

The Environmental Report for the GTA Project contains the following references to the Environmental Guidelines for Construction, June 2012. The referenced sections of the Environmental Guidelines for Construction are attached in numerical order.

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4.2

SURVEY AND UTILITY LOCATES

Activity Description:

Prior to ground disturbance, the first step in construction involves right-of-way survey and utility locates. The right-of-way boundaries are surveyed and clearly marked with stakes, flagging or fencing. Additional or reduced workspace areas and environmental resources requiring protection are also surveyed and marked. Surveying activities have low potential to cause environmental impacts; however, surveyors must be given appropriate direction regarding the construction right-of-way width, location of additional workspace and instructions for activities in the vicinity of environmentally sensitive areas.

Identification of foreign crossings such as pipelines (either owned by Enbridge or others), utility lines (buried, laying on the ground or overhead), cables, roads, railway lines and other underground structures is also undertaken prior to construction. Buried foreign lines must be exposed prior to installing a pipeline in their vicinity to ensure the safety and protection of the existing infrastructure. Environmental protection during "hot line" exposure is conducted by salvaging topsoil prior to hydrovac exposure, followed by proper disposal of the hydrovac slurry in order to maintain equivalent soil productivity post-construction.

Objectives:

1. To limit the project footprint to the approved workspace.
2. To avoid or reduce the potential disturbance of site-specific environmental resources.
3. To locate utility line crossings in consideration of environmental resources.

Guidelines for Implementation:

Considerations for Survey at Environmentally Sensitive Sites

In order to further protect various site-specific environmental features occurring along the construction right-of-way, the width of the construction right-of-way may be narrowed to avoid or reduce the amount of disturbance near these important environmental resources. It is encouraged that the Environmental Inspector works with the survey crew to flag all environmentally sensitive sites prior to construction.

1. **Environmental Resources:** Prior to general right-of-way survey, provide the location(s) of environmentally sensitive sites on project-specific Environmental Alignment Sheets. Stake, flag, or fence and avoid, each environmental feature. If required, the Environmental Inspector will confirm the accuracy of all flagged environmentally sensitive areas. Access to/from the construction right-of-way should be conducted in a manner that reduces potential impacts to environmentally sensitive sites and environmental resources.
2. **Signage:** Clearly post signs prohibiting workers or equipment from entering the staked, flagged and/or fenced areas.
3. **Narrow Down Right-of-Way:** Where narrowing on the work side or spoil side is sufficient to avoid or protect an environmental feature, limit the workspace to as narrow an area as safely feasible.

Demarcate the feature being protected as shown in Dwg. 18 - Narrow Down Fencing. Environmental features to be protected are shown on the site-specific Environmental Alignment Sheets. Implement contingency measures if previously unidentified environmental features are discovered during construction. Site-specific environmental features may include, but are not limited to:

- Wetlands and watercourse boundaries;
 - Rare plant or rare ecological community sites;
 - Wildlife features (e.g., mineral licks, dens, habitat trees);
 - Areas of special vegetation (e.g., native prairie, old growth trees);
 - Weed infestations;
 - Historical resources and traditional land use sites;
 - Aggregate resources;
 - Known locations of contaminated soils;
 - In the vicinity of residences, urban areas, parks, natural areas, golf courses, etc.;
 - Ornamental trees, windbreaks or shelterbelts, if requested by the landowner/occupant;
 - Dugouts, if requested by the landowner/occupant; and
 - Other locations identified on the project-specific environmental alignment sheets and/or construction line list.
4. **Construction and Post-Construction:** In the event staking, flagging, fencing and/or signage are damaged or in disrepair, notify the Enbridge Construction Manager.

Considerations for General Construction Right-of-Way Survey

5. **Survey Slash Lines:** Fallen or leaning trees resulting from clearing activities are not permitted off right-of-way or in watercourses.
6. **Watercourses:** Stake and flag the riparian buffer zone before any site disturbance occurs in the vicinity of watercourses. Survey equipment is not permitted to ford watercourses. Maintain staking and flagging throughout construction, if feasible. Ensure temporary workspace does not encroach within the vegetated buffers of watercourses. See Section 3.3.4 - Riparian Areas and Buffer Zones for more information on buffer zones.
7. **Drainages:** Stake and flag drainage's in the fall or prior to heavy snowfall, if feasible, if the pipeline is to be constructed during frozen soil conditions to assist in locating gaps in the trench crown and topsoil windrow, as well as to avoid flooding or erosion problems during spring break-up.
8. **Wetlands:** Flag the edge of the riparian buffer zone before any site disturbance occurs in the vicinity of wetlands. Maintain staking and flagging throughout construction, if feasible. Ensure temporary workspace does not encroach within the vegetated buffers of wetlands. Additional guidance on wetland buffer zone widths is presented in Section 3.3.3 - Planning for Wetland Crossings.
9. **Soils:** Clearly mark, with staking, flagging and signage, any locations requiring special soil handling techniques (e.g., three-lift soils handling).
10. **Forest Soils:** If soil salvage is necessary in forested areas and grubbing is to be conducted, flag or fence the grubbing limits so that soils in adjoining areas are not disturbed.

11. **Weeds / Crop Disease:** Clearly mark, with staking, flagging and signage (if warranted), any locations with known weed infestations or crop diseases (e.g., clubroot disease) to ensure appropriate mitigative measures (e.g., equipment cleaning) are implemented to reduce the risk of spread.
12. **Crossings and Slopes:** The Environmental Inspector or the Enbridge Construction Manager should verify the final alignment to ensure areas of environmental concern have been properly flagged, staked and/or fenced.
13. **Drilling:** Before starting any horizontal directional drilling operations, the drilling contractor or surveyor will clearly flag the expected drill path on both sides of the watercourse. Ensure nest surveys have been completed along the drill path prior to drilling within the migratory bird restricted activity period.
14. **Trees:** If applicable, protect ornamental or other important trees adjacent to the construction right-of-way from damage with flags, fencing, or signs, and if appropriate, covering roots within the dripline with a minimum of 75 cm (30 inches) of topsoil.
15. **Removal:** After reclamation is complete, remove all stakes, flagging and fencing, and dispose of at an approved landfill facility or re-use as suitable.

Utility Locates

16. **Agricultural Land:** On agricultural land, salvage topsoil over the foreign line(s) prior to exposing with a hydrovac.
17. **Foreign Lines:** Salvage topsoil from the full construction right-of-way width to allow for a wider trench where multiple foreign lines are to be crossed.
18. **Hydrovac Slurry:** Empty the hydrovac truck onto subsoil at approved locations (e.g., at road crossings where the topsoil has been salvaged) or into designated disposal sumps. Ensure that hydrovac material is contained within the designated release area (i.e., will not migrate to a waterbody or onto topsoil). Adhere to the Storage and Disposal of Hydrovac Slurry Procedure in Section 6.13.
19. **Utility Locate Equipment (Watercourses):** Hydrovac or other utility locating vehicles are not permitted to ford watercourses.

4.4

TOPSOIL SALVAGE

4.4.1 Topsoil Salvage

Activity Description:

Topsoil is a valuable natural resource that is critical to agricultural productivity and successful revegetation. The potential effects of pipeline construction on soil and soil productivity are well known and understood within industry and regulatory agencies. Poor soil conservation can lower soil agricultural productivity through the mixing of topsoil and subsoil, and soil compaction.

The width of topsoil salvage on a project can be influenced by pipeline diameter, season of construction, topography, land use and type of trenching / pipe installation equipment to be used. Inappropriate topsoil salvage widths can result in topsoil/subsoil mixing, rutting and compaction. Compaction causes the formation of a hardpan layer which can be impenetrable by plant roots and serve as an impediment to water movement through the soil profile. Effective topsoil salvage, proper storage and careful handling can limit the potentially adverse environmental effects of pipeline construction.

During project planning and consultation, the appropriate regulatory authorities and landowners may identify specific topsoil salvage requests for the project. Identifying specific soil handling techniques prior to construction may help to expedite project approvals and ensure that appropriate planning and mitigation has been developed prior to construction.

“Topsoil” versus “Strippings”

Generally, “topsoil” is characterized as the uppermost layer of soil in non-forested areas where it can range from 5-45 cm (2-18 inches), or more, in depth. In forested areas, the uppermost layer is often referred to as “strippings” which includes organic litter, fine woody material and the layer of topsoil above the mineral soils of the forest floor. The depth of strippings material can vary depending on the type of forest (e.g., coniferous versus deciduous versus mixed-wood forests).

For the purposes of this document, the term ‘topsoil’ has been used to describe both topsoil and the strippings layer and when read throughout this document can be interpreted as either based on the location of the pipeline.

Objectives:

1. To conserve soil resources and maintain post-construction soil productivity.

Guidelines for Implementation:

Contingency Measures

1. **Soil Handling:** Although the EGC includes mitigative options for most soil handling scenarios (including options for topsoil and subsoil), project-specific soil surveys may identify soil characteristics which are not addressed herein (e.g., calcareous soils). In such instances, project-specific contingency measures will be developed by the Enbridge Environment Project Lead, in consultation with a qualified soil specialist, if warranted, to ensure environmental protection of soil resources.
2. **Soil Erosion:** Review the Soil Erosion Contingency Measures in Section 4.4.4 prior to construction. Implement the Soil Erosion Contingency Measures during topsoil salvage if wind or water erosion is a concern.
3. **Soil Pulverization:** Review the Soil / Sod Pulverization Contingency Measures in Section 4.4.5 prior to construction. Implement the Soil / Sod Pulverization Contingency Measures during topsoil salvage if pulverization becomes evident.
4. **Weeds / Clubroot Disease and Other Crop Diseases:** Review and implement the measures in Section 6.17 – Weeds, Section 6.3 – Clubroot Disease and Other Crop Diseases, and Dwg. 4 – Equipment Cleaning Stations, as necessary.
5. **Wet / Thawed Soils:** If soils are wet or thawed, use appropriate contingency measures until soils dry out or freeze (see Section 6.18 – Wet / Thawed Soils).

General

6. **Sod Conservation:** Retain sod on native prairie and on bush, hay and tame pasture lands if a competent sod layer exists. Grade only where safety considerations dictate in order to reduce disturbance to sod. Do not grade on native prairie, bush, hay lands or tame pasture lands on level terrain.
7. **Droughty Soils:** Assess the wind erosion hazard, competency of the sod and potential for soil pulverization due to droughty soils. The Environmental Inspector, in consultation with the Enbridge Construction Manager, will determine if measures applicable to droughty, wind erodible soils will be applied to reduce the impact of soil pulverization and wind erosion (see Section 4.4.4 - Soil Erosion Contingency Measures and Section 4.4.5 – Soil / Sod Pulverization Contingency Measures).
8. **Historical Resources:** Monitor topsoil salvage in areas with high potential for historical, archaeological, or palaeontological resources. Stop work, notify the Environmental Inspector and the Enbridge Environment Project Lead and implement the measures in Section 6.8 – Historical Resources in the event artefacts are unearthed during topsoil salvage operations.
9. **Permafrost:** Review and implement the mitigative measures in Section 6.10 – Permafrost in areas where permafrost is or may be encountered.
10. **Bellholes:** Salvage topsoil from an area larger than the bellhole on well-sodded lands (e.g., tame pasture, native prairie) during nonfrozen soil conditions to allow feathering-out of spoil over the stripped area. During frozen conditions, only salvage topsoil from the area to be excavated.
11. **Road and Rail Crossings:** Excavate bellholes away from the toe of the slope of the road or rail crossing in accordance with the crossing agreement to prevent sloughing or undermining of the structure being crossed.

12. **Landowner Requests:** Accommodate topsoil salvage preferences of the landowner, if feasible. Record any locations where the landowner has requested topsoil handling which differs from original plans.
13. **Government Land Authorities:** Accommodate topsoil salvage preferences of the government land authority, if feasible. Record any locations where the land authority representative has requested topsoil handling which differs from original plans.
14. **Responsibilities:** An Enbridge Representative or an Environmental Inspector should oversee topsoil salvage in areas where: there is poor colour change between topsoil and subsoil; there are erodible soils; the three-lift soils handling method is used; and/or, there is uncertainty about the depth of topsoil salvage.

Topsoil Salvage Depth

15. **Salvage Depth:** Salvage all available topsoil using the depths indicated on the project-specific Environmental Alignment Sheets as a guide. In the event project-specific or site-specific soil depth information is not available, salvage topsoil to the colour change (e.g., transition layer), plow layer, bottom of sod or duff layer, or 10 cm (4 inches), whichever is deepest, unless otherwise specified by the appropriate regulatory authority or as recommended by the Environmental Inspector. Increase the minimum salvage depth to 15 cm (6 inches) where work side topsoil salvage is conducted.
16. **Poor Colour Separation:** Where soil layers are not readily distinguishable by colour the Environmental Inspector will advise on the depth of topsoil to be salvaged based on the soil survey results (if available) and an evaluation of soil texture and structure.
17. **Little or No Topsoil:** Where there is little to no topsoil on cultivated lands, salvage topsoil to the plow layer, to the colour change, or to 10 cm (4 inches), whichever is greatest. Where there is little to no topsoil on native prairie, tame pasture, hay or bush land, salvage all available root zone material, to the colour change, or to 15 cm (6 inches), whichever is greatest.
18. **Variable Depth Topsoil:** Salvage topsoil so that the exposed surface has a mottled pattern composed of 50% topsoil and 50% subsoil where possible. Salvage remaining topsoil and upper subsoils (transition soils) and windrow adjacent to the topsoil windrow.
19. **Uneven Surface:** Consider salvaging topsoil on the spoil pile area when uneven surfaces are encountered on native prairie, hay and tame pasture.
20. **Equipment:** Use equipment with fine depth control (e.g., a grader or dozer) to salvage variable depth topsoil.
21. **Wetlands:** Review and implement the mitigative measures presented in Section 4.11 – Wetland Crossings regarding salvage depths for mineral soil wetlands and peatlands.

Topsoil Salvage Width

22. **Utility Locates:** On agricultural land, salvage topsoil over the foreign line(s) prior to exposing with a hydrovac.
23. **Salvage Width:** Determine appropriate salvage width(s) prior to beginning construction activities in consultation with the Enbridge Environment Project Lead and Engineering department. Table 8 presents a general summary of suggested topsoil salvage widths for various land uses during nonfrozen and frozen soil conditions. Accompanying drawings are presented in Section 7.0 of the EGC.

24. **Increased Salvage Width:** See Section 4.4.2 – Criteria for Increasing Topsoil Salvage Widths for information regarding criteria for increasing the topsoil salvage width.
25. **Salvage (Grading):** In areas where grading is required, salvage topsoil prior to grading.
26. **Soil Pulverization:** Salvage topsoil where heavy traffic is anticipated as well as extremely dry areas to reduce loss of soil structure.
27. **Native Prairie (Very Small Diameter Pipe):** For pipeline diameters smaller than 219 mm (8 inches) where narrow trench will be excavated, limit topsoil salvage to twice the trench width on native prairie.
28. **Forested Areas (Grading):** Where grading is required in forested areas, salvage topsoil to the depth indicated on the Environmental Alignment Sheets. If no depth is indicated, salvage topsoil to 15-20 cm (6-8 inches) or as advised by the Environmental Inspector.
29. **Forested Areas (Nonfrozen):** If grubbing is not required from the full right-of-way, salvage topsoil from the area where grubbing will be undertaken to the depth indicated on the Environmental Alignment Sheets, to 15-20 cm (6-8 inches) or as advised by the Environmental Inspector. If the entire right-of-way requires grubbing, topsoil should be salvaged from the full right-of-way.
30. **Forested Areas (Frozen Conditions):** Salvage a blade width of topsoil, centred over the trench, to the depth indicated on the project-specific Environmental Alignment Sheets or as advised by the Environmental Inspector.
31. **Bellholes:** During nonfrozen ground conditions, salvage topsoil from the bellhole, spoil storage area and the work/travel lane on cultivated lands. During frozen ground conditions, only salvage topsoil from the area to be excavated.
32. **Reduced Salvage Width:** Implement reduced salvage width procedures (Dwg. 32 - Topsoil Salvage - Trench Width) in localized sensitive areas during frozen or nonfrozen conditions, as advised by the Environmental Inspector.

TABLE 8 - GENERAL SUMMARY OF MINIMUM TOPSOIL SALVAGE WIDTHS BASED ON LAND USE AND SEASONAL CONDITIONS

Land Use	Topsoil Salvage Width	
	Small Diameter Pipeline (< 406.4 mm / 16 inches)	Large Diameter Pipeline (> 406.4 mm / 16 inches)
Cultivated	Nonfrozen: Trench and spoil area Frozen: Blade width	Nonfrozen: Full right-of-way Frozen: Blade width
Poorly-sodded tame pasture and hay	Nonfrozen: Trench and spoil area Frozen: Blade width	Nonfrozen: Full right-of-way Frozen: Blade width
Well-sodded tame pasture and hay	Nonfrozen: Blade width Frozen: Blade width	Nonfrozen: Trench and spoil Frozen: Blade width
Other well-sodded lands (e.g., golf courses, residential areas)	Nonfrozen: Blade width Frozen: Blade width	Nonfrozen: Blade width Frozen: Blade width
Bush / Bush-Pasture	Nonfrozen: Blade width Frozen: Blade width	Nonfrozen: Trench and spoil Frozen: Blade width
Native Prairie	Nonfrozen: Blade width Frozen: Blade width	Nonfrozen: Blade width Frozen: Blade width
Native Prairie	Nonfrozen: Twice trench width	N/A

Land Use	Topsoil Salvage Width	
	Small Diameter Pipeline (< 406.4 mm / 16 inches)	Large Diameter Pipeline (> 406.4 mm / 16 inches)
(very small diameter pipe)	Frozen: Twice trench width	
Forested areas	Nonfrozen: All areas where grubbing is required Frozen: Blade width	Nonfrozen: All areas where grubbing is required Frozen: Blade width
Watercourses	See Section 4.10 of the EGC	
Wetlands	See Section 4.11 of the EGC	

Note: Increased salvage width will be required where the trench is wider than normal (e.g., side bends, unstable trench).

Topsoil Salvage - Frozen Soil Conditions

***Note:** Frozen soil conditions exist when frost has reached the depth of the interface between the topsoil and subsoil.

33. **Pre-salvage:** Pre-salvage topsoil prior to freeze-up on lands to be constructed during frozen conditions, if feasible.
34. **Maintain Snow Cover:** Maintain snow cover over the area to be salvaged as long as possible. Remove snow immediately prior to topsoil salvage and windrow to the edges of the construction right-of-way.
35. **Gaps in Snow Windrows:** Leave periodic gaps in snow windrows on tame pasture lands and areas of native vegetation to allow wildlife and livestock movement (Dwg. 8 - Gaps and Plugs).
36. **Windrow Snow Over Trench:** Windrow snow over the trench to prevent deep frost penetration along the trench line.
37. **Work Side:** Remove or pack snow on the work side to increase frost penetration into the soil in the winter. In mid to late winter, pack snow on the work side to avoid premature thawing of the upper soils.
38. **Travel Lane:** Grade snow over the travel lane, if rough, to improve driving conditions; and either grade the spoil pile area or grade snow over the spoil pile area on cultivated lands to smooth furrows and facilitate removal of spoil during backfilling.
39. **Spoil Side:** Limit removal of snow from the spoil side. Remove excess snow that could interfere with backfilling operations. An 8-10 cm (3-4 inches) buffer layer of snow may be left in place to avoid topsoil / subsoil mixing during backfilling.
40. **Topsoil Windrows:** Walk down the topsoil windrow and windrow snow over it to reduce the risk of wind erosion during the winter. Consider watering down the topsoil windrow if snow is not available.
41. **Frozen Topsoil Salvage:** Salvage a blade width of topsoil centred over the trench (Dwg. 25 - Topsoil Salvage - Blade Width) on all land uses during frozen soil conditions. Use specialized equipment capable of accurately separating topsoil from subsoil when salvaging topsoil during frozen conditions.
42. **Frozen Topsoil Salvage:** On rare occurrences, mulching of frozen topsoil may be necessary. Discuss this practice with the Environmental Inspector and the Enbridge Environment Project Lead prior to implementation to identify scenarios where this technique is suitable.

43. **Topsoil Storage:** Store topsoil on the work side of the trench, set back to allow the tracks of the trencher to operate on level ground. However, windrowing of salvaged topsoil material on the spoil side or work side is also acceptable. Maintain separation between the topsoil and spoil piles/windrows if topsoil is windrowed on the spoil side.

Topsoil Salvage - Full Right-of-Way

44. **Implementation:** Salvage topsoil from the full right-of-way (Dwg. 27 - Topsoil Salvage - Full Right-of-Way) during dry and nonfrozen soil conditions on:
- Agricultural lands (e.g., cultivated, tame pasture, hay and bush-pasture) with localized weed infestations;
 - Cultivated lands and lands with agricultural potential that are prone to compaction or susceptible to soil mixing on the work side, (e.g., where there is less than 10 cm [4 inches] of topsoil); and
 - Areas that will be graded or filled.
45. **Special Areas:** Salvage topsoil from the full right-of-way (Dwg. 27 - Topsoil Salvage - Full Right-of-Way), if warranted, to allow for:
- A wider and deeper trench;
 - Storage of larger volumes of spoil; and
 - Heavy equipment traffic; and
 - Grading of the right-of-way.
46. **Wet / Thawed Soils:** Salvage topsoil from the full right-of-way (Dwg. 27 - Topsoil Salvage - Full Right-of-Way) if wet or thawing soil conditions are anticipated or when project activities cannot be postponed.
47. **Bores:** Salvage topsoil from the full right-of-way during nonfrozen soil conditions at all bored crossings on cultivated, hay, tame pasture, bush and bush-pasture lands (see Section 4.2 – Survey and Utility Locates, Dwg. 16 - Materials Handling at Rail Bores and Dwg. 17 - Materials Handling at Road Bores).

Topsoil Salvage - Three-Lift Soils Handling

48. **Implementation:** Salvage topsoil using the three-lift soils handling technique during dry and nonfrozen conditions where a soil survey has indicated that lower subsoils are substantially poorer in quality than upper subsoils and conventional trenching could raise the undesirable lower subsoils within the soil profile. Conduct three-lift soils handling on lands with a higher salt or gravel content in the lower subsoil than the upper subsoil (Dwgs. 28 - Topsoil Salvage - Three-Lift Soils Handling on Cultivated Land and Dwg. 29 - Topsoil Salvage - Three-Lift Soils Handling on Well-Sodded Land). Salvage upper subsoils from an area twice the width of the trench and to the depth indicated on project-specific Environmental Alignment Sheets or as otherwise advised by the Environmental Inspector.
49. **Groundwater:** Conduct three-lift soils handling to maintain groundwater flow on lands characterized by sands overlying clays at shallow depths.
50. **Storage:** Salvage and store the upper subsoil separately from the lower subsoil. Maintain a separation between the topsoil pile and the subsoil piles, and also between subsoil piles.

Topsoil Salvage - Stoniness

51. **Stony Soils:** Limit the topsoil salvage width to reduce the potential for bringing stones to the surface.

Overstrip Topsoil

52. **Overstrip:** Overstrip shallow topsoils of less than 10 cm (4 inches) in depth to a minimum depth of 10 cm (4 inches) or to the depth shown on the project-specific Environmental Alignment Sheets, or as recommended by the Environmental Inspector.
53. **Overstrip:** Salvage a minimum of 15 cm (6 inches) of material for very sandy soil even though the topsoil depth may be considerably less.

Topsoil Salvage Adjacent to Watercourses and Wetlands

54. **Topsoil Salvage:** Implement the appropriate topsoil handling measures identified herein and consistent with the soil characteristics and land use adjacent to the watercourse.
55. **Delay Salvage:** Delay topsoil salvage on approach slopes, floodplains and banks until immediately prior to construction. Salvage topsoil during nonfrozen conditions, if feasible, from all areas to be used for approach slope spoil storage and from where an instream spoil sump is to be constructed.
56. **Surface Material Salvage:** Salvage surface organic material (e.g., low vegetation, leaf litter, partially decomposed organic matter) with the upper topsoil (to the depth of the root zone) from watercourse banks for reclamation, if it can be removed intact.
57. **Topsoil Salvage (Storage):** Place topsoil in distinct piles above the high water mark in a manner that does not block drainage or runoff, construction activities, or replacement of grade material or trench spoil, and prevents erosion and siltation into the watercourse.

Topsoil Storage

58. **Avoid Admixing:** Store topsoil within the construction right-of-way boundaries, in a manner that avoids admixing of topsoil and spoil.
59. **Grade Cuts:** Place topsoil on the high side of grade cuts where practical, to prevent overlap of the grade spoil.
60. **Additional Workspace:** If more than 25 cm (10 inches) of topsoil is salvaged (e.g. deep topsoils), additional workspace may be required for storage (see Section 3.1.6 – Determining Area of Soil Storage for additional information).
61. **Windrow Gaps:** If requested by the landowner or appropriate regulatory authority, leave gaps in topsoil windrows at regular intervals to allow passage of livestock, farm equipment and wildlife. Gaps in windrows should coincide with gaps in strung or welded pipe, obvious drainage courses and where requested to accommodate surface runoff (Dwg. 8 - Gaps and Plugs).
62. **Weeds:** Monitor the topsoil windrow and other soil piles for weed growth frequently during the growing season. Implement weed control measures on topsoil windrows, if warranted (see Section 6.17 – Weeds).

Erosion Control

63. **Drifting Soils:** If drifting soils or topsoil loss is evident in areas prone to wind erosion, postpone topsoil salvage until just before trenching. If this is not practical: limit the time between topsoil salvage and final clean-up; suspend topsoil salvage and backfill operations during high winds until

a tackifier has been applied to the topsoil pile; and install wind barriers (e.g., slat fences, snow fences).

64. **Tackification:** Tackify or hydromulch topsoil windrows if the potential exists for wind erosion during construction (see Section 4.4.3 – Tackification for more information).
65. **Road and Rail Crossings:** Install temporary sediment barriers (e.g., silt fence) on sloped approaches to road and rail crossings where vegetation has been disturbed. See Dwg. 11 – Installing Silt Fence for more information.

Importing Topsoil

66. **Implementation:** If there is a need to import topsoil or subsoil onto the right-of-way (generally associated with post-construction activities) review and implement the mitigative measures presented in Section 5.1 – Backfill of Sunken Trench.

4.4.2 Criteria for Increasing Topsoil Salvage Widths

Activity Description:

During pipeline construction, several situations may arise where it may be necessary to increase the minimum topsoil salvage width requirements. In many instances, the salvage width will be increased to accommodate grading requirements for construction safety and engineering design reasons. In other cases, environmental issues are identified which necessitate increasing the topsoil salvage width as a mitigative measure.

Objectives:

1. To conserve soil resources and maintain post-construction soil productivity.

Guidelines for Implementation:

The topsoil salvage procedures described in Section 4.4.1 – Topsoil Salvage and the associated drawings in Section 7.0 of this EGC provide the minimum topsoil salvage width requirements based on land use, vegetation criteria and construction season. Table 9 provides criteria for selection of alternate soil handling methods to be implemented if an increase in the topsoil salvage width is necessary, based on site-specific conditions at the time of construction.

Note: The scenarios listed are not exhaustive. The need for increased topsoil salvage width should be determined after reviewing the project-specific Environmental Alignment Sheets and in consultation with the Environmental Inspector and the Enbridge Environment Project Lead, along with input from the Enbridge Construction Manager and the appropriate regulatory authority, if warranted.

TABLE 9 - CRITERIA FOR TOPSOIL SALVAGE PROCEDURES

Standard Salvage Width	Special Circumstances	Alternate Topsoil Salvage Method*
Trench and Spoil <ul style="list-style-type: none"> On cultivated land, poorly-sodded tame pasture and hay land Nonfrozen conditions 	<ul style="list-style-type: none"> Topsoil salvage and grading of entire right-of-way required for safe travel and equipment operation. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Anticipated high soil moisture levels in combination with heavy textured soils resulting in a high potential for excessive rutting of topsoil and compaction of subsoil. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Low soil moisture levels in combination with soil physical properties and construction activities resulting in a high potential for topsoil pulverization and subsequent erosion. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Three-lift soils handling required. 	Three-Lift Soils Handling on Cultivated Land (Dwg. 28)
Blade Width <ul style="list-style-type: none"> On well-sodded tame pasture and hay land Nonfrozen conditions 	<ul style="list-style-type: none"> Topsoil salvage and grading of the spoil storage area required to avoid topsoil/subsoil mixing under the spoil pile. 	Trench and Spoil Area (Dwg. 31)
	<ul style="list-style-type: none"> Topsoil salvage and grading of the spoil storage area 	Full Right-of-Way

Standard Salvage Width	Special Circumstances	Alternate Topsoil Salvage Method*
	<ul style="list-style-type: none"> required to avoid topsoil/subsoil mixing under the spoil pile. Topsoil salvage and grading of the work side required due to potential for excessive rutting and sod damage, or required for safe travel and equipment operation. 	(Dwg. 27)
	<ul style="list-style-type: none"> Topsoil salvage from entire right-of-way warranted due to soil moisture concerns or grading requirements. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Three-lift soils handling required (on all lands except native prairie). 	Three-Lift Soils Handling on Well-Sodded Land (Dwg. 29)
Blade Width <ul style="list-style-type: none"> Native prairie Nonfrozen conditions 	<ul style="list-style-type: none"> Safety concerns or deep topsoils warrant an increased topsoil salvage width. 	Trench and Pipe Set-Up (Dwg. 30)
Blade Width <ul style="list-style-type: none"> On all land uses during frozen conditions On localized native prairie during nonfrozen conditions where no rubber-tired traffic by vehicles will be permitted and the construction schedule can accommodate shut-down due to wet weather 	<ul style="list-style-type: none"> Topsoil salvage and grading of the spoil storage area required to avoid topsoil/subsoil mixing under the spoil pile. 	Trench and Spoil Area (Dwg. 31)
	<ul style="list-style-type: none"> Topsoil salvage and grading of pipe set-up area required for safety reasons due to deep topsoils. 	Trench and Pipe Set-Up (Dwg. 30)
	<ul style="list-style-type: none"> Topsoil salvage and grading of the spoil storage area required to avoid topsoil/subsoil mixing under the spoil pile. Topsoil salvage and grading of the work side required due to potential for excessive rutting and sod damage, or required for safe travel and equipment operation. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Topsoil salvage from entire right-of-way warranted due to soil moisture concerns or grading requirements. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Three-lift soils handling required (on all lands except native prairie). 	Three-Lift Soils Handling on Cultivated Land (Dwg. 28) or Three-Lift Soils Handling on Well-Sodded Land (Dwg. 29)
Trench and Pipe Set-Up <ul style="list-style-type: none"> Native prairie Nonfrozen conditions 	<ul style="list-style-type: none"> Topsoil salvage and grading of the spoil storage area required to avoid topsoil/subsoil mixing under spoil pile. Topsoil salvage and grading of work side required due to potential for excessive rutting and sod damage, or required for safe travel and equipment operation. 	Full Right-of-Way (Dwg. 27)
	<ul style="list-style-type: none"> Topsoil salvage from entire right-of-way warranted due to soil moisture concerns or grading requirements. 	Full Right-of-Way (Dwg. 27)

* Associated drawings are presented in Section 7.0 of this EGC.

1. **Sandy Soils**: For sandy subsoils and dunes, salvage an extra width of topsoil to allow for slumping of trench walls, or where trench walls are sloped. Minimize disturbance to surface vegetation on sandy soils or dunes wherever possible.
2. **Bedrock or Boulders**: Increase the topsoil salvage width, if warranted, at locations where bedrock or boulders may be encountered at trench depth, in order to reduce the risk of topsoil and subsoil mixing.
3. **Sidebends and Crossings**: Salvage a greater width of topsoil at sharp sidebends and prior to the riparian area (e.g., not within the riparian buffer zone) at crossings of watercourses, roads (Dwg. 17 – Material Handling at Road Bores), rail lines (Dwg. 16 – Materials Handling at Rail Bores), and utility lines to accommodate a wider and deeper trench, and larger workspace, if warranted.
4. **Unstable Trench**: When dealing with soils that have the potential for unstable trench walls, increase the topsoil salvage width if:
 - Trench walls do not stand up;
 - A wider or deeper trench is otherwise needed (e.g., dwg. 33 - topsoil salvage - unstable trench with trench and spoil area); and,
 - Extra storage is required for trench spoil.
5. **Forested Areas**: Discuss alternative topsoil salvage in forested areas with the Environmental Inspector and the Enbridge Environment Project Lead.

4.4.3 Tackification

Activity Description:

Tackification involves the distribution/spraying of a stabilizing substance or binding agent onto exposed soils (e.g., topsoil windrows or along a right-of-way where topsoil has recently been replaced) to prevent loss of the topsoil or subsoil material. Tackifier may be required where topsoil or subsoil is susceptible to loss due to wind erosion potential, water erosion potential, low moisture content of soils, low organic matter content, texture or high traffic levels. Any tackifier used should be pre-approved by the Enbridge Environment Project Lead.

Objectives:

1. To reduce the potential for wind or water erosion of topsoil or subsoil through the use of tackifier.

Guidelines for Implementation:

General

1. **Soil Erosion:** Review the Soil Erosion Contingency Measures in Section 4.4.4 prior to construction. When warranted, implement the Soil Erosion Contingency Measures during topsoil salvage or trenching activities if wind or water erosion is a concern.
2. **Approvals:** Obtain approval from the appropriate regulatory authority prior to tackifier application, if required.
3. **Locations:** Use machine application of tackifier for soil erosion control at locations identified on the Environmental Alignment Sheets as having a high potential for erosion, or in consultation with the Environmental Inspector.
4. **Equipment:** All equipment used for tackifier applications must be fully operational to the manufacturer's specification, free of any contaminants, including weeds and chemicals, and be operated by an experienced and qualified crew.
5. **Specifications:** All applications of tackifier must follow individual site specifications provided by the Enbridge Environment Project Lead, in consultation with the Environmental Inspector and using methods recommended by the manufacturer.
6. **Biodegradable:** All products applied will be biodegradable, nontoxic and has been approved by Enbridge Environment Project Lead (may also require regulatory approvals).
7. **Water Usage:** Water withdrawal for tackifier applications must be made from an approved source. A valid copy of the water withdrawal permit, where applicable, must be available for onsite inspection.

Tackification During Construction

8. **Alternatives:** Prior to applying tackifier, attempt alternative erosion control options such as storing topsoil in low profile windrows and packing, or applying water.

9. **Topsoil:** Tackify topsoil windrows on wind erodible soils, where alternative erosion control measures are not feasible or effective. Avoid disturbance to the soil windrows after tackifier has been applied. Reapply tackifier if disturbance of the topsoil windrow occurs and the potential for wind erosion remains a concern.
10. **Slopes:** Apply tackifier on steep slopes or exposed sites that will be difficult to stabilize as recommended by the Environmental Inspector.
11. **Application:** Apply tackifier at the manufacturer's recommended rate using a boom sprayer or cannon sprayer capable of providing even surface coverage of the entire topsoil windrow.

Post-Construction Tackification

12. **Reclamation:** All ground preparations (e.g., clean-up and reclamation) are to be completed prior to tackifier applications.
13. **Revegetation:** Ensure seed applications are conducted separately from and prior to applications of tackifier (see Section 4.9.3 - Revegetation).
14. **Soil Disturbance:** Where the tackifier application disturbs soils and erosion control installations (i.e., diversion berms), make the appropriate repairs and then repeat the tackifier application.

4.4.4 Soil Erosion Contingency Measures

Activity Description:

Where warranted during construction, the Environmental Inspector may recommend to the Enbridge Construction Manager or designate that soil erosion contingency measures be initiated. A record of the location, timing and reason for implementation of the contingency measures will be maintained by the Environmental Inspector. In the event that soils are impacted to an extent that reclamation may be impeded, the Enbridge Environment Project Lead or designate will notify the appropriate land or regulatory authority as soon as practical.

If wind or water erosion is evident during construction, all necessary equipment and personnel should be made available to control the erosion. During the construction phase, the Environmental Inspector, in consultation with the Enbridge Environment Project Lead and, if required, the appropriate regulatory authority, will determine appropriate procedures to be implemented to control soil erosion and other soil handling problems encountered. This subsection provides a list of control options to be implemented.

Erodible soils often have a high content of silt and very fine sand. Soils with a high content of clay are more resistant to erosion but due to poor drainage run-off erosion may occur.

Objectives:

1. To implement additional soil erosion control measures when typical measures are not effectively mitigating wind or water erosion of soils.
2. To prevent construction-related sediment from entering wetlands or watercourses.
3. To ensure post-construction soil productivity.

Guidelines for Implementation:

Water Erosion on Cultivated or Hay Land

1. **Soil Erosion:** Suspend construction until the risk of erosion has been reduced or the conditions improve.
2. **Berms:** Construct temporary berms of subsoil, sandbags or bales during construction activities.
3. **Topsoil Salvage:** Salvage the remaining topsoil and store it away from the area to be regraded.
4. **Cross Ditches:** Construct temporary cross ditches, if approved by landowner.
5. **Revegetation:** Seed with annual cereal crop or sterile hybrid if approved by the landowner.

Water Erosion on Hay Land, Tame Pasture, Bush or Bush-Pasture

6. **Berms:** Install temporary berms of subsoil, logs, timbers, sandbags or bales during construction activities.
7. **Erosion Control Devices:** Install silt fences (Dwg. 11), straw bales (Dwg. 12), biologs or equivalent temporary erosion control devices near the base of slopes.

8. **Topsoil Salvage:** Salvage remaining topsoil and store away from area to be regraded.
9. **Regrading:** Regrade rills and gullies.
10. **Topsoil Replacement:** Replace salvaged topsoil.
11. **Implementation:** Implement one or a combination of the following mitigative techniques:
 - Construct cross ditches and berms (Dwg. 1) decreasing the spacing on steeper slopes or on more erodible soils;
 - Armour the upslope face of berms with geotextile, logs or sandbags;
 - Import small diameter slash then spread and walk down;
 - Apply erosion control blanket (Dwg. 5), matting, mulch (if approved by the appropriate regulatory authority) or tackifier to hold soil;
 - Reseed and hand rake an annual cover crop, hydroseed or apply seed impregnated mats;
 - Transplant native shrubs, plant willow stakes or use other bioengineering techniques (Dwgs. 13 and 14);
 - Install slope indicators at locations where the risk of slope failure or creep exists; and
 - Consult a geotechnical engineer.

Wind Erosion of Topsoil

12. **Suspension of Work:** Suspend or relocate construction activities until winds dissipate and conditions improve.
13. **Erosion During Construction:** Consider using the following techniques if wind erosion of the topsoil windrow is of concern during construction:
 - Apply water to the topsoil windrow; a water diversion permit may be required if large volumes of water are necessary for wetting topsoils;
 - Windrow snow over the topsoil windrow;
 - Seed with a temporary cover crop or tackify the topsoil windrow (see section 4.4.3 – tackification for more information); or
 - Pack the topsoil windrow.
14. **Erosion Following Construction:** Consider using the following techniques if wind erosion is of concern after topsoil replacement:
 - Seed cereal or sterile hybrid cover crop;
 - Employ straw crimping (see the straw crimping information in section 4.9 – clean-up and reclamation);
 - Apply hydromulch or tackifier;
 - Lightly compact sandy or pulverized soils on native prairie lands;
 - Import small diameter slash for use as rollback - walk down slash; or
 - Install wind fences.

Erosion of or Failure of Streambanks

15. **Implementation:** Implement one or a combination of the following mitigative techniques, in consultation with the Enbridge Construction Manager:
- Plant willow stakes in the spring (Dwg. 14);
 - Transplant willow clumps (Dwg. 13), install willow wattles, or brush layering (Dwg. 9);
 - Apply netting or netting with straw mulch complete with seed mix;
 - Armour bank with rock rip rap (Dwg. 10);
 - Install vegetated geogrid (e.g., hedge/brush layering);
 - Install rock gabions; or
 - Reclaim stream profile to remove scour holes or instream obstructions

4.4.5 Soil / Sod Pulverization Contingency Measures

Activity Description:

Pulverization may occur on non-salvaged well-sodded lands, particularly on sandy soil and on cultivated lands with clay soils. In agricultural areas, the Soil/Sod Pulverization Contingency Measures will be implemented where sod integrity or topsoil on cultivated lands has been disturbed to the extent that the sod will not infill naturally in a reasonable time frame, or there is an unacceptably high risk of soil erosion. Locations along the pipeline route where these measures apply will be determined by the Environmental Inspector in consultation with the Enbridge Construction Manager, landowner and/or appropriate regulatory authority.

Where warranted, the appropriate regulatory authority will be notified as soon as practical that contingency measures have been implemented during construction of the pipeline.

Objectives:

1. To reduce the potential for soil or sod pulverization to ensure soil productivity is maintained.

Guidelines for Implementation:

The following contingency measures will be implemented where pulverization is occurring and topsoil was not salvaged from the entire working area of the construction right-of-way.

1. **Access:** Provide alternative access to the construction right-of-way to avoid areas prone to soil/sod pulverization.
2. **Traffic:** Reduce traffic along the construction right-of-way in areas where soils/sod is prone to pulverization.
3. **Equipment:** Use equipment with wide pad tracks during soils handling (i.e., salvaging and replacing topsoil).
4. **Topsoil Salvage:** Salvage a wider area of topsoil.
5. **Alternatives:** Implement other suitable mitigation depending on conditions encountered during construction (e.g., availability of additional temporary workspace, soil moisture levels, land use, etc.).

Implement the following measures during clean-up and reclamation activities along portions of the construction right-of-way where soil/sod pulverization occurred prior to contingency measures being implemented:

6. **Cultivate:** Lightly cultivate the affected areas. Ensure that the area of cultivation is slightly wider than the disturbed area.
7. **Harrow:** Harrow the area to prepare a seed bed.
8. **Reclamation:** Drill or broadcast seed the area as appropriate and lightly harrow the area again to cover all seed and compact the seed bed (see Section 4.9.3 – Revegetation).

9. **Reclamation:** Straw crimp, if necessary, on erosion prone soils (see Section 4.9 – Clean-Up and Reclamation for more information on straw crimping).

4.6

STRINGING, WELDING AND TRENCHING AND LOWERING-IN

4.6.1 Stringing, Welding, Trenching and Lowering-In

Activity Description:

Pipeline installation involves stringing pipe, welding, trenching and lowering the pipe into the excavation. These activities have the potential for soil compaction and rutting as well as interfering with farming activities and wildlife movement.

Excavating the trench for the pipeline is typically undertaken using backhoes or a wheel ditching machine. Spoil (subsoil) from the trench is generally piled near the trench opposite the working side. Pipe stringing involves unloading pipe from trucks onto skids in preparation for welding. After pipe stringing is complete, the pipe is bent to conform to changes in ground contour and pipeline alignment. Pipe joints are then welded together and the welds are non-destructively tested. After the welds are coated with corrosion inhibitor, pipe sections are lowered into the trench.

Objectives:

1. To avoid or reduce the potential for soil mixing and compaction.
2. To limit interference with farming activities and wildlife movement.

Guidelines for Implementation:

Preconstruction

1. **Scheduling:** During winter construction, ensure there is sufficient frost or low enough soil moisture to allow construction without causing excessive rutting or soil compaction. For more information on scheduling construction activities, see Section 3.1.2 – Project Scheduling.
2. **Scheduling:** Coordinate with landowners to reduce access disruption caused by trenching or pipe stringing.
3. **Stringing Turn-around Points:** During right-of-way planning, locate turn-around points for stringing trucks in natural clearings, where possible.
4. **Wet/Thawed Soils:** Implement the mitigative measures in Section 6.18 – Wet / Thawed Soils when warranted.
5. **Permafrost:** Review and implement the mitigative measures in Section 6.10 – Permafrost in areas where permafrost is or may be encountered.

Gaps

6. **Gaps:** If requested by the landowner, permit requirements or the appropriate regulatory authority, leave gaps in strung pipe, welded pipe and spoil windrows at regular intervals to allow passage of livestock, farm equipment and wildlife. Gaps in pipe should coincide with gaps in topsoil windrows, obvious drainage courses, wildlife trails and where requested to accommodate surface runoff (Dwg. 8 - Gaps and Plugs).

Stringing

7. **Stringing Trucks:** Confine stringing trucks, as much as feasible, to the portion of the construction right-of-way where topsoil has been salvaged. Topsoil salvage widths will be reflective of land use and construction season and, therefore, may not provide adequate space for equipment. In such instances, discuss alternative mitigative options with the Environmental Inspector.
8. **Access Conditions:** If low-ground pressure equipment is not used and ground conditions on the construction right-of-way are unstable, use swamp mats, rig mats, geotextile or corduroy (with approval from applicable regulatory agencies) to improve the bearing capacity of soft ground. Record all locations where geotextile is installed with a GPS. Do not use tree stumps, bush rip rap, imported dirt or rock fill to stabilize the construction right-of-way for vehicle traffic. Use biodegradable geotextile where it may be difficult to remove 100% of the fabric during clean-up activities. The fabric can interfere with farming implements (i.e., air seeders) and poses a risk for wildlife and livestock consumption.
9. **Pipe Caps:** Cap pipe ends to prevent wildlife from becoming trapped or confined. If pipe caps are not installed, check for confined or trapped animals prior to pipe movement/ installation.

Welding and Coating

10. **Trench Instability:** Weld pipe prior to trenching at locations with soils prone to sloughing in order to reduce the time the trench is left open.
11. **Waste:** Do not leave spent welding rods, filings/shavings from end preparation, or cut off pipe rings on the ground or in the trench. During bevelling operations, collect pipe bevel shaving debris to prevent livestock and wildlife from ingesting the shavings. Contain and collect debris from sandblasting operations.
12. **Overspray:** Where spray or paint-on coatings are applied, place a tarp of sufficient size to block overspray from contacting the ground under the operation.
13. **Concrete Coating:** Do not perform concrete coating activities near a watercourse without prior approval from the Enbridge Environment Project Lead.

Trenching

Where practical, consider matching the trench width to the pipe size and soil conditions during trenching and, when possible, on agricultural land, haul equipment and materials onto the right-of-way after topsoil salvage is completed and before trenching to localize and limit potential soil compaction (under nonfrozen ground conditions).

14. **Fences:** Install temporary fences surrounding the trench on lands where livestock are present, if requested by the landowner, in order to prevent entry onto the construction right-of-way during construction.

15. **Daily Inspections:** Inspect the trench at the start of each day and coordinate with the Environmental Inspector to remove trapped animals (if any) from the trench before commencing construction activities.
16. **Winter Construction:** Reduce the length of open trench and the time the trench is left open to limit the amount of trench sloughing, frost penetration and interference with wildlife, landowners and livestock.
17. **Trench Instability:** As trenching proceeds, identify locations where trench wall instability affects non-salvaged topsoil areas. If non-salvaged topsoil areas are sloughing into the trench, suspend trenching in the area until the topsoil is salvaged wide enough to prevent loss.
18. **Soil Conservation:** Where indicated in the project-specific Environmental Protection Plan, Construction Line Lists and/or Environmental Alignment Sheets, additional soil conservation activities may be required during trenching by excavating and storing different types of soils. Maintain separation between the topsoil and the spoil windrows and also between subsoil piles where three-lift soils handling is considered. Store trench spoil at least 1 m (3 feet) from the edge of the trench (Dwg. 27 – Topsoil Salvage – Full Right-of-Way).
19. **High Water Table:** Consider delaying trenching in areas with a high water table or unconsolidated sandy soil until just prior to lowering-in the pipe in order to prevent the trench from sloughing in and potentially admixing soils.
20. **Bedrock:** Rip bedrock in the trench, if encountered and if feasible. Ripping, breaking and the use of a rock saw is preferred over blasting.
21. **Install Trench Plugs:** To prevent the flow of water along the trench, leave hard or soft plugs at strategic locations, where the open trench could dewater a wetland community, or flood other areas.
22. **Trench Plug Removal:** During excavation of hard and soft plugs, control access to the spoil side for tracked excavators to maintain separation of the topsoil and subsoil windrows.
23. **Three-lift Soils Handling:** For information on trenching where three-lift soils handling is used, please see Section 4.4 - Topsoil Salvage, Dwg. 28 - Topsoil Salvage – Three-lift Soils Handling on Cultivated Land and Dwg. 29 - Topsoil Salvage – Three-lift Soils Handling on Well Sodded Land, as well as the project-specific Environmental Protection Plan.
24. **Unstable Trench Walls:** When dealing with soils that have potential for unstable trench walls, increase the topsoil salvage width if trench walls do not stand up and a wider or deeper trench is otherwise needed (e.g., Dwg. 33 - Topsoil Salvage – Unstable Trench with Trench and Spoil Area). Increase the topsoil salvage width if extra storage area is required for trench spoil.
25. **Watercourses and Wetlands:** For information on activities in the vicinity of or within watercourses or wetlands, please see Section 4.10 – Water Crossings and Section 4.11 – Wetland Crossings.
26. **Road and Rail Crossings:** For information on pipe activities and trenching at road and rail crossings, please see Section 4.2 – Survey and Utility Locates, Dwg. 16 - Materials Handling at Rail Bores and Dwg. 17 - Materials Handling at Road Bores.

Lowering-In

27. **Open Trench:** During winter construction and wherever practical, reduce the length of time there is open trench by lowering-in pipe as soon as possible after welding and coating to reduce the potential need to dewater or interference with livestock and wildlife.

28. **Padding**: Do not use topsoil to pad the pipe.
29. **Backfilling**: Lowering-in activities should be followed closely by backfilling in order to limit the duration of open trench

4.6.2 Dewatering Trench

Activity Description:

Before lowering the pipe into the trench, it may be necessary to dewater the trench in order to visually inspect the trench bottom for rocks or adequate depth. Trench dewatering also may be necessary:

- Where tie-in welds are necessary;
- At road or rail-boring sites;
- At locations where set-on or bag weights are placed over the pipe; and
- In other areas where increased visibility or physical access to the trench is needed.

Trench dewatering can result in erosion and or movement of water that potentially contains sediment or contaminants.

Objectives:

1. To avoid erosion, sedimentation or contamination of adjacent lands, wetlands and/or watercourses during dewatering activities.

Guidelines for Implementation:

Dewatering Trench

1. **Permits/Approvals:** Before commencing dewatering activities, ensure appropriate discharge permits and approvals are in place, if required. Consult with the Enbridge Environment Project Lead to determine if permits or approvals are required.
2. **Contingency Measures:** Review Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures prior to dewatering activities and implement the appropriate mitigative measures if siltation becomes evident during dewatering activities.
3. **Visual Inspection:** Visually inspect trench water for debris (e.g., floating solids, visible foam) and/or hydrocarbon sheen prior to dewatering. Remove floating debris, if feasible, prior to release. If a hydrocarbon sheen is observed, implement the mitigative measures presented under the 'Contaminants' heading below. If evidence of contamination is present, contact the Environmental Inspector, Enbridge Environment Project Lead, Enbridge Construction Manager or designate immediately.
4. **Equipment:** Place equipment (e.g., pumps, generators) on polyethylene sheeting or other suitable containment to prevent spills. Where possible, place equipment above the normal high water mark of watercourses or wetlands.
5. **Discharge Location:** If dewatering is required before the pipe is lowered in, pump trench water to an approved site (when applicable) and/or into appropriate sediment filtering devices (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation and Dwg. 3 – Dewatering Trench – Straw Bale Sump) to prevent erosion or sedimentation of adjacent lands or watercourses or wetlands.

6. **Groundwater:** Where trench dewatering is needed to remove inflowing groundwater, the Enbridge Construction Manager, in consultation with the Enbridge Environment Project Lead and/or Environmental Inspector, will review shallow groundwater use within 200 m (650 feet) of the area to determine the potential effects on nearby wells or dugouts.
7. **Siltation:** Use a floating suction hose equipped with a screen and elevated intake, or other measures, to prevent sediment from being sucked from the bottom of the trench.
8. **Discharge Area:** Direct water to an approved (when applicable) well-vegetated upland area through a filtration device (if required) and at a rate that promotes infiltration of the ground surface. Protect the ground at the discharge location with a sheet of plywood, geotextile or similar means to prevent scouring/erosion. Do not allow sediment laden water from pumping activities to directly enter a waterbody or wetland without prior filtration (e.g., geotextile filter bag, straw bales, etc. [Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation, Dwg. 3 – Dewatering Trench – Straw Bale Sump, Dwg. 11 - Installing Silt Fence, Dwg. 12 – Installing Straw Bales). Ensure that all discharged water is retained on the property where it was encountered. Obtain approval from municipality and downstream landowner(s) if water is to be discharged into a bar ditch or could otherwise leave the property. Monitor the discharge area so that conditions do not become too silted for adequate natural filtration to occur.
9. **Flow Rate:** Manage flow rate of the discharged water based on the site conditions to prevent erosion or scouring of the ground surface at the discharge location. Equip discharge outlets with flow dissipaters where the outflow has the potential to cause erosion.

Filtering Devices

10. **Geotextile Bag:** Size geotextile bags appropriately for the discharge flow and suspended sediment particle size. Use only nonwoven fabric bags for dewatering (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation).
11. **Geotextile Bag Disposal:** Dispose of used geotextile bags in an approved disposal facility.
12. **Straw Bale Dewatering Structure:** Size straw bale dewatering structures based on the maximum water discharge rate. See Dwg. 3 – Dewatering Trench – Straw Bale Sump.
13. **Doubling up Filtering Mechanisms:** Multiple filtering mechanisms (i.e., geotextile bag within a straw bale dewatering structure) may be used in combination.
14. **Filtering Units:** In certain circumstances, portable filter units may provide another option for water management.

Watercourses and Wetlands

15. **Discharge Location:** Do not locate dewatering points within 50 m (165 feet) of a watercourse or wetland without appropriate filtration and erosion control measures (see Sections 4.10 - Water Crossings and 4.11 – Wetlands Crossings).
16. **Wetlands:** Do not dewater any wetlands. Although temporary dewatering may be required during trenched wetland crossings, water should not be permanently removed from the wetland. Options for trench dewatering within wetlands should be discussed with the Environmental Inspector, Enbridge Construction Manager, Enbridge Environment Project Lead and, when required, the appropriate regulatory authority in order to develop the appropriate plans. Temporary sloughs under cultivation or hayed may be dewatered, if warranted. Contact the Environmental Inspector and Enbridge Environment Project Lead before any such dewatering.

17. **Watercourses and Wetlands:** If vegetation is sparse and/or discharge is near a stream or wetland, direct dewatering discharge into a geotextile bag or a straw bale/silt fence dewatering structure (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation, Dwg. 3 – Dewatering Trench – Straw Bale Sump) then onto an upland area well away from watercourses, wetlands or drainage ditches.

Contaminants

18. **Salinity:** Review the project-specific Environmental Alignment Sheets to determine if construction is occurring in an area of saline or sodic soils. If trench dewatering is necessary in these locations and there is potential for salts in the water, test the trench water with a handheld conductivity meter, if available, prior to release. Discuss the results with the Environmental Inspector and Enbridge Environment Project Lead to determine if dewatering to land is appropriate or if other options should be considered (e.g., dewater to secondary containment, tank truck).
19. **Contaminants:** If excavating in contaminated soil, petroleum compounds may be dissolved in trench water (e.g., groundwater or surface runoff) in amounts that require treatment or special dewatering approaches (e.g., tank truck). Collect a sample of the water and send to a laboratory for analysis. Confirm sampling protocols and required laboratory analyses with the Enbridge Environment Project Lead. If feasible, leave contaminated water in the trench while waiting for the results of the laboratory analysis. If necessary, remove the trench water to an onsite tank with secondary containment that has been approved by the Environmental Inspector, Enbridge Construction Manager or designate. Upon receipt of the laboratory results, mitigative or disposal options will be determined by the Enbridge Environment Project Lead.
20. **Contaminants:** If mitigation of contamination is not feasible, water will be disposed of at an approved facility. Lab results will be communicated to the disposal facility. Determine the need for a 'waste manifest' prior to hauling. If required, the waste manifest should be issued by the Environmental Inspector, Enbridge Construction Manager or designate before hauling.
21. **Contaminants:** Before dewatering the trench, any oil (free product) on the water must be completely removed or contained in the excavation. Use sorbent booms or other means to hold the sheen to a portion of the excavation well away from the pump intake hose. Keep the pump intake hose submerged throughout dewatering to prevent the sheen from entering the hose.

4.6.2 Dewatering Trench

Activity Description:

Before lowering the pipe into the trench, it may be necessary to dewater the trench in order to visually inspect the trench bottom for rocks or adequate depth. Trench dewatering also may be necessary:

- Where tie-in welds are necessary;
- At road or rail-boring sites;
- At locations where set-on or bag weights are placed over the pipe; and
- In other areas where increased visibility or physical access to the trench is needed.

Trench dewatering can result in erosion and or movement of water that potentially contains sediment or contaminants.

Objectives:

1. To avoid erosion, sedimentation or contamination of adjacent lands, wetlands and/or watercourses during dewatering activities.

Guidelines for Implementation:

Dewatering Trench

1. **Permits/Approvals:** Before commencing dewatering activities, ensure appropriate discharge permits and approvals are in place, if required. Consult with the Enbridge Environment Project Lead to determine if permits or approvals are required.
2. **Contingency Measures:** Review Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures prior to dewatering activities and implement the appropriate mitigative measures if siltation becomes evident during dewatering activities.
3. **Visual Inspection:** Visually inspect trench water for debris (e.g., floating solids, visible foam) and/or hydrocarbon sheen prior to dewatering. Remove floating debris, if feasible, prior to release. If a hydrocarbon sheen is observed, implement the mitigative measures presented under the 'Contaminants' heading below. If evidence of contamination is present, contact the Environmental Inspector, Enbridge Environment Project Lead, Enbridge Construction Manager or designate immediately.
4. **Equipment:** Place equipment (e.g., pumps, generators) on polyethylene sheeting or other suitable containment to prevent spills. Where possible, place equipment above the normal high water mark of watercourses or wetlands.
5. **Discharge Location:** If dewatering is required before the pipe is lowered in, pump trench water to an approved site (when applicable) and/or into appropriate sediment filtering devices (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation and Dwg. 3 – Dewatering Trench – Straw Bale Sump) to prevent erosion or sedimentation of adjacent lands or watercourses or wetlands.

6. **Groundwater:** Where trench dewatering is needed to remove inflowing groundwater, the Enbridge Construction Manager, in consultation with the Enbridge Environment Project Lead and/or Environmental Inspector, will review shallow groundwater use within 200 m (650 feet) of the area to determine the potential effects on nearby wells or dugouts.
7. **Siltation:** Use a floating suction hose equipped with a screen and elevated intake, or other measures, to prevent sediment from being sucked from the bottom of the trench.
8. **Discharge Area:** Direct water to an approved (when applicable) well-vegetated upland area through a filtration device (if required) and at a rate that promotes infiltration of the ground surface. Protect the ground at the discharge location with a sheet of plywood, geotextile or similar means to prevent scouring/erosion. Do not allow sediment laden water from pumping activities to directly enter a waterbody or wetland without prior filtration (e.g., geotextile filter bag, straw bales, etc. [Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation, Dwg. 3 – Dewatering Trench – Straw Bale Sump, Dwg. 11 - Installing Silt Fence, Dwg. 12 – Installing Straw Bales). Ensure that all discharged water is retained on the property where it was encountered. Obtain approval from municipality and downstream landowner(s) if water is to be discharged into a bar ditch or could otherwise leave the property. Monitor the discharge area so that conditions do not become too silted for adequate natural filtration to occur.
9. **Flow Rate:** Manage flow rate of the discharged water based on the site conditions to prevent erosion or scouring of the ground surface at the discharge location. Equip discharge outlets with flow dissipaters where the outflow has the potential to cause erosion.

Filtering Devices

10. **Geotextile Bag:** Size geotextile bags appropriately for the discharge flow and suspended sediment particle size. Use only nonwoven fabric bags for dewatering (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation).
11. **Geotextile Bag Disposal:** Dispose of used geotextile bags in an approved disposal facility.
12. **Straw Bale Dewatering Structure:** Size straw bale dewatering structures based on the maximum water discharge rate. See Dwg. 3 – Dewatering Trench – Straw Bale Sump.
13. **Doubling up Filtering Mechanisms:** Multiple filtering mechanisms (i.e., geotextile bag within a straw bale dewatering structure) may be used in combination.
14. **Filtering Units:** In certain circumstances, portable filter units may provide another option for water management.

Watercourses and Wetlands

15. **Discharge Location:** Do not locate dewatering points within 50 m (165 feet) of a watercourse or wetland without appropriate filtration and erosion control measures (see Sections 4.10 - Water Crossings and 4.11 – Wetlands Crossings).
16. **Wetlands:** Do not dewater any wetlands. Although temporary dewatering may be required during trenched wetland crossings, water should not be permanently removed from the wetland. Options for trench dewatering within wetlands should be discussed with the Environmental Inspector, Enbridge Construction Manager, Enbridge Environment Project Lead and, when required, the appropriate regulatory authority in order to develop the appropriate plans. Temporary sloughs under cultivation or hayed may be dewatered, if warranted. Contact the Environmental Inspector and Enbridge Environment Project Lead before any such dewatering.

17. **Watercourses and Wetlands:** If vegetation is sparse and/or discharge is near a stream or wetland, direct dewatering discharge into a geotextile bag or a straw bale/silt fence dewatering structure (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation, Dwg. 3 – Dewatering Trench – Straw Bale Sump) then onto an upland area well away from watercourses, wetlands or drainage ditches.

Contaminants

18. **Salinity:** Review the project-specific Environmental Alignment Sheets to determine if construction is occurring in an area of saline or sodic soils. If trench dewatering is necessary in these locations and there is potential for salts in the water, test the trench water with a handheld conductivity meter, if available, prior to release. Discuss the results with the Environmental Inspector and Enbridge Environment Project Lead to determine if dewatering to land is appropriate or if other options should be considered (e.g., dewater to secondary containment, tank truck).
19. **Contaminants:** If excavating in contaminated soil, petroleum compounds may be dissolved in trench water (e.g., groundwater or surface runoff) in amounts that require treatment or special dewatering approaches (e.g., tank truck). Collect a sample of the water and send to a laboratory for analysis. Confirm sampling protocols and required laboratory analyses with the Enbridge Environment Project Lead. If feasible, leave contaminated water in the trench while waiting for the results of the laboratory analysis. If necessary, remove the trench water to an onsite tank with secondary containment that has been approved by the Environmental Inspector, Enbridge Construction Manager or designate. Upon receipt of the laboratory results, mitigative or disposal options will be determined by the Enbridge Environment Project Lead.
20. **Contaminants:** If mitigation of contamination is not feasible, water will be disposed of at an approved facility. Lab results will be communicated to the disposal facility. Determine the need for a 'waste manifest' prior to hauling. If required, the waste manifest should be issued by the Environmental Inspector, Enbridge Construction Manager or designate before hauling.
21. **Contaminants:** Before dewatering the trench, any oil (free product) on the water must be completely removed or contained in the excavation. Use sorbent booms or other means to hold the sheen to a portion of the excavation well away from the pump intake hose. Keep the pump intake hose submerged throughout dewatering to prevent the sheen from entering the hose.

4.8

PRESSURE TESTING

Activity Description:

Industry standards and government regulations require that pipelines and other facilities are pressure tested before commissioning for integrity purposes. The withdrawal and discharge (dewatering) of hydrostatic test water must be properly managed to reduce adverse impacts within the aquatic and surrounding environment. Therefore, it is very important to ensure that each test is planned well in advance to allow for water source and discharge management, proper regulatory notification and time to obtain the necessary environmental permits and/or approvals.

Objectives:

1. To withdraw and release hydrostatic test water in accordance with applicable regulatory requirements and the Enbridge Hydrostatic Test Notification Procedure.
2. To control erosion and prevent the contamination of surface waters during dewatering activities.

Guidelines for Implementation:

Preparation

1. **Procedures:** Prior to, or at the onset of construction, the Enbridge Environment Project Lead will provide the Enbridge Construction Manager with the Enbridge Hydrostatic Test Notification Procedure. Review the Enbridge hydrostatic testing training presentation as a part of the project kick-off meeting. The Enbridge Construction Manager will provide the Enbridge Environment Project Lead with a list of all anticipated hydrostatic tests prior to construction. The Enbridge Construction Manager will also contact the Enbridge Environment Project Lead at least 4 to 6 weeks prior to the commencement of any hydrostatic test operations to confirm all permitting/notification requirements.

Approvals/Notifications

2. **Approvals / Notification:** The Enbridge Environment Project Lead is responsible for assembling all required application or notification documents and submitting the notification or application to the appropriate regulator(s). Note that notification timelines may vary by jurisdiction. Review the hydrostatic testing requirements of the jurisdiction early in the project planning phase to ensure adequate time is allotted.
3. **Notification:** Enbridge Environment may only assign responsibility to the construction contractor for obtaining appropriate approvals and notification(s) if the water to be used for the hydrostatic test is either from a municipal source or is considered rental fluid (i.e., the contractor has used the fluid previously, stores the fluid, and will re-use it for hydrostatic testing in the future), and upon completion of the hydrostatic test, the water will be disposed of at a licensed disposal facility or a municipal sewage system and/or will be stored by the contractor for future use. Otherwise, Enbridge Environment will be responsible for obtaining appropriate approvals and notifications for

hydrostatic test water diversion and release (e.g., the water will be withdrawn from sources/waterbodies other than those listed above).

4. **Regulations:** Follow all conditions outlined in the permits/approvals for water withdrawal and discharge of test water. All relevant documentation, including copies of permits/notifications must be kept on site during the hydrostatic test.

General

5. **Equipment and Workers:** Ensure that enough workers and equipment are available onsite to repair any rupture, leak or erosion problem that arises during testing.
6. **Water Trucks:** Ensure that water truck tank interiors are clean, if used to transport water to the fill site.

Water Withdrawal

7. **Location:** Only withdraw water from locations approved by the Enbridge Environment Project Lead. Avoid water withdrawal sites with known environmental sensitivities (e.g., steep slopes).
8. **Location:** Ensure withdrawal sources have sufficient quantity and quality of water required for testing purposes. Avoid use of highly saline sources of water, if practical.
9. **Scheduling:** Abide by instream restricted activity periods and applicable regulatory approval conditions where water is to be withdrawn from a fish-bearing waterbody.
10. **Sampling:** Collect and analyze water samples from potential sources of hydrostatic test water and provide the Enbridge Environment Project Lead with lab results well in advance of water withdrawal. The Enbridge Environment Project Lead will designate who is responsible for collecting samples.
11. **Screen Intake:** Screen test water intakes (maximum mesh size of 2.54 mm [0.1 inch]) to prevent the entrapment of fish or wildlife and intake of debris. Ensure pump intakes do not disturb the streambed and utilize a maximum approach velocity of 0.038 m/s (0.12 ft/s).
12. **Withdrawal Rate and Volume:** Do not exceed permitted withdrawal rates, or 10% of the flow or volume of the water source unless otherwise approved by the appropriate regulatory authority.
13. **Water Additives:** The Enbridge Environment Project Lead must approve any additives to test water before use. Avoid or minimize the use of additives, although non-toxic, biodegradable or photodegradable additives at minimum dosages may be allowed in regulatory approvals. Recover all methanol, ethylene glycol and water contaminated by freezing depressants in tanks. Do not allow contaminants to enter natural bodies of water or soils. When using additives, develop contingency measures for handling spills and leaks, as well as disposal of test water. Dispose of contaminated test water at approved sites/facilities.
14. **Equipment:** Place equipment (e.g., pumps, generators) on polyethylene sheeting or within other suitable secondary containment to prevent spills onto soils. Where feasible, place equipment above the normal high water mark of watercourses or wetlands.
15. **Refuelling:** The operation and refuelling of hydrostatic test equipment will be in accordance with the conditions outlined in Spill Prevention and Management (Section 6.12).
16. **Temporary Fill Lines:** Ensure applicable approvals are in place prior to installing a temporary fill line that extends off of the Enbridge right-of-way.
17. **Daylighting:** Follow applicable protection measures in Section 4.2 – Survey and Utility Locates, if exposure (daylighting) of the pipe is needed for inspection or repairs.

Hydrostatic Test Water Discharge

18. **Regulations:** Hydrostatic test water release requirements vary by jurisdiction. Ensure that the appropriate testing and treatment measures are implemented in accordance with applicable regulations related to discharging hydrostatic test water if test water is released into a natural waterbody. If hydrostatic test water is to be discharged onto land, obtain soil chemistry analysis, if required by the appropriate regulatory authority, prior to discharging.
19. **Chemical Recovery:** Recover all water contaminated with drying agents (e.g., methanol), if used, and return to the supplier or dispose of contaminated test water at approved sites/facilities.
20. **Chemical Additives:** Ensure that test water containing chemical additives is sampled and treated, if warranted, and discharged or collected in accordance with applicable regulatory requirements.
21. **Location:** Discharge water only at locations approved by the Enbridge Environment Project Lead. Avoid locating water discharge sites on steep slopes, muskegs or other sensitive areas. Locate dewatering sites:
 - Downstream of municipal water intakes; or
 - Upstream of municipal water intakes at a distance approved by appropriate regulatory authorities.
22. **Drainage Basin Transfer:** Ensure that test water withdrawn from one drainage basin will not enter surface waters in another drainage basin to prevent inter-basin transfer of aquatic organisms.
23. **Dewatering:** Shunt test water ahead from test section to test section, if feasible, to minimize water hauling, water usage and the number of dewatering points. Dewater the pipe/tank in such a manner that prevents soil erosion and damage to the beds and banks of water bodies. Use low velocities, dissipate water energy and utilize protective rip rap, sheeting, tarpaulins or equivalent to prevent washouts, flooding or erosion during dewatering (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation and Dwg. 3 – Dewatering Trench – Straw Bale Sump). The rate of discharge must be reduced if these measures are ineffective. Monitor discharge locations to ensure that no erosion, flooding or icing occurs. Dewater into a bar ditch if feasible, or onto non-arable land. Do not dewater onto cultivated lands or directly back into a watercourse or waterbody unless otherwise warranted due to applicable regulatory requirements. Ensure that test water discharged onto land does not flow onto the land of other adjacent landowners.
24. **Pretest Pigging Debris:** Discharge the water at an acceptable location onsite in a manner that does not cause erosion and does not allow unfiltered or silted water to directly re-enter a watercourse. Collect pigging debris and dispose of at an acceptable location (e.g., landfill).

Pneumatic Testing

25. Consult with the Enbridge Environment Project Lead for potentially applicable regulatory requirements if pneumatic testing is to be implemented.

4.10

WATER CROSSINGS

4.10.1 Water Crossings

Activity Description:

Water crossings are a unique and complex component of pipeline construction projects which typically involve a specialized, dedicated crew, specialized equipment, specific engineering design, detailed planning and potentially extensive regulatory considerations. Constructing a water crossing without adequate planning, design and environmental mitigation can result in harmful effects on aquatic habitats, fish populations, aquatic wildlife (e.g., beavers, amphibians, waterfowl, etc.), water quality and watercourse dynamics.

The following subsection outlines various environmental mitigative measures that should be considered and, where necessary, implemented to ensure a successful crossing.

Objectives:

1. To minimize siltation, protect fish habitat, maintain streamflow and prevent water pollution/contamination during construction of water crossings.
2. To restore disturbed watercourse bed and banks to as close to preconstruction condition as feasible.

Guidelines for Implementation:

1. **Schedule:** Cross waterbodies that provide fish habitat during periods of low sensitivity or as defined by the appropriate regulatory authorities. Periods of higher sensitivity are often species dependent and may include migrating, spawning or rearing periods for fish. Contact the Enbridge Environment Project Lead to discuss instream restricted activity periods for construction activities in fish-bearing watercourses. Section 3.1.2 – Project Scheduling provides additional considerations on preferred construction timing regarding fish, wildlife and waterfowl restricted activity periods which may influence the scheduling of water crossing construction. Ensure that no construction activity occurs within the wetted portion of the channel during the instream restricted activity periods unless otherwise approved by the appropriate regulatory authority.
2. **Permits / Approvals:** Confirm with the Enbridge Environment Project Lead that all appropriate permits, approvals, authorizations and/or letters of advice are in place and that required notifications have occurred prior to the commencement of construction at each water crossing. Section 3.1.7 – Environmental Permits / Approvals / Notifications provides guidance on applicable water crossing regulatory requirements. Confirm that crossing permits for canals are in place prior to the commencement of construction and that water management groups responsible for canals have been notified of construction, if warranted. Ensure that all appropriate permits for fish salvage, amphibian salvage, beaver dam removal, etc. are in place prior to construction, as warranted.

3. **Fill Material:** Locate sources of clean gravel, cobble and rip rap, if needed, prior to construction and place onsite for stabilization and restoration activities.
4. **Workspace:** Obtain and mark additional temporary workspace, if warranted, prior to initiation of instream or directional drilling work. See Section 4.10.3 - Horizontal Directional Drilling Procedure for more information on drilling activities.
5. **Buffer Zone:** Establish a 10 m (50 foot in US) buffer zone at watercourses (CAPP et al. 2005). Maintain low vegetation or a vegetated ground mat within the buffer zone of watercourses to the extent practical by walking, storing material or constructing over the undisturbed areas. Flag the edge of the riparian buffer zone before any site disturbance activities in the vicinity of a watercourse occurs. Ensure temporary workspace does not encroach within the vegetated buffers of the watercourse. See Section 3.3 – Planning for Water and Wetland Crossings for more information on buffer zones.
6. **Contingency Plan:** Review the following subsections prior to construction, as applicable:
 - Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures
 - Section 4.10.3 – Horizontal Directional Drilling Procedure
 - Section 4.10.4 – Plans for Continuance of Drilling
 - Section 4.10.5 – Water Quality Monitoring
 - Section 6.6 – Fish Habitat
 - Section 6.10 – Permafrost
 - Section 6.12 – Spill Prevention and Management

General

7. **Equipment and Refuelling:** Review and adhere to general protection measures in Sections 6.12 – Spill Prevention and Management related to equipment washing, inspection of hydraulic, fuel and lubrication systems of equipment, equipment servicing and refuelling as well as fuel storage in proximity to watercourses.
8. **Instream Duration:** All reasonable efforts should be made to minimize the duration of instream work. If feasible, complete all instream activity within 48 hours to minimize the duration and severity of disturbance, unless site-specific conditions make this impractical.
9. **Preparedness:** Ensure all necessary equipment and materials are on site and ready for installation prior to commencing water crossing construction. Complete pipe stringing, welding, pretesting (if necessary), coating and weighting, if warranted, prior to commencement of instream construction.
10. **Canals:** Bore canals, where practical, to prevent the alteration of drainage projects (Dwg. 42 - Water Crossing – Bore / Punch Method). If a bored crossing is not feasible, ensure applicable permits, approvals or authorizations are in place prior to conducting a trenched crossing.
11. **Waste:** Do not discharge or dispose of petroleum products and/or waste into waterways or onto the ground. Ensure waste storage areas are sited to prevent blockage of drainage or risk introduction of waste material into a watercourse. The Waste Storage section in Enbridge's Operating and Maintenance Procedures Book 8 may provide additional guidance on storage requirements.

12. **Washing:** Do not wash any type of equipment or machinery in watercourses or lakes. Control wastewater from construction activities, such as equipment washing or concrete mixing, to avoid discharge directly into any body of water.
13. **Weeds:** Determine the presence of aquatic or riparian noxious weeds which construction equipment could carry forward from an infested to a clean area. Wash affected equipment and purge and clean all pumps before proceeding from one area to the next if noxious weeds or other pest species such as zebra mussels are known to be present in the area.
14. **Aquatic Pests:** Clean all equipment transferred between major watersheds to ensure that aquatic pests or weeds are not transferred.
15. **Equipment:** Ensure that the hydraulic, fuel and lubrication systems of any equipment working instream are in good repair to avoid leakage. Operate all equipment in a manner that prevents deleterious substances from entering fish habitat. Thoroughly inspect and clean equipment of oils, mud and vegetative debris before commencement of instream work.
16. **Materials:** Ensure that all material placed within the wetted perimeter of a watercourse is non-toxic.
17. **Water Intakes:** Screen the test water intakes (maximum mesh size of 2.54 mm [0.1 inch]) to prevent the entrapment of fish or wildlife and intake of debris. Ensure pump intakes do not disturb the streambed and utilize a maximum approach velocity of 0.038 m/s (0.12 feet/s).
18. **Snow:** Ensure snow graded from the construction right-of-way is stored in a manner that does not lead to increased erosion during spring melt. Ensure that melting "dirty" snow is not allowed to run-off directly into a watercourse.
19. **Snow Fills or Ice Bridges:** Plow and store snow for snowfill vehicle crossings prior to earth-moving activities (e.g., topsoil salvage and grading) to maintain clean snowfill.
20. **Survey:** Section 4.2 – Survey and Utility Locates provides guidance on survey, staking and flagging in the vicinity of watercourses.
21. **Clearing, Grubbing and Shrub Salvage:** Review and adhere to the protection measures related to clearing, grubbing and shrub salvage in vicinity of watercourses identified in Section 4.3.1 – Clearing and Grubbing.
22. **Burning:** Review and adhere to the protection measures related to burning activities identified in Section 6.5 – Fire Prevention and Control.
23. **Debris:** Remove trees, debris or soil inadvertently deposited within the high water mark of watercourses in a manner that minimizes disturbance of the bed and banks.

Topsoil Salvage and Grading Adjacent to Watercourses

24. **Erosion Control:** Implement appropriate erosion control prior to topsoil salvage as warranted.
25. **Topsoil Salvage:** Review Section 4.4.1 – Topsoil Salvage and implement the appropriate topsoil handling measures consistent with the soil characteristics and land use adjacent to the watercourse.
26. **Grading:** Review Section 4.5 – Grading and implement the applicable measures for grading in the vicinity of watercourses.

Vehicle Crossings

27. **Selection of Vehicle Crossing Method:** The final selection of vehicle crossing method will be completed by the Enbridge Construction Manager (or designate), in consultation with the Enbridge Environmental Project Lead and, when necessary, the appropriate regulatory authority. Section 3.3.1 – Planning for Water and Wetland Crossings provides additional information on vehicle crossing structures.
28. **Permits / Approvals:** Confirm with the Enbridge Environment Project Lead that all appropriate permits, approvals, authorizations and/or letters of advice are in place and that required notifications have occurred prior to the installation of vehicle crossing structures at each water crossing. Install vehicle crossing structures in accordance with the requirements of the permit, approval, authorization, etc. Section 3.1.7 – Environmental Permits / Approvals / Notifications provides guidance on applicable regulatory requirements.
29. **Signage:** Install upstream and downstream warning signage in accordance with regulatory approvals, if required.
30. **Existing Bridges:** Use existing bridges whenever possible. Secondly, clear span bridges or ice/snow bridges should be used for temporary crossings (Dwg. 36 – Vehicle Crossing – Existing Bridge and Dwg. 41 – Vehicle Crossing – Temporary Bridge).
31. **Water Use:** If water extraction is necessary for the construction of temporary vehicle crossings (e.g., ice bridges [Dwg. 37 – Vehicle Crossing – Ice Bridge]), consult the appropriate regulatory authorities to determine the maximum permissible withdrawal volume. The Enbridge Environment Project Lead will obtain all necessary permits prior to withdrawal.
32. **Ramp and Culvert:** See the mitigative measures presented on Dwg. 38 – Vehicle Crossing – Ramp and Culvert.
33. **Swamp Mat Ford:** See the mitigative measures presented on Dwg. 40 – Vehicle Crossing – Swamp Mat Ford.
34. **Snow Fills or Ice Bridges:** Use only clean ice/snow for construction of ice bridges. Additional mitigation is presented on Dwg. 37 - Vehicle Crossing – Ice Bridge and Dwg. 39 – Vehicle Crossing – Snow Fill.
35. **Snow Fills or Ice Bridges:** Do not use sand or gravel for the snow or ice bridge approaches. Construct approaches of compacted snow and ice of sufficient thickness to protect the stream and banks.
36. **Snow Fills or Ice Bridges:** Notch opening in snow or ice bridges prior to spring break-up when safe to do so and remove any associated debris from the watercourse. Stabilize banks and approaches and restore to preconstruction conditions.
37. **Bridge Removal:** Remove crossing structures and associated debris, where feasible, prior to freeze-up (for summer construction) and prior to break-up (for winter construction). Remove structures by physical means, not blasting. Crossing structures may be left in place for final clean-up (e.g., reseeded) if no other access is available and if they are designed to withstand high water flows during spring break-up. Regulatory approvals may be required to leave temporary bridges in place during spring break-up.

Weighting

38. **Concrete Coating:** Do not perform concrete coating activities near a watercourse without prior approval from the Enbridge Environment Project Lead.

Pretest

39. **Pressure Testing:** Review and implement the mitigative measures presented in Section 4.8 – Pressure Testing prior to commencing any testing.
40. **Pretest Pigging Debris:** Collect pretest pigging water and debris. Discharge the water at an acceptable location on-site in a manner that does not cause erosion and does not allow unfiltered or silted water to directly re-enter a watercourse. Dispose of the remaining debris with other construction waste, in accordance with applicable guidelines, at an approved facility.

Pipe Installation - General

41. **Trench Spoil:** As much as possible, store instream spoil on the streambank within a containment area to prevent silty runoff from wet spoil from entering the watercourse (see Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures).
42. **Trench Plugs:** Before removing hard plugs adjacent to watercourses, install soft plugs where necessary to prevent silty trench water from entering the watercourse. Dewater the trench onto stable, well vegetated uplands (see Section 4.6.2 - Dewatering Trench).
43. **Dewatering:** Follow the mitigative measures presented in Section 4.6.2 – Dewatering Trench when water is encountered in the trench or bellholes, or dewatering of the isolated crossing area is necessary.
44. **Flooding and High Flows:** Postpone instream construction if excessive flows or flood conditions are present or anticipated. Ensure that all spoil piles are moved well above the flood line. Resume activities when water levels have subsided or equipment / techniques suitable for conditions are deployed. See Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures for additional information.
45. **Water Quality Monitoring:** Implement a water quality monitoring program to assess the immediate effects of crossing construction as directed by applicable permits, approvals, authorizations, etc (see Section 4.10.5 – Water Quality Monitoring).
46. **Clean-Up:** Commence clean-up activities on trenched crossings immediately following backfill and installation of erosion control.

Open Cut Crossings

47. **Open Cut:** Trench through watercourse if dry or frozen to the bottom at the time of construction. Retain hard plugs at each bank until just prior to pipe installation. If necessary to control subsurface water and trench sloughing, install temporary soft plugs and dewater trench onto stable surfaces in a manner that does not cause erosion of soils or sedimentation of watercourses. Work from both banks, utilizing two backhoes if necessary, to expedite the crossing (Dwg. 48 - Watercourse Crossing – Open Cut Method for Dry/Frozen Watercourses and Dwg. 49 – Watercourse Crossing – Open Cut Method for Flowing Watercourses).
48. **Instream Surface Material:** Salvage the streambed surface material (e.g., cobble, boulders) and stockpile separately to cap the trench during backfilling. Place salvaged surface material above the high water mark in a manner that does not block drainage or runoff. If excavating equipment must

encroach into a watercourse during surface material salvage, operate on a sled or clean construction mats, if practicable.

49. **Trench Spoil:** Construct a temporary storage area for spoil above the high watermark of the watercourse if spoil is likely to be highly saturated. Excavate a pit or construct berms of packed earth, staked straw bales or swamp weights, if warranted, to prevent spoil from flowing back into the watercourse. Containment berms and spoil should be back from the streambank to maintain the vegetative buffer.
50. **Instream Spoil Storage:** If the watercourse is wider than what can be trenched without a hoe entering the water, consider placing instream spoil in discrete piles away from the areas of highest water velocity. Do not windrow spoil across the stream channel or block more than two thirds of the channel. Consult with the Enbridge Environment Project Lead prior to storing spoil within the channel. The Enbridge Environment Project Lead will consult with the appropriate regulatory authorities if warranted.
51. **Backfill:** Backfill the trench with original streambed material unless permits/approvals specify otherwise and restore the streambed to its preconstruction profile. When backfilling streambanks, pump the trench dry and compact the dry soil in lifts in order to prevent streambank sloughing.
52. **Erosion Control:** Install temporary erosion control measures within 24 hours of backfilling the crossing. Inspect the temporary erosion control structures on a daily basis and repair, if warranted, before the end of each working day.

Isolated Crossings

53. **Drawings:** Employ the Channel Diversion, Flume, Dam and Pump or High Volume Pump installation method when/if water is present at the time of construction and a trenchless crossing is either not feasible or appropriate. Associated drawings are presented in Section 7.0 of this EGC.
54. **Isolation:** Do not use earthen berms to isolate the crossing construction area.
55. **Flow:** Maintain 100% of downstream flow throughout instream activity period in fish-bearing waterbodies.
56. **Intake Pumps:** Ensure pump intakes do not disturb the streambed and are screened with a maximum mesh size of 2.54 mm (0.1 inch) and maximum approach velocity of 0.038 m/s (0.12 feet/s).
57. **Discharge Water:** Ensure water from flumes, pump-arounds, diversions or other methods do not cause erosion, scouring or introduce sediment into the channel.
58. **Fish Salvage:** Suspend construction activities to allow for fish salvage to occur within the isolated area prior to dewatering.
59. **Dewatering:** Dewater the segment of the watercourse between the isolation structures, if feasible and safe to do so. Pump any silt-laden water out between the dams onto stable surfaces in a manner that does not cause erosion of soils, sedimentation of watercourses, or where icing will not be a problem. Additional mitigation is presented in Section 4.6.2 - Dewatering Trench, Dwg. 2 - Dewatering Trench - Filter Bag / Vegetation and Dwg. 3 - Dewatering Trench - Straw Bale Sump.
60. **Trench Plugs:** Leave hard ditch plugs at least 3 m (10 feet) wide and leave in place to protect banks from sloughing until the crossing has been initiated in fish-bearing watercourses.
61. **Trenching:** Salvage the streambed surface material (e.g., cobble, boulders, organics) and stockpile separately to cap the trench during backfilling. Salvage the upper 0.5 m ([1.5 feet] minimum) of

clean granular material, if present, and stockpile separately from the streambed surface material and the remainder of the trench spoil.

62. **Spoil Storage:** Place salvaged surface material above the high water mark in a manner that does not block drainage or runoff. Construct a sump with berms, silt fences or straw bale filters to contain excavated instream spoil so that it does not re-enter the waterbody.
63. **Sediment Accumulation:** Remove any accumulations of silt and sediment within the isolation area that resulted from crossing construction. Spread all silt, sediment and unused trench spoil removed from the watercourse at a location above the high water mark where the materials will not re-enter the watercourse.
64. **Backfill:** Backfill streambeds to their preconstruction contour with original streambed material unless permits specify otherwise. Return salvaged streambed surface material (or material of equivalent quality) to top layer of backfill. Where granular material is encountered at the surface during excavation, cap the trench with 0.5 m (1.5 feet) of clean granular material.
65. **Erosion Control:** Install temporary erosion control measures within 24 hours of backfilling the crossing. Inspect the temporary erosion control structures on a daily basis and repair, if warranted, before the end of each working day.

Trenchless Crossings

66. **Drawings:** Review the drawings for Watercourse Crossing - Horizontal Directional Drill Method (Dwg. 47) and Watercourse Crossing - Bore / Punch Method (Dwg. 42) for additional mitigation.
67. **Horizontal Directional Drill:** Review Section 4.10.3 – Horizontal Directional Drilling Procedure and Section 4.10.4 – Plans for Continuance of Drilling prior to commencement of trenchless crossing construction so that measures can be implemented quickly in the event of a drilling mud frac-out or crossing failure.
68. **Contingency Plans:** Implement the contingency crossing method (i.e., isolation or open cut) in the event that the trenchless crossing is unsuccessful. Ensure all applicable permits, approvals or authorizations are in place for the contingency crossing method prior to implementation.
69. **Drilling Mud:** Utilize an inert, nontoxic bentonitic clay-based material as drilling mud.

Recontour Banks

70. **Streambanks:** Recontour banks to their preconstruction contour and height with salvaged surface organic material (if removed intact), and protect with coconut matting or equivalent, if necessary to stabilize. Tie restoration prescriptions into that which is adjacent on either bank. Plant willow stakes to anchor matting and provide additional stability where shrubs existed prior to construction and where warranted (Dwg. 9 - Hedge/Brush Layering and Dwg. 14 - Live Shrub Staking).
71. **Rip rap:** Install rip rap bank armouring (Dwg. 10 - Installing Rip Rap) along unstable banks with high erosion potential.
72. **Hedge/Brush Layering:** Install hedge/brush layering (Dwg. 9 - Hedge/Brush Layering), if required, to maintain or enhance fish habitat along unstable banks with high erosion potential.

Clean-Up and Reclamation

73. **Trench Breakers:** Install trench breakers if banks are composed of organic materials to reduce the risk of sloughing of unconsolidated material. Determine the location of trench breakers by onsite

investigation considering the potential for subsurface flow, erodibility of backfill material and degree of slope. See Dwg. 35 - Trench Breakers – Watercourse / Wetland for more information.

74. **Subdrains:** Install subdrains or pole drains to divert shallow groundwater flow from the construction right-of-way and to improve slope stability (Dwg. 24 - Subdrains).
75. **Restoration:** Maintain or restore natural drainage and channel configuration. Restore trenched canals and drainage ditch crossings to preconstruction conditions.
76. **Vegetation:** Replace aquatic vegetation and organic debris removed from the construction area following trench backfilling. Transplant shrubs or install willow stakes (Dwg. 14 - Live Shrub Staking) or utilize other bioengineering techniques (e.g., hedge-brush layering [Dwg. 9 - Hedge/Brush Layering]) during reclamation of streambanks where shrubbery was present prior to construction and where warranted.
77. **Approach Slopes:** Recontour and stabilize approach slopes and install temporary berms and cross ditches, and silt fences where run-off from the construction right-of-way may flow into a watercourse (Dwg. 1 - Cross Ditches and Berms, and Dwg. 11 – Installing Silt Fence). Maintain silt fences or equivalent sediment control structure in place at the base of approach slopes until revegetation of the construction right-of-way is complete.
78. **Erosion Control:** Maintain silt fences in place, where warranted, until the vegetation has become re-established.
79. **Browse Control Fencing:** Fence off reclaimed areas, where warranted, to prevent damage by cattle or wildlife.
80. **Vehicle Crossing Structures:** Remove equipment crossing structures as a part of cleanup and restoration.
81. **Seeding:** Seed disturbed banks and vehicle crossing locations with an approved cover crop and native seed mix prior to spring freshet wherever feasible. See Section 4.9 – Clean-Up and Reclamation for additional information.

4.10.2 Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures

Activity Description:

The plans presented herein describe contingency mitigative measures to minimize watercourse and wetland sedimentation attributed to periods of extreme precipitation during construction and post-construction, or excessive flow or flooding during instream construction activities.

The Environmental Inspector will notify the Enbridge Construction Manager or designate and the Enbridge Environment Project Lead that contingency measures have been initiated and will maintain a record of the location, timing and reason for implementation of the contingency plan. Appropriate regulatory authorities should be notified as soon as practical, by the Environmental Inspector or the Enbridge Environment Project Lead, that contingency measures have been implemented during construction of the pipeline.

Objective:

1. To minimize siltation of watercourses and wetlands during periods of extreme precipitation or excessive flow.

Guidelines for Implementation:

Watercourse / Wetland Siltation Contingency Measures

1. Should an extreme precipitation or streamflow event threaten, or other circumstances occur which may render the existing sediment control measures inadequate, implement the procedures outlined below progressively or individually as warranted.
 - Prohibit the operation or parking of construction equipment close to the banks of watercourses where there is a risk of bank sloughing, failure of the vehicle crossing or flooding of the work area.
 - Install additional silt fencing to minimize silt-laden water from entering a watercourse or wetland (Dwg. 11 – Installing Silt Fence).
 - Excavate cross ditches to divert runoff away from watercourses (Dwg. 1 – Cross Ditches and Berms).
 - Construct berms of subsoil, sandbags, rock, timber, straw bales or hay bales on approach slopes and/or banks to divert runoff from the construction right-of-way and onto well-vegetated lands. The location and material of the sediment control structures will be determined by the Environmental Inspector.
 - Import sandbags and place strategically to help stabilize and add height to banks to minimize flooding of nearby areas, especially where vegetation has been removed.
 - Implement the Soil Erosion Contingency Measures (see Section 4.4.4).

- The Enbridge Environment Project Lead will engage a qualified aquatic specialist/qualified environmental specialist with experience directing mitigative measures to minimize sediment deposition in watercourses related to construction activities.
2. Cease work immediately if sediment-laden water or other deleterious substances are entering a watercourse. The containment and clean-up of this material is to occur immediately (if feasible, without causing further environmental damage) to prevent it from moving downstream.

Flood and Excessive Flow Contingency Measures

3. Monitor the weather conditions on a daily basis. If a major storm is predicted or occurs, the Environmental Inspector or qualified aquatic specialist/qualified environmental specialist will inspect all watercourse / wetland crossings where construction is in progress or has been completed, to determine whether additional corrective actions are needed.
4. At watercourses / wetlands where an isolated crossing method is preferred, the proposed isolation crossing techniques may not be feasible during periods of excessive flow or unusually wet seasons. Excessive flows are those greater than the seasonally expected normal range based on existing and predicted flow data.
5. Implement the following contingency measures progressively or individually, as warranted, if excessive flow or flood conditions are anticipated prior to commencing watercourse crossing construction.
 - Assess the capability of the proposed crossing method to handle the potential flow rates and have backup equipment available. Proceed with the proposed crossing method if it is determined to be adequate by the Environmental Inspector, in consultation with the Enbridge Construction Manager and Contractor.
 - If determined by the Environmental Inspector that the proposed crossing method is not adequate to handle the potential flow, defer water crossing construction to a later time when the flow rate has subsided.
 - Alternatively, request the appropriate regulatory authority for permission to use the approved alternative crossing method.
 - The Enbridge Environment Project Lead will engage a qualified aquatic specialist/qualified environmental specialist with experience directing mitigative measures to minimize sediment deposition in watercourses related to construction activities.
6. Implement the following contingency measures progressively or individually, as warranted, if excessive flow or flood conditions should occur during watercourse crossing construction.
 - Withdraw all equipment or tanks containing fuel, oil or other hazardous materials from potential flood areas.
 - Relocate all topsoil piles at the direction of the Environmental Inspector.
 - Relocate spoil piles, to the extent feasible, to a position above the anticipated high water level.
 - Remove all stationary and mobile equipment deployed at the crossing site to a safe area above the anticipated high water level.
 - Remove any instream flume or dam equipment that may impede streamflow, if safe to do so.

- Evaluate vehicle crossing structure to determine whether adequate free-board is present on bridges and adequate capacity is available in culverts. Take corrective measures as appropriate to avoid flooding of adjacent lands.
- Implement the Soil Erosion Contingency Measures (see Section 4.4.4).

4.10.3 Horizontal Directional Drilling Procedure

Activity Description:

Horizontal directional drilling involves using a slant drill to drill under a watercourse and the approach slopes. An accidental release of drilling mud or sediment laden water into a watercourse during the construction of a trenchless crossing could adversely affect the environment. Both the Contractor and Enbridge must be diligent during all aspects of a horizontal directional drill to ensure that the potential for an instream drilling mud release is minimized or, if it does occur, that environmental impacts are minimized.

Objectives:

1. To minimize the risk of an instream drilling mud release during horizontal directional drilling of watercourses.
2. To minimize environmental impacts in the event an instream drilling mud release does occur.

Guidelines for Implementation:

1. **Environmental Considerations:** Use a horizontal directional drill method for large watercourses that are environmentally sensitive to instream or streambank activity, or where conventional methods are not feasible due to engineering or navigational constraints (Dwg. 47 – Watercourse Crossing – Horizontal Directional Drill Method).
2. **Permits, Approvals and Notifications:** The Enbridge Environment Project Lead will obtain all necessary horizontal directional drill permits and approvals from the appropriate regulatory authorities, and notify appropriate authorities prior to construction. Inconsistencies between conditions of different approvals will be resolved before construction.
3. **Contingency Measures:** Develop project-specific (or watercourse-specific) contingency measures for the inadvertent release of drilling mud into watercourses or land, as required, in consultation with the Enbridge Environment Project Lead, Environmental Inspector, Enbridge Construction Manager and a qualified aquatic specialist/qualified environmental specialist.
4. **Contingency Crossing Methods:** Implement the contingency crossing plan if the horizontal directional drilling method is unsuccessful. Alternative crossing methods such as open-cut or isolation may create instream disturbances. Ensure that appropriate permits/approvals are in place and notify the appropriate regulatory authorities according to the permit conditions. Ensure that supervisory personnel are aware of this contingency plan prior to commencement of drilling activity (Dwg. 44 – Watercourse Crossing – Dam and Pump Method and Dwg. 45 – Watercourse Crossing – Flume Method).
5. **Clean-up Measures:** Develop clean-up measures prior to drilling. The measures will be prepared by the drilling Contractor in consultation with the Enbridge Environment Project Lead and Environmental Inspector, when warranted. The Enbridge Construction Manager will ensure that Enbridge Lands and Right-of-Way have acquired the appropriate access approvals in the event the release area is off the construction right-of-way.

6. **Pre-Construction Meeting:** At a minimum, environmental issues or concerns, mitigative measures, contingency measures and water quality monitoring requirements will be reviewed with the Enbridge Construction Manager, Environmental Inspector, available crew members, contractors and other representatives before project construction starts. Additional meetings may be required before specific crossings so that environmental considerations specific to the crossing are clear and understood. Review the contingency measures for potential problems resulting from crossing method failures or adverse conditions, taking into account any instream restricted activity periods.
7. **Materials:** Before any crossing work starts, stockpile all required materials on site. Install surface water runoff and seepage controls before construction and maintain throughout installation.
8. **Drilling Equipment:** Set up drilling equipment a minimum of 10 m (50 feet in the United States [US]) from the edge of the watercourse (e.g., outside the riparian buffer zone). Do not clear or grade within this 10 m (50 feet in US) buffer area (see Section 4.3.1 – Clearing and Grubbing).

Horizontal Directional Drilling

9. **Soil Salvage and Protection:** Salvage the topsoil in the drilling workspace and store to the side, away from the work area.
10. **Containment Structures:** Construct or install a containment structure, if required, to capture drilling mud.
11. **Monitoring:** The water quality monitoring crew (or the Environmental Inspector, if no crew is available) will monitor instream water quality and provide progress information to the Enbridge Construction Manager and Environmental Inspector. Refer to Section 4.10.5 – Water Quality Monitoring for information on implementing a water quality monitoring program.
12. **Drilling Mud:** Use water from an approved source (typically the watercourse) in accordance with applicable permits to mix drilling mud. The mud mix must be appropriate for aquatic life in the stream (e.g., pure bentonite clay with no unapproved additives).
13. **Drilling Mud Additives:** The Enbridge Environment Project Lead, in consultation with the Enbridge Construction Manager, will develop a list of additives and obtain approvals for their use from the appropriate regulatory authorities before drilling commences. The list will be forwarded to the Environmental Inspector prior to the commencement of drilling. No toxic additives will be allowed. The Material Safety Data Sheets will be provided to the Enbridge Environment Project Lead who will provide it to the applicable regulators, when requested.
14. **Drilling Mud Storage:** During drilling operations, prevent mud and slurry from flowing into the stream or adjacent wetlands by storing it away from the streambank within an earthen berm sediment control structure, tanks or other containment methods.
15. **Fluid Containment:** The Environmental Inspector will visually monitor the work area and entry point during drilling to detect potential losses to the surface. If losses are detected where a watercourse may be affected, either reduce the annular pressure and monitor turbidity in the watercourse or stop drilling. Contain, clean up and transfer drilling mud back to the rig before drilling operations resume. Section 4.10.4 – Plans for Continuance of Drilling provides additional information.
16. **Dewatering:** When dewatering containment pits, sumps or ditches, vacuum drilling mud into a hydrovac truck and dispose of at an approved facility or as per applicable regulatory requirements. Do not permit discharge of contaminated fluids (e.g., drilling mud) on or off site without appropriate regulatory approvals.

17. **Demobilization:** When practical, replace topsoil and clean-up/reclaim the site after drilling equipment has been removed.
18. **Clean-up:** Reclaim entry and exit sumps that contained drilling mud immediately after completion of drilling and remediate to meet appropriate regulatory authority guidelines.

Emergency Response

19. **Contingency Measures:** In the event of an inadvertent mud release, review and adhere to the procedures presented in the project-specific contingency measures for inadvertent releases to water or land.
20. **Emergency Response Equipment:** Ensure that materials and equipment required for emergency response are onsite in sufficient quantities during drilling operation to contain any inadvertent drilling mud releases. The materials may include, but are not limited to:
 - Sandbags;
 - Silt fence, silt curtain;
 - T-bar posts;
 - Post pounders;
 - Straw bales;
 - Light towers;
 - Shovels;
 - Floating sediment boom;
 - 6 mil polyethylene;
 - Vacuum trucks;
 - Boat, where deemed necessary; and
 - Trash pumps with sufficient lengths of leak free hose and suction heads.
21. **Hydrovac Truck:** Maintain hydrovac truck(s) onsite during pullback operations.
22. **Water Quality Sampling Equipment:** Maintain the appropriate water quality sampling equipment onsite during drilling operation to ensure that accurate water quality samples are taken (see Section 4.10.5 – Water Quality Monitoring).
23. **Emergency Response Equipment:** Ensure that appropriate communication devices or methods are available for use during monitoring operations.
24. **Drilling Mud Losses:** Suspend drilling operations immediately if excessive loss of drilling mud is noted and conduct a detailed examination of the drill path and surrounding area for evidence of a release to the surface. Immediately notify the Enbridge Construction Manager and the Environmental Inspector. If a frac-out is detected, the Contractor will implement strategies to seal or plug off fractures, to limit the loss of circulation. The Contractor will also implement a procedure for tracking fluid loss and for sealing frac-outs.
25. **Drilling Mud Release - Terrestrial:** If the release is to land, and if the amount of mud released is not great enough to allow practical collection, the mud release will be allowed to dry and dissipate naturally. The Environmental Inspector will notify the Enbridge Construction Manager and the

Enbridge Environment Project Lead. The Enbridge Environment Project Lead, or their designate, will notify the appropriate regulatory authorities. Contain and further prevent drilling mud from entering the watercourse from near shore areas by installing a berm of subsoil, sandbags or other material approved by the Environmental Inspector.

26. **Drilling Mud Release - Instream:** The water quality monitoring crew will conduct instream water quality sampling as outlined in the project-specific monitoring plan, and as advised by the Environmental Inspector, to determine whether a frac-out has caused fluids to enter the watercourse (see Section 4.10.5 – Water Quality Monitoring). If the drilling mud release enters a watercourse, implement continuous water quality monitoring as per the monitoring plan. If turbidity results exceed applicable regulatory thresholds, the Water Quality Monitors will immediately notify the Environmental Inspector who will notify the Enbridge Construction Manager and the Enbridge Environment Project Lead. The Enbridge Environment Project Lead, or their designate, will notify the appropriate regulatory authorities. Instream and near-shore containment/clean-up objectives include the following:

Instream:

- Divert streamflow around the mud release to the extent practical, if approved;
- Install silt fencing around the exit point(s), if feasible;
- Remove mud from the watercourse by pumping, using shovels; using an excavator bucket; sediment boom; and/or silt fencing; and
- Dispose of mud in accordance with applicable regulatory requirements.

Onshore:

- Use a hydrovac truck, silt fencing, shovels and other effective equipment to contain and dispose of the drilling mud;
 - Contain the mud release immediately to limit the area affected and prevent the mud from entering the watercourse;
 - Clean-up the area; and
 - Dispose of mud in accordance with applicable regulatory requirements.
27. **Drilling Mud Release:** In consultation with the appropriate regulatory authorities, leave mud in place if current streamflow levels inhibit removal operations or removal will result in unacceptable terrain or instream damage. Before allowing filtered water to enter the watercourse, ensure that turbidity and/or total suspended solids levels are within approved regulatory thresholds. Prepare a report summarizing the events leading up to the release as well as measures taken following the release to reduce impacts on the environment. The report may be a collaborative effort between the Environmental Inspector, Enbridge Construction Manager, Drilling Contractor and water quality monitors, or individual reports may be submitted from the aforementioned personnel. A copy of this report(s) will be provided to the Enbridge Environment Project Lead.
28. **Continuance of Drilling:** Refer to Section 4.10.4 – Plans for Continuance of Drilling before resuming directional drilling if a drilling mud release has occurred.
29. **Contingency Crossing Method:** The Enbridge Environment Project Lead will notify the appropriate regulatory authorities if the horizontal directionally drilled crossing was unsuccessful and the contingency crossing method will be implemented

4.10.4 Plans for Continuance of Drilling

Activity Description:

If an accidental release of drilling mud during horizontal directional drilling occurs, follow the guidelines below before resuming drilling.

Objective:

1. To reduce the likelihood of further release of drilling mud during a water crossing horizontal directional drill.

Guidelines for Implementation:

1. Resume directional drilling (see Section 4.10.3 – Horizontal Directional Drilling Procedure) only if the potential for significant adverse impacts to the environment is low, as determined by the Enbridge Environment Project Lead, Environmental Inspector, inspection staff, qualified aquatic specialist/qualified environmental specialist, drilling or geotechnical consultant (if warranted) and the drilling Contractor.
2. The Enbridge Environment Project Lead will consult with the appropriate regulatory authorities and obtain all necessary approvals, if warranted, should any modifications to the watercourse crossing technique or instream activities be required. Generally, contingency plans should be developed and approved during the project planning phase to avoid time delays during construction.
3. Implement measures to reduce the potential for further release of drilling mud into the watercourse or onto land. Appropriate measures will vary depending on the lessons learned during the previous drill attempt.
4. Progressively implement the following measures to prevent the further release of drilling mud into the watercourse or onto land, while ensuring adequate containment and control of the previous release.
 - Ensure that appropriate structures, materials, equipment and personnel are in place and available in the event of a subsequent release of drilling mud.
 - Reduce drilling mud pressures, if practical.
 - Plug fissures/fracture with inert sealers or plugging agents pumped into the drill hole and leave undisturbed for an appropriate period of time whereupon drilling will be resumed. If the sealing agents are not successful, drilling will be suspended and the plan reviewed and revised.

Additional mitigative measures may be presented in the project-specific Environmental Protection Plan, or may be identified in consultation with the Environmental Inspector and Enbridge Environment Project Lead.

4.10.5 Water Quality Monitoring

Activity Description:

Water quality monitoring involves assessing or measuring turbidity (Nephelometric Turbidity Units) and total suspended solids during pipeline water crossings. Water quality monitoring is implemented to detect sedimentation or potential drilling mud releases into the watercourse. A change in water quality due to sedimentation or a frac-out may negatively impact downstream aquatic resources.

Water quality monitoring will be implemented as directed by regulatory approvals, or at the direction of the Enbridge Environment Project Lead, in consultation with the Environmental Inspector and Enbridge Construction Manager.

*** In this section, the term 'water crossing' implies any type of construction technique including open cut, isolated open-cut and trenchless (i.e., horizontal directional drill or bore) techniques. ***

Objectives:

1. To enhance the potential for early warning of a potentially harmful elevation of total suspended solids resulting from water crossing construction.
2. To assist in adjusting construction activities in response to monitoring results to minimize the potential impact of sediment mobilizations.
3. To help document the potential extent of impacts should an exceedance of an established threshold of total suspended solid concentrations occur.
4. To assist with project-specific regulatory compliance.

Guidelines for Implementation:

1. **Water Monitoring Personnel:** Utilize a qualified water quality monitoring crew to undertake water quality monitoring during construction. The water quality monitoring crew will be selected by the Enbridge Environment Project Lead prior to construction. During construction, the water quality monitors will report to the Environmental Inspector, who in turn will consult with and report to the Enbridge Environment Project Lead, Enbridge Construction Manager and Drilling Contractor, as necessary.
2. **Supervisory Personnel:** Supervisory personnel will be onsite at all times during water crossing construction to ensure that emergency response measures, if warranted, are implemented immediately and effectively. Enbridge will also assign inspection personnel to the site during all phases of water crossing construction.
3. **Emergency Response Personnel:** Ensure additional personnel are available to assist in emergency response implementation in the event of a sedimentation event. Water quality monitoring personnel are expected to continue monitoring activities if a frac-out occurs to document the impacts and extent of the frac-out. The water quality monitoring crew should not be used to supplement crews implementing the emergency response.

4. **Preconstruction Meeting:** The Environmental Inspector and water quality monitoring crew will participate in a preconstruction start-up meeting (generally held just prior to the onset of a water crossing). Discussion items will include a review of the monitoring plans, schedules, regulatory commitments and contingency measures for handling high sediment loads. Preconstruction meetings are generally held for each water crossing (see Section 4.10.1 – Water Crossings, Section 4.10.3 – Horizontal Directional Drilling Procedure and the Enbridge Specification for Pipeline Construction [Canada] - Horizontal Directional Drilling for additional information).
5. **Monitoring Plan:** Document the following on an individual watercourse basis as part of the water quality monitoring plan:
 - Locations of sampling transects upstream and downstream of the water crossing;
 - Sampling depths; and
 - Sampling frequency, duration and procedures.
6. **Monitoring Plan:** The water quality monitoring crew will commence water quality monitoring prior to water crossing construction activities to record background/baseline data. They will monitor water quality on a continuous basis during water crossing construction. They will continue monitoring following construction activities until the Environmental Inspector, in consultation with a qualified aquatic specialist/qualified environmental specialist and the Enbridge Construction Manager, determines otherwise.
7. **Communications:** Maintain communication between the Environmental Inspector, Enbridge Construction Manager, construction crew and water quality monitoring crew during water crossing construction, to confirm that sediment monitoring is completed professionally and safely, and that the data collected meets the requirements of Enbridge and appropriate regulatory authorities.
8. **Communications:** The water quality monitoring crew will inform the Environmental Inspector of ongoing monitoring results frequently during construction and provide advice about the significance of the information. The information may provide guidance for maintaining or modifying construction activities, if required, in consultation with the Environmental Inspector and the Enbridge Construction Manager.
9. **Communication:** During trenchless crossing construction, position personnel equipped with appropriate communications devices (e.g., hand held radios) at the most advantageous locations to observe any sign of a drilling mud release to the surface or within the watercourse.
10. **Communication:** Share monitoring information with the appropriate regulatory authorities upon request, or when a problem is identified. The Enbridge Environment Project Lead is responsible for regulatory liaison, unless a designate is assigned.
11. **Sampling Methods:** During ice-free, open water conditions, sample water by boat, from shore, or by wading into the water (if depth and flows allow and it is safe to do so).
12. **Sampling Methods:** Conduct all manual water quality monitoring during daylight conditions when boat operation or wading (or walking along banks where moderate flows are encountered) is required or in locations where artificial lighting is provided. If 24 hour monitoring is required (e.g., during horizontal directionally drilled crossings) and it is not feasible for personnel to monitor at night, discuss the use of alternative monitoring options (e.g., data loggers) with the Enbridge Environment Project Lead.
13. **Sampling Methods:** On watercourses with ice cover, onsite conditions may allow visual monitoring of water quality by observing open reaches or, if safe (e.g., if ice is thick enough), by augering and

maintaining an open hole in the ice for sampling. Continue to evaluate ice conditions throughout the monitoring program. If open reaches are not available for monitoring and ice cover is not safe, notify the appropriate regulatory authorities. Discuss alternative options, if warranted.

14. **Sampling Methods:** If the watercourse is frozen to the bottom, onsite conditions will not allow visual monitoring of water quality by observing open reaches or by augering and maintaining an open hole in the ice for sampling. Continue to visually monitor areas where early detection of a frac-out may be possible (e.g., at the base of coniferous overhanging the watercourse).
15. **Sampling Methods:** The water quality monitoring crew will analyze the turbidity samples collected using a portable turbidity meter. They will calibrate the turbidity meter prior to the commencement of water crossing construction and as required throughout the duration of construction activities.
16. **Turbidity – Total Suspended Solids Relationship:** Use turbidity, expressed as Nephelometric Turbidity Units, to provide a surrogate measurement of total suspended solids in mg/L, since turbidity is more readily measured in the field. Use the predicted relationship between turbidity and total suspended solids as a tool during the monitoring program to predict real-time total suspended solids values during water crossing construction.
17. **Sampling Methods:** For quality assurance and quality control, duplicate sampling of turbidity will be completed periodically (e.g., daily) at selected transects and compared with the initial reading to ensure that measurements are consistent. If warranted, replicate total suspended solids samples may also be analyzed.
18. **Sampling Methods:** The Environmental Inspector will collect written notes and take digital photographs of excavation, drilling and containment measures each day and during any events that could affect turbidity.
19. **Changes to Sampling Frequency:** Ensure any potential changes to the frequency of turbidity sampling on site are reviewed with the Environmental Inspector prior to implementation. Ensure sampling frequency is sufficient to describe spatial and temporal changes in water quality and do not compromise the integrity of the water quality monitoring program.
20. **Frac-Out Monitoring:** At horizontal directionally drilled crossings, visually monitor both onshore and instream portions of the drill path and surrounding area for signs of drilling mud release. Determine the size of the area to be monitored by evaluating geotechnical conditions (i.e., amount of fracturing, type and depth of substrate) and drilling conditions (i.e., depth of drill path, distance between watercourse and entry and exit points) in consultation with the Environmental Inspector and/or qualified geotechnical specialist, if warranted. Frac-out monitoring should be undertaken continuously throughout drilling activities, and efforts should be increased if/when the Drilling Contractor indicates mud returns are not consistent (e.g., mud is being lost).
21. **Sedimentation Events:** In the event of sedimentation (e.g., frac-out, release of sediment laden water from an isolated crossing), the water quality monitoring crew will continuously monitor water quality until background or near-background turbidity levels are restored, unless otherwise advised by the Environmental Inspector or applicable regulatory requirements. The water quality monitoring crew will maintain contact with the Environmental Inspector throughout the event and may provide input on mitigative options. The Environmental Inspector, in consultation with the Enbridge Construction Manager and Enbridge Environment Project Lead, if warranted, will make appropriate decisions on the continuance of construction and/or modification of methods.
22. **Sedimentation Events:** In the event of sedimentation, collect total suspended solid samples to correspond with turbidity sampling in order to provide an accurate record of the sedimentation

event. A comparison of results from all transects against applicable regulatory thresholds will be needed to determine if total suspended solid concentrations thresholds were exceeded. After the total suspended solids sample results are obtained from a laboratory, a relationship between total suspended solids and turbidity can then be determined. This relationship then allows turbidity results to be retroactively compared to exceedance criteria for total suspended solids.

4.11

WETLAND CROSSINGS

Activity Description:

Pipeline construction has the potential to affect habitat, hydrologic and water quality functions of wetlands. Construction activities may be minimized in wetlands and/or special construction techniques may be necessary to reduce disturbance to plants, soils and wetland function (e.g., hydrologic, water quality and habitat).

Objectives:

1. To minimize siltation, protect riparian habitat, maintain wetland function and prevent water pollution/contamination during construction of wetlands.
2. To restore wetlands to as close to preconstruction condition as practical.

Guidelines for Implementation:

1. **Permits and Notifications:** ensure the Enbridge Environment Project Lead has obtained all necessary permits and submitted notifications, if required, prior to construction in wetlands. See Section 3.1.7 – Environmental Permits / Approvals / Notifications for additional information (Dwg. 51 – Wetland Crossing – Open Cut Method for Open Water (Frozen), Dwg. 52 – Wetland Crossing – Open Cut Method for Peatlands (Frozen) and Dwg. 53 – Wetland Crossing – Open Cut Method with Push-Pull).
2. **Schedule:** Attempt to schedule construction in wetlands during late fall and winter when wetlands are most likely at their driest or frozen. Complete all work as quickly as practical to reduce the duration of disturbance.
3. **Rare Plants:** If any rare plants or rare ecological communities are identified along wetland margins (e.g., riparian areas) during preconstruction surveys, implement the appropriate mitigation prior to vegetation clearing activities. Appropriate mitigative measures will be determined by the Enbridge Environment Project Lead, in consultation with a qualified botanist/biologist and the appropriate regulatory authorities, if warranted.
4. **Wildlife:** In consultation with the Enbridge Environment Project Lead, schedule vegetation clearing or other construction activities involving heavy equipment outside of the migratory bird restricted activity period and restricted activity periods for wildlife species of concern. Wetlands identified as having high quality wildlife habitat potential as identified in the project wildlife survey and by the appropriate regulatory authority may not be precleared or premowed, unless otherwise approved by the appropriate regulatory authority. However, elsewhere, construction activities may proceed within the nesting period where the area has been precleared or premowed prior to the onset of the migratory bird nesting period or species-specific restricted activity period provided a recently completed nest survey has determined that no active nests are present.

5. **Narrow Down Fencing:** Where feasible, narrow down the proposed area of disturbance (e.g., right-of-way) and avoid adjacent wetlands by using fencing, stakes or flagging. Clearly identify the wetland boundaries and limit traffic in the vicinity of the fenced, staked or flagged area. See Dwg. 18 - Narrow Down Fencing for details. Generally, narrowing down the right-of-way is not feasible in peatlands.
6. **Delineation:** Where wetlands are unavoidable (e.g., the right-of-way crosses a wetland), clearly delineate the right-of-way boundaries using fencing, staking or flagging. Identify the start and end points of the wetland and limit disturbance or encroachment beyond the fenced, staked or flagged construction right-of-way.

General

7. **Spill Prevention:** Ensure planned activities adhere to the following spill prevention measures:
 - Do not store fuel tanks, containers or stationary equipment within the normal high water mark of wetlands, unless secondary containment is provided;
 - Ensure double-walled fuel tanks have a tertiary containment;
 - Do not permit refuelling or servicing of equipment within the normal high water mark of wetlands except where secondary containment is provided; and
 - Ensure equipment used for construction within the wetland is well maintained and free of fluid leaks.
8. **Spills:** In the event of a spill, immediately implement measures to stop, control the migration of, and clean up the spilled substance as outlined in Section 6.12 – Spill Prevention and Management.
9. **Buffer Zones:** Protect and maintain shallow shoreline areas that contain emergent vegetation (e.g., graminoids) by establishing buffer zones. Section 3.3.4 – Riparian Areas and Buffer Zones provides information on the establishment of wetland buffer zones. Generally, a 10 m (50 feet in the United States [US]) buffer zone is to be established at all wetlands.
10. **Workspace:** Locate all additional work areas (such as staging areas, grade/borrow areas for ramping, additional spoil storage areas) a minimum 10 m (50 feet in US), if possible, from wetland boundaries except where adjacent upland consists of actively cultivated land or other disturbed land.
11. **Equipment:** Use wide-track equipment, low-ground pressure equipment or conventional equipment operated from swamp mats, rig mats or corduroy ramps as per recommendations in Section 3.3.1 - Determining Vehicle Watercourse Crossing Methods when working on saturated soils during nonfrozen conditions. The use of corduroy in wetlands will be determined by the Environmental Inspector. The Environmental Inspector will consult with the appropriate regulatory authority (and obtain approval, if required) prior to using merchantable timber as rollback or corduroy. See Section 4.3.2 – Merchantable Timber Salvage and Section 4.3.3 – Nonmerchantable Timber for additional guidance on corduroy. Remove corduroy used in wet areas upon completion of construction.
12. **Vegetation Salvage:** Salvage flagged or fenced live trees or shrubs from banks of wetlands if requested by the Environmental Inspector or noted in the project-specific Construction Line List. Store salvaged trees and shrubs on the side of the construction right-of-way in a manner such that they do not dry out before replanting during restoration.

13. **Culverts:** Install temporary culverts, if warranted, to prevent grade or trench spoil or salvaged surface materials from blocking natural drainage and causing ponding.
14. **Weather:** Postpone construction in wetlands if excessive rain or flood conditions exist or are anticipated, and construction methods cannot be modified to cope with the increased water. If thawed soil conditions occur during winter construction, implement the procedures related to Wet / Thawed Soils in Section 6.18.

Access

15. **Access / Shoo-flies:** Follow the mitigative measures related to vehicle crossings and shoo-flies at wetlands as noted in Section 3.2 – Determining Temporary Access Roads and Shooflies and Section 3.3 – Planning for Water and Wetland Crossings.
16. **Access (Frozen):** Remove or pack snow over the work side and spoil side in early winter to increase frost penetration into the soil in order to protect the ground surface, fill in depressions and limit compaction and rutting. Blade off any additional snow to the sides of the construction right-of-way.

Clearing and Grading

17. **Grubbing (Wetlands):** Delay grubbing on slopes adjacent to a wetland or within 10 m (50 feet in US) of the banks until construction of a crossing is imminent. Grubbing will be limited to the trench line within the vegetated buffer zone. Grub the spoil side and travel lane only if absolutely necessary.
18. **Clearing and Grading:** Review and adhere to protection measures related to clearing and grading in vicinity of wetlands identified in Section 4.3 – Clearing and Section 4.5 – Grading.

Erosion Control

19. **Sediment Barriers:** Install a temporary sediment barrier (e.g., silt fence, silt curtain), where warranted, to eliminate the flow of sediment from clean spoil piles and disturbed areas into nearby wetlands.
20. **Maintenance:** Inspect the temporary erosion control structures on a daily basis and repair, if warranted, before the end of each working day.

Salvage of Upper Surface Material

21. **Test Holes:** Consider excavating test holes on the trench line to determine mineral soil/organic content and water table depth. This may help to identify surface material depth, trench water management needs, potential for sloughing and other factors that may affect construction to help with planning an effective crossing.
22. **Salvage Depth (Mineral Soils):** Salvage the upper surface material of all mineral wetlands to a maximum depth of 40 cm (16 inches), or to the depth of colour change where there is less than 40 cm (16 inches) of surface material, or as advised by the Environmental Inspector.
23. **Salvage Depth (Peatlands):** Salvage the upper 40 cm (16 inches) of peat material during frozen and nonfrozen conditions. In some instances the total depth of peat will be salvaged, as per project-specific recommendations or the advice of the Environmental Inspector. Do not salvage peat material deeper than 40 cm (16 inches). Areas of peat greater than 40 cm (16 inches) in depth will be trenched with a single lift to the total depth of peat or trench depth, whichever is encountered first. Avoid admixing by maintaining separation between the topsoil windrows and the subsoil.
24. **Salvage Width (Mineral Soils):** Adhere to the boundaries of wetlands and salvage widths at the time of construction, unless otherwise advised by the Environmental Inspector. Reduce the salvage

widths within wetlands to the width of the trench area. Salvage width should be narrow enough to minimize disturbance, and wide enough to prevent topsoil/subsoil mixing in the event of trench instability.

25. **Salvage Width (Peatlands):** Adhere to the boundaries of wetlands and salvage widths at the time of construction, unless otherwise advised by the Environmental Inspector. Wetland crossings that are dry or frozen at the time of construction will typically use trench line only salvage unless otherwise advised by the Environmental Inspector.
26. **Shallow Peatlands:** Salvage and store peat separately from the underlying mineral material and replace in order such that the peat material rather than the underlying soils remain on the surface to ensure that future drainage through the shallow peat material is not impeded.
27. **Storage:** Store salvaged surface material at a sufficient distance from the trench so that it does not slump or flow into the trench, if trench instability occurs.

Trenching and Lowering-In

28. **Wetland Crossing Method:** The selection of pipeline wetland crossing methods should be determined by the Enbridge Construction Manager in consultation with the Enbridge Environment Project Lead and, when necessary, the qualified wetland specialist/qualified environmental specialist and/or appropriate regulatory authorities. Section 3.3.3 – Planning for Wetland Crossings provides additional information on the selection of an appropriate wetland pipeline crossing method.
29. **Open Trench:** Plan trenching, installation and backfilling to minimize the period of open trench.
30. **Spoil Storage:** Store excavated material in a manner that does not interfere with natural drainage patterns. If necessary, haul spoil to a nearby location for storage (e.g., for wet spoil that does not stack well).
31. **Dewatering:** Do not dewater any wetlands. Although temporary dewatering may be required during trenched wetland crossings, water should not be permanently removed from the wetland. Options for trench dewatering within wetlands should be discussed with the Environmental Inspector, Enbridge Construction Manager, Enbridge Environment Project Lead and, when required, the appropriate regulatory authority in order to develop the appropriate plans. Temporary sloughs under cultivation or hayed may be dewatered, if warranted. Contact the Environmental Inspector and Enbridge Environment Project Lead before any such dewatering. Direct dewatering discharge onto a well vegetated upland area with appropriate erosion protection and flow dissipation, if warranted (Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation) to prevent silt-laden water from flowing into wetlands.
32. **Trench Water:** If deep water is encountered, salvaged surface material and trench spoil may be used as a containment berm/barrier (Dwg. 50 – Wetland Crossing – General). Consider using spoil material from the trench line as a containment barrier where salvaged surface material is not able to support a berm/barrier. Alternate dam devices such as an Aquadam or bag weights are other options (Dwg. 50 – Wetland Crossing – General). Pump excess water from work area and trench to opposite side of berm or work ramp within the wetland.
33. **Trench Plugs:** Where the open trench could dewater a wetland or flood other areas, leave temporary hard or soft plugs at identified locations to prevent the flow of water along the trench. Ensure the trench does not provide a drainage conduit into or out of wetland during or after construction. Install trench plugs if warranted (Dwg. 34 – Trench Breakers / Ditch Plugs).

34. **Buoyancy:** Do not perform concrete coating activities near a wetland without prior approval from the Enbridge Environment Project Lead.
35. **Trench Breakers:** Install trench breakers, where warranted, in the adjacent upland at the edge of perched wetlands to prevent the pipe trench from acting as a drain (Dwg. 35 – Trench Breakers – Watercourse / Wetland).

Trenchless Crossings

36. **Trenchless Crossings:** Obtain and mark workspace areas at wetlands to be horizontal directional drilled in order to allow for monitoring, containment and clean-up of an inadvertent release (frac-out) of drilling mud.
37. **Drilling Mud:** Follow the drilling mud frac-out monitoring and other measures provided in the Horizontal Directional Drilling Procedure (Section 4.10.3) during horizontal directional drilling.

Backfilling

38. **Backfilling:** Backfill the trench with excavated trench spoil. Remove any excess trench spoil to an upland location approved by the appropriate regulatory authorities. Ensure that all wetlands trenched during frozen conditions are backfilled prior to spring break-up.
39. **Backfilling:** Backfill peat and mineral soils in the appropriate order such that peat material rather than the underlying mineral soils remain at the surface so that future drainage through the shallow peat material is not impeded.
40. **Erosion Control:** Install temporary erosion control structures (e.g., silt fences and/or straw bales) within 24 hours of backfilling the wetland crossing. Ensure silt fences have been installed properly, are solid and filter fabric is tight (Dwg. 11 – Installing Silt Fence).

Clean-Up and Restoration

41. **Mineral Wetlands:** Replace salvaged topsoil and upper soil material over the salvaged area. Ensure wetland contours and drainage channels are restored and a permanent trench crown is not created. Replace salvaged topsoil or upper surface material as evenly as possible over the salvaged area.
42. **Peatlands:** Leave a low trench crown during clean-up of peatlands to allow for settlement of backfill. Leave breaks in the trench crown at obvious drainages and leave frequent breaks in the trench crown in any area identified as peatland to reduce the risk of ponding water on or adjacent to the pipeline subsequent to tree removal.
43. **Recontour:** Recontour the wetland and restore surface hydrology patterns to as close to preconstruction profile as practical during reclamation.
44. **Mulch:** Spread mulch to a depth of no more than 5 cm (2 inches) along the construction right-of-way in areas classified as treed peatlands.
45. **Access Removal:** Remove swamp mats, matting, geotextiles and subsoil ramps, if used to cross wetlands, unless otherwise advised by the Environmental Inspector, where access may be necessary for clean-up. Remove all vehicle crossings upon the completion of the construction program.
46. **Revegetation:** If required, replant salvaged trees/shrubs along the disturbed margin(s) of the wetland as instructed by the Environmental Inspector.
47. **Revegetation:** If required, install willow staking along the wetland to stabilize disturbances and reduce sedimentation risk to wetland (Dwg. 13 – Live Shrub Cuttings Bundles and Dwg. 14 – Live Shrub Staking) where shrubs were present prior to construction and where advised by the Environmental Inspector. Where practical, allow mineral wetlands and peatlands to naturally regenerate following construction.

48. **Seeding:** Do not seed mineral wetlands or peatlands (i.e., allow for natural regeneration) unless approved by project-specific authorizations. Consult with the Enbridge Environment Project Lead to determine if seeding of the riparian areas adjacent the wetland is required. Seed with an appropriate native or riparian seed mix if it is deemed warranted.

Post-Construction

49. **Erosion Control Removal:** Remove any sediment barriers that remain after the disturbed area is revegetated and the area is stable.
50. **Maintenance:** Schedule routine operations and maintenance activities in mineral wetlands and peatlands during frozen conditions, where possible.

6.1

ACCESS DEVELOPMENT AND CONTROL

Activity Description:

The upgrading of existing access routes and creation of new permanent or temporary access routes for a project have the potential to impact the environment. Maintaining a balance between the requirements for the safe construction of pipelines and the protection of habitat and associated resource use through access development or access management contingency measures can reduce the effects of increased access.

Objectives:

1. To restrict traffic along the right-of-way and access roads during construction and post-construction activities to reduce potential interaction or impacts to environmentally sensitive areas and reclamation activities.
2. To respect existing and traditional access corridors and limit access-related conflicts with other resource users in the area.
3. To limit the line-of-sight and ease of access along the right-of-way by natural predators (e.g., wolves).
4. To avoid or limit disturbance of high quality, sensitive wildlife habitat, riparian areas and areas with high potential for soil erosion.

Guidelines for Implementation:

General

1. **Land Use:** Ensure that access development and control measures are consistent with the environmental management objectives of the area (e.g., forestry area, community pasture, etc.) and the applicable regulatory requirements for the area.
1. **New Access:** Work with applicable resource managers, appropriate regulatory authorities, resource users, as well as other affected stakeholders (e.g., non-traditional trappers, etc.) to define locations where access development is necessary and the type(s) of access control to be implemented.
2. **Procedures:** Review the access control procedures in conjunction with Section 6.5 – Pipeline Right-of-Way Traffic. Site-specific access management measures may be shown on the project-specific construction drawings and/or Environmental Alignment Sheets.

Preconstruction

3. **Surveys:** In the event approvals, authorizations or permits are required for access development, conduct preconstruction environmental surveys along the proposed access routes if environmental information is necessary for the application.
4. **Environmental Features:** During environmental surveys, identify areas that require flagging, fencing or signage to be erected prior to clearing activities. Some examples of site-specific environmental

features that may require fencing include rare plants, den sites, protected stands of trees, Ungulate Winter Ranges, as well as traditional gathering areas or other cultural resources.

5. **Revegetation:** Consult the appropriate regulatory authorities to develop the appropriate native seed mixes for use during post-construction reclamation.

Construction Access Development

6. **Existing Access:** Where practical, use existing roads and rights-of-way to limit disturbance, including:
 - Route the right-of-way parallel to, or overlapping, existing linear disturbances (e.g., roads, seismic lines, pipelines) (section 3.1.3 – routing);
 - Use existing access roads where available;
 - Coordinate the development of new (temporary) roads with other industrial operators; and
 - Use existing watercourse vehicle crossings, where possible.
7. **Access Control:** Implement access control on existing access routes in a similar fashion as current pipeline operators where Enbridge parallels existing pipeline rights-of-way. For example, if a third-party operator has installed rollback across their right-of-way to deter access, implement rollback over the Enbridge right-of-way at the same location.
8. **Rollback:** Install rollback for access control as directed by the Enbridge Construction Manager or designate in consultation with the Environmental Inspector, in accordance with the locations identified on the project-specific Environmental Alignment Sheets and the applicable regulatory requirements (see Section 4.3.3 – Nonmerchantable Timber).
9. **Vehicles:** Utilize multi-passenger vehicles for the transport of construction crews to/from the construction right-of-way, where practical, to minimize air emissions and potential for wildlife mortality. Confine construction equipment and vehicles to the designated construction right-of-way, temporary work space, existing public roads and approved temporary access roads to reduce potential environmental impacts.
10. **Traffic (Right-of-Way):** Restrict construction traffic where the potential for pulverization of soil or sod is high. Provide alternate access to the construction right-of-way, if feasible, to avoid unnecessary travel. See Section 4.4.5 – Soil / Sod Pulverization Contingency Measures for more information.
11. **Speed Limits:** Adhere to posted speed limits on access roads to reduce the risk of collisions with wildlife.
12. **Access Ramps:** Do not use topsoil to construct ramps.
13. **Bar Ditches Materials and Drainage:** Excavate subsoil from the trench line for use as bar ditch ramping material at locations where disturbance is to be minimized (e.g., native prairie). Install appropriately sized culverts to maintain drainage where needed under access ramps in bar ditches.
14. **Watercourses:** Locate temporary access roads as far from the watercourse as practical to minimize clearing and grading near the watercourse.
15. **Wetlands:** Consider the use of shoo-flies to avoid wetlands along the construction right-of-way where substantial disturbance could arise due to construction traffic. Limit access through wetlands to vehicles/equipment necessary for wetland construction. Section 3.2 – Determining Temporary Access Roads and Shoo-flies and Section 3.3.3 - Planning for Wetland Crossings.

16. **Horizontal Directional Drill:** For horizontal directional drill crossings, limit clearing to that required for access along the construction right-of-way if alternate access is not readily available.
17. **Need for Additional Access:** If a need for additional access is identified during construction, Enbridge Construction, in consultation with Enbridge Environment, Lands and Right-of-Way, must approve any proposed access not previously authorized for use.

Decommissioning Temporary Access

18. **Clean-up:** Weather permitting, conduct clean-up as soon as practical where construction access is no longer necessary. Except where limited by terrain stability and other considerations, restore all grade cuts to stable contours, approximating preconstruction conditions, or according to applicable provincial/territorial regulatory requirements.
19. **Cross Ditches and Diversion Berms:** Install cross ditches and diversion berms on moderate to steep slopes to divert surface water off the construction right-of-way (Dwg. 1 - Cross Ditches and Berms). Finalize the exact locations of cross ditches and diversion berms in the field in consultation with the Environmental Inspector and a geotechnical engineer where appropriate.
20. **Track Cleat Imprinting:** Consider using tracked equipment to pack and imprint the surface. Ensure track cleat imprints are perpendicular to the fall line of the slope, where practical. Do not allow track cleat imprinting in locations where safety could be compromised.
21. **Reclamation:** Reclaim all temporary access after construction (i.e., alternate compaction, recontour, replace topsoil where salvaged, and vegetate), unless otherwise specified in the project-specific Construction Line List. Replant decommissioned access roads with native species, restore riparian vegetation, provide erosion control, limit lines-of-sight and reclaim selected habitat areas. Restore all watercourse crossings, watercourse banks and approach slopes to stable contours using local material, and vegetate as needed with the appropriate seed mix and woody plant materials (Section 4.10.1 – Water Crossings and Dwg. 14 - Live Shrub Staking and Dwg. 9 - Hedge / Brush Layering). Employ shrub transplants, brush layering using local native stock, or bioengineering techniques, to enhance slope stability and restore riparian habitat features at designated watercourses. Ensure the Environmental Inspector determines the extent of these measures in consultation with a qualified aquatic specialist/qualified environmental specialist and construction management.

Post-Construction Access Deactivation and Control

22. **Clean-up:** Remove bar ditch ramps and culverts following construction to facilitate access from existing roads to the construction right-of-way to prevent blockage of spring runoff in ditches. Remove all temporary bridge spans and stabilize the banks to preconstruction conditions
23. **Revegetation:** Revegetate temporary access and work areas, and riparian areas along the construction right-of-way to restrict access. Revegetate selected locations to provide long-term access control, limit lines-of-sight and re-establish wildlife habitat.
24. **Fencing:** Install temporary fences, if warranted, to restrict grazing and trampling of seeded right-of-way until vegetation becomes established or less palatable.
25. **Access Control:** Install, where required, suitable barriers. For example, use material from blasting, fencing, gates, or excess material from grading to limit access (excludes pre-existing access). Where required, distribute slash material evenly over the right-of-way as advised by the Environmental Inspector (see Section 4.3.3 – Nonmerchantable Timber). Do not “walk down” rollback for access control with heavy equipment.

26. **Post-Construction Monitoring and Reporting:** Where warranted, establish a post-construction program for monitoring the success of access control and reclamation. Make adjustments to access control measures if warranted. Reporting to the appropriate regulatory authority may also be required as a condition of access approvals or authorizations.

6.12

SPILL PREVENTION AND MANAGEMENT

Activity Description:

Spills of hazardous materials during construction have the potential to affect environmental resources such as soil, wetlands, vegetation, wildlife habitat and aquatic ecosystems. This procedure describes measures to be implemented to prevent spills from occurring during construction and the steps to be taken if a spill of hazardous materials occurs to reduce the effects on environmental resources on and off the construction right-of-way.

Objectives:

1. To reduce the potential for spills to occur through preventative measures.
2. To respond to accidental spills in an efficient manner to reduce the effects on environmental resources.

General Spill Prevention Measures:

1. **Training:** Operators or onsite construction foremen will be trained to contain spills or leakage from equipment.
2. **Fluids and Chemicals:** Ensure that no fuel, lubricating fluids, hydraulic fluids, antifreeze, herbicides, biocides or other chemicals are dumped or disposed of on the ground or into any watercourse or wetland.
3. **Equipment:** Maintain appropriate spill equipment at all worksites. Assess the risk potential for site-specific spills to determine the appropriate type of response equipment to be stored onsite and suitable location for storage. Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (i.e., sorbent pads, sorbent boom and rope). Carry additional spill prevention and clean-up material, and equipment such as a tarp, shovel and heavy plastic bags in bulk fuel trucks, service trucks and pick-ups with box-mounted fuel tanks.
4. **Refuelling / Servicing:** Refuel and service mobile equipment well away from the normal high water mark of watercourses or wetlands, or as indicated in regulatory authorizations. Where equipment must operate and be refuelled/serviced (e.g., light plants, generators, water pumps, snow makers, etc) within the normal high water mark of a waterbody, ensure that:
 - All containers, hoses and nozzles are free of leaks;
 - All fuel nozzles are equipped with automatic shut-offs;
 - Operators are stationed at both ends of the hose during fuelling unless the ends are visible and readily accessible by one operator;

- Fuel remaining in the hose is returned to the storage facility;
 - The environmental inspector has been consulted prior to equipment being fuelled within the normal high water mark of a waterbody to ensure appropriate mitigation has been utilized; and
 - Additional procedures described in the section on refueling tanks, equipment and containers in Enbridge's O&M Book 8 are implemented.
5. **Service:** Servicing of equipment within wetlands or watercourse is prohibited without site-specific approval from an Environmental Inspector. Place drip pans or other forms of secondary containment underneath equipment/vehicles when servicing equipment/vehicles with the potential for accidental spills (e.g., oil changes, servicing of hydraulic systems).
 6. **Organic Fields:** Prohibit refuelling/servicing of equipment/vehicles on organic fields unless otherwise approved by the landowner.
 7. **Storage:** Do not store fuel tanks, containers or stationary equipment within the normal high water mark of a watercourse or wetland, unless otherwise indicated in regulatory authorizations. If this is not feasible, secondary containment must be provided regardless of container size. If the fuel tank is double-walled, tertiary containment must be provided. Fuel storage areas, pumps, generators and other sources of deleterious substances must be within a containment system of sufficient capacity to ensure that deleterious substances do not enter fish habitat. Appropriate spill kits will be kept at fuel or hazardous materials storage, refuelling and maintenance or refuelling service vehicles.
 8. **Watercourse Crossing Equipment:** Inspect hydraulic, fuel and lubrication systems of equipment used in water crossing construction to ensure that the systems are in good condition and free of leaks. Clean equipment to be used instream or adjacent to a waterbody/wetland or otherwise ensure equipment is free of grease, oil or other fluids, mud, dirt and vegetation, both prior to entering the waterbody and upon completion of instream activity. Prevent the discharge of materials toxic to fish or other aquatic life into a watercourse or waterbody.
 9. **Watercourses and Wetlands:** Do not wash equipment or machinery in watercourses or wetlands.

Spill Contingency Measures

Initial Response

10. **Initial Response:** Report spills immediately to the Enbridge Construction Manager or designate and the Environmental Inspector, who will immediately ensure that:
 - Action is taken to control danger to human life;
 - The necessary equipment and personnel are mobilized, and measures are being implemented to stop the source of the spill, if safe to do so, and commence clean-up;
 - The Enbridge Environment Project Lead is notified; and
 - The contractor will make all resources available to contain and clean-up the spill.
11. **Notifications:** The Enbridge Environment Project Lead will ensure the appropriate regulatory authority is notified.

Spill Containment Procedures

12. **Hazardous Materials:** Guidelines for the safe handling, storage, use and disposal of potentially hazardous materials are provided in the Sections, Waste Storage and Waste Transportation in Enbridge's O&MP Book 8.
13. **Containment and Clean-Up:** Following initial response of a spill of a hazardous material, ensure the following containment procedures are carried out:
 - Identify the product, stop source and physically contain the spill as soon as safe to do so;
 - Avoid use of water or fire extinguishing chemicals on non-petroleum product spills since many chemicals react violently with water and chemical extinguishing agents may release toxic fumes. In addition, chemicals may be soluble in water and dispersal makes containment and clean-up more difficult;
 - Prohibit traffic on contaminated soils, except where required for containment and clean-up;
 - Use natural depressions or berms constructed with materials and equipment in proximity to the site to physically contain a spill on land. Deploy booms to contain a spill in water; and
 - Immediately notify the Enbridge Environment Project Lead of the incident.
14. **Spill from a Truck:** If hazardous materials are spilled from a truck, ensure that:
 - Spilled petroleum product is contained;
 - The tanker is pumped dry (into appropriate containers or another tanker);
 - The tanker is removed from the site;
 - Spilled product is picked up;
 - The contaminated area is cleaned-up;
 - Dispose of sorbent pads, contaminated soil and vegetation at an approved facility; and
 - Immediately notify the Enbridge Environment Project Lead of the incident.
15. **Watercourse or Wetland:** Follow the general guidelines listed below for spills adjacent to or in a watercourse or wetland:
 - Construct berms and/or trenches to contain spilled product prior to entry into a watercourse or wetland;
 - Deploy booms, skimmers, sorbents, etc., if feasible, to contain and recover spilled material from a watercourse or wetland;
 - Pick up spilled product;
 - Immediately notify the Enbridge Environment Project Lead of the incident; and
 - Implement any additional clean-up measures resulting from consultation with the appropriate regulatory authorities.
16. **Spot Spills:** Immediately report all small spills of fuels or hazardous materials to the Environmental Inspector. Suspend construction activity and travel in the immediate vicinity of a spot spill until permission to resume activity has been granted by the Enbridge Construction Manager in consultation with the Environmental Inspector. The Environmental Inspector, in consultation with

the Enbridge Environment Project Lead, will determine appropriate methods to remove or restore contaminated soils. Contaminated soil and vegetation will be disposed of at an approved facility.

17. **Record Keeping:** The Environmental Inspector or Enbridge Construction Manager will ensure that a Spill Report has been completed and will include a record of the report in the project files and forward a copy of the report to the Enbridge Environment Project Lead.
18. **Spill Tracking:** The Enbridge Environment Project Lead will ensure that all spills are documented in Enbridge's Incident Tracking Table.
19. **Contaminated Soil Notification Form:** If warranted, the Environmental Inspector or Enbridge Construction Manager will complete a Contaminated Soil Notification Form as directed by the Enbridge Environment Project Lead.

6.14

SURFACE WATER MANAGEMENT

Activity Description:

During construction, activities associated with site preparation and the use of heavy vehicles cause soil exposure and, therefore, the potential exists for soil erosion on the construction right-of-way. The potential for erosion is affected by several factors including, but not limited to, precipitation, flowing water, steep slopes and susceptibility of the soils present to erosion.

General Soil Erosion Contingency Measures are presented in Section 4.4.4 and contingency measures for flood or excessive flow conditions specifically during watercourse or wetland crossing construction is presented in Section 4.10.2. The information presented in this subsection addresses surface water management along the entire construction right-of-way throughout all phases of construction.

Objectives:

1. To control surface runoff from adjacent lands onto the construction right-of-way.
2. To establish and maintain effective sediment control measures on the construction right-of-way.

Guidelines for Implementation:

General

1. Review Section 4.4.4 – Soil Erosion Contingency Measures for mitigative measures regarding soil erosion.
2. Review Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures for mitigative measures regarding erosion in the vicinity of watercourses and wetlands.
3. Review Section 6.18 – Wet / Thawed Soils for guidance on wet soils handling and considerations for implementing a shut-down.
4. Maintain sufficient quantities of silt fence, straw mulch, washed rock, geotextile fabric and erosion control blankets on site to address erosion and sediment control as the work progresses.

Construction

5. **Erosion and Sediment Control:** Install sediment control devices/materials immediately following initial ground disturbance on the construction right-of-way (e.g., clearing, grubbing, topsoil salvage). Install sediment control devices, such as a silt fence, straw bales or biologs around the perimeter of the construction right-of-way, where warranted, to prevent overland flow from transporting sediment into wetlands/watercourses or off the construction right-of-way. Inspect and maintain erosion control devices regularly (e.g., weekly and within 24 hours of a precipitation event [Dwg. 11 – Installing Silt Fence]).
6. **Clearing:** Limit clearing to the minimum necessary to safely complete the job while reducing potential opportunities for erosion. Clearing within additional workspace will be reduced if the entire

workspace is not necessary for construction. See Section 4.3.1 – Clearing and Grubbing for additional mitigation.

7. **Grubbing:** Limit grubbing to areas where soil removal is necessary (e.g., trench line, areas to be graded). See Section 4.3.1 – Clearing and Grubbing for additional mitigation. Walk down or mow shrubs and small trees rather than cutting, if feasible.
8. **Topsoil Storage:** Topsoil should be stockpiled, and protected with erosion control devices where appropriate to minimize the potential for surface waters to erode the piles. Stockpile salvaged topsoil in a location that will prevent erosion and siltation of watercourses and wetlands. Place topsoil in distinct piles above the high water mark of watercourses in a manner that does not block drainage or runoff, construction activities, or replacement of grade material or trench spoil, and prevents erosion and siltation into watercourses or wetlands. Limit the amount and duration of soil exposure.
9. **Weather:** Monitor heavy precipitation and rain-on-snow events, and communicate the need for any additional preparations, if warranted. If a storm event is predicted, implement additional controls in active work areas, so that runoff leaving the site does not cause sedimentation of any watercourses or wetlands. Stabilize banks and grade cuts with a high potential for erosion.
10. **Surface Drainage:** Control surface drainage near construction sites and install ditches/berms, if warranted, to prevent clean surface water from entering excavations or areas of disturbed and erodible soils.
11. **Windrow Gaps:** Leave gaps in soil and spoil windrows, if warranted, at obvious drainage courses and where requested to accommodate surface runoff (Dwg. 8 – Gaps and Plugs).
12. **Dewatering:** Implement filtering devices to intercept and retain sediment-laden runoff or discharge water to prevent sedimentation. See Section 4.6.2 – Dewatering Trench, Dwg. 2 – Dewatering Trench – Filter Bag / Vegetation and Dwg. 3 – Dewatering Trench – Straw Bale Sump for additional mitigation.
13. **Cross Ditches and Diversion Berms:** Install cross ditch(es) and diversion berm(s) as per Dwg. 1 – Cross Ditches and Berms to prevent runoff along the construction right-of-way and possible subsequent erosion. Exact locations of berms will be determined in the field. Tie berms into existing erosion control structures where prevalent on the adjacent right-of-way. Install berms immediately downslope of all breakers on moderate to steep slopes, where present. See Dwg. 34 – Trench Breakers / Ditch Plugs for additional information on installation.
14. **Sediment Ponds:** If warranted, install sediment ponds (e.g., settlement sumps) at discharge outlets from ditches and berms to intercept and retain sediment-laden runoff thereby allowing sediment to settle out. Ensure sediment ponds are established at an appropriate distance from any watercourse or wetland, unless otherwise approved by the Environmental Inspector.
15. **Monitoring:** Inspect and maintain erosion control devices regularly (e.g., weekly or within 24 hours of a precipitation event) until vegetation on erosion prone areas is established. Remove large deposits of sediment/debris captured by erosion control devices as required.
16. **Off Right-of-Way Erosion Control:** In the event erosion control devices must be installed in areas off the construction right-of-way, obtain the necessary land access approvals prior to performing the work.

Winter Erosion Control

17. **Erosion and Sediment Control:** Frozen ground conditions may preclude some erosion control options (e.g., straw crimping), however, best efforts should be made to ensure appropriate protection is in place prior to spring break-up. Silt fencing, cross ditches and diversion berms, subdrains, and spreading slash are suitable erosion control options for areas constructed during frozen ground conditions. Seeding or planting (e.g., willow stakes [Dwg. 13 – Live Shrub Cuttings Bundles and Dwg. 14 – Live Shrub Staking]) efforts may also be implemented but should be discussed with the Environmental Inspector and Enbridge Environment Project Lead prior to implementation.
18. **Final Clean-up:** In areas constructed during frozen ground conditions where access is limited during the spring/summer (e.g., boreal forest, peatlands, muskeg), ensure final clean-up is completed before vacating the area. Ensure sediment control devices are sturdy and capable of handling potentially large storm events with minimal maintenance.
19. **Culverts:** If temporary culverts are to remain in place after winter construction, ensure they are adequately sized to handle spring flows (e.g., meltwater).

Post-Construction

20. Section 4.9 – Clean-Up and Reclamation provides additional information on post-construction erosion control measures.

6.15

VEGETATION SPECIES OF CONCERN

Activity Description:

The following procedures provide contingency measures for the discovery of vegetation species of concern prior to and during construction. Vegetation species of concern can include rare vascular plants, rare non-vascular plants, and rare ecological communities. Areas of native vegetation (e.g., areas dominated by species that would historically and naturally occur, rather than introduced agronomics or invasive species) often provide habitat for vegetation species of concern, but that does not preclude their occurrence elsewhere.

Objectives:

1. To avoid project effects on vegetation species of concern by applying best management practices during pipeline planning and construction.

Vegetation Species of Concern Mitigation Measures:

Preconstruction

1. **Routing:** Limit the length of pipeline to the extent feasible on sensitive landscapes such as native vegetation to reduce potential disturbance to native vegetation (see Section 3.1.3 – Routing). Consultation with a qualified botanist/biologist during the planning phase can help to determine areas with the potential for rare plants or rare ecological communities.
2. **Preconstruction Assessment:** When required, rare plant and rare ecological community assessments must be conducted by a qualified botanist/biologist in areas of potential habitat (e.g., native vegetation, riparian areas of watercourses and wetlands, and forested areas) (see Section 3.1.4 – Environmental Supporting Studies). In the event that rare plants or rare ecological communities are identified during preconstruction environmental assessments the plant or community will be assessed and appropriate mitigative measures will be determined. Assessment criteria include, but are not limited to:
 - The position of the plant or community on the construction right-of-way;
 - The relative rarity of the plant or community (regionally, nationally, etc.);
 - The local abundance of the plant or community;
 - The growth habit and propagation strategy of the plant or community; and
 - The habitat preferences of the plant or community.
3. **Mitigation:** Mitigative options will be determined in consultation with the Enbridge Environment Project Lead and, when warranted, a qualified botanist/biologist and the appropriate regulatory authority. Mitigative options may include, but are not limited to:
 - Narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging (Dwg. 18 – Narrow Down Fencing);

- Inform all users of access restrictions along native vegetation segments and in the vicinity of flagged or fenced sites (see Section 6.1 – Access Development and Control);
 - Temporarily cover the site with geotextile pads, flex net or swamp mats (Dwg. 19 – Rare Plant – Dirt Ramp and Dwg. 21 – Rare Plant – Temporary Bridge);
 - Extend road or watercourse bores to avoid or limit potential impact on the plant or community;
 - Realign the route to avoid the plant or community; and/or
 - Propagate rare plants or specific portions of sensitive communities via vegetative or reproductive means (e.g., salvaging and transplanting portions of sod and surrounding vegetation or collecting of cuttings). Transplanted materials may be moved to a suitable location off right-of-way, and in some instances, post-construction revegetation efforts may require transplanting back onto the reclaimed right-of-way (Dwg. 20 - Rare Plant – Live Plant Salvage and Transplant).
4. **Avoidance:** Determine the need to develop project-specific procedures to avoid disturbance to vegetation species of concern or rare ecological communities.

Construction

5. **Scheduling:** Attempt to schedule topsoil salvage on native prairie and native vegetation during frozen conditions when construction activities can be maintained within a narrower construction right-of-way, thereby reducing disturbance of the vegetation (see Section 3.1.2 – Project Scheduling).
6. **Narrow Right-of-Way:** Narrow down the construction right-of-way to the extent feasible at site-specific environmental features adjacent to the boundaries of the construction right-of-way such as native prairie or old growth trees as per the direction of the Environmental Inspector and/or as noted on the project-specific Environmental Alignment Sheets, if prepared (Dwg. 18 - Narrow Down Fencing).
7. **Grading:** Reduce grading to the extent feasible in areas with vegetation species of concern.
8. **Discovery During Construction:** In the event that rare plants or rare ecological communities are identified or suspected along the right-of-way during construction (e.g., during survey activities, prior to clearing and topsoil salvage), notify the Environmental Inspector and the Enbridge Environment Project Lead. Flag or fence the area until the plant or community can be confirmed. If warranted, the Enbridge Environment Project Lead may enlist a qualified botanist/biologist to assist with confirmation. Protection measures will be based on site-specific conditions and species sensitivity criteria. Final decisions on mitigative measures will be made by the Enbridge Environment Project Lead in consultation with a qualified botanist/biologist and, when necessary, the appropriate regulatory authority. Mitigative measures generally fall into categories of avoidance (e.g., narrowing the right-of-way [Dwg. 18]), reducing disturbance (e.g., ramping over the plant (Dwg. 19)) and alternative reclamation techniques (e.g., propagation or transplantation).

Post-Construction

9. **Revegetation:** Implement planned planting strategies (e.g., propagated plants, cuttings, transplanting back onto the right-of-way). Record the locations (e.g., GPS coordinates) where transplants were installed for future monitoring. Revegetate disturbed noncultivated woodlands and native prairie areas with native species that reflect the surrounding vegetation except where regulatory agencies indicate that natural recovery is preferable (see Section 4.9 - Clean-Up and Reclamation for more information).

10. **Monitoring:** Conduct post-construction monitoring of rare plant locations to ensure mitigative measures were successful. Post-construction monitoring should be undertaken during the appropriate growing season for the species of concern (e.g., early or late blooming species) and should be conducted by a qualified botanist/biologist.

6.18

WET / THAWED SOILS

Activity Description:

Construction during wet or thawing soil conditions can lead to rutting and/or compaction concerns which may result in a reduction in soil productivity. In order to limit terrain disturbance and soil structure damage, additional mitigative measures are warranted during periods of wet or thawing conditions.

Objectives:

1. To ensure soil productivity is maintained by implementing contingency measures or a shutdown procedure when wet or thawing soils are evident on the construction right-of-way.

Guidelines for Implementation:

Inspection and Shut Down Decision

Enbridge will assign Environmental Inspectors with sufficient training and soils-related experience to be able to identify soils that are too wet for a particular activity and when the soils are sufficiently dry to allow the activity to resume. The decision to continue or suspend particular pipeline construction activities on lands with excessively wet/thawed soils will be made by the Enbridge Construction Manager or designate in consultation with the Environmental Inspector. The Environmental Inspector or Enbridge Construction Manager or designate will employ the criteria presented in Tables 10 and 11 at the end of this subsection, to guide the application of contingency measures. Operators, foremen, activity inspectors, contractors, etc. will be made aware of their responsibility in notifying their supervisors, managers or the Environmental Inspector of poor ground conditions (e.g., pooling water, rutting) to minimize potential lag times before a decision is made.

Where topsoil has been replaced, all heavy traffic is to be suspended during excessively wet/thawed soil conditions (see Tables 10 and 11). A record of the location, timing and reason for implementation of the procedures to address Wet / Thawed Soils will be maintained by the Environmental Inspector. In the event that activities are suspended, the landowner and the appropriate regulatory authorities, if warranted, will be notified as soon as practical by Enbridge Environment Project Lead their designate, or the Environmental Inspector if authorized by the Enbridge Environment Project Lead.

Soils are considered to be excessively wet when the planned activity could cause damage to soils either due to: rutting by traffic through the topsoil layer into the subsoil; soil structure damage during soil handling; compaction and associated pulverization of topsoil; and topsoil structure damage due to heavy traffic.

Contingency Measures

Contingency measures will be implemented once one of the following indicators occurs:

- Rutting of topsoil to the extent that admixing may occur;
- Excessive wheelslip;

- Excessive build-up of mud on tires and cleats;
- Formation of puddles; or
- Tracking of mud as vehicles leave the right-of-way.

Where weather conditions are such that excessively wet/thawed soil conditions are likely to occur, contingency measures may, if warranted and practicable, be implemented prior to the occurrence of the above indicators.

The contingency measures listed below will be implemented individually or in combination, if warranted, based on site-specific conditions.

Wet Soil Contingency Measures (e.g., during nonfrozen soil conditions)

- Restrict construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks.
- Work only in nonproblem areas, such as well-drained soil or well-sodded lands, until conditions improve.
- Install geotextiles, swamp mats or corduroy constructed from nonsalvageable timber in problem areas. Record all areas where geotextiles, swamp mats or corduroy have been installed.
- Consider salvaging an additional width of topsoil in problem areas.
- Suspend construction until soils dry out.

Thawed Soil Contingency Measures (e.g., during frozen soil conditions)

- Restrict construction traffic, where feasible, to equipment with low-ground pressure tires or wide pad tracks.
- Work only in nonproblem areas, such as frozen or well-drained soils, until conditions improve.
- Postpone construction until evening or early morning when the ground is frozen.
- Install geotextiles, swamp mats or corduroy constructed from nonsalvageable timber in problem areas. Record all areas where geotextiles, swamp mats or corduroy have been installed.
- Employ frost inducement measures such as snow packing or plowing to increase the load-bearing capacity of thawed ground.
- Suspend construction until soils dry out or freeze.

Resuming Construction

If the indicators of excessively wet/thawed soil conditions are no longer evident, soils will be considered dry enough to resume activity.

TABLE 10 - CRITERIA FOR THE SUSPENSION OF ACTIVITIES DUE TO EXCESSIVELY WET SOIL CONDITIONS

Land Use(s)	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Cultivated, Poorly-sodded Hay, Tame Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil salvage / replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Trench and spoil area salvaged	Pipe stringing	No, if stringing truck traffic is restricted to the stripped area
	Trench and spoil, and work area salvaged	Pipe stringing	No
	No salvage conducted	Welding	Yes
	Trench and spoil area salvaged	Welding	Yes
	Trench and spoil, and work area salvaged	Welding	No
	Trench and spoil area salvaged	Trenching	No
	Trench and spoil area salvaged	Lowering-in	Yes
	Trench and spoil, and work area salvaged	Lowering-in	No
	Trench and spoil area salvaged	Backfilling	No, if backfilling with back hoes or clean-up bucket Yes if dozers are used.
	Trench and spoil, and work area salvaged	Backfilling	No
	Trench and spoil area salvaged	Testing	Yes (Testing would not be initiated but would continue if filling with test water has begun)
	Trench and spoil, and work area salvaged	Testing	No
	Topsoil replaced	Testing	Yes (Testing would not be initiated but would continue if filling with test water has begun)
Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable	
Well-sodded Lands; Hay, Tame Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil salvage / replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width salvage conducted	Pipe stringing	No, if stringing truck traffic is restricted to the salvaged area
	Blade width and work area salvaged	Pipe stringing	No
	No salvage conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width salvage conducted	Welding	No - activity to be closely

Land Use(s)	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
			monitored and suspended if warranted
	Blade width and work area salvaged	Welding	No
	Blade width salvage conducted	Trenching	No
	Blade width salvage conducted	Lowering-in	No - activity to be closely monitored and suspended if warranted
	Blade width and work area salvaged	Lowering-in	No
	Blade width salvage conducted	Backfilling	Yes
	Blade width and work area salvaged	Backfilling	Yes
	Blade width salvage conducted	Testing	No
	Blade width and work area salvaged	Testing	No
	Topsoil replaced	Testing	Yes (Testing would not be initiated but would continue if filling with test water has begun)
	Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable

TABLE 11 - CRITERIA FOR THE SUSPENSION OF ACTIVITIES DUE TO THAWED SOIL CONDITIONS

Land Use	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Cultivated and Poorly-sodded Hay, Tame Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil salvage / replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width salvage conducted	Pipe stringing	No - if stringing truck traffic is restricted to the salvaged area
	No salvage conducted	Welding	Yes
	Blade width salvage conducted	Welding	Yes
	Blade width salvage conducted	Trenching	No
	Blade width salvage conducted	Lowering-in	Yes
	Blade width salvage conducted	Backfilling	Yes
	Blade width salvage conducted	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
	Topsoil replaced	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable	

Land Use	Topsoil Salvage Status	Construction Activity	Suspend Activity for Environmental Issue?
Well-sodded Lands; Hay, Tame Pasture, Native Prairie and Bush-Pasture	No salvage conducted	Soils handling (topsoil salvage / replacement)	Yes
	No salvage conducted	Pipe stringing	Yes
	Blade width salvage conducted	Pipe stringing	No - if stringing truck traffic is restricted to the salvaged area
	No salvage conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width salvage conducted	Welding	No - activity to be closely monitored and suspended if warranted
	Blade width salvage conducted	Trenching	No
	Blade width salvage conducted	Lowering-in	No - activity to be closely monitored and suspended if warranted
	Blade width salvage conducted	Backfilling	Yes
	Blade width salvage conducted	Testing	No
	Topsoil replaced	Testing	Yes - testing would not be initiated but would continue if filling with test water has begun
Topsoil replaced	Clean-up	Yes - heavy traffic not permitted; No - quad traffic likely acceptable	

6.19

WILDLIFE

Introduction:

This procedure was developed to address issues pertaining to wildlife and identify mitigative measures to be implemented during the planning and construction phases of a project. These procedures also provide contingency plans for the discovery of wildlife species of concern prior to and during construction, and for wildlife encounters.

Objectives:

1. To minimize project effects on wildlife and wildlife habitat by applying best management practices during pipeline planning and construction.

General Wildlife Mitigation Measures:

Preconstruction Planning

1. **Scheduling:** Contact Enbridge Environment Project Lead to establish timing constraints for construction activities. Schedule activities before or after periods of concern to the extent feasible and adhere to applicable timing constraints unless otherwise approved by the applicable regulatory authorities. See Section 3.1.2 – Project Scheduling, Section 3.1.4 – Environmental Supporting Studies and Section 3.1.7 – Environmental Permits / Approvals / Notifications for more information.
2. **Species of Concern Review:** Investigate the potential for the presence of wildlife species of concern through project-specific wildlife studies or through public species at risk databases. Develop mitigation plans for wildlife species of concern or their site-specific habitat if directed by the regulatory agencies responsible for the management of the species (e.g., caribou protection plan). Determine the need to develop project-specific access control procedures to minimize disturbance to sensitive wildlife. See Section 6.1 – Access Development and Control for more information.
3. **Species of Concern Discovery:** In the event of a discovery of a wildlife species of concern during pre-construction wildlife surveys, appropriate mitigative measures will be determined by the Enbridge Environment Project Lead in consultation with a qualified biologist/qualified environmental specialist and the appropriate regulatory authorities, if warranted. The Wildlife Species of Concern Discovery Contingency Measures subsection (below) provides recommendations for mitigative measures. Mitigative measures developed will be implemented prior to construction as appropriate.

Construction

4. **Access Control:** Implement measures from Section 6.1 – Access Development and Control as appropriate for the project during the construction phase.
5. **Scheduling:** Adhere to restrictions on construction activities for identified sensitive wildlife species unless otherwise approved by the appropriate regulatory authority. Premow or preclear the construction right-of-way on woodlands, native prairie and tame pasture lands prior to the migratory

bird restricted activity period to discourage nesting along the construction right-of-way if construction has been approved to occur during the migratory bird restricted activity period. If construction is to occur during the migratory bird restricted activity period, preconstruction wildlife surveys/sweeps will be conducted by a qualified biologist/qualified environmental specialist to determine whether any nesting migratory birds will be impacted by construction. Use appropriate mitigation in consultation with the Enbridge Environment Project Lead and the appropriate regulatory authorities to protect any discovered active or suspected nests.

6. **Notification:** The Enbridge Environment Project Lead will notify the appropriate regulatory authorities prior to commencement of construction, if required by project approvals. See 3.1.7 – Environmental Permits / Approvals / Notifications for more information. The Enbridge Environment Project Lead will notify the appropriate regulatory authorities if construction will damage beaver ponds, dams and lodges, muskrat push-ups or other aquatic furbearer habitats, raptor nests, mineral licks or other evidence of special wildlife use in the area. Obtain applicable permits, authorizations or approvals prior to disturbance as required.
7. **Habitat Preservation:** Flag or fence off environmentally sensitive areas (e.g., nests, mineral licks, dens, etc.) as specified in the project-specific wildlife survey and related environmental instructions, prior to clearing and construction. See Section 4.2 – Survey and Utility Locates for more information. Narrow down the construction right-of-way and temporary workspace where nest sites or other critical site-specific habitats are encountered by the route to avoid habitat loss (Dwg. 18 – Narrow Down Fencing). Implement measures to restore lost habitat (e.g., transplanting or planting of important shrubs, installing artificial nest boxes and platforms) at locations where narrowing down is not practical and the potential for loss of important habitat exists (Dwg. 14 – Live Shrub Staking).
8. **Species of Concern Discovery During Construction:** Implement the Wildlife Species of Concern Discovery Contingency Measures provided below if a tree to be cleared contains an active bird nest, or if a ground nest, burrow or den is discovered during clearing. Suspend the work activity in the immediate vicinity of the discovery, fence or flag off the area, and contact the Environmental Inspector.
9. **Wildlife Mortality:** The following recommendations are aimed at limiting potential for wildlife mortality during construction.
 - Erect fencing around such areas as boreholes, entry/exit pits and sump pit excavations to prevent wildlife entrapment. Work expeditiously to maintain a tight construction spread (i.e., limit interval between front end work activities such as grading and back end activities such as clean-up) to avoid or reduce potential barriers and hazards to wildlife.
 - Utilize multi-passenger vehicles for the transport of construction crews to and from the construction right-of-way, where practical, to lessen the potential for accidents due to tiredness, excess speed and the volume of traffic on local roads as well as reduce air emissions and potential for wildlife mortality.
 - Consider construction traffic speed limits on access roads to reduce the risk of collisions with wildlife (see Section 6.1.1 - Pipeline Right-of-Way Traffic for more information).
 - Screen test the water intakes in accordance with regulatory screening requirements, to prevent the entrapment of fish or wildlife.
 - Wildlife / Human Interaction: The following recommendations are aimed at limiting potential for wildlife / human conflicts during construction.

- Report scavenging or dangerous wildlife along with the location and details to local wildlife authorities and, if appropriate, the local police department.
 - Personnel are prohibited from harming, harassing or feeding wildlife or livestock.
 - Do not allow recreational use of all-terrain vehicles, snowmobiles or firearms on the construction right-of-way.
 - Do not allow pets on the construction right-of-way.
 - Personnel are not permitted to hunt or fish on any worksite.
 - Report any incidents or collisions with wildlife to the Environmental Inspector, who will notify local wildlife authorities and, if appropriate, the local police department as (see the Wildlife Encounter Contingency Measures below).
 - Store all garbage in animal-proof containers when potential wildlife/human conflicts may occur.
 - Examine the trench on a daily basis for wildlife which may have become trapped overnight. In the event an animal becomes trapped in the trench, report the location and species of wildlife to the Environmental Inspector prior to commencing any construction activities. The Environmental Inspector, in consultation with the Enbridge Construction Manager and a qualified wildlife biologist/qualified environmental specialist (if warranted), will ensure the wildlife is removed from the trench appropriately.
10. **Wildlife / Human Interaction:** The following recommendations are aimed at limiting potential for wildlife / human conflicts during construction.
- Report scavenging or dangerous wildlife along with the location and details to local wildlife authorities and, if appropriate, the local police department.
 - Personnel are prohibited from harming, harassing or feeding wildlife or livestock.
 - Do not allow recreational use of all-terrain vehicles, snowmobiles or firearms on the construction right-of-way.
 - Do not allow pets on the construction right-of-way.
 - Personnel are not permitted to hunt or fish on any worksite.
 - Report any incidents or collisions with wildlife to the Environmental Inspector, who will notify local wildlife authorities and, if appropriate, the local police department as (see the Wildlife Encounter Contingency Measures below).
 - Store all garbage in animal-proof containers when potential wildlife/human conflicts may occur.
 - Examine the trench on a daily basis for wildlife which may have become trapped overnight. In the event an animal becomes trapped in the trench, report the location and species of wildlife to the Environmental Inspector prior to commencing any construction activities. The Environmental Inspector, in consultation with the Enbridge Construction Manager and a qualified wildlife biologist/qualified environmental specialist (if warranted), will ensure the wildlife is removed from the trench appropriately.
11. **Wildlife Movement:** In critical habitat identified by the Enbridge Environment Project Lead, consider leaving periodic gaps (approximately 3 m [10 feet] wide) in windrowed snow if snow windrows are greater than 0.75 m [2.4 feet] in height, or as instructed by the Environmental Inspector. Gaps are typically at intervals (approximately every 400 m [1,280 feet]) along the route, located at obvious

trails used by trappers or wildlife, and generally coincide with gaps in topsoil windrows and strung pipe. See Dwg. 8 – Gaps and Plugs for more information.

12. **Wildlife / Livestock / Farm Equipment Movement:** Leave periodic gaps in set-up and welded pipe to allow wildlife, farm equipment and livestock to cross the construction right-of-way. Gaps shall be located at obvious trails and, where requested, for farm equipment and livestock. Ensure breaks in pipe coincide with gaps in topsoil, spoil, snow (if present) and rollback (if present) windrows. See Dwg. 8 – Gaps and Plugs for more information.
13. **Wildlife / Livestock Movement:** Minimize the length of open ditch and reduce the time the trench will be left open to limit the amount of trench sloughing, frost penetration and interference with wildlife, landowners and livestock. Ensure backfilling of lowered-in pipe is completed by nightfall during winter construction to minimize hazards to livestock and wildlife.

Post-Construction

14. **Wildlife Movement:** Leave gaps in rollback used for erosion control at all obvious wildlife trails.
15. **Habitat Connectivity:** Maintain habitat connections, where possible, in key areas by placing coarse woody slash/debris, planting appropriate vegetation or both, across the right-of-way.
16. **Revegetation:** Revegetate disturbed noncultivated woodlands and native prairie areas with native species that reflect the surrounding vegetation except where regulatory agencies indicate that natural recovery is preferable (see Section 4.9 - Clean-Up and Reclamation for more information).
17. **Access Control:** Implement measures from Section 6.1 – Access Development and Control as appropriate for the project following construction.

Wildlife Species of Concern Discovery Contingency Measures

Wildlife Species of Concern Discovery Prior to Construction

In the event that wildlife species of concern or their site-specific habitat is discovered during project-specific wildlife studies along the pipeline route prior to construction, the discovery will be assessed and the following criteria will be documented for consultation with the Enbridge Environment Project Lead:

- The position of the wildlife or habitat feature with respect to the proposed area of development;
- The presence of topographic features or vegetation to effectively screen the wildlife or habitat from construction activities;
- Critical timing constraints for the species; and
- The potential for an alteration of construction activities to minimize or avoid sensory disturbance.

The mitigative measures available may include, but are not limited to, the following:

- Abide by regulatory timing constraints within the recommended setback distances unless otherwise approved by appropriate regulatory authorities;
- Abide by daily timing restrictions on construction activities;
- Where required, narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging (dwg. 18 – narrow down fencing);
- Alter or delay construction activities to avoid sensory disturbance (e.g., no burning);

- Extend road or watercourse bores to avoid or minimize effects on the site;
- Inform all users of access restrictions in the vicinity of flagged or fenced sites;
- Realign the route to avoid the site;
- Salvage and transplant vegetation or native seed of critical importance to wildlife species of concern where the habitat could not be avoided;
- Install nest boxes or platforms or otherwise replace or enhance habitat during reclamation or restoration; and
- Relocate nests or other habitat features or individuals if practical (and approved by appropriate regulatory authorities) and monitor post-construction response (where applicable) or as per applicable regulatory requirements.

The project-specific wildlife study or environmental plans will outline the appropriate mitigation to be implemented at each site.

Wildlife Species of Concern Discovery During Construction

In the event that wildlife species of concern or their site-specific habitat is discovered during construction of the pipeline, the discovery will be assessed and appropriate mitigation measures from the list above will be determined.

Wildlife species of concern and their habitat characteristics will be identified by the Enbridge Environment Project Lead and provided to the Environmental Inspector. The Environmental Inspector will be provided with detailed information on identifying wildlife species of concern and their site-specific habitat.

In the event that wildlife species of concern or their site-specific habitat are discovered during construction of the pipeline, follow the measures outlined below.

- Suspend work immediately in the vicinity of any newly discovered wildlife species of concern. Work at that location may not resume until the measures below are undertaken.
- Notify the Environmental Inspector who will notify the Enbridge Construction Manager or designate.
- The Environmental Inspector will assess the discovery and either allow construction to be resumed or, in the event of a confirmed or potential discovery, proceed by notifying the Enbridge Environment Project Lead and, if warranted, the appropriate regulatory authorities.
- The Enbridge Environment Project Lead may deem it necessary for a qualified biologist/qualified environmental specialist to visit the site and will, regardless of whether a site visit is warranted, develop an appropriate mitigation plan in consultation with the qualified biologist/qualified environmental specialist. The mitigative measures available include those listed above.

Wildlife Encounter Contingency Measures

In the event of an encounter with wildlife during the construction phase of the project, either at the construction site or on the commute to and from the construction site, follow the measures outlined below.

- Report any incidents (e.g., aggressive behaviour, nuisance behaviour) with wildlife to the Environmental Inspector. The Environmental Inspector will assess the incident and determine if it is safe to continue/resume work. If necessary, the Environmental Inspector will notify the Enbridge Environment Project Lead.

- Report any trapped, injured, or dead animals on the site to the Environmental Inspector. The Environmental Inspector will notify the Enbridge Environment Project Lead who will contact the appropriate regulatory authority to consult on appropriate action, if warranted.
- Report location and details of collisions with wildlife to the Environmental Inspector. If necessary, the Environmental Inspector will notify the Enbridge Environment Project Lead.

In all scenarios above, the Enbridge Environment Project Lead will ensure the appropriate regulatory authorities and police are notified, if warranted. Note, the Enbridge Environment Project Lead may choose to delegate the Environmental Inspector to undertake notification of appropriate regulatory authorities.

6.2

AIR QUALITY

Activity Description:

Pipeline construction activities may cause temporary, short-term increases in air emissions and dust. Key issues related to air quality are the environmental effects of potential added emissions of criteria air contaminants, hazardous air pollutants and greenhouse gases. The primary sources of air emissions during construction will be from fuel combustion while transporting crews to and from the work site as well as the operation of heavy equipment required for construction.

Objectives:

1. To comply with applicable air quality requirements for relevant criteria air contaminants, hazardous air pollutants, greenhouse gases and dust during construction.
2. To limit vehicle emissions and road dust to the extent feasible to reduce impacts on air quality.

Guidelines for Implementation:

1. **Maintenance:** Follow proper equipment maintenance schedules.
2. **Idling:** Reduce unnecessary idling of equipment to the extent feasible.
3. **Transportation:** Use multi-passenger vehicles (e.g., crew trucks) to transport crews to the site to the extent practical and limit the amount of traffic and accompanying emissions.
4. **Dust (Residential):** Control construction-related road dust near residential areas and other areas as advised by the Environmental Inspector. Control practices may include wetting the construction right-of-way with water. A water diversion permit may be required if large volumes of water are necessary for controlling dust. The Enbridge Environment Project Lead will obtain the appropriate permits in consultation with the Enbridge Construction Manager and the appropriate regulatory authority.
5. **Dust (Suppressants):** Control dust emissions by applying dust suppressants, if warranted. Consult with applicable disposition holders or appropriate regulatory authorities for requirements and/or approvals to use dust suppressants. Avoid scheduling dust-generating activities (as practical) during periods of high wind to further limit dust emissions.

6.6

FISH HABITAT

Activity Description:

Fish species may be identified during the aquatic assessment for the project. Watercourse crossing installation (access roads and pipelines), access road construction, water withdrawal, dewatering (e.g., during an isolated pipeline crossing) and riparian vegetation clearing activities have the potential to affect fish habitat availability and fish abundance.

All watercourses are to be considered fish-bearing until otherwise determined by an aquatic assessment or direction from the appropriate regulatory authority.

Objectives:

1. To minimize project effects on fish populations and fish habitat by applying best management practices during pipeline planning and construction.

General Fish Habitat Mitigation Measures:

Pre-Construction Planning

1. **Avoidance:** Route the pipeline to avoid critical habitats in watercourses to the extent feasible (see Section 3.1.3 - Routing).
2. **Schedule:** Schedule construction of waterbodies crossings during periods when fish habitat is less sensitive or as defined by the appropriate regulatory authority(ies). Periods of higher sensitivity are often species dependent and may include migrating, spawning or rearing periods for fish. Contact the Enbridge Environment Project Lead to establish instream restricted activity periods for construction activities in fish-bearing waterbodies (see Section 3.1.2 - Project Scheduling).
3. **Schedule:** Ensure no construction activities occur within the wetted portion of the channel during a restricted activity period unless otherwise approved by the appropriate regulatory authorities.
4. **Fish Salvage:** Suspend construction activities to allow for fish salvage to occur within the isolated area prior to dewatering, if warranted. Ensure that all appropriate permits for fish salvage are in place prior to construction, as applicable.
5. **Species of Concern:** In the event a fish species of concern is discovered prior to or during construction, implement the appropriate mitigative measures provided in this section.

Construction

6. **Sedimentation:** Suspend instream work if sedimentation is occurring unless explicitly authorized by the appropriate regulatory authorities. Implement the mitigative measures presented in Section 4.10.2 – Watercourse / Wetland Siltation Prevention and Excessive Flow Contingency Measures to control sediment loading.
7. **Equipment:** Ensure that the hydraulic, fuel and lubrication systems of any equipment working instream are clean and in good repair to avoid leakage. Operate all equipment in a manner that

prevents deleterious substances from entering fish habitat. Ensure that all material placed within the wetted perimeter of a watercourse is not toxic to aquatic species.

8. **Flow:** Maintain 100% of downstream flow throughout instream activity period in fish-bearing waterbodies.
9. **Instream Duration:** All reasonable efforts should be made to limit the duration of instream work. Complete all instream activity as quickly as feasible to reduce the duration and severity of disturbance.
10. **Water Quality Monitoring:** Implement water quality monitoring (as per project specific requirements) to assess the immediate effects of crossing construction as directed by regulatory permits, approvals, authorizations, etc (see Section 4.10.5 - Water Quality Monitoring).

Fish Habitat Reclamation Techniques

11. **Restoration:** Maintain or restore natural drainage and channel configuration.
12. **Reclamation Methods:** Ensure reclamation methods, techniques and structures are completed in accordance with the applicable regulatory permits, authorizations, approvals and guidelines.
13. **Streambanks:** Transplant shrubs or install willow stakes (Dwg. 14 - Live Shrub Staking) or utilize other bioengineering techniques (e.g., hedge/brush layering [Dwg. 9 - Hedge / Brush Layering]) during reclamation of streambanks where shrubbery was present prior to construction and where warranted.
14. **Monitoring:** Monitor watercourse reclamation activities during construction and at intervals described in post-construction monitoring documents. Obtain and comply with all necessary regulatory permits, authorizations, approvals and/or guidelines. Focus post-construction monitoring on persistence and effectiveness. Consider corrective measures where reclamation is not successful.

Fish Species of Concern Discovery Contingency Measures

Fish Species of Concern Discovery Prior to Construction

In the event that fish species of concern or sensitive fish habitats are identified during the aquatic assessment, the habitat must be assessed by a qualified aquatic specialist/qualified environmental specialist based on the following criteria (see Section 3.1.4 – Environmental Supporting Studies):

- Position of the fish habitat feature with respect to the proposed crossing;
- The timing of construction versus the appropriate restricted activity period for the fish species; and
- The potential for an alteration of construction activities or method to reduce disturbance.

Notify the appropriate regulatory authorities to discuss site-specific mitigative options. The mitigative measures available include, but are not limited to, the following:

- Abide by restricted activity periods for sensitive periods (unless otherwise approved by the appropriate regulatory authority);
- Consider a partial bypass or trenchless crossing technique (e.g., horizontal directional drill or bore);
- Consider vehicle crossing methods that limit disturbance (*i.e.*, use existing bridges or install temporary bridge); and

- Determine, in consultation with the appropriate regulatory authorities, if habitat compensation will be required.

Fish Species of Concern Discovery During Construction

In the event that fish species of concern or sensitive fish habitats are identified during construction, implement the following mitigative measures:

- Suspend work immediately in the watercourse. Work at that location may not resume until the measures below are undertaken;
- Notify the environmental inspector who will notify the enbridge construction manager or designate;
- The environmental inspector will assess the discovery and either allow construction to be resumed or, in the event of a confirmed or potential discovery proceed by notifying the enbridge environment project lead and, if warranted, the appropriate regulatory authorities; and
- The enbridge environment project lead may deem it necessary for a qualified aquatic specialist/qualified environmental specialist to visit the site and will develop appropriate mitigation.

6.8

HISTORICAL RESOURCES

Activity Description:

Construction activities such as grading, topsoil salvage, excavations and even trenchless activities have the potential to affect historical resources. Cultural, historic, archaeological and palaeontological resources are collectively known as historical resources and can include pre-contact and post-contact features (National Energy Board 2011).

***Note: Personnel are NOT permitted to collect and/or keep any artefacts. All historical resources identified must be catalogued, collected by Enbridge and submitted to the appropriate regulatory authority. ***

Objectives:

1. To identify and preserve historical resources that may be affected by construction activities.

General Historical Resources Mitigation Measures:

Pre-construction Planning

1. **Historical Resources Assessment:** Investigate the potential for the presence of archaeological, historical or palaeontological sites through the project-specific historical resources assessment (see Section 3.1.4 – Environmental Supporting Studies).
2. **Avoidance:** Avoidance is the preferred method for all historical resource sites. If avoidance is not feasible, follow the mitigative measures set out in the project-specific historical resources report.
3. **Historical Resources Discovery:** In the event of a historical resources discovery on site prior to or during construction, implement the appropriate mitigative measures identified in the Historical Resources Discovery Contingency Measures provided below.

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4. **Topsoil Salvage:** Monitor topsoil salvage in areas with high potential for historical resources.
5. **Grading:** Do not permit grading in proximity to known archaeological, historical or palaeontological sites unless otherwise approved by the appropriate regulatory authority.
6. **Work in Proximity:** Follow the mitigative measures set out in the appropriate regulatory approvals or project-specific historical resources report for any known sites. Mitigative measures may include, but are not limited to, the following:
 - Have a qualified historical resource specialist (e.g., archaeologist or palaeontologist) present to monitor excavation operations;
 - Narrow down the proposed area of disturbance and protect the site using fencing or clearly mark the site using flagging (dwg. 18 - narrow down fencing);
 - Install geotextile and matting to protect the site;

- Conduct an excavation to salvage and establish an adequate record of the site according to the appropriate regulatory historical resources guidelines;
- Horizontal directionally drill under the site/resource, if feasible; or
- Realign the route to avoid the site.

Historical Resources Discovery Contingency Measures:

Historical Resource Discovery Prior to Construction

In the event that archaeological, historical or palaeontological resources are discovered during the historical resources assessment (see Section 3.1.4 – Environmental Supporting Studies), assess the site based on the following criteria:

- The importance of the site;
- The location of the site with respect to the route;
- The feasibility of alternate routing or siting to avoid the resource (see section 3.1.3 – routing); and
- Input from the appropriate regulatory authority.

Historical Resource Discovery During Construction

In the event that archaeological, historical or palaeontological resources are discovered during construction, suspend work immediately in the vicinity of the suspected site. Work at that location may not resume until the measures below are implemented:

- Notify the Environmental Inspector who will notify the Construction Manager or designate and the Enbridge Environment Project Lead;
- The Environmental Inspector shall provide an initial assessment of suspected archaeological, palaeontological and historical remains and either allow construction to resume or, in the event of a confirmed or potential discovery, proceed by notifying the Enbridge Environment Project Lead who will notify a qualified historical resource specialist and the appropriate regulatory authority, if required; and
- The Enbridge Environment Project Lead may deem it necessary for the qualified historical resource specialist to visit the site. Regardless of whether a site visit is required, develop an appropriate mitigation plan in consultation with the qualified historical resource specialist and, if necessary, the appropriate regulatory authority.

6.9

NOISE ABATEMENT

Activity Description:

Nuisance noise will be created by construction equipment and may affect wildlife resources and nearby residents.

Objectives:

1. To comply with applicable regulations and guidelines for noise during construction.
2. To reduce construction-related noise to the extent feasible near receptors.

General Noise Abatement Mitigation Measures:

1. **Noise Assessment:** Discuss the need for a noise assessment with the Enbridge Environment Project Lead (see Section 3.1.4 – Environmental Supporting Studies). More detailed assessments may be required if requested by the appropriate regulatory authority or if the project has associated facilities which may result in increased noise levels over existing levels during operations or maintenance.
2. **Control Noise:** Take reasonable measures to control construction related noise near residential areas. Alter equipment, erect noise barriers, or change the work schedule if excessive noise becomes a nuisance to nearby residents.
3. **Noise By-Laws:** Unless otherwise noted in municipal noise by-laws, generally conduct construction activity between the hours of 07:00 and 22:00. Note, some construction activities, once started, must continue on a 24 hour basis (e.g., horizontal directional drilling may be continuous until completion).
4. **Scheduling:** Consider noise abatement and scheduling construction at noise-sensitive locations during non-sensitive times, to limit disruption to sensitive receptors, including wildlife.
5. **Equipment:** Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Turn off equipment when not in use. Enclose noisy equipment and use noise barriers, where warranted, to limit the transmission of noise beyond the construction site. Locate stationary equipment, such as compressors and generators, away from noise receptors. Replace or repair equipment parts generating excessive noise.
6. **Trucking:** Inform truck drivers and mobile equipment operators that the use of engine retarder brakes will not be permitted in previously identified noise-sensitive locations.
7. **Access:** Maintain access roads to limit vehicle noise and noise from vibration.
8. **Air Traffic:** If flyovers of the pipeline are required, avoid low altitude flights, except as necessary for the safety and security of the pipeline. Restrict all air traffic to daytime hours.