



Tłıchǫ All-season Road Fish and Fish Habitat Protection Plan

Insert applicable LWB project numbers

March 2016

Version 1

Government of
Northwest Territories



REVISION HISTORY

| Version | Date | Notes/Revisions |
|---------|------------|---|
| 1 | March 2016 | Original version (in draft) to accompany permit application to Board for preliminary screening. |
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DEFINITIONS AND ACRONYMS

| | |
|---------------------|---|
| ARD | Acid Rock Discharge |
| DOT | Department of Transportation |
| DFO | Fisheries and Oceans Canada |
| FFHPP | Fish and Fish Habitat Protection Plan |
| GNWT | Government of the Northwest Territories |
| NWT | Northwest Territories |
| Project | Any development that requires a land use permit or water licence. |
| Proponent | Applicant for, or holder of, land use permit or water licence. |
| WLWB | Wek'èezhìi Land and Water Board |
| Adaptive management | A process for applying remedial methods and procedures when there is a failure in the predicted performance of designs and measures intended to protect environmental values. |
| Deleterious | Any substance that, if added to any water, would degrade or alter or form part of a process of degradation or alteration of the quality of that water so that it is rendered or is likely to be rendered deleterious to fish or fish habitat or to use by man of fish that frequent that water (Fisheries Act). |
| Habitat | Air, soil, water, food, cover and all the other components of the natural environment of wildlife or of a species of wildlife (NWT Wildlife Act). |
| Mitigation | Measures taken to eliminate or reduce a potential project effect. |
| Monitoring | The process of observing and documenting project activities. |
| TSS | Total Suspended Solids |
| Wildlife | Big game, birds of prey, furbearing animals, migratory game birds, nongame animals, non-licence animals and upland game birds, including any hybrid offspring resulting from the crossing of 2 wildlife animals (NWT Wildlife Act). |
| Worker | A person employed by the Developer or the Contractor to work on the project. |
| WMMP | Wildlife Management and Monitoring Plan Guidelines |



1 INTRODUCTION

1.1 PURPOSE

The Fish and Fish Habitat Protection Plan (FFHPP) is intended to apply to the construction of the proposed Tłıchq All-season Road (TASR). During the operation and maintenance of the highway, DOT will work with the fisheries manager(s) as well as utilize the DOT Erosion and Sediment Control manual. This FFHPP is part of a larger Environmental Management Plan, which addresses all aspects of environmental protection for activities associated with project construction. It is supplemented by the following plans:

- Waste Management Plan
- Emergency Response Plan
- Spill Contingency Plan
- Erosion and Sediment Control Plan
- Quarry Operations Plans (site-specific)
- Engagement Plan (including engagement record)
- Archaeological Site Chance Find Protocol
- Wildlife and Wildlife Habitat Protection Plan
- Erosion and Sediment Control Manual
- In-Field Water Analysis Plan

The FFHPP is intended to provide mitigation measures against activities such as accidental fuel spills, water withdrawal and overpressures in waterbodies or watercourses related to the use of explosives. Measures include mitigation for the highway right of way (ROW), installation of watercourse crossing structures, highway maintenance, camp operations, waste and fuel storage, accidental spills and conducting borrow pit operations.

1.2 RELEVANT GUIDANCE

The FFHPP was prepared in accordance with guidance provided in the following best management practices (BMP) publications:

- Fisheries and Oceans Canada. 1993. *Land Development Guidelines for the Protection of Aquatic Habitat*
- Fisheries and Oceans Canada. 1995. *Freshwater Intake End-of-Pipe Fish Screen Guideline*
- Fisheries and Oceans Canada. 1998. *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.*



- Fisheries and Oceans Canada. 2007. *Northwest Territories Operation Statement: Fish Timing Windows*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Culvert Maintenance*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Clear-span Bridges*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Ice Bridges and Snow fills*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Bridge Maintenance*
- Fisheries and Oceans Canada. 2010. *Protocol for Winter Water Withdrawal in the Northwest Territories and Nunavut*
- Fisheries and Oceans Canada. 2011. *Fish Screen Design Criteria for Flood and Water Truck Pumps*
- Fisheries and Oceans Canada. 2014. *Fisheries Protection Program* web site (www.dfo-mpo.gc.ca/pnw-ppe/fpp-ppp/index-eng.html)
- Indian and Northern Affairs Canada. 2003a. *Northern Land Use Guidelines Vol. 5: Access Roads and Trails*
- Indian and Northern Affairs Canada. 2003b. *Northern Land Use Guidelines Vol. 6: Camps and Support Facilities*
- Indian and Northern Affairs Canada. 2003c. *Northern Land Use Guidelines Vol. 7: Pits and Quarries.*

2 PROJECT DESCRIPTION

The proposed Tłıchq All-season Road (TASR) involves changing the location of the existing Tłıchq Winter Road System between Highway 3 and the community of Whatì to the overland all-season alignment illustrated in Map 1. The proposed TASR is defined as an all-season road approximately 94 km in length and 60 m in width. The TASR will have a cleared driving surface of approximately 8.5 m in width to accommodate a two lane gravel road with culverts and/or two lane bridges over water crossings as necessary.

The project is located within Mqwhì Gogha Dè Nıttèè, the traditional territory of the Tłıchq Dene. The proposed TASR is intended to provide improved service to the Tłıchq community of Whatì, which is currently serviced by the existing winter road.

The route is within the Taiga Plains and is within the zone of discontinuous permafrost (ECG 2007). The region provides habitat for a wide range of wildlife, fish and vegetation species. A description of environmental conditions within and surrounding the proposed TASR corridor is included in the Project Description Report (PDR).

The location of the 94 km all-season road begins at KM 196 along Highway 3 and continues in a northwesterly direction to the community government boundary of Whatì. The alignment is situated



within the geographic coordinates 62°28'54" to 63°10'37" N latitude and 116°29'07" to 117°00'05" W longitude. The proposed footprint is entirely contained within the Wek'èezhii area and begins approximately 40 km southwest of Behchokò off Highway 3. Approximately 17 km of the road is located on Tłjchq lands.

Map 1 currently indicates the proposed TASR corridor, major bridges, waterbodies, nearby communities, and roads, while archaeological sites and significant traditional knowledge sites are included in the PDR.

2.1 CONSTRUCTION SCHEDULE

The construction schedule will hinge on a final decision of the strategy to be employed. Construction from both ends would not likely alter day-to-day and month-to-month scheduling of individual contractors, but would have a substantial effect on the timeline of the overall project in terms of planning. It is estimated that construction will take up to four years and that construction will occur year-round while following best practices according to season and terrain location.

Any in-water works will be completed between July 16 and September 14 of any given year or when frozen solid or dry as identified in the DFO Fish Timing Windows for the NWT.

2.2 CONTRACTOR EDUCATION

The FFHPP will be reviewed with the Contractor that will be completing the work. The purpose of this review is to ensure the Contractor understands the intent of the FFHPP, to gain buy-in for the plan, to obtain feedback on possible improvements, and to ensure the Contractor understands how to implement the plan. The contractor will be responsible for educating highway construction crews on the content of the plan and its importance to be implemented correctly.

3 WATERCOURSE CROSSINGS AND RIGHT OF WAY

3.1 DESCRIPTION

The proposed TASR will cross 15 watercourses (Map 1). The watercourses vary in size from ephemeral drainages, with only seasonal flow, to large permanent watercourses, which flow year-round. Proposed crossing structures include large sized culverts and clear span bridges. Table 1 provides a comprehensive listing of each structure. Table 2 provides brief fish and fish habitat information for each of the major watercourses.

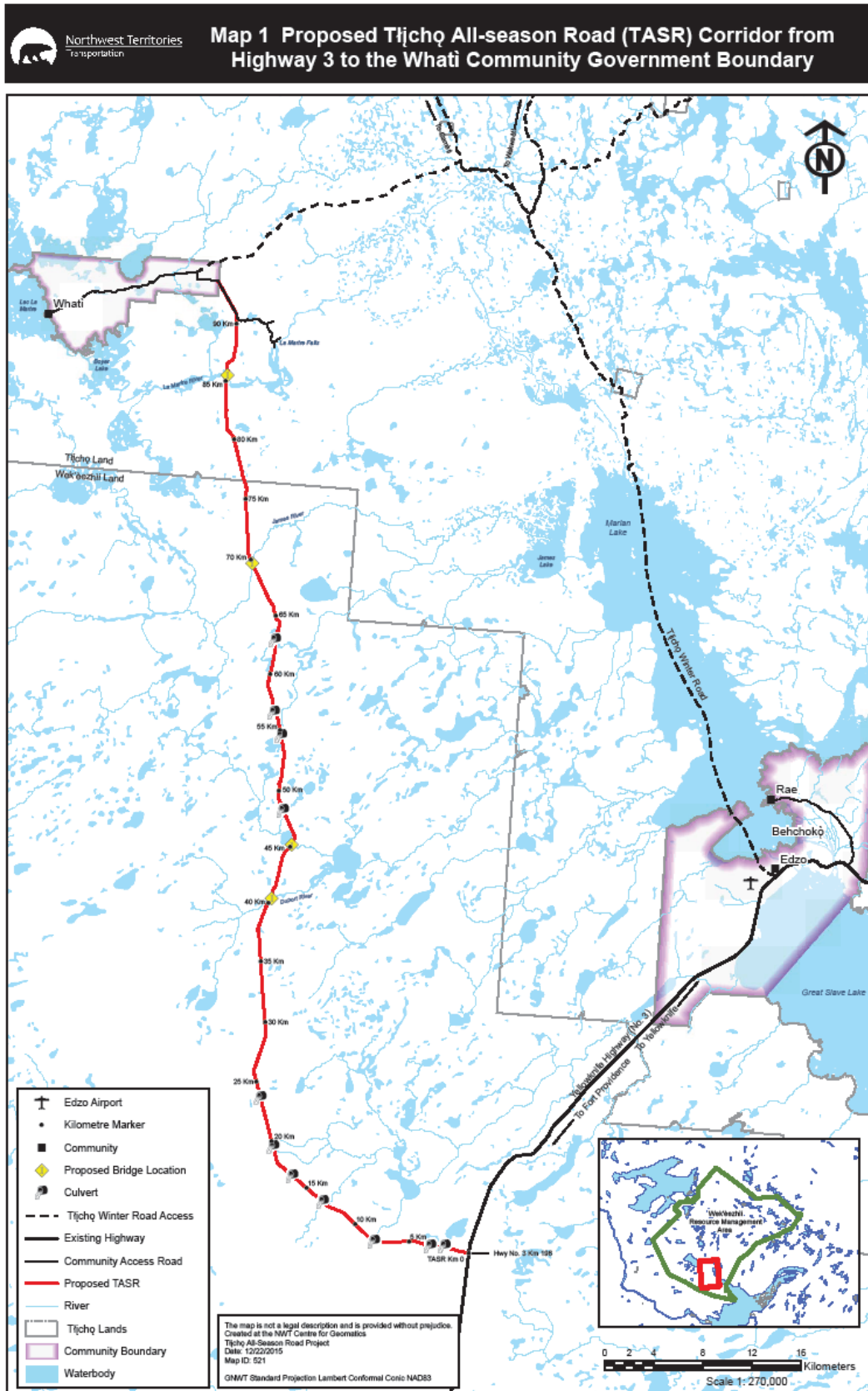




Table 1 Water crossing structures within proposed TASR corridor

| Crossing ID | Crossing KM | N | W | Culvert/Bridge Description |
|----------------|-------------|-----------|------------|----------------------------|
| 1 | 2.03 | 62°29'05" | 116°31'26" | 2x1200 CSP |
| | 2.38 | 62°29'05" | 116°31'50" | |
| 2 | 3.21 | 62°29'06" | 116°32'48" | 2x1400 CSP |
| | 3.22 | 62°29'06" | 116°32'48" | |
| 3 | 7.84 | 62°29'04" | 116°38'07" | 2x1400 CSP |
| | 7.86 | 62°29'04" | 116°38'09" | |
| 4 | 13.228 | 62°30'40" | 116°43'16" | 3x1400 CSP |
| | 13.233 | 62°30'40" | 116°43'16" | |
| | 13.238 | 62°30'40" | 116°43'17" | |
| 5 | 16.53 | 62°31'43" | 116°46'22" | 1x2430 SPCSP |
| 6 | 19.427 | 62°32'54" | 116°48'22" | 2x2430 SPCSP |
| | 19.432 | 62°32'54" | 116°48'22" | |
| 7 | 23.58 | 62°35'00" | 116°49'57" | 2x1400 CSP |
| | 23.59 | 62°35'01" | 116°49'57" | |
| 8 (Duport) | 40.40 | 62°43'48" | 116°50'21" | 48 m bridge |
| 9 | 45.18 | 62°46'13" | 116°48'51" | 24 m bridge |
| 10A | 48.21 | 62°47'40" | 116°49'53" | 3660x1910 Arch Culvert |
| 10 | 48.28 | 62°47'42" | 116°49'55" | 1x1200 CSP |
| 11 | 54.48 | 62°50'56" | 116°50'38" | 2x1400 CSP |
| | 54.52 | 62°50'58" | 116°50'38" | |
| 12 | 56.56 | 62°51'57" | 116°51'32" | 1x1000 CSP |
| 13 | 62.69 | 62°55'06" | 116°51'56" | 3x1400 CSP |
| | 62.70 | 62°55'06" | 116°51'56" | |
| | 62.71 | 62°55'07" | 116°51'56" | |
| 14 (James) | 68.67 | 62°58'26" | 116°54'43" | 80 m bridge |
| 15 (La Martre) | 85.40 | 63°06'34" | 116°58'33" | 100 m bridge |

Note: CSP = corrugated steel pipe; SPCSP = structural plate corrugated steel pipe

Additional specifications are available in Appendix I of PDR.



Table 2 Habitat characteristics at major water crossings along proposed TASR

| Crossing | Approx. Width | Cover % | Habitat Type | Substrate | Comments | Photo # in Appendix Q of PDR |
|-----------------|--------------------------------|---|---------------------|-------------------------|---|------------------------------|
| Duport River | 3.5-5 m, floodplain 50-75 m | grasses 70% shrubs 25% conifers 5% | run/pools | silt/sand | Extensive meanders with abundant isolated and seasonally connected floodplain pools. Large woody debris, entrenched eroding banks, cyprinids under vegetation. | 23, 24 |
| @ KM45.2 | 11.5 m | grasses 2% shrubs 70% conifers 28% | run/riffle | gravel/ cobble | Limited water with very little flow, but enough to sustain cyprinids. Old algae mat covers substrate. | 25 |
| James River | 10.0 m | grasses 20% shrubs 65% conifers 15% | riffle/pool /run | cobble/ organics | Meandering river with limited undercut banks. Deep well defined channel with cobble, gravel and boulders. | 27 |
| La Martre River | 50-60 m | grasses 50% shrubs 40% conifers 10% | riffle/pool | sand/ gravel/ cobble | Extremely habitable river. Main outflow to Lac La Martre and excellent fish habitat river. Large waterfalls many kilometers downstream of the bridge crossing location. | 28 |

3.2 RIPARIAN AREAS

Vegetated areas immediately adjacent to a watercourse are referred to as riparian areas. These areas are valuable in maintaining fish habitat and stabilizing stream banks. Riparian areas can provide cover to fish, be a source of nutrients to the aquatic environment and moderate water temperatures. The following applies to all watercourse crossings; regardless of type or classification of the watercourse. Additional information can be obtained in [Appendix A](#) (Riparian Zone Preservation BMP 30).

- Riparian areas will be maintained. When practical, riparian vegetation at water crossings will be altered by hand. If machinery must be used, machinery will be operated on land and in a manner that minimizes disturbance to the banks of the water body.
- Removal of vegetation will be limited to the width of the ROW.
- When altering a tree or shrub that is located on the bank of a watercourse, it will not be cut < 10 cm from the ground to allow the root structure soil stability to be maintained.
- Banks will be restored to original condition if any disturbance occurs.
- Grading of the stream banks for the approaches will not occur.
- If the stream bed and banks are steep or highly erodible (e.g. dominated by organic materials and silts), erosion and degradation are likely to occur as a result of equipment fording, then a temporary crossing structure or other practice (e.g. snow fill) will be used to protect these areas.



- Waste materials created by construction will be stabilized and removed from the work site to prevent them from entering the watercourse and potentially causing blockages to fish or the input of deleterious substances.
- A vegetated buffer strip will be maintained between the worksite and watercourse, except at the actual crossing location.

3.3 WATERCOURSE CROSSING GENERAL MITIGATION MEASURES

The following sections and mitigation applies to all watercourse crossings. Additional information can be obtained in [Appendix B](#) (Best Management Practices: Construction Practices, M1 and [Appendix C](#) (Northern Land Use Guidelines: Roads and Trails). Mitigation for sedimentation and erosion control is located in DOT's Erosion and Sediment Control Manual.

- Construction activities will be planned to minimize in-stream work.
- Disturbance of the natural banks will be kept to a minimum.
- In-stream work will be planned to occur as a single event at any one location.
- In-stream work will be restricted to low or no flow periods and abide by the DFO fish timing windows for the NWT.
- In-stream activities will be minimized as they may restrict stream flow or divert the natural stream course.
- Dried or wet concrete and other deleterious materials will be prevented from entering the creek during construction and the Spill Contingency Plan will be adhered to.
- Formworks will be removed from the site after their removal from the abutments and retaining walls to prevent debris from entering the watercourse and causing blockages or alterations in stream flow and fish movements.
- Design of the bridge will prevent runoff from the bridge deck and side slopes and approaches will be directed to a vegetated area to prevent deleterious substances from entering the watercourse.
- Culvert size will be designed to allow passage of upstream movement of spawning sized fish (e.g. Northern Pike) with no more than a three day delay during a 1:10 year flow event.
- The culvert will be aligned parallel to the existing natural channel and located on a straight stream section.
- The culvert will be matched to meet normal flow velocities for all seasons.
- The channels of the equalization culverts will be sloped in such a manner to prevent fish stranding during high flow events.



3.4 SNOW FILL/ICE BRIDGES

Snow fills involve compacting snow in the stream bed to create a road surface and are generally used for lighter types of traffic use. Ice bridges usually occur over larger watercourses and can be built-up to take heavy loads. Both types of temporary winter crossing methods may be used during the construction phase of the highway. The construction and use of snow fills and ice bridges will follow DFO's (2007) Operational Statement for Ice Bridges and Snow Fills (Appendix D).

- Ice bridges or snow fills must not obstruct the flow of water in a stream by causing it to freeze to the bottom.
- Prior to spring break-up, breach the ice bridge using physical means or create a v-notch in the middle of the ice bridge to allow it to melt from the centre.
- Snow fills will not restrict water flow at any time.
- If water is being pumped from a lake or river to build up and maintain the ice bridge, see Section 5 (Water Sources and Withdrawal) for mitigation.

4 EQUIPMENT MAINTENANCE, FUEL STORAGE AND REFUELING

The construction and maintenance of the highway requires the use of various forms of equipment from graders to trucks to water pumps and generators. The storage and use of fuels, hydraulic fluids and lubricants without proper mitigation could lead to the deposition of deleterious substances into watercourses or waterbodies. The following mitigation is designed to prevent these deleterious substances from entering aquatic systems.

- Fuels, lubricants and hydraulic fluids for equipment used will be carefully handled to avoid spillage, properly secured against unauthorized access or vandalism, provided with spill containment and disposed of in accordance with the Waste Management Plan.
- Fuel caches will be located on flat stable terrain or in natural depressions away from slopes to waterbodies.
- Fuel caches will be clearly marked and drums will be placed on their sides and spaced to allow for inspection.
- All fuel storage containers will have integrated 110% secondary containment.
- Refueling and servicing of machinery and storage of fuel and other materials for the machinery will occur, a minimum of 100 m away from any waterbody. Equipment used in or near water will be clean and free of oil, grease or other deleterious substances.
- All equipment will be inspected regularly to ensure it is free of leaks.
- Hydraulic fluids for machinery used for in-stream work will be biodegradable in case of accidental loss of fluid.



- Drip pans and drip trays will be placed under all equipment while not in use.
- The Spill Contingency Plan will be implemented if a spill occurs. Crews on site will be familiar with the SCP; and any spillage of fuels, lubricants or hydraulic oils will be immediately contained and the contaminated material removed from the site and properly disposed of in an approved disposal facility.
- Any spills will be reported immediately to the **Northwest Territories Spill Line (867-920-8130)**.

4.1 WASTE STORAGE AND TRANSPORTATION

No waste is planned to be deposited into the environment.

- All camp waste will be handled, stored and disposed of in accordance with the Waste Management Plan.
- Wastes that are temporarily stored on site will be kept in secure containers at least 100 m from any waterbody.
- Waste oils and hydraulic fluids should be collected in leak-proof containers and removed from the site for proper disposal or recycling.
- All unused fuel and empty fuel and hazardous material containers will be removed from the camps and properly disposed of at approved facilities.
- Wastes will be back hauled by qualified personnel.

5 WATER SOURCES AND WITHDRAWAL

Water will be required for use in camps, dust suppression and possible winter road construction. A majority of the water used will be during the construction phase of the project and is expected to only be taken from lakes. Waterbodies used for water withdrawal during construction would be used for only one to two years as different lakes are utilized for water withdrawal as road construction progresses. Water use during the operation of the highway will primarily be for dust suppression. All water use activities will be monitored and tracked and if required, regulated through a water licence.

- Waterbodies to be used for winter withdrawal will be identified by following DFO's Protocol for Winter Water Withdrawal in the Northwest Territories (**Appendix E**).
- In one ice-covered season, total water withdrawal from a single waterbody is not to exceed 10% of the available water volume calculated using the maximum expected ice thickness of 1.5 m.
- In cases where there are multiple users withdrawing water from a single waterbody, the total combined withdrawal volume is not to exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness as provided above.



- Only waterbodies with maximum depths that are ≥ 1.5 m than their corresponding maximum expected ice thickness will be considered for water withdrawal. Waterbodies with less than 1.5 m of free water beneath the maximum ice are particularly vulnerable to the effects of water withdrawal.
- Fish screens will be designed using the DFO (2011) Fish Screen Design Criteria for Flood and Water Truck Pumps (Appendix F).
- The screen should be kept clean and free of ice and debris.
- The screen should also be inspected for any damage prior to each withdrawal.
- If there is any evidence of fish impingement or entrainment, the operator should immediately stop the pumping operation and relocate to a different water source.
- A second screen should be kept on hand as a backup that could be used if the primary screen is frozen due to icing or is damaged during operations.
- The withdrawal of any watercourse will not exceed 5% of the instantaneous flow, in order to maintain existing fish habitat.

6 BORROW SOURCES

Borrow sources have been identified for use during the construction and maintenance of the project. Specific quarry operations plans have been developed for each borrow source to mitigate potential environmental effects and support applications for permits from GNWT – Lands. The quarry operations plans describe the aspects of managing the borrow sources from the start of operations to final reclamation. The Erosion and Sediment Control Manual provides mitigation on sedimentation and erosion control for the borrow sources. This section of the FFHPP provides mitigation for fish and fish habitat related to potential effects from the:

- Use of explosives
- Melt water and runoff during spring and summer
- Site remediation and closure
- Temporary winter access roads
- Monitoring for acid rock drainage potential (ARD)

6.1 GENERAL MITIGATION

Additional information can be obtained in Appendix B (Best Management Practices: Construction Practices, M1) and Appendix G (Northern Land Use Guidelines: Pits and Quarries).

- All the material that was brought onsite, including structures, equipment, and all camp waste will be removed during borrow pit reclamation.



- At sites where the topography has been modified, the natural contours will be reconstructed to restore natural drainage patterns and re-vegetated upon closure.
- See Section 3.2 (Riparian Areas) of this plan for any work in or near riparian areas.

6.2 PERMAFROST

- At least 2 m of overburden or other suitable material will be placed on exposed ice surfaces to provide insulation.
- Positive drainage will be established and maintained to prevent the formation of an end-pit lake at any permafrost prone areas.

6.3 EXPLOSIVES

- No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e. overpressure) greater than 50 kPa.
- After loading a charge in a hole, the hole is to be backfilled (stemmed) with sand or gravel to the level of the substrate/water interface or the hole collapsed to confine the force of the explosion to the formation being fractured.
- All “shock-tubes” and detonation wires are to be recovered and removed after each blast (when possible).
- The use of ammonium nitrate-fuel oil mixtures will not occur in or near water due to the potential production of toxic byproducts (e.g. ammonia).

6.4 WINTER ACCESS ROADS

Temporary winter roads and access trails will be required to access the borrow sources during construction and maintenance of the project. These winter roads will only be operational when the ground is sufficiently frozen and there is an adequate layer of snow to prevent damage to the ground by vehicles. Additional information can be obtained in Appendix C (Northern Land Use Guidelines: Roads and Trails). Snow fills or ice bridges construction on access roads will follow the mitigation in Section 2.4 of this plan.

6.5 ACID ROCK DRAINAGE (ARD) AND METALS LEACHING

During the geotechnical analysis prior to potentially opening a pit, samples will have geochemical testing for ARD and metals leaching potential. Once a pit is in operation, if there is a potential for ARD or metals leaching, a monitoring program will be put in place to ensure the aggregate is suitable for use and not contribute to ARD or metals leaching.



7 CAMPS

Temporary camps will be used to house workers during the construction of the project. Mitigation for sedimentation and erosion control related to camps is provided within the Erosion and Sediment Control Manual.

- Sewage waste and grey water will be stored onsite before being transported to an approved disposal facility.
- All the material that was brought onsite, including structures, equipment, and all camp waste will be removed at camp closure. Incinerators may be used.
- Camps are expected to be placed in selected borrow sources. Construction of water and erosion structures to prevent erosion will be completed, if required (refer to the Erosion and Sediment Control Manual).

8 HIGHWAY MAINTENANCE

Operating conditions for road use will be established to protect the integrity of the road and the safety of the users. To that end, regular maintenance will be required to keep the road in good and safe condition.

- Load limits will be implemented on roads to preserve the roadbed.
- During snow removal operations, care will be taken to not damage riparian vegetation near watercourse crossings.
- Snow from the road will be placed or ploughed off the highway in such a manner that during spring melt it drains into vegetated areas.
- Culvert maintenance will follow protocols set in the DFO Operational Statement for Culvert Maintenance (DFO 2007) provided in Appendix H; key mitigation measures include:
 - The removal of accumulated material (i.e. branches, stumps, other woody materials, garbage, ice, buildup, etc.) should be conducted between the period of July 15 and September 15, as per DFO fish timing windows for the NT, unless there is immediate blockage of water or fish movement at which time removal can occur.
 - Emergency debris removal using hand tools or machinery (e.g. backhoe) can be carried out at any time of year. Emergencies include situations where carrying out the project immediately is in the interest of preventing damage to property or the environment, or is in the interest of public health or safety. All other measures in the DFO Culvert Maintenance Operational Statement should be followed to the greatest extent possible.
 - The removal of riparian vegetation, if necessary, should be kept to a minimum.



- The removal of accumulated material (i.e. branches, stumps, other woody materials, garbage, etc.) will be limited to the area within the culvert, immediately upstream of the culvert and to that which is necessary to maintain culvert function and fish passage.
- Accumulated material and debris will be removed slowly to allow clean water to pass, to prevent downstream flooding and reduce the amount of sediment-laden water going downstream. Gradual dewatering will also reduce the potential for stranding fish in upstream areas.
- The removal of any beaver or any obstructions caused by beavers that affect the functionality of the water crossing should be conducted in consultation with ENR.
- Refer to the DOT Erosion and Sediment Control Manual for mitigation related to sedimentation and erosion control. Bridge maintenance will follow the DFO Operational Statement for Bridge Maintenance (DFO 2007) provided in Appendix I. Key mitigations include:
 - Unless the debris accumulation is an immediate threat to the integrity of the piers and abutments, the removal of debris will be conducted between July 15 and September 15 to avoid disruption of sensitive life stages of fish.
 - Ice buildup removal can be conducted at any time of year.
 - The removal of material will be limited to that which is necessary to protect piers and abutments.
 - Debris will be removed by hand or with machinery operating from shore.
 - Emergency debris removal using hand tools or machinery (e.g. backhoe) can be carried out at any time of year. Emergencies include situations where carrying out the project immediately is in the interest of preventing damage to property or the environment, or is in the interest of public health or safety. All other measures in the operational statement about bridge maintenance will be followed to the greatest extent possible.
 - Shrouding will be used to trap and prevent concrete and other bridge materials from entering the watercourse during structural repairs and reinforcements.
 - The removal of riparian vegetation will be kept to a minimum and limited to the ROW of the bridge. If riprap requires repair, install riprap material at a similar slope to maintain a uniform stream bank and natural stream alignment.
 - Riprap will be placed so as not to interfere with fish passage or constrict the channel width.
 - Measures to prevent sedimentation and provide erosion control can be found in the DOT Erosion and Sediment Control Manual.



9 MONITORING

Monitoring Measures for sedimentation and erosion are provided in the DOT Erosion and Sediment Control Manual. Monitoring from unplanned events such as spills is provided in the Spill Contingency Plan.

During highway operations, the structural integrity and performance of bridges and culverts along the road will be routinely monitored by DOT inspectors.

Bridges and culverts will be cleaned as required. During winter, culverts will be monitored for icing during routine inspection tours of the highway.

Explosives using ammonium nitrate oil based mixtures will be used for construction of the project. The release of ammonium or nitrate into the aquatic environment is not expected as borrow sources will have a minimum set back of 100 m from a watercourse.

9.1 WATER WITHDRAWAL

Monitoring includes:

- Recording of quantities of water withdrawn from lakes.
- Measurement of water depth below ice at the beginning and end of winter water withdrawal from any given lake where water withdrawal occurs.

9.2 ACID ROCK DRAINAGE AND METALS LEACHING

Geochemical sampling for ARD and metals leaching prior to opening up a potential pit will identify any ARD and metals leaching concerns. Any aggregate pit with potential ARD will have a sampling protocol to test for ARD.

9.3 REPORTING

If there are any deficiencies identified as it relates to fish and fish habitat, immediate corrective action will be taken and noted. Any permits, licences, or other legal instruments that involve fish and fish habitat reporting requirements will have reporting requirements embedded within them.

10 REFERENCES

Ecosystem Classification Group (ECG). 2007. Ecological Regions of the Northwest Territories – Taiga Plains. Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT, Canada. Viii + 173 pp. + folded insert map



Kavik Stantec Inc. 2013. Inuvik to Tuktoyaktuk Highway: Fish and Fish Habitat Protection Plan. Inuvik, NT.

DRAFT



Appendix A

RIPARIAN ZONE PRESERVATION BMP 30

Riparian Zone Preservation

Sediment Control and Erosion Control

B.M.P. #30

Description and Purpose

- Protection of existing plants and trees adjacent to all natural water bodies (riparian zones) adjacent to construction areas
- Existing vegetation acts as an effective vegetative buffer strip as a form of erosion and sediment control measure

Applications

- Permanent measure
- Existing established vegetation acts as an effective sediment control and erosion control buffer strip barrier to slow down flows and allow sedimentation filtration to occur
- May be used along property boundaries to minimize sediment transport off construction site despite non-presence of watercourse adjacent

Advantages

- Existing dense vegetation is more effective than any man-made structures or devices for sediment or erosion control, however, other forms of sediment and erosion control measures may be required on construction sites in addition to preserved riparian zones
- Any denuding of vegetation along steep valley slope with highly erodible soil will be detrimental and inductive to long-term sedimentation yield; it is important only to strip necessary areas along the footprint of construction. Preservation of riparian zone is mandatory along river valley slopes and along the edge corridor of waterbodies

Limitations

- Preservation of riparian zones may interfere with construction efficiency
- Careful planning is required to work around preserved riparian zones

Construction

- It is highly important to preserve an established vegetative buffer as freshly planted vegetation generally require substantial growth periods before they are as effective as established riparian zones
- Wherever possible, retain as much existing vegetation as possible between construction areas and sensitive zones (wetlands, marshes, streams, floodplains, etc.) to entrap sediment and to minimize sediment transport off of the construction site into the sensitive zones

| | |
|--------------------------------------|------------|
| Riparian Zone Preservation | B.M.P. #30 |
| Sediment Control and Erosion Control | |

- Define and delineate riparian zones to be preserved in Environmental Construction Operations Plan (ECO Plan) prior to commencement of construction
- Clearly mark riparian zones to be preserved in the field (with construction fencing, survey flagging, or other highly visible measure) so all personnel involved with construction operations can identify areas to be preserved

Construction Considerations

- Riparian zones must be fenced off immediately to minimize trespassing and to ensure effectiveness of riparian zone is maintained
- Do not allow equipment to enter areas not necessary to construction
- Based on site-specific situations established buffer zones of adequate width

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans
- Maintain fences protecting riparian zones from trespassing



Appendix B

BEST MANAGEMENT PRACTICES: CONSTRUCTION PRACTICES M1

BEST MANAGEMENT PRACTICES

Construction Practices

M1

FACTSHEET

1 of 3

DESCRIPTION AND PURPOSE

Work performed in and around water can potentially result in adverse effects on fish and fish habitat. These effects can be prevented by incorporating standard best management practices (BMP) into all work occurring in or near water. The BMP listed below should be used routinely for all watercourse crossing and maintenance projects.

GENERIC BEST MANAGEMENT PRACTICES

INSTREAM WORK

- Plan the project so that the amount of instream work is kept to a minimum
- Where possible, plan instream work to occur as a single event
- Restrict instream work to low flow periods where possible
- Limit machinery access to a single point on one bank
- Limit distance between machinery access point and work site
- Adhere to timing restrictions
- Minimize flow constriction
- Use instream pad built of washed gravel where instream equipment activity would generate excess sediment

RIGHT-OF-WAY

- Keep right-of-way for watercourse crossings as narrow as possible within the constraints of safety and construction requirements
- Limit removal of vegetation to the width of the right-of-way
- Clear vegetation from unstable or erodible banks by hand, avoiding the use of heavy machinery
- Develop sediment control plans and install sediment control measures before starting work
- Inspect sediment control measures regularly and make necessary repairs immediately after damage has been discovered
- Stockpile top soil removed from the right-of-way outside of the active floodplain and use measures such as silt fences and holding ponds to prevent stockpile runoff from entering the watercourse
- Minimize the length of time that unstable erodible soils are exposed
- Direct runoff containing sediment away from the stream into a vegetated area
- Construct suitably sized settling ponds to precipitate suspended sediment before water is discharged into the watercourse
- Stabilize erodible soils as soon as practical by seeding, spreading mulch or installing erosion control blankets
- Allow at least 4 weeks of growing season when using seeding to stabilize erodible soils
- Maintain a vegetated buffer strip between the work site and watercourse except at the actual crossing location

BEST MANAGEMENT PRACTICES

Construction Practices

M1

FACTSHEET

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GENERIC BEST MANAGEMENT PRACTICES (CONT'D)

MACHINERY

- Machinery should arrive on site in a clean, washed condition, free of fluid leaks
- Install stabilized entrances at vehicle and machinery access points
- Limit the amount and duration of instream work with heavy machinery. Work from the banks where possible
- Refuel machinery at locations well removed from the watercourse (maintain a minimum 100 m separation)
- Wash and service vehicles and machinery at locations well removed from the watercourse
- Work on instream pads composed of washed gravel to minimize sediment entrainment

POTENTIALLY TOXIC MATERIALS

- Use bio-friendly hydraulic fluids in equipment operating in or adjacent to watercourse
- Store fuel, lubricants, hydraulic fluid and other potentially toxic materials at locations well removed from the watercourse
- Isolate storage areas so that spilled fluids cannot enter the watercourse
- Prepare a spill contingency plan
- Report all spills:

AENV 24 Hour Spill Reporting Line: 1-800-222-6514

- Ensure creosote treated and pressure treated lumber is completely dry (no evidence of seepage of treatment materials) before use in or near watercourse
- Lumber used in construction should be treated and painted at a site well removed from the watercourse
- Use bridge skirts or other appropriate measures to prevent material from entering watercourse when painting, cleaning or resurfacing bridge deck and superstructures
- Do not use ammonium nitrate-fuel oil (ANFO) based explosives

COFFERDAMS AND BERMS

- Use cofferdams (earth fill, sheet pile or other proprietary designs) to separate instream work site from flowing water
- Use clean, washed material for construction and face berms with clean granular material
- Design cofferdams to accommodate the expected flows of the watercourse
- Limit cofferdams to one side of the watercourse at any one time and ensure that they block no more than one-third of the channel
- Restore the original channel bottom grade after removing cofferdams
- Treat all water pumped from behind the cofferdams to remove sediment before discharge

TEMPORARY DIVERSION CHANNELS

- Construct temporary diversion channels in the dry, starting from the downstream end
- Design temporary diversion channels to accommodate expected watercourse flow from storm events (generally 1 in 5 year event, though the 1 in 2 year event may be used for non-critical situations)
- Use erosion control methods where appropriate

BEST MANAGEMENT PRACTICES

Construction Practices

M1

FACTSHEET

3 of 3

- Leave the existing channels untouched until the temporary diversions are constructed

GENERIC BEST MANAGEMENT PRACTICES (CONT'D)

- Open diversion channels from the downstream end first
- Use clean, washed material to close existing channels and divert water to temporary diversion channels
- Use gradient controls to ensure that diversion channel slopes correspond to the existing channel gradients
- Protect unstable bends from erosion

PUMPED DIVERSIONS

- Used where a channel must be completely blocked to allow work 'in the dry'
- Must not be used where there are fish passage concerns
- Intakes must be sized and screened to prevent debris blockage and fish mortality
- Pumping system should be sized to accommodate expected watercourse flow from storm events (generally 1 in 5 year event, though the 1 in 2 year event may be used for non-critical situations)
- Discharge point should be armored with clean rock to prevent erosion

RECLAMATION AND SITE CLEANUP

- Begin reclamation and site cleanup as soon as construction has been completed
- Remove all waste material from the active floodplain
- Recontour, stabilize and revegetate disturbed areas to suit original conditions
- Remove all temporary facilities and structures
- Stabilize all slopes leading directly to the watercourse
- Seed exposed slopes immediately if there are at least 4 weeks remaining in the growing season. If this is not possible, slopes should be revegetated immediately in the next growing season



Appendix C

NORTHERN LAND USE GUIDELINES: ROADS AND TRAILS

Please see GNWT Lands website for download:

<http://www.lands.gov.nt.ca/en/northern-land-use-guidelines>.



Appendix D

DFO OPERATIONAL STATEMENT FOR ICE BRIDGES AND SNOW FILLS



ICE BRIDGES AND SNOW FILLS

Fisheries and Oceans Canada
Northwest Territories Operational Statement

Version 3.0

Ice bridges and snow fills are two methods used for temporary winter access in remote areas. Ice bridges are constructed on larger watercourses that have sufficient stream flow and water depth to prevent the ice bridge from coming into contact with the stream bed or restricting water movement beneath the ice. Snow fills, however, are temporary stream crossings constructed by filling a stream channel with clean compacted snow.

Ice bridge and snow fill crossings provide cost-effective access to remote areas when lakes, rivers and streams are frozen. Since the ground is frozen, ice bridges and snow fills can be built with minimal disturbance to the bed and banks of the watercourse. However, these crossings can still have negative effects on fish and fish habitat. Clearing shoreline and bank vegetation increases the potential for erosion and instability of the banks and can lead to deposition of sediments into fish habitat. There is also potential for blockage of fish passage during spring break-up.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with the subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your ice bridge or snow fill project without a DFO review when you meet the following conditions:

- your planned work is not located in a critical area, as identified in a NWT Community Conservation Plan or other applicable land use plan,
- ice bridges are constructed of clean (ambient) water, ice and snow,
- snow fills are constructed of clean snow, which will not restrict water flow at any time,
- the work does not include realigning the watercourse, dredging, placing fill, or grading or excavating the bed or bank of the watercourse,
- materials such as gravel, rock and loose woody material are NOT used,
- where logs are required for use in stabilizing shoreline approaches, they are clean and securely bound together,

and they are removed either before or immediately following the spring freshet,

- the withdrawal of any water will not exceed 10% of the instantaneous flow, in order to maintain existing fish habitat,
- water flow is maintained under the ice, where this naturally occurs,
- this Operational Statement is posted at the work site and is readily available for reference by workers, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Constructing an Ice Bridge or Snow Fill* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in the violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact the DFO office in your area if you wish to obtain DFO's opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all local, municipal, territorial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (www.sararegistry.gc.ca). If you have questions regarding this Operational Statement, please contact the DFO office in your area (see Northwest Territories DFO office list).

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Northwest Territories Operational Statement notification form (www.dfo-mpo.gc.ca/regions/central/habitat/os-ao/prov-terr/index_e.htm) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Constructing an Ice Bridge or Snow Fill

1. Use existing trails, winter roads or cut lines wherever possible as access routes to limit unnecessary clearing of additional vegetation and prevent soil compaction.
2. Construct approaches and crossings perpendicular to the watercourse wherever possible.

3. Construct ice bridge and snow fill approaches using clean, compacted snow and ice to a sufficient depth to protect the banks of the lake, river or stream. Clean logs may be used where necessary to stabilize approaches.

4. Where logs are used to stabilize the approaches of an ice bridge or snow fill:

4.1. The logs are clean and securely bound together so they can be easily removed.

4.2. No logs or woody debris are to be left within the water body or on the banks or shoreline where they can wash back into the water body.

Note: The use of material other than ice or snow to construct a temporary crossing over any ice-covered stream is prohibited under section 11 of the *Northwest Territories Fishery Regulations*, unless authorized by a Fishery Officer. Please contact the nearest NWT DFO office.

5. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be necessary to accommodate the road. This removal should be kept to a minimum and within the road right-of-way.

6. Install sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and decommissioning activities and make all necessary repairs if any damage occurs.

7. Operate machinery on land or on ice and in a manner that minimizes disturbance to the banks of the lake, river or stream.

7.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.

7.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water or spreading onto the ice surface.

7.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.

7.4. Restore banks to original condition if any disturbance occurs.

8. If water is being pumped from a lake or river to build up the bridge, follow DFO's *NWT Winter Water Withdrawal Protocol* (available from the DFO offices listed below), and ensure that the intakes are sized and adequately screened to prevent debris blockage and fish mortality (refer to DFO's *Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995) available at www.dfo-mpo.gc.ca/Library/223669.pdf).

9. Crossings do not impede water flow at any time of the year.

10. When the crossing season is over and where it is safe to do so, create a v-notch in the centre of the ice bridge to allow it to melt from the centre and also to prevent blocking fish passage, channel erosion and flooding. Compacted snow should be removed from snow fills prior to the spring freshet.

11. Stabilize any waste materials removed from the work site to prevent them from entering the lake, river, or stream. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.

12. Vegetate and stabilize (e.g., cover exposed areas with erosion control blankets or tarps to keep the soil in place and prevent erosion) any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses. Cover such areas with mulch to prevent erosion and to help seeds germinate. If re-vegetation is not possible due to climatic extremes and/or lack of appropriate seed or stock, the site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

12.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved or until such areas have been permanently stabilized by other effective sediment and erosion control measures, in the event that re-vegetation is not possible.

FISHERIES AND OCEANS CANADA OFFICES IN NORTHWEST TERRITORIES

Yellowknife Area Office

Fisheries and Oceans Canada
Suite 101 – Diamond Plaza
5204 - 50th Ave.
Yellowknife, NT X1A 1E2
Phone: (867) 669-4900
Fax: (867) 669-4940

Inuvik District Office

Fisheries and Oceans Canada
Box 1871
Inuvik, NT X0E 0T0
Phone: (867) 777-7500
Fax: (867) 777-7501

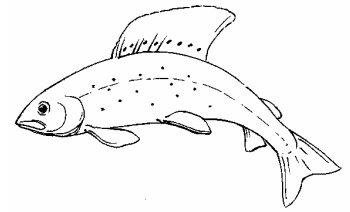
Aussi disponible en français

http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_f.asp



Appendix E

**DFO'S PROTOCOL FOR WINTER WATER
WITHDRAWAL IN THE NORTHWEST
TERRITORIES AND NUNAVUT**



DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut

Rationale

In the Northwest Territories and Nunavut, winter activities such as access road construction, exploratory drilling and camp operations often require large amounts of water. Excessive amounts of water withdrawn from ice-covered waterbodies can impact fish through oxygen depletion, loss of over-wintering habitat and/or reductions in littoral habitat. The potential for such negative impacts to over-wintering fish and fish habitat has made winter water withdrawal a critical issue for Fisheries and Oceans Canada (DFO) in the Northwest Territories and Nunavut. To mitigate impacts to fish from water withdrawal from ice-covered waterbodies, and to provide standardized guidance to water users, including volume limits for certain water source types, DFO has developed this protocol in conjunction with industry and other regulators.

For the purposes of this protocol, a **waterbody** is defined as any water-filled basin that is potential fish habitat. A waterbody is defined by the ordinary high water mark of the basin, and excludes connecting watercourses.

This protocol will **not** apply to the following:

- Any waterbody that is exempted by DFO (e.g. Great Bear Lake, Great Slave Lake, Gordon Lake, and others as and when determined by DFO), and;
- Any waterbody from which less than 100m³ is to be withdrawn over the course of one ice-covered period.

In order to establish a winter water withdrawal limit for a given waterbody, the following criteria must be adhered to:

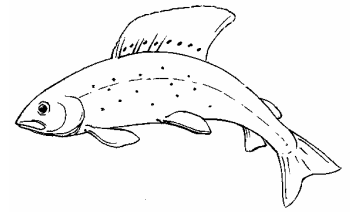
1. In one ice-covered season, total water withdrawal from a single waterbody is not to exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness provided in Table 1.
2. In cases where there are multiple users withdrawing water from a single waterbody, the total combined withdrawal volume is not to exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness provided in Table 1. Therefore, consistent and coordinated water source identification is essential.
3. Only waterbodies with maximum depths that are $\geq 1.5\text{m}$ than their corresponding maximum expected ice thickness should be considered for water withdrawal (Table 1). Waterbodies with less than 1.5m of free water beneath the maximum ice are considered to be particularly vulnerable to the effects of water withdrawal.
4. Any waterbody with a maximum expected ice thickness that is greater than, or equal to, its maximum depth (as determined from a bathymetric survey) is exempt from the 10% maximum withdrawal limit (Table 1).

To further mitigate the impacts of water withdrawal, water is to be removed from deep areas of waterbodies (>2m below the ice surface) wherever feasible, to avoid the removal of oxygenated surface waters that are critical to over-wintering fish. The littoral zone should be avoided as a water withdrawal location. Water intakes should also be properly screened with fine mesh of 2.54 mm (1/10") and have moderate intake velocities to prevent the entrainment of fish. Please refer to the *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO, 1995) which is available upon request, or at the following internet address: www.dfo-mpo.gc.ca/Library/223669.pdf.

In order to determine the maximum water withdrawal volume from an ice-covered waterbody, and thereby conform to this protocol, the following information must be provided to DFO for review and concurrence prior to program commencement.

Water Source Identification

1. Proposed water sources, access routes, and crossing locations clearly identified on a map, with geographical coordinates (latitude/longitude and/or UTM) included.
2. Any watercourse connectivity (permanently flowing and/or seasonal) between the proposed water source and any other waterbody or watercourse.



DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut

3. Aerial photos or satellite imagery of the water sources.
4. Estimated total water withdrawal requirement for work or activity and estimated total water withdrawal per water source (in m³).

Bathymetric Survey Results

1. For all waterbodies: One longitudinal transect, connecting the two farthest shorelines, is to be conducted regardless of waterbody size. Note: a longitudinal transect may be straight or curved in order to accommodate the shape of a lake (see Figure 1).
2. For waterbodies equal to or less than 1 km in length: a minimum of one longitudinal transect and two perpendicular transects are to be conducted. Perpendicular transects should be evenly spaced on the longest longitudinal transect, dividing the lake into thirds (Figure 1).
3. For lakes greater than 1 km in length: a minimum of one longitudinal transect is to be conducted. Perpendicular transects (minimum of 2) should be evenly spaced on the longest longitudinal transect at maximum intervals of 500 m.
4. Additional transects should be run as required to include irregularities in waterbody shape such as fingers or bays (Figure 1).
5. All longitudinal and perpendicular transects are to be conducted using an accurate, continuous depth sounding methodology, such as open water echo sounding or ground penetrating radar (GPR), that provides a continuous depth recording from one shore to the farthest opposing shore (Figure 1). Any alternative technology should be reviewed by DFO prior to implementing for bathymetric surveys.

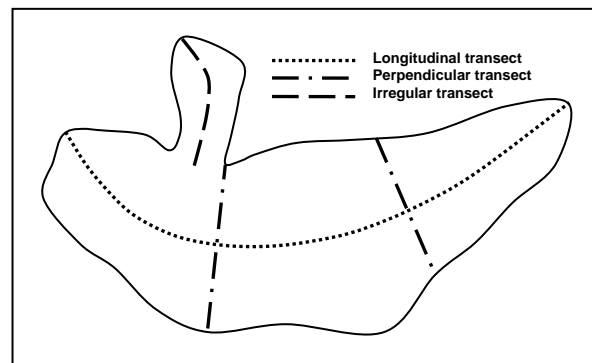
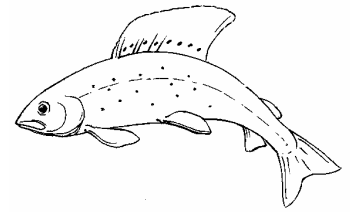


Figure 1. Minimum transect layout for a lake that is less than 1 km in length, with an irregularity.

Volume Calculations

1. Document the methods used to calculate surface area. If aerial photos or satellite imagery were used, provide the date (day/month/year) taken, as surface area may change depending on the time of year. If maps were used, provide the year that they were surveyed.
2. Detail the methods used to determine the total volume of free water, incorporating the relevant bathymetric information.
3. Calculate the available water volume under the ice using the appropriate maximum expected ice thickness, i.e. $Total\ Volume_{lake} - Ice\ Volume_{max\ thickness} = Available\ Water\ Volume$ (see Table 1 for maximum ice thickness).
4. For programs where ice-chipping is used, the total ice volume to be removed from the waterbody should be converted to total liquid volume and incorporated into the estimate of total water withdrawal requirement per water source.



DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut

Table 1. Maximum expected ice thickness, and corresponding water depth requirements, for different regions in the Northwest Territories.

| Area | Maximum Expected Ice Thickness (m) | Minimum Waterbody depth Required for 10% Water Withdrawal (m) |
|---|------------------------------------|---|
| Above the Tree Line | 2.0 | ≥3.5 |
| Below the Tree Line - North of Fort Simpson | 1.5 | ≥3.0 |
| Deh Cho –South of Fort Simpson | 1.0 | ≥2.5 |

A brief project summary report documenting and confirming total water volume used per water source and corresponding dates should be submitted to DFO within 60 days of project completion. Information should be provided in the following format (this information would also be useful as part of the project description):

| | |
|---------------------------------------|---|
| Lake ID | number and/or name |
| Coordinates | latitude and longitude and/or UTM coordinates |
| Surface area | in ha |
| Total Lake Volume | in m ³ |
| Under Ice Volume | in m ³ (based on max ice thickness for region) |
| Max expected ice thickness value used | in m |
| Calculated 10% Withdrawal volume | in m ³ |
| Total required water volume extracted | in m ³ |
| Aerial photographs of waterbody | PDF format |
| Bathymetric Map(s) of waterbody | PDF format |

Any requests deviating from the above must be submitted to DFO and will be addressed on a site-specific basis.

Beaver and Muskrat

Many species of animals are highly sensitive to water fluctuations. In areas where beaver and muskrat may occur, the appropriate agencies or organizations should be consulted to determine if harmful effects will result from your activities, and whether these effects can be successfully mitigated through modifications to your plans including best management practices.

Please note that adherence to this protocol does not release the proponent of the responsibility for obtaining any permits, licenses or authorizations that may be required.

For more information contact DFO at (867) 669-4915.



Appendix F

**DFO'S FISH SCREEN DESIGN CRITERIA FOR
FLOOD AND WATER TRUCK PUMPS**



Fish Screen Design Criteria for Flood and Water Truck Pumps Fisheries and Oceans Canada

Overview

Development is ever increasing in the north, with many associated activities occurring in the winter months when access to remote locations is facilitated by seasonal winter roads made of snow and ice. The construction and maintenance of winter roads often require large quantities of water that is withdrawn from ice-covered lakes, ponds, streams, and rivers. The duration and frequency of water withdrawals for access construction is limited at a given water source compared to more permanent structures such as a municipal or permanent camp water intake.

During construction or maintenance, water is used to strengthen or repair sections of the roadway. Water can be applied to the surface of the ice road using a flood pump or a water truck. Flood pumps are used to pump water directly from an auger hole to the surrounding surface area, and are used when a larger volume of water is required and a source of water is available at the site (Figure 1). Water trucks also need to extract water through holes augered through the ice, but have the ability to transport and distribute water over a larger area including portages (overland sections between waterbodies).

Fig.1. Flood Pump and the flood pump in use.



As with any water intake that operates in fish bearing waters, protection of fish from entrainment (i.e. fish drawn into the water intake) or impingement (i.e. fish held in contact with the intake screen and cannot escape) is required. The objective of this document is to



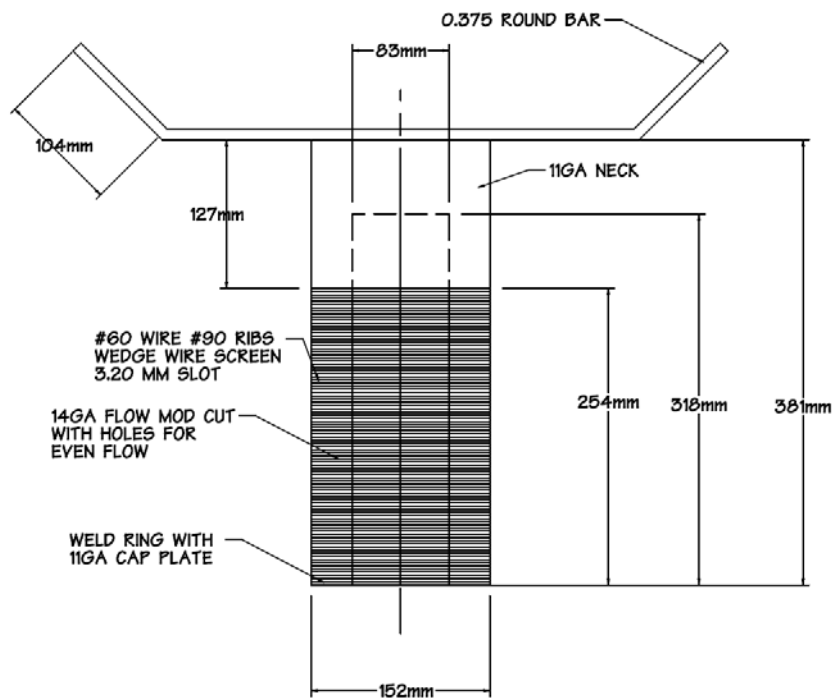
supplement the existing Department of Fisheries and Oceans (DFO) Freshwater Intake End-of-Pipe Fish Screen Guideline (hereafter “the DFO intake guideline) by providing fish screen design criteria to address the unique requirements and challenges of protecting fish at water intakes that are mobile, temporary and extract water through ice.

Design criteria for fish screens that are to be used for winter access construction need to take into consideration a number of factors including: the diameter of the auger hole, operating conditions, the potential for ice build-up and freezing of screens. The size and shape of the fish screen is constrained by the auger hole dimensions and ice thickness. The most common auger diameter used is eight inches, and ice thickness can exceed one meter.

Based on a series of recent field tests of various fish screen designs, done in collaboration with DFO, the Tibbitt to Contwoyto Winter Road Joint Venture, and Nuna Logistics, the hanging basket screen design (Figure 2) with 3.20mm (0.125 inch) mesh without a baffle tube has been adopted as the design standard for flood pumps and water trucks

Fig. 2. Hanging basket screen design for water trucks (a) and flood pumps (b) © www.screen services.com. Note that baffle tubes (flow modulators) are shown in the figure but were later removed from the final design to improve pumping capacity.

a)





the area. Swimming ability is measured in terms of swimming speed and endurance time (the time that a fish can maintain a given swimming speed). Approach velocity is a function of the water withdrawal rate and the size (gross area) of the intake screen. The larger the screen area the lower the approach velocity.

- The DFO intake guideline contains a summary of required screen area sizes for the two groups of fish species, anguilliform (fish that swim like eels) and subcarangiform (swim like trout) species for a range of water withdrawal rates up to 125 L/s (2000 US gpm). For more information on the approach velocity design criteria please refer to the DFO intake guideline (see link to this document under References).
- Prototype hanging basket screens were developed for both water trucks and flood pumps and tested during the winter road field season (Table 1 and Fig. 2). Based on an assessment of the potential fish species that were at risk during the field tests, the subcarangiform group was selected as the design species. The surface area size for the screens was obtained from Table 2 in the DFO intake guideline based on the required pumping rate. The prototype basket screens were designed for 8 inch diameter boreholes.
- The hanging basket screen design was found to be most practical in terms of balancing fish protection needs with the challenges of winter water withdrawal, based on the reduced risk of entrainment and impingement due to the relatively short pumping time (less than 10 minutes at a given location), limited space between the screen and the auger hole for fish to be in, and noise levels from flood pumps which are in close proximity to where the water is being extracted acting as a potential deterrent for some fish species.
 - Both of the prototype basket screens used in testing were initially equipped with baffle tubes to ensure an even velocity distribution across the face of the screen. Testing of the flood pump with the basket screen resulted in a significant decrease in pumping capacity due to the head loss of the screen within the confines of the auger hole. The pumping capacity of the flood pump improved significantly when the baffle tube was removed from the screen. While the baffle tube did not significantly affect the pumping capacity of the water truck, the added protection to fish while the basket screen was in the auger hole was minimal and therefore it was removed.





Fig. 3. Hanging basket screen in use with water truck and flood pump.



- The recommended 3.20mm (0.125 inch) mesh size is based on a risk assessment that included fish species present and timing of the water withdrawal, location of the screens and as mitigation for potential icing effects. This differs from the design criteria for open water conditions which should use the maximum design opening recommended in the DFO intake guideline of 2.54 mm (0.10 inch) for the default 25 mm fish size.
- Screen openings may be round, square, rectangular or any combination thereof, but should not have any protrusions that could injure fish.
- The fish screen should be constructed of materials that can withstand the extreme winter temperatures and handling requirements of winter water withdrawals.
- Potential debris loading of the hanging basket screen is expected to be low because pumping time is short, the basket is positioned above the bed of the water source and sediment levels in the water column are generally lower in the winter.
- The hanging basket fish screen design could also be adapted for use in open water conditions by suspending the basket at the water surface with the use of a float or other support where water depth is sufficient to maintain the screen elevated above the bed of the water source
- **Please Note:** The recommended design where the screen is within the auger hole does not include a baffle tube. However, any proposed alternative that result in the screen being below the auger hole should include a baffle tube to produce an equal velocity distribution along the screen face to eliminate high velocity zones. A baffle tube would be required for any screen design used in open water conditions.



Table 1. Pump capacity and corresponding fish basket sizing criteria for pumps that were used during the winter road field test.

| Pump Type | | Pumping Capacity | | Screen Size | | |
|-------------|--|------------------|--------|------------------------|--------|----------------------------|
| | | L/s | US gpm | Area (m ²) | Length | Diameter |
| Water Truck |  | 12.62 | 200 | 0.121 | 254 mm | 152 mm or (6 inches) |
| Flood Pump |  | 27.32 | 433 | 0.255 | 533 mm | 152 mm or (6 inches) |

Note: L/s = litres per second & US gpm = US gallons per minute

Screen Operation Criteria

- The screen should be kept clean and free of ice and debris.
- The screen should also be inspected for any damage prior to each withdrawal.
- If there is any evidence of fish impingement or entrainment the operator should immediately stop the pumping operation and relocate to a different water source.
- A second screen should be kept on hand as a backup that could be used if the primary screen is frozen due to icing or is damaged during operations.

Concluding Remarks

Properly designed fish screens for water intakes used in fish bearing waters will reduce the risk potential of injury or death to fish during the water extraction process and is a requirement under Section 30 of the *Fisheries Act*.

The hanging basket fish screen design presented in this document was developed based on the specific flood and water truck pumps used during the ice road construction field tests. The lower risk potential to fish based on the use of temporary water sources and the limited duration and frequency of water withdrawals at these sources and the operational challenges were factors in the selection of the basket screen design.



Please let us know how the screens are working as we are developing this guidance in conjunction with you, the operator. If fish are encountered, please document as much information as possible such as species, numbers, location, and water depth. Provide comments and/ or fish information to DFO by email at Bruce.Hanna@dfo-mpo.gc.ca or by phone at (867) 669-4931).

Acknowledgments

This document was prepared by Rick Gervais and Bruce Hanna, Fisheries and Oceans Canada. We would like to thank everyone who was involved in the design, construction and testing of the fish screens. In particular we would like to acknowledge Erik Madsen – Tibbitt to Contwoyto Winter Road Joint Venture; Alan Fitzgerald and the field crew from NUNA Logistics for their time, effort and commitment; Pete Cott, Fisheries and Oceans Canada and Charity Clarkin, BHP Billiton for reviewing and providing input on this guidance document; and Paul Whitham, Screen Services for designing and manufacturing the screens that were used in the field test..

References

Department of Fisheries and Oceans (DFO) 1995. Freshwater Intake End-of-Pipe Fish Screen Guideline. Department of Fisheries & Oceans Publication DFO/5080. Available at: www.dfo-mpo.gc.ca/Library/223669.pdf



Appendix G

NORTHERN LAND USE GUIDELINES: PITS AND QUARRIES

Please see GNWT Lands website for download:

<http://www.lands.gov.nt.ca/en/northern-land-use-guidelines>.



Appendix H

DFO OPERATIONAL STATEMENT FOR CULVERT MAINTENANCE



CULVERT MAINTENANCE

Fisheries and Oceans Canada
Northwest Territories Operational Statement

Version 3.0

Culvert maintenance is undertaken to extend the life of the structure and to ensure that it functions as designed, thus ensuring public safety and safe fish passage. Culvert maintenance includes the removal of accumulated debris (e.g., logs, boulders, garbage, ice build-up) that prevents the efficient passage of water and fish through the structure. Culvert maintenance may also include the reinforcement of eroding inlets and outlets, but does not include the replacement of damaged or destroyed bevel ends. Culverts requiring regular maintenance should be considered for future remediation via redesign or reinstallation.

Culvert maintenance activities can affect fish and fish habitat by the removal of woody debris that is important for cover and food production, by causing flooding and excessive stream scouring if blockages are removed too quickly, excessive erosion and sedimentation from the use of equipment along the stream bank, and disruption of critical fish life stages. Replacement of eroded rock armouring can alter flows and fish movement patterns if done excessively.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your culvert maintenance project without a DFO review when you meet the following conditions:

- your planned work is not located in a critical area, as identified in a NWT Community Conservation Plan or other applicable land use plan,
- the work does not include realigning the watercourse, installing a culvert liner or support struts, replacing damaged or destroyed bevel ends, or extending/replacing the existing culvert,
- explosives are not used to remove debris,

- the work does not include any dredging, infilling (e.g., filling scour pools) or excavation of the channel upstream or downstream of the culvert,
- this Operational Statement is posted at the work site and is readily available for reference by workers, and
- you incorporate the *Measures to Protect Fish and Fish Habitat when Maintaining Culverts* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact the DFO office in your area if you wish to obtain DFO's opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all local, municipal, territorial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in the Operational Statement must also comply with the *Species at Risk Act* (www.sararegistry.gc.ca). If you have questions regarding this Operational Statement, please contact the DFO office in your area (see Northwest Territories DFO office list).

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Northwest Territories Operational Statement notification form (www.dfo-mpo.gc.ca/regions/central/habitat/os-oo/prov-terr/index_e.htm) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Maintaining Culverts

1. Use existing trails, roads, or cut lines wherever possible to avoid disturbance to the riparian vegetation.
2. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be required. This removal should be kept to a minimum.

3. Unless accumulated material (i.e., branches, stumps, other woody materials, garbage, ice build-up, etc) is preventing the passage of water and/or fish through the structure, time material and debris removal to prevent disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the Northwest Territories In-Water Construction Timing Windows). Any proposal to conduct such work under ice-covered conditions, with the exception of ice build-up removal, requires prior review by DFO.
4. Emergency debris removal using hand tools or machinery (e.g., backhoe) can be carried out at any time of year. Emergencies include situations where carrying out the project immediately is in the interest of preventing damage to property or the environment, or is in the interest of public health or safety. DFO is to be notified immediately. You should follow all other measures to the greatest extent possible.
5. Install effective sediment and erosion control measures before starting work to prevent sediment from entering the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.
6. Limit the removal of accumulated material (i.e., branches, stumps, other woody materials, garbage, etc) to the area within the culvert, immediately upstream of the culvert and to that which is necessary to maintain culvert function and fish passage.
7. Remove accumulated material and debris slowly to allow clean water to pass, to prevent downstream flooding and reduce the amount of sediment-laden water going downstream. Gradual dewatering will also reduce the potential for stranding fish in upstream areas.
8. Operate machinery on land (from outside of the water) and in a manner that minimizes disturbance to the banks of the watercourse.
 - 8.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 8.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 8.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 8.4. Restore banks to original condition if any disturbance occurs.

9. If replacement rock reinforcement/armouring is required to stabilize eroding inlets and outlets, the following measures should be incorporated:
 - 9.1. Place appropriately-sized, clean rocks into the eroding area.
 - 9.2. Do not obtain rocks from below the ordinary high water mark (see definition below) of any water body.
 - 9.3. Avoid the use of rock that is acid-generating. Also avoid the use of rock that fractures and breaks down quickly when exposed to the elements.
 - 9.4. Install rock at a similar slope to maintain a uniform stream bank and natural stream alignment.
 - 9.5. Ensure rock does not interfere with fish passage or constrict the channel width.
 - 9.6. If any in-water work is involved, adhere to fisheries timing windows, as outlined in Measure 3 above.
10. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.
11. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. If re-vegetation is not possible due to climatic extremes and/or lack of appropriate seed or stock, the site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.
 - 11.1. Maintain effective sediment and erosion control measures until re-vegetation of the disturbed areas is achieved or until such areas have been permanently stabilized by other effective sediment and erosion control measures, in the event that re-vegetation is not possible.

FISHERIES AND OCEANS CANADA OFFICES IN NORTHWEST TERRITORIES

Yellowknife Area Office

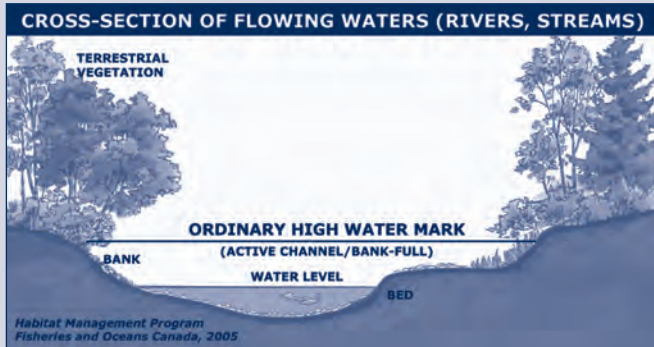
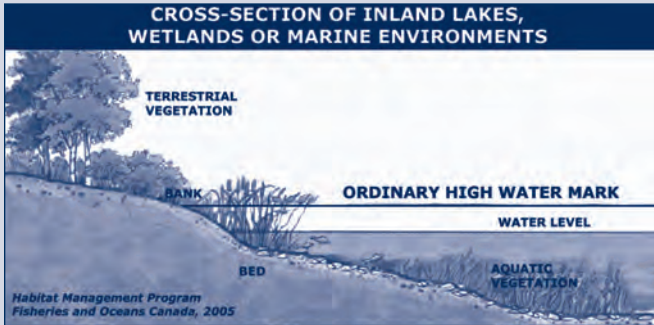
Fisheries and Oceans Canada
Suite 101 – Diamond Plaza
5204 - 50th Ave.
Yellowknife, NT X1A 1E2
Phone: (867) 669-4900
Fax: (867) 669-4940

Inuvik District Office

Fisheries and Oceans Canada
Box 1871
Inuvik, NT X0E 0T0
Phone: (867) 777-7500
Fax: (867) 777-7501

Definition:

Ordinary high water mark – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bank-full level” which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).



Aussi disponible en français

http://www.dfo-mpo.gc.ca/oceans-habitat/habitat/modernizing-moderniser/epmp-pmpe/index_f.asp



Appendix I

DFO OPERATIONAL STATEMENT FOR BRIDGE MAINTENANCE



BRIDGE MAINTENANCE

Fisheries and Oceans Canada Northwest Territories Operational Statement

Version 3.0

Bridge maintenance is undertaken to extend the life of the structure and to ensure that it functions as designed, thus ensuring public safety. This Operational Statement applies only to: deck sweeping and washing to remove traction material (e.g., sand and salt residue), cleaning of all bridge components (substructure, superstructure and deck), the removal and application of protective coatings, deck wearing surface replacement, the removal of debris to protect piers and abutments, and structural repairs.

Bridge maintenance activities have the potential to negatively impact fish and fish habitat by introducing sand, sediments, deck surface materials such as concrete and asphalt, and other deleterious substances (e.g., salt, paint, solvents, oil and grease) into watercourses. Removal of woody debris and riparian vegetation may alter natural habitat features and flows that exist in the watercourse. Operation of machinery may impact habitat on the banks and bed, and result in erosion and sedimentation. Placement of rock to stabilize structures may alter natural habitat and flows, and block fish passage.

Fisheries and Oceans Canada (DFO) is responsible for protecting fish and fish habitat across Canada. Under the *Fisheries Act* no one may carry out a work or undertaking that will cause the harmful alteration, disruption or destruction (HADD) of fish habitat unless it has been authorized by DFO. By following the conditions and measures set out below you will be in compliance with subsection 35(1) of the *Fisheries Act*.

The purpose of this Operational Statement is to describe the conditions under which it is applicable to your project and the measures to incorporate into your project in order to avoid negative impacts to fish habitat. You may proceed with your bridge maintenance project without a DFO review when you meet the following conditions:

- your planned work is not located in a critical area, as identified in a NWT Community Conservation Plan or other applicable land use plan,
- the work does not include realigning the watercourse or replacing the existing bridge,
- the work does not involve new dredging, placing fill (e.g., filling scour pools) or excavating the bed or bank of the watercourse below the ordinary high water mark (HWM) (see definition below),
- explosives are not used to remove debris, including ice build-up,
- the withdrawal of any water will not result in reduction in the wetted width of a stream, and will not exceed 10% of the instantaneous flow, in order to maintain existing fish habitat,
- this Operational Statement is posted at the work site and is readily available for reference by workers, and

- you incorporate the *Measures to Protect Fish and Fish Habitat when Maintaining a Bridge* listed below in this Operational Statement.

If you cannot meet all of the conditions listed above and cannot incorporate all of the measures listed below then your project may result in a violation of subsection 35(1) of the *Fisheries Act* and you could be subject to enforcement action. In this case, you should contact the DFO office in your area if you wish to obtain DFO's opinion on the possible options you should consider to avoid contravention of the *Fisheries Act*.

You are required to respect all local, municipal, territorial or federal legislation that applies to the work being carried out in relation to this Operational Statement. The activities undertaken in this Operational Statement must also comply with the *Species at Risk Act* (www.sararegistry.gc.ca). If you have questions regarding this Operational Statement, please contact the DFO office in your area (see Northwest Territories DFO office list).

We ask that you notify DFO, preferably 10 working days before starting your work by filling out and sending the Northwest Territories Operational Statement notification form (www.dfo-mpo.gc.ca/regions/central/habitat/os-eo/prov-terr/index_e.htm) to the DFO office in your area. This information is requested in order to evaluate the effectiveness of the work carried out in relation to this Operational Statement.

Measures to Protect Fish and Fish Habitat when Maintaining a Bridge

1. Deck Sweeping

- 1.1. Adequately seal drains and open joints before sweeping to prevent material from falling into the watercourse.
- 1.2. Clean and remove debris and sediment from drainage devices and dispose of the material in a way that will prevent it from entering the watercourse.

2. Deck Washing

- 2.1. Sweep decks, including curbs, sidewalks, medians and drainage devices to remove as much material as practical before washing.
- 2.2. Adequately seal drains and open joints before washing to prevent sediment-laden wash-water from entering the watercourse.

- 2.3. Direct wash-water past the ends of the bridge deck to a vegetated area to remove suspended solids, dissipate velocity and prevent sediment and other deleterious substances from entering the watercourse. If this cannot be achieved, use silt fences or other sediment and erosion control measures to prevent wash-water from entering the watercourse.
- 2.4. When extracting water from a watercourse, follow DFO's *NWT Winter Water Withdrawal Protocol* (available from the DFO offices listed below) and ensure the intakes of pumping hoses are equipped with an appropriate device to avoid entraining and impinging fish. Guidelines to determine the appropriate mesh size for intake screens may be obtained from DFO (*Freshwater Intake End-of-Pipe Fish Screen Guideline* (1995), available at www.dfo-mpo.gc.ca/Library/223669.pdf).
- 2.5. Where possible, avoid using small streams as a source for water.

3. Removal and Application of Protective Coatings

- 3.1. Remove paint or protective coatings in a manner that prevents any paints, paint flakes, primers, blasting abrasives, rust, solvents, degreasers or other waste material from entering the watercourse.
- 3.2. Use measures such as barges or shrouding to trap and prevent blasting abrasives, protective coatings, rust and grease from entering the watercourse.
- 3.3. Contain paint flakes, abrasives, and other waste materials for safe disposal.
- 3.4. Store, mix and transfer paints and solvents on land and not on the bridge to prevent these materials from entering the watercourse in the event of a spill.
- 3.5. Do not clean equipment in the watercourse or where the wash-water can enter the watercourse.

4. Removal of Debris (e.g., including woody debris, garbage and ice build-up)

- 4.1. Unless the debris accumulation is an immediate threat to the integrity of the piers and abutments, time debris removal to avoid disruption to sensitive fish life stages by adhering to appropriate fisheries timing windows (see the *Northwest Territories In-Water Construction Timing Windows*), with the exception of ice build-up removal, which can be done at any time of year.
- 4.2. Limit the removal of material to that which is necessary to protect piers and abutments.
- 4.3. Remove debris by hand or with machinery operating from shore or a floating barge.
- 4.4. Emergency debris removal using hand tools or machinery (e.g., backhoe) can be carried out at any time of year. Emergencies include situations where carrying out the project immediately is in the interest of preventing damage to property or the environment, or is in the interest of public health or safety. DFO is to be notified immediately. **You should follow all other measures to the greatest extent possible.**

5. Structural Repairs and Reinforcements

- 5.1. Use barges or shrouding to trap and prevent concrete and other bridge materials from entering the watercourse.

- 5.2. If replacement rock reinforcement/armouring is required to stabilize eroding areas around bridge structures (e.g., abutments and/or wing walls), the following measures should be incorporated:

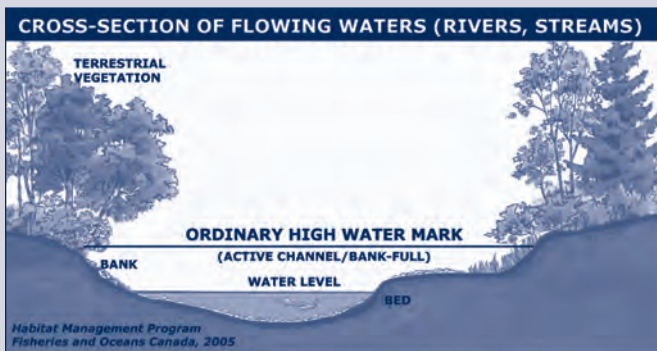
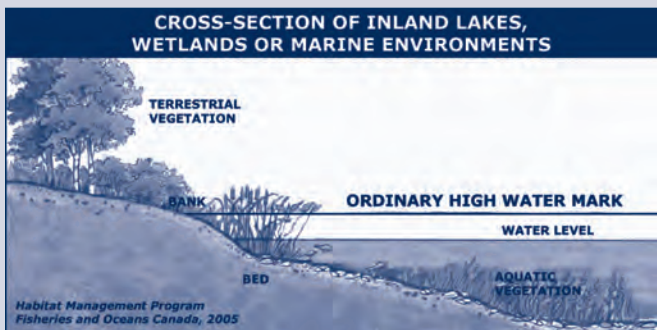
- 5.2.1 Place appropriately-sized, clean rocks into the eroding area.
- 5.2.2 Do not obtain rocks from below the HWM of any water body.
- 5.2.3 Avoid the use of rock that is acid-generating. Also avoid the use of rock that fractures and breaks down quickly when exposed to the elements.
- 5.2.4 Install rock at a similar slope to maintain a uniform stream bank and natural stream alignment.
- 5.2.5 Ensure rock does not interfere with fish passage or constrict the channel width.
- 5.2.6 If any in-water work is involved, adhere to fisheries timing windows, as outlined in Measure 4.1 above.

6. If working from land, install effective sediment and erosion control measures before starting work to prevent the entry of sediment into the watercourse. Inspect them regularly during the course of construction and make all necessary repairs if any damage occurs.
7. While this Operational Statement does not cover the clearing of riparian vegetation, the removal of select plants may be required. This removal should be kept to a minimum and limited to the right-of-way of the bridge.
8. Operate machinery on land (from outside of the water) or on the water (i.e., from a barge or vessel) in a manner that minimizes disturbance to the banks or bed of the watercourse.
 - 8.1. Machinery is to arrive on site in a clean condition and is to be maintained free of fluid leaks.
 - 8.2. Wash, refuel and service machinery and store fuel and other materials for the machinery away from the water to prevent any deleterious substance from entering the water.
 - 8.3. Keep an emergency spill kit on site in case of fluid leaks or spills from machinery.
 - 8.4. Restore banks to original condition if any disturbance occurs.
9. Stabilize any waste materials removed from the work site to prevent them from entering the watercourse. This could include covering spoil piles with biodegradable mats or tarps or planting them with grass or shrubs.
10. Vegetate any disturbed areas by planting and seeding preferably with native trees, shrubs or grasses and cover such areas with mulch to prevent erosion and to help seeds germinate. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. If re-vegetation is not possible due to climatic extremes and/or lack of appropriate seed or stock, the site should be stabilized using effective sediment and erosion control measures. In areas with permafrost, care should be exercised to ensure these measures do not cause thawing or frost heave.

- 10.1. Maintain effective sediment and erosion control measures until re-vegetation of disturbed areas is achieved or until such areas have been permanently stabilized by other effective sediment and erosion control measures, in the event that re-vegetation is not possible.

Definition:

Ordinary high water mark (HWM) – The usual or average level to which a body of water rises at its highest point and remains for sufficient time so as to change the characteristics of the land. In flowing waters (rivers, streams) this refers to the “active channel/bank-full level” which is often the 1:2 year flood flow return level. In inland lakes, wetlands or marine environments it refers to those parts of the water body bed and banks that are frequently flooded by water so as to leave a mark on the land and where the natural vegetation changes from predominately aquatic vegetation to terrestrial vegetation (excepting water tolerant species). For reservoirs this refers to normal high operating levels (Full Supply Level).



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