Revision 4 Environmental Management Plans: Erosion and Sediment Control Plan, Hazardous Materials Management Plan, Waste Management Plan, Wildlife Management Plan, Spill Contingency Plan, Fisheries Management Plan, Permafrost Monitoring Plan, and Closure and Reclamation Plan

Construction of Concrete Arch Bridge along Inuvik to Tuktoyaktuk Highway (ITH) at km 131.2 over Gunghi Creek

Prepared for:

Government of the Northwest Territories
Department of Infrastructure

Prepared by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
5681 – 70 Street
Edmonton, AB T6B 3P6
Canada
T: 780-436-21525

and

Allen Services & Contracting Ltd.
55104 Lamoureux Drive
70 King Road
Sturgeon County, Alberta T8L 5A8

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Version #	Date	EMP Section	Description of Change
1	November 18, 2019		
2	December 6, 2019	3.0	Updated Erosion and Sediment Control Plan
2	December 6, 2019	5.0	Updated Waste Management Plan
2	December 6, 2019	6.0	Updated Wildlife Management Plan
2	December 6, 2019	7.0	Updated Spill Contingency Plan
2	December 6, 2019	8.0	Updated Aquatic Effects Monitoring Plan
2	December 6, 2019	10.0	Updated Site Closure and Reclamation Plan
3	November 20, 2020	Document Title, 1.0, 2.1, 9.0, 9.1	Aquatic Effects Monitoring Plan has been changed to Fisheries Management Plan
3	November 20, 2020	-	All table numbers updated throughout the document.
3	November 20, 2020	2.2	Updated monitoring and reporting procedures
3	November 20, 2020	3.3	Updated erosion and sediment control procedures
3	November 20, 2020	3.3.3 and 7.3	Updated work schedule
3	November 20, 2020	4.1	Additional measures for refueling, drip pans, and fuel storage vessels
3	November 20, 2020	4.2	Additional measures for drip pans, and storage vessels
3	November 20, 2020	7.7.5	Added requirements for follow-up reporting of spills
3	November 20, 2020	8.0	Title changed from Aquatic Effects Monitoring to Fisheries Management at the request of DFO to provide clarification that this encompasses all fisheries related management and monitoring, including water quality monitoring.
3	November 20, 2020	8.1	Paragraph 2 has been changed and paragraph 3 was added
3	November 20, 2020	8.1.1	Reference to instream worksite isolation was removed; Reference to Fish and Fish Habitat Protection Measures and Environmental Protection Measures changed to Mitigation Measures;
3	November 20, 2020	8.2	Proponent contact updated
3	November 20, 2020	8.4	Title changed from Fish and Fish Habitat Protection Measures to Mitigation Measures; Entire section has been updated and includes additional mitigation measures; Instream isolation measures removed (project has been approved by DFO with understanding that water will not be present in a liquid state at

Version #	Date	EMP Section	Description of Change
			the watercourse crossing during construction and therefore instream isolation during construction will not be required)
3	November 20, 2020	-	Version 2, Section 8.5 Surveillance Network Program has been removed (addressed under separate Fisheries Management and Monitoring Plan and QAQC Plan documents); Version 2, Section 8.5.1 Total Suspended Solids/Turbidity Monitoring Plan has been removed (project has been approved by DFO with understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore water quality monitoring during construction will not be required)
3	November 20, 2020	8.5	Previously Section 8.5.2 in version 2
4	November 27, 2020	3.3.3	March 30, 2020 updated to March 30, 2021
4	November 27, 2020	8.1.1	Reference to section 9.4 mitigation measures updated to section 8.4
4	November 27, 2020	3.2, 5.2, 6.2, 7.2, 7.7.6, and 10.2	Proponent contact information updated.
4	November 27, 2020	10.3	July 2020 updated to July 2021

1.0 Introduction

The Gunghi Creek crossing is located along the Inuvik to Tuktoyaktuk Highway (ITH) at km 131.2. The project consists of replacing the existing 2000 mm in diameter Corrugated Steel Pipe (CSP) with an invert length of 38 m that has major sagging in the center. The proposed replacement structure is a 7518 mm span by 3200 mm rise precast concrete arch bridge. The new bridge will have a 38.96 m length and be installed on a 40° left hand forward (LHF) skew. The project is scheduled for construction during the 2019/2020 winter when environmental impacts such as dust, erosion and silt contamination can be minimized. The following provides information on environmental management of erosion and sediment control, hazardous materials, waste management, wildlife management, spill contingency, fisheries management, permafrost monitoring, site closure and reclamation, and emergency response.

2.0 Environmental Management Plan Implementation

2.1 Training and Communication

The Contractor will ensure all workers are aware of applicable environmental legislation and project specific requirements before construction starts. Environmental Management Plans (EMP) will be communicated to all staff by means of Site Orientation and through regular on-site Safety Meetings and daily Tailgate meetings. Potential topics will include:

- Environmental Management Plan Contents and Onsite location;
- Environmental Management Plan Team Roles and Responsibilities;
- Location of Environmentally Sensitive Areas;
- Permit Requirements Best Management Practices and Mitigation Measures;
- Erosion and Sediment Control Measures;
- Hazardous Material and Waste Management;
- Wildlife Encounter Management;
- Spill Contingency Plans and Location of Spill Kits;
- Emergency Response Procedures;
- Fisheries Management;
- Permafrost Monitoring;
- Monitoring & Reporting Procedures;
- Environmental Emergency Response;
- Site Closure and Reclamation; and
- Contact Information.

Following an environmental impact event, the site superintendent will hold an onsite tailgate meeting to inform crew, discuss the event, receive feedback, assess the response, determine how effective the EMP was in dealing with the event, discuss changes to be made and concerns of workers, supervisors and/or the Contract Authority. Updates will made to the EMP's, as required and implemented immediately following the meeting. This meeting will be held as soon as reasonably practical after the event.

2.2 Monitoring & Reporting

The Contractor will incorporate EMP monitoring and inspections into established corporate safety site inspections. Regular (daily and/or weekly) inspections will be conducted as outlined in the individual EMP's herein. Inspection checklists and reports will be prepared and maintained onsite. Any changes to EMP's, monitoring, or reporting requirement will be communicated during project meetings.

During construction, an environmental monitor will be on site to ensure mitigation measures are being implemented correctly and to respond to any issues that may arise. Monitoring is also intended to support a feedback mechanism so that mitigation measures can be implemented or revised where and when necessary.

A separate Fisheries Management and Monitoring Plan[1] has been developed to outline short-term (construction phase) and medium and long-term (post-construction) monitoring and reporting.

2.3 Documentation

The Contractor will identify a location in the Site Office (trailer) for all applicable EMP documentation including:

- Current Environmental Management Plan's;
- Regulatory permits, approvals, authorizations, and/or notifications;
- Relevant training and meeting (tailgate, meeting minutes) records;
- Current erosion and sediment control plan and drawings;
- Hazardous/non-hazardous material inventory;
- Records of environmental incidents (spill reports);
- Completed environmental inspection checklists, reports, and resolutions;
- Completed environmental monitoring reports (inspections); and
- Site orientation, safety meeting, tailgate meeting and project progress minutes.

3.0 Erosion and Sediment Control Plan

3.1 Purpose and Scope

The Erosion and Sediment Control Plan (ESCP) was a commitment of the Developer. The plan describes the objectives and mitigation measures related to erosion and sediment control to be used in the construction and operation of the Gunghi Creek crossing including the watercourse crossing, temporary detour, and right-of-way construction. The plan will be complementary to terms and conditions contained in all relevant permits and Authorizations. The ESCP is a "living" plan and will be updated as new information is brought forward. Once the crossing is operational, the ESCP will be reviewed every five years or as required to provide the best guidance in preventing sedimentation and erosion of watercourses and waterbodies.

1 Wood Environment & Infrastructure Solutions. 2020. Fisheris Management and Monitoring Plan, Gunghi Creek Crossing Replacement. Prepared for Government of the Northwest Territories, Department of Infrastructure, Yellowknife, Northwest Territories. Prepared by Wood Environment & Infrastructure Solutions, Edmonton, Alberta.

3.2 Primary Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

3.3 Procedures of Erosion and Sediment Control Measures

As construction activities under this contract are being carried out in the winter, the potential for erosion is considered to be very low. The Contractor will continually monitor the site for signs of erosion and will implement Erosion and Sediment Control (ESC) measures as necessary, as per the contract. The Contractor will install silt fencing along areas of disturbance soils/stockpiles where required to reduce the chance of erosion and/or silt contaminating the waterbodies once the thaw occurs. All ESC measures will be inspected regularly to ensure that they are functioning properly and are maintained, cleaned and/or upgraded as required until complete revegetation of all disturbed areas is achieved. All disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.

The Project has been approved and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities will not be required.

3.3.1 Project Footprint

The crossing replacement works including the temporary detour below the ordinary high water mark will be 368 m^2.

3.3.2 Effects and Mitigation

A list of activities, potential effects and proposed mitigation measures are provided in Table 2.

Table 2. Activities, Potential Effects, and Proposed Mitigation Measures

Activities	Potential Effects	Proposed Mitigation Measures
Detour Construction	• Sediment entering the watercourse	• An ice bridge will be built across the watercourse. • Grading of the stream banks for the detour road approaches will not occur. • Clean snow & imported water will be used. • V notch will be created at the creek crossing on completion. • Removal of the vegetation will be limited to the width of the right-of-way. • All disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction. • Silt fence will be maintained until re-vegetation of disturbed areas is achieved.
Existing Roadway Excavation	• Sediment entering the watercourse	• Existing material will be removed from site.
Stockpiling	• Sediment entering the watercourse	• Spoil and sediment-laden snow will be removed and disposed away from the site.
Removal of existing culvert	• Sediment entering the watercourse	• The work area will be isolated from flowing water, if any.
Pile Drilling & Installation	• Sediment entering the watercourse	• Load & haul existing material offsite. • Contain cuttings to pile location.
Rock Riprap Installation	• Sediment entering the watercourse • Erosion of the watercourse banks • Scour of the watercourse bed	• The work area will be isolated from flowing water, if any. • Disturbance of the natural banks and streambed will be kept to a minimum. • Rock riprap will be placed upstream, downstream and along the bottom of the proposed arch bridge which will be free of silt and other debris. • Machinery will be operated in a manner that minimizes disturbance to the banks of the stream. • Banks will be restored to original condition if any disturbance occurs.
BEBO ARCH & Beam installation	• Sediment entering the watercourse	• Installation to be done with equipment on land.
Backfill over Arch	• Sediment entering the watercourse	• Place carefully granular material at the upstream and downstream edge of the arch bridge to avoid material falling in creek. • Granular material will be placed around the arch bridge.
Work Site Cleanup	• Sediment entering the watercourse	• All disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction. • Sediment fences (see Appendix A) will be placed around all disturbed areas after construction and maintained until re-vegetation of disturbed areas is achieved.

3.3.3 Work Schedule

The Project is tentatively scheduled for December 1, 2020 - April 15, 2021, where works are expected to be completed during frozen surface water/no flow conditions. Instream works are planned to be completed by March 30, 2021, prior to the spring freshet and the restricted activity timing window for instream work of April 1 to July 15. Details of the proposed schedule are available in Appendix B.

4.0 Hazardous Materials Management Plan

4.1 Fuel

No fuel will be stored onsite. However, a double wall fuel tank as part of the light tower/power source will be onsite. All reasonable precautions will be taken to ensure no contamination is caused due to spills. Industry best practices will be followed including the use of spill containment (trays) and spill kits, fire extinguishers, and barriers (e.g., spill mats, drip pans, trays) to protect workers and the environment during onsite refueling of stationary and mobile equipment. A dedicated area will be used for refueling equipment. Refuelling of equipment with limited mobility will be refuelled above the ordinary high-water mark and refueling activities will conducted as follows:

- The fuel transfer will be visually and continually monitored;
- A containment tray will be placed below the vehicle's refueling portal;
- Fuel transfer nozzles will be operated manually and will not be locked in the open position;
- Spill kits, including absorbent pads, will be positioned in close proximity to the stationary equipment during refueling operations;
- Fuel transfers will be conducted with an operator at each end of the transfer hose;
- Fuel transfers will be conducted when there is adequate visibility; and
- Fuel transfer equipment components such as pumps, hoses and nozzles will be visually checked for leaks or damage prior to each refueling operation.

Spill mats and/or drip pans / trays will be placed under all mobile fueling containers and under equipment when not in use. Drip pans will be free of ice and snow prior to and during use to ensure appropriate containment volumes. Any fuel storage vessels left for extended periods of time (including overnight in vehicles), should be stationed in an area that contains sufficient secondary containment (i.e., drip pans, lined with bermed area, double walled enviro-tanks etc.).

An emergency spill response kit will be kept onsite in case of leaks or spills from machinery. Regular inspection and maintenance of all vehicles/machinery will be conducted. Washing, refueling, servicing and staging of machinery and equipment will be conducted at least 100 m from a water body to prevent the release of any deleterious substances to the water body.

4.2 Lubricating and Hydraulic Oil

The Contractor will make every effort to ensure the area remains free of oil products, including secondary containment for the storage of oil products, and the use of drip trays under parked machinery and when oil servicing. Drip pans will be free of ice and snow prior to and during use to ensure appropriate containment volumes. In the unlikely event of a spill (ex. broken hydraulic hose), the Contractor will use industry best practices, to minimize the spill, contain, and clean-up in a safe and timely way. Any storage vessels left for extended periods of time (including overnight in vehicles), should be stationed in an area that contains sufficient secondary containment (i.e., drip pans, lined with bermed area, double walled enviro-tanks etc.). Biodegradable oils and lubricants (e.g., white lithium greases and vegetable oil

hydraulic fluid) will be used in any equipment that will be working in the watercourse. The Contractor will keep emergency spill kits onsite in case of fluid leaks or spills from machinery as a contingency for such an occurrence. Contingency plans, mitigation and emergency response will be implemented to prevent and address equipment leaks and spills.

5.0 Waste Management Plan

5.1 Purpose and Scope

Allen Services & Contracting Ltd. has prepared the following Waste Management Plan for all wastes associated with pre- construction and construction activities of the Gunghi Creek Culvert Replacement along the Inuvik to Tuktoyaktuk Highway at km 131.2. The WMP will apply to the Developer and all associated Project contractors involved in the generation, treatment, transferring, receiving, and disposing of waste materials for the project. This plan will be effective immediately and throughout the pre-construction and construction phases of the project.

5.2 Primary Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

5.3 Storage Methods

No on-site camp is proposed for the work. One porta potty will be on site. When required, sewage waste will be transported to the closest municipal waste facility. Solid waste will be stored in covered metal bins and disposed at a solid waste facility as required. Sewage and solid waste will be disposed of according to the Hamlet of Tuktoyaktuk or Town of Inuvik regulation.

5.4 Letter(s) of Agreement

Allen Services & Contracting Ltd will store, transport and dispose of each waste type. They are a general contractor and do this on a regular basis. They have established and maintained accounts with Municipal landfills and sewage waste in Inuvik and Tuktoyaktuk including tipping fees for this purpose. They have disposal arrangements through KBL environmental for disposal of contaminants in the Yukon and Alberta. They are also licensed with the GNWT as a hazardous waste carrier.

5.5 Construction Material Waste

The Contractor expects to generate waste construction material onsite including, packaging from deliverables, steel banding, plastic bag material, cut-offs from Styrofoam board, wooden dunnage and culvert demolition waste. All of this waste will be stored on site in a refuse bin and transported to the landfill in Inuvik or Tuktoyaktuk as required.

5.6 Waste Generated by the Contractor

Waste potentially generated during the project includes: sediment, sewage, solid, and hazardous waste (e.g., fuels, oils, batteries and lubricants), as outlined in Table 3. All waste generated onsite by the Contractor, including empty oil containers, oil and fuel filters, spill clean-up material, will be stored in designated spill resistant containers and transported to proper disposal facility in Inuvik. Table 4 outlines disposal methods for potential waste generated by the project. The project area will be inspected daily for waste and any waste will be collected and properly disposed.

Hazardous materials and wastes (e.g., fuels, oils, batteries and lubricants) will be stored in a clearly marked area (e.g. signs and/or flagging) more than 100 m from the high-water mark of any water body. Hazardous wastes will be transported to an approved facility for treatment / disposal.

If other contaminated materials require disposal (i.e., spill pads), these will be disposed of through a licensed facility.

Table 3. Gunghi Creek Crossing Replacement Potential Waste Types

Waste Type	Description
Solid Waste	Food waste, wrappings, waste paper, non-recyclables and empty containers.
Sewage	sewage waste from onsite (1 Porta Potty only)
Recyclable Waste	Beverage containers
Hazardous Waste	Empty oil containers, oil and fuel filters, and spill cleanup material (Sorbent pads, booms, free liquids and solids).
Scrap Culvert	Excavated culvert will be compacted & transported to local municipal landfill in Inuvik.

Table 4. Gunghi Creek Crossing Replacement Waste Type, Volume and Disposal Methods

Waste Type	Hazardous or Non-hazardous	Estimated Volume (m^3)	Disposal Method
Solid Waste	Non-hazardous	10 m^3	Transported to an approved solid waste facility as required.
Sewage	Non-hazardous	1 m^3	Transported to a sewage lagoon facility for disposal or treatment as required.
Recyclable Waste	Non-hazardous	1 m^3	Transport to recycling facility as required.
Hazardous Waste	Hazardous	0 m^3	Transported to an approved facility for disposal or treatment as required.
Scrap Culvert	Non-hazardous	1 m^3	Transported to local municipal landfill in Inuvik after the existing culvert is removed.

6.0 Wildlife Management Plan

6.1 Purpose and Scope

This section provides the Wildlife Management Plan (WMP) for the Gunghi Creek crossing replacement Project. The WMP was developed to ensure compliance with federal and territorial regulations including Aboriginal Affairs and Northern Development Canada (AANDC) and Environment Canada (*Migratory Birds Convention Act* and *Species at Risk Act)*.

The WMP identifies potential issues and concerns for expected wildlife species and species of conservation concern, and provides effects and mitigation measures to address these potential issues.

6.1.1 Issues and Concerns

Potential direct or indirect construction-related effects to the wildlife are expected to be limited and include the following:

- Temporary increase in equipment noise during the installation program and equipment transport. Sensory disturbance associated with habitat clearing and construction activities and may discourage species from using habitat adjacent to the Project.
- Potential temporary wildlife avoidance of the area during the crossing replacement program. However, following construction, species are expected to return to adjacent habitats.
- Movement patterns of animals may be temporarily disrupted by construction activities.
- Direct mortality of wildlife may occur if clearing is required, however nesting activities are not expected during the proposed winter construction, and any minor clearing involved is anticipated to be localized. As the proposed works are scheduled for completion April 15 and only minor clearing will be required, the vegetation clearing timing constraint of May 20 to August 17 will be adhered to.

Proposed monitoring and mitigation plans are provided below in Section 6.5 to avoid or minimize adverse impacts to wildlife and wildlife habitat.

6.2 Primary Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

6.3 Expected Wildlife Species

There are 25 mammals potentially occurring in the LSA, as outlined in Table 5. Kiggiak-EBA Consulting Ltd. reported approximately 137 bird species in the region of the ITH including songbirds, upland birds, waterfowl, raptors and owls[2]. Only 17 of these bird species are year-round residents, while the remaining 120 are migratory species with the majority only occupying the region in the summer[3]. The RSA does not overlap any amphibian ranges of species known to occur in the NWT[4].

[2] Kiggiak-EBA Consulting Ltd. 2010. Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories. EISC Application. Kiggiak-EBA Consulting Ltd. Inuvik, NT.

[3] Kiggiak-EBA Consulting Ltd. 2010. Project Description Report for Construction of the Inuvik to Tuktoyaktuk Highway, Northwest Territories. EISC Application. Kiggiak-EBA Consulting Ltd. Inuvik, NT.

[4] Conference of Management Authorities. 2017. Management Plan for Amphibians in the Northwest Territories. Species at Risk (NWT) Act Management Plan and Recovery Strategy Series. Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT. 73 + iii pp.

Table 5. Mammals Potentially Occurring Within the LSA of the Gunghi Creek Crossing[1]

Common Name	Scientific Name
Barren-ground shrew	*Sorex ugyunak*
Tundra shrew	*Sorex tundrensis*
Masked shrew	*Sorex cinereus*
Northern red-backed vole	*Clethrionomys rutilus*
Tundra vole	*Microtus oeconomus*
Brown lemming	*Lemmus sibiricus*
Collared lemmings	*Dicrostonyx groenlandicus, D. kilangmiutak, D. richardsoni*
Arctic hare	*Lepus arcticus*
Snowshoe hare	*Lepus americanus*
Arctic Ground Squirrel	*Spermophilus parryii*
Beaver	*Castor canadensis*
Muskox	*Ovibos moschatus*
Barren-ground caribou (Tuktoyaktuk Peninsula, Cape Bathurst, and Bluenose-West herds)	*Rangifer tarandus groenlandicus*
Polar bear	*Ursus maritimus*
Moose	*Alces americanus*
Grizzly bear	*Ursus arctos*
Tundra wolf	*Canis lupus*
Red fox	*Vulpes vulpes*
Arctic fox	*Vulpes lagopus*
Lynx	*Lynx canadensis*
Wolverine	*Gulo gulo*
Ermine	*Mustela ermine*
Porcupine	*Erethizon dorsata*
Least weasel	*Mustela nivalis*
River otter	*Lontra canadensis*

Notes 1: Government of Canada. 2019; Kiggiak-EBA Consulting Ltd. 2010.

6.4 Species of Conservation Concern

Of the 25 terrestrial mammals and 137 bird species that potentially occur in the LSA, 18 are federally listed as outlined in Table 6[5].

5] Government of Canada. 2019. Species at Risk Public Registry. Available at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm

Table 6. Status of Federal and Territorial Listed Species Potentially Occurring in the LSA

Common Name	Scientific Name	Federal Status[1]		NWT Status		
		COSEWIC	SARA	NWT Species at Risk Listing[2]	Species at Risk Committee Assessment[2]	General Status[3]
Barren-ground Caribou	*Rangifer tarandus groenlandicus*	Threatened	No Status	Threatened	Threatened	At Risk
Grizzly bear	*Ursus arctos*	Special Concern	Special Concern	No Status	Special Concern	Sensitive
Polar Bear	*Ursus maritimus*	Special Concern	Special Concern	Special Concern	Special Concern	Sensitive
Wolverine	Gulo gulo	Special Concern	Special Concern	No Status	Not At Risk	Sensitive
Eskimo Curlew	*Numenius borealis*	Endangered	Endangered	Not Applicable	Not Applicable	At Risk
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Special Concern	No Status	Not Assessed	Sensitive
Peregrine Falcon	*Falco peregrinus*	Not At Risk	Special Concern	No Status	Not Assessed	Sensitive
Short-eared Owl	*Asio flammeus*	Special Concern	Special Concern	No Status	Not Assessed	Sensitive
Bank Swallow	*Riparia riparia*	Threatened	Threatened	Not Applicable	Not Applicable	At Risk
Barn Swallow	*Hirundo rustica*	Threatened	Threatened	Not Applicable	Not Applicable	At Risk
Buff-breasted Sandpiper	*Calidris subruficollis*	Special Concern	Special Concern	Not Applicable	Not Applicable	Sensitive
Harris's Sparrow	*Zonotrichia querula*	Special Concern	No Status	Not Applicable	Not Applicable	Undetermined
Horned Grebe	*Podiceps auratus*	Special Concern	Special Concern	Not Applicable	Not Applicable	Sensitive
Red Knot	*Calidris canutus islandica*	Special Concern	Special Concern	Not Applicable	Not Applicable	At Risk
Red Knot (Rufa subspecies)	*Calidris canutus rufa*	Endangered	Endangered	Not Applicable	Not Applicable	At Risk
Red-necked Phalarope	*Phalaropus lobatus*	Special Concern	Special Concern	Not Applicable	Not Applicable	Sensitive

Notes 1. **COSEWIC** – Committee on the Status of Endangered Wildlife in Canada[6]; **SARA** – *Species at Risk Act*; **Threatened** - A wildlife species that is likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction; **Special Concern** – A wildlife species that may become threatened or endangered because of a combination of biological characteristics and identified threats; **Endangered** – A wildlife species facing imminent extirpation or extinction; **Not At Risk** – A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances [7];
2. **Threatened** – a species likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction; **Special Concern** – a species that may become threatened or endangered because of a combination of biological characteristics and identified threats; **No Status** – species was assessed and found to be not at risk of extinction given the current circumstances; **Not Assessed** – species has not been assessed; **Not Applicable** – Species at Risk (NWT) Act does not apply to this species;
3: WGNWT 2016. **At Risk -** species for which a detailed assessment has recently been completed and determined that the species is at high risk of extinction or extirpation.; **Sensitive** – species that are not at high risk of extinction or extirpation but may require some special attention or protection to prevent them from becoming at risk; **Undetermined** - . species for which insufficient information, knowledge, or data is available to reliably evaluate their general status rank[8].

[6] Government of Canada. 2016. COSEWIC Wildlife Species Status Categories and Definitions. Available online at: https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife/wildlife-species-status-categories-definition.html
[7] Government of Canada. 2019. Species at Risk Public Registry. Available online at: http://www.sararegistry.gc.ca/sar/index/default_e.cfm
[8] Government of Northwest Territories, Department of Environment and Natural Resources. 2018. Species at Risk in the Northwest Territories 2018. ISBN 978-0-7708-0261-5.

6.5 Mitigation Measures

Wildlife in the area may include terrestrial and aquatic mammals, including muskrats and waterfowl. As construction activities will be conducted in the winter months, when the region is not expected to support migratory birds, the *Migratory Birds Convention Act* and its regulation will not be an issue. If for any reason work is carried out over into the spring, this plan will be updated.

An onsite Wildlife Monitor will be aware of the potential species of concern in the area and conduct monitoring of construction activities as they relate to wildlife and wildlife habitat protections and the mitigation measures outlined in the EMP. Monitoring activities will provide a means of measuring the effectiveness of mitigation measures in avoiding or minimizing potential effects on wildlife.

The following mitigation measures will be implemented to ensure protection of wildlife and wildlife habitat:

- Prior to construction a survey will be conducted to ensure no active grizzly/ black bear, wolverine or lynx dens occur within 250 m of the project site. Where dens are identified the appropriate management agency will be identified to determine appropriate mitigation.
- All wildlife sightings will be documented and reported to the appropriate management agency.
- Daily and weekly reporting will be completed by the Wildlife Monitor and include, location (UTM coordinates or latitude / longitude), date, species, number, sex/age if known, wildlife behavior, and any wildlife -vehicle / human interactions.
- Workers will not feed, harass, or approach wildlife.
- Firearms or hunting, trapping and fishing by workers will not be allowed.
- When possible, wildlife will be given the right-of-way and will be left alone, unless there is a human safety issue.
- All project personnel will undergo a wildlife awareness program, which will include prevention measures for wildlife mortality and reporting procedures for wildlife-related incidents.
- Waste will be stored, handled, and transported in accordance with the Waste Management Plan, including storage of all solid waste in sealed, bear-proof containers.
- The project area will be inspected daily for waste. Any waste will be collected and properly disposed.
- The GNWT Bear Encounter Response Guidelines will following in the event of a bear encounter
- Where caribou approach the construction site or active ungulate mineral/salt licks are observed a temporary suspension of construction may be required to adhere to recommended setback distances outlined in Table 7. Where caribou or active mineral/salt licks are observed appropriate the environmental management agencies should be contacted to determine appropriate mitigation.

Table 7. Recommended Wildlife Setback Distances [9]

Wildlife	Feature or Habitat	Setback Distance
Caribou	N/A	500 m
Ungulates (general)	Mineral/salt lick	1 km

9 Aboriginal Affairs and Northern Development Canada, Fisheries and Oceans, Environment Canada – Canadian Wildlife Service and GNWT – Department of Environment and Natural Resources (AANDC). 2012. Northern Land Use Guidelines – Volume 9a: Northwest Territories Seismic Operations.

7.0 Spill Contingency Plan

7.1 Purpose and Scope

The purpose of this Spill Contingency Management Plan is to outline response actions and mitigation procedures for potential spills of any size and to address commitments made by the Allen Services & Contracting Ltd. This plan will identify key response personnel and their roles and responsibilities in the event of a spill as well as the equipment and other resources available to respond to a spill. It details spill response procedures that will minimize potential health and safety hazards, environmental damage, and clean-up efforts. The plan has been prepared to ensure quick access to all the information required in responding to a spill.

7.2 Company Name, Site Name, Site Location and Mailing Address

The project is the Gunghi Creek Culvert Replacement located at km 131.2 along ITH (#10), 14 km south of Tuktoyaktuk as shown on Figure 1.

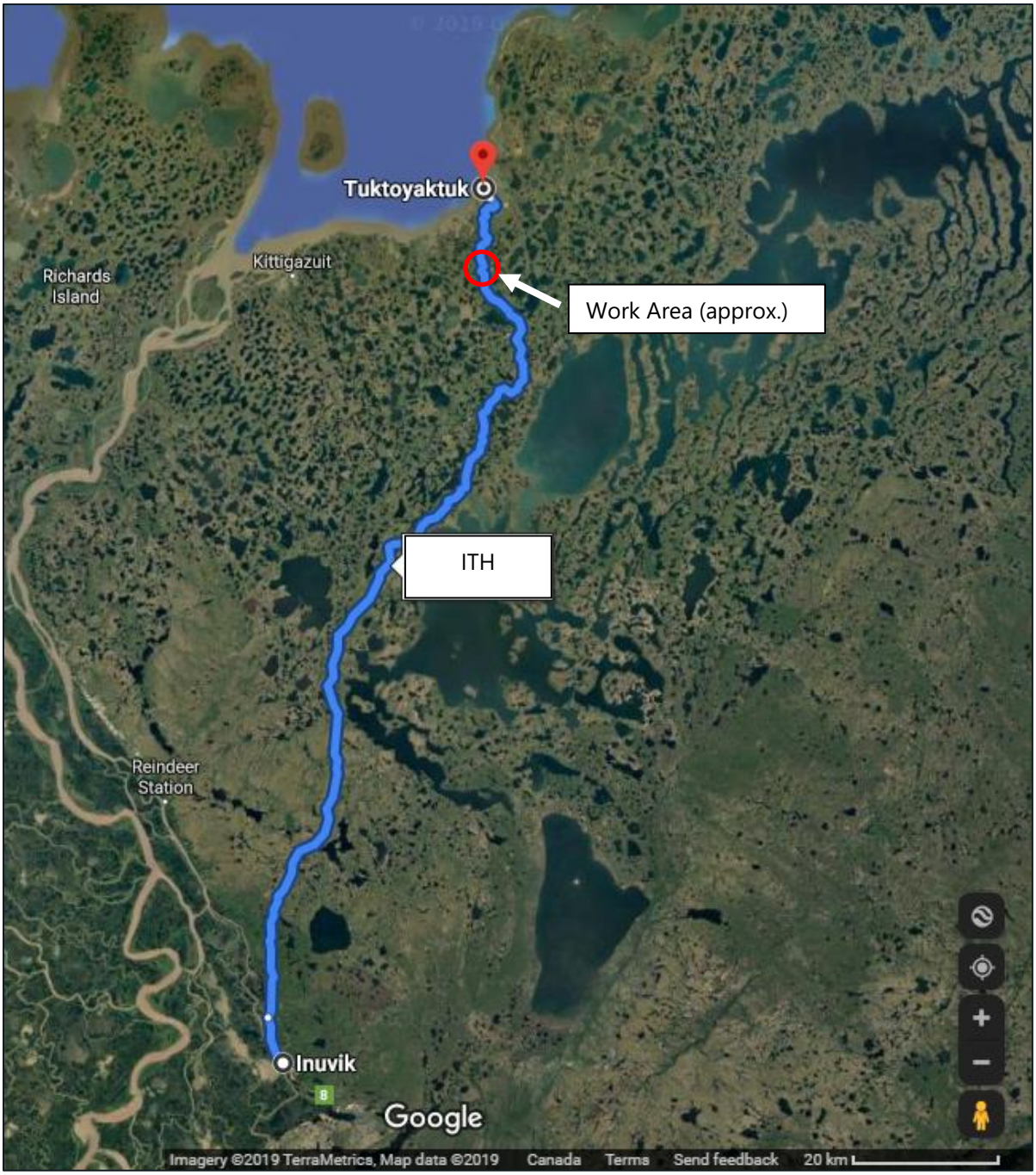


Figure 1. Gunghi Creek Crossing at km 131.2 along the ITH (#10)

Contact information for this Project are as follow.

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

7.3 Effective Date of Spill Contingency Plans

The Spill Contingency Plan will be effective as of January 1, 2020 prior to the proposed construction start date of December 1, 2020.

7.4 Distribution of the Plan

Table 8 outlines a list of individuals/organizations that will receive a copy of the Spill Contingency Plan. Additional copies of the Spill Contingency Plan can be obtained from Dean S. Smith of Allen Services & Contracting Ltd. and will be kept on-site in the project trailer.

Table 8. Distribution List for Spill Contingency Plan

Name	Title	Company
Dean S. Smith	Project Manager	Allen Services & Contracting Ltd.
Brian McCarthy	General Manager	Allen Services & Contracting Ltd.

7.5 Company Environmental Policy

Allen Services & Contracting Ltd. takes its environmental responsibilities seriously and is committed to following sound environmental management practices and executing their business activities so that the environment is not adversely affected.

It is the policy of Allen Services & Contracting Ltd. to thus ensure that all reasonable measures are taken to identify and control conditions that may cause adverse environment impact and to respond

immediately and effectively to any incidents that may occur so that worker and public safety is maintained, and property and environmental damage minimized.
Proactive planning with respect to the potential impact of construction activities on the environment is a critical component of effective environmental protection. Accordingly, all Allen Services & Contracting Ltd. construction sites and facilities are required to develop and have in place an Environmental Plan prior to commencement of activities.

Where environment controls are found to have been compromised, remediation activities will be undertaken immediately.

7.6 Hazardous Materials On-Site

Table 9 outlines details of hazardous materials normally stored on-site. MSDS's for each hazardous material is provided in Appendix C. Appendix D provides a site map showing the construction site. The Gunghi Creek flow direction is from west to east. The emergency response and spill equipment will be in the job shack. Storage location of hazardous material will be 100 m away from Gunghi Creek.

Table 9. Type and Amount of Hazardous Materials Normally Stored On-Site

Material Type	Amount	Storage Capacity	No. of Storage Containers
Diesel Fuel	3-drums	55 gallon each	3-drums
Gasoline	3-drums	55 gallon each	3-drums
Propane	3-cylinder	20 lbs each	3-cylinders
Biodegradable Oils	1-container	5 gallon	1-container
Biodegradable Lubricants	1-container	5 gallon	1-container

Appendix D provides a site map showing the construction site. The Gunghi Creek flow direction is from west to east. The emergency response and spill equipment will be in the job shack. Storage location of hazardous material will be 100 m away from Gunghi Creek.

7.7 Process for Staff Response to Media and Public Enquiries

Depending on the severity of an emergency, the media may attempt to contact company representatives in person at the incident site or in close proximity to the site. These representatives include rovers, roadblock personnel, onsite personnel or other people the media deem credible to represent the company.

If you are approached by the media:

- Be Polite.
- Never use the phrase "No comment".
- If a more senior person is immediately available at your location, redirect the inquiry to that person.
- If you are the most senior person at your location, advise the media that you are not the Corporate Spokesperson.
- Gather the information on the Media Inquiry Form, if possible.
- Advise the media that the Corporate Spokesperson will be in contact with them.

- An example of the script you may use is:

> **My name is (your name).**
> **I am not the Corporate Spokesperson. However, (name of Corporate Spokesperson) could help you with your questions. May I have your name and the name of your organization? I will have (Spokesperson) call you back as soon as possible.**

- Forward the Media Inquiry Form or any call back commitments to your supervisor as soon as possible.
- The media will be working to a deadline.
- The supervisor will pass the Media Inquiry Form or call back commitments to the Corporate Spokesperson for response.
- Be careful not to deny information or facts. Again, simply state that you are not the Corporate Spokesperson.
- Although a press release may indicate information about the number of people injured, NEVER disclose any information about the names of those injured or extent of their injuries. Next-of-kin notification must be completed before this information is released.

In cases where it is not possible to pass along the information to a more senior company representative, the follow statement may be released: Media Statement
"We are in the early stages of gathering information on this situation to determine our involvement and response. Of utmost priority is the safety and protection of the public and all responders. Company information will be available to you when we know more. Feel free to leave your contact number with me or call our corporate office in Inuvik at 867-777-4000 for information.

7.7.1 Response Organization

The following sections provides the preventative measures, initial spill response actions, flowchart of response organization and control and containment.

7.7.1.1 Preventative Measures

The Contractor will take every precaution to avoid any type of environmental impact. The following preventative measures will be put in place:

- Verify last maintenance records for all mobile/heavy equipment and ensure good condition before starting the equipment;
- Complete the pre-use inspection on all mobile/heavy equipment;
- Pay special attention to lines, fuel tanks, hydraulics, etc.;
- Complete a worksite inspection and note all locations which could be contaminated;
- Review SDS for hazardous products such as oil and fuel;
- Prepare required PPE such as gloves, goggles, etc.;
- Use spill donuts to create a barricade between the creek and equipment, where reasonably practicable;
- Have fully stocked spill kits nearby; and
- Ensure phone numbers are available on-site for NWT Spill Report Line.

7.7.1.2 Initial Spill Response Actions

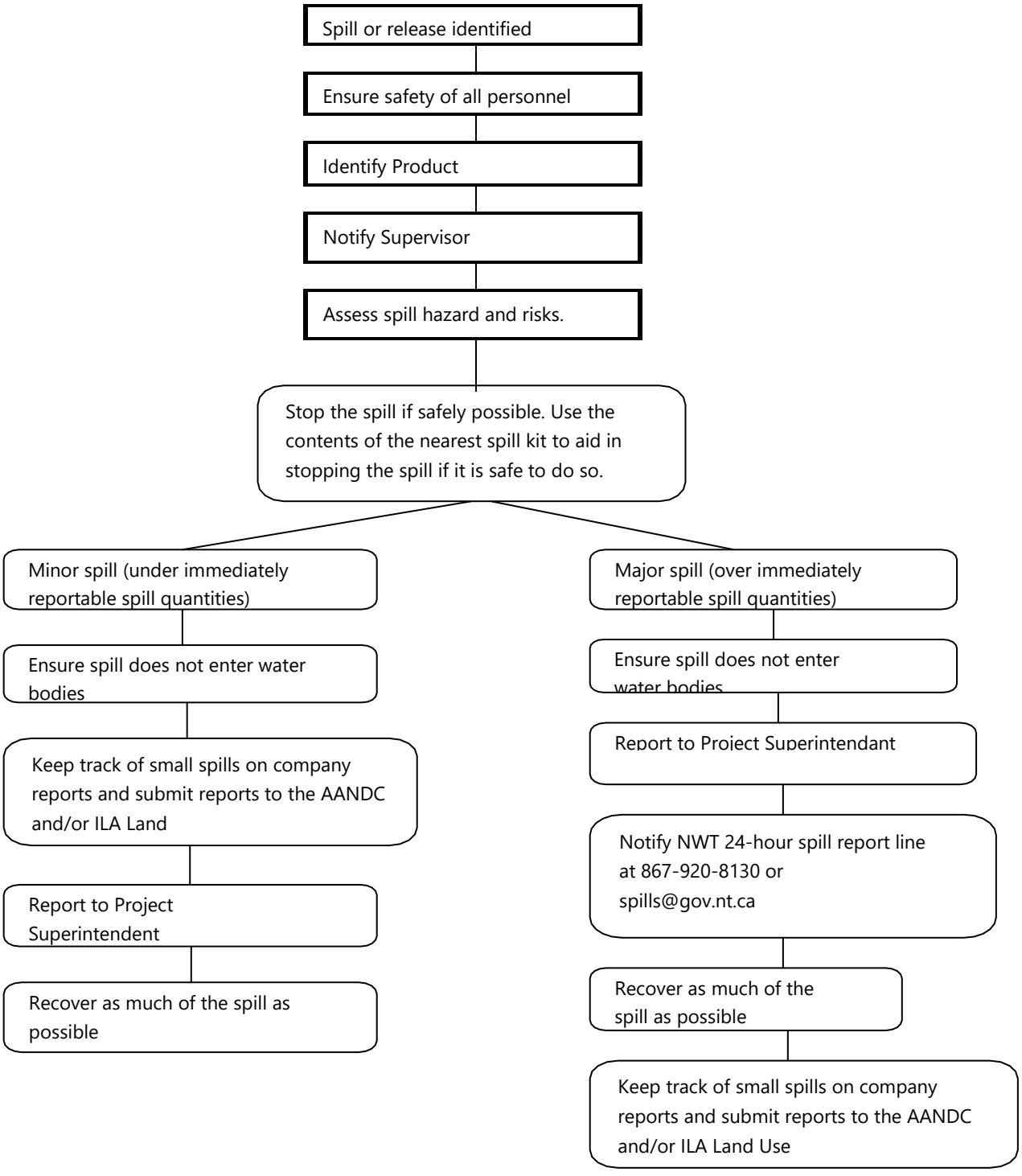
Procedures for Initial Actions:

- Ensure safety of all personnel.
- Assess spill hazards and risks.
- Remove all sources of ignition.
- Stop the spill if safely possible (e.g. shut off pump, replace cap, tip drum upwards, patch leaking hole). Use the contents of the nearest spill kit to aid in stopping the spill if it is safe to do so.
- No matter what the volume is, notify camp manager.
- Contain the spill - use contents of spill kits to place sorbent materials on the spill, or use shovel to dig to contain spill. Methods may vary depending on the nature of the spill.
- Relay information to internal company contacts, government agencies.

Size up considerations for a spill site:

- Are there any nearby public (workers, traffic, residents) that would need to be evacuated or diverted from the spill area?
- Is there a fire or explosion hazard? What is the ignition source?
- Are concentrations safe or is additional PPE needed?
- Are the areas deemed hazardous? (mark with flags)
- What are the ground and weather conditions? (Snow, gravel, sand, etc.)
- Where is the location of the leak? The type of release and the volume released? Is it reportable? Has it been reported to the regulator?
- How long has the spill been taking place?
- Are air monitoring trailers required?
- Is the spill into a watercourse or a water body?
- Is the spill contained or migrating? Which direction? How far can it go?
- If the spill is not contained, determine and prioritize the containment points and methods to be used.
- What lands or water bodies may be affected?
- How is it going to be contained and cleaned up?
- How to access the spill site, the source of the spill and recovery points, what equipment is required? Is oil spill equipment (oil spill co-op) required?
- Where can spill responders park so as not to interfere with spill equipment? (Minimize vehicular traffic as much as possible at the spill site.)
- Are there and residences in the area?
- Should the spill site be cordoned off to prevent wildlife from entering?
- Will a media response be required?

7.7.1.3 Flowchart of Response Actions



7.7.1.4 Control and Containment

- If possible, immediately shut off the source of the spill ensuring your own safety.
- Determine what will be affected by the spill.
- Assess speed and direction of the spill and cause of movement (water, wind and slope)
- Prioritize and set up containment points.
- Where possible, prevent a spill from entering a watercourse.
- Have a contingency plan ready in case spill worsens beyond control or if the weather or topography impedes containment.
- Use safest and simplest method to get job done within resource and safety capabilities.
- Plug and patch (e.g. fix faulty valve or hole in drum).
- Absorb or adsorb (e.g. applying absorbent pads to oil spill).
- Transfer (e.g. removing product to waste truck or new container).
- Containerize (e.g. put leaking drum into over-packed drum).
- Reposition (e.g. upright or roll and chock leaking container).
- Others (e.g. hot-tap, vent and burn, flaring).
- Contain the spill - containment is a priority for limiting environmental damage.
- Contain as close to source as safe and practical.
- Avoid excessive walking or driving on the spill area.
- Consider ground disturbances guidelines.
- Determine where bell holes or trenches would be most effective.
- Keep trenches as shallow and narrow as possible, to prevent additional clean-up and minimize groundwater impact. Supplement with berms where possible.
- Use practical containment tools and equipment including shovels, dump trucks, sand bags, plastic bags, heavy earth moving equipment, "Plug and Patch", foam, salvage covers, adsorbents, booms, hose, redwood plugs, etc.
- If weirs are installed, they should be able to handle large flow rates and surges.
- Surface run off may have to be diverted from the spill site if wet conditions are present.
- Ensure the health and safety of the persons responding to the spill
- Once containment has been achieved, recovery and clean-up operations begin immediately.
- Recover as much product and saturated debris as possible.
- Keep environmental disturbance to a minimum.

7.7.2 Response Personnel, Duties, and Communication

All personal hired to work on the Project will be familiar with on-site spill prevention, response and clean-up measures. Available communication equipment will be two-way radios and satellite phones.

7.7.3 Potential Spill Sizes and Sources

Table 10 provides a list of the hazardous materials, their potential discharge events with worst case discharge volume and direction of potential discharge.

Table 10. Potential Spill Sizes, Sources and Discharge Direction for each Hazardous Materials

Material (Sources)	Potential Discharge Events	Discharge Volume (Worst Case)	Direction of Potential Discharge
Diesel Fuel	Leak from equipment/containers and spill while refuelling equipment	165 gallons (625 liters)	Towards Gunghi Creek
Gasoline	Leak from vehicles/containers and spill while refuelling vehicles	165 gallons (625 liters)	Towards Gunghi Creek
Propane	Puncture of cylinder	14 gallons (53 liters)	In air
Biodegradable Oils	Leak from equipment/container and spill while pouring oil in equipment	5 gallons (19 liters)	Towards Gunghi Creek
Biodegradable Lubricants	Leak from equipment/container and spill while lubricating equipment	5 gallons (19 liters)	Towards Gunghi Creek

Large Spills

1. A command and control center may be needed.
2. Temporary access roads may be needed.
3. Establish Zones may be needed. [i.e.: Hot Zone (downwind first)].

	Minor Leak	Small Leak	Large Leak
Liquid Spill:	100ft (30m)	400ft (125m)	1,200ft (375m)

- Record names and functions of all personnel on site.
- Establish an evacuation area.
- Implement a safety indoctrination procedure for spill site.
- Establish a communication system.
- Set up 24-hour supervision of site.

Note: For Fuel or hydraulic spills the threshold limit is 100 liters. When reporting a spill of 100 liters or more to the NWT Spills Hotline, the person reporting the spill shall provide the following:

1. Date and time of spill.
2. Direction spill is moving (or if it has stopped).
3. Name and phone number of persons close to the location of the spill.
4. Type of released product and quantity spilled.
5. Cause of spill.
6. Whether the spill is continuing or has stopped.
7. Description of the existing containment.
8. Actions taken to recover, clean-up and dispose of spilled product.
9. Name, address and phone number of person reporting the spill.
10. Name of the person in charge of management or control at the time of the spill.

7.7.4 Potential environmental impacts of spill

This section of the plan describes the types of materials that could be spilled, the potential environmental impacts, and the worst-case scenario associated with that type of spill.

7.7.4.1 Potential Environmental Impacts of Spill

Overall for hazardous materials discussed below, impacts are lower during winter as snow is a natural sorbent and ice forms a barrier limiting or eliminating soil or water contamination, thus a spill can be more readily recovered when identified and reported.

1. ***Gasoline***
   - **Environmental impacts:** Gasoline may be harmful to wildlife and aquatic life. It is not readily biodegradable and has the potential for bioaccumulation in the environment. Gasoline is quick to volatize. Runoff into water bodies must be avoided.
   - **Worst case scenario:** All tanks or drums were punctured or open simultaneously and contents seeped into surrounding soil and water bodies. This could cause illness or death to aquatic life and indirectly affect wildlife feeding from the land and water.

2. ***Diesel Fuel***
   - **Environmental impacts:** Diesel may be harmful to wildlife and aquatic life. It is not readily **biodegradable** and has the potential for bioaccumulation in the environment. Diesel burns slowly and thus risk to the environment is reduced during recovery as burn can be more readily contained compared to volatile fuels. Runoff into bodies of water must be avoided.
   - **Worst case scenario:** All fuel tanks and drums were punctured or open simultaneously and contents seeped into surrounding soil and water bodies. This could cause illness or death to aquatic life and indirectly affect wildlife feeding from the land and water.

3. ***Propane***
- **Environmental impacts:** Propane may be harmful to wildlife and surrounding environment. It has the potential to accumulate in the environment. Propane is extremely volatile and is the most flammable material stored on site, thus immediate impacts to the surrounding environment are a concern.
- **Worst case scenario:** All cylinders were punctured or failed simultaneously, and contents leaked into the surrounding environment and ignited leading to an explosion. This could cause serious environmental impacts in the immediate surroundings. Safety during emergency response to a propane spill is the utmost concern.

4. ***Sewage***
- **Environmental Impacts:** When sewage is discharged into river bodies without proper treatment, organic matters present in sewage causes depletion of dissolved oxygen which in turn affect aquatic ecosystem existing in the water bodies. Some gases like methane, carbon-di-oxide, sulphur dioxide, etc. are formed in sewage and escape into atmosphere causing air pollution and accelerating global warming by greenhouse gases.
- **Worst case scenario:** Portable toilet (i.e., Porta Potty) on site leaks onto the ground causing an unsanitary situation at site, and potentially having environmental and health related issues at the location.

5. ***Biodegradable* Oils and Lubricants (e.g., white lithium greases and vegetable oil hydraulic fluid)**
- **Environmental Impacts:** Biodegradable oils and lubricants will be used when working in the watercourse, which have a lower aquatic toxicity than traditional products. Biodegradable oils and lubricants break down when subjected to sunlight, water and microbial activity, however, biodegradability may be reduced in the winter.
- **Worst case scenario:** All fuel tanks and storage containers were punctured or open simultaneously and contents seeped into surrounding soil and water bodies. This may result in illness or death to aquatic life and indirectly affect wildlife feeding from the land and water.

7.7.5 Action Plan

Spills that are a potential environmental or human health hazard, including oil or fuel spills may occur on-site. A spill that meets criteria for a reportable spill defined as a substance that is likely to be an imminent environmental or human health hazard or meets or exceeds the volumes of "reportable quantities for spills in the NWT" as outlined in Appendix E will be reported to the Spill Report Line at **(867) 920-8130** and a Spill Report Form will be completed and submitted by fax **(867) 873-6924**) or email (**spills@gov.nt.ca**).

NT/NU SPILL REPORT LINE / 24-hour Spill Report Line:
Phone: (867) 920-8130
Email: spills@gov.nt.ca
Fax: (867) 873-6924

A detailed report on each occurrence will be submitted to the inspector not later than thirty (30) days after initially reporting the event.

All staff will be trained in spill response prior to working onsite. All Spill Report documents will be available in the site office. Local Fire, Ambulance, and Police contacts are included in Contractors Site Emergency Response Plan. The Contractor Emergency Contact Numbers will be posted in Site Office and are included in the Emergency Response Plan. The following spill response materials will be maintained on-site:

- Spill Kits in equipment and vehicles, which will contain sorbent material, a disposable container, safety gloves and goggles, and a shovel.
- Extra spill kits and materials will be available to contain larger spills and be stored at in the on-site trailer.
- Sorbent material to be carried in vehicles and equipment vehicles: **10 pads and 2 socks**.
- Fuel and service trucks: **200 pads and 12 socks**.

7.7.6 Technical Assistance Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

7.7.7 Notification Procedure to Alert Public

Travelers along ITH who drives by the construction site will be notified if a significant spill occurs. If required, the spill area will be barricaded and supervised to protect the public.

7.7.8 Procedures for Containing and Cleaning up the Spill on Land, Water, and Snow/Ice

7.7.8.1 Spill Assessment (Land)

Following the initial hazard assessment and development of a site safety plan, gather detailed information on the location and effects on the spill on the land base. Identify and document the spill boundary with the appropriate equipment, including:

- PPE;
- Gas detection monitors;
- Compass;
- Measuring device (i.e. GPS);
- Shovel;
- Quantabs or conductivity meter for produced water or emulsion spills;
- Hoe, drill or sampling equipment of sub-surface contamination is suspected; and
- Camera.

First ensure that there are no flammable vapours in the area. Produce a sketch of the spill and take appropriate photographs. Next, identify land uses in areas affected by the spill. Look at whether the spill affects private land owners, public land (green areas, parks), dispositions (pipelines, utilities, roads, facilities, trappers, etc.), or sensitive areas (protected areas, wildlife habitat, archaeological resources etc.). Based on the land use in the spilled area, determine the possible public that could be directly impacted; evaluate site for wildlife, and determine the approval requirements for accessing the spill site. It is important to note the terrain, soil types, characteristics and conditions, as well as the vegetation types on site. Surface run-off patterns, erosion potential, moisture levels and movement of the water table can all impact the severity of the spill and the way in which it can be contained so it is imperative to take note of all these things before proceeding with cleanup. When the previous considerations have been addressed, the next course of action is to determine the equipment resources that are required to control the spill. The initial assessment will impact what equipment will be used, how it will be transported to the spill site and how it will improve or create access to the spill.

Land spills will spread outward from the initial spill point toward lower-lying areas. Penetration downward into the soil will also occur at a rate that is dependent on the soil type and the nature of the product spilled. During spills in winter petroleum will spread under the snow making definition of the extent of the spill area difficult.

The Project Superintendent should:

- Attempt to restrict spills on land to as small an area as possible based on site conditions; and
- Prevent the spill from entering water bodies or watercourses or flowing into culverts, within the bounds of safety and practicality.

The method chosen for land containment and recovery is dependent on site conditions and the equipment available. A summary of common options is presented in the Table 11.

Table 11. Land Containment Options

Containment Method	Technique Description	Comments
Earth or Sand Dike (All Seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sandbags filled with soil or sand are used to contain spill. Augment with poly-sheeting if available.	Sufficient dry earth, gravel or sand needs to be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Work crews and/or earth-moving equipment are required to build dike.
Snow or Ice Dike (Winter Only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces. Augment with poly-sheeting if available.	Sufficient snow or water needs to be available to contain spill. Snow or ice dike will melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crews and/or earth-moving equipment are required to build snow dike. Water spraying equipment may be required to construct ice dike.
Sorbent Dike (All Seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents need to be disposed in compliance with government legislation. Sufficient sorbent or sorbent boom, work crews and storage containers or a lined storage area for contaminated sorbents need to be available to build sorbent dike.
Trench or Sump (All Seasons)	A trench or sump is excavated downslope on sloping terrain to limit surface or subsurface spill movement. Work crews and/or earthmoving equipment are required to build trench or sump, as well as plastic or other impermeable sheeting for a trench liner.	It is recommended that the trench be dug to the bedrock or permafrost, which will then provide containment layer for the spilled fuel. Clean topsoil should be removed before trench construction. Frozen soil, bedrock close to the surface or soil type (e.g. sand) may result in erosion or further penetration in sandy soil. Ensure no other pipelines or underground utilities are in the excavation area.

Containment Method	Technique Description	Comments
Vacuum Truck	A vacuum truck is used to recover spilled material from a dike or trench in areas accessible by trucks or heavy equipment.	The method depends on site access. Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before starting recovery activities.
Pumping Spilled Material into Storage	A pump is used to recover spilled material from a dike or trench in areas not accessible by vacuum trucks	Pumps need to be safe for use at the spill site and compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Skid tanks, tanker trucks, port-a-tanks, fuel bladders, permanent tanks, or a lined excavated area need to be available to provide storage for the recovered material. A work crew and power supply for the pump needs to also be available.

7.7.8.2 Spill Assessment (Watercourse)

Begin by assessing the characteristics of the affected watercourse including width, depth and velocity. Shoreline characteristics and sensitivities also need to be taken into consideration. The degree of oil impact, degree of sensitivity (ecological, cultural, human use, etc.) and the physical limitations can all affect the way in which a spill will be contained.

Petroleum products will spread outward from the origin of the spill eventually achieving a stable thickness on the water. Spills on rivers, creeks or streams will flow downstream, contaminating riverbanks and vegetation, affecting wildlife, fish and water users in the area of the spill.

The rate of the spill movement will depend on the current speed of the water and the time of year. Current may flow faster in the deepest channels in the river and slower in the shallower areas, due to varying volumes of water. Flow in a watercourse will also be faster in the spring because of snowmelt entering from the surrounding area. River currents in summer and fall will be generally slower than in the spring.

Spill velocity on a watercourse may be estimated quickly by using a current velocity meter or by timing the movement of a floating object on the watercourse over a set distance.

Table 12 is used for estimating spill velocity based on a 30 metres (100 foot) distance:

Table 12. Spill Velocity based on 30 metres (100 foot) Distance

Time Required For Object to Travel 30 metres (100 feet)	Surface Current Speed			Boom Angle
Seconds	Km/h	m/s	Miles/hour	Degrees
216	0.5	0.14	0.3	60
108	1.0	0.28	0.6	60
72	1.5	0.42	0.9	60
54	2.0	0.56	1.2	45
43	2.5	0.69	1.5	45
36	3.0	0.83	1.9	45
31	3.5	0.97	2.1	15
27	4.0	1.11	2.5	15
24	4.5	1.25	2.8	15
22	5.0	1.39	3.1	15
18	6.0	1.67	3.7	15

Note: In currents faster than 6.0 km/h (3.7 mph), or in excessively turbulent waters, the use of containment booms may be impractical and other containment or protection methods such as the use of diversion or exclusion booms may be required.

The velocity calculated will be an approximation only, as the watercourse velocity varies at different points across the river, due to changes in river depth and at various points upstream and downstream on the river. In the initial stages of spill on a watercourse, lighter-end materials will tend to evaporate, especially in warm weather. Other processes that might affect spill behaviour include dispersion of the petroleum into the water, formation of stable oil/water emulsions and stranding or oil along the shoreline.

Containment of a spill on a watercourse should be completed as quickly as possible as the spilled material has the potential to travel a much greater distance and contaminate a larger area than spills on land. The Project Superintendent will implement appropriate containment actions based on the size of the watercourse and current velocity.

Containment methods for watercourse recovery options are provided in Table 13.

Table 13. Watercourse Recovery Options

Containment Method	Technique Description	Comments
Vacuum Truck	A vacuum truck is used to recover free petroleum form water in areas accessible by trucks or heavy equipment.	A vacuum truck and operator are required. Use of this method is subject to site access. Surface disturbance and soil damage may result from the site. Topsoil may need to be stripped from the site before conducting recovery activities.
Pumping of Spilled Material into Storage	A pump is used to recover free oil from the watercourse in areas not accessible by vacuum trucks.	Pumps need to be safe for use at the spill site and be compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Technique will generate large volumes of contaminated water that will require storage. Skid tanks, tankers, port-a-tanks, fuel bladders, permanent tanks, or a lined excavated area need to be available to provide storage for the recovered material. A work crew and power supply for the pump need to also be available.

7.7.8.3 Spill Assessment (Ice Covered Water)

The first step in an ice covered water assessment is to identify the On-Site Supervisor and Safety Supervisor and appoint an Ice Assessment Team. The applicable equipment will then be identified to ensure that all resources necessary are available to contain the spill. Before beginning an assessment, ensure workers are protected against exposure to cold, warm-up facilities and food have been provided, and designated a rest area off the ice.

An Ice assessment team will proceed from the shore and drill one test hole in the ice to determine ice thickness, current velocity, water depth below ice and current direction of water flow. If the ice is safe to continue, the ice assessment team can proceed across the watercourse. As the assessment team moves away from the shore, it may be necessary to reposition anchors from shore to on-ice with the use of ice anchors.

Following the initial assessment of the ice across the watercourse, the team may move downstream (approximately 9 metres) and drill test holes across the watercourse. At this point, it is important to stagger the holes in order to obtain a more accurate assessment. The On-Site Safety Supervisor will then declare whether or not the weight bearing capacity is sufficient to continue work without the use of safety lines or anchors.

7.7.8.3.1 Spills on Ice

Spills on ice will tend to spread out from the spill source toward lower-lying areas. Surface depressions, cracks and pockets in the ice will cause the spilled material to pool. A significant volume of some oils can be absorbed into the ice.

The presence of oil on or in ice increases solar heating and the rate of melting. Subsequent freezing and melting may eventually cause the oil to migrate through the surface of the ice. Opening in the ice may allow the spilled material to migrate into open water or allow the spill to be swept under ice, making response operations more difficult.

The information presented should be used as a guideline only in determining typical load-bearing capacity of ice. The Project Supervisor needs to determine whether it is safe to work on ice based on actual site conditions.

The ability for ice on a river, stream or lake to support the weight of workers and equipment is determined by effective ice thickness which is based on the thickness of clear ice and presence of white ice.

Clear ice (sometimes called blue ice) is translucent and well compressed with few air pockets. This ice is very strong and has a high load bearing capacity.

White ice (or snow ice) is very porous, with many air pockets and is much weaker. White ice has approximately half the load bearing capacity of clear ice. White ice is formed by constant melting and freezing of the top layer of ice due to solar heating or mild temperatures and is normally found on top of clear ice.

Holes should be drilled in the ice at the work site, before starting any on ice operations, to determine the average thickness of white and clear ice.

Effective ice thickness then can be calculated using the formula in Table 14.

Table 14. Effective Ice Thickness Calculation

Effective Ice Thickness = clear ice thickness + 1/2 white ice thickness
Example: The spill site has 20 inches of clear ice and 10 inches of white ice 20 inches clear ice + 1/2 x 10 inches white ice = 25 Effective Ice Thickness
Note: If water lies between layers, use the depth of only the top layer of white ice.

Based on the effective ice thickness, a determination can be made as to the stationary and moving loads that may be supported by the ice. Normally less ice required for continuous movement on the ice than for stationary loads as less pressure is exerted on any one point on the ice during movement.

Tables 15 and 16 will assist the Project Supervisor and Safety Supervisor to determine the permissible loads on ice based on the effective ice thickness:

Table 15. Load Bearing Capacity of Ice Thickness for Continuous Travel

Permissible Load	Effective Ice Thickness – Inches (Centimeters)	
	Lake	River
One person on foot	2.0 (5.0)	2.5 (6.3)
Group, in single file	3.2 (8.0)	3.5 (8.8)
Passenger car, 4400 lbs (2000kg)	7.1 (17.8)	8.3 (20.8)
Light truck 5500 lbs (2500kg)	7.9 (19.8)	9.1 (22.8)
Medium Truck 7700 lbs (3500kg)	10.2 (25.5)	11.8 (29.5)
Heavy Truck 17,500 lbs (8000kg)	13.8 (34.5)	16.1 (22.8)
20,000 lbs (9000kg)	15.0 (37.5)	17.3 (43.3)
50,000 lbs (23,000kg)	24.8 (62.0)	28.7 (71.8)
99,000 lbs (45,000kg)	31.5 (78.8)	36.2 (90.5)
150,000 lbs (68,000kg)	39.4 (98.5)	45.3 (113.3)
240,000 lbs (109,000kg)	49.2 (123.0)	56.7 (141.8)

Table 16. Weight Bearing Capacity for Stationary Loads and Working on Ice

Permissible Load	Effective Ice Thickness – Inches (Centimeters)	
	Lake	River
2200 lbs (1000kg)	8.0 (20.0)	9.1 (22.8)
4400 lbs (2000kg)	12.0 (30.0)	14.0 (35.0)
8800 lbs (4000kg)	18.0 (45.0)	21.0 (52.5)
17,600 lbs (8000kg)	24.0 (60.0)	27.0 (67.5)
50,000 lbs (23,000kg)	44.0 (110.0)	50.0 (125.0)
99,000 lbs (45,000kg)	59.0 (147.5)	68.0 (170.0)
150,000 lbs (68,000kg)	71.0 (177.5)	82.90 (205.0)
240,000 lbs (109,000kg)	91.0 (227.5)	105.0 (262.5)

Temperature may affect the load-bearing capacity of ice on a water body. Air temperatures need to remain below the freezing point of water (0°C) for a sufficient period to allow the ice to adequately support a stationary or moving load. Temperature effects are dependent on ice thickness, as follows:

- Less than 50 centimetres (20 inches) of ice: temperature needs to be constant for 3 days;
- Between 50 and 100 centimetres (20 and 40 inches) of ice: temperature needs to be constant for (4) days; and
- Over 100 centimetres (40 inches) of ice: temperature need to be constant for 5 days.

Sudden drops or increases in temperature can also cause thermal stressing or cracking of ice requiring temporary load restrictions for 3 to 5 days following the change. Thawing due to warm temperatures may also significantly affect ice conditions. On-site personnel should take extreme care when evaluating ice conditions during a thaw and limit work on or near ice under these conditions.

Containment and cleanup options for spills on ice are similar to those on land and are summarized in Tables 17 and 18.

Table 17. On Ice Containment Options

Containment Method	Technique Description	Comments
Earth or Sand Dike (All Seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sand bags filled with earth or sand are used to contain the spill. Augment with impermeable or poly-sheeting if available.	Effective ice thickness needs to be sufficient to support the weight of manpower and equipment required to build the dike. Sufficient dry earth, gravel or sand needs to be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Earth or sand placed on ice needs to be removed before spring break up. Work crews and/or earth moving equipment are required to build dike.
Snow or Ice Dike (Winter Only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces. Augment with impermeable or poly-sheeting if available.	Effective ice thickness needs to be sufficient to support the weight of manpower and equipment required to build the dike. Sufficient snow or water needs to be available to contain the spill. Snow or ice dike may melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crew and/or earth moving equipment are required to build snow dike. Water spraying equipment may be required to construct and maintain an ice dike.
Sorbent Dike (All Seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents needs to be disposed of properly to comply with government regulations. Sufficient sorbent or sorbent boom, work crews and storage containers or lined storage area for contaminate sorbents needs to be available to build sorbent dike.

Table 18. On Ice Clean Up Options

Clean Up Method	Technique Description	Comments
Manual Removal by Work Crew and/or Equipment (Winter)	A work crew or earth moving equipment are used to remove thick oil or contaminated snow and ice.	Effective ice thickness needs to be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. Manual removal may be a difficult and time consuming process. A work crew with hand tools or earth moving equipment and operators, as well as ice cutting equipment, may be required. Lined storage area or storage drums are required to store contaminate material before treatment or disposal. Oil present in snow may be skimmed off during spring thaw.
Steaming of Ice Surface	Steam is used to melt ice surface to aid in spill cleanup. The technique may be used in association with other clean up and recovery techniques.	Effective ice thickness needs to be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. A work crew with steaming equipment is required to undertake this method.
Sorbents (Spring to Fall)	The method is used in isolated areas to clean up small amounts of oil.	Clean up is labour intensive and time consuming. Limited access to site may make this method difficult or impossible. Sorbents are not very effective on weathered oil in cold weather. Sorbents may freeze to the surface. Sorbents needs to be disposed of properly to comply with government regulations. Sufficient sorbent, work crews and storage containers or a lined storage area for contaminated sorbents needs to be available.

Clean Up Method	Technique Description	Comments
Snow or Ice Melting	Snow or ice is removed from the cleanup site and melted in heated tanks to allow spilled material to be skimmed off the surface of the melted water. The technique may be used in association with other clean up and recovery techniques.	Contaminated snow or ice needs to be removed from cleanup site and placed in melting tanks. The method may be labour intensive and time consuming, as melting is not very efficient for cleanup of large volumes of petroleum contaminated ice. In very cold temperatures, sufficient heat may not be available in the tanks to melt ice. A work crew, heating tanks, skimming equipment, transfer vehicles and operators are required. A lined storage facility for storage of contaminated ice or snow before melting may also be required, as well as storage tanks for storing recovered petroleum.

7.7.8.3.2 Spills Under Ice

Spills of petroleum under ice will spread and will travel under the ice at a velocity that is less than the current speed of the watercourse. The spill will tend to follow the path of the main current flow. The spill product may become trapped in crevices, cracks, pockets, and other irregularities under the ice and may freeze from the underside of the ice anywhere downstream or outward from the original spill. This will make recovery and cleanup operations extremely difficult.

Before conducting any response operations to contain, remove and clean up oil under ice, the Project Supervisor should ensure that the Safety Supervisor and Ice Assessment Team have calculated the effective ice thickness to ensure it will support the weight of personnel and equipment.

For spills under ice, the Project Supervisor should attempt to determine the location of the spilled material and bring the spill to the surface of the water for containment and recovery. Spill movement under the ice is normally located by drilling holes through the ice using an ice auger downstream of the spill source on a flowing watercourse or outward from the spill source on a non-flowing water body. Alternately, aerial reconnaissance may be used to attempt to locate spilled material in cracks at the surface or under thin ice. Once the spill has been located, containment operations can be conducted to bring the spilled product to the surface.

Containment operations are normally accomplished by constructing slots in the ice. Ice slots allow petroleum products trapped under the ice to rise to the surface for recovery.

The slot is normally constructed at an angle in relation to the shore depends on the current velocity, similar to a containment boom placed in a flowing river. For higher currents in the river, a shallower angle is used for the ice slot, while a larger angle may be used for lower current flows.

If a slot is constructed at too great an angle to the current, turbulence may occur, sweeping the spilled material under the ice or downstream. Plywood or other types of sheeting may be placed on the downstream side of the slot and frozen in place to facilitate containment of the spilled material. The ice slot should be 0.5 to 1.0 metre (1.6 to 3.3 feet) wide, to aid in containment. Ice blocks may be cut using a

ditch witch or backhoe if the effective ice thickness is sufficient to allow stationary equipment on the ice. [If ice is too thin for equipment but safe for personnel, crews equipped with chainsaws and proper safety gear can cut the ice.] Ice blocks can be removed to clear the slot or pushed under the ice downstream of the slot if sufficient water depth is available.

Ice blocks are extremely heavy (one cubic foot of ice weighs 24 kilograms (53 pounds). Blocks should be cut to a size that will allow the crews or equipment to remove them easily. To aid in block removal, the ones nearest the shore should be removed first and remaining blocks should be floated toward shore for removal. Plywood or other sheeting can be used upstream of the slot to divert oil into the slot for recovery. Narrow slots may be cut into the ice with a chainsaw and sheeting may be wedged into the slots to channel the main current toward the ice slot in a manner similar to a diversion boom in open water.

Table 19. Under Ice Containment Options

Containment Method	Technique Description	Comments
Ice Slotting	Ice slots are cut into ice on rivers to collect oil moving under the ice. The technique is best used for rivers with current, as oil will be moved toward slot by current.	Effective ice thickness needs to be sufficient to support the weight of manpower and equipment required to build slot. All personnel working near any open water need to take safety precautions. The location of the spill needs to be confirmed by drilling holes downstream of the spill source before constructing the ice slot. Total containment of spilled petroleum in an ice slot is unlikely, due to material trapped under ice. Snowmobiles, communications gear, and ice augers may be required to determine the location of the spill. Work crews, chainsaws and/or a backhoe or ditch witch are required to construct an ice slot. A recovery device such as a heat-traced ice skimmer is required to recover spilled material. Storage tanks or a lined excavated storage area may be required to store recovered oil/water mixture.

7.7.8.3.3 Spills in Broken Ice

The risk to life safety of the personnel attempting spill response in broken ice conditions using existing technology is extreme. Emergency operations in broken ice conditions during spring thaw or winter freeze up are extremely difficult. When oil is mixed with floating ice or covered by a very thin ice cover, ice interferes with the collection of the oil and could damage containment and recovery equipment. The presence of ice also makes the use of boats difficult.

Before authorizing any spill response operations in broken ice conditions, the Project Supervisor along with the appropriate regulatory agencies, will evaluate whether it is safe or feasible to undertake containment and recovery operations and what methods should be used.

Containment options for spills during freeze up or break up are similar to those for spills on a river and on ice. If containment operations are determined to be feasible based on site conditions, the Project Supervisor will attempt to deflect ice away from the containment site.

Deflection of ice may be achieved using log booms or ice dams. A log boom consists of logs cabled together with chain, anchored upstream of a conventional containment boom. An ice dam is constructed upstream of the oil spill site and containment site, to attempt to divert upstream ice away from a containment site.

Log booms are deployed at an angle away from the containment site. Logs are spaced to allow spilled materials and water to move directly toward the containment site, while diverting the ice towards the opposite shore, allowing the ice to pass around the containment site.

7.7.8.4 Snow Spills

Snow is a natural sorbent, thus as with spills on soil, spilled fuel can be more easily recovered. Generally, small spills on snow can be easily cleaned up by raking and shovelling the contaminated snow into plastic bags or empty barrels, and storing these at an approved location.

Dikes can be used to contain fuel spills on snow. By compacting snow down slope from the spill and mounding it to for a dike, a barrier or berm is created thus helping contain the spill. If the quantity of spill fairly large, a plastic tarp can be placed over the kike such that the spill pools at the base of the dike. The collected fuel/snow mixture can then be shovelled into barrels or bags, or collected with sorbent materials.

7.7.9 Procedures for transferring, storing and managing spill-related wastes

Contaminated materials will be stored in a secure container for disposal. Allen Services & Contracting Ltd have disposal arrangements through KBL environmental for disposal of contaminants in the Yukon and Alberta. They are also licensed with the GNWT as a hazardous waste carrier.

7.7.10 Procedures for Restoring Affected Areas

Site remediation options are outside the scope of this Spill Contingency Plan. Site restoration will be determined by consultation among the Project Supervisor, Allen Services & Contracting Ltd. staff, environmental protection agency personnel and any external environmental consultants that are contracted by the company.

7.7.11 Resource Inventory

7.7.11.1 On-Site Resources

7.7.11.1.1 Personnel

All personnel hired to work on the Project will be familiar with on-site in spill prevention, response and clean-up measures (see Section 7.7.11).

7.7.11.1.2 Equipment, Spill Kits and Sorbent Materials

- 1-spill kit located in job shack as described in Section 7.7.11.1.3;
- 10 pads and 2 socks of sorbent material in each vehicles and equipment vehicles;
- Disposable container, safety gloves, goggles and shovel in each vehicles and equipment vehicles;
- 1-49 Ton Hydraulic Excavator;
- 1-30 Ton Hydraulic Excavator;
- 1-D9N Cat Bulldozer c/w Ripper;
- 1-50 T Crane;
- 2- Vibratory Compactor;
- 1-Tracked Skid Steer;
- 1- Loader c/w Bucket & Forks;
- 1-JOB/EMERGENCY SHACK;
- 2-LIGHT TOWER (s);
- 1-2000 l -Double Walled Fuel Cube; and
- 2- Pick Up truck.

7.7.11.1.3 Spill Kit Contents

The following outlines the recommended minimum requirements for contents of the spill kit to be used during the Project; the Contractor is responsible to supply the spill kit. Each spill kit will be regularly inspected to ensure it always contains the following, at a minimum (in part from INAC 2007[10]):

- 1 – 205 L open top steel drum with lid, bolting ring and gasket (spill kit container);
- 10 disposable large 5 mil polyethylene bags (dimensions 65 cm x 100 cm) with ties;
- 4 – 12.5 cm x 3 m (5 in. X 10 ft.) sorbent booms;
- 10 kg bag of sorbent particulate;
- 100 sheets (1 bail) of 50 cm x 50 cm sorbent sheets;
- 2 large (5 m x 5 m) plastic tarps;
- 1 roll duct tape;
- 1 utility knife;
- 1 field notebook and pencil;
- 1 rake;
- 1 pickaxe;
- 3 spark-proof shovels;
- 4 Tyvex® splash suits;
- 4 pairs chemical resistant gloves;
- 4 pairs of splash protective goggles; and
- Instruction binder, including Spill Contingency Plan.

10 Indian and Northern Affairs Canada (INAC). 2007. Guidelines for Spill Contingency Planning. Water Resources Division, INAC, Yellowknife, NT Available online: https://www.enr.gov.nt.ca/sites/enr/files/guidelines_for_spill_contingency_planning_2007.pdf

The entire spill kit contents, with the exception of the spark-proof shovels, can be stored within the 205 L steel drum. The drum will be sealed securely to protect the spill kit contents, though should always be accessible without the use of tools (i.e., finger tight bolt ring). The drum's bolt ring should be inspected regularly during inspections to ensure it turns freely and is lubricated.

Extra spill response materials should also be available for use, in addition to the spill kit contents. The spill kit will be located in the job shack as shown Appendix D.

7.7.11.2 Off-Site Resources

If required, additional resources will be provided from Inuvik or Tuktoyaktuk. Access to Inuvik from the Project site is approximately 2 hours by vehicle and 10 minutes to Tuktoyaktuk.

7.7.12 Training Program

Allen Services & Contracting Ltd. is committed to ensure all personnel involved in an emergency response fully understand their roles and the roles of others whom they may interact with during an incident. To meet this commitment and to ensure personnel respond effectively, training activities will include:

Orientation

- Provide employees and contractor management with an orientation to Allen Services & Contracting Ltd.'s Emergency Response Plan and its applicable elements.
- Ensure all employees are familiar with and trained in the safe work procedures related to the handling of petroleum products and fueling equipment (see Appendix F).
- Discuss and clarify bridging between contractors' emergency response procedures and this Allen Services & Contracting Ltd. ERP where applicable.
- Utilize summary wall charts outlining key responsibilities and lines of communication for quick reference purposes.
- Devote a portion of scheduled safety and/or staff meetings to discussion of emergency response issues on and on-going basis.
- Keep on site record of the training provided, when it was provided and who attended.

Specialized Emergency Response Training

- Make available (through the Allen Services & Contracting Ltd. Safety Advisor) all required training.
- Ensure employees and contractor personnel comply with Allen Services & Contracting Ltd.'s safety training requirements (e.g. First Aid/CPR, WHMIS, Transportation of Dangerous Goods, Firefighting, etc.).

Emergency Drills

- Employees and contractors will conduct drills on an on-going basis to ensure readiness, including, but not restricted to:
  - Firefighting;
  - Spill response;
  - First aid;
  - Confined space entry; and
  - Man down.

External Orientation

- As appropriate, brief and familiarize all external groups or agencies having a role in this Emergency Response Plan with the overall plan and their specific responsibilities under the plan.

7.8 Discovery of Historic Contamination

Immediately stop work. Contact site superintendent, and contract authority. Contain the immediate area to ensure contamination doesn't spread. Site superintendent and contract authority will determine the proper steps to proceed with clean-up and/or inspection from another authority.

8.0 Fisheries Management Plan

8.1 Purpose and Scope

This section provides the Fisheries Management Plan (FMP) for the Gunghi Creek crossing replacement Project. The FMP was developed to ensure compliance with the *Fisheries Act*, federal and territorial regulations including Aboriginal Affairs and Northern Development Canada (AANDC), Fisheries and Oceans Canada (DFO), and the Fisheries Joint Management Committee (FJMC).

The FMP identifies potential issues and concerns related to fisheries resources during construction and provides mitigation measures to address these potential issues. During construction an environmental monitor will be on site to ensure mitigation measures are being followed correctly and to respond to any issues that may arise.

The Project has been approved[11] and Fisheries Management Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities, fish rescue/salvage from instream construction worksite, and water quality monitoring will not be required. during the construction phase.

A separate Fisheries Management and Monitoring Plan[12] has been developed to outline short-term (construction phase) and medium and long-term (post-construction) monitoring and reporting.

8.1.1 Issues and Concerns

Potential direct or indirect construction-related effects to the fisheries resources of Gunghi Creek are largely related to the accidental release of a deleterious substance and include the following:

- During instream construction projects, sediment has the potential to be released or mobilized through the erosion of exposed soils, constriction or diversion of channel flows, and by disturbances to the channel bed or banks. Erosion and sedimentation at/or near the water crossing may impact water quality, fish habitat and fish health.

11 Audet-Lecouffe, José . FFHPP Biologist. Department of Fisheries and Oceans. Telephone and Email communication 2020, with Jessica Parker, Environmental Biologist, Wood Environment & Infrastructure Solution Communication. RE: Gunghi Creek - Fisheries Management and Monitoring Plan.

12 Wood Environment & Infrastructure Solutions. 2020. Fisheris Management and Monitoring Plan, Gunghi Creek Crossing Replacement. Prepared for Government of the Northwest Territories, Department of Infrastructure, Yellowknife, Northwest Territories. Prepared by Wood Environment & Infrastructure Solutions, Edmonton, Alberta.

- Accidental releases of wastes and fuels (i.e., sewage wastes, solid wastes [i.e., household and construction garbage], and hazardous wastes [hydrocarbons, hydraulic fluids]) at/or near the water crossing have the potential to impact water quality and fish health.
- Temporary access roads and/or snow fills at water crossing have the potential to result fish passage blockage during spring break-up.
- Accumulated debris (logs from clearing, boulders, garbage, ice-build-up etc.) can prevent efficient passage of water and fish at water crossing and may impact fish movement and water flows.

These potential effects can be mitigated by avoiding instream construction to the extent possible (e.g., operating machinery from outside of the watercourse), implementation of appropriate erosion and sediment control measures, proper storage and handling of hazardous materials, and removal of introduced snow fills or debris from the channel as described in the Mitigation Measures (Section 8.4).

It is expected the monitoring will support the implementation of mitigation measures to minimize impacts of construction and to provide a feedback mechanism so that mitigation measures can be adjusted where and when necessary.

8.2 Primary Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

8.3 Project Footprint

The crossing replacement works including the temporary detour below the ordinary high water mark will be 368 m^2.

8.4 Mitigation Measures

All Project activities will adhere to design specifications, conditions of project approvals (provided Appendix A), relevant guidance documents (Section 3.0), the PDRs and EMP, and will be performed in accordance with the established BMP's and/or mitigation measures outlined below. The Project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities, water quality monitoring and fish rescue/salvage from instream construction worksite will not be required.

8.4.1 General

- Replace/restore any disturbed habitat features and remediate any areas impacted by the Projects works before spring thaw.
- Avoid fording the watercourse and conduct works from above the streambanks, wherever possible. Where instream access is required by construction machinery access should be restricted to one location within the instream work area and traffic should be limited. The access site must be chosen with care, where banks are low, and will be limited to the instream worksite.
- The construction limits will be conspicuously marked with flagging tape to ensure that construction personnel know the disturbance must remain within the proposed footprint and right-of-way.
- Any excavated areas of the channel bed will be backfilled with material that is the same (or better) quality and gradation that was removed.
- Only clean rock, appropriately sized and free of deleterious substances will be used for riprap. These materials will be obtained off site and will not be taken from below the ordinary high-water mark (OHM)[13] of any watercourse.
- Construction will be halted during periods of heavy precipitation (e.g., greater than 15 mm recorded over a 24-hour period, a short duration storm that generates visible sheet flow).
- All spoil materials and debris will be removed from the site and properly disposed of above the OHM so that they do not enter any water body.
- Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.
- The Contractor will adhere to environmental management outlined in *Revision 4 – Environmental Management Plans: Erosion and Sediment Control Plans Hazardous Materials Management Plan, Waste Management Plan, Wildlife Management Plan, Spill Contingency Plan, Monitoring Plan, Permafrost Monitoring Plan, and Closure and Reclamation Plan.*

8.4.2 Construction Timing and Duration

Instream activities are to be completed during frozen surface water/no flow conditions in December 2020, which will occur outside the restricted activity timing window for works in or around water of April 1 to July 15. Frozen surface water/no flow conditions are conducive to safe working conditions in the creek channel and may assist in reducing sediment transport capacity. Further, the Project has been approved and FMMP developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction. All efforts will be made by the Contractor to minimize the duration of instream activities and complete the works as expediently as possible. Clean-up of construction at the crossing location will commence immediately following the instream works.

13 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. This refers to the "active channel/bankfull level", which is often the 1:2 year flood flow return level.

8.4.3 Riparian Area Protection

The following measures will be implemented for the protection and/or re-establishment of riparian vegetation.

- Limit impacts on riparian vegetation to those approved for the Project works.
- All work will be conducted from above the streambanks, wherever possible, to avoid disturbance to riparian vegetation. Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.
- Maintain an undisturbed vegetated buffer zone between areas of on-land activity and the OHM of any water body, where possible.
- Minimize clearing of riparian vegetation (where possible, prune or top vegetation rather than uprooting/grubbing) and use existing roads, cut lines or trails when accessing the work area to minimize further disturbance within the riparian area (eg., soil compaction, clearing).
- Use methods to prevent soil compaction such as swamp/rig mats or pads.
- Prompt implementation of ESC measures of all disturbed areas.
- Implementing measures to reduce the introduction and spread of weeds and invasive plant species, such as washing and inspecting vehicles/equipment prior to its arrival onsite to ensure that they have been cleaned and are free of dirt, mud, weeds and invasive species; utilizing weed-free seed mixtures; and monitoring to identify potential locations for control measures; is recommended.
- Weed control methods will be implemented during the construction in areas where weed problems are identified. The use of herbicides is not recommended within the Project site due to potential runoff into Gunghi Creek.

8.4.4 Construction Machinery, Staging and Access

Construction staging areas and creek access will be located in areas that minimize disturbance to the creek, riparian and floodplain areas. Construction staging and access will be established to ensure that:

- Staging and creek access areas will be identified by the contractor and construction area boundaries will be marked with conspicuous flagging tape to ensure that construction personnel know limits and boundaries of the allowable work area.
- General preparation of the staging areas will be completed prior to the commencement of instream works.
- Avoid fording the watercourse and conduct works from above the streambanks, wherever possible. Where instream access is required by construction machinery access should be restricted to one location within the instream work area and traffic should be limited. The access site must be chosen with care, where banks are low, and will be limited to the instream worksite.
- All equipment and machinery will be assembled, cleaned and checked for proper mechanical operation prior to entering the work site. Regular inspections will be completed to ensure that hydraulic, fuel, and lubrication systems are in good condition and equipment is free of leaks.
- Washing, refueling, servicing and staging of machinery and equipment will be conducted at least 100 m from a water body to prevent the entry of any deleterious substances.
- All equipment that is to be used will be free of weed species and aquatic invasive species.
- Equipment travel and operation will be suspended or modified (i.e., swamp mats) in areas where rutting problems on wet ground are jeopardizing topsoil structure and integrity at the work site.

8.4.5 Instream Work

The following measures will be implemented for the protection aquatic resources.

- Instream activities are to be completed during frozen surface water/no flow conditions in December 2020. Instream works will be avoided during the restricted activity timing window of April 1 to July 15.
- Instream works will be confined to the approved area.
- Minimize removal of any instream natural structures (e.g., woody debris, boulders; if removed, return to its original location).
- Any excavated areas of the channel bed will be backfilled with material that is the same or better quality and gradation that was removed.
- Only clean rock, appropriately sized and free of deleterious substances will be used for riprap. These materials will be obtained off site and will not be taken from below the average high-water level of any watercourse.
- All spoil materials and debris will be removed from the site and properly disposed of above the high-water mark so that they do not enter any water body.
- Should the need for dewatering arise (e.g., groundwater seepage), water will be released into a well vegetated area or settling basin and not directly into any water body. Water returning to the watercourse will be of equal or better quality than the water in the watercourse.

8.4.5.1 Instream Equipment

All equipment and machinery that will be working within the creek will be assembled, cleaned and checked for proper mechanical operation prior to entering the watercourse. Regular inspections will be completed to ensure that hydraulic, fuel, and lubrication systems are in good condition and equipment is free of leaks. Any equipment that arrives in a dirty condition, as determined by the Environmental monitor will not be allowed on the RoW or facilities site until it has been cleaned.

Biodegradable oils and lubricants (e.g., white lithium greases and vegetable oil hydraulic fluid) will be used in equipment that will be working within the watercourse. Used oil, filter and grease cartridges, lubrication containers, and other products of equipment maintenance will be contained and disposed of at the nearest industrial waste facility.

8.4.6 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented as outlined in Section 3.0. Effective ESC measures will be in place prior to disturbance, during and after construction to prevent sediment from entering a water body. All ESC measures will be inspected regularly to ensure they are functioning properly and are maintained, cleaned and/or upgraded as required until complete revegetation of all disturbed areas is achieved.

8.4.7 Spill Management

Spill management measures will be implemented as outlined in Section 7.0.

8.4.8 Temporary Access Road – Snow Fill

The following measures will be implemented for the construction, operation and removal of the onsite detour.

- It is understood that construction of the temporary access will not require pumping of any water from any nearby water body.
- Construction/operation of the temporary access/crossing will be during frozen ground conditions and with an adequate layer of snow to prevent damage to the ground by vehicles.
- Construct approaches or access road crossings perpendicular to the watercourse where possible.
- Construct approaches using clean (ambient), compacted snow and ice to a sufficient depth to protect the stream banks or shoreline.
- The banks of the watercourse should be protected using suitable erosion control measures to the satisfaction of the inspector.
- Where logs are used to stabilize the approach, the logs are to be clean and securely cabled together. No logs and woody debris are to be left in the river or on the banks or shoreline.
- Any material placed below the Ordinary High Water mark (OHW[14]) shall be free of any contaminants, debris, or fine material.
- Any temporary modification of the watercourse bank shall be returned to the original state. All materials shall be removed upon project completion.
- Any debris on the surface of the crossing will be removed immediately following construction completion.
- The snow bridge should be V-notched once construction is completed to allow it to melt from the center.
- Remove compacted snow from snow fills prior to the spring freshet.

8.5 Hazardous Waste Monitoring Plan

Based on the Project works, the most likely contaminant of potential concern for the Project is petroleum hydrocarbons associated with construction equipment (found in hydraulic fluids, diesel fuel and gasoline). The Contractor emergency spill response plan and contingency measures are provided in Section 7.0. In the unlikely event of a spill incident on site, the contractor will immediately implement the appropriate spill notification, response and mitigation measures as specified in the Spill Contingency Plan (Section 7.0). After clean-up the spill area will be reviewed for any sign of further contamination.

In large spills, or in the case a spill is released into the watercourse, this may require the input from an environmental specialist to verify the clean-up of the site is satisfactory. The Contractor will have a qualified environmental specialist on standby with appropriate training and qualifications to complete confirmatory water quality sampling and testing (i.e. sampling for hydrocarbons). The sampling will be conducted at the release site and/or containment area to confirm spill clean-up. Confirmatory samples will be sent to an approved laboratory for analysis. Criteria for confirmatory samples will follow Canadian Environmental Quality Guidelines, where appropriate. Standard lab testing criteria and quality assurance and quality control (QA/QC) plans will be established upon selection of a qualified analytical laboratory. Emergency Spill Response Reporting be conducted in as outlined in Section 7.0.

[14] OHW = ordinary high water level, approximately 1:2 year flow depth

9.0 Permafrost Monitoring Plan

As the proposed development occurs within an area that has been previously disturbed by the exiting highway and watercourse crossing potential negative effects to permafrost (permafrost melt) are expected to be fully mitigated with the implementation of the following mitigation measures and permafrost monitoring is not expected to be required:

- Timing of Construction. To avoid rutting and erosion in permafrost terrain, construction and overland travel will only take place during the winter when the active layer is well-frozen.
- In areas of ice-rich permafrost, cross drains will be stacked on top of each other to maintain drainage in the event that the lower cross drain freezes, where required.
- Prior to the spring melt/freshet, the disturbed soil will be stabilized using effective erosion and sediment measures, vegetated and/or seeded. In areas with permafrost, care will be exercised to ensure these measures do not cause thawing or frost heave;
- At least 2 m of spoil material or other suitable material will be placed on any exposed ice surfaces to provide insulation.

10.0 Site Closure and Reclamation Plan

10.1 Purpose and Scope

The purpose of this Site Closure and Reclamation Plan is to outline when the Project will be completed and list the reclamations that will be carried out at the end of construction.

10.2 Primary Contacts

CONTRACTOR

Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8

Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

PROPONENT

Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

10.3 Demobilization and Reclamation Details

The project is scheduled for construction during winter 2020/2021 when environmental impacts such as dust, erosion and silt contamination can be minimized. Seasonal deficiencies and final cleanup will occur in July 2021. Details of the Project schedule is provided in Appendix B.

At the end of the construction, all equipment will be driven where possible via ITH from site to the Inuvik head office. Tracked equipment, light towers, fuel cube, Porta Potty, and job site Trailer to be loaded and hauled by tractor trailer from site to Inuvik. Reclamation of banks and beds of the watercourse impacted due to construction activities and the temporary detour will be reinstated. Reclamation of impacted vegetation due to temporary detour and construction activities will be revisited post freshet and further reclamation and reseeding completed at that time. Additional details related to the temporary detour are as follows:

- No water withdrawal from nearby water bodies will be required for the temporary detour. Any water required for the project will be transported to site from the Hamlet of Tuktoyaktuk and will not be locally sourced.
- The temporary detour 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.
- The snow bridge will be V-notched once construction is completed to allow it to melt from the center.
- Compacted snow from snow fills will be removed prior to the spring freshet.
- Winter ice roads will be allowed to deteriorate naturally at the end of winter, following the construction period.

11.0 Emergency Response Plan

The Contractor has prepared Emergency Response Procedures, provided in Appendix F. The document includes emergency contact numbers and reposnse procedures in the event of a personnal injury, incident or emergency, leak or spill, bomb threat, explosion, severe weather, or natural disaster.

Appendix A

GNWT Erosion and Sediment Control Best Management Practices #1 (Sediment Fences)

Sediment Fence Sediment Control	B.M.P. #1

- Useable life of approximately one year dependent on regular maintenance

Construction

- Two methods of installation are commonly used
  - Trench method (common method)
  - Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent) (used in areas where soil depth is not a concern, therefore has not been included in this manual)
- Trench Method
  - Select location of sediment fence (fence must be level - along contours)
  - Excavate a trench approximately 0.15 m deep by 0.15 m wide for entire length of fence along upstream side of posts;
  - With fabric on the upstream or upslope side toward the flow, drive support posts a minimum of 0.3 m into ground, spaced a maximum of 2 m apart;
  - Extend the loose flap of filter fabric the bottom to cover the base of trench (see figure);
  - Backfill and compact soil in trench, being careful not to damage fence or dislodge posts;
  - Where extra support is required, attach the wire mesh or snow fencing, as reinforcement, to upstream side of posts with staples or other type of ties. If using fencing material which is not stapled to the posts, place the wire mesh or snow fencing first and then line the upslope side with the fabric. Secure all tightly to the posts.

Construction Considerations

- Site Selection
  - Size of drainage area upslope of the sediment fence should be no greater than 0.1 ha for each 30 m length of sediment fence;
  - Maximum slope length above sediment fence should be no greater than 30 m;
  - Maximum slope gradient above the sediment fence should be no greater than 2H:1V;
- Fence should be placed on contour (level) to produce proper water detention;

Sediment Fence Sediment Control	B.M.P. #1

- Fence should be placed far enough away from toe of slope to provide adequate retention area (minimum of 1.8 m away from toe of slope is recommended) which will also permit access by equipment to conduct maintenance;
- Fence should not be installed immediately adjacent to a stream. The fence should be as far from the stream edge as possible and at a minimum far enough (>1.0 m is recommended) from the stream bank to allow room for a second fence to be installed, should the first one fail or become damaged; Ends of fence should be angled upslope (smile) to collect runoff;
- Fence fabric should not extend more than 0.7 m above grade when installed correctly;
- Fence fabric (and wire mesh or snow fence, if used) should be dug into a trench at least 0.15 m deep (six inches) and lay across the bottom of the trench 0.15 m to prevent undercutting of fence by runoff; Fence stakes can be wood or metal material dependent on design and ground conditions;
- Stakes are to be placed on downstream side of fence, fabric on the same side as the material to be contained;
- Posts should not be spaced greater than 2 m apart;
- Wire mesh or standard snow fencing may be placed on the upslope side of the fencing to provide additional strength and support reinforcement;
- Fence material should be cut from a continuous roll to avoid joints. If joints are necessary, the wrapping of fabric around the fence post with a minimum overlap of 0.2 m and staples should be used to attach the fabric to the post);
- Fence material (and wire mesh or snow fence, if used) should be attached to posts with heavy duty staples, tie wires, or hog rings;
- Trench backfill should be compacted.
- Long sections of silt fence are more prone to failure than short sections.
  - Maximum length of each section of silt fence should be 40 m.
  - Sediment fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours (level). The J pattern allows for an escape path for detained water (minimizes pushing over or overtopping of the fence structure).

Inspection and Maintenance

- Inspection frequency should be in accordance with the PESC and TESC Plans. Sediment fences should be inspected daily but at a minimum of once every 7 days, as well as after significant storm events and spring melt.

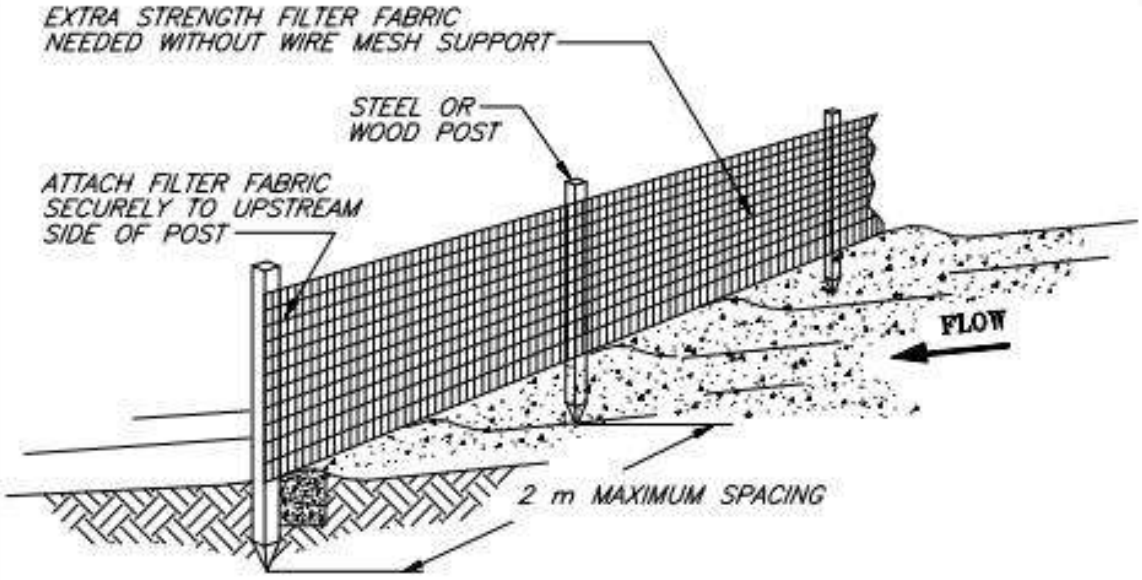
- Repair undercut fences. This is a sign that the fence was incorrectly installed or overloaded. Repair or replace damaged fencing (split, torn, loose or weathered) fabric immediately.
- Sediment build up should be removed once it accumulates to a depth of 0.3 m (one foot).
- Sediment should be removed and stored at a suitable stockpile location with no surface flow;
- Remove fence after vegetation is established;
- Deactivate fabric by cutting the fencing material between the stakes and pulling to remove; bottom trenched-in portion of fence fabric should be removed from the ground to avoid groundwater interception and potential for wildlife entanglement.

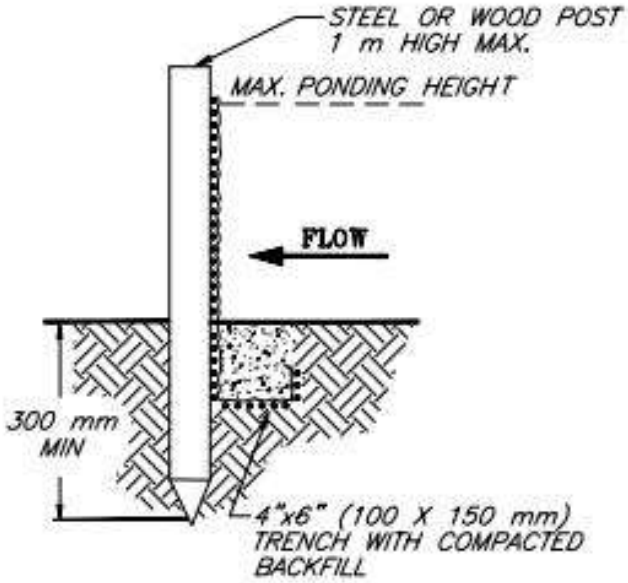
Similar Measures

- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

Design Considerations

- For sediment fence to work as a system, the following factors should be considered:
  a) quantity – adequate number, location, and spacing of fences for efficient detention and sedimentation
  b) installation – must be done correctly and on contour
  c) compaction – backfill and trenching of fabric
  d) support – posts adequately embedded, appropriate selection of post material and spacing
  e) attachment – secure fabric to post
- Install sediment fence in a 'J' hook or 'smile' configuration, so that the ends are higher than the fenceline to contain the water and sediment





TRENCH METHOD DETAIL

NOTES:

1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
2. INSPECT AND REPAIR FENCE DAILY AND AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES 200 mm.
3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA WILL NOT CONTRIBUTE SEDIMENT OFF-SITE.
4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

Sediment Fence (Trench Method)

From: Soils-Applied Earthcare - EROSION DRAW 3.0

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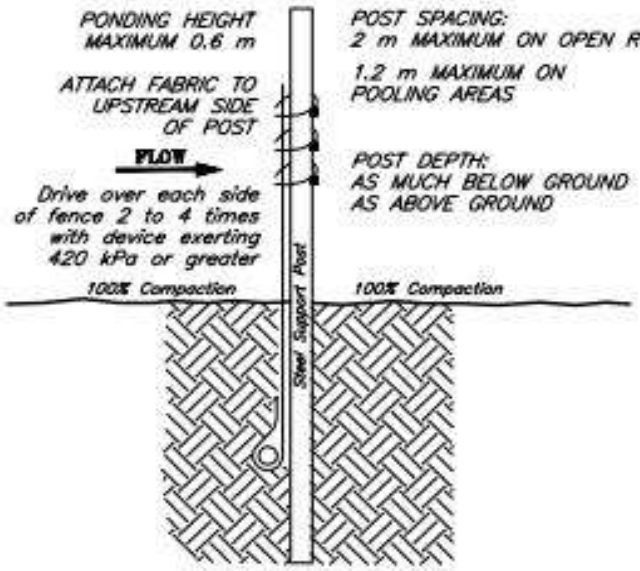
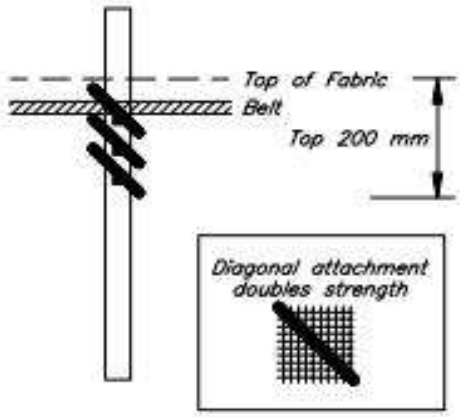
Government of the Northwest Territories – Transportation

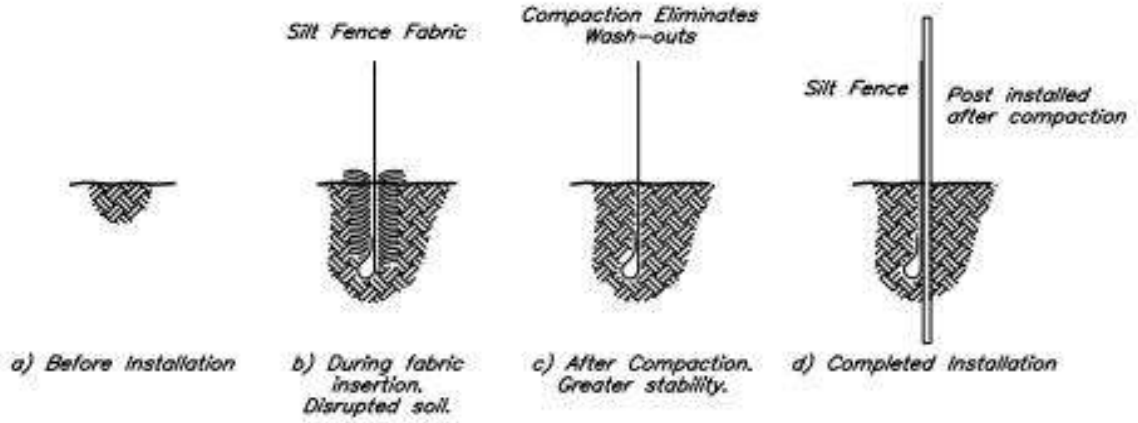




ATTACHMENT DETAILS:

- Gather fabric at posts, if needed.
- Utilize three ties per post, all within top 200 mm of fabric.
- Position each tie diagonally, puncturing holes vertically a minimum of 25 mm apart.
- Hang each tie on a post nipple and tighten securely.
- Use cable ties (50 lbs) or soft wire.

MECHANICAL (SLICING) METHOD



MECHANICAL (SLICING) METHOD INSTALLATION SEQUENCE

NOTES:

1. INSTALLATION MACHINE MUST ALLOW CONTINUOUS SLICING AND EMBEDMENT OF GEOTEXTILE INTO GROUND WITH MINOR GROUND DISTURBANCE.
2. INSTALLATION MACHINE TYPES WILL VARY WITH MANUFACTURER.
3. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

NOT TO SCALE

SOURCE: CARPENTER T. 2000

Sediment Fence (Mechanical Method)

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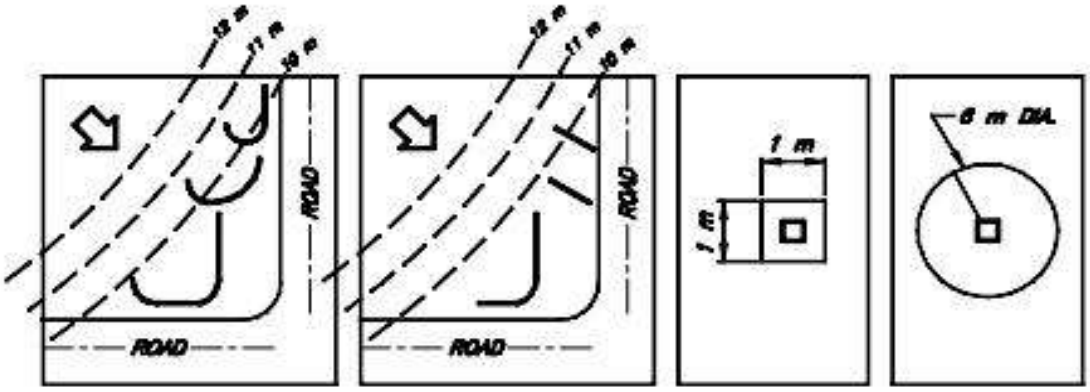
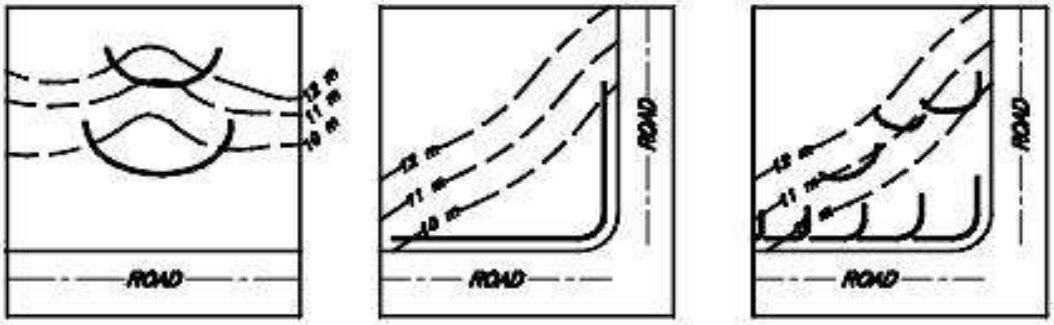


"J" CONFIGURATION

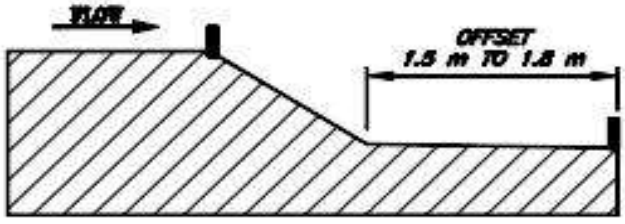
SILT FENCE BARRIER AT STORM INLET



"SMILE" CONFIGURATION

AVOID LONG INSTALLATION

COMBINATION OF "SMILE" AND "J" CONFIGURATIONS



LOCATION AT TOP AND BOTTOM OF SLOPE

NOT TO SCALE

NOTE:

1. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

SOURCE: CARPENTER T. 2000

Sediment Fence (Configuration Plan)

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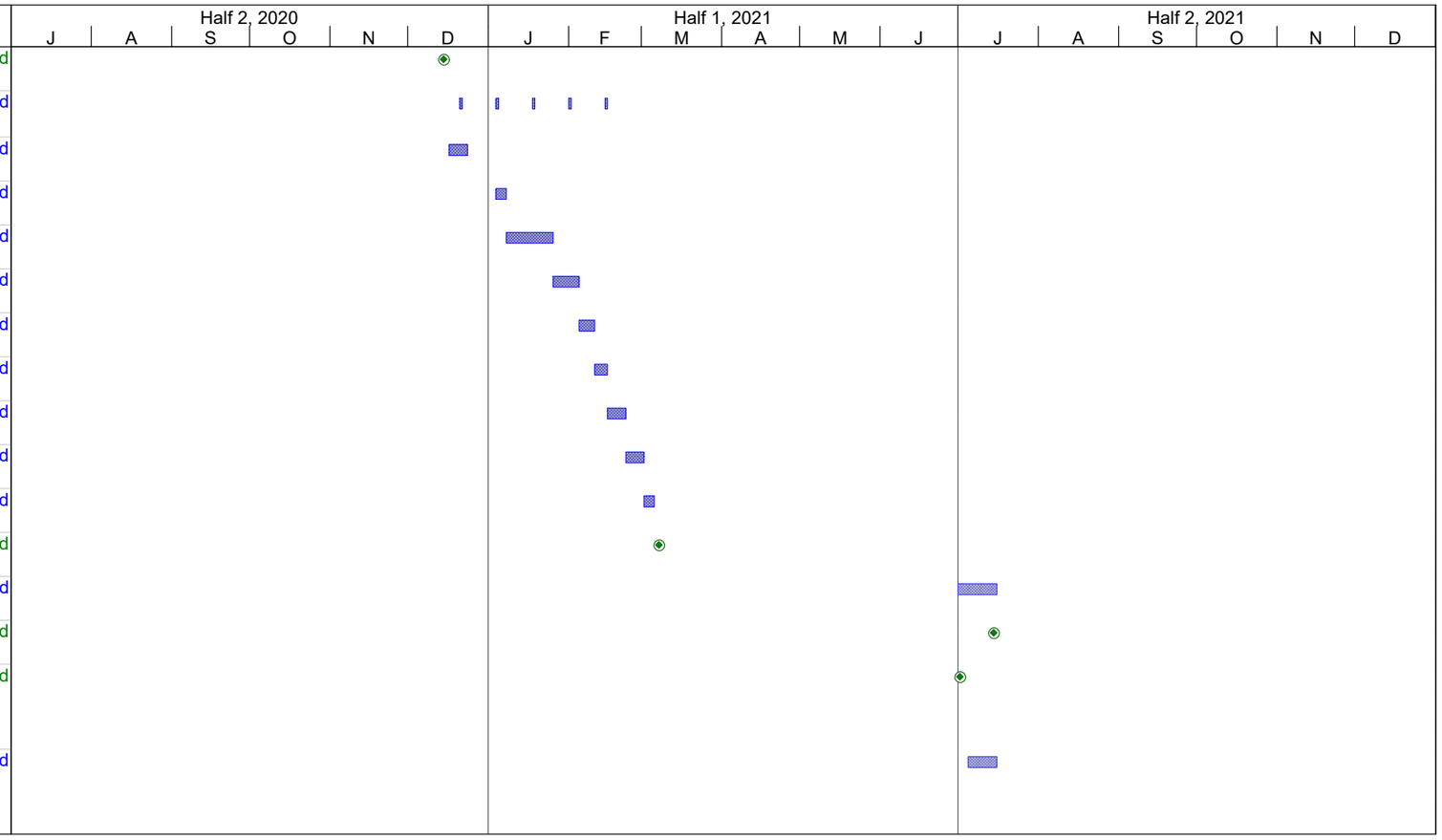
Appendix B

Project Schedule

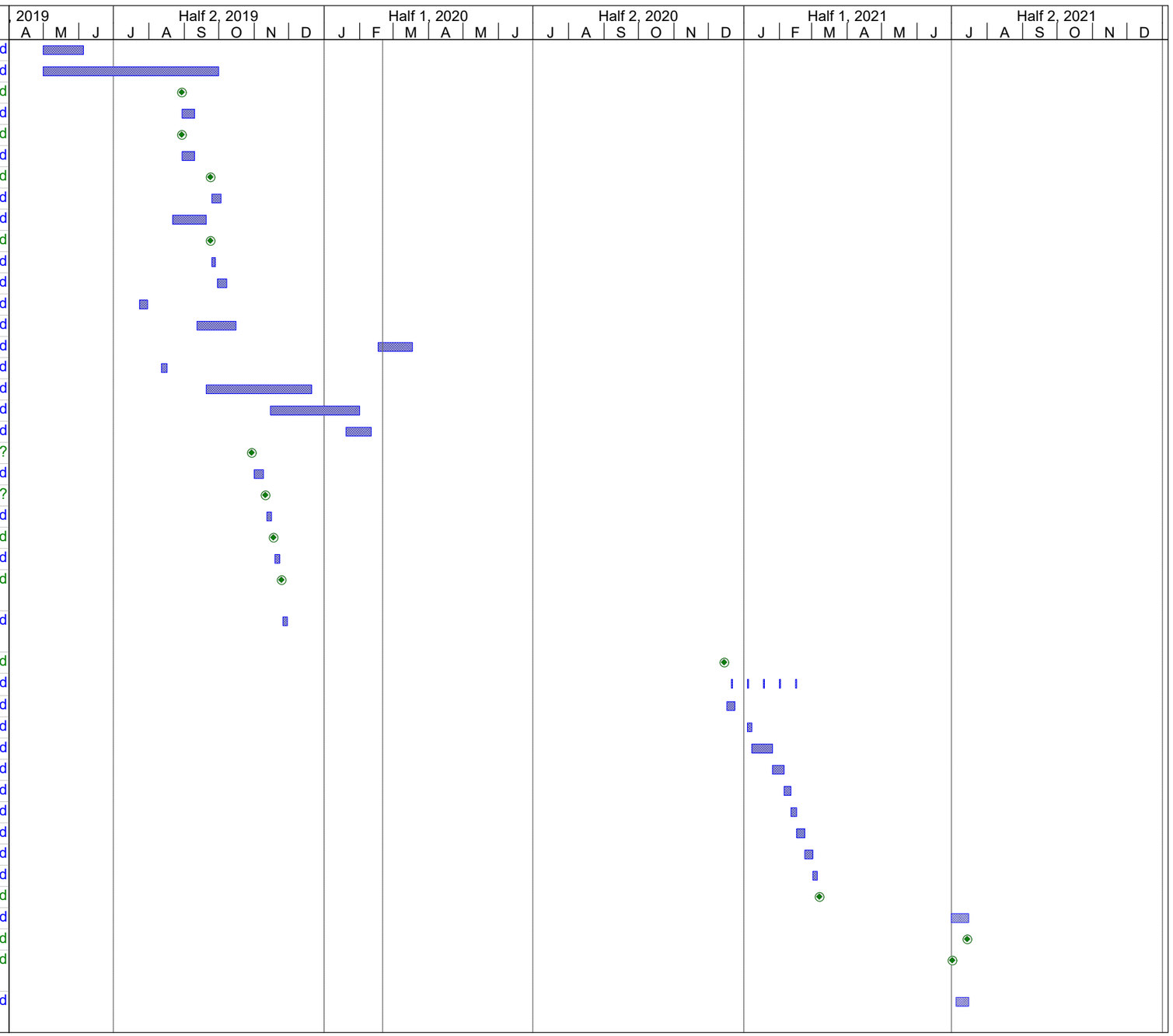
Schedule - Gunghi Creek Structure (2020-2021)

ID	Task Name	Start	Finish	Duration
1	Mobilize	Tue 12/15/20	Tue 12/15/20	1 d
2	Bi-weekly Construction Meetings	Mon 12/21/20	Thu 3/4/21	54 d
8	Detour Construction	Thu 12/17/20	Wed 12/23/20	5 d
9	Embankment Excavation	Mon 1/4/21	Thu 1/7/21	4 d
10	Piling	Fri 1/8/21	Mon 1/25/21	12 d
11	Adfreeze	Tue 1/26/21	Thu 2/4/21	8 d
12	Pile Cap	Fri 2/5/21	Wed 2/10/21	4 d
13	Assembly Arch and Grouting	Thu 2/11/21	Mon 2/15/21	3 d
14	Backfill	Tue 2/16/21	Mon 2/22/21	5 d
15	Trim and Roadway Tie-ins	Tue 2/23/21	Mon 3/1/21	5 d
16	Remove Detour	Tue 3/2/21	Fri 3/5/21	4 d
17	Final Inspection with GNWT and Dillon & Open to Traffic	Mon 3/8/21	Mon 3/8/21	1 d
18	Seasonal Deficiencies	Thu 7/1/21	Thu 7/15/21	11 d
19	Final Cleanup	Thu 7/15/21	Thu 7/15/21	1 d
20	Final Construction Report and As-built Drawings Submission	Fri 7/2/21	Fri 7/2/21	1 d
21	Final Construction Report and As-Built Drawings - Department Review	Mon 7/5/21	Thu 7/15/21	9 d



Schedule - Gunghi Creek Structure (2019-2021)

ID	Task Name	Start	Finish	Duration
1	Information Review	Wed 5/1/19	Tue 6/4/19	25 d
2	Detailed Design	Wed 5/1/19	Mon 9/30/19	110 d
3	90% Design Submission (IFR & Design Calc)	Fri 8/30/19	Fri 8/30/19	1 d
4	90% IFR - Department Review	Fri 8/30/19	Mon 9/9/19	7 d
5	Hydrotechnical Design Report Submission	Fri 8/30/19	Fri 8/30/19	1 d
6	Hydrotechnical Report - Department Review	Fri 8/30/19	Mon 9/9/19	7 d
7	IFC Drawing Submission	Tue 9/24/19	Tue 9/24/19	1 d
8	IFC Drawings - Department Review	Wed 9/25/19	Wed 10/2/19	6 d
9	Cast BEBO Arch Segments	Thu 8/22/19	Thu 9/19/19	22 d
10	Pile Cap Shop Drawings Submission	Tue 9/24/19	Tue 9/24/19	1 d
11	Pile Cap Shop Drawings - Department Review	Wed 9/25/19	Fri 9/27/19	3 d
12	Cast Pile Cap Beams	Mon 9/30/19	Mon 10/7/19	6 d
13	Site Survey & Detour Tour	Wed 7/24/19	Tue 7/30/19	5 d
14	Transport Arch Segments to Inuvik	Thu 9/12/19	Tue 10/15/19	25 d
15	Transport Arch Segments to Site	Mon 2/17/20	Tue 3/17/20	25 d
16	Prepare Aggregates	Mon 8/12/19	Fri 8/16/19	5 d
17	Pipe Piles Procurement	Fri 9/20/19	Fri 12/20/19	66 d
18	Aquire Snow and Prepare Detour	Fri 11/15/19	Fri 1/31/20	56 d
19	Transport Pile Cap Beam & Piling Pipe to Site	Mon 1/20/20	Mon 2/10/20	17 d
20	Technical Project Specifications Submission	Wed 10/30/19	Wed 10/30/19	1 d?
21	Technical Project Specifications - Department Review	Fri 11/1/19	Fri 11/8/19	6 d
22	Project QC Methodology Submission	Mon 11/11/19	Mon 11/11/19	1 d?
23	Project QC Methodology - Department Review	Tue 11/12/19	Fri 11/15/19	4 d
24	Project Safety Plan Submission	Mon 11/18/19	Mon 11/18/19	1 d
25	Project Safety Plan - Department Review	Tue 11/19/19	Fri 11/22/19	4 d
26	Environmental & Water Management Procedures during Construction Submission	Mon 11/25/19	Mon 11/25/19	1 d
27	Environmental & Water Management Procedures during Construction - Department Review	Tue 11/26/19	Fri 11/29/19	4 d
28	Mobilize	Tue 12/15/20	Tue 12/15/20	1 d
29	Bi-weekly Construction Meetings	Mon 12/21/20	Thu 3/4/21	54 d
35	Detour Construction	Thu 12/17/20	Wed 12/23/20	5 d
36	Embankment Excavation	Mon 1/4/21	Thu 1/7/21	4 d
37	Piling	Fri 1/8/21	Mon 1/25/21	12 d
38	Adfreeze	Tue 1/26/21	Thu 2/4/21	8 d
39	Pile Cap	Fri 2/5/21	Wed 2/10/21	4 d
40	Assembly Arch and Grouting	Thu 2/11/21	Mon 2/15/21	3 d
41	Backfill	Tue 2/16/21	Mon 2/22/21	5 d
42	Trim and Roadway Tie-ins	Tue 2/23/21	Mon 3/1/21	5 d
43	Remove Detour	Tue 3/2/21	Fri 3/5/21	4 d
44	Final Inspection with GNWT and Dillon & Open to Traffic	Mon 3/8/21	Mon 3/8/21	1 d
45	Seasonal Deficiencies	Thu 7/1/21	Thu 7/15/21	11 d
46	Final Cleanup	Thu 7/15/21	Thu 7/15/21	1 d
47	Final Construction Report and As-built Drawings Submission	Fri 7/2/21	Fri 7/2/21	1 d
48	Final Construction Report and As-Built Drawings - Department Review	Mon 7/5/21	Thu 7/15/21	9 d



Appendix C

Material Safety Data Sheets (MSDS)

Material Safety Data Sheet

DIESEL FUEL

1 . Product and company identification

Product name : DIESEL FUEL

Synonym : Seasonal Diesel, #1 Diesel, #2 Heating Oil, #1 Heating Oil, D50, D60, P40, P50, Arctic Diesel, Farm Diesel, Marine Diesel, Low Sulphur Diesel, LSD, Ultra Low Sulphur Diesel, ULSD, Mining Diesel, Naval Distillate, Dyed Diesel, Marked Diesel, Coloured Diesel, Furnace special, Biodiesel blend, B1, B2, B5, Diesel Low Cloud (LC).

Code : W104, W293; SAP: 120, 121, 122, 125, 126, 129, 130, 135, 287, 288

Material uses : Diesel fuels are distillate fuels suitable for use in high and medium speed internal combustion engines of the compression ignition type. Mining Diesel has a higher flash point requirement, for safe use in underground mines.

Manufacturer : PETRO-CANADA
P.O. Box 2844
150 – 6th Avenue South-West
Calgary, Alberta
T2P 3E3

In case of emergency : Petro-Canada: 403-296-3000
Canutec Transportation: 613-996-6666
Poison Control Centre: Consult local telephone directory for emergency number(s).

2 . Hazards identification

Physical state : Bright oily liquid.

Odour : Mild petroleum oil like.

WHMIS (Canada) :

Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

COMBUSTIBLE LIQUID AND VAPOUR. CAUSES EYE AND SKIN IRRITATION.

Combustible liquid. Severely irritating to the skin. Irritating to eyes. Keep away from heat, sparks and flame. Do not get in eyes. Avoid breathing vapour or mist. Avoid contact with skin and clothing. Use only with adequate ventilation. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : Inhalation of this product may cause respiratory tract irritation and Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death.

Ingestion : Ingestion of this product may cause gastro-intestinal irritation. Aspiration of this product may result in severe irritation or burns to the respiratory tract.

Skin : Severely irritating to the skin.

Eyes : Irritating to eyes.

Potential chronic health effects

Chronic effects : No known significant effects or critical hazards.

Carcinogenicity : Diesel engine exhaust particulate is probably carcinogenic to humans (IARC Group 2A).

Mutagenicity : No known significant effects or critical hazards.

Teratogenicity : No known significant effects or critical hazards.

2 . Hazards identification

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Medical conditions aggravated by over-exposure : Avoid prolonged or repeated skin contact to diesel fuels which can lead to dermal irritation and may be associated with an increased risk of skin cancer.

See toxicological information (section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Kerosine (petroleum), hydrodesulfurized / Fuels, diesel / Fuel Oil No. 2	64742-81-0 / 68334-30-5 / 68476-30-2	95 - 100
Fatty acids methyl esters	61788-61-2 / 67784-80-9 / 73891-99-3	0 - 5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4 . First-aid measures

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognised skin cleanser. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5 . Fire-fighting measures

Flammability of the product : Combustible liquid

Extinguishing media

Suitable : Use dry chemical, CO_2, water spray (fog) or foam.

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Products of combustion : Carbon oxides (CO, CO2), nitrogen oxides (NOx), sulphur oxides (SOx), sulphur compounds (H2S), smoke and irritating vapours as products of incomplete combustion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

5 . Fire-fighting measures

Special remarks on fire hazards : Flammable in presence of open flames, sparks and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. This product can accumulate static charge and ignite.

Special remarks on explosion hazards : Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Runoff to sewer may create fire or explosion hazard.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see section 8).

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not ingest. Avoid contact with eyes, skin and clothing. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container.

Storage : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. Ensure the storage containers are grounded/bonded.

8 . Exposure controls/personal protection

Ingredient	Exposure limits
Kerosine (petroleum), hydrodesulfurized	**ACGIH TLV (United States). Absorbed through skin.** TWA: 200 mg/m³ 8 hour(s).
Fuels, diesel	**ACGIH TLV (United States). Absorbed through skin.** TWA: 100 mg/m³, (Inhalable fraction and vapour) 8 hour(s).
Fuel oil No. 2	**ACGIH TLV (United States). Absorbed through skin.** TWA: 100 mg/m³, (Inhalable fraction and vapour) 8 hour(s).

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Recommended: nitrile, neoprene, polyvinyl alcohol (PVA), Viton. Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9 . Physical and chemical properties

Physical state : Bright oily liquid.

Flash point : Diesel fuel: Closed cup: ≥40°C (≥104°F)
Marine Diesel Fuel: Closed Cup: ≥60°C (≥140°F)
Mining Diesel: Closed Cup: ≥52°C (≥126°F)

Auto-ignition temperature : 225°C (437°F)

Flammable limits : Lower: 0.7%
Upper: 6%

Colour : Clear to yellow (This product may be dyed red for taxation purposes).

Odour : Mild petroleum oil like.

Odour threshold : Not available.

pH : Not available.

Boiling/condensation point : 150 to 371°C (302 to 699.8°F)

Melting/freezing point : Not available.

Relative density : 0.80 to 0.88 kg/L @ 15°C (59°F)

Vapour pressure : 1 kPa (7.5 mm Hg) @ 20°C (68ºF).

Vapour density : 4.5 [Air = 1]

Volatility : Semivolatile to volatile.

Evaporation rate : Not available.

Viscosity : Diesel fuel: 1.3 - 4.1 cSt @ 40°C (104°F)
Marine Diesel Fuel: 1.3 - 4.4 cSt @ 40°C (104°F)

Pour point : Not available.

Solubility : Insoluble in cold water, soluble in non-polar hydrocarbon solvents.

10 . Stability and reactivity

Chemical stability : The product is stable.

Hazardous polymerisation : Under normal conditions of storage and use, hazardous polymerisation will not occur.

Materials to avoid : Reactive with oxidising agents and acids.

Hazardous decomposition products : May release COx, NOx, SOx, H2S, smoke and irritating vapours when heated to decomposition.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Kerosine (petroleum), hydrodesulfurized	LD50 Dermal	Rabbit	>2000 mg/kg	-
	LD50 Oral	Rat	>5000 mg/kg	-
	LC50 Inhalation Vapour	Rat	>5000 mg/m³	4 hours
Fuels, diesel	LD50 Dermal	Mouse	24500 mg/kg	-
	LD50 Oral	Rat	7500 mg/kg	-
Fuel oil No. 2	LD50 Oral	Rat	12000 mg/kg	-

Conclusion/Summary : Not available.

Chronic toxicity

Conclusion/Summary : Not available.

Irritation/Corrosion

Conclusion/Summary : Not available.

Sensitiser

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Diesel engine exhaust particulate is probably carcinogenic to humans (IARC Group 2A).

11 . Toxicological information

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Kerosine (petroleum), hydrodesulfurized	A3	-	-	-	-	-
Fuels, diesel	A3	3	-	-	-	-
Fuel oil No. 2	A3	3	-	-	-	-

Mutagenicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : Not available.

Reproductive toxicity

Conclusion/Summary : Not available.

12 . Ecological information

Environmental effects : No known significant effects or critical hazards.

Aquatic ecotoxicity

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimised wherever possible. Empty containers or liners may retain some product residues. This material and its container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
TDG Classification	UN1202	DIESEL FUEL	3	III		-
DOT Classification	Not available.	Not available.	Not available.	-		-

PG* : Packing group

15 . Regulatory information

United States

HCS Classification : Combustible liquid
Irritating material

Canada

WHMIS (Canada) : Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

15 . Regulatory information

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International regulations

Canada inventory : All components are listed or exempted.

United States inventory (TSCA 8b) : All components are listed or exempted.

Europe inventory : All components are listed or exempted.

16 . Other information

Label requirements : COMBUSTIBLE LIQUID AND VAPOUR. CAUSES EYE AND SKIN IRRITATION.

Hazardous Material Information System (U.S.A.) :

Health	2
Flammability	2
Physical hazards	0
Personal protection	H

National Fire Protection Association (U.S.A.) :

References : Available upon request.
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Date of printing : **7/6/2010.**

Date of issue : 6 July 2010

Date of previous issue : 7/3/2009.

Responsible name : **Product Safety - JDW**

Indicates information that has changed from previously issued version.

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds

Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228

For Product Safety Information: (905) 804-4752

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

GASOLINE - ETHANOL

1 . Product and company identification

Product name : GASOLINE - ETHANOL

Synonym : SuperClean, SuperClean 94 (Montreal), GASOHOL, Regular, Mid-Grade, Plus, WinterGas, RegularClean, PlusClean, marked or dyed gasoline, Super Premium (94 RO), E-10, Ultra 94, Ethanol blended gasoline

Code : GASOHOL

Material uses : Gasoline-Ethanol is used in spark ignition engines including motor vehicles, farm vehicles, inboard and outboard boat engines, small engines and recreational vehicles.

Manufacturer : PETRO-CANADA
P.O. Box 2844
150 – 6th Avenue South-West
Calgary, Alberta
T2P 3E3

In case of emergency : Petro-Canada: 403-296-3000
Canutec Transportation: 613-996-6666
Poison Control Centre: Consult local telephone directory for emergency number(s).

2 . Hazards identification

Physical state : Clear liquid.

Odour : Gasoline

WHMIS (Canada) :

Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

OSHA/HCS status : This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Emergency overview : WARNING!

FLAMMABLE LIQUID AND VAPOUR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER. CONTAINS MATERIAL WHICH MAY CAUSE HERITABLE GENETIC EFFECTS.

Flammable liquid. Irritating to eyes, respiratory system and skin. Keep away from heat, sparks and flame. Avoid exposure - obtain special instructions before use. Do not breathe vapour or mist. Avoid contact with eyes, skin and clothing. Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure. Contains material which may cause heritable genetic effects. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use. Wash thoroughly after handling.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Inhalation : Inhalation of this product may cause respiratory tract irritation and Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death.

Ingestion : Ingestion of this product may cause gastro-intestinal irritation. Aspiration of this product may result in severe irritation or burns to the respiratory tract. Ingestion of this product may cause Central Nervous System (CNS) Depression, symptoms of which may include; weakness, dizziness, slurred speech, drowsiness, unconsciousness and in cases of severe overexposure; coma and death.

Skin : Irritating to skin.

Eyes : Irritating to eyes.

2 . Hazards identification

Potential chronic health effects

Chronic effects : This product contains an ingredient or ingredients, which have been shown to cause chronic toxic effects. Repeated or prolonged exposure to the substance can produce blood disorders.

Carcinogenicity : Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure.

Mutagenicity : Contains material which may cause heritable genetic effects.

Teratogenicity : No known significant effects or critical hazards.

Developmental effects : No known significant effects or critical hazards.

Fertility effects : No known significant effects or critical hazards.

Medical conditions aggravated by over-exposure : Repeated or prolonged contact with spray or mist may produce chronic eye irritation and severe skin irritation. Repeated skin exposure can produce local skin destruction or dermatitis.

See toxicological information (Section 11)

3 . Composition/information on ingredients

Name	CAS number	%
Gasoline	86290-81-5	90 - 97
Toluene	108-88-3	10 - 20
Ethanol	64-17-5	5 - 10
Benzene	71-43-2	0.5 - 1.5

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

4 . First-aid measures

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical attention immediately.

Skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash skin thoroughly with soap and water or use recognised skin cleanser. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : Wash out mouth with water. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

Notes to physician : No specific treatment. Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.

5 . Fire-fighting measures

Flammability of the product : Flammable.

Extinguishing media

Suitable : Use dry chemical, CO_2, alcohol-resistant foam or water spray (fog).

Not suitable : Do not use water jet.

Special exposure hazards : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.

Products of combustion : Carbon oxides (CO, CO2), nitrogen oxides (NOx), lead, aldehydes, ketones, phenols, polynuclear aromatic hydrocarbons, smoke and irritating vapours as products of incomplete combustion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on fire hazards : Extremely flammable in presence of open flames, sparks, and heat. This product can accumulate static charge and ignite. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back.

Special remarks on explosion hazards : Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Containers may explode in heat of fire. Runoff to sewer may create fire or explosion hazard.

6 . Accidental release measures

Personal precautions : No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilt material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapour or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment (see Section 8).

Environmental precautions : Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods for cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Dilute with water and mop up if water-soluble. Alternatively, or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor.

Large spill : Stop leak if without risk. Move containers from spill area. Approach the release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see section 13). Use spark-proof tools and explosion-proof equipment. Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilt product. Note: see section 1 for emergency contact information and section 13 for waste disposal.

7 . Handling and storage

Handling : Put on appropriate personal protective equipment (see Section 8). Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Do not get in eyes or on skin or clothing. Do not ingest. Avoid breathing vapour or mist. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use non-sparking tools. Take

7 . Handling and storage

precautionary measures against electrostatic discharges. To avoid fire or explosion, dissipate static electricity during transfer by earthing and bonding containers and equipment before transferring material. Empty containers retain product residue and can be hazardous. Do not reuse container. Ground all equipment containing material.

Storage : Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see section 10) and food and drink. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination. Ensure the storage containers are grounded/bonded.

8 . Exposure controls/personal protection

Ingredient	Exposure limits
Gasoline	**ACGIH TLV (United States).** TWA: 300 ppm 8 hour(s). STEL: 500 ppm 15 minute(s).
Toluene	**ACGIH TLV (United States).** TWA: 20 ppm 8 hour(s).
Ethanol	**ACGIH TLV (United States).** STEL: 1000 ppm 15 minute(s).
Benzene	**ACGIH TLV (United States). Absorbed through skin.** TWA: 0.5 ppm 8 hour(s). STEL: 2.5 ppm 15 minute(s).

Consult local authorities for acceptable exposure limits.

Recommended monitoring procedures : If this product contains ingredients with exposure limits, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiratory protective equipment.

Engineering measures : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapour or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. Recommended: A NIOSH-approved air-purifying respirator with an organic vapour cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air-purifying respirators is limited. Use a positive-pressure, air-supplied respirator if there is any potential for uncontrolled release, exposure levels are unknown, or any other circumstances where air-purifying respirators may not provide adequate protection.

8 . Exposure controls/personal protection

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Recommended: polyvinyl alcohol (PVA), Viton®. Consult your PPE provider for breakthrough times and the specific glove that is best for you based on your use patterns. It should be realized that eventually any material regardless of their imperviousness, will get permeated by chemicals. Therefore, protective gloves should be regularly checked for wear and tear. At the first signs of hardening and cracks, they should be changed.

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

9 . Physical and chemical properties

Physical state : Clear liquid.

Flash point : -43°C (-45.4°F) (NFPA)

Auto-ignition temperature : Not available.

Flammable limits : Lower: 1.4% (NFPA)
Upper: 7.6% (NFPA)

Colour : Clear to slightly yellow, undyed liquid. May be dyed for taxation purposes.

Odour : Gasoline

Odour threshold : Not available.

pH : Not available.

Boiling/condensation point : 26 to 200°C (78.8 to 392°F)

Melting/freezing point : Not available.

Relative density : 0.7 to 0.78 kg/L @ 15°C (59°F)

Vapour pressure : 41 to 107 kPa (307 to 802 mm Hg) @ 15°C (59°F)

Vapour density : 3 to 4 [Air = 1] (NFPA)

Volatility : Not available.

Evaporation rate : Not available.

Viscosity : 0.6 cSt @ 40ºC (104ºF)

Pour point : Not available.

Solubility : Hydrocarbon components virtually insoluble in water. Ethyl alcohol is completely soluble in water.

10 . Stability and reactivity

Chemical stability : The product is stable.

Hazardous polymerisation : Under normal conditions of storage and use, hazardous polymerisation will not occur.

Materials to avoid : Reactive with oxidising agents, acids and interhalogens.

Hazardous decomposition products : May release COx, NOx, aldehydes, ketones, phenols, polynuclear aromatic hydrocarbons, smoke and irritating vapours when heated to decomposition.

11 . Toxicological information

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Gasoline	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	13600 mg/kg	-
Toluene	LD50 Dermal	Rabbit	12125 mg/kg	-
	LD50 Oral	Rat	636 mg/kg	-
	LC50 Inhalation Vapour	Rat	7585 ppm	4 hours
Ethanol	LC50 Inhalation Vapour	Rat	>32380 ppm	4 hours
Benzene	LD50 Dermal	Rabbit	>8240 mg/kg	-
	LD50 Oral	Rat	930 mg/kg	-
	LC50 Inhalation Vapour	Rat	13700 mg/kg	4 hours

Conclusion/Summary : Not available.

Chronic toxicity

Conclusion/Summary : Not available.

Irritation/Corrosion

Conclusion/Summary : Not available.

Sensitiser

Conclusion/Summary : Not available.

Carcinogenicity

Conclusion/Summary : Not available.

Classification

Product/ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Gasoline	A3	2B	-	-	-	-
Toluene	A4	3	D	-	-	-
Ethanol	A3	-	-	-	-	-
Benzene	A1	1	A	+	Proven.	+

Mutagenicity

Conclusion/Summary : Not available.

Teratogenicity

Conclusion/Summary : There is a wealth of information about the teratogenic hazards of Toluene in the literature; however, based upon professional judgement regarding the body of evidence, WHMIS classification as a teratogen is not warranted.

Reproductive toxicity

Conclusion/Summary : Not available.

12 . Ecological information

Environmental effects : No known significant effects or critical hazards.

Aquatic ecotoxicity

Conclusion/Summary : Not available.

Biodegradability

Conclusion/Summary : Not available.

13 . Disposal considerations

Waste disposal : The generation of waste should be avoided or minimised wherever possible. Significant quantities of waste product residues should not be disposed of via the foul sewer but processed in a suitable effluent treatment plant. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilt material and runoff and contact with soil, waterways, drains and sewers.

Disposal should be in accordance with applicable regional, national and local laws and regulations.

Refer to Section 7: HANDLING AND STORAGE and Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION for additional handling information and protection of employees.

14 . Transport information

Regulatory information	UN number	Proper shipping name	Classes	PG*	Label	Additional information
TDG Classification	UN1203	GASOLINE	3	II		-
DOT Classification	Not available.	Not available.	Not available.	-		-

PG* : Packing group

15 . Regulatory information

United States

HCS Classification : Flammable liquid
Irritating material
Carcinogen

Canada

WHMIS (Canada) : Class B-2: Flammable liquid
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations.

International regulations

Canada inventory : All components are listed or exempted.

United States inventory (TSCA 8b) : All components are listed or exempted.

Europe inventory : All components are listed or exempted.

16 . Other information

Label requirements : FLAMMABLE LIQUID AND VAPOUR. CAUSES RESPIRATORY TRACT, EYE AND SKIN IRRITATION. CANCER HAZARD - CONTAINS MATERIAL WHICH CAN CAUSE CANCER. CONTAINS MATERIAL WHICH MAY CAUSE HERITABLE GENETIC EFFECTS.

Hazardous Material Information System (U.S.A.) :

Health	3
Flammability	3
Physical hazards	0
Personal protection	H

National Fire Protection Association (U.S.A.) :

References : Available upon request.
™ Trademark of Suncor Energy Inc. Used under licence.

Date of printing : **10/24/2012.**

Date of issue : 24 October 2012

Date of previous issue : 4/22/2010.

Responsible name : **Product Safety - DSR**

Indicates information that has changed from previously issued version.

For Copy of (M)SDS : Internet: www.petro-canada.ca/msds

Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228

For Product Safety Information: (905) 804-4752

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

SECTION 1. IDENTIFICATION

Product name	:	PROPANE
Synonyms	:	Propane HD-5, Propane commercial, Liquified Petroleum Gas (LPG), C3H8, CGSB Propane Grade 1, CGSB Propane Grade 2, odorized propane, stenched propane, automotive propane.
Product code	:	100139
Manufacturer or supplier's details		Petro-Canada P.O. Box 2844, 150 - 6th Avenue South-West Calgary Alberta T2P 3E3 Canada
Emergency telephone number		Suncor Energy: +1 403-296-3000; Canutec Transportation: 1-888-226-8832 (toll-free) or 613-996-6666; Poison Control Centre: Consult local telephone directory for emergency number(s).

Recommended use of the chemical and restrictions on use

Recommended use	:	Propane is used as a fuel gas, refrigerant and as a raw material for organic synthesis. It is also used as a laboratory gas. The grade determines the propane content. It is supplied as pressurized liquid in tanks.
Prepared by	:	Product Safety: +1 905-804-4752

SECTION 2. HAZARDS IDENTIFICATION

Emergency Overview

Appearance	Gas at room temperature; liquid when stored under pressure., Liquefied compressed gas.
Colour	colourless
Odour	Propane is an odourless gas. Odourized propane will contain up to 30 g Ethyl Mercaptan per 1000 L of propane.

GHS Classification

Flammable gases	:	Category 1
Gases under pressure	:	Liquefied gas
Simple Asphyxiant	:	Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements : **Prevention:**
Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
Response:
Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
In case of leakage, eliminate all ignition sources.
Storage:
Protect from sunlight. Store in a well-ventilated place.

Potential Health Effects

Primary Routes of Entry : Eye contact
Inhalation
Skin contact

Inhalation : Inhalation may cause central nervous system effects.
May cause respiratory tract irritation.
Inhalation of vapours may cause drowsiness, headache, dizziness and disorientation.

Skin : Contact with rapidly expanding gas may cause burns or frostbite.

Eyes : Contact with rapidly expanding gas may cause burns or frostbite.

Ingestion : Exposure by this route unlikely.

Aggravated Medical Condition : Overexposure may lead to cardiac sensitization.

Other hazards

None known.

IARC No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance / Mixture : Mixture

Hazardous components

Chemical name	CAS-No.	Concentration
propane	74-98-6	90 - 100 %
propylene	115-07-1	1 - 5 %
butane	106-97-8	1 - 2.5 %
ethane	74-84-0	1 - 1.5 %
methane	74-82-8	0.1 - 0.2 %

SECTION 4. FIRST AID MEASURES

If inhaled : Move to fresh air.
Artificial respiration and/or oxygen may be necessary.
Seek medical advice.

In case of skin contact : In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash skin thoroughly with soap and water or use recognized skin cleanser.
Wash contaminated clothing before reuse.
Seek medical advice.

In case of eye contact : Remove contact lenses.
Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.
Obtain medical attention.

If swallowed : Not a significant route of exposure.

Most important symptoms and effects, both acute and delayed : First aider needs to protect himself.

SECTION 5. FIREFIGHTING MEASURES

Suitable extinguishing media : Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media : No information available.

Specific hazards during fire-fighting : If the product release cannot be shut off safely, allow the product to burn itself out.
Cool closed containers exposed to fire with water spray.

Hazardous combustion products	:	Carbon oxides (CO, CO2), smoke and irritating vapours as products of incomplete combustion.
Further information	:	Prevent fire extinguishing water from contaminating surface water or the ground water system.
Special protective equipment for firefighters	:	Wear self-contained breathing apparatus and full protective wear. Wear a positive-pressure supplied-air respirator with full face-piece.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. In case of inadequate ventilation wear respiratory protection. Remove all sources of ignition.
Environmental precautions	:	If the product contaminates rivers and lakes or drains inform respective authorities.
Methods and materials for containment and cleaning up	:	Prevent further leakage or spillage if safe to do so. Ensure adequate ventilation. Use explosion-proof ventilation equipment. Non-sparking tools should be used. Contact the proper local authorities.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling	:	For personal protection see section 8. Smoking, eating and drinking should be prohibited in the application area. In case of insufficient ventilation, wear suitable respiratory equipment. Avoid contact with skin, eyes and clothing. Avoid breathing gas. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity. Use only with adequate ventilation. Keep away from heat and sources of ignition. Keep container closed when not in use. Do not use sparking tools. Do not enter areas where used or stored until adequately ventilated.
Conditions for safe storage	:	Store in original container. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Keep in a dry, cool and well-ventilated place. Keep in properly labelled containers. To maintain product quality, do not store in heat or direct sunlight.

Keep away from sources of ignition - No smoking.
Ensure the storage containers are grounded/bonded.

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value type (Form of exposure)	Control parameters / Permissible concentration	Basis
propane	74-98-6	TWA	1,000 ppm	CA AB OEL
		TWA	1,000 ppm	CA BC OEL
		TWAEV	1,000 ppm 1,800 mg/m3	CA QC OEL
propylene	115-07-1	TWA	500 ppm 860 mg/m3	CA AB OEL
		TWA	500 ppm	CA BC OEL
		TWA	500 ppm	ACGIH
butane	106-97-8	TWA	1,000 ppm	CA AB OEL
		TWA	600 ppm	CA BC OEL
		STEL	750 ppm	CA BC OEL
		TWAEV	800 ppm 1,900 mg/m3	CA QC OEL
ethane	74-84-0	TWA	1,000 ppm	CA AB OEL
		TWA	1,000 ppm	CA BC OEL

Engineering measures : Use only in well-ventilated areas.
Use explosion-proof ventilation equipment.
Adequate ventilation to ensure that Occupational Exposure Limits are not exceeded.

Personal protective equipment

Respiratory protection : Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Filter type : Always wear NIOSH-approved self-contained breathing apparatus when handling this material.

Hand protection
Material : Wear insulated gloves to prevent frostbite.

Remarks : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Eye protection : Wear face-shield and protective suit for abnormal processing problems.

Skin and body protection : Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the spe-

cific work-place.

Protective measures	:	Wash contaminated clothing before re-use. Wear suitable protective equipment.
Hygiene measures	:	Remove and wash contaminated clothing and gloves, including the inside, before re-use. Wash face, hands and any exposed skin thoroughly after handling.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Gas at room temperature; liquid when stored under pressure., Liquefied compressed gas.
Colour	:	colourless
Odour	:	Propane is an odourless gas. Odourized propane will contain up to 30 g Ethyl Mercaptan per 1000 L of propane.
Odour Threshold	:	No data available
pH	:	No data available
Pour point	:	No data available
Boiling point/boiling range	:	-42 °C (-44 °F)
Flash point	:	-104 °C (-155 °F) Method: closed cup
Fire Point	:	No data available
Auto-Ignition Temperature	:	450 °C (842 °F)
Evaporation rate	:	No data available
Flammability	:	Extremely flammable in presence of open flames, sparks, and heat. Vapours are heavier than air and may travel considerable distance to sources of ignition and flash back. Rapid escape of vapour may generate static charge causing ignition. May accumulate in confined spaces.
Upper explosion limit	:	9.5 %(V)
Lower explosion limit	:	2.1 %(V)
Vapour pressure	:	10,763 mmHg (38 °C / 100 °F)
Relative vapour density	:	1.56
Relative density	:	No data available
Density	:	No data available

Solubility(ies)		
Water solubility	:	No data available
Partition coefficient: n-octanol/water	:	No data available
Viscosity		
Viscosity, kinematic	:	No data available
Explosive properties	:	Do not pressurise, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Containers may explode in heat of fire. Vapour explosion hazard indoors, outdoors or in sewers. Propane may form explosive mixtures with air.

SECTION 10. STABILITY AND REACTIVITY

Possibility of hazardous reactions	:	Hazardous polymerisation does not occur. Stable under normal conditions.
Conditions to avoid	:	Heat, flames and sparks.
Incompatible materials	:	Reactive with oxidising agents and halogenated compounds.
Hazardous decomposition products	:	May release COx, smoke and irritating vapours when heated to decomposition.

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure
Eye contact
Inhalation
Skin contact

Acute toxicity

Product:

Acute oral toxicity	:	Remarks: No data available
Acute inhalation toxicity	:	Remarks: No data available
Acute dermal toxicity	:	Remarks: No data available

Components:

butane:

Acute inhalation toxicity	:	LC50 (Rat): 658 mg/l Exposure time: 4 h Test atmosphere: gas

Skin corrosion/irritation

Product:

Remarks: No data available

Serious eye damage/eye irritation

Product:

Remarks: No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

No data available

Reproductive toxicity

No data available

STOT - single exposure

No data available

STOT - repeated exposure

No data available

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Product:

Toxicity to fish	:	Remarks: No data available
Toxicity to daphnia and other aquatic invertebrates	:	Remarks: No data available
Toxicity to algae	:	Remarks: No data available
Toxicity to bacteria	:	Remarks: No data available

Persistence and degradability

Product:

Biodegradability	:	Remarks: No data available

Bioaccumulative potential

No data available

Mobility in soil

No data available

Other adverse effects

No data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods

Waste from residues	:	The product should not be allowed to enter drains, water courses or the soil. Offer surplus and non-recyclable solutions to a licensed disposal company. Waste must be classified and labelled prior to recycling or disposal. Send to a licensed waste management company. Dispose of as hazardous waste in compliance with local and national regulations. Dispose of product residue in accordance with the instructions of the person responsible for waste disposal.

SECTION 14. TRANSPORT INFORMATION

International Regulations

IATA-DGR

UN/ID No.	:	UN 1978
Proper shipping name	:	Propane
Class	:	2.1
Packing group	:	Not assigned by regulation
Labels	:	Class 2 - Gases: Flammable (Division 2.1)
Packing instruction (cargo aircraft)	:	200

IMDG-Code

UN number	:	UN 1978
Proper shipping name	:	PROPANE
Class	:	2.1
Packing group	:	Not assigned by regulation
Labels	:	2.1
EmS Code	:	F-D, S-U
Marine pollutant	:	no

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

National Regulations

TDG

UN number	:	UN 1978
Proper shipping name	:	PROPANE

Class	:	2.1
Packing group	:	Not assigned by regulation
Labels	:	2.1
ERG Code	:	115
Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

This product has been classified according to the hazard criteria of the Hazardous Products Regulations (HPR) and the SDS contains all of the information required by the HPR.

The components of this product are reported in the following inventories:

DSL	On the inventory, or in compliance with the inventory
TSCA	All chemical substances in this product are either listed on the TSCA Inventory or are in compliance with a TSCA Inventory exemption.
EINECS	On the inventory, or in compliance with the inventory

SECTION 16. OTHER INFORMATION

For Copy of SDS	:	Internet: www.petro-canada.ca/msds Canada-wide: telephone: 1-800-668-0220; fax: 1-800-837-1228 For Product Safety Information: 1 905-804-4752
Prepared by	:	Product Safety: +1 905-804-4752
Revision Date	:	2018/06/07

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

PRODUCT

Product Name: **MOBIL EAL 224H**
Product Description: Plant/Vegetable Oil
Product Code: 201560105010, 601831-00
Intended Use: Hydraulic fluid

COMPANY IDENTIFICATION

Supplier: **East Coast Lubes Pty Ltd (Queensland and Northern Territory)**
A.B.N. 37 117 203 611
Cnr North and Mort Streets
Toowoomba, Queensland 4350 Australia

24 Hour Emergency Telephone 1300 131 001
Supplier General Contact 1800 069 019

Supplier: **Southern Cross Lubes (Victoria and Tasmania, New South Wales and Australian Capital Territory)**
58-66 Ajax Road
Altona, Victoria 3018, Australia

24 Hour Emergency Telephone 1300 131 001
Product Technical Information
Supplier General Contact 1300 466 245
1300 552 861

Supplier: **Perkal Pty Ltd Trading as Statewide Oil (Western Australia)**
A.B.N. 43 009 283 363
14 Beete Street
Welshpool, Western Australia 6106 Australia

24 Hour Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information
Supplier General Contact (08) 9350 6777
(08) 9350 6777

Supplier: **Perkal Pty Ltd Trading as Statewide Oil (South Australia)**
A.B.N. 43 009 283 363
6-10 Streiff Rd
Wingfield, South Australia 5013 Australia

24 Hour Emergency Telephone (8:00am to 4:30pm Mon to Fri) 1300 919 904
Product Technical Information
Supplier General Contact (08) 8359 8995
(08) 8359 8995

SECTION 2 HAZARDS IDENTIFICATION

This material is not hazardous according to regulatory guidelines (see (M)SDS Section 15).

Other hazard information:

Physical / Chemical Hazards:
No significant hazards.

Health Hazards:
High-pressure injection under skin may cause serious damage. Mildly irritating to skin. May be irritating to the eyes, nose, throat, and lungs.

Environmental Hazards:
No significant hazards.

NOTE: This material should not be used for any other purpose than the intended use in Section 1 without expert advice. Health studies have shown that chemical exposure may cause potential human health risks which may vary from person to person.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

This material is defined as a mixture.

No Reportable Hazardous Substance(s) or Complex Substance(s).

Name	CAS#	Concentration*	GHS Hazard Codes
2,6-DI-TERT-BUTYLPHENOL	128-39-2	1 - < 2.5%	H315, H400(M factor 1), H410(M factor 1)

* All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume. Other ingredients determined not to be hazardous up to 100%.

SECTION 4 FIRST AID MEASURES

INHALATION
Remove from further exposure. For those providing assistance, avoid exposure to yourself or others. Use adequate respiratory protection. If respiratory irritation, dizziness, nausea, or unconsciousness occurs, seek immediate medical assistance. If breathing has stopped, assist ventilation with a mechanical device or use mouth-to-mouth resuscitation.

SKIN CONTACT
Wash contact areas with soap and water. Remove contaminated clothing. Launder contaminated clothing before reuse. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician as a surgical emergency. Even though initial symptoms from high pressure injection may be minimal or absent, early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

EYE CONTACT

Flush thoroughly with water. If irritation occurs, get medical assistance.

INGESTION

First aid is normally not required. Seek medical attention if discomfort occurs.

NOTE TO PHYSICIAN

None

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA

Appropriate Extinguishing Media: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

Inappropriate Extinguishing Media: Straight streams of water

FIRE FIGHTING

Fire Fighting Instructions: Evacuate area. Prevent run-off from fire control or dilution from entering streams, sewers or drinking water supply. Fire-fighters should use standard protective equipment and in enclosed spaces, self-contained breathing apparatus (SCBA). Use water spray to cool fire exposed surfaces and to protect personnel.

Unusual Fire Hazards: Pressurised mists may form a flammable mixture.

Hazardous Combustion Products: Aldehydes, Incomplete combustion products, Oxides of carbon, Smoke, Fume, Sulphur oxides

FLAMMABILITY PROPERTIES

Flash Point [Method]: >221°C (430°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D

SECTION 6 ACCIDENTAL RELEASE MEASURES

NOTIFICATION PROCEDURES

In the event of a spill or accidental release, notify relevant authorities in accordance with all applicable regulations.

PROTECTIVE MEASURES

Avoid contact with spilled material. Warn or evacuate occupants in surrounding and downwind areas if required, due to toxicity or flammability of the material. See Section 5 for fire fighting information. See the Hazard Identification Section for Significant Hazards. See Section 4 for First Aid Advice. See Section 8 for advice on the minimum requirements for personal protective equipment. Additional protective measures may be necessary, depending on the specific circumstances and/or the expert judgment of the emergency responders.

SPILL MANAGEMENT

Land Spill: Stop leak if you can do so without risk. Recover by pumping or with suitable absorbent.

Water Spill: Stop leak if you can do so without risk. Confine the spill immediately with booms. Warn other shipping. Remove from the surface by skimming or with suitable absorbents. Seek the advice of a specialist before using dispersants.

Water spill and land spill recommendations are based on the most likely spill scenario for this material; however, geographic conditions, wind, temperature, (and in the case of a water spill) wave and current direction and speed may greatly influence the appropriate action to be taken. For this reason, local experts should be consulted. Note: Local regulations may prescribe or limit action to be taken.

ENVIRONMENTAL PRECAUTIONS

Large Spills: Dyke far ahead of liquid spill for later recovery and disposal. Prevent entry into waterways, sewers, basements or confined areas.

SECTION 7 HANDLING AND STORAGE

HANDLING

Avoid contact with skin. Prevent small spills and leakage to avoid slip hazard. Material can accumulate static charges which may cause an electrical spark (ignition source). When the material is handled in bulk, an electrical spark could ignite any flammable vapors from liquids or residues that may be present (e.g., during switch-loading operations). Use proper bonding and/or earthing procedures. However, bonding and earthing may not eliminate the hazard from static accumulation. Consult local applicable standards for guidance. Additional references include American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practice on Static Electricity) or CENELEC CLC/TR 50404 (Electrostatics - Code of practice for the avoidance of hazards due to static electricity).

Static Accumulator: This material is a static accumulator.

STORAGE

The type of container used to store the material may affect static accumulation and dissipation. Do not store in open or unlabelled containers.

Material is defined under the National Standard [NOHSC:1015] Storage and Handling of Workplace Dangerous Goods.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Biological limits

No biological limits allocated.

ENGINEERING CONTROLS

The level of protection and types of controls necessary will vary depending upon potential exposure conditions.

Control measures to consider:
No special requirements under ordinary conditions of use and with adequate ventilation.

PERSONAL PROTECTION

Personal protective equipment selections vary based on potential exposure conditions such as applications, handling practices, concentration and ventilation. Information on the selection of protective equipment for use with this material, as provided below, is based upon intended, normal usage.

Respiratory Protection: If engineering controls do not maintain airborne contaminant concentrations at a level which is adequate to protect worker health, an approved respirator may be appropriate. Respirator selection, use, and maintenance must be in accordance with regulatory requirements, if applicable. Types of respirators to be considered for this material include:
Particulate
No special requirements under ordinary conditions of use and with adequate ventilation.

For high airborne concentrations, use an approved supplied-air respirator, operated in positive pressure mode. Supplied air respirators with an escape bottle may be appropriate when oxygen levels are inadequate, gas/vapour warning properties are poor, or if air purifying filter capacity/rating may be exceeded.

Hand Protection: Any specific glove information provided is based on published literature and glove manufacturer data. Glove suitability and breakthrough time will differ depending on the specific use conditions. Contact the glove manufacturer for specific advice on glove selection and breakthrough times for your use conditions. Inspect and replace worn or damaged gloves. The types of gloves to be considered for this material include:
Nitrile,Viton
Chemical resistant gloves are recommended.

Eye Protection: If contact is likely, safety glasses with side shields are recommended.

Skin and Body Protection: Any specific clothing information provided is based on published literature or manufacturer data. The types of clothing to be considered for this material include:
Chemical/oil resistant clothing is recommended.

Specific Hygiene Measures: Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practise good housekeeping.

ENVIRONMENTAL CONTROLS

Comply with applicable environmental regulations limiting discharge to air, water and soil. Protect the environment by applying appropriate control measures to prevent or limit emissions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Note: Physical and chemical properties are provided for safety, health and environmental considerations only and may not fully represent product specifications. Contact the Supplier for additional information.

GENERAL INFORMATION

Physical State: Liquid

Colour: Pale Yellow
Odour: Characteristic
Odour Threshold: N/D

IMPORTANT HEALTH, SAFETY, AND ENVIRONMENTAL INFORMATION

Relative Density (at 15 °C): 0.921
Flammability (Solid, Gas): N/A
Flash Point [Method]: >221°C (430°F) [ASTM D-92]
Flammable Limits (Approximate volume % in air): LEL: N/D UEL: N/D
Autoignition Temperature: N/D
Boiling Point / Range: N/D
Decomposition Temperature: N/D
Vapour Density (Air = 1): N/D
Vapour Pressure: [N/D at 20ºC]
Evaporation Rate (n-butyl acetate = 1): N/D
pH: N/A
Log Pow (n-Octanol/Water Partition Coefficient): N/D
Solubility in Water: Negligible
Viscosity: 36.8 cSt (36.8 mm2/sec) at 40 ºC | 8.3 cSt (8.3 mm2/sec) at 100°C
Oxidizing Properties: See Hazards Identification Section.

OTHER INFORMATION

Freezing Point: N/D
Melting Point: N/A
Pour Point: -34°C (-29°F)

SECTION 10 STABILITY AND REACTIVITY

STABILITY: Material is stable under normal conditions.

CONDITIONS TO AVOID: Excessive heat. High energy sources of ignition.

INCOMPATIBLE MATERIALS: Strong oxidisers

HAZARDOUS DECOMPOSITION PRODUCTS: Material does not decompose at ambient temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

INFORMATION ON TOXICOLOGICAL EFFECTS

Hazard Class	Conclusion / Remarks
Inhalation	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Irritation: No end point data for material.	Negligible hazard at ambient/normal handling temperatures.
Ingestion	
Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin	

Acute Toxicity: No end point data for material.	Minimally Toxic. Based on assessment of the components.
Skin Corrosion/Irritation: No end point data for material.	Mildly irritating to skin with prolonged exposure. Based on assessment of the components.
Eye	
Serious Eye Damage/Irritation: No end point data for material.	May cause mild, short-lasting discomfort to eyes. Based on assessment of the components.
Sensitisation	
Respiratory Sensitization: No end point data for material.	Not expected to be a respiratory sensitizer.
Skin Sensitization: No end point data for material.	Not expected to be a skin sensitizer. Based on assessment of the components.
Aspiration: Data available.	Not expected to be an aspiration hazard. Based on physico-chemical properties of the material.
Germ Cell Mutagenicity: No end point data for material.	Not expected to be a germ cell mutagen. Based on assessment of the components.
Carcinogenicity: No end point data for material.	Not expected to cause cancer. Based on assessment of the components.
Reproductive Toxicity: No end point data for material.	Not expected to be a reproductive toxicant. Based on assessment of the components.
Lactation:	Not expected to cause harm to breast-fed children.
Specific Target Organ Toxicity (STOT)	
Single Exposure: No end point data for material.	Not expected to cause organ damage from a single exposure.
Repeated Exposure: No end point data for material.	Not expected to cause organ damage from prolonged or repeated exposure. Based on assessment of the components.

OTHER INFORMATION

For the product itself:

Repeated and/or prolonged exposure may cause irritation to the skin, eyes, or respiratory tract.

IARC Classification:
The following ingredients are cited on the lists below: None.

--REGULATORY LISTS SEARCHED--

1 = IARC 1 2 = IARC 2A 3 = IARC 2B

SECTION 12 ECOLOGICAL INFORMATION

The information given is based on data for the material, components of the material, or for similar materials, through the application of bridging principals.

ECOTOXICITY

Material -- Not expected to be harmful to aquatic organisms.

PERSISTENCE AND DEGRADABILITY
Biodegradation:
Majority of components -- Expected to be readily biodegradable.

ECOLOGICAL DATA

Ecotoxicity

Test	Duration	Organism Type	Test Results
Aquatic - Acute Toxicity	96 hour(s)	Americamysis bahia	LC50 >5000 mg/l
Aquatic - Acute Toxicity	96 hour(s)	Oncorhynchus mykiss	LC50 >5000 mg/l
Aquatic - Chronic Toxicity	7 day(s)	Ceriodaphnia dubia	NOELR >5000 mg/l
Aquatic - Chronic Toxicity	7 day(s)	Pimephales promelas	NOELR >5000 mg/l

SECTION 13 DISPOSAL CONSIDERATIONS

Disposal recommendations based on material as supplied. Disposal must be in accordance with current applicable laws and regulations, and material characteristics at time of disposal.

DISPOSAL RECOMMENDATIONS

Product is suitable for burning in an enclosed controlled burner for fuel value or disposal by supervised incineration at very high temperatures to prevent formation of undesirable combustion products. Even though this product is readily biodegradable, it must not be indiscriminately discarded into the environment. Protect the environment. Dispose of used oil at designated sites. Minimize skin contact. Do not mix used oils with solvents, brake fluids or coolants.

Empty Container Warning Empty Container Warning (where applicable): Empty containers may contain residue and can be dangerous. Do not attempt to refill or clean containers without proper instructions. Empty drums should be completely drained and safely stored until appropriately reconditioned or disposed. Empty containers should be taken for recycling, recovery, or disposal through suitably qualified or licensed contractor and in accordance with governmental regulations. DO NOT PRESSURISE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH.

SECTION 14 TRANSPORT INFORMATION

LAND (ADG) : Not Regulated for Land Transport

SEA (IMDG): Not Regulated for Sea Transport according to IMDG-Code

Marine Pollutant: No

AIR (IATA): Not Regulated for Air Transport

SECTION 15 REGULATORY INFORMATION

This material is not considered hazardous according to Australia Model Work Health and Safety Regulations.

Product is not regulated according to Australian Dangerous Goods Code.

No Poison Schedule number allocated by the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) established under the Therapeutic Goods Act.

AS1940 COMBUSTIBLE CLASS: C2

REGULATORY STATUS AND APPLICABLE LAWS AND REGULATIONS

Listed or exempt from listing/notification on the following chemical inventories (May contain substance(s) subject to notification to the EPA Active TSCA inventory prior to import to USA): AICS, DSL, ENCS, IECSC, ISHL, KECI, PICCS, TCSI, TSCA

SECTION 16 OTHER INFORMATION

KEY TO ABBREVIATIONS AND ACRONYMS:

N/D = Not determined, N/A = Not applicable, STEL = Short-Term Exposure Limit, TWA = Time-Weighted Average

KEY TO THE H-CODES CONTAINED IN SECTION 3 OF THIS DOCUMENT (for information only):
H315: Causes skin irritation; Skin Corr/Irritation, Cat 2
H400: Very toxic to aquatic life; Acute Env Tox, Cat 1
H410: Very toxic to aquatic life with long lasting effects; Chronic Env Tox, Cat 1

THIS SAFETY DATA SHEET CONTAINS THE FOLLOWING REVISIONS:
Composition: No components information was modified.
Section 08: Environmental Control - Note information was modified.
Section 09: Viscosity information was modified.
Section 11: Dermal Lethality Test Comment information was added.
Section 15: National Chemical Inventory Listing information was modified.

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affiliates in which they directly of indirectly hold any interest.

DGN: 2007539DAU (554219)

Prepared by: Exxon Mobil Corporation
EMBSI, Clinton NJ USA
Contact Point: See Section 1 for Local Contact number

End of (M)SDS

SAFETY DATA SHEET

1. Identification

Product identifier **White Lithium Grease**

Other means of identification

Product Code No. 03080 (Item# 1003341)

Recommended use Lubricating grease

Recommended restrictions None known.

Manufacturer/Importer/Supplier/Distributor information

Manufactured or sold by:

Company name CRC Industries, Inc.

Address 885 Louis Dr.
Warminster, PA 18974 US

Telephone

General Information 215-674-4300

Technical Assistance 800-521-3168

Customer Service 800-272-4620

24-Hour Emergency 800-424-9300 (US)

(CHEMTREC) 703-527-3887 (International)

Website www.crcindustries.com

2. Hazard(s) identification

Physical hazards	Flammable aerosols	Category 1
	Gases under pressure	Liquefied gas
Health hazards	Skin corrosion/irritation	Category 2
	Serious eye damage/eye irritation	Category 2B
	Reproductive toxicity (fertility)	Category 2
	Specific target organ toxicity, single exposure	Category 3 narcotic effects
	Aspiration hazard	Category 1
Environmental hazards	Hazardous to the aquatic environment, acute hazard	Category 2
	Hazardous to the aquatic environment, long-term hazard	Category 2

OSHA defined hazards Not classified.

Label elements

Signal word Danger

Hazard statement Extremely flammable aerosol. Contains gas under pressure; may explode if heated. May be fatal if swallowed and enters airways. Causes skin irritation. Causes eye irritation. May cause drowsiness or dizziness. Suspected of damaging fertility. Toxic to aquatic life with long lasting effects.

Precautionary statement

Prevention	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. - No smoking. Do not spray on an open flame or other ignition source. Pressurized container: Do not pierce or burn, even after use. Do not apply while equipment is energized. Extinguish all flames, pilot lights and heaters. Vapors will accumulate readily and may ignite. Use only with adequate ventilation; maintain ventilation during use and until all vapors are gone. Open doors and windows or use other means to ensure a fresh air supply during use and while product is drying. If you experience any symptoms listed on this label, increase ventilation or leave the area. Avoid breathing mist or vapor. Wash thoroughly after handling. Wear protective gloves/protective clothing/eye protection/face protection. Avoid release to the environment.
Response	If swallowed: Immediately call a poison center/doctor. Do NOT induce vomiting. If on skin: Wash with plenty of water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse. If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell. If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. If exposed or concerned: Get medical advice/attention. Collect spillage.
Storage	Store in a well-ventilated place. Store locked up. Protect from sunlight. Do not expose to temperatures exceeding 50°C/122°F. Exposure to high temperature may cause can to burst.
Disposal	Dispose of contents/container in accordance with local/regional/national regulations.
Hazard(s) not otherwise classified (HNOC)	Static accumulating flammable liquid can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite liquid and vapor. May cause flash fire or explosion.

3. Composition/information on ingredients

Mixtures

Chemical name	Common name and synonyms	CAS number	%
liquefied petroleum gas		68476-86-8	30 - 40
2-methylpentane		107-83-5	20 - 30
distillates (petroleum), hydrotreated heavy naphthenic		64742-52-5	10 - 20
naphtha (petroleum), hydrotreated light		64742-49-0	10 - 20
n-hexane		110-54-3	3 - 5
zinc oxide		1314-13-2	< 1
2,2-dimethylbutane		75-83-2	< 0.3
2,3-dimethylbutane		79-29-8	< 0.3
3-methylpentane		96-14-0	< 0.3
calcium bis(dinonylnaphthalenesulphonate)		57855-77-3	< 0.3

Specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. First-aid measures

Inhalation	Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/physician if you feel unwell.
Skin contact	Remove contaminated clothing. Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
Ingestion	Call a physician or poison control center immediately. Rinse mouth. Do not induce vomiting. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Most important symptoms/effects, acute and delayed	Aspiration may cause pulmonary edema and pneumonitis. May cause drowsiness and dizziness. Headache. Nausea, vomiting. Irritation of eyes. Exposed individuals may experience eye tearing, redness, and discomfort. Skin irritation. May cause redness and pain.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. Keep victim under observation. Symptoms may be delayed.
General information	IF exposed or concerned: Get medical advice/attention. Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire-fighting measures

Suitable extinguishing media	Water fog. Foam. Carbon dioxide (CO2). Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable extinguishing media	Do not use water jet as an extinguisher, as this will spread the fire.
Specific hazards arising from the chemical	Contents under pressure. Pressurized container may rupture when exposed to heat or flame. This product is a poor conductor of electricity and can become electrostatically charged. If sufficient charge is accumulated, ignition of flammable mixtures can occur. Static electricity accumulation may be significantly increased by the presence of small quantities of water or other contaminants. Material will float and may ignite on surface of water. During fire, gases hazardous to health may be formed.
Special protective equipment and precautions for firefighters	Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.
Fire-fighting equipment/instructions	In case of fire: Stop leak if safe to do so. Move containers from fire area if you can do so without risk. Containers should be cooled with water to prevent vapor pressure build up.
General fire hazards	Extremely flammable aerosol. Contents under pressure. Pressurized container may rupture when exposed to heat or flame.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Keep unnecessary personnel away. Keep people away from and upwind of spill/leak. Remove all possible sources of ignition in the surrounding area. Keep out of low areas. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Wear appropriate protective equipment and clothing during clean-up. Avoid breathing mist or vapor. Emergency personnel need self-contained breathing equipment. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Ventilate closed spaces before entering them. Use appropriate containment to avoid environmental contamination. Local authorities should be advised if significant spillages cannot be contained. For personal protection, see section 8 of the SDS.
Methods and materials for containment and cleaning up	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Keep combustibles (wood, paper, oil, etc.) away from spilled material. The product is immiscible with water and will spread on the water surface. Prevent product from entering drains. Stop the flow of material, if this is without risk. Wipe up with absorbent material (e.g. cloth, fleece). Clean surface thoroughly to remove residual contamination. For waste disposal, see section 13 of the SDS.
Environmental precautions	Avoid release to the environment. Inform appropriate managerial or supervisory personnel of all environmental releases. Prevent further leakage or spillage if safe to do so. Avoid discharge into drains, water courses or onto the ground. Use appropriate containment to avoid environmental contamination.

7. Handling and storage

Precautions for safe handling	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Minimize fire risks from flammable and combustible materials (including combustible dust and static accumulating liquids) or dangerous reactions with incompatible materials. Pressurized container: Do not pierce or burn, even after use. Do not use if spray button is missing or defective. Do not spray on a naked flame or any other incandescent material. Do not smoke while using or until sprayed surface is thoroughly dry. Do not cut, weld, solder, drill, grind, or expose containers to heat, flame, sparks, or other sources of ignition. Use caution around energized equipment. The metal container will conduct electricity if it contacts a live source. This may result in injury to the user from electrical shock and/or flash fire. Protect containers from physical damage; do not drag, roll, slide, or drop. When moving containers, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport containers. Avoid breathing mist or vapor. Avoid contact with eyes, skin, and clothing. Avoid prolonged exposure. Pregnant or breastfeeding women must not handle this product. Should be handled in closed systems, if possible. Use only in well-ventilated areas. Wear appropriate personal protective equipment. Wash hands thoroughly after handling. Avoid release to the environment. Observe good industrial hygiene practices. For product usage instructions, see the product label.
Conditions for safe storage, including any incompatibilities	Level 3 Aerosol. Pressurized container. Protect from sunlight and do not expose to temperatures exceeding 50°C/122 °F. Do not puncture, incinerate or crush. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. Avoid spark promoters. These alone may be insufficient to remove static electricity. Store in a well-ventilated place. Store away from incompatible materials (see Section 10 of the SDS).

8. Exposure controls/personal protection

Occupational exposure limits

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	PEL	5 mg/m3	Mist.
		2000 mg/m3	
		500 ppm	
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)	PEL	400 mg/m3	
		100 ppm	
n-hexane (CAS 110-54-3)	PEL	1800 mg/m3	
		500 ppm	
zinc oxide (CAS 1314-13-2)	PEL	5 mg/m3	Respirable fraction.
		5 mg/m3	Fume.
		15 mg/m3	Total dust.

US. ACGIH Threshold Limit Values

Components	Type	Value	Form
2,2-dimethylbutane (CAS 75-83-2)	STEL	1000 ppm	
	TWA	500 ppm	
2,3-dimethylbutane (CAS 79-29-8)	STEL	1000 ppm	
	TWA	500 ppm	
2-methylpentane (CAS 107-83-5)	STEL	1000 ppm	
	TWA	500 ppm	
3-methylpentane (CAS 96-14-0)	STEL	1000 ppm	
	TWA	500 ppm	
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	TWA	5 mg/m3	Inhalable fraction.
n-hexane (CAS 110-54-3)	TWA	50 ppm	
zinc oxide (CAS 1314-13-2)	STEL	10 mg/m3	Respirable fraction.
	TWA	2 mg/m3	Respirable fraction.

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
2,2-dimethylbutane (CAS 75-83-2)	Ceiling	1800 mg/m3	
		510 ppm	
	TWA	350 mg/m3	
		100 ppm	
2,3-dimethylbutane (CAS 79-29-8)	Ceiling	1800 mg/m3	
		510 ppm	
	TWA	350 mg/m3	
		100 ppm	
2-methylpentane (CAS 107-83-5)	Ceiling	1800 mg/m3	
		510 ppm	
	TWA	350 mg/m3	
		100 ppm	

US. NIOSH: Pocket Guide to Chemical Hazards

Components	Type	Value	Form
3-methylpentane (CAS 96-14-0)	Ceiling	1800 mg/m3	
		510 ppm	
	TWA	350 mg/m3	
		100 ppm	
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)	Ceiling	1800 mg/m3	
	STEL	10 mg/m3	Mist.
	TWA	5 mg/m3	Mist.
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)	TWA	400 mg/m3	
		100 ppm	
n-hexane (CAS 110-54-3)	TWA	180 mg/m3	
		50 ppm	
zinc oxide (CAS 1314-13-2)	Ceiling	15 mg/m3	Dust.
	STEL	10 mg/m3	Fume.
	TWA	5 mg/m3	Fume.
		5 mg/m3	Dust.

Biological limit values

ACGIH Biological Exposure Indices

Components	Value	Determinant	Specimen	Sampling Time
n-hexane (CAS 110-54-3)	0.4 mg/l	2,5-Hexanedion, without hydrolysis	Urine	*

* - For sampling details, please see the source document.

Exposure guidelines

US - California OELs: Skin designation

n-hexane (CAS 110-54-3) Can be absorbed through the skin.

US ACGIH Threshold Limit Values: Skin designation

n-hexane (CAS 110-54-3) Can be absorbed through the skin.

Appropriate engineering controls Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions. If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits. If exposure limits have not been established, maintain airborne levels to an acceptable level. Provide eyewash station. Eye wash fountain and emergency showers are recommended.

Individual protection measures, such as personal protective equipment

Eye/face protection Wear safety glasses with side shields (or goggles).

Skin protection

Hand protection Wear protective gloves such as: Nitrile. Polyvinyl chloride (PVC). Viton/butyl.

Other Wear appropriate chemical resistant clothing.

Respiratory protection If engineering controls are not feasible or if exposure exceeds the applicable exposure limits, use a NIOSH-approved cartridge respirator with an organic vapor cartridge. Use a self-contained breathing apparatus in confined spaces and for emergencies. Air monitoring is needed to determine actual employee exposure levels.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

General hygiene considerations Observe any medical surveillance requirements. When using do not smoke. Always observe good personal hygiene measures, such as washing after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants.

9. Physical and chemical properties

Appearance

Physical state Liquid.

Form	Aerosol. Grease.
Color	Off-white.
Odor	Solvent.
Odor threshold	Not available.
pH	Not available.
Melting point/freezing point	-244.7 °F (-153.7 °C) estimated
Initial boiling point and boiling range	118.4 °F (48 °C) estimated
Flash point	< 0 °F (< -17.8 °C) Tag Closed Cup
Evaporation rate	Fast.
Flammability (solid, gas)	Not available.
Upper/lower flammability or explosive limits	
Flammability limit - lower (%)	1 % estimated
Flammability limit - upper (%)	8 % estimated
Vapor pressure	2377.8 hPa estimated
Vapor density	> 1 (air = 1)
Relative density	0.64 estimated
Solubility (water)	Insoluble.
Partition coefficient (n-octanol/water)	Not available.
Auto-ignition temperature	437 °F (225 °C) estimated
Decomposition temperature	Not available.
Viscosity (kinematic)	Not available.
Percent volatile	98.4 % estimated

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Material is stable under normal conditions.
Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
Conditions to avoid	Heat, flames and sparks. Contact with incompatible materials.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Information on likely routes of exposure

Inhalation	May cause drowsiness and dizziness. Headache. Nausea, vomiting. Prolonged inhalation may be harmful.
Skin contact	Causes skin irritation.
Eye contact	Causes eye irritation.
Ingestion	Droplets of the product aspirated into the lungs through ingestion or vomiting may cause a serious chemical pneumonia.
Symptoms related to the physical, chemical and toxicological characteristics	Aspiration may cause pulmonary edema and pneumonitis. May cause drowsiness and dizziness. Headache. Nausea, vomiting. Irritation of eyes. Exposed individuals may experience eye tearing, redness, and discomfort. Skin irritation. May cause redness and pain.

Information on toxicological effects

Acute toxicity	May be fatal if swallowed and enters airways.

Components	Species	Test Results
calcium bis(dinonylnaphthalenesulphonate) (CAS 57855-77-3)		
Acute		
Dermal		
LD50	Rabbit	> 20 g/kg
Oral		
LD50	Rat	> 5000 mg/kg
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
Oral		
LD50	Rat	> 5000 mg/kg
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)		
Acute		
Dermal		
LD50	Rabbit	> 2000 mg/kg
n-hexane (CAS 110-54-3)		
Acute		
Dermal		
LD50	Rabbit	> 1300 mg/kg
Oral		
LD50	Rat	15840 mg/kg
zinc oxide (CAS 1314-13-2)		
Acute		
Oral		
LD50	Rat	> 5000 mg/kg

* Estimates for product may be based on additional component data not shown.

Skin corrosion/irritation Causes skin irritation.

Serious eye damage/eye irritation Causes eye irritation.

Respiratory sensitization Not a respiratory sensitizer.

Skin sensitization This product is not expected to cause skin sensitization.

Germ cell mutagenicity No data available to indicate product or any components present at greater than 0.1% are mutagenic or genotoxic.

Carcinogenicity Not classifiable as to carcinogenicity to humans.

IARC Monographs. Overall Evaluation of Carcinogenicity

Not listed.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US. National Toxicology Program (NTP) Report on Carcinogens

Not listed.

Reproductive toxicity Suspected of damaging fertility.

Specific target organ toxicity - single exposure May cause drowsiness and dizziness.

Specific target organ toxicity - repeated exposure Not classified.

Aspiration hazard May be fatal if swallowed and enters airways. If aspirated into lungs during swallowing or vomiting, may cause chemical pneumonia, pulmonary injury or death.

Chronic effects Prolonged inhalation may be harmful.

12. Ecological information

Ecotoxicity Toxic to aquatic life with long lasting effects.

Components		Species	Test Results
2-methylpentane (CAS 107-83-5)			
Aquatic			
Acute			
Crustacea	EC50	Daphnia	1 - 10 mg/l, 48 hours
Fish	LC50	Fish	1 - 10 mg/l, 96 hours
distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	1000 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	5000 mg/l, 96 hours
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)			
Aquatic			
Acute			
Crustacea	EC50	Daphnia	1 - 10 mg/l, 48 hours
Fish	LC50	Fish	1 - 10 mg/l, 96 hours
n-hexane (CAS 110-54-3)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	2.101 - 2.981 mg/l, 96 hours
zinc oxide (CAS 1314-13-2)			
Aquatic			
Acute			
Crustacea	EC50	Water flea (Daphnia magna)	0.098 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	1.1 mg/l, 96 hours

* Estimates for product may be based on additional component data not shown.

Persistence and degradability

Bioaccumulative potential

Partition coefficient n-octanol / water (log Kow)	
2,2-dimethylbutane	3.82
2,3-dimethylbutane	3.42
2-methylpentane	3.74
3-methylpentane	3.6
n-hexane	3.9
Bioconcentration factor (BCF)	
naphtha (petroleum), hydrotreated light	10 - 25000
zinc oxide	60690

Mobility in soil No data available.

Other adverse effects No other adverse environmental effects (e.g. ozone depletion, photochemical ozone creation potential, endocrine disruption, global warming potential) are expected from this component.

13. Disposal considerations

Disposal of waste from residues / unused products If discarded, this product is considered a RCRA ignitable waste, D001. Collect and reclaim or dispose in sealed containers at licensed waste disposal site. Contents under pressure. Do not puncture, incinerate or crush. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container. Dispose in accordance with all applicable regulations.

Hazardous waste code D001: Waste Flammable material with a flash point <140 F

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied. Empty containers should be taken to an approved waste handling site for recycling or disposal.

14. Transport information

DOT

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Label(s)	2.1
Packing group	Not applicable.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Special provisions	N82
Packaging exceptions	306
Packaging non bulk	None
Packaging bulk	None

IATA

UN number	UN1950
UN proper shipping name	Aerosols, flammable, Limited Quantity
Transport hazard class(es)	
Class	2.1
Subsidiary risk	-
Packing group	Not applicable.
ERG Code	10L
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
Other information	
Passenger and cargo aircraft	Allowed with restrictions.
Cargo aircraft only	Allowed with restrictions.

IMDG

UN number	UN1950
UN proper shipping name	AEROSOLS, LIMITED QUANTITY
Transport hazard class(es)	
Class	2
Subsidiary risk	-
Packing group	Not applicable.
Environmental hazards	
Marine pollutant	No.
EmS	Not available.
Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

15. Regulatory information

US federal regulations This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

SARA 304 Emergency release notification

Not regulated.

OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Not regulated.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

n-hexane (CAS 110-54-3)
zinc oxide (CAS 1314-13-2)

CERCLA Hazardous Substance List (40 CFR 302.4)

n-hexane (CAS 110-54-3)	Listed.
zinc oxide (CAS 1314-13-2)	Listed.

CERCLA Hazardous Substances: Reportable quantity

n-hexane (CAS 110-54-3)	5000 LBS

Spills or releases resulting in the loss of any ingredient at or above its RQ require immediate notification to the National Response Center (800-424-8802) and to your Local Emergency Planning Committee.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

n-hexane (CAS 110-54-3)

Clean Air Act (CAA) Section 112(r) Accidental Release Prevention (40 CFR 68.130)

Not regulated.

Safe Drinking Water Act (SDWA) Not regulated.

Food and Drug Administration (FDA) Not regulated.

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Section 311/312 Hazard categories Immediate Hazard - Yes
Delayed Hazard - Yes
Fire Hazard - Yes
Pressure Hazard - Yes
Reactivity Hazard - No

SARA 302 Extremely hazardous substance No

US state regulations

US. California. Candidate Chemicals List. Safer Consumer Products Regulations (Cal. Code Regs, tit. 22, 69502.3, subd. (a))

distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)
liquefied petroleum gas (CAS 68476-86-8)
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
n-hexane (CAS 110-54-3)

US. New Jersey Worker and Community Right-to-Know Act

2,2-dimethylbutane (CAS 75-83-2)
2,3-dimethylbutane (CAS 79-29-8)
2-methylpentane (CAS 107-83-5)
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
n-hexane (CAS 110-54-3)
zinc oxide (CAS 1314-13-2)

US. Massachusetts RTK - Substance List

2,2-dimethylbutane (CAS 75-83-2)
2,3-dimethylbutane (CAS 79-29-8)
2-methylpentane (CAS 107-83-5)
3-methylpentane (CAS 96-14-0)
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
n-hexane (CAS 110-54-3)
zinc oxide (CAS 1314-13-2)

US. Pennsylvania Worker and Community Right-to-Know Law

2,2-dimethylbutane (CAS 75-83-2)
2,3-dimethylbutane (CAS 79-29-8)
2-methylpentane (CAS 107-83-5)
3-methylpentane (CAS 96-14-0)
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
n-hexane (CAS 110-54-3)
zinc oxide (CAS 1314-13-2)

US. Rhode Island RTK

distillates (petroleum), hydrotreated heavy naphthenic (CAS 64742-52-5)
naphtha (petroleum), hydrotreated light (CAS 64742-49-0)
n-hexane (CAS 110-54-3)

US. California Proposition 65

WARNING: This product contains a chemical known to the State of California to cause cancer.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

titanium dioxide (CAS 13463-67-7) Listed: September 2, 2011

Volatile organic compounds (VOC) regulations

EPA

VOC content (40 CFR 51.100(s)) 100 %

Consumer products (40 CFR 59, Subpt. C) Not regulated

State

Consumer products	Not regulated (semi-solid lubricant)
VOC content (CA)	84.7 %
VOC content (OTC)	84.7 %

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)
A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

Issue date	01-16-2015
Revision date	10-06-2017
Prepared by	Allison Yoon
Version #	03
Further information	CRC # 568F-G/1002591-1002592
HMIS® ratings	Health: 2* Flammability: 4 Physical hazard: 0 Personal protection: B
NFPA ratings	Health: 2 Flammability: 4 Instability: 0
NFPA ratings	

Disclaimer

The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. This information is accurate to the best of CRC's knowledge or obtained from sources believed by CRC to be accurate. Before using any product, read all warnings and directions on the label. For further clarification of any information contained on this (M)SDS consult your supervisor, a health & safety professional, or CRC Industries, Inc..

Revision Information

Product and Company Identification: Product Codes
Physical & Chemical Properties: Multiple Properties
Transport Information: Agency Name, Packaging Type, and Transport Mode Selection
Other information, including date of preparation or last revision: Further information

Appendix D

Site Map

EMERGENCY RESPONSE PLAN

Project: Gunghi Creek Culvert Replacement (CT2346)
Location: Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

Approximate Work Location

N

- First Aid Kit and other Emergency Equipment
- Fire Extinguisher
- Spill Kit
- Eyewash Station
- Air Horn
- Muster Point
- Job Shack

* All equipment may be transported to location 2

Appendix E

Reportable Quantities for Spills in the Northwest Territories

Table E1. Reportable Quantities for Spills in the Northwest Territories

Substance	Reportable Quantity
Explosives Compressed gas (toxic/corrosive) Infectious substances Sewage and Wastewater (unless otherwise authorized) Radioactive materials Unknown substance	Any amount
Compressed gas (Flammable) Compressed gas (Non-corrosive, non-flammable)	Any amount of gas from containers with a capacity greater than 100L
Flammable liquid	≥100 L
Flammable solid Substances liable to spontaneous combustion Water reactant substances	≥ 25 kg
Oxidizing substances	≥ 50 L or 50 kg
Organic peroxides Environmentally hazardous substances intended for disposal	≥1 L or 1 kg
Toxic substances	≥ 5 L or 5 kg
Corrosive substances Miscellaneous products, substances or organisms	≥ 5 L or 5 kg
PCB mixtures of 5 or more ppm	≥ 0.5 L or 0.5 kg
Other contaminants--for example, crude oil, drilling fluid, produced water, waste or spent chemicals, used or waste oil, vehicle fluids, wastewater.	≥ 100 L or 100 kg
Sour natural gas (i.e., contains H_2S) Sweet natural gas	Uncontrolled release or sustained flow of 10 minutes or more
Flammable liquid Vehicle fluid	≥ 20 L When released on a frozen water body that is being used as a working surface
Reported releases or potential releases of any size that: are near or in an open water body; are near or in a designated sensitive environment or habitat; Pose an imminent threat to human health or safety; or Pose an imminent threat to a listed species at risk or its critical habitat	Any amount

NT-NU SPILL REPORT

OIL, GASOLINE, CHEMICALS AND OTHER HAZARDOUS MATERIALS

NT-NU 24-HOUR SPILL REPORT LINE
Tel: (867) 920-8130 • Fax: (867) 873-6924 • Email: spills@gov.nt.ca

REPORT LINE USE ONLY

A	Report Date: MM DD YY	Report Time:	☐ Original Spill Report **OR** ☐ Update # _____ to the Original Spill Report	**Report Number:**
B	Occurrence Date: MM DD YY	Occurrence Time:		
C	Land Use Permit Number (if applicable):		Water Licence Number (if applicable):	
D	Geographic Place Name or Distance and Direction from the Named Location:		Region: ☐ NT ☐ Nunavut ☐ Adjacent Jurisdiction or Ocean	
E	Latitude: _____ Degrees _____ Minutes _____ Seconds		Longitude: _____ Degrees _____ Minutes _____ Seconds	
F	Responsible Party or Vessel Name:		Responsible Party Address or Office Location:	
G	Any Contractor Involved:		Contractor Address or Office Location:	
H	Product Spilled: ☐ Potential Spill	Quantity in Litres, Kilograms or Cubic Metres:	U.N. Number:	
I	Spill Source:	Spill Cause:	Area of Contamination in Square Metres:	
J	Factors Affecting Spill or Recovery:	Describe Any Assistance Required:	Hazards to Persons, Property or Environment:	
K	Additional Information, Comments, Actions Proposed or Taken to Contain, Recover or Dispose of Spilled Product and Contaminated Materials:			

L	Reported to Spill Line by:	Position:	Employer:	Location Calling From:	Telephone:
M	Any Alternate Contact:	Position:	Employer:	Alternate Contact Location:	Alternate Telephone:

REPORT LINE USE ONLY

N	Received at Spill Line by:	Position:	Employer:	Location Called:	Report Line Number:

Lead Agency: ☐ EC ☐ CCG/TCMSS ☐ GNWT ☐ GN ☐ ILA ☐ AANDC ☐ NEB ☐ Other: _____

Significance: ☐ Minor ☐ Major ☐ Unknown

File Status: ☐ Open ☐ Closed

Agency:	**Contact Name:**	**Contact Time:**	**Remarks:**
Lead Agency:			
First Support Agency:			
Second Support Agency:			
Third Support Agency:			

Appendix F

Allen Services and Contracting Emergency Response Procedures

PROJECT SAFETY PLAN

GUNGHI CREEK CULVERT REPLACEMENT

ALLEN SERVICES & CONTRACTING LTD.

70 KING ROAD
PO BOX 3190
INUVIK, NT
X0E 0T0

PHONE: (867) 777-4000
FAX: (867) 777-4077

www.arcticallens.ca






Prepared for
GOVERNMENT OF THE NORTHWEST TERRITORIES

Prepared by
ALLEN SERVICES & CONTRACTING LTD.

Prepared on
October 31, 2019

Project Name:……Gunghi Creek Culvert Replacement
AS&C Project #:……n/a
Event ID:……CT2346
Estimated Construction Start:……TBA
Estimated Construction End:……TBA
Project Location:……Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

CONTENTS

1.0 Introduction

Allen Services & Contracting (AS&C) Ltd.'s policy and mission are to perform its work in the safest manner as reasonably practicable, consistent with good construction practices and industry standards, and with regard to the health, safety and environmental welfare of people, assets, operation and the environment. The management of Allen Services & Contracting Ltd. strongly believes that work performed safely yields the highest quality at the lowest cost possible.

To meet this policy and mission, Allen Services & Contracting Ltd. has implemented a comprehensive Health and Safety Management System, develops Project Safety Plans (PSPs), Pre-Job Hazard Analyses (PJHAs), Emergency Response Plans (ERPs) and ensures these plans and Occupational Health & Safety Regulations, Act and Code are followed on all our work sites. Allen Services & Contracting Ltd. strives to continually improve health and safety in the workplace and to prevent all injuries, illnesses and any incidents which could cause harm to property or the environment. Allen Services & Contracting Ltd.'s copy of the Health and Safety Management System is available online under the following link:

https://www.dropbox.com/s/dk7frdqg8vofgp6/H%26S%20Management%20System%20V1.0.pdf?dl=0

1.1 Introduction

The purpose of this Project Safety Plan (PSP) is to provide the Client, Allen Services & Contracting Ltd. employees and subcontractors a reference of health & safety rules, procedures and the work being completed at the Gunghi Creek Culvert Replacement project.

The Project Safety Plan is designed to assist personnel working at the Gunghi Creek Culvert Replacement project and to provide an overview of Allen Services & Contracting Ltd.'s health and safety practices, procedures, rules, reporting requirements, guidelines for identifying, assessing and controlling hazards and environmental aspects associated with the work. The Pre-Job-Hazard-Analysis (PJHA) is a vital part of pre-project preparation and is enclosed with this Project Safety Plan.

This Project Safety Plan will commensurate with work until demobilization date and will be in conformance with the specific requirements of the Client's HSE requirements and in conformance with the Northwest Territories Occupational

Health & Safety Act and Regulations as well as with Allen Services & Contracting Ltd.'s policies, rules and procedures.

1.2 Scope of Work

Allen Services & Contracting Ltd. and its subcontractors will replace the existing culvert located on Inuvik – Tuktoyaktuk Highway, at approximately km marker 131.2, 14 km south of Tuktoyaktuk, NT with a new engineered open bottom concrete arch bridge. Work will include but will not be limited to off-site manufacturing of the arches, transportation to site, building of ice road to detour traffic, excavating for the new structure, augering for piles and setting piles, installation of concrete beam on piles, welding of beam onto pile, lifting and hoisting of arches into place and backfilling of excavation.

2.0 Project Contacts

2.1 Allen Services & Contracting Ltd. Project Key Contacts

Role/Position	Name	Cell/Phone	Email
Site Supervisor - Owner/President	Brian McCarthy Sr.	(780) 271-5666	bmccarthy@arcticallens.ca
Site Supervisor	Lee McMann	(780) 999-0177	lmcmann@arcticallens.ca
Site Safety Representative	Barry Setzer	(867) 678-5078	
General Manager (Project Management)	Dean Smith	(780) 914-9300	dsmith@arcticallens.ca
Logistics Manager	Lee McMann	(780) 999-0177	lmcmann@arcticallens.ca
Safety Consultant	Lena Stotko	(780) 266-7676	lena@verussafety.ca

2.2 Client Key Contacts

Role/Position	Name	Cell/Phone	Email
Manager Structures – Bridges, GNWT	Ann Kulmatycki	(867) 767-9086 ext. 31127	ann_kulmatycki@gov.nt.ca
Project Manager, Structures Section/Bridges	David MacDonald	(867) 446-2227	david_bmacdonald@gov.nt.ca
Structural Engineer, Dillon Consulting	David Amorim	(204) 229-8441	damorim@dillon.ca

3.0 RESPONSIBILITIES

3.1 Principal (Prime) Contractor

Allen Services & Contracting Ltd. assumes the role of the Principal (Prime) Contractor for this project and is responsible for the overall health and safety of all personnel involved in work including AS&C Ltd. employees and subcontractors, the protection of any persons including other contractors, visitors and the general public who may be affected by conduct of this work and the environment that may affected by conduct of this work. AS&C Ltd. will fulfill its role as the Principal (Prime) Contractor as outlined in the NT Health and Safety Act and Regulations.

3.2 Site Supervisors

AS&C Ltd.'s Site Supervisors will comply with and enforce the compliance by all personnel on site with applicable federal and territorial health and safety regulations, this Project Safety Plan and AS&C Ltd.'s policies, rules and procedures. Site Supervisors will ensure all personnel are aware of all hazards on site and control measures to be implemented. Site Supervisors will be responsible for all aspects of work under the contract and for ensuring workers' health and safety on the work site.

3.3 Site Safety Representatives

Site Safety Representatives are responsible for the overall health & safety of personnel on site, the preparation and holding of toolbox/safety meetings, ensuring FLHAs are completed as required, ensuring hazards are identified and either eliminated or reduced to an acceptable level, preparation and holding of Joint OHS Committee meetings, incident investigations and reporting to appropriate authorities and AS&C Ltd. management, providing orientations on site, monitoring of compliance with Health and Safety legislation by all workers and health & safety documentation organization and retention.

3.4 Safety Consultant

The Safety Consultant is responsible for the development of this PSP, PJHA, Emergency Response Plans and the preparation of project related documentation before project start.

3.5 Employees and Subcontractors (Workers)

Employees and subcontractors will follow and comply with all rules, regulations, policies, practices and procedures set out by the NWT Safety Act, Regulations, AS&C Ltd.'s Health and Safety Management System and this PSP.

3.6 Project Management

Project Managers are responsible for the management of this project, ensuring all contract requirements, deadlines and specifications are followed, to communicate with the Client on all project and health & safety matters and to support the Site Supervisors and Site Safety Representatives in all their initiatives to fulfil project and health & safety requirements.

3.7 Visitors

Visitors are considered all persons not involved in work activities who request access to the site to review the progress of the project or persons such as inspectors, estimators, engineers, etc. All visitors to site will receive a visitor orientation that will cover hazards on site, controls to be used, emergency procedures and PPE requirements. All visitors must follow the Site Supervisor's instructions, hazard controls, site procedures and PPE requirements.

All visitors must report to the Site Supervisor upon arrival on site and must be escorted around the worksite at all times to ensure their own and others' health & safety at the work site.

4.0 SITE-SPECIFIC HEALTH AND SAFETY ORIENTATION

All personnel on site will receive a site-specific health and safety orientation. The orientation will include all site-specific rules, PPE requirements, reporting procedures for incidents and hazards, toolbox/safety meetings, use of equipment, and tools, site-specific hazards and emergency response procedures including muster points and emergency phone numbers.

5.0 COMMUNICATION

5.1 Emergency Communication

AS&C Ltd. will ensure all required project contact phone numbers and emergency phone numbers are available and/or posted on site. At a minimum, Site Supervisors will carry a two-way radio with them to contact emergency services and a functioning cell phone with booster, if applicable.

In case of an emergency on site, AS&C Ltd. will provide an air horn to communicate the emergency to personnel on site. In the event of an emergency, work on site will stop and the Site Supervisor and Site Safety Representative will assess the scene and take appropriate measures to reduce farther effects of the emergency, to tend to injured personnel and to reduce environmental damages.

To ensure all persons are accounted for in the event of an emergency, all employees and subcontractors must sign in when arriving on site and sign out when leaving the site on AS&C Ltd.'s sign-in/sign-out protocol. For further information on Emergency response, please refer to the Environmental management Plan, section

5.2 Project Meetings

Project meetings will be held on an as-and-when needed basis, will be directed by the Manager, Structures and attended by AS&C Ltd. key personnel.

5.3 Daily Toolbox Talks

The Site Safety Representative in collaboration with the Site Supervisor will prepare and hold daily toolbox talks with all personnel on site to communicate changes and updates to health and safety and operations on site. The minutes of the toolbox talks will be kept on site for reference and will be provided to the Client upon request.

5.4 Weekly Safety Meetings

The Site Safety Representative in collaboration with the Site Supervisor will hold weekly safety meetings with all personnel on site. The attendance of the safety meetings is mandatory for all personnel working on this project.

The weekly safety meetings shall not be longer than 30 minutes in duration, record the topics discussed, corrective actions, accountabilities and names of attendees. The meeting minutes will be kept on site for reference and will be provided to the Client on a weekly basis, if applicable.

5.5 WSCC Communication & Documentation

AS&C Ltd.'s Site safety Representative will communicate all incidents to AS&C Ltd.'s management. Management will report all dangerous occurrences and reportable incidents to the Chief OHS Officer as per Safety Act and Regulations and will provide copies of all documentation and communication between the Principal (Prime) Contractor and WSCC to the Client.

6.0 HAZARD ASSESSMENT AND CONTROL

6.1 Pre-Job Hazard Analysis

AS&C Ltd. will develop a Pre-Job-Hazard-Analysis based on the work environment (location) and jobs/tasks performed, identify the hazards associated with the environment, jobs/tasks and will develop recommendations for control measures for those hazards. All hazards will be assessed for risk based on frequency and severity. All personnel on site must use the recommended control measures when controlling hazards. Control measures put in place must eliminate or reduce risk levels to an acceptable level. The PJHA is a vital part of this PSP and will be provided to the Client for review before project start.

6.2 Field Level Hazard Assessment (FLHAs)

All workers are required to complete/review and sign Field Level Hazard Assessments every day before beginning work. FLHAs will cover all major tasks completed during the day including but not limited to the use of tools, materials and equipment, the work environment and activities throughout the day. All identified hazards must be assessed and controls must be assigned within the ongoing work site hazard assessment (FLHA) for that specific hazard.

6.3 Hazard Reporting

Hazard Reporting is a useful tool to ensure hazards, which have not yet been identified, are addressed as the project progresses. During the progression of the project all employees are required to:

- Identify potentially hazardous conditions and acts and notify the Site Supervisor of the hazards.
- Correct hazardous conditions and acts when there is no danger to the worker or others.
- Report all situations in which imminent danger is present and refuse work.
- Participate in the investigation of imminent danger situations or hazardous conditions.

7.0 WORKER TRAINING AND COMPETENCY

7.1 Worker Training

AS&C Ltd. will ensure all personnel on site will have the required safety training and certification to perform their work in a safe manner.

Training will include but will not be limited to:

- Site-Specific Health & Safety Orientation
- WHMIS 2015/GHS
- Fall Protection
- Environmental Awareness
- Emergency Preparedness
- Aerial Work Platform
- Hours of Service
- Mobile Equipment
- Ground Disturbance
- First Aid
- Environmental and Wildlife Awareness
- Personal Protective Equipment
- Hazard Awareness
- OH&S Supervisor Safety Training

7.2 Worker Competency

All workers will be trained in safe work practices and safe job procedures for the equipment they are required to operate. Equipment includes “things” used to equip workers at a worksite and includes tools, supplies, machinery, etc.

A worker who is not competent to perform work that may endanger the worker or others will not perform the work unless under direct supervision of a worker who is competent to perform the work.

A worker must immediately report to the Site Supervisor any equipment that is in a condition that will compromise the safety of the worker using it, will not perform the function for which it is needed, is not strong enough for its purpose or has an obvious defect. AS&C Ltd.’s Site Supervisor will ensure all workers who enter any AS&C Ltd. worksite are competent to perform their work.

8.0 PERSONAL PROTECTIVE EQUIPMENT

8.1 Basic PPE

Basic PPE must be worn at all times and will include:

- CSA approved Type II Class E hard hat
- CSA approved steel or composite toe safety boots with 6” ankle support

- CSA z94 or ANSI z87 approved safety glasses with side shields

8.2 Specialized PPE

Specialized PPE such as respirators, face shields, hearing protection and fall protection will be worn by all workers as per specific task requirement and/or site condition. All specialized PPE will be inspected visually before each use by all workers and as per manufacturer's specifications. At start-up of project, all specialized PPE will be inspected using a written form.

Specialized PPE and RPE on this project will include:

- Gloves - Jobs with potential of injury to hands will require workers to wear task specific gloves (i.e. Kevlar gloves, impact resistant gloves, etc.)
- Hi-vis vest or coveralls with hi-vis stripes
- Hearing protection (ear muffs during cutting of concrete)
- Face shields
- Welding helmets
- Half-face respirators with P100 cartridges during welding operations

9.0 WHMIS AND SDS

AS&C Ltd.'s Site Supervisor is responsible to ensure all required Safety Data Sheets (SDS) for hazardous products being used on-site are readily available to workers throughout the duration of the project.

The Site Supervisor will ensure that all products have labels as per WHMIS 2015/GHS requirement and that all workers have current WHMIS training.

10.0 INSPECTIONS

10.1 Worksite Inspections

The Site Safety Representative in collaboration with the Supervisor will conduct daily informal (walk around) inspections and weekly formal (recorded and planned) inspections using a pre-written inspection form to identify and prevent unhealthy and unsafe conditions. Findings will be communicated to all employees during the daily toolbox talk, weekly safety meeting, or more often and as required.

10.2 Tool Inspections

All workers will inspect their tools visually every day before use. Tools without required guards/modified tools or defective tools must be tagged out and taken out of service immediately. Tools which are tagged out will not be used until defects are corrected.

Tool inspections will be completed on a monthly basis using the pre-written inspection form.

10.3 Mobile/Heavy Equipment Inspections

All workers using mobile/heavy equipment will inspect their equipment daily prior use on a written form. Equipment pre-use inspections will be completed by the operators. The daily equipment pre-sue inspection will be available on site for review. All equipment will be maintained within manufacturer specifications and will be in good condition.

10.4 PPE Inspections

All workers will inspect their PPE visually every day prior use. All PPE will be clean, in good condition and appropriate for the task. PPE inspection items will be checked off on the daily FLHA form.

11.0 INCIDENT INVESTIGATION AND REPORTING

All incidents and accidents (including near misses) must be immediately reported to the Site Supervisor and Site Safety Representative. The Site Supervisor will notify management immediately of any incidents on site. Management will report incident to the Client and follow Northwest Territories' legislated incident reporting procedures (see section 10. "Incident/Accident Investigation & Reporting" of AS&C Ltd.'s Health & Safety Management System).

If an injured person requires immediate medical assistance, the Site Supervisor or Site Safety Representative will contact Medical Assistance and inform of the injury, will discuss first aid measures and transportation options. All incidents/accidents and near misses will be investigated using the procedure as set out in the Allen Services & Contracting Ltd. Health & safety Management System.

The purpose of incident investigations will focus on root cause determination and the prevention of recurrence. Incident Investigations should take place as soon as possible. Written incident reports must be completed no later than 48 hours after the incident and incident investigation reports no later than 72 hours after

the incident. All incidents, accidents and near misses will be reported and reports will be made available to the Client by project management.

12.0 VIOLENCE AND HARASSMENT

AS&C Ltd. has developed a Violence and Harassment policy and program and expects all employees, subcontractors and visitors to follow this policy. AS&C Ltd. is committed to providing and promotes a work environment free of violence and harassment. Any act of violence or harassment committed by or against any worker, visitor or member of the public is unacceptable conduct and will not be tolerated. Violations of this policy will be handled in an objective but firm manner.

13.0 SUBSTANCE ABUSE

AS&C Ltd. is committed to a ZERO Tolerance Policy with respect to inappropriate use and possession of drugs and alcohol in the workplace. The possession, distribution or use of mood-altering substances at the workplace, or coming to work under the influence of such substances is a violation of our rules and will be subject to disciplinary action, including a possible dismissal.

The President and project management have the authority to immediately dismiss personnel from the worksite who are under the influence or are in possession of substances and to request a D&A test under reasonable grounds or post incident.

A person found under the influence or in possession will be reprimanded by senior management and disciplinary actions will be taken as per AS&C Ltd.'s disciplinary action chart.

14.0 ENVIRONMENT

Allen Services & Contracting Ltd. takes its environmental responsibilities seriously and is committed to following sound environmental management practices and executing our business activities so that the environment is not adversely affected. Where environmental controls are found to have been compromised, remediation activities will be undertaken immediately.

AS&C Ltd.'s Site Supervisor is responsible for overseeing and controlling activities on site, the prevention of harm to the environment, appropriate waste disposal and any measure taken to prevent environmental damages.

Environmental Management Plans have been developed and are included in

this project safety package. For further information on environmental protection measures, such as spill contingency, waste management, sediment and erosion control, wildlife protection, aquatic life protection, etc., please refer to the Environmental Management Plan.

15.0 SITE-SPECIFIC EMERGENCY RESPONSE PLAN

A site-specific emergency response plan (ERP) has been developed for this project and will be implemented on site upon project start. The ERP will be discussed with all personnel during site-specific orientation and relayed to any visitors that may require access to the worksite. The ERP will include procedures for possible emergency situations, emergency phone numbers, a map of the work site including Muster Point, a map to the closest health facility and emergency response procedures. The site-specific emergency response plan will be made available to all employees at the work site.

16.0 TRAFFIC ACCOMMODATION PLAN

Due to the nature of the project and location of work, traffic will need to be diverted. AS&C Ltd. will build an ice road to divert the traffic during the period of construction work. A Traffic Accommodation Plan will be developed and provided to the Client for review. The Traffic Accommodation Plan will outline activities, procedures, locations and signage for the diversion of traffic during construction activities.

17.0 WORKING ALONE

AS&C Ltd. will not allow any worker to work alone throughout the duration of this project. All employees and subcontractors must work with at least one other worker at all times and have the possibility to either be seen at all times or be able to verbally communicate at all times. A 2-way radio must be available on site at all times to summon emergency services, if required.

18.0 FIRE PROTECTION

AS&C Ltd. is responsible to provide all fire extinguishers on this project. Fire extinguishers on mobile equipment will me a minimum of 2 A 10 B.C. and all other areas will be equipped with fire extinguishers with a minimum rating of 2 A 40 B. C. All fire extinguishers will be maintained as required and monthly inspections will be completed.

19.0 HOT WORK

A Hot Work Permit is required for all operations involving open flame or producing heat and/or sparks. This includes brazing, grinding, cutting, soldering, thawing pipe, torch-applied roofing, and welding. All personnel performing this type of work will request a hot work permit from the Site Supervisor. The Site Supervisor will coordinate hot work activities will all personnel. Hot work will have fire/spark watch, welding blankets and the area will be continuously monitored, a fire watch including a final fire inspection will be completed.

Hot work will be required during the welding of beams onto the piles. A shelter will be built around the welding activities to reduce environmental affects and to assure quality of welds and safety of workers.

20.0 FIRST AID

AS&C Ltd. will provide first aid services, first aid attendants, supplies and equipment in accordance with the applicable requirements of part 5, section 53 through 66 of the Occupational Health and Safety Regulations.

EMERGENCY RESPONSE PROCEDURES

GUNGHI CREEK CULVERT REPLACEMENT PROJECT

Project Location:
Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktu

Table of Contents

1.0 Emergency Phone Numbers

Tuktoyaktuk Health Services

Main Phone 8:30 – 17:00……..(867) 977 - 2321
Satellite Phone……..01-8816-326-17088
After Hours Emergency/Nurse……..(867) 977 - 2321

Tuktoyaktuk Fire Department……(867) 977 - 2222
Tuktoyaktuk Police (RCMP)……...(867) 977 - 1111

Regulatory Contacts

NWT Spill Hotline……..24 hrs……(867) 920 - 8130
Poison Centre……24 hrs……(800) 332 - 1414
WSCC Reporting Line……..24 hrs……(800) 661 - 0792
WSCC Information……(867) 678 - 2301
NWT Chief Safety Officer……(800) 661 - 0792

Utilities

Natural Gas……..Inuvik Gas……(800) 511 - 3447
Electrical……NWT Power Corp……...(800) 668 - 5506

Allen Services & Contracting Ltd.

Brian McCarthy Sr……Supervisor…….....(780) 271- 5666
Barry Setzer.....Site Safety Rep.....(867) 678 - 5078
Lee McMann …….Supervisor.....(780) 999 - 0177
Allen Services Office……..…….....(867) 777 - 4000

Other Phone Numbers

Roger Gruben – camp location Tuktoyaktuk.....(867) 977 - 2230

1.1 General Information for Emergency Response on Active Work Sites

1. In the event that the Media arrives on site – please DO NOT answer any questions;

   **REFER ALL MEDIA QUESTIONS TO AS&C Media Spokespersons ONLY:

   - **Brian McCarthy (Northwest Territories)**
   - **Dean Smith (Alberta)**

2. Do not smoke in emergency situations!
3. Wardens:

   On work sites, the Site Supervisor is always the 1st Chief Warden. The 1st Chief Warden will appoint a 2nd Chief Warden for the events that the 1st Chief Warden is absent.

- If 1st Chief Warden is absent, the 2nd Chief Warden becomes the 1st Chief Warden.
- A Warden must be always present at an active work site – plan ahead!
- If working in remote locations – establish contact with medical emergency facilities and fire department. Provide details of potential emergencies and of your location. Sending a map of the location ahead of time can save valuable time during an emergency and will aid the responders in finding the location faster.
- If working in remote location – remember that a simple first aid kit may not be sufficient. Ensure to have a stretcher, blankets, splints, designated first aid room, etc. in place.
- Ensure the vehicle for transportation of injured or ill is large enough to accommodate a stretcher.
- Familiarize yourself with the routes to medical services, if ambulance services are not available.

2.0 Fire Response Procedure

1. If you are the first one to discover the fire **sound the alarm with 3 short blasts on the air horn, short pause, then 3 short blasts on the air horn again.**
2. Attempt to extinguish the fire only if it is safe to do so. As a rule of the thumb, **if you can't put the fire out within 5 seconds, abandon your efforts.** Remember these steps:

   P – Pull the pin
   A – Aim low at the base of the fire
   S – Squeeze the handle
   S – Sweep from side to side

3. Report the fire to your Chief Warden, the Chief Warden will notify the Fire Department of the fire from a safe location by two-way radio or mobile phone. Fire Department should be called ONLY by the Chief Warden. Provide the address and or description of the location.
4. Shut down your tools and/or equipment, if it is safe to do so.
5. **CALMLY** evacuate the area on a direct and safe way, don't run.
6. Assist others, if it is safe to do so.
7. Assembly at Muster Point for a head count.
8. Report any information about the fire to your Warden.
9. Remain at the Muster Point until cleared to go back ONLY by your Warden or Fire Department authority.
10. Do not smoke in emergency situations!

If You Are On Fire

- **STOP** where you are
- **DROP** to the floor or ground and
- **ROLL** your body to smother the fire.

3.0 Medical Emergency Response Procedure (General)

1. Assess the scene and take charge of the situation, if it is safe to do so.
2. If there are others around you, call them to assist you. Call for the Chief Warden.
3. If the scene is unsafe, proceed with evacuation procedure.
4. Attempt to rescue the victim only if it does not endanger yourself and others.
5. If the scene is safe, check the victim for vital signs as instructed in First Aid Training. If you do not have First Aid Training call someone who has completed the training as listed on the First Aid Attendant list. Do not move the injured unless absolutely necessary.
6. If there are life-threatening injuries or the victim is unresponsive call for medical assistance immediately or instruct someone to call and to report back to you.
7. In case of rendering assistance to personnel exposed to hazardous materials, consult the Safety Data Sheet (SDS) and wear the **appropriate personal protective equipment.**
8. Continue to assist the victim until help arrives or until ready for transportation
9. Do not smoke in emergency situations!

3.1 First Aid Procedure

Administer immediate first aid to injured or exposed personnel using the following steps:

1. Move injured personnel only if necessary to prevent their exposure to further harm.
2. For spills affecting small portions of skin, immediately flush with flowing water for at least 15 minutes. If no visible burn exists, wash with warm water and soap, removing any jewelry to facilitate proper decontamination.
3. For spills on clothes or large areas of skin, quickly initiate showering while removing all contaminated clothing, shoes and jewelry. It may be necessary to cut the clothes off in some instances to prevent contamination of the eyes.
4. Contaminated clothes should be laundered when possible (at work, separate from other clothing, or use a contracted laundering service), decontaminated or discarded. Never take contaminated clothing home.
5. Do not use creams, lotions or salves, except to neutralize the spilled material (e.g., calcium gluconate gel for hydrofluoric acid exposure and polyethylene glycol [PEG 300] for phenol exposure).
6. For splashes into the eyes, immediately irrigate the eyes at an eyewash station for at least 15 minutes. Hold the eyelids away from the eyeball, moving eye in all directions to wash thoroughly behind the eyelids.
7. If necessary administer artificial respiration, but only if CPR trained.

In all cases, the exposed or injured person must seek medical attention:

1. Call emergency services.
2. Relevant safety information such as an SDS should accompany the person.
3. Notify the injured person's supervisor as soon as possible.
4. For non-life threatening/non-critical injuries or illnesses, see Reporting Accidents & Injuries, section 10, of the safety manual.

3.2 Amputation Injuries and Emergencies

If you witness an amputation:

- Call emergency services.
- Stop the bleeding. A complete amputation may not bleed very much. The cut blood vessels may spasm, pull back into the injured part, and shrink. This slows or stops the bleeding. If there is bleeding, do the following:
    - If available, wash your hands with soap and water and put on disposable gloves. If gloves are not available, use many layers of clean cloth, plastic bags, or the cleanest material available between your hands and the wound.
    - Have the injured person lie down and elevate the site that is bleeding.
    - Remove any visible objects in the wound that are easy to remove and remove or cut clothing from around the wound.
    - Apply steady direct pressure for a full 15 minutes. If blood soaks through the cloth, apply another one without lifting the first. If there is an object in the wound, apply pressure around the object, not directly over it.
    - If moderate to severe bleeding has not slowed or stopped, continue direct pressure while getting help. Do all you can to keep the wound clean and avoid further injury to the area.
    - Mild bleeding usually stops on its own or slows to an ooze or trickle after 15 minutes of pressure. It may ooze or trickle for up to 45 minutes. Use the Check Your Symptoms section to determine your next steps.
- Check and treat for shock. The trauma of the accident or severe blood loss can cause the person to go into physiologic shock. Signs of physiologic shock include:
    - Passing out (losing consciousness).
    - Feeling very dizzy or light-headed, like the person may pass out.
    - Feeling very weak or having trouble standing up.
    - Being less alert. The person may suddenly be unable to respond to questions, or he or she may be confused, restless, or fearful.
- Emotional stress from the event may cause symptoms such as light-headedness or fainting. This is sometimes called "emotional shock." Light-headedness and fainting from emotional stress may be confused with physiologic shock.

3.3 Care for an Amputated Body Part

- Recover the amputated body part, if possible, and transport it to the hospital with the injured person. If the part can't be found right away, transport the injured person to the hospital and bring the amputated part to the hospital when it is found.
- Gently rinse off dirt and debris with clean water, if possible. Do not scrub.
- Wrap the amputated part in a dry, sterile gauze or clean cloth.
- Put the wrapped part in a plastic bag or waterproof container.
- Place the plastic bag or waterproof container on ice. The goal is to keep the amputated part cool but not to cause more damage from the cold ice. Do not cover the part with ice or put it directly into ice water.

3.4 Care for the Part of the Body Where the Amputation Occurred

- Stop the bleeding.
- Elevate the injured area.
- Wrap or cover the injured area with a sterile dressing or clean cloth until medical treatment is received.

3.5 Care for a Partially Amputated Body Part

- Elevate the injured area.
- Wrap or cover the injured area with a sterile dressing or clean cloth. Apply pressure if the injured area is bleeding. This will slow the bleeding until the person receives medical care. You don't want to cut off the blood flow to the partially amputated part, so pressure needs to be light—just enough to slow blood loss.
- Gently splint the injured area to prevent movement or further damage.

3.6 Heart Attack First Aid

If you believe you are having a heart attack:

- Call emergency authorities. Don't ignore or attempt to tough out the symptoms of a heart attack. If you don't have access to emergency medical services, have a co-worker drive you to the nearest hospital.
- Do not drive yourself to the hospital.
- Chew and swallow an aspirin, unless you are allergic to aspirin or have been told by your doctor never to take aspirin.
- Take nitroglycerin, if prescribed. If you think you're having a heart attack and your doctor has previously prescribed nitroglycerin for you, take it as directed. Don't take anyone else's nitroglycerin, because that could put you in more danger.

If someone else is having a heart attack:

- Call 9-1-1 immediately.
- Begin CPR if the person is unconscious. If you are with a person who is unconscious, tell the 9-1-1 dispatcher or another emergency medical specialist. You may be advised to begin cardiopulmonary resuscitation (CPR).
- If you haven't received CPR training, doctors recommend performing only chest compressions (about 100 to 120 compressions a minute). The dispatcher can instruct you in the proper procedures until help arrives.
- If an Automated External Defibrillator (AED) is immediately available and the person is unconscious, follow the device instructions for using it.
- If the person is conscious, ask if they have medication for their condition.
- Find/get the medication for them and hand it to them. Do not administer the medication, let the person administer the medication themselves.
- Call 9-1-1 and/or transport the person to the Hospital.

4.0 Emergencies in Individuals With Diabetes

Patients with diabetes may develop complications of the disease, which may present as a medical emergency. Two emergencies that the OFA attendant will most commonly encounter are:

1. **Hypoglycemia** — low blood sugar
2. **Hyperglycemia** — high blood sugar

When managing a patient with diabetes and a decreased level of consciousness, the OFA attendant can often find it difficult to determine if the patient is suffering from hypoglycemia or hyperglycemia.

Hypoglycemia Signs and Symptoms

The OFA attendant must suspect hypoglycemia whenever a patient with diabetes becomes confused or behaves irrationally. Because of the brain's dependence on adequate levels of glucose, failure to quickly recognize and treat hypoglycemia will result in progressive deterioration of the patient's condition and possibly death.

The earliest signs of hypoglycemia are:

- hunger
- pale, clammy skin
- dizziness, trembling, weakness
- confusion, restlessness, irrational behaviour

As hypoglycemia progresses, the patient may develop slurred speech or collapse, or become unresponsive. Seizures and profound sweating are also quite common. The patient's respiration and pulse may increase somewhat but, they often remain normal despite the changes to the patient's level of consciousness.

Hypoglycemia Management

1. The basic principle of treatment is to provide glucose in any form.
2. If the patient is conscious, any sugar-containing substance will suffice — honey, syrup, sugar and water, fruit juice, soft drinks, (not diet drinks), glucose tablets, or candy.
3. The OFA attendant should not be concerned about giving too much sugar. Sips of juice or small amounts of candy are insufficient. A full glass of juice with sugar added or a whole candy bar is usually required.
4. All individuals, even if they regain their normal status, should be referred for medical assessment. All patients with diabetes and a decreased level of consciousness are in the Rapid Transport Category.
5. If the patient has a decreased level of consciousness and is thus not able to take anything by mouth, the OFA attendant has limited options. For hypoglycemic patients in a remote workplace or where medical resources are not readily accessible, it is recommended that a small amount of sugar be placed under the lateral or ¾-prone patient's tongue.
6. Concentrated glucose jelly or glucose tablets are commercially available.

7. Care must be taken when administering sugar because such patients are at very high risk of choking or of aspirating liquid, even if the patients are placed ¾-prone or suction equipment is available. The most effective way to give glucose to these patients is intravenously.
8. After conducting the primary survey and managing any life-threatening conditions, the OFA attendant should position the patient in the lateral or ¾-prone position.
9. With the patient in the lateral or ¾-prone position, the OFA attendant completes the secondary survey. If medical assistance (ambulance) is delayed, the attendant should attempt to place a teaspoon of sugar or concentrated sugar solution — e.g., honey or syrup - under the patient's tongue and the area between the inside of the cheek and the teeth and gums while awaiting transport or en-route.
10. The OFA attendant must take care not to place the sugar at the back of the throat because it may cause the patient to choke. Special attention must be devoted to maintaining the airway of the comatose patient.

Hyperglycemia

When the blood sugar of a person with diabetes rises to high levels, a chain of events is triggered in the body's metabolism. In the absence of adequate amounts of insulin, the body's cells are unable to use glucose and they begin to malfunction. High levels of blood glucose cause excessive urination, which in turn causes severe dehydration and thirst. The changes to the body's metabolism result in acidic waste products accumulating in the blood. This causes a loss of appetite, nausea, vomiting, and deep, rapid breathing. The breath has a characteristic fruity, sweet odour, caused by the accumulation of these acid waste products.

This sequence of events develops gradually, usually over the course of a few days. However, it can progress to coma and, ultimately, death if not adequately treated. At this extreme, hyperglycemia becomes a true emergency.

Hyperglycemia Signs and Symptoms

The earliest signs of hyperglycemia are:

- thirst
- excessive urination
- loss of appetite
- weakness, dizziness

As the hyperglycemia progresses and the body's metabolism alters in other ways, the following signs and symptoms develop:

- nausea, vomiting
- deep, rapid breathing
- dry mouth
- breath has a characteristic fruity sweet odour • weak, rapid pulses
- warm, dry skin
- decreased level of consciousness, coma

Hyperglycemia Management

The OFA attendant can do little to treat hyperglycemia. These patients require prompt treatment in hospital with intravenous fluids and insulin. The OFA attendant must manage the patient's ABCs and complete the primary survey. The patient with a decreased level of consciousness requires special attention to the airway.

5.0 Burn Emergencies

5.1 Major Burn Wound Management

1. Cooling may limit the depth of the burn for some first- and second-degree burns — e.g., from a propane flash or scald. Cooling is soothing and provides some pain relief for all types of burns. Cooling should start within 5 minutes of the burn and be applied for a maximum of 20 minutes.
   A helper can continue the cooling during RTC packaging or the secondary survey. Cooling should be limited to 20% of the body surface. Cooling of a greater portion of the body surface can cause hypothermia. Never apply ice. Any available source of water may be used — e.g., tap water from a kitchen sink or a garden hose. Sterile water or saline solution is neither superior to tap water nor necessary.

2. If water is used to put out the fire, the patient's entire body may have to be covered. This is done to put out the fire but should not be prolonged. In these circumstances, once the fire is out, wet and burned clothing should be removed. Do not cool more than 20% of the body surface except to extinguish flames.

3. Remove burned clothing to ensure all smouldering or melting fabric is no longer in contact with the skin.

4. Remove rings, wrist watches, and footwear, if possible.

5. Elevate burned extremities, if possible. This may decrease fluid loss and tissue swelling. Do not splint burned limbs unless there is an obvious fracture or dislocation.

6. Do not break blisters.

7. Do not apply creams, ointments, or topical anaesthetics to burns.

8. Apply wet dressings on burns to less than 20% of the body surface. Any burn in excess of 20% can be covered with dry dressings or clean sheets. Do not apply tight, encircling dressings.

9. After the burns are dressed, keep the patient comfortable and cover him or her with blankets if necessary.

10. Monitor the patient's ABCs frequently en-route to the hospital.

5.2 Minor Burn Care First - Degree Burns

- Unless a first-degree burn has involved a very large area — e.g., 40% to 50% — of the body surface, a patient with a first-degree burn usually does not require hospitalization. The principal problem in first-degree burns is pain, which can be relieved by cold water compresses. These should be applied only to a maximum 20% of the body surface at any one time. Cold towels are usually effective for burns of the trunk or face. Stop the cooling if the patient starts to shiver.

5.3 Partial-Thickness Second-Degree Burns

- The principal problems with second-degree burns are infection, pain, and shock caused by loss of fluid into blisters. Treatment is similar to that of a first-degree burn. Cooling applied within 5 minutes of burn may limit the depth of this type of burn and reduce pain.
- Do not deliberately break blisters because this may lead to secondary infection.
- If blisters do spontaneously rupture, allow the fluid to drain and treat the burn as outlined previously.

5.4 Third-Degree Burns and Full-Thickness Second-Degree Burns

- All full-thickness burns, regardless of size, should be referred to medical attention as soon as possible.

5.5 Chemical Burns

Chemical burns result from contact with corrosive or caustic substances, usually strong acids or alkalis. A chemical will continue to burn as long as the substance remains in contact with the skin. Early removal of the chemical is of great importance.

The type of tissue injury varies with the chemical properties of the substance involved. The OFA attendant should be familiar with the substances used in his or her particular workplace.

Three primary factors determine the severity of an injury:

1. properties of the chemical
2. concentration of the chemical
3. length of exposure to the chemical

Management of Chemical Burns

The management of chemical burns follows the Priority Action Approach with special emphasis on the following considerations. Throughout the management, the OFA attendant must be careful not to come into contact with the substance.

1. Immediately dilute and remove the chemical
   by copious flushing with water (see Figure 37- 5). Speed is essential. Dry powder chemicals should be brushed from the skin before flushing is started, unless large

quantities of water are immediately available (see Figure 37-6). For the specific management of hydrofluoric acid see Hydrofluoric Acid.

2. Begin flushing immediately, preferably with a hose or shower (see Figure 37-7) and flush vigorously with water for 30 consecutive minutes — by the clock. When the chemical is known not to be water soluble or the substance causing the burn is unknown and not dissolving in the water irrigation, mineral oil should be liberally applied to the burn site for 1 minute. Immediately following the mineral oil application, continue to flush with water for 30 minutes.

3. The use of buffer-irrigating solutions has been considered as an alternative to flushing with water for years. The purpose of the buffer or neutralizing agent is to neutralize the substance rendering chemicals harmless through chelation and encapsulation, eliminating or reducing the severity of the burn. The idea is logical, but impractical. Neutralizing agents are rarely as available as water and some create heat during the neutralizing process, harming the patient. Water irrigation is safe and practical. Immediate access to a flushing system is key in affecting outcomes.

4. Remove any of the patient's clothing that is soiled with the chemical. Continue flushing until the burning sensation stops.

5. Estimate the degree and extent of the burn using the Rule of Nines, as with a heat burn.

6. Continue flushing or use saline-soaked dressings, reapplied every 30 minutes, when possible.

7. Transport to medical aid, constantly monitoring and recording the patient's condition. It may be necessary to continue flushing the area during transportation.

6.0 Gas Leaks and Spills

6.1 Gas Leaks

1. Upon smelling or noticing a gas leak or strong unusual vapors, evaluate the situation. If you believe it to be of dangerous nature, sound the alarm with **3 short blasts on the air horn, short pause, then 3 short blasts on the air horn again.**
2. Shut down your tools and equipment, if it is safe to do so.
3. **CALMLY** evacuate the building on a direct and safe way through the nearest exit, don't run.
4. Assist others on your way out and shut all doors, if it is safe to do so.
5. Assembly at Muster Point for a head count.
6. Report any information about leak/smell to your Warden. The Warden will contact emergency authorities.
7. Remain at the Muster Point until cleared to go back ONLY by your Warden or Emergency Authority (i.e. Police, Fire Department).
8. Do not smoke in emergency situations!

6.2 Chemical and Reportable Spills

1. Evaluate the spill situation: determine if the spill is hazardous or non-hazardous material, quantities of material, areas of concern, potential chemical reactions.
2. Evaluate the need for Personal Protective Equipment.
3. Block any drains if you are inside or in an area where storm sewers are present.
4. Confine the spill area: use absorbent socks or absorbent booms to confine the spill area.
5. Absorb the confined area: use absorbent mats and pads or granular absorbent to absorb the spill.
6. Contact the Chief Warden and report the spill.
7. Package and dispose of contaminated material: any materials used to absorb the spill and contaminated soil should be stored in an approved container and disposed of in an appropriate facility.
8. Reporting: Complete any required health and safety and environmental reports as required by the type and quantity of materials spilled in coordination with the Chief Warden and/or Safety representative.
9. Do not smoke in emergency situations!

6.3 Non-Hazardous Spills

- Will be contained using the spill kits available in at the facility/job site.
- Will be reported based on volume and type of material.
- Contaminated soil will be removed and bagged for safe disposal.
- Contaminated soil will only be disposed of at an approved facility.

6.4 Hazardous Spills

- Allen Service & Contracting Ltd. employees are not trained to respond to hazardous material spills and should contact specially trained crews to control the spill.

7.0 Bomb Threats and Explosions

7.1 Bomb Threats

1. If a threat is received by phone, mail or other means, get as much information as possible.
2. If the threat is received by phone, try to keep the person on the line for as long as possible. Do not hang up the phone, even after the call has been terminated.
3. If a threat is received in person, try to get as much information as possible.
4. Contact your Chief Warden immediately when possible and if it is safe to do so.
5. If a suspicious device is identified, sound the alarm with **3 short blasts on the air horn, short pause, then 3 short blasts on the air horn again.**
6. Shut down your equipment or tools, if it is safe to do so.
7. Evacuate the immediate area and notify your Chief Warden to notify local Emergency Authorities (i.e. Police).
8. **CALMLY** evacuate the building on a direct and safe way through the nearest exit, don't run.
9. Assembly at Muster Point for a head count, if the Muster Point area is safe. If it is not safe, assembly in an area close to the Muster Point where you are visible.
10. Report any information about the bomb threat to your Warden.
11. Remain at the Muster Point until cleared to go back ONLY by your Warden or Emergency Authorities (i.e. Police, Fire Department).
12. Do not smoke in emergency situations!

7.2 Explosions

1. Get down on the floor, take shelter under tables or desks, and protect your face and head against flying glass and debris.
2. **Once it is safe to do so, CALMLY** evacuate the building on a direct and safe way through the nearest exit, don't run.
3. Assist others on your way out, if it is safe to do so.
4. Assembly at Muster Point for a head count, if the Muster Point area is safe. If it is not safe, assembly in an area close to the Muster Point where you are visible.
5. If applicable, assist injured persons and provide first aid.
6. Report any information about the explosion to your Warden.
7. Remain at the Muster Point until cleared to go back ONLY by your Warden or Emergency Authority (i.e. Police, Fire Department).
8. Do not smoke in emergency situations!

8.0 Severe Weather and Natural Disasters

8.1 Tornado

1. When you notice severe weather, seek inside shelter.
2. Seek shelter under desks or tables, if possible.
3. Heavy items that may cause injury should be moved to the floor.
4. Stay away from outside walls and windows
5. Use arms to protect head and neck
6. Remain sheltered until the tornado threat is announced to be over.

8.2 Blizzard

1. Stay calm and await instructions from your Warden.
2. Stay indoors!
3. If there is no heat:
    i. Close off unneeded rooms or areas
    ii. Stuff towels or rags in cracks under doors
    iii. Cover windows at night
4. Eat and drink. Food provides the body with energy and heat. Fluids prevent dehydration.
5. Wear layers of loose-fitting, light-weight, warm clothing, if available.

9.0 Workplace Violence

1. Notify your Chief Warden immediately by phone or other means and report the occurrence. If not possible, contact or let someone contact emergency authorities.
2. Do NOT attempt to physically intervene. Protect yourself first.
3. **STAY CALM**, stay out of way and wait for authorities to arrive.
4. Report all information to your Chief Warden and emergency authorities (i.e. Police).

10.0 Trucker's and Driver's Emergencies

Hi-way trucks are equipped with GEO-TRAC and two-way radio for tracking, monitoring and communication.

Before beginning a trip, all hi-way truck drivers must:

- Inspect their truck and trailer, if applicable
- Ensure fire extinguisher and first aid kit are available
- Check if GEO-TRAC is functioning
- Check if two-way radio is functioning
- Ensure they have a functioning and charged cell phone with them and a charger
- Trips should be planned as to avoid night driving or driving after 10pm

Before beginning a trip, all pick-up drivers must:

- Inspect their vehicle and trailer, if applicable
- Ensure fire extinguisher and first aid kit and reflective triangles are available
- Ensure they have a functioning and charged cell phone with them and a charger
- Trips should be planned as to avoid night driving or driving after 10pm

In case of a break down or accident not involving other vehicles/traffic and physical injuries:

- Put on your hi-vis vest or clothing with hi-vis stripes
- Turn on your hazard lights
- Before Exiting the vehicle ensure there is not traffic or that you step onto traffic
- Secure the scene/vehicle by placing reflecting triangles 100 meters behind the truck/vehicle
- Investigate the problem
- Call your trip supervisor, report and follow instructions

In case of physical injuries:

- If you are or another person are injured, try to administer first aid, if possible
- Call 9-1-1 for medical aid
- Call your trip supervisor immediately
- Report the injury and severity of injury
- Wait for help to arrive, if applicable

What to do if there is no cell service:

- Try calling other truckers with the two-way radio
- Communicate your problem and ask to make a call for you
- If other truckers don't have service, ask for other truckers to help you
- Try waving other traffic down – follow procedure for break down or accident

If you are stranded in remote area:

- Try contacting other truckers with two-way radio
- If the two-way radio is broken, try contacting your supervisor with your cell phone
- If there is no cell service, push the distress/panic button on GEO-Track

EMERGENCY RESPONSE PLAN

Project: Gunghi Creek Culvert Replacement (CT2346)
Location: Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

Approximate Work Location

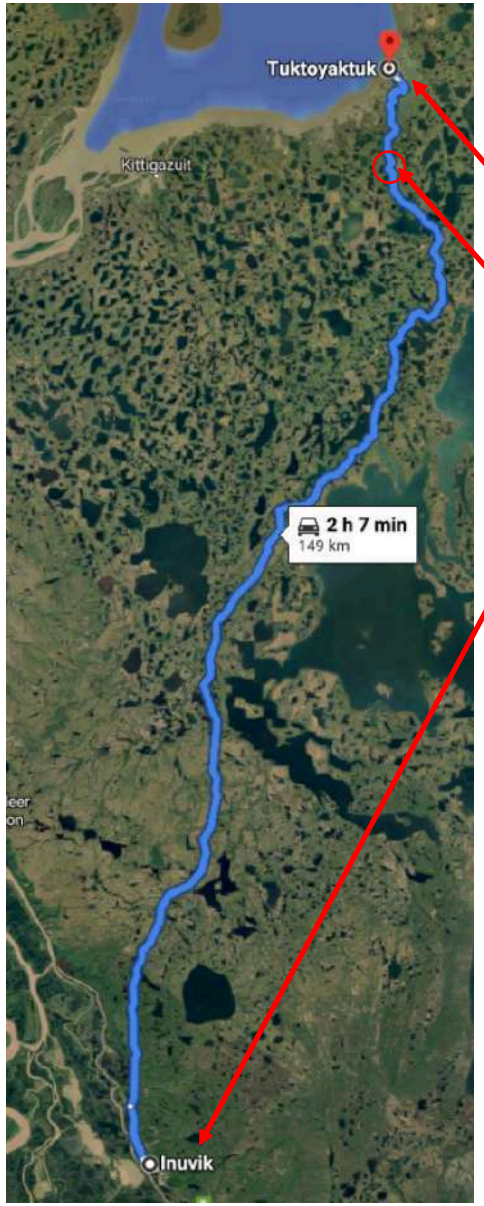
N

- First Aid Kit and other Emergency Equipment
- Fire Extinguisher
- Spill Kit
- Eyewash Station
- Air Horn
- Muster Point
- Job Shack

* All equipment may be transported to location 2

EMERGENCY RESPONSE PLAN

Project: Gunghi Creek Culvert Replacement (CT2346)
Location: Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

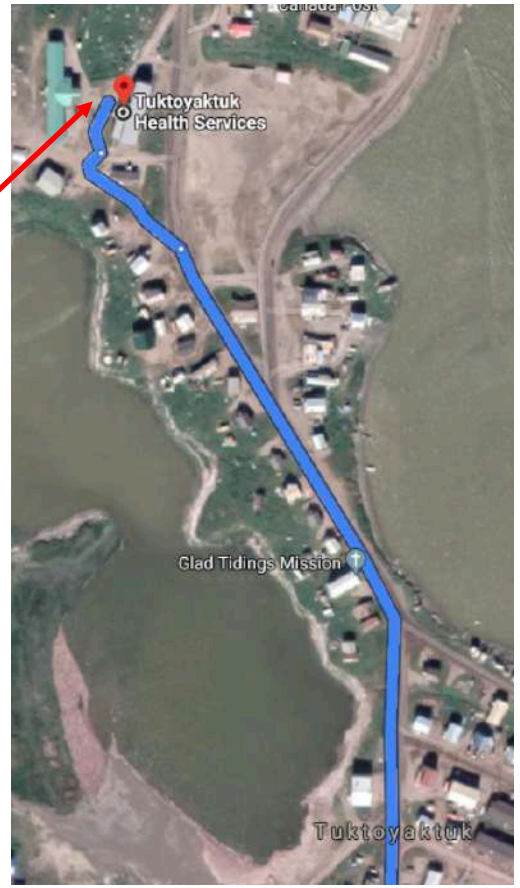


Tuktoyaktuk

Work Area (approx.)

Inuvik

Area Overview and Medical Aid



Directions from work area to Tuktoyaktuk Health Services

Distance: ca. 14.8 km and ca. 20 min (across frozen river)

1. Head east on Dempster Hwy/NT-8 N for ca. 14 km

2. Turn left onto Tetlit Gwich'In Rd and keep driving for ca. 1 km

Tuktoyaktuk Health Services

Address:
Bag Service 1000
Tuktoyaktuk, NT X0E 1C0

Main phone: 867-977-2321
Satellite phone: 01-8816-326-17088

After Hours Emergency: 867-977-2321

Hours of Operation:
Monday to Friday: 08:30-17:00

EMERGENCY RESPONSE PLAN

Project: Gunghi Creek Culvert Replacement (CT2346)
Location: Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

Basic Emergency Response Procedure

- Do not panic, stay calm
- Shut down your equipment, if it is safe to do so
- Assess the scene
- Sound the alarm – 3 short blasts on the air horn, short pause, then again 3 short blasts or shout: HELP-HELP-HELP

- If a person is injured, ensure first aid is provided
- Assess the injury - If severe injury, call Health Services for assistance/guide and to announce arrival with injured

- If fire, use the fire extinguisher and try to extinguish the fire
- If the fire is too big, leave the area immediately
- Call the Fire Department

- Assemble at Muster Point, if not assisting
- Remain at Muster Point until given clear by Site Supervisor

- For all other emergencies, follow the specific Emergency Response Procedures for type of emergency

Remember: DO NOT DISTURB the scene
DO NOT SMOKE in emergency situations
Do not talk to media

EMERGENCY RESPONSE PLAN

Project: Gunghi Creek Culvert Replacement (CT2346)
Location: Inuvik - Tuktoyaktuk Highway, Marker 131.2, 14 km south of Tuktoyaktuk

Emergency Phone Numbers

First Aiders on site marked with 

Tuktoyaktuk Health Services
Main Phone 8:30 – 17:00……..(867) 977 - 2321
Satellite Phone……..……...01-8816-326-17088
After Hours Emergency/Nurse……..……....(867) 977 - 2321

Tuktoyaktuk Fire Department……(867) 977 - 2222
Tuktoyaktuk Police (RCMP)……....(867) 977 - 1111

Regulatory Contacts
NWT Spill Hotline……..24 hrs……..….(867) 920 - 8130
Poison Centre……24 hrs……..….(800) 332 - 1414
WSCC Reporting Line……..24 hrs……..….(800) 661 - 0792
WSCC Information…….....(867) 678 - 2301
NWT Chief Safety Officer……(800) 661 - 0792

Utilities
Natural Gas……..Inuvik Gas……..….(800) 511 - 3447
Electrical……..……NWT Power Corp……...(800) 668 - 5506

Allen Services & Contracting Ltd.

Brian McCarthy Sr……Supervisor…….(780) 271- 5666

Barry Setzer.....Site Safety Rep....(867) 678 - 5078

Lee McMann ……Supervisor..... (780) 999 - 0177

Allen Services Office……..……..….(867) 777 - 4000

Other Phone Numbers

Roger Gruben – camp location Tuktoyaktuk.....(867) 977 - 2230

Fisheries Management and Monitoring Plan

Gunghi Creek Crossing Replacement

Project: EB193003

Prepared for:

Government of the Northwest Territories
Department of Infrastructure

Yellowknife, Northwest Territories

November 2020

Fisheries Management and Monitoring Plan

Gunghi Creek Crossing Replacement

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Prepared for:
Government of the Northwest Territories, Department of Infrastructure
Yellowknife, Northwest Territories

Prepared by:
Wood Environment & Infrastructure Solutions
5681 – 70 Street
Edmonton, AB T6B 3P6
Canada
T: 780-436-2152

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List of Acronyms

BMP	Best Management Practice
CWQG	Canadian Water Quality Guideline.
DFO	Department of Fisheries and Oceans Canada
EISC	Environmental Impact Screening Committee
EMP	Environmental Management Plan
ESC	Erosion and Sediment Control
FJMC	Fisheries Joint Management Committee
FMMP	Fisheries Management and Monitoring Plan
GNWT	Government of the Northwest Territories
ITH	Inuvik to Tuktoyaktuk Highway
IWB	Inuvialuit Water Board
NTS	National Topographic Series
NTU	Nephelometric Turbidity Units
OHM	Ordinary High-Water Mark
PDR	Project Description Report
RoW	Right-of-Way
QA/QC	Quality Assurance/Quality Control
SNP	Surveillance Network Program
TSS	Total Suspended Solids

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Contact Information

Proponent:
Kamran Ata, P.Eng.,
Government of the Northwest Territories
Transportation Infrastructure
2nd Floor, Tatsaotine Building
PO Box 1320
5015 – 49th Street
Yellowknife, NT X1A 2L9
Phone: 867-767-9086 ext. 31134
Fax: 867-873-0288
E-mail: Kamran_Ata@gov.nt.ca

Contractor
Dean S. Smith
Allen Services & Contracting Ltd.
55104 Lamoureux Drive
Sturgeon County, Alberta T8L 5A8
Phone: 780-992-9300
Fax: 780-992-9555
E-mail: dsmith@arcticallens.ca

Brian McCarthy
Allen Services & Contracting Ltd.
70 King Road
P.O. Box 3190
Inuvik, NT X0E 0T0
Phone: 867-777-4000
Fax: 867-777-4077
E-mail: bmccarthy@arcticallens.ca

Engineering Consultant
Riaz Abbas, M.Eng., P.Eng.,
Bridge Manager, Infrastructure
Wood Environment & Infrastructure Solutions
5681 – 70 Street
Edmonton, Alberta T6B 3P6
Phone: (780) 377-3613
Fax: (780) 435-8425
E-mail: riaz.abbas@woodplc.com

Inspector
Water Resources Officer
Environment and Natural Resources
Government of the Northwest Territories
P.O. Box 2749
Inuvik, NT X0E 0T0
Phone: 867-678-6676
Fax: 867-678-6699

Laboratory Analyst
Taiga Environmental Laboratory
Environment and Natural Resources
Government of the Northwest Territories
P.O. Box 1320
Yellowknife, NT X1A 2L9
Phone: 867-767-9235 ext. 53150
Fax: 867-920-8740

Spill Report Line:
24-Hour Spill Reporting Line:
(867) 920-8130

Department of Fisheries and Oceans
José Audet-Lecouffe B.Sc. M.Env.
Biologist
Fish and Fish Habitat Protection Program
Fisheries and Oceans Canada Arctic Region
301-5204 50th Aveenue (Franklin)
Yellowknife NT X1A 1E2
Phone: (867) 444-0684
Email: Jose.Audet-Lecouffe@dfo-mpo.gc.ca

1.0 Introduction

The Government of the Northwest Territories Department of Infrastructure (GNWT) proposes replacement of the existing culvert over Gunghi Creek carrying the Inuvik to Tuktoyaktuk Highway (ITH), south of Tuktoyaktuk, Northwest Territories (the 'Project'). This Fisheries Management and Monitoring Plan (FMMP) document has been developed in collaboration with Fisheries Joint Management Committee (FJMC) and Department of Fisheries and Oceans (DFO) to meet conditions of the Project approvals: Environmental Impact Screening Committee (EISC) *Decision Letter 10-19-02,* the Inuvialuit Water Board (IWB) *Water Licence N5L1-1843*, and DFO Letter of Advice *19-HCAA-01678*. This plan also consolidates construction-related mitigation and monitoring outlined in the Project Description Reports (Wood 2019a; Wood 2019b) and Environmental Management Plan – Revision 3 (Wood 2020a).

The FMMP outlines environmental protection measures that will be implemented in a manner that minimizes impacts during construction and includes a Monitoring Program applicable to the Short-Term (Construction phase) and Medium and Long-Term (Post-construction phase). Implementation of FMMP is also intended to support a feedback mechanism so that mitigation measures can be implemented or revised where and when necessary.

2.0 Project Description

The Gunghi Creek crossing is located 14 km south of Tuktoyaktuk at the ITH KM marker 131.2 (Zone 8W, 577222.00 m E, 7693944.00 m N).The Project will involve replacement of the existing 2000 mm diameter by 38 m long corrugated steel pipe culvert (CSP) with a new 7518 mm span by 3500 mm rise by 38.966 m length open bottom concrete arch bridge, installed with a 0.0015 m/m streambed gradient to match average surveyed streambed gradients. The approved watercourse crossing replacement works will include channel restoration and an onsite detour (ice road and snow fill) to bypass traffic during construction. The Project will not involve water withdrawal from any water sources.

Channel bed restoration through the new open bottom arch bridge will promote flow roughness, slow water velocities, restore habitat connectivity and fish passage through the replacement watercourse crossing. Channel restoration will consist of a 0.45 m thick constructed channel bed of Class 1 rock riprap with over non-woven geotextile that will be embedded and graded to transition smoothly to the natural channel bed elevations upstream and downstream of the structure. The constructed channel bed will incorporate rock boulders (Class 2 [projecting 350 mm above the Class 1 riprap] spaced at 5.0 m intervals. The channel bed transitions will extend 5 m upstream and downstream from the new bridge structure. Armored bank transitions at the bridge inlet and outlet ends will have 2:1 slopes. The Project works will occur within the existing ITH right-of-way (RoW) obtained by the Government of the Northwest Territories, Department of Infrastructure from the Inuvialuit Regional Corporation.

The Project work is tentatively scheduled to begin December 2020 with completion by April 2021, where instream works are expected to be conducted during frozen surface water/no flow conditions, outside the restricted activity timing window for works in or around water of April 1 to July 15. Further, the Project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities, water quality monitoring and fish rescue/salvage from instream construction worksite will not be required.

3.0 Relevant Guidelines

The FMMP was prepared in accordance with the guidance documents outlined below, intended to ensure compliance with Project approvals and applicable territorial and federal legislation. It is understood the DFO Operational Statements are no longer in effect, however the documents are considered best management practices (BMPs) and were therefore considered in preparation of the FMMP.

- Fisheries and Oceans Canada. 2019. *Measures to Protect Fish and Fish Habitat;*
- Fisheries and Oceans Canada. 2020. *Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater;*
- Fisheries and Oceans Canada. 2020. *Interim Code of Practice: Culvert Maintenance;*
- Fisheries and Oceans Canada. 1995 *Freshwater Intake End-of-Pipe Fish Screen Guideline;*
- Fisheries and Oceans Canada. 2013. *Northwest Territories Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat;*
- Fisheries and Oceans Canada. 2007. *Northwest Territories Operational Statement: Fish Timing Windows;*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Culvert Maintenance;*
- Fisheries and Oceans Canada. 2007. *Operational Statement for Ice Bridges and Snow Fills;*
- Fisheries and Oceans Canada. 1993. *Land Development Guidelines for the Protection of Aquatic Habitat;*
- Indian and Northern Affairs Canada. 2010. *Northern Land Use Guidelines Vol. 5: Access Roads and Trails;*
- Canadian Council of Ministers of the Environment. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*; and
- Alberta Transportation. 2017. *Special Provision – Turbidity.*

4.0 Issues and Concerns

The following issues or concerns related to potential Project related effects have been identified in the Project Description Reports (PDR), Environmental Management Plan (EMP), and by the Fisheries Joint Management Committee, Department of Fisheries and Oceans, Inuvialuit Water Board, Environmental Impact Screening Committee, Tuktoyaktuk Hunters and Trappers Committee, and the Department of Environment and Natural Resources, Government of the Northwest Territories.

- Alterations to stream flow and road/bank erosion as potentially detrimental to fish and fish habitat along the Inuvik-Tuktoyaktuk Highway (ITH) and the associated drainage. Concern that mitigation measures undertaken to date have failed or were met with limited success.
- Design and construction of the replacement crossing will impede fish passage.
- The existing culvert and channel are shallower than pre-existing channel conditions.
- Accumulated debris (logs from clearing, boulders, garbage, ice-build-up etc.) can prevent efficient passage of water and fish at the watercourse crossing and may impact fish movement and water flows.
- Removal of riparian vegetation may affect water quality and fish habitat and health.
- Erosion and sedimentation may impact water quality, and fish habitat and health.
- Accidental releases of wastes and fuels (i.e., sewage wastes, solid wastes [i.e., household and construction garbage], petroleum and hazardous wastes [hydrocarbons, hydraulic fluids]) at/or near the watercourse crossing have the potential to impact water quality and fish health.
- Temporary access roads and/or snow fills at water crossing have the potential to result fish passage blockage during spring break-up.

- The following goals of the FJMC (2017) *One People One Plan, Inuvialuit Plan for Fishing on the Inuvik to Tuktoyaktuk Highway* must be met:
  - Maintain the existing stocks of fish in a way that ensures our ability to harvest and maintain traditional and economic activities for generations to come in keeping with the spirit of the IFA.
  - Ensure that our interactions with the fisheries maintain the integrity of the fish and the fish habitat.

5.0 Fisheries Management Goals and Objectives

The following goals and objectives have been identified in the Project PDR and EMP, and by the Fisheries Joint Management Committee and Department of Fisheries and Oceans for the management of fisheries resources related to the Gunghi Creek crossing replacement Project.

- Protection and/or re-establishment of riparian vegetation.
- To ensure that deleterious substances (e.g., sediment, hazardous waste, toxic geochemicals) are not deposited into the receiving environment.
- To maintain water quality in the receiving environment at a level that allows for current and future water uses and the protection of aquatic life.
- To ensure fish passage is maintained following removal of the temporary access road/crossing.
- To ensure fish passage and water flows are maintained during all flow stages through the watercourse crossing following construction completion. Removal of stranded fish within any instream isolated work areas during construction.
- Design and construction of the replacement crossing and channel bed enhancement will restore original flow depths.

In addition, the proposed project is expected to facilitate the following goals of the FJMC (2017) *One People One Plan, Inuvialuit Plan for Fishing on the Inuvik to Tuktoyaktuk Highway*.

- Design of the replacement crossing is expected to maintain fish passage in order to meet the goal of maintaining the existing stocks of fish in a way that ensures ability to harvest and maintain traditional and economic activities for generations to come.
- Design of the replacement crossing is expected to restore habitat connectivity through the replacement crossing in order to meet the goal of maintaining the integrity of the fish and the fish habitat.

6.0 Biophysical Environment and Potential Project Related Effects

6.1 Riparian Vegetation

Riparian areas are valuable to fish and fish habitat as they provide overstream and shading cover, drop-in nutrient supply and provide bank stability. Vegetation at the Project site is dominated by low and dwarf shrub species (dwarf birch [*Betula nana*] and willows) (Stantec 2018). No occurrences of non-native or species at risk plants have been identified at the Project site (ACCS 2019; GNWT 2018a).

Potential Effects

Construction activities may result in minor clearing of riparian vegetation along the existing disturbed RoW. In addition, non-native or invasive plant species (i.e., weeds) often colonize disturbed areas through the dispersal of seeds by wind, water, wildlife or human-related activity. Invasive plants can move into adjacent areas and displace or otherwise affect the post-disturbance recovery of native vegetation. Given

the nature of the Project, there will be opportunities for weeds to invade disturbed areas. The spread of weeds into disturbed areas typically occurs over a medium time period (1-5 years). However, if native vegetation cover can be re-established in a timely manner, weed spread is predominantly eliminated.

6.2 Hydrology

Gunghi Creek originates from Tiktaliktuk Lake approximately 6.0 km upstream of the crossing and drains through a small number of lakes before ultimately discharging into Tuktoyaktuk Harbour approximately 4.0 km downstream. Gunghi Creek has been classified as a permanent watercourse averaging 10.6 m wide and 1.47 m at bankfull height and is expected to freeze to the bottom in the winter. Stream flow in Gunghi Creek is expected to increase in May, with peaks typically reached in June from a combination of snow and ice melt and summer rainfall, and decline after June with rainstorm generated peaks until it reaches base flows in November-December onward. Contributing surface runoff varies throughout the year, but is typically highest in May-June, due to a thin active layer above the permafrost. As temperature and solar radiation increases the active layer increases in depth, resulting a lowered water table and decrease in surface water runoff.

Potential Effects

Watercourse crossing structures have potential to alter natural flow regimes through confined flows and or blockage of the crossing by debris. The proposed replacement crossing and associated channel bed restoration have been designed to improve and maintain channel connectivity and the natural flow regime through the replacement crossing structure at the 1:10 year flood. Further, the proposed replacement structure will provide adequate freeboard to facilitate debris passage over a range of floods.

Instream works are expected to be conducted during frozen surface water/no flow conditions. As such, no hydrologic changes are expected to occur during construction. Further, the project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities and water quality monitoring will not be required.

6.3 Fish and Fish Habitat

Fish species potentially to occurring in Gunghi Creek are presented in Table 1. Of the nine (9) species identified as potentially occurring in the creek, only three (3) (broad whitefish, northern pike, and ninespine stickleback) were reported to inhabit the creek. None of the species potentially occurring in Gunghi Creek are federally listed as a species of special concern, extirpated, endangered or threatened and all species, except pond smelt (ranked as undetermined) were ranked as secure in the NWT. Gunghi Creek was not identified as containing critical habitat for any fish species (DFO 2019a).

The downstream waters of Gunghi Creek (downstream of 1.2 km downstream of the crossing) was identified as an area with potential occurrence of Dolly Varden, a federally listed as a species of 'special concern' (DFO 2019a; GoC 2019a). However, Dolly Varden have not been identified as a species potentially occurring in Gunghi Creek or within the NWT range identified by Stewart et al (2010).

Fish habitat at the crossing was rated by Stantec (2018) as moderate for spawning and rearing, poor-moderate for fish migration, and poor for overwintering habitat. Overall fish use of Gunghi Creek was

expected to be seasonal (open-water) and fish habitat at the crossing was suspected to be primarily a migratory corridor for northern pike, ninespine stickleback and coregonid species (Stantec 2018).

Table 1. Fish Species Potenitally Occurring in Gunghi Creek

Species	Scientific Name	Presence	Sport Fish?	NWT GSRank[5]	SARA Status[6]
Lake whitefish	*Coregonus clupeaformis*	Potential[1]	Yes	Secure	None
Broad whitefish	*Coregonus nasus*	Known[2]	Yes	Secure	None
Least cisco	*Coregonus sadinella*	Potential[1,2]	No	Secure	None
Northern pike	*Esox lucius*	Known[2]	Yes	Secure	None
Pond smelt	*Hypomesus olidus*	Potential[1]	No	Undetermined	None
Burbot	*Lota lota*	Potential[1]	Yes	Secure	None
Ninespine stickleback	*Pungitius pungitius*	Known[2]	No	Secure	None
Lake trout	*Salvelinus namaycush*	Potential[1]	Yes	Secure	None
Inconnu	*Stenodus leucichthys*	Potential[3,4]	Yes	Sensitive	None

Notes:

1. Bond and Erickson (1985), Chang-Kue and Jessop (1992)
2. IMG-Golder (2009)
3. Sawatsky et al. (2007)
4. The use of Gunghi Creek by inconnu ("coney") was suggested by the local wildlife monitor
5. NWT GSRank = species General Status Rank in the Northwest Territories (GNWT 2016)
6. SARA Status = species status under the federal *Species at Risk Act* (ECCC 2018)

Potential Effects

There is the potential for the accidental release of a deleterious substance (e.g., sediments, construction debris, hydrocarbons, and hydraulic fluids) during construction. These substances can negatively affect fish health and habitat, reproductive success, behaviour or result in direct fish mortality.

Watercourse crossing structures have potential to limit/restrict fish passage. The replacement open bottom concrete arch bridge was designed to accommodate fish passage, based on the 1 in 10 year 3 day delay discharge (3Q10) and the DFO Swim Distance & Water Velocity Tool during peak flows (1:2 year flood) for the weakest swimmer (northern pike) of species potentially occurring in Gunghi Creek. Further, the arch bridge design will incorporate rock boulders (Class 2 [800 mm in diameter]) spaced at 5.0 m intervals along the arch bridge invert and reconstructed channel to provide rest areas for fish and promote fish passage. As such, fish passage is anticipated to be accommodated through the replacement structure.

There is potential for alteration or loss of fish habitat resulting from construction of watercourse crossing structures. The replacement works will result in the alteration/improvement of previously disturbed fish habitat through the existing crossing and a net-gain of fish habitat through a wider replacement structure. The proposed channel bed enhancement will maintain long-term instream habitat diversity and habitat connectivity through the Project site. Further, the crossing was designed to match the natural streambed gradient and elevations upstream and downstream of crossing and is therefore expected to restore natural channel depth through the crossing. Overall, productive capacity of fish habitat through the crossing structure is anticipated to improve with a wider channel bed, restored natural streambed and habitat connectivity, and increase in channel area and habitat diversity available to fish.

The Project work is tentatively scheduled during frozen surface water/no flow conditions. Further, the Project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities, water quality monitoring and fish rescue/salvage from instream construction worksite will not be required.

7.0 Cumulative Effects

Cumulative effects or changes to the environment were reviewed in terms of the Project plus existing, approved and planned developments within the Project area. The Project footprint has already been impacted by clearing of native vegetation along the existing ITH RoW. The proposed Project will result in only minor local changes to vegetation and aquatic resources in the area. However, anticipated effects resulting from the Project can be effectively mitigated with implementation of mitigation measures outlined in the Project PDRs, EMP and this FMMP. As a result, overall cumulative effects were expected to be neutral.

8.0 Construction Mitigation Measures

All Project activities will adhere to design specifications, conditions of project approvals (provided Appendix A), relevant guidance documents (Section 3.0), the PDRs and EMP, and will be performed in accordance with the established BMP's and/or mitigation measures outlined below. The Project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore instream worksite isolation facilities, water quality monitoring and fish rescue/salvage from instream construction worksite will not be required.

8.1 General

- Replace/restore any disturbed habitat features and remediate any areas impacted by the Projects works before spring thaw.
- Avoid fording the watercourse and conduct works from above the streambanks, wherever possible. Where instream access is required by construction machinery access should be restricted to one location within the instream work area and traffic should be limited. The access site must be chosen with care, where banks are low, and will be limited to the instream worksite.
- The construction limits will be conspicuously marked with flagging tape to ensure that construction personnel know the disturbance must remain within the proposed footprint and right-of-way.
- Any excavated areas of the channel bed will be backfilled with material that is the same (or better) quality and gradation that was removed.
- Only clean rock, appropriately sized and free of deleterious substances will be used for riprap. These materials will be obtained off site and will not be taken from below the ordinary high-water mark (OHM)[1] of any watercourse.
- Construction will be halted during periods of heavy precipitation (e.g., greater than 15 mm recorded over a 24-hour period, a short duration storm that generates visible sheet flow).
- All spoil materials and debris will be removed from the site and properly disposed of above the OHM so that they do not enter any water body.

1 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. This refers to the "active channel/bankfull level", which is often the 1:2 year flood flow return level.

- Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.
- The Contractor will adhere to environmental management outlined in *Revision 3 – Environmental Management Plans: Erosion and Sediment Control Plans Hazardous Materials Management Plan, Waste Management Plan, Wildlife Management Plan, Spill Contingency Plan, Fisheries Management Plan, Permafrost Monitoring Plan, and Closure and Reclamation Plan.*

8.2 Construction Timing and Duration

Instream activities are to be completed during frozen surface water/no flow conditions in December 2020, which will occur outside the restricted activity timing window for works in or around water of April 1 to July 15. Frozen surface water/no flow conditions are conducive to safe working conditions in the creek channel and may assist in reducing sediment transport capacity. Further, the Project has been approved and FMMP developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction. All efforts will be made by the Contractor to minimize the duration of instream activities and complete the works as expediently as possible. Clean-up of construction at the crossing location will commence immediately following the instream works.

8.3 Riparian Area Protection

The following measures will be implemented for the protection and/or re-establishment of riparian vegetation.

- Limit impacts on riparian vegetation to those approved for the Project works.
- All work will be conducted from above the streambanks, wherever possible, to avoid disturbance to riparian vegetation. Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.
- Maintain an undisturbed vegetated buffer zone between areas of on-land activity and the OHM of any water body, where possible.
- Minimize clearing of riparian vegetation (where possible, prune or top vegetation rather than uprooting/grubbing) and use existing roads, cut lines or trails when accessing the work area to minimize further disturbance within the riparian area (eg., soil compaction, clearing).
- Use methods to prevent soil compaction such as swamp/rig mats or pads.
- Prompt implementation of ESC measures of all disturbed areas.
- Implementing measures to reduce the introduction and spread of weeds and invasive plant species, such as washing and inspecting vehicles/equipment prior to its arrival onsite to ensure that they have been cleaned and are free of dirt, mud, weeds and invasive species; utilizing weed-free seed mixtures; and monitoring to identify potential locations for control measures; is recommended.
- Weed control methods will be implemented during the construction in areas where weed problems are identified. The use of herbicides is not recommended within the Project site due to potential runoff into Gunghi Creek.

8.4 Construction Machinery, Staging and Access

Construction staging areas and creek access will be located in areas that minimize disturbance to the creek, riparian and floodplain areas. Construction staging and access will be established to ensure that:

- Staging and creek access areas will be identified by the contractor and construction area boundaries will be marked with conspicuous flagging tape to ensure that construction personnel know limits and boundaries of the allowable work area.

- General preparation of the staging areas will be completed prior to the commencement of instream works.
- Avoid fording the watercourse and conduct works from above the streambanks, wherever possible. Where instream access is required by construction machinery access should be restricted to one location within the instream work area and traffic should be limited. The access site must be chosen with care, where banks are low, and will be limited to the instream worksite.
- All equipment and machinery will be assembled, cleaned and checked for proper mechanical operation prior to entering the work site. Regular inspections will be completed to ensure that hydraulic, fuel, and lubrication systems are in good condition and equipment is free of leaks.
- Washing, refueling, servicing and staging of machinery and equipment will be conducted at least 100 m from a water body to prevent the entry of any deleterious substances.
- All equipment that is to be used will be free of weed species and aquatic invasive species.
- Equipment travel and operation will be suspended or modified (i.e., swamp mats) in areas where rutting problems on wet ground are jeopardizing topsoil structure and integrity at the work site.

8.5 Instream Work

The following measures will be implemented for the protection aquatic resources.

- Instream activities are to be completed during frozen surface water/no flow conditions in December 2020. Instream works will be avoided during the restricted activity timing window of April 1 to July 15.
- Instream works will be confined to the approved area.
- Minimize removal of any instream natural structures (e.g., woody debris, boulders; if removed, return to its original location).
- Any excavated areas of the channel bed will be backfilled with material that is the same or better quality and gradation that was removed.
- Only clean rock, appropriately sized and free of deleterious substances will be used for riprap. These materials will be obtained off site and will not be taken from below the average high-water level of any watercourse.
- All spoil materials and debris will be removed from the site and properly disposed of above the high-water mark so that they do not enter any water body.
- Should the need for dewatering arise (e.g., groundwater seepage), water will be released into a well vegetated area or settling basin and not directly into any water body. Water returning to the watercourse will be of equal or better quality than the water in the watercourse.

8.5.1 Instream Equipment

All equipment and machinery that will be working within the creek will be assembled, cleaned and checked for proper mechanical operation prior to entering the watercourse. Regular inspections will be completed to ensure that hydraulic, fuel, and lubrication systems are in good condition and equipment is free of leaks. Any equipment that arrives in a dirty condition, as determined by the Environmental monitor will not be allowed on the RoW or facilities site until it has been cleaned.

Biodegradable oils and lubricants (e.g., white lithium greases and vegetable oil hydraulic fluid) will be used in equipment that will be working within the watercourse. Used oil, filter and grease cartridges, lubrication containers, and other products of equipment maintenance will be contained and disposed of at the nearest industrial waste facility.

8.6 Erosion and Sediment Control

Erosion and sediment control (ESC) measures will be implemented as outlined in the Environmental Management Plans, Erosion and Sediment Control Plan. Effective ESC measures will be in place prior to disturbance, during and after construction to prevent sediment from entering a water body. All ESC measures will be inspected regularly to ensure they are functioning properly and are maintained, cleaned and/or upgraded as required until complete revegetation of all disturbed areas is achieved.

8.7 Spill Management

Spill management measures will be implemented as outlined in *Revision 3 – Environmental Management Plans: Erosion and Sediment Control Plans Hazardous Materials Management Plan, Waste Management Plan, Wildlife Management Plan, Spill Contingency Plan, Fisheries Management Plan, Permafrost Monitoring Plan, and Closure and Reclamation Plan.* All Project personnel will be aware of the plan and understand procedures and protocols related to spill management.

8.8 Temporary Access Road – Snow Fill

The following measures will be implemented for the construction, operation and removal of the onsite detour.

- It is understood that construction of the temporary access will not require pumping of any water from any nearby water body.
- Construction/operation of the temporary access/crossing will be during frozen ground conditions and with an adequate layer of snow to prevent damage to the ground by vehicles.
- Construct approaches or access road crossings perpendicular to the watercourse where possible.
- Construct approaches using clean (ambient), compacted snow and ice to a sufficient depth to protect the stream banks or shoreline.
- The banks of the watercourse should be protected using suitable erosion control measures to the satisfaction of the inspector.
- Where logs are used to stabilize the approach, the logs are to be clean and securely cabled together. No logs and woody debris are to be left in the river or on the banks or shoreline.
- Any material placed below the Ordinary High Water mark (OHW[2]) shall be free of any contaminants, debris, or fine material.
- Any temporary modification of the watercourse bank shall be returned to the original state. All materials shall be removed upon project completion.
- Any debris on the surface of the crossing will be removed immediately following construction completion.
- The snow bridge should be V-notched once construction is completed to allow it to melt from the center.
- Remove compacted snow from snow fills prior to the spring freshet.

[2] OHW = ordinary high water level, approximately 1:2 year flow depth

9.0 Monitoring Program

The Monitoring Plan is intended to assess effectiveness of construction mitigation measures, integrity of the replacement crossing, and provide a feedback mechanism so that mitigation measures can be adjusted where and when necessary to meet goals and objectives outlined herein. Monitoring will be conducted by either GNWT personnel, construction operator's, community environmental monitors or qualified environmental contractors.

9.1 Short-Term Monitoring Plan (Construction Phase)

Short-term (construction phase) monitoring will be conducted to assess effectiveness of mitigation measures by either GNWT personnel, construction operator's, community environmental monitors or qualified environmental contractors and will include monitoring of Hazardous Waste. During construction an environmental monitor will be on site to ensure mitigation measures are being followed correctly and to respond to any issues that may arise.

The Project has been approved (pers. comm. Audet-Lecouffe) and Fisheries Management and Monitoring Plan developed with the understanding that water will not be present in a liquid state at the watercourse crossing during construction and therefore water quality monitoring will not be required during the construction phase.

9.1.1 Hazardous Waste Monitoring Plan

In the case a spill is released into the watercourse, the Contractor will have a qualified environmental specialist on standby with appropriate training and qualifications to complete confirmatory water quality sampling and testing (i.e. sampling for hydrocarbons). Monitoring measures, including sampling location, frequency, type, and analysis will be determined at the time of the spill and will be based on the type, timing, location and size of spill. At a minimum sampling will be conducted at the release site and/or containment area to confirm spill clean-up. Confirmatory samples will be sent to the approved laboratory (Taiga Environmental Laboratory; see Contacts) for analysis. Criteria for confirmatory samples will follow *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, where appropriate. Standard lab testing criteria and quality assurance and quality control (QA/QC) plan will be established with the approved analytical laboratory. Emergency Spill Response Reporting will be conducted as outlined in the EMP. Clean-up and reclamation of any spills or unauthorized discharges of water or waste will be completed to the satisfaction of the inspector.

9.1.2 Reporting

Detailed construction notes (i.e., a log of instream construction activity), and photographs of the work area will be documented. Up-to-date daily monitoring records will be maintained on site at all times during the construction program. Further, reporting will be conducted to evaluate the performance of mitigation measures outlined herein and any additional remedial/corrective measures implemented.

9.2 Medium and Long-Term Monitoring Plan (Post-construction phase)

During post-construction operation of the crossing, monitoring will be conducted to assess operational integrity of the replacement crossing to meet fisheries management goals and objectives and conditions of Project approvals. The following outlines medium-long-term monitoring components to be implemented following construction completion. Monitoring will be conducted by either GNWT

personnel, construction operator's, community environmental monitors or qualified environmental contractors.

9.2.1 Watercourse Crossing Inspections and Maintenance

A monitoring/inspection program will be undertaken to assess structural integrity and performance of the constructed crossing works and provide a feedback mechanism so that remedial/corrective measures can be implemented to ensure goals and objective outlined herein and conditions of Project approvals are met.

Parameters and Frequency of Inspections

Monitoring/inspection parameters and frequency are detailed in Table 2.

Table 2. Watercourse Crossing Inspection Parameters

Parameter	Measurement	Frequency[1,2]
Physical condition of slopes and streambanks	Visual observation: • Signs of erosion or slumping	Following spring freshet[1]: • In years 0 – 3; • Ongoing/routine inspections throughout the life of the crossing under the GNWT inspection program.
Physical obstructions to fish passage	Visual observation: • Debris build-up (e.g., woody, substrate or other) • Compacted snow at temporary crossing	
Stream flow / hydraulic obstruction to fish passage	Field measurement. See Section 9.2.2	See Section 9.2.2
Physical condition of arch bridge	Visual observation: • Damage from freeze heaving etc. • Streambed gradient matches design 0.0015 m/m gradient and elevation of the natural channel upstream and downstream of the crossing	Following spring freshet[1]: • In years 0 – 3; • Ongoing/routine inspections throughout the life of the crossing under the GNWT inspection program.
Physical condition of channel bed enhancement	Visual observation: • Changes in composition or distribution of Class 1 riprap and boulders (e.g., scour pool, erosion or build-up of eroded material)	
Erosion and sediment controls	Visual observation: • Areas of erosion or instability • Exposed non-biodegradable sediment controls that can be removed, as per the *Erosion and Sediment Control Manual* (GNWT 2013);	
Revegetation	Visual observation: • Areas of poor vegetation establishment (riparian and upland) • Presence of weeds	• Spring and summer: in years 0, 2, 3, and 5; and[2] • Summer: in years 7 and 10.[2]

Notes: 1: Timing of the inspections will be conducive to flow conditions in Gunghi Creek, and will be determined based on ambient air conditions, hydrologic data and flow discharges of Gunghi Creek or receiving waters where available, and/or visual observations of flow conditions in the Gunghi Creek; 2: Pers comm Audet-Lecouffe 2020.

Remedial/Corrective Measures and Follow-up Monitoring Inspections

Where operational deficiencies in the replacement crossing are identified (i.e., deficiencies in monitoring/inspection parameters) then remedial/corrective measures will be undertaken. Measures may include but are not limited to installation of erosion and sediment control measures, restoring channel bed material, or repairing damaged crossing structure. For revegetation establishment, weed control measures (e.g., mowing, hand picking, seeding of a temporary vegetation cover [annuals]), topsoiling and/or reseeding may be required; generally accepted revegetation success is greater than or equal to 80%. The use of herbicides is not recommended within the Project site due to potential runoff into Gunghi Creek. Follow-up monitoring will be required to evaluate effectiveness of any implemented remedial/corrective measures.

Where post-construction crossing maintenance is required the Fisheries and Oceans Canada *Interim Code of Practice for Culvert Maintenance* provides useful information on the measures to follow to ensure that fish and fish habitat are protected, as follows:

Protection of fish

- Plan in water works, undertakings or activities to respect timing windows to protect fish and fish habitat.
- Conduct in-water works, undertakings and activities during periods of low flow.
- Limit the duration of in-water works, undertakings and activities so that it does not diminish the ability of fish to carry out one or more of their life processes (e.g. spawning, rearing, feeding, migrating).
- Employ fish exclusion netting (up and downstream) to isolate the work site if fish are observed in the vicinity of the works, undertakings and activities.
- Maintain an appropriate depth and flow (i.e. base flow and seasonal flow of water) for the protection of fish.

Protection of fish passage

- Maintain fish passage during the works, undertakings and activities.
    - Avoid changing flow or water level; and
    - Avoid obstructing and interfering with the movement and migration of fish.

Protection of the riparian zone

- Limit access to shorelines and banks or areas adjacent to water bodies.
- Prune or top the vegetation instead of grubbing/uprooting.
- Limit grubbing on watercourse banks to the area required for the footprint of works, undertakings and activities.
- Construct roads, access points and approaches perpendicular to the watercourse or water body.
- Remove vegetation or species selectively and in phases.
- Re-vegetate the disturbed areas with native species suitable for the site.
- Restore the stream banks and riparian vegetation affected by the works, undertakings and activities to their natural state (substrate granularity, profile, vegetation, etc.).

Protection of fish habitat from sedimentation

- Use only clean materials (e.g., rock, coarse gravel, wood, steal, snow) for works, undertakings and activities.
- Install effective erosion and sediment control measures prior to beginning works, undertakings and activities in order to stabilize all erodible and exposed areas.
    - Develop and implement an erosion and sediment control plan to avoid the introduction of sediment into any water body during all phases of the works, undertakings and activities;
    - Schedule work to avoid wet, windy and rainy periods and heed weather advisories;
    - Regularly inspect and maintain the erosion and sediment control measures and structures during all phases of the works, undertakings and activities;
    - Regularly monitor the watercourse for signs of sedimentation during all phases of the works, undertakings and activities and take corrective action if required;
    - Use biodegradable erosion and sediment control materials whenever possible;
    - Keep the erosion and sediment control measures in place until all disturbed ground has been permanently stabilized;
    - Remove all sediment control materials once site has been stabilized; and
    - Dispose of, and stabilize, all excavated material above the ordinary high water mark or top of bank of nearby waterbodies and ensure sediment re-entry to the watercourse is prevented.

Protection of fish and fish habitat from deleterious substances (including suspended sediment)

- Develop and immediately implement a response plan to prevent deleterious substances from entering a water body.
    - Stop works, undertakings and activities in the event of a spill of a deleterious substance;
    - Immediately report any spills (e.g., sewage, oil, fuel or other deleterious material), whether near or directly into a water body;
    - An emergency spill kit will be kept onsite ring all phases of the works, undertakings and activities;
    - Contain any water with deleterious substances;
    - Ensure clean-up measures are suitably applied so as not to result in further alteration of the bed and/or banks of the watercourse;
    - Clean-up and appropriately dispose of water contaminated with deleterious substances;
    - Maintain all machinery on site in a clean condition and free of fluid leaks;
    - Wash, refuel and service machinery and store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering the water; and
    - Dispose of all waste materials (e.g., construction, demolition, commercial logging) above the ordinary high water mark to prevent entry into the water body.

Additional measures for culvert maintenance

- Limit the removal of accumulated material and debris (e.g., branches, stumps, other woody materials, garbage, etc.) to the area within the culvert and immediately upstream and downstream of the culvert.
    - Remove accumulated materials and debris slowly to allow clean water to pass, to prevent downstream flooding and to reduce the amount of sediment-laden water going downstream; and
    - If maintenance activities reduce the water level within the culvert, take appropriate measures to restore previous streambed elevation/conditions.
- If replacement rock reinforcement/armouring is required to stabilize eroding inlets and outlets, the following measures should be implemented:
    - Place appropriately-sized, clean rocks into the eroding area;
    - Do not obtain rocks from below the ordinary high water mark of any water body;
    - Ensure that acid generating rock is not used;

- Avoid the use of rock that fractures and breaks down quickly when exposed to the elements; and
- Install rock at a similar slope to maintain a uniform stream bank and natural stream alignment.

DFO should be notified prior to conducting any emergency debris removal work. Where emergency material/debris removal is required, the work should follow all other measures to the greatest extent possible. The DFO notification form is found here: https://www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/forms-formes/notification-eng.pdf.

9.2.2 Fish Passage and Stream Flow

Monitoring will be conducted to confirm fish passage aligns with DFO fish passage requirements and stream flows are maintained at all flow stages through the replacement crossing and temporary access/crossing.

Frequency

Temporary Access/Crossing – Stream Flows

Monitoring of the temporary access/crossing will be conducted immediately prior and during the spring freshet.

Replacement Crossing – Fish Passage and Stream Flows

Monitoring will be conducted following the spring freshet[3] and in the fall during the low flow stage[3] in years 0 – 3, and in future years during ongoing/routine inspections throughout the life of the crossing under the GNWT inspection program.

Methods

Temporary Access/Crossing – Stream Flows

Monitoring will be conducted to ensure fish passage is accommodated through the snow bridge and include inspection of the snow bridge to confirm v-notch was constructed in the centre of the crossing and snow is melting. The inspection will serve as a feedback mechanism to determine where additional mitigation measures are necessary, such as removal of compacted snow.

Replacement Crossing – Fish Passage and Stream Flows

A fish passage study will be completed in relation to 1) gradient through the crossing; 2) water velocities present in the crossing structure during the spring freshet; and 3) flow connectivity during low flow conditions as follows.

1) The newly constructed and natural channel streambed elevations and gradient will be measured to ensure the following:
   - Design 0.0015 m/m gradient is maintained through the replacement crossing; and
   - Elevations through the replacement crossing match the natural channel upstream and downstream of the crossing.

3 Timing of the inspections will be conducive to flow conditions in Gunghi Creek, and will be determined based on ambient air conditions, hydrologic data and flow discharges of Gunghi Creek or receiving waters where available, and/or visual observations of flow conditions in the Gunghi Creek.

Where design gradient is not maintained and/or constructed and natural channel elevations do not maintain a smooth transition through the replacement crossing remedial/corrective measures will be implemented.

2) Monitoring during the spring freshet will include velocity and water depth measurements at the crossing inlet. Where velocity is less than or equal to the design velocity 0.97 m/s as approved under the DFO Letter of Advice *19-HCAA-01678* to meet fish passage requirements of the DFO Swim Distance & Velocity Tool, fish passage is expected to be maintained.

   Where field measured velocity exceeds design velocity remedial/corrective measures will be identified.

3) During the low flow stage minimum flow depth will be measured in natural channel upstream and downstream of the crossing, and through the replacement crossing, including the channel bed enhancement area and transition area to the natural channel upstream and downstream of the crossing. Minimum flow depth measured in the natural channel will be compared to that of the operational replacement crossing measurements. Obstruction or interference with fish passage is not expected where minimum flow depth above the Class 1 riprap through the replacement crossing matches the minimum natural channel depth.

   Where field measured minimum flow depth is shallower than the natural channel remedial/corrective measures will be identified.

9.2.3 Reporting

Detailed monitoring/inspection notes and photographs of the work area will be documented. Follow-up reporting will be completed to include the following:

- Summary results of each inspection, including any deficiencies in the structural integrity or performance of the constructed replacement crossing;
- Identify where additional monitoring/inspection is required; and
- Identify any remedial/corrective measures required or taken to ensure goals and objectives outlined herein and conditions of the Project approvals are met.

9.2.4 Water Quality

Monitoring will be conducted to assess water quality of the receiving environment downstream of the crossing. Water quality sampling and analysis will be conducted in accordance with Annex 1: Surveillance Network Program of the *Water Licence N5L1-1843,* provided in the Appendix A and detailed below. Monitoring will be conducted by GNWT personnel, construction operator's, community environmental monitors or qualified environmental contractors.

Water Quality Parameters

The water quality parameters to be sampled and analyzed under the SNP are detailed below. Turbidity, temperature, DO, pH and conductivity will be measured in-situ using a water quality multi-probe. All other parameters will be sent to an approved laboratory for analysis.

- Total Suspended Solids (TSS);
- Turbidity (Nephelometric Turbidity Units);
- Temperature;

- Dissolved Oxygen (DO);
- pH;
- Conductivity;
- Calcium;
- Magnesium;
- Hardness;
- Nutrients (ammonia, nitrate, nitrite);
- Total Arsenic;
- Basic metal scan (including: total Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe);
- Total mercury; and
- Total petroleum hydrocarbons,

As part of the Surveillance Network Program (SNP) flow and volume will be measured and recorded for daily, monthly and annual quantities (in cubic meters [m^3] or litres [L]) of sewage collected and transported off site to the licenced Sewage Waste Disposal Facilities.

Sample Location

Signs to identify monitoring stations will be posted within seven (7) days prior to the beginning of construction and be located and maintained to the satisfaction of the Inspector. Monitoring stations will be located 50 m upstream (Station No. 1843-1a) and 50 m downstream (Station No. 1843ab) of the watercourse crossing.

Frequency of Sampling and Analysis

The licence stipulates that frequency of sampling and analysis will conducted in two parts:

1) Immediately following the completion of the construction activities sample monthly during periods of open water.
2) Once annually during spring freshet for the duration of the licence (i.e., up to and including 2025).

Standards and Criteria for Evaluating Effects

Baseline water quality data was not available at the time of writing to characterize conditions of Gunghi Creek to develop site-adapted or site-specific environmental quality objectives/criteria. As standards have not been stipulated in conditions of the *Water Licence N5L1-1843*, criteria for water quality will follow the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, which are generally the most stringent guidelines. Water quality parameters to be sampled and analyzed, as per *Water Licence N5L1-1843* are listed in Table 3.

Long-term exposure guidelines are presented to identify waterborne concentrations intended to protect all forms of aquatic life for indefinite exposure periods, following construction completion. **Short-term** exposure guidelines are not presented as they are intended for guidance on the impacts of severe, but transient, situations (e.g., spill events to aquatic receiving environments, infrequent releases of short-lived/non-persistent substances or inappropriate use or disposal of a substance). Where a short-term/severe exposure is identified following construction completion, the cause of the event and compliance criteria should be identified, and additional compliance monitoring may be required.

Table 3. Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life

Parameter	Criteria[1,2]	Criteria Source
Ammonia	Total Ammonia: see Table 4 below. Un-ionized Ammonia: concentration not to exceed 0.019 mg NH_3/L. (equivalent to 0.016 mg/L NH_3-N)	CCME 2010
Arsenic (As; Total)	Concentration not to exceed 5 µg/L	CCME 2001
Cadmium (Cd; Total)	**Long-term:** for waters of 50 mg $CaCO_3$/L hardness, concentration not to exceed 0.09 µg/L. At hardness values between 17 and 280 mg $CaCO_3$/L, the CWQG can be calculated with the equation: $CWQG\ (\mu g/L) = 10^{\{0.83(\log[hardness]) - 2.46\}}$	CCME 2014
Calcium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Chromium (Cr)	Total Chromium: No water quality criteria for protection of aquatic life. Hexavalent Chromium (Cr(VI)): concentration not to exceed 1 µg/L. Trivalent Chromium (Cr(III)): concentration not to exceed 8.9 µg/L	CCME 1999a
Cobalt (Co)	No water quality criteria for protection of aquatic life	CCME 2019a
Conductivity	No water quality criteria for protection of aquatic life.	CCME 2019a
Copper (Cu)	When the water **hardness ($CaCo_3$) is 0 to < 82 mg/L**, Cu concentration not to exceed 2 µg/L. At **hardness ≥82 to ≤180 mg/L**, Cu concentration not to exceed the value calculated using the following equation: $CWQG\ (\mu g/L) = 0.2 * e^{\{0.8545[\ln(hardness)]-1.465\}}$ At **hardness >180 mg/L**, Cu concentration not to exceed 4 µg/L. If the **hardness is unknown**, not to exceed 2 µg/L.	CCME 2019a
Dissolved Oxygen	For cold water ecosystems: 6.5 mg/L to 9.5 mg/L	CCME 1999b
Hardness ($CaCO_3$)	No water quality criteria for protection of aquatic life; Used to determine hardness dependent criteria of other parameters.	CCME 2019a
Iron (Fe)	Concentration not to exceed 300 µg/L	CCME 2019a
Lead (Pb)	When the **hardness ($CaCo_3$) is 0 to ≤ 60 mg/L**, Pb concentration not to exceed 1 µg/L At **hardness >60 to ≤ 180 mg/L**, Pb concentration not to exceed the value calculated using the following equation: $CWQG\ (\mu g/L) = e^{\{1.273[\ln(hardness)]-4.705\}\ (\mu g/L)}$ At **hardness >180 mg/L**, Pb concentration not to exceed 7 µg/L. If the **hardness is unknown**, Pb concentration not to exceed 1 µg/L	CCME 2019a
Magnesium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Manganese (Mn)	**Long-term:** CWQG (µg/L dissolved Mn) is calculated using the calculator in Appendix B of the *Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese* (CCME 2019c), found here: http://st-ts.ccme.ca/en/index.html?lang=en&factsheet=129.	CCME 2019b CCME 2019c
Mercury (Hg; Total)	Concentration not to exceed 0.026 µg/L	CCME 2003

Parameter	Criteria[1,2]	Criteria Source
Nickel (Ni)	When the water **hardness ($CaCo_3$) is 0 to ≤ 60 mg/L**, Ni concentration not to exceed 25 µg/L. At **hardness > 60 to ≤ 180 mg/L**, Ni concentration not to exceed the value calculated using the following equation: *CWQG (µg/L) = $e^{\{0.76[ln(hardness)]+1.06\}}$* At **hardness >180 mg/L**, Ni concentration not to exceed 150 µg/L. If the **hardness is unknown**, Ni concentration not to exceed 25 µg/L.	CCME 2019a
Nitrate	**Long-term:** concentration not to exceed 13 mg NO_3^-/L (equivalent to 2.93 mg NO_3^--N/L)	CCME 2012
Nitrite	Concentration not to exceed 60 µg NO_2-N/L (equivalent to 197 µg NO_2/L).	CCREM 1987
pH	Acceptable between 6.0 and 9.0	WL
Total Petroleum Hydrocarbon (TPH)	Maximum average concentration not to exceed 3 mg/L Maximum concentration of any grab sample not to exceed 5 mg/L	WL
Total Suspended Solids (TSS)	**During clear flow**: Maximum average increase of 5 mg/L from background levels for a longer term exposure (e.g., 30-d period). **During high flow or turbid waters**: Maximum increase of 25 mg/L from background levels at any one time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.	CCME 2002
Turbidity (Nephelometric Turbidity Units)	**During clear flow**: Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period). **During high flow or turbid waters**: Maximum increase of 5 NTUs from background levels at any one time when background levels are between 8 and 50 NTUs. Should not increase more than 10% of background levels when background is >50 NTUs.	CCME 2002
Temperature	**Thermal Stratification**: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins. **Maximum Weekly Average Temperature**: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.	CCME 1999c
Zinc (Zn)	**Long-term:** CWQG for dissolved zinc and is calculated using the following equation, which is valid for hardness ($CaCO_3$) between 23.4 and 399 mg/L, pH between 6.5 and 8.13, and DOC between 0.3 to 22.9 mg/L: CWQG = $\exp^{(0.947[\ln(\text{hardness mg·L-1})] - 0.815[\text{pH}] + 0.398[\ln(\text{DOC mg·L-1})] + 4.625)}$.	CCME 2018
Notes: 1: *Canadian Water Quality Guidelines for the Protection of Aquatic Life* available at the time of writing. Where updated guidelines are published prior to the start of sampling, the most recent criteria shall be followed; 2: WL – *Water Licence N5L1-1843*.		

Table 4. Canadian Water Quality Guideline for Total Ammonia (mg NH_3/L) for the Protection of Aquatic Life

Temperature (°C)	pH							
	6.0	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**10.0**
0	231	73.0	23.1	7.32	2.33	0.749	0.25	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021
Notes: CCME 2019c								

10.0 Quality Assurance / Quality Control Plan

As per Conditions of the *Water Licence N5L1-1843*, all field operation staff shall be provided with appropriate advice/training on how to implement the mitigation measures and monitoring procedures outlined in this FMMP.

In accordance with *Water Licence N5L1-1843,* sampling, preservation and lab analysis will be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, the American Waterworks Association and the Water Environmental Federation or by such other methods as approved by the approved Analyst (Taiga Environmental Laboratory).

The Quality Assurance/Quality Control (QA/QC) Plan (provided in Appendix B), prepared by Wood and approved by the Analyst (Taiga Environmental Laboratory), as per Conditions of the *Water Licence N5L1-1843,* will be implemented for the Water Quality monitoring.

11.0 Analysis

As per Conditions of the *Water Licence N5L1-1843*, water quality analysis will be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, the American Waterworks Association and the Water Environmental Federation or by such other methods as approved by the approved Analyst (Taiga Environmental Laboratory). Lab testing standards will be confirmed with the approved Analyst.

12.0 Reporting and Notification

Monitoring/inspection and maintenance records will be completed for all work conducted under the Monitoring Plan. The records will include results of the monitoring/inspection activities, and indicate any issues/deficiencies that were identified. Results of the monitoring program will be provided in a report, which will also evaluate the performance of mitigation measures, integrity of the operational replacement crossing, and provide a description of the corrective measures implemented.

The DFO Yellowknife Office will be notified at least 10 days before starting the Project works. In accordance with the DFO Letter of Advice *19-HCAA-01678* results of the Monitoring Plan will be reported to DFO: One report will be submitted to DFO outlining results of construction monitoring, and an annual report will be submitted for the term of the *Water Licence N5L1-1843* (i.e., up to and including 2025).

In accordance with the *Water Licence N5L1-1843*, the monthly and annual SNP results, including laboratory results, QA/QC results and interpretation, and data analysis or calculations will be submitted as part of the Annual Report to the Inuvialuit Water Board by January 31st of each year for the term of the licence (ie., up to and including 2025). All data and information from the SNP will presented in tabular summaries. Any anomalies and trends will be identified. Rationale for why any samples were not collected will also be provided.

13.0 Closure

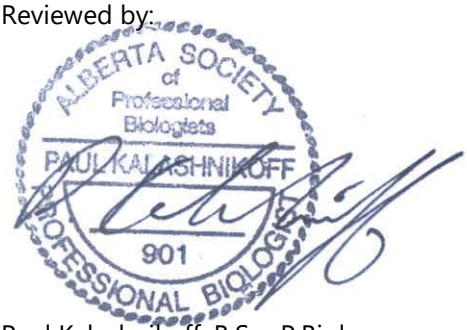
This report has been prepared for the exclusive use of the Government of the Northwest Territories and their authorized users for specific application to the project site. The methods identified were prepared in accordance with the proposed work scope for the site, industry best management practices and guidelines, and conditions of approvals for the Project. No other warranty, expressed or implied, is made.

We trust that the information contained within this report satisfies your requirements. Should you have any questions, please contact the undersigned at your earliest convenience.

Respectfully submitted,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Reviewed by:



Jessica Parker, B.Sc., P.Biol.
Environmental Biologist

Paul Kalashnikoff, B.Sc., P.Biol.
Senior Environmental Biologist

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Appendix A

Project Approvals

INUVIALUIT SIVUNNIUQPAIT IMAKKUN

INUVIALUIT WATER BOARD

January 31, 2020

David B. MacDonald
Project Manager
Government of Northwest Territories
Department of Infrastructure
P.O. Box 1320
5015 – 49 Street, Yellowknife, NT X1A 2L9

Dear Mr. MacDonald:

RE: N5L1-1843 – Government of Northwest Territories, Department of Infrastructure – Gunghi Creek Culvert Replacement with Open Bottom Concrete Arch Bridge, NWT

The Inuvialuit Water Board (IWB) is pleased to attach Water Licence N5L1-1843 granted to Government of Northwest Territories, Department of Infrastructure for the period commencing February 1, 2020 and expiring January 31, 2025. Included are the terms and conditions applying to the Licence and the General Procedures for the Administration of Licences in that portion of the Inuvialuit Settlement Region located in the Northwest Territories. Please review the Licence, the terms and conditions and the General Procedures and address any questions to the IWB.

A copy of the Licence and all documentation associated with the application and issuance of the Licence has been filed on the IWB Public Register. Copies are available at the IWB office and on the IWB website. All inspection reports and other documentation related to the Licence will also be filed in the Public Register and will be considered if an amendment to the Licence is requested.

The IWB appreciates the cooperation of the Licencee in complying with the terms and conditions of the Licence. Should you have questions or concerns, please contact Mardy Semmler, Executive Director, at 867-678-2942.

Sincerely,

Roger Connelly
Chairperson

Attachments

Copied to: Lloyd Gruben, Water Resource Officer – ENR Inuvik Region

INUVIALUIT SIVUNNIUQPAIT IMAKKUN

INUVIALUIT WATER BOARD

INUVIALUIT WATER BOARD

Pursuant to the *Waters Act* and Waters Regulations the Inuvialuit Water Board, hereinafter referred to as the Board, hereby grants to

Government of Northwest Territories, Department of Infrastructure

PO Box 1320
5015-49 Street, Yellowknife
Northwest Territories, X1A 2L9
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water and deposit waste as provided for under the *Waters Act* and Waters Regulations and subject to and in accordance with the terms and conditions specified in this Licence.

Licence Number	N5L1-1843
Licence Type	"B"
Water Management Area	Northwest Territories - 5
Location	69° 20' 37.957" N and 133° 2' 17.542" W Northwest Territories
Purpose	To cross a watercourse
Description	Industrial Undertaking
Quantity of Water Not To Be Exceeded	No water withdrawal from any source
Effective Date of Licence	February 1, 2020
Expiry Date of Licence	January 31, 2025

This Licence issued and recorded at Inuvik includes and is subject to the annexed conditions.

INUVIALUIT WATER BOARD

Chairperson

Date January 30, 2020

PART A: SCOPE AND DEFINITIONS

1.Scope

a) This Licence entitles the Government of Northwest Territories, Department of Infrastructure to cross a watercourse associated with an industrial undertaking for the "replacement of the existing culvert with an open bottom concrete arch bridge on Gunghi Creek" located in the Inuvialuit Settlement Region (ISR) of the Northwest Territories with coordinates 69° 20' 37.957" North and 133° 2' 17.542" West.

b) This Licence is issued subject to the conditions contained herein with respect to the crossing of a watercourse, taking of water and the depositing of waste of any type in any waters or in any place under any condition where such waste or any other waste that results from the deposits of such waste may enter any waters. Whenever new Regulations are made, or existing Regulations are amended by the Commissioner in Executive Council under the *Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of waste that may be so deposited or under which any such waste may be so deposited, this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations.

c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable federal, territorial and municipal legislation for which any and all applicable licences and permits shall also be obtained by the Licensee.

d) This Licence is issued subject to the conditions contained herein with respect to the use of waters and deposit of waste as prescribed in Section 10 and Section 11 of the *Waters Act.*

2. Definitions

In this Licence: N5L1-1843

"*Act*" means the *Waters Act,* S.N.W.T. 2014, c.18;

"Amendment" means a change to any terms and conditions of this Licence as provided for under Section 36 (1)(b) of the *Act*;

"Analyst" means a person designated as an analyst by the minister under Section 65 (1) of the *Act;*

"Approved Waste Disposal Facilities" mean all facilities approved for the disposal of waste;

"Board" means the Inuvialuit Water Board;

"Closure" means the permanent dismantlement of the Project for the specific purpose of making it unavailable for its originally intended use. This includes the removal of associated equipment and structures used in the construction or maintenance of the undertaking;

"Construction" means any activity initiated to build any component of, or associated with, the Project;

"Contingency Plan" means a detailed program of action designed to control and/or minimize the effects of an emergency situation in which prompt corrective measures, beyond normal procedures, are required to protect human life, to minimize injury and/or losses, and to reduce the exposure of physical assets and the receiving environment to risks resulting from an incident;

"Discharge" means the approved direct or indirect release of any water or waste into a receiving environment;

"Earthworks" are engineered structures that are constructed with or require excavation into one or more of the following unconsolidated materials: waste rock, tailings, overburden, sand, silt, clay, gravel, soil or any other borrow material;

"Engineer" means a person registered as a professional engineer with the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists and whose principal field of specialization is appropriate to address the components of the Project;

"Greywater" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing, but does not include toilet wastes;

"Hazardous Wastes" mean those wastes with properties such as flammability, corrosiveness, or inherent toxicity that may pose a variety of risks, from skin damage on contact, to the contamination of ground water, surface water, or soil leaching when improperly treated, stored, transported, or disposed of, or otherwise managed;

"Inspector" means a person designated by the minister under Section 65 (1) of the *Act*;

"Maximum Average Concentration" means a running average of any four (4) consecutive analytical results obtained during a single open water season. If less than four (4) analytical results are obtained, then the running average is the average of those samples collected;

"Minister" means a duly appointed member of the Government of the NWT (GNWT) Executive Council who is responsible for the *Act*;

"Modification" means an alteration to an existing approved physical structure that forms part of the Project that introduces a new structure or replaces or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion;

"Project" means the replacement of the existing culvert with an open bottom concrete arch bridge on Gunghi Creek by Government of Northwest Territories, Department of Infrastructure as defined in the water licence application and associated documents, which includes the Project Description;

"Receiving Environment" means, for the purpose of this licence, the natural environment that receives any deposit or discharge of waste, including seepage or runoff, from the Project;

"Reclamation" means the process of restoring the Project area, as nearly as possible, to the same condition as it was prior to the commencement of the licensed activity;

"Regulations" means rules and or directives promulgated pursuant to Section 63 of the *Act*;

"Sewage" means all toilet wastes and greywater;

"Spill" see 'Unauthorized Discharge';

"Surveillance Network Program (SNP)" means a monitoring program, as detailed in Annex 1 of this Licence, requiring environmental sampling and analysis, to determine water quality, to assess discharge quality, determine licensee compliance with Licence terms and conditions and to assess potential licensee activity impact on the environment;

"Temporary Hazardous Waste Containment Area" means a bermed and lined area constructed and maintained for the temporary storage of hazardous wastes, prior to their treatment and/or disposal;

"Toilet Wastes" means all human excreta and associated products, but does not include greywater;

"Unauthorized Discharge" means a spill, a release, discharge or seepage of any waters or waste not authorized under this licence or by an Inspector;

"Waste" means any substance defined as waste as defined by Section 1 of the *Act;*

"Waters" means any waters as defined by Section 1 of the *Act;* and

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board no later than January 31 of each year which shall contain the following information on Project related activities during the prior 12 month period:
    a) the monthly and annual quantities in cubic metres (m^3) or litres (L) of sewage disposed of and associated disposal location;
    b) the monthly and annual quantities and types of non-hazardous waste removed from the Project and associated disposal locations;
    c) the monthly and annual quantities and types of hazardous waste removed from the Project and associated disposal locations;
    d) the quantities and types of hazardous and non-hazardous waste temporarily stored on site including disposal plans for each type of waste;
    e) a summary report which includes all data and information generated under the "Surveillance Network Program (SNP)";
    f) a summary of the existing culvert replacement and an open bottom concrete arch bridge construction and installation activities completed and an updated construction schedule;
    g) a list and description including location and volumes of all unauthorized discharges, spills and summaries of all associated remediation activities and follow-up action taken;
    h) a description of any spill training and communications exercises carried out;
    i) a report on any studies required by the Board and a brief description of any future studies planned by the Licensee;
    j) a summary of modifications and/or major maintenance work as related to the Project completed;
    k) a description of any updates and/or revisions to any of the following plans:
        i. Spill Contingency Plan
        ii. Waste Management Plan;
        iii. Erosion and Sediment Control Plan;
        iv. Aquatic Effects Monitoring Plan;
        v. Wildlife Management Plan, and
        vi. Closure and Reclamation Plan.

2. The Licensee shall comply with the "Surveillance Network Program" annexed to this Licence, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.

3. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

4. The Licensee shall, within seven (7) days prior to beginning of construction, post the necessary signs to identify the stations of the "Surveillance Network Program". All postings shall be located and maintained to the satisfaction of the inspector.

5. Any meters, devices or other such methods used for measuring the volumes of water used or waste disposed and discharged shall be installed, operated and maintained by the Licensee to the satisfaction of the inspector.

6. The Licensee shall ensure a copy of this Licence is maintained at the site of operation at all times.

7. The Licensee shall, at a minimum, implement all of the policies, practices, mitigation measures, recommendations and procedures for the protection of the environment referred to in its application, Project Description Reports and other documents submitted regarding the replacement of existing culvert and construction and installation of an open bottom concrete arch bridge.

8. All field operation staff shall be provided with appropriate advice/training on how to implement these policies, practices, mitigation measures, recommendations and procedures.

9. The Licensee shall ensure that all contractors and sub-contractors conform to all terms and conditions of this Licence.

10. Where applicable, relevant Fisheries and Oceans Canada's operational statements shall be applied. The Licensee shall co-develop a Fisheries Management and Monitoring Plan for Gunghi Creek with the Fisheries Joint Management Committee and DFO.

11. The Licensee shall operate in accordance with any plans approved pursuant to the conditions of this Licence and with any revisions to such plans, as may be made from time to time pursuant to the conditions of this Licence and as approved by the Board. If any plan is not approved by the Board, the Licensee shall revise the plan according to the Board's direction and re-submit it to the Board for approval.

12. All revised and/or updated environmental management plans submitted to the Board shall include a brief summary of the changes made to the plan.

13. In any activity associated with the project, the Licensee shall take every reasonable precaution to protect the environment.

14. In a form acceptable to the Board, the Licensee shall submit two (2) copies of all reports, plans, maps and drawings in printed format accompanied by two (2) electronic copies (CDs or USBs).

PART C: CONDITIONS APPLYING TO WATER USE

1. There shall be no water withdrawal involved for the project from any water sources.

PART D: CONDITIONS APPLYING TO WASTE MANAGEMENT AND DISPOSAL

1. The Licensee shall manage all wastes and hazardous waste in accordance with the approved Waste Management Plan or as otherwise approved by the Board.

2. The Waste Management Plan as approved by the Board shall be made available to all involved parties throughout the duration of the project.

3. The Licensee shall use porta-potties (portable toilet facilities) on site for sewage generated by the construction crew. The sewage shall be pumped out from porta-potties as needed and transported to the approved Sewage Waste Disposal Facilities for disposal.

4. The Licensee shall collect, segregate and temporarily store all on site garbage and hazardous wastes in a manner acceptable to the inspector prior to disposal to the approved Solid Waste Disposal Facilities.

5. Hazardous materials should be handled in a manner to prevent contamination of any waterbody to the satisfaction of the inspector.

6. All hazardous wastes must be handled and managed according to the Transportation of Dangerous Goods Act and Government of the Northwest Territories' Guideline for Hazardous Waste Management (2017) and removed for disposal to an approved waste disposal facility.

7. Unless authorized by this Licence, the Licensee shall ensure that any wastes associated with this undertaking do not enter any water body.

8. All wastes, soils, and vegetation associated with the project shall be handled, stored, transported and disposed of in such a manner that they are not deposited, or allowed to be deposited, into any waterbody. All materials shall be stored above the ordinary high-water mark to the satisfaction of the inspector.

9. During construction, if water is present in a liquid state in the watercourse crossings listed in Annex 1: Surveillance Network Program, Part A, it shall be sampled daily at 50 m upstream and 50 m downstream of the watercourse crossings and shall not exceed the following effluent standards:

    a) An increase in Total Suspended Solid (TSS) between the downstream and upstream sample of 100 mg/L; and

    b) For the downstream sample, the effluent standards for Total Petroleum Hydrocarbon (TPH) and pH:

Parameter	Maximum Average Concentration	Maximum Concentration of Any Grab Sample
Total Petroleum Hydrocarbon (TPH)	3 mg/L	5 mg/L
pH	Between 6.0 and 9.0	Between 6.0 and 9.0

10. In the event that the surveillance station water quality exceeds the effluent standards outlined in this Licence the inspector shall be immediately notified.

11. The Licensee shall notify the inspector and take necessary corrective action to mitigate any erosion problems to the satisfaction of the inspector.

PART E: CONDITIONS APPLYING TO CONSTRUCTION

1. The Licensee shall ensure that the culvert replacement and open bottom concrete arch bridge construction and installation project is supervised by an engineer. The Licensee shall also ensure that the following post-construction information for the open bottom concrete arch bridge is signed and stamped by an engineer, and submitted to the Board and the inspector: construction records, as-built documentation, and a summary of any deviations from the original design that required engineer approval.

2. The post-construction information shall be provided to the Board and the inspector within ninety (90) days of completion of the construction.

3. The Licensee shall undertake necessary corrective measures to mitigate negative impacts on surface drainage resulting from the Licensee's activities to the satisfaction of the inspector. Work facilities shall be located so as to minimize negative impacts to surface drainage.

4. The Licensee shall ensure that there is no obstruction of water flow in watercourses as a result of engineered structures being placed in, or about, a watercourse.

5. The Licensee shall implement best practices for erosion control during construction and maintenance work to the satisfaction of the inspector.

6. For the excavation, backfill and the removal of debris activities, the Licensee shall control siltation or sedimentation downstream of the work area and minimize further erosion to the extent possible, utilizing appropriate measures to the satisfaction of the inspector.

7. Exposure of permafrost layers shall be minimized to the extent possible and capped following construction activities in order to reduce the potential for future permafrost melt.

8. The Licensee shall implement erosion control measures in accordance with the approved Erosion and Sediment Control Plan.

9. The Licensee shall implement erosion and sediment control measures by installing silt fences anchored properly and that regular maintenance be performed to prevent ripping and lean over from the weight of snow. All trapped sediment should be cleaned from the silt fences.

10. Equipment used during the construction, excavation and backfill shall be mechanically sound and free of leaks. Washing, refueling, servicing and staging of machinery and equipment shall be conducted at least hundred (100) m from a water body to prevent the entry of any deleterious substances.

11. All construction for the watercourse crossings shall be conducted in accordance with Department of Fisheries and Oceans Regulations.

12. It remains the responsibility of the Licensee to avoid causing serious harm to fish in compliance with the *Fisheries Act*, and avoid prohibited effects on listed aquatic species at risk, any part of their critical habitat or the residences of their individuals in compliance with the *Species at Risk Act*.

13. It is the Licensee's responsibility to notify the Department of Fisheries and Oceans if they have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery.

14. The Licensee shall implement the Aquatic Effects Monitoring Plan as approved by the Board.

15. All work should be timed to avoid damage to fish, including their eggs, juveniles, spawning adults and/or the organisms upon which they feed.

16. The Licensee shall implement the Wildlife Management Plan as approved by the Board.

17. The Licensee shall not destroy, damage or disturb any wildlife habitat or wildlife activities throughout the duration of the project;

18. The Licensee shall operate any bulk fuel storage facilities in accordance with all applicable federal and territorial legislation and industry standards, including:
    a) Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products (2003); and
    b) National Fire Code of Canada (2015).

19. Fuel storage areas, lubricants, hydraulic fluids, coolants and similar substances shall be stored a minimum of hundred (100) metres from the ordinary high-water mark of any waters in such a way that said substances are not deposited in or allowed to be deposited in waters and not located in a waters drainage channel.

20. All fuel or storage vessels containing hazardous substances left for extended periods of time (including overnight in vehicles), should be stationed in an area that contains sufficient secondary containment (i.e. drip pans, lined bermed areas, double walled enviro-tanks etc.).

21. Personnel shall be trained to ensure that any unauthorized discharge is contained and remediated to the satisfaction of an inspector. In case refuelling takes place near water, in-water spill planning shall be considered to prevent inadvertent releases.

22. All heavy equipment and refuelling vehicles must carry portable spill kits that include items such as absorbent pads, containment booms, and spill pool catchment receptacles.

23. The Licensee's standard operating procedures shall ensure that all drip trays are snow and ice free prior to and during use to ensure appropriate containment volumes.

24. A dedicated area shall be used for refueling equipment with measures taken to ensure capture and containment of drips and potential spills.

25. Refueling of equipment with limited mobility shall be refueled above the ordinary high-water mark and refueling activities shall adhere to the following:
    a) the fuel transfer shall be visually and continually monitored;
    b) a containment tray shall be placed below the vehicle's refueling portal;
    c) fuel transfer nozzles shall be operated manually and will not be locked in the open positions;
    d) spill kits, including absorbent pads, shall be maintained in close proximity to the stationary equipment during refueling operations;
    e) fuel transfers shall be conducted with an operator at each end of the transfer hose;
    f) fuel transfers shall only be conducted when there is adequate visibility; and
    g) fuel transfer equipment components such as pumps, hoses and nozzles shall be visually checked for leaks or damage prior to each refueling operation.

PART F: CONDITIONS APPLYING TO TEMPORARY DETOUR WATERCOURSE CROSSING

1. The Licensee shall implement the following measures at the temporary detour watercourse crossing:
    a) the banks of any watercourse should be protected using suitable erosion control measures to the satisfaction of the inspector;

b) any materials placed below the normal high-water mark used in the construction of watercourse crossings shall be free of any contaminants, debris, or fine materials;
c) the temporarily modified watercourse banks to establish the watercourse crossings shall be returned to their original state. All the materials shall be removed upon project completion;
d) all watercourse crossings shall be conducted in accordance with Fisheries and Oceans Canada regulations;
e) the Licensee shall ensure that no debris is left on the surface of the crossings;
f) the temporary detour shall be operated when the ground is sufficiently frozen and there is an adequate layer of snow to prevent damage to the ground by vehicles;
g) the snow bridge shall be V-notched once construction is completed to allow it to melt from the center; and
h) compacted snow from snow fills shall be removed prior to the spring freshet.

PART G: CONDITIONS APPLYING TO MODIFICATIONS

1. Except for those engineered structures addressed by Part E, Item 1 the Licensee may, without written approval from the Board, carry out modifications to the planned project provided that such modifications are consistent with the terms of this Licence and the following requirements are met:
    a) the Licensee has notified the Board and the inspector in writing of such proposed modifications at least five (5) days prior to beginning the modifications;
    b) such modifications do not place the Licensee in contravention of either the Licence or the *Act*;
    c) the Board has not, during the five (5) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than five (5) days; and
    d) the Board has not rejected the proposed modifications.

2. Modifications for which the conditions referred to in Part G, Item 1 have not been met may be carried out only with written approval from the Board.

3. The Licensee shall provide to the Board as-built plans and drawings of the modifications signed and stamped by an engineer referred to in this Licence within ninety (90) days of completion of the modifications.

PART H: CONDITIONS APPLYING TO UNAUTHORIZED DISCHARGE CONTINGENCY PLANNING

1. The Licensee shall implement the Spill Contingency Plan as approved by the Board.

2. The Licensee will maintain a copy of the approved Spill Contingency Plan in a readily available location to the satisfaction of the inspector.

3. The Licensee shall ensure that petroleum products, hazardous material and other wastes associated with the Project do not enter any waters.

4. The Licensee shall ensure that all containment berms are constructed of an impermeable material to the satisfaction of the inspector.

5. If, during the period of this Licence, an unauthorised discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
    a) implement relevant components of the Spill Contingency Plan;
    b) report the incident immediately via the 24-Hour Spill Reporting Line: **867-920-8130**;

c) report each spill and unauthorized discharge of waste to the inspector within 24 hours; and
d) submit to the inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

6. All spills and unauthorized discharges of water or waste shall be cleaned up and the affected area reclaimed to the satisfaction of the inspector.

PART I: CONDITIONS APPLYING TO CLOSURE AND RECLAMATION

1. The Licensee shall implement the Closure and Reclamation Plan as approved by the Board.

2. Upon completion of all activities, the Licensee shall ensure that all materials, equipment, temporary structures and debris are removed from the site. Other final restoration activities as may be outlined in the Project Description shall be implemented to the satisfaction of the inspector.

3. All disturbed areas relating to the Water Licence activities shall be restored with an approved natural or native seed mixture to the satisfaction of the inspector.

INUVIALUIT WATER BOARD

Chairperson

January 30, 2020
Date

ANNEX 1: SURVEILLANCE NETWORK PROGRAM

LICENSEE: Government of Northwest Territories, Department of Infrastructure
LICENCE NUMBER: N5L1-1843
EFFECTIVE DATE OF LICENCE: February 1, 2020
EFFECTIVE DATE OF SURVEILLANCE NETWORK PROGRAM: February 1, 2020

A. Sampling Stations

Station Number	Description of Sampling Stations
1843-1a	50 m upstream from the watercourse crossing
1843-1b	50 m downstream from the watercourse crossing

B. Sampling and Analysis Requirements

1. Watercourse crossing "Surveillance Network Program" shall be sampled and analyzed for the following parameters and compared for any exceedances between upstream and downstream stations:

Station Number	Parameters	Sampling Frequency
1843-1a; and 1843-1b	Total Suspended Solids (TSS), Turbidity (Nephelometric Turbidity Units), Temperature, Dissolved Oxygen, pH, Conductivity, Calcium, Magnesium, Hardness, Nutrients (Ammonia, nitrate, nitrite), Total Arsenic, Basic Metal Scan (Total Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe), Total Mercury, Total Petroleum Hydrocarbon (TPH)	Immediately following the completion of the construction activities – monthly during periods of open water. and Once annually during spring freshet for the duration of the licence.

2. Sample collection requirements such as sampling location, frequency and parameters in accordance of the Surveillance Network Program may be modified by the inspector.

3. All sampling, preservation, and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association, the American Waterworks Association and the Water Environmental Federation or by such other methods as approved by an analyst.

4. All off-site analysis shall be performed in a laboratory as approved by an analyst.

5. The Licensee shall, at least five (5) days prior to beginning of the culvert replacement and bridge construction, submit to an analyst for approval a Quality Assurance/Quality Control Plan, a copy of the approved plan shall be submitted to the Board.

6. The Quality Assurance/Quality Control Plan shall be implemented as approved by an analyst.

C. Flow and Volume Measurement Requirements

1. The Licensee shall measure and record in cubic metres (m^3) or litres (L) the daily, monthly and annual quantities of sewage collected and transported off site to the licenced Sewage Waste Disposal Facilities.

D. Reports

1. The Licensee shall submit the following information in electronic and printed formats as part of the **Annual Report** required in Part B, Item 1 of the Licence:

   a) all laboratory results and analysis of all data collected during each SNP sampling period for the previous year;
   b) tabular summaries of all data and information generated under Part B and C of the SNP;
   c) rationale for any SNP sites where samples were not collected;
   d) Quality Assurance/Quality Control results and interpretations, in accordance with the approved Quality Assurance/Quality Control Plan;
   e) any interpretive comments and calculations; and
   f) identification of any anomalies and trends.

INUVIALUIT WATER BOARD

Chairperson

January 30, 2020
Date

GENERAL PROCEDURES FOR THE ADMINISTRATION OF LICENCES ISSUED UNDER THE *WATERS ACT* IN THAT PORTION OF THE INUVIALUIT SETTLEMENT REGION LOCATED IN THE NORTHWEST TERRITORIES

1. At the time of issuance, a copy of the Licence is placed in the Public Register at the Inuvialuit Water Board (IWB) Office and on the IWB website.

2. To enforce the terms and conditions of the Licence, the Minister of Environment and Natural Resources has appointed Inspectors in accordance with Section 65(1) of the Waters Act. The Inspectors coordinate their activities with officials of the Water Resources Division of the Department of Environment and Natural Resources. The Inspector responsible for the Licence N5L8-1841 is located in Inuvik, NT at the Department of Environment and Natural Resources Office.

3. To keep the IWB and members of the public informed of the Licensee's conformity to Licence Terms and Conditions, the Inspector prepares reports which detail observations on how each requirement of the Licence has been met. These reports are forwarded to the Licensee with a covering letter indicating what action, if any, should be taken. The inspection reports and covering letters are placed in the Public Register, as are any responses received from the Licensee pertaining to the inspection reports. Licensees must respond to all areas of concern outlined in the inspection reports.

4. If renewal of the Licence is contemplated it is the responsibility of the Licensee to apply to the IWB for renewal of the Licence. The past performance of the Licensee, new documentation and information, and points raised during a public hearing, if required, will be used to determine the terms and conditions of any Licence renewal. Please note that if the Licence expires and another has not been issued, then Water and Waste disposal must cease, or you, the Licensee, would be in contravention of the *Waters Act*. It is suggested that an application for renewal of the Licence be made at least eight months in advance of the Licence expiry date.

5. If, for some reason the Licence requires an amendment, a public hearing may be required. You are reminded that applications for amendments should be submitted as soon as possible to provide the IWB with ample time to go through the amendment process. The process may take up to six (6) months or more depending on the scope of the amendment requested.

.....2

6. Specific clauses of your Licence make reference to the IWB, Analyst or Inspector. The contact person, address, phone and fax number of each is:

BOARD: Executive Director
Inuvialuit Water Board
Box 2531
INUVIK, NT X0E 0T0

Phone No: (867) 678-2942
Fax No: (867) 678-2943

ANALYST: Analyst
Taiga Environmental Laboratory
Environment and Natural Resources
Government of the NWT
P.O. Box 1320
YELLOWKNIFE, NT X1A 2L9

Phone No: (867) 767-9235 ext. 53150
Fax No: (867) 920-8740

INSPECTOR: Water Resources Officer
Environment and Natural Resources
Government of the Northwest Territories
P.O. Box 2749
INUVIK, NT X0E 0T0

Phone No: (867) 678-6676
Fax No: (867) 678-6699

ENVIRONMENTAL IMPACT SCREENING COMMITTEE

January 17th, 2020 **EISC Registry File:** [**10-19-02**]

David B MacDonald
Department of Infrastructure, GNWT
5015-49th Street
Yellowknife, NT
X1A 2L9

Dear Mr. MacDonald:

Project Title: Gunghi Creek Crossing Replacement

Proponent: Government of the Northwest Territories, Department of Infrastructure

Thank you for submitting your project description (PD) to the Environmental Impact Screening Committee (EISC) for the above-named project. The EISC mandate is derived from the *Inuvialuit Final Agreement* (IFA) section 11(36), which states that "no license or approval shall be issued that would have the effect of permitting any proposed development to proceed unless the provisions of IFA section 11(36) have been complied with".

During its special meeting of January 8th, 2020, the EISC discussed your project proposal and reviewed the Screening Record (Record) compiled over the screening comment period. The EISC determined that the Record was complete for the purpose of making an EISC decision and closed the Record. After closing the Record, the EISC Chair appointed a Screening Panel (Panel) pursuant to Section 11 (19) of the IFA. The Panel then met to determine if the proposed development could have a significant negative environmental impact and whether the development could have a significant negative impact on present or future wildlife harvesting.

Review of the Record
In reaching its decision, the EISC considered the information contained in the PD and comments and advice received from reviewers during the screening comment period, which concluded January 6th, 2019. These considerations are summarized below.

This summary is intended to assist the reader in understanding the EISC's reasoning and does not mean that the EISC did not consider all other relevant portions of the Record with respect to the matter.

1) Nature of Activities

a) The Government of the Northwest Territories is proposing the replacement of the existing watercourse crossing carrying the Inuvik to Tuktoyaktuk Highway (ITH) over Gunghi Creek, located at ITH km marker 131.2 (approximately 14 km south of Tuktoyaktuk). The existing 2000mm diameter by 38m long corrugated steel pipe that was built in April 2010 requires replacement due to major sagging in the centre of the existing structure. The proposed replacement structure is an open bottom concrete arch bridge 7518mm span by 3500 mm rise by 38.966 m long on a 40° RHF skew.

b) The required work includes:
   i. Primary Project Activities

a. Clearing and grading, stripping and stockpiling of topsoil and subsoil
b. Watercourse crossing structure removal and installation
c. Installation of signage
d. Waste disposal

ii. Ancillary Activities
a. Staging areas
b. Traffic management
c. Related traffic signage
d. Erosion and sediment control
e. Water management

iii. Related Equipment
a. Loader, haul truck
b. Backhoe
c. Auger
d. Dozers, excavators

c) Fuel Requirements:

Material Type	**Amount**	**Storage Capacity**
Diesel Fuel	3 drums	55 gallons each
Gasoline	3 drums	55 gallons each
Propane	3 cylinders	20 lbs each
Biodegradable Oils	1 container	5 gallons
Biodegradable Lubricants	1 container	5 gallons

d) Waste Management

i. Spill and emergency response equipment will be stored in the job shack.
ii. All hazardous material will be 100m away from Gunghi Creek.
iii. The Spill Contingency Plan will be followed in the event of a spill.

Waste Type	**Hazardous or Non-hazardous**	**Estimated Volume (m3)**	**Disposal Method**
Solid Waste	Non-hazardous	10 m^3	Transported to an approved solid waste facility as required
Sewage	Non-hazardous	1 m^3	Transported to a sewage lagoon facility for disposal or treatment as required
Recyclable Waste	Non-hazardous	1 m^3	Transport to a recycling facility as required
Hazardous Waste	Hazardous	0 m^3	Transported to an approved facility for disposal and treatment
Scrap Culvert	Non-hazardous	1 m^3	Transported to local municipal landfill in Inuvik after the existing culvert is removed

2. Location

a) The site is located at km marker 131.2 which is approximately 14 km south of Tuktoyaktuk.

3. Duration

a) 2 months.

4. Timing

a) February 15, 2020 – April 15, 2020. In stream work to be completed by March 30, 2020 prior to the spring freshet and restricted activity timing window for instream work of April 1 to July 15.

5. Frequency

a) Once

6. Magnitude of environmental effect

a) Low-moderate

7. Scale of the environmental effect

a) The project activities will occur within the existing ITH right-of-way at kilometer 131.2.

8. Nature of environmental effect (potential direct, indirect, cumulative impact)

a) **Geology, Permafrost and Soils**

i. **Potential Effects**

Potential effects to geology, permafrost and soils occur during the construction related activities. These activities include site clearing, soil handling, excavation, grading and reclamation of the land surface. Potential effects of the Project on soil quality may include:

• Admixing, which results in a loss of soil profile integrity, dilution of organic matter and reduction of nutrient status, and possibly changes in water holding capacity (i.e., a reduction in soil quality);
• Permafrost exposure, which results in greater potential of permafrost melt and erosion;
• Compaction, which degrades soil structure, thus reducing permeability and aeration;
• Erosion, which results in loss of soil volume; and
• Contamination by spills or leaks.

These effects may lead to a reduction of soil suitability after restoration.

ii. **Mitigation Measures**

1) Construction activities will be scheduled to avoid periods of rapidly changing weather, including heavy rains or rapid snow melt, which could lead to surface run off and soil erosion. Construction will occur during frozen conditions.

2) Construction area boundaries and areas of concern will be marked with barriers to ensure that construction personnel know they are working in or near sensitive areas that cannot be disturbed and to limit the area of disturbance to the PDA.

3) Topsoil (the organic veneer) will be salvaged and stored separately from underlying mineral soils. Although color change between topsoil and subsoil is a good indicator of the soil profiles, care will be exercised to ensure proper topsoil salvage.

4) Soil salvage operations will be conducted with qualified supervision and in a manner to maximize the quality of the soil for future use in reclamation. In particular, topsoil will be

conserved, and measures will be implemented to reduce admixing (e.g., scheduling of topsoil stripping activities during daylight hours).

5) Exposure of permafrost layers will be minimized to the extent possible and capped following construction activities in order to reduce the potential for future permafrost melt.

6) During construction, stabilization of soil stockpiles, and management of surface run-off (snowmelt, rainfall) will reduce the erosion potential of runoff. Erosion and sediment control (ESC) measures will be used to reduce soil surface exposure, as required, in order to minimize both water and wind erosion.

7) To minimize soil compaction, to the extent possible, the following will be implemented:
   i. schedule construction activities to avoid work on wet soils;
   ii. minimize the number of repeated passes over areas prone to compaction; and
   iii. use tracked vehicles rather than conventional tires and rig matting when warranted by soil moisture conditions.

8) Temporary ESC measures during construction will be the responsibility of the construction Contractor. ESC measures will be implemented to prevent loss of soils and sedimentation of through erosion.

9) A spill prevention and response plan will be designed and implemented as part of the Contractor's ECO Plan during construction to prevent contamination of any soil system, including soils stored for later use, and in the event of accidental contamination during operation, to immediately respond and mitigate the contamination. A Guide to the Spill Contingency Planning and Reporting Regulations (GNWT 2011) will be followed.

iii. **Residual Effects**

Most potential effects on soil quality due to admixing, permafrost melt, compaction or erosion, can be successfully mitigated with the recommended mitigation measures and BMPs, including soil handling, implementation of ESC measures, and reclamation and revegetation as part of the Project design (Appendix A).

The primary mitigation for potential effects related to accidental spills and releases is prevention through BMPs for fuel storage, re-fueling and spill response. Accidental releases are anticipated to be localized and will be handled immediately as outlined in the spill response plan as part of the Contractor's ECO Plan during construction.

Overall, the residual effects resulting from the Project related to admixing, compaction/rutting, contamination and/or soil erosion, are all considered to be negative, low in magnitude, limited to the PDA in extent, long-term in duration, and reversible. The residual effect resulting from the Project related to permafrost melt is considered to be negative, low in magnitude, limited to the PDA in extent, long-term in duration, and irreversible. Mitigation measures identified to address potential effects on geology, permafrost and soils within the PDA are anticipated to fully mitigate potential negative environmental effects.

a) Vegetation

i. **Potential Effects**

Construction activities may result in minor clearing along existing disturbed RoW. Removal of native vegetation can result in exposed soil and create a potential source of sedimentation. Minimizing the spatial extent of vegetation clearing to reduce exposed soil in the PDA, and prompt implementation of ESC measures are anticipated to mitigate the effects on vegetation.

Non-native or invasive plant species (i.e., weeds) often colonize disturbed areas through the dispersal of seeds by wind, water, wildlife or human-related activity. Invasive species are often strong competitors with native species in disturbed environments. Invasive plants can move into adjacent areas and displace or otherwise affect the post-disturbance recovery of native vegetation. Given the nature of the Project, there will be opportunities for weeds to invade disturbed areas. The spread of weeds into disturbed areas typically occurs over a medium time period (1-5 years). However, if native vegetation cover can be reestablished in a timely manner, weed spread is predominantly eliminated.

No rare species (including Species at Risk), or unique vegetation communities have been identified in the PDA. The potential for loss of rare plant populations or unique plant communities due to the Project is considered low largely based on the small footprint of the PDA.

ii. **Mitigation Measures**

The following measures will be implemented to address potential effects of the Project on the vegetation.

1) The removal of vegetation will be restricted to the minimal acceptable requirements to avoid potential disturbance to native vegetation communities outside the PDA.

2) Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.

3) Prompt implementation of ESC measures of all disturbed areas.

4) Implementing measures to reduce the introduction and spread of weeds and invasive plant species, such as washing and inspecting vehicles/equipment prior to its arrival onsite to ensure that they have been cleaned and are free of dirt, mud, weeds and invasive species; utilizing seed weed-free seed mixtures; and monitoring to identify potential locations for control measures; is recommended.

5) Post-construction monitoring following winter construction to identify areas of instability and/or erosion. Where vegetation establishment is inadequate, or erosion/instability is identified, remedial measures will be implemented.

6) Post-construction monitoring to identify occurrences of weed establishment throughout disturbed areas. Follow-up (e.g., implementing weed control measures) may be required if and where monitoring identifies problem areas (e.g., infestations of weeds designated as prohibited noxious or noxious are identified).

7) Weed control methods will be implemented during the construction, reclamation and maintenance phases of the Project in areas where weed problems are identified. The use of herbicides is not recommended within the Project site due to potential runoff into Gunghi Creek.

8) Following winter construction, weed control measures, such as mowing, hand picking, seeding of a temporary vegetation cover (annuals) may be required on site until the desired vegetation becomes established.

iii. **Residual Effects**

Minor clearing and grubbing will be required for the construction of the Project. In addition to clearing, indirect disturbances to native vegetation from dust effects in the spring and potential for spread of nonnative plants/invasive weeds were considered. There is expected to be a nil-low potential for the Project to have an effect on rare species or unique vegetation communities. With implementation of recommended mitigation measures, residual effects on vegetation related to direct effects (vegetation clearing) and indirect effects (weeds/invasive species) are predicted to be negative, low in magnitude, limited to the PDA in extent, long-term in duration, and reversible.

b) Wildlife and Wildlife Habitat

i. Potential Effects

Construction related effects on wildlife are expected to be limited. Indirect effects from sensory disturbance is often associated with habitat clearing and construction activities and may discourage most species from using habitat adjacent to the Project. Most wildlife will avoid construction activities and habitats in the immediate vicinity of active work sites during the day and return during periods of inactivity (e.g., overnight). Most bird species are highly susceptible to noise disturbance; however, nesting activities are not expected during the proposed winter construction. Following construction, species are expected to return to adjacent habitats.

The movement patterns of animals, particularly mammals and ungulates, may be temporarily disrupted by construction activities. Construction activities are expected to occur during daylight hours, and animal movements may occur during periods of inactivity. Overall, substantial barriers to movement from construction activity are not expected to differ from current levels. As birds are highly mobile, construction and recreational activity not anticipated to cause significant barriers to movement.

Direct mortality of wildlife may occur if clearing is required, however nesting activities are not expected during the proposed winter construction, and any minor clearing involved is anticipated to be localized top the PDA. As the proposed works are scheduled for completion April 15 and only minor clearing will be required, the vegetation clearing timing constraint of May 20 to August 17 will be adhered to.

ii. Mitigation Measures

1) Prior to construction a survey will be conducted to ensure no active grizzly/ black bear, wolverine or lynx dens occur within 250 m of the project site. Where dens are identified the appropriate management agency will be identified to determine appropriate mitigation.

2) Clearly delineate by staking or flagging any construction access routes, temporary workspaces and environmentally sensitive areas prior to disturbance to minimize clearing necessary for construction workspaces.

3) Limit construction to daylight hours to allow animals to move through the project site overnight.

4) Use noise reduction equipment to muffle or control noise levels and reduce sensory disturbance to wildlife.

5) Ensure waste management plans are adhered to at all times to prevent attraction of wildlife to work site. Waste storage and accidental spill sites should be fenced to prevent wildlife access.

6) Limit the size of permanent and temporary workspaces to the greatest extent possible, and reclaim work areas immediately following construction.

7) Prohibit pets, firearms or recreational use of all-terrain vehicles in construction sites.

8) Do not harass or feed wildlife.

9) Record all wildlife observed within or near construction activities for submission to appropriate management agency.

10) Store hazardous materials securely in an appropriate location to avoid interaction with wildlife.

11) Where caribou approach the construction site or active ungulate mineral/salt licks are observed a temporary suspension of construction may be required to adhere to recommended setback distances outlined in the table below. Where caribou or active mineral/salt licks are observed appropriate the environmental management agencies should be contacted to determine appropriate mitigation.

Wildlife	**Feature or Habitat**	**Setback Distance**
Caribou	N/A	500m
Ungulates (general)	Mineral/salt lick	1km

Notes; 1: AANDC et al 2012.

iii. Residual Effects

Residual habitat losses associated with the proposed development are very small and will effect an area that is occupied by the existing crossing structure and ITH roadway RoW. With the implementation of revegetation of the PDA residual effect related to habitat loss is considered to be negative in direction, local in extent, low in magnitude and reversible. Construction activities are anticipated to result in an increased amount of noise and traffic and will likely result in increased sensory disturbance. Due to the overall small scale of the Project and anticipated short construction timeframe, the residual effect related to sensory disturbance is considered to be negative in direction, local in extent, low in magnitude and reversible.

c) Aquatic Environment

i. Potential Effects

Potential direct or indirect construction-related effects to the aquatic environment of Gunghi Creek are discussed below.

Release of Deleterious Substances

There is the potential for the accidental release of contaminants during construction. Contaminants may include sediments, debris, hydrocarbons, and hydraulic fluids. These substances could affect fish health, reproductive success, behaviour or result in direct fish mortalities. These potential effects can be mitigated by avoiding instream construction to the extent possible (e.g., operating machinery from outside of the watercourse), instream worksite isolation techniques where required, implementation of appropriate erosion and sediment control measures, and proper storage and handling of hazardous materials. Residual impacts are expected to be negative, low in magnitude, local in geographic extent, short-term in duration, reversible and isolated.

Fish Passage

The replacement open bottom concrete arch culvert was designed to accommodate fish passage during peak flows for the weakest swimmer (northern pike) of species potentially occurring in Gunghi Creek. As per the DFO Swim Distance & Water Velocity Tool, at the design velocity 0.97 m/s (inlet velocity, Table 9), 50% of northern pike can swim a distance of 13 m, while 87.5% can swim 6 m. Accordingly, the arch culvert design will incorporate rock boulders (Class 2 [800 mm in diameter]) spaced at 5.0 m intervals along the arch culvert invert and reconstructed channel to provide rest areas for fish and promote fish passage. Katopodis and Gervais (2016) have identified that fish have the ability to detect and utilize zones of lower velocity, where the Class 1 riprap along the headslopes and bank margin and Class 2 rock boulders are expected to increase roughness and reduce local flow velocities through flow turbulence and provide resting areas for fish moving upstream. As such, fish passage is anticipated to be accommodated through the replacement structure.

	Depth (m)	Velocity (m/s)	Upstream Velocity (m/s)	Downstream Velocity (m/s)	Freeboard (m)
Q_{100} (16 m_3/s)	1.7	0.9	1.7	1.8	1.6
3Q10 (6.6 m_3/s)$_2$	1.3	1.01	0.97	0.95	2.1
Q_2 (4.8 m_3/s)	1.1	0.98	0.87	0.84	2.3
Q_{check} (32 m_3/s)	2.3	1.1	2.5	2.6	0.7

Notes 1: Wood 2019, provided in Appendix C; 2: 3Q10 is fish passage flow.

Fish Habitat and Channel Area Affected

The proposed works will affect an area that has previously been disturbed by the existing crossing. No critical habitats were identified at the Project site. The proposed works will affect pool habitat, used primarily by migratory fish and is considered to have moderate productive capacity.

Replacement of the existing twin 2000 mm diameter by 38.0 m long culvert with a new 7518 mm span by 3500 mm rise by 38.966 m long open bottom concrete arch bridge will result in a net-gain of 217 m2[3] and alteration of approximately 562 m2 of channel area [4] that will remain available to fish. Channel widening through the replacement structure will improve flow conveyance capacity and accommodate fish passage. The proposed replacement structure will provide adequate freeboard to facilitate debris passage over a range of floods. Channel enhancement will also be incorporated to maintain long-term instream habitat diversity and habitat connectivity through the Project site. Channel enhancement features will include Class 2 rock boulders spaced 5 m apart and Class 1 rock riprap along the newly graded streambed, which will also transition smoothly into the natural channel bed and streambank upstream and downstream of the crossing. Overall, productive capacity of fish habitat through the crossing structure is anticipated to improve through reconstructing a wider channel bed and increase in channel area and habitat diversity available to fish in the replacement crossing PDA.

ii. Mitigation Measures

General

1) Instream works will be avoided during the restricted activity timing window of April 1 to July 15.

2) The construction limits will be conspicuously marked with flagging tape to ensure that construction personnel know the disturbance must remain within the proposed footprint and right-of-way.

3) All work will be conducted from above the streambanks, wherever possible, to avoid disturbance to riparian vegetation. Disturbed areas will be stabilized, vegetated and/or seeded as soon as possible after construction.

4) An Erosion and Sediment Control Plan (ESCP) will be prepared and implemented. Effective ESC measures will be in place prior to disturbance, during and after construction to prevent sediment from entering the watercourse and wetlands. All ESC measures will be inspected regularly to ensure that they are functioning properly and are maintained, cleaned and/or upgraded as required until complete revegetation of all disturbed areas is achieved.

5) Minimize clearing of riparian vegetation (where possible, prune or top vegetation rather than uprooting/grubbing), minimize removal of any instream natural structures (e.g., woody debris, boulders; if removed, return to its original location), and use existing roads, cut lines and trails when accessing the work area to minimize further disturbance within the riparian area (soil compaction, clearing).

6) Any excavated areas of the channel bed will be backfilled with material that is the same quality and gradation that was removed.

7) Only clean rock, appropriately sized and free of deleterious substances will be used for riprap. These materials will be obtained off site and will not be taken from below the average high-water level of any watercourse;

8) Construction will be halted during periods of heavy precipitation.

9) All equipment and machinery will be assembled, cleaned and checked for proper mechanical operation prior to entering the work site. Regular inspections will be completed to ensure that hydraulic, fuel, and lubrication systems are in good condition and equipment is free of leaks.

10) Biodegradable oils and lubricants (e.g., white lithium greases and vegetable oil hydraulic fluid) will be used in any equipment that will be working in the watercourse.

11) Washing, refueling, servicing and staging of machinery and equipment will be conducted at least 100 m from a water body to prevent the entry of any deleterious substances.

12) If fuel is to stored on site, it must be placed within a lined containment berm that is to be located at least 100 m from any water body. The berm is to have a capacity of 110% relative to the volume of fuel being stored.

13) All equipment that is to be used will be free of weed species and aquatic invasive species.

14) All spoil materials and debris will be removed from the site and properly disposed of above the high-water mark so that they do not enter any water body.

15) The Contractor will prepare an emergency spill response plan and contingency measures as part of the Environmental Construction and Operation (ECO) Plan. Information provided in the EMP in Appendix B will also be included in the Contractor's ECO.

Instream Isolation

Where the watercourse is dry or frozen to the channel bottom at the time of work the requirement to isolate does not apply.

1) Any instream works in flowing water conditions will be isolated during construction. 100% of downstream flow should be maintained at all times. Where ice is present, the diverted water will be returned to the watercourse under the ice. All diverted or discharged water will meet the requirements of the federal water quality guidelines (CCME 2002).

2) Any bypass pumping or water withdrawal will be conducted as follows:

- Must pass through a screen with openings that are no larger than 2.54 mm and at a velocity that does not result in the entrainment and entrapment of fish or fish fry.
- The fish screen must be constructed of materials that can withstand extreme winter temperatures.
- The screen should be: kept clean of ice and debris, be inspected for damage before each withdrawal, pump should be stopped if any sign of fish impingement or entrainment, and a secondary screen should be kept onsite in case the primary screen gets frozen or damaged.
- The inlet screen will not be placed directly on the bottom of the water body and will be placed in a manner that prevents disturbance on the channel bed material.
- All openings for guides and seals will be smaller than the opening width of the screen material (2.54 mm) so fish cannot pass through.
- Protect large screens with trash racks fabricated of bar (150 mm spacing is typical) or grating in areas where there is debris loading (i.e. woody material, leaves or algae mats).
- Approach velocity directly in front of the screen will not exceed the designed approach velocity at any location.
- Ensure there is enough structural support to prevent sagging or collapsing of the screen panel.
- Where ice is present on the water body, the diverted water will be returned to the water body downstream of the instream worksite, under the ice.

3) Materials in isolation berms will be made of non-earthen materials and not introduce clay or silt into any watercourse. Instream works will be confined to the isolated channel section. Accumulations of deposited sediment will be removed from within the isolated area prior to removing the isolation barrier.

4) Should the need for dewatering arise, water will be released into a well vegetated area or settling basin and not directly into any water body. Water returning to the watercourse will be of equal or better quality than the water in the watercourse.

5) If water, standing or flowing, is present in the isolated work zone at the time of construction, a fish rescue program will be completed prior to the start of instream work to ensure all fish are protected.

6) Any fish will be rescued from the isolated area prior to construction and be relocated, unharmed, into an area containing sufficient flow and cover. Fish rescue may require a territorial licence. Rescue operations employing effective methods (e.g. electrofishing, seine netting, minnow trapping) carried out as stipulated in the research license.

Temporary Access Road -Snow Fill

1) It is understood that construction of the temporary access will not require pumping of any water from any nearby water body.

2) Construct approaches or access road crossings perpendicular to the watercourse where possible.

3) Construct approaches using clean (ambient), compacted snow and ice to a sufficient depth to protect the stream banks or shoreline.

4) Where logs are used to stabilize the approach the logs are to be clean and securely cabled together. No logs and woody debris are to be left in the river or on the banks or shoreline.

5) The snow bridge should be V-notched once construction is completed to allow it to melt from the center.

6) Remove compacted snow from snow fills prior to the spring freshet.

Turbidity Monitoring
Where water is present during construction the Contractor's operations will be subject to the maximum allowable increase in Total Suspended Solids in the watercourse, as specified by the Canadian Water Quality Guidelines (CCME 2002). These guidelines provide threshold levels for water quality monitoring. It is expected the monitoring will support the implementation of recommended environmental protection measures to minimize impacts of construction and to provide a feedback mechanism so that mitigation measures can be adjusted where and when necessary.

iii. Residual Effects
The proposed works will result in a net-gain of 217 m2and alteration of approximately 562 m2 of channel area that will remain available to fish. Overall, productive capacity of fish habitat through the crossing structure is anticipated to improve and channel widening through the replacement structure will improve flow conveyance capacity and accommodate fish passage. It is anticipated that residual effects will be offset through the implementation of channel enhancement, which will maintain long-term instream habitat diversity and habitat connectivity through the Project site. Potential effects on aquatic resources will be mitigated through the implementation of construction BMPs and recommended mitigation measures, including the implementation of an ESC Plan. Residual effects are considered to be positive in direction, low in magnitude, local in extent, short-term in duration and irreversible.

d) Archaeology

i. Potential Effects
No archaeological sites have been recorded at or near the Gunghi Creek crossing. Also, the surrounding lands were not identified as having archaeological potential in the overview study (Kaggiak-EBA 2010). The Project will not affect recorded archaeological resources and is unlikely to affect unrecorded archaeological resources.

ii. Mitigation Measures
Since the Project will not affect archaeological resources, no mitigation measures need to be implemented. The Project is, however, subject to reporting requirements should a previously unrecorded archaeological resource be discovered accidentally (see Prince of Wales Northern Heritage Centre 2019a).

iii. Residual Effects
The Project will not result in residual effects with respect to archaeological resources.

9. Ecological context of environmental effect (on wildlife, habitat, biodiversity):

a) The site is located within Category C and E of the Tuktoyaktuk, Aklavik, and Inuvik Community Conservation Plans
    i. The site is an important fish habitat and important historic and present subsistence harvest area for people of Inuvik and Tuktoyaktuk

10. Wildlife harvesting context of environmental effect (place, timing, etc.)

a)

Community	Designated Area	Site /Management No.
Tuktoyaktuk, Inuvik	Spring/summer/fall/winter caribou harvesting	302C, 306C, 309C, and 315C
Tuktoyaktuk	Spring goose harvesting	304C
Tuktoyaktuk	Spring/fall fishing	305C and 310C
Tuktoyaktuk	Winter wolverine harvesting	314C
Tuktoyaktuk	Grizzly bear denning	322C
Tuktoyaktuk, Inuvik	Caribou herds[2] winter range	701E
Tuktoyaktuk, Inuvik	Fish lakes and rivers	704C
Tuktoyaktuk, Inuvik	Tuktoyaktuk-West grizzly bear management	I/GB/04
Tuktoyaktuk, Inuvik	South Beaufort polar bear management area	I/PB/03

Notes 1: THTC et al 2016; and IHTC et al 2016; 2: Tuktoyaktuk Peninsula, Cape Bathurst, and Bluenose-West Caribou herds.

11. Likelihood of environmental effect occurring:

a) Moderate impact to fish and fish habitat but would improve current conditions based off smaller culvert.

12. Project addresses community concern:

a) The Tuktoyaktuk Hunters and Trappers Committee noted that the creek is much shallower now with the culvert and would like to see the creek restored to its original depth. The proponents proposed culvert replacement structure will allow for channel bed restoration.

Comments Received by the EISC

Department of Environment and Natural Resources (ENR)

ENR provided several comments and recommendations on Fuel Storage and Spill Contingency Planning and Reporting, Wildlife Disturbance and Harassment, Wildlife Sightings and Encounters, Wildlife Attractants and Waste Management, Northwest Territories Listed and Pre-listed Species at Risk, Wildlife Cumulative Effects Tracking, and Wildlife Abodes. ENR also included 'General Bear Encounter Guidelines' for the Proponent's reference.

Fisheries Joint Management Committee (FJMC)

The FJMC has received reports regarding issues with the Gunghi Creek culvert and is pleased that action is being taken to fix these issues.

The GNWT and consultants should develop and operate under a state-of-the-art fisheries residual impact management plan.

During the Inuvik-Tuktoyaktuk Highway Environmental Impact Review, it was identified that alterations to stream flow and road erosion as potentially detrimental to fish and fish habitat along the highway corridor. These concerns should continue to be considered in ongoing construction and maintenance along the highway corridor. While the concerns are addressed in the project description, diligent monitoring is necessary to ensure their effectiveness, as measures taken for the Inuvik-Tuktoyaktuk Highway have frequently been unsuccessful. The FJMC is willing to work with the Imaryuk Monitor Program, as well as the Government of the Northwest Territories and Fisheries and Oceans Canada, to assist in monitoring any residual impacts and impacts that may occur at spring freshet.

In addition to the above comments, the proponent should ensure that their understanding of the Fisheries Act is consistent with the recent amendments (Bill C-68)

Department of Fisheries and Oceans (DFO)

DFO reviewed the project as described and stated that it may result in harmful alteration, disruption or destruction of fish habitat or prohibited effects on listed aquatic species at risk. The project requires a site-specific review and has been sent to the Fisheries Protection Program Regulatory Review unit in Yellowknife. Should DFO determine that the proposed project requires *Fisheries Act* Authorization, regulated timelines will apply.

Transport Canada (TC)

TC stated that under the Canadian Navigable Waters Act (CNWA), the CNWA authorizes and regulates interference with the public right to navigation. There are two types of navigable waterways under the CNWA; non-scheduled and scheduled. Gunghi Creek is not a scheduled navigable waterway. In this case, the Proponent has opted to deposit information on the online registry about the project and public a notice inviting public comments. Where any concerns were put forth by the public and resolved by the Proponent, the works may proceed based on the timelines in subsection 10.2(1) of the Act. If concerns are not resolved, the commenter may request that the Minister direct the owner to submit an application for approval.

Aklavik Hunters and Trappers Committee (AHTC)

The AHTC supports comments made by the Inuvik and Tuktoyaktuk Hunters and Trappers Committee.

Tuktoyaktuk Hunters and Trappers Committee (THTC)

According to the Proponent, THTC president Darrel Nasogaluak provided an e-mail to the Proponent stating that the THTC is very happy to see that the Gunghi Creek culvert will be replaced and wants to be sure that the creek post-construction will be as deep as it originally was as, as it is now much shallower with the culvert.

Inuvik Hunters and Trappers Committee (IHTC)

The IHTC has no comments or concerns.

EISC Decision

After careful deliberation, the Panel delivered an **11(17)(b)** decision:

"The development, if authorized subject to environmental terms and conditions recommended by the Screening Committee, will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement." [IFA s. 11. (17)(b)]

In reaching this 11(17)(b) decision, the Panel provided the following recommendations:

1. The Proponent shall follow all proposed mitigation measures, emergency response plans, and spill contingency plans described in this Decision Letter including those contained in the comments received from the Department of Environment and Natural Resources. In addition, and unless specifically addressed otherwise in this Decision Letter, the Proponent shall follow its submitted PD and its commitments therein.

2. The Proponent shall contact the Department of Fisheries and Oceans (DFO) - Regulatory Review Unit in Yellowknife, Northwest Territories for a site-specific review of the proposed project activities for the development of satisfactory mitigation measures to avoid harmful alteration, disruption or destruction of fish habitat.

3. The Proponent shall co-develop a Fisheries Management and Monitoring Plan for Gunghi Creek with the Fisheries Joint Management Committee and DFO.

4. The Proponent's standard operating procedures shall ensure that all drip trays are snow and ice free prior to and during use to ensure appropriate containment volumes.

5. The Proponent's mitigation measures should incorporate clearly defined triggers for action whenever possible. Generally speaking, the proposed mitigations are written with qualifiers that make implementation uncertain, e.g., "heavy precipitation". An example of a clear trigger and commitment would be: "construction work will be suspended when TSS reaches a value set by the regulators".

6. The Proponent shall submit a clear project timeline for all stages of construction activities which shall be provided to the Tuktoyaktuk and Inuvik Hunters and Trappers Committee and Community Corporation.

7. If the Proponent is unable to complete the proposed activities by April 15, 2020 as proposed, the EISC shall be notified of any changes to the PD.

A copy of the decision form for this file is attached to the email notification of this decision.

Both the Decision Letter and the Decision Form for this file will be placed on the file held in the EISC Registry.

If you have any questions regarding this decision, please don't hesitate to contact me directly at 1(867)777-2828, Extension 1014.

Sincerely,

Michel Lindsay
EISC Coordinator

Attachments:
1) EISC Decision Form
2) ENR Comment Letter
3) DFO Comment Letter
4) FJMC Comment Letter

cc: EISC Distribution List
EISC Distribution List

David MacDonald, Project Manager, GNWT
Jessica Parker, Environmental Biologist, Wood Environment and Infrastructure Solutions
Larry Carpenter, Chair, Wildlife Management Advisory Council (NWT)
Jodie Maring, Wildlife Management Advisory Council (NT)
Rosemin Nathoo, Wildlife Management Advisory Council (NT)
Lindsay Staples, Chair, Wildlife Management Advisory Council (NS)
Kaitlin Wilson, Wildlife Management Advisory Council (NS)
Alan Kennedy, Chair, Fisheries Joint Management Committee
Emily Way-Nee, Fisheries Joint Management Committee
Kiyo Campbell, Fisheries Joint Management Committee
Eli Nasogaluak, Fisheries Joint Management Committee
Vernon Amos, Chair, Inuvialuit Game Council
Chanda Turner, RP, Inuvialuit Game Council
Davonna Kasook, RP, Inuvialuit Game Council
John Donihee, Chair, Environmental Impact Review Board
Lenora McLeod, Coordinator, Environmental Impact Review Board
David Livingstone, Chair, Environmental Impact Screening Committee
Jennifer Lam, Committee Program Manager, Joint Secretariat
Chloe Brogan, Community-Based Monitoring Program, Joint Secretariat
Cassandra Elliott, TLK, Joint Secretariat
Kayla Hansen-Craik, MPA, Joint Secretariat
Paulatuk Hunters and Trappers Committee
Aklavik Hunters and Trappers Committee
Inuvik Hunters and Trappers Committee
Olokhaktomiut Hunters and Trappers Committee
Sachs Harbour Hunters and Trappers Committee
Tuktoyaktuk Hunters and Trappers Committee
Mardy Semmler, Executive Director, Inuvialuit Water Board
Bijaya Adhikari, Inuvialuit Water Board
Duane Smith, Chair, Inuvialuit Regional Corporation
Kate Darling, General Counsel, Inuvialuit Regional Corporation
Charles Klengenberg, Director of Lands, Inuvialuit Land Administration
Glenna Noksana, Inuvialuit Land Administration
Alec Sandra Macdonald, Regulatory Specialist, GLWB
Erika Tramm-Tizya, Transboundary Specialist, Gwich'in Lands and Resources
GNWT Environmental Assessment and Monitoring
Nathen Richea Manager Water Regulatory, ENR, GNWT
Aurora Research Institute
Naomi Smethurst, Culture and Heritage, ECE, GNWT
Lorraine Seale, Department of Lands, GNWT

Dan Carmichael, Regional Superintendent, Department of Lands, GNWT
Marsha Branigan, Environment and Natural Resources, GNWT
Loretta Ransom, Environment and Natural Resources, GNWT
Patrick Clancy, Environment and Natural Resources, GNWT
Johnny Lennie, Manager Oil and Gas Planning, PR Division, GNWT
Ian Butters, Manager, Oil and Gas Rights, GNWT
Peter Clarkson, Regional Director, Department of the Executive, GNWT
Don Craik, Superintendent, ITI, GNWT
Lorie Fyfe, Regional Superintendent, Inuvik Region, MACA
Veronique D'Amours-Gauthier, DFO
Fisheries Protection Program, Fisheries and Oceans Canada
Beaufort Sea Partnership
Nelson Perry, Parks Canada Agency
Alison Cassidy, Resource Management Officer, Parks Canada
Eric Reed, Canadian Wildlife Service, ECCC
Environmental Assessment and Marine Program for Yukon, ECCC
Mark Dahl, Senior Oceans Disposal Officer, Environment Canada
EA North NWT
Christy Wickenheiser, National Energy Board
Anne-Marie Hesse, National Energy Board
Dinah Elliott, Environmental Specialist, CIRNAC
Sarah Robertson, Senior Project Officer, CANNOR
Georgina Williston, Senior Environmental Assessment Coordinator, EC
Sarah Chan, Manager of Environmental Affairs, Department of Environment, YTG
Mike Suitor, North Yukon Regional Biologist, Department of Environment, YTG
Stephanie Muckenheim, IFA Implementation and Projects Coordinator, YTG
Brian Groves, Manager of Museums, Tourism, & Culture, YTG
Jodie MacMillan, Development Assessment Archeologist, Heritage Branch, Tourism & Culture
Cameron Eckert, Special Projects Officer, YTG
Carrie Mierau, Yukon Parks Branch, YTG
YESAB, Dawson Office

ENVIRONMENTAL IMPACT SCREENING COMMITTEE

Environmental Impact Screening Decision Form

EISC FILE: 10-19-02

Project Title: Gunghi Creek Crossing Replacement

Proponent: Government of the Northwest Territories, Department of Infrastructure

DECISION OF THE SCREENING PANEL:

Section 11.(17) of the IFA requires that, "On receipt of a project description, the Environmental Impact Screening Committee shall expeditiously determine if the proposed development could have a significant negative environmental impact and shall indicate in writing to the government authority competent to authorize the development that, in its view:

(a) The development will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement.

☑ (b) The development, if authorized subject to environmental terms and conditions recommended by the Screening Committee, will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement.

(c) The development could have significant negative impact and is subject to assessment and review under the Inuvialuit Final Agreement.

(d) The development proposal has deficiencies of a nature that warrant a termination of its consideration and the submission of another project description".

EISC file 10-19-02 was considered a development subject to screening pursuant to section 11.(1) of the IFA.

Based on the evidence before it, the Screening Panel determined that in the case of **EISC file 10-19-02** The development, if authorized subject to environmental terms and conditions recommended by the Screening Committee, will have no such significant negative impact and may proceed without environmental impact assessment and review under the Inuvialuit Final Agreement. (IFA 11.(17)(b)).

In reaching this 11(17)(b) decision, the Panel provided the following recommendations:

1. The Proponent shall follow all proposed mitigation measures, emergency response plans, and spill contingency plans described in this Decision Letter including those contained in the comments received from the Department of Environment and Natural

Resources. In addition, and unless specifically addressed otherwise in this Decision Letter, the Proponent shall follow its submitted PD and its commitments therein.

2. The Proponent shall contact the Department of Fisheries and Oceans (DFO) - Regulatory Review Unit in Yellowknife, Northwest Territories for a site-specific review of the proposed project activities for the development of satisfactory mitigation measures to avoid harmful alteration, disruption or destruction of fish habitat.

3. The Proponent shall co-develop a Fisheries Management and Monitoring Plan for Gunghi Creek with the Fisheries Joint Management Committee and DFO.

4. The Proponent's standard operating procedures shall ensure that all drip trays are snow and ice free prior to and during use to ensure appropriate containment volumes.

5. The Proponent's mitigation measures should incorporate clearly defined triggers for action whenever possible. Generally speaking, the proposed mitigations are written with qualifiers that make implementation uncertain, e.g., "heavy precipitation". An example of a clear trigger and commitment would be: "construction work will be suspended when TSS reaches a value set by the regulators".

6. The Proponent shall submit a clear project timeline for all stages of construction activities which shall be provided to the Tuktoyaktuk and Inuvik Hunters and Trappers Committee and Community Corporation.

7. If the Proponent is unable to complete the proposed activities by April 15, 2020 as proposed, the EISC shall be notified of any changes to the PD.

Signed on the 8th day of January 2020

David Livingstone, Chair
Signature on File

Shannon O'Hara, Inuvialuit Member
Signature on File

Gerald Inglangasuk, Inuvialuit Member
Signature on File

Ron Wallace, GNWT Member
Signature on File

Todd Slack, Canada Member
Signature on File

Bengt Pettersson, Yukon Member
Signature on File

November 26, 2019

Michel Lindsay
EIS Coordinator
Environmental Impact Screening Committee
Joint Secretariat, Inuvialuit Settlement Region
Inuvialuit Corporate Centre, Suite 204, 107 Mackenzie Road
Inuvik, NT X0E 0T0

Dear Ms. Lindsay:

Re: INF GNWT
EISC Screening – 10/19-02
Gunghi Creek Crossing Replacement
Request for Comment

The Department of Environment and Natural Resources (ENR), Government of the Northwest Territories (GNWT) has reviewed the application at reference based on its mandated responsibilities under the *Environmental Protection Act,* the *Forest Management Act*, the *Forest Protection Act, the Species at Risk (NWT) Act, the Waters Act* and the *Wildlife Act* and provides the following comments and recommendations for the consideration of the EISC.

Topic 1: Industrial and Solid, Liquid or Sewage Waste Disposal

Comment(s):

If the Proponents Waste Management Plan or methods of waste disposal indicate that project waste, or industrial waste, will be transported to community infrastructure for disposal, the Proponent should not assume they may deposit industrial, or other wastes, generated outside of community boundaries, in Northwest Territories community Solid and Liquid Waste Disposal Facilities.

Recommendation(s):

1) Should the Proponent intend to deposit waste in an NWT community Solid and Liquid Waste Disposal Facility, ENR requests that the Proponent demonstrate in the Waste Management Plan, and to the EISC, that the receiving communities' Solid and Liquid Waste Disposal Facility holds a Water Licence that authorizes the disposal of any industrial waste streams originating from outside municipal

boundaries. The Proponent should also demonstrate to the Board that the community has been consulted, and has consented in writing, regarding the use of its infrastructure for disposal of the waste streams and quantities in question, and the disposal of such wastes will not contravene the Waters Act or the *Environmental Protection Act* and related Regulations and Guidelines.

Topic 2: Hazardous Waste Management

Comment(s):

All Proponents that generate hazardous wastes must be registered as a generator of hazardous waste in the NWT.

The Guideline for the General Management of Hazardous Waste in the NWT defines hazardous waste and outlines the roles and responsibilities of generators, carriers, and receivers of hazardous waste in the NWT. The ENR, Environment Division (ED) registers generators, carriers, receivers, and tracks the disposal of hazardous waste generated in the NWT to registered receiving facilities on hazardous waste movement documents (manifest). The definition of hazardous waste includes all waste materials that are 'dangerous goods' according to the Transportation of Dangerous Goods Regulations, and any additional waste of special concern that the ED has determined hazardous until proven otherwise, including but not limited to:

a) incinerator waste and/or residuals (including bottom ash and fly ash);
b) any liquid or solid wastes contaminated with refined petroleum products;
c) bilge wastes;
d) vehicle or vessel servicing wastes
e) drilling wastes;
f) produced fluids (Glycol / Hydrocarbon / Inorganic Mixtures);
g) tailings; and
h) any hydrocarbon, lead, mercury or other forms of contaminated soils.

The Guideline for the General Management of Hazardous Waste in the NWT and the Transportation of Dangerous Good Regulations may be found at the following sites:

http://www.enr.gov.nt.ca/sites/enr/files/resources/128-hazardous_waste-interactive_web.pdf

http://www.tc.gc.ca/eng/tdg/clear-menu-497.htm

Recommendation(s):

1) If the Proponent is using or generating hazardous waste, they must register as a generator of hazardous waste in the NWT and track the disposal of hazardous waste from the site activities to registered receivers on hazardous waste

movement documents provided by ENR. Please contact the Environment Division, ENR to register or for more information contact Mr. Mike Martin, Hazardous Substance Specialist, Environment Division, ENR by email (Mike_Martin@gov.nt.ca) or by phone (867) 767-9236 extension 53182.

Topic 3: Fuel Storage and Spill Contingency Planning and Reporting

Comment(s):

ENR acknowledges the proponent's Spill Contingency Plan.

In addition, the Proponent should also follow best practices for fuel storage and spill containment during project activities which may include the following recommendations.

Recommendation(s):

1) To assist in spill contingency planning, information is provided in EPA *Spill Contingency Planning and Reporting Regulations* found here:

   https://www.justice.gov.nt.ca/en/files/legislation/environmental-protection/environmental-protection.r2.pdf

   If clarification or further information is needed please contact the Environment Division, ENR directly to aid in the development of the Plan

2) In accordance with the *Spill Contingency Planning and Reporting Regulations Section 10*, all spills in accordance with Schedule B must be reported immediately to the 24-hour Spill Report Line (867) 920-8130.

3) In the event of a spill the Inuvik Region Environmental Assessment Coordinator, Alicia McRae should also be contacted at (867) 678-6553.

4) With respect to the *Environmental Protection Act Section 5 (1b)* all spills, regardless of amount, must be cleaned up, and contaminated materials disposed of at an approved facility, or in an approved manner. Additionally, as indicated in *Section 5(1c)* all reasonable efforts must be made to notify any parties affected or potentially affected by the spill.

5) Fuel storage areas should be greater than 100m distance from the ordinary high water mark of a water body and not located in a drainage channel.

6) All fuel or storage vessels containing hazardous substances left for extended periods of time (including overnight in vehicles), should be stationed in an area

that contains sufficient secondary containment (i.e. Drip pans, lined bermed areas, double walled enviro-tanks etc.).

7) It is recommended spill kits be provided. Personnel should be trained to ensure that in the event of a spill it is contained and remediated appropriately to industry-accepted best practices and regulatory approval. In case refuelling takes place near water, in water spill planning should be considered to prevent inadvertent releases.

8) ENR recommends, for the operator's convenience and increased environmental protection, that all heavy equipment and refuelling vehicles carry portable spill kits that include items such as absorbent pads, containment booms, and spill pool catchment receptacles. Readily available and fully stocked spill kits can effectively mitigate potential spills.

Topic 4: Wildlife Disturbance and Harassment

Comment(s):

Unless authorized by a Licence or Permit, paragraphs 52(a) and (b) of the *Wildlife Act* prohibit engaging in an activity that is likely to result in significant disturbance to big game or other prescribed wildlife, or to unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife.

Schedule A – Part 1 of the *Wildlife General Regulations,* sets out the species prescribed as big game, and Schedule B sets out prescribed wildlife for the purpose of paragraphs 52(a) and (b) of the *Wildlife Act*.

Disturbance to wildlife from sources such as noise, light, vibrations, and human presence can result in energetic stress, avoidance of key habitat, loss of reproductive fitness, injury or mortality of wildlife. Activities that may cause sensory disturbance to wildlife include vehicle traffic, stationary machinery, noise from blasting, excavation, crushing, seismic testing, vegetation clearing, and lighting or flaring.

Recommendation(s):

1) The Proponent should be aware that no wildlife should be disturbed, chased, or harassed by human beings on foot, in a motorized vehicle, or by aircraft. Unless authorized by a Licence or Permit, paragraphs 52(a) and (b) of the *Wildlife Act* prohibit engaging in an activity that is likely to result in significant disturbance to big game or other prescribed wildlife, or to unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife. However, subject to section 55 of the *Wildlife Act* a person may chase wildlife

away from a camp or work site if doing so is necessary to prevent injury or death to a person or damage to property.

2) Wildlife shall be given the right of way at all times.

3) Suspend activities temporarily if one or more individuals of a big game species are spotted within five hundred (500) meters of the work site.

Topic 5: Wildlife Sightings and Encounters

Comment(s):

Proponents are encouraged to record wildlife sightings and to submit these records to ENR's WMIS. Wildlife sightings data provides useful information for assessing changes in species distribution and the timing and location of different life history events such as migration, denning, nesting, calving, etc.

Recommendation(s):

1) Submit information about wildlife sightings (species, date, time, location, number of individuals, sex, behaviour, etc.) to WMIS at WMISTeam@gov.nt.ca. Inuvik Region, ENR is especially interested in observations of caribou, muskox and any bear sightings. For further information on the WMIS consult:

   http://www.enr.gov.nt.ca/programs/wildlife-research/wildlife-management-information-services

2) Contact the Inuvik Regional ENR office at 867-678-6696, to report wildlife sightings, and to obtain blank wildlife sightings forms.

3) It is recommended the proponent and personnel observe the advice in the attached *General Bear Encounter Guidelines*.

4) For Wildlife Emergencies call Inuvik Regional Office at: (867) 678-0289. For any other Wildlife concerns call Toby Halle, Renewable Resource Officer III at: (867) 678-6681 or Lila Voudrach, Manager, Wildlife and Environment at: (867) 678-6680.

Topic 6: Wildlife Attractants and Waste Management

Comment(s):

Subject to sub-section 66(1) of the *Wildlife Act* no person shall store food, waste, or other substances in a manner that may attract big game or other prescribed wildlife and put people, domestic animals, or wildlife in danger.

Subject to sub-section 65(1) of the *Wildlife Act*, it is illegal to intentionally feed big game, furbearers or other prescribed wildlife. Schedule A – Part 2 of the *Wildlife General Regulations* sets out the species prescribed as fur-bearers.

Recommendation(s):

1) The Proponent should utilize food and garbage handling and storage procedures that will minimize the attraction of wildlife.

2) The Proponent should store all food, waste, washed recyclables and debris that may attract wildlife within sealed animal proof containers until final disposal.

3) The Proponent should ensure that sealed animal proof containers are cleaned once emptied to minimize the attraction of wildlife.

4) The Proponent should ensure that all grey water (dishwater, showers, laundry, etc.) and black water (sewage) are treated and disposed of in a manner that will minimize the attraction of wildlife.

5) The Proponent should remove all waste petroleum products including used oil filters, rags, scrap metal, discarded machinery, parts, drums, barrels, or plastics to an approved waste disposal facility.

Topic 7: Reporting Wildlife Defence/Property Kills and Wildlife Incidents

Comment(s):

Subject to paragraph 57(a) of the *Wildlife Act*, any big game or other prescribed wildlife that is killed to prevent injury or death to a person or damage to property must be reported to ENR as soon as is practicable. Section 7 of the *Wildlife General Regulations* describes what information must be included in the report.

Subject to section 58 of the *Wildlife Act* and sub-section 8(1) of the *Wildlife General Regulations*, any person who accidentally kills or seriously wounds big game or other prescribed wildlife with a motorized vehicle on a highway must report the event to an officer within 24 hours after the incident.

Recommendation(s):

1) Report all sightings of bears in and around the project location to your local ENR office. Any defence of life and property kills must be reported to the appropriate ENR office immediately. Please contact the following Regional Office as required:

    - Inuvik Region Wildlife Emergency Line at (867) 678-0289

2) Ensure all field personnel have completed a bear safety training course to decrease the risk of attracting bears to work sites and threats to human safety, learn how to respond to bear encounters, and decrease the risk of wildlife mortality resulting from kills in defence of life and property.

3) Consult the "Safety in Grizzly Bear and Black Bear Country" brochure, available at:

http://www.enr.gov.nt.ca/sites/enr/files/resources/safety_in_grizzly_and_black_bear_country_english.pdf

4) Report to an ENR officer as soon as is practicable any wildlife that is killed to prevent injury or death to a person or damage to property.

5) Report to an ENR officer any big game or other prescribed wildlife that is killed or seriously wounded by a motorized vehicle on a highway within 24 hours after the incident.

6) Reports must include at minimum the name of the person who killed or injured the wildlife, an explanation of the incident, the time, date and location of the incident, the species or quantity involved, and any other information requested by the wildlife officer.

7) Contact the regional ENR office to obtain blank wildlife incident forms.

Topic 8: Wildlife: NWT Listed and Pre-listed Species at Risk

Comment(s):

Sections 76 and 77 of the *Species at Risk (NWT) Act* require the Minister of Environment and Natural Resources to make a submission to the body responsible for assessing the potential impacts of a proposed development, or for considering a Land Use Permit or Water Licence application, respecting the potential impacts of the proposed development, Permit or Licence application on a NWT-listed or pre-listed species or its habitat. NWT-listed species are those that are on the NWT List of Species at Risk. Pre-listed species are those that have been assessed by the NWT Species at Risk Committee (SARC) but have not yet been added to the NWT List of Species at Risk.

The Proponent should be aware that NWT-listed or pre-listed species at risk and their habitat may also be subject to protection under existing sections of the NWT *Wildlife Act*.

As a best practice, ENR encourages the Proponent to consider potential impacts, mitigation measures and monitoring requirements for species at risk listed under the federal *Species at Risk Act*, as well as those designated as at risk by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that may occur in the project area, and the prohibitions that may apply to these species under federal legislation.

The project area overlaps with the ranges of the following NWT-listed and/or pre-listed species:

- Polar Bear – Listed as of Feb 2014, Special Concern in the NWT
- Grizzly Bear – Listed as Threatened
- Barren-ground Caribou – Listed as Threatened

Recommendation(s):

1) Although the project overlaps with the range(s) of the species listed above, ENR is of the opinion that the nature, areal extent, scale and/or timing of the proposed project are such that the likelihood of potential impacts to NWT-listed or the pre-listed species at risk listed above can be avoided or minimized if ENR's wildlife recommendations in this letter are implemented as necessary, including the application of any wildlife mitigation and monitoring measures outlined in the Proponent's Land Use Permit application and supporting documents.

Topic 9: Wildlife Abodes

Comment(s):

Subject to sub-section 51(2) of the *Wildlife Act*, it is illegal to break into, destroy, or damage a den, beaver dam or lodge, muskrat push-up or hibernaculum unless you have an Aboriginal or treaty right or a Permit to do so.

Protection of dens, beaver lodges, muskrat push-ups, and hibernacula is essential to ensuring reproductive success and survival of both adults and young.

Recommendation(s):

1) If applicable, the Proponent should conduct pre-activity surveys within 800m of the project footprint to identify active bear dens if project activities will occur between September 30 and March 30. Surveys should be conducted in the fall to detect freshly dug dens.

2) If an active bear den is detected, or suspected, the Proponent should implement and maintain an 800 m exclusion zone until the bear emerges in spring.

3) If a bear den and exclusion zone would result in the halt of part or the entire program, the Proponent should contact ENR to discuss alternative mitigation options. The location of active bear dens should be kept confidential between the developer and ENR until after emergence in the spring.

Topic 10: Project Footprint

Comment(s):

To better understand cumulative effects in the NWT, ENR-NWT Cumulative Impact Monitoring Program has developed the 'Inventory of Landscape Change' (ILC). One of the layers incorporated in the ILC is derived from public registry documents and validated through satellite imagery. Submission of standardized spatial data to public registries facilitates data acquisition for this layer.

Keeping track of the disturbance footprint of development activities is also an important component of tracking and informing the management of cumulative effects on wildlife and wildlife habitat.

Recommendation(s):

1) ENR recommends that the proponent provide geospatial data for the project footprint at the commencement of the land use operation and at the end of the land use operation for posting on the public registry. It is recommended that the "MVLWB Standards for Geographic Information Systems (GIS) Submissions" could be referred to when submitting spatial data

Comments and recommendations were provided by ENR technical experts in Environmental Protection and Waste Management Division, the Wildlife Management Division, and the Inuvik Region and were coordinated and collated by the Environmental Assessment and Monitoring Section (EAM), Environmental Stewardship and Climate Change Division.

Should you have any questions or concerns, please do not hesitate to contact Patrick Clancy, Environmental Regulatory Analyst at (867) 767-9233 Ext: 53096 or email patrick_clancy@gov.nt.ca.

Sincerely,

Patrick Clancy

Environmental Regulatory Analyst
Environmental Assessment and Monitoring Section
Environmental Stewardship and Climate Change Division
Department of Environment and Natural Resources
Government of the Northwest Territories

Att: General Bear Encounter Guidelines

Fisheries and Oceans Canada | Pêches et Océans Canada

Central & Arctic Region
Fish and Fish Habitat Protection Program
867 Lakeshore Rd.
Burlington, ON
L7S 1A1

Région centrale et de l'Arctique
Programme de protection du poisson et de son habitat
867 chemin Lakeshore
Burlington, ON
L7S 1A1

January 3, 2020

Your file *Votre référence*
EISC Registry File # 10-19-02

Our file *Notre référence*
19-HCAA-01973

Michel Lindsay
Coordinator, Environmental Impact Screening Committee
Inuvialuit Corporate Centre, Suite 204
107 Mackenzie Road
PO Box 2120, Inuvik, Northwest Territories X0E 0T0

Subject: Culvert to bridge replacement, Gunghi Creek, Tuktoyaktuk - EISC Notice of Proceeding – Implementation of Measures to Avoid and Mitigate the Potential for Prohibited Effects to Fish and Fish Habitat

Dear Michel Lindsay:

Fisheries and Oceans Canada's Fish and Fish Habitat Protection Program (DFO-FFHPP) would like to thank the Environmental Impact Screening Committee (EISC) for the opportunity to provide comments on the Government of the Northwest Territories, Department of Infrastructure's (the Proponent) application for the Gunghi Creek Crossing Replacement Project (the Project).

DFO-FFHPP has reviewed the Proponent's application pursuant to its mandate to determine if the project will result in the death of fish by means other than fishing and/or the harmful alteration, disruption or destruction (HADD) of fish habitat which are prohibited under subsections 34.4(1) and 35(1) of the *Fisheries Act*. The Project as described, may result in HADD or prohibited effects on listed aquatic species at risk.

The Project requires site specific review and has been sent to the Fisheries Protection Program Regulatory Review unit in Yellowknife.

A Fisheries Protection Biologist from the Regulatory Review Unit will be contacting you shortly. For your information, the Supervisor for Regulatory Review is:

Alasdair Beattie
Alasdair.Beattie@dfo-mpo.gc.ca
(604) 666-5841

Please note that should DFO determine that the proposed project requires a *Fisheries Act* Authorization, regulated timelines will apply. Following submission of an Application for Authorization, DFO will respond within 60 days regarding whether the application is complete or incomplete. When a complete Application for Authorization has been received, DFO will issue the *Fisheries Act* Authorization or inform the proponent of its refusal to do so, within 90 days of the date upon which the application was deemed complete. These regulated timelines may be stopped with notification from DFO. Further information is available at www.dfo-mpo.gc.ca/pnw-ppe/reviews-revues/authorization-autorisation-eng.html.

If you have any questions with the content of this letter, please contact Ashley Lindley at our Burlington office at 905-336-6235, or by email at Ashley.Lindley@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,

Rick Kiriluk,
A/Team Leader, Triage and Planning
Fish and Fish Habitat Protection Program

FISHERIES JOINT
MANAGEMENT COMMITTEE
Joint Secretariat – Inuvialuit Renewable Resource Committees
Box 2120, Inuvik, NT, X0E 0T0
Tel: (867) 777-2828; Fax: (867) 777-2610; Email: fjmc-fisheries@jointsec.nt.ca

December 17, 2019

Michel Lindsay
Coordinator, Environmental Impact Screening Committee
Joint Secretariat, Inuvialuit Settlement Region
PO Box 2120
Inuvik, NT
X0E 0T0

Re: Gunghi Creek Crossing Replacement – EB193003

Dear Ms. Lindsay,

The Fisheries Joint Management Committee (FJMC) is a co-management body established under the Inuvialuit Final Agreement to assist the Inuvialuit and Canada in fulfilling their rights and obligations within the agreement related to fisheries management in the ISR. Since the construction of the Inuvik-to-Tuktoyaktuk Highway (ITH), the FJMC has been involved in EIA follow-up monitoring of impacts on fish and fish habitat through the initiation of the Imaryuk Monitor Program. The Imaryuk Monitors carry-out regular patrols along the highway and inspect the many water-crossings. Issues with the Gunghi Creek culvert have been reported by the monitors for quite some time and the FJMC is pleased that action is being taken to fix these issues.

In carrying out this project, the Government of the Northwest Territories and consultants should develop and operate under a state-of-the-art fisheries residual impact management plan. In the initial construction of the ITH, the Inuvialuit Settlement Region Environmental Impact Review Board (EIRB) identified alterations to stream flow and road erosion as potentially detrimental to fish and fish habitat along the highway corridor. These concerns should continue to be considered in ongoing construction and maintenance along the highway. While these concerns are addressed in the project description, diligent monitoring is necessary to ensure their effectiveness, as measures taken for the ITH have frequently been unsuccessful. The FJMC is willing to work with the Imaryuk Monitor Program, as well as the Government of the Northwest Territories and Fisheries and Oceans Canada, to assist in monitoring of any residual impacts and impacts that may occur at spring freshet.

In addition to the above comments, the proponents should ensure that their understanding of the Fisheries Act is consistent with the recent amendments (Bill C-68).

Sincerely,

Dr. Alan Kennedy
Chair, Fisheries Joint Management Committee

Appendix B

Quality Assurance and Quality Control Plan

Quality Assurance and Quality Control Plan

Surveillance Network Program

Gunghi Creek Crossing Replacement

Project: EB193003

Prepared for:

Government of the Northwest Territories, Department of Infrastructure

Yellowknife, Northwest Territories

September 2020

Quality Assurance and Quality Control Plan - Surveillance Network Program

Gunghi Creek Crossing Replacement

Project: EB193003

Prepared for:
Government of the Northwest Territories, Department of Infrastructure
Yellowknife, Northwest Territories

Prepared by:
Wood Environment & Infrastructure Solutions
5681 – 70 Street
Edmonton, AB T6B 3P6
Canada
T: 780-436-2152

September 2020

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1.0 Introduction

The Government of the Northwest Territories, Department of Infrastructure (GNWT) proposes replacement of the Gunghi Creek culvert carrying the Inuvik to Tuktoyaktuk Highway (ITH), south of Tuktoyaktuk, Northwest Territories (the 'Project'). This Quality Assurance and Quality Control Plan (QA/QC)[1, 2] document has been developed by Wood Environment & Infrastructure Solutions (Wood) and approved by a Taiga Environmental Laboratory Analyst to meet conditions for the Surveillance Network Program (SNP) of the Inuvialuit Water Board (IWB) *Water Licence N5L1-1843*.

2.0 Field Sampling

All sampling and preservation will be conducted in accordance with the *Standard Methods for the Examination of Water and Wastewater*[3].

2.1 Sample Collection

2.1.1 Location

Signs to identify monitoring stations will be posted within seven (7) days prior to the beginning of construction and be located and maintained to the satisfaction of the Inspector. Monitoring stations will be located 50 m upstream (Station No. 1843-1a) and 50 m downstream (Station No. 1843b) of the watercourse crossing.

2.1.2 Sampling Equipment

Temperature, dissolved oxygen, pH and conductivity parameters will be measured in-situ using a YSI Pro-Plus multi meter or other similar multi meter. Equipment used to measure in-situ water quality will be cleaned and calibrated prior to each use, to ensure the meter does not contaminate or alter the concentration or accuracy of parameters being measured. Calibration will be conducted using at least three concentrations of standards and one blank. Sample bottles will be provided by Taiga Environmental Laboratory in order to ensure they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sample devices, bottles, and filtration devices will be constructed of non-metallic material. New bottles provided by Taiga Environmental Laboratory will be used for each monthly/annual sampling event. Filtering devices will consist of either a syringe and 45 µm filter or manual vacuum pump with filter. A new syringe will be used for each sample event and location. Alternatively, samples required to be filtered can be submitted to Taiga Environmental Laboratory without preservative within 24 hours - 2 days, depending on the sample storage time. Table 1 provides a list of the appropriate sample bottle material, minimum sample size, applicable preservative, and maximum storage time before being processed by the lab.

1 ***Quality Assurance (QA):*** is the system of activities designed to better ensure that quality control is done effectively

2 ***Quality Control (QC):*** is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy, and reliability

3 Rice, E.W., R.B. Baird, A.D. Eaton. 2017. Standard Methods for the Examination of Water and Wastewater, 23rd Edition. American Public Health Association, The American Waterworks Association and the Water Environmental Federation.

Table 1. Applicable Sample Bottle Material, Sample Size, Preservative and Storage Times

Parameter		Container	Minimum Sample Size (ml)	Preservation	Maximum Storage Time
Conductivity		polyethylene	500	Refrigerate 4°C	24 hours
Hardness		polyethylene	100	add 1:3 nitric acid or unpreserved	6 months
Metals, General		polyethylene	250	Total: add 1:3 nitric acid Dissolved: filter immediately, add 1:3 nitric acid	1 month
Mercury (Hg; Total)		Glass	500	Add Conc. HNO3 or pH<2 or H2SO4 + 1 ml of 5% K2Cr2O7, refrigerate 4°C	28 days
Nitrogen	Ammonia	polyethylene	500	Analyze as soon as possible or add 1:3 nitric acid, refrigerate OR (*) unpreserved	7 days
	Nitrate	polyethylene	100	Analyze as soon as possible or refrigerate	48 hours
Total Suspended Solids		polyethylene	500	Refrigerate	7 days
Turbidity		polyethylene	500	Analyze same day; store in dark up to 24 hours, refrigerate	
Total Petroleum Hydrocarbon (TPH)		Glass or wide-mouth calibrated	1000	Add 1:3 nitric acid, refrigerate	28 days

2.1.3 Sampling Methods

The water quality parameters to be sampled and analyzed under the SNP are detailed below. Turbidity, temperature, DO, pH and conductivity will be measured in-situ using a water quality multi-probe. All other parameters will be sent to Taiga Environmental Laboratory for analysis.

- Total Suspended Solids (TSS);
- Turbidity (Nephelometric Turbidity Units);
- Temperature;
- Dissolved Oxygen (DO);
- pH;
- Conductivity;
- Calcium;
- Magnesium;
- Hardness;
- Nutrients (ammonia, nitrate, nitrite);
- Total Arsenic;
- Basic metal scan (including: total Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe);
- Total mercury; and
- Total petroleum hydrocarbons.

Sample Frequency

The licence stipulates that frequency of sampling and analysis will conducted in two parts:

1) Immediately following the completion of the construction activities sample monthly during periods of open water.
2) Once annually during spring freshet for the duration of the licence (i.e., up to and including 2025).

Sample Collection and Equipment

Temperature, dissolved oxygen, pH and conductivity parameters will be measured in-situ using a YSI Pro-Plus multi meter or other similar approved equipment. The meter probe(s) will be placed in the water column above the substrate at each sample location.

Water samples collection, using bottles provided by Taiga Environmental Laboratory will be conducted by plunging a sample bottle to mid depth, with the opening positioned toward the current before allowing it to fill. The bottle will be rinsed in the channel water three times before collecting the sample on the fourth submersion. Room will be left (approximately 2% of the sample container) in the bottle for preservative addition and mixing.

Field Blanks and Replicate Samples

Field blanks will be provided by Taiga Environmental Laboratory and contain distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks will be taken to the field and handled and preserved as part of the sample program. Replicate samples (duplicates) will be collected from the same station at the same time as other samples at each sample location.

2.2 Sample Handling

2.2.1 Preservation

After collection, samples will be preserved by adding chemicals provided by Taiga Environmental Laboratory and as directed by the lab in order to prevent chemical or biochemical changes to the sample. Chemicals will be added to the sample bottle(s) immediately after the sample is collected. Alternatively, only samples required to be filtered can be submitted to the lab without preservative within 24 hours – two (2) days, depending on the sample storage time. Table 1 provides a list of applicable preservatives and maximum storage time prior to sample being processed.

2.2.2 Sample Identification and Chain of Custody

Samples will be identified by marking bottle labels provided by the lab, with a water resistant, non-smear felt pen or pencil. Bottle labels will include a minimum of the following information:

- Company Name and Sampling Persons;
- Sample Location (.i.e., Station No. 1843-1a or Station No. 1843-1b);
- Date and Time;
- Sample type (e.g., water); and
- Preservative.

The chain of custody form provided in Appendix A will be filled out and submitted to lab to identify where lab results will be sent, track samples (sample type and number of bottles), and identify lab required lab analysis/parameter.

2.2.3 Transportation

Immediately following sample collection, samples will be placed upright in a cooler or other storage container that does not contaminate the samples and permits a snug, immobile storage space during transfer. Samples will be kept cool (i.e., 4 °C) and delivered to Taiga Environmental Laboratory as soon as possible after collection (i.e., within 24 hours) in order to ensure samples are analyzed by the lab within appropriate timing windows (see Table 1 for maximum storage time). Samples with will

3.0 Lab Analysis

3.1 Lab Accreditation

Taiga Environmental Laboratory will conduct analyses. The labs' certificate of accreditation, including parameters for which they are certified for is provided in Appendix B.

3.2 Detection Limits

Detection limits for all parameters will be identified and provided by the lab and will be reported when any SNP data is submitted in the Annual Report to the Inuvialuit Water Board.

3.3 Methodology

Lab analyses will be conducted in accordance with the *Standard Methods for the Examination of Water and Wastewater*[4].

Baseline water quality data was not available at the time of writing to characterize conditions of Gunghi Creek to develop site-adapted or site-specific environmental quality objectives/criteria. As standards have not been stipulated in conditions of the *Water Licence N5L1-1843*, criteria for water quality will follow the *Canadian Water Quality Guidelines for the Protection of Aquatic Life*, which are generally the most stringent guidelines. Water quality guidelines for parameters outlined in the *Water Licence N5L1-1843* are presented in Appendix C.

Long-term exposure guidelines are presented to identify waterborne concentrations intended to protect all forms of aquatic life for indefinite exposure periods, following construction completion. **Short-term** exposure guidelines are not presented as they are intended for guidance on the impacts of severe, but transient, situations (e.g., spill events to aquatic receiving environments, infrequent releases of short-lived/non-persistent substances or inappropriate use or disposal of a substance). Where a short-term/severe exposure is identified during Surveillance Network Program, the cause of the event and compliance criteria should be identified, and additional compliance monitoring may be required.

4 Rice, E.W., R.B. Baird, A.D. Eaton. 2017. Standard Methods for the Examination of Water and Wastewater, 23rd Edition. American Public Health Association, The American Waterworks Association and the Water Environmental Federation.

4.0 Reporting Requirements

In accordance with the *Water Licence N5L1-1843*, the monthly and annual SNP results, including laboratory results, QA/QC results and interpretation, and data analysis or calculations will be submitted as part of the Annual Report to the Inuvialuit Water Board by January 31st of each year for the term of the licence (i.e., 2020 up to and including 2025). All data and information from the SNP will be presented in tabular summaries. The report will also include any information used to analyze the samples and determine acceptability of the data. Any anomalies and trends will be identified. Rationale for why any samples were not collected will also be provided. Results of the duplicate and field blank samples will be submitted with each required SNP report.

5.0 Closure

This plan has been prepared for the exclusive use of the Government of the Northwest Territories and their authorized users for specific application to the project site. The methods identified were prepared in accordance with the proposed work scope for the site, industry best management practices and guidelines, and conditions of approvals for the Project. No other warranty, expressed or implied, is made.

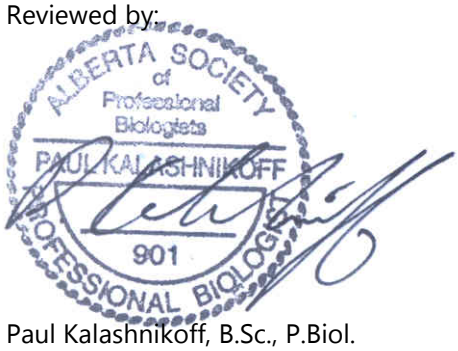
We trust that the information contained within this report satisfies your requirements. Should you have any questions, please contact the undersigned at your earliest convenience.

Respectfully submitted,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Jessica Parker, P.Biol., CPESC
Environmental Biologist / Erosion and Sediment Control Specialist

Reviewed by:



Paul Kalashnikoff, B.Sc., P.Biol.
Senior Environmental Biologist

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Appendix A

Chain of Custody Form

Government of Northwest Territories
Gouvernement des Territoires du Nord-Ouest

TAIGA ENVIRONMENTAL LABORATORY – FIELD SHEET

4601 – 52 Avenue, Yellowknife, NT, X1A 2L9 • Tel: (867) 767-9235 • Fax: (867) 920-8740 • email: taiga@gov.nt.ca

Laboratory Use Only
Batch No.:

Send Results and Invoice to: (Please notify if results or invoice are to be sent to different locations)	
Company/Agency:	
Address:	
City/Town:	
Province/Territory:	Postal Code:
Phone:	Fax:
E-mail:	
Signature:	

Client Project No.:	
Date Collected:	Time Collected:
Sampler:	
Location:	
Rush Required: ☐ Yes ☐ No	
Note: *Analysis may be subcontracted without prior notice. See reverse for how to complete form and sampling protocols.*	
Laboratory Use Only	
Date Received:	Received By:
Comments:	

WATER SAMPLES

Sample Type (freshwater, sewage, wastewater, potable, groundwater, salt water, etc.)			
Client Sample ID (as it should appear on final report)			
Taiga Sample ID (Laboratory Use Only)			

Bottle Type and Parameter — **[√] PLEASE CHECK PARAMETERS REQUESTED BELOW:**

Routine	pH, Conductivity, Alkalinity	☐ pH ☐ Cond ☐ Alk	☐ pH ☐ Cond ☐ Alk	☐ pH ☐ Cond ☐ Alk
	Individual Anions Suite ☐	☐ Cl ☐ SO_4 ☐ F ☐ NO_2-N ☐ NO_3-N	☐ Cl ☐ SO_4 ☐ F ☐ NO_2-N ☐ NO_3-N	☐ Cl ☐ SO_4 ☐ F ☐ NO_2-N ☐ NO_3-N
	Total Nitrite (NO_2) + Nitrate (NO_3)	☐ NO_2-N + NO_3-N	☐ NO_2-N + NO_3-N	☐ NO_2-N + NO_3-N
	Individual Cations Suite ☐	☐ Ca ☐ Mg ☐ Na ☐ K	☐ Ca ☐ Mg ☐ Na ☐ K	☐ Ca ☐ Mg ☐ Na ☐ K
	Hardness (Calculated)	☐ Hardness	☐ Hardness	☐ Hardness
	Reactive Silica	☐ SiO_2	☐ SiO_2	☐ SiO_2
	Colour	☐ Apparent ☐ True	☐ Apparent ☐ True	☐ Apparent ☐ True
	Laboratory Use Only	Received: ☐ Y ☐ N	Received: ☐ Y ☐ N	Received: ☐ Y ☐ N
Nutrients	Chlorine: Total, Residual	☐ T. Cl ☐ R. Cl	☐ T. Cl ☐ R. Cl	☐ T. Cl ☐ R. Cl
	Chemical Oxygen Demand	☐ COD	☐ COD	☐ COD
	Turbidity	☐ Turbidity	☐ Turbidity	☐ Turbidity
	Total Suspended Solids, Dissolved Solids	☐ TSS ☐ TDS	☐ TSS ☐ TDS	☐ TSS ☐ TDS
	Ammonia	☐ NH_3-N	☐ NH_3-N	☐ NH_3-N
	Phosphorus: Total, Dissolved, Ortho	☐ TP ☐ DP ☐ OP	☐ TP ☐ DP ☐ OP	☐ TP ☐ DP ☐ OP
	Carbon: Total, Dissolved	☐ TOC ☐ DOC	☐ TOC ☐ DOC	☐ TOC ☐ DOC
	Nitrogen: Total, Dissolved	☐ TN ☐ DN	☐ TN ☐ DN	☐ TN ☐ DN
	Visible Oil and Grease	☐ Visible	☐ Visible	☐ Visible
	Laboratory Use Only	Received: ☐ Y ☐ N	Received: ☐ Y ☐ N	Received: ☐ Y ☐ N
Sterile	Fecal Coliforms (FC)	☐ FC	☐ FC	☐ FC
	Total Coliforms (TC), E. Coli (EC)	☐ TC ☐ EC	☐ TC ☐ EC	☐ TC ☐ EC
	Enterococci (EN)	☐ EN	☐ EN	☐ EN
	Laboratory Use Only	Received: ☐ Y ☐ N °C Sterile Container: ☐ Y ☐ N	Received: ☐ Y ☐ N °C Sterile Container: ☐ Y ☐ N	Received: ☐ Y ☐ N °C Sterile Container: ☐ Y ☐ N
	Biochemical Oxygen Demand	☐ BOD	☐ BOD	☐ BOD
	Carbonaceous BOD	☐ CBOD	☐ CBOD	☐ CBOD
	Laboratory Use Only	Received: ☐ Y ☐ N °C	Received: ☐ Y ☐ N °C	Received: ☐ Y ☐ N °C
Metals	Please indicate if sample is preserved and/or filtered	☐ Pres ☐ Filt ☐ Pres	☐ Pres ☐ Filt ☐ Pres	☐ Pres ☐ Filt ☐ Pres
	ICP-MS(1): Cd, Cr, Cu, Co, Mn, Ni, Pb, Zn, Fe	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved
	ICP-MS(2): 25 element scan includes As (not included: B, Bi, Hg, Sn)	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved
	Individual Metals by ICP-MS (please circle each metal): Ag, Al, As, B, Ba, Be, Bi, Cd, Co, Cr, Cs, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Rb, Sb, Se, Sn, Sr, Ti, Tl, U, V, Zn	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved	☐ Total ☐ Dissolved
	Laboratory Use Only	TM Rec'd: ☐ Y ☐ N DM Rec'd: ☐ Y ☐ N	TM Rec'd: ☐ Y ☐ N DM Rec'd: ☐ Y ☐ N	TM Rec'd: ☐ Y ☐ N DM Rec'd: ☐ Y ☐ N
	Hexane Extractable Material (O&G)	☐ HEM	☐ HEM	☐ HEM
	Laboratory Use Only	Rec'd: ☐ Y ☐ N Pres: ☐ Y ☐ N	Rec'd: ☐ Y ☐ N Pres: ☐ Y ☐ N	Rec'd: ☐ Y ☐ N Pres: ☐ Y ☐ N
	BTEX, Purgeable HC (40mL x 2 vials)	☐ BTEX ☐ Purg HC	☐ BTEX ☐ Purg HC	☐ BTEX ☐ Purg HC
	Extractable HC (1L amber glass bottle)	☐ Ext HC	☐ Ext HC	☐ Ext HC
	Trihalomethanes (40 mL x 2 vials)	☐ THM	☐ THM	☐ THM
	Laboratory Use Only	Vial Rec'd: ☐ Y ☐ N Ext Rec'd: ☐ Y ☐ N	Vial Rec'd: ☐ Y ☐ N Ext Rec'd: ☐ Y ☐ N	Vial Rec'd: ☐ Y ☐ N Ext Rec'd: ☐ Y ☐ N
	Other: *See special request form*			

For safety purposes, please disclose any contaminants (e.g. heavy metals, cyanide, etc.) that may be present at high levels and pose a risk to human health:

HOW TO FILL OUT THIS FORM

Company/Agency	The full, legal company name.
Address	Full street address, including suite or unit number, if applicable. Final reports will be sent to this address.
City/Town	City or Town
Province/Territory	Province or Territory
Postal Code	Postal Code
Phone	Full telephone number, including area code and extension, if applicable.
Fax	Facsimile number.
E-mail	E-mail address, if available.
Signature	Signature of the individual filling out the form.
Client Project No.	This information will appear on the final analytical report.
Date Collected	Enter the date(s) that the samples were collected.
Time Collected	Enter the time(s) the sample(s) were collected in military time or note if it is a.m or p.m.
Sampler	The name of the individual who collected the sample.
Location	The general location of where the samples were collected.
Rush Required	Indicate if regular or Rush turnaround time is required. Check yes only if Rush is required, no if not.
Sample Type	Identify the sample matrix (freshwater, drinking water, soil, etc.).
Client Sample ID	Identify each submitted sample. This identification will appear on the analytical report.
Test Column	Check off the tests you require for each sample submitted.

IMPORTANT INFORMATION

Turnaround Time
Standard turnaround time is 10 business days. Please note that turnaround time delays may occur if the *Field Sheet* is incomplete or incorrectly filled out.

RUSH Analysis
Rush turnaround time is 5 business days. All samples received at the lab are analyzed on a 'first come, first serve' basis unless otherwise specified as Rush. Rush samples will be place in the front of the line and analyzed prior to routine samples. A premium charge of 100% shall be charged for the analysis. Rush services depend on staff availability, analysis required and capabilities of the lab. Please contact the lab prior to requesting this service.

Sample Receipt, Custody and Storage
All submitted samples remain the sole property of the client and may be returned to the client for appropriate storage or disposal at the discretion of Taiga Environmental Laboratory.

All submitted samples will be stored for 30 days from the date the final report is printed. Arrangements can be made to hold the samples for an extended time at a nominal fee.

Sampling Supplies
Sample bottles, preservatives, labels and forms are available at no cost when requesting services. To place a bottle order, please submit a *Bottle &/or Preservative Order Form* a minimum of 48 hours in advance. Please note the shipment of Dangerous Goods may be delayed due to availability of qualified airline agents to process the paperwork.

Shipping Charges
All shipping costs are the responsibility of the client.

Confidentiality
All data and reports are considered confidential and the property of the client. No information shall be released to others without documented approval from the client.

Limit of Liability
Although every care and precaution is taken in the performance of our services, our liability for loss or damage in all circumstances is limited to re-analysis of the sample(s) at our expense or the cancellation of charges.

Taiga Environmental Laboratory reserves the right to refuse to proceed with an analysis if the lab does not have the capability and/or resources to meet analysis requirements, including facilities and equipment, scientific expertise, analytical capabilities, staff scheduling, Quality Assurance/Quality Control specifications and report.

Parameter Group	Marking	Preservative	Instructions
Routine	GREEN	Keep Cool at 4°C	1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle.
Nutrients	BLACK	Keep Cool at 4°C	
Biochemical Oxygen Demand (BOD)/Carbonaceous BOD (CBOD)	PURPLE	Keep Cool at 4°C	1. Rinse bottle three (3) times with sample. 2. Fill to top and cap bottle. 3. Sample must be sent to the lab within 24 hours of collection.
Microbiological	STERILE	Sodium Thiosulphate Keep Cool at 4°C	1. **DO NOT RINSE BOTTLE.** 2. Fill to top and cap. 3. Sample must be sent to the lab within 24 hours of collection.
Total Metals	RED	5 mL of 1:3 nitric acid in Red-dot vial	1. Rinse bottle three (3) times with sample. 2. Fill to near the top. 3. Add contents of preservative vial. 4. Cap bottle and mix.
Dissolved Metals	RED	5 mL of 1:3 nitric acid in Red-dot vial	1. **Filter sample with 0.45 um Cellulose Acetate filter.** 2. Rinse bottle three (3) times with filtrate. 3. Fill to near the top. 4. Add contents of preservative vial. 5. Cap bottle and mix.
Hexane Extractable Material (HEM)	YELLOW	4 mL of 1:3 sulphuric acid in Yellow-dot vial	1. **DO NOT RINSE BOTTLE.** 2. Fill to shoulder of bottle. 3. Add contents of preservative vial. 4. Cap bottle and mix.
BTEX, THM and Purgeable Hydrocarbons	40 mL CLEAR GLASS W/ WHITE LID	Keep Cool at 4°C	1. **DO NOT RINSE BOTTLE.** 2. Fill vials completely leaving **NO** air bubbles.
Extractable Hydrocarbons	1 L AMBER GLASS WITH WHITE LID	Keep Cool at 4°C	1. **DO NOT RINSE BOTTLE.** 2. Fill to top and cap.
Cyanide, Total and WAD	BLUE	1 mL of 6N sodium hydroxide solution	1. Rinse bottle three (3) times with sample. 2. Fill to near the top of container. 3. Add contents of preservative vial. 4. Cap bottle and mix.
Thiocyanate	ORANGE	2 mL 25% sulphuric acid; or keep cool at 4°C	
Phenol	YELLOW with P	2 mL of 20% sulphuric acid	

Appendix B

Taiga Environmental Laboratory Certificate of Accreditation

CALA Directory of Laboratories

Canadian Association for Laboratory Accreditation Inc.

Membership Number: 2635
Laboratory Name: Taiga Environmental Laboratory
Parent Institution: Government of Northwest Territories (GNWT)
Address: P.O. Box 1320 4601 - 52nd Avenue Yellowknife NT X1A 2L9
Contact: Mr. Bruce Stuart
Phone: (867) 767-9235
Fax: (867) 920-8740
Email: bruce_stuart@gov.nt.ca; taiga@gov.nt.ca; Glen_hudy@gov.nt.ca

Standard: Conforms with requirements of ISO/IEC 17025
Clients Served: All Interested Parties
Revised On: December 11, 2019
Valid To: March 5, 2022

Scope of Accreditation

Solids (Inorganic)
Moisture - Solids [Soil] (030)
TEL007; CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD
GRAVIMETRIC
Percent Moisture

Solids (Organic)
BTEX - Solids [Soil] (072)
TEL038; modified from EPA 502.2 and EPA 5030B and EPA 602
GC/MS - PURGE AND TRAP
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Toluene

Solids (Organic)
Purgeable Hydrocarbons - Solids [Soil] (074)
TEL056; CCME CWS PETROLEUM HYDROCARBONS IN SOIL - TIER 1 METHOD
GC/FID - PURGE AND TRAP
F1: C6-C10

Water (Inorganic)
Alkalinity - Water (066)
TEL060:PC TITRATE; modified from SM 2320 A and SM 2320 B
AUTO TITRIMETRIC
Alkalinity (pH 4.5)

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Water (Inorganic)
Ammonia Nitrogen - Water (089)
TEL068; modified from SM 4500-NH3 G
COLORIMETRIC - DISCRETE
Ammonia

Water (Inorganic)
Anions - Water (059)
TEL055; modified from SM 4110 B
ION CHROMATOGRAPHY
Chloride
Fluoride
Nitrate
Nitrite
Sulfate

Water (Inorganic)
Biochemical Oxygen Demand (BOD) - Water (004)
TEL019; modified from SM 5210 A and SM 5210 B
D.O. METER
BOD (5 day)
CBOD (5 day)

Water (Inorganic)
Carbon - Water (029)
TEL033; modified from SM 5310 B
INFRARED
Organic Carbon

Water (Inorganic)
Cations - Water (042)
TEL055; modified from SM 4110 B
ION CHROMATOGRAPHY
Calcium
Magnesium
Potassium
Sodium

Water (Inorganic)
Chemical Oxygen Demand (COD) - Water (061)
TEL016; modified from SM 5220 D
REFLUX - COLORIMETRIC
COD

Water (Inorganic)
Colour - Water (063)
TEL051; modified from SM 2120 C
SPECTROPHOTOMETRIC
Apparent Colour
True Colour

Water (Inorganic)
Conductivity - Water (068)
TEL059:PC TITRATE; modified from SM 2510 B
AUTO CONDUCTIVITY METER
Conductivity (25˚C)

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Water (Inorganic)
Dissolved Metals - Water (013)
TEL035; modified from EPA 200.8
ICP/MS
Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Molybdenum
Nickel
Rubidium
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Water (Inorganic)
Mercury - Water (080)
TEL062; modified from EPA 245.7
ATOMIC FLUORESCENCE
Mercury

Water (Inorganic)
Oil and Grease - Water (060)
TEL024: HEM; modified from EPA 1664A (REVISION A)
GRAVIMETRIC - EXTRACTION
Total Oil and Grease

Water (Inorganic)
pH - Water (067)
TEL058:PC TITRATE; modified from SM 4500-H+ A and SM 4500-H+ B
AUTO - pH METER
pH

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Water (Inorganic)
Phosphate - Water (087)
TEL069; modified from SM 4500-P F
COLORIMETRIC - DISCRETE
Phosphate

Water (Inorganic)
Reactive Silica - Water (090)
TEL070; modified from SM 4500-SI F
COLORIMETRIC - DISCRETE
Reactive Silica

Water (Inorganic)
Solids - Water (011)
TEL008, TEL009; modified from SM 2540 C and SM 2540 D
GRAVIMETRIC
Total Dissolved Solids
Total Suspended Solids

Water (Inorganic)
Total and Dissolved Nitrogen - Water (086)
TEL066; modified from ASTM D5176-91 and ISO 11905
PYROLYSIS - CHEMILUMINESCENCE
Dissolved Nitrogen
Total Nitrogen

Water (Inorganic)
Total and Dissolved Phosphorus - Water (088)
TEL069; modified from SM 4500-P F
COLORIMETRIC - DISCRETE
Dissolved Phosphorus
Total Phosphorus

Water (Inorganic)
Total Metals - Water (054)
TEL035; modified from EPA 200.8
ICP/MS
Aluminum
Arsenic
Barium
Beryllium
Boron
Cadmium
Cesium
Chromium
Cobalt
Copper
Iron
Lead
Lithium
Manganese
Mercury
Molybdenum

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Nickel
Rubidium
Selenium
Silver
Strontium
Thallium
Tin
Titanium
Uranium
Vanadium
Zinc

Water (Inorganic)
Turbidity - Water (028)
TEL006; modified from SM 2130 B
NEPHELOMETRY
Turbidity

Water (Microbiology)
Coliforms - Water (045)
TEL053; modified from IDEXX QUANTI-TRAY
MOST PROBABLE NUMBER (QUANTI-TRAY)
Escherichia coli
Total Coliforms

Water (Microbiology)
Fecal (Thermotolerant) Coliforms - Water (041)
TEL017; modified from SM 9222 D
MEMBRANE FILTRATION (mFC)
Fecal (Thermotolerant) Coliforms

Water (Microbiology)
Fecal Streptococci - Water (055)
TEL053; modified from IDEXX QUANTI-TRAY
MOST PROBABLE NUMBER (QUANTI-TRAY)
Fecal streptococci

Water (Organic)
BTEX - Water (070)
TEL037:BTEX; modified from EPA 502.2 and EPA 5030B and EPA 602
GC/MS - PURGE AND TRAP
Benzene
Ethylbenzene
m,p-Xylene
o-Xylene
Toluene

Water (Organic)
Extractable Hydrocarbons - Water (085)
TEL067; modified from EPA 3510C and EPA 3630C and SM 6010
GC/FID - SOLID PHASE EXTRACTION
C10-C50

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Water (Organic)
Purgeable Hydrocarbons - Water (084)
TEL044; modified from EPA 5030 and EPA 8000 and EPA 8015 and EPA 8260B
GC/FID - PURGE AND TRAP
C6-C10

Water (Organic)
Trihalomethanes (THM) - Water (077)
TEL039:THM; modified from EPA 502.2 and EPA 5030B and EPA 602
GC/MS - PURGE AND TRAP
Bromodichloromethane
Bromoform
Chlorodibromomethane
Chloroform

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Appendix C

Canadian Water Quality Guidelines for the Protection of Aquatic Life

Table C1. Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life

Parameter	Criteria[1,2]	Criteria Source
Ammonia	Total Ammonia: see Table 3 below. Un-ionized Ammonia: concentration not to exceed 0.019 mg NH_3/L. (equivalent to 0.016 mg/L NH_3-N)	CCME 2010
Arsenic (As; Total)	Concentration not to exceed 5 µg/L	CCME 2001
Cadmium (Cd; Total)	**Long-term:** for waters of 50 mg $CaCO_3$/L hardness, concentration not to exceed 0.09 µg/L. At hardness values between 17 and 280 mg $CaCO_3$/L, the CWQG can be calculated with the equation: $CWQG\ (\mu g/L) = 10^{\{0.83(\log[hardness]) - 2.46\}}$	CCME 2014
Calcium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Chromium (Cr)	Total Chromium: No water quality criteria for protection of aquatic life. Hexavalent Chromium (Cr(VI)): concentration not to exceed 1 µg/L. Trivalent Chromium (Cr(III)): concentration not to exceed 8.9 µg/L	CCME 1999a
Cobalt (Co)	No water quality criteria for protection of aquatic life	CCME 2019a
Conductivity	No water quality criteria for protection of aquatic life.	CCME 2019a
Copper (Cu)	When the water **hardness ($CaCo_3$) is 0 to < 82 mg/L**, Cu concentration not to exceed 2 µg/L. At **hardness ≥82 to ≤180 mg/L**, Cu concentration not to exceed the value calculated using the following equation: $CWQG\ (\mu g/L) = 0.2 * e^{\{0.8545[\ln(hardness)]-1.465\}}$ At **hardness >180 mg/L**, Cu concentration not to exceed 4 µg/L. If the **hardness is unknown**, not to exceed 2 µg/L.	CCME 2019a
Dissolved Oxygen	For cold water ecosystems: 6.5 mg/L to 9.5 mg/L	CCME 1999b
Hardness ($CaCO_3$)	No water quality criteria for protection of aquatic life; Used to determine hardness dependent criteria of other parameters.	CCME 2019a
Iron (Fe)	Concentration not to exceed 300 µg/L	CCME 2019a
Lead (Pb)	When the **hardness ($CaCo_3$) is 0 to ≤ 60 mg/L**, Pb concentration not to exceed 1 µg/L At **hardness >60 to ≤ 180 mg/L**, Pb concentration not to exceed the value calculated using the following equation: $CWQG\ (\mu g/L) = e^{\{1.273[\ln(hardness)]-4.705\}\ (\mu g/L)}$ At **hardness >180 mg/L**, Pb concentration not to exceed 7 µg/L. If the **hardness is unknown**, Pb concentration not to exceed 1 µg/L	CCME 2019a
Magnesium	No water quality criteria for protection of aquatic life; used to determine hardness.	CCME 2019a
Manganese (Mn)	**Long-term:** CWQG (µg/L dissolved Mn) is calculated using the calculator in Appendix B of the *Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese* (CCME 2019c), found here: http://st-ts.ccme.ca/en/index.html?lang=en&factsheet=129.	CCME 2019b CCME 2019c
Mercury (Hg; Total)	Concentration not to exceed 0.026 µg/L	CCME 2003

Parameter	Criteria[1,2]	Criteria Source
Nickel (Ni)	When the water **hardness ($CaCo_3$) is 0 to ≤ 60 mg/L**, Ni concentration not to exceed 25 µg/L. At **hardness > 60 to ≤ 180 mg/L**, Ni concentration not to exceed the value calculated using the following equation: $CWQG\ (\mu g/L) = e^{(0.76[ln(hardness)]+1.06)}$ At **hardness >180 mg/L**, Ni concentration not to exceed 150 µg/L. If the **hardness is unknown**, Ni concentration not to exceed 25 µg/L.	CCME 2019a
Nitrate	**Long-term:** concentration not to exceed 13 mg NO_3^-/L (equivalent to 2.93 mg NO_3^--N/L)	CCME 2012
Nitrite	Concentration not to exceed 60 µg NO_2-N/L (equivalent to 197 µg NO_2/L).	CCREM 1987
pH	Acceptable between 6.0 and 9.0	WL
Total Petroleum Hydrocarbon (TPH)	Maximum average concentration not to exceed 3 mg/L Maximum concentration of any grab sample not to exceed 5 mg/L	WL
Total Suspended Solids (TSS)	**During clear flow**: Maximum average increase of 5 mg/L from background levels for a longer term exposure (e.g., 30-d period). **During high flow or turbid waters**: Maximum increase of 25 mg/L from background levels at any one time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.	CCME 2002
Turbidity (Nephelometric Turbidity Units)	**During clear flow**: Maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period). **During high flow or turbid waters**: Maximum increase of 5 NTUs from background levels at any one time when background levels are between 8 and 50 NTUs. Should not increase more than 10% of background levels when background is >50 NTUs.	CCME 2002
Temperature	**Thermal Stratification**: Thermal additions to receiving waters should be such that thermal stratification and subsequent turnover dates are not altered from those existing prior to the addition of heat from artificial origins. **Maximum Weekly Average Temperature**: Thermal additions to receiving waters should be such that the maximum weekly average temperature is not exceeded.	CCME 1999c
Zinc (Zn)	**Long-term:** CWQG for dissolved zinc and is calculated using the following equation, which is valid for hardness ($CaCO_3$) between 23.4 and 399 mg/L, pH between 6.5 and 8.13, and DOC between 0.3 to 22.9 mg/L: $CWQG = \exp^{(0.947[ln(hardness\ mg{\cdot}L\text{-}1)] - 0.815[pH] + 0.398[ln(DOC\ mg{\cdot}L\text{-}1)] + 4.625)}$.	CCME 2018

Notes: 1: *Canadian Water Quality Guidelines for the Protection of Aquatic Life* available at the time of writing. Where updated guidelines are published prior to the start of sampling, the most recent criteria shall be followed; 2: WL – *Water Licence N5L1-1843.*

Table C2. Canadian Water Quality Guideline for Total Ammonia (mg NH_3/L) for the Protection of Aquatic Life

Temperature (°C)	pH							
	6.0	**6.5**	**7.0**	**7.5**	**8.0**	**8.5**	**9.0**	**10.0**
0	231	73.0	23.1	7.32	2.33	0.749	0.25	0.042
5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

Notes: CCME 2019c