WATER QUALITY MONITORING AND FISH SALVAGE PLAN FOR THE GRAND RAPIDS PIPELINE GP LTD. GRAND RAPIDS PIPELINE PROJECT (SPREADS 1 AND 3A)

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8395

Prepared for:

Grand Rapids Pipeline Project

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1.0 INTRODUCTION

Grand Rapids Pipeline GP Ltd. (Grand Rapids), in its capacity as general partner of the Grand Rapids Pipeline Limited Partnership, applied to the Alberta Energy Regulator (AER) pursuant to Part 4 of the *Pipeline Act* to construct and operate pipelines and associated installations, collectively named the Grand Rapids Pipeline Project (the Project).

The AER issued Decision 2014 ABAER 012 on October 9, 2014 granting approval for select Project applications, subject to the conditions outlined in Appendix 1 of the AER Decision. Condition No. 17 outlined the following water quality monitoring requirements:

> *"Where watercourses are not dry or frozen to bottom at the time of construction and where flowing water occurs, Grand Rapids must, through the use of a qualified aquatic environmental specialist, ensure that a water quality monitoring program is implemented during construction to monitor and confirm the effectiveness of the mitigation measures employed. This requirement applies to both horizontal directional drilling and isolated open cut crossings."*

TERA, a CH2M HILL Company (CH2M) was retained by Grand Rapids to prepare the following water quality monitoring and fish salvage plan for spreads 1 and 3a along the pipeline route to be constructed during summer/fall 2015. There are 16 watercourse crossings (WC1 to WC5 and WC12 to WC22) and two fish-bearing drainages (FD1 and FD5) along spreads 1 and 3a of the pipeline route. See Table 1 for further details regarding the watercourse and fish-bearing drainage crossings along spreads 1 and 3a.

The objectives of this water quality monitoring and fish salvage plan are to provide:

- details on the conditions for determining if water quality monitoring is needed;
- general water quality monitoring sampling methods;
- turbidity and total suspended solids (TSS) monitoring methods;
- fish salvage methods; and
- reporting requirements.

Grand Rapids is committed to ensuring that all pipeline installations across watercourses are conducted in a manner that is efficient, effective and conducted in adherence with industry best management practices to minimize potential effects on the environment. Within Section 8.4 of the Green and White Area Environmental Protection Plans (EPPs) (Grand Rapids Pipeline GP Ltd. 2014a,b) for the Project, Grand Rapids commits to conducting "*fish salvage, in accordance with permit conditions, using appropriate methods and equipment*", at all isolated trenched crossings. In addition, Grand Rapids commits to the development of "*water quality monitoring plans to monitor for sediment events during instream construction activities as required by the applicable regulatory approvals*." This plan provides further details regarding where and how water quality monitoring and fish salvage activities will be conducted along spreads 1 and 3a of the Project.

1.1 Project Description

Grand Rapids is a corporation, incorporated pursuant to the laws of Alberta, whose business is the development and operation of pipelines and associated installations to transport hydrocarbon products and crude oil within Alberta. Grand Rapids is jointly owned by subsidiaries of TransCanada PipeLines Limited and Phoenix Energy Holdings Limited.

The Project will comprise one transmission pipeline system (made up of two parallel pipelines, described below), one lateral pipeline system (made up of two parallel pipelines, described below) and various associated pipeline installations.

The Project consists of:

- one approximately 460.5 km pipeline with an O.D. of 508 mm from the Grand Rapids MacKay Terminal to terminals in the Edmonton area (the 508 mm pipeline) to:
  - initially transport approximately 90,000 barrels per day (bbl/d) of blended crude bitumen from the Grand Rapids MacKay Terminal at NW 34-89-14 W4M, approximately 30 km northwest of Fort McMurray, to the Edmonton area at 8-5-53-23 W4M; and
  - subsequently transport approximately 330,000 bbl/d of diluent from the Edmonton or Heartland areas to delivery points in the west Athabasca oil sands area;
- one approximately 460.5 km pipeline with an O.D. of 914 mm from the Grand Rapids MacKay Terminal to terminals in the Edmonton area to transport approximately 900,000 bbl/d of blended crude bitumen from the west Athabasca oil sands area to the Edmonton and Heartland areas (the 914 mm pipeline);
- one 4.5 km, 610 mm O.D. pipeline to transport approximately 400,000 bbl/d of blended crude bitumen from the Grand Rapids MacKay Receipt Station to the Grand Rapids MacKay Terminal (the 610 mm lateral pipeline);
- one 4.5 km, 406 mm O.D. pipeline to transport approximately 200,000 bbl/d of diluent from the Grand Rapids MacKay Terminal to the Grand Rapids MacKay Receipt Station (the 406 mm lateral pipeline); and
- seven associated pipeline installations, which include two tank farms and five pump stations, located at the following five pipeline installation sites:
  - Grand Rapids MacKay Terminal, located at NW 34-89-14 W4M, which includes a tank farm and pump station;
  - Grand Rapids Thornbury Terminal, located at NE 29-79-14 W4M, which includes a pump station;
  - Grand Rapids Wandering River Pump Station, located at NW 19-73-16 W4M, which includes a pump station;
  - Grand Rapids Grassland Pump Station, located at NE 15-67-18 W4M, which includes a pump station; and
  - Grand Rapids Heartland Terminal, located at SE 28-55-21 W4M, which includes a tank farm and pump station.

This water quality monitoring and fish salvage plan has been prepared to support clearing and construction activities for the watercourses and fish-bearing drainages located along spreads 1 (SE 28-89-14 W4M to NW 19-85-18 W4M) and 3a (SE 13-80-15 W4M to SW 21-74-16 W4M), which are scheduled for construction in winter 2015/2016. Construction of spreads 1 and 3a will encompass the pipeline route from approximately KP 000 to KP 66 + 000 and KP 132 + 430 to KP 181 + 670. This water quality monitoring and fish salvage plan outlines the procedures and standards for which water quality monitoring and fish salvage will take place, and demonstrates compliance with AER Condition No. 17 (Decision 2014 ABAER 012).

TABLE 1

SUMMARY OF PROPOSED WATERCOURSE AND FISH-BEARING DRAINAGES CROSSINGS ALONG THE PROPOSED PIPELINE ROUTE (REV 7)

Site No.	Name	Legal Location (W4M), UTM Coordinates (NAD 83, Zone 12) Latitude/Longitude (DD-MM-SS)	Watercourse Class and RAP	Open Water Mean Channel Morphology (m)	Fish Species Captured or Observed During Open Water Assessment (Previously Documented) [2]	Beaver Activity Present	Winter 2013 Results	Recommended Pipeline Crossing Method	Recommended Contingency Pipeline Crossing Method	Recommended Vehicle/ Equipment Crossing Method (Frozen)	Recommended Vehicle/ Equipment Crossing Method (Open Water)	Planned Pipeline Crossing Method	DFO Regulatory Requirement for Planned Crossing Methods	QAES Recommendations for Planned Pipeline Method	Comments
CONSTRUCTION SPREAD 1 (WINTER) NOVEMBER 2015 TO MARCH 2016 (20 INCH) AND NOVEMBER 2016 TO MARCH 2017 (36 INCH)															
FD1	Fish-bearing drainage	SE 28-89-14 428722E, 6289943N 56° 44' 52.8" N/ 112° 9' 55.8" W	n/a	Bankfull Width: n/a Wetted Width: 8.8 Water Depth: 1.0	Finescale dace, brook stickleback (lake chub, pearl dace previously documented in fish-bearing drainage).	No	Ice Depth: 0.3 m Water Depth: 0.8 m DO: 5.1 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Access from both sides	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 30 km upstream from the MacKay River.
WC1	Buffalo Creek	NE 18-87-17 395673E, 6268713N 56° 33' 4.1" N/ 112° 41' 49.5" W	Mapped Class C April 16 to July 15	Bankfull Width: 11.8 Wetted Width: 9.4 Water Depth: 0.4	Pearl dace, brook stickleback (finescale dace, pearl dace and brook stickleback previously documented in Buffalo Creek).	Yes but not influencing water levels	Ice Depth: 0.2 m Water Depth: 0.2 m DO: 5.5 mg/L Flow: <0.1 m³/s	Option A: Isolate if water present/open cut if dry or frozen to bottom with reclamation plan Option B: Trenchless	Option A: n/a Option B: Isolate if water present/ open cut if dry or frozen to bottom with reclamation plan	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP. • Recommend water quality monitoring as per mitigation measures in Section 8.4 of the EPP. • Reclamation plan for an isolated crossing method.	Proposed crossing is approximately 12 km upstream from the Athabasca River.
WC2	Unnamed tributary to the Athabasca River	SW 2-87-18 391554E, 6264516N 56° 30' 45.1" N/ 112° 45' 44.3" W	Mapped Class C April 16 to July 15	Bankfull Width: 3.9 Wetted Width: 12.0 Water Depth: 1.5	No fish captured or observed (brook stickleback previously documented in the unnamed tributary to the Athabasca River).	No	Ice Depth: 0.3 m Water Depth: 1.0 m DO: 1.8 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from the Athabasca River.
WC3	Livock River	SW 18-86-18 386467E, 6257779N 56° 27' 2.9" N/ 112° 50' 31.2" W	Mapped Class C April 16 to July 15	Bankfull Width: 11.0 Wetted Width: 9.0 Water Depth: 0.5	Lake chub, brook stickleback (finescale dace, lake chub, longnose sucker, fathead minnow and brook stickleback previously documented in Livock River).	No	Ice Depth: 0.3 m Water Depth: 0.1 m DO: n/r Flow: n/r	Isolate if water present/open cut if dry or frozen to bottom	Trenchless	Snowfill/ice bridge	Clear span bridge	Trenchless	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend water quality monitoring as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 17 km upstream from the Athabasca River.
WC4	Unnamed tributary to the Livock River	NE 6-86-18 386916E, 6255355N 56° 25' 45.0" N/ 112° 50' 1.2" W	Unmapped Class C None	Bankfull Width: 1.8 Wetted Width: 15.6 Water Depth: 0.5	No fish captured or observed (Finescale dace, lake chub, longnose sucker, fathead minnow and brook stickleback previously documented approximately 10 km downstream in the Livock River).	Yes - influencing water levels	Ice Depth: 0.2 m Water Depth: 0.3 m DO: 2.7 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 10 km upstream from the Livock River.
WC5	Unnamed tributary to the Athabasca River	NW 19-85-18 386188E, 6250962N 56° 23' 22.4" N/ 112° 50' 36.8" W	Mapped Class C April 16 to July 15	Bankfull Width: 3.6 Wetted Width: 3.2 Water Depth: 0.4	Pearl dace, brook stickleback (no fish previously documented in the unnamed tributary to the Athabasca River).	Yes – not influencing water levels	Ice Depth: 0.1 m Water Depth: <0.1 m DO: 5.5 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from the Athabasca River.

TABLE 1 Cont'd

Site No.	Name	Legal Location (W4M), UTM Coordinates (NAD 83, Zone 12) Latitude/Longitude (DD-MM-SS)	Watercourse Class and RAP	Open Water Mean Channel Morphology (m)	Fish Species Captured or Observed During Open Water Assessment (Previously Documented) [2]	Beaver Activity Present	Winter 2013 Results	Recommended Pipeline Crossing Method	Recommended Contingency Pipeline Crossing Method	Recommended Vehicle/ Equipment Crossing Method (Frozen)	Recommended Vehicle/ Equipment Crossing Method (Open Water)	Planned Pipeline Crossing Method	DFO Regulatory Requirement for Planned Crossing Methods	QAES Recommendations for Planned Pipeline Method	Comments
CONSTRUCTION SPREAD 3a (WINTER) NOVEMBER 2015 TO MARCH 2016 (20 INCH) AND NOVEMBER 2017 TO MARCH 2018 (36 INCH)															
WC12	Unnamed tributary to Dropoff Creek	SE 13-80-15 425104E, 6199304N 55° 55' 59.8" N/112° 11' 55.8" W	Unmapped Class C April 16 to July 15	Bankfull Width: 0.8 Wetted Width: 18.0 Water Depth: 0.4	Brook stickleback (finsecale dace, pearl dace, unknown cyprinid species and brook stickleback previously documented in Dropoff Creek).	Yes – influencing water levels	Ice Depth: <0.1 m Water Depth: 0.1 m DO: 7.0 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 9 km upstream from Dropoff Creek.
WC13	Unnamed tributary to Dropoff Creek	NW 5-80-14 427297E, 6196078N 55° 54' 16.7" N/112° 9' 46.3" W	Unmapped Class C April 16 to July 15	Bankfull Width: 1.9 Wetted Width: 1.5 Water Depth: 0.4	Brook stickleback (finsecale dace, pearl dace, unknown cyprinid species and brook stickleback previously documented in Dropoff Creek).	Yes - influencing water levels	Ice Depth: 0.2 m Water Depth: 0.3 m DO: n/r Flow: n/r (data collected 1km upstream)	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 18 km upstream from Dropoff Creek.
WC14	Unnamed tributary to Dropoff Creek	SW 29-79-14 427442E, 6192177N 55° 52' 10.6" N/112° 9' 34.3" W	Unmapped Class C April 16 to July 15	Bankfull Width: 0.7 Wetted Width: 0.8 Water Depth: 0.2	No fish sampling conducted since not on Fish Research License (finsecale dace, pearl dace, unknown cyprinid species and brook stickleback previously documented in Dropoff Creek).	No	Ice Depth: 0.3 m Water Depth: 0.2 m DO: 5.1 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from Dropoff Creek.
WC15	Unnamed tributary to Dropoff Creek	NE 19-79-14 426574E, 6191211N 55° 51' 39.0" N/112° 10' 6.0" W	Unmapped Class C April 16 to July 15	Bankfull Width: 0.7 Wetted Width: 1.7 Water Depth: 0.1	No fish sampling conducted since not on Fish Research License (finsecale dace, pearl dace, unknown cyprinid species and brook stickleback previously documented in Dropoff Creek).	No	No winter data collected	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from Dropoff Creek.
WC16	Unnamed tributary to Dropoff Creek	NE 18-79-14 426115E, 6190351N 55° 51' 10.9" N/112° 10' 48.8" W	Unmapped Class C April 16 to July 15	Bankfull Width: 0.6 Wetted Width: 0.9 Water Depth: 0.2	No fish sampling conducted since not on Fish Research License (finsecale dace, pearl dace, unknown cyprinid species and brook stickleback previously documented in Dropoff Creek).	No	No winter data collected	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from Dropoff Creek.
FD5	Fish-bearing drainage	SW 18-79-14 425682E, 6189008N 55° 50' 27.2" N/112° 11' 12.4" W	n/a	Bankfull Width: n/a Wetted Width: 80.6 Water Depth: 0.8	Brook stickleback (brook stickleback previously documented in fish-bearing drainage)	Yes – influencing water levels	Ice Depth: 0.4 m Water Depth: 0.3 m DO: 2.9 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Access from both sides	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 15 km upstream from Dropoff Creek.
WC17	House River	SW 10-78-15 421805E, 6178337N 55° 44' 39.9" N/112° 14' 44.2" W	Mapped Class C September 16 to July 15	Bankfull Width: 24.4 Wetted Width: 25.2 Water Depth: 0.8	Emerald shiner, spottail shiner, fathead minnow, lake chub, pearl dace, trout-perch, longnose sucker, unknown cyprinid species (Arctic grayling, northern pike, lake chub, longnose dace, finescale dace spottail shiner, lowa darter, longnose sucker, white sucker, slimy sculpin, spoonhead sculpin, trout-perch previously documented in the House River).	No	Ice Depth: n/r Water Depth: n/r DO: 11.8 mg/L Velocity: 0.4 m/s	Trenchless	Trenchless (redrill)	Snowfill/ice bridge	Clear span bridge	Trenchless	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Recommend water quality monitoring as per mitigation measures in Section 8.4 of the EPP. • Contingency is to redrill. • Any instream work would require additional site-specific mitigation and should be further discussed with a QAES, DFO and AESRD.	Proposed crossing is approximately 60 km upstream from the Athabasca River.

TABLE 1 Cont'd

Site No.	Name	Legal Location (W4M), UTM Coordinates (NAD 83, Zone 12) Latitude/Longitude (DD-MM-SS)	Watercourse Class and RAP	Open Water Mean Channel Morphology (m)	Fish Species Captured or Observed During Open Water Assessment (Previously Documented) [2]	Beaver Activity Present	Winter 2013 Results	Recommended Pipeline Crossing Method	Recommended Contingency Pipeline Crossing Method	Recommended Vehicle/ Equipment Crossing Method (Frozen)	Recommended Vehicle/ Equipment Crossing Method (Open Water)	Planned Pipeline Crossing Method	DFO Regulatory Requirement for Planned Crossing Methods	QAES Recommendations for Planned Pipeline Method	Comments
WC18	Unnamed tributary to the House River	SE 32-77-15 419046E, 6174378N 55° 42' 30.2" N/112° 17' 18.1" W	Unmapped Class C None	Bankfull Width: 1.1 Wetted Width: 4.5 Water Depth: 0.4	No fish captured or observed (Arctic grayling, northern pike, lake chub, longnose dace, finescale dace spottail shiner, lowa darter, longnose sucker, white sucker, slimy sculpin, spoonhead sculpin, trout-perch previously documented in the House River).	No	Ice Depth: <0.1 m Water Depth: <0.1 m DO: 1.3 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 10 km upstream from the House River.
WC19	Unnamed tributary to the House River	NE 32-76-15 418474E, 6165939N 55° 37' 57.0" N/112° 17' 41.9" W	Mapped Class C April 16 to July 15	Bankfull Width: 5.6 Wetted Width: 5.6 Water Depth: 1.1	Pearl dace, lake chub, longnose sucker, white sucker, brook stickleback (finescale dace, fathead minnow previously documented in the unnamed tributary. Arctic grayling, northern pike, lowa darter, longnose dace, trout-perch, previously documented in the unnamed tributary to the House River).	Yes - influencing water levels	Ice Depth: 0.7 m Water Depth: 0.5 m DO: 8.7 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP. • Recommend water quality monitoring as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 20 km upstream from the House River.
WC20	Unnamed tributary to the House River	NW 20-76-15 418021E, 6162313N 55° 35' 59.4" N/112° 18' 3.9" W	Mapped Class C April 16 to July 15	Bankfull Width: 3.2 Wetted Width: 17.4 Water Depth: 0.7	Brook stickleback (pearl dace, spottail shiner previously documented at proposed crossing. Arctic grayling, northern pike, lowa darter, longnose dace, lake chub, trout-perch, longnose sucker previously documented in the unnamed tributary to the House River).	Yes - influencing water levels	Ice Depth: 0.2 m Water Depth: 0.1 m DO: 7.1 mg/L Flow: <0.1 m³/s	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 30 km upstream from the House River.
WC21	Unnamed tributary to the Wandering River	NW 2-75-16 413109E, 6148078N 55° 28' 16.0" N/ 112° 22' 28.3" W	Mapped Class C April 16 to July 15	Bankfull Width: 2.9 Wetted Width: 2.8 Water Depth: 0.4	Longnose sucker, brook stickleback (white sucker and lake chub previously documented in unnamed tributary to the Wandering River).	No	No winter data collected	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 35 km upstream from the Wandering River.
WC22	Unnamed tributary to the Wandering River	SW 21-74-16 410978E, 6142711N 55° 25' 21.1" N/112° 24' 23.5" W	Mapped Class C April 16 to July 15	Bankfull Width: 10.9 Wetted Width: 20.1 Water Depth: 0.9	Brassy minnow, lake chub, white sucker, brook stickleback (longnose sucker previously documented in unnamed tributary to the Wandering River).	Yes - influencing water levels	Ice Depth: 0.3 m Water Depth: 0.5 m DO: 7.0 mg/L Flow: n/r	Isolate if water present/open cut if dry or frozen to bottom	n/a	Snowfill/ice bridge	Clear span bridge	Isolate if water present/open cut if dry or frozen to bottom	Meets DFO's self-assessment process if all QAES recommendations and mitigation measures are implemented.	• Implement mitigation measures as per Section 8.4 of the EPP. • Recommend a fish salvage be conducted if water present at the time of construction, as per mitigation measures in Section 8.4 of the EPP. • Recommend water quality monitoring as per mitigation measures in Section 8.4 of the EPP.	Proposed crossing is approximately 20 km upstream from the Wandering River.

Notes: n/a (not applicable), n/r (not recorded), FTB (frozen to bottom)

1 Determined from the *Code of Practice Management Area Maps* for Fort McMurray, Lac La Biche (AENV 2006a,b).

2 FWMIS 2014.

3 A trenchless pipeline crossing method can be used at any proposed crossing.

4 An isolated open-cut trenched crossing method is considered acceptable by CH2M Aquatic Specialists; however, a trenchless HDD method is planned due to engineering reasons.

2.0 WATER QUALITY MONITORING

The water quality monitoring sampling methods provided below have been designed to represent appropriate monitoring measures for both trenchless and trenched isolation watercourse crossing methods. If environmental conditions warrant adjustments to the water quality monitoring plan, the on-site QAES will define appropriate water quality monitoring plan refinements.

2.1 Water Quality Sampling Rationale

Water quality monitoring is needed where flow volumes and velocities are sufficient to transport sediment downstream of the construction site where suitable fish habitat is present. Water quality monitoring is not needed when the watercourse is dry or frozen to the bottom at the time of construction, or if there is insufficient flow to cause the downstream transport of sediment.

If water is present during construction at a watercourse, a qualified aquatic environment specialist (QAES) will determine if water quality monitoring is needed based on:

- the stream flow conditions (*i.e.,* flow volume and velocity) on-site during the proposed construction timing;
- the on-site water quality as it relates to fish health during the proposed construction timing;
- the quality and proximity of fish habitat within the zone of influence (ZOI); and
- fish species present downstream of the crossing location.

As part of the AER conditions in Appendix 1 of the AER Decision, Condition No. 16 outlines the following pre-construction assessment requirements:

> "Grand Rapids through the use of a qualified aquatic environmental specialist must assess the status of all fish-bearing watercourse crossings at the time of construction to verify that the proposed crossing method remains valid."

Information collected from these assessments will be included in the water quality monitoring report to be submitted following completion of watercourse crossing construction for spreads 1 and 3a.

2.2 Spread 1 and 3a Crossings – Sampling Rationale

Water quality monitoring is not recommended on any wetlands or the two fish-bearing drainages (FD1 and FD5) along spreads 1 and 3a due to their minimal flow velocities and associated lack of connectivity with downstream fish habitat; however, fish salvages may be required depending on the conditions found on-site during construction.

Typically, water quality monitoring is not needed on watercourses with a bankfull width less than 5 m due to reduced flows and limited fish habitat values (overwintering) during winter construction. For the 11 watercourses in spreads 1 and 3a (WC2, WC4, WC5, WC12, WC13, WC14, WC15, WC16, WC18, WC20 and WC21) with bankfull widths less than 5 m and where water is present during construction, water quality monitoring is not anticipated since reduced flows and limited fish habitat are anticipated at these sites.

Watercourses with a bankfull width greater than 5 m have a higher potential for providing suitable overwintering habitat and may have sufficient flow to transport suspended sediment substantial distances downstream of the crossing location. There are three watercourses which are planned to be isolated in spreads 1 and 3a (WC1,, WC19 and WC22) with bankfull widths greater than 5 m. Water quality monitoring needs will be determined by a QAES prior to instream construction for these three watercourses. As much lead-time as possible will be given to the QAES in order to schedule appropriate activities. Confirmation of flow and suitable fish habitat will be conducted prior to setting up the water quality monitoring equipment. Please see Sections 2.6 and 2.7 for further information regarding the frequency of water quality monitoring sampling during instream activities and in the event of an increase in turbidity.

A trenchless crossing is planned on the Livock and House rivers (WC 3 and WC17) in spread 1 and 3a respectively; water quality monitoring will be conducted at WC 3 and WC17 based on the anticipated stream flow conditions and fish habitat values present at this site.

Daily updates from the construction representatives regarding the drill progress, isolation progress and any notable construction events will need to be provided to the water quality monitoring crew on-site. Notable events that have the potential to influence turbidity will be documented and reported where necessary.

2.3 Water Quality Guidelines

To ensure the protection of aquatic resources during construction, provincial and federal guidelines have been established for both short-term exposure (*i.e.*, 24 hours) and long-term exposure (*i.e.*, between 24 hours and 30 days) to suspended sediment. Federally, the Canadian Council of Ministers of the Environment (CCME) has developed guidelines for TSS and turbidity in the *Canadian Water Quality Guidelines for Protection of Aquatic Life* (CCME 2007). Provincially, Alberta Environment and Sustainable Resource Development (AESRD) has developed guidelines for TSS in the *Surface Water Quality Guidelines for Use in Alberta* (AENV 1999). The CCME guidelines for TSS and turbidity and AESRD guidelines for TSS are provided in Table 2.

For isolated trenched crossings, increases in turbidity/TSS levels are expected during the installation and removal of isolation dams. These increases in turbidity/TSS levels typically return to background levels within the short-term exposure (*i.e.,* 24 hours) timelines; however, some increases may return to background levels within the long-term exposure (*i.e.*, between 24 hours and 30 days) timelines. Water quality monitoring will encompass these turbidity/TSS increases and will show when turbidity/TSS levels have returned to background levels.

TABLE 2

CCME AND AESRD GUIDELINES FOR TSS AND TURBIDITY

	Water Quality Parameter Exceedance Level		
	CCME		AESRD
Duration of Exceedance	TSS	Turbidity[1]	TSS
CLEAR FLOW PERIODS			
Short-term exposure (*i.e.,* 24 hours)	Maximum average increase of 25 mg/L from background levels.	Maximum average increase of 8 Nephelometric Turbidity (NTU) from background levels.	Not to be increased by more than 10 mg/L over background value for acute and chronic aquatic life toxicity levels.
Long-term exposure (*i.e.,* between 24 hours and 30 days)	Maximum average increase of 5 mg/L from background levels.	Maximum average increase of 2 NTU from background levels.	
HIGH FLOW PERIODS			
Short-term exposure (*i.e.,* 24 hours)	Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is greater than 250 mg/L.	Maximum increase of 8 NTU from background levels at any time one time when background levels are between 8 and 80 NTU. Should not increase more than 10% of background levels when background is greater than 80 NTU.	Not to be increased by more than 10 mg/L over background value for acute and chronic aquatic life toxicity levels.
Long-term exposure (*i.e.,* between 24 hours and 30 days)			

Note: 1 Turbidity is measured in NTU.

2.4 Turbidity and Total Suspended Solids Monitoring

For watercourse crossings in spreads 1 and 3a, turbidity will be measured on-site and the CCME guidelines for turbidity will be followed.

If no water quality impacting events (*e.g.*, drilling mud release) occur during construction, TSS samples will not need to be collected. If a water quality impacting event (*e.g.*, drilling mud release) occurs during construction, it is recommended that TSS samples be collected and analyzed, and a TSS/turbidity correlation be established. If an event occurs, water samples for TSS can be collected and sent to an accredited laboratory for analysis. Laboratory TSS data can then be correlated to turbidity data and a

relationship can be established for the remainder of construction. There is no requirement to conduct TSS/turbidity correlations prior to construction.

A correlation between turbidity and TSS is often unique for each location or situation. Typically, this relationship is established by collecting samples over the range of TSS concentrations that occur during a sediment event while simultaneously recording turbidity readings. After the TSS sample analysis results are obtained from the lab, a relationship between TSS and turbidity can be determined. This relationship then allows turbidity results to be directly compared to exceedance criteria for TSS.

2.5 Water Quality Monitoring Stations

Water quality monitoring typically occurs within the established ZOI of a crossing. The ZOI is the reach of the watercourse that has the highest potential to be impacted from construction activities associated with a proposed watercourse crossing. The length of the ZOI is determined in the field based on a variety of factors (*e.g.,* channel depth, flow velocity and channel morphology). The ZOI typically represents the area of the watercourse where 90% of the sediment load caused by construction activities is expected to fall out of suspension and be deposited (AENV 1999, Government of Alberta 2013).

Transect locations will be determined by a QAES and strategically located to help facilitate documenting the decay of any sediment mobilization events that occur as the distance downstream increases. Table 3 provides an example of the placement of transects relative to the crossing location for a small watercourse with a ZOI of 400 m. Larger watercourses with a larger ZOI may require additional transects. Transect locations will vary per site based on water velocity, water depth, wetted width, uniformity of flow and safety as well as other site-specific variables. For the House River (WC17), transects will be set-up at approximately 200 m upstream from the crossing location (background), at the crossing location, and at approximately 100 m, 200 m, 400 m and 800 m downstream of the crossing location. Each transect will include a sonde, recording turbidity data at 10 minute intervals throughout the drill as well as manual sampling. The location, duration and magnitude of effects from increased turbidity will be augmented during daylight hours with manual sampling conducted simultaneously with sonde data. This set-up is designed to detect construction-related effects (*e.g.*, drilling mud release).

To ensure adequate sampling and that the water quality monitoring crew can cover the entire circuit regularly during daylight hours, the number of sampling stations across all transects (except those upstream of the crossing) has been set at three, although this will be dependent on the site conditions and the discretion of the water quality monitoring crew.

TABLE 3

EXAMPLE SAMPLING TRANSECTS RELATIVE TO THE CROSSING LOCATION FOR A SMALL WATERCOURSE

Transect No.	Example Transect Relative to the Crossing Location	No. of Monitoring Stations at Transect	Water Quality Sampling Method
T1 (control transect)	100 m upstream of the crossing	One in the thalweg	Data sonde and manual sampling
T2	At the crossing	Three across the channel with one in the thalweg	Manual sampling at all three stations
T3	50 m downstream of the crossing	Three across the channel with one in the thalweg	Data sonde in the thalweg and manual sampling at all three stations
T4	100 m downstream of the crossing	Three across the channel with one in the thalweg	Data sonde in the thalweg and manual sampling at all three stations
T5	200 m downstream of the crossing	Three across the channel with one in the thalweg	Data sonde in the thalweg and manual sampling at all three stations
T6 (if necessary)	400 m downstream of the crossing	Three across the channel with one in the thalweg	Data sonde in the thalweg and manual sampling at all three stations

As T1 (*i.e.,* upstream of the crossing) is assumed to be the least likely of these transects to be affected by construction activities, turbidity and TSS data collected here will serve as a control and will represent the theoretical background levels throughout construction. As such, the establishment of a single monitoring station where access is most convenient for the sampling crew (*e.g.*, along either bank) will be sufficient.

By sampling within the thalweg, a single station at T1 will also sufficiently capture background turbidity and TSS levels.

Conditions permitting, monitoring stations may be maintained at each of the remaining transects (*i.e.*, one in the thalweg and one on either side of the thalweg at approximately half the remaining distance to each bank). In theory, this should allow the magnitude and duration of mobilized sediment (regardless of where it occurs) to be tracked at multiple locations downstream within the expected ZOI. The number of monitoring stations may increase depending on wetted width and fish habitat present at the time of construction.

Data sondes and manual sampling stations will be established as indicated in Table 3. One data sonde will be installed upstream from the crossing site, preferably at T1. The remaining sondes will be installed downstream from the crossing. Downstream from the crossing, the sondes will be installed in the sampling station associated with the channel's thalweg. It is expected that the sondes will be anchored in place either to the left or right bank, or to the watercourse bed.

If a transect cannot be established in the area as described in this plan, it is expected that the transect will be moved to another suitable location. If a monitoring station cannot be established along a transect in the area as described in this plan, it is expected that the station(s) will be moved to another suitable location along the same transect and will remain the same distance from the right-of-way. Rationale for moving transect(s) and/or station(s) will be documented and included in reporting.

The water quality monitoring crew will determine the most appropriate method of travel on-site. Since the crew may be travelling by foot, it is realistic to expect that two or three manual monitoring passes will be possible under normal monitoring circumstances. In the interest of crew safety, monitoring crew(s) will only be on-site during daylight hours, regardless of whether HDD construction occurs around the clock.

2.6 Data Logging

Sampling for turbidity will primarily occur with the use of data sondes secured at several sampling transects. Each sonde will be programmed to record turbidity in NTU at 10-minute intervals on a 24-hour basis. The monitoring crew will access and upload data collected at least once a day during daylight hours. In addition, at least one of the data sondes may be equipped with a satellite telemetry unit, enabling the near "real time" remote observation of monitoring data from this location. Data from this station can be made available to construction management, environmental inspection and Project management staff for *in situ* updates during the construction period. Consideration will also be given to ensuring that the unit includes an alarm feature that will provide a warning to the night shift, enabling the Environmental Inspector, construction and monitoring staff to evaluate the situation/conditions and respond appropriately (*i.e.*, at the discretion of the Environmental Inspector).

2.7 Manual Water Quality Monitoring

Supplemental manual water quality monitoring will also occur at each station using a hand-held turbidity meter. Manual water quality monitoring will be used to verify data sonde readings and to supplement data loggers at high priority areas based on the construction schedule or in the event of a frac-out.

Manual sampling will occur in daylight hours only during normal construction activities. A water quality monitoring crew will not be present during the night shift, unless specified by Grand Rapids. Data collected by the sondes during the night shift will enable the collection of data around the clock, but will also alleviate potential safety risks associated with having a crew in/around the watercourse at night. If an emergency arises (*i.e.*, frac-out) during the night shift, the water quality monitoring crew may be summoned to the site at the discretion of the Environmental Inspector.

When collecting water samples for turbidity analysis, the scoop to collect water will be triple-rinsed prior to sample collection. The sample will be collected from 60% depth. The sampling cuvette will be rinsed with deionized or distilled water between samples. The cuvette will be filled from the scoop with no rinses to prevent settling of the sediment and will be cleaned with a lint-free cloth before being placed into the meter to obtain a turbidity measurement. Turbidity measurements will be taken immediately once the water is poured into the cuvette to limit particle settlement. Samples that are not measured quickly will be mixed prior to obtaining a turbidity reading.

2.8 Total Suspended Solids Sampling

Throughout the construction period, if a frac-out or exceedance event is suspected, the water quality monitoring crew will collect approximately 30 TSS samples per watercourse for submission to an approved laboratory for analysis of TSS levels. TSS samples will be collected from all transects and station locations and over a range of turbidity levels that are observed.

Only sealed sample bottles provided by a laboratory will be used to collect TSS samples. Once the sample bottle is filled with water, a subsample will be poured into a sampling cuvette and turbidity will be measured. Once this value is recorded, it will also be written on the sample bottle along with the date, time and location of the sample, the sample identification number, crew initials, and the name of the watercourse from which it was taken. TSS water samples will be refrigerated immediately and transported to an approved laboratory for analyses as soon as possible, and in accordance with the laboratory's chain of custody form (additional storage and transportation requirements may be provided by the laboratory when the sample bottles are provided).

2.9 Standard Monitoring Activities for Horizontal Directional Drill Crossings

The following standard monitoring activities will be used to ensure a potential frac-out event is identified as quickly as possible, and any potential effects to aquatic and riparian resources from a frac-out event can be mitigated at trenchless crossings.

- Prior to commencing any drilling operations, the Crossing Contractor will clearly flag the entire expected drill path, including both sides of the watercourse channel, for quick reference in the event of a potential fracture.

- Grand Rapids or the Crossing Contractor will provide to the water quality monitoring crew the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan that explains the specific tasks that will be completed if fluid loss is detected, or should an inadvertent release of drilling fluid occur.

- During the pilot hole drilling and reaming phases, and in addition to water quality monitoring, the Crossing Contractor will also monitor for the loss of drilling fluid. This will consist of closely scrutinizing the amount of fluid returns coming to the drill pit or shaker tank and monitoring the amount of make-up drilling fluid required in the mixing tanks.

- During the pilot hole drilling and any subsequent phases, the Crossing Contractor will implement and follow Annular Pressure Monitoring Protocol (AP). AP would be used to measure the pressure between the wall of the bore hole and the drill pipe in the bore hole. The pressure during the drill will be modelled prior to any drilling activities. The drilling will then proceed by adhering to this pre-determined pressure profile. The AP will be followed during the entire drill in the event that a pressure loss and/or a pressure spike are observed. The Crossing Contractor will make the necessary changes to the drilling activities to ensure that pressures keep within the pre-calculated pressure profile.

- An Electronic Drilling Recorder will also document all drilling activities and mud volumes. This information will be documented on a continuous basis and be maintained by the drilling personnel in order to correlate drilling status with potential seepage events.

- Onshore monitoring of the drill path will be conducted by the Crossing Contractor's personnel, who will be positioned in the most advantageous locations to watch for any sign of surface migration at all times during drilling, reaming and pipe installation procedures. The Crossing Contractor will provide personnel to walk the drill path and its vicinity on each side of the alignment after every 100 m drilled, and/or at 4-hour intervals during drilling operations unless safety concerns require the frequency to be altered to monitor for surface seepage.

- A detailed observation sheet will be kept on-site for all onshore monitoring of the HDD bore path.

- The Crossing Contractor will provide all monitoring documentation (*i.e.*, pressures, mud volumes and onshore) to the on-site Environmental Inspector daily or as requested.

- A named Crossing Contractor representative responsible for drilling will be on-site at all times during drilling, reaming and pipe installation procedures to ensure that all preventative measures, and, if necessary, emergency response measures, are implemented effectively.

- This Crossing Contractor representative will keep the on-site Environmental Inspector informed of the drilling program status on a daily basis in writing.

- Visual and voice contact will be maintained at all times between all drilling and monitoring personnel to ensure that any operational changes are communicated immediately and effectively between the observation personnel and drilling rig operators. Hand-held two-way radio communications provided by the Crossing Contractor will also be utilized.

- Contingency plans for monitoring and communications, reporting, clean-up and continuance of drilling activities will be in place for addressing inadvertent mud returns.

- In the event of sediment releases or spills of deleterious substances during the construction of the trenchless crossings, implement the Directional Drilling Procedures and Instream Drilling Mud Release Contingency Plan (Appendix 1E of the EPP). The Crossing Contractor will alert the on-site Environmental Inspector and conduct a detailed examination of the drill path.

- The Crossing Contractor and/or Construction Contractor will have additional personnel available to assist in emergency response implementation. Water quality monitoring personnel are expected to continue water quality monitoring so they can document the impacts and extent of the frac-out, and will not be used to supplement crews implementing the emergency response.

2.10 Safety Considerations

The water quality monitoring crew at each watercourse will be comprised of two CH2M staff. CH2M staff will be Aquatic Specialists deployed from Calgary who are certified Swift Water Rescue Technicians and Ice Rescue Technicians – Level 1 during frozen conditions. If the monitoring crew at any point detects unsafe conditions, adjustments to the monitoring plan will occur on-site and as conditions permit.

CH2M's Standard Operating Procedures for conducting water quality monitoring during open water and frozen conditions may also need to be approved by Grand Rapids and the Construction Manager before water quality monitoring activities occur. The aquatic environment surrounding the crossing location will be visited immediately prior to construction to assess conditions and/or to install appropriate safety measures/techniques to mitigate potential hazards. If the water quality monitoring crew is deployed to the site and they confirm that safe open water and/or ice conditions exist, the water quality monitoring program will be implemented. If unsafe conditions cannot be mitigated to enable the implementation of the water quality monitoring plan as provided, adjustments to the plan will be made on-site and as conditions permit. If water quality monitoring is not possible due to safety concerns, the Environmental Inspector will notify applicable regulatory agencies.

During frozen conditions, an initial ice assessment is required to establish a safe water quality monitoring route. It is recommended that a crew of two to three people be utilized for the initial ice assessment for safety precautions. The crew will establish the monitoring transects while assessing ice thickness and strength to establish a safe route to utilize for daily water quality monitoring activities. Depending on ice conditions, anchor and belay systems may be required. CH2M's ice safety assessment and establishment of a safe water quality monitoring route is intended for CH2M personnel only (*i.e.,* subcontractors and/or equipment will travel on the ice at their discretion). After the initial ice assessment and establishment of a safe water quality monitoring route, the crews will conduct ongoing ice assessments, especially if weather and flow conditions change. If the monitoring crew detects unsafe conditions at any point, adjustments to the monitoring plan will be implemented on-site, as conditions permit. Ice safety procedures and safe ice assessments will be done in accordance with CH2M's Ice Safety Manual (TERA Environmental Consultants 2014).

3.0 FISH SALVAGE

The fish salvage crew at each watercourse will be comprised of two CH2M staff. These staff will be Aquatic Specialists deployed from Calgary who are certified Swift Water Rescue Technicians, Ice Rescue Technicians and electrofishing crew leads and members. The fish salvages will be conducted by the water quality monitoring crew (led by a QAES) under the terms of the Project Fish Research License (FRL).

A fish salvage will be conducted at trenched crossings at all watercourses and fish-bearing drainages if water is present at the time of construction. Following the installation of the isolation dams and when directed by the construction team that it is safe to do so, the water quality monitoring crew will proceed to capture and relocate the fish from the isolated work area. The water quality monitoring crew will determine the most appropriate method of capturing fish from within the isolated area to ensure fish can be captured and relocated without harm. Capturing methods may involve backpack electrofishing, seine netting and/or dip-netting. Electrofishing will be conducted by trained personnel using a Smith Root backpack electrofisher under the appropriate settings and in adherence to the Alberta Fisheries Management Division *Electrofishing Policy Respecting Injuries to Fish*. If injuries/casualties occur, the appropriate documenting and reporting will also occur. Salvage efforts within the isolated area of the crossing will occur until effort no longer yields the capture of fish, at the discretion of the on-site QAES.

Water levels may need to be lowered to allow for the effective capture of all fish in the isolated work area. The water quality monitoring crew will communicate with the construction team to lower water levels as needed until all fish have been removed from the isolation. Grey water that is pumped out of the isolated work area will be pumped onto land so that it will not introduce sediment into the watercourse and fish screens will be used on the intake hose to avoid harming fish.

Any fish captured will be held live in buckets or tubs with ample fresh stream water for short periods in order to identify, enumerate and measure them, as per the requirements of the FRL, prior to release. If fish sampling efforts produce greater than 100 fish of the same non-sportfish species, an enumerated subsample of that species will be taken. Fish will be released downstream of the construction site into similar habitat from which they were captured.

If a watercourse crossing is isolated for more than 14 consecutive days, a QAES will conduct a migration survey to determine if fish are congregating near the isolation and attempting to migrate upstream or downstream. If fish are congregating, it is recommended that they be moved around the isolation following the above fish salvage protocol in order to continue their migration.

4.0 REPORTING

As part of the AER conditions outlined in Appendix 1 of the AER Decision, Condition No. 18 of AER Decision 2014 ABAER 012 includes immediate reporting to the AER in the event a suspended solids exceedance occurs:

> *"Any exceedance of AESRD's suspended sediment thresholds must be reported to AER immediately and appropriate mitigation measures must be implemented."*

In the event that any of AESRD's TSS or turbidity thresholds are exceeded, or in the event that unforeseen circumstances or issues are encountered during construction, a detailed report will be prepared and provided to the appropriate regulatory agencies within prescribed timelines (*e.g.,* within 7 days to the province), as required. Turbidity and TSS results will be correlated to the sequence of construction activities so that resultant effects on water quality, if any, can be determined and quantified. Potential adverse effects of sediment suspension during construction will be discussed in the context of the duration, magnitude and distance of travel of the plume(s).

In addition to immediate reporting, CH2M will prepare a summary report for Grand Rapids upon the completion of the water quality monitoring and fish salvage of the crossings constructed along spreads 1 and 3a of the pipeline route.

5.0 REFERENCES

5.1 Literature Cited

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