MEMORANDUM

TO Stu Niven, Manager, Environmental Affairs, Department of Infrastructure, GNWT

DATE 17 October, 2017

CC

FROM Cam Stevens and Damian Panayi, Golder Associates Ltd.

PROJECT NO. 1665943

FISH HABITAT SURVEY FOR THE TŁĮCHǪ ALL-SEASON ROAD

Introduction

As per commitments (#7 and #14) made during the technical session for the environmental assessment (EA-1617-01) of the Tłı̨chǫ All-Season Road (TASR) in Behchokǫ̀ (August 15 to 17, 2017), the Government of the Northwest Territories (GNWT) agreed to take Fisheries and Oceans Canada (DFO) and a local harvester to visit the watercourse crossings along the TASR where culverts are proposed to confirm the ephemeral nature of these crossings. Golder Associates Ltd. (Golder) was then retained by the GNWT to lead this tour and also conduct a fish habitat evaluation at stream crossings along the TASR during late summer/early fall 2017. Vincent Harper from DFO and harvester John Beaverho from Whatì partook in this fieldtrip on September 20 and 21, 2017 with Golder.

The objectives of the fish habitat evaluation were to confirm the ephemeral nature of streams (see commitment #14), describe fish habitat and channel characteristics in the vicinity of the proposed crossing locations, and to confirm the habitat descriptions in the Adequacy Statement Response (ASR). Only crossings accessible by all-terrain vehicle (ATV) from Highway 3 were considered (Figure 1). The survey list included all locations up to crossing 13, approximately 63 km from the staging area on the existing trail near Highway 3. As the focus of the survey was to confirm the ephemeral nature of stream crossings, the James River crossing (14) and La Martre River crossing (15) were excluded from the surveys as they were relatively inaccessible from Highway 3.

The final list of crossing locations for evaluation included the following:

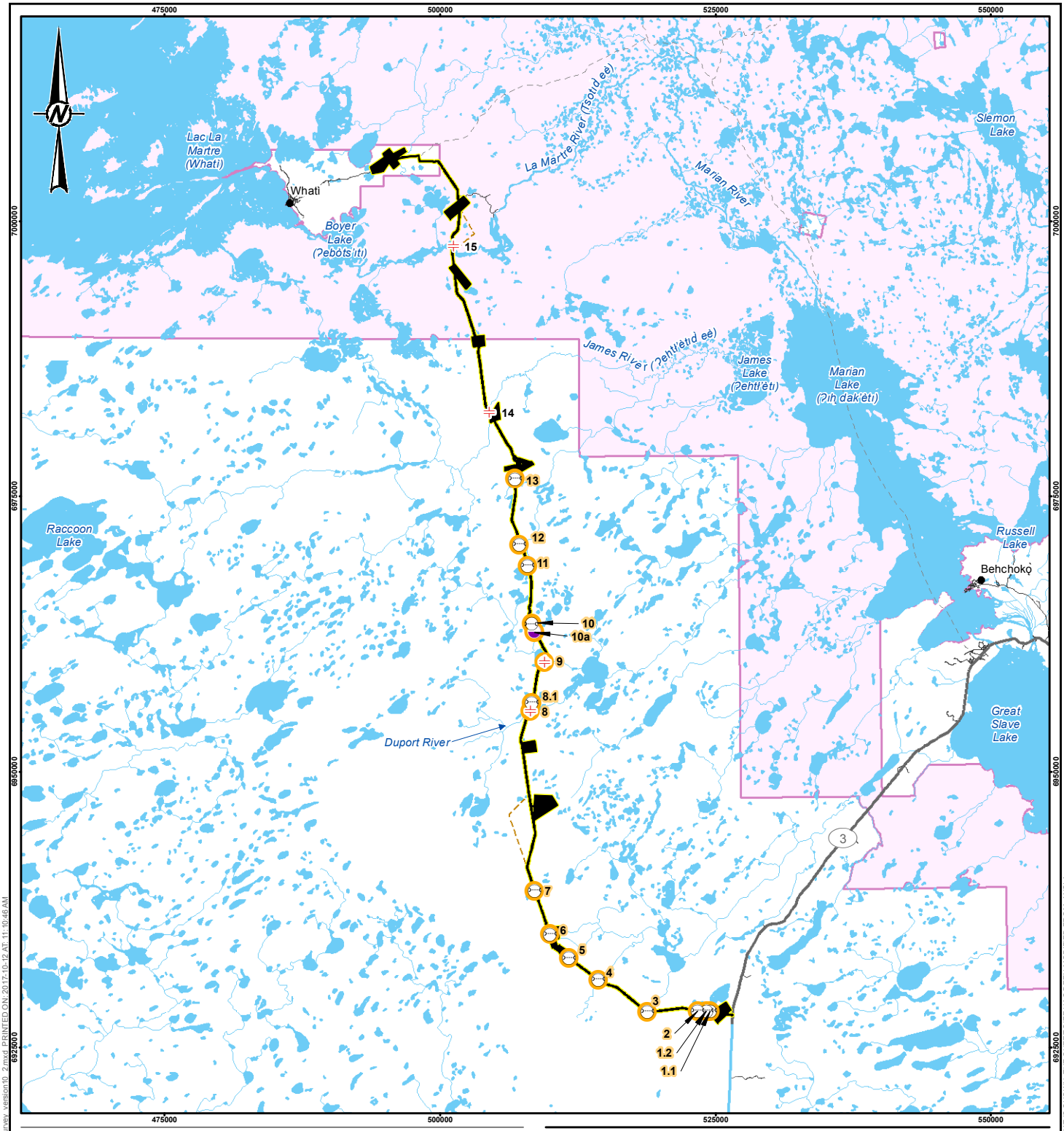
- Crossing 10a, a proposed arch culvert
- Crossing 9 (unnamed creek), and crossing 8 (Duport River), where clear-span bridges will be installed
- All crossings where closed pipe culverts will be installed (crossing 1.1 to 7, and crossing 10, 11, 12, and 13)

Crossing 12 was included in the field survey. This crossing was described in the Project Description Report (PDR), but was not included in the ASR because it was assumed to have no interaction with fish habitat given available information at the time of the assessment.

Methods

Fish habitat was evaluated within the proposed Right of Way (ROW) using Golder's internal habitat classification methods (see definitions in Appendix A). General reach descriptions downstream and upstream of the ROW were recorded. All observations were supplemented with photographs. Data collection included the following variables:

- Watercourse class (ephemeral, intermittent, small/large permanent) and stage (dry, low, moderate, and high)
- Habitat types, such as riffle, run, and pool habitats
- *In-situ* water quality (temperature, pH, and conductivity)
- Stream channel measurements, such as bankfull and wetted widths, and maximum depths
- Substrate types (e.g., gravel, cobble) and instream and overhead cover (e.g., woody debris)
- Habitat potential or quality for small and large-bodied fish, and any incidental observations of fish



LEGEND

- POPULATED PLACE
- ALL-SEASON ROAD
- LOCAL ROAD
- WINTER ROAD
- OLD AIRPORT ROAD
- WATERCOURSE
- TŁĮCHǪ LAND
- WATER BODY
- FISH HABITAT SURVEY LOCATION

PROPOSED CROSSING STRUCTURES

- PROPOSED BRIDGE
- PROPOSED ARCHED (OPEN BOTTOM) CULVERT
- PROPOSED CLOSED BOTTOM CULVERT
- PROJECT FOOTPRINT

0 10 20

1:500,000 KILOMETRES

REFERENCE(S)

1. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 11 DATUM: NAD83

CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES

PROJECT
TŁĮCHǪ ALL-SEASON ROAD

TITLE
PROPOSED TASR WATER CROSSINGS AND CROSSINGS SURVEYED FOR FISH HABITAT DURING SEPTEMBER 20-21, 2017

CONSULTANT
Golder Associates

YYYY-MM-DD	2017-10-12
DESIGNED	CS
PREPARED	LMS
REVIEWED	CS
APPROVED	DP

PROJECT NO.	REV.	FIGURE
1665943	0	1

Summary of Results

During September 20 and 21, 2017, a total of 16 crossing locations were surveyed for fish habitat and channel characteristics (Table 1; also see Photos 1 to 32). The crossings were accessed by ATV travel on the existing trail near the junction with Highway 3 (Figure 1). The furthest surveyed crossing from the staging area was crossing 13. Where possible wetlands along the TASR alignment were avoided while travelling by ATV and any streambeds that were crossed were carefully navigated at the proposed crossing location. Survey results are summarized in Table 1, and photographs of the crossings follow in the same order that they are presented in the table.

The survey confirmed that twelve of the crossings will be installed on ephemeral watercourses, all of which lack a defined bed and banks (Table 1). Nine crossings were characterized by dry habitats where flows would only be present for a short period during the spring freshet (i.e., Crossing 1.1 to 7, and 11). All crossings proposed at ephemeral watercourses are unlikely to affect fish habitat with the possible exception of crossing 12 where the road will cross a riparian wetland connecting two ponds. There is the potential for the road to affect fish habitat as the ROW may extend into riparian areas that may be inundated during high flows (e.g., during spring freshet) (see Photos 29 and 30).

One new watercourse crossing was identified. The new crossing (8.1) is located approximately 0.84 road-km north of the Duport River crossing (Table 1; Figure 1). The watercourse at this crossing was classified as an ephemeral draw-intermittent class (see Photos 19 and 20) with moderate potential to support small-bodied fish and minimal potential to support large-bodied fish.

Three of the proposed crossings are on permanent watercourses, including crossing 8 (Duport River crossing), 9, and 10a. Based on habitat present at these locations, the watercourses have the potential to support at least one of the following large-bodied fish species: Arctic Grayling, Walleye, Northern Pike, Burbot, White Sucker, and Longnose Sucker. Crossing 10a is the only crossing where there will be a culvert installed and where there is the potential for effects to large-bodied fish habitat during construction; clear span bridges are proposed for crossing 8 and 9.

The watercourse at crossing 10a was described as an irregular meander, confined to the stream banks, and with an incised channel form (Photos 23 and 24). Within the ROW, the maximum depth was 0.4 m, the mean bankfull width was 1.8 m, and the bank height from the water surface was approximately 0.6 m. The bankfull width and the wetted width measurements were similar at the time of the survey. Stream banks were described as moderately to highly stable with scrubland vegetation dominating riparian areas. The stream habitat within the ROW was classified as a shallow run (or glide), with riffle and deeper run habitats occurring outside of the ROW. Substrate was a near equal combination of fines (e.g., organics, silt) and coarse substrates (mainly cobble). Stream cover (approximately 40%) was provided by wood debris, overhanging vegetation, and undercut banks. No fish were observed at the time of the survey; however visibility was limited by stream cover. *In-situ* water measurements included a high conductivity reading of 2,626 microsiemens per centimetre (µS/cm) that suggests an upstream groundwater influence.

The culvert crossing results from the field survey are generally consistent with the ephemeral descriptions of the culvert crossings in the ASR. For two crossings (crossing 11 and 13), the field survey showed that the environmental assessment overestimated fish habitat quality. There is no discernible watercourse channel, and there is no potential to support Northern Pike and White Sucker at crossings 11 and 13. For one crossing (10a), the field survey noted that the actual watercourse hydroperiod may be longer due to groundwater influences, however, the determination of habitat potential or likelihood of supporting large-bodied fish in the field was similar to that made in the ASR (moderate-to-high versus moderate) such that the conclusions in the ASR do not change.

Table 1: Summary of Fish Habitat Surveys at TASR Crossings Visited September 20 and 21, 2017.

ID	Class	Stage	Description of Crossing Site (Right of Way; ROW)[1]	Description of Reach	Large-Bodied Fish Habitat Potential	Small-Bodied Fish Habitat Potential	Fish Observed
1.1	Ephemeral Draw	Dry	▪ 20 m south of existing trail[1] ▪ birch seep/shrubby wetland	▪ no defined bed or banks ▪ ephemeral draw extends beyond ROW	None	Minimal	None
1.2	Ephemeral Draw	Dry	▪ 100 m south of existing trail ▪ dry upland forest	▪ no defined bed or banks ▪ upland forest	None	None	None
2	Ephemeral Draw	Dry	▪ 200 m south of existing trail ▪ dry upland forest	▪ no defined bed or banks ▪ upland forest	None	None	None
3	Ephemeral Draw	Dry	▪ near existing trail ▪ dry, early stage upland forest	▪ no defined bed or banks ▪ upland forest	None	None	None
4	Ephemeral Draw	Dry	▪ near existing trail ▪ dry upland forest	▪ no defined bed or banks ▪ upland forest	None	None	None
5	Ephemeral Draw	Dry	▪ near existing trail ▪ dry upland forest	▪ no defined bed or bank ▪ upland forest	None	None	None
6	Ephemeral Draw	Dry	▪ near existing trail ▪ ephemeral wetland to NE (downstream) ▪ dry, early stage forest to SW (upstream) ▪ less than 20 m width draw	▪ no defined bed or banks ▪ upland forest	None	None	None
7	Ephemeral Draw	Dry	▪ near existing trail ▪ ephemeral wetland to NE (downstream) ▪ dry forest to SW (upstream) ▪ less than 30 m width draw	▪ no defined bed or banks ▪ ephemeral draw extends downstream beyond ROW	None	None	None
8	Large Permanent	Low-Moderate	▪ crossing is 160 m E (downstream) of existing crossing ▪ braided channels; two mains channels in ROW, each with 5 m wetted/bankfull width ▪ cobble/fine substrate types ▪ deep run habitat (3 m max. depth)	▪ 1,747 µS/cm, 8.1 pH, 6.6ºC ▪ braided, meandering, occasionally confined, and incised stream ▪ shrub/meadow riparian habitat (moderate bank stability) ▪ debris at existing crossing may be a barrier at low flows	High	High	Unidentified small-bodied fish

Table 1: Summary of Fish Habitat Surveys at TASR Crossings Visited September 20 and 21, 2017.

ID	Class	Stage	Description of Crossing Site (Right of Way; ROW)[1]	Description of Reach	Large-Bodied Fish Habitat Potential	Small-Bodied Fish Habitat Potential	Fish Observed
8.1[2]	Ephemeral Draw-Intermittent	Low-Moderate	▪ approximately 0.5 to 1 m stream width ▪ gravel/fine substrate types ▪ shallow run and riffle habitat within ROW; ▪ cascade downstream of centreline may be barrier to fish	▪ discontinuous defined bed and bank ▪ winding, confined, and open channel ▪ treed/shrub riparian habitat ▪ seasonal low-flows may be a barrier to fish movements	Minimal	Low-Moderate	None
9	Large Permanent	Low	▪ crossing is 170 m SE (downstream) of existing trail ▪ 6 m bankfull/wetted width, with maximum depth of 0.75 m in ROW ▪ cobble/fines as dominant substrate types ▪ run, riffle, and pool habitat	▪ 1,125 µS/cm, 8.0 pH, 8.2°C ▪ winding, confined, and neutral channel ▪ forest dominated riparian cover (moderate to high bank stability) ▪ no barriers to passage within 100 m of centreline	Moderate-high	High	Cyprinids
10	Ephemeral Draw	Low	▪ 30 m west of existing trail ▪ shrubby fen to NW, treed fen to SE ▪ 55 m wide fen ▪ open water 20 m east centreline	▪ no defined bed or banks ▪ fen extends beyond ROW	None	Low	None
10a	Small Permanent	Low-Moderate	▪ crossing is 30 m SW (downstream) of existing trail ▪ 2 m wetted/bankfull width with maximum depth of 0.5 m in ROW ▪ cobble/fines as dominant substrate ▪ shallow run habitat	▪ 2,626 µS/cm, 8.0 pH, 8.3°C ▪ irregular meandering, incised, and confined stream ▪ shrub-dominated riparian cover (moderate to high bank stability) ▪ no barriers to passage in vicinity	Moderate-high	High	None
11	Ephemeral Draw	Dry	▪ near existing trail ▪ treed fen west and east of crossing ▪ 55 m wide fen	▪ no defined bed or banks ▪ fen extends beyond ROW to east ▪ small lake west of ROW	None	Minimal	None
12	Ephemeral Draw	Low	▪ 160 m west of existing trail ▪ shrub riparian wetland between two ponds ▪ 60-m wide riparian wetland	▪ no defined bed or banks ▪ Cyprinids observed in ponds NE and SW of ROW	Minimal	Moderate	None
13	Ephemeral Draw	Low	▪ near existing trail ▪ treed fen west and east of crossing; 190 m wide fen	▪ no defined bed or banks ▪ fen extends beyond ROW	None	Minimal	None

[1] The updated road alignment does not always follow the existing trail; a centreline refers to the updated road alignment at the mid-point of a crossing over the waterbody

[2] Newly identified crossing location at 508327 E 6956304 N, Zone 11 V

Photo 1: Crossing 1.1, From Centreline, Facing South (Upstream), Sept. 21, 2017

Photo 2: Crossing 1.1, From Centreline, Facing North (Downstream), Sept. 21, 2017

Photo 3: Crossing 1.2, From Centreline, Facing South (Upstream), Sept. 21, 2017

Photo 4: Crossing 1.2, From Centreline, Facing North (Downstream), Sept. 21, 2017

Photo 5: Crossing 2, From Centreline, Facing South (Upstream), Sept. 21, 2017

Photo 6: Crossing 2, From Centreline, Facing North (Downstream), Sept. 21, 2017

Photo 7: Crossing 3, From Centreline, Facing South (Upstream), Sept. 21, 2017

Photo 8: Crossing 3, From Centreline, Facing North (Downstream), Sept. 21, 2017

Photo 9: Crossing 4, From Centreline, Facing Southwest (Upstream), Sept. 21, 2017

Photo 10: Crossing 4, From Centreline, Facing Northeast (Downstream), Sept. 21, 2017

Photo 11: Crossing 5, From Centreline, Facing Southwest (Upstream), Sept. 21, 2017

Photo 12: Crossing 5, From Centreline, Facing Northeast (Downstream), Sept. 21, 2017

Photo 13: Crossing 6, From Centreline, Facing West (Upstream), Sept. 21, 2017

Photo 14: Crossing 6, From Centreline, Facing East (Downstream), Showing Thermistor, Sept. 21, 2017

Photo 15: Crossing 7, From Centreline, Facing West (Upstream), Sept. 21, 2017

Photo 16: Crossing 7, From Centreline, Facing East (Downstream), Sept. 21, 2017

Photo 17: Duport River Crossing (8), From Centreline, Facing West (Upstream), Sept. 21, 2017

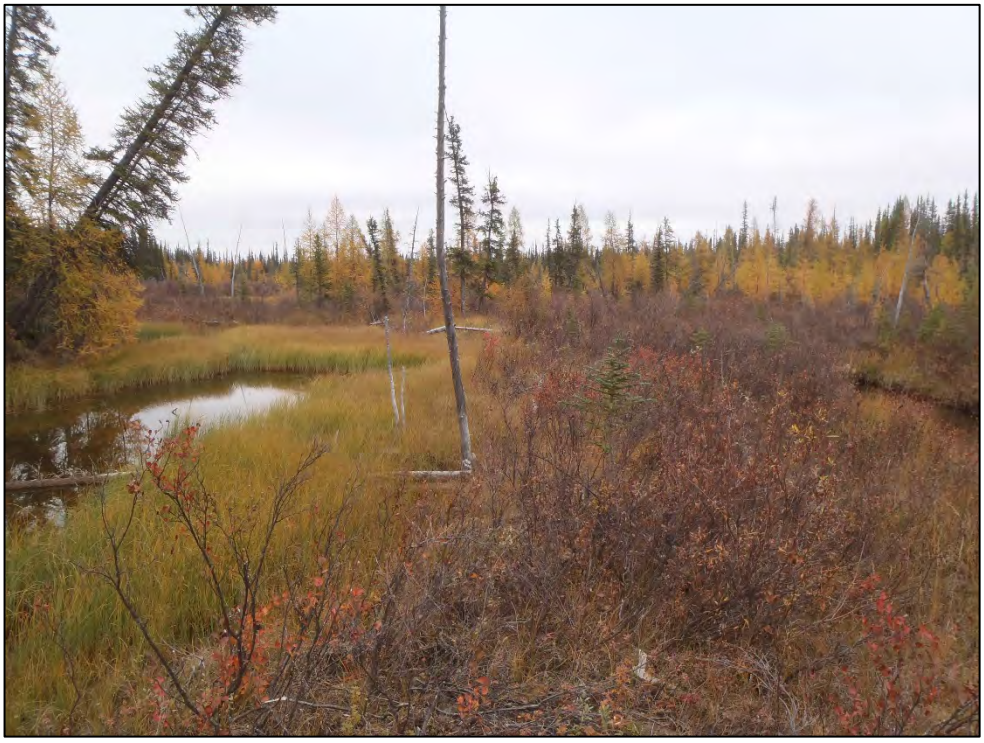


Photo 18: Duport River Crossing (8), From Centreline, Facing East (Downstream), Sept. 21, 2017

Photo 19: Potential Crossing 8.1, Facing West (Upstream), Sept. 20, 2017

Photo 20: Potential Crossing 8.1, Facing East (Downstream), Sept. 20, 2017

Photo 21: Crossing 9, From Centreline, Facing West (Upstream), Sept. 21, 2017

Photo 22: Crossing 9, From Centreline, Facing East (Downstream), Sept. 21, 2017

Photo 23: Crossing 10a, Approximately 10 m Upstream from Centreline, Sept. 21, 2017

Photo 24: Crossing 10a, Approximately 10 m Downstream from Centreline (Facing Southwest), Sept. 21, 2017

Photo 25: Crossing 10, From Centreline, Facing Southwest, Sept. 20, 2017

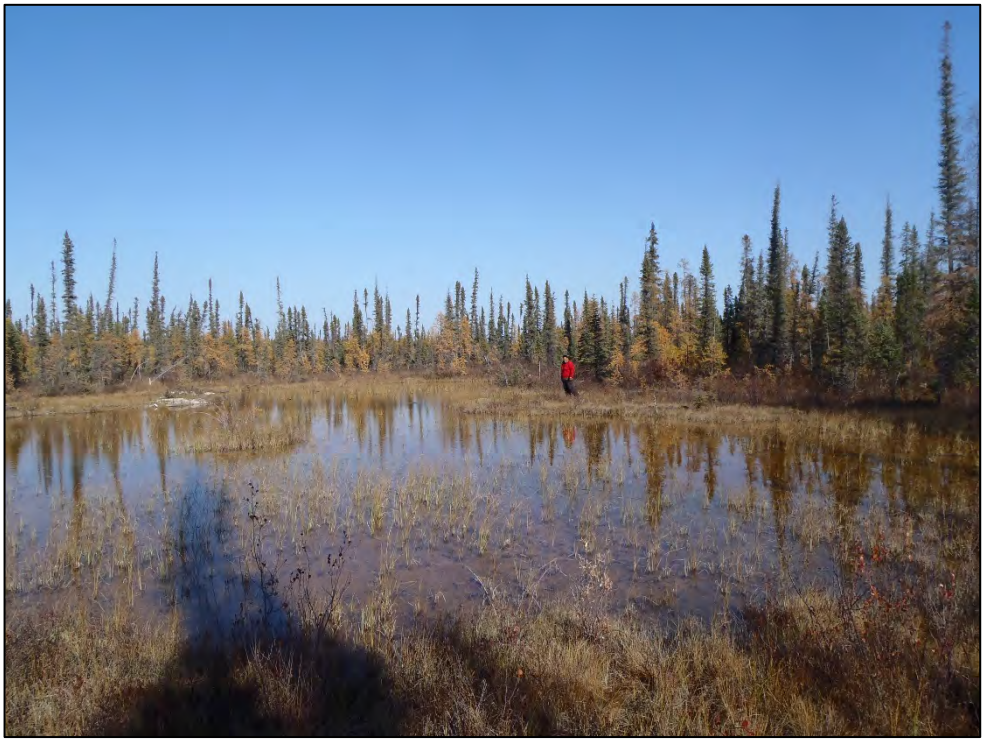


Photo 26: Crossing 10, From Centreline, Facing Northeast, Sept. 20, 2017

Photo 27: Crossing 11, From Centreline, Facing West (Upstream), Sept. 20, 2017

Photo 28: Crossing 11, From Centreline, Facing East (Downstream), Sept. 20, 2017

Photo 29: Crossing 12, Approximately 20 m Northwest of Centreline, Facing Southeast, Sept. 20, 2017

Photo 30: Immediately North of Crossing 12, Facing South and Crossing Location, Sept. 20, 2017

Photo 31: Crossing 13, From Centreline, Facing West, Sept. 20, 2017

Photo 32: Crossing 13, From Centreline, Facing East, Sept. 20, 2017

APPENDIX A

Habitat Definitions

Date: 17 October, 2017
Project No. 1665943
To: Stu Niven, Manager, Environmental Affairs, Department of Infrastructure, GNWT

Selected habitat variables are defined below based on Golder's internal technical procedure for mapping fish habitat on watercourses.

Bank Stability

The stability or erodibility of the banks is based on factors such as bank slope, bank material, evidence of seepages, undercutting, erosion and slumping. Unstable banks are banks which shed material (bank material or vegetation) into the watercourse. The input of fine sediments into rivers and streams can result in detrimental sedimentation of instream habitats. Alternatively, vegetation and other bank materials which fall in the channel may be beneficial by providing cover for fish or may be detrimental by causing blockages.

Channel

The channel is the main component of a watercourse. It is the area of the watercourse that typically has flowing water, on at least a seasonal basis, and is usually defined by the area of the stream substrate. The channel is distinguishable from the banks since it has contact with flowing water for at least a portion of each season which usually prevents establishment of permanent vegetation.

Channel form refers to the cross-sectional shape of the channel as defined by the width:depth ratio of the channel. Channel form will range from deeply incised (low width:depth) to broad (high width:depth).

Channel Unit (also referred to as habitat type)

Channel units are the hydraulic and morphological features of a stream channel. A channel unit is a section of channel which is homogeneous with respect to water depth, velocity and cover and is separated from other channel units by gradients in these parameters. Channel units are sometimes referred to as habitat types. The most common channel units are **pool**, **riffle** and **run**, although a total of 12 channel units have been defined (Table A1).

Cover

Cover is defined as aspects of the physical environment which provide resting places or protection from predators for fish. Cover can consist of instream cover - any feature which provides a velocity shelter (e.g., large substrate particles, submerged debris, etc.), or overhead cover - any feature which provides visual isolation for the fish (e.g., overhanging vegetation, undercut bank, turbulence, water depth).

Table A1: Stream Habitat Types

Channel Unit	Type	Class	Symbol	Description
Falls			FA	Highest water velocity; involves water falling over a vertical drop; impassable to fish
Cascade			CA	Extremely high gradient and velocity; extremely turbulent with entire water surface broken; may have short vertical sections, but overall is passable to fish; armoured substrate; may be assoc. with chute (RA/CH)
Chute			CH	Area of channel constriction, usually due to bedrock intrusions; associated with channel deepening and increased velocity
Rapids			RA	Extremely high velocity; deeper than riffle; substrate extremely coarse (l.cobble/boulder); instream cover in pocket eddies and associated with substrate
Riffle			RF	High velocity/gradient relative to run habitat; surface broken due to submerged or exposed bed material; shallow relative to other channel units; coarse substrate; usually limited instream or overhead cover for juvenile or adult fish (generally ≤0.5m deep)
Run (glide)			R	Moderate to high velocity; surface largely unbroken; usually deeper than RF; substrate size dependent on hydraulics
	Depth/ Velocity Type			Run habitat can be differentiated into one of 4 types: deep/slow, deep/fast shallow/slow, or shallow/fast
		Class 1	R1	Highest quality/deepest run habitat; generally deep/slow type; coarse substrate; high instream cover from substrate and/or depth (generally >1.0 m deep)
		Class 2	R2	Moderate quality/depth; high-mod instream cover except at low flow; generally deep/fast or moderately deep/slow type (generally 0.75-1.0m deep)
		Class 3	R3	Lowest quality/depth; generally shallow/slow or shallow/fast type; low instream cover in all but high flows (generally 0.5-0.75m deep)
Flat			FL	Area characterized by low velocity and near-laminar flow; differentiated from pool habitat by high channel uniformity; more depositional than R3 habitat
Pool			P	Discrete portion of channel featuring increased depth and reduced velocity relative to riffle/run habitats; formed by channel scour
		Class 1	P1	Highest quality pool habitat based on size and depth; high instream cover due to instream features and depth; suitable holding water for adults and for overwintering (generally >1.5m deep)
		Class 2	P2	Moderate quality; shallower than P1 with high-mod instream cover except during low flow conditions, not suitable for overwintering
		Class 3	P3	Low quality pool habitat; shallow and/or small; low instream cover at all but high flow events
Impoundment		Class 1-3	IP (1-3)	Includes pools which are formed behind dams; tend to accumulate sediment/organic debris more than scour pools; may have cover associated with damming structure; identify as Class 1, 2 or 3 as for scour pools
	Dam Type			Three types of impoundments based on dam type; debris, beaver and landslide
Backwater			BW	Discrete, localized area of variable size exhibiting reverse flow direction; generally produced by bank irregularities; velocities variable but generally lower than main flow; substrate similar to adjacent channel with higher percentage of fines
Snye			SN	Discrete section of non-flowing water connected to a flowing channel only at its downstream end; generally formed in a side-channel or behind a peninsula
Boulder Garden			BG	Significant occurrence of large boulders providing significant instream cover; always in association with an overall channel unit such as a riffle (RF/BG) or run (e.g., R1/BG)

Stream Confinement

Stream confinement refers to the confinement of the watercourse within the boundaries of the floodplain. It is the degree to which the lateral movement of the stream channel is limited by terraces or valley walls.

Stream Pattern

Channel pattern describes the sinuosity of the channel or the degree to which the channel deviates from straightness. Sinuosity is the channels meander pattern which can range from straight to tortuously meandering.

Substrate

Stream substrate is the material found on the bottom of the channel portion of the watercourse. It refers to the surficial deposits that can be seen when viewing the streambed. As part of the habitat evaluation process, the substrate is evaluated with respect to particle size composition. Particle size composition refers to the proportions of the substrate particles within each category from a series of size categories. The size categories employed are presented on Table A2. These range from fine sediments (fines are particles <2 mm in size and include clay, silt and sand) through gravels, cobbles, boulders and bedrock. A substrate evaluation is conducted by visual observation. The observer estimates the percentage of the substrate particles, by surface area, in each of the size categories.

Table A2: Substrate Definitions

Class Name	Abbreviation		Size Range	
	Specific	General	mm	Inches
Clay/Silt	Si	Si	<0.06	<0.0024
Sand	Sa	Sa	0.06-2.0	0.0024-0.08
Small Gravel	S Gr	Gr	2-8	0.08-0.3
Medium Gravel	M Gr		8-32	0.3-1.3
Large Gravel	L Gr		32-64	1.3-2.5
Small Cobble	S Co	Co	64-128	2.5-5
Large Cobble	L Co		128-256	5-10
Small Boulder	S Bo	Bo	256-762	10-30
Large Boulder	L Bo		>762	>30
Bedrock	Be	Be	-	-

Watercourse Classes

- Ephemeral draw = no defined bed/bank
- Intermittent = defined bed/banks <0.5 m wide
- Small Permanent = defined channel 0.5 to 5.0 m wide
- Large Permanent = defined channel > 5.0 m wide