potential for these increased impacts, Enbridge decided to only use the open cut method at streams where no flow is present at the time of crossing. As such, impairment to any special designations will be avoided or minimized under this scenario.

Enbridge proposes to use either the dam and pump or flume method at the smaller, flowing waterbodies listed in table 3-1. These methods, while slightly different (in that one is passive and employs flumes and the other is active and relies on pumps), are functionally similar and provide a comparable level of waterbody and water quality protection. Both methods isolate the work area from the stream flow and minimize sedimentation. This is achieved by limiting the suspension and transport of sediments to short periods of time when the dams and flume are installed and removed, and the stream flow is restored across the work area after installation of the pipeline.

While the HDD method avoids cutting the bed and banks of a waterbody, this method has specific requirements (e.g., longer duration, need for large additional workspace for equipment and pipe string fabrication, and suitable topography and subsurface conditions), that limit its feasibility in some areas without resulting in additional resource impacts. The HDD method also requires a minimum crossing length of 1,280 feet for 30-inch outside diameter pipe. A crossing length of 1,280 feet or greater for the narrow waterways listed above is not warranted and may not be feasible without additional ROW, and suitable topography and subsurface geology. Moreover, as described in the table, use of the HDD method at many of the 15 waterbodies could have additional wetland and waterbody impacts due to the additional workspace required for drilling and pipe string fabrication. These additional impacts would offset any environmental advantages of the HDD. Additionally, further use of the HDD method would result in extension of the Project construction schedule to accommodate the additional time required to complete an HDD, resulting in longer disturbance to resources near the HDD locations that would remain disturbed until the HDDs could be completed.

Data Request Question 3.b. Response:

As stated in Enbridge's Draft Water Quality Monitoring Plan, prior to construction Enbridge will collect baseline water quality data from perennial streams that will be crossed by the pipeline centerline during construction of the Project, as well as select intermittent streams (if water is present at the time of construction). Enbridge identified 30 streams for preconstruction water quality sampling. Enbridge will collect grab samples at each pipeline crossing location approximately 5 days prior to start of the stream crossing. Samples will be analyzed for dissolved oxygen ("DO"), pH, conductivity, temperature, chemical oxygen demand ("COD"), turbidity (field measurement) and total suspended solids ("TSS"). COD and TSS analysis will be completed by a certified laboratory using standard analytical methodologies. DO, pH, conductivity, and temperature measurements will be collected in the field using standard analytical methodologies. During construction Enbridge will collect samples at approximately 100 feet upstream and downstream of the crossing where Enbridge has secured landowner permission for off ROW access, or will access the sample site from the waterbody where safe stream conditions allow (i.e., depth). Samples will be collected during the installation of temporary dams and during the removal of the temporary dams. The upstream sample collection distance of 100 feet was chosen so it would be above the influence of construction-related activities but close enough to the crossing to minimize the potential for additional non-construction related inputs that could distort the results. These upstream samples will provide baseline water quality information for each crossing at the actual time of the pipe installation. The downstream sampling location was selected to be representative of stream conditions below the construction work area. The modelling conducted by RPS indicates that most of the suspended sediments will settle close to the crossing area. Enbridge believes 100 feet downstream is sufficiently close to register any effects but far enough downstream to allow for uniform mixing of any elevated sediments within the water column and stream width. The 100 foot distance also takes into account the potential access limitations at each respective waterbody. Enbridge's landowner agreements for construction and operation of the pipeline workspace do not include authorization to use or access any portions of the property or stream farther from the crossing area. Enbridge also has to consider safety and the protection of its employees, contractors, and construction personnel. Sampling locations that require bushwacking along or walking in the stream for a considerable distance away from the proposed workspace would increase the hazards and risks. Additionally, walking up and down the stream bed to access sampling locations could result in additional sedimentation and environmental disturbance that could affect the results.

Enbridge will collect additional water quality samples at the first downstream public road crossing when:

- Field turbidity sample results (Nephelometric Turbidity Unit or "NTU"[1]) are greater than 5 NTUs over upstream level when the upstream levels are 50 NTUs or less; or,
- When the downstream NTU readings are greater than 10 percent above upstream NTU readings when the upstream readings are greater than 50 NTUs.

Similar to the access restrictions at the proposed crossing locations, Enbridge can only use public access points such as road crossings or points where Enbridge has acquired landowner permission to collect additional water quality samples further downstream.

Regarding potential need for additional water quality monitoring locations at downstream connection points where "effects may be aggregated", Enbridge has assessed locations where stream confluences occur downstream of the individual waterbody crossings. The results of this assessment are presented in Table 3-1. There is a potential for some aggregated effects due to hydrological connections between some of the proposed waterbody crossings. For example, one tributary to Silver Creek on Table 3-1 is crossed twice. Also, a number of streams on Table 3-1 either flow into other waterbodies that are crossed by the Project or receive waters from other upstream waterbodies that are crossed by the Project. The modelling performed by RPS, indicates that the elevated TSS levels and deposition of sediments resulting from the proposed dry crossing methods would be finite, of short duration, and highly localized (see additional discussion of RPS' modelling in responses to Data Request 4, 5, and 8). This suggests cumulative or aggregated effects would only occur if two crossings are in close hydrological proximity and occur at the same time. As indicated on Table 3-1, most of the proposed crossings are not in close hydrological proximity to other crossings. Of those that are in close hydrological proximity, Enbridge would avoid crossing these streams at the same time. It should also be noted that many of the final receiving waterbodies of the crossings listed on Table 3-1 would be crossed by a trenchless method, which would avoid or minimize the risk of aggregated effects at these crossings. Enbridge's proposed mitigation measures and implementation of its EPP would further reduce the potential for any aggregated effects.

[1] A Nephelometric Turbidity Unit ("NTU") is a measure of the opaqueness of a fluid due to the presence of suspended solids (inorganic or biological). The higher the concentration of suspended solids in the water, the higher the turbidity is and the dirtier it looks.

Enbridge is still coordinating with the respective agencies on a final Water Quality Monitoring Plan. Enbridge will submit the final plan following agency discussions.

Data Request Question 4: *The Environmental Protection Agency (EPA) has identified the Kakagon-Bad River Sloughs and the Bad River as Aquatic Resources of National Importance (ARNIs). Please describe measures that would be employed to monitor and address potential sedimentation and other water quality impairments to these waters which may result from construction-related activities. We anticipate addressing this comment may expand the minimum number of waters proposed for monitoring in comment 3 above. In addition to addressing the ARNIs identified, please describe how you propose to meet Bad River Band's narrative and numeric water quality standards (WQS) as part of your proposed construction activities.*

Data Request Question 4 Response:

As explained in the response below, sedimentation impacts resulting from pipe installation at water crossings are expected to be localized, limited in duration, and less than TSS concentrations resulting from less than storm-related events. Modelled TSS concentrations (resulting from any installation method) are expected to meet the Bad River Band's water quality standards before reaching the Reservation and will thus not degrade downstream water quality. No sedimentation impacts will occur to the Bad River as a result of the proposed HDD at that location; if an inadvertent return were to occur during the HDD process at the Bad River, TSS concentrations of released drilling fluid, based on modeling, would be expected to diminish to concentrations below the Bad River Band's water quality standards before reaching the Reservation. Because the Kakagon-Bad River Sloughs are located far downstream from any pipe installation locations, all TSS concentrations at the location of the Sloughs will be expected to meet the Bad River Band's water quality standards as a result of all pipe installation activities. To ensure that TSS concentrations are consistent with modelled TSS levels and meet applicable water quality standards, Enbridge will implement a Water Quality Monitoring Plan, as described further below.

POTENTIAL EFFECTS OF THE PROJECT ON WATER QUALITY

The primary water quality parameter affected by pipeline construction is a short-term increase in TSS: (a) during active instream construction that are re-suspended from the stream bed during the installation of aquadams or other barriers and when crossings are re-flooded after completion of the crossing, or (b) as a result of an unexpected inadvertent return of drilling fluid during an HDD. As discussed in Enbridge's application materials and supplemental information, increased sedimentation and turbidity can temporarily reduce dissolved oxygen levels in the water column and can re-suspend materials within the stream bed sediments. The extent of impacts from sedimentation and turbidity would depend on sediment loads, stream flows, stream bank and streambed composition, sediment particle size, and the duration of the disturbances[2].

[2] U.S. Environmental Protection Agency. 2003. Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS): Potential Approaches. A. U.S. EPA Advisory Board Consultation. Draft. U.S. EPA Office of Water and Office of Science and Technology. August 2003. Available online at: https://www.epa.gov/sites/production/files/2015-10/documents/sediment-report.pdf

Assessment of Sediment Release and Transport Resulting from Pipe Installation Activities

To evaluate the potential of the Project to impact water quality, and to inform the need for monitoring and where the monitoring should take place, Enbridge contracted RPS to conduct a quantitative assessment of sediment dispersion from planned waterbody crossing activities. RPS analyzed the potential effects of sediment using SSFATE, a computational sediment dispersion modeling tool that was developed jointly by RPS and the U.S. Army Corps of Engineers ("USACE") to simulate sediment resuspension and deposition. This model has been used extensively in the United States and internationally to assess the potential impacts of sediment releases. The SSFATE model provided information to assess the potential concentrations of sediment (TSS) within the water column in exceedance of background values, the downstream extent of elevated concentrations, and the depositional footprint of sediments that may be caused by both planned and accidental discharges of sediment due to installation techniques of the relocated pipeline as it crosses the range of water bodies within the Project area.

Specifically, RPS modeled 18 hypothetical sediment release scenarios in SSFATE to assess the magnitude and timing of potential concentrations of sediment within the water column (i.e., TSS) on top of background values (referred to as "in exceedance of") and the depositional footprint of sediments that may be caused by discharged sediment from installation (planned construction and accidental discharges) of the Project as it crosses the range of waterbodies within the Project area. Background values represent TSS levels in the waterbodies prior to and without pipe installation activities.

The analysis modeled: (1) potential sediment releases associated with instream construction using dry trenching methods[3] in small to medium watercourses along the pipeline route; and (2) sedimentation resulting from the release of drilling fluid during an HDD that results in an unexpected inadvertent return into large watercourse crossings being crossing using the HDD technique. Specifically, with respect to dry trenching methods RPS looked at small watercourses of 5 feet (1.5 meters) width and 1 foot (0.3 meter) depth and medium watercourses of 25 feet (7.6 meters) width and 3 feet (0.9 meter) depth and simulated downstream sediment transport under a range of river flow conditions representative of a June-August construction period (flows ranging from 0.16 to 0.39 meters/second). While a successful HDD will not result in any sedimentation impacts to a water crossing, RPS also modeled an inadvertent return occurring at large watercourses, including the Bad River. The goal of RPS' study was to identify temporary or permanent impacts on water quality parameters of concern (specifically TSS) upon installation of the proposed watercourse crossings.

Sediment Analysis Results

The results of RPS' analysis, which are specified in greater detail in the RPS report, indicate that the increased TSS concentrations in the water column caused by use of the dry crossing method or an unexpected inadvertent return during an HDD would be localized, limited in duration and not degrade water quality (both at the site of the crossing and downstream). While Wisconsin Department of Natural Resources ("WDNR") holds a water quality standard of 40 mg/L for TSS associated with construction dewatering activities, RPS identified a more conservative (i.e., more protective) representative calculated threshold of 19 mg/L TSS (based upon the measured relationship between turbidity and TSS within the Bad River) that correlates to the Bad River Band's water quality standard for turbidity within

[3] Enbridge does not propose to cross any flowing waterbodies using the open cut (wet trench) crossing method. Give that this method will not be used while water is flowing in the crossed waterbody, this method will not result in any TSS impacts to water quality.

the exterior boundaries of the Reservation. Further details regarding RPS's method for calculating this 19 mg/L representative calculated threshold is provided in the RPS report.

As explained below, and as explained in further detail in the RPS report, TSS levels resulting from pipe installation at water crossings are expected to be below the 19 mg/L TSS representative calculated threshold before reaching the Reservation boundary. All increased TSS levels resulting from construction would be temporary only (not permanent), and far less than TSS levels that result during storm-related events.

Dry Crossing Methods: Use of a dry crossing method would increase the suspension and downstream transport of sediment. As modelled, crossings in small and medium watercourses are expected to be completed within 20-32 hours, respectively, and would actively release sediment for a total of 4 hours (small) and 10 hours (medium). Associated increases in TSS concentrations would generally follow the same timing of the installation and removal activities, quickly attenuating after the sediment disturbances cease.

The sediment loads in the watercourses produced initially larger TSS concentrations near the installation site (up to 132 mg/L) due to the conservatively large assumed amount of sediment that was re-suspended and the shallow watercourse depths (1-3 ft deep). However, TSS concentrations predicted downstream of the trenched installations (e.g., 500-1,000 m) were on the order of <1 to 30 mg/L for the small watercourse and <1 to 10 mg/L for the medium watercourse. These levels are consistently below background conditions for the anticipated construction period of June-August, and would be expected to have a lesser magnitude and more brief effect on TSS in the water column than storm-related events, which would be expected to have a greater and more enduring effects on TSS in the water column than the proposed installation activities. As compared to storm-related events that can cause TSS values to exceed hundreds to thousands of mg/L over long periods of time, waters crossed by the Project would be expected to have TSS concentrations near the installation site up to 132 mg/L, which would decrease below 19 mg/L approximately 1,000 meters downstream of the crossing and last only 4-10 hours per crossing. By 1,000 m (or 1 km) downstream, the TSS predictions were below the more conservative representative calculated threshold of 19 mg/L. This TSS concentration is expected to last on the order of tens of minutes to hours at any specific location over the course of approximately one day as the TSS is transported downstream. Therefore, TSS concentrations are predicted to be well below the calculated threshold for all watercourses represented by the simulated small and medium watercourse scenarios by the time any suspended sediments reached the Reservation boundary.

HDD: TSS impacts would not occur for any pipe successfully installed via an HDD. TSS impacts could, however, occur as a result of an unexpected inadvertent return, which would cause TSS levels to rise as a result of the release of drilling fluid (bentonite) in the water column. As noted above, RPS modelled a potential inadvertent release occurring at the Bad River, which EPA has identified as an Aquatic Resource of National Importance ("ARNI"). The effect of a hypothetical inadvertent return would be somewhat greater as compared to TSS levels resulting from a dry crossing method, but would also be temporary, of short duration and confined to a relatively short downstream distance of the crossing.

If an unexpected inadvertent release of drilling fluid in a waterbody were to occur, the greatest deposition would be near the release location, as well as toward the center of the river channel. Modeling results indicate that a discharge into the watercourse is expected to produce initially large TSS concentrations near the release site (more than 20,000 mg/L) due to the large volume of drilling fluid (bentonite) that could hypothetically be released in a relatively short period of time. However, TSS concentrations are expected to decrease quickly – for example, at distances 500-1,000 m downstream, RPS modelled TSS concentrations between 10-300 mg/L, which is less or of similar magnitude to background conditions and also less than TSS levels typically caused by storm-related events. By 2,000 m (or 2 km) downstream, TSS predictions for all scenarios were below the more conservative representative calculated threshold of 19 mg/L. Levels above the representative calculated threshold of 19 mg/L lasted on the order of hours at any specific location over the course of one to two days as the TSS was transported downstream.

Nearly all of the discharged drilling fluid resulting from an unexpected inadvertent return eventually settles within the model domain, regardless of river flow rate. The greatest deposition is expected to occur near the release location, as well as toward the center of the river channel. Based on the modeling, the distance and area covered by deposition above 5-10 mm thickness would be greatest for an inadvertent return release during the final reaming pass under low flow conditions. The model predicted deposition at this level would extend up to 40 m downstream of the release location. While the model predicted very large areas of deposition less than the 0.1 mm reporting threshold, no deposition above that threshold was predicted past 400 m downstream, well upstream of the Bad River Reservation boundary.

Compliance with the Bad River Band's Water Quality Standards: As noted above, all TSS concentrations would be less than TSS levels resulting from storm-related events and are less than or similar to background TSS levels in the waterbodies crossed by pipe installation activities. Because the Proposed Route crosses the various watercourses in the Project area at distances between 2.1 km and 23.9 km (1.3 and 14.9 miles) upstream of the Reservation boundary, TSS concentrations, as modeled by RPS, are expected to be below the more conservative representative calculated threshold of 19 mg/L by the time any suspended sediments from trenching installations (or an inadvertent return on the Bad River) reach the Reservation boundary.

Accordingly, while EPA has identified the Bad River as an ARNI, its crossing via HDD will be expected to result in no impact; or in the unexpected case of an inadvertent return, the release of drilling fluid into the Bad River would be temporary, isolated, and be less than 19 mg/L before reaching the Reservation boundary. Sedimentation impacts resulting from pipe installation (whether via dry crossing methods or HDD) are expected to have no impact on the Kakagon-Bad River Sloughs, which are located many more miles downstream within the Reservation. Any TSS plumes in waterbodies crossed by the Project are expected to be temporary in any given location and would therefore not pose a permanent impact to downstream waters, whether individually or cumulatively. Also, because: (a) TSS levels are the primary water quality parameter affected by pipeline construction, and (b) TSS levels resulting from construction will not exceed the representative calculated threshold on waters within the Reservation, all other Bad River water quality standards (whether numeric or narrative) would be complied with and downstream water quality would not be degraded as a result of pipe installation activities.

Please also see Enbridge's response to Data Request Question 5, which provides further information regarding temporary discharges into waterbodies associated with different pipeline crossing methods. Please also see Enbridge's response to Question 8, which provides further information regarding the potential for proposed regulated activities to cause degradation by disrupting life stages of aquatic life, fish spawning, and wildlife dependent on these systems. These responses further demonstrate that appropriate methods have been chosen for the waterbodies that will crossed by the Relocation, and water quality (including the aquatic environment) will not be degraded as a result of construction activities.

PROPOSED CROSSING METHODS FOR TRIBAL ORW/OTRW

The Project will cross six waterbodies designated by the Bad River Band of Lake Superior Chippewa ("Bad River Band") as Outstanding Resource Waters ("ORW"): White River, Marengo River, Bear Trap Creek, Brunsweiler River, Tyler Forks, and Vaughn Creek. The Project will also cross the Bad River, which has sections within the exterior boundaries of the Reservations designated as both ORW as well as Outstanding Tribal Resource Waters ("OTRW"). However, the Project will not cross any of these waterbodies within the Bad River Reservation. The closest crossing of a Tribal designated OWR/OTRW waterbody to the Reservation is over 2.4 river miles (3.8 km) upstream of the exterior Reservation boundary.

Enbridge proposes to cross all Tribal ORW/OTRW waters, with the exception of Bear Trap Creek, using a trenchless crossing technique (HDD or Direct Pipe). Provided there is not an inadvertent return of drilling fluid into the water, Enbridge's use of a trenchless method will avoid direct impacts to existing water quality as there will be no instream construction disturbance, or disturbance of the respective stream banks. Based on field observations, Bear Trap Creek is an intermittent waterbody at the crossing location. Enbridge proposes to cross Bear Trap Creek, located approximately 8.6 river miles (13.8 km) upstream of the Bad River Reservation, while no flow is present or using a dry crossing technique if water is present and flowing at the time of construction. Use of the dry crossing technique will limit potential downstream sedimentation impacts to the period of instream construction activities associated with the installation and removal of temporary dams. Enbridge does not propose to cross any flowing waterbodies using the open cut (wet trench) crossing technique. Additional details regarding these methods and their potential impacts to water quality are included in the discussion of sedimentation impacts above and in Enbridge's Data Request Question 5 response.

PROPOSED MITIGATION FOR TRIBAL ORW/OTRW WATERBODIES

As discussed above, Enbridge proposes to cross all waterbodies listed in Table 4-1 using a trenchless crossing technique with the exception of Bear Trap Creek, which Enbridge proposes to cross while no flow is present or by creating a dry crossing if there is flowing water at the time of construction. Refer to Enbridge's response to Data Request Question 5 for descriptions of dry crossing techniques. As explained above, use of the trenchless technique avoids instream disturbance and will have no impact on Bad River Band's designated uses or numeric water quality standards. As discussed in Enbridge's application materials and supplemental materials, Enbridge will clear and maintain a 30 to 50 foot wide corridor along the easement between the entrance and exit locations of the trenchless crossings (Enbridge proposes to maintain a 50 easement at the Tyler Forks crossing). Clearing and maintenance of the permanent easement will result in a change in riparian habitat from the existing to open habitat; however, no wetland fill will be required.

In addition to the utilization of the low impact crossing methods described above and in Data Request Question 5 and 8, Enbridge will avoid and minimize impacts on waterbodies by implementing the applicable measures described in its EPP and additional requirements identified in applicable permits and approvals from the USACE and the WDNR. Enbridge's EPP outlines construction-related environmental policies, procedures, and mitigation measures Enbridge developed for its pipeline construction projects based on their experience during construction. It meets or exceeds applicable federal, state, and local environmental protection and erosion control specifications, technical standards, and practices. Enbridge will avoid and minimize the potential for spills that could impact water quality by implementing the spill prevention, containment, and controls measures as outlined in its EPP.

Enbridge's implementation of the proposed mitigation and crossing methods will ensure that the Project meets the Bad River Band's numeric and written water quality standards.

WATER QUALITY MONITORING

Enbridge's water quality monitoring plan has been developed based upon an analysis of the potential effects of the proposed action on water quality, including potential effects of the various proposed crossing methods as well as the applicable water quality standards that need to be maintained.

Enbridge will implement a Water Quality Monitoring Plan to confirm the predicted modelling results and ensure the Bad River Band's water quality standards are maintained. A copy of Enbridge's draft Water Quality Monitoring Plan was previously submitted to the USACE and other agencies for review and comment. The major elements of the plan are summarized below.

Prior to construction Enbridge will collect baseline water quality data from perennial streams that will be crossed by the pipeline centerline during construction of the Project, as well as select intermittent streams (if water is present at the time of construction). Enbridge has identified the following 19 waterbodies and tributaries of waterbodies that will cross upstream of the Bad River Reservation that will be included in the preconstruction water quality sampling program: Beartrap Creek, White River, Marengo River, Brunsweiler River, and unnamed tributary to the Brunsweiler River, Trout Brook, and unnamed tributary to Trout Brook, Billy Creek, an unnamed tributary to Billy Creek, Silver Creek, three unnamed tributaries to Silver Creek, Bad River, an unnamed tributary to the Bad River, Tyler Forks, Potato River, Vaugh Creek, and an unnamed tributary to Vaugh Creek.

Enbridge will collect grab samples at the pipeline crossing location of each of these waterbodies approximately 5 days prior to start of the stream crossing (if stream flow is present) as a baseline measurement. Samples will be analyzed for dissolved oxygen ("DO"), pH, conductivity, temperature, chemical oxygen demand ("COD"), turbidity (field measurement) and TSS. COD and TSS analysis will be completed by a certified laboratory using standard analytical methodologies. DO, pH, conductivity, and temperature measurements will be collected in the field using standard analytical methodologies.

Two of the 19 waterbodies listed above are identified under Section 303(d) of the Clean Water Act as impaired:

- sasc1012p - Trout Brook (fecal coliform); and,
- sase1020p - Marengo River (fecal coliform).

One additional waterbody crossed by the Project is listed as a Section 303(d) waterbody (Bay City Creek – listed for exceedance of total phosphorus standards); however, this waterbody does not flow into the Bad River Reservation. The water quality parameters will include those described above as well as analysis for the respective impairment. Photographs will be taken (upstream, downstream, and across) to document physical conditions at each site.

Active Construction Sampling

During instream construction, Enbridge will collect water quality samples for analysis of the same parameters within 100 feet upstream of the crossing. Enbridge will also collect water quality samples approximately 100 feet downstream of the crossing (or approximately 100 feet downstream of the discharge point where the dam and pump method is used) where Enbridge has secured landowner permission for off right-of-way access, or will access the sample site from the waterbody where safe stream conditions allow (i.e., depth). Samples will be collected during the installation of the temporary dams and removal of the temporary dams.

Enbridge will collect additional water quality samples at the first downstream public road crossing when:

- Field turbidity sample results (NTU[4]) are greater than 5 NTUs over upstream level when the upstream levels are 50 NTUs or less; or,
- When the downstream NTU readings are greater than 10 percent above upstream NTU readings when the upstream readings are greater than 50 NTUs.

A table and maps of the proposed sampling locations (which includes the 19 waterbodies discussed here as well as several other waterbodies) are included in Attachment A of Enbridge Water Quality Monitoring Plan.

Post Construction Sampling

Following completion of instream construction activities, Enbridge will complete streambank restoration/stabilization and restore natural stream flow through the construction workspace. Enbridge will then collect daily water quality samples for three additional days upstream of the crossing location and downstream of the crossing location at approximately the same locations as the active construction samples. Enbridge will collect additional samples at one-week post construction and one-month post construction.

Horizontal Directional Drills and Direct Pipe Crossings

In the event of an in-stream inadvertent return, Enbridge will collect water samples upstream of the crossing location and 100 feet downstream of the inadvertent return location where Enbridge has secured landowner permission for off right-of-way access. Additionally, Enbridge will collect water samples at each public road crossing downstream of the instream inadvertent return location to the exterior boundary of the Bad River Reservation. Samples will be collected from the stream bank where public rights-of-way allow or will be collected from the respective bridge. Enbridge notes that changes in downstream water quality may be due to inputs from tributaries where the confluence of the tributary and the primary waterbody being sampled occurs upstream of the sampling location.

Enbridge will notify the Bad River Band of an in-stream inadvertent return and will work with the Bad River Band to obtain permission to collect additional water samples within the Reservation boundary at public road crossing locations if upstream sampling locations indicate that downstream migration of suspended sediments associated with an inadvertent return progress into the Bad River Reservation. Samples will be collected every six hours from each location following discovery of an instream inadvertent return. Once the in-stream inadvertent return has been successfully stopped and/or contained, water quality samples will be collected from each location daily for an additional five days at each sampling location described above. Collected samples will be analyzed for DO, pH, conductivity, temperature, COD, turbidity (field measurement), and TSS.

Enbridge will finalize and resubmit the Water Quality Monitoring Plan following further discussions with the respective agencies.

[4] A Nephelometric Turbidity Unit ("NTU") is a measure of the opaqueness of a fluid due to the presence of suspended solids (inorganic or biological). The higher the concentration of suspended solids in the water, the higher the turbidity is and the dirtier it looks.

Data Request Question 5: *Please provide additional information and analysis on the potential effects of temporary discharges into waterbodies associated with different pipeline installation methods. Describe the analysis used to determine the proposed method of installation for each specific waterbody crossing or groups of waterbody crossings, identify the anticipated effects and risks associated with the proposed waterbody crossing method and how those risks would be managed to reduce adverse effects to the aquatic ecosystem including water quality. Please provide the equivalent information and analysis for each feasible and practicable potential alternative crossing method for each waterbody or groups of waterbodies and compare the anticipated effects of the alternative crossing method to the proposed crossing method.*

Data Request Question 5 Response:

Evaluation of Pipeline Waterbody Crossing Methods

Enbridge evaluated a variety of different crossing methods depending on the type and characteristics of the waterbody being crossed. The methods Enbridge evaluated were the open-cut (wet-trench), dry crossing (flume or dam-and-pump), HDD, and Direct Pipe methods. Enbridge did not consider crossing any waterbodies using a cofferdam system as this method introduces higher safety risks with having personnel in an open excavation within the streambed to complete tie-in welds. Enbridge determined which method it would use based on the characteristics of the waterbody to be crossed and the suitability and advantages and disadvantages of each of the waterbody crossing method. Enbridge identified and considered the applicability and relative advantages and disadvantages of each crossing method. These are summarized in table 5.1 and evaluated further in the text below.

Table 5.1
Applicability and Advantages and Disadvantages of Pipeline Waterbody Crossing Methods

Method	Description	Applicability	Advantages	Disadvantages
Open Cut (Wet Trench)	Open-cut crossing technique that involves trenching through the waterbody while water continues to flow across the instream work area.	Generally suitable for small, non-fishery streams, such as agricultural ditches and intermittent waterways, as well as larger waterbodies where other crossing methods are not practical. In Wisconsin, these are primarily waterbodies located within large, saturated wetlands, and waterbodies with beaver dams.	Rapid construction / installation No need for specialized equipment Compatible with granular substrates and some rock Minimizes period of instream activity Generally maintains streamflow Maintains fish passage Relatively short duration of sediment release (<24 hours)	Requires implementation of erosion and sediment control devises to mitigate potentially high sediment release during excavation and backfilling Instream stockpiling of spoil on wide watercourses May interrupt streamflow

Table 5.1
Applicability and Advantages and Disadvantages of Pipeline Waterbody Crossing Methods

Method	Description	Applicability	Advantages	Disadvantages
Dry Crossing—Dam and Pump	Create a dry work area by damming the flow up and downstream of the crossing and pumping water around. Dam materials may include, but are not limited to, sand bags, aqua dams, sheet piling, or street plates.	Generally suitable for streams with low flow and defined banks where fish passage is not of concern. Generally works best in non-permeable substrate and preferred for crossing meandering channels.	Limited sediment release Maintains streamflow Minimal release and transport of sediment downstream that is not likely to result in negative effects to fish and fish habitat. Relatively dry working conditions May be adapted for non-ideal conditions Hose can be routed around area of construction May reduce trench sloughing and trench width	Minor sediment release during dam construction, dam removal, and as water flushes over area of construction Slow construction / installation resulting in extended period instream and prolonged sediment release Fish salvage may be required from dried-up reach Short-term barrier to fish movement Specialized equipment and materials Slow construction / installation Hose(s) may impede construction traffic Seepage may occur in coarse, permeable substrate Susceptible to mechanical failure of pumps

Table 5.1
Applicability and Advantages and Disadvantages of Pipeline Waterbody Crossing Methods

Method	Description	Applicability	Advantages	Disadvantages
Dry Crossing—Flume	Create a dry work area by damming the flow up and downstream of the crossing and installing flume to convey water. Dam materials may include, but are not limited to, sand bags, aqua dams, sheet piling, or street plates.	Generally suitable for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing where fish passage is of concern. The waterbody should have defined banks and channel with solid, fine-textured substrate.	Limited sediment release Maintains streamflow May allow fish passage Minimal release and transport of sediment downstream that is not likely to result in negative effects to fish and fish habitat Allows for flushing of substrates Relatively dry or no flow working conditions May be adapted for non-ideal conditions May reduce trench sloughing and trench width	Minor sediment release during dam construction, removal and as water flushes over area of construction Slow construction / installation Fish salvage may be required from dried-up reach Short-term barrier fish passage if water velocity in culvert is too high Difficult to trench and lay pipe, especially large diameter pipe, under flume pipe Work area may not stay dry in coarse, permeable substrate Seepage may occur in coarse, permeable substrate

Table 5.1
Applicability and Advantages and Disadvantages of Pipeline Waterbody Crossing Methods

Method	Description	Applicability	Advantages	Disadvantages
Horizontal Directional Drilling (or other similar trenchless method such as guided bore)	Place a rig on one side of the waterbody and drill a small-diameter pilot hole under the waterbody along a prescribed profile. Upon completion of the pilot hole, the Contractor uses a combination of cutting and reaming tools to accommodate the desired pipeline diameter. Drilling mud is necessary to remove cuttings and maintain the integrity of the hole. The Contractor then pulls the pipe section through and welds the adjoining sections of pipe on each side of the waterbody.	Generally suitable to cross sensitive or particularly deep, wide, or high-flow waterbodies and depends on site-specific topography and the local geologic substrate. Typically drilling is not feasible in areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels. This method requires a minimum crossing length of 1,280 feet for 30-inch outside diameter pipe with 56 feet of depth and 90 feet bottom tangent. The minimum length assumes similar elevations on each side of the crossing.	No sediment release unless an inadvertent return occurs Minimal bank and approach slope disturbance No streambed disturbance unless an inadvertent return occurs Maintains normal streamflow Maintains fish passage Significantly reduces cleanup and restoration in between entry and exit points May be able to construct during sensitive fisheries restricted-activity windows	Potential for inadvertent release of drilling fluids in unconsolidated gravel, coarse sand, and fractured bedrock and clays Requires ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials Tree and brush clearing is necessary to install guide wires for monitoring and steering the drill bit Requires obtaining water to formulate the drilling fluid as well as hydrostatic testing Success depends on substrate Requires specialized equipment Slow construction / installation Limited drilling radius that is allowed for pilot hole Pull string area along the alignment for the same length of the crossing to allow continuous pullback Drill stem may get "stuck in the hole" and tools can get lost, especially on large diameter reams No guarantees that drill will be successful May damage coating / pipe during pullback

Notes: ATWS = additional temporary workspace
Source: Canadian Association of Petroleum Producers, Canadian Energy Pipeline Association, and Canadian Gas Association, 2005.

Open Cut (Wet Trench) Method

As described in the table above, the open cut wet method is generally suitable for small, non-fishery streams, such as agricultural ditches and intermittent waterways, as well as larger waterbodies where other crossing methods are not practical. In Wisconsin, these are primarily waterbodies located within large, saturated wetlands, and waterbodies with beaver dams. The open-cut (wet trench) crossing technique involves trenching through the waterbody while water continues to flow across the instream work area. The open cut (wet trench) method:

- allows for rapid construction / installation of the pipeline compared to other methods;
- does not require any additional specialized equipment (other than what is used for standard construction;
- is compatible with granular substrates and some rock;
- minimizes period of instream activity;
- generally maintains streamflow if flow is present;
- maintains fish passage if relevant;

However, it also:

- results in more sedimentation of the waterway, both in terms of total sediments released and the duration of the sedimentation event, than dry crossing methods.
- requires the bed and banks to be trenched;
- may require instream stockpiling of spoil in wide watercourses if equipment is unable to reach the middle of the waterbody from the banks; and
- it may interrupt streamflow.

As described in the Sediment Discharge Modeling Assessment that was prepared by RPS to evaluate the potential fate and transport of sediments disturbed during pipeline installation, the open cut (wet trench) crossing method would result in the highest concentration of suspended sediments. RPS reported that short term suspended sediment concentrations downstream of open-cut wet pipeline watercourse crossings have been observed at levels from <1 to 11,000 mg/L (Reid and Anderson, 1999), which is considerably higher than the other crossing methods Enbridge evaluated. At wide waterbodies this method would likely also require Enbridge to operate equipment within the flowing water.

Largely for the reasons discussed above including avoiding substantial releases to sediment during trenching and backfilling and the need to operate trenching and backfilling equipment in flowing water, Enbridge has chosen to limit (i.e., only use) the open cut (wet trench) construction technique to cross small, narrow waterbodies and ditches that have no flow at the time of the crossing[5].

<u>Dam and Pump and Flume Dry Crossing Methods</u>

The dam and pump, and flume methods offer comparable protection but differ slightly in terms of suitability and required equipment. The dam and pump method is generally suitable for streams with low flow and defined banks where fish passage is not of concern. It generally works best in non-permeable substrate and is preferred for crossing meandering channels. The flume method is generally suitable for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing where fish passage is of concern. Additionally, the waterbody should have defined banks and channel with solid, fine-textured substrate.

[5] It should be noted that Enbridge will have equipment onsite to conduct a dry-ditch crossing of these waterbodies should any of these dry waterbody begin to flow during construction.

Both methods involve construction of temporary dams consisting of sandbags, inflatable dams, aqua-dams, sheet piling, and/or steel plates upstream and downstream of the proposed trenchline to isolate the work area from the stream flow. These dams will extend across the entire streambed and will be built to a height to withstand the highest water levels anticipated at the time of construction. The water upstream of the upper dam will either be pumped around the work zone or directed into one or more flume pipes that extend across the work area to maintain normal flows. This will isolate the work areas from the waterbody and allow Enbridge to excavate the trench, install and backfill the pipe, and restore the bed and banks under relatively dry conditions.

The trench across the waterbody will be excavated by equipment operating from the bank or banks. At present and because these methods will not be used at the widest waterbodies, Enbridge does not anticipate the need for any of the trenching or backfilling equipment to work within actively flowing water. The width of the trench in waterbodies will vary depending on the depth of the trench, soil type, and soil saturation at each crossing location. Enbridge estimates that the width at the bottom of the trench would be a minimum of 42 inches up to approximately 72 inches. The width at the top of the trench would be a function of depth versus soil stability at that specific location, but may be approximately 15 to 20 feet in width. Enbridge will minimize the width of the trench in waterbodies by minimizing the length of time the excavated ditch is open to reduce the potential for slumping and/or ditch cave-ins. Excavated trench spoil will be placed on the bank above the high water mark and used to backfill the trench after the pipeline is installed. A prefabricated segment of pipeline sized to extend across the entire width of the waterbody will be placed into the trench under the dam and pump hose or flume using side-boom tractors or similar equipment. Concrete coating, pipe sacks, or set-on weights will be used, as necessary, to provide negative buoyancy for the pipeline, which will then be backfilled using native material. Once the trench is backfilled, the bed and banks will be restored as near as practicable to preconstruction contours and stabilized in accordance with Enbridge's EPP and applicable waterbody crossing permits. Stabilization measures will include seeding, installation of erosion control blankets, or installation of riprap materials, as appropriate. Excavated material not required as backfill to reestablish the streambed profile or stream banks will be removed and disposed of at upland disposal sites. In each case and for each method, Enbridge will adhere to measures specified in Enbridge's EPP and additional requirements specified in waterbody crossing permits.

The primary advantages of both the dam and pump and flume methods over an open cut (wet trench) method are that they would:

- reduce sedimentation to minor, short term releases, which would be limited to the short periods primarily when the dams and flume are installed and removed and when flow is restored across the work area following installation of the pipe crossing;
- avoid potential interruption of streamflows; and
- allow the pipeline crossing work area to be isolated from the stream flow and performed in relatively dry working conditions.

The primary disadvantages of the dam and pump and the flume methods compared to open cut (wet trench) method are that they:

- require specialized equipment (e.g., dam materials, pumps, flumes);
- may create a short-term barrier fish passage;
- entail slower construction; and

- complicate installation of the pipeline, either because pumps are needed to maintain flows or the difficulty of threading of the pipeline under the flume.

As previously mentioned, the dam and pump and flume methods are comparable and similar with respect to impacts on and protection of water quality. Additionally, other than the long-term clearing of vegetation on the maintained right-of-way, both methods would only have a minor and short-term waterbody effects. As described in the Sediment Discharge Modeling Assessment that was prepared by RPS to evaluate the potential fate and transport of sediments disturbed during pipeline installation, sediment concentrations downstream of dry trenched crossings, which use dams to isolate the work area from the stream flow, largely limit sedimentation to the periods of dam installation and removal, and generally result in much lower short term downstream sediment concentrations than comparable open cut (wet trench) crossings. TSS concentrations predicted by RPS for dry crossings farther downstream of the installations (e.g., 500-1,000 m) were on the order of <1 to 30 mg/L for the modelled small watercourse and <1 to 10 mg/L for the modelled medium watercourse, which was consistent with the magnitude of TSS exceedances observed in actual measurements collected during installation of the Guardian pipeline in 2008 (see the RPS report). RPS also concluded that the proposed dry crossing installation activities would have a lower magnitude and shorter duration effect on TSS in the water column than natural storm-related events, which can cause TSS values to exceed hundreds to thousands of mg/L over periods of time that are longer than these installation periods. Finally, the modelling results suggests that no deposition above 5 mm would be expected in small watercourses, and the majority of deposition that does occur would be within 17 m downstream of the installation site. For the medium watercourse scenarios, RPS' modelling predicted that depositions above 5 mm would extend, at most, 3 m downstream, and the majority of deposition that does occur would be within 30 m downstream of the installation site.

For these reasons, Enbridge proposes to cross the smaller, narrower flowing waterbodies using either the dam and pump or flume dry crossing method. As previously discussed, the dam and pump method is generally most suitable for streams with low flow and defined banks where fish passage is not of concern. It generally works best in non-permeable substrate and is preferred for crossing meandering channels. The flume method in contrast is generally best for crossing relatively narrow streams that have straight channels and are relatively free of large rocks and bedrock at the point of crossing, and/or where fish passage is of concern. Where the flume method is used, the waterbody should have defined banks and channel with solid, fine-textured substrate. Enbridge's contractor will decide which method to use in the field based on the regulatory requirements and the site-specific conditions at the crossing during the time of construction.

Horizontal Directional Drill Method

HDD is conducted by placing a drill rig in a relatively large additional temporary workspace ("ATWS") on one side of the waterbody and drilling a small-diameter pilot hole from the drill entry point under the waterbody along a prescribed profile to the drill exit point. To do this, a drill bit will be attached to a hollow drill pipe that is turned by a drilling machine at the ground surface. To start each HDD, the operator will use a smaller bit, typically a 12-inch bit, attached to a steering device called a SUB. The SUB will be magnetically coupled to guide wires that are run above ground on either side of the drill, allowing the operator to steer the bit. Once the pilot hole has been completed, larger drill bits will be attached to the drill stem and run through the pilot hole to ream out the bore to the desired size. The drilling operation will be facilitated by drilling mud, which is a combination of water, bentonite clay and other additives. The drilling mud will be circulated to cool the bit and carry spoil back to the surface for screening, before is it recirculated. Typically, several reaming passes of increasing size will be required to create a bore hole large enough for the pipeline. The bore hole will be reamed larger than the product pipe to ensure it can be pulled back into the reamed hole without getting stuck. Before the bore hole is completed, the pipe segment to be installed in the hole will be fabricated on the opposite side of the crossing from the drill rig. When the bore hole is completed, a pulling head will be attached to the product pipe and it will be "pulled back" into the hole to complete the bore. The pull string will be welded, inspected, hydro tested and coated in advance of being pulled back into the reamed hole to the drill rig. After the pull string of pipe is installed, the contractor will weld it onto the adjoining sections of pipe on each side of the waterbody.

As described in table 5-1, the HDD method is generally suitable to cross sensitive or particularly deep, wide, or high-flow waterbodies where the site-specific topography and the local geologic substrate are suitable. It is generally unsuitable and not used for narrow waterbody crossings, particularly for large diameter pipelines which require long HDDs. For a 30-inch outside diameter pipe, the minimum HDD crossing length is approximately 1,280 feet with 56 feet of depth and a 90 foot bottom tangent. Typically drilling is also not feasible in areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels.

The advantages of the HDD method compared to open cut methods are that:

- it avoids or reduces construction caused sedimentation more than either wet trench or dry crossing methods provided there is not an inadvertent return of drilling fluid into the waterbody;
- there is no streambed or bank disturbance unless an inadvertent return occurs;
- there are no potential streamflow or fish passage effects; and
- it reduces the amount of cleanup and restoration necessary between the HDD entry and exit points.

The disadvantages of the HDD method compared to open cut methods include that:

- there is a potential for inadvertent release of drilling fluids, particularly in unconsolidated gravel, coarse sand, and fractured bedrock and clays;
- it requires large cleared ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials;
- it requires water to formulate the drilling fluid as well as hydrostatic testing;
- its success depends on substrate;
- it requires specialized equipment;
- it slows construction / installation of the crossing;
- it must be a fairly long to accommodate the drilling radius limitations, which make shore drills infeasible;
- it requires a long flat or gently sloped staging area the same length of the crossing to fabricate the pipe string and allow continuous pullback of the pipe;
- it requires relatively similar elevations on the drill entry and exit sides;
- the pipe coating / pipe may be damaged during pullback

As previously mentioned one advantage of the HDD method is that it either avoids or reduces construction caused sedimentation more than other dry crossing methods provided there is not an inadvertent return of drilling fluid into the waterbody. If there is an inadvertent return, the effect of water quality would depend on the volume of drilling fluid released to the water and the size and flow of the waterbody it enters. RPS modelled the effects of an inadvertent return to the Bad River to estimate the potential impact of a spill within any of the large waterbodies that Enbridge proposes to HDD. The modelling indicates that the discharge into the watercourse would initially produce large TSS concentrations near the release site (more than 20,000 mg/L) due to the large volume of drilling fluid (bentonite) released in a relatively short period of time. The highest concentrations would occur during a large release volume associated with a Final Ream Pass[6] under low river flow conditions, where dilution and dispersion would be lowest. Under this scenario, predicted TSS concentrations farther downstream (e.g., 500-1,000 m) would be on the order of 10-300 mg/L. On the low end, the TSS concentrations would likely be on the same order as those anticipated for the dam and pump or flume methods, but on the high end would likely exceed those methods. The modelling however, indicates that the concentrations associated with an HDD related inadvertent return would likely still be smaller or of similar magnitude to that typically caused by storm-related events, which can cause TSS to exceed hundreds to thousands of mg/L over longer periods of time that are longer than these installation periods.

Based on the RPS modelling, it is predicted that nearly all of the discharged bentonite would eventually settle regardless of river flow rate. The greatest deposition would occur near the release location, as well as toward the center of the river channel. The distance and area covered by deposition above 5-10 mm thickness would be greatest for an inadvertent return release during the final reaming pass under low flow conditions, and the model predicted deposition at this level extended up to 40 m downstream of the release location. While the model predicted very large areas of deposition less than the 0.1 mm reporting threshold, no deposition above that threshold was predicted past 400 m downstream.

Based on the criteria listed in table 5-1, the results of Enbridge's studies, and the analysis described above Enbridge proposes to use the HDD method at the 12 waterbodies listed in table 5-2.

[6] RPS estimates the bentonite load rate for the final reaming pass (11.0 MT/h) would be approximately twice that of the pilot hole (5.5 MT/h).

Table 5.2
Proposed Horizontal Direction Drill Waterbody Crossings

Primary Crossing Feature	Near Milepost	Crossing Method
White River	4.0	HDD
Deer Creek	6.4	HDD
Brunsweiler River	14.1	HDD
Highway 13/UNT Brunsweiler River [a]	15.2	HDD
Trout Brook	16.6	HDD
Billy Creek	17.3	HDD
Silver Creek	19.1	HDD
Krause Creek	22.3	HDD
Bad River	24.2	HDD
Tyler Forks	34.0	HDD
Potato River	37.9	HDD
Vaughn Creek	39.6	HDD

[a] UNT Brunsweiler River will be crossed as part of the Highway 13 HDD and is not an HDD specific to the waterbody crossing itself

Direct Pipe Method

The Direct Pipe installation method will be used to cross the Marengo River near milepost 11.4. The direct pipe method is another trenchless construction method that is similar to HDD, but it also combines with processes related to microtunnelling. The Direct Pipe installation method is a single continuous process that allows the trenchless installation of a pre-fabricated pipeline segment to occur simultaneously with the development/advancement of the bore hole. This method differs from HDD in that a much larger initial cutterhead is used, eliminating the reaming process, and the product pipe is used as the means to advance the drilling head through the drill profile. The pipe and cutting head are advanced by use of a thruster, which pushes the cutting head and pipe segments forward. The drilling head mechanism includes the cutting head as well as the motors used to turn the cutting head. The mud motors use drilling mud that is pumped through a hose that runs inside the pipe back to the pumps to hydraulically rotate the cutting head and cut the bore path. Mud from the outlet of the mud motors is then jetted into the rock face to cool the cutting teeth and sweep the cut material away from the face and into the exhaust mud line that is also inside the product pipe. This exhaust mud line carries the spoil from the drilling face back to the mud tanks where the mud and debris are separated through screens and shakers, the clean mud is then recirculated down the hole and the process is repeated. The drilling head is fitted with instrumentation and steering rams that provide data for the operator, allowing them to steer the cutting head as it is advanced. Once through to the exit point, the steering head is removed from the product pipe and the drill is complete.

Similar to the HDD method, the Direct Pipe method is generally suitable to cross sensitive or particularly deep, wide, or high-flow waterbodies where the site-specific topography and the local geologic substrate are suitable. It is generally unsuitable and not used for narrow waterbody crossings, particularly for large diameter pipelines.

The advantages of the Direct Pipe method compared to open cut methods are that:

- it avoids or reduces construction caused sedimentation more than either wet trench or dry crossing methods provided there is not an inadvertent return of drilling fluid into the waterbody;
- there is no streambed or bank disturbance unless an inadvertent return occurs;

- there are no potential streamflow or fish passage effects;
- direct pipe installations may be shorter and shallower than HDD installations;
- it reduces the amount of cleanup and restoration necessary between the Direct Pipe entry and exit points; and
- has a wide range of subsurface conditions that it can be used in where other trenchless methods may not be preferable/feasible (e.g., areas of glacial till or outwash interspersed with boulder and cobbles, fractured bedrock, or non-cohesive coarse sands and gravels).

The disadvantages of the Direct Pipe method compared to open cut methods include that:

- there is a potential for inadvertent release of drilling fluids;
- it requires large cleared ATWS on both sides of the crossings to stage construction, fabricate the pipeline, and store materials;
- it requires water to formulate the drilling fluid;
- it requires specialized equipment within limited quantity and availability within the United States;
- it slows construction / installation of the crossing;
- it must be a fairly long to accommodate the drilling radius limitations;
- it requires a long flat or gently sloped staging area the same length of the crossing to fabricate the pipe string and allow continuous pullback of the pipe;
- it requires relatively similar elevations on the entry and exit sides;
- it requires anchoring horizontally and vertically as well as installation of thrusting blocks to accommodate the forces associated with the pipe and cutting tool advancement; and,
- the pipe coating / pipe may be damaged during installation.

As previously mentioned one advantage of the Direct Pipe method is that it either avoids or reduces construction caused sedimentation more than other dry crossing methods provided there is not an inadvertent return of drilling fluid into the waterbody. If there is an inadvertent return, the effect of water quality would depend on the volume of drilling fluid released to the water and the size and flow of the waterbody it enters, similar to the process described above for the HDD method

Direct pipe installations may be shorter and shallower than HDD installations because the bore hole is continuously cased, thereby limiting the risk of hole collapse and the inadvertent release of drilling fluids.

Comparative Analysis

Based on the differences described above, Enbridge believes the open cut (wet trench) crossing method would result in the greatest environmental impact if flowing water is present. This is because it would require trenching and pipe installation within the waterbody while water is flowing across the work area. Although it would shorten the duration of the crossing, the direct and prolonged contact of equipment and other materials with the disturbed soils and substrates would result in the greatest amount of sediment being suspended and transported downstream. To avoid the potential for these increased impacts, Enbridge decided to only use the open cut (wet trench) method at streams where no flow is present at the time of crossing.

Enbridge proposes to use either the dam and pump or flume method at smaller flowing waterbodies, which constitute the majority of the proposed pipeline crossings. These methods, while slightly different (in that one is passive and employs flumes and the other is active and relies on pumps), are functionally similar and provide a comparable level of waterbody and water quality protection. Both isolate the work area from the stream flow and minimize sedimentation by limiting the suspension and transport of sediments to short periods of time when the dams and flume are installed and removed and the stream flow is restored across the work area after installation of the pipeline. Sediment concentrations downstream of dry trenched crossings, which use dams (e.g., sandbags, coffer dams, steel plate) to isolate the trench, are generally much lower than open cut wet crossings (Reid et al., 2002). Moreover, RPS modeling indicates that the added TSS from dry trenched crossings would be temporary and of short duration; and of the same or less magnitude than the natural variability in TSS of each system and well below natural TSS concentrations associated with spring freshets and summer storm events. RPS' modelling also predicts that the deposition of sediments would be minor and localized to the downstream proximity of the crossing area.

Where dam and pump or flume methods are not feasible or practicable because the depth or width of the waterbody is too great or the volume of the anticipated flow is too high, bed and bank restoration is anticipated to be challenging; geotechnical studies indicate an elevated potential for scour or channel movement; and where even greater minimization of potential impacts is warranted, Enbridge proposes to use a trenchless method, primarily the HDD method. The trenchless installation methods will avoid cutting the bed and banks, and increase the distance of disturbed workspace from the waterbody, and thus potentially further minimize the risk of sedimentation. However, as described above, these methods have specific requirements (longer duration, need for large additional workspace for equipment and pipe fabrication, and suitable topography and subsurface conditions), that limit the feasibility in some areas. A trenchless method also carries the risk of an inadvertent return. Based on this, Enbridge believes that, even if feasible, the environmental benefits of the trenchless methods at narrow low flowing waters are relatively small compared to other dry crossing methods, and could be negated if there were an inadvertent return within the waterbody.

Regardless of crossing method, Enbridge will avoid and minimize impacts on waterbodies by implementing the applicable measures described in its EPP and additional requirements identified in applicable permits and approvals from the USACE and the WDNR. Enbridge's EPP outlines construction-related environmental policies, procedures, and mitigation measures that Enbridge developed for its pipeline construction projects based on its experience during construction. It meets or exceeds applicable federal, state, and local environmental protection and erosion control specifications; technical standards; and practices.

The Contractor will leave at least a 20-foot buffer (from the ordinary high water mark ("OHWM")) of undisturbed herbaceous vegetation on all stream banks during initial clearing, except where grading is necessary for bridge installation, or where applicable regulations and/or permit conditions restrict. The Contractor may cut and remove woody vegetation within this buffer during clearing, leaving the stumps and root structure intact. The Contractor will leave non-woody vegetation and the soil profile\intact until they are ready to begin trenching the stream crossing. The Contractor will properly install and maintain sediment control measures at the 20-foot buffer line adjacent to streams immediately after clearing and prior to initial ground disturbance.

Where necessary, ATWS will be used to accommodate additional equipment and materials associated with waterbody crossings. Enbridge designed ATWS to be at least 50 feet away from the OHWM if topographic or other physical conditions, such as stream channel meanders, allow; and if safe work practices or site conditions do not allow for a 50-foot setback, ATWS will be no closer than 20 feet from the OHWM, subject to site-specific approval.

Data Request Question 6: *As we have discussed in regular meetings with you, additional information and analysis is needed regarding construction-related risks to aquifers. Please identify where aquifers are located with proximity to Corps regulated activities and describe measures that would be taken to minimize the potential for inadvertent aquifer breaches due to construction activities.*

Data Request Question 6 Response:

Enbridge completed multiple studies to identify areas along the proposed pipeline route with potential shallow confined aquifers. This included analysis of publicly available aquifer information; analysis of publicly available well records in the project area; review of geologic, hydrologic, and topographic setting; and field investigations.

As part of its engineering and constructability analysis, Enbridge conducted extensive geotechnical investigation in 2020. The geotechnical investigations were primarily targeted towards "HDD/Direct Pipe crossings and valve settings. Groundwater levels were estimated based on the moisture level observed within geotechnical boring samples and were measured at the end of each boring where possible. This investigation documented multiple areas where shallow unconfined groundwater was encountered.

Aquifer breaches during construction occur where the construction activities extend deep enough to penetrate the confining layer above an aquifer. Enbridge reviewed the project route and determined the maximum depth of construction activities along the route. Maximum depth of construction activities included HDD locations, areas where sheet piling may be used, valve site locations, and crossings of existing utilities as examples.

Enbridge also completed aquifer analysis studies in 2022. The studies looked at publicly available aquifer information, analysis of publicly available well records in the Project area, and/or review of geologic, hydrologic, and topographic setting.

The depth of construction analysis was combined with the aquifer analysis to determine areas where confined aquifers may be encountered by construction activities, confirming that there are no areas with "High Likelihood" of encountering artesian conditions. The majority of the project alignment was defined as having a "low likelihood" of encountering aquifers with artesian conditions. Limited areas were defined as having "Moderate Likelihood" for encountering artesian conditions. This ranking does not mean artesian conditions are present or will be encountered during construction; it only means that there are enough contributing conditions to proceed with some caution and possibly perform some additional investigations.

In 2022, Enbridge conducted additional subsurface investigations along the Proposed Route utilizing hand probes and hand augers to verify areas that may require sheetpile, to identify rock depth, and to assess the potential for confined aquifer conditions in the "Moderate Likelihood" ranking areas. These additional subsurface investigations indicated artesian conditions will not be encountered at the planned construction depths. Based on geotechnical analysis, it is unlikely the proposed HDDs will encounter confined aquifers. However, it the HDD encounters a confined aquifer, the HDD installation methodologies can control/seal the drill path as drilling progresses.

Data Request Question 7: *Please provide additional information and analysis on potential adverse water quality and hydrological effects of blasting in waterbodies and wetlands. Specifically, provide an evaluation of alternative installation methods in each of these areas, which clearly addresses the practicability of the alternative crossing method(s) and provide a comparison of environmental effects. Describe measures that would be implemented to minimize the risks associated with blasting in waterbodies and wetlands, including how baseline and post-construction monitoring would inform the need for corrective or mitigative measures. The locations of aquatic resources proposed for blasting must be identified on maps and provided along with your analysis.*

Data Request Question 7 Response:

As previously submitted, Enbridge anticipates that blasting will be required for portions of pipeline route where bedrock is present at or within the trench depth. Blasting is expected to be necessary in several wetlands and waterbodies, which are crossed by the pipeline route within these shallow bedrock areas. Enbridge is finalizing information on blasting areas and will provide location information and a list of wetlands/waterbodies where blasting is likely under separate cover.

Crossing methods

There are two primary methods to establish a trench in areas with shallow bedrock, excavation by mechanical means without blasting and excavation (i.e., fracturing the bedrock) by mechanical means with blasting. Mechanical means of rock removal without blasting include equipment such as excavator-mounted hydraulic ram/hammers, rotary trenching machines, track-mounted rippers, rock saws, or similar equipment. The practicability of excavating a trench using only mechanical means is dependent on the type and hardness of the bedrock crossed. Mechanical only excavation methods are practicable in soft (paralithic) bedrock, but generally impracticable in hard (lithic) bedrock such as that found in the Project area. Enbridge had determined that excavation using only mechanical methods is likely not practicable in shallow bedrock areas along the Project route due to the hardness of the bedrock.

Environmental Effects

The limited blasting required for installation of a pipeline through shallow bedrock areas is different than the blasting applications used for large-scale rock blasting typically used for larger-scale applications such as leveling large areas at construction sites, building roadways, or for production blasting (open pit) used in quarry and industrial non-metallic mining. Trench blasting is more confined than a normal open pit blast and results in lower explosives consumption per cubic feet of blasted rock. The diameter of trench blast holes is normally smaller, which provides better distribution of the explosive in the rock, avoids excessive overbreak outside the width of the trench, and helps avoid high peak overpressure (noise) and high peak particle velocity (vibration) readings. Trench blasting is controlled with a “precision blast design” by a certified blasting professional.

Although Enbridge has determined that excavation using only mechanical means is not practicable in shallow bedrock areas along the proposed Project route, Enbridge has evaluated potential impacts associated with mechanical rock excavation compared to blasting. As noted above, the ability to excavate a trench using only mechanical means is dependent on the type and hardness of the bedrock crossed. The harder the bedrock requiring removal is, the longer the construction process becomes to remove the material using only mechanical methods (assuming it is soft enough to be removed by only mechanical means). The slower speed of mechanical construction would (1) increase the duration of rock removal noise impacts at a given location from seconds (for blasting) to days or weeks; (2) increase the duration of vibration impacts; (3) increase the overall construction duration resulting in a longer period between initial ground disturbance and final restoration; and (4) increase equipment air emissions due to the extended work duration and additional equipment needs.

Mechanical only rock removal techniques would produce a vibration with a consistent frequency for long periods of time (days to weeks, depending on site conditions); as such, mechanical rock removal techniques would potentially result in increased impacts from vibrations and frequencies for longer periods of time. While trench blasting would produce a higher vibration than mechanical methods, it would be a one-time event lasting for a very short period of time (milliseconds), and its frequency could be adjusted through timing of the blast to further minimize associated impacts. The increase in vibration duration using mechanical only excavation techniques could potentially result in increased turbidity associated with groundwater discharges in the Project area due to the vibration causing a suspension of fine material in the water. If used to trench across shallow bedrock in a waterbody, the slower speed of mechanical only methods would extend the time of instream disturbance; increase the duration of vibration in the streambed; and increase the length of time that the stream flow would need to be pumped around the isolated construction work area, which would in turn prolong the duration of impeded fish and other aquatic organism passage. Additionally, extending the time period of instream construction would increase the potential risk of leaks in the temporary dams, which could result in downstream turbidity and sedimentation. A longer crossing duration would also increase the chance of a storm event during the crossing timeframe, which might overwhelm the temporary dams and the contractor's ability to move stream water around the isolated construction work area.

Potential Blasting Impacts

The impacts of blasting on surface water and groundwater resources could include:

- Temporary increases in turbidity in well water and/or springs near the construction right-of-way.
- Fracturing of the rock, temporarily affecting local groundwater flow patterns and groundwater yield of nearby wells and springs around the blast site.
- Temporary alternation of surface runoff flow if temporary ground upheaval occurs as result of blasting.
- Although blasting does not typically result in large, aboveground explosions, it could potentially cause small amounts of flyrock to land in freshwater resources, temporarily disturbing substrate sediment and increasing turbidity. Additionally, flyrock from blasting deposited beyond the limits of the construction area could accumulate and create a layer of fill on top of native wetland soils, crush vegetation, and diminish water storage capacity.
- The introduction of contaminants associated with blasting residue, such as nitrogen.
- Effects on aquatic biota in the blasting area.

The effects of blasting on aquatic biota varies by species (Yelverton et al., 1975)[7], but generally relatively small organisms and those close to the blast or near the sediment surface experience higher mortality (Yelverton et al., 1975; Munday et al., 1986[8]). Non-lethal effects may include eye distension,

[7] Yelverton, J.T., D.R. Richmond, W. Hicks, H. Saunders, and E.R. Fletcher. 1975. The relationship between fish size and their response to underwater blast. Lovelace Foundation for Medical Education and Research Topical Report, DNA 3677T, Albuquerque, NM. Prepared for the Defense Nuclear Agency

[8] Munday, D.R., G.L. Ennis, D.G. Wright, D.C. Jeffries, E.R. McGreer, and J.S. Mathers. 1986. Development and evaluation of a model to predict effects of buried underwater blasting charges on fish populations in shallow water areas. Canada Technical

hemorrhage, hematuria, and damage to bodily systems (Hastings and Popper, 2005[9]; Godard et al., 2008[10]; Carlson et al., 2011[11]; Martinez et al., 2011[12]).

Potential pipeline related blasting impacts, such as changes in water levels and/or turbidity in shallow aquifers, tend to be localized and temporary since water levels quickly re-establish equilibrium and turbidity levels rapidly subside following blasting, trenching, pipeline installation, and backfilling. Enbridge will avoid or minimize groundwater impacts by implementing construction techniques described in its construction and restoration plans, such as using temporary and permanent trench plugs. Following construction, Enbridge will restore the ground surface to original contours as closely as practicable and restore vegetation on the right-of-way to establish surface drainage and recharge conditions as closely as possible to those prior to construction.

Clearing and grading of stream banks, blasting, instream trenching, trench dewatering, and backfilling could each result in temporary, local modifications of aquatic habitat including sedimentation, increased turbidity, and decreased dissolved oxygen concentrations. These impacts would be limited to the period of instream construction, and conditions would return to normal shortly after stream restoration activities are completed. These impacts will be mitigated using best management practices included in the EPP.

Sedimentation and increased turbidity can occur as a result of in-stream construction activities including blasting, trench dewatering, or stormwater runoff from construction areas and access roads. In slow moving waters, increases in suspended sediments (turbidity) may increase the biochemical oxygen demand and reduce levels of dissolved oxygen in localized areas during construction. Suspended sediments also may alter the chemical and physical characteristics (e.g., color and clarity) of the water column on a temporary basis. Enbridge's EPP includes procedures to minimize potential impacts associated with construction.

<u>Proposed Blasting Minimization Techniques</u>

Project blasting will be done in accordance with all applicable federal, state and local laws and regulations applicable to obtaining, transporting, storing, handling, blast initiation, ground motion monitoring, and disposal of explosive materials and/or blasting agents. These include:

- Bureau of Alcohol, Tobacco and Firearms – 27 C.F.R. § 181 (Commerce in Explosives). Occupational Safety and Health Administration – 29 C.F.R. § 1926.90 (Safety and Health Regulations for Construction Blasting and Use of Explosives
- Pipeline Hazardous Material Safety Administration – 49 C.F.R. § 177 (Carriage by Public Highway)

Report of Fisheries and Aquatic Sciences. No. 1418, Vancouver, BC, Department of Fisheries and Oceans, Habitat Management Division.

[9] Hastings, M.C. and A.N. Popper. 2005. Effects of sound on fish. Prepared for the California Dept. of Transportation. Subconsultant to Jones & Stokes; California Department of Transportation Contract No. 43A0139, Task Order 1. January 28, 2005.

[10] Godard, D.R., L. Peters, R. Evans, K. Wautier, P.A. Cott, B. Hanna, and V. Palace. 2008. Histopathological assessment of the sub-lethal effects of instantaneous pressure changes (IPC's) on rainbow trout (Onchorhynchus mykiss) early life stages following exposure to detonation under ice cover. Environmental Studies Research Funds Report No. 164, Winnipeg. 93 p.

[11] Carlson, T., G. Johnson, C. Woodley, J. Skalski, and A. Seaburg. 2011. Compliance monitoring of underwater blasting for rock removal at Warrior Point, Columbia River Channel Improvement Project 2009/2010. Pacific Northwest National Laboratory Completion Report (PNNL-20388). Prepared for the U.S. Army Corps of Engineers.

[12] Martinez, J.J., J.R. Myers, T. J. Carlson, Z.D. Deng, J.S. Rohrer, K.A. Caviggia, and M.A. Weiland. 2011. Design and implementation of an underwater sound recording device. Sensors 11:8519-8535.

- Explosives and Blasting Agents – OSHA, 29 C.F.R § 1910.109 (Safety in the Workplace When Using Explosives)
- Department of Energy– 18 C.F.R. § 2.69 (Guidelines to be Followed by Natural Gas Pipeline Companies in the Planning, Locating, Clearing and Maintenance of Right-of-Way and the Construction of Above Ground Facilities)

Enbridge proposes to implement the project-specific *Blasting Plan* that was developed in accordance with industry-accepted standards for the use, storage, and transportation of explosives and is consistent with applicable federal, state, and local codes, ordinances, and permits; manufacturers' prescribed safety procedures; and industry practices. Enbridge will adhere to strict safety precautions during blasting and will exercise care to prevent damage to nearby structures, utilities, wells, springs, and other important resources. Blasting will only be conducted during daylight hours. Enbridge will implement controlled blasting using small, localized detonations and low-force charges that are designed to transfer the explosive force only to the rock that is designated for removal. This method results in a small scale, controlled, rolling detonation with limited ground upheaval and does not typically result in large, aboveground explosions. The potential effect of flyrock would be minimized to a minor impact through the use of blasting mats and other measures identified in the Project Blasting Plan.

Due to the controlled nature of blasting associated with pipeline trench excavation, Enbridge does not anticipate that bedrock fractures will create a potential conduit that could drain shallow, near surface groundwater from wetland areas or result in long term or permanent changes to the hydrology of any wetland. Additionally, Enbridge will install trench breakers to prevent preferential flow down the backfilled ditchline in accordance with Enbridge's EPP. Use of trench breakers to prevent preferential flow down the backfilled ditch line is an industry and USACE recognized best management practice[13]. Following pipeline placement and backfilling, groundwater levels are expected to return to pre-construction elevations and flow paths.

To minimize the potential release of contaminants, such as nitrogen compounds associated with blasting materials, Enbridge will adhere to strict management of nitrogen-based explosives during the storage, handling, transportation, bore-hole loading, and detonating phases of blasting. The Project will use only packaged explosives (no bulk explosives will be used) with proven resistance to water infiltration to prevent leaching of soluble materials from the explosives. The use of packaged explosives will reduce the potential for spills and minimize the exposure of explosive products to wet weather and groundwater conditions. The type of explosive product used, and the associated blasting pattern will be selected to maximize the effectiveness of the blasting process to accomplish the desired results while minimizing the mass of explosives required thereby minimizing the potential amount of residual (unconsumed) blasting material. The types of explosives that may be used will have the best available detonation properties, low residual waste profiles, and higher safety and reliability of detonation. The Project's blasting contractor will communicate with the drillers to obtain geological information for each shot and will adjust the mass of explosives accordingly. Explosives will not be primed until immediately before use and will not be allowed to lay overnight in drilled holes (unless completion of the detonation is delayed due to weather or other events).

In-stream Minimization Techniques

For flowing waterbody crossings that may require blasting due to shallow bedrock, Enbridge will initiate the dry crossing method (i.e., dam and pump) prior to blasting to isolate the workspace and blasting

[13] U.S. Army Corps of Engineers. Little Rock District. Sediment and Erosion Control Guidelines for Pipeline Project.

area from natural streamflow. Installation of the temporary instream dams is expected to disperse mobile aquatic organisms away from the crossing area before the blast is conducted and minimize propagation of the blast energy. However, non-mobile aquatic organisms within the isolated stream segment would be affected by the blast.

For waterbody blasts, as for all blasting, the contractor will use only specialized trench-blasting explosives that do not contain perchlorate or ammonium nitrate fuel oil to avoid the discharge of remnant residues into the waterbody.

Enbridge's goal will be to initiate excavation within 72 hours of blasting and Enbridge will maintain active stream isolation throughout the entire construction process (unanticipated event such as inclement weather or safety related stand-downs may delay the start of excavation). Prior to backfilling, Enbridge will install trench breakers within the adjacent upland area (location to be based on site-specific conditions) to prevent subsurface flow of water (either from the waterbody or to the waterbody). Enbridge will restore the bed and banks of each waterbody as near as practicable to preconstruction conditions, will seed the disturbed areas of the stream bank and install erosion blankets above the ordinary high water mark in accordance with its EPP to minimize potential bank erosion prior to returning waterflow to the isolated segment of the stream.

For small, non-flowing waterbody crossings and waterbodies that are dry at the time of construction and are located in areas of shallow bedrock, Enbridge proposes to install temporary upstream and downstream dams to isolate the area of excavation/blasting prior to blasting as a proactive method to minimize the potential for downstream sediment migration should the waterbody begin to flow following blasting and prior to instream construction. Enbridge will initiate the open-cut crossing method within five days following blasting. Enbridge will have equipment and materials on site ready to initiate a dry crossing technique should the stream begin to flow following blasting.

Prior to backfilling, Enbridge will install trench breakers within the adjacent upland area (location to be based on site-specific conditions) to prevent subsurface flow of water (either from the waterbody or to the waterbody). The bed and banks of each waterbody will be restored as near as practicable to preconstruction conditions prior to removal of the upstream and downstream temporary dams. Enbridge will seed the disturbed areas of the stream bank and install erosion blankets above the ordinary high water mark to minimize potential bank erosion.

After the pipeline is installed and appropriate padding is placed around the pipe, blast rock would be returned to the trench to the top of the original bedrock elevation. Large rock not suitable for use as backfill would be hauled off to an approved disposal location or used as beneficial reuse, per landowner or land management agency approval and as required by permit requirements.

Where in-stream blasting would be conducted, the waterbody substrate would be restored to natural grade after pipe installation is complete in accordance with the Project Environmental Protection Plan ("EPP").

<u>Post Construction Monitoring</u>

Enbridge's proposed Wetland and Waterbody Restoration and Post-Construction Monitoring Plan ("Monitoring Plan") includes special provisions for monitoring sensitive resource areas (wetlands and waterbodies) where blasting was required to install the pipeline through shallow bedrock areas. Enbridge's post-construction wetland and waterbody monitoring plan is designed to identify changes to these features following construction.

Post Construction Waterbody Monitoring

Enbridge proposes to monitor each waterbody annually for a period of five years post construction to identify potential additional reclamation measures due to sparse bank vegetation, unstable banks or observed erosion of stream banks, and/or stream elevation differences (higher/lower streambed over the ditchline). This information will be compared to baseline data collected prior to construction, including:

- civil survey elevation information along the proposed centerline of each stream starting and extending approximately 50 feet back from the top of each stream bank (where stream depth and velocity allows for safe access);
- additional photographs documenting upstream, downstream and of each bank crossing at the proposed centerline;
- visual assessment of streambed characteristics (observed streambed materials and characteristics such as gravel, cobble, riffles, pools);
- visual assessment of fish habitat such as undercut banks, instream structures (e.g., logs), potential spawning gravel; and
- visual evidence of bank erosion at or near the proposed centerline crossing

During the first year of post-construction monitoring, Enbridge will evaluate each open cut (wet trench) and/or dry crossing and visually compare stream conditions to preconstruction baseline information to determine if post-construction conditions are similar to pre-construction conditions. Additionally, Enbridge will assess the progression of bank revegetation and document any restoration site concerns. If differences are identified during the post construction monitoring of waterbodies, Enbridge will coordinate with the respective agencies to develop a site-specific restoration/reclamation plan. Enbridge's Operations will also conduct frequent aerial patrols of the pipeline right-of-way in accordance with federal frequency requirements. Aerial patrol personnel are trained to look for potential erosion and/or changes at streams that could affect the pipeline such as scouring, new beaver dam impoundments, or similar changes. If identified during aerial patrols, Enbridge would dispatch ground personnel to investigate the locations further.

Post Construction Wetland Monitoring

Enbridge's proposed wetland monitoring plan will evaluate success of wetland revegetation within disturbed areas associated with pipeline construction as well as observed for changes to adjacent wetland areas potentially associated with alternation of natural surface or subsurface drainage conditions. These observations will include identifying upslope ponding or changes to wetland vegetation potentially due to pipeline construction as well as observing potential hydrology and vegetation changes downslope due to altered hydrology. As with waterbodies, if such situations are identified during the post construction monitoring of wetlands, Enbridge will coordinate with the respective agencies to develop a site-specific restoration/reclamation plan.

Enbridge understands that the USACE may request additional baseline data at select wetland locations to document groundwater information upslope and downslope of the proposed pipeline centerline in wetlands that have been documented as having groundwater discharge. Collection of additional baseline information may include the installation of groundwater monitoring wells prior to construction. Enbridge will continue to coordinate with the USACE on the potential need for groundwater monitoring wells and locations. Where groundwater monitoring wells may be requested, Enbridge would attempt to acquire landowner permission for installation of the wells and associated access. Each location would be recorded using GPS.

Data Request Question 8: *Please provide additional information and analysis regarding the potential for proposed regulated activities to cause degradation by disrupting life stages of aquatic life, fish spawning, and wildlife dependent on these systems. Describe how an evaluation of baseline conditions and post-construction restoration and monitoring at waterbody crossings would inform measures taken to minimize the potential for construction-related effects on the biological characteristics of the aquatic ecosystem, including fish, crustaceans, mollusks, and other aquatic organisms and other wildlife. As appropriate, your response should include a discussion about potential for habitat fragmentation and any potential synergistic effects to species which use riverine and riparian areas. Attachment N of Environmental Impact Report (Revised August 2020 EIR) provides typical stream restoration examples. Please provide additional information that describes which restoration method you propose to utilize for each Corps-regulated waterway crossing. Use site-specific crossing plans for waterways that illustrates the baseline condition of each waterway (bank height, bank width, water depth) to inform how the streambed and banks would be restored post-construction.*

Data Request Question 8 Response

Sediment and Turbidity

As discussed in Enbridge's application materials and supplemental information, increased sedimentation and turbidity can displace and impact fisheries and aquatic resources. Suspended sediments can adversely affect submerged macrophytes by reducing light available for photosynthesis by plants. Suspended sediments settling out on the bottom of waterbodies can cover spawning beds and other habitats as well as smother fish eggs and benthic biota. Sediment deposition onto streambeds can alter stream bottom characteristics such as converting sand, gravel, or rock substrate to finer grain materials. Habitat alterations can reduce juvenile fish survival, spawning habitat, and benthic community diversity and health. Increased turbidity can also temporarily reduce dissolved oxygen levels in the water column and reduce respiratory functions in stream biota. Turbid conditions can also reduce the ability for biota to find food sources or avoid prey, and cause physiological effects in fish, such as gill clogging. The extent of impacts from sedimentation and turbidity would depend on sediment loads, stream flows, stream bank and streambed composition, sediment particle size, and the duration of the disturbances (EPA, 2003).

However, few studies have evaluated the effects of pipeline crossings on aquatic ecosystems. Moreover, the papers that have been published specific to pipeline construction, such as Reid and Anderson, 1999, have generally looked at the effects of open cut (wet trench) crossings not the more protective methods proposed by Enbridge for crossing flowing waterbodies. Still, these investigations are useful for extrapolating some conclusions regarding the potential impacts of the proposed pipeline.

The majority of aquatic effects associated with pipeline construction are the result of instream construction and the erosion associated with runoff of disturbed soils from adjacent uplands, both of which can increase the suspension and downstream deposition of sediment in watercourses. The documented downstream effects of open cut (wet trench) crossings include increases in embeddedness of the streambed and changes to streambed composition and channel morphology. Other potential pipeline impacts include alteration of the habitat at the crossing location as a result of trenching and backfilling and associated changes in bank composition and riparian vegetation.

Reid and Anderson, 1999 evaluated the effects of 27 open cut (wet trench) waterbody crossings. They reported that suspended sediment levels increased rapidly with the onset of instream construction and peaked during trenching (in some cases in the range of several thousand mg/L,), and to a lesser degree during blasting and backfilling. The increase in suspended sediment resulting from pipeline construction depends on the size and flow of the waterbody, the bed material, and sediment particle settling rate (Long *et. al.* 1998). Narrow waterbody crossings are completed more quickly and disturb less bed material than the crossings of wider waterbodies. Low flows can result in minimal dilution and high suspended sediment concentrations but also minimal downstream transport and deposition of sediments. Streambeds comprised primarily of clay and silt sized particles can generate persistent plumes of high turbidity. Alternatively, sediments from disturbed beds consisting of large particles of gravel and sand settle out downstream close to the construction area.

Although not consistently reported, some studies have also reported reductions in the abundance of benthic invertebrate and fish communities have been observed downstream of open-cut (wet trench) pipeline waterbody crossings. Reid and Anderson, 1999, suggested that these observed effects were likely the result of emigration of organisms out of the affected downstream areas and reduction in the suitability of habitat due to sedimentation associated with the use of open-cut crossings.

Given the use of dry crossings for the Project, any increase in the concentration of suspended sediment concentration and downstream deposition of sediments as a result of pipeline construction would be short term. The increases in suspended sediment would be primarily limited to the period of instream construction and multiple post-construction monitoring studies of downstream streambed conditions have found that sediments deposited downstream as a result of pipeline construction are completely removed within 6 weeks to 2 years of construction.

Any effects on benthic and fish communities are also expected to be short term. As reported by Reid and Anderson, 1999, where these effects are seen, they are typically transient and most studies have reported recovery to post-construction conditions within one year of construction.

Given that Enbridge proposes to avoid open cut (wet trench) crossings and will cross most streams using a substantially less impactful dry crossing technique, Enbridge does not anticipate any substantial, widespread, or long-term effects on benthic invertebrate or fish communities.

To mitigate these potential impacts, Enbridge would only conduct open cut (wet trench) crossings without installing dams for waterbodies that are dry (no water present) or that have no perceptible flow. Open cut crossings that are dry at the time of construction would have no downstream migration of sediment associated with construction of the crossing as no flowing water would be present. Enbridge will cross waterbodies that have perceptible flow using either a trenchless or dry crossing method.

Several factors can influence the effectiveness of dry crossing techniques, the levels of sediment and turbidity produced are typically short term and minor. As described in response to Question 5, Enbridge hired RPS to complete a Sediment Discharge Modeling Assessment, a copy of which has been provided to the USACE under separate cover. The results of RPS' modeling evaluation support the findings of earlier studies that some downstream sediment transport may occur during waterbody crossings, but the effects will be of short duration and minor. As described in the Sediment Discharge Modeling Assessment, Enbridge's use of dry trenched crossing methods will result in short term periods of sedimentation during the installation and removal of temporary dams, but much of the effect would be of shorter duration and result in lower downstream sediment concentrations than open cut (wet trench) crossings. RPS predicted that TSS concentrations for dry crossings 500 to 1,000 m downstream of the installations would be on the order of <1 to 30 mg/L for a small watercourse and <1 to 10 mg/L for a medium watercourse. RPS also concluded that the proposed dry crossing installation activities would have a lower magnitude and shorter duration effect on TSS in the water column than natural storm-related events, which can cause TSS values to exceed hundreds to thousands of mg/L over periods of time that are longer than these installation periods. The RPS modelling results also indicate that no deposition greater than 5 mm would occur downstream of dry crossings. In small watercourses the majority of sediment deposition would be less than 5mm in depth and would travel no farther than 17 m downstream of the installation site. In medium watercourses, RPS' modelling predicts that depositions above 5 mm would extend, at most, 3 m downstream of the crossing, and that the majority of deposition would occur within 30 m downstream of the installation site.

The likely range of effects on aquatic resources in the Project area are also discussed in the Sediment Discharge Modeling Assessment. Additionally, the impacts can be approximated by applying the predicted suspended sediment to the Newcombe and Jensen, 1996, model. Results from this model suggest a very low probability of fish mortality from construction, with local crossing area impacts consisting of mostly sublethal effects (e.g., short-term physiological stress and reduction of feeding), and limited habitat degradation.

Since Enbridge will restore the bed and banks using native material, the sediment flush is anticipated to be similar to natural stream conditions following a rain event. Between the dams of dry crossings and in non-flowing waterbodies where standing water is present, it is anticipated that there would be increased turbidity and sedimentation in the crossing vicinity, potentially decreasing the dissolved oxygen if standing water is present, and potentially suffocating eggs and larvae of aquatic species and benthic invertebrates. These effects could temporarily degrade the quality of the habitat in the immediate crossing area, making it unsuitable for spawning and rearing activities. However, because there is no flow, these effects would be localized to the trench area and are not expected to extend downstream of the crossing locations. Moreover, based on previous studies, Enbridge expects the areas directly impacted within the construction workspace will be rapidly recolonized as a result of emigration and new egg deposition from adults within days to months (Brooks and Boulton, 1991; Matthaei and Townsend, 2000)

Blasting

Blasting may be necessary in some waterbodies where there is shallow bedrock. As discussed above, blasting has the potential to increase sedimentation, although not to the extent of trenching. It can also have direct impacts on aquatic organisms in the vicinity of the blast. The direct effects of blasting on aquatic biota varies by species (Yelverton et al., 1975), but include death generally for relatively small organisms and higher mortality for those close to the blast or near the sediment surface (Yelverton et al., 1975; Munday et al., 1986). Non-lethal effects may include eye distension, hemorrhage, hematuria, and damage to bodily systems (Hastings and Popper, 2005; Godard et al., 2008; Carlson et al., 2011; Martinez et al., 2011).

Enbridge will implement its *Blasting Plan* to minimize impacts on aquatic species. Additional details regarding the measures of this plan were included in Enbridge's application and are described in response to Data Request Question 7. In addition to the plan, Enbridge has committed to conducting blasting under no flow conditions or where flow is present after the upstream and downstream dams (see the dry crossing methods) are installed and the area to be blasted is isolated. Enbridge will also be utilizing matting to minimize noise and vibration and will adhere to the time of year restrictions and/or waivers where applicable.

Loss of Streambank Cover

Streamside vegetation, large woody debris, rocks, undercut banks, high flow channels, and floodplains collectively form riparian habitat. Riparian habitat provides valuable structure and opportunities for fish and stream biota. Both open-cut and dry crossing (trenching) methods will temporarily remove some of this habitat and potentially cause locally elevated water temperatures and reduced levels of dissolved oxygen, making the locations less suitable for aquatic biota. Consequently, fish and other stream biota will likely be displaced to similar habitat upstream or downstream of the pipeline crossing.

As previously stated, Enbridge proposes to limit the clearing of riparian trees and other vegetation to include only what is necessary to safely construct and operate the pipeline. Enbridge designed the proposed workspace to minimize impacts on riparian vegetation by narrowing the width of its standard construction right-of-way at most waterbody crossings to 95 feet. Enbridge is also proposing to use the HDD and Direct Pipe methods at several waterbodies, which will further reduce the width of clearing adjacent to these waterbodies. After construction is complete, streambeds and banks will be stabilized and restored to preconstruction conditions to the fullest extent possible using native materials. Streambed structures such as rock and gravel will be returned to the stream, and the stream banks will be revegetated. It is expected that streambed biota, such as invertebrates that serve as food sources for fishes, will recolonize the affected areas within days to months (Brooks and Boulton, 1991; Matthaei and Townsend, 2000), although the recolonization for some species could take longer (Wallace, 1990). Additionally, Enbridge will only maintain a 50-foot-wide easement in herbaceous vegetation following construction. The remaining temporary workspace will be allowed to revegetate, permitting the re-establishment of woody vegetation. This will limit the overall long-term impacts associated with loss of riparian habitat to a small portion of each stream, reducing longer term negative effects to aquatic biota and wildlife dependent on these systems.

Changes to Channel Morphology

Where open cut methods are utilized, trenching and backfilling will impact the bed and banks of waterbodies. These effects are expected to be temporary, however, longer term alterations to channel morphology have been reported at some pipeline crossing locations (Reid and Anderson 1999). These included increased channel width and reduced water depth at the crossing location, and meanders 2 to 4 years after construction. Enbridge will minimize the risk for longer term effects by employing BMPs during construction including reestablishing as near as practicable the original elevation and contours of the bed and banks and installing erosion controls and revegetating disturbed areas to stabilize stream banks and adjacent areas. Enbridge will also conduct post-construction monitoring to evaluate the success of stream bed and bank restoration (see Monitoring Plan). Any adverse changes that are observed will be documented and any changes that are determined to be a risk to the pipeline or environment will be rectified.

Habitat Fragmentation

The clearing of vegetation and creation of a pipeline right-of-way will fragment forest, riparian, and aquatic habitats. Enbridge provided additional information regarding potential forest fragmentation in its comments to the WDNR's *Draft Environmental Impact Statement* (comments submitted on April 15, 2022). Enbridge is providing those comments to the USACE as Attachment 8-A. The fragmentation of riparian habitats (including wetlands) will be similar to those described in the April 15, 2022, comments. The fragmentation of aquatic habitats will be minor and limited in size and duration. As described above, the open cut (wet trench) and dry crossing construction methods will directly impact the bed and banks of waterbodies. These methods have the potential to increase the suspension and downstream transport of sediments, and the potential for erosion in adjacent areas. These effects, in turn, could contribute to the temporary fragmentation of aquatic habitat. However, as described above, Enbridge's proposed crossing methods and mitigation measure including the restoration of streambed and banks, will minimize the scale (affected area) and duration of aquatic habitat fragmentation.

Aquatic and Terrestrial Nuisance and Invasive Species

The introduction or transfer of aquatic invasive species from one waterbody to another is a risk when using the same equipment in multiple waterbodies or when equipment travels through multiple waterbodies. The introduction of aquatic invasive species has the potential to change the health and natural diversity of watersheds within the Project area. Enbridge will control the potential transport of invasive aquatic species through adherence to federal and state-specific regulations for preventing the land transport of such species, by primarily utilizing municipal sources for HDDs, hydrostatic testing, and dust control, and, where sourced from surface waters, by discharging hydrostatic test waters into well vegetated upland areas. As described in response to Question 12, only one of the waterbodies affected by the Project has been documented to contain aquatic invasive species. Specifically, Tyler Forks, has been documented to contain the Banded Mystery Snail (*Vivaparus georgianus*). Enbridge proposes to cross this waterbody using the HDD method and to install a clear span bridge; therefore, no equipment is expected to come into contact with the water as part of pipeline installation. Enbridge has proposed Tyler Forks as a source for hydrostatic test water appropriation. Water withdrawn from Tyler Forks will be discharged into an upland discharge structure near Tyler Forks and will not be discharged into other streams. Infested waterbodies will be addressed in accordance with the language provided in Section 4.0 of Enbridge's EPP and Invasive and Noxious Species Management Plan ("INS Plan") (Attachment 8-B).

A stated in response to Data Request Question 12, Enbridge conducted field surveys and documented 23 different invasive species along the survey corridor. Enbridge will control invasive terrestrial and riparian species in accordance with its INS Plan and the language provided in Section 4.0 of Enbridge's EPP. Specific measures of this plan include : identification of infested areas; pre-treatment controls (application of herbicide, hand pulling, or mechanical measures such as mowing); cleaning of equipment prior to arrival at the construction site; using timber mats where appropriate to prevent equipment from contacting and picking up and transporting invasive plants; segregating topsoil in all infested areas; using weed-free erosion control materials; conducting routine monitoring; and restoring disturbed areas following installation of the pipeline. These measures will promote the establishment of desirable plant species and deter the spread of invasive plant species.

Spill Prevention, Control, and Countermeasures

Accidental spills of construction-related fluids (e.g., oil, gasoline, or hydraulic fluids) into waterbodies could result in water quality impacts that affect fish and other aquatic organisms in adjacent streams, if present. The potential impact would depend on the type and quantity of the spill, and the dispersal and attenuation characteristics of the waterbody. An inadvertent release of fuel or equipment fluids could have acute impacts on fish and aquatic species including direct mortality, altered behavior, changes in physiological processes, or changes in food sources. In turn, ingestion of large numbers of contaminated fish or aquatic species could impact other species located higher in the food chain that prey on this biota.

To reduce the potential for surface water contamination and resulting impacts on aquatic life, Enbridge will implement the measures in its EPP, which include BMPs to minimize the potential for accidental releases and measures that would be implemented to clean up any releases. Some of these BMPs include conducting routine inspections of construction equipment, tanks, and storage areas to help reduce the potential for spills or leaks; restricting refueling and the handling of hazardous materials to greater than 100 feet from wetland and waterbody resources; and the use of secondary containment around all containers and tanks.

Streambank Restoration Methods

Enbridge's proposed streambank restoration measures are described in the Environmental Information Report ("EIR"). Table 1 in Appendix N of Enbridge's August 28, 2020, supplements the EIR references specific figures depicting the streambank restoration methods for 12 waterbodies. The streambank restoration method for all other waterbodies except those that will be crossed by trenchless methods will be in accordance with Figure 6 of Appendix N. The baseline conditions that were recorded for each of these waterways during Enbridge's field delineations is included on the table that is part of Enbridge's response to Data Request Question 3. Enbridge has also prepared site-specific profile drawings for perennial waterbodies crossed by the pipeline centerline using a dry crossing technique (Attachment 8-C).

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Data Request Question 9: *Describe whether riprap or other fill material would be permanently discharged below the ordinary high-water mark of waterways for post-construction restoration as such discharges require permit authorization.*

Data Request Question 9 Response:

As indicated in Enbridge's application materials, after the pipeline is installed Enbridge will:

- restore streambeds as near as practicable to its pre-construction condition, with no impediments to normal water flow; and
- restore the streambanks as near as practicable to pre-construction conditions, unless the original slope is determined to be unstable.

It is Enbridge's intent to restore streambed and streambanks as near as practicable to preconstruction conditions using native material excavated from the bed and banks of each waterbody. Once the bank is reestablished, the disturbed areas will be seeded in accordance with Enbridge's EPP and stabilized with erosion control blanket material. If native bank material is determined not to be suitable for reconstructing the banks due to soil properties, instability, or potential for significant bank erosion, Enbridge may stabilize disturbed streambanks with rock riprap or other bank protection methods, with appropriate agency approval.

Enbridge provided typical stream restoration drawings along with its August 2020 application update materials (see Attachment N of the August 2020 EIR). Attachment N of the Environmental Impact Report includes a table (Table 1) listing locations where Enbridge anticipates the need for either riprap or other bank bioremediation methods based on an engineering field review of each crossing. Enbridge has developed site-specific drawings for final stabilization at these locations (see Attachment 9-A). Additional waterbodies may require enhanced bank stabilization methods depending on site-specific conditions at the time of construction. If additional enhanced bank stabilization methods are necessary, Enbridge will coordinate with the respective agencies to determine the most appropriate stabilization method.

Data Request Question 10: *Our review of wetland functional assessments in the field have revealed that portions of the proposed route are located within high-quality forested wetlands or wetland complexes with apparent groundwater discharge, such as springs and seeps. Please identify all areas where pipeline installation is proposed in these wetland types and hydrogeologic settings and evaluate where adjustments to the route alignment could avoid or minimize construction-related effects to these areas. We are happy to meet with you to discuss any questions about locations we have identified in our review. The evaluation provided to our agency must describe the practicability of realigning, including opportunities for use of non-aquatic areas and other aquatic areas with less adverse impact, considering logistics, technical feasibility, and cost. Where your analysis indicates route adjustments cannot be made to avoid or minimize regulated construction activities in high-quality forested wetlands and/or groundwater discharge wetlands, you must describe actions to minimize potential primary and secondary effects resulting from construction-related activities. Describe how baseline and post-construction vegetation and hydrology monitoring upgradient and downgradient of proposed pipeline crossing would inform the need for corrective action or additional compensatory mitigation.*

Data Request Question 10 Response:

Locations of High-quality Forested Wetlands or Wetland Complexes with Apparent Groundwater Discharge

Enbridge conducted wetland and waterbody surveys during the 2019 and 2020 field seasons following the methodology described in the 1987 US AC E Wetlands Delineation Manual[14] and Regional Supplement for the Northcentral and Northeast Region[15]. Wetland delineations involved collecting sample transects from upland to wetland and recording this information on standardized wetland determination data forms. Additionally, each collected wetland sample point was classified using the Cowardin system, a simple hierarchical national classification system. The community mapping of the wetland features was also based on the assigned Cowardin classification. A secondary classification was also assigned for each wetland sample point using the Eggers and Reed[16] classification system. The latter system is much more specific than the Cowardin system, focused on wetland plant communities of Minnesota and Wisconsin. However, the Eggers and Reed classification system is broad compared to other relevant classification systems, such as the native plant community classification system used in Wisconsin[17].

The wetland determination data forms specifically reference the area being sampled. However, this measure alone does not address the condition and functional value of that sample area or the entire feature. As such, field crews evaluated each wetland using the Wisconsin Wetland Rapid Assessment

[14] Environmental Laboratory. (1987). "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

[15] U.S. Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, C. V. Noble, and J. F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[16] Eggers S. D., Reed D. M., Reed D. M. 2015 Wetland Plants and Plant Communities of Minnesota and Wisconsin, Version 3.2. U.S. Army Corps of Engineers, St. Paul District.

[17] Epstein, E.E. 2017. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management. Wisconsin Department of Natural Resources, PUB-SS-1131H 2017, Madison

Methodology ("WSRAM")[18], determining the functional value, floristic integrity, condition assessment of the wetland assessment area and buffer, and assessment of potential impacts. The floristic integrity assessment was focused on primary questions pertaining to invasive species cover, strata, Natural Heritage Information plant community ranking, and relative frequency of the plant community within the watershed. Excluded from this assessment was the optional documentation of vascular plant species and cover/abundance.

Enbridge completed additional vegetation surveys during the 2022 field season on a subset of wetlands within the current Project area to expand the assessment of floristic integrity. This subset of wetlands was restricted to those that ranged in quality from moderate to high based on the data collected during the initial wetland delineation field efforts (2019-2020). This report is provided under separate cover.

Enbridge would like to meet with the USACE to discuss the data that has been collected regarding high quality wetlands/wetland complexes with apparent groundwater discharge. Following this meeting, Enbridge will prepare a set of maps and associated tables of these areas.

Potential for Workspace Adjustments or Route Realignments

The proposed Project will cross an area of Wisconsin with numerous and large wetland systems. As previously stated in Enbridge's application materials and supplemental information filings, it is not feasible to avoid all wetland and waterbody impacts associated with construction of a linear project such as the proposed Project. Enbridge's evaluation of major route alternatives demonstrates this fact. As described in its application materials, Enbridge evaluated a number of different routes in order to select the proposed route. Enbridge did not field delineate these alternative routes but did conduct desktop analyses, which indicate that all of these other routes cross and would impact a substantial number of wetlands. Given the preponderance of forested wetlands in the region, the wetlands affected by these other routes would include many high-quality forested wetlands.

After selecting the proposed route as environmentally preferable to other major route alternatives, Enbridge conducted extensive wetland and waterbody field surveys along a corridor encompassing the proposed alignment. The corridor evaluated by these field surveys (which was typically between 300 and 500 feet wide) was intentionally wider than the proposed workspace. Enbridge attempted to minimize resource disturbance within this corridor to the extent practicable and adjusted the proposed route where feasible and agreeable by the landowners. Enbridge also modified and reduced construction workspace where practicable to avoid sensitive wetland resource while still maintaining adequate room to safely construction the Project. Where impacts could not be avoided, Enbridge will minimize impacts through BMPs and implementation of its EPP. Enbridge has also developed a Compensatory Wetland Mitigation Plan ("Mitigation Plan") to offset both permanent and temporary wetland impacts. Enbridge believes that the proposed route provides the least environmentally damaging practicable alternative. Route and/or workspace modifications on minimize impacts to specific resource areas would likely shift impacts to other sensitive resource areas, and increase the overall length of the route. This would increase the acreage of land disturbed and the duration of construction. Any changes to the route would also require initiating new landowner approvals (Enbridge has secured all required landowner approvals for the proposed route), require new surveys if there is workspace beyond the existing survey corridor, increase overall Project costs, and result in Project delays.

18 https://dnr.wisconsin.gov/topic/wetlands/methods.html#:~:text=The%20Wisconsin%20Wetland%20Rapid%20Assessment,wetland%20performs%20a%20given%20function. Accessed December 2022.

Actions to Minimize Potential Primary and Secondary Effects Resulting from Construction-related Activities

The primary impact of pipeline construction and right-of-way maintenance activities on wetlands is the temporary removal of wetland vegetation during active construction and the conversion of forested and shrub-scrub wetland vegetation to emergent wetland vegetation within the permanent right-of-way. Pipeline construction also requires soil disturbance associated with excavation, installation, and backfilling of the pipeline ditch. There is also a potential for impacts on groundwater-surface water hydrology particularly in the vicinity of blasting, or as a result of changes in topography. These effects would be greatest during and immediately following construction and most, with the exception of vegetation and habitat impacts, will cease after the trench is backfilled, contours are restored, and erosion controls are installed. Longer term impacts include the conversion of forested and shrub-scrub wetland to emergent wetland within the permanent easement.

Upon completion of construction, Enbridge will revegetate disturbed areas in accordance with the EPP unless otherwise directed by landowners or land managing agencies. Timely restoration of the construction right-of-way and reseeding with an appropriate seed mix will minimize the duration of vegetative disturbance. Active revegetation measures and rapid colonization by annual and perennial herbaceous species in the disturbed areas will restore most vegetative cover within the first growing season. Enbridge will allow woody shrubs and trees to recolonize the temporary construction right-of-way and extra workspaces as described in the EPP. As natural succession proceeds in these areas, the early successional or forested communities present before construction will eventually reestablish. Enbridge will also employ BMPs to control the introduction and spread of noxious weeds and invasive plant species as described in the EPP and Invasive and Noxious Species Management Plan. The Project will result in the permanent conversion of forested and shrub-scrub wetlands to emergent wetland within the maintained easement for operational purposes, including facilitating aerial inspections, preserving pipeline integrity, and providing access for maintenance or emergency work in compliance with federal regulations.

Enbridge will minimize impacts on adjacent vegetation through adherence to soil erosion control measures and by confining clearing activities to the approved Project workspaces. As stated in Enbridge's application materials, Enbridge has reduced the width of the construction right-of-way from 120 feet to 95 feet wide in wetlands, where practicable based on site-specific conditions

To protect wetland soils, Enbridge will install construction matting (where necessary) and/or use low ground weight equipment to minimize the potential for soil mixing (rutting) and compaction. Enbridge also proposes to segregate up to 1 foot of topsoil over the trench line in unsaturated wetlands. Segregated topsoil, which contains native seeds and root stock, will be stored separate from other spoil materials and will be spread over the disturbed area following trench backfilling. During backfilling, efforts will be taken to restore the natural ground contour and restore surface drainage patterns as close to preconstruction conditions as practical. To minimize the potential for preferential subsurface water flow along the backfilled ditchline, Enbridge will install trench breakers within the trench at wetland-upland boundaries prior to backfilling. These efforts will restore the natural hydrology to the wetland as well as to adjacent, undisturbed wetlands.

Proposed Monitoring to Inform the Need for Corrective Action or Additional Compensatory Mitigation

Enbridge has developed a Monitoring Plan to assess the success of restoration efforts following completion of construction activities. As part of the Monitoring Plan, Enbridge will visit each wetland affected by the Project during the first growing season after construction. Enbridge will record general conditions in each wetland including: presence and distribution of hydrophytes and estimated cover; presence/absence of invasive species and estimated cover; natural indicators such as wildlife observations (incidental); visual evidence of rutting, compaction, or erosion; status of erosion controls; elevation changes; off-road vehicle activity; and other third-party disturbances[19]. Enbridge will take representative photographs in each wetland to document first year post-construction conditions.

In addition to the collection of the baseline information described above, Enbridge will establish 1-meter by 1-meter random plot locations (1-meter quadrat locations to be selected by field personnel during the first monitoring season) in 50 percent of the low and medium functional value wetlands, and in all of the high functional value wetlands. The exception would be in wetlands located between the HDD entry and exit points where Enbridge reduced the construction right-of-way to 30 feet and activities were restricted to only vegetation clearing, which will be maintained as part of the permanent easement, for these areas, Enbridge will conduct only a post construction walk-over inspection. No plots would be established in these wetlands.

The location of each plot will be recorded by GPS and marked on aerial photographs in order to maintain consistent plot locations for the duration of the monitoring program. The same plots will be assessed each year, generally around the same time of year. At a minimum, one plot will be established for approximately every half-acre of affected wetland in the right-of-way. For example, a wetland that is between 0 and 1.0 acre in size will have at least two plots; a wetland that is at least 1.0 acre but less than 1.5 acres in size will have at least three plots; and a wetland that is at least 1.5 acres but less than 2.0 acres on the right-of-way will have at least four plots.

The species within each plot will be identified and recorded and the dominant species will be noted. Hydrologic indicators will be identified and the presence/absence of invasive species within the plot will be documented. Where forested wetlands are allowed to regenerate naturally, tree regrowth or natural recruitment will be documented on data sheets. The percent cover for each species, as well as the total percent cover by native hydrophytes, total percent cover for the entire plot, and relative percent of native hydrophytes will be estimated.

Additional Measures in High Functional Value Wetlands

In addition to the data collection discussed above, timed-meander surveys will be conducted in high functional value and medium functional value with high floristic quality wetlands, as well as select wetlands adjacent to Areas of Special Natural Resource Interest (“ASNRI”) waterbodies. The field surveyors will select an assessment area within each wetland that is representative of the wetland overall. Within this area, the surveyors will conduct the timed-meander survey. This will involve identifying within a specified amount of time the plant species within each assessment area and categorizing each species relative abundance (e.g., abundant, common, occasional, uncommon, rare) and percent areal cover within the assessment area.

Data will be recorded on data forms that will be used along with photographs to document the progress of restoration and compare previous seasons of monitoring. Sample data forms are provided in Appendix B.

[19] Other third-party disturbances could include excavations, filling, tree clearing, and livestock grazing.

Seeps and Groundwater Discharge Wetlands Where Blasting Occurred

Prior to the start of construction, Enbridge will work with the respective agencies to identify select wetlands to install monitoring wells upslope and downslope of these types of wetlands where blasting is anticipated.

Monitoring wells will be installed in nests to allow for the determination of groundwater flow direction and to assess if there are changes in groundwater conditions upgradient and downgradient of the pipeline. Each nest will consists of at least 3 monitoring wells installed in a triangular pattern with at least one of the monitoring wells located on the opposite side of the pipeline. It is anticipated that the monitoring wells will be constructed of 2-inch, 10-slot, screened polyvinyl chloride ("PVC") or stainless-steel pipe with a point (for direct push of the well into the soil) equipped with a 2-inch solid riser. Either the riser pipe or the expandable plug is vented to allow atmospheric equilibrium to develop in the well.

Wells will be monitored using non-vented, pressure-based loggers (e.g. In-SiteTM or HOBO®), installed in the wells and programmed to record absolute pressure at 1-hour intervals. Barometric pressure data will be collected using pressure-based loggers programmed to record absolute pressure at 1-hour intervals installed in an above-ground vented well riser. One barometric pressure logger will be installed in a monitoring well at each of the following milepost monitoring ranges: 996.0-996.1; 1074.7-1075.0; and 1105.1-1105.9. Water levels will be measured manually by a water level meter (e.g., Solinst®) at least bi-annually during installation and retrieval of the water level loggers from the monitoring wells. The wells will be resurveyed on an annual basis.

Data loggers will be installed following spring thaw and retrieved after the end of each growing season. Enbridge will continue to collect data on an annual basis during construction and post-construction during the frost-free period or until the performance standards have been met and reviewed by the applicable agencies. Where performance standards at specific sites have not been met by year 5 of monitoring, Enbridge, in consultation with the agencies, may extend monitoring at those sites.

During each monitoring visit, Enbridge will photograph and record the locations of each groundwater seep/discharge and wetland blasting area and note the hydrological characteristics of each area. Any seep or discharge that cannot be relocated will be noted, and any wetland, seep or discharge that has moved or exhibits modified hydrology compared to baseline information will be recorded and described.

Enbridge will continue to monitor the revegetation of affected wetlands annually for up to 5 years to assess wetland restoration, as described in the Year 1 Post Construction Monitoring effort. Wetland monitoring during years 3 and 5 will also focus on both landscape level and on-the-ground assessments of whether hydrology on and the off-right-of-way are similar and consistent with the baseline conditions identified during pre-construction field surveys. Enbridge will also revisit any areas of crowning or subsidence, or other sites identified during years 1 and 3 monitoring where restoration did not meet the performance standards established in Section 3.8. If possible the subsequent monitoring will be performed during the same season/time of year as the Year 1 monitoring.

Wetland Success Criteria

Wetland restoration shall be considered successful if all of the following criteria are satisfied:

- vegetation in the monitored wetland is at least 70 percent of either the baseline cover documented in the wetland prior to construction, or at least 70 percent of the cover in adjacent unaffected wetland areas;
- there is no evidence of adverse changes to baseline hydrology and drainage;

- wetland topography is restored to baseline conditions and similar to the topography of adjacent undisturbed wetland areas;
- the percent cover of invasive species within the construction workspace is similar to or less than the percent cover in adjacent undisturbed areas outside of the construction workspace and within the same community type.
- if natural rather than active revegetation was used, the plant species composition and distribution is consistent with early successional wetland plant communities in the affected ecoregion; and
- the presence, density, and distribution of invasive vegetation species is less than or similar to pre-construction baseline conditions.

Post-Construction Restoration and Corrective Actions

Enbridge will work closely with the USACE and the WDNR to determine success or additional steps if performance standards are not reached after the planned monitoring is completed. Post-construction restoration activities will be adaptive, based on the results of monitoring, changing site conditions (e.g., land use) and geared toward the final goal of restoring pre-construction characteristics of the resource (i.e., vegetation and hydrology). In determining whether corrective action is needed, Enbridge will evaluate the potential resource impacts from conducting the additional restoration compared to taking no action with continued monitoring.

Not every potential corrective action can be determined at this time but possible corrective measures that may need to be implemented include:

- Installation of additional erosion controls or sediment barriers to stabilize soils and capture or redirect runoff;
- Re-grading or re-contouring to address topography or hydrology issues;
- Implementation of integrated approaches to invasive or noxious weed infestations as outlined in Enbridge's Invasive and Noxious Species Management Plan and in accordance with Section 4.0 of Enbridge's EPP;
- Reseeding and/or the addition of soil amendments, or supplementing the original seed mix to meet success criteria;
- Supplemental plantings of tree and/or shrubs in selected areas to enhance stabilization or vegetation diversity.

Enbridge will address site stabilization issues that are identified during post-construction monitoring. Erosion and sediment control BMP deficiencies that have the potential to allow silt-laden water to enter wetlands or waterbodies will be prioritized and promptly addressed to prevent resource impacts. If the selected erosion and sediment control BMP is not effective at a particular location (e.g., continued failure), other solutions will be evaluated, such as re-contouring an area to alleviate a drainage flow pattern that is causing erosion or adding additional erosion and sediment control BMPs to divert drainage to a well-vegetated area.

Examples of topography or hydrology-related issues that may require additional restoration include: unexpected ponding, unexpected drainage, and/or disruptions to flow patterns causing changes in pre-construction wetland hydrology. Corrective actions, such as regrading or re-contouring, will be implemented if crowning, subsidence, or the restored grade is determined to be interfering with the goal of re-establishing vegetative communities according to the local eco-type, or pre-construction wetland hydrology including affects to adjacent undisturbed wetlands. Where such issues are identified, Enbridge will reference pre-construction baseline data including available pre-construction ground elevation data, vegetation data, and pre-construction photographs.

Corrective actions for unexpected alterations to groundwater flow related to changes in topography may include regrading or re-contouring. Actions that may require additional temporary impacts on a wetland or waterbody will be conducted according to pertinent permit requirements and in consultation with applicable agencies.

If the cover of invasive species within a particular community type is higher within the construction workspace compared to the percent cover of the same species in adjacent undisturbed areas outside of the construction workspace or within the construction workspace as documented by pre-construction surveys, Enbridge will manage the issue in accordance with its Invasive Species Management Plan.

Monitoring may determine that some areas have not successfully revegetated after the first growing season. Causes for seeding failure include poor germination or insufficient seeding take as a result of weather conditions, soil conditions, disturbance from cattle or wildlife, competition from invasive species, or erosion. Enbridge will reseed areas that are not adequately revegetated during the monitoring period. Changes in hydrology can also prevent successful restoration. If impacts on hydrology are identified, Enbridge will take actions to investigate the cause and restore the hydrology. Other actions may also be taken across Project areas that are not meeting the restoration goals include regrading to restore proper elevations, fertilizing low nutrient soils, decompacting soils, setting up exclusion areas to stop grazing or foraging, implementing Enbridge's Invasive Species Management Plan, and/or supplementing seed mixes.

Data Request Question 11: *As we have previously discussed with you, quantitative vegetation surveys must be completed in high-quality wetlands. The wetland functional assessments that you completed utilizing the Wisconsin Rapid Assessment Methodology (WSRAM) provides for a qualitative assessment of wetland quality. The quantitative survey information will inform post-construction restoration, monitoring, and compensatory mitigation requirements. We are happy to meet with you to discuss any questions about locations of these resources we have identified in our review.*

Data Request Question 11 Response:

As stated in Enbridge's response to Data Request Question 10, Enbridge conducted wetland and waterbody surveys during the 2019 and 2020 field seasons following the methodology described in the 1987 U.S. Army Corps of Engineers Wetlands Delineation Manual[20] and Regional Supplement for the Northcentral and Northeast Region[21]. Wetland delineations involved collecting sample transects from upland to wetland and recording this information on standardized wetland determination data forms. Additionally, each collected wetland sample point was classified using the Cowardin system, a simple hierarchical national classification system. The community mapping of the wetland features was also based on the assigned Cowardin classification. A secondary classification was also assigned for each wetland sample point using the Eggers and Reed[22] classification system. The latter system is much more specific than the Cowardin system, focused on wetland plant communities of Minnesota and Wisconsin. However, the Eggers and Reed classification system is broad compared to other relevant classification systems, such as the native plant community classification system used in Wisconsin[23].

The wetland determination data forms specifically reference the area being sampled. However, this measure alone does not address the condition and functional value of that sample area or the entire feature. As such, field crews evaluated each wetland using the Wisconsin Wetland Rapid Assessment Methodology ("WSRAM")[24], determining the functional value, floristic integrity, condition assessment of the wetland assessment area and buffer, and assessment of potential impacts. The floristic integrity assessment was focused on primary questions pertaining to invasive species cover, strata, Natural Heritage Information plant community ranking, and relative frequency of the plant community within the watershed. Excluded from this assessment was the optional documentation of vascular plant species and cover/abundance.

Enbridge completed additional vegetation surveys during the 2022 field season on a subset of wetlands within the current Project area to expand the assessment of floristic integrity. This subset of wetlands

[20] Environmental Laboratory. (1987). "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss.

[21] U.S. Army Corps of Engineers. 2011. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0), ed. J. S. Wakeley, R. W. Lichvar, C. V. Noble, and J. F. Berkowitz. ERDC/EL TR-12-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

[22] Eggers S. D., Reed D. M., Reed D. M. 2015 Wetland Plants and Plant Communities of Minnesota and Wisconsin, Version 3.2. U.S. Army Corps of Engineers, St. Paul District.

[23] Epstein, E.E. 2017. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management. Wisconsin Department of Natural Resources, PUB-SS-1131H 2017, Madison

[24] https://dnr.wisconsin.gov/topic/wetlands/methods.html#:~:text=The%20Wisconsin%20Wetland%20Rapid%20Assessment,wetland%20performs%20a%20given%20function. Accessed December 2022.

was restricted to those that ranged in quality from moderate to high based on the data collected during the initial wetland delineation field efforts (2019-2020). This report is provided as Attachment 11-A.

Enbridge would like to meet with the USACE to discuss the data that has been collected regarding high quality wetlands.

Data Request Question 12: *Executive Order 13112, as amended by Executive Order 13751, requires executive departments and agencies to take steps to prevent the introduction and spread of invasive species, and to support efforts to eradicate and control invasive species that are established. Therefore, we require that you provide an Invasive Species Management (INS) Plan that outlines management strategies to minimize the spread of INS identified within the proposed construction workspace and access roads. The INS Plan must outline management strategies that would be implemented prior to construction, during construction, restoration, and post-construction monitoring.*

Data Request Question 12 Response:

Enbridge conducted surveys in 2021 for state-listed invasive species, pursuant to the Wisconsin Chapter NR 40 Invasive Species Rule, within the Project's proposed workspaces including mainline workspaces, access roads, valve areas, and pipe yards. The surveys were specific to regulated plant species in the restricted category, which is a list of 63 species (Attachment 12-A). Enbridge also reviewed public information for other aquatic invasive species (non-vegetative) that are known to be present in waterbodies crossed by the Project. Sources reviewed by Enbridge include:

https://dnr.wi.gov/lakes/invasives/aisbywaterbody.aspx

Aquatic Invasive Species - Ashland County (wi.gov)

https://dnr.wi.gov/lakes/invasives/AISByWaterbody.aspx?location=26

Vegetation

Enbridge's field surveys document 23 different invasive vegetation species at over 900 locations throughout the survey area. The species, plant type, and number of observed occurrences are listed in Table 12-1.

Table 12-1

Invasive Species Occurrences

Scientific Name	Common Name	Plant Type	Occurrences
Aegopodium podagraria	Bishop's goutweed	Herbaceous	1
Alliaria petiolata	Garlic mustard	Herbaceous	4
Berberis thunbergii	Japanese barberry	Woody/Shrub	2
Campanula rapunculoides	Creeping bellflower	Herbaceous	2
Caragana arborescens	Siberian peashrub	Woody/Shrub	1
Centaurea jacea	Brown knapweed	Herbaceous	19
Centaurea stoebe	Spotted knapweed	Herbaceous	102
Cirsium arvense	Canada thistle	Herbaceous	165
Cirsium palustre	European marsh thistle	Herbaceous	9
Coronilla varia	Crown vetch	Herbaceous	12
Epipactis helleborine	Helleborine orchid	Herbaceous	3
Euphorbia esula	Leafy spurge	Herbaceous	9

Table 12-1

Invasive Species Occurrences

Scientific Name	**Common Name**	**Plant Type**	**Occurrences**
Frangula alnus	Glossy buckthorn	Woody/Shrub	36
Galeopsis tetrahit	Hemp nettle	Herbaceous	59
Lonicera complex	Non-native honeysuckles	Woody/Shrub	72
Lythrum salicaria	Purple loosestrife	Herbaceous	2
Myosotis scorpioides	Aquatic forget-me-not	Herbaceous	42
Pastinaca sativa	Wild parsnip	Herbaceous	15
Rhamnus cathartica	Common buckthorn	Woody/Shrub	160
Robinia pseudoacacia	Black locust	Woody/Shrub	4
Tanacetum vulgare	Tansy	Herbaceous	201
Typha complex	Hybrid cattail	Herbaceous	83
Valeriana officinalis	Garden heliotrope/Valerian	Herbaceous	18

Aquatic Invertebrates

Based on publicly available data, only one of the waterbodies that the Project crosses has been documented to contain an aquatic invasive species. This waterbody is Tyler Forks, which has been documented as containing the Banded Mystery Snail (*Vivaparus georgianus*). Enbridge proposes to cross this waterbody using the HDD method and to install a clear span bridge; therefore, no equipment is expected to come into contact with the water as part of pipeline installation. Enbridge has proposed Tyler Forks as a source for hydrostatic test water appropriation. Water withdrawn from Tyler Forks will be discharged into an upland discharge structure near Tyler Forks and will not be discharged into other streams. Enbridge's EPP contains best management practices to minimize potential impacts to aquatic species associated with water withdrawal.

Treatment and Control

The introduction of invasive species has the potential to change the health and natural diversity of watersheds within the Project area. As discussed in Data Request Response #8, the noxious weed infestations listed above will be addressed in accordance with its Invasive and Noxious Species Management Plan (see Attachment 8-B) and in accordance with Section 4.0 of Enbridge's EPP. Enbridge will control the potential transport of invasive aquatic species through adherence to federal and state-specific regulations for preventing the land transport of such species, by primarily utilizing municipal sources for HDDs, hydrostatic testing, and dust control, and, where sourced from surface waters, by discharging hydrostatic test waters into well vegetated upland areas within the appropriation source watershed.

Specific measures of this plan include: identification of areas with INS species; pre-treatment controls for those areas (application of herbicide, hand pulling, or mechanical measures such as mowing); cleaning of equipment prior to arrival at the construction site; using timber mats where appropriate to prevent equipment from contacting and picking up and transporting invasive plants; segregating topsoil in all areas with INS species; using weed-free erosion control materials; conducting routine monitoring;

and restoring disturbed areas following installation of the pipeline. These measures will promote the establishment of desirable plant species and deter the spread of invasive plant species.

To control the potential spread of Banded Mystery Snail Enbridge proposes to cross Tyler Forks using the HDD method and to install a clear span bridge; therefore, no equipment is expected to come into contact with the water as part of pipeline installation. Enbridge has proposed Tyler Forks as a source for hydrostatic test water appropriation. Water withdrawn from Tyler Forks will be discharged into an upland discharge structure near Tyler Forks and will not be discharged into other streams.

Post Construction Monitoring

Enbridge's Monitoring Plan (Attachment 12-B) describes Enbridge's proposed monitoring of wetlands for potential introduction and/or expansion of existing invasive vegetation. In accordance with the Monitoring Plan, Enbridge will record general conditions in each wetland including: presence and distribution of hydrophytes and estimated cover; presence/absence of invasive species and estimated cover; natural indicators such as wildlife observations (incidental); visual evidence of rutting, compaction, or erosion; status of erosion controls; off-road vehicle activity; and other third-party disturbances[25]. Enbridge will take a representative photograph in each wetland to document post-construction conditions.

Wetland restoration will be considered successful if all of the following criteria are satisfied:

- vegetation in the monitored wetland is at least 70 percent of either the baseline cover documented in the wetland prior to construction, or at least 70 percent of the cover in adjacent unaffected wetland areas;
- there is no evidence of adverse changes to baseline hydrology and drainage;
- wetland topography is restored to baseline conditions and similar to the topography of adjacent undisturbed wetland areas;
- if natural rather than active revegetation was used, the plant species composition and distribution is consistent with early successional wetland plant communities in the affected ecoregion;
- presence, density, and distribution of invasive vegetation species is less than or similar to pre-construction baseline conditions.

Enbridge will work closely with the WDNR and the USACE to determine success or additional steps if performance standards are not reached after the first three years of monitoring. Additional seeding and/or control measures may be conducted if deemed necessary to achieve restoration goals. Any seeding and control measures will be done in accordance with the EPP and permit requirements.

[25] Other third-party disturbances could include excavations, filling, tree clearing, and livestock grazing.

Data Request Question 13*. In addition to the information requested above regarding route alignment adjustments, we request additional information on the initial alternatives analysis provided in Section 4 of the Supplemental Information in your application, along with Section 3 of the EIR. Please provide the following:*

Data Request Question 13.a*. Address any changes to your analysis of the No Action Alternative since your application.*

Data Request Question 13.a. Response:

The No Action Alternative remains the continued operation of Line 5 along the existing route through the Bad River Reservation. Enbridge notes that litigation concerning Line 5's crossing of the Bad River Reservation remains ongoing. *See Bad River Band of the Lake Superior Tribe of Chippewa Indians of the Bad River Reservation v. Enbridge Energy Co., Inc., et al*., No. 3:19-cv-00602-wmc (W.D. Wis. July 23, 2019). As a result of its consideration of issues/arguments presented to it to date, the court has stated that it will not issue any order requiring the immediate shut down of Line 5 as a remedy for the Band's trespass claims. *See id*. at ECF No. 360 (Sept. 7, 2022) ("the court must deny the Band's request .as an immediate shutdown of the pipeline would have significant public and foreign policy implications"); (10/27/22 AM Trial Transcript at 13:16-13:18) ("it was clear I [am not] willing to consider an immediate shutdown of the pipeline ..."). A final order by the court remains forthcoming. Absent the court's forthcoming order directing otherwise, it is Enbridge's intention to operate Line 5 within the Bad River Reservation until the Relocation is placed into service.

Data Request Question 13.b*. For system alternatives, address the potential for use of existing pipelines in combination with one another and with other transportation means (truck, rail), for conveyance of all or a portion of the substances transported in the existing Line 5.*

Data Request Question 13.b. Response:

There are no existing pipelines (whether used with one another and/or in combination with other transportation modes) to transport all of the petroleum products carried by Line 5 from Superior, Wisconsin to Sarnia, Ontario and to points in between. Before addressing Question 13.a, it is important to first explain the volumes of petroleum products that are transported by Line 5 to delivery locations, as is addressed in Section I below. Section II addresses the unavailability of existing pipelines to transport Line 5 volumes, including in combination with other existing transportation modes.

I. <u>Overview of Line 5 Volumes</u>

In the context of the petroleum products pipeline industry, Line 5 is a large pipeline with a total capacity of 540,000 barrels per day ("bpd"). On an annual average basis, Line 5 transports approximately 80,000 bpd of natural gas liquids ("NGLs", composed primarily of propane and butane) and approximately 460,000 bpd of light crude. Line 5 usage has always remained at or around its average capacity of 540,000 bpd since 2013, when capacity on the pipeline was expanded from 490,000 bpd to address increased shipper demand.

<u>NGL Transport on Line 5</u>: The annual average of approximately 80,000 bpd of NGLs that are transported on Line 5 are essential to meeting the demand for propane and butanes in Michigan and Ontario. During some winter months, Line 5 deliveries exceed 100,000 bpd of NGLs. It is unusual for any crude oil pipeline also to transport NGLs, like Line 5. By batching NGLs in the pipeline with crude oil, Line 5 provides "just-in-time" deliveries of propane to meet increased demands in winter months, which is a

transportation advantage that cannot be replicated by existing infrastructure in the region. The NGLs transported by Line 5 originate in Western Canada and are shipped by the Enbridge Mainline pipelines to Superior, from where they are transported to facilities known as "fractionators," which break down the NGLs into their constituent parts, propane and butane. The fractionators, each operated by Plains (which are partially owned by Pembina Pipeline Corporation), are located in Superior, Wisconsin; Rapid River, Michigan; and Sarnia, Ontario. For the markets they serve, each of these facilities is the largest single source of propane in the region, and the propane they produce is primarily used for heating homes and businesses. The butanes produced at the very large Sarnia facility are used in a variety of industrial applications noted further below.

Line 5 is the only existing source of NGLs for these fractionators. Line 5 is also the only Enbridge pipeline that is physically able to transport NGLs downstream of Superior, Wisconsin to these fractionators (other Enbridge pipelines, such as Lines 6, 14, 61, 78 that are located south of Superior are not capable of transporting NGLs). Once fractionated, the Line 5 NGLs produce approximately 60,000 bpd of propane and 20,000 bpd of butanes.

While Line 5 does not transport NGLs directly to the Superior, Wisconsin fractionator, the NGL volumes received by that Plains facility are available only as a result of Line 5's operation; if Line 5 did not transport NGLs beyond Superior, it would not be economically viable for Enbridge to transport NGLs via its mainline system to only the Superior fractionator. The Superior fractionator is responsible for producing, based on NGL volumes enabled by Line 5's operation, about 7 percent of the total propane supply for Wisconsin and Minnesota, and a much higher percentage of propane supply for just northern Wisconsin and Minnesota.

At Rapid River, there is a Plains fractionator that extracts propane from the NGLs, and returns the unneeded butane fraction to Line 5. As noted, the Rapid River fractionator is entirely reliant on Line 5 NGL volumes for its feedstock; it has no other source for NGLs. It is also responsible for producing (from the Line 5-transported NGLs) 65% of the propane needed for residential heating and other essential uses in the Upper Peninsula in Michigan.

The remainder of the NGLs transported on Line 5 via the Straits are delivered to the very large Plains' fractionator in Sarnia, which produces both propane and butanes. As noted, the Sarnia fractionator is entirely reliant on Line 5 NGL volumes for its feedstock; it has no other source for NGLs. The Sarnia fractionator services the Michigan and Eastern Canada propane markets, and the butanes are key feedstocks for regional petrochemical facilities and refineries, including use as fuel additives and for other industrial purposes. The Sarnia fractionator, which is the largest in eastern Canada, supplies virtually all of the propane consumed in Ontario and about 56% of the propane needs for Michigan's Lower Peninsula. Plains has disclosed that, on an annual basis, its Sarnia facility produces approximately 800 million gallons of propane and approximately 400 million gallons 21,000 bpd of butanes.[26] This volume exceeds annual propane/butane demand in Ontario, resulting in exportation of excess volumes back to the United States. Plains has, for example, disclosed that it sells approximately 13,000 bpd of propane from the Sarnia fractionator directly in Michigan. The annual demand for propane in Michigan is approximately 25,000 bpd, so the Plains propane sales alone from the Sarnia fractionator supplied about 56% of the Lower Peninsula propane demand.

[26] Statistics Canada. Table 25-10-0026-01 Supply and demand of natural gas liquids, annual https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2510002601.

Plains has stated that any failure on the part of Line 5 to continue to reliably deliver these NGL volumes to its fractionators in Superior, Rapid River, and Sarnia will result in their closure, and the concomitant loss of propane to consumers in the region.

Line 5 Crude Oil Volumes: Apart from its crucial role in NGLs transport, Line 5 is also a major source of crude oil supply for refineries in Michigan, northern Ohio, western Pennsylvania, Ontario, and Quebec. In 2021, Midwestern refineries processed 3,753,000 bpd. Of this amount, almost 99 percent of all refinery crude oil receipts were delivered by pipeline, with the small balance delivered by barge and truck.[27] The proportion delivered via rail was negligible, and nearly all refineries served by Line 5 do not have any crude oil rail service. Moreover, the proportion delivered via pipeline has changed little over the years, underscoring that pipelines remain the most efficient, economical and safest means of transporting large volumes of liquid product.

All volumes of crude oil that are transported on Line 5 are received in Superior, Wisconsin; except there is a single intermediate receipt point on Line 5 at Lewiston, Michigan, where a relatively small volume of locally-produced Michigan crude oil (approximately 9,500 bpd) is collected and transported via Line 5 to U.S. and Canadian refineries. The table below provides a list of the 10 refineries that are supplied by Line 5 crude oil volumes. The table also shows the individual refinery capacities and their estimated crude oil throughputs. These refineries are key sources for refined product supply for Michigan, Ohio, western Pennsylvania, Ontario, and Quebec. The total crude oil demand in this region (based on refinery capacities) is estimated to be approximately 1,188,400 bpd. Accordingly, the crude oil transported by Line 5 (about 460,000 bpd) represents about 40 percent of their total crude oil throughput. Line 5 is responsible for about the same portion of their total refined product production in the region. From Line 5 volumes, these refineries produce primarily transportation fuels—gasoline, jet fuel, and diesel.

[27] *See* U.S. Energy Information Administration, Refinery Receipts of Crude Oil by Method of Transportation; https://www.eia.gov/dnav/pet/pet_pnp_caprec_dcu_nus_a.htm.

REGIONAL REFINERY CAPACITY

(Thousands of Barrels per Day, Unless Noted)

	Refinery Capacity
Detroit/Toledo Region	
BP-Husky Toledo	155.0
Marathon Detroit	140.0
PBF Toledo	172.8
Subtotal/Average	**467.8**
Pennsylvania	
United Warren	65.0
Ontario	
Imperial Nanticoke	113.0
Imperial Sarnia	119.0
Shell Sarnia	78.0
Suncor Sarnia	85.0
Subtotal/Average	**395.0**
Quebec	
Suncor Montréal	137.0
Valero Lévis	235.0
Subtotal/Average	**372.0**
Grand Total	**1,299.8**

The specific Line 5 crude oil delivery points are at Marysville, Michigan, and several sites in Sarnia, Ontario. From the Marysville delivery point, the Marathon Detroit refinery and two refineries in Toledo, Ohio (BP-Husky and PBF Toledo), receive Line 5 crude oil via third-party crude oil pipelines. In addition to supplying the three Canadian refineries located in the Sarnia area (Imperial, Shell, and Suncor), Line 5 is also connected to other Enbridge pipelines that transport crude oil to refineries in Nanticoke, Ontario (Imperial), western Pennsylvania (United), and Quebec (Suncor and Valero Lévis). Specifically, in addition to supplying three Canadian refineries located in Sarnia, Line 5 is also connected to Enbridge Line 7 and Line 9 at Sarnia. Enbridge Line 7 connects to the Imperial refinery in Nanticoke, Ontario, and a third-party pipeline that delivers crude oil to the United refinery in western Pennsylvania. Enbridge Line 9 transports crude oil from Sarnia to Montréal, Quebec.

II. <u>The Use of Existing Pipelines, Including in Combination with Other Modes, to Transport All of Line 5 Volumes is Not Feasible/Practicable</u>

The use of existing pipelines to transport all 540,000 bpd of petroleum products carried by Line 5 is not an available, practicable alternative. For purposes of responding to this request, Enbridge addresses NGL and crude oil transport separately below.

A. There Are No Existing Pipelines or Alternative Transportation Modes to Transport Line 5's 80,000 BPD of NGLS

There is no existing pipeline alternative to Line 5 for the supply of NGLs to the fractionators located in Superior, Rapid River, Sarnia. As noted above, Line 5 is the only existing pipeline on Enbridge's mainline system that can transport NGLs south of Superior; while other Enbridge pipelines connect to Superior (*e.g.*, Line 6A, Line 14, and Line 61), they are not capable of transporting NGLs. Nor are there any existing third-party pipelines, whether utilized in combination with rail/truck, that are connected to the Line 5 delivery points, or that have available capacity to deliver the type of NGLs that are transported by Line 5 to fractionators.

<u>Superior NGL Volumes</u>. As explained above, Line 5 enables the transport of NGLs on Enbridge's mainline system to Superior, a portion of which are delivered to the Superior fractionator. Enbridge's mainline system is currently the only existing pipeline that transports NGLs to Superior. Without Line 5, NGLs would not be transported on the Enbridge mainline system to Superior, and thus current deliveries to Plains' Superior fractionator would cease. There are also no other existing pipelines owned or operated by third-parties, including any that could be used in combination with truck/rail facilities, to transport NGLs to the Superior fractionator.[28] The lack of existing alternatives (in a scenario where Line does not enable the transport of NGLs to Superior) is further evidenced by the fact that Plains has disclosed that its Superior fractionator would cease operation if Line 5 did not continue to enable the transportation of NGLs to this facility via Enbridge's mainline system. Accordingly, without Line 5 enabling NGL deliveries to Superior, new NGL transportation facilities would be required, which would require significant investment, permitting, and take years to complete.

<u>Rapid River Volumes</u>. As noted above, Line 5 is the only pipeline on the Enbridge mainline system that connects to and is located south of Superior, Wisconsin that can transport NGLs. There are also no other existing Enbridge or third-party pipelines connecting to Rapid River. Accordingly, without Line 5 NGL deliveries to Rapid River, new NGL transportation facilities would be required, which would require significant investment, permitting, and take years to complete.

<u>Sarnia Volumes</u>. As noted above, Line 5 is the only pipeline on the Enbridge mainline system that connects to and is located south of Superior, Wisconsin that can transport NGLs. While Enbridge's Line 78 connects directly to Sarnia, it (and the lines that connect to it – Lines 6A, 14, 61) cannot transport NGLs. The only existing third-party-owned pipeline in the geographic area of Sarnia that could theoretically deliver Y-grade NGLs to Sarnia is the Utopia pipeline. It originates in the Marcellus/Utica Shale in Ohio and terminates at Windsor, Ontario. However, the Utopia pipeline is currently designed to deliver ethane to Sarnia petrochemical customers, and the Sarnia fractionator is designed to process a mixed propane/butanes NGL. Further, the Y-grade NGLs available in the Marcellus/Utica Shale for potential delivery on the Utopia pipeline (even assuming that the NGLs could somehow be diverted from the local fractionators in the area and that the Utopia pipeline had capacity to transport those NGLs), cannot be processed by the Sarnia fractionator. Plains, the operator of the Sarnia fractionator, would not undertake the cost and modifications necessary to process Y-grade NGLs, and, as noted

[28] For example, the Enterprise Mid-America Pipeline (MAPL) system, which originates in Conway, is a pipeline segment that supplies Wisconsin. However, the terminus of this pipeline segment is at Janesville, near the southern border of Wisconsin, and is 357 miles away from Superior. The propane deliveries from this MAPL pipeline segment are understood to be currently absorbed by the markets in southern Wisconsin and northern Illinois. Also, the MAPL segment connected to Wisconsin is already operating at capacity and is incapable of delivering additional propane. There are no other NGL pipelines in existence in proximity to the Superior market.

above, has indicated that it would shut down the fractionator without Line 5, evidencing a lack of existing alternatives to provide it with its necessary NGL feedstock. Accordingly, without Line 5 NGL deliveries to Sarnia, new NGL transportation facilities would be required, which would require significant investment, permitting, and take years to complete.

B. There Are No Existing Pipelines to Transport All Line 5's 460,000 BPD of Crude Oil

Pipelines are almost the exclusive means by which Midwestern refineries receive crude oil. There are not existing crude oil pipelines, whether used in combination with rail or trucking, that are capable of transporting all of the 460,000 bpd of crude oil that is transported by Line 5 from Superior to Sarnia and points in between to Midwestern refinery destinations.

There are only three crude oil pipelines that are currently in operation serving the Line 5 delivery area. These are Enbridge's Line 5, Line 78, and a pipeline owned by a third-party, the Maumee Pipeline. The Maumee Pipeline originates in Lima, Ohio and terminates at the Samaria Station, Michigan. It is fully utilized at its capacity of 159,700 bpd and thus has no capacity to transport any portion of Line 5 crude oil volumes.

There is the potential to transport a small portion of Line 5 volumes on Enbridge's Line 78. At Superior, as noted above, Enbridge operates three southbound pipelines that transport crude oil from Superior to three locations in Illinois, which connect to Enbridge's Line 78 pipeline: Line 6A, Line 14, and Line 61. Line 6A, Line 14, and Line 61 are all at or near capacity and they lack the necessary capacity to transport an additional 460,000 bpd of crude oil to Line 78 that is currently transported by Line 5.

Even assuming that Enbridge pipelines connecting from Superior (Lines 6A, 14, and 61) had available capacity to transport any portion of the 460,000 bpd of Line 5 crude oil volumes for further delivery on Line 78, Line 78's capacity is limited to 570,000 bpd and therefore cannot transport the full 460,000 bpd of Line 5 crude oil volumes. Line 78 originates at the Enbridge Flanagan terminal located in the Chicago area and terminates in Sarnia, with delivery points in Stockbridge,[29] Michigan, Marysville, and Sarnia. Assuming that Line 78 were utilized up to its capacity of 570,000 bpd to transport crude oil to Line 5 delivery points, this would still result in a shortfall of approximately 334,700 bpd. In other words, Line 78 capacity would only allow for the transport of approximately 125,000 bpd of the 460,000 bpd of crude oil transported to refineries currently served by Line 5. This shortfall could potentially be reduced to 226,700 bpd assuming that existing rail and tanker unloading facilities were reactivated to serve the Quebec refineries that receive Line 5 crude oil volumes. However, some of these facilities would require refurbishment before they could be utilized, and the time and cost to do so is unknown.

Accordingly, without Line 5 crude oil deliveries, new crude oil transportation facilities would be required, which would require significant investment, permitting, and take years to complete.

[29] From Stockbridge, the three refineries in the Detroit/Toledo area served by Line 5 can be accessed via a combination of Enbridge (Lines 17 and 79) and third-party pipelines.

Data Request Question 13.c*. For the route alternatives you provided, explain how the evaluation and comparison of these alternatives supports the search for the least environmentally damaging practicable alternative required by the 404(b)(1) guidelines.*

Data Request Question 13.c. Response:

In evaluating Enbridge's application for the Relocation, USACE must evaluate alternatives that are practicable and reasonable. In accordance with the USACE 404(b)(1) guidelines at 40 C.F.R. § 230.10(a), a permit cannot be issued if a practicable alternative exists that would have less adverse impact on the aquatic ecosystem, and that the alternative does not have significant adverse environmental consequences to other natural ecosystem components.

In terms of USACE's 404(b)(1) analysis, "practicable" is defined as meaning the alternative is "*available* and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." 40 C.F.R. § 230.3(l) (emphasis added). USACE has explained that an alternative needs to fail only one practicability factor to be eliminated during the Section 404(b)(1) screening process.

As explained in response to Question 13.b above, existing pipelines (whether used in combination with one another or with other transportation modes) are not available to transport all of the 540,000 bpd of petroleum products to Line 5 delivery points. No portion of Line 5 NGLs could be transported via existing pipelines because none exist, or those that may exist (*e.g.*, in the Sarnia area) do not transport the correct NGL product for fractionation. While a portion of Line 5 crude oil volumes (approximately 125,000 bpd) could theoretically be transported on Enbridge's Line 78 to Sarnia, this would still result in a shortfall of 334,700 bpd (or 226,700 bpd if rail/tanker facilities were reactivated to deliver crude oil to the Quebec refineries served by Line 5). Likewise, there are not adequate existing non-pipeline options (rail, truck, barge) that connect to existing pipelines in the Line 5 delivery area to transport all Line 5 volumes.

Due to the fact that existing pipelines (whether used in combination or with other modes) are not available to transport all Line 5 volumes, this is not a practicable alternative under USACE's 404(b)(1) guidelines. USACE has also explained that alternatives making it to Step 4 (identification of the least environmentally damaging alternative ("LEDPA")) are only those that are practicable. Because the use of existing pipelines (whether used in combination with one another or with other modes) is not practicable, this is not an alternative that should be carried forward for LEDPA analysis under Section 404(b)(1).

Aside from the fact that the use of existing pipelines (whether used in combination or with other modes) is not a "practicable" alternative, any alternative that contemplates the development of new pipelines and/or truck/rail facilities to transport all Line 5 NGL and crude oil volumes would result in other significant adverse environmental consequences resulting from their construction and/or operation.

Data Request Question 14: *We have received comments expressing concern that enforcement of state trespass laws will restrict tribal access to lands used for hunting, fishing, and gathering natural resources. Please describe how pipeline construction activities may impair access to areas where treaty rights are exercised, and how any potential impairment may be mitigated.*

Data Request Question 14 Response:

Enbridge will work with any tribal members to facilitate access to public lands during construction, and no long-term impairment to the exercise of tribal treaty rights will be caused by the relocation.

These actions will minimize any limitations during pipeline construction on the exercise of treaty rights by tribal members and access to hunting on public lands consistent with Wisconsin law and regulations. In Wisconsin, the rights to hunt and fish are established both by treaty as well as by the Wisconsin Constitution. Section 5 of the Treaty of 1837 reserves to members of the Ojibwa the right to hunt, fish, and gather upon the lands, the rivers and the lakes within the Ceded Territory, where the Project is located. These rights reserved by the Treaty of 1837 currently applies to public lands in the Ceded Territory. Likewise, Article I, Section 26 of the Wisconsin Constitution guarantees that all Wisconsin citizens have the right to hunt, fish, trap, and take game, subject only to reasonable restrictions prescribed by law. Such reasonable restrictions include, for example, exclusions from privately owned dwellings, buildings, or fenced farm areas not open to the general public for hunting, or actions constituting trespass under Wis. Stat. Ch. 943.143 or 943.15.

During active pipeline construction or maintenance, in areas where the relocated Line 5 will cross public land, access to Enbridge's ROW will be temporarily restricted, as required under federal regulations to ensure the safety of the contractors and general public during excavation and trenching. During those activities, Enbridge will make its best efforts to accommodate requests for access to public lands requiring a crossing of the ROW to exercise treaty rights and will identify a point of contact to facilitate safe access to public lands by tribal members seeking to exercise treaty rights. Access to these areas will continue to be open for all legal activities at all other times.

Post construction, no long-term impairment to the exercise of tribal treaty rights will occur. Wisconsin's trespass law applicable to energy providers are not currently restricting tribal access to lands used for hunting, fishing, and gathering natural resources, and the relocation project will not restrict access in the future. Wis. Stat. § 943.143 was adopted by the Wisconsin Legislature in 2015, and initially applied to all electrical and natural gas transmission right-of-way throughout the State of Wisconsin. Coverage under Section 943.143 was expanded to petroleum pipelines four years later. While significant portions of the Ceded Territory are crossed by electrical and natural gas transmission pipelines (as well as Line 5), in the seven years since the statute was adopted, Enbridge has not identified any case where a tribal member engaged in hunting, fishing, or gathering was prosecuted under this provision.

Finally, Enbridge has prepared an Environmental Justice Plan, which was included as Appendix O to the December 2021 DEIS prepared by the Wisconsin Department of Natural Resources. That Plan includes Enbridge's commitment to allow the exercise of treaty- and constitutionally protected rights along the pipeline right-of-way. That plan also notes that tribal members have asked for confirmation of Enbridge's consent to the lawful exercise of treaty rights in the right-of-way on public land.